



Status and distribution of
Icelandic-breeding geese: results of
the 2015 international census

Wildfowl & Wetlands Trust Report

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Goose & Swan Monitoring

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Summary

The 56th consecutive annual census of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese took place during autumn and early winter 2015. Sites holding Pink-footed Geese were primarily checked in October and November, whilst those holding Greylag Geese were checked primarily in November. Some sites in the UK were also counted during late August and September in order to estimate the numbers of Greylag Geese from the British population present prior to the arrival of Icelandic migrants. Coverage in Britain was very good, with the majority of the key sites covered. Count data were also received from Southwest Norway, Ireland and Iceland, the latter based on ground and aerial counts. Weather conditions were generally considered favourable during the October census periods with very few sites reporting underestimated counts. However, poor weather during the November census may have affected that count, especially at sites around the Irish Sea.

Maxima of 530,961 Pink-footed Geese and 116,330 Greylag Geese were counted in October and November, respectively. These figures were adjusted to account for major sites that were not counted and for the number of British Greylag Geese counted prior to this census, resulting in population estimates of **536,871** Pink-footed Geese and **95,403** Iceland Greylag Geese. Compared to the previous year, the 2015 figures represent an increase of 36.5% in the Pink-footed Goose population and a small increase of 6.4% in the Greylag Goose population.

Fifteen sites held over 10,000 Pink-footed Geese in October. Montrose Basin, Angus held the largest number ever recorded at a single site, with 85,632 birds recorded there in October. Combined counts from the 27 sites exceeding 1% of the population estimate accounted for 88.5% of the total October count. Iceland Greylag Geese were found primarily in Orkney (40.0% of the population estimate) and Iceland (36.7%).

The breeding success of Pink-footed Geese was similar to the mean for the previous decade at 18.8% young compared to 18.4% (mean 2005-2014). The mean brood size of successful pairs was 1.89 goslings, which was slightly lower than the mean recorded during the preceding decade (2.07). The breeding success of Iceland Greylag Geese was slightly lower than the mean for the previous decade with flocks containing 20.4% young compared to 22.2% (mean 2005-2014), and the mean brood size of 2.73 goslings per successful pair was slightly higher than the previous decade mean (2.27), although both measures were based on a small sample sizes.

1 Introduction

The Pink-footed Goose *Anser brachyrhynchus* population which breeds in Iceland and east Greenland winters almost exclusively in Britain (Mitchell 2002), while Greylag Geese *Anser anser* breeding in Iceland principally winter in north Britain, with small numbers in Ireland and Southwest Norway (Swann & Brockway 2002). Large concentrations of both species occur in autumn, particularly in East Central Scotland, Southwest Lancashire and Norfolk (Pink-footed Goose) and North Scotland (Greylag Goose), notably in Orkney. As winter progresses, redistribution to other parts of the wintering range occurs 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 each year since 1990, 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. Pink-footed Geese arrive earlier than Greylag Geese and are therefore usually best counted in October. The November count allows for the later migration of Greylag Geese to be completed.

This report presents an overview of the 56th consecutive annual census and an update on the population size and breeding success of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese following the 2015 breeding season.

2 Methods

Counts were conducted by a network of volunteer observers and professional conservation staff over the weekends of 17/18 October and 14/15 November 2015. 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 were flying in, or at dawn, as they departed to feeding areas. Dates of the coordinated counts were chosen to avoid periods of full moon as far as possible (27 October and 25 November), thus minimising the likelihood of geese remaining in feeding areas overnight. In a small number of areas where roost sites were 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, counts from the Solway Firth, Orkney, Shetland, Southwest Norway, Faroe Islands and Iceland are treated as consolidated sites. Up to 2012, geese in Caithness were counted during the daytime when they were feeding on agricultural land and the county was treated as a consolidated site. However, since 2012, roost counts have been undertaken and these are now reported separately.

Three types of adjustment could be applied to the count totals in order to generate the population estimates. In some cases, where a count was not undertaken, an estimate of the number of geese present was provided by local counters. For regularly monitored sites (those counted in at least three of the previous five years) that were not counted during the 2015 census, and no estimate was provided by a local counter, numbers were estimated from the mean of the counts made during the relevant month during the previous five years (2010–2014). Estimated numbers (from either source) that exceeded 0.5% of the current IGC peak count total were added to this peak count to give the adjusted population estimate.

Increasing numbers of British/Irish Greylag Geese in core wintering areas for the Icelandic migrants, such as Shetland, Orkney, the Moray Firth, Bute and other parts of Scotland and Ireland means that assessing the abundance of the Iceland population is difficult. Where there are reasonable estimates of the abundance of British Greylag Geese (for example on Orkney) these are subtracted from winter counts. However, up to date information on the abundance of British Greylag Geese south and east of an arbitrary line from Bute east to Aberdeen is largely lacking and, simply as a precaution, any counts obtained through IGC from this area are matched by subtracting that figure (assuming that the majority of birds counted are British). This is unsatisfactory, and is only carried out as a precautionary measure. An analysis of movements of Iceland Greylag Geese based on sightings of individually marked birds in the late 1990s/early 2000s showed that some Icelandic migrants moved south within Scotland to winter (Swann *et al.* 2005). It is not known if this is still the case since ringing of the population stopped in the mid-2000s. It is highly likely that a small proportion of Icelandic migrants do move south to winter in south east Scotland, but since the proportion is unknown, a precautionary approach has been adopted.

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 to early December were used to determine the proportion of young and the mean brood size of successful pairs.

3 Results

3.1 Coverage and conditions

The number of sites covered in each month is shown in Table 1. Compared to previous years, coverage throughout the range of both species during late 2015 was considered good

Table 1. The number of sites counted and the number of sites holding Pink-footed and Greylag Geese in October and November 2015.

	October	November
Number of Pink-footed Goose sites counted	113	126
Total number of sites holding Pink-footed Geese	70	65
Number of Greylag Goose sites counted	-	119
Total number of sites holding Greylag Geese	-	67

Outwith Britain, an aerial survey was carried out in Iceland in November and this was combined with information from hunters to provide an estimate of goose numbers there. Data were also received from several sites in Southwest Norway in January 2016. In Ireland, full coverage of sites was not possible (as had been carried out in autumn 2007) but counts from the 12 sites thought to hold Iceland Greylag Geese were provided for November.

