



**GREENLAND BARNACLE GEESE
BRANTA LEUCOPSIS IN BRITAIN
AND IRELAND: RESULTS OF
THE INTERNATIONAL CENSUS,
SPRING 2013**

WWT Report

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September 2013

Published by:
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This publication should be cited as:

Mitchell, C. & C. Hall 2013. *Greenland Barnacle Geese Branta leucopsis in Britain and Ireland: results of the international census, spring 2013*. Wildfowl & Wetlands Trust, Slimbridge. 31pp.

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Summary

Between 1959 and 2013, thirteen full international surveys of the Greenland population of Barnacle Goose have been conducted at wintering sites in Ireland and Scotland using a combination of aerial survey and ground counts. This report presents the results of the 2013 census, conducted primarily between 15–17 March in Scotland and 25–27 March in Ireland. In Ireland, 31 sites, out of 72 checked, were found to hold 17,500 Greenland Barnacle Geese and in Scotland, 38 sites, out of 224 checked, were found to hold 63,170 geese. The total wintering population was estimated at 80,670 birds. This represents a 14.4% increase on the 2008 census total.

The number counted on Islay in spring 2013, the most important site in the winter range, was similar to that recorded in spring 2008, compared to an increase of 23.3% from 2003 to 2008. The number of geese throughout the remainder of Scotland increased by 37.2% since 2008, compared with an increase of 23.5% between 2003 and 2008. In Ireland, an increase of 43.1% has occurred since the survey of spring 2008, compared to an increase of 35.3% from 2003 to 2008.

Up to 2013, the increase in the population as a whole was largely dictated by increases at a small number of key sites. Currently, Islay, Tiree, Coll, Oronsay/Colonsay, South Walls, Inishkea Islands and Ballintemple/Lissadell hold the majority of geese (75.5% of the total in 2013) with Islay alone holding 55.7% of the population total. Overall, numbers at these seven key sites have increased more than six-fold since 1959. Total numbers outside these areas have also increased, albeit at a lower rate (less than a three-fold increase). However, in both Scotland and notably in Ireland, combined numbers at the key sites have stabilised since 2008, whereas numbers at outlying sites have increased. It is possible that Islay, and other key sites, may have reached a carrying capacity. It is also possible that the disturbance caused by the shooting of Greenland Barnacle Geese annually on Islay, as part of the goose management scheme run by Scottish Natural Heritage (2,062 Barnacle Geese shot in winter 2012/13, M.Laurie, SNH, pers. comm.), may have led to some geese abandoning the island and wintering elsewhere in the range. This possible redistribution of geese within the winter range merits further research.

The 2013 census found 33 sites that exceeded the threshold for national importance; 14 of these also exceeded the threshold for international importance. Of these, Oronsay/Colonsay and South Walls both held more than 1% of the international total in 2013, but are not classified as SPAs for Greenland Barnacle Geese (although Switha, the principal roost site of the South Walls flock, is an SPA).

The suite of SPAs which have Greenland Barnacle Goose as a qualifying species held 91.2% of the national and 71.5% of the international population in Scotland (*i.e.* UK) and 77.9% of the national and 16.9% of the international population in the Republic of Ireland. The number of Greenland Barnacle Geese has increased on six of the nine SPAs in Scotland in line with the overall increase in the population. These six sites are close to relatively large areas of managed grassland, particularly on Islay. Three remote offshore island SPAs in Scotland have shown a decline in usage (Monach Isles, Shiant Isles and Treshnish Isles) despite an increase in the overall population. In Ireland, of the 22 SPAs which have Greenland Barnacle Geese as a feature, 14 have sufficient data to examine trends. The number of geese has increased at eight of the 14 SPAs, is stable at four SPAs and has declined at two SPAs (Duvillaun Islands and Mid-Clare Coast).

The current monitoring strategy of one complete international census every five years and annual counts at a subset of important sites appears inadequate in terms of fully understanding the conservation status (abundance and population trend) of Greenland Barnacle Geese, and only provides a snapshot of their distribution and site use at that time. For those protected sites where birds are a notified or qualifying interest feature, the minimum requirement for Common Standards Monitoring (CSM) is one survey per cycle of six years. If, however, the feature is based on the number of geese at a site, it is recommended that surveys are conducted in at least three different relevant seasons within the six-year cycle. It is therefore recommended that additional counts are undertaken across the complete SPA network where coverage is currently less than annual, particularly those sites that are counted less than three times in every six years. This will require the use of aerial survey to count inaccessible offshore islands.

The suite of sites counted annually should be appraised to ensure that they give a reliable indication of the population trend between years when complete censuses take place. The feasibility of additional mid-winter counts, to better ascertain the mid-winter distribution and identify those sites which are important at that time of year, should also be explored to help improve knowledge of site use and potential impacts of changing site and population management.

The Scottish Government/Scottish Natural Heritage are proposing to maintain the shooting of Greenland Barnacle Geese on Islay at a level of approximately 1,800 birds per annum in winter 2013/14, and planning is underway to introduce an Adaptive Management Scheme on Islay, that may involve an increase in the number of geese shot, beyond 2013/14. Given this, there is a need for further surveys in addition to those carried out for population status assessment, in addition to information on demography and movements of the geese, that ensure adequate information is available to underpin population management and to investigate the possible displacement of Greenland Barnacle Geese from Islay as a consequence of the shooting.

1 Introduction

The world range of the Barnacle Goose *Branta leucopsis* comprises three distinct populations: the North Russian/Eastern Baltic breeding population which winters in the Netherlands and north Germany; the Svalbard breeding population which winters on the Solway Firth, Scotland/England; and a third population which breeds in northeast Greenland (Ogilvie *et al.* 1999). The Greenland population winters almost exclusively in north and west Scotland and west Ireland. In Scotland, the wintering range extends throughout the Inner and Outer Hebrides and north to Orkney. On the west coast of Ireland, the main concentrations occur between the Dingle Peninsula, Co. Kerry, and Inishowen in north Co. Donegal.

The first full survey of wintering sites was undertaken in 1959/60 (Boyd 1968), since when there have been 13 full international censuses, conducted at approximately five-yearly intervals (see Mitchell *et al.* 2008). Some of the wintering sites can be surveyed by ground counts, but because of the inaccessible nature of most sites (many are uninhabited, comparatively remote islands), aerial survey is required to achieve complete coverage of the population. This report presents the results of the 2013 census which was coordinated in Scotland by the Wildfowl & Wetlands Trust (WWT) and, in Ireland, by the National Parks and Wildlife Service (NPWS).

2 Methods

The methodology employed for the international census has been previously described in full (Walsh & Merne 1988). Weather conditions, length of daylight hours and type of aircraft (in the past) have meant that aerial surveys were more easily carried out in late March or early April (Boyd 1968). Aerial surveys are conducted using a high-winged aircraft flying at approximately 150–200 m above ground or sea. Counts are undertaken as the geese are flushed by the approaching aircraft. One observer makes a visual estimate of flock size while the second attempts to photograph the geese. The photographs are examined later and, if of good quality, are used to derive the count for the census total. The visual count is used where the quality of the photograph is poor or where there were difficulties photographing the entire flock. All islands where Greenland Barnacle Geese have previously been recorded are surveyed, as are, where practicable, all other islands and adjacent mainland coast where suitable vegetation is present.

Ground counts are made on several key sites in Scotland and Ireland where large flocks occur and where access is possible. Ground counts are used to derive the census totals for these sites, since this method provides the most accurate estimates for large flocks. The first ground-based counts on Islay were made in 1952/53 and these have continued annually since. In recent years, two or three counts have been undertaken on Islay each winter (in late autumn, mid-winter, and early spring) by Scottish Natural Heritage (SNH) as part of the Islay Goose Management Scheme, to assess numbers of Greenland White-fronted Geese *Anser albifrons flavirostris* and Greenland Barnacle Geese. The international census of Barnacle Geese is timed to coincide with the spring count. Counts are usually repeated on two consecutive days and the mean of these (the 'adopted' count), unless one is deemed inaccurate, is used as the island total. SNH and the Royal Society for the Protection of Birds (RSPB) undertake at least two counts each winter on both Tiree and Coll and sites in southwest Argyll, coordinated with those on Islay. SNH also carries out monthly ground counts on South Walls, Orkney as part of the Barnacle Goose Refuge Scheme and have done so since winter 1994/95. As part of the international census, ground-based counts are also undertaken at other known sites (where accessible), e.g. the Sutherland coast and North Uist. In Ireland, ground counts on the Inishkea Islands began in 1962 and have continued annually to the present, while regular counts have been made at Lissadell/Ballintemple.

The aerial survey was planned to be coordinated on or around the weekend 16/17 March, but due to differences in weather, strong westerly winds meant that the counts in Ireland were delayed by ten days (see below).

The 2013 aerial survey of Scottish sites was conducted on two days, 15–16 March 2013, using a twin-engine Partenavia aircraft. A total of 13 hours flying was undertaken, surveying approximately 190 islands and remote areas along the west and north coast. Surveys were conducted only when weather conditions were suitable. The daily flight itinerary comprised:

- 15 March: Islands off Islay, west coast Argyll, Mull, Coll/Tiree, Small Isles, islands from Barra Head to Barra, Sound of Barra, Monach Isles, North Uist/Sound of Harris, west Harris, west Lewis to Stornoway.
- 16 March: Stornoway, Shiant, Skye, Wester Ross then to west Sutherland.

Aerial survey in Ireland was undertaken using an Air Corp Reims Rocket Cessna 172 and was carried out on two days, 26–27 March 2013. Poor weather in west Ireland in mid-March had hampered attempts to coordinate the two flights and 26–27 March was the earliest weather window available to the survey team in Ireland.

Approximately 10 hours flying was undertaken, surveying sites in a south to north direction along the west coast from the Blasket Islands, Co. Kerry to Inishtrahull, Co. Donegal. Weather conditions were good, with good light and visibility and generally light winds. The daily flight itinerary comprised:

- 26 March: Blasket Islands to the North Mayo coast and landed at Strandhill, Co. Sligo.
- 27 March: Inishmurray Island, Co. Sligo and then northwards to Inishtrahull Island, Co. Donegal.

Ground counts were coordinated with the aerial survey in each country and most were conducted within a few days of the flights (see Table 1 for dates).

Photo verification of the flocks encountered during the aerial survey provides greater accuracy than visual estimates made at the time. The accuracy of visual counts has, however, been shown to be acceptable when numbers have been compared to those derived from photographic verification of individual flocks (Delany & Ogilvie 1994, Cranswick *et al.* 2000).

3 Results

During the 2013 census, coverage was comprehensive with a total of 296 islands and mainland sites visited. Thirty-one of the 72 sites surveyed in Ireland were found to hold Greenland Barnacle Geese and 38 of the 224 sites in Scotland were found to have birds present. Counts at all sites holding Greenland Barnacle Geese during the 2013 census are given in Table 1 and their locations are shown in Figures 1 & 2. Sites visited in Scotland but where no geese were found are listed in Appendix 1.

The Irish total was 17,500 geese, while that of Scotland was 63,170 geese. A flock of *c.* 200 Greenland Barnacle Geese was recorded at the Dyfi Estuary, Wales, in October to December 2012 (R. Jones pers. comm.), but the flock left the site in late December 2012 and, in March 2013, at the time of the census, a count was undertaken there and no geese were present. Thus, the total population estimate was 80,670 birds.

Overall, 87.5% of the census total comprised estimates from ground counts, 5.6% were counted from photographs and 6.9% from visual estimates obtained during aerial survey. Overall, 22 flocks were counted by visual estimation during aerial survey (median 155 birds, range 4–2,250) and where no photograph was available for verification.

Table 1 Sites holding Greenland Barnacle Geese in March 2013.

