



INACCESSIBLE ISLAND

seabird monitoring manual



PETER G RYAN

Inaccessible Island Seabird Monitoring Manual

Research Report

Peter G Ryan

Published by the RSPB Conservation Science Department

RSPB Research Report No 16

Published by the Royal Society for the Protection of Birds,
The Lodge, Sandy, Bedfordshire SG19 2DL, UK. © 2005

The Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire SG19 2DL, UK.
All rights reserved. No parts of this book may be reproduced in any form or by any means without
the prior written permission of the Society.

ISBN 1 901930 70X

Recommended citation: Ryan, PG (2005). Inaccessible Island Seabird Monitoring Manual. RSPB
Research Report No.16. Royal Society for the Protection of Birds, Sandy, Bedfordshire, UK. ISBN
1 901930 70X.

All photographs by Peter Ryan.

Summary

At least five species of globally threatened seabirds breed at Inaccessible Island: (Northern) rockhopper penguin *Eudyptes chrysocome moseleyi* (Vulnerable), Tristan albatross *Diomedea [exulans] dabbenena* (Endangered), Atlantic yellow-nosed albatross *Thalassarche chlororhynchos* (Endangered), sooty albatross *Phoebastria fusca* (Endangered) and spectacled petrel *Procellaria conspicillata* (Critically Endangered). A further two species of global concern may breed (grey petrel *Procellaria cinerea* and Atlantic petrel *Pterodroma incerta*). Three of the four landbirds are also listed as globally threatened. This document summarises monitoring protocols for the five threatened seabirds known to breed on Inaccessible Island, and presents baseline information currently available for these species. It is designed to act as a manual and basic resource for future monitoring of the island's threatened seabird populations.

It assumes monitoring efforts take place in November, which overall is perhaps the best month for monitoring seabirds on the island. The target is to monitor trends in at least 10% of the populations of each threatened species.

Acknowledgements

The spectacled petrel survey in 2004 was funded by a grant from the UK Overseas Territories Environment Programme (OTEP), administered by Geoff Hilton of the Royal Society for the Protection of Birds. Fieldwork at Inaccessible Island was assisted logistically by the Tristan da Cunha Natural Resources Department and Ovenstones Agencies Pty Ltd. I am extremely grateful to James Glass, Clarence October and Nick du Plessis for their help and support. Frans Hoffman from the South African Directorate: Antarctica and Islands kindly arranged the loan of an HF radio for the expedition. During November-December 2004, Cliff Dorse assisted me greatly in the field. The monitoring protocols suggested stem partly from previous visits to Inaccessible Island, when I was assisted by Coleen Moloney. Permission to conduct research at Inaccessible Island was granted by the Tristan Administrator, Mike Hentley, and the Tristan Island Council. An earlier draft of this document was improved by comments from Geoff Hilton, Richard Cuthbert and Cliff Dorse.



Picture 1. Inaccessible Island from the sea

Contents

Summary	i
Acknowledgements	ii
Contents	iii
1 Introduction	1
1.1 Background to this manual	1
1.2 Background to Inaccessible Island.....	1
2 Logistical issues	3
2.1 Access & permission.....	3
2.2 Fieldwork logistics on the island.....	3
3 Outline of monitoring protocols	5
3.1 Summary of species' status and monitoring methods.....	5
3.2 Recent population trends.....	7
3.3 Monitoring frequency	7
4 Individual Species Accounts	8
4.1 (Northern) rockhopper penguin <i>Eudyptes chrysocome moseleyi</i>	8
4.2 Tristan albatross <i>Diomedea [exulans] dabennena</i>	11
4.3 Atlantic yellow-nosed albatross <i>Thalassarche chlororhynchos</i>	13
4.4 Sooty albatross <i>Phoebastria fusca</i>	16
4.5 Spectacled petrel <i>Procellaria conspicillata</i>	18
4.6 Other species	24
5 References	29
Appendix 1: Contact details for key personnel & agencies	30
Appendix 2: GPS co-ordinates for key features on Inaccessible Island	31

1 Introduction

1.1 Background to this manual

Inaccessible Island, one of three main islands in the Tristan da Cunha group, is a globally important breeding site for at least 16 species of seabirds (Hagen 1952, Elliott 1957, Fraser et al. 1988, Ryan et al. 1990, Ryan & Moloney 2000, Ryan & Glass 2001). Five of these species are listed as globally threatened (BirdLife International 2004): (Northern) rockhopper penguin (Vulnerable), Tristan albatross (Endangered), Atlantic yellow-nosed albatross (Endangered), sooty albatross (Endangered) and spectacled petrel (Critically Endangered). A further two species of global concern, grey petrel (Near-threatened) and Atlantic petrel (Vulnerable), may also breed at the island (Ryan & Glass 2001).

Although periodic estimates of the population sizes of various seabird species breeding on Inaccessible Island have been made over several decades (Table 2), there has never been a formal monitoring programme, in the sense of successive counts using a consistent sampling and counting protocol. For this reason, population trends of all species are poorly known. It is thus difficult to identify and prioritise conservation problems as they arise, or to confirm whether conservation actions have been successful. This report describes monitoring protocols for the five threatened species, as well as other easily counted, surface-nesting seabirds, based on visits to Inaccessible Island in November–December 2004, as well as previous visits in 1988–1990 and 1999/2000. Its aim is to document repeatable census protocols, which, if followed by ornithologists visiting the island, will allow reliable estimates of future population changes.

1.2 Background to Inaccessible Island

Inaccessible Island (37° 18'S, 12° 41'W) is a cool-temperate island of volcanic origin in the central South Atlantic Ocean, mid-way between the southern tip of Africa and South America. Together with Nightingale and Tristan, it is one of three main islands in the Tristan da Cunha archipelago. Nightingale Island lies 20 km to the southeast, the main island of Tristan 40 km to the northeast, and Gough Island is 400 km south-southeast. The four islands form the United Kingdom Overseas Territory of Tristan da Cunha, with an Administrator (appointed by the UK Government on a three-year basis) and elected Island Council. The permanent population of slightly fewer than 300 people is based on Tristan, but there is a South African weather station on Gough Island, which is staffed year-round by a team of 6–8 people.

Inaccessible Island is described in detail in the island's Management Plan (Ryan & Glass 2001), which should be read by anyone planning to visit the island. It is available online as a series of pdf files from the UK Overseas Territories' Conservation Forum website (<http://www.ukotcf.org/>). Inaccessible Island is 14 km² (Figure 2), *ca* 5.7 km east-west and 4.6 km north-south, intermediate in size between Tristan (96 km²) and Nightingale (4 km², including the offshore islets, Alex and Stoltenhoff). Inaccessible is characterised by steep cliffs around the entire coastline, and an undulating plateau that rises from some 150 m at the eastern end (Harold's Plain) to over 500 m at the western end. Swale's Fell, the highest point, is *ca* 580 m above sea level. There has been substantial slumping along the plateau edge on the north-western side of the island, driven by ongoing marine erosion.

The island's plateau is dissected by several watercourses that terminate in spectacular waterfalls down the eastern cliffs. The largest catchment, draining more than a quarter of the island, reaches the coast at the Waterfall, at the eastern end of the northeast coast. The only area of level land at sea level is between Blenden Hall and West Point. Narrow raised platforms occur beneath the cliffs along the northeast coast north of the Waterfall and Salt Beach. Boulder beaches are found along much of the shoreline. There are several wave-washed offshore rocks and one vegetated stack, Cave Rock, all within 500 m of the main island.

Inaccessible Island, its islets and waters out to 12 nautical miles, were declared a Nature Reserve in 1997 under the Tristan da Cunha Conservation (Amendment) Ordinance of 1997, and added to the Gough Island World Heritage Site in 2004. All native animals and plants are protected. The importation of alien animals and plants is prohibited, as is any agricultural or horticultural activity (Ryan & Glass 2001). Construction of any infrastructure (huts, aerals, etc.) requires a permit. Waters within 200 nautical miles (370 km) of the islands are protected by the Tristan da Cunha Fishery Limits Ordinance of 1983 (as amended 1991, 1992 & 1997). Fishing rights within 50 nautical miles of the coastline currently are restricted to a single concession holder, subject to island-specific quotas and size limits, for the main target species, the Tristan Rock Lobster *Jasus tristani*. Fishing at Inaccessible Island is performed from vessels operating out of Cape Town, currently the *Edinburgh*.

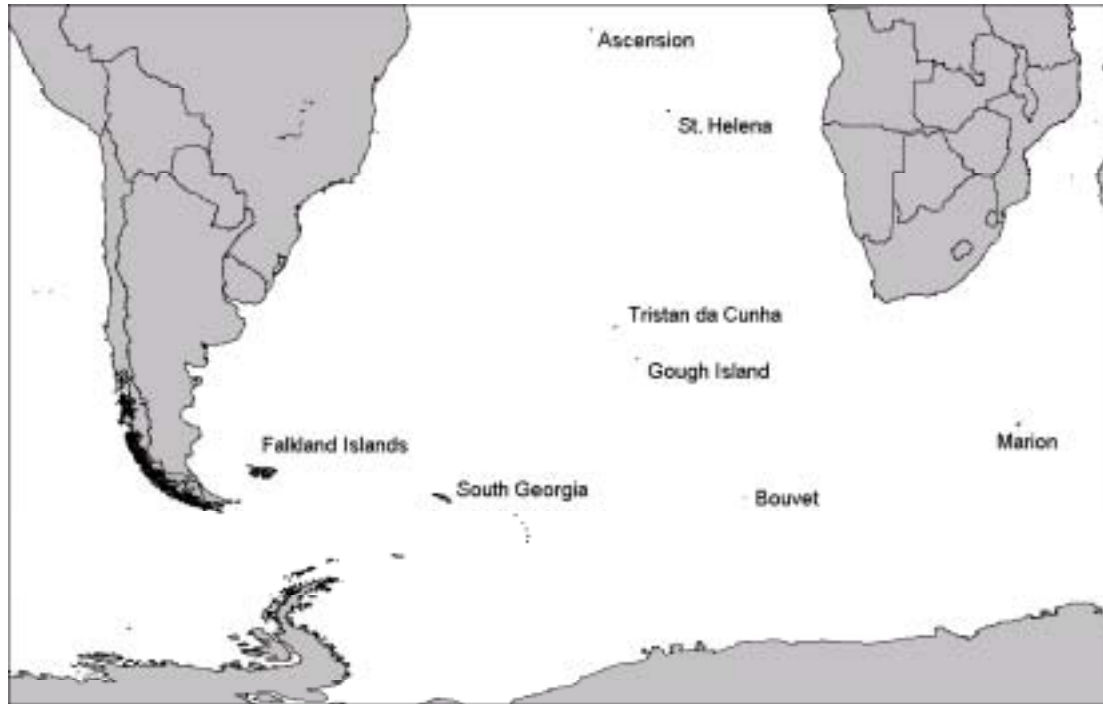


Figure 1. The South Atlantic and Indian Oceans, indicating the position of Inaccessible Island and other main islands

2 Logistical issues

2.1 Access & permission

Any plan to conduct monitoring operations at Inaccessible must be made in conjunction with the Conservation Officer, Simon Glass, as well as Tristan's Natural Resources Department, through James Glass, and the Territory's Administrator (see Appendix 1 for contact details). Tristan can only be reached by sea. The fishing vessels make several trips to and from Cape Town each year and carry small numbers of passengers, but demand for berths is high, and passages must be arranged well in advance. Sailing schedules are only released at most one year ahead, and dates are somewhat flexible, making long term planning problematic. The South African research and supply vessel, the *SA Agulhas*, operated by the Department of Environmental Affairs & Tourism as part of the South African National Antarctic Programme, visits Tristan each spring (September-October) *en route* to Gough Island, and an increasing number of cruise ships now call at Tristan.

