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SEABIRD NUMBERS AND BREEDING SUCCESS IN BRITAIN AND IRELAND, 1992

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Further information on patterns or trends shown in the report, or on particular regions or colonies, can also be obtained through the report compilers.

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1. INTRODUCTION

This is fourth 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 (SMP). This programme is designed to encourage seabird monitoring by a range of individuals and organisations, and collate the results for a regular, up-to-date summary. We hope that the information summarised will provide useful feedback to the many individuals and organisations who provide results and be of interest to conservationists and seabird researchers in general.

Breeding success and population changes noted at seabird colonies in 1992 are summarised here, and comparative results for the period 1986-92 are also presented. Among the results included are summaries of the RSPB's complete survey of breeding skuas in Orkney and Shetland (which were last censused fully in 1982-86). Other notable results from 1992 include another year of successful breeding by seabirds in Shetland (following almost total failure for several species in 1988-90); continued low breeding success of kittiwakes in SW Britain and SE Ireland; and continued variable breeding success of terns (with predation or high tides the main factors reducing success).

The format of the report is, in general, similar to that in previous years, and some background information on data sources and conventions is repeated below. Summary details of seabird monitoring methods were given in the 1989 report and in Appendix 1 of the 1990 report (Walsh *et al.* 1990, 1991). Details of methods may also be obtained from the report compilers.

Except where specifically noted, the results presented refer to coastal/marine populations of seabirds, but limited reference is made to inland results for some species (notably cormorant and gulls). Collation of data for inland colonies may be more complete in future reports.

Any offers of help for future seasons, or comments on this report, would be greatly appreciated. Gaps in coverage are identified in many of the species accounts (report section 2), and 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, ongoing monitoring, we would be pleased to receive unpublished or unreported data on numbers or breeding success at *any* seabird colony in Britain or Ireland, whether coastal or inland. Such data would be added to the longterm databases maintained by JNCC and RSPB, including the JNCC/Seabird Group Seabird Colony Register and the RSPB Tern Database.

Sources of information for the report

Information was collated from many sources, including: research or wardening staff of RSPB, SOTEAG and JNCC; wardening staff of Scottish Natural Heritage (SNH), English Nature (EN) and the Countryside Council for Wales (CCW); organisations including local wildlife trusts, universities, bird observatories, ringing groups, the Institute of Terrestrial Ecology, the Seabird Group, and others; and many individual fieldworkers. A full list is given under Acknowledgments (report section 3).

Seabird monitoring 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 is undertaken at several geographically-dispersed 'key sites', largely through contracts placed with other organisations. These sites include 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), in cooperation with SNH.

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 SMP. 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.

The majority of 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 1.1.

Through their network of reserves, RSPB monitor 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 storm 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.

Data for some 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 Wildlife Service of the Office of Public Works, the Irish Wildbird Conservancy, and the National Trust, and counts or productivity-monitoring at some colonies are funded by the Seabird Group.

Data-presentation and methods

Fuller details are given in the 1989 report, but some indications of the potential limitations of information presented in this report are given below.

Population changes: use of regional samples and annual indices

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 only, 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 1.2 below. For most species, population data have been summarised region-by-region. Valid counts (see below) 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.

Not all monitored colonies are counted annually, and population comparisons between years are thus often based on different combinations of colonies. Recent population trends (1986-92) have been estimated using a system of population indices, with 1986-87 average counts set as an arbitrary 100. Most colonies counted in 1992 were also counted in one or both of those years, when most of the coverage for the Seabird Colony Register was achieved. (See 1989 report for fuller details of index calculations, and table 1.1 for summaries of net population changes between 1969 and c1986.)

Regional population changes are also tabulated for 1991-92. Note that changes between these years will not necessarily match changes shown by population indices, as not all colonies included in 1992 index values may have been counted in 1991. (The exceptions are terns, for which a stricter 'chain method' of calculating indices has been used, based only on colonies counted in consecutive years; a high proportion of colonies of these species is counted annually.) Some short-term fluctuations shown by the annual indices may reflect the use of data for different colonies in different years, and may thus be of little significance. Counts of some seabird populations can also show reflect natural, temporary, fluctuations in numbers attempting to breed. With longer runs of data, however, such methodological or temporary effects should have relatively little influence on apparent trends.

Accuracy and representativeness of seabird 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 the most 'difficult' species, guillemot and razorbill, 5-10 counts of adults attending colonies in June each year are needed in order to minimise the effect of day-to-day variations in numbers. (Repeat counts of apparently occupied fulmar sites are also recommended.) .

Where 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).

As mentioned above, 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 monitoring efforts are directed at 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.

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, e.g., 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 *c*50 '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 will overestimate the productivity of breeding pairs slightly. The methods used for fulmar, shag, kittiwake, guillemot and puffin were developed for the Seabird Monitoring Programme by Harris (1989), and can be applied to similar species. Field tests of these methods suggest that the degree of overestimation is generally up to 10 or 20%, depending on the frequency of monitoring visits during the season. This is considered acceptable, as major geographical or year-to-year changes will still be obvious. Where methods are known to have differed greatly between years this is noted for the relevant colony.

Table 1.1 **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 counts, except arctic tern, are taken) for further details.

	Coastal population		% change[c]	Total population[d]	
	Britain[a]	Britain & Ireland[b]	1969-87 B & I coast	Britain	Britain & Ireland
Fulmar	537 000	571 000	+85%	571 000	571 000
Manx shearwater[e]	250 000+	*c*275 000	?	*c*275 000	*c*275 000
Storm petrel	41+ cols	72+ colonies	?	72+ cols.	72+ cols.
Leach's petrel	7+ colonies	8+ colonies	?	8+ cols.	8+ cols.
Gannet	158 700	187 900	+36%	187 900	187 900
Cormorant	6 050	10 400	+30%	12 500	11 700
Shag	36 400	47 300	+40%	47 300	47 300
Arctic skua	3 350	3 350	≤ +220%	3 350	3 350
Great skua	7 900	7 900	≤ +150%	7 900	7 900
Black-headed gull	77 300	84 200	+13%	323 000	233 000
Common gull	14 800	15 700	+21%	124 400	71 400
Lesser black-backed gull	62 300	64 400	+28%	108 700	88 700
Herring gull	135 000	191 000	-43%	221 000	206 000
Great black-backed gull	18 300	23 300	+3%	23 500	23 400
Kittiwake	492 000	544 000	+22%	544 000	544 000
Sandwich tern	14 050	18 400	+53%	18 600	18 600
Roseate tern	135	475	-80%	135	475
Common tern	11 850	14 700	-1%	16 900	16 000
Arctic tern[f]	42 400	44 900	-14%	42 900	45 500
Little tern	2 400	2 800	+40%	2 800	2 800
Guillemot	1 047 000i	1 203 001i	+118%	1 047 000i	1 203 001i
Razorbill	147 000i	179 000i	probably +	182 000i	182 000i
Black guillemot	37 500i	41 000i	probably +	41 000i	41 000i
Puffin[g]	895 000i	930 000i	slightly +?	930 000i	930 000i

Notes:

[a] Figures for Britain exclude Isle of Man and Channel Isds (included under Britain & Ireland).

[b] Irish figures include some estimates (mainly for fulmar, shag and gulls) for coastal sections which had not been surveyed by 1988.

[c] 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.

[d] British & Irish totals for some species include estimates of inland populations, to be revised once further information has been collated for the SCR.

[e] Manx shearwater figures very approximate (midpoints of population estimates).

[f] 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;

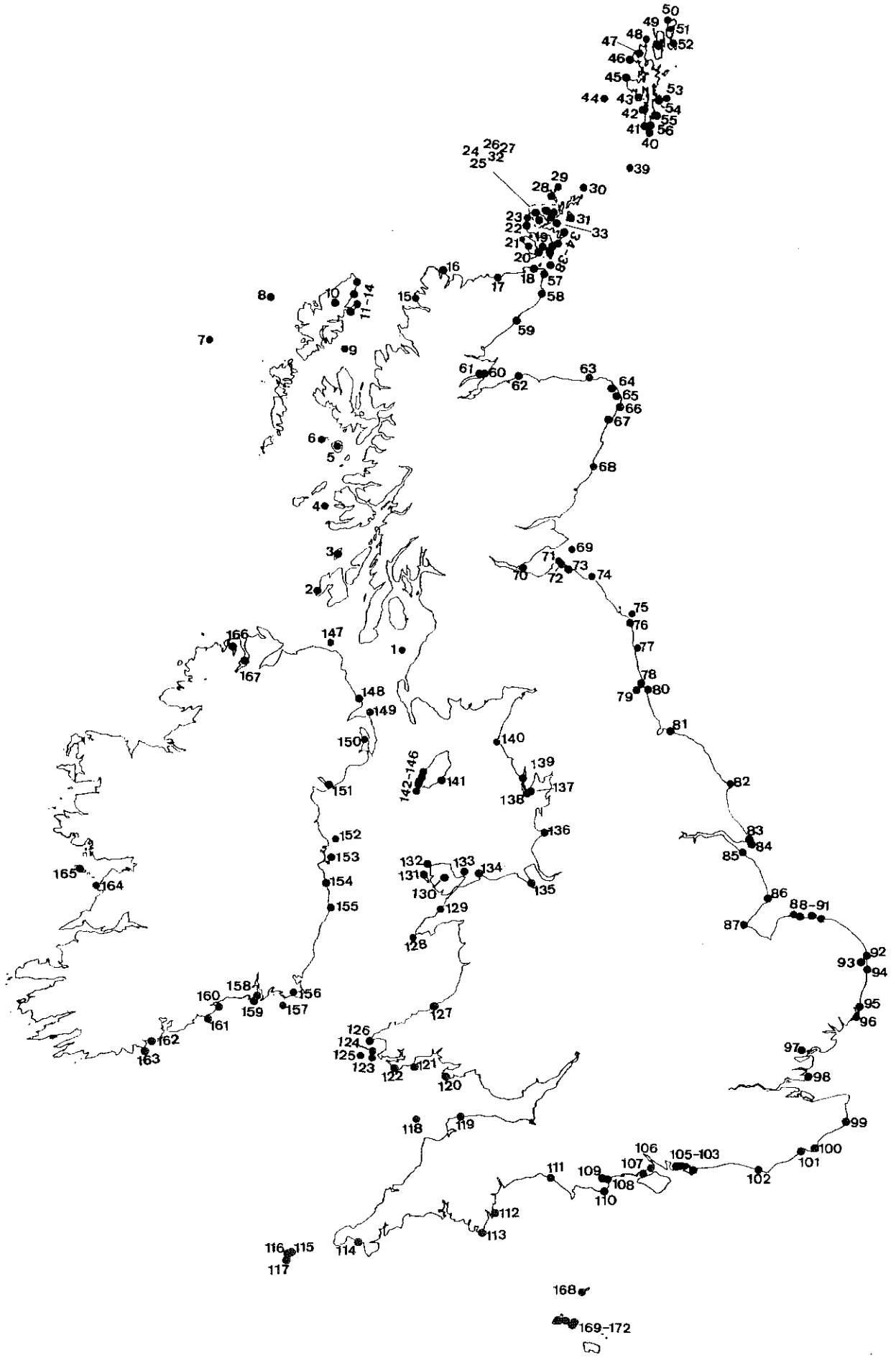
[g] Puffin figures very approximate (include high proportion of counts of pairs, multiplied by two to give individuals).

Table 1.2 **Groupings of coastal counties or districts used is assessing population changes for regional samples.** [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 (clockwise from SW Scotland)	Defined region
Annandale & Eskdale, Nithsdale, Stewartry, Wigtown, Kyle & Carrick, Cunninghame, Inverclyde, Dunbarton, Argyll & Bute	SW Scotland
Lochaber, Skye & Lochalsh, Ross & Cromarty (west), Sutherland (northwest), Western Isles	NW Scotland
Shetland	Shetland
Orkney	Orkney
Caithness, Sutherland (east), Ross & Cromarty (east), Inverness	N Scotland
Nairn, Moray, Banff & Buchan, Gordon, City of Aberdeen, Kincardine & Deeside	NE Scotland
Angus, City of Dundee, NE Fife, Kirkcaldy, Dunfermline, City of Edinburgh, East Lothian, Berwickshire	SE Scotland
Northumberland, Tyne & Wear, Durham, Cleveland, N Yorkshire, Humberside, Lincolnshire	NE England
Norfolk, Suffolk, Essex	E England
Kent, E Sussex, W Sussex, Hampshire, Isle of Wight	SE England
Dorset, Devon, Cornwall, Isles of Scilly, Somerset, Avon, Gloucestershire, Channel Isds	SW England /Channel Islands
Gwent, S Glamorgan, Mid Glamorgan, W Glamorgan Dyfed, Gwynedd, Clwyd	Wales
Merseyside, Lancashire, Cumbria, Isle of Man	NW Eng./I. of Man
Londonderry, Antrim, Down	NE Ireland
Louth, Meath, Dublin, Wicklow, Wexford, Waterford	SE Ireland
Cork, Kerry, Limerick, Clare	SW Ireland
Galway, Mayo, Sligo, Donegal	NW Ireland

Figure 1.1. **Colonies/ locations referred to in the report** (numbers refer to map, p. 13)

Abberton Reservoir	97
Ailsa Craig	1
An Dun	59
Anglesey	130
Annet	117
Bardsey	128
Bempton	82
Berry Head	112
Big Doon	162
Big Sark	172
Blacker's Hole	110
Blakeney Point	90
Bradda	143
Bray Head	154
Breil Nook	82
Bressay	54
Breydon Water	93
Brownsea Island	108
Bullars of Buchan	66
Burray	36
Burton Bradstock / West Bay	111
Calf of Man	142
Canna	6
Carlingford Lough	151
Cellar Head (Lewis)	13
Chichester Harbour	104
Cliffs of Moher	164
Colonsay	3
Coquet Island	77
Costa Head	24
Covesea	62
Devil's Truck	120
Douglas	141
Dunbar	73
Dungeness	100
Dunmore East	158
Dunottar - Catterline	68
Durlston Head	110
Easington	83
Egilsay	27
Elegug Stacks	122
Eshaness	46
Fair Isle	39
Faraid Head	16
Farne Islands	75
Fetlar	52
Flannan Isles	8
Flotta	19
Foula	44
Foulness / Maplin	98
Foulney	137
Fowlsheugh	68
Frampton Marsh	87
Gateshead	79
Gibraltar Point	86
Glen Maye	145
Gorregan	117
Grassholm	125
Great Ormes Head	134
Great Saltee	157
Great Yarmouth	92
Gruney (Ramna Stacks)	48
Guernsey	169
Gugh	117
Gultak	35
Handa	15
Havergate	96
Helvick Head	160
Hermaness	50
Hodbarrow	139
Holkham NNR	89
Hoy	21
Inchmickery	70
Inishmore	165
Ireland's Eye	153
Iresgeo	58
Isle of May	69
Jethou	170
Kettla Ness	42
Lady's Island Lake	156
Langstone Harbour	105
Larne Lough	148
Les Etacs	168
Lewis	10
Little Sark	171
Loch of Strathbeg	64
Lochtyn	127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2.1 Red-throated diver *Gavia stellata*

Breeding numbers and success (table & figure 2.1.1)

In Shetland, numbers of successful pairs (those with chicks in mid July) were again assessed in sample areas of Unst, Bressay, North Roe and Eshaness (Okill 1992). Overall, more pairs were productive than in 1991, and 1992 was one of the most successful recent years for Shetland divers. Numbers of successful pairs either increased or remained stable in individual study areas. Average brood-size was also high (1.42 overall), with a higher proportion broods of two chicks than during 1987-91. However, most broods of two were on Unst (average brood-size 1.76), and brood-sizes elsewhere were lower (1.27) (Okill 1992).

Figures for productivity (chicks fledged per breeding pair) are also available. It was a particularly successful year at Hermaness, Unst (1.9 chicks/pair, the highest figure recorded for any Shetland area during 1986-92). Elsewhere in Shetland (Yell, Fetlar and Foula), productivity was moderately high, at 0.5-0.86 chicks fledged/pair; in each case, this was lower than in 1991, but well above the 1986-90 average. Overall productivity for Shetland divers, at *c*0.8 chicks/pair, was similar to 1991 and higher than in any year 1986-90.

Divers in Orkney again had only a moderately successful season overall, with an average 0.52 chicks estimated to have fledged per pair. This is slightly higher than in 1991, but similar to the average for recent years. As in 1988-91, productivity was lowest for Rousay birds (0.27 chicks/pair in 1992). Brood sizes for successful pairs were lower than in Shetland, averaging only 1.18 chicks per brood (with broods of 2 chicks recorded on Hoy only).

Discussion

A further improvement in breeding success of Shetland divers may, at least in part, be a reflection of increased availability of sandeels (an important food item for Shetland birds) compared to the period 1988-90. Marked variations in success were again seen between different parts of Shetland and of Orkney, and these presumably reflected variations in such factors as predation or human disturbance. Illegal egg-collecting apparently still occurs in some areas, with evidence of this in the North Roe area of Shetland in 1992 (Okill 1992).

Systematic data are less readily available for red-throated divers outside of the Northern Isles (which hold the bulk of the British population). We would welcome any information on breeding success or population changes elsewhere for annual summary in this report.

Table 2.1.1 **Red-throated diver breeding success, 1986-92**: estimated number of chicks fledged per breeding pair. Note that numbers of pairs do not necessarily indicate total populations in study areas. For 1986-90, mean ±standard error of annual figures is presented (equivalent to mean ±half-range when n = 2 years).

	1986-90 years	fledged/pair mean	s.e.	1991 prs	fledged /pr	1992 prs	fledged /pr
Hermaness	5	**0.82**	0.12	8	**0.88**	8	**1.87**
Fetlar	5	**0.37**	0.09	18	**0.55**	18	**0.50**
Yell	5	**≤0.46**	0.07	19	**1.21**	21	**0.86**
Foula	4	**0.40**	0.07	11	**0.63**	12	**0.58**
SHETLAND sample total	5	**0.50**	0.04	56	**0.84**	59	**0.83**
Hoy	4	**0.55+**	0.05	91	**0.60**	61	**0.59**
Rousay	3	**0.23**	0.09	11	**0.27**	11	**0.27**
Mainland	2	**0.41**	0.03	17	**0.76**	14	**0.43**
ORKNEY sample total	4	**0.50**	0.07	119	**0.44**	86	**0.52**

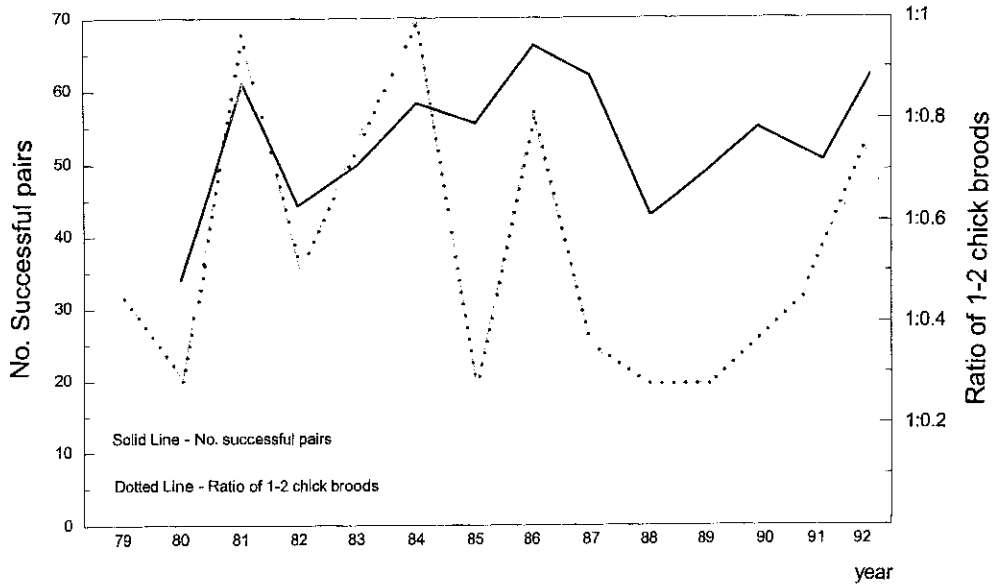

Figure 2.1.1 **Annual variation in numbers of successful pairs and in brood-size at fledging of red-throated divers in Shetland study-areas** (from Okill 1992)

2.2 Fulmar *Fulmarus glacialis*

Breeding numbers (table & figure 2.2.1)

Fulmar numbers in all monitored regions appear to be stable or increasing at present, based on 1986-92 trends, with significant increases noted for Shetland, NE England and Wales. The most notable change since 1991 was a 23% increase at monitored Shetland colonies (with significant increases at three out of four colonies). 1991-92 changes in other regions were generally minor, or based on only one or two colonies.

Breeding success (table 2.2.2)

Average productivity at 29 colonies around Britain was again moderately high, at 0.45 ($\pm$ 0.04) chicks estimated to have fledged per occupied site. This represented a slight, but significant, increase compared to 1991, based on colonies where the same methods were used in both years (average change +0.03 $\pm$ 0.01 chicks/site, $t21 = 2.21$, $P<0.05$).

Fulmars in Shetland and Orkney were the most successful, overall, in each case averaging 0.53 ($\pm$ 0.03) chicks/site. Productivity was generally lower in other regions, although a significant improvement was seen on the Scottish east coast (average change +0.11 $\pm$ 0.04 chicks/site). This contributed to an overall improvement for colonies on the North Sea coast as a whole (+0.05 $\pm$ 0.02 for colonies between Shetland and Northumberland).

Some individual colonies in northern Britain had a notably successful year. On Ailsa Craig, in the Firth of Clyde, most breeding pairs failed in recent years, but twelve pairs fledged an average of 0.8 chicks in 1992. Few colonies are monitored further south, and those on the Isle of Man continue to rear rather few chicks in relation to numbers of apparently occupied sites.

Discussion

At present, replicated counts of apparently occupied fulmar sites are made in a few Scottish regions only. Without such counts, day-to-day variation in attendance of non-breeding fulmars at suitable 'sites' can cloud any real population changes. Even with replicate counts, year-to-year changes in attendance of non-breeders might also create difficulties. Nevertheless, it seems clear that fulmar populations around Britain continue to increase.

Attendance by non-breeding fulmars at apparently suitable sites also leads to difficulties in assessing breeding success. Assessing actual numbers of breeding pairs is difficult, but the recommended technique for productivity assessment goes some way towards achieving this, by identifying sites regularly occupied by a sitting bird. Where data in Table 2.2.2 are based on single or average counts of apparently occupied sites, there is probably a tendency to underestimate productivity, because of the inclusion of non-breeders. Apparent variation in productivity between colonies or regions could thus, in some cases, be a reflection of differences in the proportion of non-breeders in samples. This should be borne in mind in comparing results for different colonies, where different methods have been used.

Table 2.2.1 **Population changes at monitored fulmar colonies, 1991-92** (apparently occupied sites in June). Superscript = number of colonies with 10+ AOS counted in 1991; counts with a reported inaccuracy of >±5%, and regional samples <100 AOS, are excluded. Figures for regions in block capitals are based on the means of 4-10 counts per year at each colony.

