THE BIRDS OF ANTIPODES ISLAND, NEW ZEALAND

By JOHN WARHAM and BRIAN D. BELL*

ABSTRACT

Past information on the birds of Antipodes Island is reviewed and an account given of the findings of the first scientific party to live ashore, from 28 January 1969 to 12 March 1969. The bird list of 37 species includes 16 for which breeding is proven (11 seabirds and 5 landbirds); eight seabirds that almost certainly breed but whose eggs or chicks have yet to be seen; four seabirds and two landbirds that possibly breed and two seabirds and two landbirds that appear to be stragglers. Three seabirds known only from nearby seas complete the tally.

Dimensions are given of birds handled or collected. Most were petrels and included a sample of Soft-plumaged Petrels, previously unrecorded in New Zealand, the skins of which were compared with those of other populations and judged to belong to the nominate race. Skins of the Little Shearwaters, collected for the first time at Antipodes Island, agreed with examples of the subspecies *elegans* from the South Atlantic.

A census was attempted of the Wandering Albatross population, and the penguin and Northern Giant Petrel colonies were mapped.

The seabird fauna is compared with the seabird faunas of our other southern islands.

INTRODUCTION

Antipodes Island at 49°41'S 178°48'E is one of the few islands in the west-wind zone south of New Zealand that remain virtually unmodified by man. Alien species include a few self-introduced passerine birds, the house mouse *Mus musculus,* which is abundant, and a few plants like *Stellaria media* and *Poa annua,* which are rare. The mice and the plants were presumably introduced accidentally in stores and fodder carried ashore by sealers and other early visitors. None of these alien species appears to be having any significant impact on the native plants and animals which are of particular interest as components of ecosystems that have largely disappeared elsewhere. In recognition of this, the island has been a " reserve for the preservation of fauna and flora " the highest level of protection afforded under the New Zealand reserves system. Now it is a Nature Reserve under the Reserves Act 1978.

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Antipodes Island lies 730 km SE by E of the southern end of the South Island and some 220 km south of the Bounty Islands (Fig. 1 insert). It consists of the Main Island, about 2025 ha and some 6.8 x 5.1 km in extent; two smaller Bollons and Archway Islands (c. 65 ha), and a number of offshore stacks and islets (Fig. 1). All appear to be of volcanic origin. There are many eroded craters around the indented and cliffed coastline where lava flows and breccias are exposed. The coastal cliffs are pitted with small to large caves and there are some small caves inland.

