POPULATION SIZE AND TRENDS OF FOUR GLOBALLY THREATENED SEABIRDS AT GOUGH ISLAND, SOUTH ATLANTIC OCEAN

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SUMMARY

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Gough Island in the South Atlantic Ocean is a site of international significance for breeding seabirds, yet for most species population estimates have not been quantified and there is as yet no formal provision for long-term monitoring. This study undertook surveys of four species of globally threatened seabirds: Northern Rockhopper Penguins *Eudyptes chrysocome moseleyi* (Vulnerable), Atlantic Yellow-nosed Albatrosses *Thalassarche chlororhynchos* (Endangered), Sooty Albatrosses *Phoebetria fusca* (Endangered) and Southern Giant Petrels *Macronectes giganteus* (Vulnerable) from September 2000 to September 2001. Northern Rockhopper Penguins were only counted from a limited number of sites. However, comparison of numbers at The Glen and Sophora Glen in 2000 with earlier counts at these two sites suggests that the island population is still around 145 000 pairs. Ground counts of 11% of available habitat indicate that Atlantic Yellow-nosed Albatrosses nest at an average density of 5.0±1.0 pairs/ha, and the total breeding population is estimated to be 5300 pairs (CI: 3000 to 7500 pairs). Scan counts of Sooty Albatrosses on 2.6 km of coastal cliffs found an average of 6.2±1.2 birds/100 m, and the coastal breeding population is estimated to be 2600 pairs (CI: 1500 to 3500 pairs), with no more than 5000 pairs on the island in total. Counts of the two known inland-breeding sites of Southern Giant Petrels indicate a total population of 225–245 pairs. Comparison with earlier studies indicate that Southern Giant Petrels have increased since 1979 and that Sooty Albatrosses have decreased by nearly 60% since 1972. The estimated annual rate of decrease of Sooty Albatrosses on Gough Island (3%) matches the observed trends of this species breeding on Marion and Possession Islands in the southern Indian Ocean. Together, these results suggest that the global population of the species may decrease by around 74%–75% over three generations (90 years), justifying the recent upgrading of the conservation status of the Sooty Albatross to Endangered.

Key words: Northern Rockhopper Penguin, *Eudyptes chrysocome moseleyi,* Atlantic Yellow-nosed Albatross, *Thalassarche chlororhynchos,* Sooty Albatross, *Phoebetria fusca*, Southern Giant Petrel, *Macronectes giganteus,* population estimates, trends, conservation, Gough Island

INTRODUCTION

Gough Island, located in the central South Atlantic Ocean, is a proclaimed nature reserve and a UNESCO World Heritage Site of international importance for breeding seabirds (Collar & Stuart 1985, Cooper & Ryan 1994, Rowlands 2001). It holds virtually the entire world population of the Endangered Tristan Albatross *Diomedea dabbenena* and Vulnerable Atlantic Petrel *Pterodroma incerta,* as well as four other globally threatened seabirds, including the world's largest population of Endangered Sooty Albatrosses *Phoebetria fusca,* the second largest population of Endangered Atlantic Yellow-nosed Albatrosses *Thalassarche chlororhynchos,* over 100 000 pairs of Vulnerable Rockhopper Penguins *Eudyptes chrysocome* of the northern subspecies *moseleyi,* and small numbers of Vulnerable Southern Giant Petrels *Macronectes giganteus* at their northernmost breeding locality. It is also one of the most important sites in the world for several other (non-threatened) burrowing petrels, including Great Shearwaters *Puffinus gravis,* Kerguelen Petrels *Aphrodroma brevirostris* and Broad-billed Prions *Pachyptila vittata* (Richardson 1984; Cooper & Ryan 1994; BirdLife International 2000, 2003).

Although Gough Island is clearly of great significance for bird conservation, the difficulties of access and mountainous terrain mean that knowledge of the avifauna is still relatively poor. In spite of the enormous ornithological importance of Gough, only once previously (in 1955, see Swales 1965) has an ornithologist stayed on the island for more than a few weeks. Despite its isolation, the seabird colonies on Gough Island are thought to be under substantial threat, due to the impact of longline fishing, which causes mass mortality through drowning of birds caught on the hooks (e.g. Gales 1998, Gales *et al.* 1998). At present however, our knowledge of population sizes and trends of the seabirds of Gough Island is so poor that it is impossible to determine how severe the problems are, although evidence from longline observers and at-sea recoveries strongly suggests that birds from Gough Island are affected by bycatch mortality (Cooper 1994, Neves & Olmos 1998; Glass *et al.* 2000, Ryan *et al.* 2001, Ryan *et al.* 2002).

