



Plate 2. Bass Rock, the world's largest Gannet colony, 23 June 2014. © S. Murray

The status of the Gannet in Scotland in 2013–14

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All 16 Gannet colonies in Scotland were counted in 2013–14. Combined colony totals indicated that Scotland currently holds 243,505 apparently occupied sites (58% and 46% of the east Atlantic and world populations, respectively). Numbers were divided very unevenly between the colonies with Bass Rock (now the world's largest colony), St Kilda and Ailsa Craig together holding 70% of the Scottish population. Gannets started to nest on Barra Head, Berneray in 2007 and breeding may now be regular on Rockall. Numbers at St Kilda, Sule Stack and Scar Rocks were stable, but all other colonies had increased, some spectacularly. Overall the Scottish population increased by 33% between 2003–04 and 2013–14 at an average rate of increase of 2.9% per annum. Although the Gannet appears less vulnerable to climate change than many other UK seabirds, the proposed construction of major offshore wind farms close to colonies in the North Sea and the imminent ban on fishery discards, could pose future threats to this species.

Introduction

Decadal counts of the number of Gannets *Morus bassanus* at colonies in Britain and Ireland have been made since the 1980s (Murray & Wanless 1986, 1997, Murray *et al.* 2006). At the time of the last census in 2003–04, Scotland had 14 gannetries containing 182,511 apparently occupied sites, which represented 58% of the total for the east Atlantic and 44% of the world populations, respectively (Murray *et al.* 2006). Numbers at most colonies were increasing and new gannetries had been founded at Sule Skerry (2003) and Westray (2003). However, the overall rate of increase of the Scottish Gannet population appeared to have slowed compared to the previous 20 years. Given that widespread declines of seabird species have been reported at Scottish colonies since 2000 (Miles 2013), the 2013–14 Gannet survey provided an ideal opportunity to assess the current status of one of Scotland's most iconic species.

Methods

Aerial surveys of St Kilda, the Flannan Isles, Sula Sgeir, Sule Stack and Sule Skerry were made in 2013 under contract to Scottish Natural Heritage (SNH) and full section-by-section details of these counts are given in Wanless *et al.* (2015). Further aerial surveys of Scar Rocks, Ailsa Craig, Hermaness, Troup Head and Bass Rock were made in 2014 in collaboration with the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS). Other observers counted Foula in 2013 and Barra Head (Berneray), Rockall, Westray, Hermaness (land and sea count), Noss and Fair Isle in 2014. The counts of the Bass Rock and Scar Rocks are documented in detail in Murray *et al.* (2014b,c) and the current paper concentrates on the counts of colonies not detailed elsewhere and gives an overview of the state of the Scottish population in 2013–14.

The 2013–14 survey was carried out using similar methods to those adopted in 1984–85 and refined in 1994–95 and 2003–04. Thus, where possible, colonies were photographed from the air and the numbers of apparently occupied sites (AOS, a site occupied by one or two Gannets irrespective of whether nest material was present) were counted. Although non-breeding birds in ‘club’ areas are easily distinguished when counts are made from the land or sea, they can cause problems during aerial surveys. In practice, most non-breeders fly off in response to the aircraft; those that remain are usually obvious due to (a) the irregular spacing of birds/pairs compared to site holders/nest holders, and (b) the lack of guano that makes the club areas less white than breeding areas. In 2013–14 visits were made to check colony boundaries and the locations of clubs at St Kilda, Flannan Isles, Sula Sgeir, Troup Head, Hermaness, Bass Rock and Ailsa Craig.

Prior to the current survey counts were done by marking AOS either directly on colour prints, or after projecting colour transparencies onto a flat white surface. However, in 2013–14, digital cameras were used for the aerial surveys and the downloaded images were counted on computer screens using either Photoshop or Paint Shop Pro 7 software. This enabled images to be viewed at different magnifications and colour contrasts and each AOS was blocked out with a dot using the paintbrush option. Dot colour was changed after every 100 AOS to facilitate keeping a rough tally of the total and a tally counter was used to keep an accurate running score. Counts were made independently by two or more experienced counters, without knowledge of totals recorded by the other counters, to prevent subconsciously counting high or low because of prior information. Elsewhere, counts were made directly in the field, sometimes augmented by photographs taken from the sea or land. In these cases, the unit was the apparently occupied nest (AON, one or two birds at a site with nest material present). Sites with a chick, but no obvious nest, were included in this category. Neither count unit provides an unbiased estimate of the number of breeding pairs, nor is it strictly correct to equate occupied sites with pairs, as some sites may be held by a single bird for at least a year (Nelson 1978). The unavoidable lack of cross-colony standardisation makes it impossible to calculate a grand total for Scotland in terms of a common unit. Our estimates of the Scottish population, and the east Atlantic and world totals, are therefore, a combination of totals of AOS at the majority of colonies and a few counts of AON. No correction factors were applied to either unit, and for convenience the grand total, is expressed as AOS. Surveys were mainly carried out in June or July, except for Barra Head (May) and the Hermaness aerial survey (August).