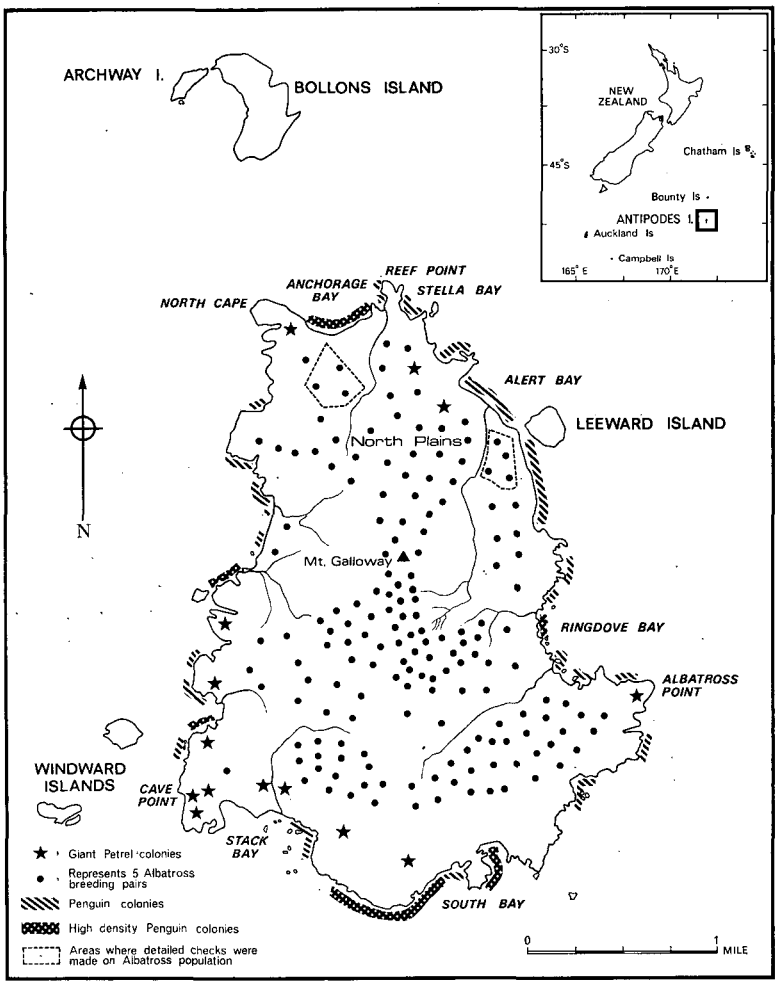

FIGURE 1 — The Antipodes Islands.

From the sea the island looks like a finely tufted carpet due to its covering of tussock grassland dominated by *Poa litorosa.* However, in many places at lower elevations, the tussock and ferns — particularly the shield fern *Polystichum vestitum* — grow exuberantly, rising above head height, so as to make one's passage both tiring and time-consuming. Furthermore, tussock and fern rise from big stools or " nigger-heads " whose crowns of live and dead leaves are often interwoven intimately from plant to plant. Between the pillars the ground is bared, forming a maze of narrow passages used as runways by petrels and by parrots. The activities in this super-terranean zone are almost impossible to observe, the pillars being so crowded together that birds may be heard but not seen.

The ground rises inland to form an undulating plateau at about 200 m where the vegetation is lower and less dense and walking is much easier, particularly along the many slight ridges. Grasses still predominate but there is much *Blechnum* fern, damp depressions filled with a sedge *Carex ternaria,* while the lines of watercourses are generally marked by dark green bands of *Polystichum* fern. Shallow gullies are often choked with dense wind-cropped *Coprosma antipoda* whose stout interlaced trunks and tough branches form an impenetrable barrier to progress: such gullies have to be outflanked.

The highest hills reach about 400 m. Their conical sides are scarred with natural slips where the peaty soil has slid from the underlying rock. Older slips bear almost pure stands of club mosses *(Lycopodium fastigiatum* and *L. varium)* and *Stereocaulon* lichen. The latter grows some 200 mm high and from a distance looks like snow. The climate is windy and wet with much local mist and winds predominantly from the west. What sparse meteorological data are available are given by Warham & Johns (1975).

Apart from the Bounty Islands, less is known of the birds of Antipodes Island than of any other of New Zealand's islands in the Southern Ocean. From 1886 to 1950 most visits of scientists were restricted to a few hours on shore while the crews of government steamers inspected a hut shelter and replenished supplies of food and clothing for the succour of castaways. Birds were captured alive and dead by the captains and passengers of these vessels and some of these specimens remain in various collections. Among the names on specimen labels from this period are A. Reischek, Dannefaerd and W. H. Travers.

In 1901 the Governor-General of New Zealand, the Earl of Ranfurly, visited the island in SS *Hinemoa* and collected or arranged the collection of birds at Antipodes and the other southern islands on behalf of the British Museum of Natural History (BMNH). These were described by Ogilvie-Grant (1905). Following this there were only sporadic landings by ornithologists until 1926 when the Whitney South Sea Expedition of the American Museum of Natural History

(AMNH) collected both off and on-shore between 16 and 23 February. Most of the specimens taken by Rollo H. Beck and his assistants J. C. Correia and Hicks are in the AMNH but a few are in collections in New Zealand and elsewhere. Some information on this material was published by R. C. Murphy, e.g. in his *Oceanic Birds of South America* (1936). One of us (JW) was kindly given access to Beck and Correia's logs in the AMNH and relevant observations on their activities at and around Antipodes Island have been incorporated into the present account.

Between 4 and 10 November 1950, R. A. Falla led an expedition to the island and some 89 bird specimens taken from the boat and from on land are in the National Museum of New Zealand (NMNZ), Wellington. Information gathered during that visit was included in books by Oliver (1955) and Falla *et al.* (1966). We have also drawn on the bird notes made by E. G. Turbott, which have been kindly made available to us.

