



**Status and distribution of
Icelandic-breeding geese: results of
the 2011 international census**

Wildfowl & Wetlands Trust Report

Author

Carl Mitchell

August 2012

© The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee/Scottish Natural Heritage

All rights reserved. No part of this document may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the copyright holder.

This publication should be cited as:

Mitchell, C. 2012. *Status and distribution of Icelandic-breeding geese: results of the 2011 international census*. Wildfowl & Wetlands Trust Report, Slimbridge.

This report was produced under the Goose & Swan Monitoring Programme (GSMP). This programme monitors numbers and breeding success of geese and swans in the UK during the non-breeding season. GSMP is organised by the Wildfowl & Wetlands Trust (WWT) in partnership with the Joint Nature Conservation Committee (JNCC), on behalf of the Countryside Council for Wales (CCW), Natural England (NE) and the Northern Ireland Environment Agency (NIEA) and Scottish Natural Heritage (SNH).

Wildfowl & Wetlands Trust

Slimbridge
Gloucester
GL2 7BT
T 01453 891900
F 01453 890827
E monitoring@wwt.org.uk
Reg. Charity no. 1030884
England and Wales, SC039410
Scotland

Joint Nature Conservation

Monkstone House
City Road, Peterborough
PE1 1JY
T 01733 562626
F 01733 555948
E communications@jncc.gov.uk

Scottish Natural Heritage

Great Glen House
Leachkin Road, Inverness
IV3 8NW
T 01463 725000
F 01463 725067
E enquiries@snh.gov.uk



Goose & Swan Monitoring

Contents

| | |
|------------------------------|-----------|
| Summary | iv |
| 1 Introduction | 1 |
| 2 Methods | 2 |
| 3 Results | 3 |
| 3.1 Coverage and conditions | 3 |
| 3.2 Total numbers | 4 |
| 3.2.1 Pink-footed Goose | 4 |
| 3.2.2 Greylag Goose | 4 |
| 3.3 Regional Distribution | 7 |
| 3.3.1 Pink-footed Goose | 7 |
| 3.3.2 Greylag Goose | 7 |
| 3.4 Principal concentrations | 10 |
| 3.4.1 Pink-footed Goose | 10 |
| 3.4.2 Greylag Goose | 10 |
| 3.5 Breeding success | 14 |
| 4 Discussion | 16 |
| 5 Acknowledgements | 19 |
| 6 References | 20 |

Summary

The 52nd consecutive census of Greenland/Iceland Pink-footed Geese and Iceland Greylag Geese took place during autumn and early winter 2011. Sites holding Pink-footed Geese were primarily checked in October and November, whilst those holding Greylag Geese were checked primarily in November and December. The staggering of counts has become necessary due to later departures of Greylag Geese from their breeding grounds in Iceland. 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 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 census periods with very few sites reporting underestimated counts.

Maxima of 244,725 Pink-footed Geese and 128,915 Greylag Geese were counted in November 2011. 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 246,725 Pink-footed Geese and 119,915 Iceland Greylag Geese. Compared to population estimates in 2010, the 2011 figures represent a decrease of 17.2% in the Pink-footed Goose population and an increase of 8.1% in the Greylag Goose population.

The breeding success of Pink-footed Geese was much lower than the mean for the previous decade at 8.5% young (mean percent young 2001–2010: 19.4%). The mean brood size of successful pairs was 1.77 goslings, which was lower than the mean recorded during the preceding ten years (2.14). The breeding success of Iceland Greylag Geese was slightly lower than the mean for the previous decade with flocks containing 19.6% young (mean percent young 2001–2010: 21.9%), and the mean brood size of 1.92 goslings per successful pair was lower than that of the most recent ten year mean (2.45) although the latter measure was based on a small sample size.

An additional spring count took place in late February 2012. Again, coverage was good with a total of 176,312 Pink-footed Geese and 97,896 Iceland Greylag Geese counted. These figures represent 72% and 80% of the autumn population estimates respectively. The counts confirmed that the majority of the Iceland population of Greylag Geese over winter on Orkney, however three sites in central Scotland held over 1,000 birds at this time. Pink-footed Geese had started their northward spring movement within Britain with some of the largest counts being recorded in Scotland.

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 Britain, 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 on 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 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. However, due to the late departure of both species from Iceland in some years (*e.g.* Worden 2006) a third coordinated count in December was introduced in 2005. Special emphasis is now placed on counting sites holding Pink-footed Geese in October and November, and sites holding Greylag Geese in November and December.

The IGC counts were initiated to provide population estimates for the Pink-footed Geese and Iceland Greylag Geese. The counts were timed to take place just after the geese arrive back in Britain, while they are gathered in large numbers at well known roost sites. They also provide important information on the distribution of the geese during the autumn and early winter. However, large autumn flocks soon break up and the geese become much more widely dispersed. Additional spring counts were carried out from 1982 to 1986, from 1988 to 1990 and from 1994 to 1996. Spring is an important time for geese; they feed vigorously, storing nutrient reserves for successful migration and breeding. It is therefore important to have periodic counts of both populations throughout the autumn and early winter period to establish the important areas for these geese at this time of year. An additional spring count was undertaken in late February 2012.

This report presents an overview of the 52nd consecutive census and an update on the population size and breeding success of Pink-footed and Greylag Geese following the 2011 breeding season.

2 Methods

Counts were conducted by a network of volunteer observers and professional conservation staff over the weekends of 1/2 October, 5/6 November, 3/4 December 2011 and 25/26 February 2012. The spring count was in addition to the normal autumn population estimate counts. The last coordinated efforts to assess the spring distribution of Pink-footed and Iceland Greylag Geese were in 1994 to 1996.

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 (23 October, 21 November, 21 December and 7 February), 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 of geese in Caithness, the Solway Firth, Orkney, Shetland, Southwest Lancashire, Southwest Norway, Faroe Islands and Iceland are treated as consolidated sites.

Three types of adjustment were applied to the count totals in order to generate 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 2011 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 (2006–2010). 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.

In addition, counts of Greylag Geese breeding in Britain made during August/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 late September to early 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 late 2011 and February 2012 was good, especially in November. The number of sites covered in each month is shown in Table 1.

Table 1. The number of sites counted and the number of sites holding Pink-footed and Greylag Geese in October, November and December 2011 and February 2012.

| | October | November | December | February |
|---|---------|----------|----------|----------|
| Number of Pink-footed Goose sites counted | 106 | 133 | 129 | 137 |
| Number of sites holding Pink-footed Geese | 29 | 59 | 56 | 65 |
| Number of Greylag Goose sites counted | 90 | 129 | 105 | 110 |
| Number of sites holding Greylag Geese | 26 | 53 | 51 | 56 |

Outwith Britain, a combination of aerial survey, ground counts and estimates from hunters provided an estimate of goose numbers in Iceland in autumn 2011 (see Discussion). Data were also received from several sites in Southwest Norway in January. In Ireland, full coverage of sites was not possible (as had been carried out in autumn 2007) but counts from nine sites thought to hold Iceland Greylag Geese were provided for November. No counts were received from the Faroe Islands in autumn 2011.

Five sites met the criteria for the calculation of an estimated count due to lack of coverage. Horsey Mere (Norfolk) was not counted in October, but the local counter estimated that 5,000 Pink-footed Geese were present. The local counter at Wedholme Flow (Cumbria) estimated that 2,000 Pink-footed Geese were present during the November count. In Ireland, ten sites were counted in November. No counts were undertaken there during the December or February count weekends and the November total count (1,460 Iceland Greylag Geese) was therefore used as an estimated count in December and February. No count was made in Shetland during the November or February count and 7,673 Iceland Greylag Geese (the number counted in December) was therefore used as an estimated count in November and February (but see Discussion). No counts of Iceland Greylag Geese were undertaken during any of the census periods in Southwest Norway, however, 2,730 birds (the number counted there in January 2012) was used as an estimated count for the November, December and February census periods.

An attempt was made to allow 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.* 950), Shetland (*c.* 500), Orkney (*c.* 10,000 birds, but see Discussion), Caithness (*c.* 1,000), Loch Fleet (*c.* 500) and Badenoch & Strathspey (*c.* 250). Small numbers of British Greylag Geese occur throughout south Scotland and north England and where counts were thought to involve summering birds these have also been deducted.

