



Plate 87. Noup Head lighthouse, Westray, Orkney, 16 August 2016. Aerial survey Section 16 between red lines, c10 AOS lower left corner. © Historic Environment Scotland

An aerial survey of Gannets on Westray, Orkney, in August 2016

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An aerial survey of the Gannet colony on Westray, Orkney, was made for the first time on 16 August 2016 and found 1,560 AOS, contrasting with a land survey made on 30 May 2016, which found 1,020 AON. The aerial survey photographs show areas of the cliffs that are hidden from land. This, and the different count units used, are the main reasons for the higher aerial survey figure. A third population estimate was made by combining breeding productivity figures from an RSPB monitoring plot with chicks visible in the aerial photographs, which gave a calculated estimate of 1,306 AON. Whichever population estimate is used, it is clear that the colony is expanding rapidly. Future land counts will likely underestimate numbers so would best be combined with an occasional aerial survey to more precisely define colony size.

Introduction

Gannets *Morus bassanus* were first recorded breeding on Noup Head, Westray in 2003, when five nests were found; eggs were seen in two nests and a single young is thought to have fledged (Wanless *et al.* 2005). Since then, counts of nests made almost annually have shown that the population has increased dramatically, to 1,020 AON by 20 May 2016. These counts have been made from the land, but recent aerial surveys elsewhere have shown land-based counts can seriously underestimate the colony size e.g. Scar Rocks and Troup Head (Murray *et al.* 2014, 2015). During August 2016, Historic Environment Scotland flew archaeological surveys across Orkney, including Westray, and this note reports on counts of the gannetry at Noup Head made from photographs taken during this survey and compares them with a count made from the land earlier in the year.

Methods

At 13:00 on 16 August 2016, DC flying just off the gannetry took a series of overlapping images during a single pass at c.200 m ASL above the cliffs (highest point 76 m) and ending well south of any breeding gannet sites. Starting from Noup Head lighthouse (Plate 87) the gannet nesting area extends for just over 1 km to South Hellian (Figure 1). The cliffs form a relatively straight line with only two conspicuous outcropping headlands, Kelda Ber and Lawrence's Piece. There are no offshore islets or sea stacks to block the view of the main cliffs and nesting ledges. More than 40 photographs were taken with a Nikon D800E digital camera using a 70-mm lens, which gives images of a very high resolution, up to 47 MB (Plates 88 & 89). Flying conditions were excellent, although the bright overhead sun resulted in the overexposure of some photographs of the whitened, guano-encrusted ledges. For each over-exposed photograph exposure levels were reduced and the image was restored to an approximation of normal brightness and definition on the computer. Photoshop or Paint Shop Pro 7 software was then used to view images at different magnifications and colour contrasts and each occupied breeding site or chick was blocked out with a dot using the paintbrush option.

Although non-breeding birds in 'club' areas are easily distinguished when counts are made from the land or sea, they can theoretically 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, (b) the lack of guano that makes the club areas less white than breeding areas and (c) plumage differences. The Westray images were unusual in showing strikingly few non-breeders present in the colony. It is unlikely that they would have flown off earlier as the aircraft was first positioned well offshore to assess the cliffs and the close-in flying time was under one minute. If large numbers of non-breeders leave a colony they are obvious flying over the sea but these images show very little gannet traffic over water or close to the breeding cliffs.



Figure 1. Noup Head, Westray, Orkney. Gannets currently breed between Noup Head Lighthouse and South Hellian. Contains OS data. © Crown copyright and database right 2017

