

**Breeding ecology and diet
of Great and Arctic skuas
on Handa Island 2007**



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**Annual Report of the Handa Island Skua Monitoring
Programme 2007**

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Suggested citation

Smith, C. & Jones, T. (2007) Handa Island Skua Monitoring Programme Final Report 2007. Unpublished report to SWT, SNH, JNCC and The Seabird Group.

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Cover page: Arctic skua chick on Handa Island, T. Jones 2007

Figure 2: Great skua ringed in 1989, T. Jones 2007

Maps by T. Jones 2007

1. Summary

2007 saw the fifth full season of activities by the Handa Island Skua Monitoring Programme. Productivity of Handa's Great (*Stercorarius skua*) and Arctic skua (*S. parasiticus*) populations continued to be monitored following standard methodologies, and chicks ringed with standard BTO and Darvic colour rings. As in previous years productivity of Great skuas was monitored by focusing on a representative sample of pairs spread across 2 study sites, and the whole Arctic skua population was monitored. Great skua diet continued to be monitored by systematic sampling of regurgitated pellets from breeding pairs and club-sites. All data were collected in a series of targeted visits at key stages throughout the breeding season.

The small Arctic skua population increased in size for the first time since 2000, with 20 breeding pairs and 2 non-breeding pairs holding territory in 2007. The all-island survey of Great skuas was not carried out this year.

Great skua productivity was the second highest since intensive monitoring began in 2003, with 0.76 chicks fledged per pair. Mean Great skua egg volume and clutch size both increased from previous years. However, among the 13 pairs of Arctic skua monitored, mean clutch size continued to decline and productivity remained low with only 0.23 chicks fledged per pair. Of the three chicks known to have successfully fledged, two were predated before leaving the island. This level of post-fledging mortality is consistent with previous years.

An immature bird from each species, fledged in or since 2004 on Handa (as identified by colour-rings deployed by the Programme), were seen returning to the island for the first time this year.

Pellets collected from breeding Great skuas were evenly split between fish and bird this year. As in previous years the non-breeders consumed a lower proportion of fish than the breeders. The majority of fish obtained were from fishery discards, also as seen in previous years.

A paper summarising the results of the 2003-2006 breeding seasons of both species has been accepted by the journal *Bird Study* for imminent publication. The Programme plans to continue intensive monitoring of Handa's skuas populations in 2008.

2. Methods

In 2007 fieldwork was conducted in a series of targeted visits by fieldworkers focused on key stages during the breeding season. The first visit, to locate nests, was timed to coincide with mean lay-date as determined from previous years' data (Jones, 2003; Smith & Jones, 2004, 2005, 2006). The timing of subsequent visits enabled monitoring of productivity throughout the season, and diet of breeding Great skuas during chick-rearing stage (Table 1).

Table 1. Fieldwork dates and personnel

Date	Data collected	Fieldworker(s)
25-27 May	Great skua nests, mapping, egg vols & clutch size	Claire Smith & Chris Rodger
6 June	Great skua nests, mapping, egg vols & clutch size	Andrew Ramsay
26-27 June	Great skua nests - productivity	Andrew Ramsay
14-26 July	Great skua chicks and Arctic nests and chicks, Great skua pellets, ringing	Trevor Jones & Andrew Ramsay
31 July - 1 Aug	Great skua pellets	Danni Klein & Chris Curtis
8-10 August	Fledglings both species and post-fledgling mortality, Great skua pellets	Andrew Ramsay
17 August	Fledglings both species and post-fledgling mortality, Great skua pellets	Andrew Ramsay

Methods for locating and marking nests, monitoring productivity and Arctic skua post-fledging mortality were consistent with previous seasons. All breeding Arctic skuas (Appendix 2) and a sample of 66 Great skua pairs across the two established study sites (Appendix 1) were monitored. See Jones, 2003 for a detailed methodology, and Smith & Jones, 2004 for explanation of selection of study sites.

Pellets were collected from 14 Great skua territories (seven in each study site) and two club sites. Pellet collection began later than usual this year with territories cleared of pellets on 15th July and collection beginning on 21st July. Fish species were identified by otoliths with reference to C. Smith's collection and an identification guide (Harkonen, 1986).

The number of birds at Great and Arctic skua club-sites was counted opportunistically throughout the season.

3. Results

3.1 Population

3.1.1 Great skua

The all-island census was not carried out this year.

Great skuas held two main club-sites this year, with occasional use of a third site. The maximum club-site count was of 39 birds on the 7th June.