Weather conditions were reported as good or reasonable for most sites in all four census periods, with one site reporting counts being affected by disturbance in October, two in November and five in December. Poor visibility affected counting at three sites in October, two in November and one in February. Overall, neither disturbance nor poor visibility were thought to have adversely affected the counts at principal sites.

3.2 Total numbers

3.2.1 Pink-footed Goose

Totals of 162,542 and 244,725 Pink-footed Geese were counted in October and November, respectively (Figure 1, Table 2). These represent decreases of 45.4% and 9.8%, respectively, compared to the unadjusted total counts in the same months in the preceding year. Coverage was good and, for November, only one estimated count needed to be added to the unadjusted total and so the peak winter total in November 2011 was used to derive a population estimate of 246,725 geese. This represents a decrease of 17.2% compared to 2010, when 297,798 individuals were estimated. In 2011, 66.4% of the total November count (unadjusted) was counted in October, 83.7% in December and 72.0% in February (Table 3).

3.2.2 Greylag Goose

Totals of 128,915 and 115,985 Greylag Geese were counted in November and December, respectively (Figure 1, Table 2). The November count was 6.3% higher than that recorded in November 2010, whereas the December 2011 count represents a decrease of 4.4% compared to the unadjusted total count in the same month in the preceding year. Following adjustments for British Greylag Geese and the addition of estimated counts, the peak winter total in November 2011 was used to derive a population estimate of 119,915 Iceland Greylag Geese. This represents an increase of 8.1% compared to the previous estimate of 110,962 geese recorded in 2010 (see Section 4). In 2010, 82.9% of the total November count (unadjusted) was counted in December, but in 2011 the corresponding figure was higher at 91.2% (Table 3).

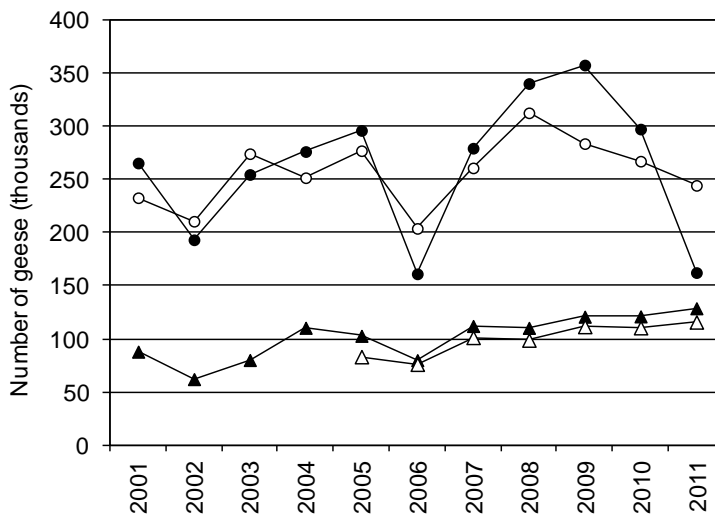


Figure 1. Peak (unadjusted) counts of Pink-footed Geese (circles) in October (filled) and November (open) and Iceland Greylag Geese (triangles) in November (filled) and December (open) counted during the Icelandic-breeding Goose Census, 2001 to 2011.

Table 2. Totals of Pink-footed Geese and Iceland Greylag Geese by country and region in October, November and December 2011 and February 2012. 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.

| Region/Area | October | | November | | December | | February | |
|----------------------------------|------------|------------|-------------|------------|-------------|-------------|-------------|------------|
| | Pinkfoot | Greylag | Pinkfoot | Greylag | Pinkfoot | Greylag | Pinkfoot | Greylag |
| Iceland* | 20,000 | nc | 0 | 44,796 | 0 | 10,000 | 0 | 1,000 |
| Norway* | nc | nc | nc | nc | nc | nc | nc | nc |
| | | | | [+2,730] | | [+2,730] | | [+2,730] |
| Faroe Islands* | nc | nc | nc | nc | nc | nc | nc | nc |
| Ireland | nc | nc | 0 | 1,460 (10) | nc | nc | nc | nc |
| | | | | [-950] | | [-950] | | [-950] |
| | | | | | | [+1,460] | | [+1,460] |
| Shetland* | nc | nc | nc | nc | 0 | 7,637 (1) | nc | nc |
| | | | | [-5,247] | | [-5,247] | | [-5,247] |
| | | | | [+7,637] | | | | [+7,637] |
| Orkney* | nc | nc | 211 (1) | 65,845 (1) | 336 (1) | 70,733 (1) | 4,454 (1) | 77,513 (1) |
| | | | | [-10,000] | | [-10,000] | | [-10,000] |
| Caithness* | nc | nc | 0 (1) | 6,207 (1) | 7 (1) | 5,462 (1) | 6,186 (1) | 3,861 (1) |
| | | | | [-1,000] | | [-1,000] | | [-1,000] |
| Highland | 425 (12) | 1,500 (13) | 8,954 (17) | 5,252 (18) | 22,109 (16) | 13,207 (18) | 33,171 (18) | 5,184 (18) |
| | | [-500] | | [-750] | | [-750] | | [-750] |
| Moray | 6,000 (1) | 0 (1) | 600 (1) | 22 (1) | 1,200 (1) | 180 (1) | 500 (1) | 0 (1) |
| Aberdeenshire | 38,900 (6) | 80 (5) | 48,698 (5) | 699 (6) | 34,853 (6) | 1,008 (6) | 34,390 (5) | 1,511 (7) |
| Angus/Dundee | 11,050 (1) | 0 (1) | 23,090 (1) | 0 (1) | 25,391 (1) | 102 (1) | 3,164 (2) | 1,230 (2) |
| Perth & Kinross | 15,500 (8) | 716 (10) | 13,387 (17) | 553 (17) | 9,142 (13) | 3,296 (13) | 8,300 (14) | 2,016 (15) |
| Stirling/Falkirk/ Clackmannan | 1,918 (3) | 450 (2) | 9,076 (4) | 266 (2) | 11,591 (4) | 590 (3) | 4,076 (4) | 410 (2) |
| Fife | 240 (19) | 235 (10) | 3,769 (24) | 972 (24) | 2,647 (23) | 668 (23) | 10,253 (22) | 1,381 (22) |
| | | [-235] | | [-235] | | [-235] | | [-235] |
| Argyll & Bute | 17 (1) | 23 (1) | 105 (2) | 990 (2) | 0 (1) | 1,400 (1) | 407 (1) | 3,067 (2) |
| Clyde | nc | nc | nc | nc | nc | nc | nc | nc |
| Ayrshire | nc | nc | nc | nc | nc | nc | nc | nc |
| Dumfries & Galloway ** | 0 (2) | 106 (2) | 4,568 (2) | 250 (3) | 6,631 (5) | 87 (3) | 9,813 (8) | 194 (2) |
| Cumbria ** | 0 (2) | 150 (2) | 150 (1) | 0 (1) | 1,802 (3) | 0 (1) | 16,151 (4) | 0 (1) |