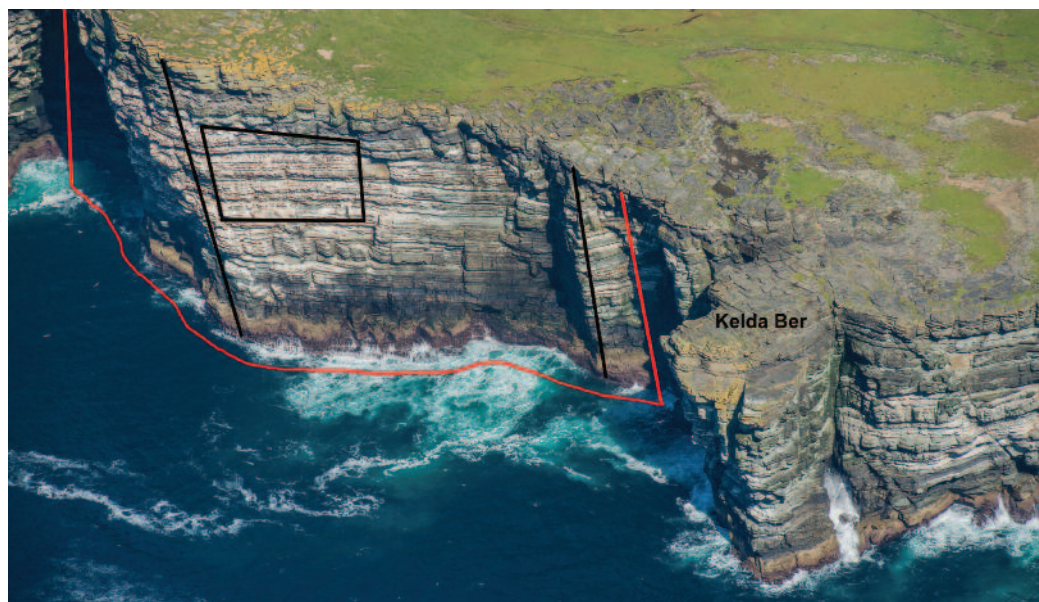


Plate 88. The RSPB Kelda Ber monitoring plot located between the black lines. Air survey Section 10 is bounded by the red line. The area within the black outlined box is enlarged in Plate 89. Noup Head, Westray, Orkney, 16 August 2016. © Historic Environment Scotland

All the photographs were of high image quality and definition and of the 16 chosen each defined a single count section. Each section photograph overlapped with adjacent sections to ensure there was no ambiguity about boundaries. These were drawn directly on photographs and defined as far as possible using prominent natural features, in some cases corresponding with names given on Ordnance Survey maps. So far as could be judged there are next to no hidden areas on the cliffs, with the exception of Section 9, but no nests were found here during the land survey.

Aerial photographs use the count unit apparently occupied site (AOS, a site occupied by one or two Gannets irrespective of whether nest material was present). However, the late date of the Westray survey (16 August) meant there were many large chicks present without obvious nests, with by contrast, single birds and pairs attending nests with no obvious chick visible. The high resolution of the images made possible the precise recognition of the categories of AOS and also allowed the counting of large chicks (Plate 89). We therefore counted chicks and also AOS without a visible chick separately (Table 1).



SM also counted individual Gannets, separated where possible into adults and immatures, both flying over water and on ledges not used for nesting.

Plate 89. Section of the Kelda Ber monitoring plot enlarged from Plate 88, illustrating the high resolution the Nikon D800E is capable of. Noup Head, Westray, Orkney, 16 August 2016. © Historic Environment Scotland

Table 1. Westray Gannet surveys. RSPB land - count 30 May 2016 (AON). Aerial survey 16 August 2016 (AOS with and without chicks). Notes: (1) Section 9 partly obscured from the air. No AON seen from land. (2) RSPB monitoring plot is within Section 10.

| Section numbers | AOS with chick | SM (air) AOS with no chick | AOS Total | AOS with chick | MPH (air) AOS with no chick | AOS Total | RSPB (land) AON Total |
|-----------------|----------------|-------------------------------|-----------|----------------|--------------------------------|-----------|--------------------------|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 11 | 22 | 33 | 13 | 24 | 37 | 135 |
| 4 | 158 | 76 | 234 | 166 | 71 | 237 | |
| 5 | 27 | 25 | 52 | 28 | 21 | 49 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 ¹ | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 ² | 136 | 114 | 250 | 142 | 112 | 254 | 237 |
| 11 | 182 | 190 | 372 | 177 | 161 | 338 | 300 |
| 12 | 102 | 109 | 211 | 103 | 116 | 219 | 338 |
| 13 | 101 | 99 | 200 | 106 | 82 | 188 | |
| 14 | 124 | 95 | 207 | 127 | 82 | 209 | 10 |
| 15 | 3 | 2 | 5 | 3 | 1 | 4 | |
| 16 | 4 | 6 | 10 | 4 | 7 | 11 | 10 |
| Total | 848 | 726 | 1574 | 869 | 677 | 1,546 | 1,020 |
| Mean AOS | 1,560 | | | | | | |

D. Roche (RSPB) made two counts from the land, the first on 30 May was of apparently occupied nests (AON, one or two birds at a site with nest material present). At this early date, nests would be obvious, mainly with adults sitting tight on eggs or very small chicks. Some late pairs would still have to lay but these would have been included in the count of AON. The later visit on 23 August counted chicks only.

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).

Results

Independent counts of the photographs by SM and MPH found 1,574 AOS and 1,546 AOS, respectively, an average of 1,560 AOS. There was similar close agreement between their counts of chicks, (848 and 869, average 858. Table 1). This can be attributed to high image quality and the relatively small number of AOS and chicks in each section.