3.1.2 Arctic skua

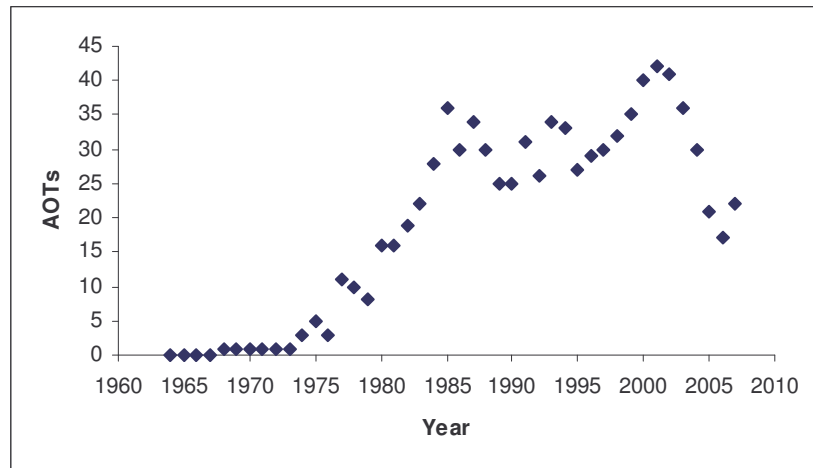


Figure 1. Number of Arctic Skua apparently occupied territories on Handa Island since 1964.

A total of 20 Arctic skua nests plus 2 apparently occupied territories (AOTs) were located on Handa this year, up from 15 breeding pairs and 2 AOTs in 2006 (figure 1). The former “stronghold” area around Bothy Loch contained only 5 territories. Colour phase in these polymorphic birds was determined for 18 breeding pairs, of which 11 comprised two dark phase adults, 3 were both light phase adults, and 4 were mixed pairs (see Appendix 2).

In 2007 four birds (3 light and 1 dark phase) were present at the club site on the 6th June, suggesting that they were non-breeders. This is in contrast to 2005 and 2006 when birds only began attending the club-site from July, suggesting they were failed breeders rather than non-breeders.

3.2 Re-sightings and recoveries

Three Great skuas colour-ringed as adults in 1989 were re-sighted this year, in the E3 (fig. 2), F5 and K8 areas of the island. At least one of these birds bred this year.



Figure 2. Great skua colour-ringed on Handa in 1989; still breeding on Handa in 2007

A single Great skua and a single Arctic skua were sighted on the island this year wearing the Darvic rings deployed on Handa since 2004 (though sightings were brief and the ring numbers were not read). Given that young birds do not usually return to the colony until they are at least 3 or 4 years old (Hamer, 2001; Phillips, 2001), it is likely that they were ringed as chicks in 2004.

The light phase female Arctic skua ringed as a chick by Bob Furness in 1989 was again breeding near the village, with a new partner. This bird (known locally as Betty) is now 18 years old.

A Great skua, colour-ringed A8 on Handa in 2004, was sighted off the West coast of Ireland in the autumn.

3.3 Breeding Statistics

Table 2. Breeding statistics of Great and Arctic skuas on Handa 2007.

Standard deviations are given where appropriate. Sample sizes are in parentheses; note these vary at different stages of the season according to timing of visits.

	Breeding pairs monitored	Mean egg volume¹	Mean clutch size	Chicks fledged² per pair
Great skua total	66	81.75 ± 5.2 (42)	1.85 ± 0.3 (52)	0.76 (66)
Study site 1	30	82.65 ± 3.42 (19)	1.86 ± 0.35 (22)	0.5 (30)
Study site 2	36	81.0 ± 6.28 (23)	1.83 ± 0.38 (30)	0.97 (36)
Arctic skua	20	44.17 ± 2.93 (17)	1.53 ± 0.51 (17)	0.23 (13)

¹For Great skuas, we used the egg with the greatest volume (Furness, 1987); for Arctic skuas, we used the egg with the greatest volume, except where we observed which egg was laid first, in which case we used the α -egg (n=3)

²Great skuas were considered fledged if still alive after 40 days; Arctic skuas were considered fledged if still alive after 28 days

Great skua study sites

Both α -egg volume and clutch size of study site 1 pairs were slightly larger than those of study site 2, although not significantly so (see table 2).

Productivity of study site 2 pairs was nearly double that of birds within study site 1: 0.97 vs 0.5 chicks per pair.

