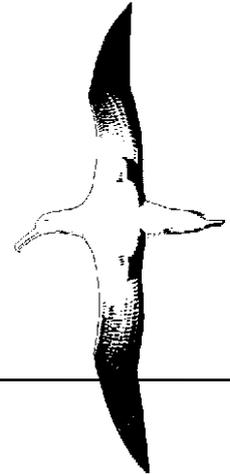


Albatross Research



Numbers of Northern Giant Petrel breeding on Antipodes Island in 2021 and 2022



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ABSTRACT

The number of northern giant petrel chicks on Antipodes Island were counted just before they fledged during the summers of 2020-21 and 2021-22. Counts were made on foot and through use of a drone. The number of chicks in the two years was similar (194, 188) and using nesting success measures from Macquarie Island, estimates of the number of breeding pairs of 304 and 295 were made. The number of northern giant petrels nesting on the island seems to have decreased and then increased since 1969 when they were first counted and this may be due to declines in the number of eastern rockhopper and erect-crested penguins nesting on the island, and an increase in the abundance of New Zealand fur seals.

INTRODUCTION

Northern giant petrels (*Macronectes halli*) have a southern circumpolar distribution and breed on subantarctic islands between 44°S and 54°S. In 2000 they had a total breeding population of about 11,800 pairs (Patterson et al. 2008, ACAP 2010) and appeared to be increasing at some locations and decreasing at others (Woehler et al. 2001; Patterson et al. 2008). They face a range of terrestrial and marine threats, summarized in Parker et al. (2019). The most-studied populations in the south Atlantic and south Indian Oceans have fluctuated between substantial increases and decreases (ACAP 2010), linked to changes in food availability such as expanding fur seal populations (*Arctocephalus gazelle* & *A. tropicalis*) and increased fisheries discards (Gonzalez-Solis et al. 2000), and on Macquarie Island to secondary non-target poisoning during operations to eradicate mammals and subsequent increases once those predators had been removed (Alderman et al. 2019).

The New Zealand region supports about 21% of the global total of northern giant petrel (ACAP 2010), mainly on the Chatham Islands, but population trends in the region are poorly known. The Chatham Islands population, which is primarily on tiny Motuhara/Forty-Fours, was estimated at 2,000 breeding pairs in 1993 (Robertson & Sawyer 1994) with a more reliable count of 2,150 pairs in 2017 (Bell et al. 2017, Bell et al. 2018). The much smaller populations elsewhere have been counted less often: Campbell Island in 1995/96 (234 breeding pairs, Wiltshire & Scofield 2000), Antipodes Island in 1995 (132 breeding pairs, Tennyson et al. 2002) and 2000 (230 breeding pairs, Wiltshire & Hamilton 2003), and in the Auckland Islands (340 breeding pairs, Parker et al. 2019). Only at Macquarie Island with its relatively large population of around 1500 breeding pairs has the population been regularly monitored (ACAP 2010). However, on Enderby Island in the Auckland Island archipelago numbers are known to

have increased from 2 chicks in 1988 to 96-123 chicks in annual counts in 2015–2018 (Parker *et al.* 2019).

Giant petrel colonies often move between seasons (Voisin 1968; Wiltshire & Scofield 2000) and thus population trend can only be detected when the whole of an island group is surveyed within one season – a substantial undertaking on large, remote subantarctic islands. Although Antipodes Island is remote, it is small compared to the other subantarctic islands on which northern giant petrel nest, and it is possible to count all pairs nesting there within a week. However, it is necessary to make counts in several successive seasons if an accurate population estimation is to be made, as a variable proportion (15-40%) of adults in any one year breed (de Byun *et al.* 2007).

Although giant petrel colonies move between seasons, they mostly do not move far (pers. obs.) and the records of past locations of giant petrel colonies provide a focus for searching Antipodes Island. In addition to the whole island counts of giant petrel nesting pairs on Antipodes Island in 1995 and 2000, a rough estimation of the number and location of nesting pairs was made in 1969 (Warham & Bell 1979). Likewise, most scientific parties visiting the island since 1994 have recorded the number and location of any nests incidentally seen (McClelland *et al.* 2001, Sagar and Thompson 2008, Sommer *et al.* 2008, Sommer *et al.* 2009, Sommer *et al.* 2010 and annual Albatross Research field notebooks 1996–2019) and these partial counts over time provide a picture of where giant petrel usually nest on Antipodes Island.