| Region/Area | October | | November | | December | | February | |
|---|-------------|------------|----------------|----------------|------------|------------|------------|----------|
| | Pinkfoot | Greylag | Pinkfoot | Greylag | Pinkfoot | Greylag | Pinkfoot | Greylag |
| Lothians | 17,558 (15) | 1,213 (15) | 10,698 (14) | 966 (14) | 3,556 (14) | 1,237 (14) | 609 (15) | 363 (15) |
| | | [-750] | | [-750] | | [-750] | | [-363] |
| Borders | 18,700 (13) | 75 (13) | 12,458 (12) | 71 (12) | 500 (11) | 127 (11) | 7,509 (16) | 655 (14) |
| | | [-75] | | [-71] | | [-75] | | [-75] |
| Northumberland | 2,577 (4) | 0 (3) | 9,372 (9) | 566 (9) | 1,826 (8) | 215 (7) | 3,100 (7) | 743 (6) |
| | | | | [-400] | | [-215] | | [-400] |
| Lancashire & Merseyside* | 23,808 (8) | 0 (8) | 49,438 (8) | 0 (8) | 25,020 (8) | 0 (8) | 24,094 (8) | 0 (8) |
| N Wales/Dee Estuary | nc | nc | 250 (1) | 0 (1) | 500 (1) | 0 (1) | 1,800 (2) | 0 (2) |
| Humberside | 2,903 (2) | 0 (2) | 3,520 (1) | 0 (1) | 1,410 (1) | 0 (1) | 1 (1) | 0 (1) |
| Lincolnshire | 0 (3) | 0 (3) | 31 (3) | 0 (3) | 300 (3) | 0 (3) | nc | nc |
| Norfolk | 3,756 (7) | 0 (7) | 46,350 (9) | 0 (9) | 56,010 (9) | 0 (9) | 8,350 (8) | 0 (8) |
| <i>Raw total counts</i> | 162,542 | 4,584 | 244,725 | 128,915 | 204,831 | 115,985 | 176,328 | 99,128 |
| <i>Adjustment for non-Icelandic birds</i> | n/a | -1,560 | n/a | -19,403 | n/a | -19,222 | n/a | -19,020 |
| <i>Estimated</i> | +5,000 | | +2,000 | +10,403 | | +4,190 | | +11,863 |
| Population | | | 246,725 | 119,915 | | | | |

* several feeding sites consolidated

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

nc no count received

n/a adjustment not applicable

3.3 Regional Distribution

3.3.1 Pink-footed Goose

The mass arrival of Pink-footed Geese into Britain arrived after the early October 2011 count weekend (see Discussion), but Northeast Scotland held the highest number of birds in that month with a high percentage also present in Southeast Scotland/Northwest England (Table 3, Figure 2). By early November, after the mass arrival, Pink-footed Geese had gathered in Northeast Scotland, East Central Scotland and the west of England. By December, many geese were in the southern half of Britain with nearly a quarter of the number counted in East England. The late winter/spring movement of Pink-footed Geese through Britain was well underway by the time of the late February counts, with North and Northeast Scotland holding the bulk of the birds counted.

3.3.2 Greylag Goose

The autumn distribution of Greylag Geese was typical, with a very low proportion present in Britain during October, though this partly reflects the emphasis on November and December counts for this population and the consequent lack of counts submitted for October. By November, nearly one third of the population was still in Iceland and nearly two thirds were present in North Scotland, principally on Orkney (Table 3, Figure 3). The distribution in December was similar to November, although $\approx 10,000$ birds still remained in Iceland (see Discussion). By February, the vast majority of geese were still in North Scotland, although the first migrants had begun to arrive back in Iceland to join $\approx 1,000$ that had over-wintered there.

Table 3. National and, within Britain, regional distribution of Pink-footed Geese and Iceland Greylag Geese counted during October, November and December 2011 and February 2012, expressed as a percentage of the maximum count for each species. Estimated counts not included.

| | Pink-footed Goose | | | | Greylag Goose | | | |
|---------------------------------------|-------------------|--------------|-------------|-------------|---------------|--------------|-------------|-------------|
| | Oct | Nov | Dec | Feb | Oct | Nov | Dec | Feb |
| Iceland | 8.2 | 0.0 | 0.0 | 0.0 | 0.0 | 30.2 | 6.7 | 0.7 |
| Ireland | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.6 | 0.6 |
| North Scotland | 0.2 | 3.7 | 9.2 | 17.9 | 1.3 | 63.6 | 76.9 | 69.8 |
| Northeast Scotland | 18.3 | 20.1 | 14.7 | 14.3 | 0.1 | 0.5 | 0.8 | 1.0 |
| East Central Scotland | 11.7 | 20.2 | 19.9 | 10.5 | 1.1 | 1.4 | 3.3 | 3.6 |
| Southwest Scotland/ Northwest England | 0.0 | 2.0 | 3.4 | 10.8 | 0.2 | 0.8 | 1.0 | 2.2 |
| Southeast Scotland/ Northeast England | 15.9 | 13.3 | 2.4 | 4.6 | 1.4 | 1.9 | 1.8 | 1.8 |
| West England | 9.7 | 20.3 | 10.4 | 10.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| East England | 2.4 | 20.4 | 23.6 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 66.4 | 100.0 | 83.7 | 72.0 | 4.1 | 100.0 | 91.2 | 79.7 |

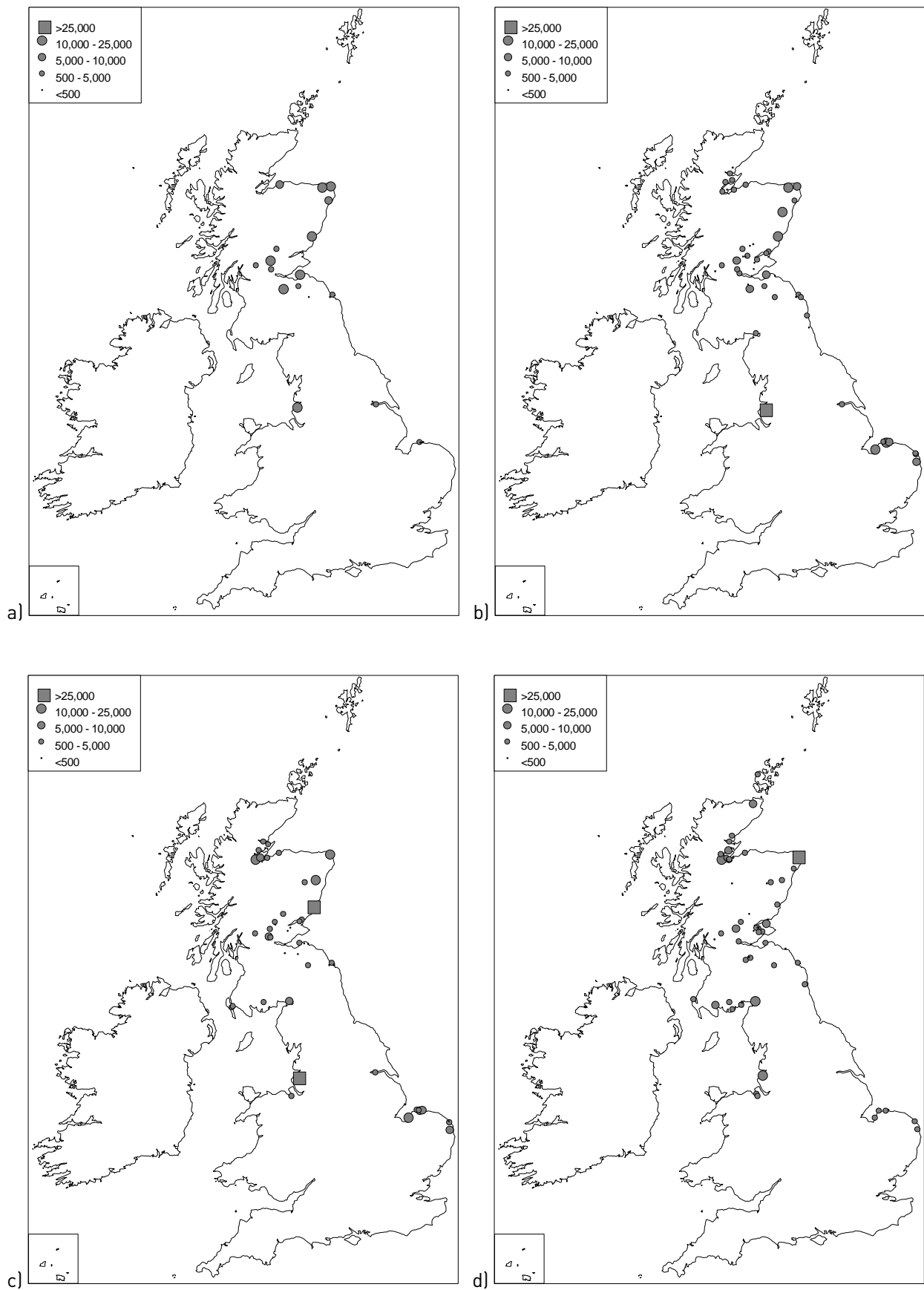


Figure 2. Distribution of Pink-footed Geese in Britain and Ireland in October (a), November (b), December 2011 (c) and February 2012 (d). Estimated counts are not shown.