The University of Canterbury Expedition, led by J.W., established its base at Reef Point on the Main Island on 28 January 1969 and worked there until 12 March 1969. A general account of this expedition has appeared (Warham & Johns 1975). This included a history of the islands, a bibliography, and descriptions of the climate, physiography and geology as well as outlines of the research programmes undertaken. An account of the flora is in preparation (E. J. Godley MS.).

Our work on birds included a general survey of the species present, together with detailed studies of the ecology of the penguins, petrels and parrots. Some of this has already appeared, e.g. that on the penguins *Eudyptes chrysocome* and *E. sclateri* (Warham 1972a; 1972b; 1975) as has some on the parrots (Taylor 1975 and *in* Forshaw 1973). Data on petrel body temperatures and wing loadings have also been published (Warham 1971; 1977). Ornithological collecting was not planned to be a major activity but 65 birds were taken and are in the NMNZ as skins or spirit specimens. We made no attempt to excavate (and hence destroy) petrel burrows, but some were accidentally broken into during excavations for our hut and tents. Most nocturnal petrels were caught after being lured to the ground with the aid of a torch or a 100-watt spotlight powered by a battery or portable electric generator. Spotlighting was carried out at four widely separated places.

In the following accounts means are given, ± one standard deviation for sample sizes of five or more. Weights, obtained with the use of spring balances, are accurate to ± 1%. Standard measurements follow the methods of Witherby *et al.* (1941). In referring to the remiges we have regarded that at the leading edge as the outermost or first functional primary, ignoring that on the thumb. Data for wing lengths either omit or mention any birds in moult with outer primaries still growing.

Names follow Kinsky (1970), but the nomenclature of the crested penguins, genus *Eudyptes,* is brought into line with recent findings and with the International Commission of Zoological Nomenclature's Opinion 1056 suppressing the use of *atratus.* Also the giant petrels, *Macronectes giganteus* and *M. halli* are treated as full species, in agreement with confirmatory work done since their separation by Bourne & Warham (1966).

SPECIES LIST

KING PENGUIN *Aptenodytes patagonicus*

A single bird was standing close to the shoreline at Anchorage Bay on 4 February. Although the pink area along the proximal half of the lower mandible was well developed, the almost white auricular patches and the poor development of the yellow suffusion below the throat showed that this was a sub-adult bird: it may have been a two- or three-year old, judging by Stonehouse's (1960) data. The bird was fat and its dorsal plumage faded to a brownish-grey. It stood higher up the slope for its moult which had started by 13 February. All the old feathers had been lost by 28 February and the bird was last seen on 6 March. This species is a fairly frequent straggler to the southern islands and has been recorded twice before at Antipodes Island — in February 1907 (Plunket 1912) and on 1 April 1923 (Archey 1923). The nearest breeding place is Macquarie Island. Lord Plunket's specimen went to the National Museum of Ireland.

ROCKHOPPER PENGUIN *Eudyptes crestatus (= chrysocome)*

An abundant breeding species. The annual cycle at Antipodes Island has not been described. The birds are believed to arrive about 7 October, a month later than the larger *E. sclateri,* to lay about 1 November and to hatch their eggs about 4 December after 33-34 days' incubation (Warham 1963; 1972a). E. G. Turbott *(in litt.)* noted that on 4-10 November 1950 these penguins were still in pairs on eggs, the larger clean and hence recently laid, so that incubation proper had only just begun.

When we arrived on 28 January the Rockhopper chicks were well advanced in growth and were feathering. Some had left for the sea by 9 February and most had gone by 20 February and by then the number of adults ashore had also dwindled. By about 15 February the yearlings had also moulted and gone, and on 12 March the whole Rockhopper population appeared to be at sea. At Macquarie Island these birds are absent for 28-35 days before returning to moult (Warham 1963) and so the breeding adults' return to Antipodes Island should occur around 5-10 April. That this is approximately correct is suggested by Oliver (1955: 69) who reported that on 4 April 1927 " the young were in their first plumage and the adults, many moulting, were standing about in thousands on the breeding ground." Oliver appears to have confused freshly moulted adults (thin, clean, light-weight and appearing

much smaller than those in " pre-moult fat " condition) for young in their first plumage. The young birds must have left nearly two months before.