The aim of this study was to estimate the current size of the breeding population of northern giant petrel on Antipodes Island in 2020/21 and in 2021/2022 by counting all pre-fledging chicks and comparing these with earlier counts to detect any long-term trend in population size.

METHODS

Field survey coverage and timing

On Antipodes Island northern giant petrel nest in country where small ground undulations support a vegetation mosaic of open ground interspersed with low shrubs and ferns which provide shelter and cover for chicks (pers. obs). These sites are often in the ecotone between the distinctive vegetation community on the steep coastal slopes of Antipodes Island, and the extensive *Poa litorosa* tussock-land on the gentle plateau in the island's interior. They also occur in the ecotone between dense fields of mega-herb on poorly drained sites and *Poa litorosa* tussock-land on adjacent better-drained ground (pers. obs).

All sites on Antipodes Island where northern giant petrel nests had previously been reported from were collated and mapped (Figure 1). Likely sites for colonies (as described above) and previously recorded colonies were then visited on foot where access was possible and where it was not, checked using a combination of binoculars and a drone. The areas surrounding each previously recorded nesting locality were checked particularly carefully since while northern giant petrel on Antipodes Island never nest in the same spot in consecutive years, they often move only a few hundred metres from the previous year's nesting location (pers. obs.).

In the 2020/2021 summer, between the 20th December 2020 and the 1st February 2021, almost all sites at which northern giant petrels had previously been recorded were inspected (Figure 2) by these methods, with 80% of the colonies counted in mid-late December 2020.

In the 2021/2022 summer, trip-timing was not quite as optimal, with sites inspected between 1st January 2022 and 4th February 2022, with most counts undertaken in early to mid-January. Only the areas where giant petrel had nested the previous year were thoroughly checked (Figure 3). One area which had supported 5 breeding pairs in 2021 was unable to be visited in 2022.

The 5 small offshore islets and larger Bollons Island were not surveyed. It is possible small numbers nest there, though no giant petrel activity has been previously noted on any of these small islands, when visited in 1978 (Taylor 2006) or scanned with binoculars from Antipodes Island in recent years.