Four sites met the criteria for the calculation of an estimated count due to lack of coverage. In Angus, Loch of Lintrathen was not counted in October, although birds were known to be roosting there, and an estimate of 5,910 Pink-footed Geese was added. In Orkney, no counts were undertaken on Stronsay, Westray or Shapinsay, and estimates of 5,096, 1,196 and 446 Greylag Geese were added. No counts of Iceland Greylag Geese were undertaken during November in Southwest Norway, however, 502 birds (the number counted there in January 2016) was used as an estimated count for the November census period. This approach has been adopted for several years; guidance from local counters in Southwest Norway suggests that the winter influx of Iceland migrants (determined by the presence of marked individuals from Iceland) occurs in late October or early November and they remain there throughout the winter (A Follestad pers. comm.).

An attempt was made to account for the presence of British Greylag Geese in areas where Iceland Greylag Geese were also known to winter. Treatment of the principal locations was discussed in the 2009 IGC report (Mitchell 2010) and involves Lough Swilly (c. 300), Shetland (c. 5,000), Orkney (18,050 birds, see Discussion), Caithness (c. 1,000) and Highland (c. 750). British Greylag Geese also occur throughout south Scotland and north England and where counts were thought to involve British birds these have also been deducted (see Methods).

Weather conditions were reported as good or reasonable for most sites in October although stormy weather, particularly in the Irish Sea and associated coastal areas, affected some count sites in November. At sites holding Pink-footed Geese, poor visibility caused by mist affected two sites in October. The stormy conditions in November affected three sites, notably on the Solway Firth where counting was hampered. One site suffered from disturbance in November due to a dog walker. For sites holding Greylag Geese, poor visibility affected two sites in November, again notably on the Solway Firth. Overall, poor visibility was not thought to have adversely affected the counts at principal sites in October, although westerly sites in November, particularly the Solway Firth, may have been adversely affected by the stormy weather (see Discussion).

3.2 Total numbers

3.2.1 Pink-footed Goose

Totals of 530,961 and 269,579 Pink-footed Geese were counted in October and November, respectively (Figure 1, Table 2). These represent an increase of 37.1% and a decrease of 19.5%, respectively, compared to the unadjusted total counts in the same months in the preceding year. Coverage was good and only one estimated count needed to be added to the unadjusted total and so the peak winter total in October 2015 was used to derive a population estimate of 536,871 geese. This represents an increase of 36.5% compared to October 2014, when a total of 393,170 individuals was estimated. In autumn 2015, 50.9% of the October count (unadjusted) was counted in November (Table 3).

3.2.2 Greylag Goose

In November 2015, 116,330 Greylag Geese were counted (Figure 1, Table 2). The unadjusted November count was 2.9% lower than that recorded in the previous year. Following adjustments for British Greylag Geese and the addition of estimated counts, the count total was used to derive a population estimate of 95,403 Iceland Greylag Geese. This represents an increase of 6.4% compared to the previous estimate of 89,668 geese recorded in 2014.

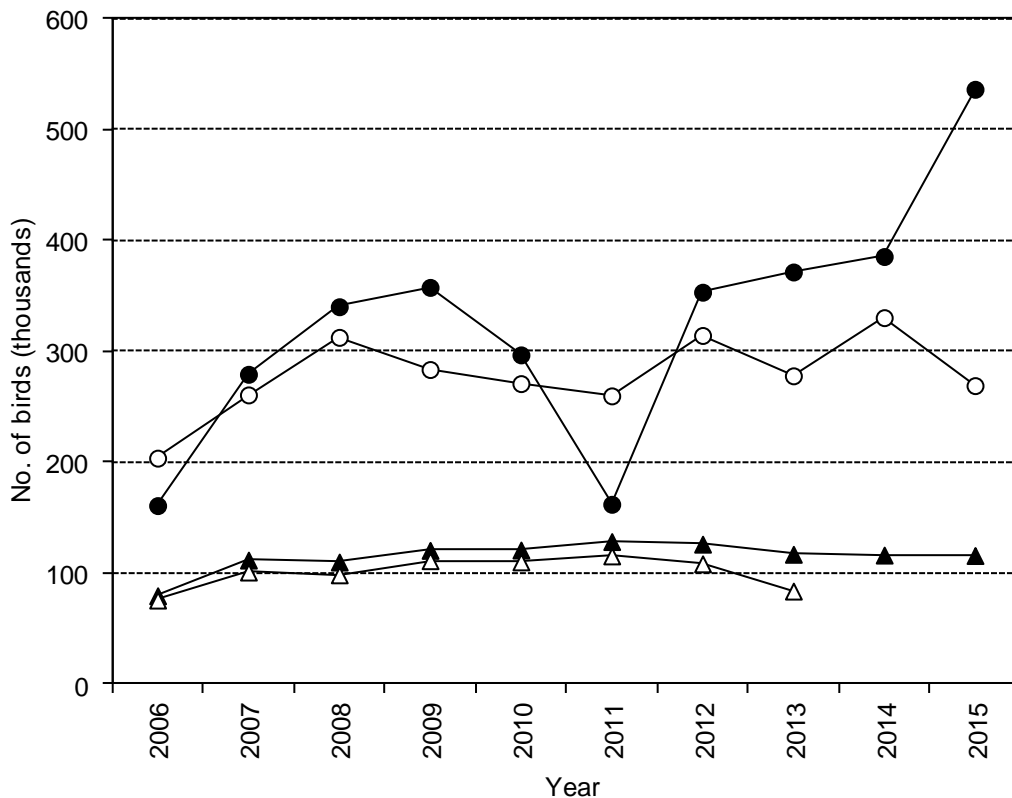


Figure 1. Peak (unadjusted) counts of Pink-footed Geese (circles) in October (filled) and November (open) and Iceland Greylag Geese (triangles) in November (filled) and December (open) counted during the Icelandic-breeding Goose Census, 2006 to 2015.

Table 2. Totals of Pink-footed Geese and Iceland Greylag Geese by country and region in October and November 2015. 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 counted.

