Status and distribution of Icelandic-breeding geese: results of the 2006 international census

Wildfowl & Wetlands Trust Report

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Goose & Swan Monitoring

Contents

Summary

The 47th consecutive census of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese took place during autumn and winter 2006. In addition to the two usual counts undertaken in October and November, a third count in December (introduced in 2005) was also conducted as part of a three year trial to re-assess the most suitable time for a complete census of Iceland Greylag Goose. This is necessary due to recent data indicating that departure from the breeding grounds is occurring later. Some sites in the UK were also counted during September in order to estimate the numbers of UK-breeding Greylag Geese from the Northwest Scotland and Re-established populations present at sites prior to the arrival of Icelandic migrants. Coverage in Britain was far lower than in previous years, and data were not received for a number of key sites. No data were received from Norway. In Iceland, an aerial survey of the south, together with coordinated ground counts conducted throughout the rest of the country in November 2006, contributed to goose estimates there.

Weather conditions were generally considered favourable during the counts. Maxima of 203,168 Pink-footed Geese and 80,042 Greylag Geese were counted in November 2006. These figures were adjusted to account for major sites that were not counted and for the number of Greylag Geese from the Re-established and Northwest Scotland populations counted prior to this census, resulting in population estimates of 229,123 Pink-footed Geese and 82,339 Greylag Geese. Both estimates were lower than those calculated for 2005, representing decreases of 24.3% in Pink-footed Goose numbers and 16.2% in Greylag Goose numbers.

The breeding success of Pink-footed Geese was slightly above average for the previous decade at 19.3% young (mean proportion of young 1996-2005: 18.6%, ± 0.5 s.e.). The mean brood size of successful pairs was 2.2 goslings, which equalled the mean recorded during the preceding ten years (mean brood size 1996-2005: 2.2, ± 0.06 s.e.) The breeding success of Iceland Greylag Geese was slightly higher than average, with flocks containing 20.6% young (mean 1996-2005: 19.5%, ± 1.4 s.e.). The mean brood size of 1.9 goslings per successful pair was below that of the recent ten year mean (mean 1996-2005: 2.7, ± 0.06 s.e.).

Full analyses of the data generated by the December count will not be possible until the end of the three year trial period, owing to limited data prior to 2005. Since previous analysis has indicated that the Icelandic-breeding Goose Census (IGC) is effective in measuring population size of Pink-footed Goose, the priorities of the IGC are to improve monitoring of Greylag Geese by the completion and analysis of the December census data in 2007 in order to re-assess the most appropriate time for census of the Iceland Greylag Goose population; the need to achieve complete coverage across the range with a particular focus to develop coordinated counts in Iceland and Norway; and the collection of age assessment data across the range using standardised methods.

1 Introduction

The Pink-footed Goose *Anser brachyrhynchus* population which breeds in Iceland and eastern Greenland winters almost exclusively in Britain and Ireland, as does the Icelandic-breeding Greylag Goose *Anser anser* (Wernham *et al.* 2002). Large concentrations of these species occur in autumn, particularly in East Central Scotland, Lancashire and Norfolk (Pink-footed Goose) and North and East Scotland (Greylag Goose). As winter progresses, redistribution to other parts of the wintering range is evident and, hence, an estimation of the size of these populations is most effective in autumn (Mitchell & Hearn 2004, Hearn & Mitchell 2004).

The Icelandic-breeding Goose Census (IGC) is undertaken annually and aims to assess the size, distribution and breeding success of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese. Two coordinated counts have been undertaken since 1990 (e.g. Rowell 2005), the first in October and the second in November. These are timed to coincide with periods when these geese are most concentrated after their arrival in Britain from Iceland. Pink-footed Geese arrive earlier than Greylag Geese and are therefore usually best censused in October. The November count allows for the later migration of Greylag Geese to be completed.

However, the results of recent censuses, and other information, suggest that the departure of both species from Iceland may be occurring later (Worden 2006). For Pink-footed Goose, this later arrival is detected by the November count, but for Greylag Goose, where arrival occurs later than Pink-footed Goose, a substantial proportion of birds remaining in Iceland may be missed during the November count. A third coordinated count in December was therefore introduced in 2005 for a three-year trial period (Worden 2006). This additional count will help to re-assess the best period in which to undertake a census to obtain good population estimates for Iceland Greylag Geese. This report presents the 47th consecutive census and provides an update on the population size and breeding success of Pink-footed and Greylag Geese following the 2006 breeding season.

2 Methods

Counts were conducted by a network of volunteer observers and professional conservation staff over the weekends of 14/15 October, 11/12 November and 16/17 December 2006. In some cases, counts made close to these dates were included in the coordinated census if there was no reason to suspect they duplicated other counts. Most counts were of roosting geese, made either at dusk, when the birds are flighting in, or at dawn, as they depart to feeding areas. Dates of the coordinated counts were chosen to coincide with new moons as far as possible (22 October, 20 November and 20 December), thus minimising the likelihood of geese remaining in feeding areas overnight. In a small number of areas where roost sites are poorly known, inaccessible or infrequently used, daytime counts of feeding birds were made. Consequently, in this report the term site is applied to a range of geographical areas. Most are individual waterbodies where a goose roost occurs, whilst some are feeding areas around known roosts, and others are a mixture of these two. All sites are, however, areas to which an individual count can be attributed. For the purpose of analysis, Caithness, Orkney, Shetland, Southwest Lancashire and Iceland are treated as consolidated sites.

Two types of adjustment were applied to the peak count totals in order to generate population estimates. For regularly monitored sites (those counted in at least three of the previous five years) that were not counted during the 2006 census, numbers were estimated from the mean of the counts made during the relevant month during 2001-2005. Estimated numbers that exceeded 0.5% of the current IGC peak count total were added to this peak count to give the adjusted population estimate. The October count at Westwater Reservoir, Tweeddale, was estimated in a different way, however, since two counts were made at the site three days either side of the census weekend. However, these varied by 14,420 birds and so an average of these two counts was taken (36,042).

In addition, counts of UK Greylag Geese (*ie* birds from the Re-established or Northwest Scotland populations) made during September, before the arrival of Icelandic migrants, were subtracted from the IGC count at some sites to improve the estimate of the number of Iceland Greylag Geese present at that time.

To assess breeding success, experienced observers made assessments of the proportion of young (first-winter birds are separable from older birds by differences in plumage characteristics) in goose flocks and of brood size during the autumn. Data collected during September and November were used to determine the proportion of young and the mean brood size of successful pairs.

3 Results

3.1 Coverage and conditions

Coverage in Britain and Ireland during counts in 2006 was far lower than the preceding year, with 78 sites visited in October, 130 in November, and 127 in December. Overall, this represents a decrease of 29.3% in the number of sites counted compared to the 2005 census, when 139 sites were visited in October, 174 in November and 161 in December. Outside Britain and Ireland, counts were made at several sites in the Faroe Islands in all three months and estimates of the maximum number of Pink-footed Geese and Greylag Geese in Iceland in October and November, respectively, were determined through an aerial survey of the south coast and coordinated ground counts elsewhere. No data were received from Norway.