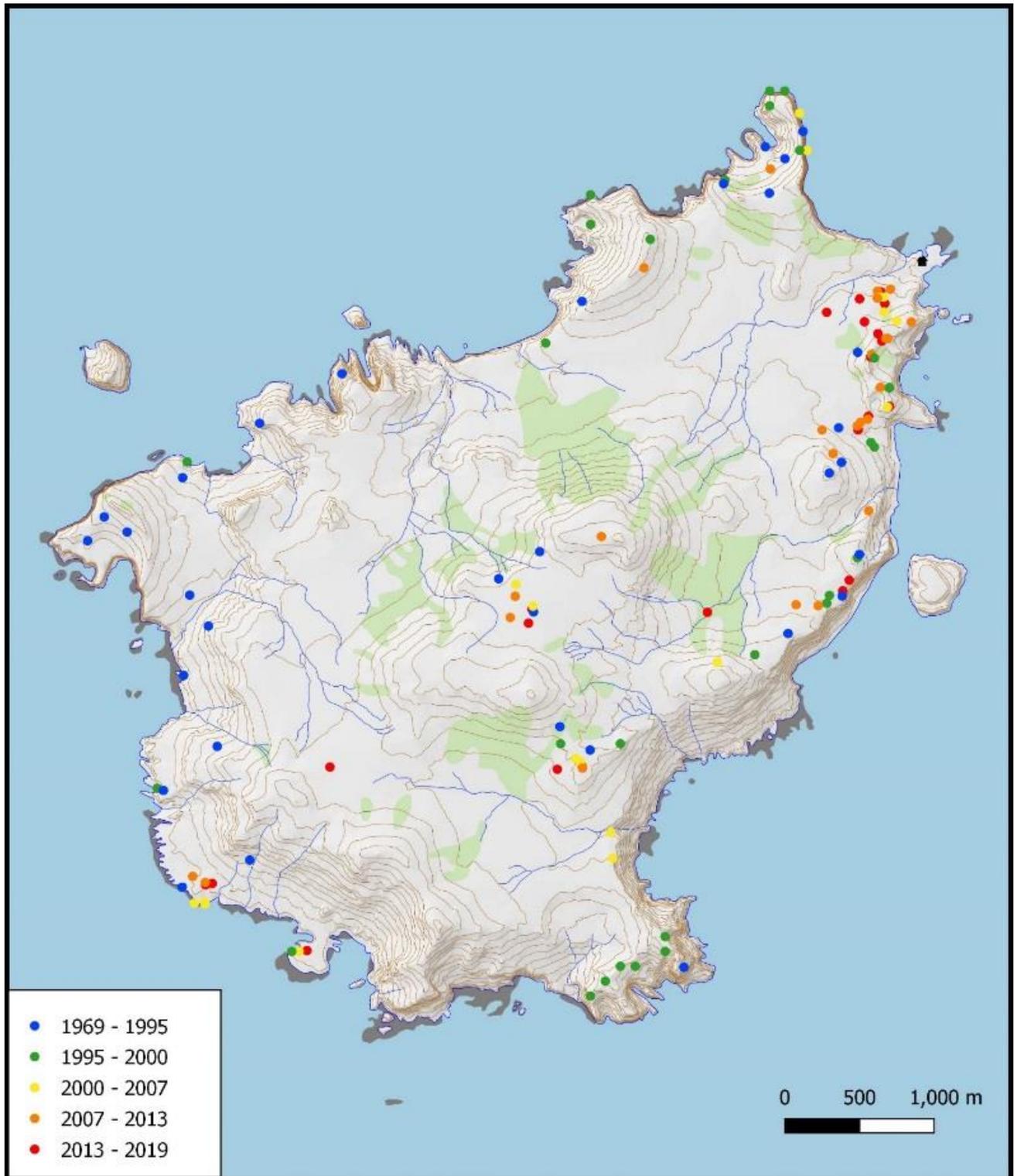


Figure 1: All locations on Antipodes Island where northern giant petrel pre-fledging chicks had been seen between 1969 and 2019.