Country	Date	Site	Grid reference	Number of Geese	Survey method ¹
Ireland					
Clare	1 26-Mar	Mutton Island	Q975745	450	E
Galway	2 26-Mar	St. Macdara's Island	L720300	680	P
	3 26-Mar	Inishark	L490650	454	E
	4 26-Mar	Birmore Island	L810265	280	P
	5 26-Mar	Davillaun	L587663	160	E
	6 26-Mar	Cruagh Island	L529549	150	E
	Mayo	7 26-Mar	Inishkea Islands (North & South)	F550220	2,250
8 26-Mar		Termoncarragh	F647355	640	G
9 25-Mar		Cross Lough	F642291	620	G
10 25-Mar		Annagh Head	F654340	490	G
11 26-Mar		Moynish Island	L865943	320	E
12 25-Mar		Carriglahan	F616207	225	G
13 25-Mar		Fallmore	F622183	205	G
14 26-Mar		Roonagh Lough	L752760	200	E
15 26-Mar		Insihdalla	L633721	45	E
16 26-Mar		Kid Island	F790435	30	E
Sligo	17 25-Mar	Ballintemple	G600440	4,140	G
	18 25-Mar	Streedagh	G632497	246	G
	19 25-Mar	Kilmacannon	G590442	205	G
	20 27-Mar	Inishmurray	G572540	17	E
Donegal	21 27-Mar	Mallin Head	C422573	1,800	G
	22 25-Mar	Dunfanaghy	C020380	1,215	G
	23 27-Mar	Trawbreaga	C454479	890	G
	24 27-Mar	Raithin O'Birne Island	G466798	560	P
	25 27-Mar	Inishbarnóg	G640963	340	P
	26 27-Mar	Inishsirr	B785304	318	P
	27 27-Mar	Inishboffin, Inishdoeey and Inishbeg	B895385	232	E
	28 27-Mar	Inishkeeragh	B680122	191	E
	29 27-Mar	Roaninish	B659028	100	P
	30 27-Mar	Green Island/Illanaran	B632149	35	E

Country	Date	Site	Grid reference	Number of Geese	Survey method ¹
Wexford	31 26-Mar	North Slobland	T080240	12	E
Ireland Total				17,500	
Scotland					
Kintyre peninsula	32 17-Mar	Machrihanish	NR6719	4	G
Islay	33 16/17 Mar	Islay	NR3362	44,914	G
Inner Hebrides	34 17-Mar	Jura	NR4471	183	G
	35 17-Mar	Island of Danna	NR6978	704	G
	36 15-Mar	Garbhe Reis	NR7597	91	E
	37 15-Mar	Reis ant-Struith	NR7399	4	E
	38 17-Mar	Oronsay/Colonsay	NR3588	2,342	G
	39 15-Mar	Luing	NM7407	490	P
	40 15-Mar	Fladda (Treshnish Isles)	NM2943	50	P
	41 17-Mar	Tiree	NL9645	4,518	G
	42 17-Mar	Coll	NM1655	980	G
	43 15-Mar	Muck/Eilean nan Each	NM4279	140	P
Skye	44 16-Mar	Isay	NG2157	223	P
	45 16-Mar	Eilean Creagach	NG2965	91	E
	46 16-Mar	Eilean Trodday	NG4479	80	G
	47 16-Mar	Staffin Island	NG4969	47	G
Outer Hebrides	48 15-Mar	Fiaray	NF7010	310	E
	49 15-Mar	Ceann Ear (Monach Isles)	NF6562	292	P
	50 15-Mar	Ceann Iar (Monach Isles)	NF6063	190	E
	51 17-Mar	Balemor/Paible	NF7466	37	G
	52 17-Mar	Balranald/Goula	NF7070	541	G
	53 17-Mar	Grenitote/Sollas/Malacate	NF8175	476	G
	54 17-Mar	Vallay	NF7776	88	G
	55 17-Mar	Kirkibost/Knockline	NF7565	1,064	G
	56 15-Mar	Boreray	NF8581	900	P
	57 17-Mar	Berneray	NF9182	975	G
	58 15-Mar	Coppay	NF9394	110	E
	59 17-Mar	Ballshare	NF7762	342	G
West Sutherland	60 16-Mar	Eilean Mhuire (Shiants)	NG4198	200	E
	61 17-Mar	Summer Isles/Glas-leac Mor	NB9509	5	E
	62 17-Mar	Summer Isles/Achiltibuie	NC0208	144	P
North Sutherland	63 17-Mar	Glas-leac Beag	NB9205	20	P
	64 17-Mar	Eilean Hoan	NC4467	822	G
Orkney	65 17-Mar	South Walls	ND3189	1,740	G
	66 17-Mar	Loch of Skail	HY2418	48	G
	67 17-Mar	Marwick	HY2224	2	G
	68 17-Mar	Swannay	HY3028	2	G
	69 17-Mar	Breck/Dovecott	HY4120	1	G
Scotland total				63,170	
Wales					
Dyfed	17-Mar	Dyfi Estuary	SN6090	0	G
Total population				80,670	

Notes:

¹ G denotes ground count, P denotes photographic verification and E denotes visual estimate made during the aerial survey.

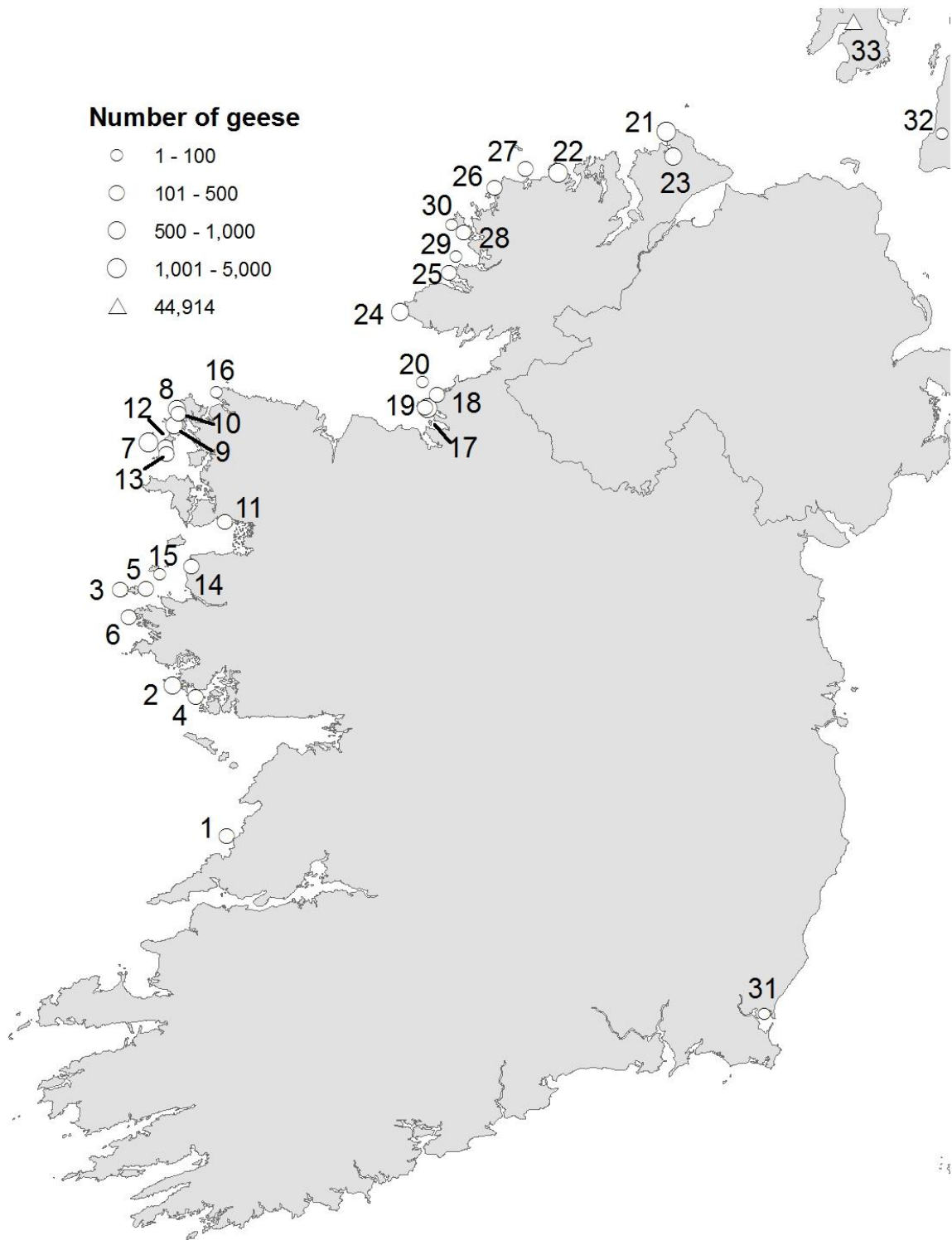


Figure 1 Sites in Ireland holding Greenland Barnacle Geese in March 2013 (see Table 1 for key to site numbers).

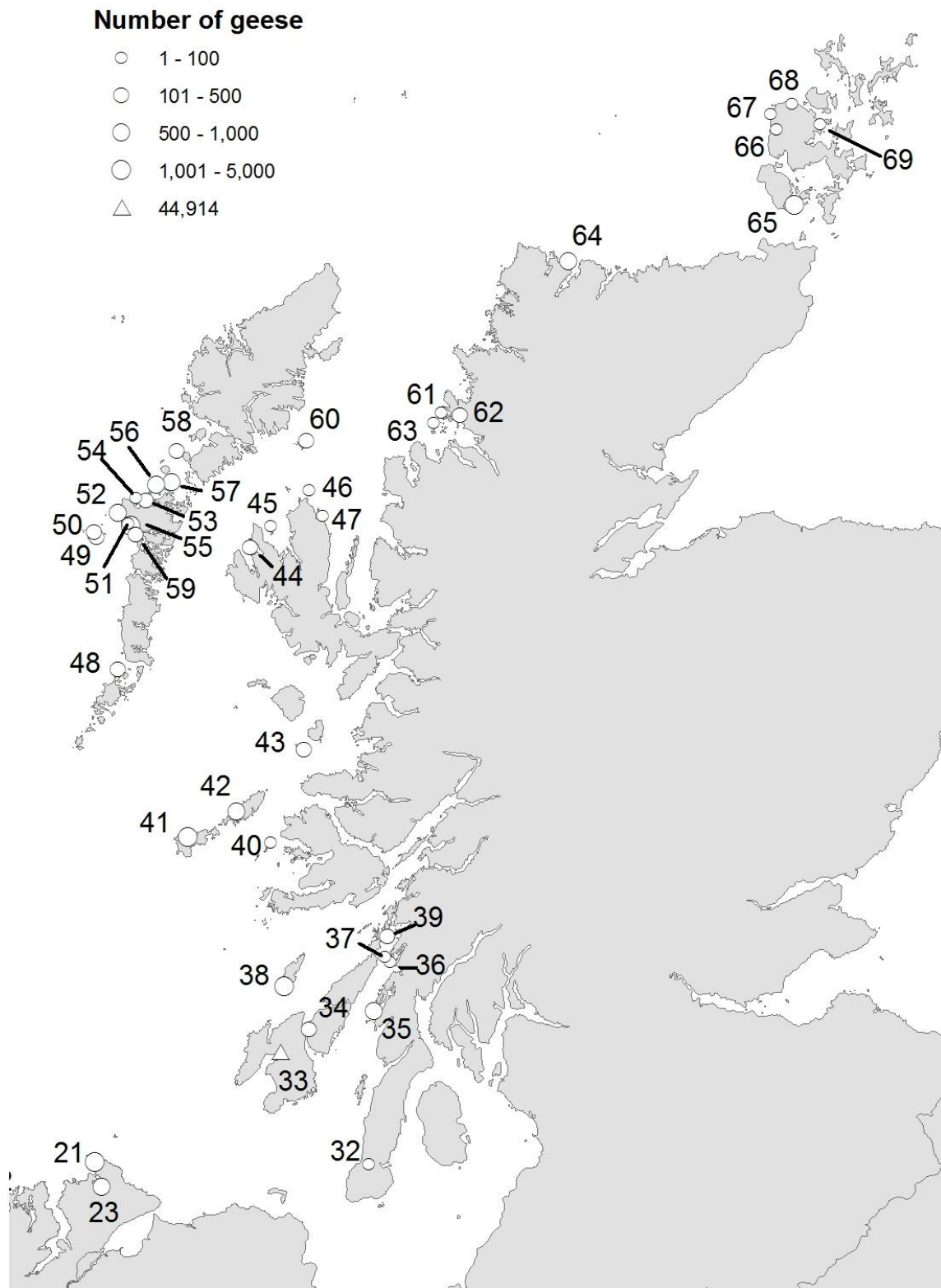


Figure 2 Sites in Scotland holding Greenland Barnacle Geese in March 2013 (see Table 1 for key to site numbers).

3.1 Long-term trends and distribution

Total numbers of Greenland Barnacle Geese have continued to follow an upward trend (Figure 3). The increase on Islay, ongoing since the 1960s (except for a drop in numbers in the 1980s), has, however, stabilised over the past five years. In contrast, overall numbers elsewhere in Scotland remained relatively constant throughout the 1970s and 1980s, but have increased since 1994 and continued to do so during the most recent five years. Numbers on the Inishkea Islands have remained stable, while numbers at other Irish sites are still following a long-term upward trend.

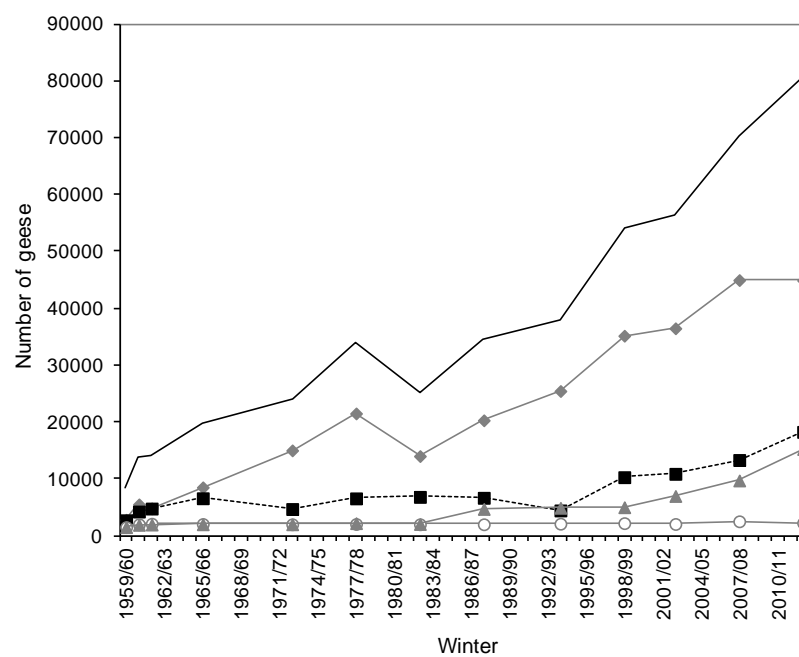


Figure 3 Census totals for the Greenland population of Barnacle Goose, 1959/60–2012/13. (— Total population, ◆ Islay, ■ Scotland excluding Islay, ○ Inishkea Islands, ▲ Ireland excluding Inishkea Islands).

There was a 14.4% increase in Greenland Barnacle Goose numbers between 2008 and 2013. The percentage change at the key sites of Islay and the Inishkea Islands, in Ireland and Scotland as a whole, and in Wales, are given in Table 2.

Table 2 Percentage change in Barnacle Goose numbers in Scotland, Ireland and Wales between March 2008 and March 2013.