Counts for several sites were estimated and included in the census totals due to lack of coverage or late data. In October, two sites met the criteria for the calculation of an estimated count of Pink-footed Geese. In November, estimated counts were calculated for five sites for Pink-footed Geese and three for Greylag Geese. Since very little data exist for December prior to winter 2005/06, it was not possible to derive estimated counts for this month. Estimated counts of Pink-footed Geese were as follows: Aberlady Bay, East Lothian (October 10,194, November 8,426), Westwater Reservoir, Tweeddale (October 36,042, November 7,918), Kilconquhar Loch, Fife (November 978), Rossie Bog, Fife (November 4,270) and Tay Estuary: Tentsmuir Point, Fife (November 2,564). Estimated counts of Greylag Geese were: Caithness (November 6,355), Kilconquhar Loch, Fife (November 1,164) and Rossie Bog, Fife (November 465).

September counts of Greylag Geese were received for ten sites, and these were used to adjust the coordinated October, November and December counts to allow for the presence of Re-established or Northwest Scotland Greylag Geese at these sites, as follows: Branton Gravel Pits, Northumberland (320), Island of Bute, Argyll (150), Caistron Quarry, Northumberland (60), Derwent Reservoir, Northumberland (307), East Chevington Pools, Northumberland (351), Gadloch, Strathkelvin (145), Holywell Pond, Northumberland (93), Tweed Estuary, Northumberland (162), Tyninghame Estuary, East Lothian (50) and Upper Badenoch sites between Aviemore and Spey Dam, Badenoch and Strathspey (150). In addition, 5,000 birds were subtracted from the Orkney count based on an assessment on the number of breeding and non-breeding pairs during summer 2006 (E. Meek, Unpubl. data).

Weather conditions were reported as good for most sites with only two sites reporting poor visibility in October, one in November and two in December. Low counts (where counters felt they had underestimated the number of birds present) were received for three sites in October, five in November and seven in December. Count accuracy was not reported for 32.1% of sites in October, 45.4% in November and 43.6% in December, however. Only one site (in October) was reported as being disturbed (with local agricultural activity cited as a possible reason for the disturbance).

3.2 Total numbers

3.2.1 Pink-footed Goose

Totals of 161,357 Pink-footed Geese were counted in October, 203,168 in November and 189,756 in December (Figure 1, Table 1). The total numbers counted in October and November 2006 were 45.6% and 21.3%, respectively, lower than the preceding year. Similarly, the total counted in December was 22.3% lower than in 2005. After the addition of estimated counts, the peak winter total in November was used to derive a population estimate of 229,123. This represents a significant decrease of 24.3% since 2005/06, when 302,774 individuals were estimated.

3.2.2 Greylag Goose

Totals of 5,659 Greylag Geese were counted in October, 80,042 in November and 76,133 in December (Figure 1, Table 1). Total counts for all three months were lower than those of the preceding year. Following adjustments and addition of estimated counts, totals were adjusted to 4,422 in October, 82,339 in November and

68,754 in December (no estimated counts were included in the December total). The population estimate of 82,339 was derived from the higher November census total and represents a decrease of 16.2% since the previous adjusted estimate of 98,243 recorded in 2005.

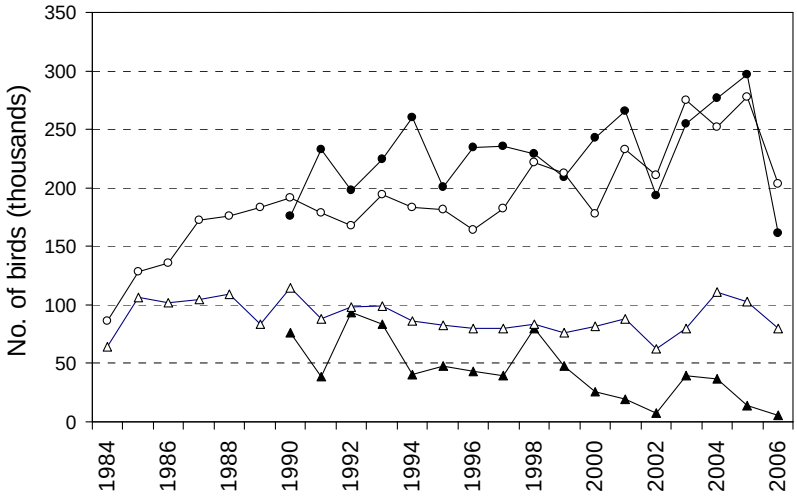


Figure 1. Peak counts of Pink-footed Geese (circles) and Iceland Greylag Geese (triangles) counted in October (filled) and November (open) during the Icelandic-breeding Goose Census, 1984 to 2006.

Table 1. Totals of Pink-footed Geese and Iceland Greylag Geese by country and region in October, November and December 2006. Raw counts are shown with adjustments for non-Icelandic birds [-x] and estimated counts given in brackets [+x]. Figures in parentheses indicate the number of sites visited.

	October		November		December	
Region	**Pinkfoot**	**Greylag**	**Pinkfoot**	**Greylag**	**Pinkfoot**	**Greylag**
Iceland+	3,000 (1)	nc	nc	6,000 (1)	nc	nc
Norway	nc	nc	nc	nc	nc	nc
Faroe Islands	6 (6)	618 (6)	0 (5)	500 (5)	1 (1)	443 (5)
Ireland	nc	nc	1 (7)	427 (7)	0 (1)	1,950 (1) [-778]
Shetland+	nc	nc	1 (14)	1,279 (14)	1 (1)	1,348 (17)
Orkney	nc	nc	0 (15)	50,937 [-5,000]	602 (2)	55,521 [-5,000]
Caithness+	nc	nc	nc	nc [+6,355]	nc	nc
Sutherland	0 (1)	820 (1)	0 (1)	400 (1)	65 (1)	1,125 (1)
Ross & Cromarty	170 (10)	148 (10)	3,735 (9)	4,030 (10)	354 (11)	2,365 (11)
Inverness/Nairn	1 (2)	0 (2)	1,200 (2)	300 (3)	430 (2)	0 (2)
Badenoch & Strathspey	0 (2)	228 (2) [-150]	4 (1)	1,827 (2) [-150]	0 (2)	1,473 (2) [-150]
Moray	3,800 (2)	22 (2)	150 (1)	1,400 (2)	120 (1)	1,007 (2)
Banff & Buchan	6,920 (1)	0 (1)	6,300 (1)	285 (1)	16,637 (1)	21 (1)
Gordon/Aberdeen	14,960 (2)	222 (3)	37,572 (4)	950 (5)	11,960 (3)	575 (5)
Kincardine & Deeside	0 (1)	0 (1)	710 (1)	320 (1)	0 (1)	630 (2)
Angus/Dundee	20,067 (4)	0 (1)	17,636 (4)	802 (3)	6,434 (4)	74 (3)
Perth & Kinross	26,151 (5)	952 (5)	16,550 (8)	5,138 (12)	13,836 (7)	3,182 (12)
Stirling/Falkirk/ Clackmannan	8,079 (3)	48 (2)	2,950 (3)	85 (2)	6 (4)	153 (5)
Fife	0 (1)	0 (1)	nc [+8,061]	nc [+1,786]	310 (1)	105 (1)
Argyll & Bute	0 (1)	750 (1) [-150]	116 (2)	1,200 (3) [-150]	196 (3)	1,987 (3) [-150]
Glasgow area*	0 (2)	185 (2) [-145]	125 (1)	567 (2) [-7]	2 (1)	320 (2) [-120]
Clydesdale	nc	nc	nc	nc	nc	nc
Stewartry/Wigtown	0 (1)	64 (1)	0 (1)	69 (1)	nc	nc
Annandale & Eskdale/Nithsdale**	1,500 (2)	59 (2)	1,168 (3)	301 (3)	4,055 (4)	199 (4)
East/Midlothian	nc [+14,514]	35 (2)	nc [+9,976]	150 (2)	436 (4)	122 (2) [-50]
Edinburgh/West Lothian	0 (1)	224 (1)	860 (1)	150 (1)	87 (1)	522 (1)
West Borders/ Tweedale***	nc [+38,317]	50 (6)	nc [+7,918]	893 (7)	0 (4)	460 (4)
NE England****	6,353 (9)	1,234 (12) [-792]	3,794 (13)	2,032 (15) [-537]	3,938 (12)	2,551 (16) [-1,131]
Humberside	3,780 (1)	0 (1)	2,340 (1)	0 (1)	2,490 (1)	0 (1)
Cumbria**	nc	nc	0 (1)	0 (1)	nc	nc
Lancashire & Merseyside+	35,565 (1)	0 (1)	39,030 (1)	0 (1)	21,070 (1)	0 (1)
Norfolk	31,005 (8)	0 (8)	68,926 (8)	0 (8)	106,726	0 (8)
Raw total counts	161,357	5,659	203,168	80,042	189,756	76,133
Adjustment for non-Icelandic birds	n/a	1,237	n/a	5,844	n/a	7,379
Estimated counts	52,831	n/a	25,955	8,141	n/a	n/a
Population Estimate	**214,188**	**4,422**	**229,123**	**82,339**	**189,756**	**68,754**