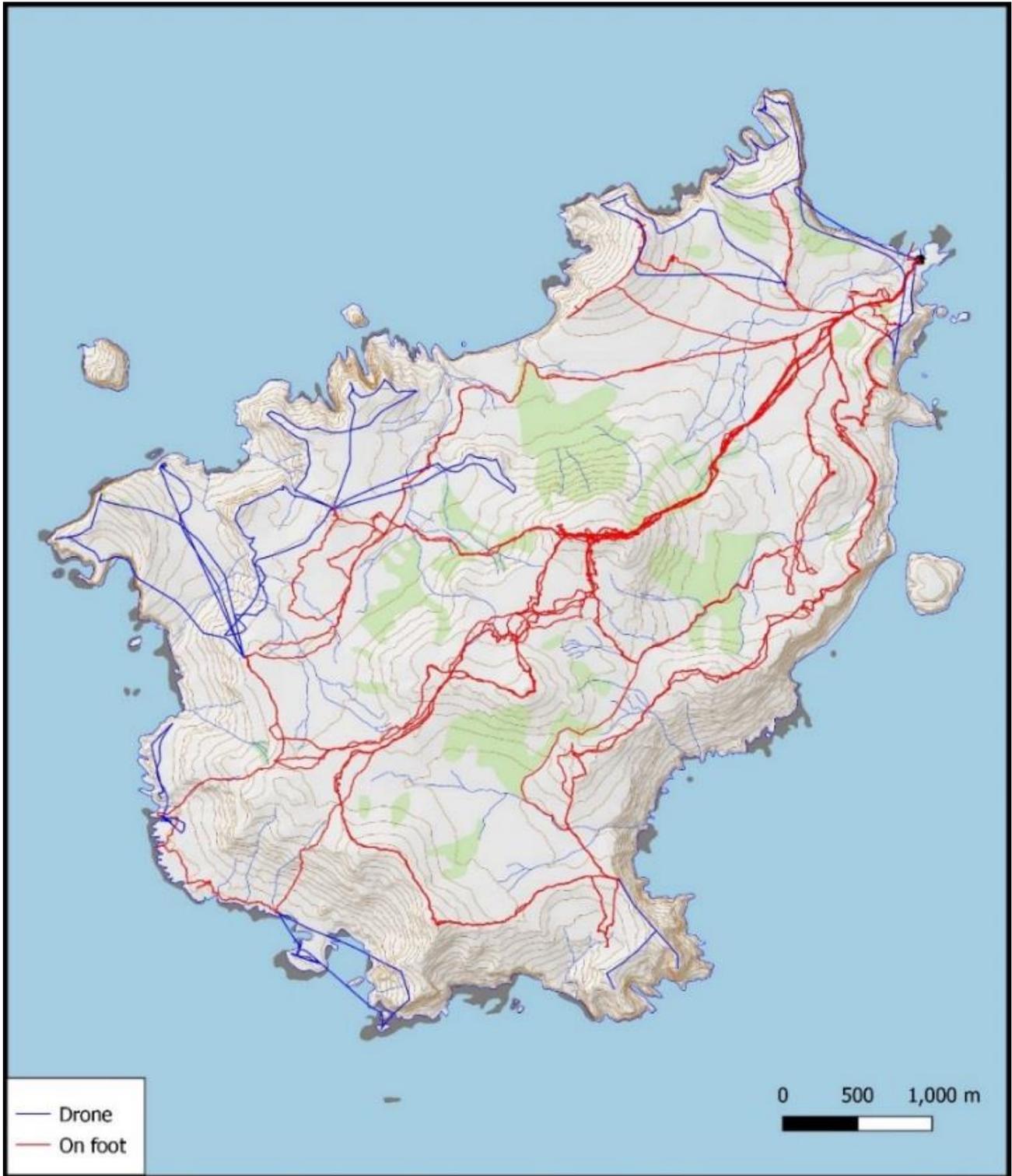


Figure 2. Sites visited on foot (red lines) or inspected by drone (blue line) on Antipodes Island in 2021

