A Survey of Leach's Storm-petrel, European Storm-petrel and Atlantic Puffin on North Rona, Western Isles in 2009.

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SUMMARY

North Rona

- In a whole-island survey 253 **Leach's Storm-petrels** responded to tapes, giving an extrapolated total (x 3.077) of 761 AOS, a population decline of 32.8% since 2001.

- A whole island survey was attempted for **European Storm-petrel**, but only 13 of the 16 sections defined in the 2001 survey were covered. A total of 132 European Storm-petrels responded to tapes, giving a minimum extrapolated population (x 2.550) of 337 AOS. There has been no overall change in the population since 2001.

- There was no evidence of change in the **Atlantic Puffin** population since 2001.

- A total 18 AOT of **Great Skua** found suggested no change since 2001 (18 AOT) and 2005 (17 AOT).

- **Great Blacked-Gulls** experienced near complete breeding failure and counts suggested only 3-400 AOT.

- A total of 852 **Black-legged Kittiwake** nests (AON) indicated a decline of 54% since 2005.

Sula Sgeir

- A search for **Leach's Storm-petrel** was made of the bothies and surrounding area but failed to elicit a response.

INTRODUCTION

North Rona and Sula Sgeir are designated a Special Protection Area (SPA) under Articles 4.1 of the EC Birds Directive, for supporting more than 1% of the UK and Ireland breeding population of Leach's Storm-petrel *Oceanodroma leucorhoa* and European Storm-petrel *Hydrobates pelagicus.* A requirement of SPA status is the regular population monitoring of qualifying species. This was done for both petrel species (and Atlantic Puffin *Fratercula artica*) for the first time in 2001 (Murray *et al* 2001 & 2008)). The survey in 2009 was required to meet international obligations for SPA monitoring and to provide the first complete colony assessment of all three species since 2001.

Aims and objectives

The aim of the of the survey was to estimate the size of the breeding population of Leach's Storm-petrel, European Storm-petrel and Atlantic Puffin on North Rona.

The objectives were:

1. A whole island survey of North Rona for all three species, based on the surveys carried out in 2001.
2. A limited survey of Sula Sgeir based on the surveys done in 2001.
3. Discuss population trends of all three species on North Rona.
4. Attempt population counts, or estimates of, Great Skua *Stercorarius skua*, Great Black-backed Gull *Larus marinus* and Black-legged Kittiwake *Rissa tridactyla*.
5. Discuss predation impacts by skuas and gulls on small petrels and puffins.

METHODS

Timing of visits

We arrived on North Rona at 10.30am on 27 June 2009 and left at 16.00 on 10 July. The aim was to conduct the survey as close as possible to the hatching date for Leach's Storm-petrel, assumed to be similar to that of St Kilda, *ie* mid to late July (Money *et al* 2008).

Sula Sgeir was visited briefly on 5 July.

Leach's and European Storm-petrel survey methods

Ground survey

The playback method entails playing recordings of the chatter call of a male Leach's Storm-petrel or the purr call of a European Storm-petrel in suitable habitat during the late incubation period, in order to elicit a reply from an incubating adult within a burrow. A hand-held dictaphone with integral speakers was used. All accessible areas on both islands, including the highest sea-cliffs on North Rona were systematically surveyed for Leach's Storm-petrel using the tape playback

technique (Giilbert *et al* 1999) and responses were counted and mapped. European Storm-petrel was partially surveyed on North Rona but not at all on Sula Sgeir.

A drawback with the tape playback method is that not all individuals respond to the taped calls (Ratcliffe *et al* 1998), so a count of responses will underestimate the total number of apparently occupied sites (AOS) at a colony. Furthermore, Leach's Storm-petrel only respond to taped chatter calls of the same sex (Taoka *et al* 1989). Therefore it is necessary to measure what proportion of birds, of both species, are present in burrows and responding to the taped calls. This was achieved by setting up a calibration plot for each species, which entailed repeatedly visiting a delimited section of the colony on successive days and each time marking new responding AOS.

Calibration plots

Calibration plots were set up on the North Rona storm beach for European Storm-petrel and along the village graveyard wall and adjacent ruins for Leach's Storm-petrel, both sites used in the 2001 survey. On the first visit to each plot, 20 responding sites were located and marked with flagged canes. The Leach's Storm-petrel plot was visited on 10 days and the European Storm-petrel plot on 8 days. The total number of AOS was then estimated by multiplying counts of responding birds, by the response rate derived from the calibration plots (see below).