Region/Area	October 2015	November 2015	
	Pinkfoot	Pinkfoot	Greylag
Iceland*	8,000 (1)	0	35,000 (1)
Norway*	nc	nc	nc [+502] (5)
Faroe Islands*	nc	nc	nc
Ireland	nc	75 (1)	1,368 [-300]
Shetland*	nc	115 (1)	5,502 (1) [-5,000]
Orkney*		522 (1)	49,413 (1) [+6,738] [-18,050]
Caithness	65 (2)	206 (12)	10,482 (12) [-1,000]
Highland	35,228 (18)	21,352 (18)	8,335 (20) [-750]
Moray	20,200 (1)	12,600 (2)	1,500 (2)
Aberdeenshire	55,077 (5)	58,241 (5)	37 (5) [-37]
Angus/Dundee	85,632 (1) [+5,910]	32,976 (2)	0 (2)
Perth & Kinross	29,900 (6)	32,516 (14)	977 (13) [-977]
Stirling/Falkirk/Clackmannan	9,667 (5)	3,212 (4)	16 (4) [-16]
Fife	7,171 (20)	9,091 (21)	1,726 (21) [-312]
Argyll & Bute	2,150 (1)	491 (1)	749 (2) [-500]
Clyde	nc	nc	nc
Ayrshire	nc	nc	nc
Dumfries & Galloway **	12,576 (7)	1,099 (8)	78 (8)

Region/Area	October 2015	November 2015	
	Pinkfoot	Pinkfoot	Greylag
			[-78]
Cumbria **	1,683 (5)	5,386 (7)	0 (7)
Lothians	21,517 (15)	4,164 (9)	223 (9)
			[-223]
Borders	107,741 (11)	12,948 (10)	422 (9)
			[-422]
Northumberland	3,900 (2)	4,100 (2)	0 (2)
Lancashire & Merseyside	92,532 (6)	24,231 (6)	-
N Wales/Dee Estuary	1,800 (2)	1,300 (2)	-
Humberside	19,800 (3)	14,080 (3)	-
Norfolk	16,322 (11)	31,396 (11)	-
<i>Raw total counts</i>	530,961	270,101	116,330
<i>Adjustment for non-Icelandic birds</i>			-27,665
<i>Estimated counts</i>	+5,910		+6,738
Population Estimate	536,871		95,403

* several feeding sites consolidated

** counts from the Solway Firth have been split between birds counted in Dumfries & Galloway and Cumbria

nc no count received

3.3 Regional Distribution

3.3.1 Pink-footed Goose

A mass arrival of Pink-footed Geese into Britain occurred just before the October 2015 count weekend (see Discussion). Approximately one quarter of the population had arrived in East Central Scotland and Southeast Scotland/Northeast England and just under a fifth in Southwest Lancashire by the middle of the month. By November, due to the low count, all regions held fewer birds, apart from East England where numbers increased slightly (Figure 2).

3.3.2 Greylag Goose

During November, just under a quarter of the population was still in Iceland and 68% were present in North Scotland, principally in Orkney (Table 3, Figure 3). Overlap between British and Icelandic populations make it difficult to determine the origin of individuals, however, it is doubtful now that many Greylag Geese encountered south of the Moray Firth in November are of Icelandic origin (but see Discussion).

Table 3. National and, within Britain, regional distribution of Pink-footed Geese and Iceland Greylag Geese counted during October and November 2015, expressed as a percentage of the maximum count for each species. Estimated counts not included.

	Pink-footed Goose		Greylag Goose
	October	November	November
Iceland	1.5	-	24.3
Faroes	-	-	-
Norway	-	-	0.3
Ireland	-	-	1.2
North Scotland	6.6	4.2	68.4
Northeast Scotland	14.2	13.3	1.1
East Central Scotland	24.9	14.7	2.8
Southwest Scotland/ Northwest England	3.1	1.3	1.0
Southeast Scotland/ Northeast England	25.1	4.0	0.9
West England	17.8	4.8	-
East England	6.8	8.6	-
Total	100	50.9	100

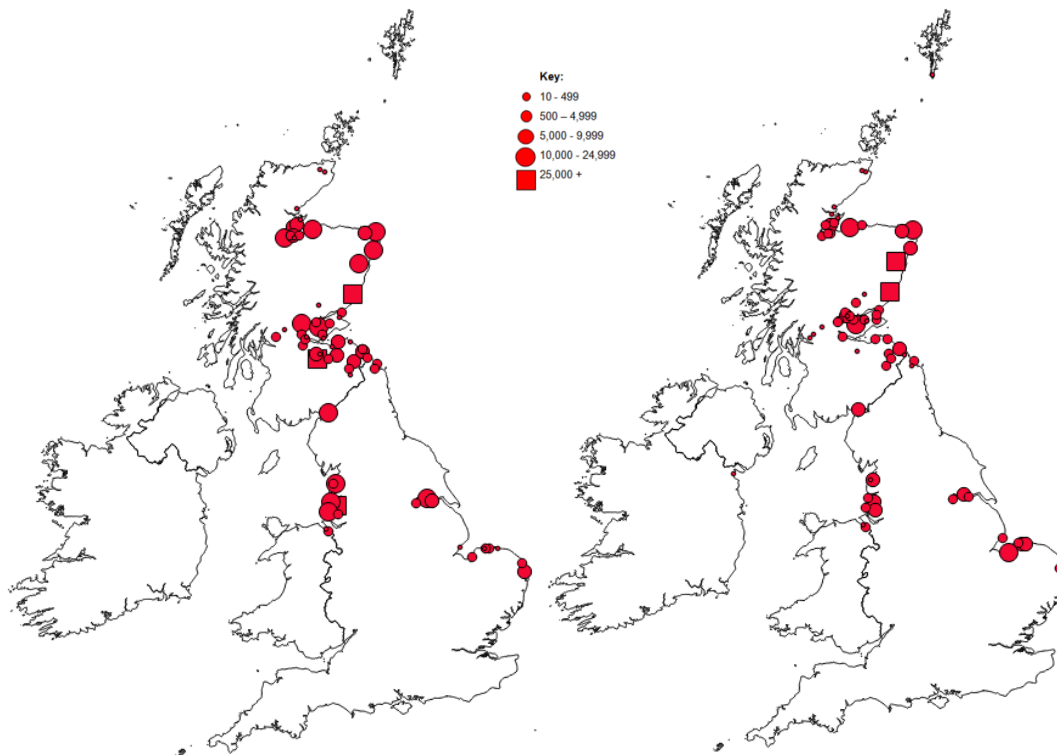


Figure 2. Distribution of Pink-footed Geese in Britain and Ireland in October (left) and November (right) 2015. Estimated counts are not shown.