	NW Scotland	SHETLAND	N. SCOTLAND	SE SCOTLAND	NE England	Wales	NW England & Isle. of Man
1991	639	1655	1430	316	260	701	749
1992	792	2035	1330	328	223	692	755
% change	+23.8[2]	+22.9[5]	-7.0[4]	+3.8[1]	-14.2[1]	-1.3[1]	+0.8[8]

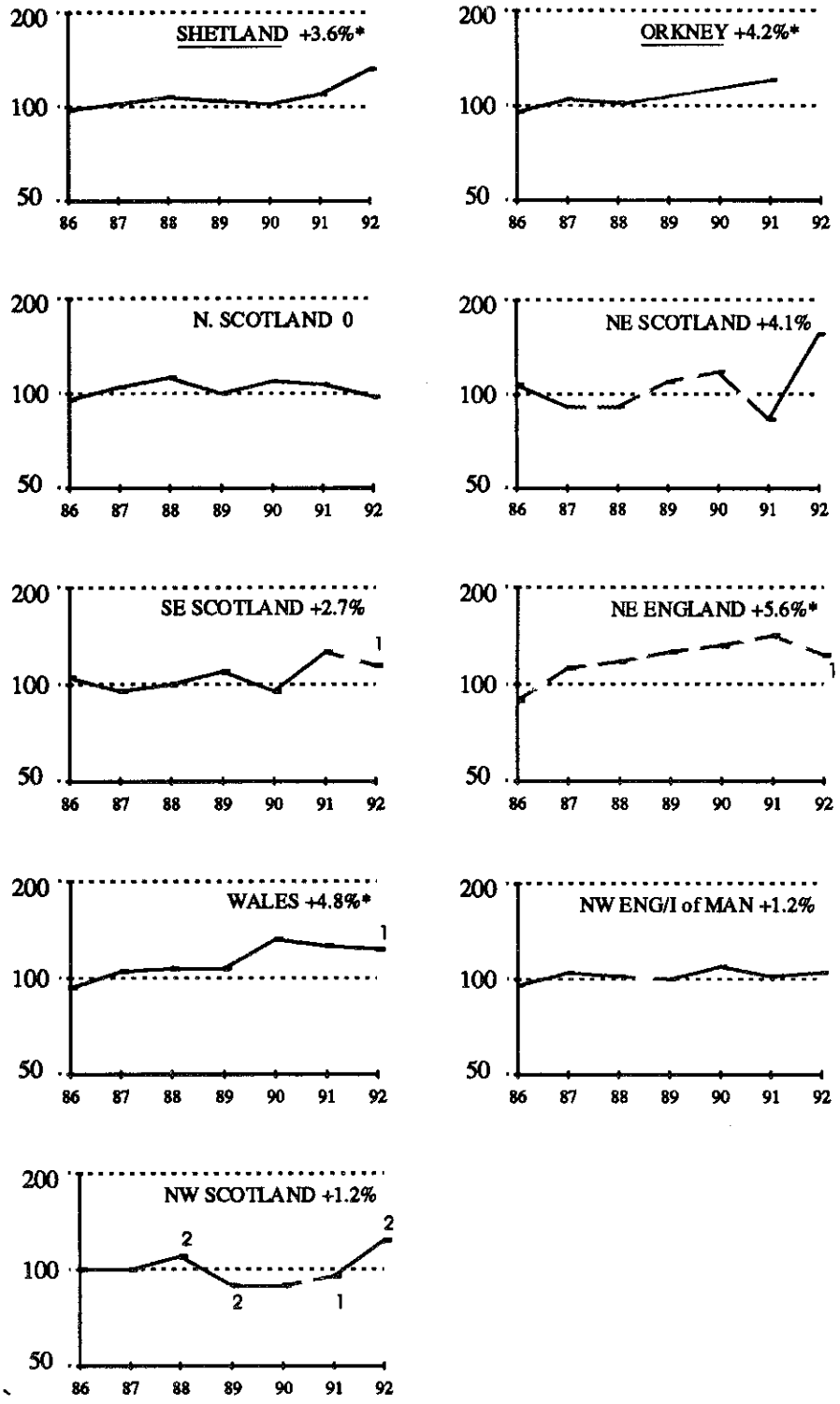

Figure 2.2.1 **Regional population indices for breeding fulmars, 1986-92 (apparently occupied sites in June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05). Underlined region names = based on 4-10 counts of study plots each year. Broken trend-lines indicate samples of 100-500 AOS. No. of colonies counted in each year = 3+ (unless 1 or 2 indicated).

Table 2.2.2 **Fulmar breeding success, 1986-92:** number of chicks fledged per apparently occupied site. Figures are based on regularly-occupied sites or on the average numbers of occupied sites in June. For 1991 and 1992, productivity is presented as mean & standard error of figures from three or more plots (standard error is equivalent to half-range of figures from two plots); n = number of sites (plots). * indicates coverage of most or all of colony.

Colony	1986-90 fledged/site			1991 fledged/site			1992 fledged/site		
	yrs	mean	s.e.	n	mean	s.e.	n	mean	s.e.
Ailsa Craig (Kyle & Carrick) (egg)		-			-		12	**0.83**	-
Colonsay (Argyll & Bute)	4	**0.43**	0.03	73(2)	**0.50**	0.04	73(2)	**0.48**	0.10
Canna (Lochaber)	5	**0.40**	0.06	45(2)	**0.33**	0.22	44(2)	**0.34**	0.13
St Kilda (W Isles)	2	**0.43**	0.03		-		321(3)	**0.44**	0.02
Lewis (W Isles)	2	**0.34**	0.07		-			-	
Handa (Sutherland)	2	**0.62**	0	167(2)	**0.41**	0.06	121(1)	A**0.34**	
Faraid Head (Sutherland)	1	**~0.34**	-		**<0.54**			-	
Hermaness, Unst (Shetland)	2	**0.35**A	0.02	303(2)	**0.32**A	0.06	280(2)	**0.30**A	0.13
Eshaness a (Shetland)	5	**0.43**A	0.04	236(4)	**0.47**A	0.03	273(5)	**0.43**A	0.05
Eshaness b	-	-	-	-	-	-	279(7)	**0.48**	0.05
Noss (Shetland)	5	**0.41**A	0.04	504(3)	**0.37**A	0.04	462(3)	**0.43**A	0.04
Westerwick a (Shetland)	1	**0.33**A	-	78(1)	**0.42**A	-	84(1)	**0.41**A	-
Westerwick b		-	-	-	-	-	76(1)	**0.45**	-
Troswick Ness a (Shetland)	5	**0.45**A	0.03	876(6)	**0.44**A	0.05	927(6)	**0.46**A	0.03
Troswick Ness b		-	-		-		95(1)	**0.56**	-
Sumburgh Head a (Shetland)	5	**0.46**A	0.06	200(3)	**0.54**A	0.07	216(3)	**0.57**A	0.02
Sumburgh Head b		-			-		30(1)	**0.59**	-
Fair Isle (Shetland)	5	**0.47**	0.06	401(5)	**0.52**	0.08	469(5)	**0.55**	0.05
North Ronaldsay (Orkney)	1	**0.34**	-		-			-	
North Hill, Papa Westray (Ork.)	2	**0.40**	0.01	82	**0.50**		88	**0.54**	
Costa Head (Orkney)	2	**0.46**	0.04	175(3)	**0.55**	0.03	198(3)	**0.53**	0.02
Row Head (Orkney)	1	**0.54**	-		-		31(1)	**0.71**	-
Mull Head (Orkney)	2	**0.36**	0.04	162(5)	**0.44**	0.06	192(5)	**0.41**	0.10
Gultak (Orkney)	2	**0.37**	0.10	140(4)	**0.49**	0.06	150(4)	**0.55**	0.11
Hoy (Orkney)	2	**0.56**	0.08	140(4)	**0.49**	0.06	180(3)	**~0.51**	0.05
Rousay, inland (Orkney)	2	**0.52**	0.0	48(3)	**0.50**	0.09	45	A**0**	
Rousay, coastal (Orkney)	1	**0.62**	-	76(3)	**0.50**	0.13	101(3)	A**0.47**	0.01

Colony	1986-90 fledged/site			1991 fledged/site			1992 fledged/site		
	yrs	mean	s.e.	n	mean	s.e.	n	mean	s.e.
St John's Head (Caithness)	1	~0.50	-		-			-	
Sandside Head (Caithness)	1	~0.54	-		≤0.58			-	
Iresgeo (Caithness)[A]	5	0.34	0.04	659(5)	0.22	0.03	591(5)	0.34	0.01
An Dun (Caithness)[A]	5	0.33	0.03	500(5)	0.22	0.02	494(5)	0.37	0.03
Isle of May (NE Fife)	5	0.44	0.07	110	0.42	-	129	0.47	-
Tantallon (E Lothian)	4	0.39	0.08	184(4)	0.42	0.12	89(2)	0.63	0.10
St Abb's Head (Berwick)	2	c.0.16	-	315(*)	0.30		330(*)	0.31	
Farne Islds (Northumberland)	5	0.54	0.06	132(3)	0.57	0.09	127(4)	0.66	0.01
Weybourne-Sheringham (Norfolk)	1	0.37	-		-			-	
Guernsey (Channel Islands)~	5	0.27	0.06	22(8)	0.32	-		-	
Skomer (Dyfed)	2	0.60	0.03		-	-	99	0.42	
Bardsey (Gwynedd)	1	0.60	-		-			-	
Calf of Man (Isle of Man)	1	0.44	-		-			-	
Traie Vane-Gob yn Ushtey (I.M.)~	2	0.25	0.02	134(*)	0.18		112(*)	0.18	-
Around Peel Hill (Isle of Man)~	3	0.21	0.02	330(*)	0.18		280(*)	0.26	-
Glen Maye (Isle of Man)~	5	0.35	0.09	28(*)	0.25		24(*)	0.29	-
Bradda (Isle of Man)~		-		44	0.29		49	0.24	-
Douglas (Isle of Man)~		-		57	0.40		68	0.43	-

[A] = figures based on average number of occupied sites in June; ~ = figures based on a single count of occupied sites in June. In both cases, number of breeding pairs may be overestimated to a greater degree than if regularly-occupied sites are used (and thus fledging success per breeding pair may be underestimated).

a, b = results based on different methods at same colony

2.3 Manx shearwater *Puffinus puffinus*

Only brief details of the 1991 season were given in last year's report, so a fuller summary is included here.

Breeding numbers 1991-1992

On Canna (Lochaber) in 1992, only 19 (46%) of 39 study burrows were known to have been laid in, similar to 43% of 58 burrows in 1991 and 42% in 1990, but below the usual 60-80% occupancy rate recorded during 1976-88 (Swann 1992).

In the Channel Islands, breeding was confirmed for the first time on Big Sark in August 1991, when at least one downy juvenile was present and 3-10 occupied burrows were estimated. In 1990, two burrows had been found occupied during daylight. On Little Sark (where first found breeding in 1989), 20-25 pairs were estimated in July 1991, with 5 juveniles seen in August. On Jethou, Guernsey, another colony first discovered in 1989, up to 15 burrows were occupied in 1992, and 6-10 chicks were present in August-September.

In the Isles of Scilly, birds were recorded ashore at several locations in 1992 (Robinson 1992). On Round Island, a conservative estimate of 50 pairs was made, based on numbers of birds in flight plus on the ground (a previous estimate of 24 occupied burrows was made in 1983). On Annet in 1991 and 1992, fewer birds were seen ashore than on Round Island, although pre-dusk numbers offshore were generally higher. Previous estimates for Annet were 350-500 pairs in 1983 and 50-300 birds in 1987. A single bird was recorded in 1992 on Gugh (where a bird was found at a burrow-entrance in 1986).

On Lundy (Devon), Webb (1991) & Aspinall (1991) found no positive evidence of breeding in 1991, despite searches over several nights. Although large numbers were calling over the island on some nights in June (possibly as 100 or more individuals), only one bird was heard calling from underground, and none was seen to land. About 1200 pairs were estimated in 1985, but there is considerable doubt about the breeding status of birds here; the actual breeding population would seem to be small or inaccessible.

Other records from known or possible colonies include birds calling in flight at Bray Head and Wicklow Head (Co. Wicklow) in 1991 (breeding has never been proven at these sites); confirmed breeding on Lunga, Treshnish Isles in 1991 (Argyll & Bute); and 50-100 pairs estimated on the Calf of Man in 1991 (32 occupied burrows in 1983). On Ramsey Island (Dyfed), 165 apparently occupied burrows were recorded in 1992; the previous history of this site appears to be undocumented.

Breeding success 1991-92

On Canna, 28 of the burrows laid in produced 13 large chicks (0.46 chicks/pair), below average for the period since 1976. In 1991, 13 large chicks were produced from 25 eggs (0.52/pair).

Shearwaters in two study areas on Skomer (Dyfed) fledged 0.50 chicks/egg in 1991-91 (n = 88 breeding pairs) and and 0.38 chicks/eggs in 1992 (n = 66), respectively. Both figures are low compared to pre-1986 data for Skomer (0.62-0.75 during 1973-76: Brooke 1990).

Discussion

None of the larger shearwater colonies was censused in 1992, but the Skomer population is likely to be censused within the next three years, once techniques have been reviewed. Further work on Rum, to follow up quadrat counts in 1990 (Furness 1990), is tentatively planned for 1995.

Further information from any of the smaller colonies would be welcomed, as in some cases the actual breeding status of shearwaters visiting these colonies is not clear, and in most cases there are few reliable estimates of breeding numbers.

2.5 Storm petrel *Hydrobates pelagicus*

Breeding numbers

On Mousa, Shetland, monitoring continued using a mapping technique developed by RSPB in 1990/91. Calling birds were censused in a sample of the island's walls and boulder beaches. A preliminary island population estimate of 4500-5000 calling birds was made.

On the Isles of Scilly a large-scale ringing programme was begun in 1992. Data collected suggest that the population may be in the region of several thousand pairs (Robinson 1992). Breeding was thought to have occurred on Annet and Round Island, with birds present at two sites on St. Agnes and one on Gugh. Predated birds were regularly found on Gugh; as in previous years cats were thought to be responsible. Breeding has not yet been proven at this site.

Discussion

There are many problems in trying to census small petrel breeding populations. Only very rough estimates are available for most colonies, and the methods used are not standardised. Single colony visits to ring or record calling birds cannot provide good population estimates. A more systematic method is required that can be applied to colonies in different habitats in different geographical areas. It would be interesting to see if the techniques used on Mousa would be equally useful at other colonies. Details of the methods used on Mousa are available from Jane Sears at the RSPB.

Leach`s petrel *Oceanodroma leucorhoa*

Breeding numbers

A visit to Gruney, Ramna Stacks (Shetland) on 6 July located eighteen occupied burrows (eight of these had been located in 1991). Two types of call were played at all burrows: the `purr` call and the `chatter` call. There were seven responses to the `purr` and ten responses to the `chatter`. Of these seventeen responses, ten came from adults with eggs, three from adult plus unknown nest contents, two from adult only and two from adults with small chicks. Nest contents were checked using an endoscope. It seems likely that the breeding population is about twenty pairs.

Discussion

No other data on Leach`s petrels in 1992 were received. Colonies are difficult to get to and some may remain undetected. Techniques used to census storm petrels on Mousa, Shetland may also be applicable to Leach`s petrels. Anyone interested in trying out this technique at a Leach`s petrel colony should contact Jane Sears at the RSPB.

2.6 Gannet *Morus bassanus*

Breeding numbers (table & figure 2.6.1)

Numbers increased at all four of the small colonies counted in both 1991 and 1992, and all small colonies have shown significant upward trends during recent years. Most notably, numbers at Troup Head, Grampian (where breeding was first recorded in 1988) almost doubled, to a peak count of 278 occupied nests in 1992. Gannets first bred on Ireland's Eye (Co. Dublin) in 1989 (*c*18 occupied sites), and reached 47 nests in 1992. The most recent addition to the list of known gannetries is Rockall, where a single nest with an egg was found on 19 June 1992 (Belaousoff 1993); about 50 other gannets, mainly immatures, were also present. Gannets have been seen on Rockall for many years, but breeding has never been proven previously (Bourne 1993). On Roareim in the Flannan Isles (Western Isles), at least 679 occupied nests (and probably *c*1000 occupied sites) were recorded in May 1992, a substantial increase from the last count (414 apparently occupied sites in 1988). At Les Etacs (Channel Islands), *c*2746 apparently occupied sites were recorded in 1992, suggesting a slight increase since 1989.

The largest colony censused in 1992 was Noss (Shetland), where 6856 occupied nests were recorded in July (Murray & Wanless 1992). Comparisons with previous counts indicated a 27-30% increase since 1982 (equivalent to an average annual increase of *c* 2.7%), and little or no change compared to 1991.

Breeding success (table 2.6.2)

Average productivity was high at monitored colonies (0.69 $\pm$0.05 chicks estimated fledged/nest, n = 6). This was slightly higher overall than in 1991, and productivity fell at only one out of five colonies. Troup Head and Hermaness gannets were the least successful (*c*0.6 chicks/nest); in contrast, Bempton gannets averaged 0.86 chicks/nest, one of the highest figures recorded for any colony recently.

Discussion

As in previous years, most population data come from the smaller colonies; nevertheless, it is useful to document the establishment and growth of these colonies as fully as possible, given that so few colonies exist. It is hoped that more frequent monitoring of several larger colonies (Grassholm in Wales, and Noss and Hermaness in Shetland) will be established in the near-future. Planning for the next full census of British and Irish gannets, to follow up the 1984-85 census (Wanless 1987), is already underway (S Wanless & S Murray, pers. comm.).

Table 2.6.1 **Population changes at individual gannet colonies, 1991-92** (peak counts of apparently occupied nests in June-July).

	Fair Isle (Shetland)	Troup Head (Banff & Buchan)	Bempton (Humberside)	Ireland's Eye (Dublin)
1991	687	94	1257	39
1992	781	278	1365	47
% change	+13.7	+195.7	+8.6	+20.5

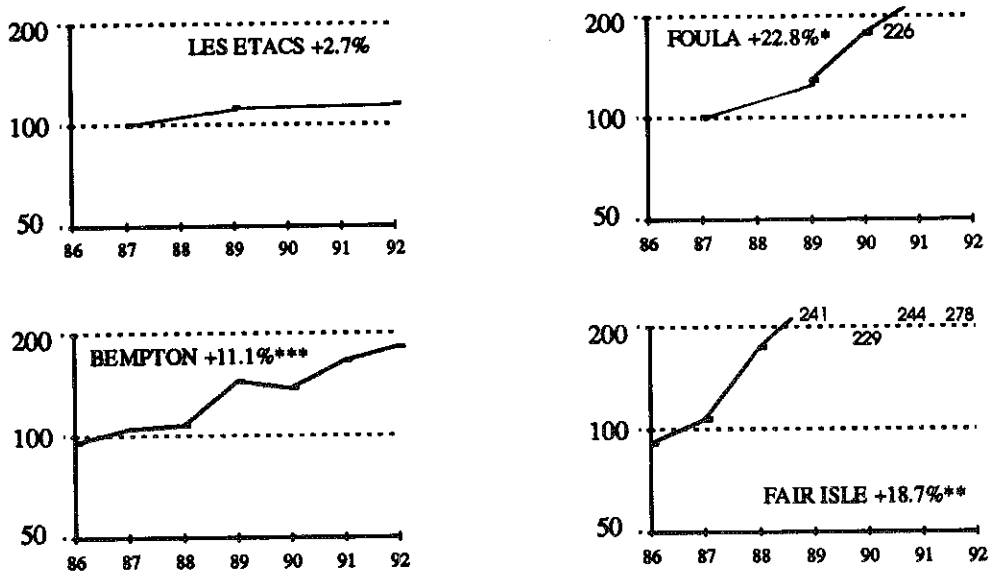

Figure 2.6.1 **Population indices for monitored gannet colonies, 1986-92 (occupied nests or sites in June/July).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01; *** P<0.001).

Table 2.6.2 **Gannet breeding success, 1986-92**: number of chicks fledged per occupied nest or per egg/apparently incubating adult. For 1991 and 1992, productivity is presented as mean & standard error of figures from three or more plots (equivalent to mean & half-range for two plots); n = numbers of nests (plots). * indicates coverage of most visible parts of colony.

Colony	1986-90 fledged/nest			1991 fledged/nest			1992 fledged/nest		
	yrs	**mean**	s.e.	n	**mean**	s.e.	n	**mean**	s.e.
Ailsa Craig (Kyle & Carrick)**		-		62(1)	**0.66**		62(1)	**0.77**	
Hermaness, Unst (Shetland)	2	**0.70**	0.08	457(1)	**0.75**		247(1)	**0.60**	
Noss a (Shetland)	5	**~0.70**	0.01	355(4)	**~0.63**	0.02	377(4)	**~0.62**	0.04
Noss b		-			-		178(2)	****0.78**	0.03
Fair Isle (Shetland)	5	**0.66**	0.06	150	**0.52**		129	**0.73**	
Troup Head (Banff & Buchan)	3	**~0.65**	0.19		-		237(*)	**~0.57**	
Bempton (Humberside)	5	**0.77+**	0.04	141(4)	**0.67**	0.02	136(6)	**0.86**	0.02

~ = figures based on comparison of August count of chicks with peak or single May/June count of occupied, well-built nests; other figures are based on regular checks of mapped nests. ** = based on 'active nests' (egg or apparent incubation recorded).

2.7 Cormorant *Phalacrocorax carbo*

Breeding numbers (table & figure 2.7.1)

Population changes from 1991 to 1992 varied between regions, but the only major decrease occurred (again) in Shetland, where all colonies are monitored. Over the period 1986-92, numbers in most coastal regions have been increasing, with significant upward trends seen for SE Scotland and NE Ireland. A complete census of Caithness (N Scotland) colonies indicated no overall change since 1986, however, while the total Shetland population has declined significantly, to only 60% of its 1987 level. Numbers nesting at monitored Welsh colonies fell by over 20% between 1990 and 1991, but made some recovery in 1992.

Growth at inland colonies in England has been very marked, with more than a threefold increase between 1986 and 1992, and a 42% increase 1991-92. A total of 617 nests were occupied at these colonies in 1992, including 414 nests at Abberton Reservoir (Essex). Five other colonies, all established during 1988-92, held between 6 and 76 nests each, while three other colonies had been occupied temporarily during 1988-90.

Breeding success (table 2.7.1)

As in previous years, only limited information is available. Cormorants at the North Sutor colony (Ross & Cromarty) had another successful season, with two study plots averaging 2.61 ($\pm$ s.e. 0.04) chicks fledged per nest (n = 112), similar to 1991 (2.54). Both colonies in Strangford Lough (Co Down) had good productivity (an improvement over 1991). In Shetland, brood sizes of productive nests were high, averaging 3.1 chicks (compared to 3.0 in 1991 and 2.6 in 1990).

Discussion

Coverage of cormorant colonies for population monitoring has markedly improved during 1991 and 1992, in large part through the ongoing Cormorant Breeding Colony Survey organised by Sellers (1993). Counts collated for this survey, and for the Seabird Colony Register, will continue to be combined. There are still some regions where improved coverage is needed, particularly the west coast of Scotland. Anyone who may be able to help is asked to contact P M Walsh (JNCC) or Dr R M Sellers (Rose Cottage, Ragnall Lane, Walkley Wood, Nailsworth, Glos. GL6 ORU).

Table 2.7.1 **Population changes at monitored cormorant colonies, 1991-92** (apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <50 AONs are excluded.