Landing on Inaccessible Island is by permit only, issued by the Administrator. Access to the island is generally by sea; the *SA Agulhas* carries a helicopter, which can be chartered to e.g. supply equipment to the hut, but this requires considerable forward planning and liaison with the Directorate: Antarctica and Islands of the South African Department of Environmental Affairs and Tourism. There are no wharves or jetties for ships. Safe anchorages generally occur off the eastern, leeward coast of the island. Under westerly wind and swell conditions, landing from small inflatable boats or dinghies can often take place at the Waterfall or Salt Beach on the northeast coast. However, there is no easy access to the plateau from these sites. Camping should take place next to the old hut immediately north of the Waterfall (37° 17.6'S, 12° 39.3'W). The other main landing beach is at Blenden Hall, near the west point of the island, where there is a small hut and access to the island interior. This beach is less protected, and requires relatively calm seas and winds from the south or east. Landing days are scarce, and it may take several weeks of waiting before one can get on or off the island.

2.2 Fieldwork logistics on the island

Accommodation on the island is available at Blenden Hall, where there is a small (9 x 6 m), well-equipped hut. The hut has two beds, but mattresses and bedding for up to six people. It also has cooking facilities (two 2-plate gas stoves, pots and pans, and crockery and cutlery for six people), and other basic equipment including a table, six chairs, five 20 l water containers and a solar panel, suitable for charging radio batteries and other limited use. Tristan's Natural Resources Department has two VHF radios which can be borrowed for communicating with ships offshore and with Tristan from the island plateau, but it is useful to have an HF radio or satellite phone to contact Tristan from the hut (which is out of line-of-sight of Tristan). There are no refrigeration facilities, but perishables such as bread and cheese (vacuum sealed) last several weeks in the relatively cool climate. No fresh vegetables or fruit may be brought to the island (see the island's Management Plan). A perennial stream provides excellent drinking water *ca* 60 m from the hut. Water is best collected where the stream cascades over a small cliff onto the beach, and a pipe can be rigged up here to provide a shower and easy watering point (but please return the pipe to the hut at the end of each visit). The West Road to the plateau ascends directly from behind the hut, but the path is overgrown when not used regularly, and novices to the island would require an island guide to establish the route. Fixed ropes have been placed to assist ascending the steeper slopes above the apple trees west of Nelson's Gulch. Access on the plateau is relatively straightforward, although progress can be slow due to thick vegetation and high densities of bird burrows in many areas.

The climate is often cool, windy and wet, but warm, sunny days do occur, so pack a sunhat and sunscreen. Waterproof walking boots and gaiters are fine on good days, but Wellington boots remain indispensable in wet weather. Fieldwork is best conducted in lightweight, quick-drying trousers and

base-layer shirts, coupled with a Polartec jumper, hat and waterproof jacket and overtrousers for unexpected showers. Orographic cloud covers the plateau on roughly half of days in summer. It is possible to work on the plateau on cloudy days, provided one doesn't need to see too far (e.g. conducting occupancy checks on Ringeye burrows), but the cloud is often accompanied by strong winds which make for unpleasant working conditions. Camping is possible on the plateau; I recommend using the existing site at Denstone Hill junction ($37^{\circ} 17.6'S$, $12^{\circ} 40.4'W$) rather than trying new sites unless absolutely necessary. Camping at more exposed sites on the higher western plateau is likely to lead to loss of tents due to high winds.

Introduced species pose the greatest conservation threat to the biota of Inaccessible Island (Ryan & Glass 2001), and so great care must be taken to ensure that all materials taken to the island are clean and free of propagules. Ideally, all clothing and equipment should be new, packed in clean boxes, and inspected before being taken ashore. Rodents are the most dangerous aliens likely to reach the island, so be especially vigilant with any materials stored on Tristan, where both House Mice *Mus domesticus* and Black Rats *Rattus rattus* are common. All vessels entering the waters of the Inaccessible Island Nature Reserve are required to have a rodent-free certificate issued in their last port of call (Ryan & Glass 2001). Limited tourism is permitted under strict conditions (see the island's Management Plan), with landings only on the eastern coast at the Waterfall or Salt Beach. Appendix 2 gives a list of coordinates for key features and routes for orientation on the island.

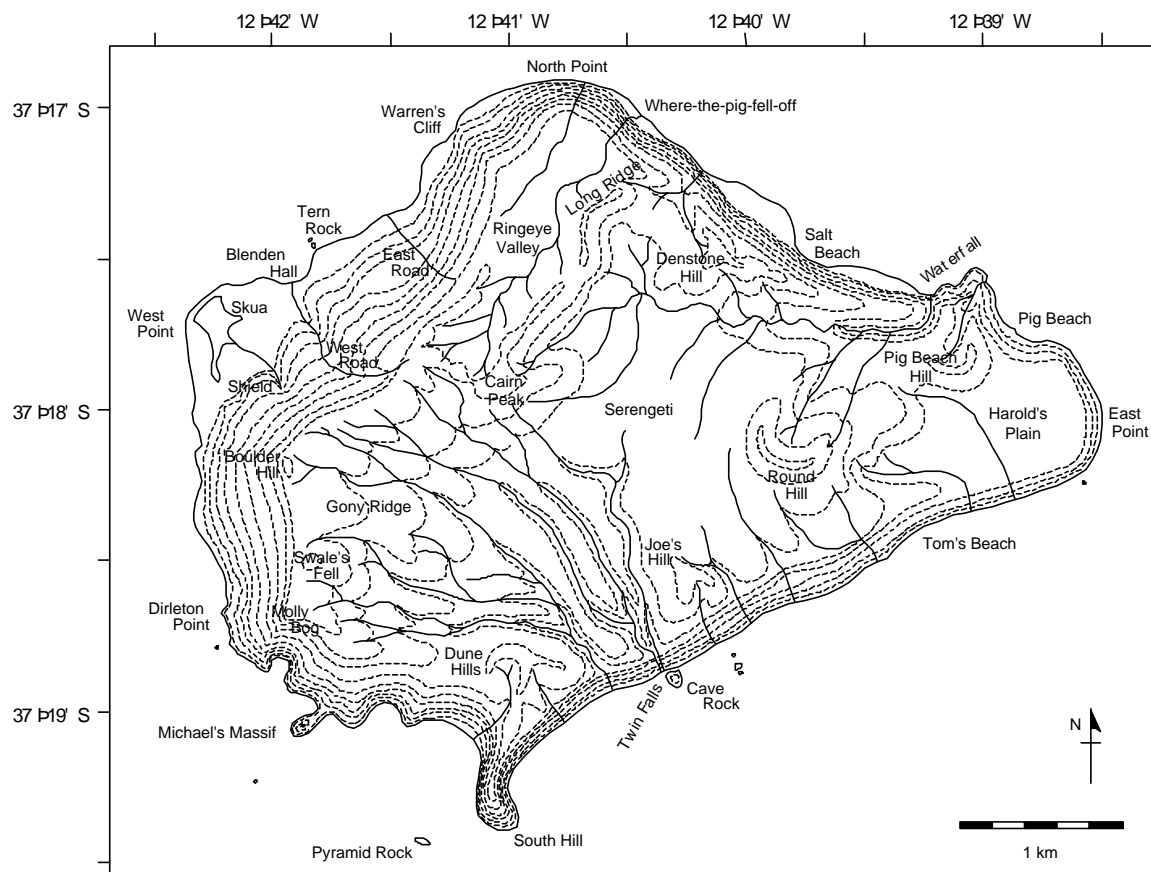


Figure 2. Map of Inaccessible Island, showing major drainage lines and approximate relief (modified from Ryan & Glass 2001)

3 Outline of monitoring protocols

3.1 Summary of species' status and monitoring methods

Spectacled petrels or Ringeyes have received most attention because they are confined as a breeding species to Inaccessible Island and have the highest threat category. Given an apparently small total population and ongoing significant long-line mortality mainly off the east coast of South America, the species has been listed as Critically Endangered. However, crude population estimates at the island show an increasing population from the 1930s to present, the increase probably representing recovery from significant predation by feral pigs on the island during the 19th century. Currently the population is estimated at *ca* 10,000 breeding pairs, and its threat status probably should be lowered to Vulnerable. A more detailed monitoring plan for the species is provided, as is baseline data on assessing burrow occupancy using tape playback during November. A core study area in the upper end of Ringeye Valley contains just over 10% of the island's population, and can be counted in a single day, with a second day needed for occupancy and validation checks. Burrow counts for the remainder of the island are presented on a catchment-by-catchment basis, so that additional areas can be monitored if resources permit. November is the best month for monitoring this species, because adults are incubating and respond well to tape playback.

Inaccessible Island has nine colonies of Northern rockhopper penguins. Most breeding takes place under almost impenetrable tussock grass *Spartina arundinacea*, making direct counts of the colonies extremely difficult and disruptive to the breeding birds. Colony size is correlated with the number of birds visible on landing beaches, and counts of beach parties provide a quick, easy monitoring tool. However, beach party size varies seasonally and with time of day, so these variables have to be considered when interpreting apparent long-term changes. Eggs are laid in September and hatch in October. Beach parties are larger in November, when birds are commuting to and from feeding chicks, than in September, when birds are incubating.

Table 1. Main survey methods and timing for monitoring priority seabird species on Inaccessible Island

Species	Number of sites	Approximate % of island population	Main survey method	Optimal Timing
Rockhopper penguin	9	100%	Estimate colony density and map colony area	September-October
			Beach-party counts	November
Tristan albatross	1	100%	Ground count of large chicks	November
			Ground count of incubating adults	January
Atlantic yellow-nosed albatross	7	20%	Scan/ground count of incubating birds	October-November
Sooty albatross	8	10%	Scan/ground count of incubating birds	October-November
Spectacled petrel	8	10%	Burrow counts and burrow	November

Species	Number of sites	Approximate % of island population	Main survey method	Optimal Timing
(Tristan) southern skua	Whole island	majority	Map territory/nest locations	November
Antarctic tern	Lowlands	majority	Scan/ground counts of incubating pairs in colonies	November-December
Brown noddy	Lowlands	majority	Scan/ground counts of incubating pairs in colonies	October-November

Together with Gough Island, Inaccessible is one of only two breeding sites for Tristan albatrosses or Gonies. For the last 70 years, the island has supported less than five pairs of this species. The only practical monitoring effort is to record all breeding attempts; these are confined to the upper parts of Gony Ridge, above 500 m on the high western plateau. November is not the ideal time for monitoring this species, which lays in January, but it does allow an estimate of annual production in terms of fledged chicks.

Atlantic yellow-nosed albatrosses, or Mollies, breed throughout the island plateau and locally on level areas on the coastal scarps down to *ca* 200 m elevation. Laying takes place in September, with eggs hatching in late November, so counts in November may be influenced by early breeding failures. The population has been estimated at 1,100 pairs, but this is almost certainly an underestimate. A total count of the population would be extremely time-consuming to undertake, but selected areas on the upper plateau can be counted fairly easily, in conjunction with spectacled petrel and sooty albatross surveys. The core spectacled petrel study area at the top of Ringeye Valley supports almost 10% of the estimated population, and can be supplemented by sampling adjacent areas around Cairn Peak, on the slump between the West and East Roads, and around Molly Bog. Together these areas had almost 400 breeding pairs in November 2004, at least 20% of the total population.

Sooty albatrosses or Peoos are less numerous, with an estimated 500 pairs, although confidence in this estimate is poor. They are largely confined to the steep coastal cliffs, where the rugged terrain combined with their relatively cryptic plumage makes counting extremely difficult. Small numbers breed at more accessible cliff sites on the island plateau. Eight sites, each supporting at least two pairs of Sooty Albatrosses, were identified, together supporting 51 pairs in November 2004, *ca* 10% of the island population. Repeated checks of these sites should give some indication of population trends, although results should be treated with caution as they are perhaps peripheral to the main breeding habitat along the coastal cliffs. Like yellow-nosed albatrosses, they are in the latter part of incubation during November, so numbers have to be corrected for early breeding failures.