Replicate counts during this and previous censuses indicate that within and between observer errors are typically between 5–10% (Murray & Wanless 1986, 1997). Differences between counts made in 2003–04 and 2013–14 of <10% could, therefore, potentially be due to observer error rather than real changes in numbers. Accordingly, changes of <10% were assumed to indicate no significant overall change and an approximately stable population. For all colonies images were checked to pinpoint any major changes in colony extent or nesting density between surveys. Unless otherwise stated, counts from 2003–04 and 2013–14 are directly comparable.

To set the 2013–14 results in context, all counts since 1900 known to us can be found in the papers listed in the references and are plotted in Figure 2 (colonies established prior to 1930) and Figure 3 (colonies founded since 1930).

Results

All 14 gannetries that were active in Scotland in 2003–04 were occupied in 2013–14, a new colony has become established on Barra Head (Berneray) and breeding on Rockall appeared to have become more regular (Figure 1). Below we present the 2013–14 counts in detail and summarise the current status of each colony in terms of changes since 2003–04 and in some cases over the longer term.

Scar Rocks (established in the 1930s, numbers stable, colony probably full)

An aerial survey on 23 July 2014 indicated that there were 2,376 AOS on Scar Rocks, a total that was almost identical to that in 2004 (2,394 AOS). Careful scrutiny of the images indicated that there is very little unoccupied, suitable nesting habitat left and the colony is probably at, or very close to, maximum capacity.

Ailsa Craig (occupied since the 16th century, increasing)

Counts by three observers of images taken on 16 June 2014, were highly consistent (range: 32,503–33,132 AOS) and gave a mean total of 33,226 AOS (Table 1). At face value this suggested an increase of 22% since 2004. However, the 2004 count was unusual in that in contrast to most of the other Scottish gannetries, numbers on Ailsa Craig had declined since the previous survey in 1995. Inspection of the 2004 photographs revealed that the decrease seemed to be due to a decline in breeding density throughout the colony, most notably in the almost empty areas apparent within Section 9/10/11. The overall total for 2014 is very similar to the 1995 figure suggesting that the population has recovered from the 2004 decline (Table 1) (Plate 3). However, detailed comparisons of the section totals for 1995 and 2014 indicate that numbers in some areas remain low, notably sections 4 & 5, 6 and 8 on the west side of the island. The most pronounced increase has occurred in sections 19 & 21 along the upper slopes at the southern edge of the colony. The reason for these marked differences is unknown. Some limited abstraction of boulder spoil has been carried out at both north and south quarries in recent years and Ailsa Craig has been free of rats since 1991 (Zonfrillo 2001). Both these operations could potentially have impacted on the Gannets, the former by possibly deterring recruitment to parts of the colony, the latter by making conditions in cliff top areas more attractive. However, Ailsa Craig has a long history of marked and unexplained fluctuations in numbers (Nelson 1978) so any interpretation of these changes must remain speculative. The colony's difficult terrain makes detailed population studies challenging, but increasing the frequency at which aerial surveys are carried out might help resolve some of the uncertainties.

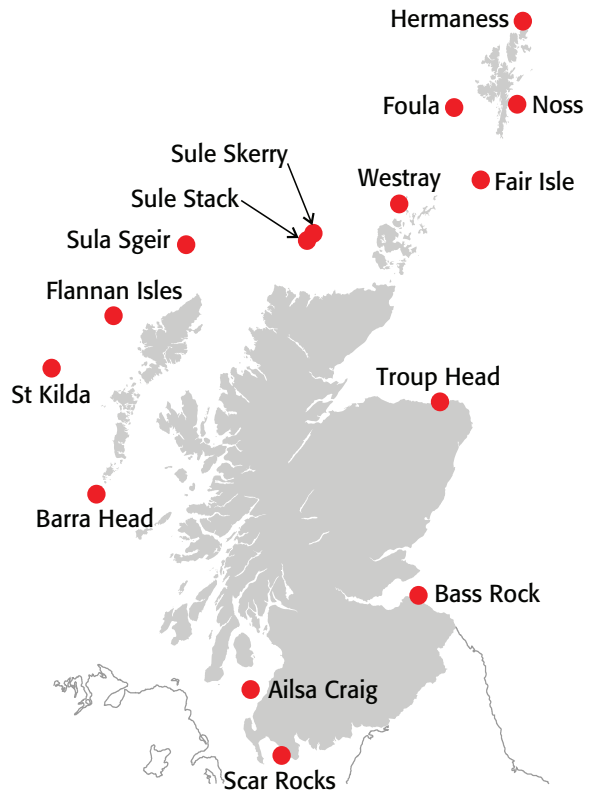


Figure 1. The locations of Gannet colonies in Scotland, 2013–14. Rockall is located 300 km west of St Kilda.