	SW Scotland	Shetland	Orkney	N Scotland	SE Scotland	NE England
1991	103	272	215	349	510	316
1992	122	225	186	344	478	322
% change	+18.4[2]	-17.3[7]	-13.5[2]	-1.4[2]	-6.3[5]	+1.9[3]

	INLAND, England	SW England	NW England & Isle of Man	Wales	NE Ireland
1991	434	425	69	760	205
1992	617	408	68	862	206
% change	+42.2[6]	-4.0[7]	-1.4[4]	+13.4[11]	+0.5[2]

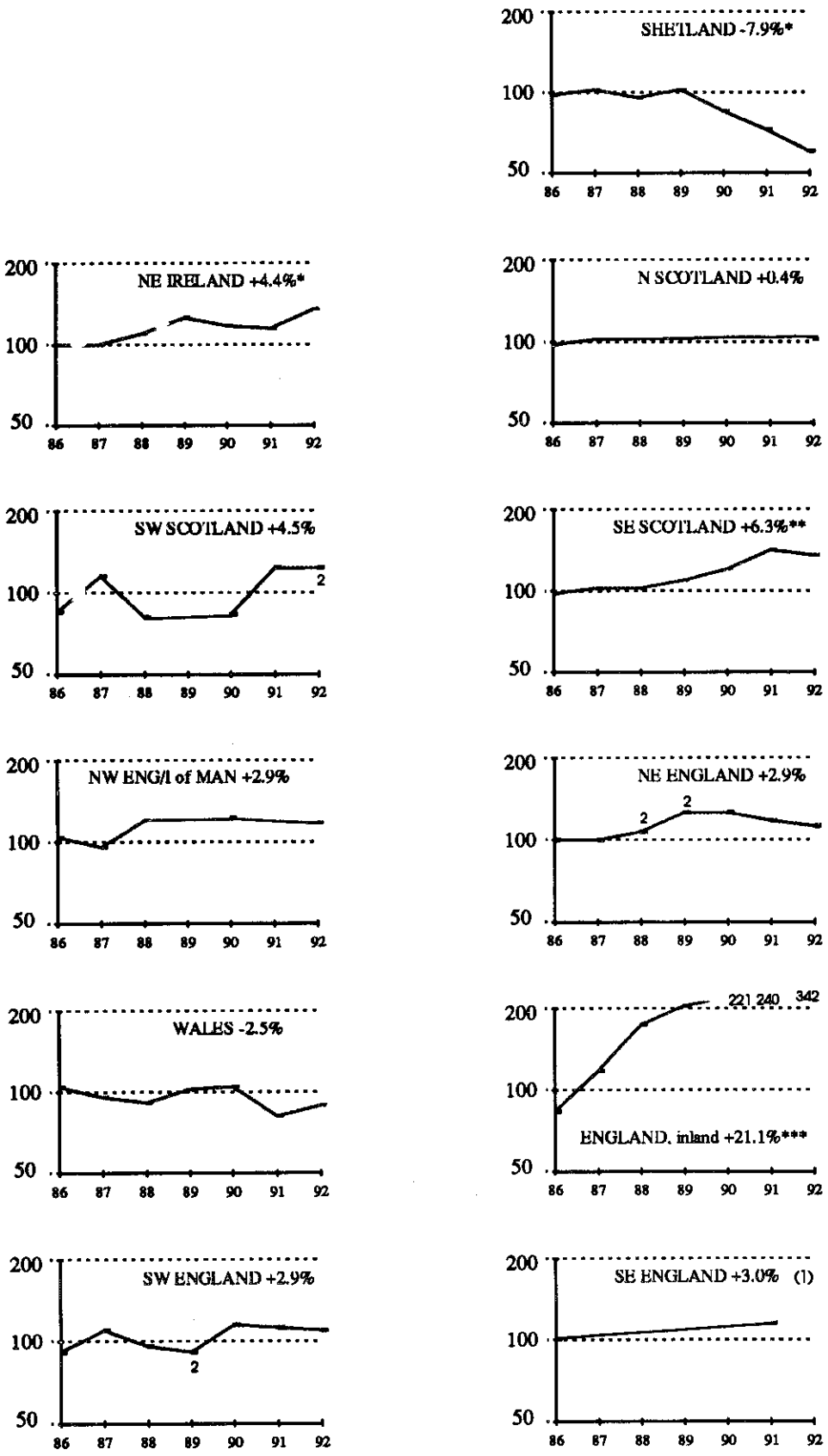

Figure 2.7.1 **Population indices for breeding cormorants, 1986-92 (occupied nests or sites in May/June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01. Broken trend lines are based on sample counts of 50-200 AONs. Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.8 Shag *Phalacrocorax aristotelis*

Breeding numbers (table & figure 2.8.1)

Counts on sections of the Shetland coast in 1992 indicate a continued, slight decline compared to 1989 counts, although differences in count dates (and a later season in 1992) may have contributed at some colonies. The monitored population in Shetland has shown a significant overall decline during 1986-92, but the decline at Sumburgh Head, at least, appears to have halted.

Numbers in most other regions increased slightly between 1991 and 1992, and 1986-92 population indices for the east coast of Britain indicate stable or increasing numbers (significant increase for NE England). Counts on part of the Grampian coast in 1992 indicated a doubling of numbers compared since 1986. Numbers at sample colonies in SW England appear to have declined slightly since 1987.

Breeding success (table 2.8.2)

Average productivity was again high at monitored colonies, with an average 1.9 chicks (± s.e. 0.12) estimated to have fledged per incubating pair at 15 colonies. This was slightly higher than in 1991, but there was no significant change either overall or regionally. Nevertheless, success was above average for recent years at most individual colonies. Only two colonies (Canna and the Isle of May) averaged <1 chick/nest. There was no obvious geographical pattern to the results overall, and Shetland birds (1.46 ±0.07 chicks/nest) were as successful as those in other regions.

Discussion

Coverage of colonies for productivity-monitoring was again improved, with the addition of four new study-colonies in 1992, in Shetland and the Moray Firth. Improved coverage elsewhere (particularly on western/southwestern coasts) would be useful.

Variability in the timing of breeding by shags is well-known, and continues to cloud trends to some extent, e.g. in Shetland. The proportion of 'adults' which breed also appears to vary, and may account for some of the fluctuations seen within regional trends. Assessment of longer-term trends is thus important. In Shetland, counts of shags in 1993 and subsequent seasons will be particularly crucial following the wreck of the tanker *Braer* near Sumburgh Head in January 1993, which resulted in a known mortality of over 800 shags (the main species affected).

Table 2.8.1 **Population changes at monitored shag colonies, 1991-92** (apparently occupied nests in May-June). Superscript = number of colonies with 10+ AONs counted in 1991; counts with a reported inaccuracy of >±5%, and regional samples <100 AONs, are excluded.

	Shetland	N.Scotland	SE Scotland	NE England	NW Scotland
1991	764	335	2891	1716	918
1992	725	343	3050	1871	925
% change	-5.1[5]	+2.4[3]	+5.5[6]	+9.0[1]	+0.8[1]

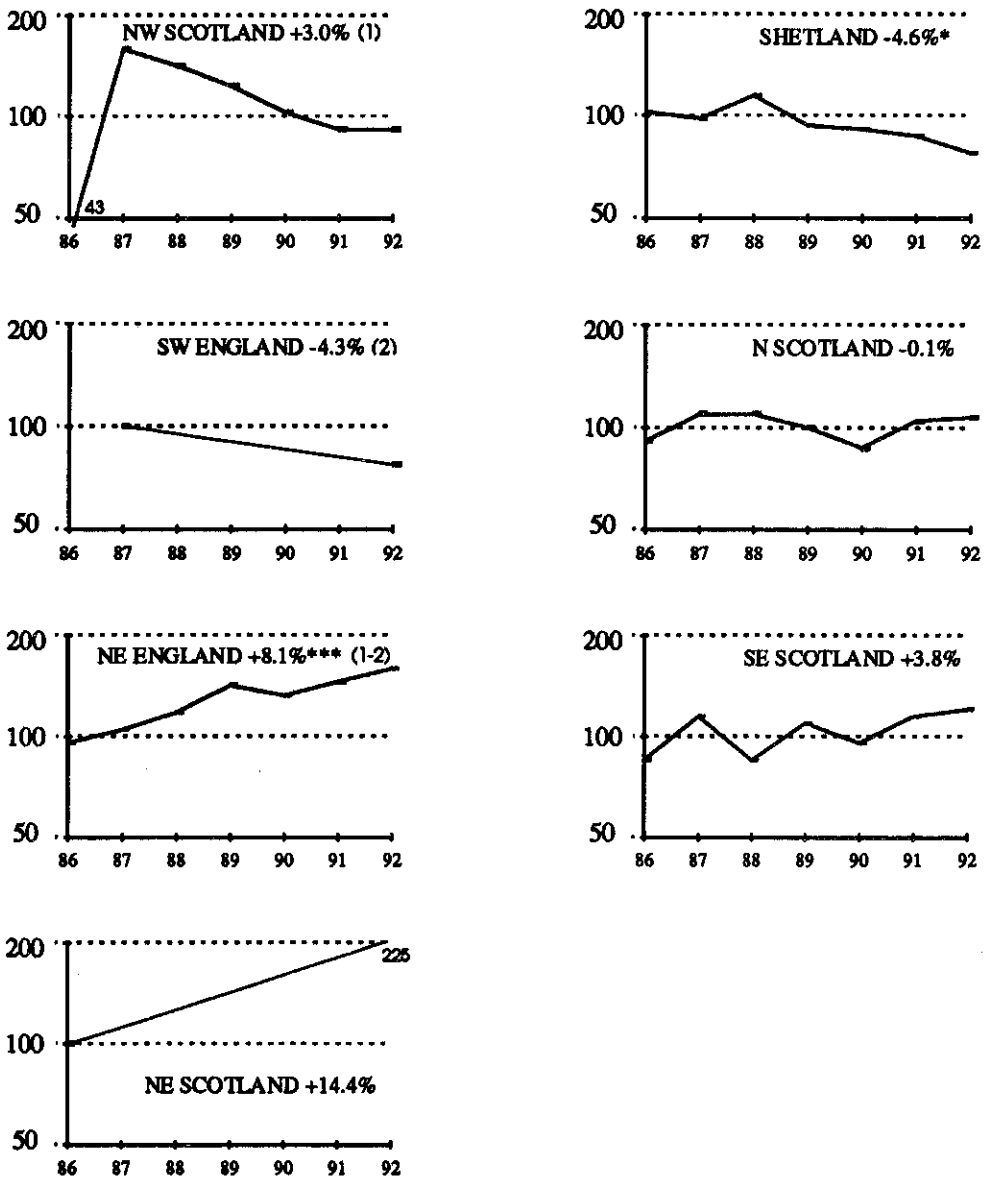

Figure 2.8.1 **Population indices for breeding shags, 1986-92 (apparently occupied nests in late May/June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01; *** P<0.001). Broken trend lines are based on samples of 50-200 AONs. Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

Table 2.8.2 **Shag breeding success, 1986-92**: number of chicks fledged per active nest (where eggs or apparent incubation recorded). For 1991 & 1992, productivity is presented as mean & standard error if based on three or more study-plots (equivalent to mean & half-range for two plots); n = number of nests (plots). * indicates coverage of most visible parts of colony.

Colony	1986-90 fledged/nest			1991 fledged/nest			1992 fledged/nest		
	yrs	**mean**	s.e.	n	**mean**	s.e.	n	**mean**	s.e.
Colonsay (Argyll & Bute)	4	**1.59**	0.13	21(2)	**1.98**	0.10	15(2)	**1.8**	0.05
Canna (Lochaber)	**5**	**1.62**	0.17	33	**1.15**		45	**0.93**	
Hermaness Unst (Shetland)	2	**0.40**	0.11	83	**1.02**		90	**1.45**	
Kettlaness (Shetland)		-			-		19(2)	**1.58**	
Troswick Ness (Shetland)		-			-		12(2)	**1.42**	
Sumburgh Head (Shetland)	3	**1.06**	0.23	38(3)	**0.97**	0.08	111(6)	**1.22**	0.13
Fair Isle (Shetland)	5	**1.28**	0.09	95	**1.18**		74	**1.65**	
North Sutor (Ross & Crom.)		-			-		36	**1.58**	
Isle of May (NE Fife)	5	**0.79**	0.15	187(14)	**1.06**	0.11	181(14)	**0.87**	0.13
St Abb's Hd (Berwickshire)	1	**0.76**		-	**1.80**		145(7)	**1.84**	0.10
Farne Isds (N'humberland)	4	**1.4**	0.12	266(10)	**0.83**	0.13	238(9)	**1.56**	0.10
Berry Head (Devon)	-	-	-	7(*)	**1.42**		4(*)	**2.75**	
Guernsey (Channel Isds)	3	**0.93**	0.06	125(12)	**1.54**		53(9)	**1.60+**	
Bardsey (Gwynedd)	1	**1.76**		17(*)	**1.82**			-	
Calf of Man (Isle of Man)		-		52(2)	**2.01**	0.13	84(3)	**1.77**	0.07

Arctic skua *Stercorarius parasiticus* D. Suddaby

Breeding numbers (tables 2.9.1-3)

A complete census of arctic skuas in Orkney (last censused in 1982) and Shetland (last censused in 1985/86) was made in 1992, coordinated by RSPB. The total of apparently occupied territories (AOTs) increased to 1056 (+2%) on Orkney and decreased to 1878 (-2%) on Shetland.

Numbers at monitored colonies on Shetland increased by 11.7% between 1991 and 1992, a reversal of recent trends. All of the increases between 1991 and 1992 have occurred at colonies close to large arctic tern colonies; Mousa (+56%), Fetlar (+32%), Noss (+13%), Foula (+13%) and Fair Isle (+10%). Numbers on Papa Westray, Orkney increased by 21% between 1991 and 1992, but accurate comparable data are not available for other Orkney colonies for these two years. On Lewis (Western Isles) numbers increased by 16% to 36 AOTs at the main colony, continuing the increase noted each year in the period 1988-91.

Breeding success (table 2.9.4)

An increase in breeding success was evident throughout Shetland in 1992. At monitored colonies, other than Foula and Fair Isle, the mean clutch size increased significantly to 1.92 ($p<0.01$), with high hatching success (83%) and very few addled eggs (2.5%). Productivity figures at all but two colonies, including Foula and Fair Isle, ranged from 0.95-1.60 chicks/territory, matching available pre-1987 productivity figures (0.94-1.21 at various colonies: Furness 1987).

On Orkney a slight increase in breeding success was evident at some colonies in 1992. At monitored colonies the mean clutch size of 1.85 was not significantly different to 1990 or 1991. Hatching success (66%) was lower than in Shetland. Average productivity (0.66 chicks/territory) was higher than in 1991, but below the average for Shetland (1.13, excluding Foula and Fair Isle) in 1992.

Discussion

Total population figures for both Orkney and Shetland have changed little since the last complete survey in the early to mid 1980s. On Orkney there has been a marked redistribution of birds within the islands. The Hoy population decreased by 48% between 1982 and 1992, contrasting with increases on several islands, notably Flotta where numbers rose by 208% to 80 AOTs. It is thought that this redistribution of birds may be a result of increased competition from great skuas (E. R. Meek pers. comm.). On Shetland there was only a 2% decrease in the census total between 1985/86 and 1992. Here too, there was a marked redistribution of birds. Numbers on Unst rose by 30%, from 207 to 346 AOTs but most other parts of Shetland showed little change or decreases.

Numbers at regularly monitored colonies on Shetland increased by 11.7% between 1991 and 1992 after having shown a steady decline since the late 1980s (e.g. -4.5% 1989-90, -4.8% 1990-91: Walsh *et al.* 1990, 1991). This increase in numbers, also noted on Foula, is presumably due to immigration or to birds returning that have not held territories in the past two or three years (Furness 1992). The increased availability of sandeels in 1991 and 1992, and the rise in arctic tern numbers and productivity, have probably allowed an increase in arctic skua breeding numbers by increasing opportunities for skuas to steal food from terns. In Shetland, numbers close to large tern colonies have increased by between 10 and 55%, while there has been a decrease of between 14 and 20% at colonies distant from large terneries (RSPB, unpublished).

Most monitored colonies on Shetland showed an improvement in breeding success, the exceptions being Mousa and Noss. Mousa suffered predation by otters *Lutra lutra* and Noss from persistent disturbance of incubating adults by great skuas, causing low hatching success (38%). Post-fledging mortality as a result of attacks from great skuas was noted on Foula, Fair Isle and at six colonies on Shetland.

Although breeding success on Orkney was slightly better than in most of the monitored colonies, predation at some colonies remains a problem. On Hoy predation of large chicks by great skuas was again common, but a few chicks did manage to fledge. On Westray, as in 1991, predation of eggs by sheep and common gulls caused many pairs to fail.

More systematic monitoring at colonies off western Scotland would be useful for comparison with the Northern isles.

Table 2.9.1 **Population changes at monitored arctic skua colonies in Shetland, 1991-92** (apparently occupied territories in late May/June). Superscript = number of colonies counted in both years.

	Foula	Fair Isle	other Shetland	total Shetland
1991	141	99	270	480
1992	159	109	268	536
% change	+12.8	+10.1	-0.7^{11}	$+11.7^{13}$

Table 2.9.2 **Population changes of arctic skuas in Orkney, 1982 - 1992** (apparently occupied territories in late May/June/early July).

	Rousay	Hoy & South Walls	other Orkney	total Orkney
1982	97	408	529	1034
1992	137	211	708	1056
% change	+41.2	-48.3	+33.8	+2.1

Table 2.9.3 **Population changes of arctic skua in Shetland, 1985/86 - 1992** (apparently occupied territories in late May/June/early July).

	Foula	Fair Isle	Other Shetland	Total Shetland
1985/86	164	115	1633	1912
1992	159	109	1610	1878
% change	-3.0	-5.2	-1.4	-1.8

Table 2.9.4 **Arctic skua breeding success, 1986-92**: number of chicks fledged per apparently occupied territory (AOT).

Colony	1986-1990	fledged per AOT		1991 fledged per AOT		1992 fledged per AOT	
	years	mean	se	n	mean	n	mean
Handa	3	**1.15**	0.07	28	**1.28**		
SHETLAND							
Unst (2 colonies)	3	**0.14**	0.05	50	**0.60**	43	**0.95**
Fetlar (2 colonies)	4	**0.04**	0.03	19	**0.84**	25	**1.60**
Yell (2 colonies)	3	**0.20**	0.09	34	**0.88**	28	**1.54**
Papa Stour	3	**0.00**	-	88	**0.51**	90	**-**
Noss	5	**0.30**	0.11	15	**0.67**	17	**1.18**
Mousa	2	**0.00**	-	16	**0.75**	25	**0.68**
Mainland (3 colonies)	3	**0.07**	0.04	48	**0.52**	40	**0.95**
SHETLAND mean excl. Foula and Fair Isle	4	**0.12**	0.03	270	**0.68**	178	**1.13±0.12**[11]
Foula	4	**0.31**	0.23	141	**>0.78**	159	**1.07**
Fair Isle	3	**0.59**	0.41	99	**0.75**	109	***c*1.20**
ORKNEY							
North Hill, Papa Westray	2	**0.29**	0.18	125	**0.73**	151	**0.79**
Westray	1	**0.40**	-	30*	**0.43**	33	**0.51**
Rousay	2	**0.48**	0.20	122	**0.76**	30*	**0.65**
Flotta	1	**0.95**	-	23*	**0.83**	24	**0.75**
Lushan Basin, Mainland	2	**0.56**	0.03	21*	**0.86**	22	**1.09**
Hoy	1	**0.09**	-	21*	**0.00**	20	**0.20**
ORKNEY mean	2	**0.43**	0.01	342	**0.60**	280	**0.66±0.12**[6]

*Occupied nests in intensively-monitored colonies

Great skua *Stercorarius skua* D. Suddaby

Breeding numbers (tables 2.10.1-2)

A complete census of great skuas in Orkney (last censused in 1982) and Shetland (last censused in 1985/86) was made in 1992, coordinated by the RSPB. The total of apparently occupied territories (AOTs) increased to 2018 (+22%) on Orkney and to 6196 (+10%) on Shetland.

On Shetland breeding was protracted, with numbers at monitored colonies increasing during June. This was especially noticeable at the smaller mainland colonies, and probably a reflection of food availability. On Fair Isle there had been little change in numbers between 1986 and 1991, but in 1992 there was a 39% increase to 110 AOT's (Harvey *et al* 1992). In contrast, numbers on Foula fell by 5% between 1991 and 1992 to 2174 AOTs (a net decline of 12.9% since 1986), and nonbreeding numbers were down on the 1990 and 1991 figures (Furness 1992).

On Lewis (Western Isles) the main colony increased by 17%, from 15 AOTs in 1991 to 18 AOTs in 1992. There was little change on Hirta, St Kilda where 53 nests were found (52 in 1991).

Breeding success (table 2.10.3)

On Shetland, average breeding success was very similar to 1991, with 0.7 chicks fledged/territory (excluding Foula and Fair Isle). At monitored colonies, excluding Foula and Fair Isle, the mean clutch size and hatching success were similar to 1991. As in 1991, productivity on Hermaness, Yell, Fetlar and Noss was higher than three mainland colonies which fledged only 16 young from 58 pairs (0.28 fledged/territory) in 1992. On Foula and Fair Isle productivity was down on the 1991 figures. On Hoy, average productivity fell from 0.8 fledged/territory in 1991 to 0.55 in 1992, figures from one colony decreasing from 1.08 in 1991 to 0.5 in 1992.

Discussion

Population figures for both Orkney and Shetland have increased since the last complete survey in the early to mid 1980s. On Orkney the great majority of the increase has taken place on Hoy, but it is notable that numbers on Stronsay and Rousay have doubled (to 15 and 31 AOTs respectively) and that Flotta, Burray and probably Shapinsay have been newly colonised. On Shetland, breeding numbers in most of the areas have increased by between 25 and 110%, but on Foula, and in North and West Mainland numbers have decreased by between 6 and 24%. Foula remains the largest colony in the world with 2174 AOT's.

Productivity figures from Shetland colonies show considerable variation, to a large extent reflecting the amount of cannibalism noted at each colony. On Hermaness, Yell and Fetlar relatively little cannibalism was noted, whereas at the mainland colonies cannibalism of small chicks by adults with large chicks became obvious during July. On Foula, chick survival was good and adult attendance high up to 10 July, but conditions deteriorated rapidly after this date and adult attendance slumped, resulting in heavy predation by other adults (Furness 1992).

On Hoy (Orkney) there was very little variation in breeding success from three colonies. As in 1991, extensive cannibalism accounted for many chick deaths, being especially common at colonies in the northwest and the east of Hoy.

As with arctic skua, more systematic monitoring in the west of Scotland would be useful for comparison with the Northern Isles.

Table 2.10.1 **Population changes of Great Skua in Orkney, 1982 - 1992** (apparently occupied territories in late May/June/early July).

	Hoy & South Walls	other Orkney	total Orkney
1982	1573	79	1652
1992	1900	118	2018
% change	+20.8	+49.4	+22.1

Table 2.10.2 **Population changes of Great Skua in Shetland, 1985/86 - 1992** (apparently occupied territories in late May/June/early July).

	Foula	Fair Isle	other Shetland	total Shetland
1985/86	2495	84	3068	5647
1992	2174	110	3912	6196
% change	-12.9	+30.9	+27.5	+9.7

Table 2.10.3 **Great Skua breeding success, 1986-92**: number of chicks fledged per apparently occupied territory (AOT).