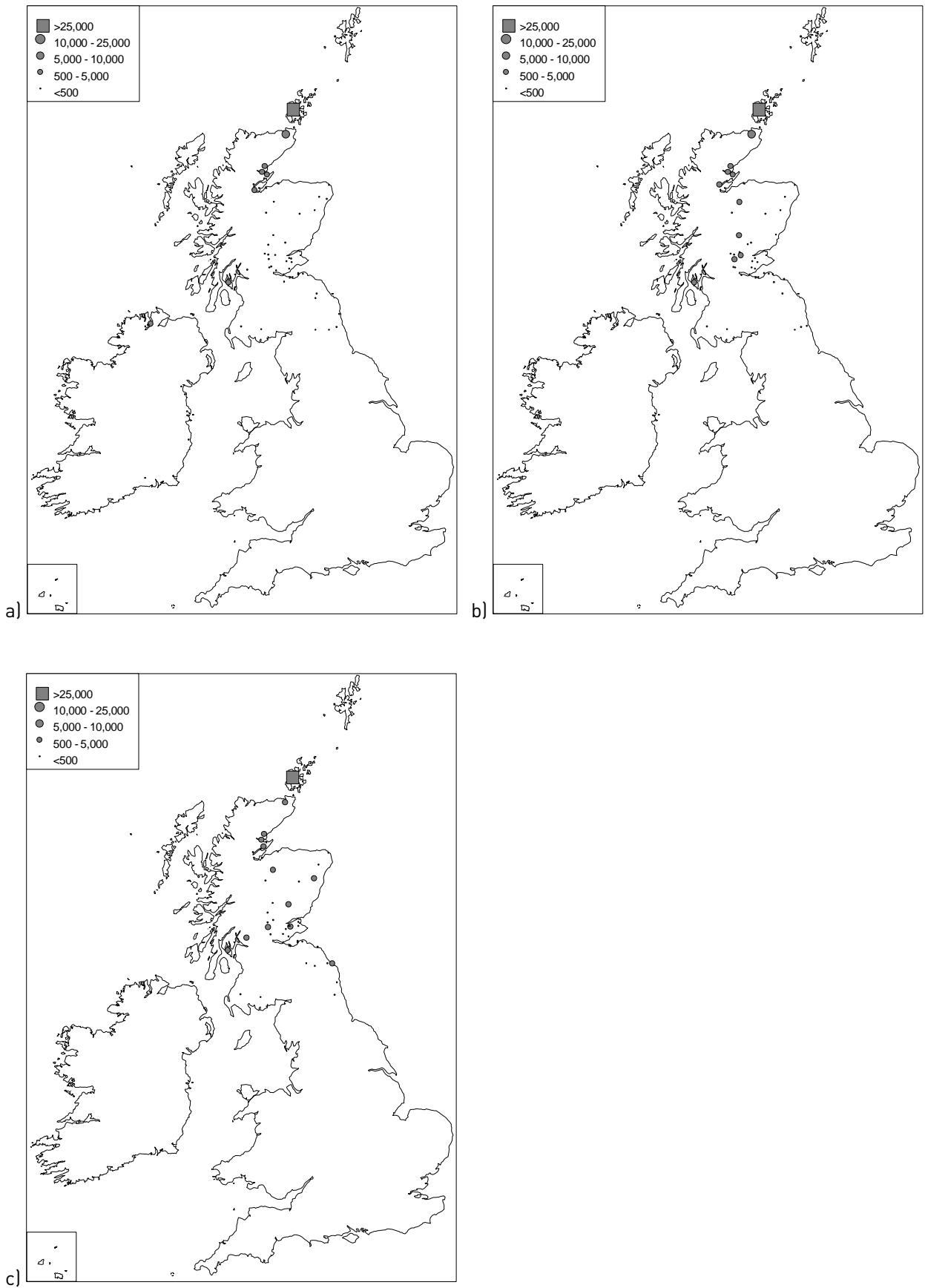


Figure 3. Distribution of Iceland Greylag Geese in Britain and Ireland in November (a), December 2011 (b) and February 2012 (c). Estimated counts are not shown.

3.4 Principal concentrations

3.4.1 Pink-footed Goose

Pink-footed Geese were recorded at 29 sites in October, 59 in November, 56 in December and 65 in February (this includes consolidated sites) (Table 1). The number of sites holding more than 1% of the 2011 population estimate (2,467 birds) was 11 in October, 22 in November, 21 in December and 18 in February. Eight sites held over 10,000 birds in October, six in November and December and four in February. Combined counts from the 22 sites exceeding 1% of the population estimate in November accounted for 90.0% of the total November count and numbers at the top five sites alone held 51.4% of the population estimate (Table 4). The most recent peak IGC counts from the two sites holding the highest mean peak counts 2007 to 2011 (Southwest Lancashire and Montrose Basin) are shown in Figure 4.

In November, high numbers were recorded at Southwest Lancashire, with 20.0% of the population estimate, Middlemuir (New Pitsligo) with 9.8% and Montrose Basin, Angus, with 9.4%. The highest count recorded for the IGC was 63,356 on 12 October at Montrose Basin, a week after the October census weekend. Likewise, at Carsebreck and Rhynd Loch (Perth & Kinross) a high count of 19,000 Pink-footed Geese was recorded on 16 October. It appears, therefore, that there was an influx of large numbers of Pink-footed Geese into northern Britain in the second week of October, unlike in autumn 2010 when many sites held peak numbers at the end of September (see Discussion).

Higher than recent (2006 to 2010) average numbers in November 2011 were recorded at: Carsebreck & Rhynd Lochs (Perth & Kinross), Dornoch Firth (Highland), Fala Flow (Lothians), Skinflats (Upper Forth), Lake of Menteith (Upper Forth), Loch Mullion (Perth & Kinross) and Middlemuir (Aberdeenshire). Lower than recent average numbers (2006 to 2010) were recorded in November 2011 at: Aberlady Bay (Lothians), Beaully Firth (Highland), Cromarty Firth: Nigg Bay (Highland), Findhorn Bay (Moray), Harperrig Reservoir (Lothians), Holburn Moss (Northumberland), Loch Flemington (Highland), Munloch Bay (Highland), River Tay: Bloody Inches (Perth & Kinross) and Scolt Head (Norfolk).

3.4.2 Greylag Goose

By November, 53 sites held Iceland Greylag Geese (Table 1), five of which held numbers exceeding 1% of the population estimate (1,199 birds) (this considers Orkney and Iceland as single sites). Excluding an estimated 10,000 summering birds (but see Discussion), Orkney held 46.6% of the total counted. The total unadjusted count of 65,845 Greylag Geese on Orkney in November was 10,000 fewer than counted in the same month in 2010, due to 44,796 birds remaining in Iceland. Greylag Geese were recorded at 51 sites in December; those with counts exceeding 1% of the population estimate increased to nine. Iceland Greylag Geese were recorded at 56 sites in February and six sites held more than 1% of the population estimate.

Higher than recent average numbers (2006 to 2010) were recorded in November 2011 at: Aberlady Bay (Lothians), Loch Fleet (Highland) and Shetland. Lower than recent average numbers (2006 to 2010) were recorded in November 2011 at: Beaully Firth (Highland), Bute (Argyll & Bute), Dornoch Firth (Highland), Findhorn Bay (Highland), Haddo House Lakes (Aberdeenshire), Loch Eye (Highland), Loch Freuchie (Perth & Kinross), Loch Insh & Spey Marshes (Highland), Loch of Skene (Aberdeenshire), Meikle Loch (Aberdeenshire) and Upper Tay Sites (Perth & Kinross). Fewer Iceland Greylag Geese are now wintering in Scotland south of the Moray Firth, reflecting their continuing movement to wintering sites in North Scotland.