Plate 3. Ailsa Craig, the gannetry from the south-west, 16 June 2014. © S. Murray

Table 1. Counts (AOS) from aerial photographs of Ailsa Craig in 1995, 2004 and 2014. The count sections are shown in Murray & Wanless (1997).

Count section	5 August 1995	6 June 2004	16 June 2014
1	946	1009	1374
2	187	85	59
3	441	245	269
4 & 5	1877	1222	1139
6	2097	1333	1578
7	954	809	1202
8	4300	2711	3279
9,10 & 11	11959	10338	12634
12	140	157	148
13 & 14	1994	1411	1845
15 & 16	2263	2279	2283
17	21	38	57
18 & 20	1439	981	1138
19 & 21	3660	4279	5880
22	0	0	0
23	177	236	341
Total	32455	27133	33226

Barra Head (Berneray) (established 2007, increasing)

The first record of Gannets breeding on Barra Head was a bird on a nest on the south cliffs in 2007. Subsequent records have been one nest (2008), two nests (2010), four nests (mid-June 2011), two chicks near fledging (August 2012) and seven nests on 11 May 2014 (details from M. Forrest in litt., J. Love in litt.).

Rockall (colonised 1992, occupied intermittently, increasing)

The first confirmed breeding on this wave-swept rock was of a single nest with an egg on 19 June 1992 (Belaoussoff 1993). There have been three further confirmed breeding records (nests and eggs found), the most recent on 1 June 2012 when there were four well-built nests, one with an egg and eight trace nests (Hancock in Murray *et al.* 2014a). N. Hancock, who was resident on the rock between 4 June and 17 July 2014, counted 28 occupied sites including three nests with eggs, 13 other well-built nests and 12 trace nests. Thus it would appear that Gannets now attempt to nest on Rockall in most years. However, successful breeding seems highly unlikely since the breeding sites are very vulnerable to bad weather. For example during a severe gale on 1 July 2014 waves broke over Hall's Ledge (Plate 4) sweeping away all the nests, even those on the summit. While Gannets may persist in attempting to breed on Rockall the colony's vulnerability to storms would seem to make it highly unlikely that it will ever produce chicks.



Plate 4. Rockall, Nick Hancock (left) on Hall's Ledge, 4 June 2014. There were six Gannet nests on the summit, 12 on Hall's Ledge and 10 elsewhere, all were swept away in a severe gale on 1 July. © A. Smith

St Kilda (occupied since at least the 17th century, numbers stable, but space for expansion)
Together the three components of the St Kilda gannetry (Boreray, Stac Li and Stac an Armin) have been the largest colony in the east Atlantic for the last 100 years. However, numbers have shown little overall change in the three aerial surveys carried out in 1994 (60,428 AOS), 2004 (59,622 AOS) and 2013 (60,290 AOS) (Plate 5). Despite the fact that there would appear to be plenty of unused, suitable nesting habitat the population seems to be stable and has been overtaken by Bass Rock (see below).



Plate 5. Boreray, St Kilda. This group of breeding Gannets on the east face of Clagan na Rosgachan have grown from a single AOS in 1959 to 671 AOS in 2013. This is one of the few areas where numbers have increased over the last 50 years. © S. Murray

Flannan Isles (established around 1969, increasing rapidly)

An aerial survey made on 19 June 2013 found 5,280 AOS, an increase of 91% since 2004. The presence of very large numbers of non-breeding birds and plenty of apparently suitable nesting habitat, suggest the population will continue to grow rapidly.

Sula Sgeir (occupied since at least the 16th century, increasing after a previous decline)

An aerial survey made on 18 June 2013 found 11,230 AOS, an increase of 22% since 2004. The colony is the only one in the UK that is still exploited for food with c.2000 well-grown chicks ('gugas') harvested each year. In 2004 there was concern that numbers were declining, but the 2013 count indicates that the population is now increasing and there would appear to be ample space for further colony expansion.

Sule Stack (occupied since at least the 18th century, numbers stable, colony probably full)

An aerial survey made on 18 June 2013 found 4,550 AOS, almost identical to the count of 4,618 AOS in 2004. There have been no changes in numbers or colony extent since at least 1994 which suggests that the rock is fully occupied.

Sule Skerry (established 2003, increasing rapidly)

Breeding was first confirmed in July 2003, when 15 pairs with eggs or chicks were found on the west side of Stack Geo (Blackburn & Budworth 2004). In 2004, 57 AOS were counted from aerial photographs. The survey on 18 June 2013 indicated that the colony had increased 30-fold with a total of 1,870 AOS.

Westray (established 2003, increasing rapidly)

A count from the land on 16 June 2014 found 751 AON (Bell 2014), a 50-fold increase from 14 AON on 21–22 June 2004. In 2012 there were 623 nests (Meek 2013).

Foula (established in the mid-1970s, probably increasing)

A count made from the sea by S. Gear on 10 June 2013 found 1,226 AON. Checks made from the land on 7 July showed additional adult plumaged birds on other ledges although no obvious signs of breeding behaviour were noted. The 2013 count indicates that the colony has increased by 33% from 919 AON in 2004. However, the 2013 count was slightly lower than the total in 2007 (1,370 AON, SNH unpublished data.). This suggests that currently the colony may not be growing, but an aerial survey would be useful to check this.