	March 2008	March 2013	Change (%)
Scotland total	58,269	63,170	8.4
Islay	44,961	44,914	0.1
Scotland excluding Islay	13,308	18,256	37.2
Ireland total	12,232	17,500	43.1
Inishkea Islands	2,525	2,250	-10.9
Ireland excluding Inishkea Islands	9,707	15,250	57.1
Wales	0	0	n/a
Population total	70,501	80,670	14.4

The long term increase may be influenced by changes in survival and/or breeding success within the population. Pettifor *et al.* (1999) showed that the population is more affected by changes in mortality than productivity. The annual percentage of first-winter birds recorded on Islay has decreased since the mid- to late 1980s, although the number of geese on Islay, up to 2008, continued to increase throughout this period (Figure 4). Potential decreases in mortality and the introduction of goose management schemes, based on payments to farmers, aimed in part to benefit geese, may have therefore supported the continued population growth within this period.

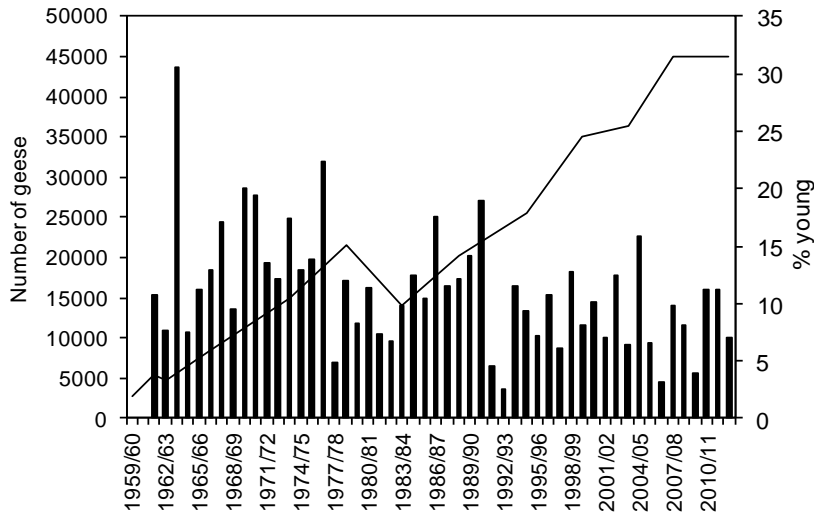


Figure 4 Population size (—) and percentage of first-winter birds (columns) of Greenland Barnacle Geese on Islay, 1959/60 – 2012/13.

It has been previously suggested that the population was becoming concentrated at a small number of sites while outlying sites, away from these key areas, saw a decline in numbers (Delany & Ogilvie 1994, Cranswick *et al.* 2000). However, the results from more recent surveys suggest that this is not the case and the number of occupied sites (>10 birds), whilst variable between censuses, has slowly increased since 1959/60 (Figure 5). The number of occupied sites in 2013 (63 sites) was the second highest on record (Figure 5).

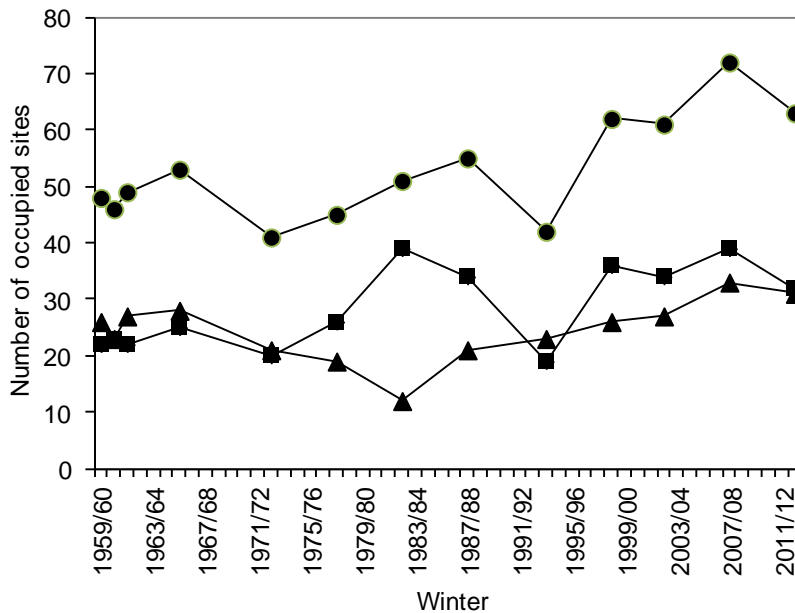
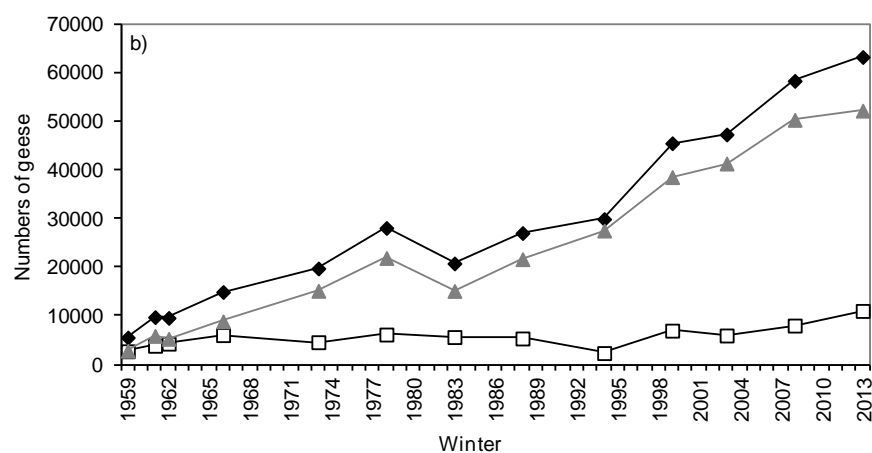
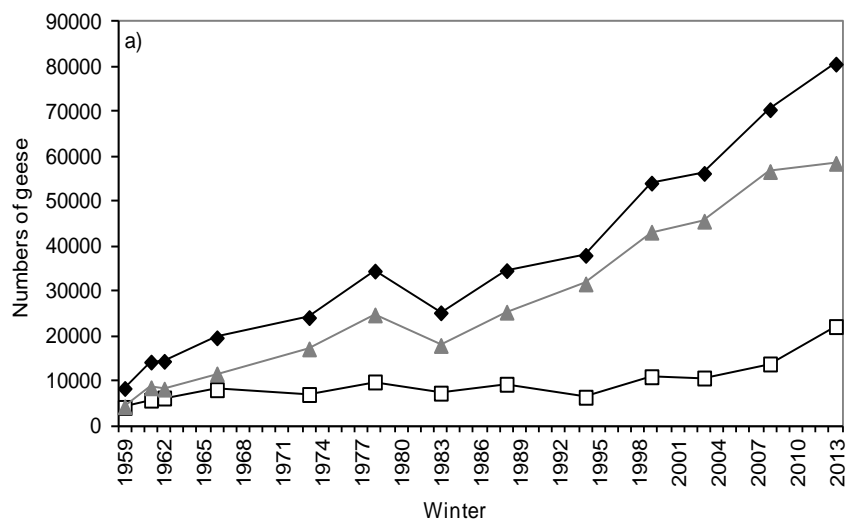


Figure 5 Number of sites occupied by Greenland Barnacle Geese (> 10 birds) in spring censuses 1959/60–2012/13 (● Scotland and Ireland, ■ Scotland, ▲ Ireland).

Up to 2008, censuses indicated that the increase in the population as a whole is largely dictated by increases at a small number of key sites. Currently, Islay, Tiree, Coll, Oronsay/Colonsay, South Walls, Inishkea Islands and Ballintemple/Lissadell hold the majority of geese (75.5% of the total in 2013) with Islay alone holding 55.7% of the population total. Overall, numbers at these seven key sites have increased more than six-fold since 1959 (Figure 6a). Total numbers outside these areas are still increasing, albeit at a lower rate (less than a three-fold increase).

However, in Scotland, the increase in combined numbers at the key sites has slowed, although there is a degree of variation with the number of geese at some sites increasing and at some decreasing. Numbers at the less important sites have generally increased (Figure 6b). Census data indicate that use of some sites, such as the Treshnish Isles and the Shiants, has decreased since the late 1970s/early 1980s. This has been coincident with an increase in use of sites such as Oronsay/Colonsay, the North Uist Machair and Islands SPA, the North Sutherland Coast SPA and South Walls/Switha. Delany & Ogilvie (1994) suggested that many uninhabited islands have seen decreases in numbers of geese owing to habitat deterioration brought about by the cessation of grazing. In contrast, habitat changes caused by the use of more intensive farming methods, and the establishment of goose management schemes, have attracted geese to alternative sites.

In Ireland, notably, combined numbers at the key sites have stabilised (Figure 6c), although there is a notable contrast between the two key sites with numbers on the Inishkea Islands having remained relatively constant since the 1960s. Numbers at Ballintemple/Lissadell have increased significantly. The total number counted at sites outside these two key areas has also continued to increase steadily from the mid-1970s, and dramatically so between 2008 and 2013. Again, there is a degree of variation with the number of geese at some sites increasing and at some decreasing.



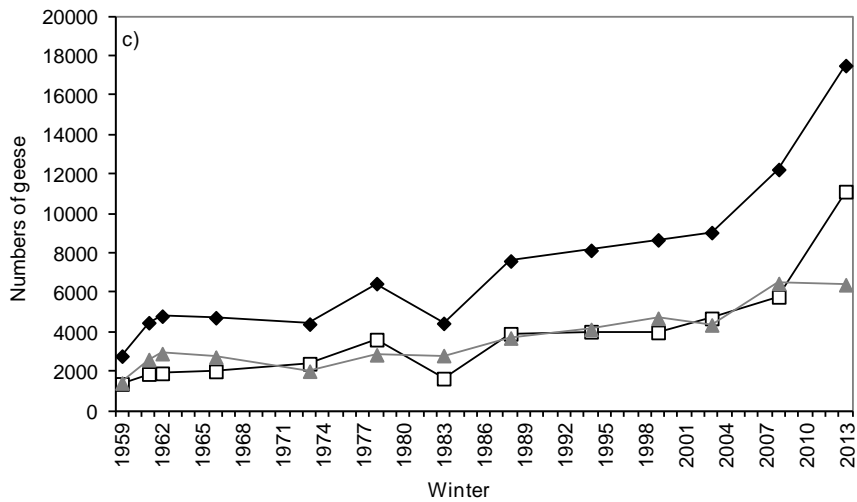


Figure 6 Trend in the number of Greenland Barnacle Geese found within and outside key sites: a) Scotland and Ireland combined, b) Scotland only and c) Ireland only; ◆ All sites, ▲ Key sites, □ other sites (key sites are Islay, Coll, Tiree and South Walls in Scotland; Inishkea Islands and Balintemple/Lissadell in Ireland).

The number of Barnacle Geese counted on Islay tends to peak in late autumn since the island is a major arrival point for the geese as they arrive from Iceland. Thereafter, a small proportion of birds move on to other wintering areas, for example to western Ireland. The peak number counted on Islay during winter 2012/13, during the regular mid-winter counts, was 46,903 (Figure 7). This is lower than the peaks in winter 2005/06 (47,962) and 2006/07 (49,104). There was almost no change in the number of Greenland Barnacle Geese on Islay between the March 2008 (44,961) and March 2013 (44,914) international censuses, whereas between March 2003 and March 2008 there was a 23% increase in numbers.

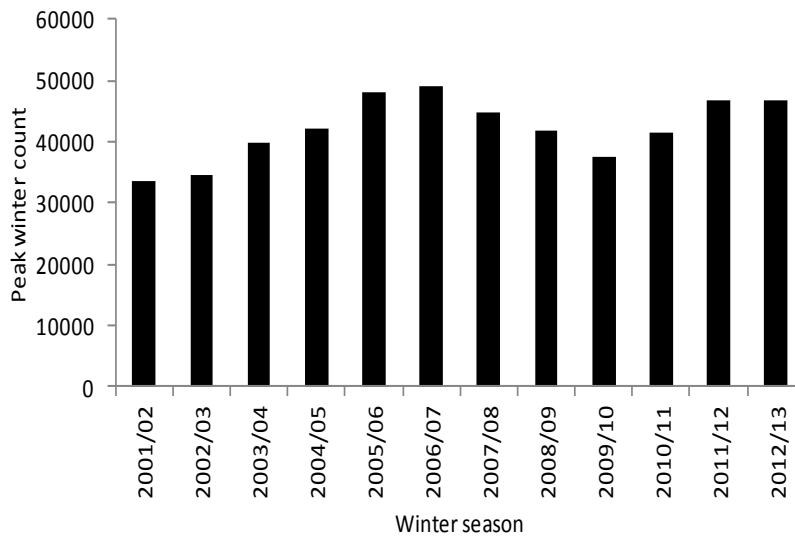


Figure 7 Peak counts of Greenland Barnacle Geese on Islay 2001/02–2012/13 (SNH data).

Since 2000, as part of a lethal scaring programme to prevent serious agricultural damage organised by SNH, Greenland Barnacle Geese have been shot on Islay. The number shot each winter has varied, with an average of 540 geese shot annually in the ten year period 2001/02 to 2010/11. However, the bag limit was increased to 2,300 birds in winter 2012/13 and the number shot in that winter increased to 2,062 (Figure 8). It is possible that the increase in disturbance caused by the recent increase in shooting activity may have led to an increase in the rate of redistribution of geese to other wintering areas. For example, the number of Greenland Barnacle Geese on Oronsay/Colonsay (c. 20 km north of Loch Gruinart, Islay) increased by 95%, from 1,200 to 2,342 between 2008 and 2013. On Tiree (c. 80 km northwest of Loch Gruinart, Islay) numbers increased by 54%, from 3,560 to 5,498 over the same period. However, increases in number on both Oronsay/Colonsay and Tiree may simply reflect the overall increase in the flyway population. The causes of the apparent redistribution of Greenland Barnacle Geese merits further research.