This manual also describes protocols for monitoring (Tristan) Southern skua, Antarctic tern and brown noddy. Map all Tristan southern skua *Catharacta antarctica hamiltoni* nests using GPS to compare with previous maps (Figure 10); also map all areas visited (as required by the Management Plan). Repeatedly count non-breeding birds in the 'club' at West Point and the adjacent pool on Skua Pond. Count Antarctic Tern *Sterna vittata* nests at the cliff behind the old hut west of the Waterfall. Count brown noddy *Anous stolidus* nests in apple groves at Blenden Hall and in island trees *Phyllica arborea* at Wilkins' Copse. Also count nests on the cliff and in pine trees behind the old hut west of the Waterfall.

3.2 Recent population trends

In comparison with 1999/2000 counts, and earlier estimates, 2004 had larger numbers of spectacled petrels and yellow-nosed albatrosses (although 1999 was a poor year in terms of breeding success for this albatross at Gough Island). There were no Tristan albatrosses on the island in 2004, but this may simply be a consequence of the small population size; with only a few pairs of a biennial-breeding species, it is quite likely that no pairs will raise a chick to near fledging age in a given year. Sooty albatrosses have probably remained roughly stable, with an increase at one of the two large inland colonies and a decrease at the other. Northern rockhopper penguins may have decreased, with beach parties in 2004 consistently smaller than those counted in 1999, but counts in 2004 were mostly made from offshore, and are similar to estimates made from a fishing vessel in 1989.

Table 2. Population estimates of birds breeding on Inaccessible Island

Species	Global status	Estimate breeding population on Inaccessible Island
(Northern) rockhopper penguin	VU	16-18,000 pairs ¹
Tristan albatross	EN	0-1 pair ^{1,3,4}
Atlantic yellow-nosed albatross	EN	2,000 pairs ¹
Sooty albatross	EN	500 pairs (low confidence) ^{2,4}
Spectacled petrel	CR	10,090 occupied burrows ¹
(Tristan) Southern skua	LC	80-100 pairs ^{2,3}
Antarctic tern	LC	100 pairs ³
Brown noddy	LC	50 pairs ³

1: data from November 2004 fieldwork. 2: Data from Ryan & Moloney (2000). 3: Data from Ryan & Glass (2001). 4: Annual breeding population of this biennially breeding species.

3.3 Monitoring frequency

Ideally, monitoring should take place annually, but for most species this is unrealistic. Fishery observers based on vessels fishing off the island can count beach parties of rockhopper penguins on an annual basis, and breeding effort by Atlantic yellow-nosed albatrosses can be checked during a two-three day visit to the island, provided at least one good day is available to climb to the plateau. Experienced observers could count both spectacled petrels and yellow-nosed albatrosses in the upper part of Ringeye Valley in a single day. More comprehensive surveys of spectacled petrels and sooty albatrosses, as well as counts of all seven yellow-nosed albatross monitoring areas requires at least a week on the island.

4 Individual Species Accounts

4.1 (Northern) rockhopper penguin *Eudyptes chrysocome moseleyi*

Summary

- ≠# Count beach parties at as many colonies as possible (see Figure 4 and Table 3), noting time of day. Make as many repeat counts as possible to control for within and between-day variations in numbers.
- ≠# If time permits, map the extent of colonies using a GPS to record locations around the periphery of each colony, then estimate nest density in a sample of 5x5 m quadrats.

Distribution and phenology

Northern rockhopper penguins breed at nine sites around Inaccessible Island (Figure 3). Their distribution appears to be constrained to some extent by the limited availability of fairly level ground at the foot of the coastal cliffs. Males return to the island in early to mid-August, followed by the females 10 days later (Elliott 1957). Eggs are laid in September, hatch in mid- to late October and fledge in late December to early January (Elliott 1957, Williams & Stone 1981, Ryan et al. 1990). First year birds return to moult from end November to early February, adults from mid January to the end of March (Elliott 1957).

Monitoring protocols

Most breeding takes place under almost impenetrable tussock grass, making direct counts of the colonies extremely difficult and disruptive to the breeding birds. Only the colony at South Hill is in more open vegetation, but even here, most nests are concealed by vegetation. Ryan et al. (1990) crudely estimated colony areas and nest density within colonies (based on observations at Blenden Hall and Warren's Cliff of densities of *ca* 0.5 nests m⁻²). Colony areas at accessible sites were estimated by estimating the distance between two observers standing on opposite sides of the colony. At other colonies, the approximate extent of the colony was estimated by looking down onto the colony from the cliffs above, but this is not very satisfactory, because the boundaries of the colonies are not always evident. With current GPS accuracy, probably the best approach will be to trace the periphery of each colony using a GPS logger. If time permits, map the extent of colonies using a GPS to record locations around the periphery of each colony, then estimate nest density in a sample of 5x5 m quadrats; e.g. count the number of active nests in 10 quadrats to estimate mean \pm SD of nest density. Ideally, counts should take place in September or early October during the incubation period.

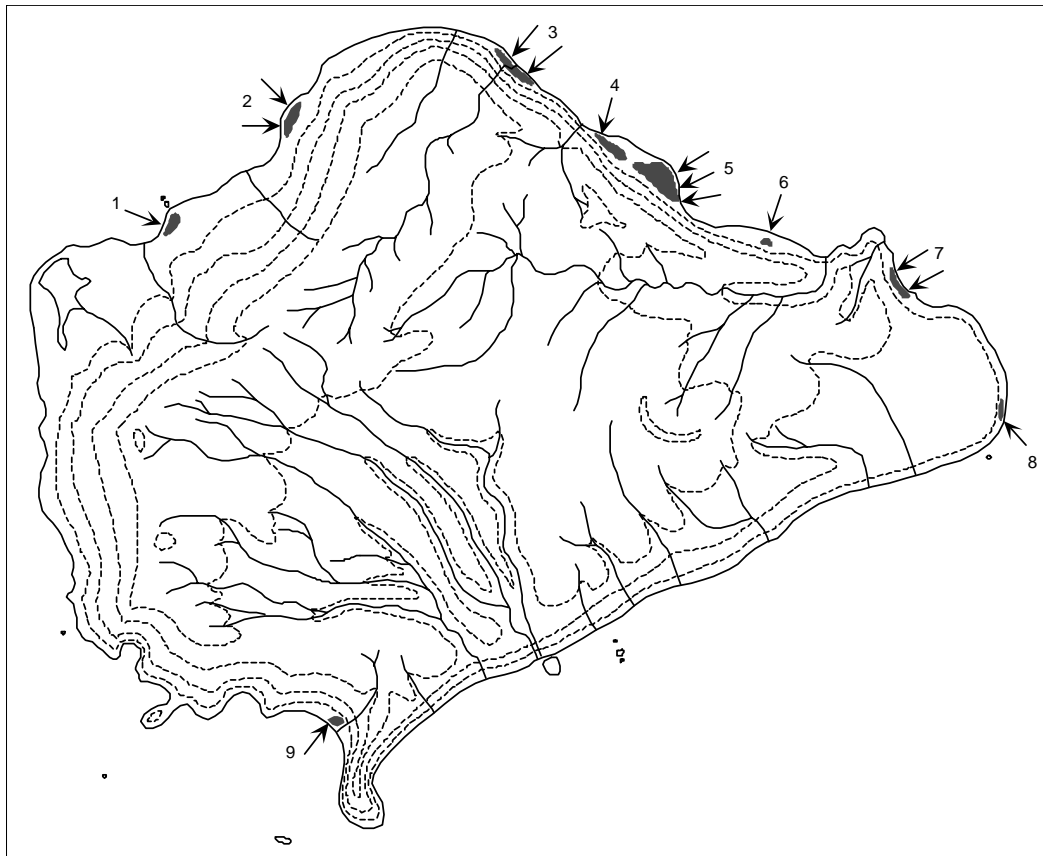
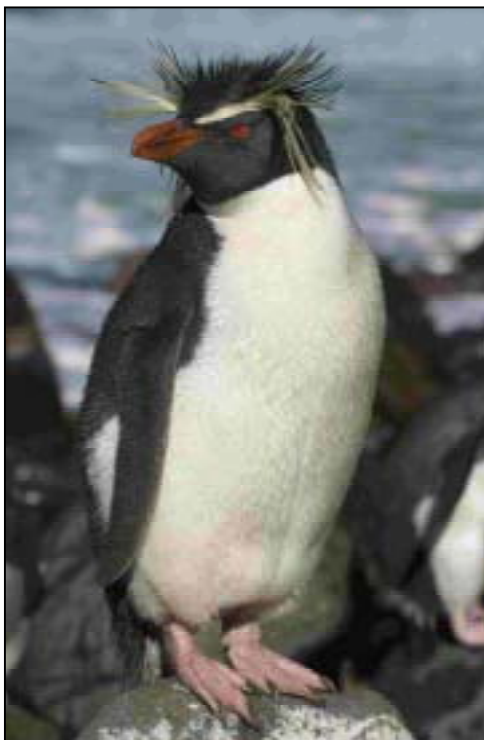


Figure 3. The distribution of the nine Northern Rockhopper Penguin colonies at Inaccessible Island, with landing beaches where beach parties can be counted arrowed



Picture 1. Northern rockhopper penguin

Fortunately, colony size is correlated with the number of birds visible on landing beaches. Despite beach parties comprising a mix of commuting breeding adults, loafing adults, prospecting sub-adults and occasional immature birds, the numbers of birds on beaches in mid-November is crudely equivalent to 15% of the estimated number of breeding pairs (Ryan *et al.* 1990):

$$\text{Number of breeding pairs} = 6.99 \times \text{beach party size} + 719$$

($r^2=0.979$)

Counts of beach parties are a quick, easy monitoring tool. However, beach party size varies seasonally and with time of day, so these variables have to be considered when interpreting apparent long-term changes. There are few data on seasonal variation, but numbers in beach parties at the Waterfall and Salt Beach in mid-late September 2004 (during incubation) were appreciably lower than in mid-November (chick rearing). There is a consistent diurnal pattern, with numbers peaking in the early morning, and again, to a lesser extent, in the evening, but remaining fairly constant throughout the rest of the day (Figure 4).

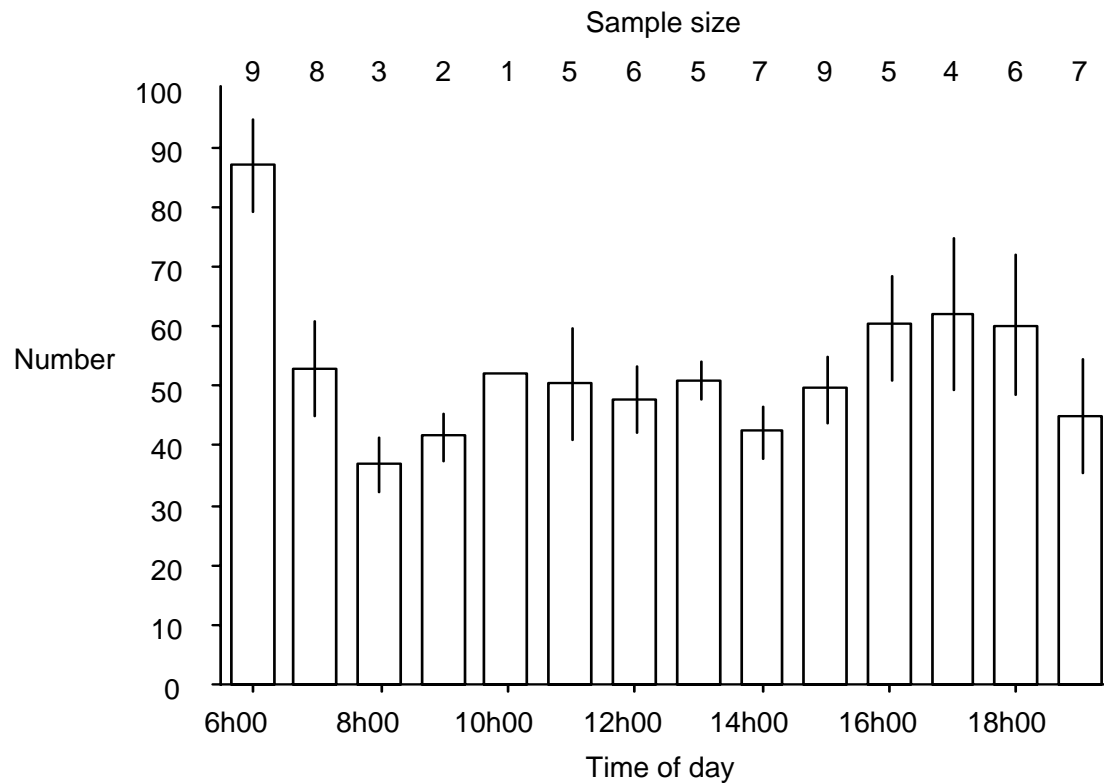


Figure 4. Counts of Northern Rockhopper Penguins (\pm SE) in the main beach party at the Blenden Hall colony as a function of time of day during November 2004

Multiple counts should be made of beach parties, where possible, noting both date and time of day. Counts can be made from vessels offshore, but these tend to be slightly lower than counts made ashore, and so all counts should be flagged as either made ashore or from vessels offshore. Also, for vessels offshore, it should be noted the type of vessel and approximate distance offshore.