Colony	**1986-1990**	**fledged per AOT**		**1991 fledged per AOT**		**1992 fledged per AOT**	
	yrs	mean	se	n	mean	n	mean
Handa (Sutherland)	2	**1.17**	0.01	89	**1.28**		
SHETLAND							
Hermaness	3	**0.74**	0.15	44	**1.14**	44	**1.07**
Fetlar (1 colony)	2	**0.16**	0.03	51	**0.73**	25	**1.12**
Mainland (3 colonies)	-	-	-	44	**0.18**	58	**0.28**
Yell (1 colony)	-	-	-	16	**0.93**	23	**0.96**
Noss	3	**0.36**	0.17	15	**0.47**	51	**0.69**
SHETLAND mean excl. Foula and Fair Isle	3	**0.47**	0.07	170	**0.69**	201	**0.67±0.15**[7]
Fair Isle	2	**0.74**	0.04	79	**0.70**	110	**0.5-0.8**
Foula	4	**0.47**	0.15	-	**0.60**	2174	**0.4-0.5**
ORKNEY							
NW Hoy	2	**0.89**	0.06	30*	**0.50**	32	**0.50**
S Hoy	-	-	-	30*	**0.83**	33	**0.65**
E Hoy	-	-	-	24*	**1.08**	26	**0.50**
HOY mean				84*	**0.80**	91	**0.55**

2.11-2.15 Black-headed gull *Larus ridibundus* to great black-backed gull *L. marinus*

The 1991 report included only a brief summary for these species, so 1991 and 1992 results are summarised in more detail here.

2.11 Black-headed gull *Larus ridibundus*

Breeding numbers 1991 and 1992 (table & figure 2.11.1)

Available data are limited , and in some cases amount to counts of only one or two colonies in a region. 1991-92 and 1992-93 changes vary markedly between the regional samples (and between years), most notable being a 28% decrease at colonies in NE England in 1991 and a 37% increase at sampled colonies in NE Ireland the same year. No significant trends are evident in any region over the period 1986-92.

Breeding success 1991 and 1992

As usual, only limited systematic data (chicks fledged by known numbers of breeding pairs) are available. At Sands of Forvie (Grampian), 370 pairs failed almost totally in 1991, fledging <0.01 chicks fledged/pair in 1991; predation by herring gulls and foxes *Vulpes vulpes* was responsible. Productivity here during 1986-90 was very variable (ranging *c* 0.04-1.04 chicks/pair). At five coastal colonies in Argyll & Bute, only 0.11+ chicks/nest fledged from 523 nests with eggs in 1991; predation by mink *Mustela vison* caused total failure at two of the colonies, while the most successful colony (0.40+ chicks/nest) apparently escaped predation. Some colonies in Shetland produced few chicks in 1992, as in several recent years. In Lincolnshire, 1800 pairs at Frampton Marsh fledged <0.01 chicks/pair in 1991, mainly a result of high tides washing out nests; high tides also resulted in 3100 pairs at Warham saltmarsh (Norfolk) fledging few chicks in 1991. Birds at Chichester Harbour (W Sussex) had a successul season in 1992 (0.7+ chicks/pair), as in 1990.

Discussion

Substantial movements of black-headed gulls can occur between colonies from year to year (or, in some cases, over the course of a single breeding season), and may produce major fluctuations in numbers at individual colonies (especially small ones). Where only a few colonies in a region are counted in a given year, true population changes may be masked by movements to or from other colonies. This is similar to the situation for breeding terns, but coverage of black-headed gull colonies is usually poorer. Some of the larger black-headed gull colonies, in particular, are irregularly counted, or their count accuracy is less clear, and population changes at other, smaller colonies may be less representative of particular regions. For example, in NW England, trends on the Ribble Estuary (which held *c*20 000 pairs in 1988: Lloyd *et al.* 1991) are not known. In SE England, the major colonies along the Solent coast held over 15 000 pairs in 1991 (Aspinall *et al.* 1993), but recent trends are not known with any accuracy, although numbers have fallen substantially since the early 1970s.

Monitoring of numbers would be helped by more complete coverage of colonies within given regions (ideally counted at about the same stage of the breeding season: Aspinall *et al.* 1993). However, coverage is undoubtedly better than the data available for this report would suggest, and anyone who

can contribute regular counts (including counts for previous years) is asked to contact the report compilers. For example, observers providing tern data to RSPB could also report (and count) breeding gulls.

Breeding success of black-headed gulls, as for terns, continues to be highly variable at coastal colonies, with high tides and predation the main adverse factors at most colonies. Again, coverage is incomplete (and probably not all systematic data have been collated), further data would be welcomed for next year's report, which may include a table summarising recent figures.

Table 2.11.1 **Population changes at monitored coastal black-headed gull colonies, 1990-91 and 1991-92** (breeding pairs/apparently occupied nests in May/June). Superscript = number of colonies with 10+ pairs counted in baseline year; counts with a reported inaccuracy of > ±15%, and regional samples <200 pairs, are excluded.

	NE Scotland	NE England	SE England	NW England	NE Ireland
1990	571	4071	1834	1050	3608
1991	370	2909	1271	1700	4935
% change	(-35.2)[1]	-28.5[3]	-30.7[2]	+61.9[2]	+36.8[>5]
1991	-	-	942	1700	4935
1992	-	-	1322	520	5735
% change	-	-	(+40.3)[1]	(-69.4)[2]	+16.2[>5]

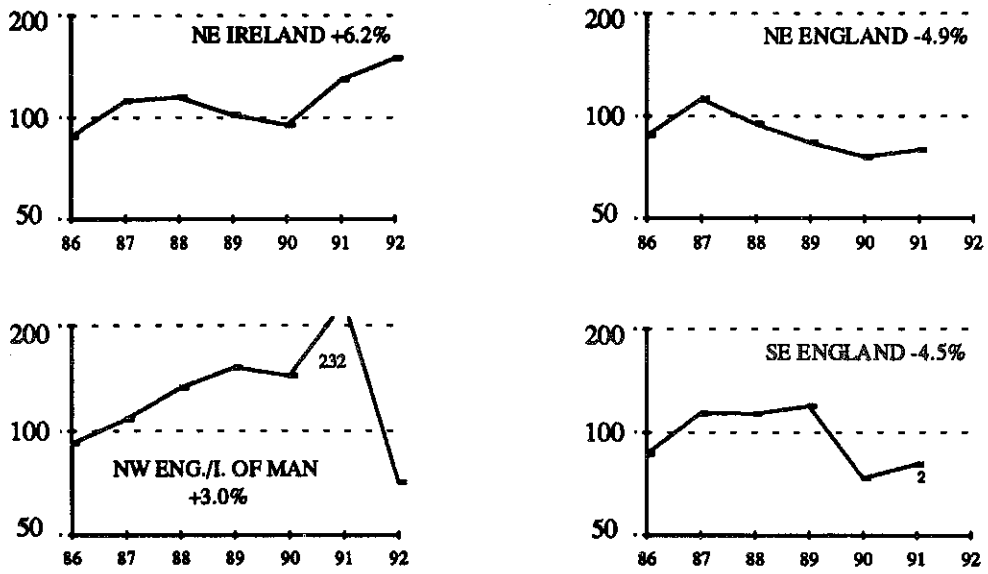

Figure 2.11.1 **Population indices for breeding black-headed gulls, 1986-92 (pairs or apparently occupied nests in May/June).** Average annual rates of change are calculated by regression of log of index against year (no significant trends). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.12 Common gull *Larus canus*

Breeding numbers 1991 and 1992

Only a few, small coastal colonies are counted regularly, with counts in most cases suggesting stable or increasing numbers during the period 1986-92 (Seabird Colony Register unpublished). Trends in the larger (coastal or inland) colonies are generally unclear. In NW Ireland, preliminary results of a 1992 survey of inland gulls suggest a *c*38% decrease for this species since 1977 (Whilde 1992).

Breeding success 1991 and 1992

Only limited systematic data (estimates of chicks fledged from known numbers of pairs) are available. Productivity was assessed at a sample of coastal colonies in western Scotland in 1992. Seven colonies (*c*300 nests) in Lochaber fledged an average of *c*0.35 chicks/nest overall (range 0.0-0.55), while nine colonies (*c*90 nests) in Argyll & Bute averaged *c*0.1-0.15 chicks/nest (range 0-0.5). Predation (largely by mink) was recorded at many of these colonies, including most of the six colonies which failed totally. On Fair Isle (Shetland), nine pairs averaged 0.22 chicks fledged/nest in 1991 and ten pairs failed totally in 1992; 1989-90 figures here were 0.9-1.1 chick/nest. Other, less systematic data indicated a poor season at most colonies visited in mainland Shetland in 1992; in Orkney, productivity was variable at Mainland colonies in 1991, but high on Hoy.

Discussion

Many coastal colonies of this species are small and often susceptible to predation or other local factors, so representative data on population trends and breeding success may be difficult to obtain. Systematic data for more of the larger colonies (for example in the Northern Isles) would be useful.

2.13 Lesser black-backed gull *Larus fuscus*

Breeding numbers 1991 and 1992 (table & figure 2.13.1)

The Isle of May population (SE Scotland) showed at substantial increase in 1991, as did the Welsh sample (mainly Skomer and Skokholm). For Wales, the 1991-92 change is uncertain because of difficulties in estimating numbers at the main colony (Skomer). Population indices for both regions indicate increasing numbers during 1986-92, although in neither case is the trend significant. The trend shown for SW England is based on Annet (Isle of Scilly), where numbers of occupied nests fell from 1000 in 1987 to 799 in 1992. For other regions, sample sizes are much smaller but the counts generally appear to indicate increasing or stable numbers during 1986-92. In NW Ireland, preliminary results of a survey of inland colonies in 1992 suggest that numbers have approximately halved since 1977 (Whilde 1992).

Breeding success 1991 and 1992

On Skomer, productivity averaged *c*0.45 chicks fledged/nest in 1991, a low figure but much higher than in 1989-90 (when average was only 0.02-0.04/nest). Success was poor in 1992, but detailed figures have not been collated yet. Productivity averaged *c*0.54 chicks fledged/nest on the Isle of May in 1991, but improved markedly to *c*1.04/nest in 1992 (1989 and 1990 figures were 0.98 and 0.54, respectively). No systematic data were available for other colonies, but success was apparently poor on Annet and several other islands in the Isles of Scilly in 1992. At Warham saltmarsh (Norfolk), eleven pairs probably failed totally in 1991 because of high tides (cf. black-headed gull).

Discussion

Population trends for this species, both in recent years and since 1969/70 (Lloyd *et al.* 1991), have generally indicated increasing (or at least stable) numbers, in contrast to herring gull. Factors other than breeding success may be important, but further data on breeding success of the two species for individual colonies or regions would be useful. Results from Skomer and other colonies in south Wales in recent years, where lesser black-backed gulls have reared very few chicks, indicate that differences in the feeding ecology may have an important influence on breeding output. In the case of Skomer birds, one possibility is that the availability of discarded fish from trawlers in adjacent parts of the Celtic Sea may have fallen, although the evidence is inconclusive (Perrins 1992, Stone *et al.* 1992).

Table 2.13.1 **Population changes at monitored coastal lesser black-backed gull colonies, 1990-91 and 1991-92** (breeding pairs/apparently occupied nests in May/June). Superscript = number of colonies with 10+ pairs counted in baseline year; counts with a reported inaccuracy of > ±15%, and regional samples <200 pairs, are excluded.

	SE Scotland	Wales
1990	618	16 318
1991	788	20 002
% change	(+27.5)[1]	+22.6[4]
1991	788	-
1992	751	-
% change	(-4.7)[1]	-

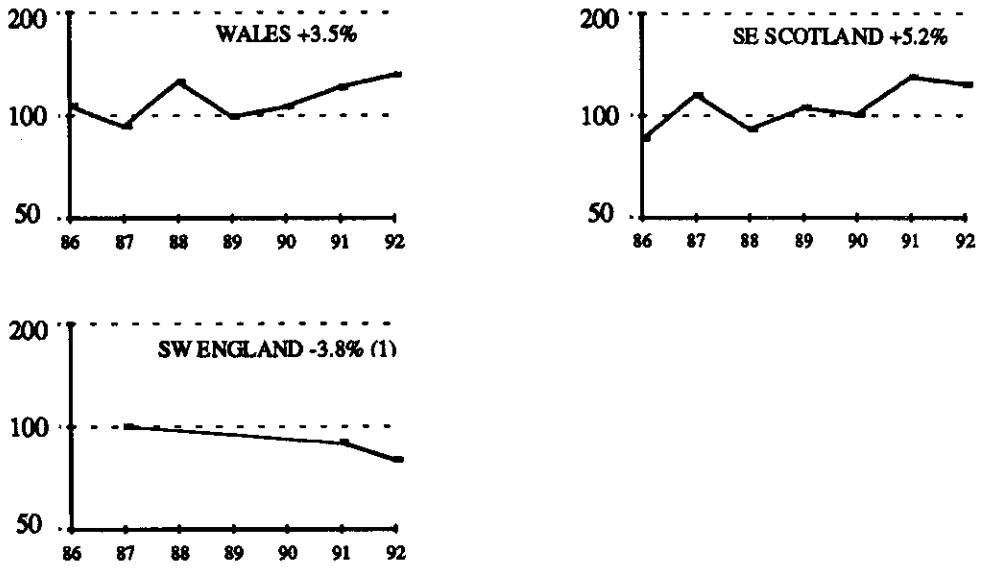

Figure 2.13.1 **Population indices for breeding lesser black-backed gulls, 1986-92 (pairs or apparently occupied nests in late May/June).** Average annual rates of change are calculated by regression of log of index against year (no significant trends). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.14 Herring gull *Larus argentatus*

Breeding numbers 1991 and 1992 (table & figure 2.14.1)

Most regional samples showed only slight population changes 1990-91 or 1991-92, or larger changes based on only one or two colonies. However, both SE Scotland and NE Ireland samples have shown significant decreases during 1986-92, including a 27% decrease 1991-92 for the latter (Strangford Lough colonies). In three other regions, numbers were roughly stable during 1986-92, although a 27% decrease was noted in the NW England/Isle of Man sample in 1992 (mainly reflecting a marked decrease at St Bee's Head). Elsewhere, available data cover small populations only, or are based on irregular counts. Results of the latter include a 60% decline on Fair Isle (Shetland) between 1986 and 1991 (262 to 107 apparently occupied nests) and a 15% increase on the Dunottar-Catterline coast (NE Scotland) between 1986 and 1992 (3202 to 3680 AONs). Preliminary results from a survey of inland populations in NW Ireland in 1992 indicate a 90% decline since 1977 (Whilde 1992).

Breeding success 1991 and 1992

Productivity of herring gulls on the Isle of May (SE Scotland) was again high, with estimates of *c*1.2 chicks fledged/pair in 1991 and *c*1.52/pair in 1992 (compared to *c*1.03-1.2 in 1989-90). Breeding success was only moderate on Canna (NW Scotland), at *c*0.75 chicks fledged/pair in 1991 and *c*0.9/pair in 1992 (compared to *c*1.6 in 1990). Only 57-60% of the Canna sample pairs had chicks in early July (compared to 77-83% in 1987-90 but 45% in 1986). In Shetland, 15 pairs on Noss averaged 1.0 chick/pair in 1991, while Mainland colonies visited in 1992 appeared to have a successful season. Productivity was high in Strangford Lough (NE Ireland), where 52 pairs on two islands fledged an average 1.71 chicks/pair in 1992 (1991 figure was 1.85/pair). Cliff-nesting birds on the Burton Bradstock/West Bay coast of Dorset were also very successful in 1992 (30 pairs fledged an average 2.4 chicks/pair in 1992). In the Isles of Scilly, productivity was moderately high on Gugh in 1991 and 1992 (probably 0.6+ chicks fledged/pair in both years). Few other figures are available: birds in Rye Harbour (E Sussex) reared *c*1.1 chick/pair in 1991, while most of the 70 pairs at Holkham NNR (Norfolk) in 1991 failed totally because of flooding by high tides.

Discussion

There was a good geographical spread of data on breeding success in 1991-92 and, while marked variations were seen between colonies, productivity was high in most cases. Populations are still declining in several areas, with little evidence of major increases anywhere. It seems likely that factors other than breeding success are having the greatest influence on numbers. A continuing factor behind some declines may be botulism, as suggested in previous reports. For example, incidents of botulism were again recorded in Strangford Lough (where breeding numbers are falling) in 1992.

Table 2.14.1 **Population changes at monitored coastal herring gull colonies, 1990-91 and 1991-92** (breeding pairs/apparently occupied nests in May/June). Superscript = number of colonies with 10+ pairs counted in baseline year; counts with a reported inaccuracy of > ±15%, and regional samples <200 pairs, are excluded.

	NW Scotland	NE Scotland	SE Scotland	Wales	NW England	NE Ireland
1990	1245	410	2004	1108	652	808
1991	1061	271	2027	1093	633	813
% change	-14.8[2]	(-33.9)[1]	+1.1[4]	-1.3[4]	(-4.4)[1]	+0.6[>5]
1991	711	-	2011	1315	660	813
1992	712	-	1948	1453	479	590
% change	(+0.1)[1]	-	-3.1[4]	+10.5[3]	-27.4[3]	-27.4[>5]

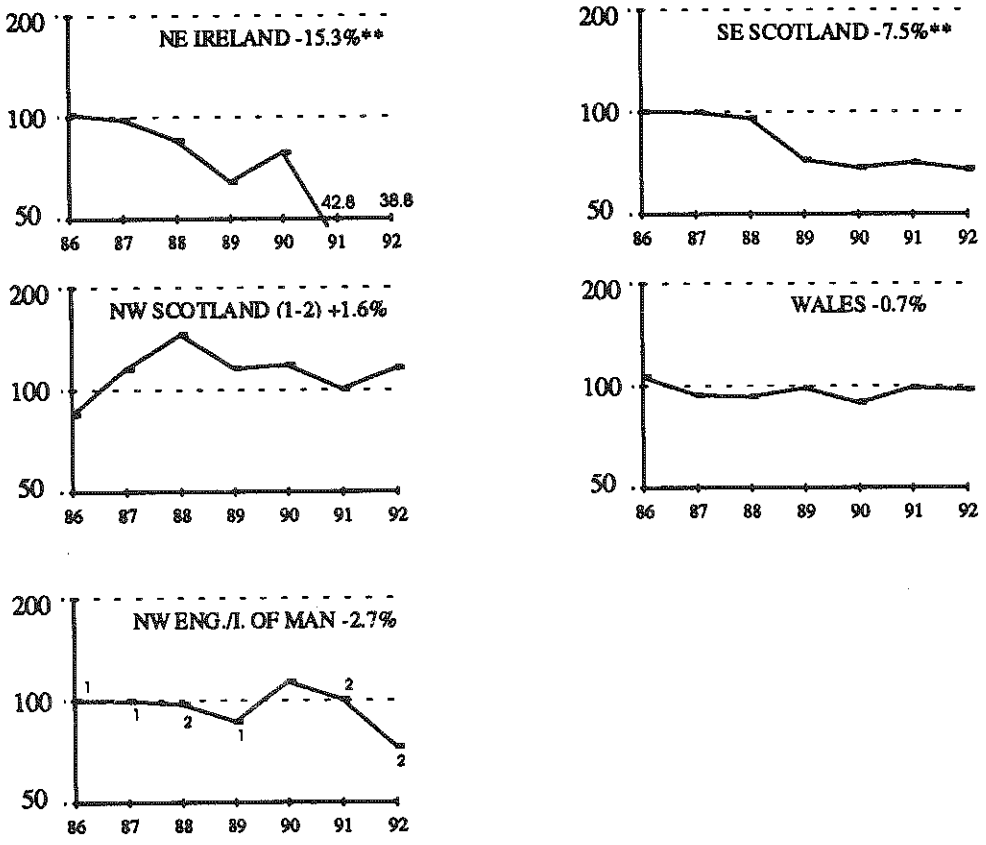

Figure 2.14.1 **Population indices for breeding herring gulls, 1986-92 (pairs or apparently occupied nests in late May/June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.15 Great black-backed gull *Larus marinus*

Breeding numbers 1991 and 1992 (table 2.15.1)

Very limited data are available, covering small regional samples only, and no attempt has been made here to assess regional 1986-92 trends in detail. On Noss (Shetland), numbers fell by 15-16% in both 1991 and 1992 (a net 32% decrease from 84 apparently occupied nests in 1986), although the population on Fair Isle increased by 41% between 1986 and 1991 (113 to 160 AONs). Net changes since 1986/87 for other colonies/populations have also been variable, and include a 25% increase on Canna (Lochaber) 1986-92 (to 75 apparently occupied territories); a 20% decrease on Annet (Isle of Scilly) 1987-92 (to 118 AONs); a 60% increase on Skomer (Dyfed) 1986-92 (to 40 AONs); a 22% decrease in Strangford Lough (Down) 1986-92 (to 67 AONs); and a 37% increase on Ireland's Eye (Dublin) 1986-91 (to 89 AONs).

Breeding success 1991 and 1992

Systematic data are available for four sites, and indicate good breeding success at each. At Nigg (Ross & Cromarty), 20 pairs fledged an estimated 2.0 chicks/nest in 1991, and 28 pairs averaged 1.86/nest in 1992. On Ailsa Craig (Kyle & Carrick), 56 pairs reared 1.84 chicks/nest in 1992. In Strangford Lough, 54 pairs reared 1.42 chicks/nest in 1992 (1.57/nest in 1991). Birds on Skokholm (Dyfed) in 1991 were slightly less succcessful: 19 nests fledged an average of 1.05 chicks (compared to 1.86/nest for 15 pairs in 1986). Elsewhere, breeding success on Hoy (Orkney) was apparently high in 1991, while chick-production at several colonies in Shetland was average or poor in 1992.

Discussion

As with other gull species, there is much scope for improvement of monitoring. For great black-backed gull, in particular, no regional samples of >100 pairs are regularly counted, in part because most populations are scattered in small colonies. More regular counts of some of the larger colonies (especially on the Northern Isles) would be useful, although accurate figures may be difficult to obtain.

Table 2.15.1 **Population changes at monitored coastal great black-backed gull colonies, 1990-91 and 1991-92** (breeding pairs/apparently occupied nests in May/June). Superscript = number of colonies with 10+ pairs counted in baseline year; counts with a reported inaccuracy of > ±15%, and regional samples <50 pairs, are excluded.

	NW Scotland*	Shetland	SW England	NE Ireland
1990	68	80	104	80
1991	75	68	102	66
% change	(+10.3)[1]	(-15.0)[1]	(-1.9)[1]	-17.5>[2]
1991	75	68	102	66
1992	75	57	118	67
% change	(0.0)[1]	(-16.2)[1]	(+15.7)[2]	+1.5>[2]

2.16 Kittiwake *Rissa tridactyla*

Breeding numbers (table 2.16.1, figures 2.16.1)

Population changes between 1991 and 1992 varied between regions, but were generally slight or based on small samples. On the North Sea coasts, slight overall decreases were noted for regional samples from Shetland south to Caithness, although some individual Caithness colonies showed increases. Increases were noted for all other east-coast regional samples, from NE Scotland south to SE England. No broad geographical patterns were apparent for 'west-coast' colonies, and there was much variation between individual colonies.

Regional population indices for the period 1986-92 indicate stable or increasing numbers in most regions during recent years (especially on North Sea coasts other than Shetland). Sampled colonies in Shetland have shown an overall significant decrease over this period (and a more marked decrease since 1981). [Note, however, that Shetland indices, relative to a 1986-87 baseline, are calculated using different combinations of colonies each year (Figure 3.16.1), so do not always agree with changes from one year to the next for smaller samples (Table 3.16.1).] Other significant regional trends were for sampled colonies in SE Ireland (significant decline during 1986-92) and for the single colony (Lowestoft) in E England (significant increase). In addition, counts in Grampian (NE Scotland) in 1992 indicated a *c*75% increase since 1986 at the main colonies, to over 110 000 occupied nests (Walsh 1993).