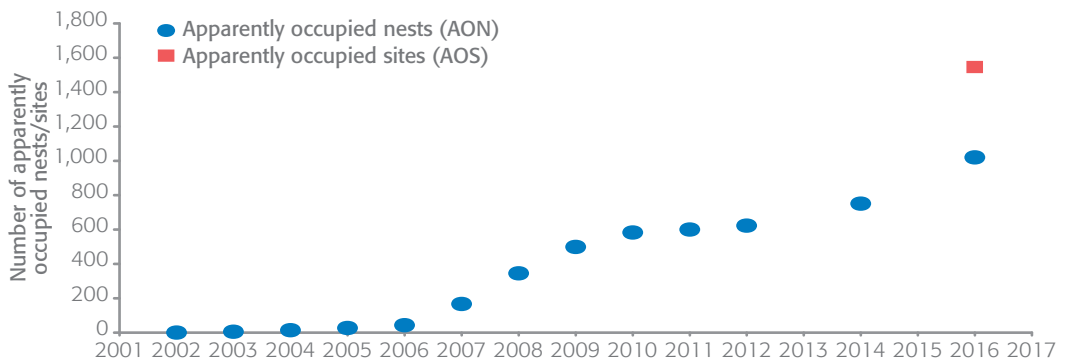


Figure 2. Plot showing counts of AON made from the land by RSPB at Westray since colony foundation in 2002 and the estimate of AOS made from aerial photographs in 2016.

A count of all 16 sections found 42 adult plumaged birds flying over water but none in any immature plumage phase. On-shore and loafing, away from nesting ledges, there were c173 'club' birds in white plumage, some of which could have been fourth- or fifth-year birds. A further 58 had dark mottled backs and wings with white heads and under parts, indicative of three-year-old immatures. We conclude that an exceptionally low number of immatures was present at the colony at this time but can offer no explanation for this.

The land count of nests visible from cliff tops on 30 May was 1,020 AON. No allowance was made for hidden ground. On 23 August, 559 chicks were counted throughout the colony. This count included 163 nests in a defined part of Kelda Ber (aerial Section 10) that was used to monitor breeding success (Plate 89). On 23 August, there were 115 near fledging young in this plot, giving a productivity figure of 0.706 chicks per nest.

Discussion

The large difference between the August aerial survey count of 1,560 AOS and the May count from the land of 1,020 AON is not an unusual result, since generally there is less hidden ground when sites are counted from aerial photographs. The Noup Head cliffs are steep with deep cut horizontal ledges which may be out of sight of cliff top vantage points. This makes it difficult to judge how much hidden ground there may be and so combining a land and aerial survey can resolve this. The clearest example on the Noup cliffs is on the Stolan face, air Section 5, where no nests were seen from the land but the photographs showed 50 AOS, including 27 chicks. Neither count found nests or sites in Sections 1 and 2 or 6 to 8 and for Section 9, partly obscured from the air, the land count found nothing. Elsewhere, in Sections 10, 11 and 16 where exact comparisons could be made, there was quite close agreement in totals (Table 1). However, in combined Sections 12 to 15 there was a large discrepancy, 620 AOS compared with 338 AON. The likeliest explanation for this is that many breeding Gannets here and elsewhere on Noup Head cannot now be seen from the land. This could explain the rather unexpected reduction in the rate of population expansion between 2010 and 2014 evident in Figure 2.

Breeding success was calculated by applying the measured nesting success in the monitoring plot to the aerial count of chicks. A proportion of the pairs that laid will have failed by the time the count of chicks was made, while others will not have bred at all. The estimate of success (70.6%) and the count of chicks (858) can be combined to estimate that there were possibly c.1,215 AON ($858/0.706$).

The count of chicks from the aerial photographs will inevitably be an under-estimate since some large chicks in the back of overhung ledges would have been overlooked, as would small young still being brooded or sheltered by adults. On 2 August 2016, Sarah Wanless and MPH used the state of plumage development to age a sample of 356 Gannet chicks at Troup Head, Banffshire, 200 km south of Westray (Nelson 1978, Murray *et al.* 2013). The distribution of chick ages there suggests that two weeks later 7.5% of chicks would have been four weeks or less old and so could potentially have been missed when counting chicks from photographs. Applying this figure to the Westray results increases the calculated total of AON to 1,306 ($1,215 \times 1.075$). The actual total could even have been slightly higher, since breeding of Gannets is later at more northern and recently established colonies (Nelson 2008, Wanless *et al.* 2008).

Regardless of which of these population estimates is used, the colony is still expanding rapidly and has plenty of space to accommodate a very much larger gannetry, albeit by displacing Guillemots *Uria aalge* from large, flatter ledges as has occurred at Troup Head and other expanding gannetries (Murray *et al.* 2015). Due to logistic constraints, routine future counts will probably continue to be made from the land, but there is an obvious need for an occasional aerial survey to more precisely define colony size, since land-based counts will continue to miss increasing numbers of nests.

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