North Rona

In 2001 the island was sub-divided into 16 sections (Murray *et al* 2008) following clearly defined natural or man-made boundaries (Fig. 1). In 2009 each was searched systematically for both species, except for sections I, O and P for European Storm-petrel. Only one species was searched for at a time to ensure that each section received the same level of effort. On Fianuis (section L) and the storm beach (section M), ropes and canes were used to sub-divide the ground into strips 15-20 metres wide to aid coverage.

Island coverage was close to 100% for Leach's Storm-petrel (Fig. 2) and 87% for European Storm-petrel, (figure derived from 2001 section totals) (Fig. 4). The only site possibly holding breeding petrels that was not surveyed was the lower, inaccessible half of Geo Mairi, between sections O and P. The Toa Rona cliffs (section P) are difficult to access and were surveyed by a single surveyor only.

Sula Sgeir

To minimise disturbance to the dense assemblage of breeding seabirds on the flat top of the rock, only the five bothies, set in a small area of eroded soil edged by boulders were surveyed (Fig. 1). Due to lack of time, only Leach's Storm-petrel could be surveyed.

Atlantic Puffin survey methods

Ground survey

The presence or absence of birds ashore was checked in the late evenings when there is a high probability of birds attending colonies, and results compared with the 2001 distribution map (Fig.5).

Burrow densities

Five transects had been set up on the east cliffs of Toa Rona in 1976/80 (Murray 1993) and periodically recounted since (Murray *et al* 2001). In 2009 the area of the original transects was revisited and burrow densities sampled (see below).

Great Skua survey methods

A whole island survey was made of apparently occupied territories (AOT) and nests were searched for (Fig. 6).

Black-legged Kittiwake survey methods

A whole island count of well built nests capable of holding eggs or small young (AON) was made (Fig. 7) and sample plots checked for breeding productivity.

RESULTS

Leach's Storm-petrel

253 birds responded to the taped calls, giving an extrapolated population of 761 AOS in 2009 compared with 490 responses in 2001, representing 1,133 AOS. There has, therefore, been an overall population decline of 32.8% between 2001 and 2009 on North Rona (Table 1).

Table 1. Number of Leach's Storm-petrel AOS on North Rona in 2001 & 2009.

Section	2001	2009	Section	2001	2009
A	0	0	**I**	85	51
B	65	48	**J**	97	48
C	0	0	**K**	159	69
D	12	9	**L**	185	171
E	328	250	**M**	28	15
F	5	9	**N**	51	54
G	23	12	**O**	21	0
H	30	24	**P**	44	0
Total				**1133**	**761**

The decline was evident in 12 out of 14 sections where there had been responses in 2001 (Table 1). The most striking losses were in sections O and P, where no responses were elicited. Both are steep cliff sites and difficult to survey, but in both years they were searched by the same surveyor, in the same way and in good weather. There are no obviously different, external circumstances to account for the lack of responses. Section K is by contrast, a shallow angled, close cropped grass slope, where most responses came from the edge of Northern Puffin colonies. The decline here, from 159 AOS in 2001 to 69 AOS in 2009 (-56%) is the next most severe of all the island sections. The village ruins (section E) is the largest and most densely concentrated of the sub colonies. Here the daytime survey found only 83 responses in 2009, representing 250 AOS, compared with 142 responses and 328 AOS respectively, in 2001. There has therefore, been a decline of 23.7% in section E between 2001 and 2009.

Further evidence of decline comes from the calibration plot. In 2001 the plot was confined to the graveyard wall, and by completion after six days, 56 AOS had been marked. In 2009 the requisite 20 responses needed on day one could only be found by expanding beyond the wall, to include all the ruins in Group A, including the chapel and cell, and also a small part of Group B (Fig. 3) (Nisbet & Gailey 1962). After 10 days this greatly expanded area gave a total of 74 responses, with 37 of these in the graveyard wall.

We also searched for calling birds elsewhere within the village during the night. Searches were made over four nights and tape playback used to encourage responses. In all, 147 responses were heard and mapped, 82 in Group A, 26 in Group B and 39 in Group C (Fig. 3). The total includes all the calibration plot burrows. It is unknown how effective this search was in pinpointing all the calling birds in the village, but it gave a considerably lower total than the results from the combined daytime survey and calibration factor, which suggested a village total of 250 AOS.

