



Mid-winter and spring counts of Pink-footed and Greylag Goose in Britain, 1995

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SUMMARY

Further to the 'traditional' autumn grey goose censuses, the second in the current phase of mid-winter and spring co-ordinated counts of Pink-footed and Greylag Geese took place over the weekends of 28/29 January and 8/9 April 1995. The total numbers of both Pink-footed Geese (c.168000) and Greylag Geese (c.48000) counted in January, represented 65% and 55%, respectively, of the numbers that had been counted in the previous autumn. In mid-winter, Pink-footed Geese appeared to be concentrated in east-central Scotland (32%) and in more southerly haunts such as west England (18%) and east England (15%). This is, however, in contrast to the previous year when over 42% of the January count was recorded in Norfolk (east England) alone. The total numbers of Pink-footed Geese (c.106000) and Greylag Geese (c.36000) counted in April were lower than had been expected. There was a large concentration of Pink-footed Geese recorded in north-east and east-central Scotland: 69% of the count total, although this is smaller than the proportion recorded there in spring 1994 (88%). Greylag Geese were more difficult to find in spring, however their distribution was shown to be more evenly distributed across Scotland in the 1995 spring count. Like the Pink-footed Geese, the bulk of the population, some 50%, was found in north-east and east-central Scotland.

INTRODUCTION

Pink-footed Geese *Anser brachyrhynchus* breeding and moulting in Greenland and Iceland number around 250000, and winter exclusively in Britain. On arrival in Britain, Pink-footed Geese congregate in well-established localities before dispersal to ultimate wintering areas. Autumn arrival areas are well known in east-central Scotland and Grampian (e.g. Newton *et al.* 1990, Bell *et al.* 1988) and staging areas also exist in south-east Scotland, particularly in the Borders and Lothians (Brown and Brown 1992). Large concentrations tend to break up as the winter progresses and in most staging areas lesser numbers stay to over-winter, although flocks of several thousand can be seen in spring (e.g. Fox *et al.* 1994). Feeding is normally by day but occasionally well into the night, usually under a full moon. Pink-footed Geese leave Scotland in April and feed in the lowland valleys of Iceland until the breeding areas, principally Thjorsarver in the south central highlands, begin to clear of snow during the first weeks of May (Fox *et al.* 1992).

The Icelandic breeding population of Greylag Geese *Anser anser*, of around 100000, joins the native and re-introduced stock of this species to overwinter in Britain, arriving in October. The wintering Greylag Geese are less conservative in their choice of roost than other grey geese, often roosting on small floodwaters, river shingle/sandbanks or small lochs, as well as larger lochs and estuaries (Newton *et al.* 1973). The return migration starts in early April, usually some two to three weeks earlier than Pink-footed Geese, with these birds feeding in the lowlands of Iceland before breeding there.

Britain supports approximately 85% of the entire world population of Pink-footed Geese (Madsen & Mitchell 1994) and approximately 90-95% of the Icelandic-breeding population of Greylag Geese. Britain therefore has a special responsibility for these geese under international legislation (EC Birds Directive, Ramsar Convention and The Bonn Convention, e.g. Stroud *et al.* 1990). Effective monitoring of trends in the numbers and distribution of these two grey goose populations is fundamental to the formulation and implementation of conservation policy with respect to Pink-footed and Greylag Geese.

A spring count of Pink-footed and Greylag Geese was carried out from 1982 to 1986, and from 1988 to 1990. Results were variable and, at least in the last few years, recorded only 60% of Pink-footed and 50% of Greylag Goose estimated population totals (as established in the previous autumn census). Late-winter and spring are important times for geese, and they feed vigorously, storing nutrient reserves required for successful migration and breeding. It is therefore important to have counts outwith the autumn period if we are to establish where the bulk of the grey goose populations feed and overwinter.

Since winter 1993-94 organised roost counts have been attempted once in mid-winter and once in the spring. This report deals with the results of two organised counts in January and April 1995.

METHODS

Co-ordinated counts were carried out on the weekends of 28/29 January and 8/9 April 1995, using the same methods as the long-running autumn counts. The counts did not attempt to cover every known goose roost in the country, but rather, ensured coverage of the most important roosts, as determined by *a priori* analysis of previous winter and spring counts in each area. In addition, analysis of the WeBS data revealed a few additional sites where *ad hoc* counts have been made in the past and which have held reasonable numbers of geese. Where knowledge of the status of geese in particular areas was largely unknown, area organisers were consulted and encouraged to take part in this process. In some areas it was not possible to cover all roosts on the official count dates, and observations made up to five days either side of the count weekend were included in the mid-winter and spring count totals. It has been possible to incorporate additional WeBS counts into this report. These are primarily of small numbers of geese recorded at sites not normally covered by the grey goose counts. Invariably they were undertaken during the day (not at dawn or dusk) and thus probably represent underestimates of the true number of geese using the site as a roost. However, they are important as a means of identifying new (or long abandoned) roosts which may become important in years to come, and efforts will be made to count these roosts during future censuses.

Comparisons are made between the mid-winter or spring counts and average winter counts from the 37 sites holding internationally important numbers of Pink-footed Geese and 29 sites holding important numbers of Greylag Geese cited in Cranswick *et al.* (1995).

RESULTS

Coverage was good, and totals of 168276 Pink-footed and 48227 Greylag Geese were recorded (Table 1). In all, 160 sites were checked on 28/29 January 1995. Most of the major roosts and most of the minor roosts identified were covered. Around this period, conditions were reasonable for counting and visibility was recorded as good in most cases. It was generally cold and overcast, the wind swinging from south-westerly to north-westerly, with rain, hail or snow-showers in some places.