* includes Cunninghame and Strathkelvin
** 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
**** includes Northumberland
+ several feeding sites consolidated
nc no count received

3.3 Regional distribution

3.3.1 Pink-footed Goose

The distribution of Pink-footed Geese varied considerably over the three counts. East Central Scotland held the greatest numbers of birds in October with higher than average proportions also present in West and East England at this time. Lower concentrations were found in North Scotland and Southwest Scotland/Northwest England. The proportion of birds' in Northeast Scotland during October was also lower than usual, although this increased to more typical levels for the region during November (22.02%). By November, numbers had decreased in East Central Scotland but had increased substantially in East England. Over half of the population (53.76%) was present in East England in December, whilst numbers in Northeast Scotland and East Central Scotland declined (Table 2, Figure 2).

3.3.2 Greylag Goose

The autumn distribution of Greylag Geese was typical, with a low proportion present in Britain during October. Those that had arrived were primarily concentrated in North Scotland, East Central Scotland and Southeast Scotland/Northeast England, though no count was made in Orkney during this month. By November, 72.2% of the population was present in North Scotland, with most of the remainder in East Central Scotland, with a similar distribution in December for those regions. During December, the proportion of birds present in East Central Scotland had approximately halved from November (Table 2, Figure 3).

Table 2. Regional distribution of Pink-footed Geese and Iceland Greylag Geese in Britain and Ireland during October, November and December 2006, expressed as a percentage of the maximum count for each species.

	Pink-footed Goose			**Greylag Goose**		
	October	**November**	**December**	**October**	**November**	**December**
Ireland	na	0.0005	na	na	0.60	1.60
North Scotland	0.08	2.43	0.71	1.41	72.20	76.32
Northeast Scotland	12.64	22.02	14.13	0.33	3.40	3.01
East Central Scotland	26.73	18.28	10.13	1.35	8.11	4.73
Southeast Scotland/ Northeast England	3.13	2.29	2.20	1.01	3.62	3.33
Southwest Scotland/ Northwest England	0.74	0.69	2.09	1.12	2.76	3.10
West England	17.51	19.21	10.37	Na	na	na
East England	17.12	35.10	53.76	Na	na	na
Total	**77.95**[1]	**100.00**	**93.39**[1]	**5.22**[1]	**90.69**[1]	**92.09**[1]

* areas defined as follows:
Ireland: all regions
North Scotland: Shetland, Orkney, Western Isles and Highland
Northeast Scotland: Grampian (Aberdeenshire & Moray)
East-central Scotland: Tayside (Perth & Kinross), Central (Stirling) and Fife
Southeast Scotland/ Northeast England: Lothian, Borders and Northumberland
Southwest Scotland/ Northwest England: Strathclyde, Dumfries & Galloway and Cumbria
West England: Lancashire and Merseyside
East England: Humberside and Norfolk

[1] Does not equal 100% because some birds were also present in other countries (Faroe Islands and Iceland)

