



Plate 120. St Kilda with (left to right) Stac an Armin, Boreray and Stac Li, 19 June 2013. © SNH/S. Murray

Gannet surveys in north-west Scotland in 2013

S. Murray, S. Wanless & M.P. Harris

A photographic survey of the Gannet colonies off the north-west coast of Scotland in 2013 found 60,290 Apparently Occupied Sites (AOS) on St Kilda, 11,230 AOS on Sula Sgeir, 5,280 AOS on the Flannan Islands, 4,550 AOS on Sule Stack and 1,870 AOS on Sule Skerry. Since 2004, numbers had increased rapidly at Sule Skerry and the Flannan Islands (47.4% per annum (pa) and 7.5% pa respectively), but had changed little at Sule Stack and St Kilda. The harvested colony on Sula Sgeir increased by 2.2% pa, reversing the trend over the previous 10 years during which the population declined at 1.2% pa.

Introduction

North-west Scotland has colonies of Gannets *Morus bassanus* on St Kilda, the Flannan Islands, Sula Sgeir, Sule Stack, and Sule Skerry. In 2013, Scottish Natural Heritage commissioned an aerial photographic survey of the numbers of Gannets at these important but infrequently counted colonies. In addition, an up-to-date assessment was required to review the basis for the licensed taking of young Gannets (gugas) from the island of Sula Sgeir. The aim of the fieldwork was to achieve 100% photographic coverage of each of the five colonies in the region and from these make counts of Apparently Occupied Sites (AOS), to compare with counts made from similar images taken during the last Scottish Gannet survey in 2004 (Murray *et al.* 2006).

Methods

The surveys were flown back-to-back on 18–19 June 2013 (Figure 1). In addition to the pilot there was a principal photographer, a back-up photographer and a third observer who was responsible for transferring camera card images to a laptop computer, which enabled each colony to be quickly photographed several times and from different angles with each circuit of the aircraft; thus, maximum photographic coverage was obtained in the minimum time, thereby reducing potential disturbance to the colony. Eighty-five digital images suitable for detailed counting (c.4% of the total number taken) were subsequently selected for making counts. Together these gave 99% coverage of the five colonies. Missing areas on Boreray were photographed from the sea or land. All the images were then manipulated in Photoshop, to draw on section boundaries that had been used in previous surveys to subdivide the colonies (Murray & Wanless 1986, 1997, Wanless 1987). This ensured that repeat counts of the sections, by the same or different observers, were standardized with respect to sectional boundaries. As in previous surveys, the count unit used was the Apparently Occupied Site (AOS, defined as a site occupied by one or two Gannets, irrespective of whether nest material is present). Images were viewed on a computer screen using either Photoshop or Paint Shop Pro 7 software and each AOS was blocked out with a dot using the paintbrush option. Counts by each observer were initially made blind, i.e. without knowing past counts or counts made by the other counters, removing any chance of subconsciously counting high or low because of prior information.

For most colonies the main counter, S. Murray, made more than one count. Average sectional values for his counts were calculated before combining with values from one (or occasionally two) additional counters (S. Wanless and M. Harris), to give overall mean section values. These mean section values were then summed and rounded off to the nearest 10 to allow for computational errors, to give a mean colony total that was taken to be the best estimate of colony size in 2013.

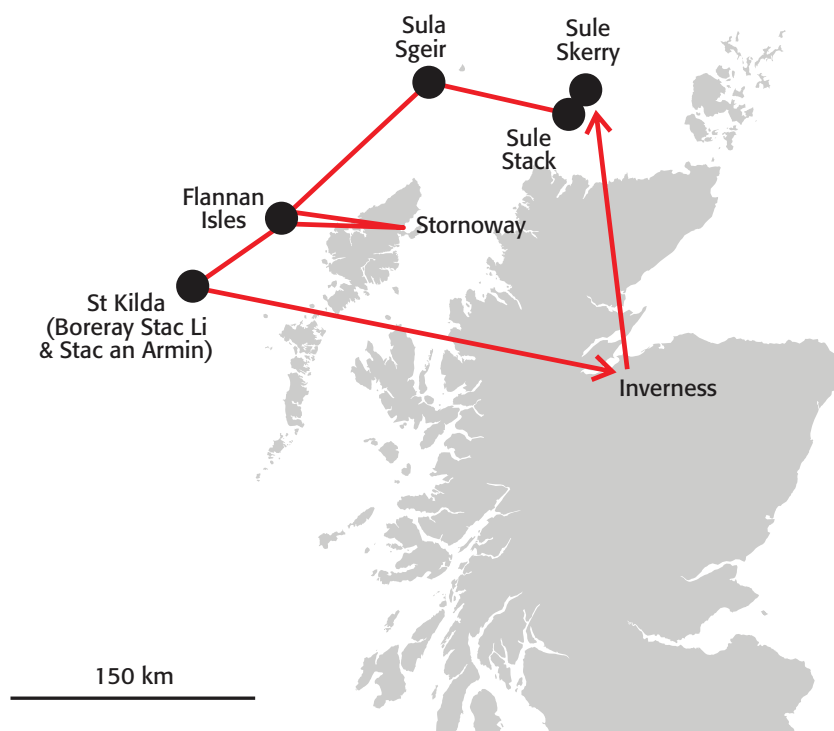


Figure 1. Locations of the five Scottish gannetries surveyed on 18 & 19 June 2013 and the flight routes between them.