Abundance and baseline data

Counts of beach parties made during mid-November 2004 were lower than those in either 1989 or 1999 (Table 7). The most marked reduction was in the colony below Where-the-pig-fell-off, which had been reduced in size in 2004 by a recent landslip that had inundated almost half of the colony; it is unknown whether this occurred when penguins were present. However, beach party counts at most other colonies were also lower than in previous years, despite the counts at all sites except Blenden Hall and Warren's Cliff taking place in the late afternoon and early morning, when numbers usually are highest (Figure 4). There is thus reason to suspect that penguin numbers at Inaccessible Island were lower in 2004 than in previous years, at least during the chick-rearing stage.

Assuming the relationship between beach party size and population estimates for a subset of colonies made in 1989 (Ryan *et al.* 1990) applies equally, it suggests that the population size in 1989 and 1999 was 24-30,000 pairs, whereas it was only 16-20,000 pairs in 2004. Reasons for such a decrease are unknown, but they mirror similar decreases reported from Gough Island and other populations of rockhopper penguins (BirdLife International 2004).

Table 3. Beach party counts of Northern rockhopper penguins on Inaccessible Island in mid-late November 2004, compared with counts at the same time of year in 1989 (Ryan et al. 1990) and 1999 (Ryan & Moloney 2000)

Colony	Year of count			Number of counts in 2004
	1989 ¹	1999 ² (range)	2004 ³ (range)	
1. Blenden Hall	100	180 (140-200)	60 (20-110)	77
2. Warren's Cliff	500	380 (320-450)	130 (80-220)	4
3. Where-the-pig-fell-off	500	700	155 (150-160)	2
4. Salt Beach north	(incl. in 5)	350 (320-400)	135 (120-150)	2
5. Salt Beach (main)	950	900 (800-1000)	550 (400-700)	2
6. Waterfall slump	150	180 (150-220)	65 (60-70)	2
7. Pig Beach	100	300	115 (80-150)	2
8. East Point	80	220	105 (70-140)	2
9. South Hill	No count	130	No count	
Total	2,380	3,340	1,315	

¹Counts made from fishing vessel offshore. ²All shore-based counts. ³Counts made from fishing vessel offshore except Blenden Hall and Warren's Cliff.

4.2 Tristan albatross *Diomedea [exulans] dabennena*

Summary

≠ Count all large chicks on Gony Ridge (Figure 5) in September-November. Count incubating breeding pairs in January-February. Opportunistic counts at other times are also useful.

Distribution and phenology

Tristan albatrosses or Gonies are confined to the upper parts of Gony Ridge, above 500 m on the high western plateau (Figure 5, approximately 37° 18.3'S, 12° 41.5-8'W). One was found in a patch of tussock among island tree woodland near Denstone Hill on 16 January 1990, but was unable to take off among the dense vegetation, and was eventually carried to the island edge and released (Ryan et al. 1990). Eggs are laid in January, and chicks fledged in late November or December. Because of the protracted breeding season, successful pairs breed at most every second year (Ryan et al. 2001).

Monitoring protocols

The only practical monitoring effort is to record all breeding attempts. Incubating adults and downy chicks are fairly easily located by their large size and white plumage. Some nests on the northern slopes of Gony Ridge are visible (with binoculars) from near the top of the West Road, but it is essential to walk along the upper parts of the ridge, because some nests are concealed in shallow depressions. November is not the ideal time for monitoring this species, because only large chicks, close to fledging age, are present. Because of the biennial breeding cycle of successful breeders and

the very small population size (see below), it is quite feasible to have no chicks fledge in some years, or even no adults laying. One advantage of counting in November is that it does allow an estimate of annual production in terms of fledged chicks.



Picture 2. Tristan albatross.

Abundance and baseline data

For the last 70 years the island has supported <5 pairs of Tristan albatross (Table 4). The population was considerably larger in the 19th century, when ‘not more than 200 pairs’ were present in 1870s (Stoltenhoff 1952). It is likely that predation by pigs and humans caused the population to collapse to its current low levels (Fraser et al. 1988).

Table 4. Numbers of breeding pairs (Jan-Feb) or large chicks (Sep-Nov) of Tristan albatrosses at Inaccessible Island

Year	Incubating pairs	Fledglings	Source
1870s	<i>ca</i> 200		Stoltenhoff 1952
1937	2		Hagen 1952
1950	2-3		Elliott et al 1957
1982		1	Fraser et al. 1988
1983	1		Fraser et al. 1988
1987		0	Fraser et al. 1988
1988		2	Ryan et al 1990
1989		0	Ryan et al 1990
1990	1		Ryan et al 1990
1999		1	Ryan et al. 2001
2000	1		Ryan et al. 2001
2004		0	PG Ryan unpubl data

4.3 Atlantic yellow-nosed albatross *Thalassarche chlororhynchos*

Summary

≠# Count all incubating birds and nests with evidence of broken eggs in seven areas centred on Cairn Peak (Figure 5). At a minimum, count the upper Ringeye Valley area that forms the core spectacled petrel monitoring area (Figure 8). Check incubating adults for bands.

Distribution and phenology

Atlantic yellow-nosed albatrosses or Mollies breed throughout the island plateau and locally on level areas on the coastal scarps down to *ca* 200 m elevation. They are most abundant on the western plateau, where the vegetation is less dense, but occur even under dense island tree woodland, provided they have access to open areas for landing and taking off. On the most exposed parts of the western plateau they frequently nest in sheltered hollows or even in pot holes, where they are easily overlooked. They also breed amongst dense vegetation (e.g. tussock grass and among procumbent island trees), requiring thorough coverage to locate all nests. Adults return to the island in late August, and eggs are laid in September (Rowan 1951). Chicks hatch from late November to early December (first chicks 24, 25 and 18 Nov in 1982, 1999 and 2004, respectively), and are brooded or guarded by their parents until mid to late December (first chicks alone 11 Dec 1999, but most remain guarded until *ca* 20 December; Ryan & Moloney 2000). Chicks fledge in April (Rowan 1951).

Breeding adults are easily counted during the incubation and chick guard stages (October to mid-December); thereafter chicks can be counted, but the later any count takes place, the greater the uncertainty about initial breeding effort due to breeding failures prior to the census. This can be crudely estimated using data from the long-term monitoring colony on Gough Island, which is checked on a regular basis. Inter-annual variation in the number of incubating pairs is correlated between study colonies on Gough and Tristan (Cuthbert et al. 2003).

Monitoring protocols

Breeding pairs of yellow-nosed albatrosses can be counted in conjunction with the spectacled petrel survey, provided the vegetation is fairly short and open. However, to count them properly requires visiting each nest to check that birds are incubating and not loafing, which adds considerably to the time needed to cover each count area. Six count areas centred on Cairn Peak (and conveniently located close to the top of the West Road) were selected, overlapping with five spectacled petrel count areas (11-14 & 16) and the Slump count area for sooty albatrosses (Figure 6). It is also worthwhile counting the area around Molly Bog, south of Swale's Fell, if time permits. The lower parts of Ringeye Valley also support large numbers of nests, but the vegetation is much denser than the slopes of Cairn Peak, making for more time-consuming and potentially inaccurate counts.

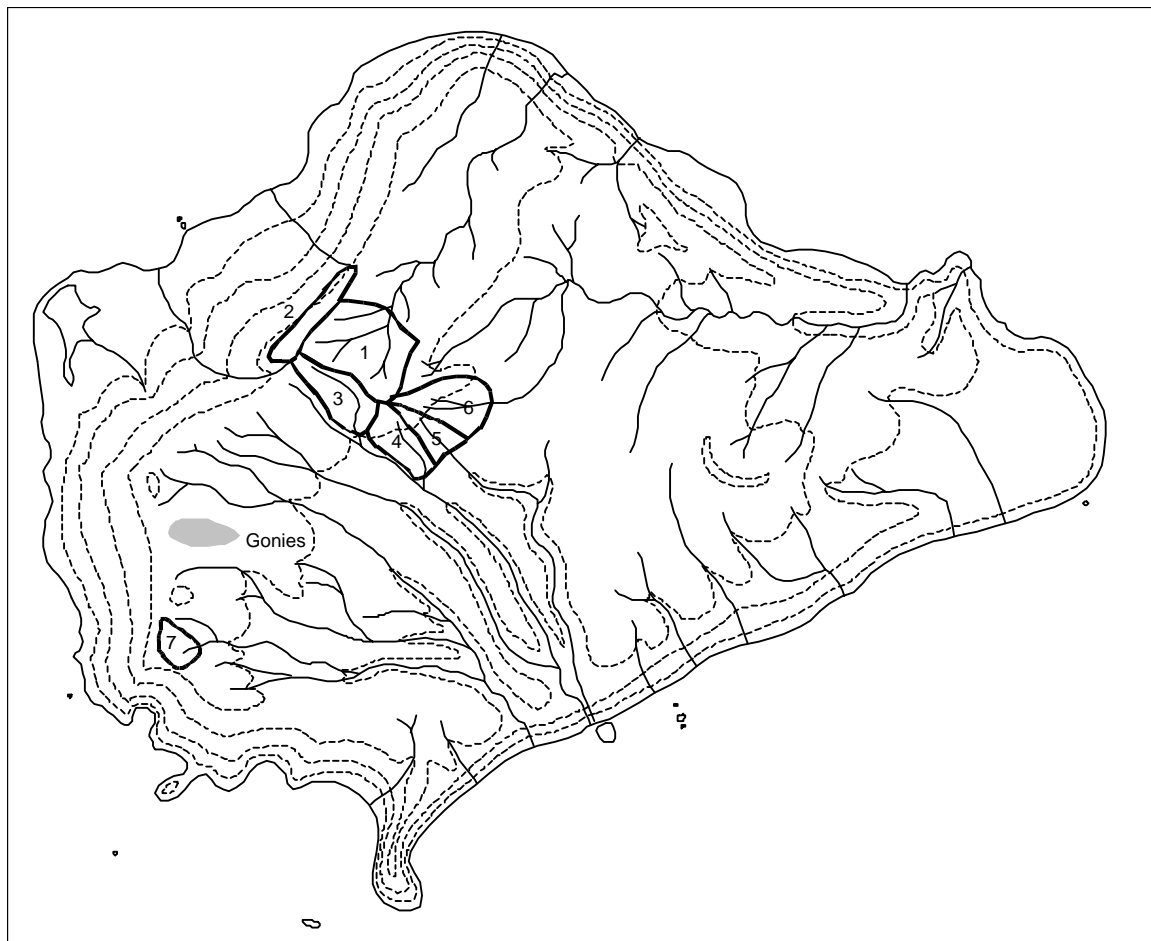


Figure 5. The approximate breeding area of Tristan Albatrosses and proposed monitoring areas for Atlantic Yellow-nosed Albatrosses (numbered 1-7) at Inaccessible Island

The actual counting is straightforward; each nest is visited to check the nest contents. Check around deserted nests for eggshell fragments that indicate failed nests. Score the total number of occupied nests (with eggs or chicks) and the number of failed nests. You can also score the number of loafers, but this varies greatly depending on weather conditions. Given the large number of rings put on adults and chicks in 1982/83 (Fraser et al. 1988), it is also worth checking all birds for rings. However, some of the rings are becoming illegible (especially the 8-series rings issued by SAFRING), and should be replaced if possible. Because yellow-nosed albatrosses breed throughout the plateau, the count areas require extra clarification:

- ≠ Upper Ringeye Valley – as defined for the spectacled petrel core census, with the same eight sub-sections (see Figure 8).
- ≠ Slump between East and West Roads – only the top of the slump to be counted, not down onto the Dragon's Teeth.
- ≠ West Road Valley – the valley extending inland from the top of the West Road, down to a point where it passes through a narrow pass with rocky walls on either side, shortly before joining First River West (37° 18.08'S, 12° 41.19'W).
- ≠ Cairn Peak south – the shallow valley adjacent to the above, extending from a lone island tree, down through a series of *Scirpus* bogs to drain into First River West. Count all albatrosses down to where the valley enters the main gorge of First River West.