The sites included in this count, and the numbers of geese recorded at each site, are listed in Appendix 1. These data are presented with the mean of four autumn census counts (1991 to 1994) for October (Pink-footed Geese) and November (Greylag Geese) to give an indication of the importance of each site at this time of year. Of the 37 sites regularly holding internationally important numbers of Pink-footed Geese, the principal omissions from the January counts were (shown with the 1989-90 to 1993-94 average winter maxima): Castle Loch (Lochmaben, 11127), Crombie Reservoir (2628), Fala Flow (9898), Skinflats (2267), Glenfarg Reservoir (3228), Hightae Loch (Lochmaben, 2124), Kinnordy Loch (7033), Lake of Menteith (2553), Loch Mahaike (2527), Loch Mullion (2073), Loch Tullybelton (4580), Gargunnock (R.Forth, 2060), and Upper Cowgill Reservoir (4650).

The distribution of Pink-footed Goose counts in January are shown in Figure 1. Large concentrations of Pink-footed Geese were recorded in Lancashire (31000), in Norfolk (24132) and on the Solway Estuary (19708). Together, these three areas represented 44% of the total counted in January, and 29% of the total October population estimate, (by comparison, the three areas held only 11% of the autumn estimate in October, and 18% in November). Pink-footed Geese were concentrated in north-east and east-central Scotland to a lesser extent, together representing a further 32% of the count total (Table 2, Figure 1).

The 16 sites which held more than 1900 Pink-footed Geese (internationally important level) in January 1995 are shown in Table 3, and all but two (Loch Flemington and Monikie Reservoir) regularly support that number or more.

For Greylag Geese, of the 29 sites regularly holding internationally important numbers, the two principal omissions from the January counts were: Corby Reservoir (1466) and Fedderate Reservoir (1967). A feature of the January count was the relatively low number of Greylag Geese recorded, approximately 56% of the total population estimate as established by the November census. The distribution of Greylag Goose counts in January is shown in Figure 2. Notable concentrations were found in north and north-east Scotland, together accounting for 49% of the count total (Table 2, Figure 2). South-west Scotland and north-west England held the lowest number of Greylag Geese, with only 16% of the count total.

The 15 sites which held more than 1000 Greylag Geese (internationally important levels) in January 1995 are shown in Table 3, and all but four (Beaully Firth, Caithness sites, Haddo Country Park and Alloa Inch) regularly support that number or more.

Spring counts

Coverage was reasonably good and a total of 106292 Pink-footed Geese and 36373 Greylag Geese were counted (Table 1). Fewer sites overall were included in the spring count (129) than the January count, although the principal omissions for both species were few. The sites included in this count, and the numbers of geese recorded at each site, are listed in Appendix 1.

For Pink-footed Geese, counts were not received from (1989-90 to 1993-94 average winter maxima already given above): Castle Loch (Lochmaben), Crombie Reservoir, Glenfarg Reservoir, Hightae Loch (Lochmaben), Loch Mahaike, Gargunnoch (R.Forth), and Upper Cowgill Reservoir. The 15 sites which held internationally important numbers of Pink-footed Geese (more than 1900) are shown in Table 3, and of these all but four (Beaully Firth, Caithness, Alloa Inch and Haddo Country Park) regularly support that number. Notable concentrations were found in north-east Scotland, and in particular the Ythan Estuary (21440) and Loch of Strathbeg (12830) - the two sites which held largest numbers in spring 1994.

The major Greylag roosts which were not covered in the April census were: Corby Loch, Fedderate Reservoir, Holburn Moss (2138), Loch of Lintrathen (3608) and Loch of Skene (13171). The total number of Greylag Geese recorded was low (36376) with only 42% of the total population as established by the November count. Notable concentrations in April 1995 were found in north and north-east Scotland, together accounting for 62% of the count total (Table 2, Figure 2). South-east Scotland and north-east England showed the lowest number of Greylag Geese, with only 6% of the count total. Notable concentrations were found at Haddo Country park (4900) and on Orkney (4012). The 11 sites which held internationally important numbers of Greylag Geese (more than 1000) are shown in Table 3, and of these all but three (Loch Flemington, Eden Estuary and Bemersyde Loch) regularly support that number.

The principal changes in the distribution of both Pink-footed and Greylag Geese at a regional level between the January and April counts are shown in Table 1. The numbers of Pink-footed Geese recorded in Ross & Cromarty increased from 557 to over 12000; those in Gordon/Aberdeen increased from 3200 to over 26000 and those in Perth & Kinross increased from 16773 to over 21000. Other regions showed a decrease in the number of Pink-footed Geese counted: from over 13000 to 1800 in Angus/Dundee; from nearly 15000 to 1630 in Fife; from nearly 20000 to 2000 on the Solway (Annandale & Eskdale/Nithsdale); from 31000 to 5000 in Lancashire and from over 24000 to virtually none in Norfolk.

Changes in the distribution of Greylag Geese were not so dramatic as in the case of Pink-footed Geese. The numbers recorded in Orkney increased from 4674 to over 6000 and those in Gordon/Aberdeen increased from 2000 to nearly 5000 - but overall, increases were small in magnitude and infrequent. More noticeably, some regions showed a decrease in the number of Greylag Geese counted: from 1000 to 33 in Angus/Dundee; from 2300 to 400 in the Glasgow area; from nearly 1700 to just 30 in Cumbria and from over 5000 to just 150 in north-east England.

Table 1. The numbers of Pink-footed and Greylag Geese recorded in Great Britain in January and April 1995. The number of sites counted is also given.

