

Sule Skerry – an overspill gannetry from Sule Stack

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Abstract

Northern Gannets *Morus bassanus* first bred on Sule Skerry, Orkney, Scotland in 2003. A count made from photographs taken using a drone in July 2018 showed that the population had increased to 4,515 apparently occupied sites with a mean annual rate of increase of 19% between 2009 and 2018. As Gannet numbers increased, they displaced several hundred pairs of Common Guillemots *Uria aalge* and about 500 pairs of Atlantic Puffin *Fratercula arctica*. Ringing of Gannet chicks showed that some of the increase on Sule Skerry was due to immigration from Sule Stack 8 km away. Northern Gannets on Sule Stack appear to occupy all suitable nesting habitat, and the breeding population has been relatively stable at around 4,500 pairs for the last 100 years. The colony on Sule Skerry is now as large as that on Sule Stack. Given that there appears to be plenty of suitable nesting habitat for more Gannets on Sule Skerry, it seems likely that the colony will continue to increase to the detriment of the nationally important population of Atlantic Puffins.

Introduction

Most species of seabirds breed colonially on isolated islands, high mainland cliffs or other situations where feeding conditions are favourable and safe from ground predators. Colonies can be large and persist for hundreds, even thousands, of years. The Northern Gannet *Morus bassanus* (hereafter Gannet) is a common seabird in the East and West Atlantic. The species was heavily exploited by humans during the nineteenth century, and at the start of the twentieth century there were only 16 colonies and the total breeding population was estimated at about 53,000 pairs (Gurney 1913). Subsequently, both the number of Gannets and the number of gannetries increased with the most recent census in 2013–14 estimating that the 54 colonies held 526,000 apparently occupied sites (Murray *et al.* 2015).

Traditionally, the Gannet's stronghold has been in northwest Scotland (Fisher & Vevers 1943; Nelson 2002). One of the longest established colonies is on Sule Stack, sometimes called Stack Skerry (59°1'N 4°30'W), an isolated rock 68 km west of mainland Orkney, Scotland which has had a large colony of Gannets since at least 1710 (Fisher & Vevers 1943). Thirteen counts of the Sule Stack gannetry between 1904 and 2013 suggest that numbers have been relatively stable with the most recent count putting the population at 4,550 apparently occupied sites



Figure 1. Sule Skerry showing the lighthouse, Northern Gannet *Morus bassanus* colony (white area either side of the geo to the right of the lighthouse) and the Atlantic Puffin *Fratercula arctica* colony (vegetated area) on 10 July 2018. © Jeff Kew

(Fisher & Vevers 1944; Murray *et al.* 2015). Many accounts have noted that Gannets have colonised the entire suitable nesting habitat, the remaining areas being regularly wave-swept and occupied by large numbers of adult-plumaged but non-breeding individuals (Stewart 1938; Nelson 2002; Murray *et al.* 2015).

About 8 km from Sule Stack lies Sule Skerry (59°5'N 4°24'W), a low-lying island with a large colony of Atlantic Puffins *Fratercula arctica* and a variety of other seabirds (Figure 1; Blackburn *et al.* 2007). There is no history of Gannets nesting on Sule Skerry. A lighthouse constructed here in 1893–95 had resident lighthouse keepers until December 1982 when the light was automated. Tomison (1904) was a keeper there from 1896 to 1903 and the only Gannets he recorded on the island were sick or injured birds. None of the last keepers to leave the island recollected Gannets landing on the island and Stark (1967) who was on the island in July 1967 did not mention the species. Members of the Sule Skerry Ringing Group first visited Sule Skerry in 1975 and have returned to the island during 23 summers up to 2018. In the early 1990s, small numbers of Gannets were regularly ashore on the western side of the island but there was no evidence of nesting. In July 2002, about 50 Gannets were present on a flat area of bare rock without any nesting seabirds but close to a colony of Common Guillemots *Uria aalge* on the upper slopes of a south-facing and sheltered geo (narrow gully). These Gannets left after a few days but in July 2003 there were eight nests with eggs, five nests with chicks and two empty nests in this area (Blackburn & Budworth 2004).

This note (1) presents a count of Gannets breeding on Sule Skerry made in 2018, (2) documents changes in numbers and colony extent between the colony's foundation in 2003 and 2018 and (3) uses ringing and retrapping data from Sule Stack and Sule Skerry to look for direct evidence of immigration fuelling the rapid increase in Gannet numbers on Sule Skerry.



