An aerial survey of Northern Gannets *Morus bassanus* on Scar Rocks, southwest Scotland, in 2014

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Abstract
An aerial survey to assess the number of Northern Gannets *Morus bassanus* on Scar (Scare) Rocks, southwest Scotland in July 2014 indicated 2,376 apparently occupied sites. This was almost identical to the number recorded using the same method in 2004. Numbers at this colony have increased rapidly during the past 60 years but Northern Gannets now have little space to increase further and the colony may be full.

Introduction
The Scar (Scare) Rocks (54°4'N 4°42'W) sit in the entrance to Luce Bay, Dumfries and Galloway, 11 km east of the Mull of Galloway (Figure 1). Northern Gannets *Morus bassanus* nest on the largest rock in the group, Big Scar. Although less than 1 ha in extent and with a maximum height of only 25 m, Big Scar has all the features typical of an offshore island, but on a reduced scale. There is a vertical cliff face on the north side and an almost detached stack (Castle Rock) on the west side (Figure 2). The main part of the island slopes at a gentle angle seaward from the highest point, mainly towards the south and southeast. The low coastline offers no barrier to storm driven waves and in such conditions they can reach well up the slope and may prevent seabirds from nesting any closer to the sea than they presently do. The raised beds of eroded blue-grey schist have resulted in a rock surface of parallel dykes and trenches that results in some birds being invisible from the sea.

Northern Gannets (hereafter 'Gannets') were first recorded ashore on Scar Rocks (then known as Big Scaur) in 1883 when two nests were found, one of which contained a broken egg (Gurney 1913). There were no subsequent records of breeding until 1939 when a single nest with a chick was found (McWilliam 1939). Regular counts since have shown that the population has increased year-upon-year (Fisher & Vevers 1943; Young 1968; North Solway Ringing Group 1973; Nelson 2002). Most counts prior to 1984 were of nests made from the land, sometimes augmented by observations made from the sea. However, as the colony expanded movement by people on the rock was restricted to avoid disturbance and this made obtaining an accurate count difficult, since some parts of the colony could not be seen from the few accessible vantage points (P. N. Collin pers. comm.). An attempt was made at an aerial survey in 1994 but it proved impossible on the

photographs to separate birds in clubs from nesting birds (P. N. Collin pers. comm.). Successful aerial surveys were undertaken in 1995 and 2004 during regular decadal assessment of the British and Irish populations (Murray & Wanless 1997; Wanless *et al*. 2005). This note reports on an aerial survey carried out in 2014.

Methods

Scar Rocks were photographed from the air between 11:24 and 11:31 hrs BST on 23 July 2014. Flying conditions were excellent, with overcast but bright skies and no turbulence, allowing several circuits to be made of the rock at heights between 200 m and 500 m. More than 80 photographs were taken with a Nikon D800E digital camera using a 70 mm lens, with the four images of Big Scar selected for counting giving 100% coverage of the gannetry. The photographs were at a very high resolution (7360 x 4912 pixels) with each image being a file of 30MB. Examples of the photographs are shown in Figures 3 & 4.

Figure 1. Northern Gannets *Morus bassanus* on Big Scar with the Mull of Galloway on the horizon, 4 July 2011. © *Andrew Bielinski*

Figure 2. A view from the sea of Castle Rock (left) and West Slope of Big Scar, 12 July 2005. © *Duncan Irving*

Prior to 1995, counts of Scar Rocks were given as a single total but in that year, four clear sections following natural features of the rock were delimited (see Murray & Wanless 1997). After aerial surveys, the boundaries of these sections were marked on the photos and the numbers were counted of apparently occupied sites (AOS), defined as one or two Gannets present on a site, irrespective of whether nests or nest material can be seen. In 2014, counts were made on computer screens using either Photoshop or Paint Shop Pro 7 software. This enabled images to be viewed at different magnifications and each AOS 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 by two experienced counters without knowledge of those made by the other counter or of previous years totals, to prevent subconsciously counting high or low because of prior information.

Results

The two independent counts gave totals of 2,394 AOS and 2,357 AOS. This range of only 1.7% of the average total of 2,376 AOS was testament to the high quality of the photographs. The 2014 total was to all intents and purposes identical to the count in 2004 (2,394 AOS, i.e. 18 AOS lower; Table 1). Both overall and by individual section, there was no evidence for any change at the colony since 2004 and the minor differences in the counts of AOS in the three smaller sections are likely due to the higher resolution of the 2014 images. A comparison between the 1995 and 2004 images found a small number of nests had become established at the lowest limit of the Plateau between those years but there was no change in this lower limit between 2004 and 2014.