DISTRICT/REGION	JANUARY			APRIL		
	Sites	Pink-footed Geese	Greylag	Sites	Pink-footed Geese	Greylag
Shetland	nc	-	-	nc	-	-
Orkney	11	0	4674	8	10	6082
Western Isles	4	0	246	4	0	339
Caithness	2	0	1845	1	2940	875
Sutherland	1	0	26	3	0	420
Ross & Cromarty	11	557	4862	9	12673	3720
Inverness/Nairn	1	2500	515	1	1061	1135
Badenoch & Strathspey	1	0	713	1	0	0
Moray	4	0	7421	4	4589	5086
Banff & Buchan	1	15000	130	1	12830	0
Gordon/Aberdeen	3	3200	2043	3	26390	4925
Kincardine & Deeside	1	0	925	1	1248	36
Angus/Dundee	9	13450	1009	7	1802	33
Perth & Kinross	13	16773	3654	16	21182	4215
Central	3	7780	945	4	3635	850
Fife	16	14956	3072	15	1630	2277
Argyll & Bute	4	1	2404	4	3	2058
Glasgow area*	6	10	2283	3	0	412
Clydesdale	1	156	0	0	0	0
Stewartry/Wigtown	8	1850	1293	7	2238	1667
Annan. & Eskdale/Nithsdale**	3	19708	119	2	2016	0
East/Midlothian	10	4632	778	8	952	478
Edinburgh/West Lothian	7	860	881	3	560	220
Borders west***	6	0	1605	5	548	1363
Tweeddale	2	8770	0	1	3500	0
North-east England	10	250	5116	6	0	152
Cumbria**	9	447	1668	4	1375	30
Lancashire and Merseyside	1	31000	0	1	5000	0
Lincs/Notts/Humberside	8	1236	0	4	0	0
Norfolk	4	24308	0	3	10	0
TOTAL	160	168276	48227	129	106292	36373

* Glasgow area includes Bearsden & Milngavie, Clydebank, Cumbernauld & Kilsyth, Cumnock & Doon Valley, Dumbarton, East Kilbride, Eastwood, Glasgow City, Hamilton, Inverclyde, Kilmarnock & Loudoun, Kyle & Carrick, Monklands, Motherwell, Renfrew and Strathkelvin.

** for convenience, counts from the Solway Firth are included in the Annandale & Eskdale/Nithsdale total even though some birds roost and feed on the Cumbrian side of the estuary.