This paper reports on a one-year study of four species of surface-nesting breeding seabirds on Gough Island. Estimates of overall populations of Northern Rockhopper Penguins, Atlantic Yellow-nosed Albatrosses, Sooty Albatrosses and Southern Giant Petrels

are made and, where possible, population estimates are compared with previous counts to assess population trends. Population estimates and trends of Tristan Albatrosses are published elsewhere (Cuthbert *et al.* 2004).

METHODS

Study site

Gough Island (40°21′S, 9°53′W), part of the United Kingdom Overseas Territory of Tristan da Cunha, is located approximately 3000 km from South Africa and South America, and 350 km south-east of Tristan da Cunha (Fig. 1). There is a permanent weather station, run under lease by the South African Department of Environmental Affairs & Tourism, but no other habitation (Cooper & Ryan 1994). It is a volcanic island, *c.* 65 km in area, with steep mountainous terrain. Four main vegetation types are found on Gough Island: coastal tussock (mainly comprising of the grasses *Spartina arundinacea* and *Parodiochloa flabellata*), fernbush (dominated by the deciduous fern *Histiopteris incisa,* the Island Tree *Phylica arborea* and tree-ferns *Blechnum palmiforme*), upland wet heath habitat (comprising a diverse assemblage of species found in all other vegetation types) and peat bogs (Wace 1961, Cooper & Ryan 1994).

Fieldwork was undertaken from September 2000 to September 2001, mainly in areas in the southeast of the island (Fig. 2). The main areas of fieldwork included The Glen and Sophora Glen and beaches from The Admiral to South Point (Northern Rockhopper Penguins), the fernbush and coastal tussock habitat from Waterfall Point to Richmond Hill (Atlantic Yellow-nosed Albatrosses) and sea-cliffs in this area (Sooty Albatrosses). The two main breeding colonies of Southern Giant Petrels are located to the south of Triple Peak and southwest of Low Hump (Fig. 2).

Survey methods

Population estimates of Northern Rockhopper Penguins, Atlantic Yellow-nosed Albatrosses, Sooty Albatrosses and Southern Giant Petrels were made using a combination of ground and scan counts. Ground counts were conducted on foot by slowly walking through an area or colony of breeding birds and visiting every nest to check for the presence of an egg. Birds on empty nests and loafing birds were also counted during these surveys. Ground counts were made within defined areas of the breeding colony that were demarcated by natural features such as rocks, trees or streams. Within each area, nesting birds were counted by walking a series of parallel transects (15–25 m wide) the edges of which were demarcated with spray paint on vegetation at regular intervals to avoid recounting nests on the following transect. Scan counts were made through binoculars over breeding areas or colonies, with a tally being kept of apparently occupied nests (based on the posture and behaviour of incubating birds) and of loafing birds. Where possible, well-defined landmarks were used to limit the potential for over- or under-counting birds.

Scan counts of Sooty Albatrosses were made along 10 sections of coastal cliff during late October and early November, when birds were incubating eggs. These counts were likely to underestimate the actual numbers (Moore 1996). Ground counts of incubating Atlantic Yellow-nosed Albatrosses were made during October in 11 areas. Count areas of the Atlantic Yellow-nosed Albatross were mapped using handheld Garmin GPS receivers, with a fix taken every 10–20 m around the boundary of the count area. For both Atlantic Yellow-nosed Albatrosses and Sooty Albatrosses, counts were made in the first weeks following the peak of egg laying, and no account was made to correct for early failures that may have occurred during this time. Southern Giant Petrels are known to breed at only three areas of Gough Island (Swales 1965, Shaughnessy & Fairall 1976, Voisin & Bester 1981, Williams 1982): located below Low Hump on the west of the island, in the valley to the south of Triple Peak at the far north end of Gough Island, and on Long Beach on the eastern coast (Fig. 2). No further breeding sites were found during the course of the year. Both inland breeding sites of Southern Giant Petrels were counted during September 2001, when birds were incubating eggs, with the number of birds on eggs and empty nests both recorded. A combination of ground counts and scan counts was used to estimate populations of Northern Rockhopper Penguins. Both scan and ground counts were repeated at several sites to test the accuracy of these methods. There were substantial but relatively consistent differences, allowing a correction to be made. For Northern Rockhopper Penguins and Sooty Albatrosses counts were repeated

