



Status and distribution of
Icelandic-breeding geese: results of
the 2016 international census

Wildfowl & Wetlands Trust Report

Authors

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Goose & Swan Monitoring

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Summary

The 57th consecutive annual census of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese took place during autumn and early winter 2016. 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 and Iceland. Weather conditions were generally considered favourable during the October census periods with very few sites reporting underestimated counts.

Maxima of 481,341 Pink-footed Geese and 121,046 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 **481,341** Pink-footed Geese and **90,471** Iceland Greylag Geese. Compared to the previous year, the 2016 figures represent a decrease of 10.3% in the Pink-footed Goose population and a decrease of 5.2% in the Iceland Greylag Goose population.

Sixteen sites held over 10,000 Pink-footed Geese in October, with Montrose Basin, Angus, holding the largest count at the time of the census (42,840 birds). Combined counts from the 30 sites exceeding 1% of the population estimate accounted for 85.3% of the total October count. Iceland Greylag Geese were found primarily in Iceland (56.5% of the population estimate) and Orkney (28.3%). The noticeable trend in increasing numbers in Iceland and decreasing numbers counted in Orkney in November, suggest that the migration of birds from Iceland is getting later each year.

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 2006–2015). The mean brood size of successful pairs was 1.75 goslings, which was slightly lower than the mean recorded during the preceding decade (2.09). The breeding success of Iceland Greylag Geese was slightly higher than the mean for the previous decade with flocks containing 23.5% young compared to 21.8% (mean 2006–2015), and the mean brood size of 2.53 goslings per successful pair was slightly higher than the previous decade mean (2.25), 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 57th 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 2016 breeding season.

2 Methods

Counts were conducted by a network of volunteer observers and professional conservation staff over the weekends of 22/23 October and 19/20 November 2016. 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 (16 October and 14 November), in an attempt to minimise 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.

Adjustments 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 2016 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 (2011–2015). 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 discounted, as it is assumed that the majority of birds from this area are from the British population. This is carried out as a precautionary measure, but is unsatisfactory as it will likely lead to the Iceland Greylag Goose population totals being underestimated slightly. 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 from September to late November 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 2016 was considered reasonable in that all the most important sites for both species were checked. However, in 2016, 11 fewer sites were counted for Pink-footed Geese in October and 17 fewer sites were counted for Greylag Geese in November, compared to the previous year.

Table 1. The number of sites counted and the number of sites holding Pink-footed and Greylag Geese in October and November 2016.

	October	November
Number of Pink-footed Goose sites counted	102	100
Total number of sites holding Pink-footed Geese	77	78
Number of Greylag Goose sites counted	-	102
Total number of sites holding Greylag Geese	-	64

Outwith Britain, no aerial survey was carried out in Iceland in November and counts of Greylag Geese there were carried out through a road survey and combined with information from hunters to provide an estimate of goose numbers. Data were also received from several sites in Southwest Norway in January 2017.

Only one site met the criteria for the calculation of an estimated count due to lack of coverage. In Ireland, no counts of Iceland Greylag Geese were submitted although birds were thought to continue to occur there, and an estimate of 2,013 Greylag Geese was added. No counts of Iceland Greylag Geese were undertaken during November in Southwest Norway; however, 700 birds (the number counted there in January 2017) 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 sites in Ireland (690 geese), Shetland (5,000), Orkney (21,000 birds, see Discussion), Caithness (1,000) and Highland (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 both survey periods. At sites holding Pink-footed Geese, poor visibility affected counting at three sites in October and at two sites in November. For sites holding Greylag Geese, poor visibility affected two sites in November. Disturbance during counting was reported from one site holding both Pink-footed and Greylag Geese in November. Overall, the cases of poor visibility and disturbance was not thought to have adversely affected the counts at principal sites.

3.2 Total numbers

3.2.1 Pink-footed Goose

Totals of 481,341 and 363,574 Pink-footed Geese were counted in October and November, respectively (Figure 1, Table 2). These represent a decrease of 9.3% and an increase of 34.6%, respectively, compared to the unadjusted total counts in the same months in the preceding year. Coverage was good and no estimated counts needed to be added to the unadjusted total and so the peak winter total in October 2016 was used to derive a population estimate of 481,341 geese. This represents a decrease of 10.3% compared to October 2015, when a total of 536,871 individuals was estimated. In autumn 2016, 75.5% of the October count (unadjusted) was counted in November (Table 3).

3.2.2 Greylag Goose

In November 2016, 121,046 Greylag Geese were counted (Figure 1, Table 2). The unadjusted November count was 4.1% higher 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 90,471 Iceland Greylag Geese. This represents a decrease of 5.2% compared to the previous estimate of 95,403 geese recorded in 2015.