*** includes Ettrick & Lauderdale, Roxburgh and Berwickshire.

nc not counted

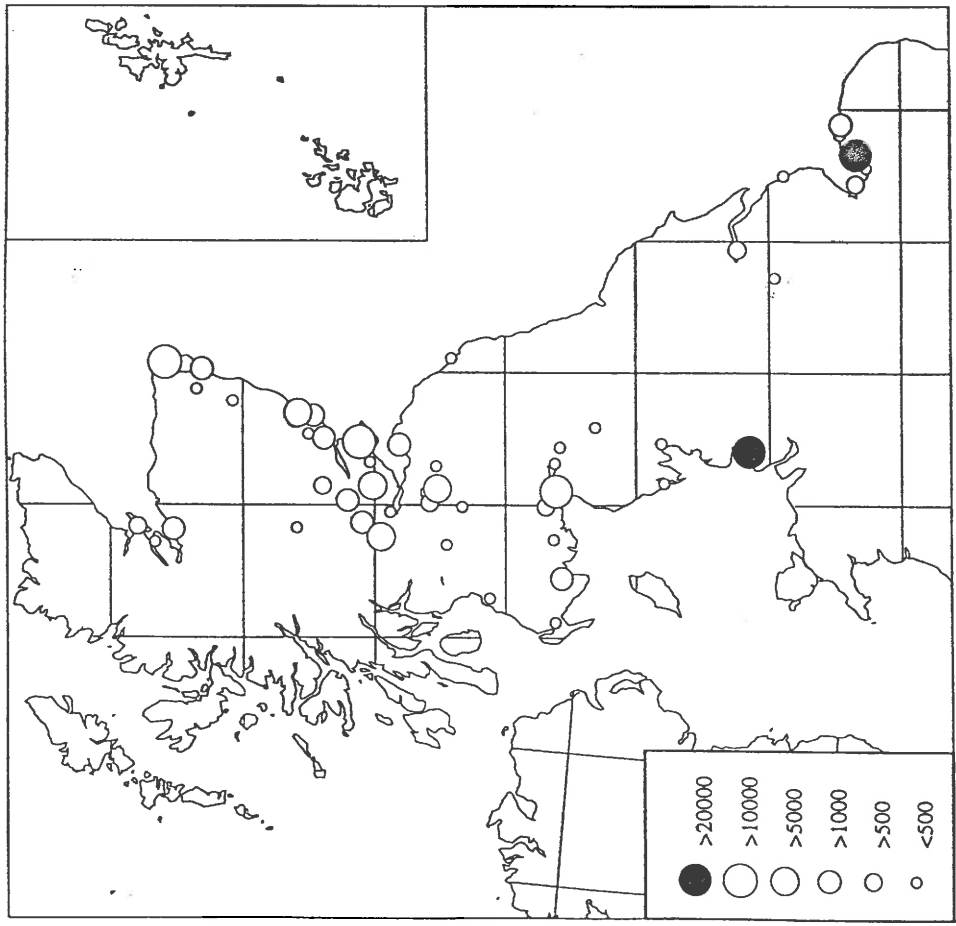


Figure 1a. The distribution of Pink-footed Geese recorded in January 1995

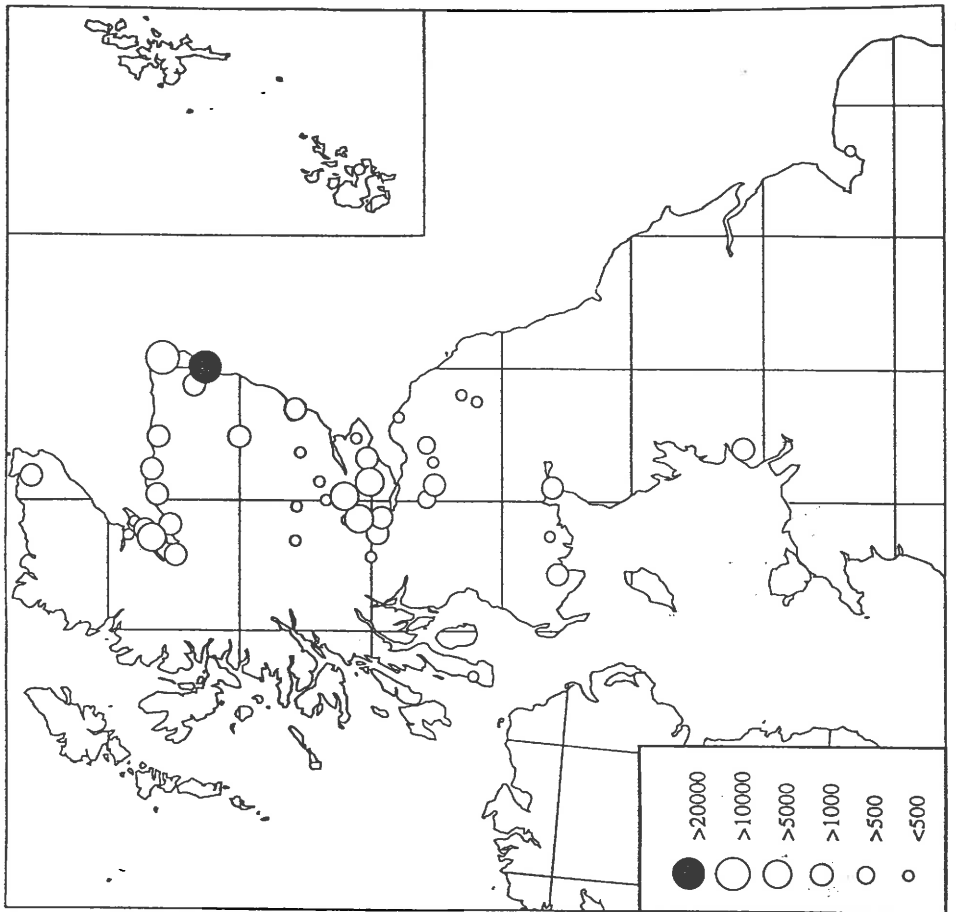


Figure 1b. The distribution of Pink-footed Geese recorded in April 1995

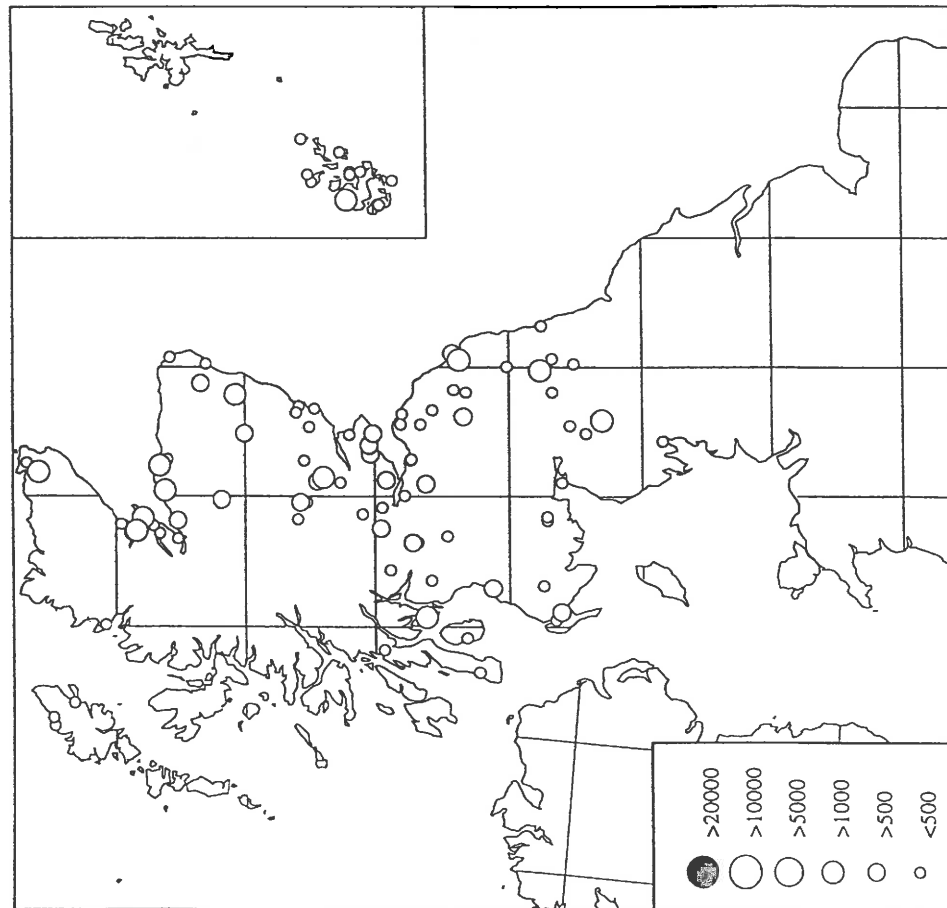


Figure 2a. The distribution of Greylag Geese recorded in January 1995

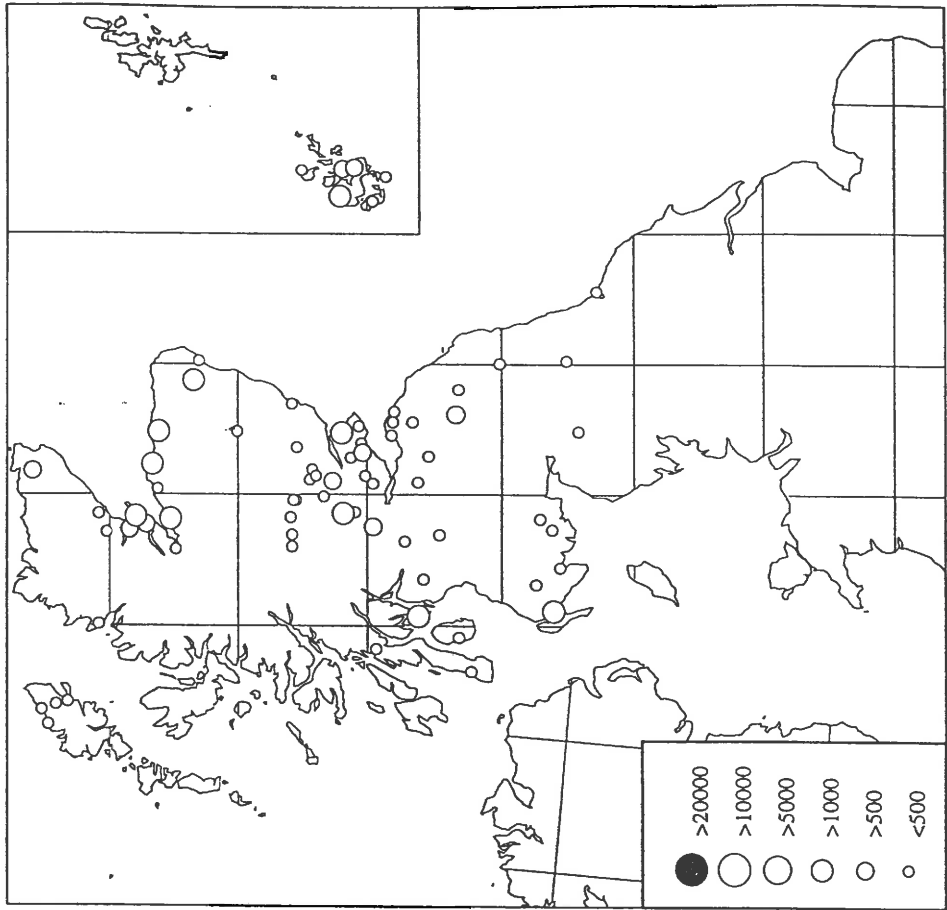


Figure 2b. The distribution of Greylag Geese recorded in April 1995

Table 2. *Gross regional distribution of Pink-footed and Greylag Geese in Britain in January and April 1995, expressed as a proportion of the count for each species.*

Area *	Pink-footed Goose		Greylag Goose	
	January	April	January	April
North Scotland	1.8	15.7	26.7	34.6
North-east Scotland	10.8	43.4	21.8	27.6
East-central Scotland	31.5	26.6	18.0	20.3
South-east Scotland/North-east England	8.6	5.2	17.4	6.1
South-west Scotland/North-west England	13.2	5.4	16.2	11.5
West England	18.4	4.7	0	0
East England	15.7	0	0	0

* areas are defined as follows (see also Figure 3):

North Scotland:	Shetland, Orkney, Western Isles, Highland
North-east Scotland:	Grampian
East-central Scotland:	Tayside, Central, Fife
South-east Scotland/North-east England:	Lothian, Borders, Northumberland
South-west Scotland/North-west England:	Strathclyde, Dumfries & Galloway, Cumbria
West England:	Lancashire, Merseyside
East England:	Humberside, Lincolnshire, Norfolk