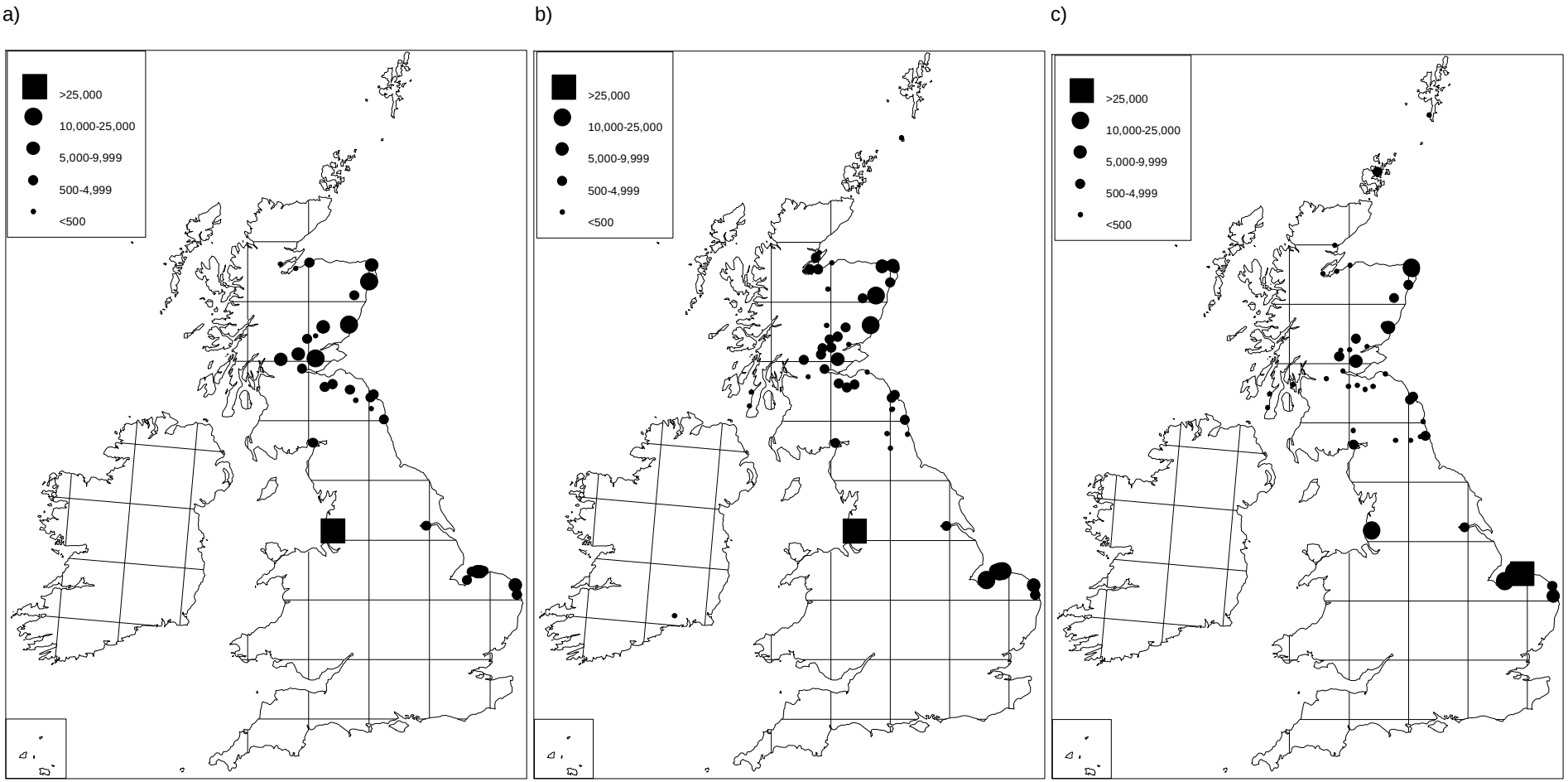


Figure 2. Distribution of Pink-footed Geese in Britain and Ireland in October (a), November (b) and December 2006 (c). Estimated counts are not shown.

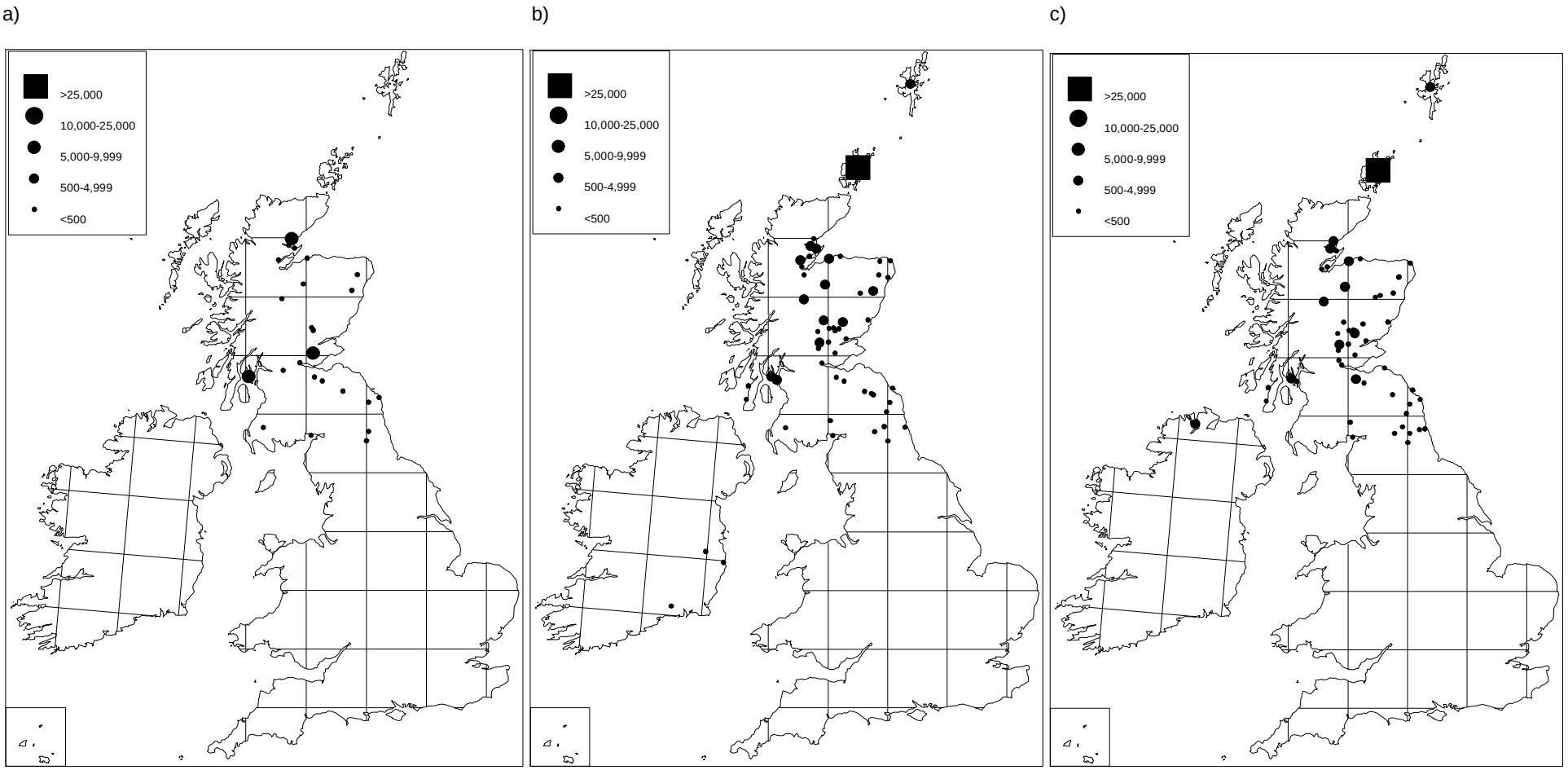


Figure 3. Distribution of Greylag Geese in Britain and Ireland in October (a), November (b) and December 2006 (c). Estimated counts are not shown.

3.4 Principal concentrations

3.4.1 Pink-footed Goose

Pink-footed Geese were recorded at 36 sites in October, 52 in November and 46 in December (this excludes estimated counts and considers Orkney, Iceland and Southwest Lancashire as consolidated sites). Those sites holding more than 1% of the population estimate (2,291) decreased from 20 in October to 17 in November but increased to 18 in December (Table 3). Four sites held over 10,000 birds in October and six in November and December.

Combined counts from the 21 sites exceeding 1% of the population estimate in November accounted for 89.4% of the total count and numbers at the top four sites alone equated to 37.7% of the population estimate (Table 3).

Particularly low numbers of Pink-footed Geese were recorded at Loch of Strathbeg, where numbers were 56.9% lower than 2005. Extensive flooding in the area is believed to have dispersed the main roost – large numbers were recorded roosting at Winter Loch, St Fergus Gas Terminal and New Pitsligo Moss, where roosting rarely occurs this early in the winter. Flooding in Perth & Kinross may have similarly contributed to lower numbers recorded at Carsebreck & Rhynd Lochs, Loch Leven and River Tay: Bloody Inches. No Pink-footed Geese were recorded at Loch Spynie during the census, a site which has recorded a mean of 10,460 birds during the November counts over the past five years (± 4478 s.e.). Particularly high numbers were recorded at South Lancashire Mosses, with 17.0% of the population estimate. This is the largest number ever recorded at the site and is greater than the mean recorded there in the preceding five years (mean 2001-2005: 26,202, ± 2383 s.e.). Higher than average numbers were also recorded at Loch of Skene (mean 2001-2005: 8,838, ± 1751 s.e.) and at Snettisham (mean 2001-2005: 13,189, ± 2136 s.e.).