We found difficulty in gauging the approximate numbers of breeding birds on the various colonies, as adults still feeding chicks spend most of the day at sea and birds in adult plumage ashore by day are probably non-breeders. However, during our stay Rockhoppers were considerably outnumbered by Erect-crested Penguins, although in November 1950 Falla (1953) thought the reverse was true. The Rockhopper colonies were scattered around the island in every suitable place, there being none only where the coast was sheer cliff (see Fig. 1).

All the colonies examined or observed from a distance contained both penguin species. Nevertheless, the Rockhoppers tended to be inland of and above the Erect-cresteds and in rougher terrain, as noted by Guthrie-Smith (1936). It appeared that the Rockhoppers chose places with overhead cover and some could be found under and around a rocky prominence in the middle of even the densest Erect-crested colony. Rockhoppers also occupied small caves and some nested among tussock grass, their sites generally being dirtier than those of the Erect-cresteds.

The work done on the Rockhopper Penguin dealt mainly with sexual dimorphism (Warham 1972a) and with vocalisations (Warham 1975). In general, the birds' displays and behaviour closely followed those described for the Macquarie Island populations (Warham 1963). We collected no specimens, but a few skins of adults, including a breeding pair, taken by R. A. Falla in 1950 are in the NMNZ and in the Auckland Museum, as are a few taken by Beck on 22 February 1926. The AMNH has most of Beck's material, some of which, labelled as adult but in full moult, are unlikely to have been breeding birds. Murphy (1936: 418) gave dimensions for four males and three females from the island. Data on larger samples of live adults, yearlings and chicks are given in Warham (1972a). The same collections also contain a few Rockhopper eggs from Antipodes Island, but we have seen no complete and authenticated clutches and know of no data on the size of the first (small) and second (large) egg laid by Rockhoppers at this breeding station.

SNARES CRESTED PENGUIN *Eudyptes robustus*

Although expected as a straggler, despite regular searches neither this nor the Fiordland Crested Penguin *(E. pachyrhynchus)* was seen. A specimen of *robustus* collected on 1 April 1923 by Gilbert Archey is preserved as a mounted skin (AV 3263) in the Canterbury Museum. It is labelled as male but is rather small-billed for an adult of breeding age (beak shape index 1588) and is probably a pre-breeder. A single bird was photographed by J. Ollerenshaw of the 1950 party; this too appears to have been a male.

ERECT-CRESTED PENGUIN *Eudyptes sclateri*

Antipodes and the Bounty Islands are the main breeding places for this distinctive crested penguin. Its annual cycle is believed to start with arrival about 10 September followed by the laying of the two eggs about 12 October (Warham 1972b). When we arrived, many chicks were still ashore but some were completely feathered and some seemed to have left. The mean departure date for the chicks was estimated as about 30 January. When we left on 12 March the colonies were almost full of birds standing in pairs at nest sites. These were almost certainly part of the breeding population, and many had begun their annual moult.

Many colonies (see Fig. 1) were just above high water on the boulder beaches backed by steep cliffs or by tussock-clad slopes. In some places, e.g. at Anchorage Bay and opposite Orde Lees Islet, the penguins had spread upwards on sloping ground to nest on any slight ledges that offered reasonably safe situations. In such areas the nesting sites extended to about 75 m a.s.l. Along the south coast there were extensive, almost level rocky flats on which were large colonies (see Fig. 8 in Warham & Johns 1975). Colonies on the Bollons and Archway Islands were visible through binoculars or telescope from North Cape.

Studies dealt mainly with sexual dimorphism, breeding behaviour and display activity (Warham 1972b) and with vocalisations (Warham 1975). We collected no specimens. A few skins brought back by R. A. Falla in 1950 are in the NMNZ and Auckland Museum collections, and others are in various New Zealand institutions. Those in the AMNH include eight skins collected by Beck or Correia on 17 and 22 February 1926. Eggs in these various collections are all single examples. The only data on the sizes of the small (first) and the large eggs typically laid by this and other eudyptids are for five clutches of infertile eggs laid by the same female nesting on the New Zealand mainland and measured by Richdale (1950).