Calibration plot and correction factor

This was carried out over 10 days between 28 June and the 7 July 2009 (Table 1). The mean response rate was 1/0.3325, giving a correction factor of 3.007. The total number of responses on the whole island was therefore, 253 x 3.007, giving a total of 761 AOS. (Upper 95% CI = 1/0.2868 = 3.486 x 253 = 882.2, Lower 95% CI = 1/0.3782 = 2.644 x 253 = 668.90)

Table 2. Leach's Storm-petrel calibration plot results.

Dates in June & July	28	29	30	1	2	3	4	5	6	7		
Nos. of new AOS found per visit	20	15	17	8	4	8	0	1	1	0		
Cumulative total of AOS	20	35	52	60	64	72	72	73	74	74		
Nos. of responses per visit	20	25	28	24	28	33	34	27	22	22		
Response rate											0.3325	mean
											0.3782	LCL
											0.2868	UCL

Sula Sgeir

The survey was confined to the five bothies and the boulders fringing the area of eroded soil in which they sit. No responses were elicited, compared with two in 2001.

European Storm-petrel

132 birds responded to the taped calls, giving an extrapolated population of 337 AOS (see below). Of the 16 sections, three (I, O & P) were not surveyed for lack of time. In 2001 there was a combined total of 19 responses in these three areas, and if a similar number is assumed for 2009, then total island responses would be 151, compared with 148 in 2001. Furthermore, at the largest sub-colony on the island, the storm beach (section M) numbers are virtually unchanged, with 203 AOS in 2001 compared with 212 AOS in 2009. Of the remaining 12 sections surveyed in 2009, six are unchanged, five have increased and two have decreased. The significant decrease in section B is offset by increases elsewhere (Table 3), which supports the premise of no overall change.

Table 3 Number of European Storm-petrel AOS on North Rona in 2001 & 2009.

Section	2001	2009	Section	2001	2009
A	3	3	**I**	10	ns[1]
B	23	5	**J**	8	5
C	0	0	**K**	33	41
D	0	0	**L**	30	43
E	20	23	**M**	203	212
F	0	0	**N**	0	0
G	0	0	**O**	30	ns
H	3	5	**P**	8	ns
Total				**371**	**337**

note ns / not surveyed

Calibration plot and correction factor

This was carried out at the storm beach over eight days between 29 June and 6 July 2009 (Table 4). The mean response rate was 1/0.392, giving a correction factor of 2.55. The total number of responses found in the 13 sub sections checked was 132, giving a partial island total of 337 AOS. (Upper 95% CI = 1/0.287= 3.48 x 132 = 459.8, Lower 95% CI = 1/0.497 = 2.012 x 265.6)

Table 4. European Storm-petrel calibration plot results

Dates in June & July	29	30	1	2	3	4	5	6		
Nos. of new AOS found per visit	20	11	8	13	1	0	0	0		
Cumulative total of AOS	20	31	39	52	53	53	53	53		
Nos, of responses per visit	20	19	22	34	18	27	11	29		
Response rate									0.392	mean
									0.497	LCL
									0.287	UCL

Atlantic Puffin

All the small sub colonies were still extant (Fig. 5) and there were no obvious changes in the areas occupied by puffins since the last survey in 2001 (Murray 2001). If birds were not seen at the time of some visits, the viability of a colony was checked by confirming the presence of occupied burrows (AOB).

There were no apparent changes to colony extent at the main colony, on the east cliffs of Toa Rona, but increases in AOB density were found in one of three sample quadrats here (Table 5). In 1993 many of the burrows were so short or eroded that incubating or brooding birds could easily be seen, this combined with high densities (mean AOB density 0.47/m^2 in 1976 to 0.75 /m^2 in 1993) suggested the imminent expansion of the colony or increases at some of the small sub-colonies elsewhere (Murray 1995). Neither seems to have occurred, but further increases in AOB density were recorded at Transect 5 in 2001 (when it was the only transect checked) and again in 2009. Densities at Transects 2 and 3 have declined slightly, but not significantly. Transects 1 and 4 are very difficult to access and were not visited in 2009. Overall there appears to have been no substantial change to the status of the puffin on Rona since 2001.

Table 5. Counts of occupied puffin burrows in five transects at Toa Rona, 1976-2009.