3.4.2 Greylag Goose

The arrival of most Greylag Geese had not occurred at the time of the October count. They were recorded at a total of 31 sites, mostly in North Scotland and East Central Scotland (23.3% and 22.3%, respectively).

By November, 75 sites held Greylag Geese, nine of which held numbers exceeding 1% of the population estimate (823) (this considers Orkney as one site). Although over half of the population was recorded in Orkney during this month (55.7%, Table 3), birds were also observed at 65 additional sites in Scotland. Greylag Geese were recorded at 76 sites in December; those with counts exceeding 1% of the population estimate decreased to seven with Orkney holding 50,521 birds. High numbers (6,161) were also recorded in North Scotland during this month.

During 2006, particularly low numbers were recorded at Loch of Skene (500) and Loch Spynie (200), representing 89.4% and 92.0% decreases, respectively, from 2005. Numbers were lower than the preceding year for birds recorded at Loch Eye, Dornoch Firth and Isle of Bute.

Numbers were, however, higher at Findhorn Bay, Strathearn, Loch Garten and Upper Tay sites. For the purpose of analysis, Orkney is treated as a consolidated site, although Table 4 shows the individual totals for the islands. Nine sites held numbers exceeding 1% of the population estimate in November and 10 in December, although these individual counts are not adjusted for the presence of UK-breeding Greylag Geese since such data are only available for Orkney as a whole. Only on East Mainland and West Mainland were there more than 10,000 birds recorded, which equates to 66.1% of the Orkney total in November (40.8% of the population estimate) and 64.2% in December (43.2%). Total numbers on Orkney during the November count were the highest recorded since monitoring began.

Table 3. Sites that supported more than 1% of the (a) Pink-footed Goose (>2291) and (b) Iceland Greylag Goose (>823) population estimates in November 2006. Note that these values are not the same as the internationally accepted threshold values for these populations that are used to identify sites of national and international importance; currently 2,700 for Pink-footed Goose and 870 for Greylag Goose (Wetlands International 2006).

a) Pink-footed Goose

Site	November count	Percentage of population estimate	Five year peak mean 2001-2005
South Lancashire Mosses, Lancashire	39,030	17	26,203
Snettisham, Norfolk	24,550	10.7	22,890
Loch of Skene, Gordon	22,930	10	9,198
Montrose Basin, Angus	15,246	6.7	13,701
Overy Marshes, Holkham, Norfolk	13,500	5.9	n/a
Wells next the sea, Norfolk	13,200	5.8	332,001
Middlemuir (New Pitsligo Moss), Aberdeen	9,662	4.2	n/a
Confidential site, Norfolk	9,150	4	39,440
Aberlady Bay, East Lothian	*8,426*	3.7	8,672
West Water Reservoir, Tweedale	*7,918*	3.5	79,181
Loch of Strathbeg, Banff & Buchan	6,300	2.7	20,937
Loch Leven, Perth & Kinross	5,295	2.3	12,238
Horsey Mere, Norfolk	5,126	2.2	4,338 [2]
Rossie Bog, Fife	*4,270*	1.9	n/a
Carsebreck & Rhynd Lochs, Perth & Kinross	3,630	1.6	6,590
Berney Marshes, Norfolk	3,400	1.5	n/a
Winter Loch, Aberdeen	2,880	1.3	n/a
River Tay: Bloody Inches, Perth & Kinross	2,845	1.2	2,180
Munlochy Bay, Ross & Cromarty	2,600	1.1	902
Tay Estuary: Tentsmuir Point, Fife	*2,564*	1.1	2,704
Read's Island Flats, Humberside	2,340	1.02	4,078

b) Greylag Goose

Site	November count	Percentage of population estimate	Five year peak mean 2001-2005
Orkney Islands (all sites)	45,937	55.7	32,994
Caithness, Highland	*6,355*	7.7	6,355
Iceland	6,000	7.3	8,558 [3]
Strathearn (west sites), Perth & Kinross	2,270	2.8	n/a
Loch Eye, Ross & Cromarty	1,631	2	4,633
Dornoch Firth, Ross & Cromarty	1,547	1.9	1,464
Findhorn Bay, Moray	1,200	1.5	947
Kilconquhar Loch, Fife	*1,164*	1.4	1,165
Loch Garten, Badenoch & Strathspey	1,150	1.4	1,640
Upper Tay sites, Perth & Kinross	1,105	1.3	746
Bute, Argyll & Bute	875	1.1	1,471

[1] Mean derived from years 2001-2005 excluding 2004 (data not available)
[2] Mean derived from years 2001-2005 excluding 2002 (data not available)
[3] Mean derived from years 2001, 2004 & 2005

Counts in italics denote estimated counts used for November 2006 count totals.

Table 4. Greylag Goose counts at individual sites on Orkney in November and December 2006 (counts have not been adjusted to take into account number of UK Greylags, as data on numbers of these populations are only available for Orkney as a whole).

	November count	% of count total	December count	% of count total	November Five year peak mean
West Mainland	22,577	27.4	24,836	30.1	16,353
East Mainland	11,074	13.4	10,825	13.1	6,422
Island of Shapinsay	4,653	5.6	4,833	5.9	3,228
Island of South Ronaldsay	2,470	3.0	2,830	3.4	1,150
Island of Sanday	2,165	2.6	2,200	2.7	1,856
Island of Stronsay	2,156	2.6	3,300	4.0	1,950
Island of Eday	1,105	1.3	1,019	1.2	649.6
Island of Rousay	1,075	1.3	1,580	1.9	n/a
Island of Westray	1,030	1.2	825	1.0	403.6
Island of Papa Westray	809	1.0	1,025	1.2	743.4
Island of Egilsay	537	0.7	889	1.1	1,523
Island of Burray	429	0.5	42	0.1	205
Island of Wyre	387	0.5	336	0.4	336.4
Island of North Ronaldsay	240	0.3	301	0.4	141.2
Isles of Hoy and Walls	230	0.3	680	0.8	558.2
Total	**50,937**	**61.7**	**55,521**	**67.3**	**35,519**

3.5 Breeding success

Totals of 28,642 Pink-footed Geese (from 54 flocks) and 2,188 Greylag Geese (10 flocks) were aged at various localities throughout Scotland and England between 18 September and 11 November. The percentage of birds aged in relation to the estimated size of the population in 2006/07 was 12.5% for Pink-footed Goose and 2.7% for Greylag Goose. Information on the brood sizes of 262 families of Pink-footed Goose and 11 families of Greylag Goose was also collected during this period.

The breeding success of Pink-footed Geese was slightly above average for the previous decade at 19.3% young (mean proportion of young 1996-2005: 18.6%, ± 0.5 s.e.). The mean brood size of successful pairs was 2.2 goslings which equalled the mean recorded during the preceding ten years (mean brood size 1996-2005: 2.2, ± 0.06 s.e.) (Table 5, Figure 4).