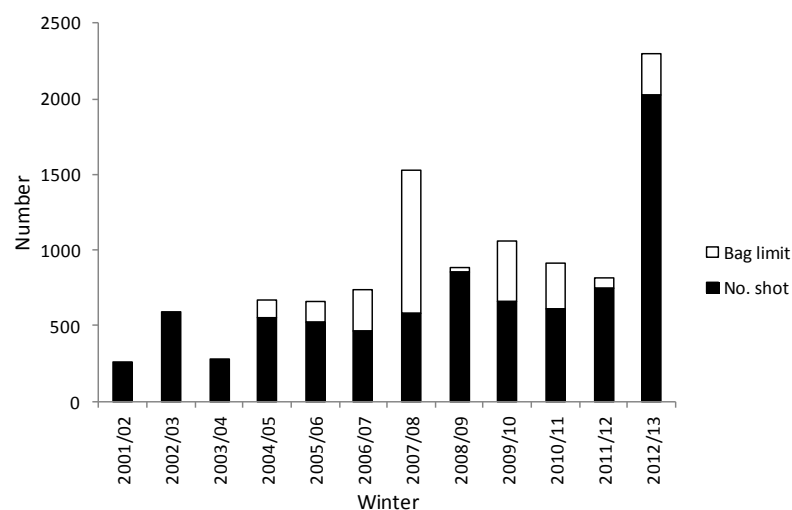


Figure 8 The number of Greenland Barnacle Geese shot on Islay 2001/02 - 2012/13 (Scottish Government/SNH data).

3.2 Nationally and internationally important sites

A site is considered internationally important if it regularly supports 1% or more of the individuals in a population (following criterion 5 of the Ramsar Convention) (Wetlands International 2012). In Britain, a site is considered nationally important if it regularly holds 1% or more of the British population estimate and in Ireland if it holds 1% or more of the all-Ireland estimate. Assessments of site importance are usually made on the basis of a minimum of three years' data, but in the absence of regular counts at many of these sites, we have here assessed the 2013 count against 1% of the international, British and all-Ireland population estimates obtained during this census. Based on the 2013 totals, the 1% threshold for international importance would be 807 geese, for national importance in Britain it would be 632 geese, and for all-Ireland importance it would be 175 geese. [Note that these are not the currently accepted national and international 1% thresholds, which remain 705 (Wetlands International 2012), 580 (Musgrove *et al.* 2013), and 90 (Crowe *et al.* 2008), respectively].

The 2013 census found 33 sites that exceeded the 2013 British or all-Ireland threshold, and 14 sites that exceeded internationally important numbers (Table 3). The number of sites exceeding nationally important numbers (based on the 1% threshold estimated at that time) decreased from 1959 to 1983, but stabilised up to 2008 and increased in 2013. The number of sites exceeding internationally important numbers has increased after a long-term decline (Figure 9).

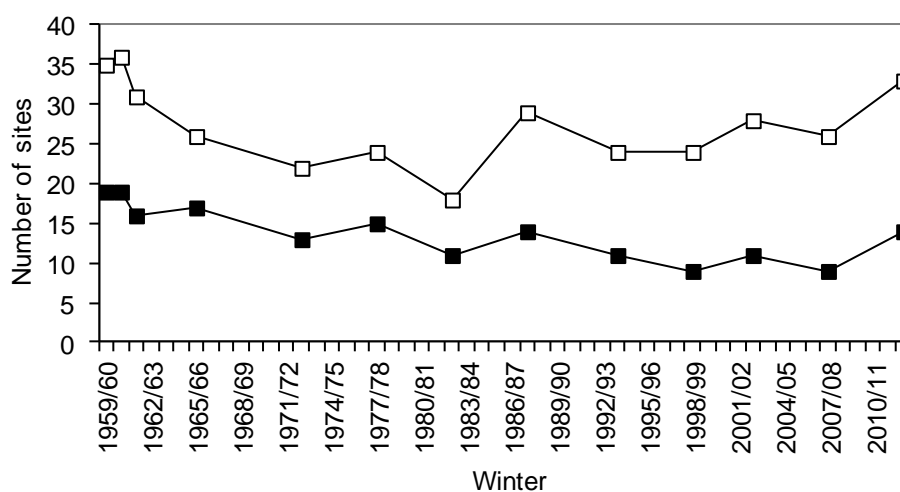


Figure 9 Number of sites in Britain and Ireland holding nationally or internationally important numbers of Greenland Barnacle Geese during census years, 1959/60 to 2012/13 (□ nationally important sites, ■ internationally important sites).

Many of the sites exceeding the threshold for international or national importance during the 2013 census are protected wholly, or in part, by classification as Special Protection Areas (SPAs) under the EC Birds Directive. Of those sites where numbers exceeded the international threshold, only Oronsay/Colonsay and South Walls are not classified as SPAs for Greenland Barnacle Geese. The latter is omitted from the current SPA boundary (despite consistently exceeding internationally important numbers since the 1980s) on the basis that it is an area of largely agricultural land rather than natural or semi-natural habitat. However, Switha, the principal roost site for the South Walls flock, is an SPA.

It is important to note that the site boundaries used in this census may not match site boundaries of SPAs, so the numbers quoted are indicative only. For example, over 44,000 Barnacle Geese were counted on Islay in March 2013, and some, but not all, of these use three SPAs where the geese are a qualifying species. Similarly on Tiree, geese counted there roost and feed both within and outwith the SPA boundary. On some offshore island groups, geese can be quite mobile, moving from within the SPA boundary to just outside it. This is particularly the case for North Uist Machair and Islands SPA where the geese range between several offshore islands, either within a day or between days. Wherever possible, allowances have been made to allocate counts of Greenland Barnacle Geese to functional feeding/roosting units that include SPAs. The number of Greenland Barnacle Geese wintering within and outwith SPAs merits further research and analysis.

Table 3 Sites holding Greenland Barnacle Geese that exceeded the 1% threshold for international importance (807 geese), national importance in Britain (632), and all-Ireland importance (175). Note that these are not the currently accepted national and international 1% thresholds, which remain 705 (Wetlands International 2012), 580 (Musgrove et al. 2013), and 90 (Crowe et al. 2008), respectively. The number recorded at each site during the 2013 census is given in parentheses.

Site name	SPA classification (<i>italics denote those sites where Greenland Barnacle Geese are a qualifying feature of the SPA</i>)
Sites holding >807 birds (internationally important) in March 2008:	
Islay (44,914)	<i>Gruinart Flats, Laggan, Bridgend Flats, Rhinns of Islay, Eilean na Muice Duibhe</i>
Tiree (4,518)	<i>Sleibhtean agus Cladach Thiriodh</i>
Oronsay/Colonsay (2,342)	
South Walls, Orkney (1,740)	<i>Switha (the main roost of the South Walls flock is an SPA)</i>
Kirkibost/Knockline, North Uist (1,064)	<i>North Uist Machair and Islands</i>
Coll (980)	<i>Coll</i>
Berneray, North Uist (975)	<i>North Uist Machair and Islands</i>
Boreray, North Uist (900)	<i>North Uist Machair and Islands</i>
Eilean Hoan, Sutherland (822)	<i>North Sutherland Coastal Islands</i>
Ballintemple/Lissadell, Co. Sligo (4,140)	<i>Ballintemple and Ballygiligan</i>
Inishkea Islands, Co. Mayo (2,250)	<i>Inishkea Islands</i>
Malin Head, Co. Donegal (1,800)	<i>Malin Head</i>
Dunfanaghy, Co. Donegal (1,215)	<i>Horn Head to Fanad Head</i>
Trawbreaga, Co. Donegal (890)	<i>Trawbreaga Bay</i>
Additional sites in Britain holding >632 birds (nationally important):	
Isle of Danna, Argyll (704)	
Additional sites in Ireland holding >175 birds (nationally important):	
St. Macdara's Island, Co. Galway (680)	<i>Slyne Head To Ardmore Point Islands</i>
Termoncarragh, Co. Mayo (640)	<i>Termoncarragh Lake & Annagh Machair</i>
Cross Lough, Co. Mayo (620)	
Rathlin O'Birne Island, Co. Donegal (560)	<i>Rathlin O'Birne Island</i>
Annagh Head, Co. Mayo (490)	<i>Termoncarragh Lake & Annagh Machair</i>
Inishshark, Co. Galway (454)	<i>High Island, Inishshark & Davillaun</i>
Mutton Island, Co. Clare (450)	<i>Mid-Clare Coast</i>

Site name	SPA classification (<i>italics denote those sites where Greenland Barnacle Geese are a qualifying feature of the SPA</i>)
Inishbarnog, Co. Donegal (340)	
Moynish More Island, Co. Mayo (320)	
Inishsirr, Co. Donegal (318)	<i>West Donegal Islands</i>
Birmore Island, Co. Galway (280)	<i>Slyne Head To Ardmore Point Islands</i>
Streedagh, Co. Sligo (246)	
Inishdooney, Co. Donegal (232)	<i>Inishbofin, Inishdooney & Inishbeg</i>
Carriglahan, Co. Mayo (225)	
Fallmore, Co. Mayo (205)	<i>Duvillaun Islands</i>
Kilmacannon, Co. Sligo (205)	<i>Ballintemple and Ballygiligan</i>
Roonagh Lough, Co. Mayo (200)	
Inishkeeragh, Co. Donegal (191)	<i>Illancrone & Inishkeeragh</i>

The suite of SPAs in Scotland and Ireland that have Greenland Barnacle Goose as a qualifying species, the proportion of the population that they held during the 2013 census and the current frequency of monitoring are shown in Tables 4 & 5. Overall, in March 2013, the suite of SPAs in Scotland held 91.2% of the national population and, in Ireland, the suite of SPAs there held 77.9% of the national population. Three of the nine SPAs in Scotland (Monach Isles, Shiant Isles and Treshnish Isles) did not hold internationally or nationally important numbers of Greenland Barnacle Geese and, in Ireland, 16 of the 22 SPAs did not hold internationally important numbers and nine did not hold nationally important numbers.

Table 4 Percentage of the international (biogeographical) and national population size of Greenland Barnacle Geese (80,670 and 63,170 geese, respectively) present in the SPA suite in Scotland in March 2013, and their current frequency of monitoring.

SPA code	SPA name	SPA total in March 2013	% of biogeographical population	% of national population	Frequency of monitoring
9003051, 9003052 and 9003053	Islay ¹	44,914	55.7	71.1	Annual
9003031	Coll ²	980	1.2	1.6	Annual
9001071	Monach Isles	482	0.6	0.8	c. 5 years
9001211	North Sutherland Coastal Islands ³	822	1.0	1.3	Annual (part)
9001051	North Uist Machair and Islands ⁴	3,947	4.9	6.2	Annual
9001041	Shiant Isles ⁵	200	0.2	0.3	c. 5 years
9002891	Switha ⁶	1,740	2.2	2.8	Annual
9002032	Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	4,518	5.6	7.2	Annual
9003041	Treshnish Isles	50	0.1	0.1	c. 5 years
TOTAL		57,653	71.5	91.2	

¹ Counts on Islay include geese using the Gruinart Flats (9003051), Bridgend Flats (9003052) and Laggan (9003053) SPAs. 44,914 geese were recorded at the time of the March 2013 census although a peak winter count of 46,903 had been recorded in December 2012.

² No Barnacle Geese were recorded on Gunna in March 2013. The Coll figure (980 geese) will include all geese using southern Coll, Crossapol and Gunna.

³ Includes counts from Eilean Hoan/Durness (where monitoring is annual) and Eilean nan Ron/Kyle of Tongue (less than annual monitoring).

⁴ Barnacle Geese can be quite mobile in North Uist using feeding and roosting grounds both within and outwith the SPA. The total of 3,947 geese was based on counts from Kirkibost/Knockline (1,064), Berneray (975), Boreray (900), Balranald/Goula (541), Baleshare (342), Vally (88) and Balemor/Paible (37). A count of 476 geese at Grenitote/Sollas/Malacate was not included in this total since this area is outside of the SPA.

⁵ 200 geese were recorded at the time of the March 2013 census although a peak winter count of c. 320-350 birds had been recorded in February 2013 (R.McKenzie pers. comm.)

⁶ Barnacle Geese feed at South Walls, Orkney (non SPA) and roost on Switha (SPA).

Table 5 Percentage of the international (biogeographical) and national population size of Greenland Barnacle Geese (80,670 and 17,500 geese, respectively) present in the SPA suite in Ireland in March 2013, and their current frequency of monitoring.