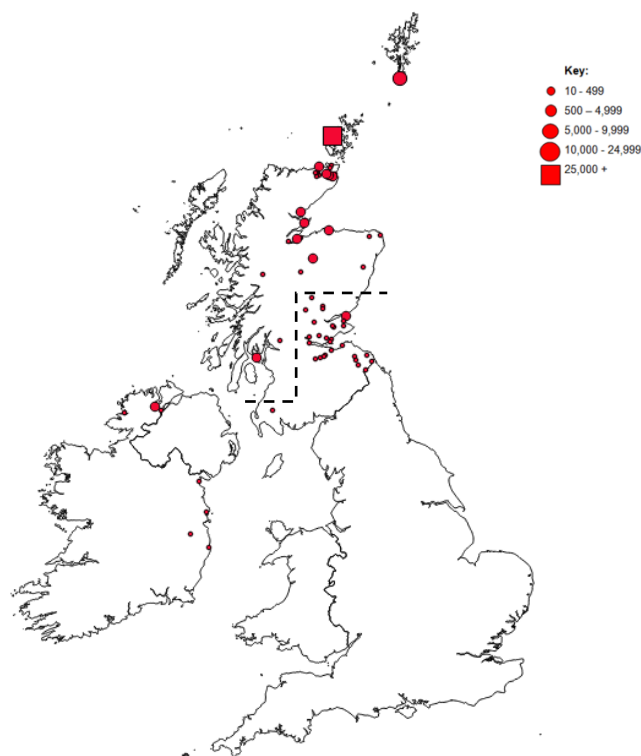


Figure 3. Distribution of Iceland Greylag Geese in Britain and Ireland in November 2015. Where the status is unknown, the mapped counts do not differentiate between Icelandic and British birds. It is unlikely that many Iceland birds are present south and east of the dashed line in November (see also Table 2).

3.4 Principal concentrations

3.4.1 Pink-footed Goose

Pink-footed Geese were recorded at 70 sites in October and 65 in November (Table 1). The number of sites holding more than 1% of the 2015 population estimate (5,369 birds) was 27 in October and 16 in November revealing a remarkable breakup in the mass concentrations soon after arrival. Fifteen sites held over 10,000 birds in October, and six in November. Combined counts from the 27 sites exceeding 1% of the population estimate accounted for 88.5% of the total October count and numbers at the top five sites alone held 44.9% of the population estimate (Table 4). The most recent peak IGC counts from the two sites holding the two highest counts in 2015 (Montrose Basin, Angus and West Water, Borders) are shown in Figure 4.

Traditionally, counts of Pink-footed Geese in Southwest Lancashire have been reported as a single consolidated site. This was partly because some counts were being undertaken during the day in feeding areas. However, since 2010, efforts have been made to count the geese using the roosts in the area (Table 5). Counts are therefore reported at the individual site level. However, in order to maintain continuity, the total count for Southwest Lancashire will also continue to be reported. In autumn 2015, the consolidated counts for Southwest Lancashire were 92,532 (October) and 24,231 (November).

In October, high numbers were recorded at Montrose Basin, Angus, which held 15.9% of the population estimate, West Water Reservoir, Borders (15.4%), WWT Martin Mere, Southwest Lancashire, (6.0%), Findhorn Bay, Moray (3.8%), Ribble Estuary (Marshside), Southwest Lancashire, (3.7%), the Alt Estuary, Southwest Lancashire (3.6%) and Loch of Strathbeg, Aberdeenshire (3.4%). It appears, therefore, that there was an influx of large numbers of Pink-footed Geese into northern Britain in the weeks prior to the mid-October count weekend.

3.4.2 Greylag Goose

In November, Greylag Geese were counted at 67 sites (Table 1), only 11 of which held numbers exceeding 1% of the population estimate (954 birds) (this considers Orkney, Iceland, Shetland and Bute as single consolidated sites). The total unadjusted count was 49,413 Greylag Geese in Orkney, however, for the first time, three islands were not counted, and an estimated 6,738 were added, bringing the total adjusted total for the archipelago to 56,151, some 9,000 birds fewer than the number counted in the previous year. Subtracting an estimated 18,050 summering British Greylag Geese (see Discussion) from the total counted on Orkney in November, gave an estimated 38,101 Iceland migrants, or 40.0% of the flyway population estimate (Table 4). Fewer Iceland Greylag Geese are now wintering in Scotland south of the Moray Firth, reflecting the redistribution to wintering sites in North Scotland.

Table 4. Sites that supported >1% of the (a) Pink-footed Goose (>5,369) and (b) Iceland Greylag Goose (>954) population estimates in October and November 2015, respectively. 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 3,720 for Pink-footed Goose and 1,070 for Iceland Greylag Goose (Wetlands International 2016). Greylag Goose counts are adjusted (*i.e.* British birds have been deducted).