Lay-dates of Great skuas

Lay-date data are incomplete this year due to the timing and frequency of visits. However, about 60% of study site nests had an alpha egg by the 27th May, and this is a minimum estimate as some birds may have laid whose nests were not recorded on this first visit.

Post-fledgling mortality of Arctic skuas

Of the 13 pairs whose productivity was closely monitored, only 3 chicks were fledged and two of these were predated before leaving the island.

3.4 Diet

Great skuas

A total of 522 single item pellets (276 from territories and 246 from club-sites) were collected this year, and an additional 12 mixed pellets.



Figure 3. Percentage composition of food items in Great skua diet among breeders (on territory) and non-breeders (at club sites). Based on single item pellets only (n=522).

This year twice as many bird (64.2%) as fish pellets (32.1%) were found on club-sites (fig. 3). For breeders, pellets were more evenly split between bird (45.3%) and fish (48.2%) pellets. Other items including rabbit, beetle, molluscs, bivalves and plant material comprised 6.5% of breeders' and 3.7% of non-breeders' pellets.

As in previous years auk was the most consumed bird family comprising 21.8% and 38.2% of breeders' and non-breeders' pellets (Table 3). Gull species were the second most important food item. Other birds consumed were Fulmar (*Fulmarus glacialis*), Storm petrel (*Hydrobates pelagicus*), and Great skua chick. The remains of a young Shag (*Phalacrocorax aristotelis*) were also found, a previously unrecorded food item for Handa's Great skuas. Pipefish (*Syngnathidae*) were also recorded for the first time.

Table 3. Great skua single item pellets collected from 14 territories and 2 club-sites.

Food item	Breeders	Non-breeders
Fish	48.2	32.1
Bird	45.3	64.2
Other	6.5	3.7
Fish	47.5	30.5
Sandeel	0.4	0.8
Pipefish	0.4	0.8
Auk	21.8	38.2
Gull	20.7	21.1
Fulmar	1.9	1.2
Shag	0.4	0
Storm petrel	0	0.8
Great skua chick	0	0.8
Unidentified bird	0.7	2.0
Rabbit	2.5	1.6
Miscellaneous	4.0	2.1

As in previous years, the vast majority of otoliths in pellets were from Norway pout (*Trisopterus esmarkii*), with Whiting (*Merlangius merlangus*) the next most common species.

Arctic skuas

No detailed observations were made of food items within Arctic skua territories this year, however one breeding pair were consuming crowberry pellets within their territory.

4 Ringing

A total of 121 Great skua and 13 Arctic skua chicks were ringed on Handa this year. All Arctic skua and 88 Great skua chicks were fitted with colour rings on the left leg (in addition to standard BTO rings on the right). The unexpectedly high number of Great skua chicks meant that we ran out of colour rings! Two styles of Darvic colour ring were fitted this year (fig. 4). All of the Arctic skuas were fitted with black-and-white rings, while Great skuas were fitted with either a black-and-white or red-and-white ring.



Figure 4. The two styles of Darvic rings deployed on skuas on Handa in 2007.

5 Discussion

Great skua breeding performance

Great skua productivity, at 0.76 chicks fledged per pair, was the second highest since current monitoring began in 2003 (Jones *et al.*, in press; Smith & Jones, 2004, 2005, 2006). Only 2004 was a more productive year with 0.88 chicks per pair. The number of chicks ringed outside the study site was also high, suggesting that productivity was high across the whole colony. Moreover, all chicks observed during July appeared healthy in weight and plumage, indicating that the Great skua food supply around the island was reliable this year, at least until the end of July.

Though lay-date data were incomplete this year, the fact that a minimum 60% of study nests contained an alpha egg by 27th May suggests that mean lay-date was closer to the 2004 and 2005 means (May 26) than the 2006 mean (May 29).

In 2007 mean egg volume and clutch size in the Great skua population were both higher than in the previous three years, which may be an effect of changes in mean parental age: on Foula egg volume and clutch size in Great skuas were found to increase with age up to 18 years old, and then to decline in older birds (Ratcliffe *et al.*, 1998). Other studies of seabirds have shown that improved food supply can also increase egg volume and clutch size (e.g. Bolton *et al.*, 1992).