SPA code	SPA name	SPA total in March 2013	% of biogeographical population	% of national population	Frequency of monitoring
800004004	Inishkea Islands	2,250	2.8	12.9	Annual
800003034	Trawbreaga Bay	890	1.1	5.1	Annual
800004068	Inishmurray	17	0.02	0.1	c. 5 years
800004084	Inishglora & Inishkeeragh	0	-	-	c. 5 years
800004093	Termoncarragh Lake & Annagh Machair ¹	1,130	1.4	6.5	Annual
800004100	Inishtrahull	0	-	-	c. 5 years
800004111	Duvillaun Islands ²	205	0.3	1.2	c. 5 years
800004114	Illaunearaun	0	-	-	c. 5 years
800004116	Inishkeel	0	-	-	c. 5 years
800004120	Rathlin O'Birne Island	560	0.7	3.2	c. 5 years
800004121	Roaninish	100	0.1	0.6	c. 5 years
800004132	Illancrone & Inishkeeragh	191	0.2	1.1	c. 5 years
800004135	Ardbolin Island & Horse Island	0	-	-	c. 5 years
800004144	High Island, Inishshark & Davillaun	614	0.8	3.5	c. 5 years
800004170	Cruagh Island	150	0.2	0.9	c. 5 years
800004182	Mid-Clare Coast	450	0.6	2.6	c. 5 years
800004194	Horn Head to Fanad Head	1,215	1.5	6.9	Annual
800004083	Inishbofin, Inishdooley & Inishbeg	232	0.3	1.3	c. 5 years
800004230	West Donegal Islands	318	0.4	1.2	c. 5 years
800004234	Ballintemple and Ballygiligan ³	4,345	5.4	24.8	Annual
800004125	Magharee Islands	0	-	-	c. 5 years
800004159	Slyne Head to Ardmore Point Islands	960	1.2	5.5	c. 5 years
TOTAL		13,627	16.9	77.9	

¹ Termoncarragh held 640 geese and Annagh Head held 490 (total 1,130) at the time of the 2013 census, but a winter peak count of 1,677 geese was recorded under the Irish Wetland Bird Survey (I-WeBS).

² Comprises 205 geese feeding at Fallmore.

³ Includes counts at Ballintemple (4,140 geese) and Kilmacannon (205).

Peak counts during the non-breeding season from the late 1950s for the nine SPAs in Scotland and 14 of the 22 SPAs in Ireland (those where sufficient count data exist to show trends) are shown in Appendix 2.

The number of Greenland Barnacle Geese has increased at six of the nine SPAs in Scotland in line with the growth in the population (Table 6 & Appendix 2). All six sites either hold, or are close to, relatively large areas of managed grassland, particularly on Islay. Three SPAs have showed a decline in usage (Monach Isles, Shinat Isles and Treshnish Isles), despite an increase in the flyway population size (Table 6 & Appendix 2). These are relatively small offshore island groups with no areas of managed grassland, although to some degree, all have been summer grazed by sheep. Summer grazing has been identified as an important requirement for over-wintering Barnacle Geese (see Ogilvie *et al.* 1999). Any reductions in this management may be having an effect on numbers wintering at these sites. Islay supports five SPAs of which three have Greenland Barnacle Goose as a qualifying species (see Table 4). However, the geese occur over much of the managed grassland on Islay, both within and outwith the SPA boundaries.

In Ireland, the number of Greenland Barnacle Geese has increased at eight of the 14 SPAs, is stable at four SPAs and has declined at two (Duvillaun Islands and Mid-Clare Coast), for which sufficient data exist to examine trends (Table 6 & Appendix 2).

Table 6 Annual rates of change in the number of Greenland Barnacle Geese at SPAs in Scotland and Ireland¹.

SPA code	Site Name	Annual rate of change (1987/88 to 2012/13) ²	Trend	Comments
Scotland				
9003051, 9003052 and 9003053	Islay	3.4%	Increase	Trend has slowed to 0.4% in most recent 10 years
9003031	Coll	5.1%	Increase	Trend reversed to -5.5% in most recent 10 years
9001211	North Sutherland Coastal Islands	2.5%	Increase	
9001051	North Uist Machair and Islands	6.7%	Increase	
9002891	Switha	3.7%	Increase	
9002032	Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)	7.9%	Increase	Trend has slowed to 4.4% in most recent 10 years
9001071	Monach Isles	-2.1%	Decrease	
9001041	Shiant Isles	-2.1% ³	Decrease	
9003041	Treshnish Isles	-3.9%	Decrease	
Ireland				
800003034	Trawbreaga Bay	8.3%	Increase	
800004093	Termoncarragh Lake & Annagh Machair	7.7%	Increase	
800004120	Rathlin O'Birne Island	4.9%	Increase	
800004144	High Island, Inishshark & Davillaun	4.6%	Increase	
800004170	Cruagh Island	7.6%	Increase	
800004083	Inishbofin, Inishdoeey & Inishbeg	4.2% ⁴	Increase	
800004230	West Donegal Islands	1.1%	Increase	
800004234	Ballintemple and Ballygiligan	4.5%	Increase	
800004004	Inishkea Islands	0.0%	Stable	
800004121	Roaninish	-0.5	Stable	
800004132	Illancrone & Inishkeeragh	0.6%	Stable	
800004159	Slyne Head to Ardmore Point Islands	0.7% ⁴	Stable	
800004111	Duvillaun Islands	-1.1%	Decrease	
800004182	Mid-Clare Coast	-2.0%	Decrease	

Notes

¹ Annual rates of change are based on counts shown in Appendix 2. Some long term count 'sites' do not match SPA boundaries exactly.

² Annual rates of change calculated from 1987/88 to 2012/13 (*i.e.* includes counts from the most recent six international censuses) by regressing the logarithmically transformed count on year to give an annual (percentage) rate of change for the population.

³ Trend affected by a nil count in 1993/94 which has been removed to generate the trend.

⁴ Trend affected by a nil count in 1987/88 which has been removed to generate the trend.

4 Discussion and recommendations

4.1 Census total and accuracy

The population of Greenland Barnacle Geese, as surveyed at wintering sites in Britain and Ireland in March 2013, was 80,670, the highest total to date, having surpassed the previous peak count of 70,501 recorded in March 2008.

Count conditions were good, although local differences in the weather between Scotland and Ireland meant that the counts were not synchronised. All of the counts in Scotland were made over a three day period (15-17 March) and all of the counts in Ireland were made over a subsequent three day period (25-27 March). Although the counts in the two countries were *c.* 10 days apart, any movements of birds at this time of year were thought to have been small. Evidence from satellite tagged Greenland Barnacle Geese marked in west Ireland suggest that the marked geese began to move north no earlier than 10 April (L.Griffin pers. comm.) and, in an analysis of spring arrival dates in Iceland, Gunnarsson & Tómasson (2011) noted first arrivals around 15 April. Thus, it seems likely that the late count in Ireland took place before geese had started their spring migration (but see below).

Estimates derived visually during aerial survey – a potential source of inaccuracy – comprised only 6.9% of the census total.

Coverage was thought to be good with no known haunts of Greenland Barnacle Geese not checked during the census. However, no geese were recorded during the winter months, or at the time of the March census, at Tongue, Sutherland, an area which normally supports 130-242 birds. No birds were also recorded in Lewis, and it is thought that the three small flocks recorded there in March 2008 (Floday, Tolsta and Port of Ness) are no longer present. On the Shiantis (Minch), approx. 320-350 Barnacle Geese were counted flying towards the islands from the direction of South Harris on 23 February 2013 by SNH staff, but only 200 geese were seen at the time of the census (R McKenzie pers. comm.). White-tailed Eagle *Haliaeetus albicilla* and Golden Eagle *Aquila chrysaetos* activity on the Shiantis was apparent and may have caused disturbance to the over wintering flock of geese. The increase in number and range of White-tailed Eagles along the west coast of Scotland in the last twenty years may be having an impact on the number and distribution of over wintering geese, especially on smaller offshore islands. At Machrihanish (Kintyre), 34 Barnacle Geese were recorded on 6 March, but only four birds were counted at the time of the census.

However, considering the caveats outlined above, none are considered to substantially affect the census total and it is therefore recommended that the population estimate for Greenland Barnacle Goose is revised to 80,670 birds.

4.2 Timing and frequency of future surveillance

The current monitoring programme of one international census every five years appears inadequate in terms of providing sufficient understanding of changes in numbers, and the distribution and use of sites throughout the wintering range. It is therefore recommended that the frequency of the international census should be increased in order to better fulfil these objectives. However, to be effective an increase in the frequency of coordinated censuses would require the participation of both countries holding wintering Greenland Barnacle Geese.

Numbers of Greenland Barnacle Geese at several of the key sites are surveyed annually and, in some cases, at different times of the winter. However, there are limited data available for most other sites. As the international census has traditionally been undertaken in late March/early April approximately once every five years, it provides only a single ‘snapshot’ of the distribution across the non-breeding range, and gives little information on within-winter use of individual haunts, or between-year variation in site use. Indeed, given the departure of the geese on their northward spring migration, typically in mid-April (but see below), it is likely that, in some years, the distribution of geese at the time of the international census may not be representative of the typical mid-winter distribution. Consequently, the current dataset may not allow for the detection of all sites of national or international importance during the main wintering period. Past surveys have typically been made in single-engine aircraft, which are less powerful, generally slower, have shorter endurance, and are less able to fly through inclement weather to reach the more remote islands, and this, to some extent, dictated the timing of the census.

In more recent censuses, a twin-engine aircraft has been used in Scotland, and this gives greater scope for undertaking additional counts in, for example, mid-winter.

Evidence from the northward spring migration of Greenland White-fronted Geese suggest that the mean departure dates from Ireland/Scotland and the mean arrival dates in Iceland occur earlier in the spring than previously (A.D. Fox pers. comm.). An analysis of arrival dates of spring migrants recorded in Iceland suggested that, in recent years, Greenland Barnacle Geese had begun to arrive earlier in the year by approximately 0.67 days per year between 1988 and 2009, or by up to 14 days over the 21 year study period, although the first arrivals in the mid 2000s were on or about 15 April (Gunnarsson & Tómasson 2011). Thus, it seems prudent to continue to carry out future aerial surveys in either early or mid-March to avoid missing birds which may start their migration in early April.

Under the Environmental Protection Act 1990 (section 133(d)), one of the functions to be undertaken through the Joint Nature Conservation Committee (JNCC) is the establishment of Common Standards Monitoring (CSM) of designated sites in Britain to allow reliable assessment of the conservation status of key interest features, to identify those factors considered to be adversely affecting the feature, and to identify priorities for action at a local and national scale (JNCC 2004, Williams 2006). For those protected sites where birds are a notified or qualifying interest feature, the minimum requirement for CSM is one survey per cycle of six years. If, however, the feature is based on the number of geese at a site, it is recommended that surveys are conducted in at least three different relevant seasons within the six-year cycle. An average of three or more counts could then be used to assess the feature condition against pre-set targets and allow confident judgement of the trend in condition of the interest feature. Some SPAs are counted annually (see Tables 4 and 5) although offshore islands, necessitating aerial survey, are often counted less frequently (generally once every five years as part of the international census). It is therefore recommended that additional counts are undertaken across the complete SPA network where coverage is currently less than annual, particularly those sites that are counted less than three times in every six years. This will require the use of aerial survey to count inaccessible offshore islands.

The suite of sites counted annually should be appraised to ensure that they give a reliable indication of the population trend between years when complete censuses take place. The feasibility of additional mid-winter counts, to better ascertain the mid-winter distribution and identify those sites which are important at that time of year, should also be explored to help improve knowledge of site use and potential impacts of changing site and population management (see below). It is important to note that this is not an exhaustive list of monitoring needs for the proposed population management; this needs to be undertaken thoroughly as part of the scheme design.

4.3 Additional surveillance and needs for population management

The Scottish Government/Scottish Natural Heritage are proposing to maintain the shooting of Greenland Barnacle Geese on Islay at a level of approximately 1,800 birds per annum from winter 2013/14, increasing to 2,300 birds if the population counts in November and December show that the number on Islay have not decreased as a result of the previous year's shooting activity. Plans are also underway to introduce an Adaptive Management Scheme on Islay, which may involve an increase in the number of geese shot, beyond 2013/14. Given this, there is a need for further surveys, in addition to those carried out for population status assessment that ensure adequate information is available to underpin any proposed population management and investigate the possible displacement of Greenland Barnacle Geese from Islay as a consequence of the shooting.

5 Acknowledgements

Aerial counts were greatly assisted by pilots Dave Rutter (Scottish survey) and Lt. Michael Barcoe (Irish survey) and we would like to thank Ravenair and the Irish Air Corps for providing both pilots and planes.

Morven Laurie and numerous counters undertook ground counts on Islay. Pat & Dave Batty, John Bowler, Paul Boyer, Jamie Boyle, Ben Jones, Russell Jones, Bob McMillan, Eric Meek, Donald Mitchell, Malcolm Ogilvie, Mike Peacock, Hazel White provided counts and valuable advice about the status of winter flocks in Scotland.

The National Parks & Wildlife Service, BirdWatch Ireland and several volunteers provided ground counts for Irish sites: thanks go to Dermot Breen, David Cabot, Cameron Clotworthy, Olivia Crowe, Martin Enright, Leonard Floyd, Jenny Fuller, Emmet Johnston, Emer McGee, Eoin McGreal, Gerry Murphy, Irene O'Brien, Aonghus O'Donail, Tim Roderick, Ralph Sheppard, Andrew Speer, David Suddaby and Fiona Wheeldon. Grateful thanks to all and apologies to anyone inadvertently omitted.

Count data from Ireland were kindly provided by Alyn Walsh and David Tierney of The National Parks & Wildlife Service.

We gratefully acknowledge the financial contribution from Scottish Natural Heritage and the Wildfowl & Wetlands Trust for survey in Scotland and from the National Parks and Wildlife Service for survey in Ireland. Comments on an earlier draft of this report were provided by Rae McKenzie, Jessica Shaw, Alyn Walsh, David Tierney, Richard Hearn & Baz Hughes.