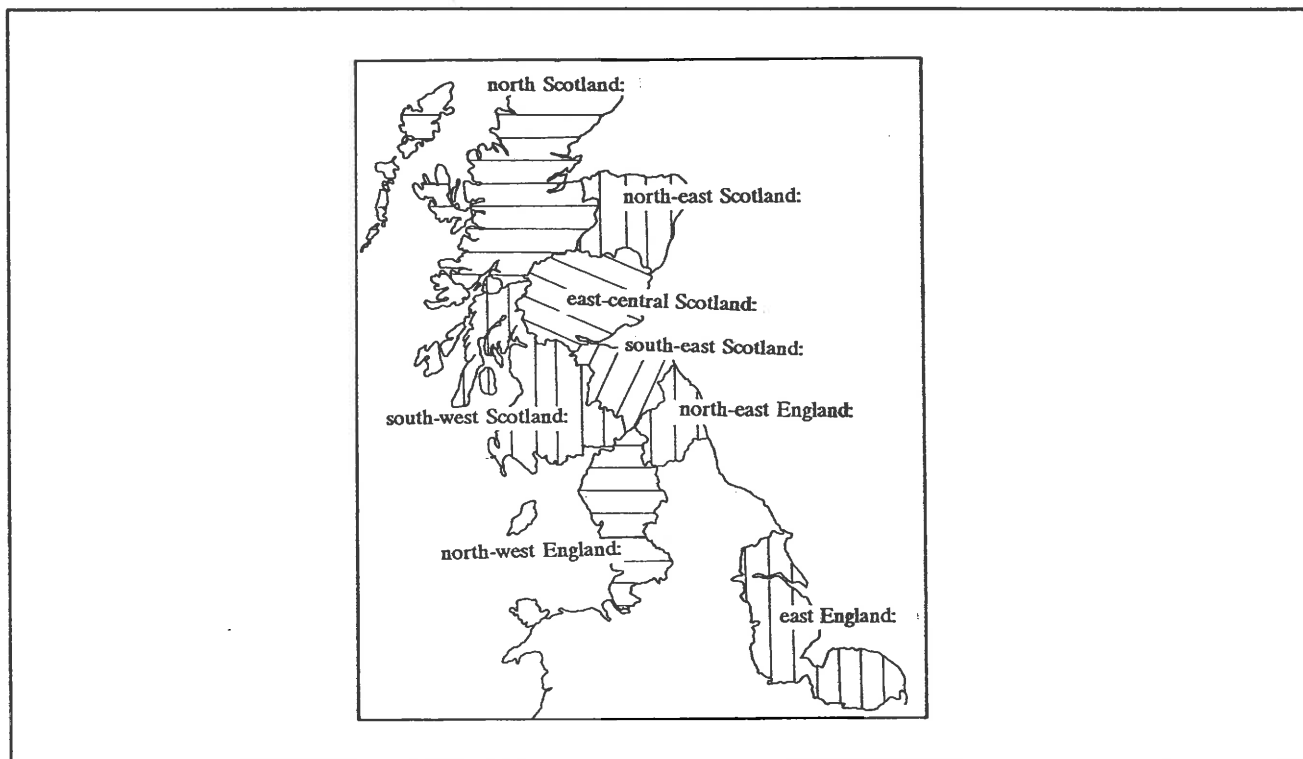


Figure 3. *Area names used in this report*

Table 3. Principal Pink-footed and Greylag Goose resorts counted in winter and spring 1995. Those sites with more than 1900 Pink-footed Geese or more than 1000 Greylag Geese counted are shown. (Column B shows counts as a proportion of census totals).

Pink-footed Geese	January count	% of total January count	April count	% of total April count
○ South Lancashire Mosses	31000	(18.4)	○ Ythan Est. (Meikle Loch/Slains)	21440 (20.2)
○ Snettisham	20830	(12.4)	○ Loch of Strathbeg	12830 (12.1)
○ Solway Estuary (consolidated)	19108	(11.4)	○ Loch Leven	7849 (7.4)
○ Loch of Strathbeg	15000	(8.9)	○ Dupplin Lochs	6650 (6.3)
○ Cameron Reservoir	14860	(8.8)	○ Carsebreck & Rhynd Lochs	5920 (5.6)
○ Loch Leven	9912	(5.9)	○ Udale Bay	5816 (5.5)
○ Montrose Basin	9100	(5.4)	○ South Lancashire Mosses	5000 (4.7)
○ West Water Reservoir	8770	(5.2)	○ West Water Reservoir	3500 (3.3)
○ Forth and Teith valleys	7780	(4.6)	● Beaulay Firth (consolidated)	2977 (2.8)
○ Aberlady Bay	4630	(2.8)	● Caithness	2940 (2.8)
○ Holkham Bay	3300	(1.9)	● Alloa Inch	2300 (2.2)
○ Carsebreck and Rhynd Lochs	3300	(1.9)	○ Wigtown Bay	2300 (2.2)
○ Meikle Loch/Slains (Ythan Est.)	3130	(1.9)	○ Cromarty Firth	2292 (2.2)
○ Dupplin Lochs	2910	(1.7)	● Haddo Country Park	2100 (1.9)
● Loch Flemington	2500	(1.5)	○ Solway Estuary (consol.)	2016 (1.9)
● Monikie Reservoirs	2000	(1.2)		
Greylag Geese	January count	% of total January count	April count	% of total April count
○ Loch Spynie	3900	(8.1)	○ Haddo Country Park	4900 (13.5)
○ Findhorn bay	3065	(6.4)	○ Orkney (west mainland)	4012 (11.0)
○ Orkney (West Mainland)	2815	(5.8)	○ Loch Spynie	2300 (6.3)
○ Bute (consolidated)	2070	(4.3)	○ Lower Bogrotten	2300 (6.3)
○ Holburn Moss	2000	(4.1)	○ Drummond Pond	2200 (6.0)
○ Dornoch Firth	1805	(3.7)	○ Loch Eye	1985 (5.5)
○ Loch Eye	1655	(3.4)	○ Bute (consolidated)	1805 (5.0)
○ Caithness	1490	(3.1)	○ Loch Inch (Stranraer)	1805 (3.3)
● Rivers Eden/Eamont (Cumbria)	1450	(3.1)	● Loch Flemington	1135 (3.3)
○ Loch of Skene	1200	(2.5)	● Eden Estuary	1071 (3.1)
○ River Tay Bloody Inches	1172	(2.4)	● Bemersyde Moss	1000 (2.9)
● Hallington Reservoir	1050	(2.2)		
● Bemersyde Moss	1000	(2.1)		

Key:

- - sites which regularly support more than 1900 Pink-footed Geese or more than 1000 Greylag Geese (from Cranswick *et al.* 1995)
- - sites which regularly support less than 1900 Pink-footed Geese or less than 1000 Greylag Geese (from Cranswick *et al.* 1995)

DISCUSSION

Mid-winter counts

The 1995 winter counts recorded approximately 65% of the estimated autumn Pink-footed Goose population (c.260000), and only 55% of the estimated autumn Greylag Goose population (c.86000, see Mitchell & Hearn 1995). The 1995 spring count recorded relatively low numbers (compared with the autumn counts) of both species; approximately 41% of the estimated autumn Pink-footed Goose population, and only 42% of the estimated autumn Greylag Goose population.