- ≠# Joe's River – the next valley draining Cairn Peak, again with a series of *Scirpus* bogs. Only count albatrosses on the upper slopes, dominated by bogferns *Blechnum palmiforme*, where there are spectacled petrel burrows; do not count where island trees come to dominate the vegetation.
- ≠# Denstone River – as per the last section, extending round to the tip of the spur of Cairn Peak that faces ENE to Denstone Hill. Again, limit the count to the upper slopes where spectacled petrels occur.
- ≠# Molly Bog – count all birds above the large dyke that cuts across the head of Molly Bog valley, in a line between 37° 18.58'S, 12° 41.85'W (just across the stream south of Swale's Fell) and 37° 18.68'S, 12° 41.73'W (on the ridge between Molly Bog and Dune Hills River).

Table 5. Approximate numbers of breeding pairs of Atlantic Yellow-nosed Albatrosses in proposed monitoring sites at Inaccessible Island in November 2004. See Figs 3 and 5 for areas

Count area	Occupied nests	Broken eggs	Total
1. Upper Ringeve Valley (total)	154	6	160
Section A	39	3	42
Section B	16	0	16
Section C	15	0	15
Section D	13	0	13
Section E	8	0	8
Section F	30	3	33
Section G	20	0	20
Section H	13	0	13
2. Slump between East and West Roads	27	0	27
3. West Road Valley	42	0	42
4. Cairn Peak south	27	1	28
5. Joe's River	39	4	43
6. Denstone River	56	0	56
7. Molly Bog	39	0	39
Total	384	11	395

Abundance and baseline data

The total population has been put at 1,100 pairs (Fraser et al. 1988, Ryan & Glass 2001), but this is probably an underestimate. The areas sampled in 2004 represent only 6% of the species' breeding range on Inaccessible, yet supported almost 400 breeding pairs (Table 5). Admittedly, the areas selected for monitoring had higher than average densities, certainly compared to the more wooded eastern plateau, but they comprise only 15% of the western plateau, suggesting a total population of

closer to 2,000 pairs. The core spectacled petrel study area at the top of Ringeye Valley supports almost 10% of the population, and when supplemented by sampling adjacent areas and around Molly Bog, the proportion of the population sampled is probably *ca* 20%.



Picture 3. Atlantic yellow-nosed albatross

The only comparable data for Inaccessible Island is a count of 41 occupied nests in upper Ringeye Valley on 9 December 1999 (Ryan & Moloney 2000), compared with 160 in 2004. However, there is considerable inter-annual variation in numbers of birds; at Gough Island, the number of pairs breeding in the long-term study colony has fluctuated from

27-70 pairs (n=20 years, CV=24%, Cuthbert et al. 2003). Breeding effort is correlated between study colonies at Tristan and Gough (Cuthbert et al. 2003), and 1999/2000 was an average year for colony size at Gough Island, but experienced the lowest recorded breeding success for Atlantic yellow-nosed albatrosses (Cuthbert et al. 2003). However, most of the failures at Gough Island in 1999/2000 occurred after the chicks hatched (Cuthbert et al. 2003), and thus should have had relatively little impact on the November count.

4.4 Sooty albatross *Phoebastria fusca*

Summary

€# Count as many inland sites as possible (see Figure 6), with the large colonies on Long Ridge and Gony Ridge most important.

Distribution and phenology

Sooty albatrosses or Peoos breed on the island's coastal cliffs and at scattered rock outcrops and steep river banks on the island plateau. Adults return to their breeding sites in September (Richardson 1984), although some may be present from mid-July (Elliott 1957). Eggs are laid in late September to early October; chicks hatch in early December and fledge in mid-May (Elliott 1957, Richardson 1984).

Monitoring protocols

Because of their cryptic plumage, sooty albatrosses are hard to detect from a distance. Coupled with their use of steep cliffs, and the preponderance of pairs breeding on the largely inaccessible coastal cliffs, much of the population is extremely hard to count. Monitoring is best confined to inland breeding sites. Eight accessible sites, each supporting more than one pair of sooty albatrosses, are listed in Table 6 and mapped in Figure 6. All can be either visited directly, or scanned with binoculars (the cliffs above the Slump) to count the number of incubating birds. Repeated checks of these sites should give some indication of population trends, although results should be treated with caution as they are perhaps peripheral to the main breeding habitat along the coastal cliffs. Count protocols are the same as for yellow-nosed albatrosses, although sites scanned with binoculars will not give an indication of failed nests.

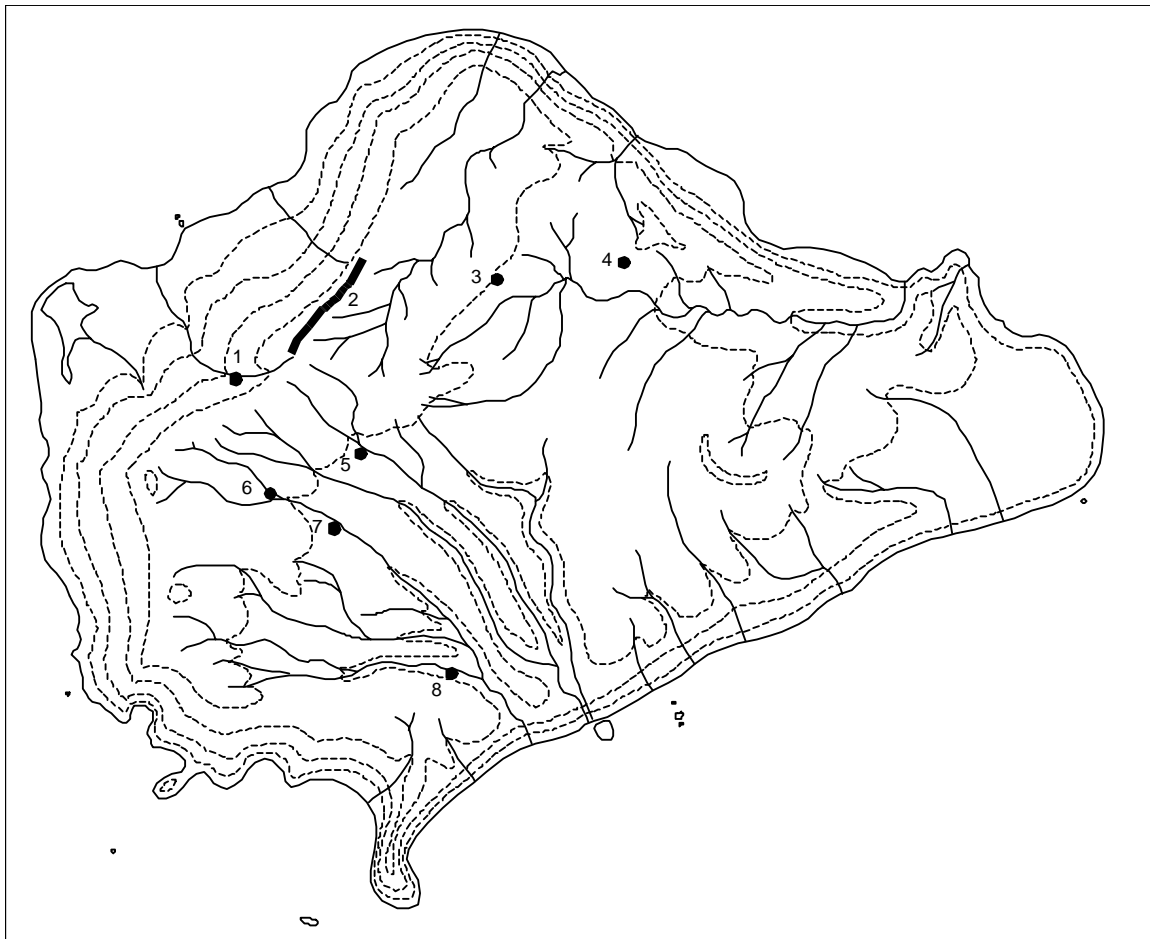


Figure 6. The location of the eight monitoring sites for sooty albatrosses at Inaccessible Island

Abundance and baseline data

The population size is poorly known, with estimates of 200 (Fraser et al. 1988) to 2,000 pairs (Elliott 1957). Ryan & Moloney (2000) suggested a population of 500 pairs, but confidence in this estimate is low. The eight monitoring sites together supported 51 pairs in November 2004, *ca* 10% of the island population (Table 6). Previous counts at the two largest colonies indicate random fluctuations, which are to be expected in a biennial breeder. Gony Ridge had five pairs in 1982/83 (Fraser et al. 1988), 17 pairs in 1999/2000 (Ryan & Moloney 2000) and 11 pairs in 2004 (Table 6). What may well be this site had only four pairs in 1937 (Hagen 1952), but this count was made late in the season (February). Elliott (1957) reported groups of up to 25 nests on Inaccessible. Long Ridge had 8 pairs in 1989 and 14 pairs in 2004 (Table 6), although one nest in 2004 had slumped down in heavy rains, trapping the incubating bird.

Table 6. Monitoring sites for sooty albatrosses on Inaccessible Island and numbers of occupied nests in November 2004

Site	Co-ordinates		Nests
1. West Road gully (west side only)	<i>ca</i> 37° 17.9'S	12° 41.6'W	4
2. Scarp between top of West Road and East Road	37° 17.83'S 37° 17.58'S	12° 41.42'W 12° 41.14'W	6
3. Long Ridge south slope	37° 17.59'S	12° 40.77'W	14

4. Denstone Crag	ca 37° 17.6'S	12° 40.2'W	5
5. Second River West (west side)	37° 18.17'S	12° 41.24'W	2
6. Boulder Hill River junction	37° 18.28'S	12° 41.35'W	3
7. Gony Ridge (NE end)	37° 18.36'S	12° 41.19'W	11
8. Dune Hills falls	37° 18.72'S	12° 41.10'W	6
Total			51

4.5 Spectacled petrel *Procellaria conspicillata*

Summary

- ⊕ Count all spectacled petrel burrows in eight stream catchments in upper Ringeye Valley (Figure 8).
- ⊕ Check counter accuracy by comparing counts in at least five smaller areas, each supporting 30-60 burrows, with a thorough count of actual burrows.
- ⊕ Check burrow occupancy using tape playback and arm probes (best linked to counter accuracy exercise, because it reveals burrows with shared entrances, false burrows, etc.).
- ⊕ If time permits, estimate numbers of burrows in other catchments for comparison with baseline data (20 areas across the island, see Figure 7. Also, test occupancy in peripheral colonies (e.g. Denstone Hill and Round Hill), using playback alone if time is limited.