Transect number	Year	Area (m^2)	Occupied burrows	Density (burrows /m^2)
1	1976	117	37	0.316
	1993	126	46	0.365
	2009			not surveyed
2	1976	72	60	0.833
	1993	72	85	1.180
	2001	330	381	1.150
	2009	180	206	1.144
3	1976	72	27	0.375
	1993	72	71	0.986
	2009	90	83	0.922
4	1976	144	55	0.381
	2009			not surveyed
5	1980	255	29	0.113
	1993	255	33	0.129
	2001	255	41	0.160
	2009	255	61	0.239

Great Skua

Two nests were found in 1965, there after numbers rose slowly to 14 pairs in 1986 (Benn *et al* 1989). There were a maximum of 18 pairs in 1993, with ten pairs confirmed breeding (Murray & Love 1994), a possible 18 pairs in 2001 (Murray 2001), not all breeding and 17 AOT were found in 2005 (Robinson 2005). In 2009 there were a maximum of 18 AOT; not all appeared to be breeding but eggs or young were found at five nests.

No evidence was found of serious predation on puffins, kittiwakes or small petrels.

Great Black-backed Gull

The species has experienced almost total breeding failure in 2009 and it is likely the colony will produce only a handful of fledged young. The reasons for this are presumably food shortages and adults appeared not to be making any effort to provision young. Four broods of small young, aged between 7-10 days were seen alive on first arrival on the island, but were later found dead, all in a starved condition. None of the corpses were eaten and there were no obvious signs of cannibalism. By early July adults were leaving territories and flocking up.

It was thus difficult to assess the breeding population but numbers are probably at there lowest

since counts began in the 1970s and the species is in urgent need of reassessment. We counted only c600 individuals and it is difficult to translate this into pairs or AOT. There were certainly less than 500 pairs, probably in the region of 3-400 pairs for 2009. The two most recent estimates were 983 AOT in 1998 (Love & Stevenson 1999) and 551 pairs in 2005 (Robinson 2005).

Black-legged Kittiwake

A whole island count was carried out, with only the interior of two small caves not checked. If they held any nests the number would have been very small. The 852 AON found in 2009 represents the lowest nest count made on North Rona (Benn *et al* 1989) (Robinson 2005) (Table 6).

Table 6 Counts of Black-legged Kittiwake AON on North Rona 1958-2009.

Year	AON	Year	AON
1958	3385	**1993**	4197
1972	3769	**2001**	3398
1976	3143	**2005**	1837
1986	3943	**2009**	852

The contents of 70 nests were checked at three sites. Thirty-six had a single chick, 25 two chicks and nine were empty. The majority of the young were aged about 28 days, but there were 11 small, downy broods. Conditions were obviously good.

DISCUSSION

Leach's Storm-petrel

North Rona and Sula Sgeir

There has been an island-wide decline in the population since 2001. The losses have been consistent across the island but are particularly obvious in the dense village colony - the only sub-colony where a similar survey has been attempted since 2001 (Robinson 2005). On 17 June 2005, SNH staff carried out a tape playback survey of most of the village, including all of groups A and C, and part of group B. The number of responses in group A (62), was similar to the 68 found in 2001 and group C showed an increase to 50, from 37 in 2001. In total, including part of group B, 122 responses were elicited, compared with 142 in 2001. This would suggest no change between 2001 and 2005, and whatever happened to cause the decline, has been sudden and recent.

On Sula Sgeir no responses were elicited in 2009, and only two in 2001. The number is too small to draw conclusions from and it could simply be that no males were present at the time of the survey.

European Storm-petrel

North Rona

The survey was incomplete but covered 13 of the 16 sections covering the island, or about 87% of the population. The largest sub-colony, in the storm beach, was surveyed and the 83 responses

elicited were almost identical to the 81 found in 2001. Similarly, totals for the village and several other areas were close or unchanged between years and suggests that, overall there has been no change in the population.

Atlantic Puffin

North Rona

There is no evidence for changes in the population since 2001, and burrow densities, which nearly doubled between 1976 and 1993 have remained high. There is however no data on breeding productivity, but it is assumed to be good in 2009, based on the size and quality of fish loads being carried by adults. There are no signs of colony increases or area expansion at any the c30 small sub colonies or on the main colony on the east cliffs.

Great Skua

North Rona

The concern that an expanding skua population would seriously impact on the small petrels, as appears to happen at St Kilda (Newson *et al* 2008), seems to be unfounded. Skua numbers have remained low and virtually unchanged since 1986 when 14 AOT were noted. There is no evidence to suggest that large numbers of any bird species are taken, and in 2009 only one freshly killed Leach's Storm-petrel was found. This could equally have been taken by a Great Black-blacked Gull. Of the identified petrel remains, six were long decayed Leach's petrels found in or near to the village, five in a similar condition on Fianuis, and one on Toa Rona, which had been ringed. Only three European Storm-petrels were found, one an uneaten, desiccated corpse at the storm beach, which had also been ringed (on Yell, Shetland in 1984). Similarly, there were very few puffin corpses noted anywhere on the island, and little evidence of predation. Only two freshly dead adults were seen killed by skuas, and less than 50 corpses were found across the island, including a single tarsus with a ring. No kittiwake predation was seen, but c12 decayed corpses, mostly pairs of wings were found.