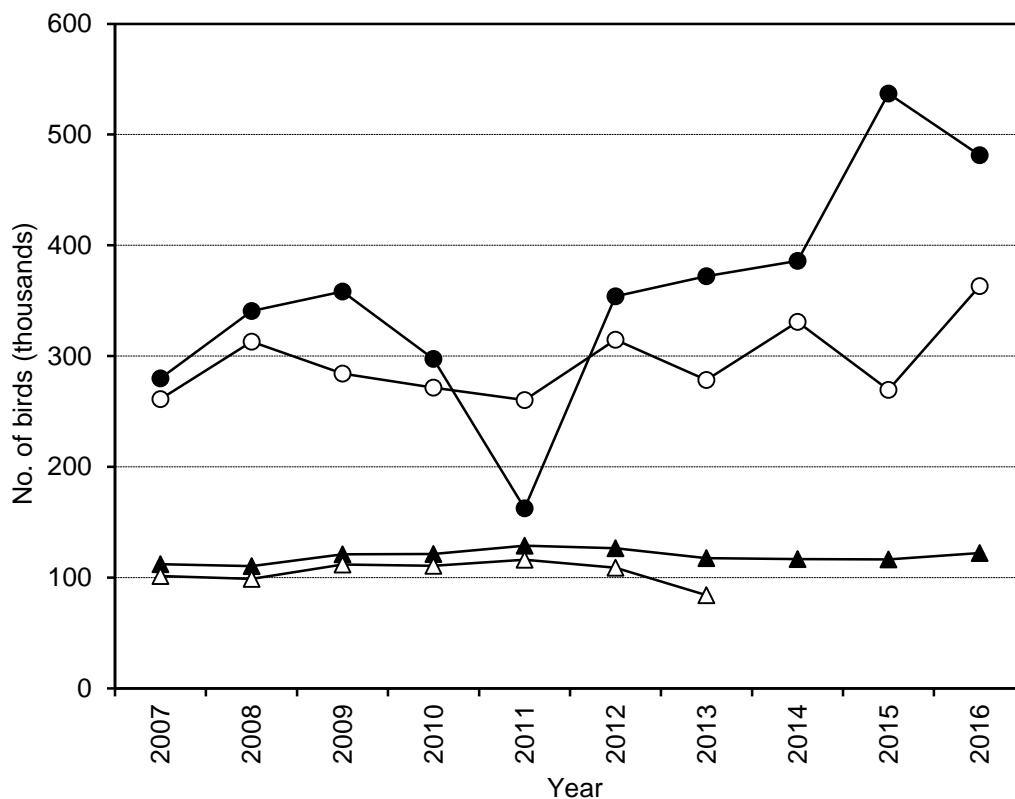


Figure 1. Peak (unadjusted) counts of Pink-footed Geese (circles) in October (filled) and November (open) and Iceland Greylag Geese (triangles) in November (filled) and December (open) counted during the Icelandic-breeding Goose Census, 2007 to 2016. Coordinated counts of Icelandic Greylag Geese have not been undertaken in December since 2013.

Table 2. Totals of Pink-footed Geese and Iceland Greylag Geese by country and region in October and November 2016. 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 2016	November 2016	
	Pinkfoot	Pinkfoot	Greylag
Iceland*	8,000 (1)	nc	50,000 (1)
Norway*	0	0	700 (1)
Faroe Islands*	nc	nc	nc
Ireland	nc	nc	[+2,013] [-690]
Shetland*	0	0	3,121 (3) [-3,121]
Orkney*	nc	409 (1)	46,654 (1) [-21,000]
Caithness	nc	822 (3)	4,717 (11) [-1,000]
Highland	68,848 (17)	40,429 (10)	9,052 (10) [-750]
Moray	11,330 (1)	5,650 (2)	775 (2)
Aberdeenshire	63,425 (6)	75,949 (7)	786 (7) [-786]
Angus/Dundee	48,160 (2)	30,792 (2)	602 (2) [-602]
Perth & Kinross	28,021 (6)	25,528 (10)	1,428 (11) [-1,428]
Stirling/Falkirk/Clackmannan	13,799 (6)	13,606 (4)	28 (4) [-28]
Fife	1,910 (9)	6,165 (9)	363 (9) [-363]
Argyll & Bute	100 (1)	1,000 (1)	0 (1)
Clyde	nc	nc	790 (1) [-790]
Ayrshire	nc	nc	nc
Dumfries & Galloway **	15,277 (7)	3,742 (7)	0 (7)
Cumbria **	7,650 (5)	6,562 (6)	70 (6) [-70]

Region/Area	October 2016	November 2016	
	Pinkfoot	Pinkfoot	Greylag
Lothians	4,294 (9)	3,235 (7)	192 (7) [-192]
Borders	43,078 (11)	24,200 (10)	444 (8) [-444]
Northumberland	4,300 (2)	3,046 (4)	1,324 (11) [-1,324]
Lancashire & Merseyside	90,913 (5)	37,270 (6)	
N Wales/Dee Estuary	2,400 (2)	5,150 (2)	
Humberside	15,400 (2)	nc	
Lincolnshire	600 (1)	nc	
Norfolk	53,836 (9)	80,019 (10)	
<i>Raw total counts</i>	481,341	363,574	121,046
<i>Adjustment for non-Icelandic birds</i>			-32,588
<i>Estimated counts</i>			+2,013
Population Estimate	481,341		90,471

* 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

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 October. By November, due to the low count, all regions held fewer birds, apart from Northeast Scotland and East England where numbers increased slightly (Table 3, Figure 2).