There was evidence of regional variation in the percentage of young Pink-footed Geese, which varied from 16.2% in East Central Scotland to 21.7% in Northeast Scotland (Table 5). Similarly, mean brood size varied from 1.7 goslings in West England to 2.4 recorded in both Southeast Scotland and East Central Scotland. The highest number of birds aged was in East England with counts conducted throughout October and in early November. No region was surveyed throughout the autumn period with the majority of birds being aged during early October (94%). Only in Northeast Scotland and East England were counts conducted during three periods. The temporal range in other regions was limited and varied between them (Figure 5). The highest proportion of young was found in flocks surveyed during late September (Figure 6).

The breeding success of Iceland Greylag Geese was slightly higher than average, with flocks containing 20.6% young (mean 1996-2005: 19.5%, ± 1.4 s.e.). The mean brood size of 1.9 goslings per successful pair was below that of the recent ten year mean (mean 1996-2005: 2.7, ± 0.06 s.e.) (Table 5, Figure 4).

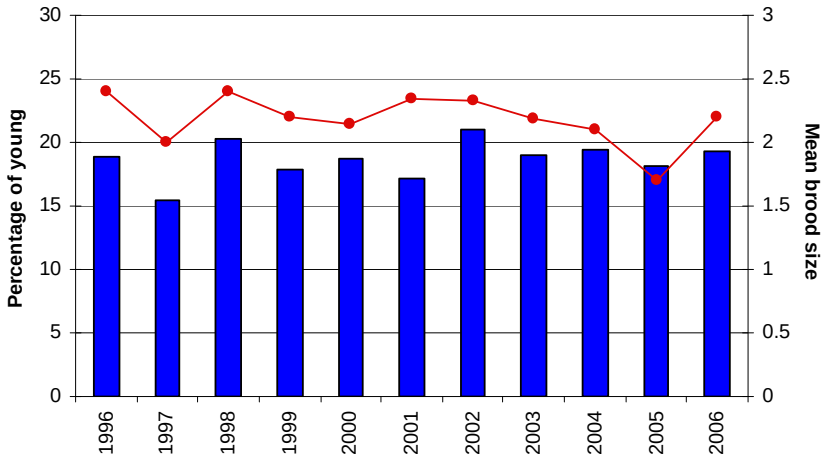
Due to their later migration and more limited range, the temporal and spatial distribution of Greylag Goose age samples was more limited. Samples were collected in one region (North Scotland) during early November.

Table 5 The percentage of young and mean brood size of Pink-footed and Greylag Geese in autumn 2006 (regions defined in Table 2).

	Region	Total aged (No. of young)	% young	No. of broods (No. of young)	Mean brood size
Pink-footed Goose[1]	Northeast Scotland	6,769 (1,471)	21.7	118 (271)	2.3
	East Central Scotland	7,655 (1,241)	16.2	51 (123)	2.4
	Southwest Scotland	1,717 (327)	19	6 (11)	1.8
	Southeast Scotland	2,511 (526)	21	25 (61)	2.4
	East England	8,418 (1,699)	20.1	53 (104)	2
	West England	1,572 (269)	17.1	9 (15)	1.7
	Total	**28,642 (5,533)**	**19.3**	**262**	**2.2**
Greylag Goose [2]	North Scotland	2,188 (451)	20.6	11 (21)	1.9
	Total	**2,188**	**20.6**	**11**	**1.9**

[1]Pink-footed Geese aged between 18 September and 7 November
[2]Greylag Geese aged between 4 November and 11 November

(a) Pink-footed Goose



(b) Greylag Goose

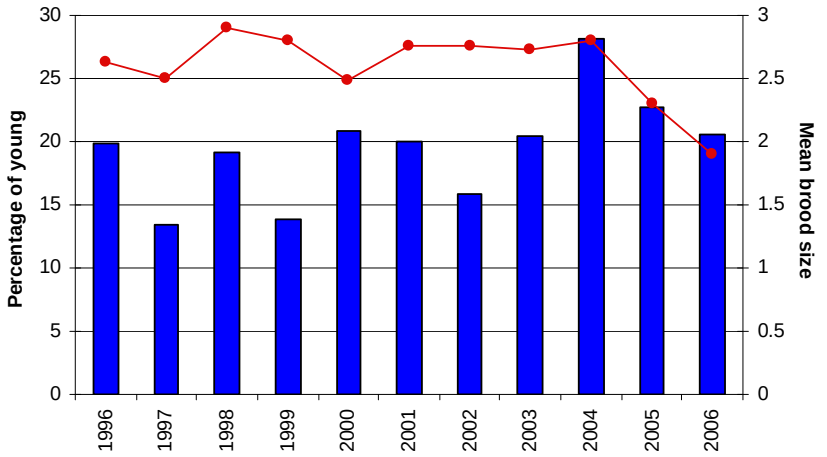


Figure 4 The percentage of young (column) and mean brood size (line) found in flocks of Pink-footed Geese (a) and Icelandic Greylag Geese (b) in Britain, 1996-2006

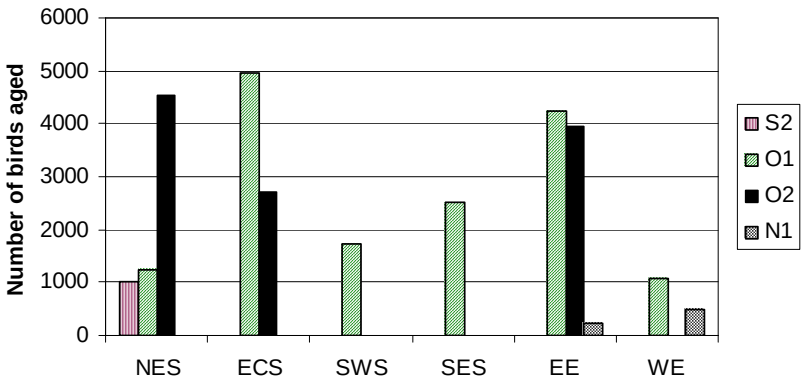


Figure 5 The temporal distribution of Pink-footed Goose age samples in each region during autumn 2006. Periods: S2 =late September, O1=early October, O2=late October, N1=early November (regions defined in Table 2)

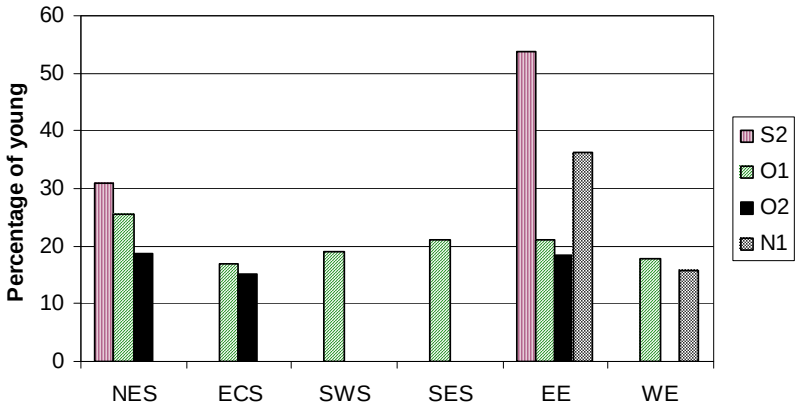


Figure 6 The percentage of Pink-footed Goose young found in each region during autumn 2006. Periods: S2 =late September, O1 =early October, O2 =late October, N1 =early November (regions defined in Table 2).