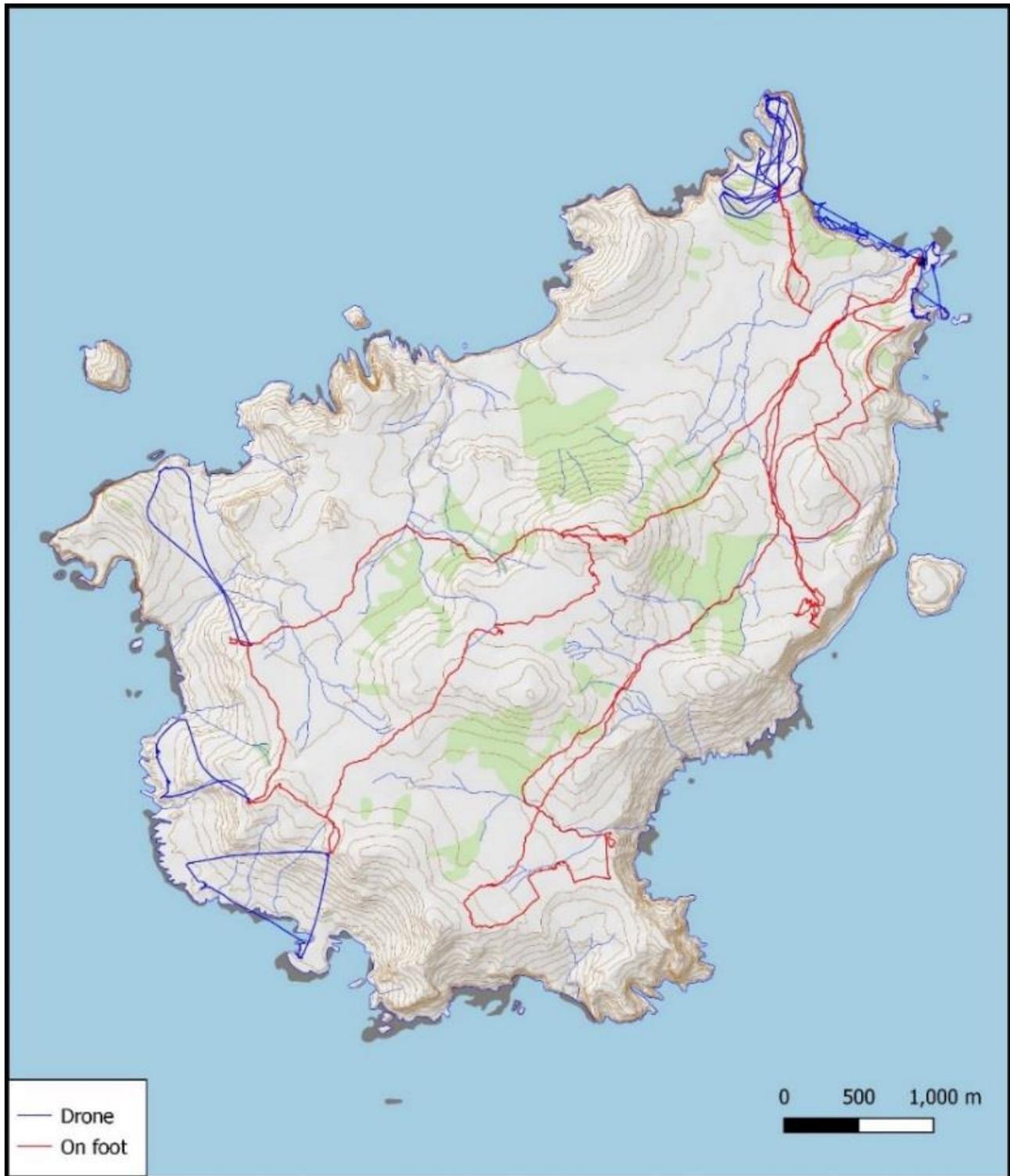


Figure 3. Sites visited on foot (red lines) or inspected by drone (blue lines) on Antipodes Island in Jan 2022.

Drone Use

A DJI Mavic Pro drone was used with goggles to survey difficult to reach locations. The drone was usually flown high and fast towards suitable habitat, then it was dropped to about 20-30 m above the ground

for slower scouting for nesting giant petrels. When a nest was spotted, the drone descended lower and a photo was taken of the nest from directly above it, which automatically recorded that nest's grid reference.

Estimate of size of breeding population

Both the 2021 and the 2022 northern giant petrel census undertaken on Antipodes Island were of pre-fledging chicks which reflect not only the number of pairs that bred that year but also their nesting success, which is variable (Voisin 1988.). Counts of nests soon after laying would provide a better index of population size, but northern giant petrels lay in late winter when Antipodes Island is rarely visited. To estimate the size of northern giant petrel breeding population the mean (63.8%) and the range (55.7%–69.8%) of breeding success on nearby Macquarie Island up until 2017 (R. Alderman, Department of Primary Industries, Parks and Environment, Tasmania [DPIPWE] *unpub. data*) was applied to the counts of near-fledging chicks on Antipodes Island, to correct for early nesting failure.

RESULTS

Number of northern giant petrel chicks counted

In the summer of 2020/2021, 180 pre-fledging chicks were counted in 15 colonies and in the summer of 2021/2022, 177 chicks were counted in 14 colonies (Table 1 and Figure 4). In 2021 mist interrupted a drone search of the south Stack Bay area in which 14 giant petrel nests were found in 2022. Only limited searching was done in the Banana Ridge and upper Ringdove areas in 2022 which almost certainly explains why no nests were seen in either that year, although both had contained small colonies of 5 chicks in 2021. While between 15–47% of northern giant petrels may take a breeding sabbatical (Hunter 1984, Voisin 1988) in a subsequent year, it seems unlikely that all birds from a colony would do so at the same time. Assuming each of these missed colonies existed and contained similar numbers of chicks to the later or earlier count, the 2020/21 count is increased by 14 chicks to an island total of 194, and the 2021/22 count is increased by 11 to an island total of 188.