Table 4. Sites that supported >1% of the (a) Pink-footed Goose (>2,467) and (b) Iceland Greylag Goose (>1,199) population estimates in November 2011, 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 3,500 for Pink-footed Goose and 980 for Iceland Greylag Goose (Wetlands International 2012). Greylag Goose counts are unadjusted (*i.e.* British birds have not been deducted).

a) Pink-footed Goose

| Site | November count | Percentage of population estimate | Five-year peak mean 2006–2010 ¹ |
|---|----------------|-----------------------------------|--|
| Southwest Lancashire | 49,438 | 20.0 | 62,962 |
| Middlemuir, Aberdeenshire | 24,200 | 9.8 | 5,932 |
| Montrose Basin, Angus | 23,090 | 9.4 | 37,788 |
| Snettisham, Norfolk | 16,040 | 6.5 | 36,505 |
| Loch of Skene, Aberdeenshire | 14,000 | 5.7 | 16,551 |
| Holkham, Norfolk | 11,480 | 4.7 | 34,332 |
| Carsebreck & Rhynd Lochs, Perth & Kinross | 9,530 | 3.9 | 14,530 |
| Loch of Strathbeg, Aberdeenshire | 8,748 | 3.5 | 34,710 |
| West Water Reservoir, Borders | 8,455 | 3.4 | 31,027 |
| Wells, Norfolk | 6,900 | 2.8 | 21,783 |
| Aberlady Bay, Lothians | 5,407 | 2.2 | 18,046 |
| Berney Marshes, Norfolk | 5,300 | 2.2 | 12,183 |
| Fala Flow, Lothians | 4,920 | 2.0 | 4,267 |
| Solway Estuary (consolidated) | 4,718 | 1.9 | 19,408 |
| Skinflats (Upper Forth) | 4,500 | 1.9 | 2,146 |
| Horse Mere, Norfolk | 4,450 | 1.8 | 6,185 |
| Westfield Flood, Smailholm, Borders | 4,000 | 1.6 | n/a |
| East Chevington Pools, Northumberland | 3,800 | 1.5 | 1,784 |
| Read's Island Flats, Yorkshire | 3,520 | 1.4 | 4,118 |
| Lindisfarne, Northumberland | 3,300 | 1.3 | 4,532 |
| Lake of Menteith, Stirling | 3,116 | 1.3 | 2,230 |
| Dornoch Firth, Highland | 3,000 | 1.2 | 47 |

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

b) Greylag Goose

| Site | November count | Percentage of population estimate | Five year peak mean 2006–2010 ¹ |
|----------------------------|---------------------|-----------------------------------|--|
| Orkney Islands (all sites) | 65,845 ² | 54.9 | 70,538 |
| Iceland (lowlands) | 44,796 | 37.4 | 15,265 |
| Caithness | 6,207 | 5.2 | 8,826 |
| Loch Fleet, Highland | 2,025 | 1.7 | 1,640 |
| Ireland (all sites) | 1,460 | 1.2 | 3,511 |

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

² Unadjusted counts (see text and Table 2).

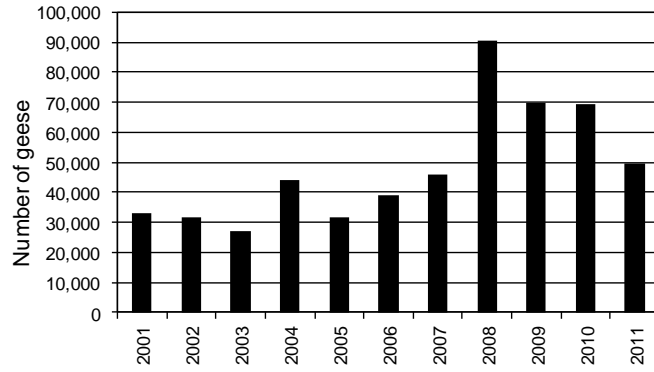
For the purpose of analysis, Orkney is treated as a consolidated site, although Table 5 shows the individual totals for the islands. Eight of the count areas on Orkney held numbers exceeding 1% of the population estimate in November, 10 did so in December, and 11 did so in February, although these individual counts are not adjusted for the presence of Greylag Geese breeding on Orkney (thought to number at least *c.* 10,000 birds, but see Discussion) since such data are only available for Orkney as a whole. As in 2009 and 2010, only on East Mainland and West Mainland were more than 10,000 birds recorded.

Table 5. Greylag Goose counts at individual sites on Orkney in November and December 2011 and February 2012 (counts have not been adjusted to take into account the number of Greylag Geese summering on Orkney since data on their numbers are only available for Orkney as a whole). Five year peak mean derived from December counts from 2006 to 2010.

| | November count | % of population estimate | December count | February Count | Five-year peak mean |
|-----------------|-------------------|-----------------------------|-------------------|-------------------|------------------------|
| West Mainland | 26,820 | 22.4 | 26,452 | 31,382 | 30,478 |
| East Mainland | 18,466 | 15.4 | 16,264 | 11,808 | 14,335 |
| Stronsay | 5,207 | 4.3 | 6,309 | 5,979 | 5,273 |
| Shapinsay | 2,320 | 1.9 | 4,154 | 6,180 | 5,184 |
| South Ronaldsay | 2,596 | 2.2 | 6,200 | 6,555 | 4,592 |
| Sanday | 4,320 | 3.6 | 4,260 | 5,326 | 3,174 |
| Eday | 1,645 | 1.4 | 1,635 | 1,637 | 1,198 |
| Papa Westray | 697 | 0.6 | 1,348 | 1,233 | 1,233 |
| Rousay | 1,690 | 1.4 | 403 | 2,043 | 1,041 |
| Egilsay | 696 | 0.6 | 232 | 576 | 738 |
| Westray | 220 | 0.2 | 980 | 2,370 | 943 |
| North Ronaldsay | 653 | 0.5 | 6,200 | 1,267 | 694 |
| Hoy and Walls | 100 | 0.1 | 1,890 | 468 | 783 |
| Wyre | 331 | 0.3 | 40 | 262 | 329 |
| Burray | 0 | 0.0 | 252 | 391 | 437 |
| Flotta | 84 | 0.1 | n/c | n/c | 263 ¹ |
| Total | 65,845 | 54.9 | 70,733 | 77,513 | 70,538 |

¹ Mean derived from 2009 and 2010 only.

a) Southwest Lancashire



b) Montrose Basin, Angus

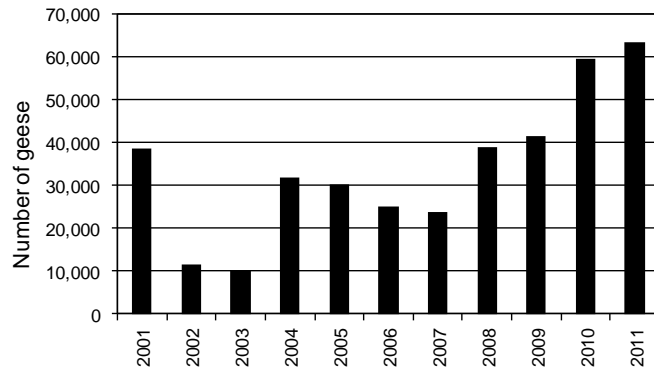
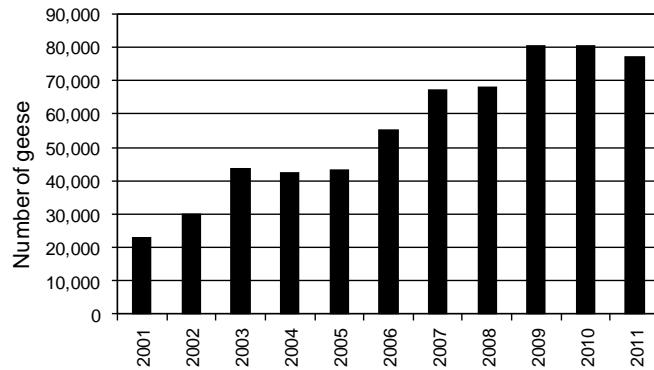


Figure 4. Peak IGC counts of Pink-footed Geese at a) Southwest Lancashire and b) Montrose Basin, Angus 2002 to 2011.