Distribution and phenology

Spectacled petrels or Ringeyes breed in burrows on the higher parts of the island plateau (Figure 7). Adults return to the colonies in September, egg laying takes place in late October, and chicks hatch in December (Ryan 1998, Ryan & Moloney 2000). The exact timing of fledging is unknown, but probably takes place during mid-March, based on a fledging period of 96-98 days in the closely related white-chinned petrel *Procellaria aequinoctialis* (Marchant & Higgins 1990). At least some adults return to the colonies after moulting, from mid-May to July, to clean out burrows and display (Rowan et al. 1951).



Figure 7. Approximate distribution of Spectacled Petrel burrows at Inaccessible Island, showing the 20 count areas reported in Table 7

Most spectacled petrels breed in loose colonies, forming distinctive ‘Ringeye bogs’ among bogfern vegetation, which are visible from some distance by the presence of *Scirpus* spp. sedges (Ryan & Moloney 2000). However, some nests are in wet heath, along stream banks, under procumbent island tree woodland, in closed-canopy island tree woodland (apparently restricted to a few nests on Denstone Hill) or in tussock grass. These sorts of nest are easily overlooked, and are often found only if the adults call. Typical burrows are readily distinguished from the burrows of other petrels at Inaccessible Island by their large size and the presence of an entrance pool or moat (Rowan *et al.* 1951, Hagen 1952, Ryan & Moloney 2000, Ryan & Dorse in press). Some burrows lacking moats may be confused with larger nests of great shearwaters *Puffinus gravis*, but the entrances tend to be wetter, and the mud at the entrance usually lacks the fine, crumbly appearance typical of great shearwater burrows. Also, great shearwater nests are usually shallower, and can be checked by inserting an arm into the burrow, whereas few spectacled petrel burrows (*ca* 10%) are short enough to reach the nest chamber (Ryan & Dorse in press). However, during the 2004 survey, at least one spectacled petrel nest was overlooked, assuming it was a great shearwater nest, until the third visit to one of the two study colonies in Ringeye Valley, when the occupant was heard calling.

Monitoring protocols

Monitoring can take place at various levels. The minimum requirement is to count the numbers of burrows in the upper section of Ringeye Valley, which supports *ca* 10% of the total estimated population (Table 7), and test their level of occupancy. If time permits, more areas can be surveyed,

following the areas shown on Figure 7, and the entire island should be surveyed on a regular basis (e.g. five-yearly).

The upper section of Ringeye Valley (Area 16 on Figure 7) is divided into eight count areas, based on stream catchments (Figure 8). Each section must be searched methodically for burrows. If there is uncertainty about the identity of a given burrow, the identity of the occupant can be checked in most instances in November by playing a tape of spectacled petrel call into the burrow entrance. PGR can supply a copy of the recording used in playback trials. If there is no response, try a tape of great shearwater, or check by inserting an arm to see if a shearwater is present. Be extremely careful when walking through colonies, especially dense colonies, because the risk of collapsing burrows is high.

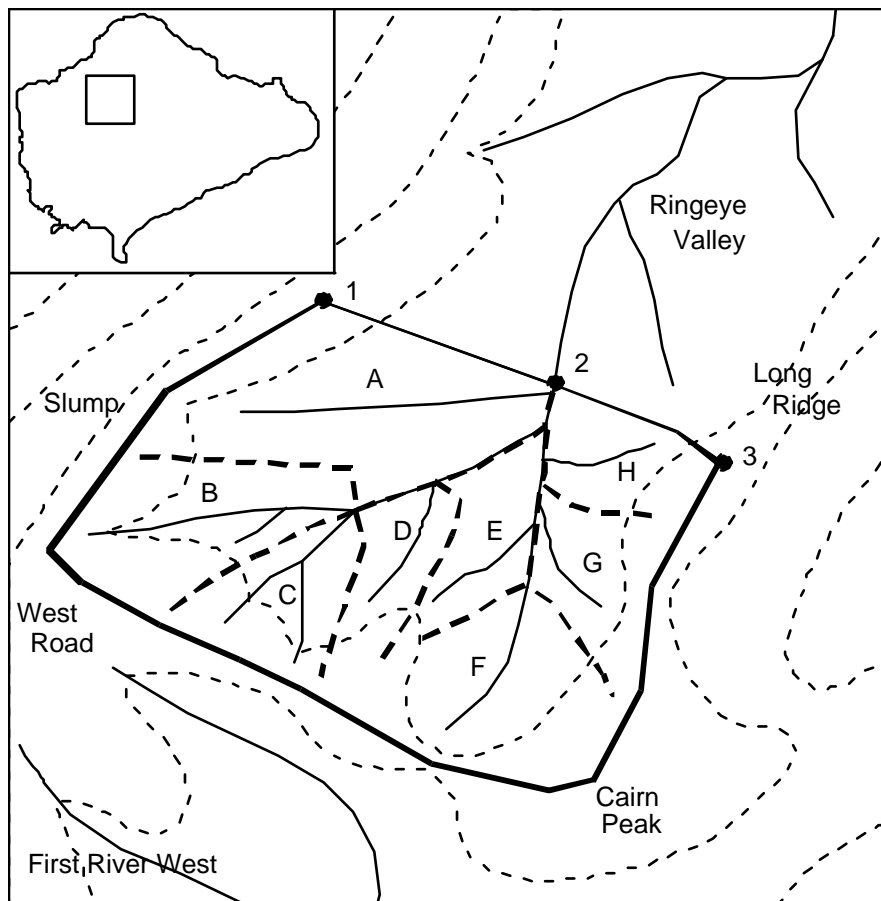


Figure 8. Sketch map of the upper part of Ringeye Valley, showing subsections of Area 16 (from Figure 7) for more detailed monitoring of trends in numbers of burrows of Spectacled Petrels

Points 1-3 define the lower boundary of the census area; their positions are 37° 17.66'S, 12° 41.20'W (1), 37° 17.73'S, 12° 41.12'W (2) and 37° 17.79'S, 12° 41.03'W (3)

Counters need to check the accuracy of their counts by estimating the numbers of burrows in a pre-determined area, then carefully checking the area to see how many burrows are actually present. At least five areas each containing 30 or more burrows should be estimated by each observer, and then counted carefully. This is best conducted in conjunction with tests of burrow occupancy (see below), because the occupancy trials detect false burrows as well as multiple burrows that share a common entrance. This exercise typically shows that burrow numbers are underestimated by 15-20%, even by relatively experienced observers (Ryan & Moloney 2000, Ryan & Dorse in press). This procedure still fails to take account of nests concealed by dense vegetation. In one study area initially thought to contain only 50 nests, four nests were subsequently found hidden among dense streamside vegetation

and one nest was overlooked because it was assumed to be a great shearwater nest. This suggests that even fairly careful checks of areas miss up to 10% of burrows, over and above the underestimate resulting from rapid census techniques.

In addition to checking counter accuracy, it is essential to monitor the level of burrow occupancy. 'Active' burrows (those visited by breeding and non-breeding birds) can be identified by the lack of vegetation growing in their entrances, although some occupied burrows (those containing an incubating pair) can appear quite overgrown. Traditionally, three indicators of burrow occupancy have been used. First, a standard tape of spectacled petrel calls is played down the burrow entrance for 10-30 sec (ceasing immediately a response is obtained). The burrow entrance is then examined for signs of recent activity: fresh vegetation (used as nest lining), fragments of eggshell (indicative of a failed nest if checked before eggs hatch in December), feathers, droppings, fresh digging or footprints. However, not all signs can be checked if there is a large moat shared by several burrows. Finally, an arm is inserted down the burrow as far as can be reached (approximately 1 m), and the burrow scored as either occupied (adult and/or egg/chick felt, or adult/chick called), empty, or uncertain (where nothing was felt but the burrow extends beyond the reach of the extended arm). A more intrusive approach, such as digging access holes to be able to reach the end of all burrow chambers, is deemed to be an unnecessary disturbance. A burrowscope has not been used due to logistical difficulties of operating such a device in extremely wet, muddy conditions on the island plateau, distant from any power source.

During November, playback of calls in the entrance of a burrow provides the best estimate of occupancy, although response rate decreases during the month, and falls markedly after the eggs hatch (Figure 9). In mid-November, adult response to playback is around 70%, with a further 8% of burrows proving to be occupied when tested with an arm probe (Ryan & Dorse in press). Birds in shallow nests are less likely to respond to playback than those in deep burrows, possibly because they can see either the tape-recorder or the observer (Ryan & Dorse in press), and so an arm probe is a valuable adjunct to playback. However, playback alone is a useful rapid indicator of occupancy, especially in peripheral areas, where there may be too little time to conduct full occupancy trials. Of the remaining burrows, most are scored as 'indeterminate', because they are too long to be sure they are empty with an arm probe. Repeated trials at 8-day intervals in November 2004 suggest that at least 60% of 'indeterminate' nests are occupied, with a cumulative proportion of *ca* 90% of burrows occupied (Ryan & Dorse in press).

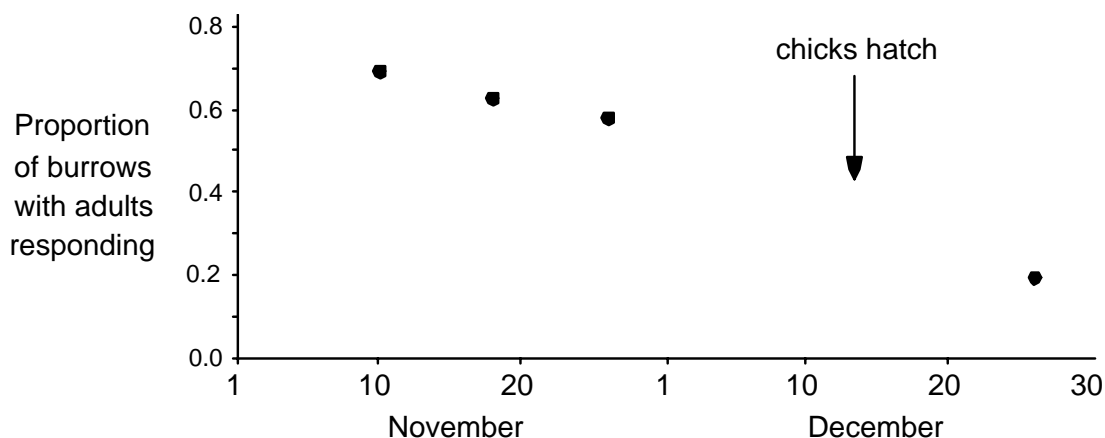


Figure 9. Proportions of Spectacled Petrel burrows where adults responded to playback as a function of date, based on data from December 1999 (Ryan & Moloney 2000) and November 2004 (Ryan & Dorse in press)

If there is a need to mark nests for repeated checks, either use tagged stakes (e.g. bamboo stakes), or attach the tags securely to vegetation above and slightly away from the nest entrance. We preferred to use wire to tie the tags to vegetation, because stakes sometimes were hard to position without going through to another burrow. However, some tags that were too close to the nest entrance were drawn into the nest (possibly by birds adding fresh vegetation to their nest mound), and others that were too close to the nest entrance were occasionally completely obscured during periodic nest 'cleaning', which plasters the area all around the burrow entrance with mud.

Abundance and baseline data

Counts of spectacled petrel burrows made in November 2004 are summarised in Table 7. Estimates of numbers of burrows increased in all count areas compared to those estimated in 1999 (Ryan & Dorse in press). Compensating for counter error (underestimating by *ca* 15%), the total number of burrows is *ca* 10,500, and possibly as high as 12,000. Assuming occupancy is at least 90%, this suggests an adult population of *ca* 10,000 pairs, and at least 20,000 birds. Numbers of burrows in the monitoring areas of upper Ringeye Valley in November 2004 are listed in Table 8.