Hermaness (established around 1917, increasing)

An aerial survey of the colony on 15 August 2014 achieved close to complete photographic coverage of the offshore skerries and the main cliffs. Two independent counts of the photographs gave totals of 25,609 AOS and 26,245 AOS respectively, and a mean of 25,927 AOS. Fortuitously, SNH staff had counted the colony earlier in the season (9 June–17 July) using the same methods as in 2003 (a direct count of nests (AON) from fixed vantage points, supplemented by boat counts of areas hidden from the land). Their initial land/sea count was given as 27,033 (Heubeck *et al.* 2014), but detailed comparison of the counts with those from the aerial survey showed that there had been double counting of some areas that were difficult to delimit from the land and sea and a corrected total of 24,885 AON was substituted (Pawley 2014). The aerial survey total would also have been higher had



Plate 6. Hermaness showing the site of the 2003 winter landslide. Breeding Gannets on Soorie Face (left) were unaffected, but a large number of nests were destroyed in a summer landslide on Saito (right), 15 June 2010. © RCAHMS

we not been able to exclude the majority of non-breeders present on the cliffs, which are a well documented feature of this colony. This was mainly due to the ground checks made by J. Swale at the time of the land count, who scrutinized the air photographs for both non-breeding birds and hidden ground. This approach worked well, with each count in effect validating the other. Given this, we have used 25,580 AOS (the mean of the land count and the mean of the two aerial counts Table 2) as the colony total for 2014, a 64% increase over the 15,633 AON in 2003.

Table 2. Counts of Hermaness (AON & AOS) from land and sea in 2003 & 2014 by SNH and an aerial survey in 2014, of AOS, by RCAHMS.

Count section	26 June & 26–27 July 2003	9 June–17 July 2014	15 August 2014
Method	Land photographs & counts and sea counts	Land photographs & counts and sea counts	Aerial photographs
Greing	109	141	141
Humla Stack	580	1175	1266
Humla Houll	629	1128	664
Burra Stack	641	930	1020
Clingra Stack	317	951	750
Flooda Stack	38	304	393
Neap North	1190	997	1526
Neap-Soorie	3873	6370	7315
Soorie-Geo Saito	2606	4410	3362
Neapna Stack	550	511	511
Soorie Stacks	60	83	83
Saito	1941	1984	2242
Tipta Skerry	0	0	289
Rumblings East	869	1767	2111
Rumblings West	nc	95	176
Vesta Skerry East	1745	3457	3151
Vesta Skerry West	485	582	927
Total	15633	24885	25927
Mean for 2014		25580	

Noss (established 1914, increasing)

A whole colony count made from the land and sea in June 2014 found 11,786 AON (Denton *et al.* 2014), an increase of 36% since 2003 (Table 3). The count follows well-established methodology in place since 1992 and each of the five counts made since then by SNH staff have shown progressive increases at both section and colony level.

Table 3. Counts (AON) from land and sea of Noss in 2003, 2008 and 2014 by SNH.

Count Section	8–14 June & 9–30 July 2003	June 2008	11 June to 2 July 2014
Cradleholm	4	8	41
Holmoless	93	115	126
Holmoless to Geordie’s Holes	2008	2212	2254
Geordie’s Holes	70	65	239
Rumblewick	355	384	379
Rumblewick Face	320	450	581
Cuddack’s Geo	3	9	56
Noup South	2850	3048	3667
Noup East	709	860	937
Noup North	965	1124	1253
Rump South	885	938	1259
Rump North	387	537	793
Geo Heogatoug	3	17	201
Total	8652	9767	11786

Fair Isle (established 1974, increase since 2004, but may currently be declining)

A land and sea count is carried out annually by Fair Isle Bird Observatory Trust staff. The 2014 count was 3,591 AON (Parnaby & Hatsell 2014). This represented a 92% increase over the 1,875 AON count for 2004, but was well down from the peak count of 4,085 nests recorded in 2011. This recent decrease would appear to be genuine, but Fair Isle is a difficult colony to count and switching to an aerial survey would help resolve uncertainties.