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Appendix 1. Sites with nil Greenland Barnacle Geese during the March 2013 census

Ireland					
Kerry	Beginish	V2898	Am Froach	NR4662	
	Young's Island	V2899	Brosdale Island	NR4962	
	Magharee Islands	Q6121	Eilean nan Gabhar	NR5367	
Clare	Loop Head	Q6847	Eilean nam Coinean	NR5468	
	Mattle Island	Q9772	Eilean Bridhe	NR5569	
Galway	Aran Islands	L8609	Eilean Mor (Jura)	NM6701	
	Gorumna island	L8824	Sound of Jura	Eilean Mor (Kintyre)	NR6675
	Mason Island	L7429	Corr Eilean	NR6775	
	CroaghnaKeela Island	L6832	Eilean Nan Coinean	NR7186	
	Illaunnacroagh Mór	L6934	Eilean Dubh	NR7187	
	Illaunnacroagh Beg	L6934	Carsaig	NR7389	
	Freaghillaun North	L6665	Eilean nan Cille	NR7597	
	Slyne Head	L5241	Reisa an t-Sruith	NR7399	
	Inishbofin	L5366	Reisa Mhic Phaidean	NM7501	
Mayo	Inishturk	L6174	Eileach an Naoimh	NM6409	
	Ballybeg	L6475	A'Chuli	NM6511	
	Caher Island	L6676	Garbh Eileach	NM6611	
	Clare Island	L6885	Dun Chonnuill	NM6812	
	Achilbeg Island	L7192	Eilean Dubh Mor	NM6910	
	Achil Island	L6704	Eilean Dubh Beg	NM6911	
	Inishkeeragh	F6030	Lunga	NM7008	
	Inishglora	F6131	Fiolan Meadhonach	NM7109	
	Stags of Broadhaven	F8448	Rubha Fiola	NM7110	
	Pig Island	F8844	Ormsa	NM7111	
	Illaunmaster	F9343	Eilean Mhic Chiarain	NM7211	
	Horse Island	F9842	Belnahua	NM7112	
	Donegal	Inishduff	G6472	Insh Island	NM7319
Inishkeel		B7000	Bach	NM7726	
Cruit Island		B7320	Eilean nan Gamhna	NM8338	
Owey Island		B7123	Eilean na Cloiche	NM8338	
Inishfree lower		B7524	Eilean Dubh	NM8339	
Gola Island		B7636	Eilean Dubh	NM8742	
Torey island		B8546	Bernera	NM7939	
Glashedy Island		C3752	Eilean Muisdale	NM7835	
Inishtrahull		C4965	Mull	Eilean Mor	NM3416
Loughros Bay	G6493		Eilean a Chalmain	NM3017	
Scotland				Eilean Dubh	NM3018
	Islay and Islands	Texa	NR3943	Eilean nam Muc	NM2819
		Eilean Bhride	NR4547	Eilean Dubh	NM2820
		Eilean a'Chuirn	NR4748	Eilean Ghomain	NM2820
	Nave Island	NR2875	Soa	NM2419	
Jura	Glas Eilean	NR4464	Iona	NM2723	
			Inchkenneth	NM4335	
			Little Colonsay	NM3736	

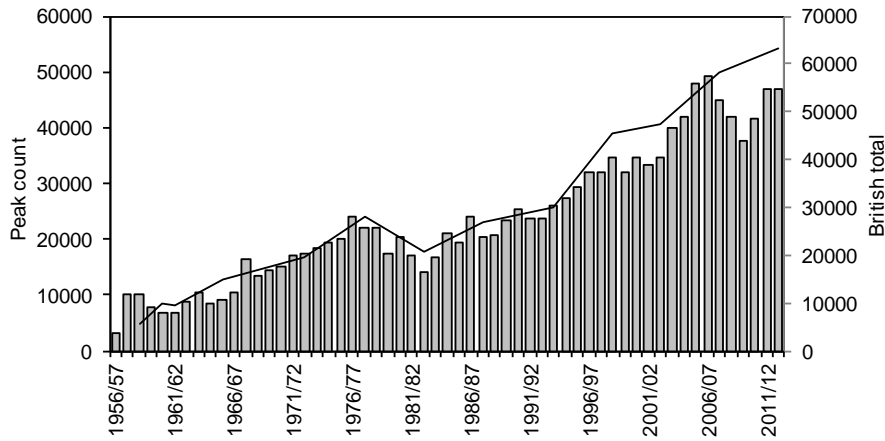
Treshnish Is	Staffa	NM3235	Monach Isles	Shillay	NF5962	
	Bac Beag	NM2437	Noth Uist	Beinn Bhaile	NF7168	
	Bac Mor	NM2438		re-seeds	NF7371	
	Lunga	NM2441		Balmartin	NF7273	
	Small Isles	Fladda	NM2943		Ben Scolpaig	NF7376
		Burgh More	NM3044	North Uist	Aird Mhic Caoilt	NF7875
		Burgh Beg	NM3044		Oronsay	NF8475
			Newton		NF8877	
Wester Ross		Eigg	NM3971	Sound of Harris	Gumersam Mhor	NG0282
		Canna/Sanday	NG2505		Gumersam Bheag	NG0381
Skye		Longa	NG7377		Langay	NG0182
	Eilean Furadh	NG7993	Gilsay		NG0280	
Islands south of Barra	Wiay	NG2936	Lingay		NG0179	
	Turner	NG2939	Groay		NG0079	
	Harlosh	NG2739	Scaravay		NG0178	
	Mingay	NG2257	Narstay		NF9777	
	Ascribs (South Ascrib)	NG3063	Opsay		NF9876	
	Ascribs (Eilean Garave)	NG2964	Sarstay		NF9776	
	Ascribs (Eilean Iosal)	NG2865	Hermetray		NF9874	
	Eilean Flodigarry	NG4871	Huletray		NF9875	
	Sgeirna Eireann	NG4872	Vaccasay		NF9775	
	Fladda-chuain	NG3861	Groatay		NF9873	
Sound of Barra	Berneray	NL5680	Tahay		NF9775	
	Mingulay	NL5683	Sursay		NF9676	
	Geirum More	NL5581	Votersay	NF9575		
	Solon Mor	NL5784	Stromay	NF9475		
	Solon Beg	NL5784	Torogay	NF9278		
	Outer Heisker	NL5786	Lingay	NF8778		
	Pabbay	NL6087	Pabbay	NF8988		
	Lingay	NL6089	Shillay	NF8891		
	Greanamul	NL6289	West Coast Harris	Gasker	NA8711	
	Flodday	NL6192		Soay Mor	NB0605	
	Sandray	NL6491		Soay Beg	NB0505	
	Muldoanich	NL6096		Fladday	NA9915	
	Biruaslum	NL6096		Kearstay	NA9617	
	Vatersay	NL6395		Greine Sgeir	NB0116	
		Liongam		NA9919		
		Eilean Mealastadh		NA9821		
		Greineim	NA9825			
		Eilean Molach	NA9932			
		Loch Roag Lewis	Old Hill	NB1143		
			Bereasaidh	NB1242		
			Floday	NB1241		
			Campay	NB1442		
			Cealasaidh	NB1441		
			Little Bernera	NB1440		

	Pabay Mor	NB1038	Eilean Mullagrach	NB9511	
	Vacsay	NB1137	Eilean Mor	NC0517	
	Vuia Mor	NB1335	Froachlan	NC0518	
	Floday	NB1033			
	Vuia Beg	NB1233			
Loch Eristort Lewis	Tabhaidh Mhor	NB4222	West Sutherland coast	A'Chleit	NC0220
	Tabhaidh Bheag	NB4122		Soyea	NC0421
	Tarnt Braigh	NB4023		Eilean Chrona	NC0633
				Mor	NC1238
Shiantis	Eilean an Tighe	NG4297		Meall Beg	NC1337
	Garbh Ebn	NG4198		Badcall Bay	NC1540
				Handa	NC1348
Wester Ross	Longa	NG7377		Loch Laxford	NC2050
	Priest Island	NB9202		Eilean a' Chunnaidh	NC2057
	Bottle Island	NB9501		Am Balg/En Buigach	NC1866
	Carn Iar	NB9602		Eilean an Roin Mor	NG4198
	Carn Deas	NB9602			
	Eilean Dubh	NB9703	North Sutherland Coast	An Garbh-eilean	NC3373
	Horse Island	NC0204		Eilean Cluimhrig	NC4665
	Meall nan Gabhar	NC0205		Rabbit Island	NC6063
	Tanera More	NB9807		Sgeir an Oir	NC6164
	Tanera Beg	NB9607		Eilean Iosa	NC6365
	Eilean Fada Mor	NB9707		Coomb Island	NC6664
	Eilean a'Char	NB9608			

Appendix 2. Long-term trends on SPAs

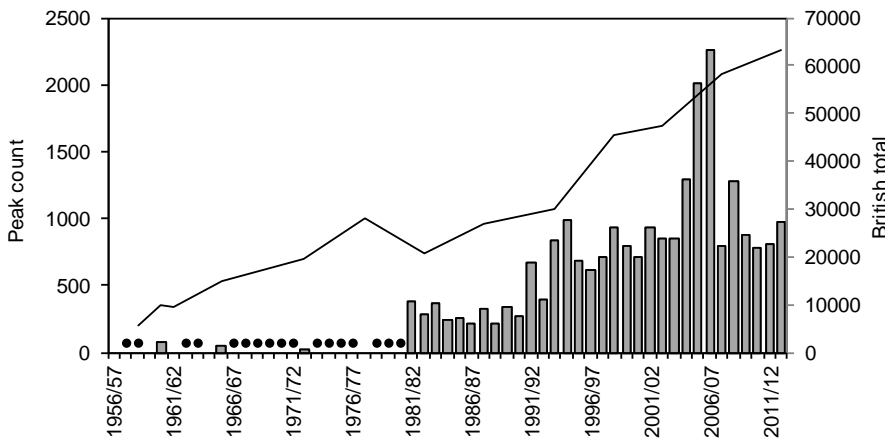
Maximum winter numbers of Greenland Barnacle Geese at nine SPAs in Scotland (Figures 1–9) and in Ireland (Figures 10–23), 1956/57–2012/13. Bars indicate maximum winter count. Dots indicate years when no data were collected. Lines indicate national total based on international censuses. Note that some long term count ‘sites’ do not match SPA boundaries exactly.

1) Islay¹, Scotland.

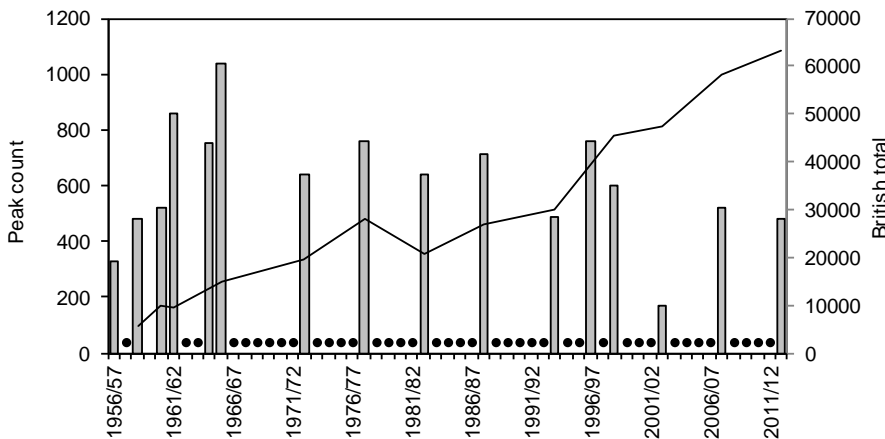


¹ Counts on Islay include geese using the Gruinart Flats, Bridgend Flats and Laggan SPAs as well as geese feeding outwith the SPA areas.

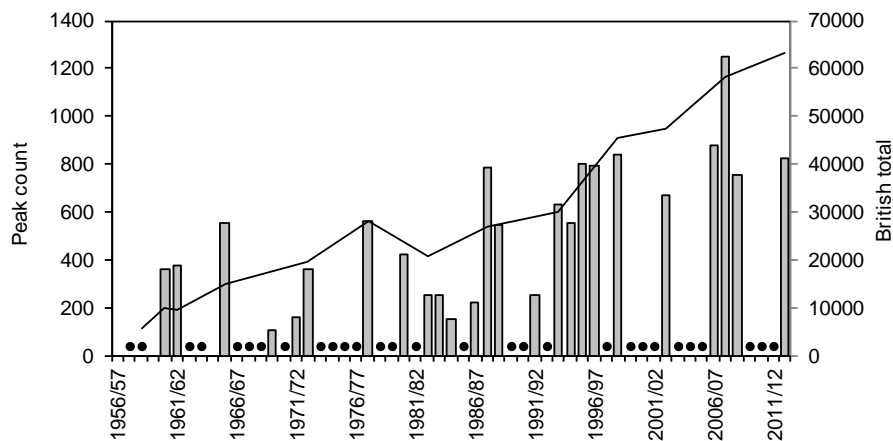
2) Coll, Scotland.



3) Monach Isles, Scotland.

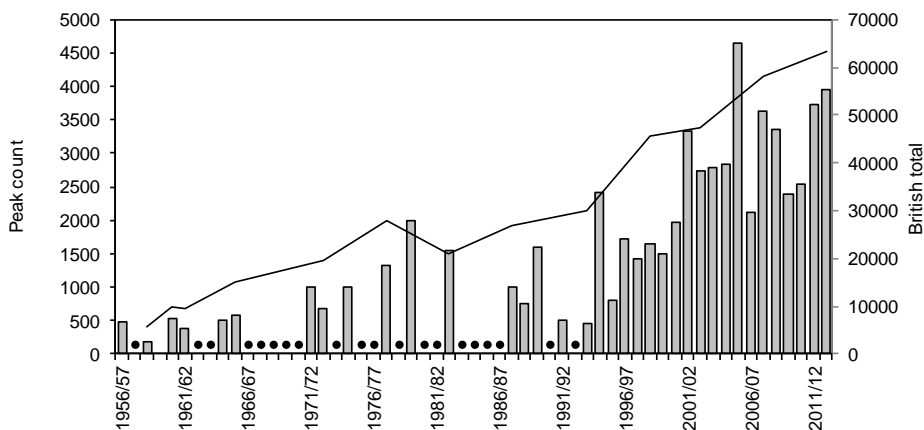


4) North Sutherland coast², Scotland.