Breeding success (table 2.16.2, figure 2.16.2)

Overall productivity in 1992 was moderately high, with an average of 0.73 chicks (±s.e. 0.06) fledged per nest at 58 colonies. This represented a significant improvement over 1991 (average change +0.17 chicks/nest ±s.e. 0.05: $t_{51} = 3.4$, $P<0.01$), although most of this improvement reflected results for colonies along the North Sea coast.

As in previous years, the North Sea colonies were more successful overall than 'west-coast' colonies, and 28 colonies between Shetland and Suffolk fledged an average 1.03 ±0.06 chicks/nest in 1992. This was a significant increase compared to 1991 (average change +0.30 ±0.06 chicks/nest: $t_{27} = 4.6$, $P<0.001$). All individual North Sea regions showed this improvement, which was also significant for Shetland (where productivity at nine colonies averaged 0.84 ±0.16 chicks/nest) and along the Scottish east coast (eight colonies averaging 1.10 ±0.12 chicks/nest). Several colonies from Shetland south to SE Scotland averaged 1.3-1.5 chicks fledged per nest, higher than any colonies elsewhere.

Off the west coast of Britain, Handa (NW Scotland) was the only colony where productivity exceeded 1.0 chick/nest in 1992. All other monitored colonies from NW Scotland south to SW England reared ≤0.8 chicks/nest. No significant changes from 1991 were noted. Average productivity at five colonies along the west coast of Scotland was 0.62 ±0.17 chicks/nest (average change -0.17 ±0.11, n.s.). Figures were even lower at 'southwestern' colonies (NW England to SW England, and SE Ireland), where 19 colonies averaged only 0.37 ±0.05 chicks/nest in 1992 (average change +0.07 ±0.07, n.s.). Thus, for the second year in succession these southwestern kittiwake colonies have, overall, been the least successful in Britain or Ireland. The continued low success of some other individual colonies, off western Scotland and western Ireland, is also noteworthy.

Discussion

Results from 1992 indicate, yet again, that kittiwake at colonies in eastern Britain have been the most successful overall, both in terms of population change and of breeding success. Colonies in Shetland remain an exception, in population terms, but have largely recovered from a period of poor breeding during 1988-90 (when low availability of sandeels markedly reduced productivity of several seabird species). Improved success at the Shetland colonies appeared to fit in with a general improvement along the North Sea coast in 1992, so might be reflecting a general improvement in food availability at these colonies. In 1991, however, a more localised improvement in success was seen at the Shetland colonies, and productivity data for other North Sea regions during 1986-90 have not always shown common patterns (see previous reports: Walsh *et al.* 1990, 1991, 1992).

Colonies in SW Britain and SE Ireland again reared few chicks in 1992, and average productivity here has been <0.5 chicks/nest throughout 1989-92. Productivity of 1.0 chick/nest has been achieved in only 8 of the 95 colony-years 1986-92 for which data are available. Localised factors have, in some cases, been implicated in poor success, e.g. mammalian predation at some Isles of Scilly colonies (Robinson 1992). On the whole, however, there is little evidence that any individual colonies have tended to do better than the regional average, and it would seem that some broad factor, most likely food availability, is involved. This may be the case in parts of western Scotland and western Scotland also. Whether or not relatively poor success is a 'normal' feature of kittiwake colonies off western coasts is not clear, in the absence of long-term data-sets, although there is evidence of low or variable success at some Irish Sea colonies in previous decades (Harris & Wanless 1990).

During 1986-92, the only significant population trend at these southwestern colonies has been a significant decrease on the Waterford/Wexford coast in SE Ireland, largely dating from 1989; productivity at these colonies did not fall markedly until the same year, however. Populations in SW Britain and SE Ireland generally showed a net increase between 1969-70 and 1985-87, but rates of increase were less than in eastern Scotland and NE England (Lloyd *et al.* 1991). This may, in part, have reflected any differences in breeding output, although other population parameters (adult and immature survival rates, recruitment) may have been equally or more important. Monitoring of adult survival rates is underway at several JNCC-funded 'key sites' around Britain. It may prove possible to model the relative importance of regional variations in productivity and survival in determining population trends, but possible variations in immature survival and recruitment are still poorly known.

Table 2.16.1 **Population changes at monitored kittiwake colonies, 1991-92** (apparently occupied nests in late May/June). Superscript = number of colonies with 10+ AONs counted in 1991; counts with a reported inaccuracy of >±5%, and regional samples <100 AONs, are excluded.

	SW Scotland	NW Scotland	Shetland (excl. Fair Isle)	Orkney	N Scotland
1991	363	2167	1570	253	4575
1992	477	2075	1460	245	4475
% change	+31.4[1]	-4.2[3]	-7.0[3]	-3.2[1]	-2.2[5]

	NE Scotland	SE Scotland	NE England	E England	SE England
1991	1294	24345	6922	157	2545
1992	1612	25218	7321	203	2878
% change	+24.6[2]	+3.6[6]	+5.8[2]	+29.3[1]	+13.1[3]

	SW England	Wales	NW England	SE Ireland	NW Ireland
1991	767	3092	1147	1933	456
1992	811	2755	1215	1871	423
% change	+5.7[6]	-10.9[4]	+18.0[1]	-3.2[4]	-7.2[1]

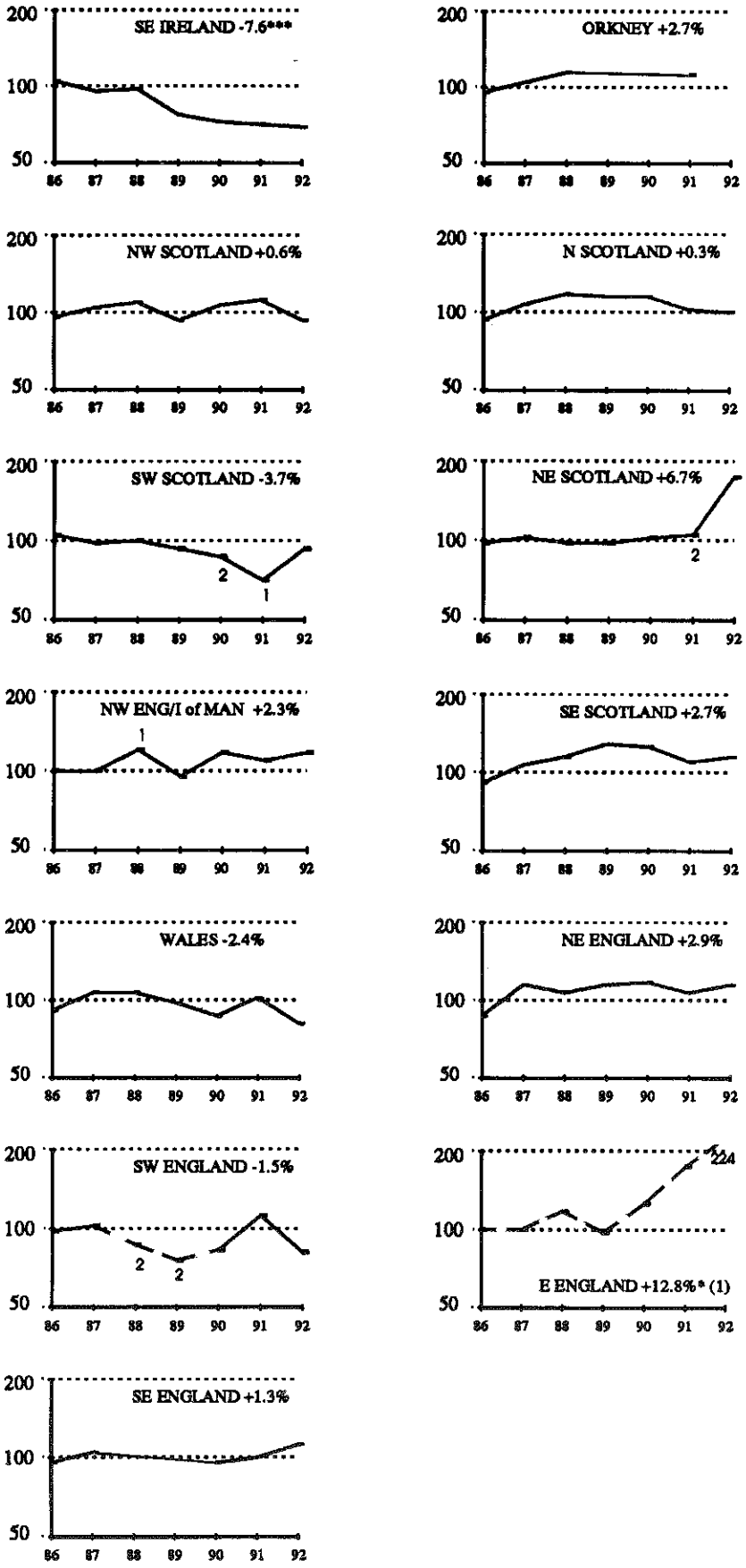

Figure 2.16.1 **Regional population indices for breeding kittiwakes, 1986-92 (occupied nests in June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01; *** P<0.001). Broken trend lines are based on sample counts of 100-500 AONs. Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

Figure 2.16.2 Breeding productivity at kittiwake colonies in 1992:

0 (○), <0.5 (◎), <1.0 (●) or 1.0+ (★) chicks fledged per well-built nest.

Table 2.15.2 **Kittiwake breeding success,1986-92**: number of chicks fledged per occupied, well-built nest ('apparently occupied nest' or AON). For 1991 and 1992, productivity is expressed as mean & standard error of figures from three or more plots (standardard error is equivalent to half-range of figures from two plots); n = number of nests (plots). * indicates coverage of most or all of colony.

Colony	1986-90 fledged/site			1991 fledged/site			1992 fledged/site		
	yrs	mean	s.e.	n	mean	s.e.	n	mean	s.e.
Rathlin Island (Antrim)	2	**0.63**	0.42		-			-	
Ailsa Craig (Kyle & Carrick)	4	**^0.14**	0.07	118(2)	**0.22**	0.03	128(2)	**0.29**	0.06
Tormisdale, Islay (Argyll & Bute)	3	**1.14**	0.1		-			-	
Colonsay (Argyll & Bute)	4	**0.84**	0.10	363(3)	**0.67**	0.02	477(3)	**0.78**	0.04
Canna (Lochaber)	5	**0.54**	0.15	314(2)	**0.64**	0.34	314(2)	**0.42**	0.30
St Kilda (Western Isles)	5	**0.56**	0.08	121(2)	**0.84**	0.03	394(6)	**0.38**	0.05
Eilean Mor, Flannans (Western Isles)	1	**<0.39**	0.05		-			-	
Eilean Mhuire, Shiants (Western Isles)	1	**<0.68**	0.13		-			-	
Stac Shuardail, Lewis (Western Isles)	2	**1.13**	0.21		-			-	
Tiumpan Hd, Lewis (Western Isles)	1	**1.04**	-		-			-	
Cellar Head, Lewis (Western Isles)	2	**0.94**	0.38		-			-	
Spainneavaig, Lewis (Western Isles)	1	**0.88**	0.09		-			-	
Handa (Sutherland)	4	**1.17**	0.18	363(5)	**1.54**	0.05	311(5)	**1.22**	0.05
Faraid Head (Sutherland)	1	**1.88**	-	50(1)	**1.38**	-		-	
Hermaness, Unst (Shetland)	2	**0.46**	0.01	170(2)	**1.06**	0.05	166(2)	**1.18**	0.15
Fetlar (Shetland)	4	**0.04**	0.04		-			-	
Eshaness (Shetland)	5	**0.57**	0.04	328(2)	**0.72**	0.04	303(2)	**0.81**	0.03
Westerwick (Shetland)	5	**<0.1**	0.09	54(*)	**0.68**	-	56(*)	**0.55**	-
Foula (Shetland)	4	**<0.42**	0.18		**<0.75**	-		**<1.39**	-
Kettla Ness (Shetland)	5	**<0.24**	0.15	126(*)	**0.05**	-	**88(*)**	0.0	-
Noss (Shetland)	5	**0.17**	0.12	231(4)	**0.17**	0.07	181(3)	**0.48**	0.15
Troswick Ness (Shetland)	5	**0.30**	0.21	119(2)	**0.32**	0.11	89(2)	**0.92**	0.29

Sumburgh Head (Shetland)	5	**0.24**	0.14	196(4)	**0.63**	0.19	161(4)	**1.49**	0.14
Fair Isle (Shetland)	5	**0.5**	0.23	1253(10)	**0.89**	0.06	1230(10)	**1.30**	0.04
Fowl Craig, Papa Westray (Orkney)	2	**0.62**	0.01	233(*)	**0.76**	-	241(*)	**1.09**	-
Rousay (Orkney)	2	**0.92**	0	338(4)	**0.80**	0.21	351(4)	**1.03**	0.02
Costa Head (Orkney)	4	(^)**1.19**	0.13	220(3)	**1.10**	0.09		-	
Marwick Head a (Orkney)	5	**1.06**	0.05	250(4)	**1.21**	0.11	288(4)	**1.17**	0.06
Row Head (Orkney)	5	(^)**1.08**	0.06	283(4)	**1.28**	0.03	350(4)	**1.02**	0.08
Mull Head (Orkney)	5	(^)**0.98**	0.08	237(3)	**1.03**	0.04	249(2)	**1.28**	0.10
Gultak (Orkney)	5	(^)**0.85**	0.11	114(2)	**0.83**	0.21	128(2)	**1.40**	0.00
Sandside Head (Caithness)	1	**0.62**	-		-			-	
Skirza Head a (Caithness)	2	**0.75**	0.13	181(1)	**0.58**		205(1)	**1.27**	
Skirza Head b	5	^**1.08**	0.08	181(1)	^**0.59**		205(1)	^**1.28**	
Iresgeo a (Caithness)	2	**0.98**	0.05	254(3)	**0.64**	0.07	264(3)	**1.38**	
Iresgeo b	5	^**1.18**	0.05	254(3)	^**0.64**	0.07	264(3)	^**1.41**	0.08
An Dun a (Caithness)	2	**1.15**	0.04	288(2)	**0.42**	0.03	313(2)	**1.33**	
An Dun b	5	^**1.31**	0.05	288(2)	^**0.43**	0.04	313(2)	^**1.39**	0.10
North Sutor (Ross & Cromarty)	1	^**0.84**	-	114(1)	^**0.89**		156(2)	**0.64**	0.22
Covesea (Moray)	3	**0.76**	0.09		-			-	
Bullers of Buchan (Banff & Buchan)	2	**1.06**	0.29	268(3)	**0.60**	0.02		-	
Sands of Forvie (Gordon)	2	**0.64**	0.18	131(2)	**0.33**	0.04	148(2)	**1.02**	0.28
Fowlsheugh (Kincardine & Deeside)	5	**1.06**	0.12		-			-	
Isle of May (NE Fife)	5	**0.90**	0.20	1172(15)	**0.27**	0.05	1062(15)	**0.61**	0.05
Dunbar (E Lothian)	5	**1.13**	0.16	415(*)	**0.70**		379(*)	**1.53**	
St Abb's Head (Berwickshire)	4	(^)**0.98**	0.15	1118(3)	**0.41**	0.15	1262(3)	**1.03**	0.05
Farne Islands (Northumberland)	4	**1.17**	0.08	633(11)	**0.60**	0.08	620(11)	**1.08**	0.11
North Shields (Tyne & Wear)	3	**1.3**	0.07		-			-	
Gateshead (Tyne & Wear)	3	**1.17**	0.08	232(*)	**1.03**		269(*)	**1.18**	
Marsden Rock (Tyne & Wear)	1	**0.96**	0.06		-			-	

Saltburn (Cleveland)	5	**1.03**	0.04	191(3)	**1.05**		220(3)	**1.15**	0.05
Bempton (Humberside)	5	**1.19**	0.18	326(6)	**1.18**	0.07	376(6)	**0.93**	0.05
Lowestoft (Suffolk)	4	**1.37**	0.08	157(*)	**1.25**	-	203(*)	**1.15**	-
South Foreland (Kent)		-		102(3)	**0.88**	0.29	122(3)	**0.90**	0.07
Newhaven-Peacehaven (E Sussex)		-			-		289(5)	**0.74**	0.18
Durlston Head (Dorset)		-			-		34(*)	**^0.0**	-
Blacker's Hole (Dorset)		-		84(*)	**^0.21**		90(*)	**^0.58**	-
Berry Head (Devon)	5	**0.75**	0.14	140(2)	**0.75**	0.09	120(1)	**0.46**	-
Start Point (Devon)		-			-		293(*)	**0.41**	0.03
Trewavas Head (Cornwall)	1	**0.04**	-		-			-	
Gugh a (Isles of Scilly)		-		110(*)	**^0.05**		109(*)	**^0.18**	-
Gugh b		-		53	**0.02**		66	**0.12**	-
Samson (Isles Of Scilly)		-		90(*)	**^0.01**		82(*)	**^0.54**	-
Annet (Isles of Scilly)		-		35(*)	**^0**		29	**0.07**	-
St Martin's (Isles of Scilly)		-		46(*)	**^0.06**		64(*)	**^0.05**	-
Gorregan/Men a' Vaur/White Isd (Scilly)		-		few	**0**		17(*)	**0.18**	-
Lundy (Devon)	4	**<0.58**	0.21		-			-	
Woody Bay (Devon)	1	**0**		150(*)	**0.17**		200(*)	**0.50**	-
Devil's Truck (W Glamorgan)		-		130(*)	**^0.16**		66	**^0.48**	-
Elegug Stacks (Dyfed)		-		284(5)	**0.12**	0.08	255(6)	**0.13**	0.10
Skomer (Dyfed)	5	**0.66**	0.09	1262(3)	**0.87**	0.07	1117(3)	**0.47**	0.12
Bardsey (Gwynedd)	4	**0.62**	0.19	81(4)	**0.0**	-		-	
Great Ormes Head (Gwynedd)	2	**0.35**	0.15	195	**0.33**	-	195	**0.53**	-
Puffin Island (Gwynedd)		-		146(3)	**^0.70**	0.04		-	
Calf of Man (Isle of Man)	5	**0.21**	0.07	143(2)	**0.42**	0.28	158(2)	**0.30**	0.04
Around Peel Hill (Isle of Man)		-			moderate-poor		41(*)	**0.0**	-
St Bee's Head (Cumbria)	5	**0.39**	0.17	118(3)	**1.15**	0.08	112(2)	**0.67**	0.02

Rockabill (Dublin)	2	**^0.68**	0.17		-			-	
Wicklow Head (Wicklow)	1	**^1.36**	-		-			-	
Great Saltee (Wexford)	2	**^0.39**	0.03		-		1109(5)	**^0.48**	0.09
Dunmore East a (Waterford)	5	**0.61**	0.10	175(1)	**0.46**	-	160(1)	**0.41**	-
Dunmore East b	5	**^0.67**	0.10	862(*)	**^0.53**	-	897(*)	**^0.52**	-
Portally (Waterford)	5	**^0.57**	0.24	87(*)	**^0.53**	-	105(*)	**^0.28**	-
Helvick Head (Waterford)	2	**^0.34**	0.04	782	**^0.57**	-	383	**^0.59**	-
Ram Head (Waterford)	2	**^0.61**	0.01	519	**^0.40**	-	486	**^0.67**	-
Big Doon (Cork)	1	**^0.33**	-		-			-	
Old Head of Kinsale (Cork)	1	**^0.59**	-		-			-	
Cliffs of Moher (Clare)	1	**<0.44**	0.10		-		451(4)	**0.82**	0.02
Inishmore, Aran Islands (Galway)	2	**0.21**	0.04	485(*)	**0.30**		441(*)	**0.53**	-

^ = productivity based on comparison of no. of large chicks present in mid July with peak or single late May-mid June count of AONs in study plots. (^) = data for some years in period 1986-90 are based on latter method.
< = productivity based on late June/early July counts of both AONs and chicks.

a, b = results based on different methods at same colony

2.17 Sandwich tern *Sterna sandvicensis*

Breeding Numbers (tables 2.17.1-2, figure 2.17.1)

Breeding numbers were relatively stable in 1992, increasing by 1.2% at 28 regularly-counted colonies in Britain and Ireland. There were, however, some marked regional changes. In Scotland the breeding population at five colonies fell by 65%, from 2002 pairs in 1991 to 696 pairs in 1992. This decrease was largely due to none breeding at Sands of Forvie (NE Scotland), where 1115 pairs bred in 1991. Conversely, numbers in NE and E England rose sharply in 1992, by 26% and 36% respectively. At Coquet Island (NE England), the breeding population of 2131 pairs in 1992 was the highest recorded there since at least 1986. The largest colony in Britain was again Blakeney Point in Norfolk, where numbers rose by 33% to 4000 pairs in 1992.

Breeding numbers in SE England rose by 107 pairs in 1992 (+26%), while in Wales the Anglesey colony decreased by 100 pairs (-17%). In NW England numbers were more stable, although there were marked colony changes. The 450 pairs at Walney were the first to breed there since 1987, but none bred at nearby Foulney for the first time since 1973. Numbers in Strangford Lough were at their lowest level (657 pairs) since 1977, and in NE Ireland as a whole the population fell by 24% in 1992. Numbers at Lady`s Island Lake (SE Ireland) fell by 23% to 1129 pairs, but there was an increase of 21% at three colonies in NW Ireland.

During 1986-92 as a whole, the only significant regional trend in numbers have been increases in NW England and SE Ireland (one colony) and a decrease in NE Ireland.

Breeding success (table 2.17.3)

Breeding success in 1992 was good, with 6400 young estimated to have fledged from 7530 pairs at 13 monitored colonies (0.85 fledged/pair). This was a considerable improvement on 0.45 fledged/pair recorded in 1991, and the highest productivity since 1987.

Productivity was again very low in NW England, where no young fledged from Hodbarrow (360 pairs) for the second year running. As usual predation by foxes *Vulpes vulpes* was the problem here. No productivity estimates were available from NE England, but breeding succes on Coquet Island was thought to be good. Colonies in E, SE and SW England enjoyed high productivity overall, with particularly high figures noted at Blakeney, Norfolk (1.0 fledged/pair) and Dungeness, Kent (1.4 fledged/pair). Productivity was high at Lady`s Island Lake, SE Ireland (1.0 fledged/pair), but low at one of the new Irish colonies and at at the larger Scottish colonies.

Discussion

Although the Sandwich tern population was stable in 1992 there were some major regional changes, as noted in other recent years. At the Sands of Forvie in NE Scotland, birds arrived in April as usual but had all gone by early May for no apparent reason. In contrast, 450 pairs bred at South Walney (NW England) after an absence of four years. This nomadic behaviour is typical of terns and highlights the need to continue monitoring at as many sites as possible.

Productivity was much improved in 1992, but whole-colony failures still occur. A major cause of breeding failure is predation by foxes, and where they are successfully excluded productivity can be greatly increased. The impact of foxes is illustrated by the situation at Hodbarrow (NW England), where they have caused total breeding failure at the chick stage in the last two years. The use of electric fencing to deter foxes from entering colonies is encouraged where practicable.

Table 2.17.1 **Numbers of Sandwich Tern breeding pairs at regularly-counted colonies in Britain and Ireland.** In addition to these, 26 pairs bred at an Isle of Man site in 1991 (none in 1986-90 or 1992).