(a) Orkney



(b) Iceland

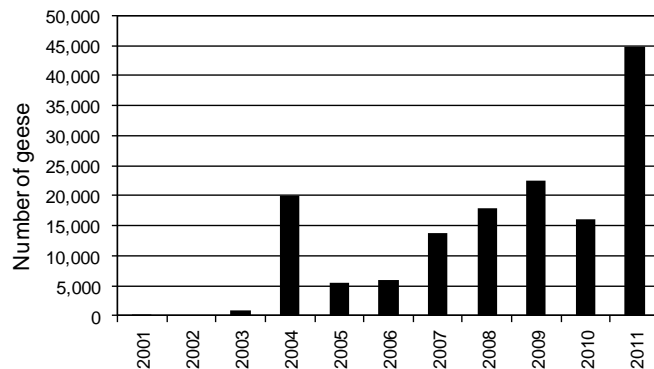


Figure 5. Peak IGC counts of Iceland Greylag Geese at a) Orkney (includes summering birds) and b) Iceland, 2002 to 2011.

3.5 Breeding success

Totals of 13,759 Pink-footed Geese (from 41 flocks) and 2,263 Greylag Geese (24 flocks) were aged at various localities in north west England, Scotland and southern Iceland between 15 September and 3 December. The percentage of birds aged in relation to the estimated size of the population in 2011 was 5.6% for Pink-footed Goose and 1.9% for Greylag Goose. Information on the brood sizes of 79 families of Pink-footed Goose and 39 families of Greylag Goose was also collected during this period.

The breeding success of Pink-footed Goose was lower than the mean for the previous decade at 8.5% young (mean proportion of young 2001–2010: 19.4%, \pm 0.5 SE). The mean brood size of successful pairs was 1.77 goslings, lower than the mean recorded during the preceding ten years (2.14, \pm 0.1 SE) (Table 6, Figure 6).

There was evidence of modest regional variation in the percentage of young Pink-footed Geese, which varied from 6.9% in north west England to 10.3% in east central Scotland (Table 6). Similarly, mean brood size varied from 1.35 goslings in north east Scotland to 1.89 in east central Scotland. The percentage young was highest in late September and typically declined to late October (Figure 7) suggesting that successful families arrived early on the winter quarters (see Patterson & Hearn 2006). A slightly higher percentage young was recorded in a late sample of 500 birds in early November.

The breeding success of Iceland Greylag Geese was slightly lower than the mean for the previous decade, with flocks containing 19.6% young (mean 2001–2010: 21.9%, \pm 1.0 SE). The mean brood size of 1.92 goslings per successful pair was also slightly lower than that of the recent ten year mean (2.45, \pm 0.1 SE) (Table 6, Figure 6), however, the brood size figures were based on a 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 two regions (southern Iceland and North Scotland) during late October and early November.

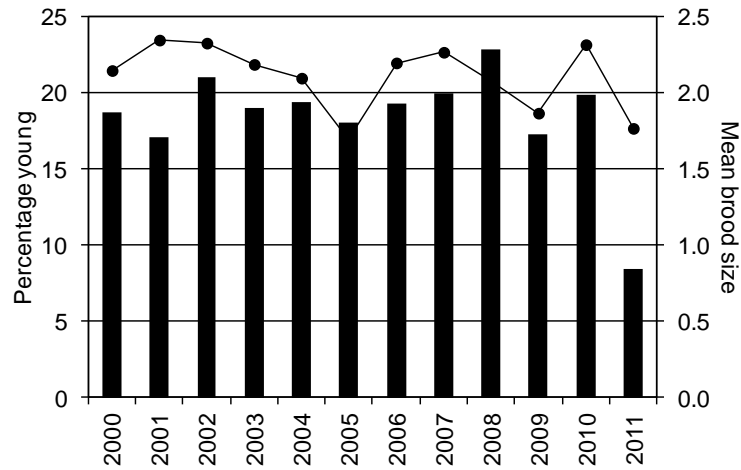
Table 6. The percentage of young and mean brood size of Pink-footed and Greylag Geese in 2011.

| | Region | Total aged | % young | No. of broods | Mean brood size |
|--------------------------------|-----------------------|---------------|-------------|---------------|-----------------|
| Pink-footed Goose ¹ | North east Scotland | 6,026 | 7.8 | 17 | 1.35 |
| | East Central Scotland | 4,842 | 10.3 | 62 | 1.89 |
| | North west England | 2,891 | 6.9 | 0 | - |
| | Total | 13,759 | 8.5 | 79 | 1.77 |
| Greylag Goose ² | South Iceland | 717 | 16.3 | 8 | 2.13 |
| | North Scotland | 1,546 | 21.1 | 31 | 1.87 |
| | Total | 2,263 | 19.6 | 39 | 1.92 |

¹ Pink-footed Geese aged between 15 September and 1 November 2011.

² Greylag Geese aged between 5 November and 3 December 2011.

a) Pink-footed Goose



b) Greylag Goose

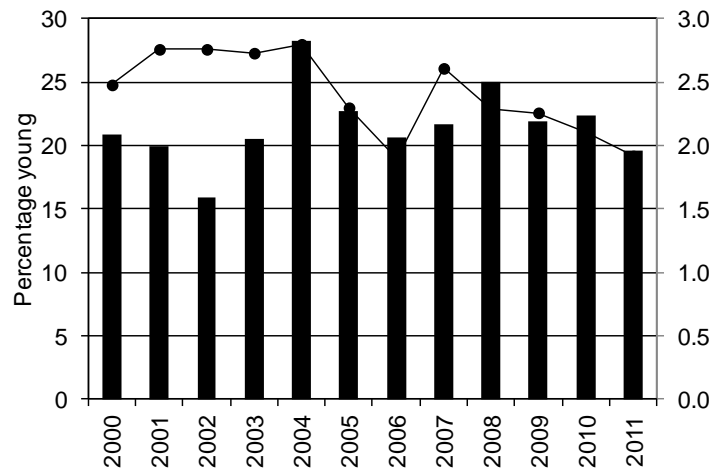


Figure 6. The percentage young (column) and mean brood size (line) found in flocks of (a) Pink-footed Goose and (b) Iceland Greylag Goose, 2001 to 2011.

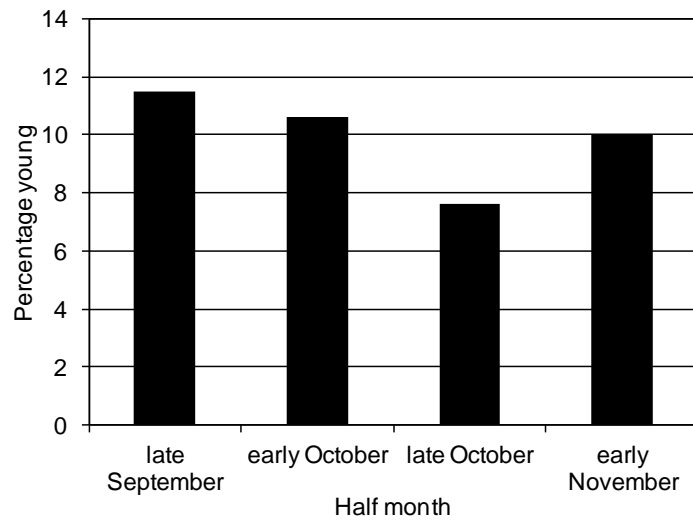


Figure 7. Mean percentage young of Pink-footed Geese during half-monthly periods of autumn 2011.

4 Discussion

The mass arrival of Pink-footed Geese had shown signs of occurring earlier in the autumn in the late 2000s. In autumn 2010, several important roosts experienced exceptionally large arrivals in the last week of September (*e.g.* 65,060 Pinkfeet counted at Montrose Bain on 1 October). In order to monitor a possible shift in the arrival patterns and to avoid a full moon on 23 October, an early date was chosen for the 2011 October count. Unfortunately, the last weeks of September brought exceptionally warm conditions to northern Britain and associated southerly winds. This no doubt affected the timing of the autumn migration and the October 2011 census weekend proved to be too early for mass arrivals. An estimated 20,000 Pink-footed Geese remained in Iceland in early October and, given that most of the geese remain in the remote interior, this figure must be treated as an underestimate. For the last four years, the largest numbers of Pink-footed Geese have been counted in October, suggesting that the November counts were lower than the true population figure, and this may have been the case in 2011 too. There is little evidence of an underestimate, however, since the major roosts were all covered, yet the population figure of 246,725 was 17.2% lower than in 2010, and a third lower than the 2009 population estimate (Figure 8). There has never been a two year decline of such a magnitude before.