3.3.2 Greylag Goose

During November, over a half of the population was still in Iceland and 42.6% 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 that many Greylag Geese encountered south and east of a line drawn from Clyde to Angus in November are of Icelandic origin (but see Discussion).

Table 3. National and regional distribution (within Britain) of Pink-footed Geese and Iceland Greylag Geese counted during October and November 2016, expressed as a percentage of the maximum count for each species. Estimated counts not included.

	Pink-footed Goose		Greylag Goose
	October	November	November
Iceland	1.7	0	56.5
Faroes	0	0	0
Norway	0	0	0.8
Ireland	0	0	nc
North Scotland	14.3	8.6	42.6
Northeast Scotland	15.5	17.0	0.9
East Central Scotland	19.1	15.8	0
Southwest Scotland/ Northwest England	4.8	2.3	0
Southeast Scotland/ Northeast England	10.7	6.3	0
West England	19.4	8.8	0
East England	14.5	16.6	0
Total	100	75.5	100

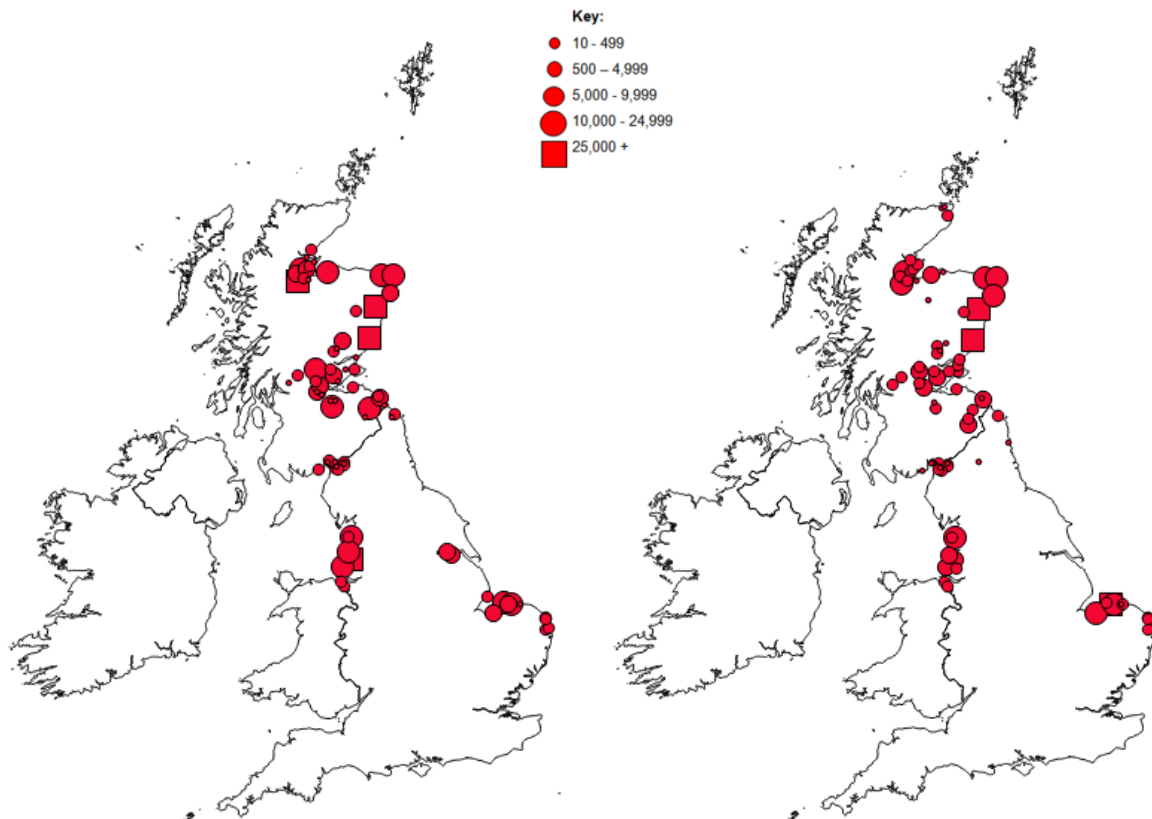


Figure 2. Distribution of Pink-footed Geese in Britain and Ireland in October (left) and November (right) 2016. Estimated counts are not shown.