In an examination of skua pellets, some small bird bones were noted, which are presumed to be from petrel species. However, too few pellets were found to draw conclusions about how many individuals might be taken in a season. Fish bones were also noted and it is possible that the skuas specialize on fish prey taken from Northern Gannet *Morus Bassanus*, at the nearby gannetry on Sula Sgeir.

Great Black-backed Gull

North Rona

Since 1972, when more than 2000 pairs of Great Black-backed gulls were breeding on North Rona (Evans 1975), numbers have slowly declined to an estimated 3-400 pairs in 2009 (pers. obs.). Evans found little evidence of high predation rates by the gulls on other seabird species and an island wide search collected only 42 individual petrel remains in 12 days. During the survey for Leach's petrel AOS in 2009 we noted all petrel remains, and of the 15 found it is probable that those on Fianuis were most likely taken by gulls, as no Great Skuas breed there. While those at the village are more probably skua victims, since they nest closer to the ruins than any gull.

It is uncertain how many of the total number of petrels killed in 2009 were found during searches, but the relatively small number suggests that, despite the combined pressure from both gulls and skuas, predation up to now has had little impact on either petrel species. However, in the changed circumstances of a serious and possibly ongoing decline of Leach's Storm- petrel, predators will take an increasing percentage of the dwindling population.

Conclusion

If predation is not the main cause of the decline then wider ecological factors must be impacting on Leach's Storm-petrel that are not affecting European Storm-petrel. Both species winter in the southeast Atlantic but utilize different niches in the breeding season (Mitchell *et al* 2004) but what complex of factors are at play can only be speculation, as nothing is known of breeding productivity or adult survival rates for North Rona birds. At St Kilda (120 miles southwest of North Rona) a major decline of 54% has occurred between 1999 and possibly 2003, certainly by 2006 (Newson et al 2008). The decline on North Rona although not so severe as St Kilda, at 32.8 % since 2001, has more serious implications in the medium term. The population being so small that if the rate of decline continues the existence of the colony would be under threat.

The combined population of both North Rona and Sula Sgeir of Leach's Storm-petrel and European Storm-petrel made up 2.3% and 1.4% respectively, of the total number of each species breeding in Great Britain in 2001 (Mitchell 2004). Therefore, North Rona and Sula Sgeir qualify as a SPA under the EC Birds Directive for their importance as a breeding site for both Annex 1 listed

species of storm-petrels.

North Rona remains the third largest of the three main colonies of UK Leach's Storm petrel after St Kilda (45,433 AOS) and the Flannan Islands (1,425 AOS) (Mitchell *et al* 2004). However, as Newson *et al* (2008) have demonstrated, there has been a major decline on Dun, St Kilda, the island holding the majority of the population in the archipelago, and there maybe equally serious losses on the other islands in the group. As this study has shown, the decline is not restricted to St Kilda and although North Rona appeared to decline later than St Kilda, the phenomenon may now be widespread in the northeast Atlantic. In the light of these losses, and the implications for SPA designations, a reassessment of the UK and Ireland population of Leach's Storm-petrel is overdue.

RECOMMENDATIONS

North Rona and Sula Sgeir will always remain difficult islands to visit and work on. If SNH continues to support research here, then clearly stated, medium term priorities would be helpful, both to organisations and ornithologists willing to go and work there.

The following recommendations are what I believe should be prioritized

1. A count of Great Black-backed Gull nests/AOT on North Rona.
2. A count of Great Skua nests/AOT on North Rona
3. Investigate the diet of Great Black-backed Gulls and Great Skuas on North Rona through observation, collection of prey remains and pellet analysis.
4. A resurvey of Leach's Storm-petrel and European Storm-petrel in the North Rona village using tape playback.
5. Map all responding petrel sites in the village over several nights.
6. A count of Black-legged Kittiwake AON on North Rona and a check on breeding productivity.
7. An aerial survey of the gannetry on Sula Sgeir
8. A count of Black-legged Kittiwake AON on Sula Sgeir.

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