Picture 4. Spectacled petrel

Previous estimates of spectacled petrel populations show a steadily increasing trend from the 1930s (Table 9), despite the predicted recent impacts of long-line fishing. This suggests that the population is still recovering from the likely severe impacts of pig predation, mainly during the 19th century (Ryan & Moloney 2000). Taken at face value, the increase from the 1930s translates into a rate of

increase of *ca* 7% per year. Given this level of growth, simple demographic models suggest that the population may have the capacity to withstand current levels of long-line mortality.

Table 7. Approximate numbers of burrows of Spectacled Petrels at Inaccessible Island in November 2004 (from Ryan & Dorse in press). See Figure 7 for count areas 1-20; Ryan & Moloney (2000) for 1999 areas

Count area	Area (1999)	Number
1. Dune Hills seaward slopes	A	370
2. Dune Hills River	B	250
3. Molly Bog River	B	400
4. Swales Fell	C	275
5. Gony Ridge	D	1510

Count area	Area (1999)	Number
6. Boulder Hill R to Fif5th R west	E	300
7. Fifth River West to Fourth River West (incl)	E	360
8. Third River West	F	195
9. Second River West	F	305
10. First River West	F/G	410
11. West Road River	G	140
12. Southern slope of Cairn Peak (into First River West)	G	280
13. SE Cairn Peak (draining into Joe's River)	H	210
14. SE Cairn Peak (draining into Denstone River)	I	715
15. Southern slopes of Long Ridge	I	325
16. Top of Ringeye Valley	J	970
17. Middle of Ringeye Valley	K	620
18. Bottom of Ringeye Valley	L	940
19. Denstone Hill	M	90
20. Round Hill	N	205
Total		8870

Table 8. Approximate numbers of burrows of Spectacled Petrels in the proposed detailed monitoring area at the top of Ringeye Valley at Inaccessible Island in November 2004. See Figure 8 for count areas

Count area	Number of burrows
Section A	10
Section B	70
Section C	90
Section D	140
Section E	10
Section F	350
Section G	220

Count area	Number of burrows
Section H	80
Total	970

Table 9. Estimates of the Spectacled Petrel population at Inaccessible Island

Year	Number of occupied burrows	Source
1937	only 6 nests late in breeding season	Hagen 1952
1949	at least 100 pairs, probably considerably more	Rowan et al 1951
1982	ca 1,000	Fraser et al. 1988
1999	6,970*	Ryan & Moloney 2000
2004	10,090	Ryan & Dorse in press

* assumes ca 91% occupancy, as found in 2004

4.6 Other species

Most other (currently non-threatened) seabirds breeding at Inaccessible Island are nocturnal, burrow-nesting species, which are hard to census. However, there are three surface-nesting, diurnal species that can be monitored with relatively little effort.

(Tristan) Southern skua *Catharacta antarctica hamiltoni*

The (Tristan) southern skua breeds at scattered sites around Inaccessible Island, with a distinct concentration around Skua Pond between West Point and Blenden Hall (Figure 10). Eggs are laid from October to at least January, with chicks fledging from December to March.



Picture 5. (Tristan) southern skua

Although not threatened, the subspecies is endemic to the Tristan islands, and can be relatively easily monitored when visiting the island in November. Breeding is fairly protracted, with pairs laying replacement clutches following early failures.

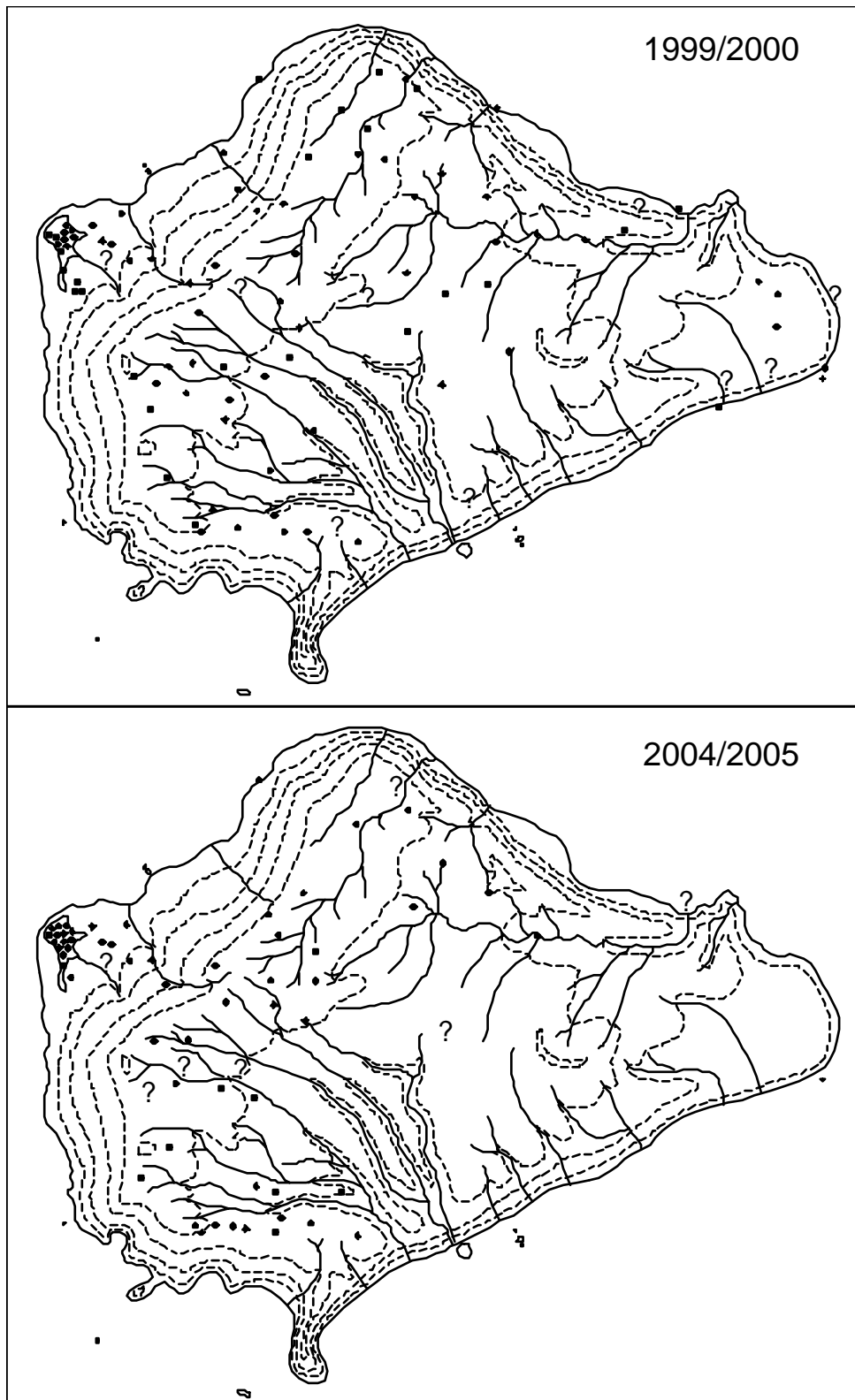


Figure 10. The distribution of (Tristan) southern skua nests at Inaccessible Island in 1999/2000 and 2004/05 (when there was little coverage of the eastern plateau and coastline). '?' denotes a pair holding territory but where a nest was not found

Nests are readily located by the agitated behaviour of adults, including a distinctive, high-pitched yelping alarm call that is only given during breeding. Nests with eggs are usually fairly easily located, but chicks often hide in vegetation and may be hard to locate. Some pairs are less demonstrative than

others, and their nests can be overlooked. The total breeding population is at least 80 pairs (Ryan & Glass 2001), and probably closer to 100 pairs (Ryan & Moloney 2000). It is unlikely that a complete census can be undertaken during routine monitoring visits, but there are fairly consistent patterns of breeding distribution (Figure 10), so that selected areas can be compared in successive visits. Obtain the location of each nest with GPS and plot onto a map of the island. Figure 9 shows the location of 90 pairs (including 9 probable breeding pairs) in 1999/2000 (Ryan & Moloney 2000) and 66 pairs (including 7 probable breeding pairs) in 2004.

It is also worth counting the numbers of non-breeding skuas in the 'club' at West Point and the adjacent pool at Skua Pond. Numbers at the club fluctuate within and between days, so several counts are necessary to obtain a reasonable idea of the number of club birds. In 1989/1990 and 1999/2000 daily maxima ranged from 60-120 birds (Ryan & Moloney 2000), but only up to 64 birds in Nov-Feb 1982/83 (Fraser et al 1988) and 40-70 in Nov-Dec 2004.

Antarctic tern *Sterna vittata tristanensis*

Like the ((Tristan) southern skua, the Antarctic tern is not threatened, but is represented at the islands by an endemic subspecies *Sterna vittata tristanensis*. Up to 100 pairs breed on the island (Ryan & Glass 2001), but few breed in the area around Blenden Hall, with only a few pairs at Warren's Cliff, and (formerly) on the Shield behind Skua Pond and at Dirleton Point (Fraser et al. 1988). However, should



a landing be made at Waterfall Beach, it is worth counting the number of pairs breeding on the cliff behind the old hut immediately north-east of the Waterfall. Adults return to the island slightly later than brown noddies, normally in late September, and only lay in November-December. They remain at the islands until at least March.

Picture 6. Antarctic tern

Brown noddy *Anous stolidus*

Brown noddies are not threatened, but breed in small numbers and are easily monitored at selected sites around Blenden Hall. It is worthwhile visiting the two apple groves ('first apples' at the bottom of Nelson's Gulch, at the foot of the West Road, and 'second apples' further west towards Wilkins' Copse) as well as searching the eastern edge of Wilkins' Copse for nests. Table 10 summarises counts made at these sites to date.

Table 10. Trends in the numbers of breeding pairs of Common Noddies around Blenden Hall, Inaccessible Island

Year	First apples	Second apples	Wilkins' Copse	Total
1982/83	0	0	1	3*
1988	?	?	1	1
1989/90	1	?	1	2
1999/00	4	2	0	6
2004	5	2	4	11

*2 nests in island trees on the West Road (Fraser et al. 1988)

Picture 7. Brown noddy



If a landing is made at Waterfall Beach, they may also be counted on the cliff behind the old hut, where they generally breed lower down than the Antarctic terns, and in the three pine trees *Pinus carribea* just past the old hut. Noddies arrive at the islands in early September, lay eggs from October, and depart by April-May. In addition to the sites listed above, small numbers of pairs are known to breed in island trees near the East Road and in Waterfall Valley on the flanks of Round Hill (Ryan & Moloney 2000).

Burrowing petrels in skua diets

One relatively easy way to monitor relative population sizes of some of the burrowing petrels is to sample skua diets (Fraser 1984, Ryan & Moloney 1991). Skua pellets and other prey remains have been collected at the West Point skua club during most recent visits to the island, providing a baseline against which future changes can be assessed. Diet composition changes seasonally in relation to seabird breeding phenology (Ryan & Moloney 1991), but is fairly consistent between years after controlling for season (Table 11). By collecting pellets, we can also monitor changes in the loads of ingested plastic in seabirds (Ryan & Fraser 1988).

Sampling requires walking along the boulder beach at West Point and collecting all intact skua pellets and other prey remains (mainly pairs of wings). Collections can be made every 3-4 days, but ideally should take place after a dry spell of at least 24 hours. Any wet pellets should be allowed to dry out on an open tray, then stored in individual plastic bags (small sandwich bags are ideal) to prevent loss of plastic particles. For longer-term storage, freezing is the best option. They can be delivered to Peter Ryan at the University of Cape Town for processing.