Figure 2. The Northern Gannet *Morus bassanus* colony on Sule Skerry on 10 May 2005 showing its spread into the Common Guillemot *Uria aalge* colony and the vegetated area where Atlantic Puffins *Fratercula arctica* breed. Sule Stack is visible 8 km away. © John Love

Methods

Between 2003 and 2007, the numbers of occupied Gannet nests on Sule Skerry were counted from the land either directly or from photographs (details in Appendix, Figure 2). However, as numbers increased the lack of a high vantage point (the island has a maximum elevation of 15 m) made land counts problematic. Hence, from 2007 onwards aerial photographs were used to estimate population size. For this method, the count unit is the apparently occupied site (defined as a site occupied by one or two Gannets irrespective of whether or not nest material is present). Although non-breeding birds in 'loafing' or 'club' areas are easily distinguished when counts are made from the land, they can be harder to identify during aerial surveys. In practice, however, most non-breeders fly off as the aircraft approaches and those that remain are usually obvious due to their irregular spacing compared to the regular dispersion of site holders/nest holders. Such was the case in the 2018 count. Counts of apparently occupied sites are inevitably slightly higher than counts of nests but there is no correction factor for converting apparently occupied sites to nests. Here we present the counts in the units in which they were reported and follow the usual convention of using the raw data when estimating rates of change (Murray *et al.* 2015). Where a range of counts is given, we use the average count for plotting and calculations.

The count in 2018 was made from photographs taken at 11:30 BST on 10 July from a height of 98 m using a Phantom 4 drone equipped with the standard camera shooting 4K video from which screenshots were taken using an iMac (Figures 3 and 4). Counts of apparently occupied sites in three near-vertical photographs covering the whole colony were made by MPH (who had been one of the counters in the aerial surveys in 2007 and 2013) using PaintShop Pro software to block out each site as it was counted.

Gannet chicks were ringed on Sule Stack in 2002, 2003, 2005, 2011 and 2015 and adults were ringed in 2002, 2003 and 2005. In 2005, 2009, 2011, 2015 and 2018 attempts were made to catch any Gannet with just a metal ring seen on Sule Skerry since this was likely an immigrant, adult Gannets ringed on Sule Skerry also had coloured rings that simplified this process.



Figure 3. The Northern Gannet *Morus bassanus* colony on Sule Skerry photographed from a drone on 10 July 2018. The three 'club' areas are distant right and left. © Jeff Kew



Figure 4. One of the near-vertical views used to count the apparently occupied sites of Northern Gannets *Morus bassanus* on Sule Skerry on 10 July 2018. The initial colonisation was at the top left-hand tip of the colony. © Jeff Kew

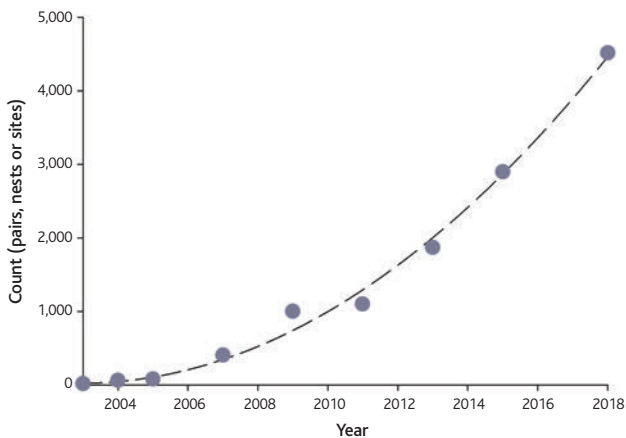
Results

Two counts of the aerial photographs taken in 2018 gave 4,463 and 4,565 apparently occupied sites (average 4,514). The images also showed continuing expansion of the colony on both sides of the geo where the initial colonisation occurred, resulting in displacement of most of the hundreds of Common Guillemots that used to breed there (Figure 3). The Gannets had also expanded into the Atlantic Puffin breeding areas along the inland fringe of the gannetry displacing around 500 pairs. In addition to the main Gannet colony, three isolated groups of loafing, nonbreeding birds were also present close to the colony (Figure 3).

Between 2002 and 2015, 4,391 Gannet chicks and 128 adult Gannets were ringed on Sule Stack. None of the adult birds were subsequently retrapped on Sule Skerry but 21 chicks were. All were aged five or more years (modal age six years) and were probably breeding (Table 1). Retraps were dominated by the 2003 cohort

Table 1. Ages at first retrapping of Northern Gannets *Morus bassanus* ringed as chicks on Sule Stack and later retrapped on Sule Skerry.