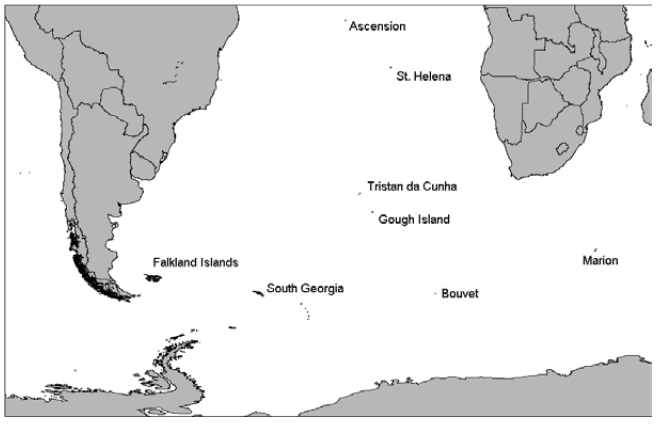

Fig. 1. The South Atlantic Ocean indicating the position of Gough Island and other major islands.

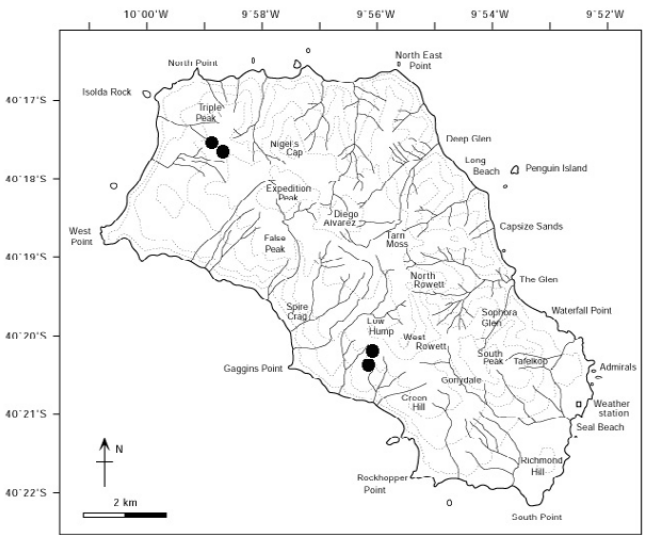

Fig. 2. Gough Island, indicating many of the main place names used in the text to describe the location of count areas. The approximate position of inland Southern Giant Petrel breeding colonies are indicated by the filled circles. The distance between contour lines is 150 m.

during the late chick-rearing period, enabling breeding success up until this time to be estimated.

Population estimates

To produce estimates on the population size of Atlantic Yellow-nosed Albatrosses and Sooty Albatrosses, it was necessary to determine the habitats and areas of Gough Island occupied by each species and the density of species within these areas. This assumes that if the habitat type was occupied by a species, then all of the available habitat on the island was occupied at the density determined counts. Because of the relatively small sample areas (5%–10% of the total habitat), and the fact that most surveys were concentrated in the southeast of the island (where the topography is relatively flat in comparison with the steep eastern glens and near vertical coastal cliffs on the west of the island), the population sizes derived from this study should be considered as crude estimates. The population size of Southern Giant Petrels is likely to be more reliable because both known major breeding sites were surveyed. The current population size of Northern Rockhopper Penguins was derived from re-sampling sites surveyed during Watkin's (1984) total-island census.

During the course of the year, the distribution and habitat occupied by Atlantic Yellow-nosed Albatrosses and Sooty Albatrosses were noted and mapped onto a 1:40 000 scale map. During the year the four major vegetation types were also mapped and the area of each habitat was estimated. Because of the steep and complex geography of Gough Island and the lack of topographic detail available from the maps, no account of slope was made in the area estimates, which consequently will slightly underestimate the true area of each habitat. This vegetation map enabled the total population of Atlantic Yellow-nosed Albatrosses to be estimated, because this species was primarily restricted to nesting in fernbush habitat. The lengths of all coastal cliff sections scanned for Sooty Albatrosses and the total perimeter of Gough Island were measured from the map. Each measurement was made three times and averaged. These estimates together with the density of Sooty Albatrosses enabled the total population around the coast to be estimated. For a more detailed description of the monitoring methods and area counted see Cuthbert & Sommer (2003). All means are presented±one standard error (s.e.), with 95% confidence limits (CI). Statistics are two-tailed and assumed significant if $P < 0.05$.