Results

St Kilda (Boreray, Stac Li & Stac an Armin)

The St Kilda population is probably stable (Figure 2), with a few very small increases confirmed photographically on Boreray and Stac an Armin between 2004 and 2013, but not on Stac Li. Qualitative differences in the count photographs and observer variation between years are the most likely explanations for most count differences.

Boreray

There were 32,333 AOS in 2004 and 32,240 in 2013. Some small increases were identified in 2013, but overall there is no evidence for any major change in numbers or distribution since 2004 (Plate 121).



Plate 121. Boreray is the most challenging gannetry in the North Atlantic to survey, 19 June 2013. © SNH/S. Murray

Stac Li

There has been an apparent increase from 13,369 AOS in 2004 to 14,990 in 2013, but it has not been possible to find photographic evidence for specific areas of expansion. However, small increases in density, distributed throughout the rock would be difficult to detect unless AOS appeared in areas historically unoccupied, such as the ground adjacent to the Gannet hunters' bothy (Plate 122).



Plate 122. Stac Li summit viewed from the south, showing the Gannet hunters' bothy (arrowed) with potential nesting space in front and above, 19 June 2013. © SNH/S. Murray

Stac an Armin

There were 13,921 AOS in 2004 and 13,060 in 2013. Despite this apparent decrease there were identifiable increases in colony extent found on the East Face (Plate 123), continuing an expansion first noted in 1994.



Plate 123. Stac an Armin east face, west face of Boreray behind, 19 June 2013. © SNH/J. Harden

Sula Sgeir

The count in 2013 was 11,230 AOS, a 21.5% increase over the 9,225 in 2004. There has been a clear and identifiable increase on the summit ridge of the colony (Plate 124) and there would appear to be space for colony expansion, although overall the colony has remained within the limits first identified in 1985.

Flannan Islands

In 2013 there were 5,280 AOS compared with 2,760 in 2004. The colony had very large numbers of non-breeders present in 2013 and ample space to expand on Roareim (Plate 125).



Plate 124. East cliffs and summit ridge of Sula Sgeir, with the guga hunters' bothies visible top right, 18 June 2013. © SNH/S. Murray



Plate 125. Flannan Islands, left to right, Eilean na Gobha, Brona Cleit and Roareim with sub-colonies, left to right, Sgeir an Eoin, Arch Stack, Main Stack and Roareim, 19 June 2013. © SNH/S. Murray

Sule Stack

In 2013, there were 4,550 AOS, compared with 4,618 in 2004. There have been no changes in numbers or colony extent since at least 1994, which would suggest that the rock is fully occupied. However, unoccupied areas remain within the north-east, north-west and south sections of the rock (Plate 126).

Sule Skerry

In 2004, the colony consisted of only 55–60 AOS on the west side of Stack Geo (Blackburn & Budworth 2004), by 2013 this had increased to 1,330 AOS, with an additional 540 on the east side (Plate 127).



Plate 126. The centre rock and summit of Sule Stack from the east; the small, detached North Rock (right) has never held breeding birds, 18 June 2013. © SNH/S. Murray



Plate 127. Sule Skerry, showing the fast-growing gannetry on each side of Stack Geo, 18 June 2013. © SNH/S. Murray

Discussion

While numbers of Gannets at most British and Irish gannetries have increased in the long-term, strong density dependent effects have been apparent with rates of increase at large, long-established colonies markedly lower than those at smaller, more recently founded ones (Lewis *et al.* 2001, Davies *et al.* 2013). Accordingly, comparing the 2013 counts with those from 2004 indicated that numbers had increased rapidly at the two smallest colonies, Sule Skerry and the Flannan Islands (47.4% per annum (pa) and 7.5% pa respectively), but had changed little at the largest colony St Kilda (Table 1, Figure 1). Although the colony on Sule Stack is relatively small, the count in 2013 indicated little or no overall change in numbers. The medium-sized colony on Sula Sgeir increased by 2.2% pa, reversing the change over the previous 10 years when the population declined at 1.2% pa.

Table 1. Counts and rates of change of AOS at gannetries in NW Scotland, 2004–13.