a) Pink-footed Goose

Site	October count	Percentage of population estimate	Five-year peak mean 2010–2014 ¹
Montrose Basin, Angus	85,632	15.9	47,034
West Water Reservoir, Borders	82,920	15.4	16,083
Martin Mere, SW Lancashire	32,290	6.0	21,760
Findhorn Bay, Moray	20,200	3.8	6,035
Ribble Estuary (Marshside), SW Lancashire	20,000	3.7	22,826
Alt Estuary, SW Lancashire	19,109	3.6	14,876
Loch of Strathbeg, Aberdeenshire	18,137	3.4	13,852
Carsebreck & Rhynd Lochs, Perth & Kinross	16,900	3.1	16,256
Morecambe Bay, SW Lancashire	15,630	2.9	17,685
Loch of Skene, Aberdeenshire	15,140	2.8	14,385
Beaully Firth, Highland	14,300	2.7	5,835
Solway Firth (consolidated)	14,259	2.7	11,137
Meikle Loch, Aberdeenshire	12,600	2.3	7,720
Loch Leven, Perth & Kinross	11,530	2.1	13,108
Whitton Sands, Yorkshire	10,230	1.9	2,181
Middlemuir, Aberdeenshire	9,200	1.7	13,304
Hule Moss, Borders	8,600	1.6	5,051
Aberlady Bay, Lothians	8,420	1.6	8,209
Read's Island Flats, Yorkshire	8,200	1.5	6,411
Iceland	8,000	1.5	8,740
Breydon Water & Berney Marshes, Norfolk	7,700	1.4	4,320
Bogbank, Borders	7,240	1.3	-
Fala Flow, Lothians	6,595	1.2	4,503
Cromarty Firth: Udale Bay, Highland	5,800	1.1	3,000
Harperrig Reservoir, Lothians	5,650	1.1	1,698
Cromarty Firth: Nigg Bay, Highland	5,550	1.0	4,050
Inner Moray Firth	5,400	1.0	-

¹ Mean derived from any IGC count (*i.e.* from any month, October, November or December).

b) Greylag Goose

Site	November count ¹	Percentage of population estimate	Five-year peak mean 2010–2014 ²
Orkney Islands (all sites)	38,101 ³	40.0	52,834
Iceland (lowlands)	35,000	36.7	25,862
Loch Eye, Highland ⁴	4,419	4.6	1,830
Loch of Kilimster, Caithness ⁵	3,868	4.1	1,375
Loch Watten, Caithness ⁵	2,800	2.9	2,848
Lower Strathspey, Highland ⁴	1,845	1.9	1,160
Scrabster Loch, Caithness ⁵	1,700	1.8	118
Loch Spynie, Moray	1,500	1.6	-
Tay Estuary; Tentsmuir Point	1,414	1.5	-

¹ Adjusted counts (see text and Table 2).

² Mean derived from any IGC count (*i.e.* from any month, October, November or December).

³ Includes estimated counts for (see Table 2 and Table 6).

⁴ Highland includes an estimated 750 British birds (Table 2) that cannot be allocated to individual sites.

⁵ Caithness includes an estimated 1,000 British birds (Table 2) that cannot be allocated to individual sites.

Table 5. Counts of Pink-footed Geese at roost sites in Southwest Lancashire in October 2015.

Count site	SPA	October 2015
Martin Mere	Martin Mere SPA	32,290
Ribble Estuary (Marshside)	Ribble/Alt Estuaries SPA	20,000
Alt Estuary	Ribble/Alt Estuaries SPA	19,109
Morecambe Bay	Morecambe Bay SPA	15,630
Simonswood Peat Moss		3,200
Cockers Dyke		2,303
Total		92,532

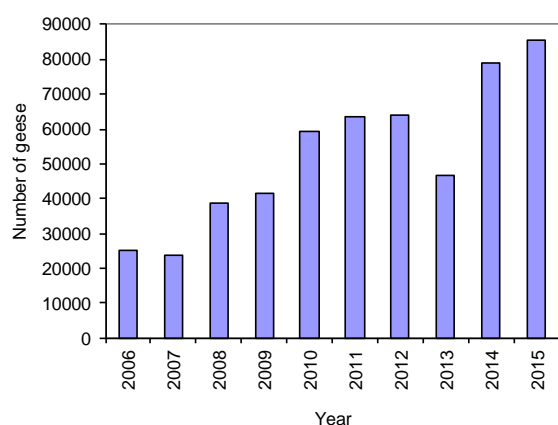
For the purposes of this report, Orkney is treated as a consolidated site, although Table 6 shows the individual totals for the islands. Eight of the islands in Orkney held numbers exceeding 1% of the population estimate in November (954 birds), although these individual counts are not adjusted for the presence of Greylag Geese breeding in Orkney (thought to number *c.* 18,050 birds in total, but see Discussion). As in 2009 to 2014, West Mainland held more than 10,000 birds.

Table 6. Greylag Goose counts at individual sites in Orkney in November 2015 (counts have not been adjusted to take into account the estimated number of British Greylag Geese in Orkney). Five-year peak mean derived from counts from 2010 to 2014.

Site	November count	% of population estimate	Five-year peak mean
West Mainland	18,496	19.4	29,548
East Mainland	7,860	8.2	13,621
Stronsay ¹	(5,096)	(5.3)	5,096
Shapinsay	5,241	5.5	4,183
South Ronaldsay	5,323	5.6	4,203
Sanday	5,448	5.7	4,391
Eday	1,867	2.0	1,463
Papa Westray	755	0.8	1,320
Rousay	885	0.9	1,179
Egilsay ¹	(446)	(0.5)	446
Westray ¹	(1,196)	(1.3)	1,196
North Ronaldsay	1,067	1.1	770
Hoy and Walls	466	0.5	578
Wyre	109	0.1	248
Burray	939	1.0	420
Flotta	173	0.2	238
Graemsay	338	0.4	168
Gairsay	446	0.5	-
Total	56,151	58.9	

¹ No counts were received from three sites in Orkney in November 2015. Estimated counts have been used for Stronsay (5,096), Egilsay (446) and Westray (1,196).

a) Montrose Basin, Angus



b) West Water Reservoir, Borders

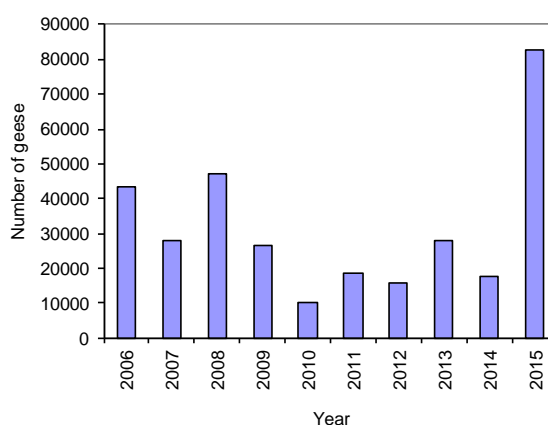


Figure 4. Peak IGC counts of Pink-footed Geese at a) Montrose Basin, Angus and b) West Water Reservoir, Borders, 2006 to 2015.