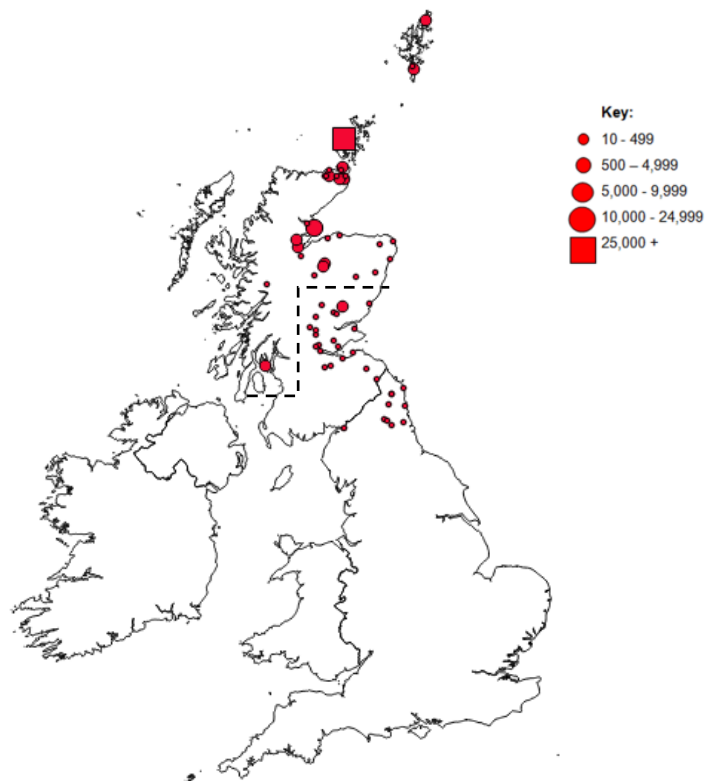


Figure 3. Distribution of Iceland Greylag Geese in Britain and Ireland in November 2016. Where the status is unknown, the mapped counts do not differentiate between Icelandic and British birds. It is unlikely that many Iceland birds are present south and east of the dashed line in November (see also Table 2). Estimated counts not shown.

3.4 Principal concentrations

3.4.1 Pink-footed Goose

Pink-footed Geese were recorded at 77 sites in October and 78 in November (Table 1). The number of sites holding more than 1% of the 2016 population estimate (4,813 birds) was 30 in October and 21 in November revealing a breakup in the mass concentrations soon after arrival. Seventeen sites held over 10,000 birds in October, and 12 in November. Combined counts from the 30 sites exceeding 1% of the population estimate accounted for 89.0% of the total October count and numbers at the top five sites alone held 33.5% of the population estimate (Table 4). The most recent peak IGC counts from the two sites holding the two highest counts in 2016 (Montrose Basin, Angus and Loch of Skene, Aberdeenshire) 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 (Appendix 1). 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 2016, the consolidated counts for Southwest Lancashire were 90,913 (October) and 37,270 (November) (Table 2).

In October, high numbers were recorded at Montrose Basin, Angus, which held 8.9% of the population estimate, Loch of Skene, Aberdeenshire (7.1%), Beaulay Firth, Highland (6.3%), WWT Martin Mere, Southwest Lancashire, (6.2%), the Alt Estuary, Southwest Lancashire (5.0%), Solway Firth (consolidated) (4.8%) and Morecambe Bay, Southwest Lancashire (4.5%) (Table 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 64 sites (Table 1), six of which held numbers exceeding 1% of the population estimate (905 birds) (this considers Iceland, Orkney, Shetland and Bute as single consolidated sites) (Table 4). Subtracting an estimated 21,000 summering British Greylag Geese from the total counted on Orkney in November (see Discussion), gave an estimated 25,654 Iceland migrants, or 28.3% of the flyway population estimate (Table 4). Fewer Iceland Greylag Geese are now wintering in Scotland south and east of the Moray Firth, reflecting the redistribution to wintering sites in North Scotland.

The most recent peak IGC counts from the two sites holding the two highest counts in 2016 (Iceland and Orkney) are shown in Figure 5. The noticeable trend in increasing numbers in Iceland and decreasing numbers counted in Orkney in November suggest that the migration of birds from Iceland is getting later each year (see Discussion).

Table 4. Sites that supported >1% of the (a) Pink-footed Goose (>4,813) and (b) Iceland Greylag Goose (>905) population estimates in October and November 2016, 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 2011–2015 ¹
Monrose Basin, Angus	42,840	8.9	52,720
Loch of Skene, Aberdeenshire	34,340	7.1	16,316
Beaully Firth, Highland	30,300	6.3	8,039
WWT Martin Mere, SW Lancashire	30,050	6.2	18,758
Alt Estuary, SW Lancashire	23,893	5.0	17,147
Solway Firth Consolidated	22,927	4.8	13,057
Morecambe Bay, SW Lancashire	21,850	4.5	19,591
Hule Moss, Borders	15,900	3.3	5,951
West Water Reservoir, Borders	15,300	3.2	32,624
Carsebreck & Rhynd Lochs, Perth & Kinross	13,700	2.8	17,320
Alness Bay, Cromarty Firth, Highland	13,544	2.8	nc
Middlemuir, Aberdeenshire	12,300	2.6	11,464
Scolt Head, Norfolk	12,300	2.6	3,258
Ribble Estuary, SW Lancashire	11,680	2.4	10,277
Wells, Norfolk	11,550	2.4	16,001
Findhorn Bay, Moray	11,330	2.4	8,510
Loch of Strathbeg, Aberdeenshire	10,735	2.2	14,042
Loch Leven, Perth & Kinross	9,860	2.0	14,380
Snettisham, Norfolk	9,375	1.9	28,824
Dingwall Bay, Cromarty Firth, Highland	9,211	1.9	2,757
Read's Island Flats, Humberside	8,700	1.8	7,113
Iceland	8,000	1.7	8,540