Table 1. Number of pre-fledging northern giant petrel chicks counted in each colony in 2021 and 2022 on Antipodes Island and the geographic location of each colony. * indicates the number of chicks was estimated from those present the year before or the year after in that general area.

General locality name	Latitude	Longitude	No. chicks in 2021	No. chicks in 2022
Hut Hill	-49.6711	178.8084	4	3
Polar Front (NE North Plains)	-49.6708	178.8053	19	17
Thum Thar Hills (ridgeline above Crater Bay)	-49.6742	178.8041	13	5
Clarke Hill (NE slopes)	-49.6784	178.8017	12	15
Mt Melville (NE slopes)	-49.6889	178.7990	26	28
Albatross Point	-49.7089	178.7799	7	5
South Bay Peninsula	-49.7096	178.7512	15	19
Ringdove-Reliance	-49.6997	178.7550	6	*6
MOAPC (Mother of All Penguin Colonies)	-49.6994	178.7391	8	11
Stack Bay south	-49.6976	178.7382	*14	14
Cave Pt (NE of)	-49.6806	178.7384	7	12
Central Plateau lake	-49.6907	178.7695	29	29
Central Plateau mega-herb slip	-49.6870	178.7791	9	10
Mt Galloway (west-end)	-49.6843	178.7760	3	1
Banana Ridge (Hill 208)	-49.6708	178.7773	5	*5
North Cape	-49.6587	178.7946	17	8
Totals			194	188

As the count in both 2021 and 2022 were made near the end of the breeding season, the nests of an unknown number of breeding pairs would have already failed. When the average breeding success rate for northern giant petrel breeding on Macquarie Island in 2007-2017 is applied as a correction factor to the Antipodes Island chick count, there were an estimated number 304 nesting pairs on Antipodes Island in 2021 and an estimated 295 nesting pairs in 2022 (Table 2).