RESULTS

Northern Rockhopper Penguin

Nearly 8000 incubating Northern Rockhopper Penguins were counted from 17 to 26 October 2000 (after extrapolating from two areas to correct for the underestimate from scan counts, see below), approximately 5% of the estimated island population of 144 235 pairs in 1984 (Watkins 1987). Three sites counted on foot were also scan counted. Scan counts underestimated the number of breeding pairs and reported 42%±4% of the total recorded from ground counts (Table 1). Three colonies were recounted from 8 to 14 January 2001 to estimate the number of surviving chicks. Survival up until this time averaged 36%±3%. A ground count of Sophora Glen (Fig. 2) was made for the first time during this period. Extrapolating back from the number of chicks counted and the average breeding success observed in other areas gives an estimated breeding population of 1587 pairs in Sophora Glen. This estimate is similar to the total of 1767 birds estimated from the scan count after correcting for the proportion of birds underestimated by scan counts (Table 1).

The difficulty of accessing the steep coastal areas of Gough Island (no small boats were available) meant that no new population estimate could be made for Northern Rockhopper Penguins. However, counts undertaken in two areas can be compared with Watkin's (1987) island survey from 1984. This survey recorded 733 and 1379 incubating pairs at The Glen and Sophora Glen, respectively, compared with counts of 754 pairs at The Glen and an estimated total of 1550 to 1800 pairs at Sophora Glen in 2000. These counts suggest that the population of Northern Rockhopper Penguins on Gough Island has not decreased since the early 1980s. The total population is still likely to be around the 145 000 pairs estimated by Watkins (1987), although this estimate is based to a large degree on scan-counts made from boats and so is likely to have underestimated the true number then. The only other recent estimate of the Gough Island population was made in 1979 and reported a total of 90 000±25 000 pairs (Williams 1980).

Atlantic Yellow-nosed Albatross

A total of 538 incubating Atlantic Yellow-nosed Albatrosses were counted within 11 count areas. There was considerable variation in density of breeding birds, ranging from 1.1 to 11.2 pairs/ha (Table 2). The overall estimated density of birds in the south-east of the island was 5.0±1.0 pairs/ha (CI: 2.9 to 7.29 pairs/ha). The 11 surveyed areas covered a total of 115 ha, *c.* 11.0% of the estimated 1040 ha of fernbush habitat. Hence the breeding population of Atlantic Yellow-nosed Albatrosses in the 2000/01 season was estimated to be around 5300 pairs (CI: 3000 to 7500 pairs). This estimate falls within the "at least 5000 to 10 000 pairs" reported by Richardson (1984) for 1972. However, this latter figure was based on a very short visit to Gough Island (*c.* five days) and cannot be used as the basis for any population trend.

TABLE 1
Counts of incubating and loafing Northern Rockhopper Penguins at nine sites on Gough Island from 17 October to 8 November 2000. The figures in parentheses for two colonies were estimated from scan counts only, and this estimate assumed that these counts recorded 42% of the ground count total as estimated from three other colonies (see Results)

Ground counts		Scan counts	
Birds on eggs	Loafing birds	Birds on eggs	% of ground count
318	138	143	45
405	129	138	34
124	37	—	
1001	143	—	
673	65	—	
730	63	339	46
754	81	—	
(1767)		738	
(2274)		950	
7866	—		42±4