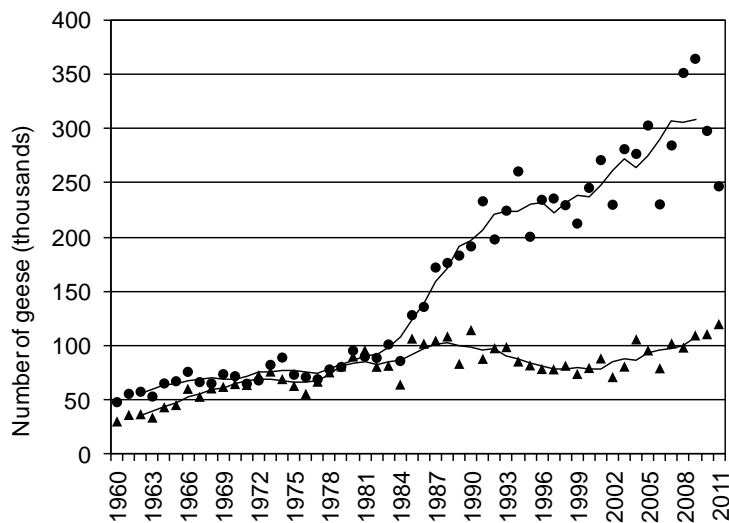


Figure 8. Population estimates for Pink-footed Goose (circles) and Iceland Greylag Goose (triangles), 1960 to 2011. The 5-year running means (*e.g.* mean for 2009 is from population estimates for 2007 to 2011) are shown as lines.

However, breeding success in summer 2011 was very low compared to the long term average of 19.4% and the lowest since 1977 (also 8.5% young). Seemingly, snow and cold temperatures in May and early June affected breeding conditions in both the remote interior and lowlands of Iceland. The Greylag Geese nesting in Iceland appeared to have escaped the effects of the cold weather, perhaps because they started nesting earlier in milder conditions. Furthermore, both winters 2009/10 and 2010/11 saw periods of harsh weather with prolonged snow cover and freezing temperatures over much of Britain. Over winter mortality may have increased during these prolonged periods of severe weather, although there were no reports of mass deaths. It is thus possible that a combination of higher than normal over winter mortality in the previous two years and a particularly poor breeding season in 2011 have contributed to a decline in the population of up to one third. Unfortunately, bag statistics are not yet available for 2011 from Iceland to see if the delayed autumn migration exposed more Pink-footed Geese to hunting mortality there. However, given the circumstances explained above, it might be prudent, for now, to consider the 2011 population figure as an underestimate. Given the unpredictability of the timing of departure from Iceland, it would also appear prudent to maintain coverage of sites holding Pink-footed Geese in both October and November, and, whenever possible, choose weekends dates near the middle of the month for the census.

The November 2011 count of Iceland Greylag Geese was thought to be reasonably comprehensive with sites being covered throughout most of the winter range although, once again, no counts were able to be undertaken in the Faroes. Coverage in Ireland was 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 Northern Ireland, is greater than reported here.

The departure of Greylag Geese from Iceland in autumn 2011 was unusually staggered. Relatively mild conditions persisted in Iceland into early December and *c.* 10,000 were still present at the time of that month's count. The increase of *c.* 7,000 birds between the December and February counts on Orkney suggest that the majority of the geese still in Iceland in December headed straight to Orkney in mid December. In addition to the unusually mild weather, the amount of barley grown in Iceland, especially in the southern lowlands where the majority of Greylag Geese are encountered in autumn, has increased in recent years (Figure 9). Despite the majority of the population now predominantly eating grass in winter on Orkney, spilled grain is highly nutritious to geese and the combination of a palatable food source and milder autumn weather conditions in Iceland has led to a delay in the autumn migration for many thousands of Greylag Geese. This is in contrast to the migration of Pink-footed Geese, outlined above, which, in some years, has begun earlier in the autumn.

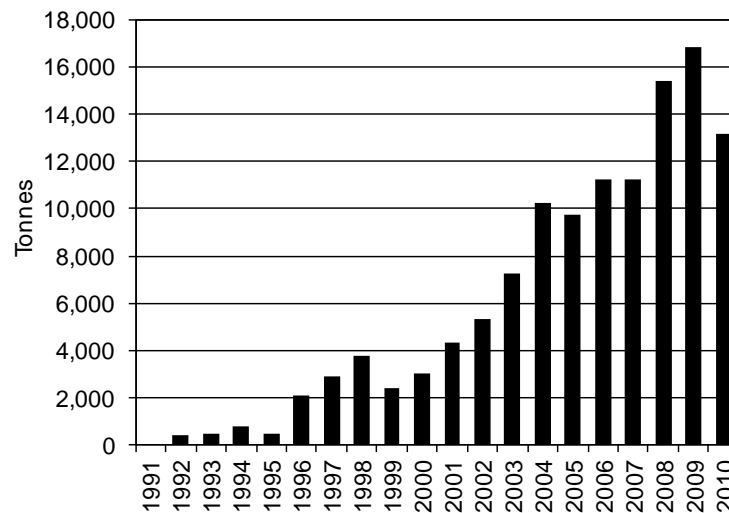


Figure 9. Amount of barley harvested in Iceland, 1991 to 2010 [source Statistics Iceland¹].

The November count of geese in Iceland was based on a dedicated aerial survey, backed up by counts made by hunters and goose counters. Excellent coverage was achieved and the count of over 44,000 birds was considered to be accurate. Annual bag statistics are not yet available from Iceland to reveal if the relatively high level of shooting experienced there in recent years continues. Breeding success in the Iceland Greylag Goose population appeared to be average in 2011 (19.6%), although the figure was based on a small sample size, and in marked contrast to the breeding success of Pink-footed Geese. Greylag Geese breed earlier in the year and in lowland areas of Iceland. It would appear that many breeding Greylag Geese managed to hatch and rear young ahead of cold weather in May and June that adversely affected the breeding opportunities of the Pink-footed Geese.

The increase in numbers counted on Orkney appears to have levelled, with a peak count of 77,513 Greylag Geese in late February 2012. The need for a comprehensive assessment of the number of summering birds on Orkney was outlined in Mitchell (2011) and it is hoped that this will be undertaken in summer 2012. For now an estimate of 10,000 birds, based on a summer survey in 2008, continues to be used as a correction factor, but this is now considered an underestimate of the true number of British Greylag Geese there. In Shetland, post breeding and winter surveys of Greylag Geese in 2010 and 2011 have revealed a summer population of *c.* 5,000 birds that is joined by *c.* 2,000 winter migrants (Harvey *et al.* 2012). Ringing of a small number of British Greylag Geese there in July 2011 revealed that none left the islands during the winter, hence it is likely that the summer stock is probably sedentary. The number and distribution of British Greylag Geese continues to increase and present problems in identification of the provenance of Greylag Geese encountered on the winter quarters.

Peak counts of Iceland Greylag Geese have occurred in November in each year since 2005, but due to the varying arrival time of migrants from Iceland, and given the recent shifts in winter distribution, it would appear prudent to maintain coverage of sites holding these birds in both November and December.

¹ www.statice.is accessed on 19 July 2012

Spring 2012 survey

Occasional spring censuses organised by WWT from 1982 to 1996 had normally taken place on dates in mid March (although in 1995 it was as late as 8 April). Evidence from arrival dates of spring migrants recorded in Iceland suggested that, in recent years, both Pink-footed and Greylag Geese had begun to arrive earlier in the year, by approximately 0.7 to 0.8 days per year between 1988 and 2009, or by up to 16 days over the 21 year study period (Gunnarsson & Tómasson 2011). Although the dates of the 2012 spring census appeared early (end of February) it was for this reason that the dates were chosen.

By the end of February, Pink-footed Geese had already begun to shift their winter distribution north. Large numbers of Pink-footed Geese left Norfolk in mid January (J.Scott pers. comm.) and the sites holding the largest number of geese were generally to the north (Figure 2, Table 7).