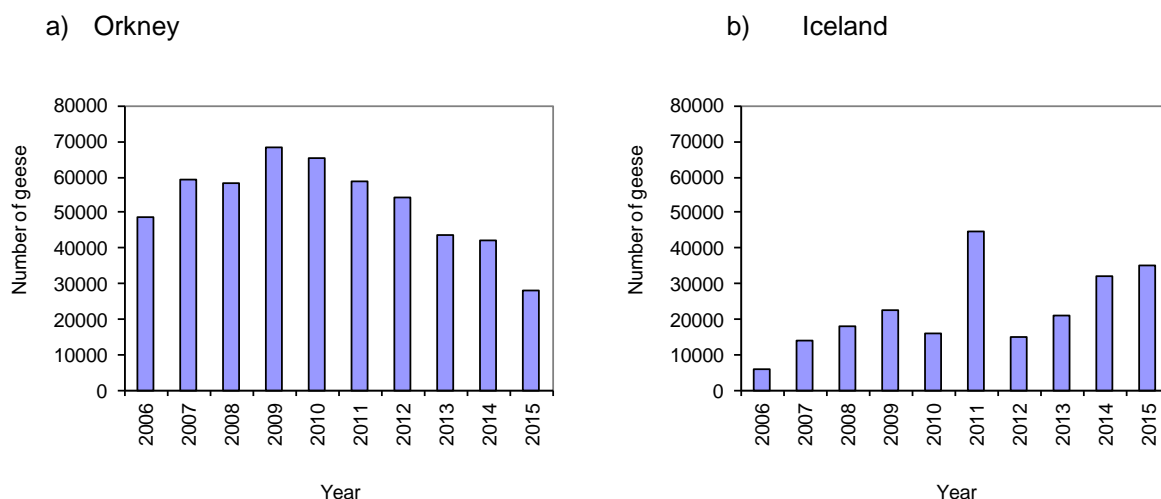


Figure 5. Peak IGC counts of Iceland Greylag Geese at a) Orkney (excludes British birds) and b) Iceland, 2006 to 2015.

3.5 Breeding success

Totals of 16,765 Pink-footed Geese (from 39 flocks) and 2,512 Greylag Geese (10 flocks) were aged at various localities, primarily in Scotland, between 15 September and 11 December 2015. The percentage of birds aged in relation to the estimated size of the population in 2015 was 3.1% for Pink-footed Geese and 2.6% for Greylag Geese. Information on the brood sizes of 404 families of Pink-footed Goose and 30 families of Greylag Goose was also collected during this period.

The breeding success (percentage young) of Pink-footed Goose was similar to the mean for the previous decade at 18.8% young (mean proportion of young 2005–2014: $18.4\% \pm 1.2$ SE). The mean brood size of successful pairs was 1.89 goslings, slightly lower than the mean recorded during the preceding ten years (2.07 ± 0.1 SE) (Table 7, Figure 6).

Age counts were undertaken in several regions, and at different times during the autumn. This leads to differences in the percentage young and mean brood sizes recorded both spatially and temporally (Table 7). Traditionally, all age counts have been collated and an overall figure calculated, but the results from autumn 2015 suggest that there is some variation in age assessments both geographically and temporally and collating all the figures masks these differences. An overall population assessment is needed, but regional differences are interesting too since consistency in them may indicate sub-populations that have experienced different breeding conditions.

The breeding success of Iceland Greylag Geese was slightly below the mean for the previous decade, with flocks containing 20.4% young (mean 2005–2014: $22.2\% \pm 0.7$ SE). The mean brood size of 2.73 goslings per successful pair was higher than that of the recent ten-year mean (2.27 ± 0.08 SE) (Table 7, Figure 6), however, the breeding success and brood size figures were based on small sample sizes. Due to their later migration and more limited range, the temporal and spatial distribution of Greylag Geese was limited and age counts were only collected in one region (North Scotland) during mid November to early December. The sampling period was later than usual (by up to one month). Although it is harder to age Greylag Geese later in the autumn, the observer felt comfortable that the age assessments were accurate.

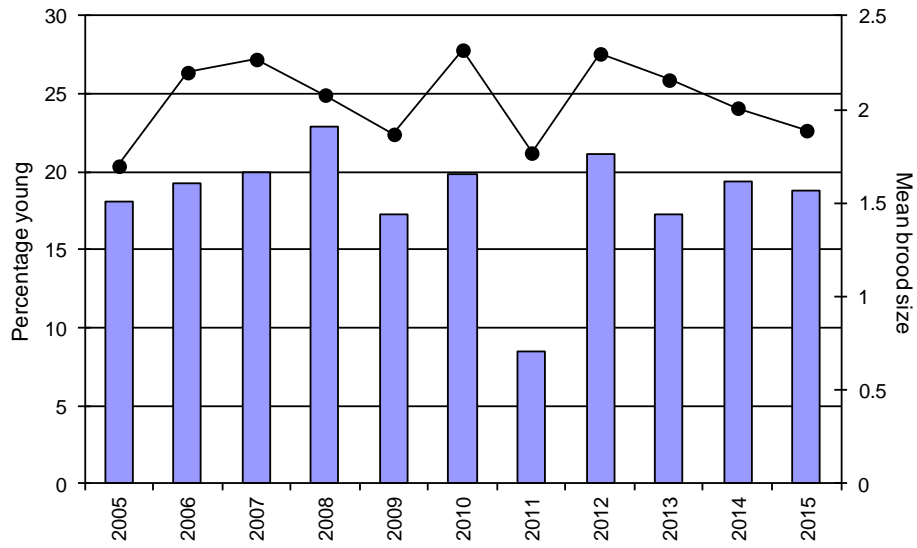
Table 7. The percentage of young and mean brood size of Pink-footed and Greylag Geese in 2015.