Sooty Albatross

A total of 145 incubating Sooty Albatrosses were counted on 10 sections of coastal cliff from 12 to 26 October 2000. The 10 areas covered a linear distance of 2590 m, *c.* 5.5% of the estimated coastline (Table 3). Relatively few birds were recorded in each count area with an average of 14.5±7.9 incubating pairs at each count area. Non-breeding birds were also rare, forming around 21% of the observations. Four areas were recounted during 21–22 March 2001, when large nearly fledged chicks were present. The pooled breeding success at these four sites up until this time was 54% (36/57, CI: 41% to 66%). The number of pairs/100 m in coastal areas varied greatly (Table 3), with an overall average of 6.2±1.2 birds/100 m (CI: 3.6 to 8.9 birds/100 m). If the estimated mean density in the south-east of the island is representative of the rest of the island, then the total population breeding on 42.1 km of coastline is estimated to be 2600 pairs (CI: 1500 to 3500 pairs). Estimating the total number of birds breeding on Gough Island is difficult because the mountainous terrain meant that numbers of birds breeding on inland cliffs could not be quantified and the total available inland habitat is unknown. Breeding Sooty Albatrosses were not observed in great numbers on inland cliffs of Gough Island, and the total island population is likely to be no greater than around 5000 pairs.

Richardson (1984) counted 650 incubating Sooty Albatrosses in 1972 on coastal cliffs along the southeast of Gough Island (Richmond Hill to The Admirals, Fig. 2). This area covers 2300 m of coastline, about 5% of the island's coastline and includes four of the areas surveyed in 2000. With 650 breeding birds and 2.3 km of coastline, the density of birds in 1972 was 15.3 birds/100 m. These counts suggest that numbers of breeding birds on the southeast coastal cliffs have decreased by nearly 60% over 28 years: an annual decline rate of around 3%.

Southern Giant Petrel

A ground count of the whole of the Low Hump colony on 14 September 2001 found a total of 169 occupied nests and one nest with the remains of a broken egg. One section of this colony was scan counted and then counted on foot, with totals of 70 and 100 incubating birds, respectively, indicating that scan counts of this area were likely to underestimate the true figure by around 30%. A scan count of the Triple Peak colony on 10 September 2001 recorded a total of 57 apparently occupied nests. Assuming that this count underestimated the true figure by 30%, then there may have been about 74 incubating birds in the area.

Due to difficulty of access the coastal areas on the east of Gough Island were not surveyed. However, only one to three pairs have ever been recorded here, all on Long Beach between Deep and Wild Glen, with records of single pairs on 8 November 1973 and 6 November 1984 (with chicks) and on 17 October 1989 (on an empty nest) (Shaughnessy & Fairall 1976, J. Cooper & P.G. Ryan unpubl. data). On 26 October 1977 three chicks were present at this locality (Voisin & Bester 1979). Assuming that the coastal population is small (and during the year no other breeding birds were found along the coastline from The Glen to the areas east of Richmond Hill; Fig. 2), then the total breeding population of Southern Giant Petrels at Gough Island is estimated to be around 225–245 pairs for 2001/02.

Previous inland counts from Gough Island have recorded substantially smaller numbers than were found during this survey. At the Low Hump colony 60 newly hatched chicks were counted in December 1959 (Swales 1965), 44 nests in two adjacent sections in early November 1979 (Williams 1982, FitzPatrick Institute unpubl. data), and 27, 30, 100 and 101 occupied nests on 19 October 1989, 10 October 1990, 12 October 1991 and 31 October 1992, respectively (J. Cooper & P.G. Ryan unpubl. data). The counts made in 1989 and 1990 were made in the upper section of the colony only and thus most probably do not represent the total numbers breeding at this locality in those years (J. Cooper *in litt.*). On 7 October 2003, 117 occupied nests were counted in this colony (J. Cooper unpubl. data). At the Triple Peak site in 1979 Williams (1982) counted five nests (four chicks and one empty nest) and R.W. Furness (unpubl. data) counted 10 chicks and five empty nests on 16 November 1985, in comparison with the estimated 57–74

TABLE 2
Counts of birds on eggs, birds on empty nests and loafing Atlantic Yellow-nosed Albatrosses at 11 sites on Gough Island from 11 October to 8 November 2000, with area and density estimates for each site, total count and mean density ±s.e.

Area (ha)	Birds on eggs	Birds on empty nests	Loafing birds	Incubating pairs/ha
4.0	39	11	9	9.8
13.7	59	6	8	4.3
8.1	33	8	2	4.0
15.9	93	18	14	5.8
7.0	8	2	2	1.1
8.5	21	2	1	2.5
6.7	28	3	3	4.2
12.2	43	12	10	3.5
21.9	40	16	6	1.8
13.3	95	42	26	7.1
7.0	79	17	32	11.2
114.5	538	137	113	5.0±1.0

TABLE 3
Counts of incubating and loafing Sooty Albatrosses at 10 coastal sites on Gough Island (from 13 October to 8 November 2000), with numbers/100 m for each site and mean numbers/100 m ±s.e.