Colony	1986	1987	1988	1989	1990	1991	1992
Loch of Strathbeg	493	130	404	239	121	283	304
Sands of Forvie	597	1082	664	744	1126	1115	0
Inchmickery	416	656	383	272	418	473	112
Coquet Island	1049	1586	1616	1164	1203	1736	2131
Farne Islands	3456	2870	3408	3445	2846	2126	2730
Scolt Head	2550	3089	2775	1052	0	0	0
Blakeney Point	1000	475	1000	1500	3000	3000	4000
Minsmere	1	0	0	0	5	20	0
Havergate	145	200	63	50	60	84	70
Foulness/Maplin	98	243	350	300	280	280	548
Dungeness	350	3	125	220	240	250	250
Rye Harbour	42	155	0	3	25	2	0
Pagham Harbour	0	0	0	0	26	2	0
Chichester Harbour	12	27	0	15	22	5	27
Langstone Harbour	0	3	2	0	0	0	0
North West Solent	176	220	305	198	150	151	150
Pitts Deep-Hurst	45	50	70	?	25	0	90
Brownsea Island	103	25	72	90	64	75	82
Anglesey	450	700	1080	830	517	601	500
South Walney	45	180	0	0	0	0	450
Foulney	400	550	700	770	720	332	0
Hodbarrow	0	0	0	50	120	520	360
Swan Island	63	74	117	138	130	135	132
Green Island	61	286	78	36	59	172	108
Strangford Lough	1418	2127	2228	962	1382	879	657
Lady`s Island Lake	524	708	412	1317	1395	1469	1129
Lough Swilly	95	102	73	76	109	99	116
Mulroy Bay	112	98	225	240	79	76	107
Total	13701	15639	16150	13763+	14122	13885	14053

Table 2.17.2 **Population changes at monitored Sandwich tern colonies, 1991-1992 (breeding pairs).** Superscript = number of occupied colonies.

	N Scotland	NE Scotland	SE Scotland	NE England	E England	SE England	Wales
1991	130	1398	474	3862	3384	410	600
1992	230	304	162	4861	4618	517	500
% change	(+76.9)[1]	-78.3[2]	-65.8[2]	+25.9[2]	+36.5[4]	+26.1[6]	(-16.7)[1]

	NW England	NE Ireland	SE Ireland	NW Ireland	TOTAL
1991	852	1186	1469	217	13885
1992	810	897	1129	263	14053
% change	-4.9[3]	-24.4[3]	(-23.1)[1]	+21.2[3]	+1.2[28]

Table 2.17.3 **Sandwich tern breeding success, 1986-92:** number of chicks fledged per breeding pair at sample colonies. (n = number of colonies)

Region	**1986-90 years**	**fledged/pair mean**	se	**1991 prs[n]**	**no. fledged/pair range**	**total**	**1992 prs[n]**	**no. fledged/pair range**	**total**
N Scotland	1	**0.63+**	-			-	230[1]		**0.35**
NE Scotland	5	**0.69**	0.09	1398[2]	0.30-0.35	**0.31**	304[1]		***c*0.49**
SE Scotland		-				-	40[1]		**1.20**
NE England	5	**0.83**	0.04	1736[1]		**0.80**			-
E England	5	**0.70**	0.16	3384[4]	0.27-0.71	**0.31**	4618[3]	0.57-1.00	**0.96**
SE England	5	**0.73**	0.11	259[4]	0.00-1.00	**0.96**	277[2]	0.55-1.4+	**1.32+**
SW England	2	**0.93**	0.29	75[1]		**0.80**	82[1]		**0.80**
Wales	2	**0.68**	0.07	600[1]		**0.55**			-
NW England	5	**0.62**	0.16	852[2]	0.00-0.15	**0.06**	810[2]	0.00-0.31	**0.17**
SE Ireland	1	**0.75**	-	1469[1]		**0.56**	1129[1]		***c*1.00**
NW Ireland		-				-	40[1]		***c*0.40**
TOTAL	5	**0.67**	0.17	9773[16]	0.00-1.00	**0.45**	7530[13]	0.00-1.4+	**0.85**

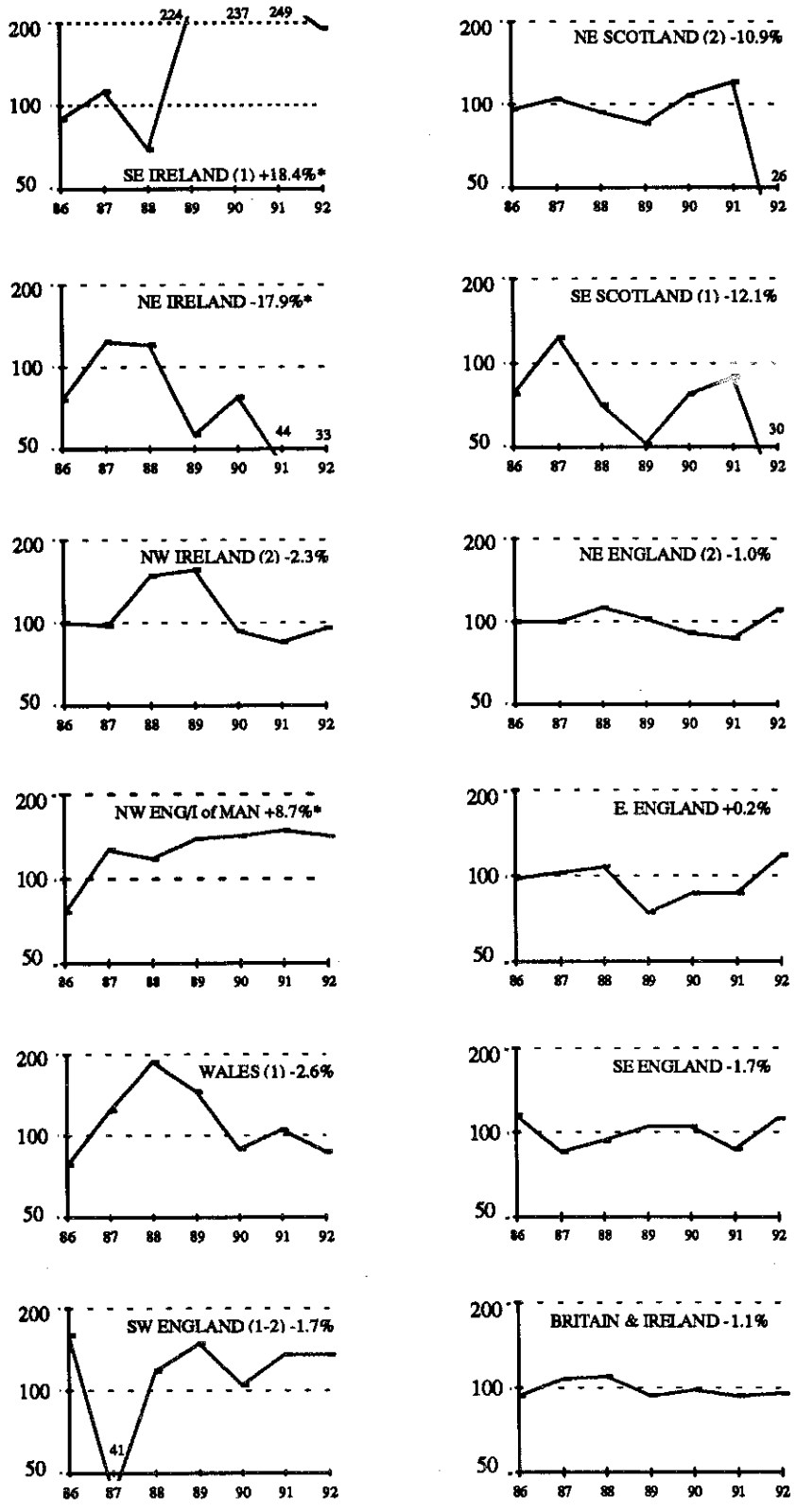

Figure 2.17.1 **Population indices for breeding Sandwich terns, 1986-92 (pairs or apparently occupied nests).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05). Broken trend lines are based on sample counts of <200 pairs (dashed line = 20-100 pairs). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.18 Roseate tern *Sterna dougallii*

A.J. del Nevo

Breeding numbers (table 2.18.1)

The British and Irish population in 1992 is estimated at *c*520 pairs. This represents an increase of 15% on the 1991 figure, and is the highest number of breeding roseate terns in Britain and Ireland since 1982. The colony on Rockabill continues to grow and has become the most productive one in Europe. It held *c*28% of the total European population (1346 pairs) in 1992. At Lady's Island Lake (SE Ireland) the breeding population increased to 76 pairs (as in 1989). In NE Ireland, none bred in Carlingford Lough for the second consecutive year. The Larne Lough colony fared little better and continued its downward trend, with three breeding pairs, the lowest in the colony's history. The traditional sites on Anglesey had a disastrous year with no breeding birds. A relatively new Anglesey colony increased to seven pairs and it is hoped that this may form the nucleus for a North Wales revival. In Scotland, Inchmickery had no breeding birds for the third consecutive year but 17 pairs bred on another island in the Forth Estuary. The Coquet Island population in NE England increased slightly to 29 pairs, the highest since 1982. Four pairs were recorded on the Farne Islands and the Scilly Isles held between six and eight pairs.

Breeding success (table 2.18.1)

Productivity estimates for Rockabill and Lady's Island lake were based on several ringing visits and produced an estimated 1.72 and 1.0 chicks per pair respectively. No young fledged from NE Ireland but the new colony in Anglesey produced 1.43 chicks per pair. Coquet Island also had a good season (1.24 chicks per pair) and fared better than the Forth Estuary colony (0.70 chicks per pair). The Farne Islands had a similar season to previous years with a productivity of 1.0 chick per pair. At least two young fledged on the Scilly Isles but the precise productivity was uncertain.

Discussion

Roseate terns in the Republic of Ireland continue to go from strength to strength. Observations on Rockabill, of birds originally ringed in other colonies, suggest a considerable movement into this colony. This has proven to be a highly successful colony but it is worrying that such a large percentage of NW Europe's roseate terns are concentrated in one site. The Forth Estuary, Coquet and the new Anglesey colony are showing signs of improvement which may, in part, as a result of appropriate conservation measures (e.g. provision of nest boxes and reduced disturbance).

In Brittany, France, the Société pour l'Etude et la Protection de la Nature en Bretagne (SEPNB) continues the difficult task of wardening a number of islets where roseate terns bred or have bred. In 1992 *c*83 pairs bred in the Baie de Morlaix with two single pairs at other sites. Breeding success was thought to be poor, with only *c*45 chicks fledging (*c*0.51 chicks/pair). The Baix de Morlaix breeding population is encouraging as 52 incubating adults (from 82 pairs) were killed by a ferret *Mustela furo* during 1991. The extent to which the increase reflected recruitment of first-time breeders or immigration from other colonies is not known.

The Azores population was not surveyed completely during 1992, but most of the important colonies were visited. A total of 750 pairs was recorded. Productivity was extremely variable and considerable inter-colony movement had evidently taken place since 1991. Baixa do Moinho (375 pairs) was almost completely devastated by human disturbance. Overall productivity for the Azores was 0.53 chicks per pair (n=288). A number of parameters (e.g. adult body weight, feeding rates) suggested that fish availability was lower than in previous years.

Table 2.18.1 **Roseate tern numbers (breeding pairs) at major colonies** (those holding 20+ pairs in at least one year) during 1986-92, and breeding success (chicks fledged/pair) in 1992.

Colony	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**Chicks per pair in 1992**
Inchmickery	18	20	21	5	0	0	0	0.0
Farne Islands	9	14	21	12	4	3	4	1.0
Coquet Island	20	17	21	25	23	20	29	1.24
Anglesey site A	200	40	45	70	35	1	0	0.0
Anglesey site B	0	21	0	19	7	0	0	0.0
Larne Lough	21	25	23	37	19	4	3	0.0
Carlingford Lough	34	40	7	25	3	0	0	0.0
Rockabill	177	250	332	194	321	366	378	1.72
Lady's Island Lake	0	8	0	76	60	56	76	1.0
Total*	490	450	480	470	490	450	520	

*Totals include other regularly-counted, small colonies (incl. SE Scotland & a third Anglesey colony in 1992).

2.19 Common Tern *Sterna hirundo*

Breeding numbers (table and figure 2.19.1)

Coverage for this species is incomplete, and the majority of monitored colonies are coastal. Thus population indices need to be treated with caution.

At 16 colonies in northern and eastern Scotland breeding numbers fell by 26% to 1082 pairs in 1992. This follows a decline of 7% in the same regions in 1991. The NE Scottish population has declined significantly during 1986-92. In contrast, there was a 29% increase in breeding numbers at 30 monitored colonies in England and Wales. Population increases were noted in all these regions except NW England, where numbers at sampled colonies fell by 8%. The largest regional increase was in NE England where numbers rose by 44%, from 812 pairs in 1991 to 1173 pairs in 1992, mainly the result of increases on Coquet Island and the Farne Islands. Notable population increases were also recorded in E and SW England (+48% and +28% respectively). Following a 37% decrease in 1991, the Welsh population rose by 17% to 470 pairs in 1992. Breeding numbers in six monitored populations in Ireland also rose significantly, from 1419 pairs in 1991 to 1681 pairs in 1992. This increase was particularly high in SE Ireland (+40%), where the Rockabill colony grew by 50% from 178 to 268 pairs in 1992; this region has shown a significant increase over 1986-92 as a whole.

Breeding success (table 2.19.2)

There was a marked improvement in productivity in all regions in 1992. In Scotland as a whole breeding success was the highest since 1987, although still rather low at 0.56 fledged/pair. Predation by American mink *Mustela vison* was again a major factor in SW Scotland.

In England productivity was relatively high at 0.76 fledged/pair (the highest since 1987). Common terns in most regions enjoyed relatively good breeding success, the exception being NW England where 153 pairs fledged only 21 young (0.14 fledged/pair). Fox predation was the problem at Hodbarrow, but on the Ribble Marshes (not included in table 2.19.2) food shortage was suspected to have been responsible for the almost total failure of 500+ pairs. On Coquet Island (NE England) 842 pairs fledged 766 young (0.91 fledged/pair), and at Breydon Water (Norfolk) productivity was again high on the artificial rafts (1.20 fledged/pair). In SE England, productivity was very high at Dungeness, where 250 pairs fledged 350 young (1.40 fledged/pair).

Welsh colonies were very successful in 1992. At five monitored colonies 518 young fledged from a total of 357 pairs (1.45 fledged/pair), with productivity particularly high at Shotton Steelworks, where 312 pairs fledged 500 young (1.60 fledged/pair). Productivity was also high in SE Ireland (0.91 fledged/pair overall), but lower than in 1991. Starvation was thought to be the cause of poor breeding success at Lady's Island Lake, where only 67 young fledged from 333 pairs (0.20 fledged/pair).

Discussion

There were distinct regional variations in population trends in Britain and Ireland in 1992. Numbers in north and east Scotland fell for the second year running. After falling by 19% in 1991, the English and Welsh sample population rose by 29% in 1992. This increase was noted for almost all regional samples, and seems likely to reflect a real overall increase. Sampled populations in NE and SE Ireland also showed a healthy rise of 18% overall in 1992.

Breeding success was higher in 1992 than in 1991 in nearly all regions. Levels of predation were lower than in 1991, and at man-made sites such as Shotton Steelworks (Clwyd) and Breydon Water (Norfolk), where this threat is reduced, productivity was very high. However, food shortage may still be a problem in some areas, and was thought to be responsible for high chick mortality at individual sites in NW England and SE Ireland.

Table 2.19.1 **Population changes at monitored common tern colonies, 1991-1992** (breeding pairs). Superscript = number of colonies with 10+ pairs counted in 1991.

	N Scotland	NE Scotland	SE Scotland	NE England	E England	SE England	SW England
1991	695	286	479	812	436	565	285
1992	621	139	322	1173	647	620	365
% change	-10.6[8]	-51.4[4]	-32.8[4]	+44.5[4]	+48.4[6]	+9.7[6]	+28.1[4]

	NW England	ENGLAND	WALES	ENGLAND/ WALES	NE Ireland	SE Ireland
1991	167	2265	400	2665	991	428
1992	153	2958	470	3428	1080	601
% change	-8.4[5]	+30.6[25]	+17.5[5]	+28.6[30]	+9.0[4]	+40.4[2]

Table 2.19.2 **Common tern breeding success, 1986-92**: number of chicks fledged per breeding pair at sample colonies. (n = number of colonies).

Region	1986 - 1990 years	fledged/pair mean	se	1991 prs[n]	no.fledged/pair range	total	1992 prs[n]	no.fledged/pair range	total
SW Scotland	3	**0.61**	0.16	984[7+]	0.00-0.60	**0.36**	1186[11]	0.00-0.71	**0.47**
NW Scotland	3	**0.23**	0.02	226[10]	0.00-1.20	**0.18**	376[9]	0.00-1.08	**0.73**
Shetland	3	**0.04**	0.00	10[1]		**0.20**			
N Scotland	2	**0.19**	0.20	715[9]	0.00-1.17	**0.53**	621[5]	0.50-1.20	**0.69**
NE Scotland	5	**0.45**	0.20	292[4]	0.00-0.72	**0.09**	102[2]	0.20-0.46	**0.33**
SE Scotland	5	**0.83**	0.20	*c*219[2]	0.42-0.50	**c0.05**	*c*409[4]	0.40-0.64	***c*0.54**
SCOTLAND	5	**0.53**	0.16	2352[32]	0.00-1.20	**0.38**	2694[31]	0.00-1.20	**0.56**
NE England	4	**0.76**	0.06	607[2]	0.00-0.71	**0.67**	882[2]	0.00-0.91	**0.87**
E England	5	**0.53**	0.08	351[4]	0.00-1.14	**0.46**	647[4]	0.05-1.20	**0.59**
SE England	5	**0.78**	0.19	327[5]	0.00-0.91	**0.63**	488[6]	0.00-1.60	**1.01**
SW England	3	**0.71**	0.20	285[3]	0.33-0.71	**0.48**	365[4]	0.37-1.20	**0.74**
NW England	3	**0.12**	0.12	166[3]		**0.00**	153[5]	0.00-0.40	**0.14**
ENGLAND	5	**0.66**	0.06	1736[17]	0.00-1.14	**0.52**	2535[21]	0.00-1.60	**0.76**
WALES	2	**0.25**	0.25	400[4]	0.05-2.00	***c*0.93**	357[5]	0.17-1.60	**1.45**
SE Ireland				428[2]	0.70-2.31	***c*1.37**	601[2]	0.20-1.79	***c*0.91**

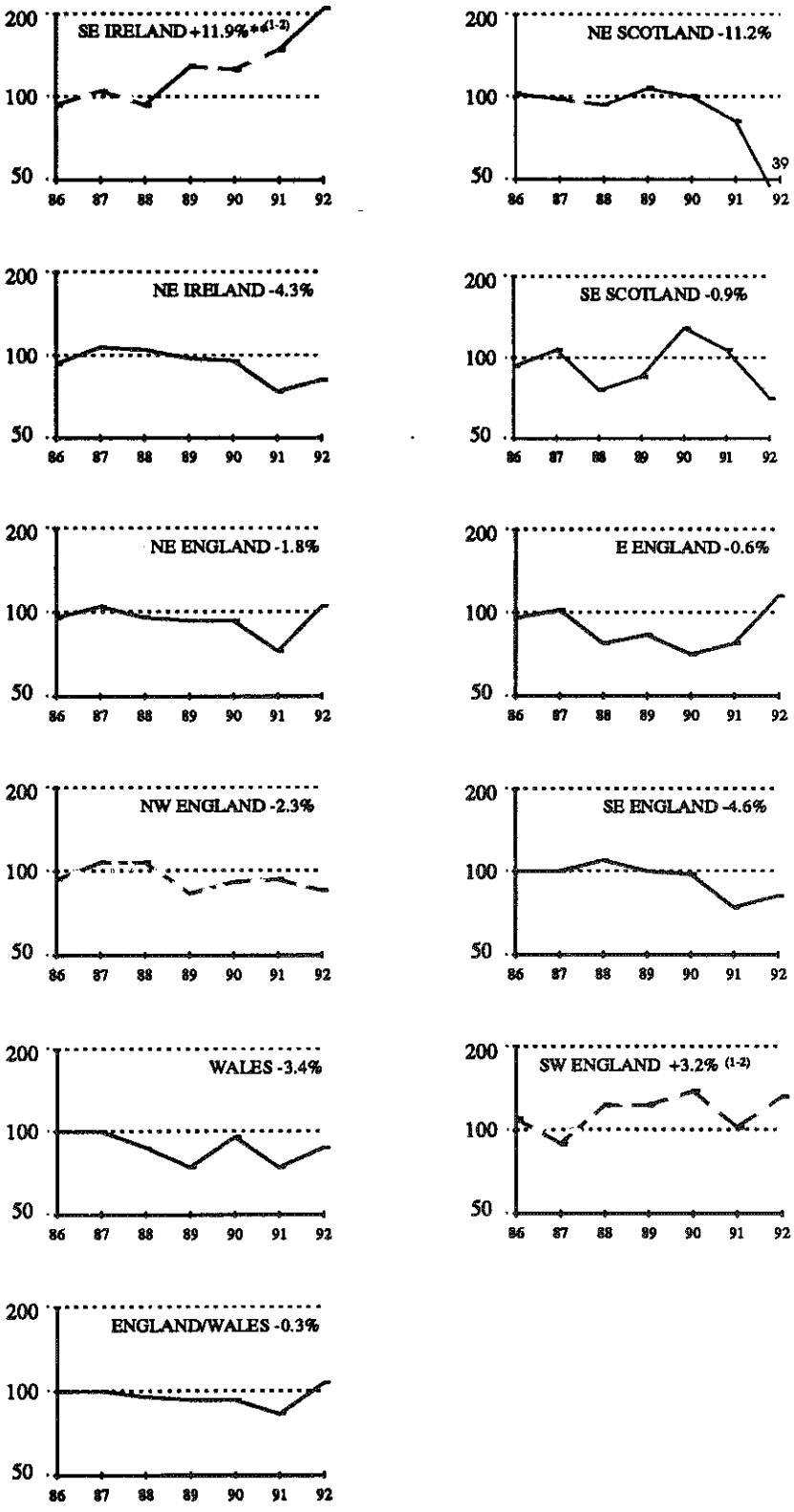

Figure 2.19.1 **Regional population indices for breeding common terns, 1986-92 (pairs or apparently occupied nests).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01). Broken trend lines are based on sample counts of 100-200 pairs (dashed liner = 50-100). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.20 Arctic tern *Sterna paradisaea*

Breeding numbers (tables 2.20.1-2, figure 2.20.1)

On Shetland, numbers at 58 colonies counted in both 1991 and 1992 increased by 35% and there were increases in eight out of nine sampling areas surveyed. In contrast, numbers at 51 colonies on Orkney fell by 7% in 1992. These figures are not comprehensive, but may indicate trends in population levels. Breeding numbers in northern and eastern Scotland were relatively stable. A major increase was noted in NE England, where the population rose by 81% to 4186 pairs, caused mainly by an 86% increase in numbers on the Farne Islands (where numbers had fallen by 43% in 1991). The Welsh population was stable at just over 1100 pairs in 1992, and numbers in the two small populations in NE Ireland rose by 72% to 167 pairs.

Breeding success (table 2.20.3)

In Shetland, 1342 pairs were monitored at 22 colonies spread throughout the islands. Breeding success was good, with an overall average of 0.7 fledged/pair. Hatching success was lower than in 1991 due to predation by gulls and skuas, and trampling by sheep. Few, if any, chicks died from starvation. Heavy predation by otters *Lutra lutra* was noted on Mousa, where about half the chicks were found headless on one visit.

Breeding success on Orkney in 1992 (0.57 fledged/pair) was much improved on the previous year, but it was still lower than on Shetland. As in the previous two years, many colonies failed with eggs or small chicks. Large colonies on Pentland Skerries (2000 birds) and Flotta (800 birds) failed completely, but at the largest colony (Papa Westray) an estimated 1700 young fledged from 2780 pairs (0.61 fledged/pair).