Improved food supply can also enhance breeding performance, however in Great skuas this has mostly been looked at in the context of changes in sand-eel abundance around Shetland (Phillips *et al.*, 1997; Ratcliffe *et al.*, 1998), and sand-eels are not abundant in the surrounding waters of Handa (or at least do not appear to be so from observations of feeding behaviour of cliff-nesting seabirds and from their absence from Great skua pellets). Sand-eels are also scarce at St Kilda (Phillips *et al.*, 1997), where Great skuas have a mixed diet very similar to the Handa birds, and where egg volume was found to be slightly higher than in the well-studied Foula, Shetland population (Phillips *et al.*, 1997; Jones *et al.*, in press).

Arctic skua breeding performance

In 2007 the Arctic skua breeding population arrested its recent annual decline with a 25% increase from the 2006 population of 15 pairs and 2 AOTs, and there were at least 2 territories in new areas of the island not used in the last five years. A ringed immature bird and other birds at the club-site suggest that young birds from Handa and elsewhere may be recruiting to the population. These may be birds produced during more productive years that are now old enough to breed.

However the Arctic skuas had a poor breeding year; 0.23 chicks fledged per year is the second lowest figure since 2003. Mean clutch size also continues to decline, which may be due to a lower quantity or quality of food available to females during egg formation, or possibly a shift in the mean age of the breeding birds. Interestingly, we do not see a similar decline in egg volume, however as sample sizes are small results should be treated with caution.

It is clear however that predation pressure from Great skuas remains high, particularly in the post-fledging period (see also Jones *et al.*, in press). The former “stronghold” of the Arctic skua population (next to Bothy Loch) remained low in density this year, and there was again no cooperative defence against Great skuas observed (first noted in Smith & Jones, 2005). In the

context of a rapidly declining British population (Mitchell *et al.*, 2004), careful monitoring of the Handa Arctic skua population over the coming years will be of great interest.

Great skua diet

Handa's Great skuas have a mixed diet of primarily bird and fish, and in 2007 the proportions of each food type in the pellets of both breeding and non-breeding Great skuas were fairly consistent with those recorded each year since 2004 (Smith & Jones, 2004, 2005, 2006).

Also consistent with previous years, non-breeders' diet contained a higher proportion of bird than breeders' (64% vs 45%), a finding which appears to emphasise the important role of fish in chick rearing for this population.

It is important to note that pellet collection began later in 2007 than in previous years; indeed, because of widespread early failure of the auk colony (Klein, 2007), most pellets were collected after the majority of auks had finished breeding at the cliffs. Nevertheless, auk remains the dominant species of bird in pellets; this is perhaps unsurprising as failed breeders will remain in the waters around Handa, well within the foraging range of the Great skuas.

The very low proportion of sand-eel in the diet, even lower than in previous years, further indicated that this species is insignificant to Handa's Great skuas. Fishing discards, on the other hand, are well represented in the pellets and apparently currently very important to maintaining high productivity. The Great skuas' diet helped them to buck the trend of other seabirds on Handa that experienced widespread breeding failure in 2007 (Klein, 2007).

6 Acknowledgements

We are grateful to the Scottish Wildlife Trust and Highland Ringing Group for their continuing supporting of our work; to Dr Jean Balfour and Mr Balfour, Mark Foxwell and the Handa Island Management team for the privilege of working on Handa; and to Danni Klein, this year's warden for her company, logistical support and help with fieldwork. Special thanks as ever to Andrew Ramsay for his unerring dedication and support. Cheers to Charles Thomson and Skipper, to Nick McWilliam for his GIS advice, and to all the volunteers who helped with fieldwork; a special thank you to Chris Rodger, Chris Curtis, Liam and Ryan Munro, Bridget Ramsay, George Ross and Stewart Swinney.

7 Workplan 2008

The programme is currently in the process of recruiting an undergraduate or Masters level biological sciences student to carry out the majority of the annual monitoring in 2008, following our established data collection methods. We propose that the student be based on the island constantly from early June until mid-late August. S/he will be trained by T. Jones at the beginning of June, and further supported on occasional visits throughout the season by A. Ramsay and other volunteers from the Highland Ringing Group. It is therefore anticipated that the amount of data collected on both productivity and diet will return to pre-2007 levels.