Table 11. Diet of (Tristan) southern skuas (% composition) in spring, estimated by analysis of pellets from the West Point skua club

Species	1982 ¹	1987	1988	1989	1999	2004	Total (excluding 1982)
	Oct- Nov	Oct	Oct	Oct- Nov	Nov	Nov	
	N=328	N=157	N=262	N=655	N=519	N=385	N=1978
White-bellied storm-petrel <i>Fregetta grallaria</i>	21.9	36.3	34.4	40.8	40.8	39.0	39.2
White-faced storm-petrel <i>Pelagodroma marina</i>	22.3	37.6	32.4	25.8	26.4	22.1	27.0
Broad-billed prion <i>Pachyptila vittata</i>	31.3	12.7	17.6	18.9	21.4	21.3	19.4
Common diving-petrel <i>Pelecanoides urinatrix</i>	10.3	1.9	6.9	3.5	4.0	3.4	3.9
Great shearwater <i>Puffinus gravis</i>	1.0	1.9	2.7	4.3	1.7	7.3	3.8
Little shearwater <i>Puffinus assimilis</i>	2.1	0.0	0.0	1.2	0.2	0.5	0.6
Soft-plumaged petrel <i>Pterodroma mollis</i>	3.0	0.0	0.4	0.3	0.4	0.3	0.3
Kerguelen petrel <i>Pterodroma brevirostris</i>	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Rockhopper penguin <i>Eudyptes chrysocome</i>	1.3	0.0	0.0	0.2	0.2	0.5	0.2
Antarctic prion <i>Pachyptila desolata</i>	0.4	0.0	0.0	0.0	0.2	0.0	0.1
Grey-backed storm-petrel <i>Garrodia nereis</i>	0.0	0.6	0.0	0.0	0.2	0.0	0.1
Antarctic tern <i>Sterna vittata</i>	0.0	0.6	0.0	0.0	0.0	0.0	0.1
Tristan thrush <i>Nesocichla eremita</i>	0.3	1.3	0.0	0.3	0.4	0.3	0.4
Inaccessible rail <i>Atlantisia rogersi</i>	0.0	0.0	0.0	0.2	0.6	0.5	0.3
Tristan bunting <i>Nesospiza acunhae</i>	0.0	0.0	0.0	0.2	0.6	0.0	0.2
Black rat <i>Rattus rattus</i>	0.0	0.0	0.0	0.2	0.0	0.0	0.1
Fish bones	0.0	1.3	1.1	1.1	0.2	0.8	0.8
Goose barnacles <i>Lepas</i> spp.	3.0	5.7	4.6	3.2	2.7	4.2	3.6

1: Data from 1982/83 were collected by M.W. Fraser, and methodological differences may account for the higher proportion of prions and diving-petrels.

5 References

- BirdLife International 2004. *Threatened Birds of the World*. BirdLife International, Cambridge UK.
- Cuthbert, R, Ryan, P.G., Cooper, J. & Hilton, G. 2003. Demography and population trends of the Atlantic Yellow-nosed Albatross. *Condor* 105: 439-452.
- Elliott, H.F.I. 1957. A contribution to the ornithology of the Tristan da Cunha group. *Ibis* 99: 545-586.
- Fraser, M.W. 1984. Foods of Subantarctic Skuas on Inaccessible Island. *Ostrich* 55: 192-195.
- Fraser, M.W., Ryan, P.G. & Watkins, B.P. 1988. The seabirds of Inaccessible Island, South Atlantic Ocean. *Cormorant* 16: 7-33.
- Hagen, Y. 1952. The birds of Tristan da Cunha. *Results Norwegian Scientific Expedition Tristan da Cunha 1937-1938* 20: 1-248.
- Marchant, S. & Higgins, P.J. (eds). 1990. *Handbook of Australian, New Zealand and Antarctic birds. Vol 1: Ratites to ducks*. Oxford University Press, Melbourne.
- Rowan, M.K. 1951. The Yellow-nosed Albatross *Diomedea chlororhynchos* Gmelin at its breeding grounds in the Tristan da Cunha group. *Ostrich* 22: 139-155.
- Rowan, A.N., Elliott, H.F.I. & Rowan, M.K. 1951. The "spectacled" form of the Shoemaker *Procellaria aequinoctialis* in the Tristan da Cunha group. *Ibis* 93: 169-174.
- Ryan, P.G. 1998. The taxonomic and conservation status of the Spectacled Petrel *Procellaria conspicillata*. *Bird Conservation International* 8:223-235.
- Ryan, P.G., Cooper, J. & Glass, J.P. 2001. The population status and conservation of the Tristan Albatross. *Bird Conservation International* 11: 33-46.
- Ryan, P.G., Dean, W.R.J., Moloney, C.L., Watkins, B.P. & Milton, S.J. 1990. New information on seabirds at Inaccessible Island and other islands in the Tristan da Cunha group. *Marine Ornithology* 18: 43-54.
- Ryan, P.G. & Fraser, M.W. 1988. The use of Great Skua pellets as indicators of plastic pollution in seabirds. *Emu* 88: 16-19.
- Ryan, P.G. & Glass, J.P. 2001. *Inaccessible Island Nature Reserve Management Plan*. Government of Tristan da Cunha, Edinburgh, Tristan.
- Ryan, P.G. & Moloney, C.L. 1991. Prey selection and temporal variation in the diet of Subantarctic Skuas at Inaccessible Island, Tristan da Cunha. *Ostrich* 62: 52-58.
- Ryan, P.G. & Moloney, C.L. 2000. The status of Spectacled Petrels *Procellaria conspicillata* and other seabirds at Inaccessible Island. *Marine Ornithology* 28: 93-100.
- Stoltenhoff, F. 1952. *Notes on birds on Inaccessible Island*. Pp. 197-203 in Rosenthal, E. *Shelter from the Spray*. Cape Times, Parow.
- Williams, A.J. & Stone, C. 1981. Rockhopper Penguins *Eudyptes chrysocome* at Tristan da Cunha. *Cormorant* 9: 59-66.



Picture 8. Ringeye Valley, Inaccessible Island

Appendix 1: Contact details for key personnel & agencies

Tristan da Cunha Administrator (currently Mike Hentley):

E: hmg@cunha.demon.co.uk

Simon Glass, Tristan da Cunha Conservation Officer

E: tdcenquiries@stratosnet.com (marked for attention of Simon Glass)

James Glass, Head of Tristan da Cunha Natural Resources Department

E: tristannrd@uuplus.com

Directorate: Antarctica and Islands of the Department of Environmental Affairs (director: Henry Valentine)

E: henryv@antarc.wcape.gov.za

T: +27 21 405 9404 (or 405 9400)

PO Box 8172, Roggebaai 8012, South Africa

Ovenstones Agencies Pty Ltd (contact personnel Jeanne Cowan or Dorrien Venn)

E: jeanne@eurex.co.za

T: +27 21 421 6169

Dr Peter Ryan (Tristan da Cunha Conservation Officer)

E: pryan@botzoo.uct.ac.za

T: +27 21 650 2966

Percy FitzPatrick Institute, University of Cape Town, Rondebosch 7701, South Africa

Royal Society for the Protection of Birds; contact personnel: Dr Geoff M Hilton (Senior Research Biologist, UK Overseas Territories) & Sarah Sanders, (Country Programmes Officer, UK Overseas Territories)

E: geoff.hilton@rspb.org.uk, sarah.sanders@rspb.org.uk

T: +44 (0)1767 680551

RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL, United Kingdom

Appendix 2: GPS co-ordinates for key features on Inaccessible Island

All values are in degrees (South and West for latitude and longitude respectively), minutes and decimal fractions of minutes.

	Feature	Latitude	Longitude
Houses			
	Blenden Hall hut	37 17.61	12 41.96
	Waterfall old hut	37 17.66	12 39.26
Coastline			
	Dirleton Bay (end of beach)	37 18.63	12 42.23
	West Point	37 17.76	12 42.40
	lower apple grove, Blenden Hall	37 17.71	12 42.00
	Blenden Hall Bay	37 17.58	12 41.88
	Tern Rock	37 17.46	12 41.73
	Warren's Cliff (end of beach)	37 17.09	12 41.22
	Salt Beach apples	37 17.32	12 39.99
	North end of Salt Beach (willows)	37 17.43	12 39.76
	Waterfall	37 17.69	12 39.19
	Pig Beach Point	37 17.53	12 39.03
	East Point	37 18.02	12 38.54
Peaks			
	Swales Fell	37 18.49	12 41.80
	Rim on Gony Ridge	37 18.35	12 41.90
	Boulder Hill	37 18.17	12 41.93
	Cairn Peak	37 17.92	12 41.13
	Denstone Hill	37 17.48	12 40.13
	Denstone Crag	37 17.56	12 40.17
	Pig Beach Hill	37 17.85	12 39.09
	Round Hill	37 18.16	12 39.86
	Joe's Hill	37 18.55	12 40.27
	Dune Hills (SE rim)	37 18.81	12 40.96
	Dune Hills saddle	37 18.81	12 41.16
	Dune Hills picnic spot	37 18.84	12 41.56
	Molly Bog	37 18.66	12 41.84
Rivers & bogs			
	Ringeye Valley top river junction	37 17.74	12 41.09
	Dick's Bog	37 17.38	12 40.82
	Where-the-Pig-Fell-Off (top of falls)	37 17.12	12 40.60
	Denstone Hill Junction	37 17.61	12 40.43
	Denstone Falls	37 17.66	12 40.15
West Road			
	upper rope, above apples	37 17.74	12 41.86
	rock before 2nd tussock patch	37 17.75	12 41.84
	half-way valley	37 17.77	12 41.82
	start of second climb	37 17.81	12 41.76
	white rock (half-way to gulley)	37 17.87	12 41.61
	bottom of gulley	37 17.88	12 41.53

	Feature	Latitude	Longitude
	turnout of gully	37 17.84	12 41.50
	slump on West Road	37 17.82	12 41.41
	top of West Road	37 17.81	12 41.40
East Road			
	bottom of East Road (cliff edge)	37 17.38	12 41.49
	lower open gully	37 17.41	12 41.46
	East Road gully	37 17.46	12 41.34
	last main step at top of gulch	37 17.54	12 41.29
	steps down	37 17.59	12 41.26
	edge of slump	37 17.56	12 41.21
	top of East Road	37 17.52	12 41.13
Long Ridge*			
	Long Ridge 1	37 17.86	12 41.02
	Long Ridge 2	37 17.79	12 40.99
	Long Ridge 3	37 17.71	12 40.91
	Long Ridge 4	37 17.60	12 40.79
	Long Ridge 6	37 17.37	12 40.70
	Long Ridge 5	37 17.50	12 40.68
	Long Ridge 7	37 17.32	12 40.66
	Long Ridge 8	37 17.28	12 40.56

*chain of peaks along Long Ridge from Cairn Peak to near Where-the-Pig-Fell-Off.



The RSPB is the UK charity working to secure a healthy environment for birds and wildlife, helping to create a better world for us all. We belong to BirdLife International, the global partnership of bird conservation organisations.

www.rspb.org.uk



The Percy FitzPatrick Institute of African Ornithology is part of the Department of Zoology at the University of Cape Town. Its mission is to promote and undertake scientific studies involving birds that contribute to the conservation of biological diversity and the sustained use of biological resources.

www.fitzpatrick.uct.ac.za



The Tristan Natural Resources Department is responsible for biodiversity conservation on Tristan da Cunha. It works in partnership with organisations from around the world, specifically the UK and South Africa, to reduce the rate of biodiversity loss on the Tristan Island group.



We are grateful to the Overseas Territories Environment Programme for the financial support that made this study possible.

For further information, please contact:

Dr Geoff M Hilton
The RSPB, UK Headquarters
The Lodge
Sandy
Bedfordshire SG19 2DL
United Kingdom
Tel: +44 (0)1767 680551
Fax: +44 (0)1767 683211
E-mail: geoff.hilton@rspb.org.uk

Dr Peter G Ryan
Percy FitzPatrick Institute of African Ornithology
University of Cape Town
Rondebosch 7701
South Africa
Tel: +27 21 650 2966
Fax: +27 21 650 3295
E-mail: pryan@botzoo.uct.ac.za

Printed on environmentally-friendly paper.

210-0177-06-07

Registered charity no 207076