In mid-winter, Pink-footed Geese appeared to be concentrated in east-central Scotland (32%) and in more southerly haunts such as west England (18%) and east England (15%) (Table 2). This is, however, in contrast to the previous year when over 42% of the January count was recorded in Norfolk (east England) alone (*e.g.* 68000 in January 1994). With the large numbers of Pink-footed Geese recorded on the Solway, in Lancashire and in Norfolk in mid-winter, clearly some birds had left traditional autumn haunts to winter at sites further south. The maximum count in Norfolk during the 1994-95 winter was of 51000 on 12 December but by late January the count had fallen to 24000 and, presumably, Pink-footed Geese had started their northward migration. Thus it seems likely that although over 40% of wintering Pink-footed Geese counted were to be found in England, either fewer Pink-footed Geese had moved to more southerly wintering haunts than in the previous winter, or the return migration had started earlier than in 1993-94. This may be explained by comparing the weather during the two mid-winter periods. Cold spells in December and January 1993-94 had clearly influenced a major movement south in that winter, whilst on the whole, mid-winter 1994-95 was milder.

The low number of Greylag Geese observed in the mid-winter and spring counts confirms the difficulties in locating this species expressed by many counters. This is consistent with the general understanding that the large flocks of Greylag Geese observed in autumn become more fragmented and dispersed throughout the winter, using many small remote lochs and temporary flooding as roosts.

In January 1995, Greylag Geese were fairly evenly distributed although more northerly haunts supported larger numbers. North Scotland (27%) and north-east Scotland (22%) held the largest proportions with east-central Scotland, south-east Scotland/north-east England and south-west Scotland/north-west England each supporting 16-18% of the count (Table 2).

Greylag Geese appeared to be slightly more dispersed in January 1995 than in April 1995, despite an 8% increase in the proportion of the count total recorded in North Scotland (Figure 2). A corresponding decrease (11%) was recorded in south-east Scotland/north-east England.

An example of the rapid autumn turnover of geese at some sites can be seen by checking the almost daily roost counts of Greylag Geese at Dinnet Lochs (Grampian) (Figure 4). Peak numbers (30000+) occurred in early November yet by December fewer than 5000 were counted using the lochs. The exodus from Dinnet Lochs during mid-November is rapid and the expectation that these same birds will be counted roosting at other sites within northern Britain may not be realised. This is presumably, in part, due to fragmentation to smaller flocks roosting in areas not covered during the censuses. Certainly there appears to be no site in northern Britain which received over 20000 Greylag Geese after November.

Interpretation of one year's data, however, should be treated with caution, since it is unclear whether the distribution of Greylag Geese and Pink-footed Geese in January 1995 was representative of an 'average' year. Organised roost counts of this nature have only been undertaken in the previous winter, however, those counts and the January 1995 counts provide good baseline data with which to compare future mid-winter counts.

Spring counts

The spring counts of the 1980s and early 1990s clearly identified north-east and east-central Scotland as the main focus for Pink-footed Geese in spring. A striking feature of the 1995 spring count was the large concentration of Pink-footed Geese recorded in north-east and east-central Scotland: 69% of the count total (Figure 1) although this is smaller than the proportion recorded there in spring 1994 (88%). A smaller proportion was recorded in north Scotland (16%) although this is three times higher than in 1994. The four areas further south held relatively few Pink-footed Geese, amounting to 15% overall.

Greylag Geese were even more difficult to find in spring than in mid-winter. The Greylag Goose population was shown to be more evenly distributed across Scotland in the 1995 spring count. Like the Pink-footed Geese, the bulk of the population, some 50%, was found in north-east and east-central Scotland (Table 2, Figure 2). However, a notable feature of their distribution in spring was the increase in the proportion of Greylag Geese found in south-east Scotland, approximately 14% of the count total. This area hosted only 4% in the previous spring counts. Thus, in spring 1995, south-east Scotland saw a substantial decrease in the number of Pink-footed Geese, and an increase in the number of Greylag Geese.