Elsewhere in Scotland, productivity was higher in 1992 than in 1991. At eight monitored colonies in the Moray Firth, 416 pairs reared 312 young (0.75 fledged/pair), the highest productivity recorded since detailed monitoring began in 1989. Breeding success in NE and SE Scotland was lower (0.38 and 0.46 fledged/pair respectively), but still an improvement on last year. On the west coast productivity was higher than in 1991, but still rather low at 0.34 fledged/pair.

In NE England 749 pairs were monitored at three colonies. Productivity was reasonable, with 382 young fledging (0.51 fledged/pair). The only region where breeding success was lower in 1992 than in 1991 was Wales, where productivity fell from 0.70 to 0.41 fledged/pair. This was largely a result of reduced breeding success at the Skerries (Gwynedd) where productivity fell from 1.00 fledged/pair in 1991 to 0.45 in 1992.

In NW England productivity was much improved on Foulney Island, where 60 pairs reared 54 young (0.90 fledged/pair), by far the best season since monitoring began in 1988. Many chicks were thought to have starved to death at Lady`s Island Lake (SE Ireland), where 196 pairs reared only 39 chicks (0.20 fledged/pair).

Discussion

Numbers of breeding birds at monitored colonies increased in Shetland for the second year running, but decreased on Orkney in 1992. Breeding success was again higher on Shetland than on Orkney, indicating that food supply may have been better on Shetland. If these conditions continue we may expect to see numbers increasing on Shetland but decreasing on Orkney. Monitoring of numbers and breeding success on Orkney and Shetland by RSPB will continue in 1993.

1992 saw improved breeding success in all regions except Wales. It is difficult to attribute this to any single factor, but it seems that more favourable weather conditions and reduced predation may have helped to increase productivity. However, chick starvation was noted in SE Ireland and food shortage may be a problem in certain areas.

Table 2.20.1 **Numbers of arctic terns (individuals) recorded at sample colonies in Shetland and Orkney which were surveyed in both 1991 and 1992** (n = no. colonies).

	n	1991	1992	% change
SHETLAND				
Fetlar	*c*38	1779	2609	+47
N.Mainland	2	70	106	+51
W.Mainland	2	59	65	+10
Delting	4	143	138	-3
S.Mainland	1	50	76	+52
Noss	1	200	220	+10
Mousa	*c*6	860	1100	+28
Unst	1	9	18	+100
Yell	3	130	125	+4
Total	*c*58	3300	4457	+35
ORKNEY				
Papa Westray	4	5760	4810	-16
Westray	4	2730	2032	-26
North Ronaldsay	*c*21	837	1024	+22
Mainland	5	332	483	+45
Walls & Flotta	6	1592	1165	-27
South Ronaldsay	3	1673	2058	+23
Rousay, Egilsay & Wyre	8	970	1355	+40
Total	*c*51	13894	12927	-7

Table 2.20.2 **Population changes at monitored arctic tern colonies. 1991-92** (breeding pairs). Superscript = number of colonies with 10+ pairs counted in 1991. Regional samples < 100 pairs in 1991 are excluded.

	Shetland*	Orkney*	N Scotland	NE Scotland	SE Scotland	NE England	Wales	NE Ireland	SE Ireland
1991	3300	13894	459	455	477	2310	1108	97	c110
1992	4457	12927	371	538	531	4186	1113	167	c196
% change	$+35.1^{58}$	-7.0^{5}	-19.2^{8}	$+18.2^{3}$	$+11.3^{3}$	$+81.2^{4}$	0.0^{4}	$(+72.2)^{2}$	$(+78.2)^{1}$

* Counts of individual adults, Shetland and Orkney (cf. table 2.21.1).

Table 2.20.3 **Arctic tern breeding success, 1986-92**: number of chicks fledged per breeding pair at sample colonies (n = number of colonies)

Region	1986-1990	fledged/pair		1991	no.fledged/pair		1992	no.fledged/pair	
	yrs	mean	se	prs[n]	range	total	prs[n]	range	total
SW Scotland	4	**0.52**	0.10	*c*253[8]	0.00-0.38	**0.17**	212[11]	0.00-0.86	**0.34**
NW Scotland	3	**0.62**	0.27	147[5]	0.11-0.26	**0.20**	9[3]		**0.44**
Shetland	5	**<0.01**	0.00	1090[19]	0.00-1.10	**0.67**	1342[22]	0.00-1.40	**0.70**
Orkney	2	**0.26**	0.06	5390[14]	0.00-0.21	**0.14**	3487[12]	0.00-0.97	**0.57**
N Scotland	2	**0.29**	0.28	443[8]	0.00-0.65	**0.35**	416[8]	0.00-1.11	**0.75**
NE Scotland	4	**0.51**	0.19	335[3]	0.00-0.12	**0.09**	448[2]		**0.38**
SE Scotland	5	**0.22**	0.07	*c*436[2]		**0.18**	538[4]	0.00-0.51	**0.46**
NE England	1	**0.76**	-	462[2]	0.40-0.68	**0.42**	749[3]	0.44-0.54	**0.51**
Wales	3	**0.76**	0.17	1108[4]	0.01-1.00+	**>0.70**	813[3]	0.21-0.45	**0.41**
NW England	3	**0.14**	0.03	41[3]	0.00-0.40	**0.24**	61[2]		**0.90**
SE Ireland				*c*110[1]		***c*0.70**	*c*196[1]		***c*0.20**

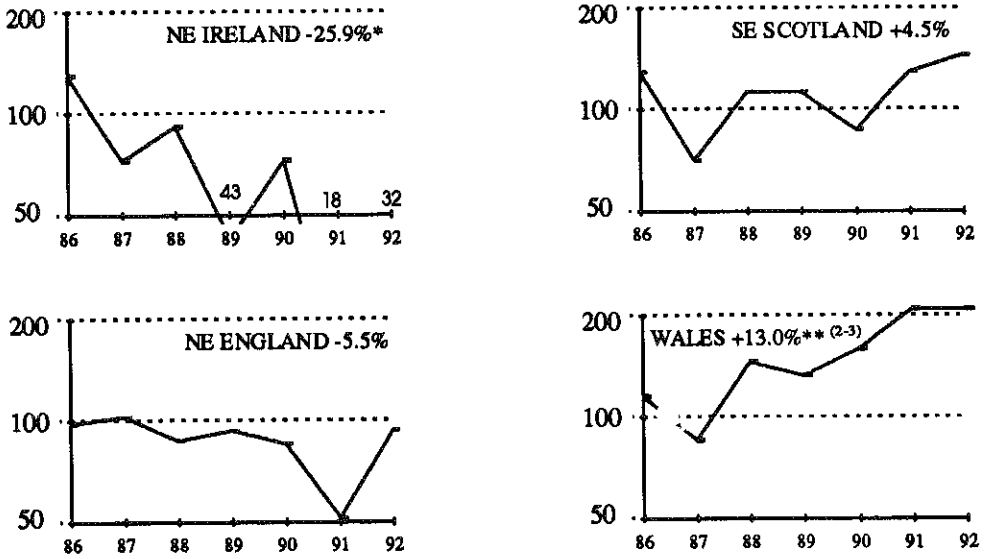

Figure 2.20.1 **Regional population indices for breeding arctic terns, 1986-92 (occupied nests or sites in May/June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01). Broken trend lines are based on samples counts of 100-200 pairs (dashed line = 50-100). Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

2.21 Little Tern *Sterna albifrons*

Breeding numbers (figure and table 2.21.1)

The monitored British population increased slightly in 1992 (+1.8% based on 64 colonies), reversing the trend of slow but steady decline noted since 1987. Most of this rise was due to an increase of 2.6% at 53 colonies in England and Wales. In contrast, numbers fell by 5.5% at 11 monitored colonies in Scotland.

Numbers in East Anglia, where the majority of little terns breed, were stable in 1992. A decline of 10% was noted at Great Yarmouth, the largest colony in Britain and Ireland, numbers falling to 249 pairs in 1992. However, there was a major increase in the population at Blakeney Point (Norfolk), from 90 pairs in 1991 to 160 pairs in 1992 (+78%). Numbers in SE England continued the decline of recent years, falling by a further 4.4% in 1992 (a significant decrease during 1986-92 as a whole). This included a decrease of 3% at Langstone Harbour (Hants.) in 1992 (formerly the second largest colony in Britain). In contrast, the breeding population in NE England rose by 23.4% in 1992, reversing the trend of decreasing numbers in the last two years.

Breeding success (table 2.21.2)

There was a distinct improvement in breeding success in Britain in 1992 (0.46 chicks fledged/pair) compared with 1991 (0.19 fledged/pair). However, productivity was below the figures recorded in each year in the period 1986-1989. In Scotland the productivity figure of 0.56 was the highest since 1988, and a substantial increase compared with 0.19 in 1991. Colonies in East Anglia fared reasonably well (0.50 fledged/pair), although there were the usual problems of predation and flooding at some sites. Breeding success at Great Yarmouth improved dramatically from 0.04 in 1991 to 0.72 in 1992. Productivity in SE England was again very low in 1992. Fox predation and high tides were largely responsible for losses at several colonies, and only 52 young fledged from 288 pairs (0.18 fledged/pair). In NE England productivity was rather low (0.33 fledged/pair); food shortage was again thought to be a problem at Gibralter Point, and merlins *Falco columbarius* were seen to take several chicks at this site as well as at Easington, Spurn and Tetney. Very high breeding success was noted at Gronant (Wales), where 52 pairs raised over 100 young (>1.9 fledged/pair).

Discussion

The small increase in the British little tern population at monitored colonies in 1992 is welcome after four years of steady decline. However, productivity figures are still rather low despite a considerable improvement compared with 1991, and may not be sufficient to maintain current population levels. Predation by birds and mammals is still a major problem at several colonies. At Great Yarmouth predation was again reduced by supplementary feeding of two pairs of kestrels, an experiment which will be repeated in 1993. The large increase in numbers at Blakeney may have included some of the unsuccessful Great Yarmouth breeders from 1991, highlighting the need for alternative sites when large colonies break up.

Table 2.21.1 **Population changes at monitored little tern colonies, 1991-1992** (breeding pairs). Superscript= number of colonies counted in both years. (Regional samples <50 pairs are excluded)

	Scotland	NE England	E England	SE England	SW England	Wales	NW England	Britain
1991	163	175	852	293	55	54	48	1640
1992	154	216	859	280	55	52	54	1670
% change	-5.5^{11+}	$+23.4^{8}$	$+0.8^{25}$	-4.4^{13}	$(0.0)^{1}$	$(-3.7)^{1}$	$(+12.5)^{5}$	$+1.8^{64+}$

Table 2.21.2 **Little tern breeding success, 1991-92**: number of chicks fledged per breeding pair at sample colonies.(n = number of colonies)

Region	1986-1990	fledged/pair		1991	no.fledged/pair		1992	no.fledged/pair	
	years	mean	se	pairs^{n}	range	total	pairs^{n}	range	total
SW Scotland	4	**0.37**	0.24	5^{1}		**0.00**			-
NW Scotland	1	***c*0.43**	-	5^{1}		**0.40**			-
N Scotland	4	**0.69**	0.37	12^{1}		**0.00**	31^{3}	1.33-1.67	**1.42**
NE Scotland	5	**0.26**	0.08	24^{2}	0.00-0.00	**0.08**	42^{2}	0.00-0.24	**<0.24**
SE Scotland	5	**0.63**	0.22	65^{5}	0.00-0.27	**0.06**	34^{5}	0.00-0.37	**0.18**
SCOTLAND	5	**0.40**	0.10	111^{10}	0.00-0.40	**0.07**	107^{10}	0.00-1.67	**0.56**
NE England	5	**0.70**	0.05	198^{10}	0.00-0.90	**0.25**	216^{8}	0.00-0.61+	**0.33+**
E England	5	**0.62**	0.09	822^{23}	0.00-1.25	**0.17**	784^{19}	0.00-1.11	**0.50**
SE England	5	**0.43**	0.16	313^{12}	0.00-2.00	**0.15**	288^{14}	0.00-0.60	**0.18**
SW England	5	**0.41**	0.08	55^{1}		**0.22**	55^{1}		**0.07**
Wales	5	**0.73**	0.30	54^{1}		**0.56**	52^{1}		**>1.92**
NW England	5	**0.34**	0.10	48^{4}	0.00-2.00	**0.92**	56^{6}	0.00-1.14	**0.86**
ENGLAND/ WALES	5	**0.58**	0.07	1490^{51}	0.00-2.00	**0.20**	1451^{49}	0.00->1.92	**0.46**
SE Ireland	4	**0.67**	0.19	24^{2}		**0.00**	58^{2}	0.00-0.04	***c*0.03**
TOTAL	5	**0.60**	0.08	1514^{53}	0.00-2.00	**0.20**	1659^{63}	0.00-2.00	**0.18**

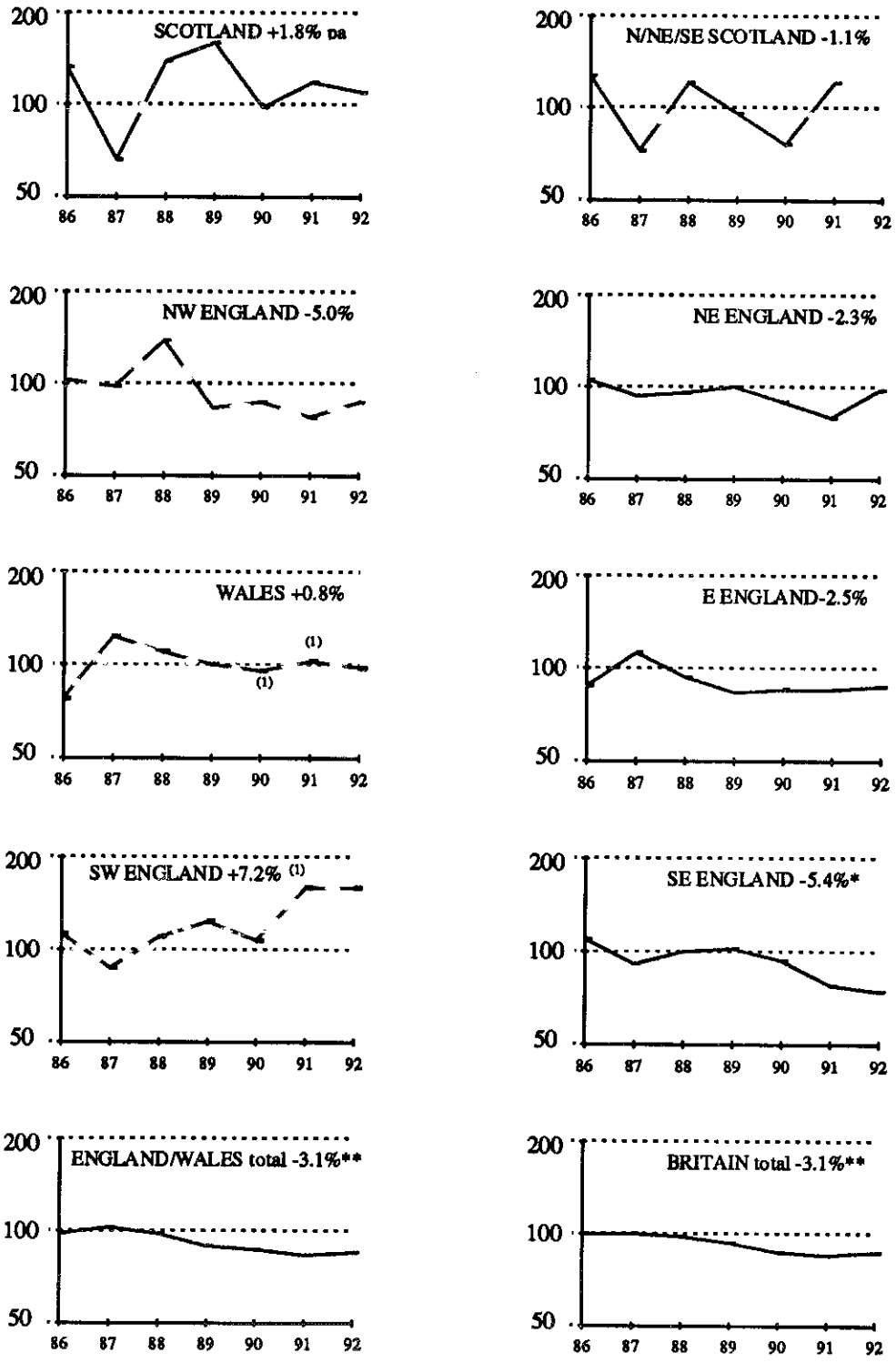

Figure 2.21.1 **Population indices for breeding little terns, 1986-92 (pairs or apparently occupied nests).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0.01). Broken trend lines are based on sample counts of 50-100 pairs (dashed line = 30-50).

2.22 Guillemot *Uria aalge*

Breeding numbers (table 2.22.1, figures 2.22.1-2)

Numbers of adults attending study plots have been stable or increasing in most regions during 1986-92, with significant upward trends for Welsh and Caithness sample populations. Changes between 1991 and 1992 were more variable from region to region, but mainly involved increased numbers or little change. Significant 1991-92 increases were noted at most colonies from Shetland to Caithness, and the only statistically significant decrease was at Bempton (NE England). An overall recovery, to *c*1987 levels, was noted at Shetland colonies, continuing the reversal of the decline in 1989-90.

An interesting record from Rockall was of an adult guillemot incubating an egg in June 1992 (Belaousoff 1993). Along with a gannet egg the same date, this was apparently the first proven breeding attempt of any seabird on Rockall, although guillemot has previously been suspected to breed (Bourne 1993).

Breeding success (table 2.22.2)

Overall productivity was again high, estimates averaging 0.77 (± s.e. 0.02) chicks fledged per breeding pair at nine colonies around Britain (the same figure as for the six colonies on North Sea coasts). This represented a slight, but significant, increase compared to 1991 both overall (average change +0.055 ± 0.014 chicks/pair, $t7 = 3.45$, $P<0.05$) and for the North Sea colonies. Little obvious geographical variation was noted, but guillemots on the Isle of May (SE Scotland) appear to have been the most successful during recent years (0.85 chicks/pair in 1992).

Discussion

Continued high productivity at all monitored colonies is encouraging, although predation appears to be keeping the figures for Sumburgh Head in Shetland below the overall average. The short nestling period for guillemots (and razorbills) does mean, however, that failure at 'pre-fledging' stage is likely to be less important than for other seabirds. Survival of fledgling guillemots following their departure from breeding ledges may be more crucial, and, based on data for the Isle of May, appears to be heavily influenced by the prevalence of gales during July-September (Halley 1992).

Changes in attendance behaviour may have influenced some of the regional population changes seen in recent years, notably in Shetland (where the marked recovery from low numbers in 1990 appears to involve, at least in part, increased attendance by non-breeders and off-duty breeders). While some of the changes seen might not be reflecting changes in actual breeding numbers, they may provide an indication of changes in environmental conditions, e.g. food availability. Further work to relate attendance patterns to breeding numbers would be useful.

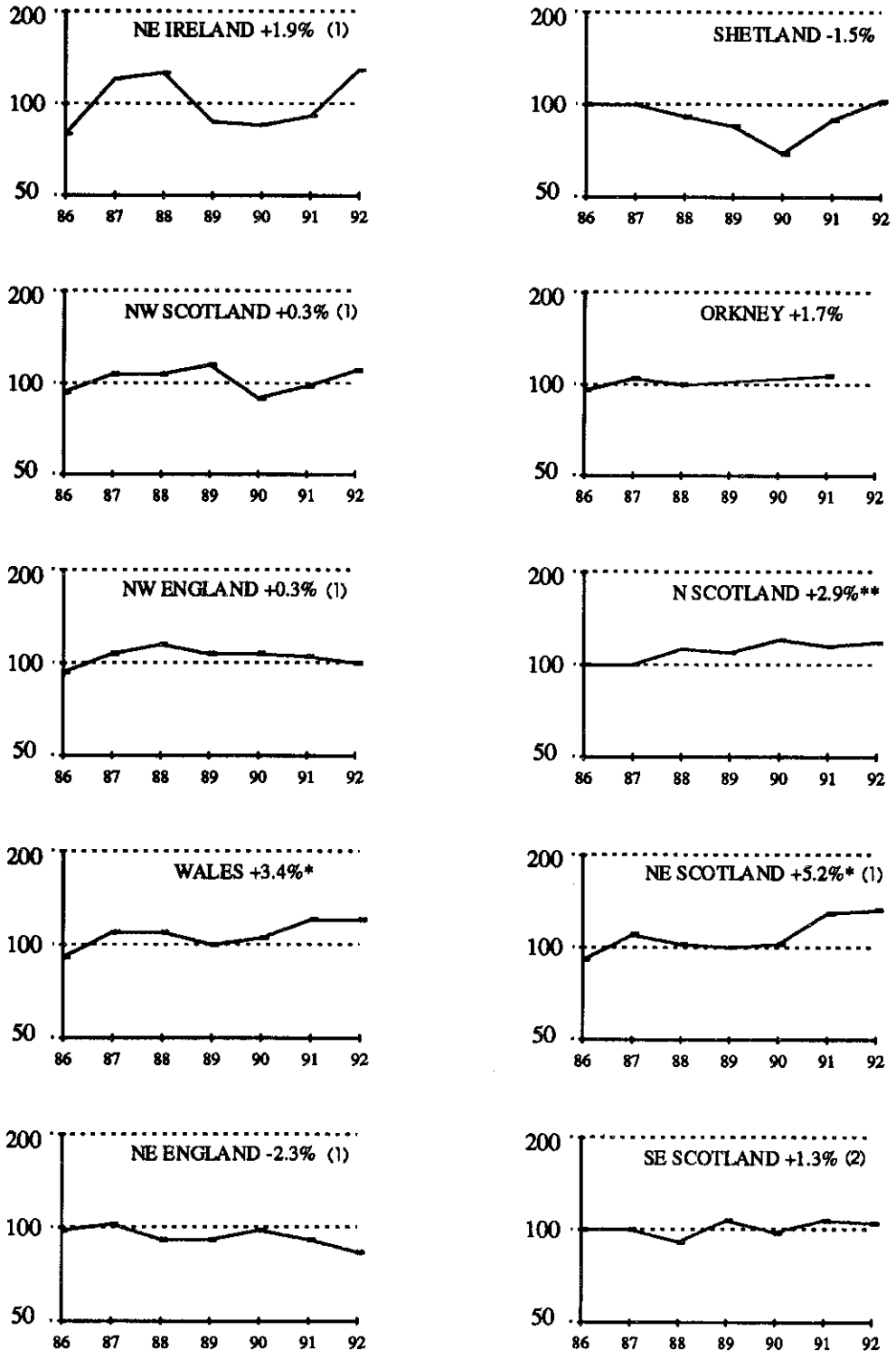

Figure 2.22.1 **Population indices for breeding guillemots, 1986-92 (adults at colonies in June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; ** P<0,01). For each region, data are based on 5-10 replicate counts in study plots each year. Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

Table 2.22.1 **Population changes at monitored guillemot colonies, 1991-92** (adults attending colony in first three weeks of June). Superscript = number of colonies counted in both years. Figures are based on the means of 5-10 annual counts of study plots within each colony.