Year ringed	2002	2003	2005	2011	2015	Total
No. ringed	90	1,054	799	1,450	998	4,391
Age at retrapping						
5 years	0	0	1	0	0	1
6 years	0	13	1	0	0	14
7 years	0	0	0	1	0	1
12 years	0	1	0	0	0	1
13 years	0	0	1	0	0	1
15 years	0	3	0	0	0	3
Total	0	17	3	1	0	21

**Figure 5.** The growth of the breeding population of Northern Gannets *Morus bassanus* on Sule Skerry between 2003 and 2018.

(80% of retraps). Despite large numbers of chicks being ringed on Sule Stack in 2005 and 2011 relatively few had been retrapped on Sule Skerry by 2018. One bird ringed as a chick at the colony on Ortac, Channel Islands, in 2009 was caught on Sule Skerry nine years later.

Discussion

The Gannet colony on Sule Skerry has increased very rapidly from its founding in 2003 up to the present (Appendix, Figure 5). The increase was particularly dramatic in the early years with numbers increasing 27-fold, from

15 nests in 2003 to 400 nests (taking the upper limit given that over 375 chicks were counted later in the season) in 2007. Subsequently, the rate of increase slowed although it was still very high with the five counts between 2009 and 2018 indicating an average rate of 19% per annum ($r^2 = 98\%$, $P = 0.001$).

The increase in numbers of Gannets breeding on Sule Skerry has shown a similar pattern to that of many newly established colonies with numbers increasing extremely rapidly (Moss *et al.* 2002). Although there are a very few records of breeding Gannets changing colonies, once an individual has bred it normally remains faithful to that colony and dispersal to other colonies occurs during the pre-breeding years (Nelson 2002; Barrett 2008). Thus, the initial rapid increases in numbers reported here must be largely dependent on the small Sule Skerry colony successfully attracting immigrants because insufficient potentially philopatric individuals will have reached even the youngest breeding age, typically at least four or five years in Gannets. Moreover, breeding success during the first few years of a colony is usually very low (Nelson 2002). At most newly established gannetries the

source populations of such immigrants are unknown. However, ringing of large numbers of Gannet chicks on Sule Stack, the nearest gannetry to Sule Skerry, showed that many recruits originated from this colony. All were birds that had been ringed as chicks with the 2003 cohort represented particularly strongly. Whether the paucity of birds from later cohorts reflects low post-fledging survival (that seems unlikely given the continuing increase of the British Gannet population; Murray *et al.* 2015) or a decrease in the rate of immigration into Sule Skerry is not clear. A shift from immigration-driven to philopatric growth has been predicted to occur at a colony size of about 620 nests (see below) which accords with this observation (Moss *et al.* 2002). In addition, one chick ringed on Ortac in the Channel Islands was retrapped on Sule Skerry indicating that at least some immigrants came from colonies that are more distant. More large-scale ringing of chicks and retrapping of ringed adults at other colonies are urgently needed to elucidate the extent of emigration of chicks from other colonies (Furness & Wanless 2014).



Figure 6. Sule Stack on 25 June 2013 when the population of Northern Gannets *Morus bassanus* was estimated at 4,550 apparently occupied sites occupying all available nesting habitat. © Stuart Murray

Moss *et al.* (2002) developed a simple population model to estimate when a Gannet colony could be sustained by its own output rather than by immigration. Assuming a mean age of first breeding of seven years, this was about 620 nests. However, counts for Sule Skerry indicate that equilibrium colony size was exceeded in 2009, six years after colonisation. Colonisation count data for 22 other Northeast Atlantic Gannet populations where the date of colonisation was known indicates that the median age when a colony reached this size was 20 years (Table 2). The only other colony with a rapid rate of increase similar to Sule Skerry is Lambay Island, Co. Dublin (details in Newton *et al.* 2015). Here, Gannets were first recorded in 2006 and by 2013, there were 728 apparently occupied



sites. Like Sule Skerry, Lambay is close to another gannetry, in this case Ireland's Eye 10 km away. Like Sule Stack, Ireland's Eye has limited room for the Gannet colony to expand, and thus is potentially a rich source of recruits to drive the rapid population increase on Lambay. Thus, only 10 years after colonisation the population on Lambay overtook that of Ireland's Eye. Sule Skerry could be similarly viewed as a satellite or overspill colony for Sule Stack that has now reached the same size as Sule Stack (Figure 6).

Table 2. Years between colonisation and reaching a population of 620 pairs, nests or sites by Northern Gannet *Morus bassanus* colonies in the Northeast Atlantic. + indicates still to reach this size. Sources: Nelson 2002; Barrett 2008; Barrett *et al.* 2017; Murray *et al.* 2015; Newton *et al.* 2015.