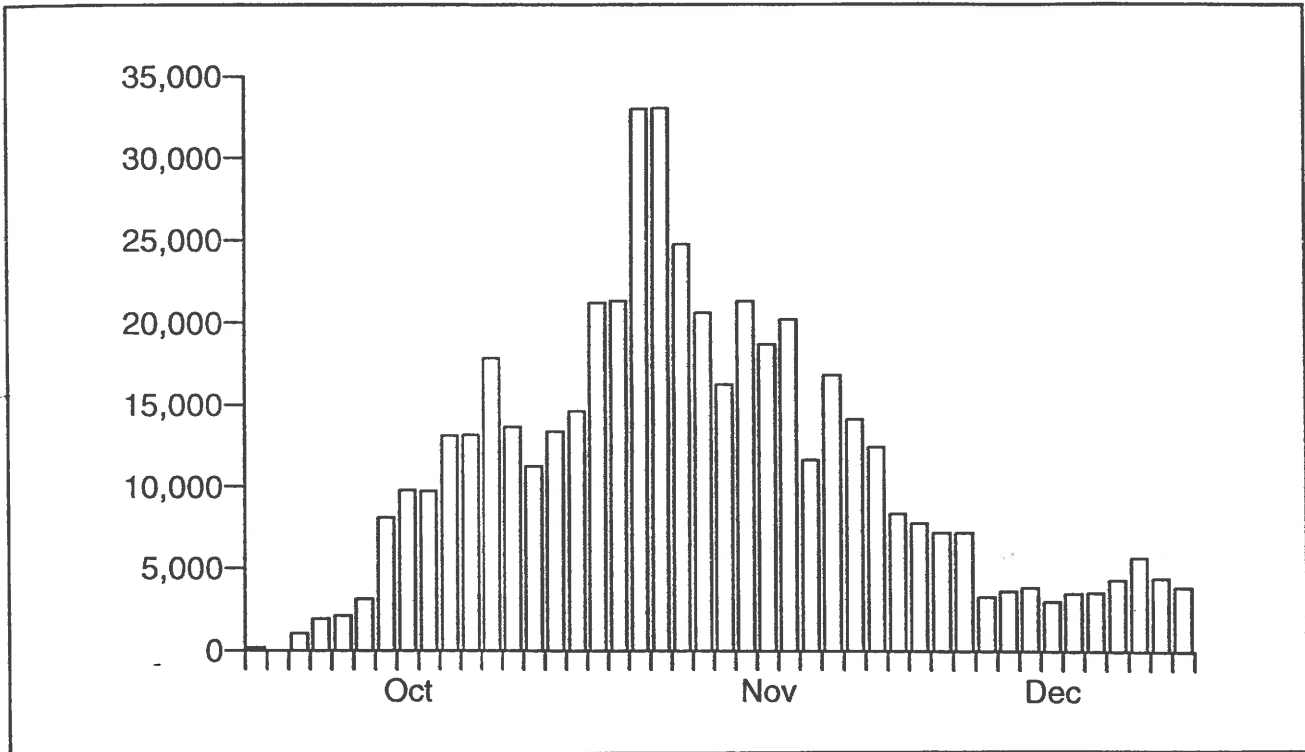


Figure 4. Roost counts of Greylag Geese at Dinnet Lochs, Grampian.

The arrival pattern of Greylag Geese in Iceland is poorly described or understood, and monitoring of their arrival in the southern lowlands of Iceland would be extremely valuable in placing the results of future spring counts in context.

Future monitoring

The voluntary goose counter network is in reasonably good shape, with new counters taking over at a few sites recently. A few gaps have been identified, however, particularly in the Strathclyde area and around the Firth of Tay, which will hopefully be filled for the 1995-96 season. Although most of the voluntary network took part in the additional counts this year, it has been made clear by several area organisers that it will be difficult to maintain this increased input every year.

Many counters expressed doubts as to the value of mid-winter and spring roost counts, on the grounds that use of roost sites is unpredictable, and birds can be widely dispersed, such that the final count is an underestimate and thus inaccurate. In order to achieve an accurate count for their area, many counters feel the need to carry out daytime feeding counts, often over extensive areas, which can involve much more time and expense than they can afford to contribute regularly. It would be worthwhile considering some form of remuneration based on mileage in some or all areas.

Many roost sites included in the counts are extremely difficult to reach, particularly in wintry conditions, and some organisers feel that counters are being put in potentially dangerous situations. There is also a strong view that the voluntary counter network is experiencing a serious overload, in terms of the number of surveys being carried out and requests for data from a range of conservation bodies.

Future spring counts would be best planned around the first week of April, should this coincide with the new moon. Within this framework, care must be taken that the count does not miss birds, since Greylag Geese are known to start their return migration to Iceland as early as the first or second week of April.

Counters should clearly be kept informed as to the reasoning behind the need for increased monitoring of grey geese, as well as having the results of their efforts returned to them quickly in a concise and straight-forward report.

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REFERENCES

- Bell, M.V., Dunbar, J. & Parkin, J. (1988) Numbers of wintering Pink-footed and Greylag Geese in north-east Scotland 1950-1986. *Scott. Birds* 15:49-60
- Brown, A.W. & Brown, L.M. (1992) Development of an internationally important Pink-footed Goose roost at West Water Reservoir, Borders Region, 1966-1990. *Scottish Birds* 16: 260-268
- Cranswick, P.A., Waters, R.J., Evans, J. & Pollitt, M.S. (1995) *The Wetland Bird Survey 1993-94: Wildfowl & Wader Counts*. BTO/WWT/RSPB/JNCC, Slimbridge
- Fox, A.D., Boyd, H. & Warren, S.M. (1992) The phenology of spring pre-nesting feeding in Iceland-nesting geese. *Ecography* 15: 289-295
- Fox, A.D., Mitchell, C., Stewart, A. *et al.* (1994) Winter movements and site-fidelity of Pink-footed Geese *Anser brachyrhynchus* ringed in Britain, with particular emphasis on those marked in Lancashire. *Bird Study* 41: 221-234
- Madsen, J. & Mitchell, C. (1994) Status of the Pink-footed Goose, 1990-1993. IWRB Goose Research Group Bulletin, No.5
- Mitchell, C. & Hearn, Richard (1995) The 1994 National Census of Pink-footed and Greylag Geese in Britain. Report to JNCC. WWT, Slimbridge, 12pp.
- Newton, I., Thom, V.M. & Brotherston, W. (1973) Behaviour and distribution of wild geese in south-east Scotland. *Wildfowl* 24: 111-121.
- Newton, S.F., Bell, M.V., Brown, A.W. & Murray, R.D. (1990). Pink-footed Goose numbers at arrival sites in eastern and central Scotland. *Scottish Birds* 16:35-36
- Stroud, D.A., Mudge, G. & Pienkowski, M.W. (1990) Protecting internationally important bird sites: a review of the EEC Special Protection Area network in Great Britain. NCC, Peterborough.