Site	October count	Percentage of population estimate	Five-year peak mean 2011–2015 ¹
Bogbank, Borders	7,670	1.6	nc
Overy Marshes, Holkham, Norfolk	6,850	1.4	21,476
Whitton Sands, Humberside	6,700	1.4	3,527
Loch Elrig, Upper Forth	6,000	1.2	nc
Udale Bay, Cromarty Firth, Highland	5,800	1.2	3,350
Meikle Loch, Slains, Aberdeenshire	5,400	1.1	9,270
Loch of Lintrathen, Angus	5,320	1.1	6,697
Skinflats, Upper Forth	5,030	1.0	3,910

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 2011–2015 ²
Iceland (lowlands)	50,000	55.2	29,662
Orkney Islands (all sites)	25,654	28.3	45,341
Loch Eye, Highland ³	5,274	5.8	2,220
Loch of Killimster, Caithness ⁴	1,890	2.1	1,998
Strathspey, Highland ³	1,060	1.2	1,229
Loch Watten, Caithness ⁴	942	1.0	2,838

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

⁴ Caithness includes an estimated 1,000 British birds (Table 2) that cannot be allocated to individual sites.

For the purposes of this report, Orkney is treated as a consolidated site, although Appendix 2 shows the individual totals for the islands. Ten of the islands in Orkney held numbers exceeding 1% of the population estimate in November (905 birds), although these individual counts are not adjusted for the presence of Greylag Geese breeding in Orkney (thought to number *c.* 21,000 birds in total, but see Discussion). As in 2009 to 2015, West Mainland held more than 10,000 birds.

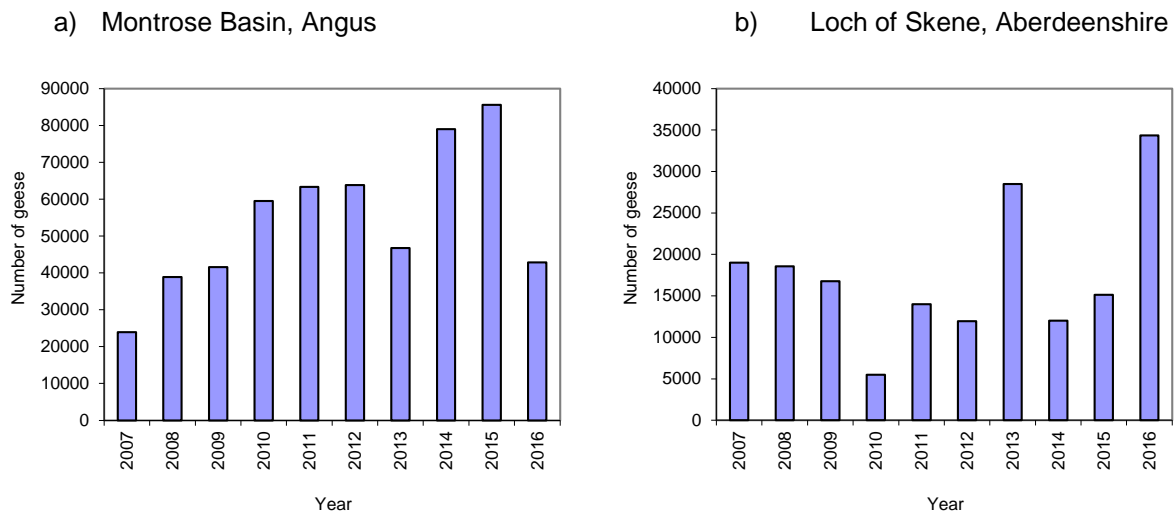


Figure 4. Peak IGC counts of Pink-footed Geese at a) Montrose Basin, Angus and b) Loch of Skene, Aberdeenshire, 2007 to 2016.

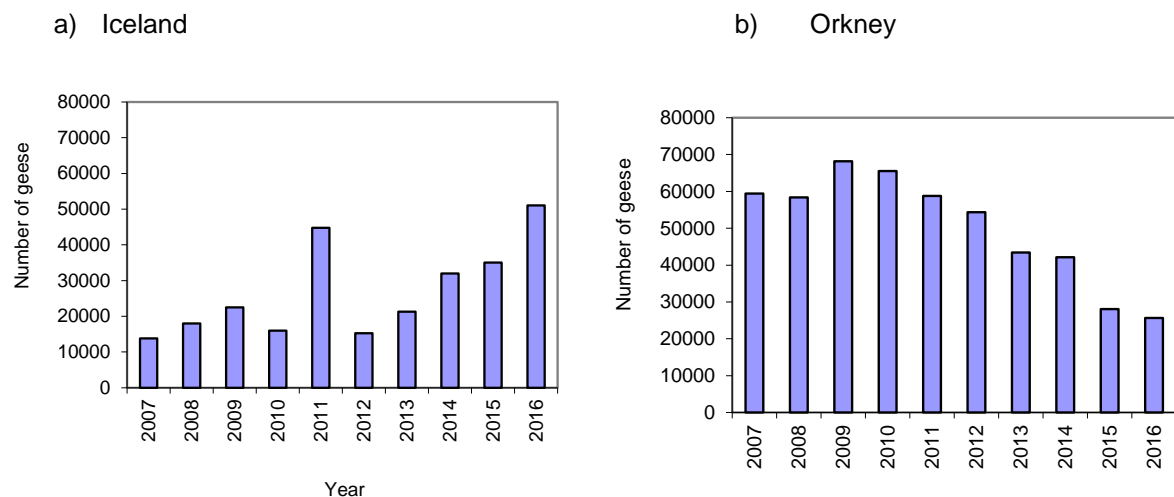


Figure 5. Peak IGC counts of Iceland Grey Lag Geese at a) Iceland, and b) Orkney (excludes British birds) 2007 to 2016.