Table 7. The largest Pink-footed and Greylag Goose counts at individual sites in late February 2012 (counts have not been adjusted to take into account the number of Greylag Geese summering on Orkney).

| Pink-footed Goose | | Greylag Goose | |
|---|--------|------------------------------|--------|
| Loch of Strathbeg, Aberdeenshire | 27,260 | Orkney | 77,513 |
| South West Lancashire | 24,094 | Caithness | 3,861 |
| Solway Firth | 16,151 | Isle of Bute | 1,750 |
| Beaully Firth, Highland | 10,000 | Loch Lomond, Argyll | 1,317 |
| Carsebreck & Rhynd Lochs, Perth & Kinross | 6,200 | Cromarty Firth, Highland | 1,300 |
| Caithness | 6,186 | Loch of Lintrathen, Angus | 1,230 |
| Cromarty Firth, Highland | 6,000 | Loch of Skene, Aberdeenshire | 1,110 |
| Wigtown Bay, Galloway | 6,000 | Iceland | 1,000 |
| Eden Estuary, Fife | 5,250 | Dornoch Firth, Highland | 926 |
| Meikle Loch, Aberdeen | 4,800 | Budle Bay, Northumberland | 650 |

The spring survey in late February has confirmed that Orkney supports large numbers of Iceland Greylag Geese throughout the winter (Figure 3, Table 7). Counts in November and December had shown that an increasing number of Iceland Greylag Geese were present in the early part of the winter and although anecdotally the geese did not appear to decline in number as winter progressed, this has now been confirmed. Typically, Caithness and the north Scotland firths held the highest counts. However, it is interesting to note that the Isle of Bute, Loch Lomond and Loch of Lintrathen, all in central Scotland, held over 1,000 birds, suggesting that some Iceland Greylag Geese still move south to winter.

Counts in 1994 to 1996 had shown that 38-51% and 34-53% of the autumn population estimates for Pink-footed and Greylag Geese, respectively, were counted in the spring (see Mitchell 1996). The comparable figures for 2012 were 72% and 80%. The reason for this discrepancy, particularly for Pink-footed Geese, is not easily explained. The November count may have been an underestimate of the true population (see above). Geese may have been at fewer sites and less dispersed in the landscape (*i.e.* not roosting on temporary flooded fields). Count coverage may have improved - there has not been a spring census since 1996 and more goose counters may have felt willing to undertake an additional count in the spring. Perhaps fewer Pink-footed Geese are being shot now than in the mid 1990s leading to higher over winter survival in mild winters. The higher value for Greylag Geese can, in part, be attributed to more birds wintering on Orkney, which has excellent count coverage. In 1996, Orkney supported 17% of the spring census total; in 2012, the figure was 56% (excluding summering birds).

5 Acknowledgements

This census is part of the long-term Goose & Swan Monitoring Programme organised by the Wildfowl & Wetlands Trust and funded by WWT and the Joint Nature Conservation Committee, in partnership with Scottish Natural Heritage. The financial support of JNCC for this important monitoring work is gratefully acknowledged.

This census would not be possible without the support of a large number of dedicated goose enthusiasts. Enormous thanks go to them and the regional coordinators for all their hard work and effort, advice and comments on their local goose situations. These include (with apologies for any omissions or mis-spellings):

D Abbott, H Addlesee, R Anderson, V Anderson, I Andrews, J Ballantyne, R Ballinger, S Barratt, B Bates, C Batty, P Batty, A Bedford, MV Bell, B Black, L Borradaile, JM Bowler, W Braid, A Bramhall, J Branscombe, T Brewis, I Brockway, D Brown, J Brown, AW Brown, DM Bryant, JC Burrow, J Calladine, NC Chambers, E Cameron, A Cheshier, T Clare, M Clarke, G Clarkson, M Cockram, R Cooper, C Corse, A Cotton, A Craggs, T Cunningham, JD Daisley, IS Davidson, T Dodman, L Dow, A Duff, K Duncan, J Dunn, S Dunstan, S Elliott, J English, B Etheridge, C Ferries, P Fletcher, A Follestad, A Forsythe, S Foster, IS Francis, M Ginns, N Godden, DK Graham, M Graham, R Graham, H Gray, A Grieve, L Griffin, GA Guðmundsson, G Guthrie, SR Hacker, J Hain, N Harper, J Harrison, N Haycock, R Heath, K Heath, A Heavisides, M Henderson, F Hewlett, P Higson, D Hill, P Hollindrake, N Holton, I Hopkins, S Hutchinson, H Insley, M Jamieson, D Jardine, G Johnson, B Jones, N Keogh, K Kirk, M Kitching, A Knight, M Laurie, AJ Lawrence, the late S Laybourne, A Leitch, L Lenehen, A Leonard, I Lewis, S Longster, D Macallister, DM Macaskill, D Mallett, B Martin, PR Massey, D Matson, W Mattingley, C Mawby, FJ Mawby, B McCutcheon, C McKay, J McCutcheon, E Meek, P Moore, C Moses, R Murray, B O'Dowd, R O'Dowd, G Ogg, D Otter, L Oxley, G P Catley, E P Gray, J Palfery, D Parkinson, IJ Patterson, M Peacock, B Rains, C Rankine, ER Rawling, K Redgrave, B Ribbands, K Robeson, A Robinson, North Ronaldsay Bird Observatory, M Rooney, M Ross, J Rowe, J Scott, D Shepherd, R Sheppard, L Shields, A Sigfússon, R Singleton, A Smart, J Smith, R Smith, T Smith, AM Smout, M Souter, A Speer, A Steel, G Sturzaker, R Strachan, R Swann, FL Symonds, P Tapsell, NW Taylor, CT Teago, A Thiel, M Thompson, R Thorne, M Thornton, A Upton, P Walsh, S Welch, R Weston, A Whewell, H White, JM Wills and RE Youngman.

In Iceland, the aerial survey was organised by Guðmundur Guðmundsson and ground counts were organised by Arnór Sigfússon. Additional age counts were provided by Ian Patterson and Chris Tomlinson. Support was also provided by Kane Brides and Colette Hall at WWT Slimbridge. Thanks also to Richard Hearn for comments on an earlier draft of this report.

6 References

Gunnarsson, TG & G Tómasson. 2011. Flexibility in spring arrival of migratory birds at northern latitudes under rapid temperature changes. *Bird Study* 58: 1-12.

Harvey, PV, Mitchell, C, Pennington, MG, Okill, JD & P Ellis. 2012. The status of the Greylag Goose in Shetland. *Scottish Birds* (In press).

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

Mitchell, C. 1996. *Mid-winter and spring counts of Pink-footed and Greylag Geese in 1996*. Wildfowl & Wetlands Trust report to the Joint Nature Conservation Committee, Slimbridge.

Mitchell, C. 2002. Pink-footed Goose. In: Wernham, CV, MP Toms, JH Marchant, JA Clark, GM Siriwardena & SR Baillie. (Eds). *The Migration Atlas: movements of the Birds of Britain and Ireland*. T. & A.D. Poyser, London.

Mitchell, C. 2010. *Status and distribution of Icelandic-breeding geese: results of the 2009 international census*. Wildfowl & Wetlands Trust/Joint Nature Conservation Committee Report, Slimbridge.

Mitchell, C. 2011. *Status and distribution of Icelandic-breeding geese: results of the 2010 international census*. Wildfowl & Wetlands Trust/Joint Nature Conservation Committee Report, Slimbridge.

Mitchell, C & RD Hearn. 2004. *Pink-footed Goose Anser brachyrhynchus (Greenland/Iceland population) in Britain and Ireland 1960/6–1999/2000*. Waterbird Review Series, 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.

Swann, R & I Brockway. 2002. Greylag Goose. In: Wernham, CV, MP Toms, JH Marchant, JA Clark, GM Siriwardena & SR Baillie. (Eds). *The Migration Atlas: movements of the Birds of Britain and Ireland*. T. & A.D. Poyser, London.

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

Wetlands International. 2012. *Waterbird Population Estimates*. Retrieved from wpe.wetlands.org on Friday 20 Jul 2012.