4 Revised population Estimates

4.1 2005 Census (Worden 2006)

Late data were received from two key sites for which estimated counts were calculated in the population estimates presented in the previous report (Worden 2006). These were for Westwater Reservoir, Tweeddale, and Caithness, and affected the Pink-footed Goose and Greylag Goose population estimates, respectively (Table 6). In addition, large counts of roosting Pink-footed Geese were received from a new site in Lancashire (Simonswood Moss).

At Westwater Reservoir, the count on the October census weekend recorded 57,382 Pink-footed Geese, an increase of 38,738 over the estimated count of 18,644 used in the 2005 population estimate. A further 5,000 Pink-footed Geese were at Simonswood Moss, a new roost where counts have not been previously made and thus where there was no estimated count incorporated into the 2005 population estimate given by Worden (2006). The addition of these data brings the population estimate to 302,774 – the first time it has reached 300,000.

In Caithness, a count of 8,577 Greylag Geese was made on the November census weekend, an increase of 2,302 over the estimated count of 6,275 used in the 2005 report. This brings the population estimate to 98,243.

Counts for these sites in other months were also received, but do not affect the overall population estimate so the details are not presented here.

Table 6 Revised Pink-footed and Greylag Goose counts and population estimates for 2006.

	Pink-footed Goose		Greylag Goose	
	Worden 2006	**New data**	**Worden 2006**	**New data**
Raw count totals	234,120	296,502	94,359	102,939
Adjusted counts	na	na	5,776	5,776
Estimated counts	24,936	6,272	7,355	1,080
Population estimate	259,056	302,774	95,938	98,243

4.2 2004 Census (Rowell 2004)

Late data from Westwater Reservoir, Tweeddale, allows an improvement to be made to the 2004 population estimate for Pink-footed Geese. A count on the October census weekend of 4,710 allows the removal of the estimated count (20,220) used. The revised population estimate has therefore now been reduced by 15,510, giving a total of 276,644.

5 Discussion

The 2006 Icelandic-breeding Goose Census has revealed decreases in the population estimates of both Pink-footed Goose and Iceland Greylag Goose since 2005, with decreases of 24.3% and 16.2%, respectively (Figure 7). The population estimate of Pink-footed Goose was notably lower than that recorded in 2005 (302,774), and was the lowest recorded since 1999 (212,493), when a substantial undercount is likely to have occurred. Following the high numbers of Greylag Geese found in 2004 and 2005, the estimate returned to a similar level as that recorded in the years prior to 2004 (mean 1999-2003: 80,013, ± 2.8 s.e.).

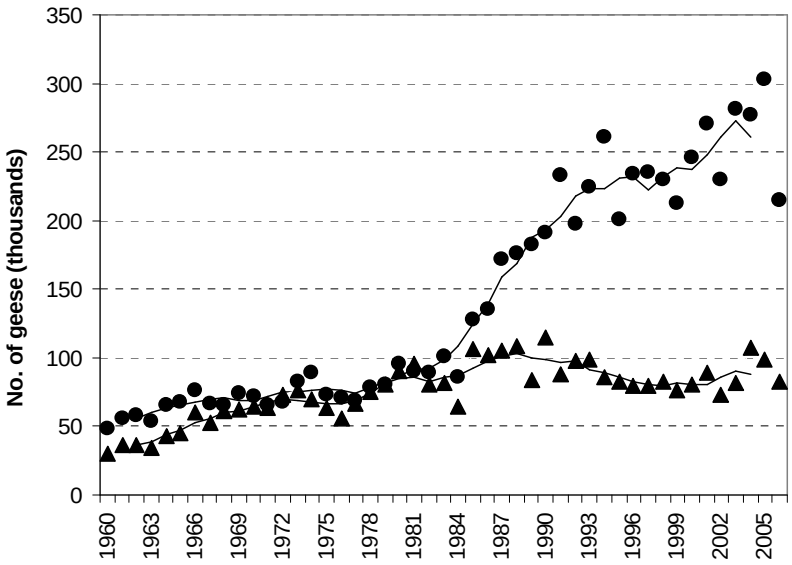


Figure 7. Population estimates for Pink-footed Goose (circles) and Iceland Greylag Goose (triangles), 1960 to 2006 The 5-year running means (e.g. mean for 2004 is from population estimates for 2002-06) are shown as lines.

The Pink-footed Goose population estimate is almost certainly a substantial underestimate, however, as it is very unlikely that a decrease of this magnitude is real given the average breeding success found during 2006. Bag statistics from Iceland for autumn 2006 are not yet available, but it is not expected that these were significantly greater than other recent years (c. 13,000; Figure 8). Pink-footed Geese were particularly late in reaching British shores in 2006, with strong to galeforce northerly winds towards the end of October (Met Office 2007) likely to have reduced goose movement at this time. Certainly counts at WWT Martin Mere, Lancashire, were very low until around mid October. Counts in Iceland during October were likely to underestimate the number present there at that time, because coverage is patchy and this species often remains dispersed in inaccessible areas at this time. However, this is unlikely to explain the low numbers recorded at key sites such as Loch of Strathbeg, during November, and it is likely that extensive flooding in many areas (notably Perthshire) affected the count that month as it resulted in greater dispersal of Pink-footed Geese than is usual and it is therefore likely that more birds than usual were missed during the count as they exploited alternative areas. The counts from the infrequently used roosts at St Fergus Gas Terminal and New Pitsligo Moss highlight the dispersed nature of Pinkfeet in Aberdeenshire at this time. Unidentified grey geese also had to be excluded from the counts (e.g. 4,407 grey geese counted at Inner Cromarty Firth, Ross & Cromarty, on 13 November, though it is likely these were predominantly Greylag Geese).

Late departures from Iceland have not just been a feature of 2006, however. The peak count of Pink-footed Geese has occurred in November in three of the past five years, whereas prior to this period, the peak count had only occurred in November on two occasions (in 1990 and 1999). Further censuses are required to clarify whether the population is now best censused in November due to this later arrival from the breeding grounds.

Typical of trends seen in more recent years, high numbers of Pink-footed Geese were recorded in Northwest England (mean 2001-2005: 32,348, ± 2209.6 s.e.) and East England (mean 2001-2005: 82,813, ± 12449.5 s.e.). Dispersal of birds from Scotland into Lancashire and Norfolk as the winter progressed was also apparent, as has been confirmed by resightings of individually marked birds (Fox *et al.* 1994).