Troup Head (established 1987, increasing rapidly)

The Troup Head gannetry was photographed from the air on 30 June 2014. Photographic coverage of all the breeding cliffs was complete, apart from one small area that was subsequently checked during a field visit to identify club areas and non-breeding groups. Since this was the first aerial survey of this colony, boundaries of count sections were delimited to tie in with prominent, named coastal features and ideally should be used in future aerial surveys (Plates 7 & 8). Two independent counts gave totals of 6,581 and 6,332 AOS respectively, a mean total of 6,456 AOS. The field visit highlighted that very large numbers of non-breeding club birds were present, particularly at the western end of the colony. Counts of these areas on the aerial photographs estimated that there were at least 1,816 club birds ashore at that time. Section counts were 1,278 AOS in A (Troup Head-Thirlet Point), 1,839 AOS in B (Thirlet Point-Mercury Heugh), 655 AOS in C and 2,684 AOS in D (Mercury Heugh-Ignet Craig). The cliffs on either side of the currently occupied sections appear to offer ample space for further colony expansion and the Gannets are clearly colonising broad ledges that are occupied by Guillemots *Uria aalge*. Comparing the 2014 total with a land and sea count of 1,547 AON on 1 July 2004 suggests an increase of over 300%. However, due to the difference in counting units this value is likely to overestimate the increase. Other recent counts from the land and sea using AON are 1,810 AON on 23 May–26 June 2009 (<http://jncc.defra.gov.uk/smp/>), 2,787 on 7–9 June 2010 (D. Goulder/RSPB & R. Mavor/JNCC) and 2,885 AON on 15–25 June 2013 (Anderson 2013). Given the current size and complexity of the Troup Head gannetry, switching to an aerial survey augmented by land checks to establish boundaries of the club areas would seem the most effective way of monitoring changes in numbers.



Plate 7. Count sections A and B between Troup Head and Mercury Heugh. Note non-breeders on the upper grass slopes of section A, 30 June 2014. © RCAHMS



Plate 8. Troup Head count sections C and D between Mercury Heugh and Iagnet Craig (not shown), 30 June 2014. © RCAHMS



Plate 9. Bass Rock from the north-east. Jetty and landing top left, 23 June 2014. © S. Murray

Bass Rock (occupied since at least the 15th century, increasing)

An aerial survey was carried out on 23 June 2014 in ideal conditions (Plate 2). Two independent counts gave 75,829 and 74,690 AOS respectively, a mean total of 75,259 AOS, indicating an increase since 2004 of 57%. This made the Bass Rock the world's largest colony of Gannets (Murray *et al.* 2014b), relegating St Kilda (60,290 AOS in 2013), and Bonaventure Island in Canada (47,669 AOS in 2011) to second and third places respectively (Chardine *et al.* 2013, Chapdelaine & Rail 2014). There is now little suitable, unoccupied nesting habitat on the upper parts of the rock, but since 2009 large numbers have congregated on the rocks around the landing area (Plate 9) with many apparent pairs showing pre-breeding behaviour (M. Sheddan pers. comm.).

Table 4. Summary of counts of Scottish Gannetries in 2013–14 and changes since the 2003–04 survey. The rate of change for the total Scottish population was calculated assuming that the combined colony counts had all been made 10 years apart.

Colony	Year	AOS/AON	Year	AOS/AON	% change	% per annum change between counts
Bass Rock	2004	48065	2014	75259	+57	+4.6
St Kilda	2004	59622	2013	60290	+1	+0.1
Ailsa Craig	2004	27130	2014	33226	+22	+2.0
Hermaness	2003	15633	2014	25580	+64	+4.6
Noss	2003	8652	2014	11786	+36	+2.9
Sula Sgeir	2004	9225	2013	11230	+22	+2.2
Troup Head	2004	1547	2014	6456	+317	+15.4
Flannan Isles	2004	2760	2013	5280	+91	+7.5
Sule Stack	2004	4618	2013	4550	-1	-0.2
Fair Isle	2004	1875	2014	3591	+92	+6.7
Scar Rocks	2004	2394	2014	2375	-1	0
Sule Skerry	2004	57	2013	1870	+3181	+47.4
Foula	2004	919	2013	1226	+33	+3.3
Westray	2004	14	2014	751	+5264	+48.9
Rockall	2004	no check	2014	28	?	?
Barra Head	2004	0	2014	7	new colony	new colony
Total	2003–04	182511	2013–14	243505	+33	+2.9

Table 5. Latest world population estimates of the Gannet. *France has two other colonies with a total of only three pairs. The Irish total is provisional.

Country	Number of colonies	Year counted	Total AOS/AON	% NE Atlantic population	% World population	Source
Scotland	16	2013–14	243505	58.4	46.3	This survey
Ireland	6	2014	47754	11.4	9.1	Newton (2014)
Wales	1	2009	39293	9.4	7.5	Murray (2009)
Iceland	8	2013–14	37216	9.0	7.1	Gardasson (in press)
France	1*	2014	21545	5.1	4.1	LPO (2014)
England	1	2012	11061	2.6	2.1	RSPB (2012)
Channel Isles.	2	2011	7885	2.0	1.5	E. Morgan/Alderney Wildlife Trust
Norway	10	2013	6000	1.4	1.1	R.T. Barrett (pers. comm.)
Faeroe Isles.	1	1996	2340	0.5	0.4	Skov <i>et al.</i> (2002)
Germany	1	2014	656	0.1	0.1	J. Dierschke (pers. comm.)
Russia	1	1998	35	<0.1	<0.1	Y.V. Krasnov (pers. comm.)
NE Atlantic total	48		417290			
Canada	6	2013	108404		20.6	Environment Canada, Canadian Wildlife Service (unpubl. data)
World total	54		525694	100	100	