	Shetland	N Scotland	NE Scotland	SE Scotland	NE England
1991	11 283	7425	2698	4484	1446
1992	12 823	7719	2756	4419	1298
% change	+13.6[7]	+3.9[5]	+2.2[1]	-1.5[2]	-10.2[1]

	SW England	Wales	NW England	NE Ireland
1991	835	6544	783	2446
1992	886	6518	739	3459
% change	+6.1[1]	-0.4[3]	-5.6[1]	+41.4[1]

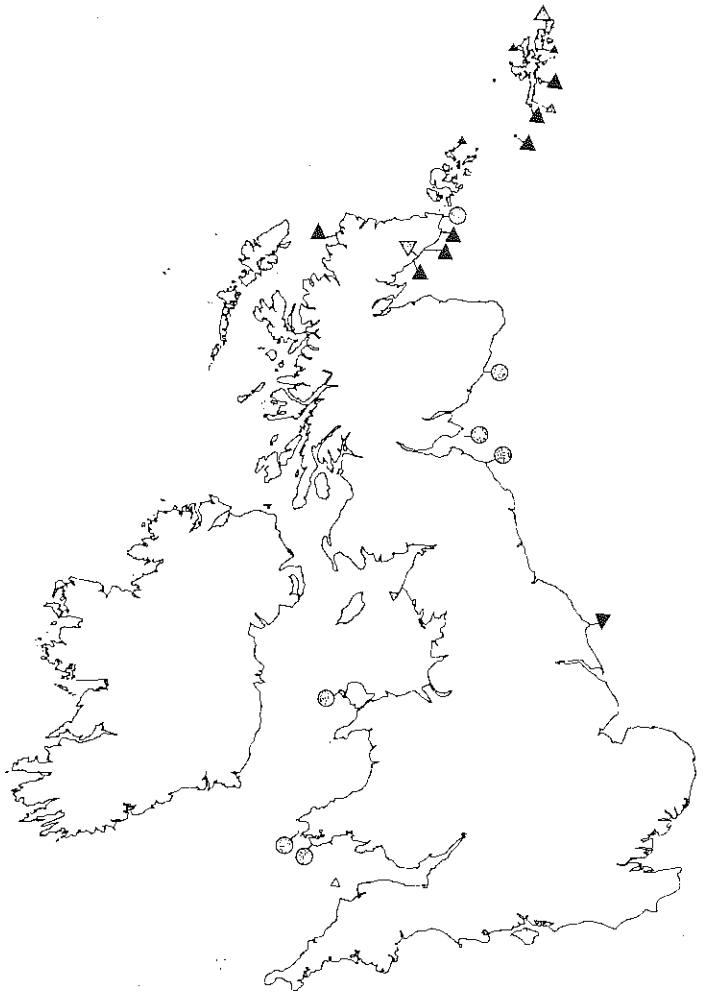

Figure 2.22.2 **1991-92 population changes at individual guillemot colonies** (based on 5-10 counts per year).
Solid triangles = significant increases (▲) or decreases (▼);
stippled triangles = non-significant increases (△) or decreases (▽) by > 5%;
stippled circles (⊙) = non-significant changes by < 5%.
Symbol sizes indicate population sample in 1991 (101-1000, 1001+ adults)

Table 2.22.2 **Guillemot breeding success, 1986-92**: number of chicks 'fledged' per site regularly occupied by a pair or per per pair laying.* For 1991 & 1992, productivity is presented as mean & standard error if based on three or more study-plots (equivalent to mean & half-range for two plots); n = number of pairs (plots).

Colony	1986-90 fledged/pair			1991 fledged/pair			1992 fledged/pair		
	yrs	mean	s.e.	n	mean	s.e.	n	mean	s.e.
Canna (Lochaber), impression		good			good			good	
Hirta St Kilda (W Isles)	1	**0.64**			-			-	
Handa (Sutherland)	3	**0.69**	0.04	233(4)	**0.67**	0.02	194(4)	**0.76**	0.01
Foula (Shetland), impression		good			good			good	
Sumburgh Head (Shetland)	2	**0.71**	0.08	86(1)	**0.71**		**96(1)**	**0.75**	-
Fair Isle (Shetland)		-		193(2)	**0.70**	0.09	**141(2)**	**0.74**	-
Papa Westray (Orkney)	2	**0.74**	0.02	140(2)	**0.72**	0.04	146(5)	**0.77**	0.03
Marwick Head (Orkney)	5	**0.7**	0.03	87(1)	**0.78**	-		-	
Row Head (Orkney)	1	**0.75**	-	79(1)	**0.83**	-		-	
Mull Head (Orkney)	2	**0.74**	0.03	90(1)	**0.70**	-		-	
Isle of May (NE Fife)	5	**0.81**	0.02	754(5)	**0.81**	0.03	745(5)	**0.85**	0.01
Farne Isds (Northumberland)	3	**0.7**	0.05	67(2)	**<0.87**	-		-	
Bempton (Humberside)		-		150(4)	**0.70**	0.03	188(4)	**0.80**	0.04
Breil Nook (Humberside)		-			-		146(2)	**0.71**	0.05
Berry Head (Devon)		-		52(2)	**0.73**	0.01	68(2)	**0.84**	0.08
Skomer (Dyfed)	2	**0.74**	0.05	140(6)	**0.75**	0.11	169(6)	**0.72**	0.04

*At colonies where monitoring begins in early May, sample is number of sites where egg or apparent incubation recorded; where monitoring begins later in May, sample also includes sites regularly attended by *pairs* (usually failed breeders). Small differences between years or colonies may reflect differences in intensity of monitoring.

2.23 Razorbill *Alca torda*

Breeding numbers (table 2.23.1, figures 2.23.1-2)

Monitored colonies in all regions showed population increases, or little change, between 1991 and 1992 (based in most cases on numbers of razorbills attending sample plots). At individual colonies, significant increases were noted at Iresgeo (Caithness) and Lundy (Devon), and a significant decrease at South Stack (Gwynedd). Population trends for regional samples during 1986-92 as a whole have, in most cases, been similar to those for guillemot (section 3.22). In Shetland, for example, both species show a marked recovery from low numbers in 1990. Most populations appear to be stable or increasing, with significant 1986-92 increases noted for Welsh, SE Scottish and NE Scottish samples.

Breeding success (table 2.23.2)

Productivity was assessed at four colonies in 1992. Productivity was high at both study colonies in the SE Scotland (>0.8 chicks/breeding pair), but was lower (<0.7 chicks/pair) on the Calf of Man and on Fair Isle (Shetland). Elsewhere in Shetland, razorbills on Foula again appeared to be breeding successfully, while at Hermaness chick weights were again much higher than in 1989-90.

Discussion

Data on productivity for this species have always been limited, in large part because of the difficulty of establishing suitable study-samples. We hope that coverage can be improved, as there are indications from some colonies of rather low breeding output in recent years. Survival or growth-rates of chicks at several Shetland colonies do appear to have improved in 1991 and 1992, however.

Difficulties are also encountered in monitoring population changes of this species, as marked day-to-day variation in attendance of adult-plumaged birds (the standard count unit) can make it difficult to identify 'real' population changes. It appears, however, that most populations are stable or increasing at present. Low numbers at Shetland colonies during 1989-90 may have reflected decreased attendance of non-breeders and off-duty breeders, as with guillemots there, but sample populations returned to 1987 levels in 1992. Sample population plots were established for this species and guillemot on two further sections of the NE Scotland coast in 1992.

Table 2.23.1 **Population changes at monitored razorbill colonies, 1991-92** (adults attending colony in first three weeks of June). Superscript = number of colonies counted in both years. Figures for regions in block capitals are based on means of 5-10 annual counts of study plots within each colony.

	Shetland	N Scotland	SE Scotland	Wales	NW England	NE Ireland
1991	334	802	692	1397	314	610
1992	335	902	711	1363	318	960
% change	$+0.3^5$	$+12.5^5$	$+2.7^2$	-2.4^3	$+1.3^1$	$+57.4^1$

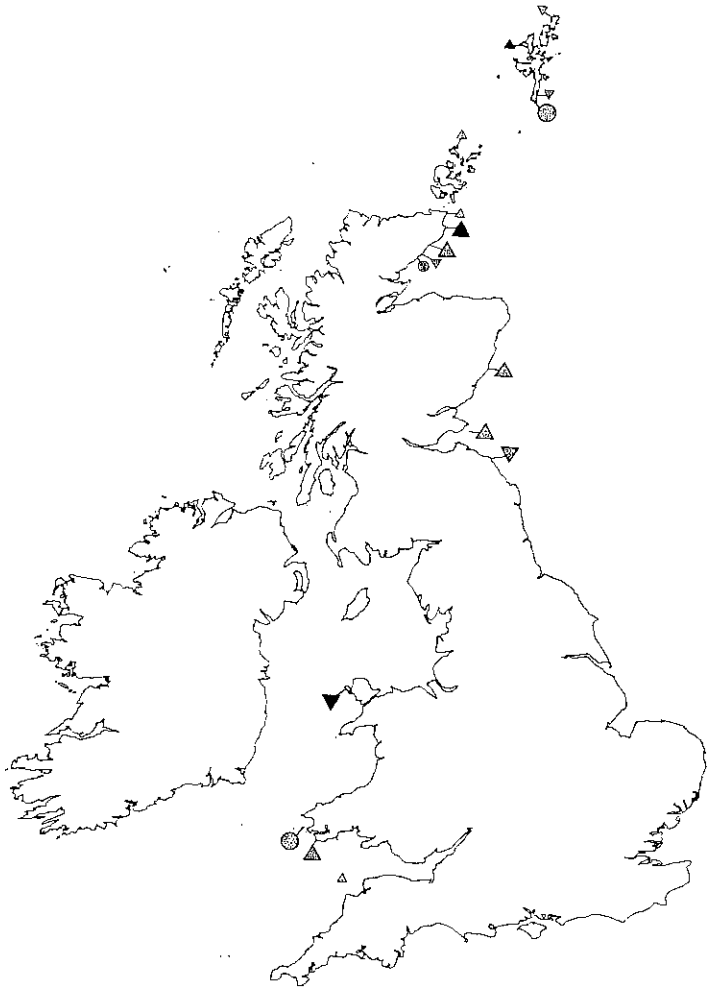

Figure 2.23.1 **1991-92 population changes at individual razorbill colonies**
(based on 5-10 counts per year).
Solid triangles = significant increases (▲) or decreases (▼);
stippled triangles = non-significant increases (△) or decreases (▽) by > 5%;
stippled circles (○) = non-significant changes, by < 5%.
Symbol sizes indicate population sample in 1991 (11-100, 101-1000 adults)

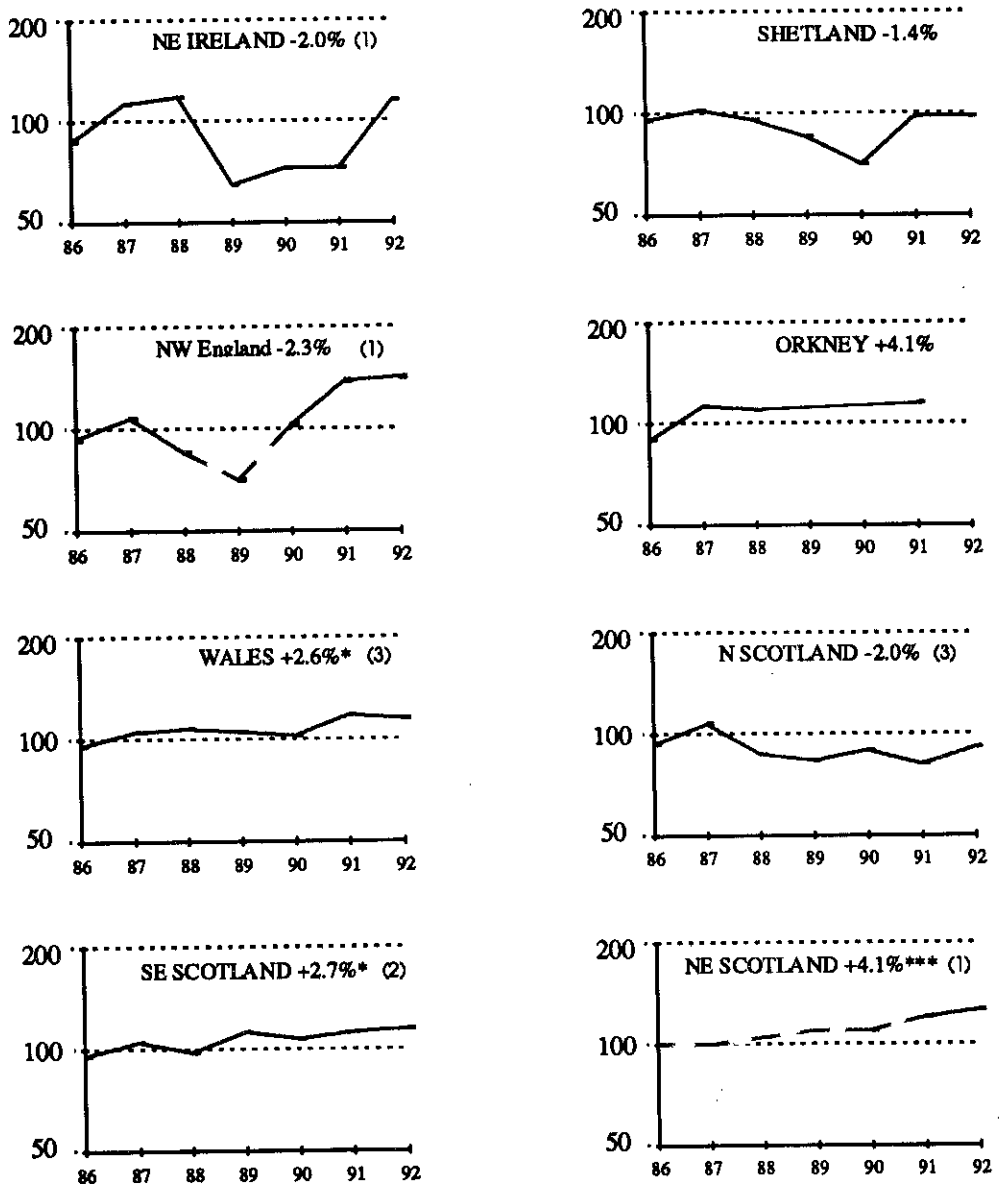

Figure 2.23.2 **Regional population indices for breeding razorbills, 1986-92 (adults at colonies in June).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05; *** P<0.001). Broken trend lines are based on sample counts of 100-200 individuals. Region names in capitals indicate indices based on 5-10 counts per colony each year. Number of colonies counted in each region in each year = 3+ (unless (1) or (2) indicated).

Table 2.23.2 **Razorbill breeding success, 1986-92**: number of chicks fledged per active site (where egg or apparent incubation recorded, or pair regularly present). For 1991 & 1992, productivity is presented as mean & standard error if based on several study-plots; n = number of pairs (plots).

Colony	1986-90 fledged/pair			1991 fledged/pair			1992 fledged/pair		
	yrs	mean	s.e.	n	mean	s.e.	n	mean	s.e.
Canna (Lochaber)		**good**			**good**			**good**	
Handa (Sutherland)	3	**0.74**	0.06						
Foula (Shetland), impression		**variable**			**good**			**good**	
Fair Isle (Shetland)	1	**0.55-0.69**		64	**≤0.58**	-	69	**≤0.55**	-
Isle of May (NE Fife)	5	**0.72**	0.01	104(4)	**0.71**	0.06	105(4)	**0.86**	-
St Abb's Head (Berwickshire)		-			-		30	**0.83**	-
Calf of Man (Isle of Man)		-			-		32	**≤0.69**	-

≤ indicates young not necessarily known to have reached fledging age

2.24 Black guillemot *Cepphus grylle*

Breeding numbers (table & figure 2.24.1)

Monitored populations in Shetland have been roughly stable during 1986-92. The few populations counted in both 1991 and 1992, here and in Orkney and the Isle of Man, increased slightly. The Orkney counts, around Papa Westray, were 15% lower than in 1983, however. On the Isle of Man, which holds the densest concentrations of tysties south of Scotland, sample counts indicate a significant increase during 1986-92 as a whole.

Breeding success (table 2.24.2)

Productivity of Fair Isle birds was high (1.0 chick fledged/pair), above average for the period 1987-92. Colonies around Papa Westray in Orkney were generally less successful, but a marked improvement at North Hill, after total failure in 1991, may have reflected control measures on rats.

Discussion

An expanded series of counts is being made in southern Shetland in spring 1983, following the wreck of the *Braer* oil-tanker in January. At least 200 tysties are known to have died in that pollution incident.

Systematic counts of the Scottish population, based on adult-plumaged birds in suitable breeding habitat during early mornings in spring, were completed in 1991, when remaining parts of SW Scotland were surveyed by JNCC (Seabird Colony Register, unpublished). More detailed monitoring of parts of the west Scottish population would be valuable, as detailed trends for this important coastline are completely unknown.

Mammalian predators are known to have a major influence on the distribution of tysties, as low-lying coasts are rarely occupied on islands which hold rats. Predation by rats can severely reduce breeding success (e.g. as suspected on Papa Westray, Orkney). The presence of feral mink *Mustela vison* on much of the west coast of Scotland must also be of concern, give their known impact on tern colonies there (see sections 2.19 & 2.20).

Table 2.24.1 **Population changes at monitored black guillemot colonies, 1991-92** (adults in breeding habitat in early morning, April/early May). Superscript = number of colonies/lengths of coastline counted in both years.

	Shetland	Orkney	Isle of Man
1991	206	518	123
1992	219	538	135
% change	+6.3[2]	+3.9[2]	+9.7[1]

Table 2.24.2 **Black guillemot breeding success, 1986-92:** number of chicks fledged per active site (where egg or apparent incubation recorded).

	1987-90 mean			1991		1992	
	yrs	yng/site	s.e.	sites	yng/site	sites	yng/site
Fair Isle (Shetland)	3	**0.73**	-	48	**0.85**	47	**1.00**
N Ronaldsay (Orkney)	1	**0.54**	-		-		-
Holm of Papa Westray (Orkney)	4	**≤1.12**	0.12	63	**≤1.09**	71	**≤0.91**
North Hill, P. Westray (Orkney)		-		27	**≤0.15**	30	**≤0.50**
Sheep Height, P. Westray (Orkney)		-		6	**0.0**	12	**≤1.58**

≤ = based on counts of chicks present in mid July.

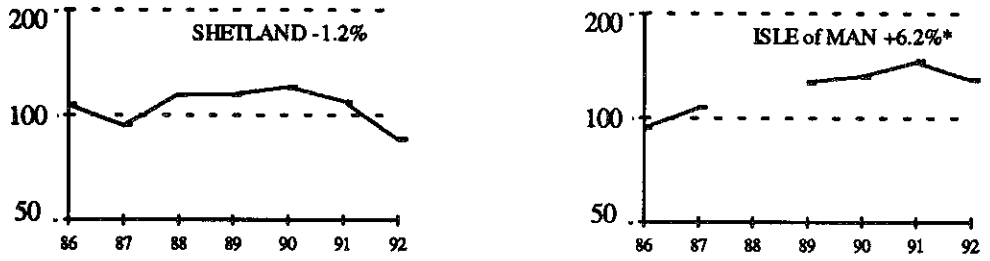

Figure 2.24.1 **Population indices for black guillemots, 1986-92 (adults at colonies in April).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05).

2.25 Puffin *Fratercula arctica*

Breeding numbers (table & figure 2.25.1)

Numbers in study transects on the Isle of May fell slightly in 1992, but have been stable overall during 1986-92. Continuing erosion of the study transect on Fair Isle probably contributed to the continued significant decline in that sample. Whether the Fair Isle population as a whole is also decreasing is not known. On Eilean Mor in the Flannan Isles (Western Isles), five transects averaged 0.46 apparently occupied burrows per m^2 (± s.d. 0.13) in 1992, or an average 60% higher than previous counts, in 1975. Observer/date differences may have contributed to some extent, however.

Breeding success (table 2.25.2)

Three Scottish colonies fledged an estimated average 0.79 (± s.e. 0.04) chicks per egg laid, little or no change from 1991. Isle of May birds were the most successful this year, but all figures were high. Breeding success also appeared to be good at Foula, Sumburgh Head, and Hermaness in Shetland. Survival of chicks was high at the latter two colonies: fledging success was 87% of 30 small chicks at Hermaness and 82% of 33 chicks at Sumburgh Head, both figures higher than in 1991 (63% and 77%, respectively).

Discussion

As in 1991, the breeding success of Shetland puffins appears to be much improved compared to the period 1986-89, although most recent data are based on chick survival only. Predation was again thought to have reduced success at Sumburgh Head, where feral ferrets *Mustela furo* appear to be a problem. Breeding success remains high at monitored colonies elsewhere, but improved coverage is still needed. Attempts to monitor success on the Flannan Islands in 1992 were foiled by bad weather, but the Scottish Wildlife Trust hopes to set up a scheme there, and possibly on the Shiants (also in the Western Isles) in 1993.

Attempts to arrive at a rough estimate of the Shiant Islands population in 1992, based on counts of adults visible, proved unsuccessful. The most recent estimate for this colony was of *c*76 000 pairs in 1970, second only to St Kilda in size. Further work is needed there, and it is hoped that sample transects can be re-surveyed in 1993. Establishment, or re-surveying, of study plots or transects elsewhere would also be useful; three-yearly counts of quadrats on Dun, St Kilda will continue in 1993.

Table 2.25.1 **Population changes at monitored puffin colonies, 1991-92** (apparently occupied burrows in sample transects).

	Fair Isle (Shetland)	Isle of May (SE Scotland)
1991	120	2140
1992	97	2051
% change	-19.2	-4.1

Table 2.25.2 **Puffin breeding success, 1986-92**: number of chicks fledged per egg or per occupied burrow; n = number of burrows

Colony	unit	1986-90 mean yrs	yng/pair	s.e.	1991 n	yng/pair	1992 n	yng/pair
Dun, St Kilda (W Isles)	egg	1	**0.68**		93	**0.72**	95	**0.76**
Hermaness, Unst (Shetland)	impression		**mainly poor**			**improved***		**good***
Foula (Shetland)	impression		**mainly poor**			**good/normal**		**good**
Sumburgh Head (Shetland)	impression		**mainly poor**			**improved***		**good***
Fair Isle (Shetland)	egg	4	**0.69**	0.04	120	**0.87**	97	**0.75**
Isle of May (NE Fife)	egg	5	**0.83**	0.05	153	**0.78**	184	**0.87**
Skomer (Dyfed)	occ. burrow	4	**0.79**	0.03	103	**0.83-0.87**		-

* = based on survival of chicks.

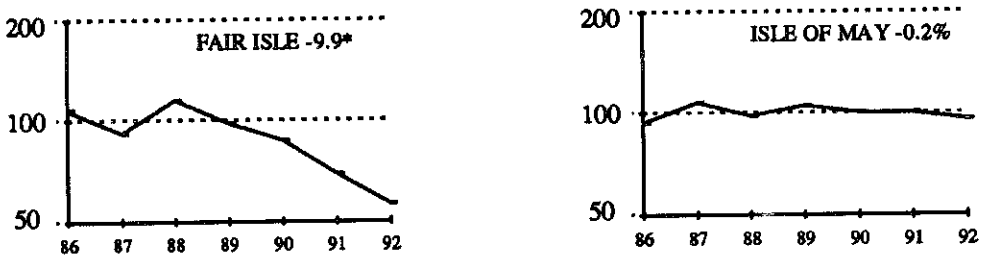

Figure 2.25.1 **Population indices for breeding puffins, 1986-92 (occupied burrows in study plots).** Average annual rates of change are calculated by regression of log of index against year (significant trends: * P<0.05).

3. ACKNOWLEDGMENTS

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