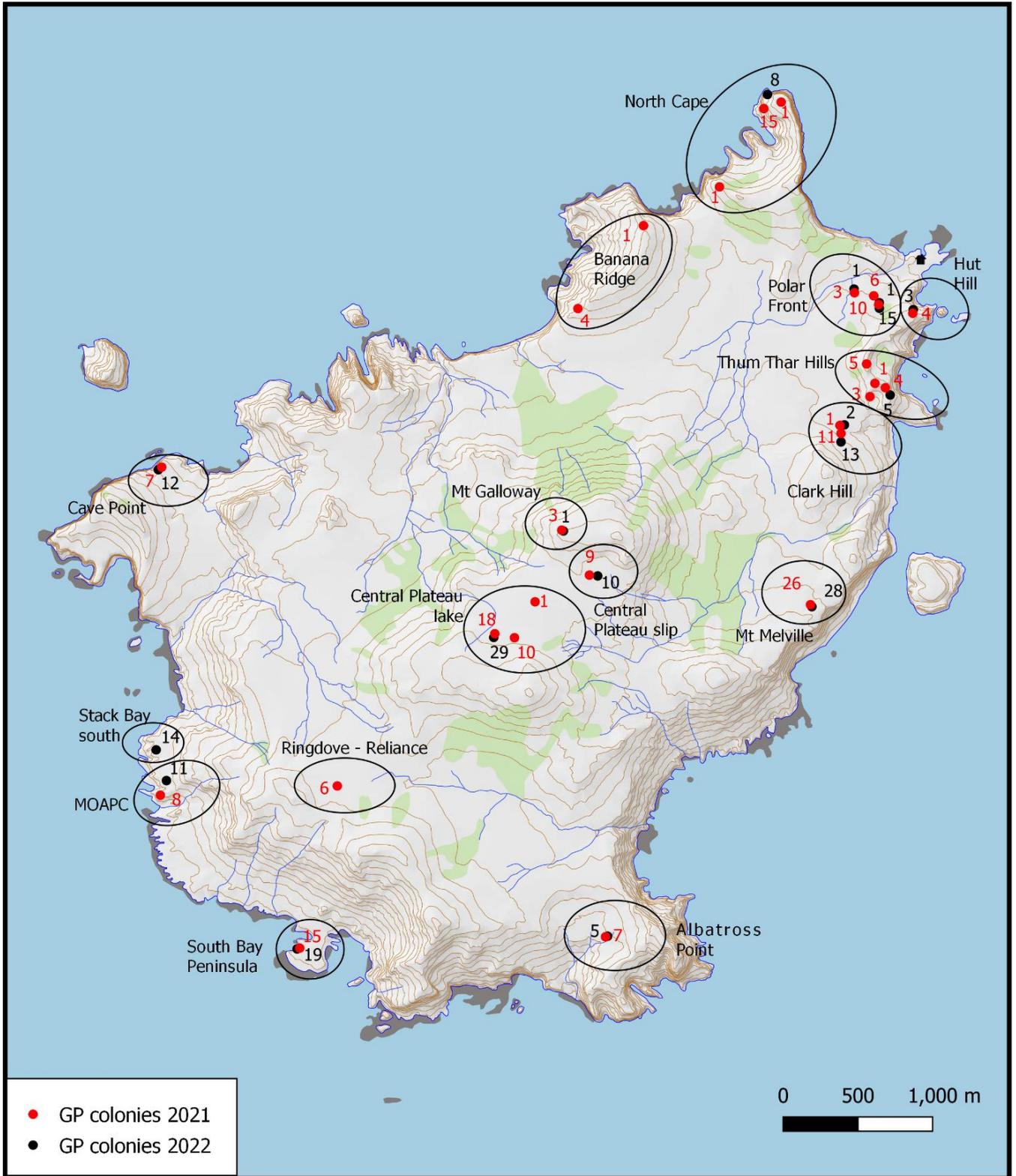


Figure 4: Number of nests with chicks found in 2021 (red solid dots) and in 2022 (black solid dots), with the “colonies” they were loosely grouped within circled and named.

Effectiveness of drone to count giant petrel chicks

The drone proved highly efficient in locating colonies on the edge of sea-cliffs which were surrounded by very difficult and time-consuming to traverse deep fern, stinging nettle and head-high tussock on pedestals of dead vegetation. It was also very useful in finding single nests some distance from the main colony (Figure 5).



Figure 5. The giant petrel colony in tall tussock beside a mega-herb meadow at North Cape, as photographed by the drone. A few nests at some distance from the main colony would likely have been missed in a ground count as the vegetation is difficult to wade through but were easily found and counted using the drone



Figure 6. A grey petrel chick taking no notice of the drone 5 m above its head. The silvery grey colour of the chick's down, plus the characteristically large cleared area the chick has created round its nest mound makes nests easy to spot from the air. Most chicks don't fledge from Antipodes before about 15th February, so even when the grey down has gone, juveniles of the year are still identifiable at the colonies due to their entirely glossy, dark grey plumage as in the photo on the right, taken on 16 Feb 2018.

Skua sometimes chased the drone, but invariably gave up when within a few metres of it, perhaps put off by the noise. Northern giant petrel chicks seemed less concerned by the drone than they usually are when approached by a human, even when the drone dropped to about 5 m above the ground to check a nest's status.

DISCUSSION

Population size and trends

This study's finding of 304 and 295 breeding pairs of northern giant petrel on Antipodes Island in 2021 and 2022 respectively, confirm the island supports a relatively small proportion of the global breeding population, but one which has not been static over time. The number of northern giant petrel nowadays breeding on Antipodes Island is closer to the 320 pairs estimated to breed there in 1969 than to the number of pairs estimated breeding there in 1995 (207) and in 2000 (204) (Table 2).

Table 2. Counts of pre-fledging chicks and estimate numbers of pairs of northern giant petrels on Antipodes Island. Estimates are derived from the mean, upper and lower nesting successes recorded on Macquarie Island. *14 chicks and **11 chicks added to these totals to account for areas not counted.