3.5 Breeding success

Totals of 22,533 Pink-footed Geese (from 34 flocks) and 2,302 Grey Lag Geese (9 flocks) were aged at various localities, primarily in Scotland, between 18 September and 26 November 2016. The percentage of birds aged in relation to the estimated size of the population in 2016 was 4.7% for Pink-footed Geese and 2.5% for Grey Lag Geese. Information on the brood sizes of 592 families of Pink-footed Goose and 32 families of Grey Lag 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 2006–2015: 18.4% \pm 1.2 SE). The mean brood size of successful pairs was 1.75 goslings, lower than the mean recorded during the preceding ten years (2.09 \pm 0.06 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 2016 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 higher than the mean for the previous decade, with flocks containing 23.5% young (mean 2006–2015: 21.8% \pm 0.5 SE). The mean brood size of 2.53 goslings per successful pair was higher than that of the recent ten-year mean (2.25 \pm 0.09 SE) (Table 7, Figure 6); however, the breeding success and brood size figures were based on a very small sample size. 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 late November.

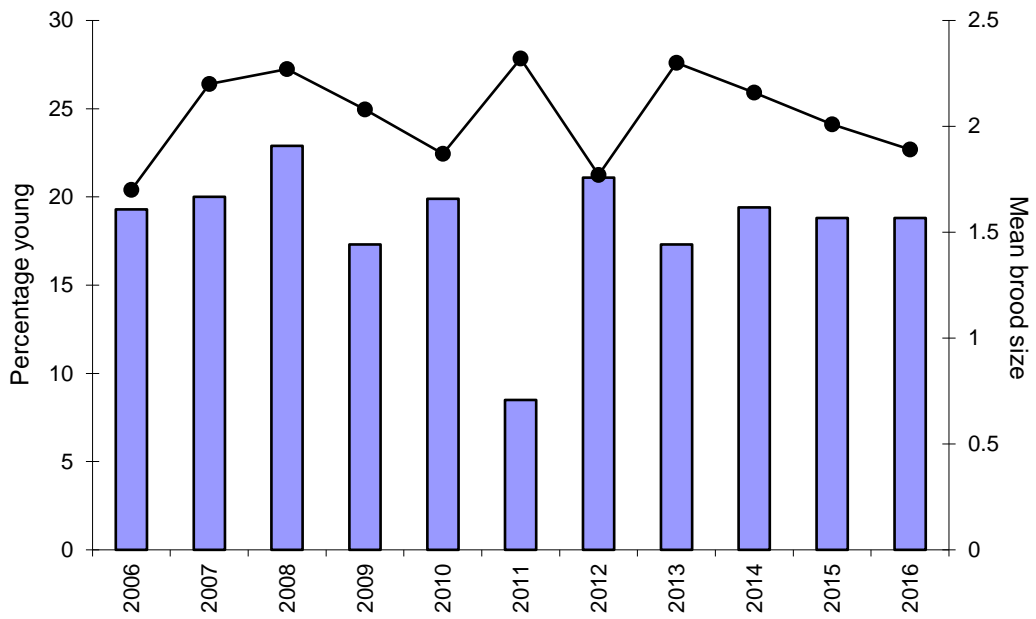
Table 5. The percentage young and mean brood size of Pink-footed and Iceland Greylag Geese in 2016.

	Region	Time period	Total aged	% young	No. of broods counted	Mean brood size
Pink-footed Goose ¹	N Scotland	Early Nov	869	23.3	10	2.30
	NE Scotland	Early Oct	1,500	26.2	48	1.94
		Late Oct	1,000	26.0	16	1.88
		Late Nov	500	21.2	3	1.67
	EC Scotland	Late Oct	3,307	19.9	1	2.00
		Early Nov	1,369	19.7	3	3.00
	West England	Late Sept	4,346	15.2	20	2.05
		Early Oct	2,366	19.3	208	1.71
		Late Oct	3,329	18.2	172	1.69
	E England	Late Oct	107	35.5	12	1.91
		Early Nov	3,840	15.2	99	1.68
	Total		22,533	18.8	592	1.75
Greylag Goose ²	N Scotland	Late Nov	2,302	23.5	32	2.53
	Total		2,302	23.5	32	2.53

¹ Pink-footed Geese were aged between 18 September and 15 November 2016.