	Years		Years
Sule Skerry, Scotland	6	Clare Island, Ireland	19+
Lambay, Ireland	7	Rouzig, France	21
Westray, Scotland	9	Helgoland, Germany	22
Storstappen, Norway	9	Flannan Isles, Scotland	22
Buholmene, Norway	10+	Hovsflesa, Norway	23+
Troup Head, Scotland	11	Ireland's Eye, Ireland	25+
Fair Isle, Scotland	12	Runde, Norway	31
Foula, Scotland	14	Scar Rocks, Scotland	43
Hermaness, Scotland	14	Syltefjord, Norway	47
Ortac, Channel Islands	16	Great Saltee, Ireland	57
Skarvklakken, Norway	17	Bempton, England	61
Noss, Scotland	19		

The Gannet population on Sule Stack had been stable for over 100 years (Gurney 1913; Murray *et al.* 2015). Prior to about 1932, up to 1,200 young were 'harvested' annually but since then the colony would have been producing many more potential recruits than could find sites on their natal island to breed (Nelson 2002). The regular reports of large numbers of adult-plumaged but nonbreeding Gannets at this colony give credence to this view. Why then did it take Gannets so long to colonise nearby and clearly visible Sule Skerry (Figure 2)? The Gannet is a conservative species when it comes to individuals choosing where to breed and new colonies are formed only infrequently. Between the start of the twentieth century and 2013–14, the world population increased ten-fold (from 53,000 to 526,000 pairs/apparently occupied sites) whereas the number of colonies only increased from 16 to 54 (Gurney 1913; Murray *et al.* 2015). Most Gannets nest on steep cliffs or on isolated low-lying islands well away from human disturbance, doubtless the result of many centuries of human persecution (Gurney 1913; Fisher & Ververs 1943, 1944). Until 1982, the presence of human inhabitants on small flat Sule Skerry throughout the year might have discouraged prospecting birds landing. However, Gannets sometimes nest in what seem to be bizarre situations well outside the normal range. Examples are on boats, jetties and floating docks in the Mediterranean (Fernandez & Bayle 1994; Giagnoni *et al.* 2015). Even after the last lighthouse keepers left, it was 10 years before Gannets were first recorded ashore on Sule Skerry and 20 years before they bred. The reason for this reluctance remains obscure.

Camp on Sule Skerry
© Jeff Kew



The Sule Skerry Atlantic Puffin population in 2018 was estimated at about 50,000 pairs making it one of the most important colonies in Britain (Blackburn 2019). Continuing expansion of the gannetry is likely to result in further incursion into Atlantic Puffin breeding areas. Currently, the Gannets occupy about 0.3 ha of the 18 ha of suitable nesting habitat. Assuming the same nest-density suggests that there could be room for 300,000 pairs. Given the current rate of increase of 19% per annum, this number could theoretically be reached within 25 years. However, the rate of increase of a Gannet population declines as the colony increases in size (Moss *et al.* 2002) so likely it will be much longer before the Gannets take over the whole island, even if that many birds would have access to sufficient prey within foraging range of the colony. Given that the Atlantic Puffin is classified as a Red-listed Bird of Conservation Concern in the UK (Eaton *et al.* 2015), the seemingly inevitable further loss of breeding habitat to Gannets will result in an interesting conservation conflict.

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Appendix 1. Counts of Northern Gannets *Morus bassanus* on Sule Skerry from its colonisation in 2003 until 2018. Units are those given in the original source.

Year	Date	Count	Method	Source
2003	13 July	15 nests	Land count	Blackburn & Budworth (2004)
2004	8 July	About 40 occupied nests	Land count	D.B.
2004	8 July	55–60 nests	Land photographs	Photo D.B., count M.P.H./S. Murray
2005	10 May	77 nests	Land photographs	Figure 2; J. Love, S. Murray
2005	July	69 pairs	Land count	Blackburn (2008)
2007	7 July	375–400 nests	Land count	Blackburn (2008)
2007	14 Aug	At least 375 large chicks	Aerial photograph	Photo Sea Mammal Research Unit, count M.P.H.
2009	July	800–1,000 nests	Land count	J.B.
2011	July	1,100 apparently occupied nests	Land count	J.B.
2013	18 June	1,870 apparently occupied sites	Aerial photograph	Murray <i>et al.</i> (2015)
2015	July	2,900 nests	Land count	J.B.
2018	10 July	4,514 apparently occupied sites	Aerial photograph	This paper