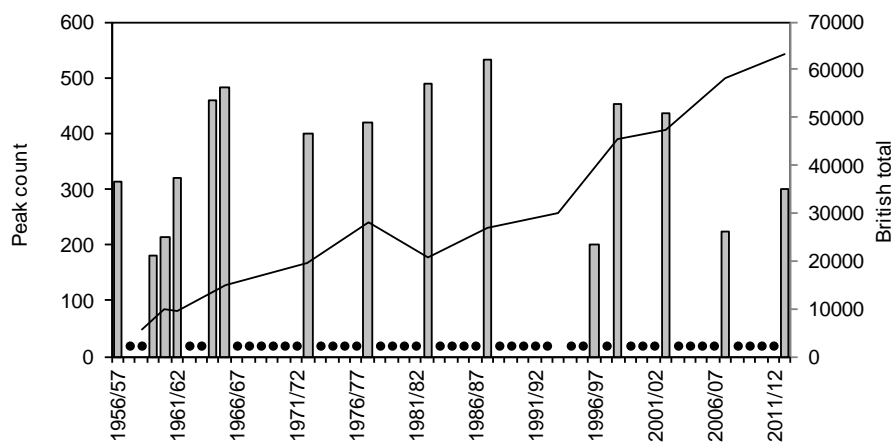
² Graph includes counts from Balnakeil (NC3968), Eilean Hoan (NC4467), Eilean nan Ron (NC6365), Neave Island (NC6664), Rabbit islands (NC6063) and mainland around the Kyle of Tongue.

5) North Uist Coast and Islands³, Scotland.

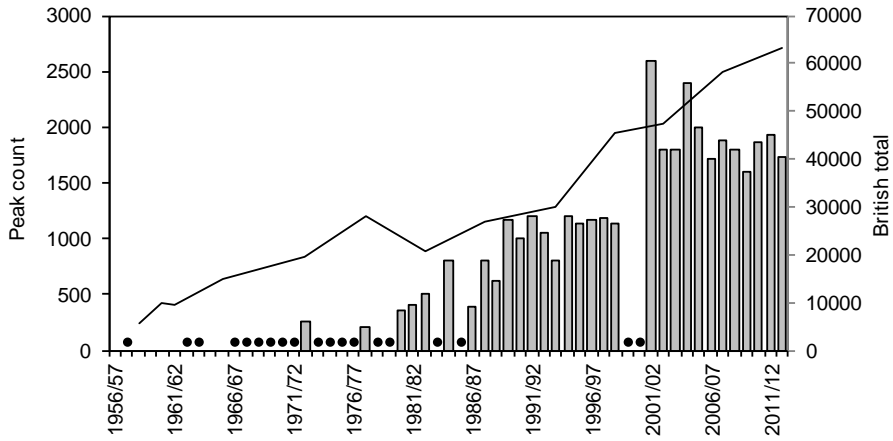


³ Graph includes counts from all islands and mainland within the SPA.

6) Shiant, Scotland.

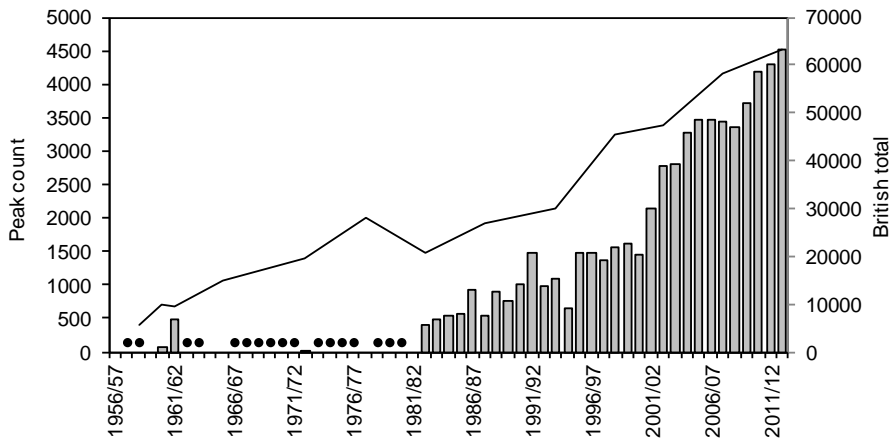


7) Switha (South Walls, Orkney)⁴, Scotland.



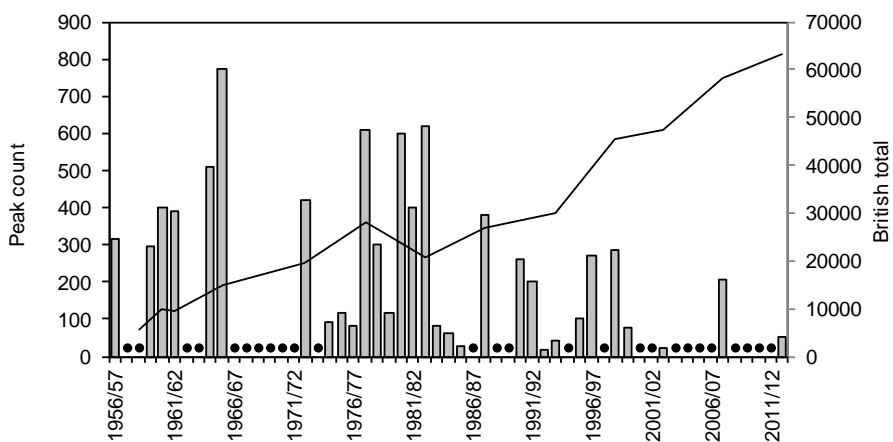
⁴ The island of Switha (ND3690) is an SPA, and where the geese roost. However, the daytime feeding grounds are on a nearby island (South Walls, ND3189) which is not protected.

8) Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast)⁵, Scotland.

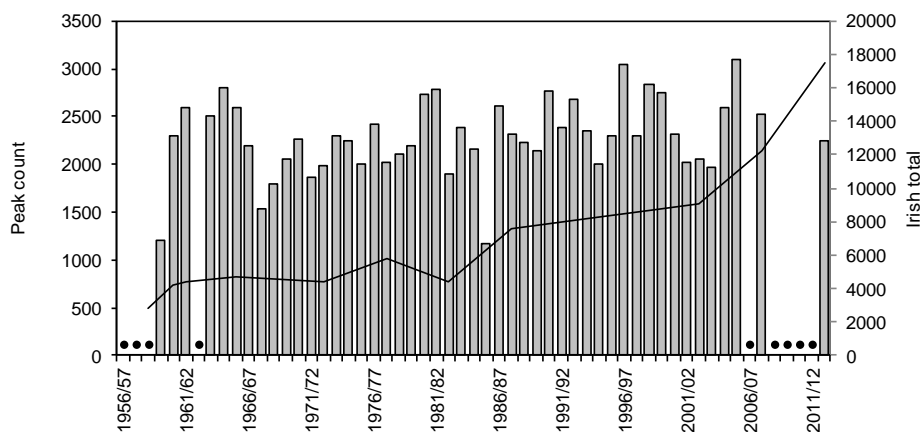


⁵ Counts on Tiree include geese using the Sleibhtean agus Cladach Thiriodh SPA as well as geese feeding outwith the SPA.

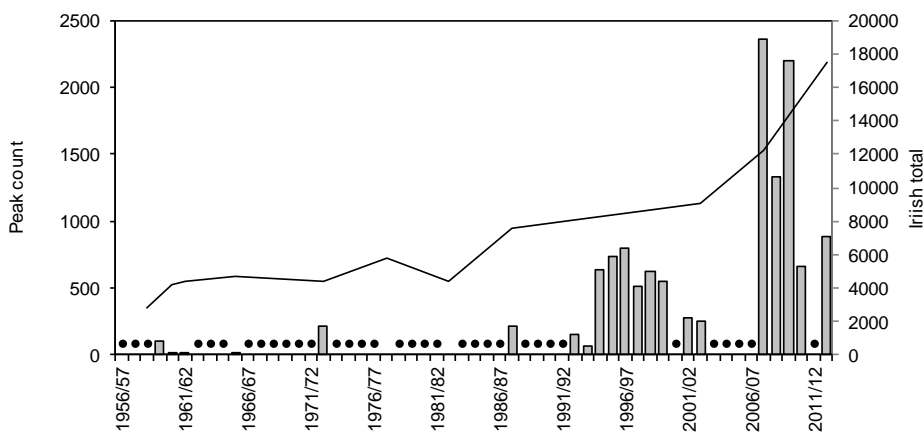
9) Treshnish Isles, Scotland.



10) Inishkea Islands, Ireland.

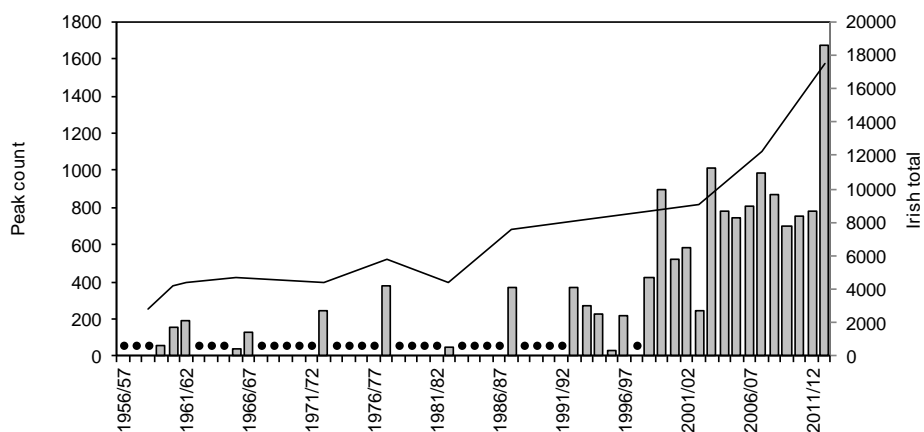


11) Trawbreaga Bay¹, Ireland.



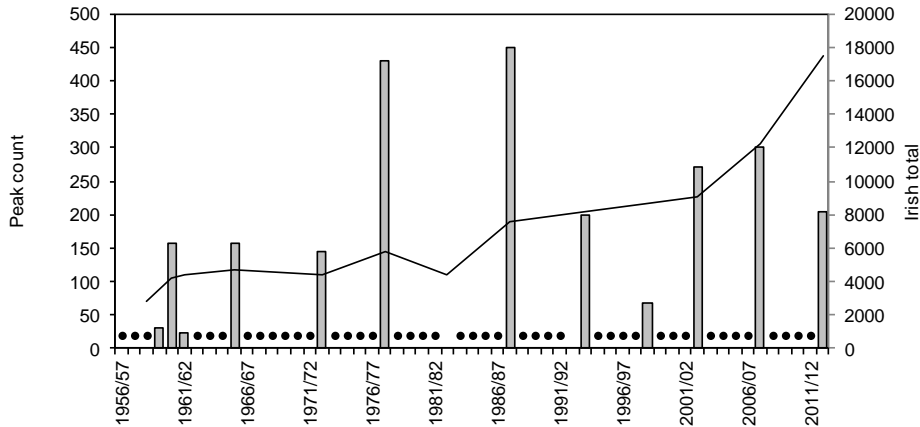
¹ Graph includes counts from Glashedy Island (C3752), Trawbreaga Bay (C4549), Doagh Isle (C4150), Malin Head (C4159), Stookaruddan (C4557), the Garvan Islands (C4360) and Inishtrahull (C4965).

12) Termoncarragh Lake & Annagh Machair², Ireland.



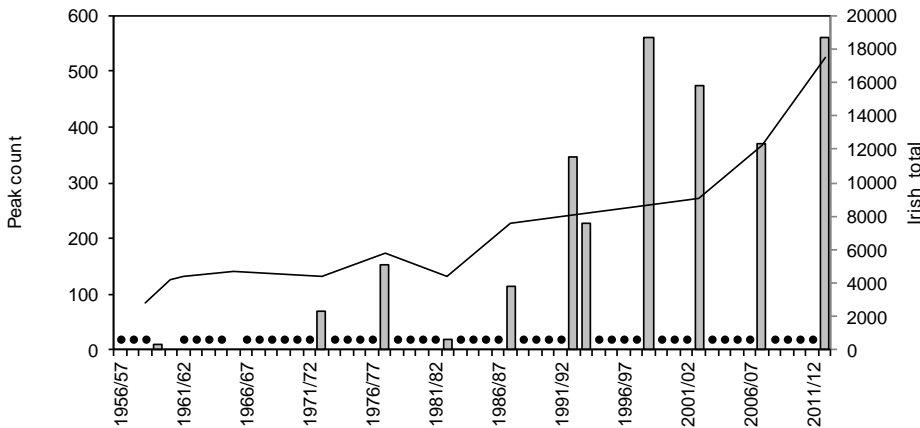
² Graph includes counts from Termoncarragh Lake (F6435), Erris Head (F7041), Illanleamnahely (F6538), Inishglora (F6131) and the Mayo Inishkeeragh Island (F6030).

13) Duvillaun Islands³, Ireland.