² Greylag Geese were aged between 18 and 26 November 2016.

a) Pink-footed Goose



b) Iceland Greylag Goose

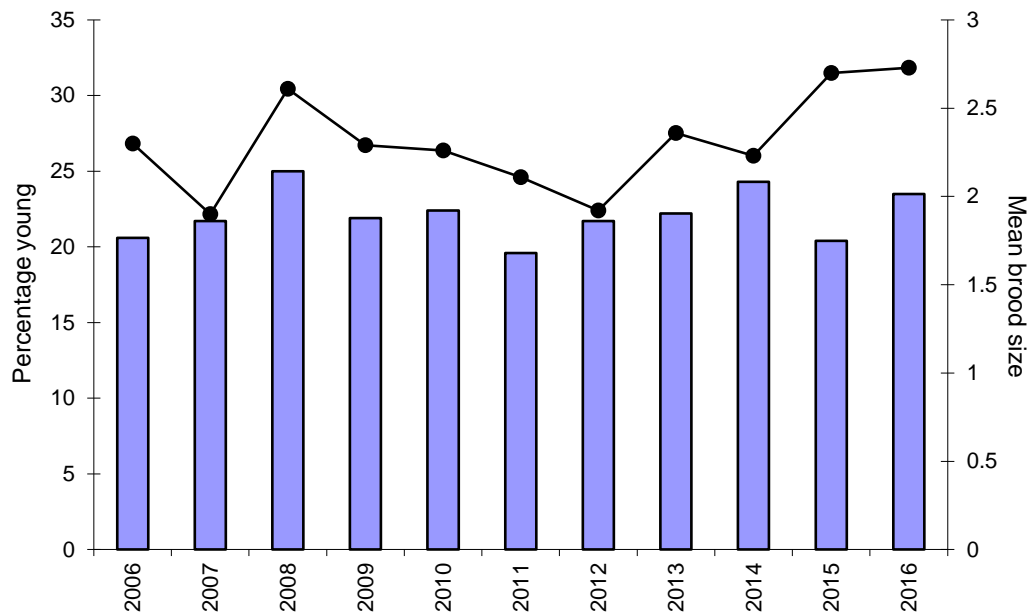


Figure 6. The percentage young (column) and mean brood size (line) found in flocks of (a) Pink-footed Goose and (b) Iceland Greylag Goose, 2006 to 2016.

4 Discussion

The 2016 Pink-footed Goose population estimate of 481,341 was 10.3% lower than the record figure for October 2015 (536,871) but the second highest population estimate ever recorded. As breeding success in 2016 was average (see below) it might have been expected that the population would have remained similar to that recorded in 2015, so it is perhaps surprising that the 2016 count was c.55,000 birds fewer than the previous year. This suggests that there may have been a degree of under counting in 2016. Despite the decline compared to 2015, the steady growth in the population would suggest an annual rate of increase since 1987 of about 3.0% per annum.

Large counts at some of the principal resorts in mid-October 2016 indicated that there had been a mass arrival of Pink-footed Geese into Britain in the weeks prior to the count weekend. 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 top five sites alone held a third of the population estimate, and the top ten sites held just over a half.

Pink-footed Goose breeding success in summer 2016, at 18.8%, was unremarkable and similar to the long-term average of 18.4% over the most recent ten years. The average productivity was also confirmed by the proportion of young in the Iceland hunting bag; at 27.0%, this was just lower than the recent average (29.4%) for the ten year period 2006 to 2015 (A. Sigfússon *in litt.*). Hunting of Pink-footed Geese in Iceland appears stable with 13,661 shot there in 2015 (the year for which the most recent data are available) compared to the long-term average of 15,837 birds over the most recent ten years. 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 maintain a steady increase in numbers.