Figure 3 (opposite top). Aerial view of the Big Scar from the south on 23 July 2014. © *Stuart Murray*
Figure 4 (opposite bottom). An aerial view of part of the central plateau of Big Scar on 23 July 2014 showing the regular spacing of the nests of Northern Gannets *Morus bassanus* and the ridges that will hide many nests when counts are made from the sea. © *Stuart Murray*

Aerial survey of Northern Gannets on Scar Rocks, southwest Scotland, in 2014

Table 1. Counts from aerial photographs of the Scar Rock gannetry (apparently occupied sites) in 1995, 2004 & 2014. In 1995 and 2004, Castle Rock was called West Stack.

	5 August 1995	6 June 2004	23 July 2014
North Cliff	26	38	54
Castle Rock	111	121	82
West Slope	211	226	175
Plateau	1,604	2,009	2,065
Total	**1,952**	**2,394**	**2,376**

Discussion

The gannetry on Scar Rock seems to have been founded around 1939, perhaps partly a result of less human disturbance during the Second World War, and has grown steadily since then (Figure 5). Between 1969 and 2004, the total Gannet population of Britain and Ireland increased by an average of 1.2% per annum (n = 4 counts: Wanless & Harris 2004; Wanless *et al*. 2005). Over the same period, Gannets on Scar Rocks appeared to increase at 2.1% p.a. (log AOS = 0.02111 year - 39, r^2 = 94.6%, n = 16 counts). However, this period spanned the time when the method of assessing numbers on Big Scar changed from nests counted on the ground or from the sea to AOS counted from aerial photos. The latter method will almost certainly have resulted in somewhat larger counts since it covers parts of the colony not easily seen from the sea. The unexpectedly low count in 2000 was made from the sea, from where it is probably not possible to see AOS in the valleys between the ridges (Figure 4) and should therefore be considered a minimum estimate.

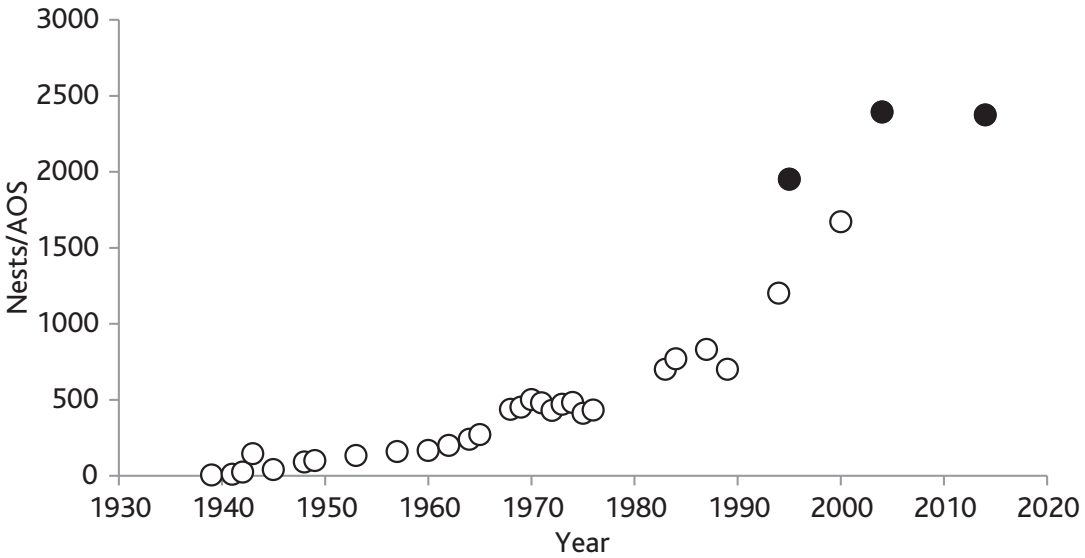

Figure 5. Counts of nests or apparently occupied sites of Northern Gannets *Morus bassanus* on Big Scar. Counts made from aerial photographs are indicated by filled circles.

In 1968, following the rapid initial increase in numbers to 437 nests, Young (1968) speculated that there was space for at least 650–700 pairs which highlights how difficult it is to predict the carrying capacity of gannetries. However, it does now seem likely that space is at a premium with the unoccupied areas being unsuitable for breeding, most being low down on rocks that appear to be washed by waves in severe weather. The density of AOS in the main Plateau section might increase but the 2014 count and photographs show no evidence for this having occurred since 2004. Inspection of Figure 5 further supports the suggestion that the colony is probably no longer increasing. Given how crowded the rock now is with breeding birds, any future survey would best be done from the air to minimise disturbance and retain comparability with the last three aerial surveys.

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