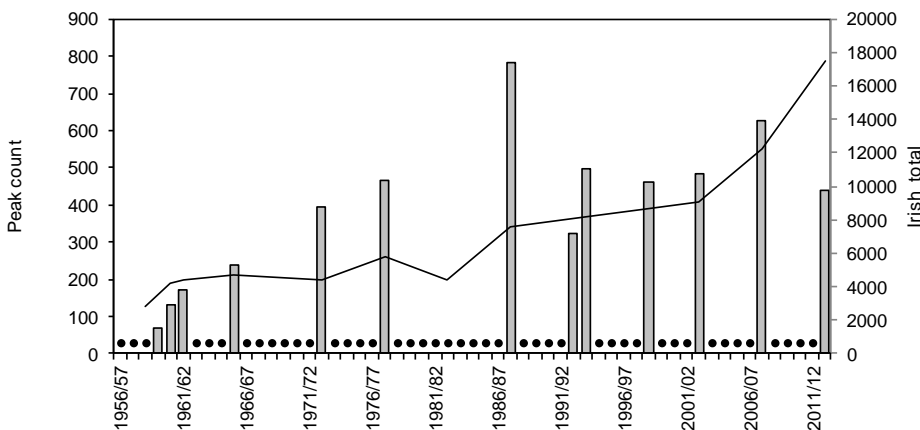


³ Graph includes counts from Duvillaun More (F5816), Duvillaun Beg (F5916), Gagta Island (F6017), Leamareha Island (F6117) and Fallmore on the mainland nearby (F6218).

14) Rathlin O’Birne Island, Ireland.

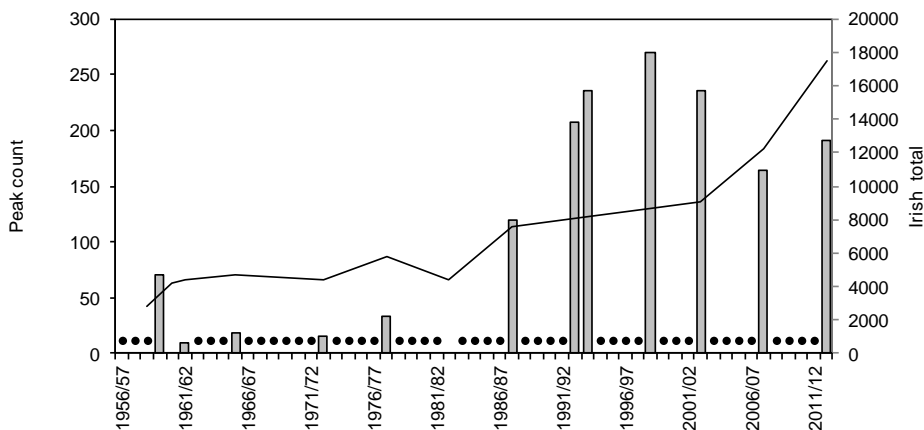


15) Roaninish⁴, Ireland.



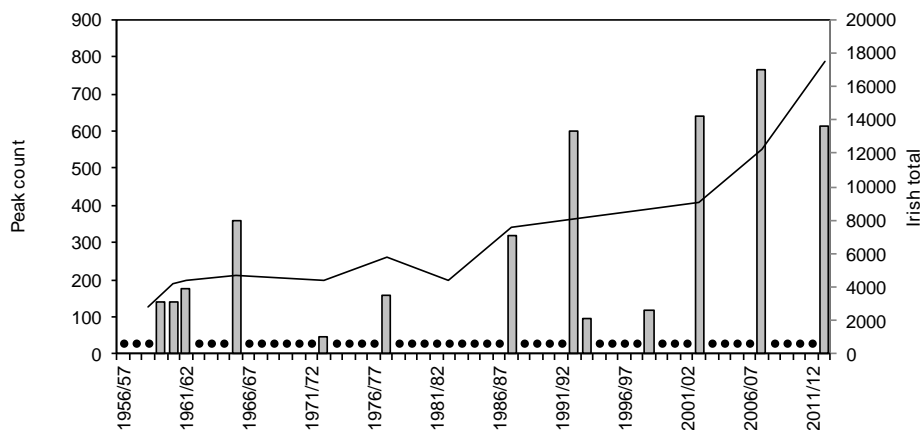
⁴ Graph includes counts from Loughros Point (G6493), Roaninish (B6502), Inishbarnog (G6496), Dawros Head (G6498), Sheskinmore Lough (G6895) and Inishkeel (B7000).

16) Illancrone & Inishkeeragh⁵, Ireland.



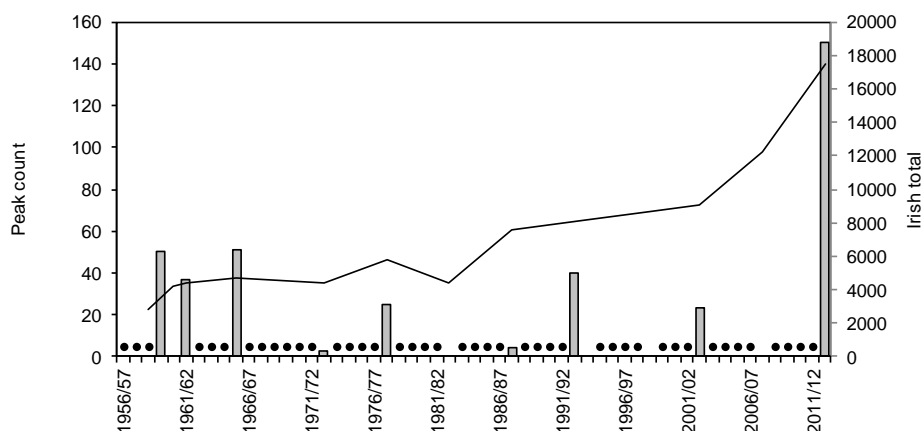
⁵ Graph includes counts from the Donegal Inishkeeragh Island (B6812), Illancrone (B6910), Inishfree Upper (B7112), Rutland Island (B7114), Aranmore Island (B6815) and Inishinny (B7118).

17) High Island, Inishshark & Davillaun⁶, Ireland.

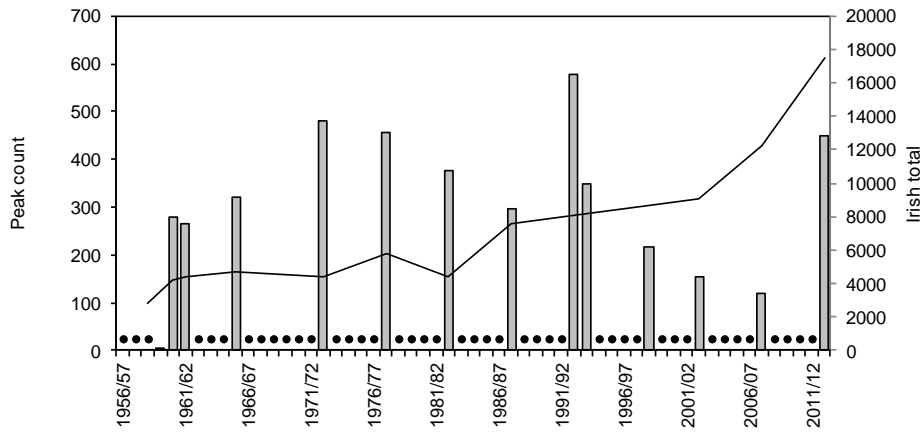


⁶ Graph includes count from Inishbofin (L5366), Inishshark (L4865), Inishgort (L5063), Inishskinny (L5164), Inishlyon (L5765), Davillaun (L5966), Lecky Rocks (L6065) and Black Rock (L4963).

18) Cruagh Island, Ireland

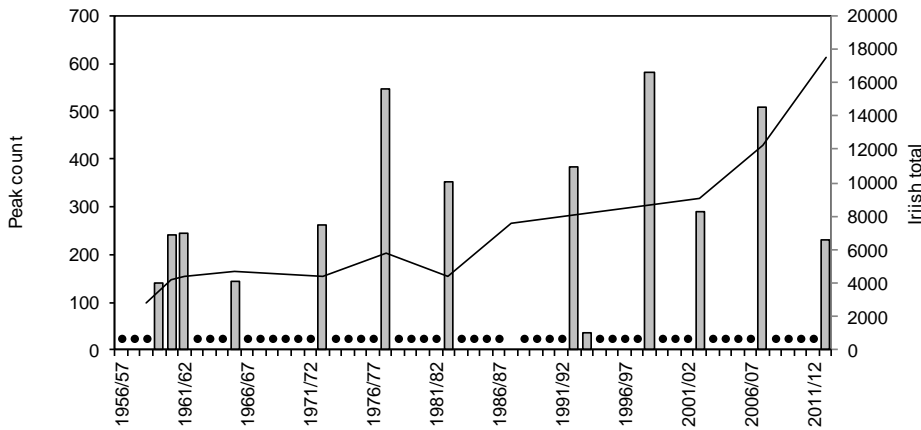


19) Mid Clare Coast⁷, Ireland.

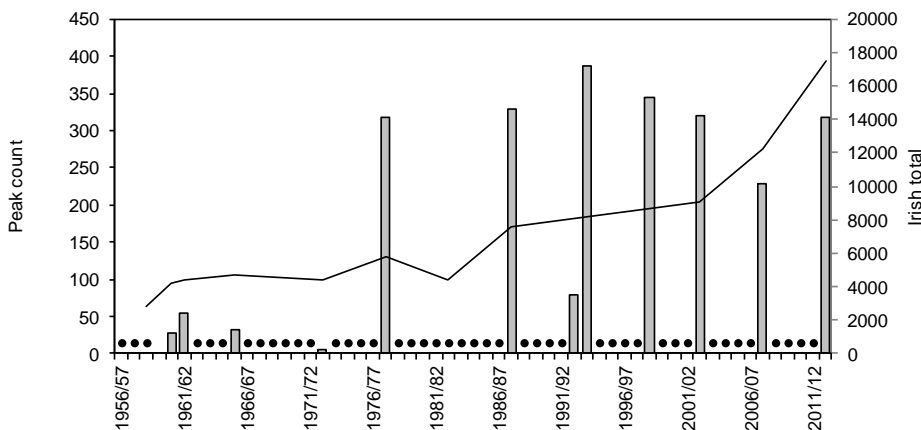


⁷ Graph includes counts from Ballard Bay (Q9166) and Carrowmore Point (Q9870) on the mainland and Mutton (Q9774) and Mattle (Q9772) Islands.

20) Inishbofin, Inishdooyey & Inishbeg, Donegal, Ireland.

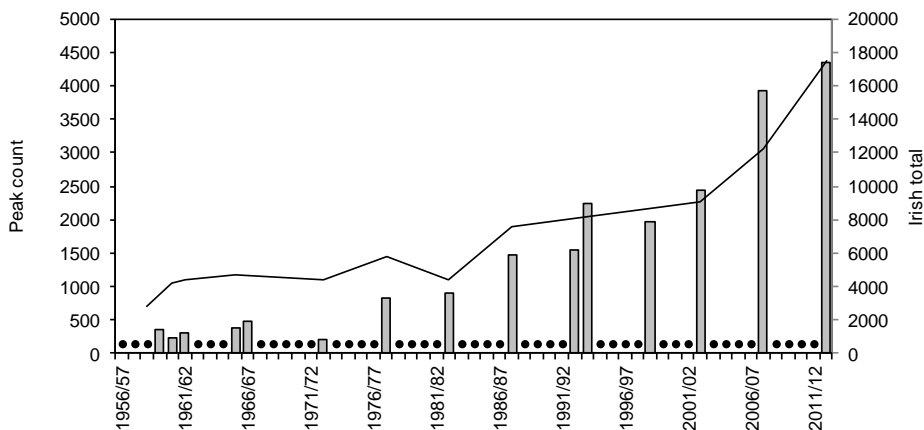


21) West Donegal Islands⁸, Ireland.



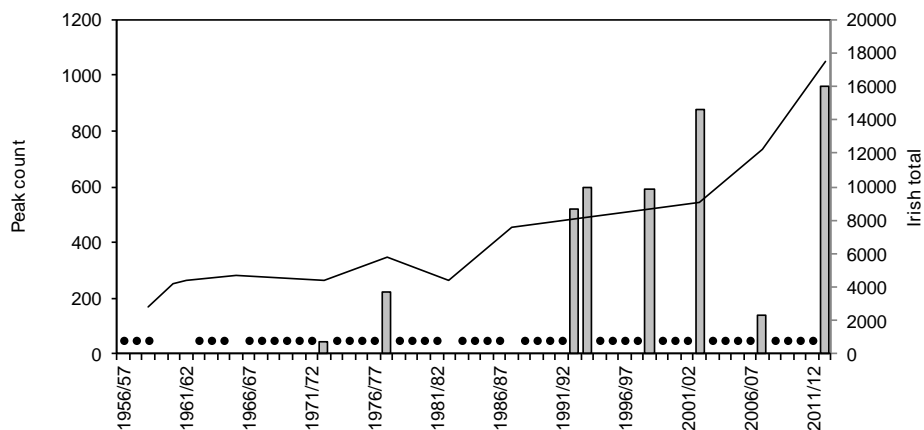
⁸ Graph includes counts from Inishsirrer (B7830), Owey Island (B7123), Inishillintry (B7322), Inishfree Lower (B7524), Gola Island (B7636), Umfin Island (B7638) and Inishmeane (B7828).

22) Ballintemple and Ballygiligan⁹, Ireland



⁹ Graph includes counts from Lissadell (G6243), Ballintemple (G5843), Streedagh Point (G6351), Conor’s Island (G6652), Inishmurray (G5754), Ardboline (G5544) and Horse Island (G5644).

23) Slyne Head to Ardmore Point Islands¹⁰, Ireland.



¹⁰ Graph includes counts from St. Macdara’s Island (L7230), Inishsherk (L8323), Dinish (L8325), Birmore Island (L8026), Inishmuskerry (L7826), Duck Island (L7627), Mason Island (L7429), Croaghnaekeela Island (L6832), Freaghillaun (L7335), Inishlacken (L7237), Earawalla Point (L6937), Bertraghboy Bay (L7538) and Illaunacroagh (L6934).