In summary, we plan the following fieldwork on the island:

Date	Data collected	Fieldworker(s)
30 May – 2 June	Great skua nests, mapping, egg vols & clutch size	CS, TJ +1
3-15 June	Great and Arctic skua nests, mapping, egg vols & clutch size; all-island survey; training of student	TJ & Student
16 June – 16 Aug	Great skua chicks, Arctic nests and chicks, Great skua pellets, ringing, fledglings and post-fledgling mortality	Student ¹

¹with support from A. Ramsay and Highland Ringing Group

8 Funding

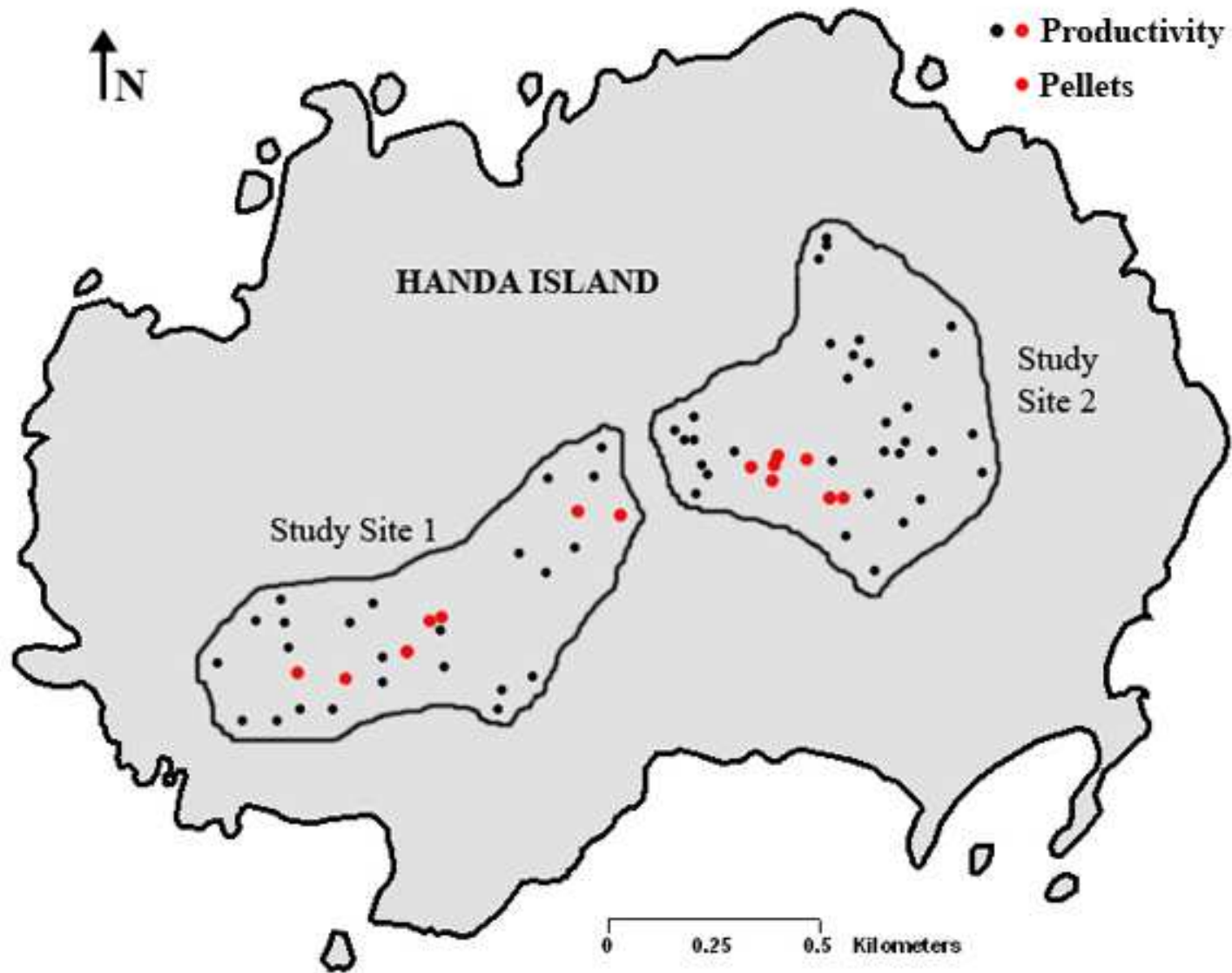
A bid in 2007 to secure long-term funding for the skua monitoring programme from Scottish Natural Heritage failed, due to changes in their rules excluding funding of activities falling under the category of research. However, a grant of £600 has been successfully secured from the Seabird Group for the 2008 field season.

Small grants have also been applied for from the British Ornithologists Union (BOU) and the Scottish Ornithologists Club (SOC); the results of these applications will be announced in spring 2008.

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Appendix 1: Map of Great skua study nests 2007, showing study sites and territories monitored for productivity and diet.



Appendix 2: Map of all Arctic skua nests 2007, showing colour phases of breeding birds.