	Region	Time period	Total aged	% young	No. of broods counted	Mean brood size
Pink-footed Goose ¹	N Scotland	Late Oct	1,350	18.4	-	-
	NE Scotland	Late Sep	1,000	27.1	36	2.33
		Early Oct	1,500	26.5	29	2.17
		Late Oct	1,000	19.8	5	2.20
		Early Nov	-	-	2	1.50
		EC Scotland	Early Oct	1,050	19.3	7
		Late Oct	4,300	17.2	10	2.70
	SW Scotland	Late Sept	427	34.9	17	3.29
	West England	Early Oct	3,400	12.6	181	1.67
		Early Nov	443	10.6	24	1.45
	E England	Late Oct	2,295	20.3	93	1.77
	Total		16,765	18.8	404	1.89
Greylag Goose ²	N Scotland	Mid-Dec	2,512	20.4	30	2.73
	Total		2,512	20.4	30	2.73

¹ Pink-footed Geese were aged between 15 September and 2 November 2015.

² Greylag Geese were aged between 14 November and 11 December 2015.

a) Pink-footed Goose



b) Greylag Goose

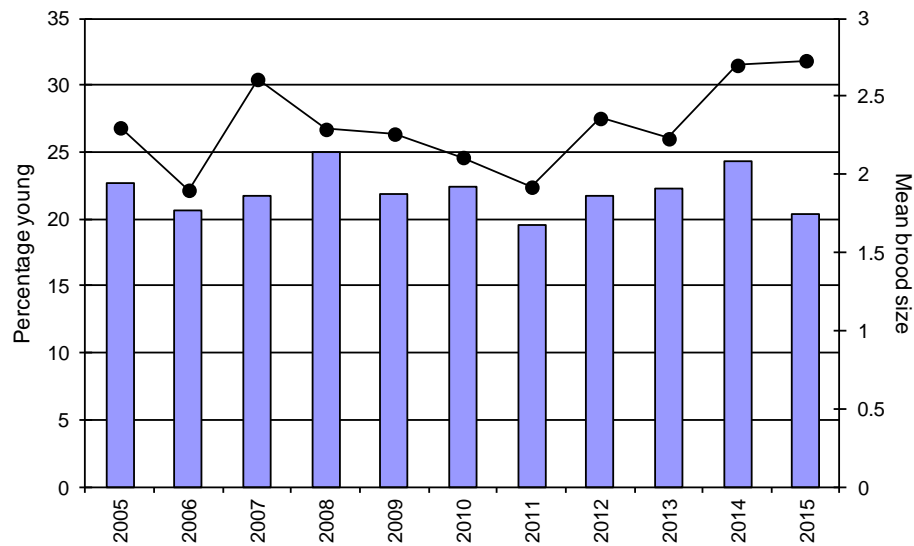


Figure 6. The percentage young (column) and mean brood size (line) found in flocks of (a) Pink-footed Goose and (b) Iceland Greylag Goose, 2005 to 2015.

4 Discussion

Very large counts at some of the principal resorts in mid-October 2015 indicated that there had been a mass arrival of Pink-footed Geese into Britain in the weeks prior to the count weekend. The count of 85,632 Pink-footed Geese at Montrose Basin, Angus, was the largest IGC count ever recorded at a single site and accounted for a sixth of the entire population. At West Water Reservoir, Borders, a record 82,920 Pink-footed Geese were counted and six roosts in Southwest Lancashire held a combined total of 92,532 birds. Together, these three sites held half the October total and a total of 27 sites held more than 1% of the population estimate (> 5,369 birds). It is well established that some key wetland sites support large numbers of geese soon after they arrive in northern Britain, and numbers decline as geese move south within Scotland or onto Lancashire and Norfolk.

The 2015 population estimate of 536,871 is a third higher than the figure for October 2014 (393,170) and, by far, the highest population estimate ever recorded. Despite this large increase in the number counted, the evidence currently available suggests that the latest count is an accurate estimate of population size. The 2015 population estimate thus confirms that the counts of autumn 2010 and 2011 underestimated the total number of geese in the population in those years. However, the increase of nearly 144,000 birds between 2014 and 2015 suggests that the most recent counts in 2012-2014 also probably underestimated the true number of birds in the population. Steady growth in the population would suggest an annual rate of increase since 1987 of about 3.0% per annum.

Pink-footed Goose breeding success in summer 2015, at 18.8%, was unremarkable and similar to the long-term average of 18.4% over the most recent ten years. Reports from Iceland suggest reasonable weather during the 2015 spring and summer months. The average productivity was also confirmed by the proportion of young in the Iceland bag; at 26.9%, this was just lower than the recent average (28.2%) for the ten year period 2005 to 2014 (A. Sigfússon *in litt.*). Hunting of Pink-footed Geese in Iceland appears stable with 16,656 shot there in 2014 (the year for which the most recent data are available). Unfortunately, no comparable data exist for the number shot in the UK. It would appear that a sustained output of around 20% young per annum, and annual mortality probably static, in terms of the number of birds shot, is sufficient to fuel a steady increase in numbers.

The possibility that the October count over-estimated the true number of Pinkfeet in Britain was discounted for a number of reasons. Firstly, checks with counters confirmed there were no typographical errors in the data entry. Checks were also made with colleagues in Denmark monitoring the Svalbard population of Pink-footed Goose and there was no evidence from marked birds that there had been an influx of birds from the Svalbard population (J.Madsen *in litt.*). Counts were well coordinated and the possibility of birds being counted more than once at different sites was considered unlikely. However, as the number of birds at some sites has increased enormously in recent years, accurate counting may have become more difficult. It is possible that in the years between 2009 and 2014, some Pink-footed Geese remained in Iceland, or even in east Greenland, at the time of the October counts, although information from hunters in the interior of Iceland in early October suggest that this is unlikely. The first snows in the interior of Iceland tend to occur in mid September, pushing the birds south, and GPS location data from recently marked Pink-footed Geese indicated that movements from east Greenland to Iceland were in early September and departure from Iceland was in the last days of September.