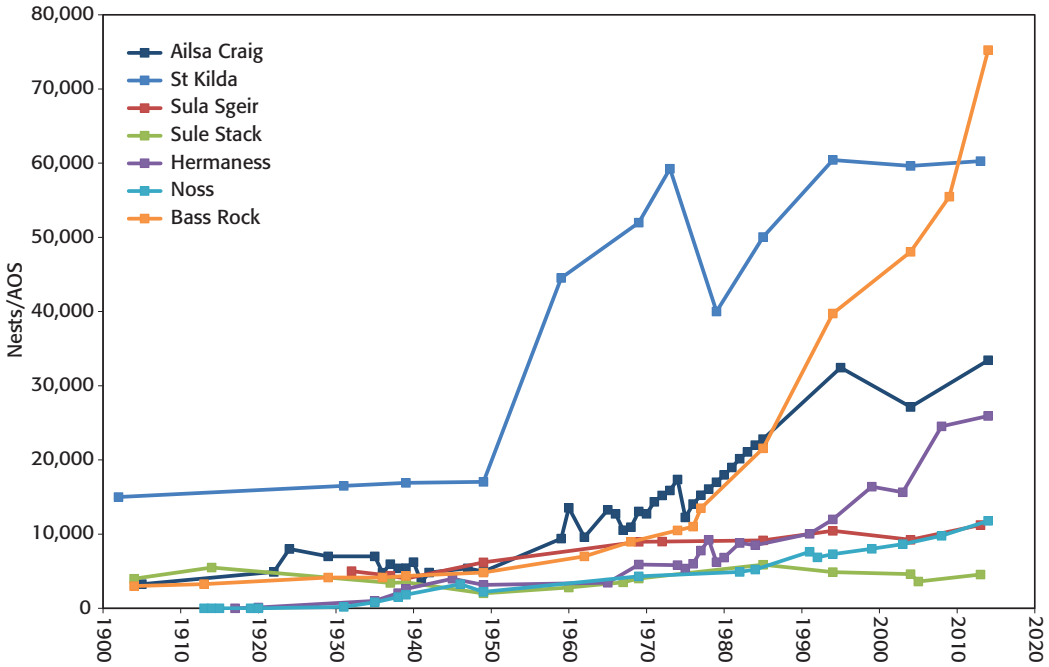


Figure 2. Counts of long-established (since before 1930) Scottish Gannet colonies between 1900 and 2014.

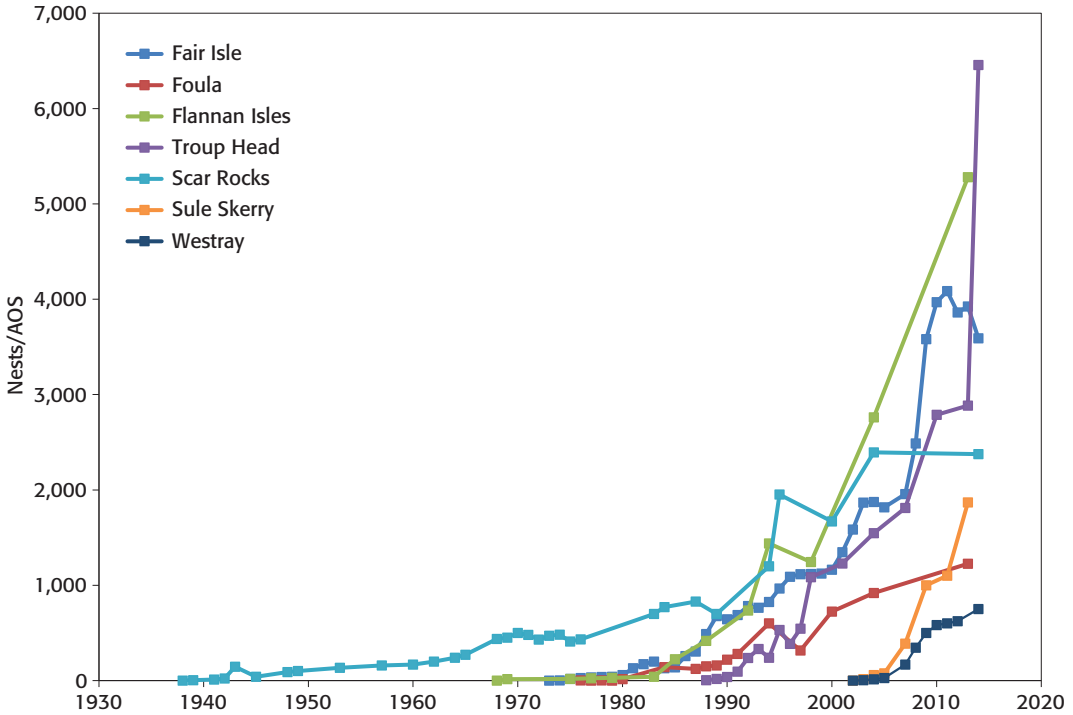


Figure 3. Counts of Scottish Gannet colonies founded since 1930 up to 2014.