Year	Nests counted	Estimated pairs	Lower limit	Upper limit	Source
1969		320			Warham & Bell 1979
1995	132	207	189	237	Tennyson et al 2002
2000	130	204	186	233	Wiltshire & Hamilton 2003
2021	194*	304	278	348	This study
2022	188**	295	269	338	This study

These estimates suggest that over the last 50 years, the giant petrel population on Antipodes Island has been variable, probably undergoing a decrease and a subsequent increase. In the absence of detailed study the causes of those fluctuations can only be guessed at. Studies of the northern giant petrel populations on south Atlantic and south Indian Ocean islands identified enhanced food resources, including expanding fur seal and penguin populations and increasing fishery discards as potential drivers of giant petrel increases, and increasing rates of accidental capture in fisheries as drivers of declines (Gonzalez-Solis *et al.* 2000, deBruyn *et al.* 2007, Delord *et al.* 2008, ACAP 2010).

There have been large changes on Antipodes Island over the last 50 years in the abundance of species which appear important to northern giant petrels. The massive eastern rockhopper penguin (*Eudyptes filholi*) population on Antipodes described and photographed in the 1950's was by 1969 in steep decline, and a survey in 1978 found only about 50,000 breeding pairs which dropped to 4000 pairs by 1995 (Taylor 2006) and hasn't recovered since. The number of erect-crested penguins (*Eudyptes sclateri*) has also declined from an estimated 115,000 breeding pairs in 1978 to 52,000 in 1995 (Taylor 2006). Usually only one of the two chicks in penguin nests survives, and as northern giant petrels are themselves rearing big chicks in December, scavenged juvenile penguins are likely to be important prey, the decreasing quantity of which may have been sufficient to explain the giant petrel decline between 1969 and 1995 on Antipodes Island. That the giant petrel population started increasing sometime after 2000 may be due to the concurrent re-establishment of New Zealand fur seal (*Arctocephalus forsteri*) which had disappeared from Antipodes in the 1880's after 330,000 were harvested. In 1950 a single old male was finally seen again on the island, but reinvasion was at first slow, with only 1000 in 1969 and 5000 in 2000 (Taylor 2006). However, since about 2010 the growth has become exponential, providing scavenging giant petrels with an alternative on land food source while breeding.

It was previously thought (Wiltshire & Hamilton 2003) that Warham & Bell's (1979) estimate of 320 pairs of giant petrel breeding on Antipodes in 1969 was unreliable, since the survey was made at the end of the breeding season and that only 29 chicks and 50 adults were banded during the 29 January–12 March 1969 expedition. However, subsequent publication of a detailed account of the 1969 expedition (Taylor 2006) makes it clear a thorough search for giant petrel nests was undertaken early in the trip and with similar or greater effort to the 2000 and 2021 surveys. Making a census and mapping the distribution of the giant petrel, the wandering albatross and the 2 species of penguin was the “main task” of one team member (Brian Bell) throughout the expedition, aided most of the time by Rowley Taylor. All likely habitat on the north, east and southern parts of the island were searched between 31 January and 7 February, and the western side on 15 February 1969. While giant petrel chicks on Antipodes Island start to fledge at the end of January, most don't fledge until ~15 February, and even once their grey down has gone the glossy evenly black plumage of chicks makes them easy to distinguish from adults (Figure 6).

The localities used by northern giant petrels to breed on Antipodes Island has been remarkably constant over time. The only noticeable shift has been a move away from Cave Point and from Hill 264 onto the Central Plateau instead. The widespread peat landslides which occurred on Antipodes Island in January 2014 created jumbles of peat at the bottom of slips on Clark Hill, and on the Central Plateau. These peat jumbles became favoured giant petrel nesting sites, providing shelter intermixed with open ground for taking off and small ponds to wash in. A large slip off Mt Waterhouse onto the Central Plateau created

several sizable lakes and all the giant petrels formerly spread out across the Central Plateau megaherb fields have instead nested around these lakes ever since.

Though small, the northern giant petrel population on Antipodes Island has been an integral part of the species guild there, apparently even shaped by that guild, as well as providing on-going vegetation modification and land fertilization through its nesting activities. Retaining a programme of regular census of the size of the breeding population remains an achievable and desirable goal, at least until more is understood about the species population trends within both Antipodes and the wider New Zealand region.

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