Thus, as far as it is possible to tell, the high October count in 2015 appears to be valid and therefore it must also be tentatively concluded that since 2009/10, the annual autumn IGC counts have probably underestimated the true number of Pink-footed Geese within the Greenland/Iceland population. The breeding range of Pink-footed Geese in Iceland has increased recently and numbers counted in north and east Greenland have also increased (Boertmann *et al.* 2015), which suggest a likely population increase. However, it is apparent that the monitoring surveillance undertaken to track the population is subtly different to the situation up to the early 2000s when the population was below 250,000 birds. In some years since 2000, more roosts, that are not counted,

are probably being used, and the timing of the IGC October count needs to be carefully chosen to avoid large number of birds remaining in Iceland. Pink-footed Geese tend to leave the highlands of Iceland once the first snow falls in September. The timing of the departure from Greenland is largely unknown.

In 2015, it would appear that for the first time since 2009/10, the vast majority of geese had left Iceland and they were concentrated at traditional roosts that are well covered by IGC; a combination that was conducive to the best population estimate possible.

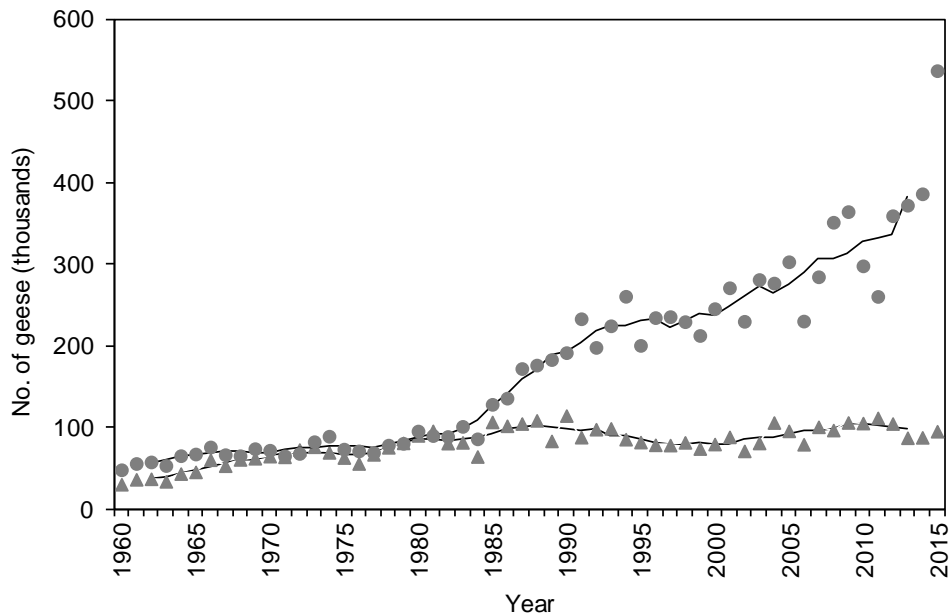


Figure 7. Population estimates for Pink-footed Goose (circles) and Iceland Greylag Goose (triangles), 1960 to 2015. The five-year running means (e.g. mean for 2013 is from population estimates for 2011 to 2015) are shown as lines. Both population estimates follow revisions set out in Mitchell (2013).

Only 270,101 birds were counted during the November 2015 count, approximately half the number counted a month before. In the three years prior to 2015, the November count had been, on average, 83% of the October count. Poor weather, particularly around the Irish Sea on the weekend of the November count affected count conditions on the Solway Firth and probably at other western sites too, which may have led to undercounts. In Southwest Lancashire numbers fell from over 92,000 geese to 24,000 between October and November, a difference of nearly 70,000 birds. The number in Norfolk only increased by 15,000 birds, so it is unlikely that those missing from Southwest Lancashire were there. Thus, undercounting on the Solway Firth and in Southwest Lancashire in November is a very real possibility. In addition, recent telemetry data have identified a number of new roosts, including flooded areas close to rivers that, due to their temporary nature, are not counted. Some Pink-footed Geese in November may have been using such roosts.

The November 2015 count of Iceland Greylag Geese was thought to be reasonably comprehensive with sites being covered throughout most of the winter range. The min-November count is now firmly in the surveillance calendar of counters throughout the flyway range. Coverage in Ireland was particularly valued, although not complete (compared with an extensive survey carried out there in autumn 2007) and it is possible that the number of geese in Ireland, particularly in Northern Ireland, is greater than reported here.

The population estimate of 95,403 geese is a slight increase on 2014 but confirms the recent decline from over 100,000 birds (counted as recently as 2012). Greylag Goose remains a favoured quarry species in Iceland, with 30,000 to 60,000 birds shot there annually (43,000 in 2014, the year

for which the most recent data are available) and, since 2012, there has been an increase in the number of Greylag Geese shot in Orkney, in order to reduce the British Greylag Goose population on the archipelago, and it is highly likely that more Icelandic migrants are being shot there too.

Orkney continues to hold the bulk of the wintering population. After deducting the number of Greylag Geese thought to be resident on the archipelago, based on a summer survey carried out in August 2015 (Mitchell *et al.* 2015), and taking account of those shot under a pilot management programme, an estimated 38,101 Icelandic birds were thought to be present in November. However, at the time of the census an estimated 35,000 birds were still in Iceland the vast majority of these will have left in the weeks following the census and migrated to Orkney to winter. The traditional Iceland 'Christmas' bird counts only recorded 2,135 Greylag Geese in that country in early January 2016. This amounts to 2.2% of the population estimate..

Breeding success in the Iceland Greylag Goose population, as measured on the wintering grounds, appeared to be average in 2015 (20.4%), although the figure was based on a small sample size collected slightly later than the ideal period. Due to their later migration and more limited range, age counts were only collected in one region (North Scotland) during late November and early December. Monitoring annual breeding success for this population is becoming more difficult because of the overlap in main wintering areas between Iceland and British Greylag Geese and in order to avoid overlap with a large and increasing number of the latter, counts are largely only carried out in one area within the region (Caithness). The percentage of young in the Iceland bag, an independent measure of annual breeding success, was 44.2%, slightly lower than the previous ten-year average of 47% (A. Sigfússon *in litt.*). The population dynamics of this population merit greater study since the population must sustain one of the highest rates of annual mortality through hunting of any goose population and is balanced, presumably, by particularly high rates of breeding success. The long term dynamics of populations that can sustain such mortality would be of particular interest to those wishing to manage goose populations.

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