Total numbers in Scotland

The counts documented above were combined to provide an estimate of the total Scottish population in 2013–14. The overall total for colonies counted using AOS was 226,116 and the total for those counted using AON was 17,389 (Table 4). Combining these figures and expressing them as AOS (the dominant unit), gave a Scottish total of 243,505 AOS. Numbers were divided very unequally between the 16 colonies with the Bass Rock, St Kilda and Ailsa Craig together holding 70% of the Scottish population.

Discussion

After the last survey of Scotland's Gannets in 2004, we speculated that the sustained period of increase throughout much of the 20th century might be coming to an end. Thus, while between 1984–85 and 1994–95 the Scottish population had increased by 27%, an average growth rate of 2.4% pa, by 2003–04 these values had declined to 6% and 0.6% pa, respectively (Murray *et al.* 2006). Much of this change was attributable to the situation in the three largest colonies, with numbers stable on St Kilda, a marked slowing of the rate of increase on Bass Rock and a decline of 16% at Ailsa Craig. Set against these findings, two new colonies had been established in Orkney (Sule Skerry and Westray) and many of the small to medium sized colonies were still increasing, in some cases rapidly. Whilst the cause (or causes) of these contrasting trends was uncertain, the observed patterns were consistent with density dependent effects. Thus, changes were most marked at the larger colonies where competition for resources would be expected to be greater, particularly if conditions were further exacerbated by reduced food availability as a result of climate change and/or fishing pressure (Davies *et al.* 2013). In addition, evidence from British and Irish ringing recoveries suggested that adult survival rate had decreased, which would also potentially reduce population growth rate (Wanless *et al.* 2006).

However, the findings from the latest survey presented here, indicate that these concerns were unfounded since over the last decade the Scottish Gannet population has increased by 34% at an average rate of 2.9% pa. Of the three largest colonies only St Kilda has barely changed and indeed has been overtaken by Bass Rock, which is now the largest Gannet colony in the world. Numbers on Ailsa Craig have recovered and are now back to the level they were in 1995. A similar reversal of fortunes was also apparent at Sula Sgeir, with the 2013 total the highest of the four counts made here since 1985. This increase is particularly surprising given that up to 2,000 well grown Gannet chicks ('gugas') continue to be killed under license each year. Without detailed data on the demography of Gannets at this colony an objective assessment of the impact of the guga hunt and associated disturbance is impossible (Beatty 1992). However, it seems unlikely that the increase is driven by the colony's own production, but rather that it is due to immigration from neighbouring colonies, possibly St Kilda and Sule Stack, neither of which are currently increasing.

Favourable conditions over the last decade are also evidenced by numbers at most of the small and medium sized colonies increasing at varying rates, a new colony being established on Barra Head, and even Rockall far out in the Atlantic, has seen the largest number of nests yet recorded on it. Only numbers at Sule Stack and Scar Rocks are unchanged, but all the evidence suggests that this is due to lack of nesting space rather than poor breeding conditions. Although totals at the Shetland colonies of Foula and Fair Isle were higher in 2013–14 compared to 2003–04, it appeared that numbers might in fact have peaked during this period and thus the populations are now declining. However, taken as a whole the changes apparent in Scottish Gannet colonies are very much in line with those anticipated by comparisons of foraging activity in 2000 and 2009, that indicated that conditions had become more favourable (Davies *et al.* 2013). Thus, colony-specific trip durations were significantly shorter in 2009 particularly at the larger colonies and those in the North Sea. Improved conditions for Gannets contrasts markedly with the situation in many other Scottish seabirds where populations are declining and breeding failures are becoming more frequent (Miles 2013). While the cause, or causes, of these problems have not been fully ascertained, poorer

conditions as a result of climate change is a leading candidate (Russell *et al.* 2014). However, ironically, while Gannets seem less sensitive to climate change and over-fishing than many other seabird species, they may be more vulnerable to some of the proposed ways of combating these problems. Thus, Gannets have been identified as being at risk of collision mortality at offshore wind farms (Cook *et al.* 2012) and the granting of recent planning consent for major developments in the Moray Firth (Plate 10) and on the Bell Rock Bank, are likely to overlap with foraging areas of birds from Troup Head and the Bass Rock, respectively. If these developments do go ahead they could, therefore, impact on these colonies, although the magnitude and nature of effects are currently highly uncertain. As well as potential changes associated with offshore renewables, imminent changes in fisheries practice as part of the reform of the Common Fisheries Policy and the end to pelagic and demersal discards, will remove a major source of prey for scavenging seabirds, including Gannets (CEU 2012). It seems likely that this will result in changes in behaviour, distribution and abundance of affected species (Bicknell *et al.* 2013). Thus, although Gannets currently seem to be one of the few seabird species that are increasing in Scotland, conditions may well change over the coming years making it particularly important to continue collecting data on abundance.