Length of coastal cliff (m)	Incubating pairs	Loafing birds	Incubating pairs/100 m
130	9	3	675
210	4	0	188
150	20	7	1364
390	27	5	698
190	18	1	964
210	6	1	281
210	17	3	797
270	15	2	563
430	23	5	539
400	6	3	125
2590	145	30	622±118

nests recorded in 2001. These counts suggest that the island population of Southern Giant Petrels has increased by a factor of around three to four since 1979.

DISCUSSION

The results of this study provide quantitative population estimates for four globally threatened seabirds breeding on Gough Island and describe the methods for repeated long-term monitoring (Cuthbert & Sommer 2003). The estimated populations of all these species, along with almost the entire Tristan Albatross population (Ryan *et al.* 2001, Cuthbert *et al.* 2004) and huge populations of burrowing petrels (Cuthbert 2004), confirm the international significance of Gough Island as a site for seabirds (Collar & Stuart 1985, Rowlands 2001).

Comparing population estimates from this study with previous studies is difficult due to differences in methods and the limited duration of most previous work. Nonetheless, the results from earlier studies are still useful for providing evidence for large-scale changes. These comparisons indicate very different population trends among species. The coastal population of Sooty Albatrosses is estimated to have decreased by nearly 60% over 28 years, populations of Northern Rockhopper Penguins have remained stable at two colonies since 1982 and the total population of Southern Giant Petrels has apparently increased markedly since 1979. The reliability of these trends depends on the accuracy and coverage of counts and the between-year variability in breeding numbers, particularly of the biennially breeding Sooty Albatross (individuals of which may breed again if they failed in the previous year; Marchant & Higgins 1990, J. Cooper unpubl. data for Gough Island). Despite these caveats, it seems unlikely that breeding numbers could fluctuate so greatly as to undermine the evidence for either a substantial decrease in Sooty Albatrosses or an increase in Southern Giant Petrels. No quantitative comparison can be made with the current and past population estimates of Atlantic Yellow-nosed Albatrosses. However long-term monitoring at one small colony on Gough Island and population modelling suggests the population of Atlantic Yellow-nosed Albatrosses is decreasing (Cuthbert *et al.* 2003).

Early estimates of Northern Rockhopper Penguin numbers on Gough Island include figures of "millions" in the 1880s (Verill 1895) and "probably two million" in 1959 (Swales 1965). If these population estimates were in any way accurate, then numbers of Rockhopper Penguins on Gough Island may have decreased by an order of magnitude prior to the counts undertaken in 1979 and 1982 (Williams 1980, Watkins 1984). Such a decrease in numbers would match the decreases in Rockhopper Penguin populations observed at other sites: over 90% for the southern nominate subspecies *chrysocome* in 60 years on the Falkland Islands (Bingham 1998) and 94% from 1940 to 1985 for the eastern subspecies *filholi* on Campbell Island (Cunningham & Moors 1994). However, neither of the early population estimates on Gough Island were based on any known effort to count penguins, and Williams (1980) considered the figures to be considerable overestimates, rather than evidence for a major decline. Validating this conclusion is difficult, although the steep coastal cliffs surrounding much of Gough Island makes such a large population unlikely. The apparent stability in the number of Rockhopper Penguins on Gough Island since 1982 is notable given that the decreases observed at other sites have continued (e.g. Bingham 1998, Cunningham and Moors 1994, Crawford *et al.* 2003b). These decreases have occurred in the southern nominate *chrysocome* subspecies (breeding on the Falkland Islands, South Georgia, Isla Pinguino and Staten Island (Argentina) and islands off Chile) and on the eastern subspecies *filholi* (breeding on Prince Edward, Marion, Heard, Crozet, Kerguelen, Macquarie, Campbell, Auckland and Antipodes islands). In contrast, there is less evidence for a decline in recent years for the northern subspecies, with apparent stable populations on Gough (this study) and Inaccessible Island in the Tristan da Cunha group (Ryan & Moloney 2000), an increasing population at St Paul Island (Woehler *et al.* 2001), but with a decreasing population of this subspecies at Amsterdam Island (Guinard *et al.* 1998, Woehler *et al.* 2001). Different environmental and anthropological factors may be affecting the three subspecies, and investigating these may well provide clues for determining the cause or causes of the observed population decreases.