Colony	2004	2013	Change (%)	Rate of change per annum (%)
St Kilda, Boreray	32,333	32,240	-0.3	0
St Kilda, Stac Li	13,369	14,990	+12.1	+1.3
St Kilda, Stac an Armin	13,921	13,060	-6.2	-0.7
St Kilda Total	59,622	60,290	+1.1	+0.1
Sula Sgeir	9,225	11,230	+21.5	+2.2
Flannans	2,760	5,280	+91.3	+7.5
Sule Stack	4,618	4,550	-1.5	-0.2
Sule Skerry	57	1,870	+3200	+47.4
Total	76,282	83,220	+9.1	+1.0

Setting the 2013 counts in a longer-term context further highlights the rapid increases in numbers at the Flannan Islands and Sule Skerry (Figure 3). Both of these sites appear to have plenty of unused, suitable nesting habitat for Gannets and thus have considerable potential for further expansion. The lack of change in numbers on Sule Stack is consistent with the situation over the last 80 years, with Gannets apparently occupying all the suitable breeding areas, so that the colony is probably at maximum capacity. It is possible that the recent colonisation and rapid increase of the colony on nearby Sule Skerry is partly due to the lack of space on Sule Stack.

St Kilda poses formidable counting problems (Plate 120) but it seems clear the population increased in the 20–40 years following the cessation of harvesting by the St Kildans in 1930. Since then numbers have been fairly stable (Figure 2), even though there would appear to be ample potential nesting habitat on Boreray and Stac an Armin.

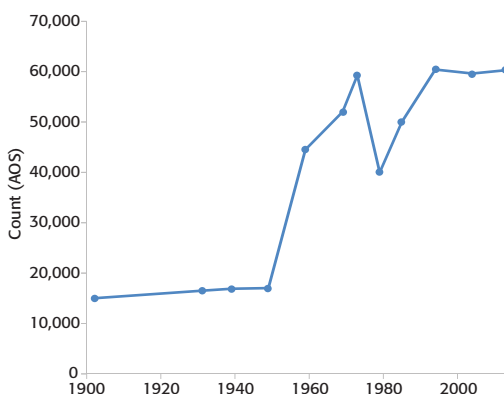


Figure 2. Counts of Gannets (AOS) on St Kilda, 1900 to 2013.

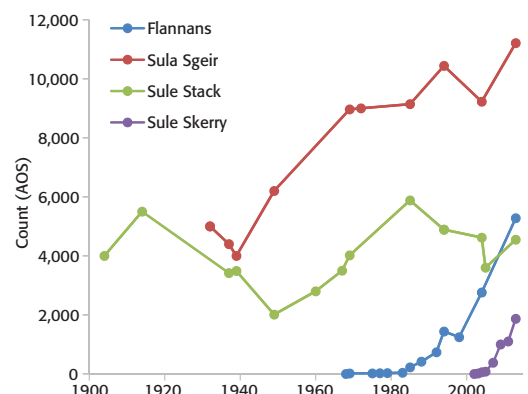


Figure 3. Counts of Gannets (AOS) on Sula Sgeir, Flannan Islands, Sule Stack and Sule Skerry, 1900 to 2013.



Plate 128. Sule Skerry with Sule Stack 10 km distant to the south-west, 18 June 2013. © SNH/S. Murray

Numbers of Gannets on Sula Sgeir have also been relatively stable, with some fluctuations, over the last 30 years (Figure 3). Here also there would appear to be some, although not extensive, unused breeding habitat, suggesting that the population may not be at maximum carrying capacity with respect to nest sites. The 2013 count indicated that numbers of AOS increased over the last nine years despite annual harvesting of young by the men of Ness. Given that the current harvesting license is for 2,000 well-grown chicks per year (equivalent to at least 17% of annual chick production), the capacity for Sula Sgeir to increase from its own production would appear to be relatively limited. However, the colony may be a sink population with recruits originating from St Kilda and Sule Stack fueling the increase.

Conclusions

The 2013 survey of the five north-west Scotland gannetries confirmed the importance of this region for Gannets, which held c.42% of the Scottish population at the time of the last national survey in 2004.

St Kilda remains the largest colony in the East Atlantic, although the Bass Rock, predicted to hold c.60,000 AOS around 2012, rivals St Kilda in size (Murray 2011). Conditions off north-west Scotland also seem favourable for the formation of new colonies with numbers at the newly colonized site on Sule Skerry increasing rapidly and an embryonic colony first recorded on Barra Head (Outer Hebrides) in 2007 (Miranda Forrest pers. comm.). Gannets are also periodically recorded breeding on Rockall, although it seems unlikely that a colony could be established here, given that in stormy conditions waves break right over the rock (Murray *et al.* 2014).

Given that the pace and magnitude of environmental change is likely to increase in Scottish waters over the next decade e.g. as a result of the imminent ban on fishery discards and the development of major offshore renewable energy schemes, maintaining the time series of Gannet counts will be essential for assessing any impacts on this species.

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