Although it is possible to count the numbers of nests in small Gannet colonies from the land or the sea with reasonable accuracy, as numbers increase this becomes progressively more difficult. In most colonies it soon becomes impossible to view the entire colony from the land and counts have to be made from both the land and sea, which increases the risk that some areas are overlooked while others are counted twice. Most of the main Scottish colonies are now surveyed by aerial photography, which has several important advantages. Crucially it is usually possible to delimit discrete counting areas using natural features of the cliffs. If these areas are standardized (e.g. Troup Head) the approach enables detailed comparisons to be made between surveys and thus identify if the extent and/or density of the colony has changed. The value of this method is further enhanced by the advent of digital photography and associated software for viewing, manipulating and archiving images which in future will make it much easier to compare results from successive surveys. Given the high conservation importance of the Scottish Gannet population and potential concerns about the adverse effects of offshore wind farms and/or changes in EU discard policy, maintaining the long tradition of colony counts of this species using 21st century technology should be a top priority.

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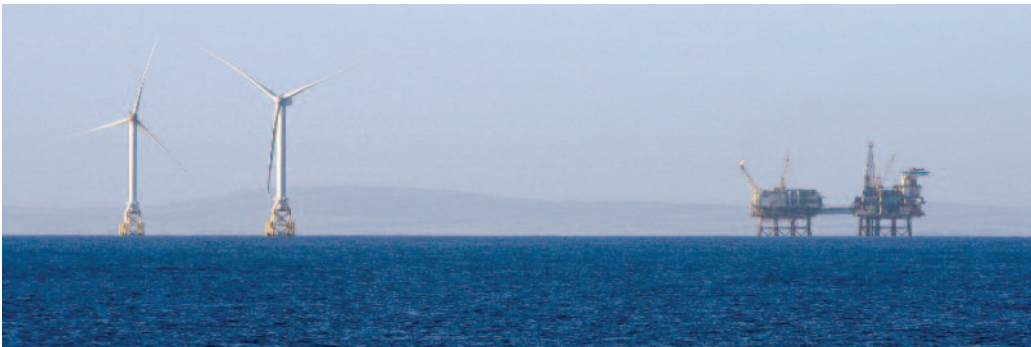


Plate 10. Beatrice Field, inner Moray Firth. Announced in 2014, this will be the core area of a 100 wind-turbine development, 28 February 2011. © S. Murray

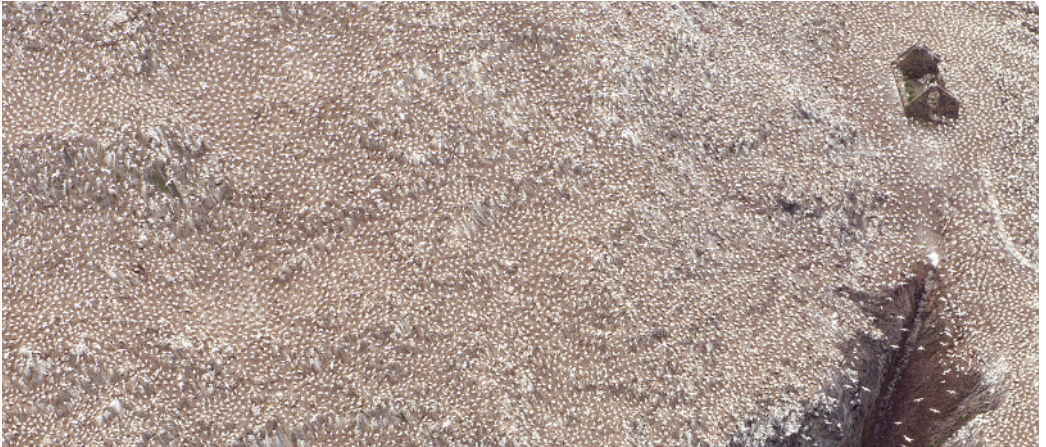


Plate 11. Gannets surround the ruined medieval chapel on Bass Rock and even breed between its walls, 23 June 2014. © S. Murray

he contributed a unique ornithological record to the history of the rock. From SNH we thank Jonathan Swale and Afra Skene for help in Shetland; from the RSPB, Chris Bell and Alan Leitch in Orkney and Crystal Maw at Ailsa Craig. From NTS, Susan Bain and Paul Sharman for their help on St Kilda. Jill Harden, Maggie Sheddan, Angus Smith, Duncan Goulder and Roddy Mavor all assisted in various ways. The aerial survey in 2013 was made under contract to SNH and we thank Andy Douse for facilitating this work. Finally, special thanks are due to our pilots, David Rutter in 2013 and Ronnie Cowan in 2014, whose skill and enthusiasm were vital to the success of the aerial surveys. Dave Cowley of RCAHMS made the flights in 2014 possible and without his support some of the key colonies would not have been surveyed.

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