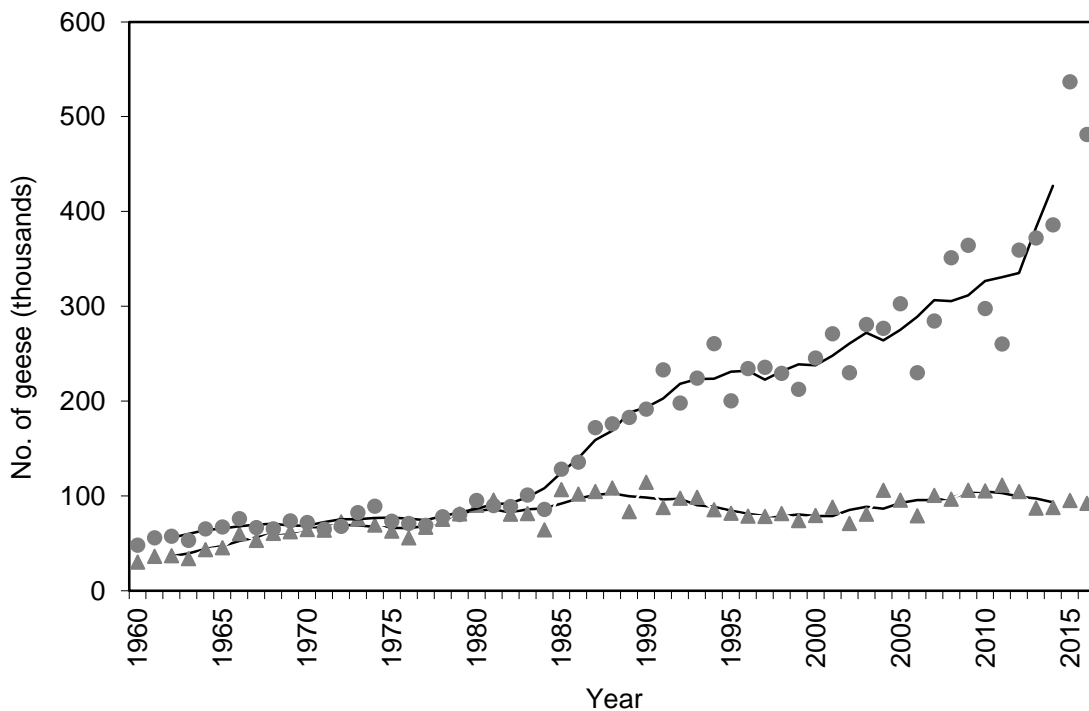


Figure 7. Population estimates for Pink-footed Goose (circles) and Iceland Greylag Goose (triangles), 1960 to 2016. The five-year running means (e.g. mean for 2014 is from population estimates for 2012 to 2016) are shown as lines. Both population estimates follow revisions set out in Mitchell (2013).

Only 363,574 birds were recorded during the November 2016 count, approximately three quarters of the number counted a month before. With surveillance at the major resorts for the species similar between the two months, it is somewhat surprising that the November counts are so low

compared to the October counts. In 2015, only half the October total was counted a month later. 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. This becomes increasingly important from late October onwards, after the population has arrived and has used arrival roosts in very large numbers and then the geese begin a period of redistribution using smaller and less frequently used roosts. As the population has grown in recent years, site use after late October may have begun to outpace the current census coverage. This suggests that the continuation of the October census for assessing the maximum population size is paramount. However, maintaining the November count (and spring count every three years) provides important information on site use at different times of the year and provides a 'safety net' in case the Pink-footed Goose migration from Iceland is late.

Twenty-four Pink-footed Geese were marked with GPS tracking devices in winter 2016/17 which will hopefully provide timely information about the movements of the species during the winter months as well as information about the timing of the movements and their interaction with man-made objects in the environment.

The November 2016 count of Iceland Greylag Geese was thought to be reasonably comprehensive with sites being covered throughout most of the winter range. The mid-November count is now firmly in the surveillance calendar of counters throughout the flyway range. The population estimate of 90,471 geese is a slight decrease on 2015 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 (35,061 in 2015, 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. This level of hunting appears to be levelling the population at 80,000 to 100,000 birds.

Iceland held the majority of the population in mid-November 2016 and there is a noticeable trend of increasing numbers in Iceland and decreasing numbers counted in Orkney in November suggesting that the migration of birds from Iceland is getting later each year. This pattern can be traced back even further. As recently as 2000, the bulk of the population had migrated from Iceland by mid-October. By 2016, the bulk of the population remained in Iceland by mid-November. The causes of the delay in migration are not well known but may be influenced by an amelioration of the autumn weather conditions and an increase in barley production in Iceland. Less harsh weather and a plentiful food supply after the harvest may be delaying the autumn migration for the bulk of the population. However, this shift in phenology presents a problem for surveillance since counting in Iceland relies on relatively few dedicated volunteers and the area in which the geese can be located is large.

Orkney continues to hold the bulk of the over-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 2016 (Mitchell *et al.* 2016), and taking account of those shot under a pilot management programme, an estimated 25,654 Icelandic birds were thought to be present in November. However, at the time of the census an estimated 50,000 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. Thus the over-winter population of Iceland Greylag Geese on Orkney is likely to be around 75,000 birds.

Breeding success in the Iceland Greylag Goose population, as measured on the wintering grounds, appeared to be average in 2016 (23.5%), 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. 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 56%, higher than the previous ten-year average of 48%

(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.

5 Acknowledgements

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Appendix 1. Counts of Pink-footed Geese at roost sites in Southwest Lancashire in October 2016.

Count site	SPA	October 2016
Martin Mere	Martin Mere SPA	30,050
Alt Estuary	Ribble/Alt Estuaries SPA	23,893
Morecambe Bay	Morecambe Bay SPA	21,850
Ribble Estuary (Marshside)	Ribble/Alt Estuaries SPA	11,680
Cockers Dyke		3,440
Total		90,913

Appendix 2. Greylag Goose counts at individual sites in Orkney in November 2016 (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 2011 to 2015.

Site	November count	% of population estimate	Five-year peak mean
West Mainland	16,228	17.9	26,000
East Mainland	6,453	7.1	12,388
Stronsay	3,348	3.7	4,856
Shapinsay	3,956	4.4	4,477
South Ronaldsay	3,169	3.5	4,357
Sanday	4,316	4.8	4,873
Eday	1,353	1.5	1,465
Papa Westray	751	0.8	1,134
Rousay	1,217	1.3	1,096
Egilsay	591	0.7	383
Westray	1,572	1.7	1,321
North Ronaldsay	799	0.9	883
Hoy and Walls	951	1.1	589
Wyre	325	0.4	215
Burray	586	0.6	607
Flotta	271	0.3	254
Graemsay	475	0.5	224
Gairsay	293	0.3	446
Total	46,654	51.6	65,128