It is also possible that there was an undercount of Greylag Geese for similar reasons, though the arrival was unlikely to have been much delayed by the October weather as this species migrates several weeks later than Pink-footed Geese. Also, there is less evidence for greater dispersal of birds, with an increasing concentration of the population on Orkney. However, November counts in Iceland, which have only recently been initiated, remain somewhat crude, with patchy coverage and anecdotal evidence (rather than accurate counts) informing the estimate of the number present from a number of areas. Coverage was also incomplete in Shetland, where it may be expected that numbers will increase given the rapid and seemingly continued redistribution northwards, which now appears to be strongly affecting numbers in the Moray Basin (e.g. very low numbers at Loch Eye). However, hunting bag estimates from Iceland since 2004 indicate that the number harvested has returned to the level (c. 37,000; Figure 8) that was believed to be the primary cause of the decline (of c. 20%) in overall abundance during the 1990s. Whilst data for 2006 are not yet available, on this basis it does not seem unreasonable to expect a decrease in abundance since 2004, as has been observed, though perhaps not of the magnitude as observed between 2005 and 2006.

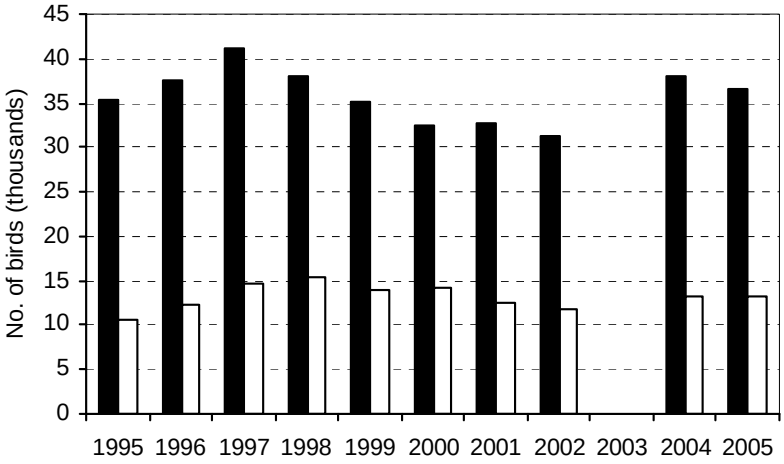


Figure 8. The number of Pink-footed Geese (open columns) and Greylag Geese (filled columns) found in hunting bags in Iceland, 1995-2005 (data was unavailable for 2003) (Source: Wildlife Management Institute, Akureyri, Iceland).

In order to address the issues causing probable undercounts in 2006 there is a need to further develop counts that are coordinated with those elsewhere in the flyway in areas where coverage is poor, particularly Iceland, but also probably Norway and Ireland (where small numbers of Iceland Greylag Geese are known to winter), as well as some areas in Britain (e.g. Shetland).

The breeding success of both Pink-footed Geese and Iceland Greylag Geese was higher than average in 2006, and the proportion of young Greylag Geese in autumn flocks has been consistently high (above 20.0%) for the past four years (including 2006; Figure 4). When compared with 2005, the proportions of young found were 6.2% higher for Pink-footed Goose, whilst for Greylag Geese the proportion of young was 9.3% lower. The proportion of young recorded in Greylag Goose flocks was higher than usual but the brood size per successful pair (1.9 goslings) was below that of the recent ten year mean and the lowest recorded since 1975 (1.5 goslings). However, the sample size was small at 11 families. Conversely, the mean brood size for Pink-footed Geese equalled that of the preceding ten year mean (2.2 goslings).

Variation in the percentage of young in flocks of Pink-footed Geese existed between regions, with comparatively high proportions recorded in Northeast Scotland (21.7%) in comparison with East Central Scotland (16.2%). Although some geese were aged in Northeast Scotland during late September, when the proportion of young in flocks is usually higher, the sample size was relatively small (3.5% of total sample aged). However, although regional variation was evident this winter, goslings appear to have been more evenly distributed across the wintering range than in 2003 and 2005 when the percentages of young ranged from 14.7% to 23.3% and 14.7% to 23.7%, respectively. Furthermore, there was little variation in the percentage of young recorded in flocks in England and Scotland (19.7% and 19.0%, respectively).

Arrival of Pink-footed Geese in Britain begins in September, particularly in Northeast Scotland, at places such as

Loch of Strathbeg, Aberdeenshire, and there is rapid movement further south as far as Lancashire and Norfolk. Higher percentages of young were found in flocks of Pink-footed Geese surveyed during late September in 2006 than in any other autumn period for (Figure 6). This has similarities with the results of age assessments made between 1994 and 2002 which found that Pink-footed Geese aged in September had higher proportions of young, than those recorded in October (Patterson & Hearn 2006). However, this does not explain such high proportions of young Pink-footed Geese found in East England during early November (Figure 6).

Although geese wintering in different parts of the autumn range in Britain can exhibit different levels of breeding success, annual patterns are correlated so that a good breeding season is reflected in a high proportion of young in all areas and vice versa (Mitchell *et al.* 1999). As different processes might be involved in the decrease over the autumn in both the percentage of young and in mean brood size of Pink-footed Geese (e.g. differential shooting mortality of juveniles and the later arrival of sections of the population with fewer young), measures of productivity should be carried out mainly in October, with samples from each region being proportional to the number of birds normally found there at that time (Patterson & Hearn 2006). By this stage, the whole population should have arrived in the UK and should have mixed well, but the percentage of young should not have decreased sufficiently to produce and underestimate of productivity (Patterson & Hearn 2006).

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7 References

Fox, AD, C Mitchell, A Stewart, JD Fletcher, JVN Turner, H Boyd, DG Salmon, WG Haines & C Tomlinson. 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.

Hearn, RD & C Mitchell. 2004. *Greylag Goose* Anser anser *(Iceland population) in Britain and Ireland 1960/61 - 1999/2000*. Waterbird Review Series, the Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Met Office. 2007. Online: http://www.metoffice.gov.uk/climate/uk/2006/october.html. Accessed 10th July.

Mitchell, C, AD Fox, H Boyd, A Sigfusson & D Boertmann. 1999. Pink-footed Goose *Anser brachyrhynchus:* Iceland/Greenland. In: Madsen J, G Cracknell & T Fox (eds). *Goose Populations of the Western Palearctic. A review of status and distribution.* Wetlands International, Wageningen, The Netherlands. National Environmental Research Institute, Ronde, Denmark.

Mitchell, C & RD Hearn. 2004. *Pink-footed Goose* Anser brachyrhynchus *(Greenland/Iceland population) in Britain and Ireland 1960/61 - 1999/2000*. Waterbird Review Series, the Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Patterson, IJ & RD Hearn. 2006. Month to month changes in age ratio and brood size in Pink-footed Geese *Anser brachyrhynchus* in autumn. *Ardea* 94: 175-183

Rowell, HE. 2005. *The 2004 Icelandic-breeding Goose Census.* The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Worden, J. 2006. *The 2005 Icelandic-breeding Goose Census.* The Wildfowl & Wetlands Trust/Joint Nature Conservation Committe, Slimbridge.

Wernham, CV, MP Toms, JH Marchant, JA Clark, GM Siriwardena & SR Baillie (eds). 2002. *The Migration Atlas: movements of the birds of Britain and Ireland.* T & A D Poyser, London.

Wetlands International. 2006. *Waterbird Population Estimates – Fourth Edition.* Wetlands International, Wageningen, The Netherlands.