Evidence for a decrease in numbers of Sooty Albatrosses and Atlantic Yellow-nosed Albatrosses matches trends observed for many albatross species elsewhere (e.g. Weimerskirch & Jouventin 1998, Nel *et al.* 2002). These decreases could well be driven by the same factor: at-sea mortality from longline fishing vessels (Gales 1998). Southern Giant Petrels are also affected by longline mortality (SC-CAMLR 1997, 1998) and the species is classified as Vulnerable (BirdLife International 2000, 2003), as populations have decreased at several sites, although on the Crozet Islands and South Georgia numbers have remained stable or increased (Patterson *et al.* 2004 unpubl. data) . The increase in numbers of Southern Giant Petrels on Gough Island may be attributable to the documented expansion in the numbers of Subantarctic Fur Seals *Arctocephalus tropicalis* on Gough (Bester 1990) and the likely subsequent increase in food resources for the species (Hunter 1983).

The decrease in numbers of Sooty Albatrosses breeding on the south-east coast of Gough Island (an estimated annual decrease of around 3% over 28 years) corresponds closely with decreases observed at other monitored breeding sites (Weimerskirch & Jouventin 1998, Nel *et al.* 2002, Crawford *et al.* 2003a). Numbers on Marion Island have decreased at an annual rate of 2.6% over eight seasons (Nel *et al.* 2002), and on Possession Island numbers have declined at 6.9% a year over a 30-year period and are projected to continue to decrease at around 3% a year (Weimerskirch & Jouventin 1998). Gough Island (5000 pairs), Marion and Prince Edward Islands (1539 pairs) and the Crozet Islands (2620 pairs) hold between 48%–73% of the total estimated breeding population of 12 500–19 000 pairs (BirdLife International 2000). If the decline rates recorded on Marion and Possession Islands reflect decreases on other islands in the Prince Edward and Crozet Groups, then the Sooty Albatross is likely to have experienced a considerable decrease in global numbers, as recognized by the recent reclassification of the species as Endangered (BirdLife International 2003). Assuming that the populations of Sooty Albatrosses have remained stable at other breeding sites (principally Tristan da Cunha, 4125–5250 pairs, and Amsterdam Island, 300–400 pairs) and using the estimated rates of decrease on Gough (3%), Marion (2.6%) and Possession (6.9% from 1966–1995, 3% from 1995), and a generation length of 30 years [where generation length (GL) is calculated as GL = 1 / m + b and median age of first breeding (b) is 10 years, and annual adult mortality (m) is 0.05; Croxall & Gaston 1988, Warham 1990], then the global population is estimated to have decreased from 21 000–26 000 pairs in 1972 to around 10 000–14 000 pairs in 2000, a decrease of 48%–51% in 28 years,

equivalent to 74%–75% over three generations. This decline qualifies the species as Endangered (decline > 50% over three generations; Birdlife International 2000, 2002). There is considerable uncertainty in this prediction because the rate of decrease for Gough Island is based on only two partial counts, there is considerable between-year variability in breeding numbers of other albatross species on Gough Island (Cuthbert *et al.* 2003, 2004), and we have no knowledge of population trends on Tristan da Cunha and Amsterdam Island. If population trends on Tristan da Cunha and Amsterdam Island were to match the rates of decrease found on other monitored islands then the conservation status of the species would warrant being upgraded to Critically Endangered.

In summary, this study provides the baseline information for monitoring population trends of four globally threatened surface-nesting seabird species at Gough Island. Contrasting population trends, both between the four species on Gough Island and between the same species on other islands, illustrate the complexity of the processes that may be affecting different species or different populations of the same species (e.g. Sagar 1999). Comparison with previous counts indicates that populations of Sooty Albatrosses have decreased dramatically and numbers of Atlantic Yellow-nosed Albatrosses are also likely to have decreased (Cuthbert *et al.* 2003). In contrast, populations of Northern Rockhopper Penguins have remained stable over the last 20 years and the total island population of Southern Giant Petrels appears to have increased.

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