ROYAL ALBATROSS *Diomedea epomophora*

A specimen in the NMNZ, collected by A. Reischek, is labelled "Antipodes Island." This is almost certainly an error in labelling, as we know of no evidence that this albatross has ever bred on the island. The surrounding seas are within its range, however, for we saw a bird of the northern race *sanfordi* at sea near the island on 6 January.

WANDERING ALBATROSS *Diomedea exulans*

Abundant at Antipodes Island. The birds breed in much darker plumage than do other populations of Wanderers, except for the very small number at Campbell Island where the common large albatross is *D. epomophora*. The Antipodes birds are also smaller than those from most other populations. A detailed description of the plumage

of New Zealand Wandering Albatrosses and a comparison with some other populations will be published (Warham & Robertson in prep.).

According to Oliver (1955: 181), the birds were found at Antipodes Island in 1886 and photographs in his book, in the paper by Waite (1909) and in Guthrie-Smith (1936), show some of the salient plumage characters of the breeding birds.

We sexed none by dissection, but with pairs at nests with eggs one bird was always markedly paler than the other, and in the small samples measured the lighter-coloured bird was always the larger (see below) and, when copulation was seen, uppermost.

Pairs at nests without eggs in late February or March were probably younger birds that had not reached full breeding status as they were generally darker than incubating birds. Even in these one member was paler than the other, although there was a great deal of variation. Only a small sample of birds was measured as it was difficult to take them from nests without risking damage to the egg by the albatross itself or by marauding skuas. Six females and eight males were measured on 19 and 23 February (Table 1). The sample comprised three pairs with eggs, three pairs at nests without eggs, and two males from pairs without eggs or nests. The albatrosses were sexed without difficulty by the lighter plumage of the males. All had bare brood patches and those without eggs may still have laid that season. Probability values are from Mann-Whitney U-tests.

It will be seen that the male Antipodes Wanderers were larger and heavier than their partners. They segregated completely according to sex when bill lengths were plotted against bill depths.

Adult Wanderers at Antipodes Island sometimes had the white feathers near the ear coverts and at the side of the neck stained with pink, a phenomenon still unexplained although known for at least 119 years (Bennett 1860). This stain is not, as was believed by Hutton (1865), always seen on both sides of the neck, nor restricted to the period of June to August. Some of the birds we saw had been feeding chicks and the positions of the stains and the disarray of the stained feathers suggested that they had been soiled during allopreening when

TABLE 1 — Measurements of Live Wandering Albatrosses at Antipodes Island

No. & sex	Wt. (kg)	Wing (mm)	Tail (mm)	Bill (mm) Length	Bill (mm) Depth at nail	Tarsus (mm)	Mid-toe & claw (mm)
♂♂	7.35 ± 0.75	655 ± 17.0	203 ± 2.85	148.1 ± 2.32	41.4 ± 1.53	116.6 ± 3.24	176.6 ± 2.34
♀♀	5.67 ± 0.94	625 ± 5.0	199 ± 6.11	138.0 ± 4.55	37.0 ± 1.74	108.7 ± 2.87	167.0 ± 7.00
P	<0.01	<0.02	n.s.	0.005	0.002	<0.01	0.05

FIGURE 2 — A pair of Wanderers; many birds breed in similar plumage. The male is on the left.
Photo: John Warham

the albatrosses fondle each other's heads and necks. The stains may have been due to carotenoids from food and/or stomach oil. According to Bennett the colour fades entirely after death, but feathers we removed still show pink stain eight years later.

Most of the adult Wanderers and their chicks had pale blue eyelids, but in some parents feeding young the eyelids were pink, evidently through flushing with blood. Except for pale yellow nails, the bill of some adults feeding chicks was bright pink and this again appeared to be due to the engorgement of blood vessels below the rhamphotheca, for finger pressure on the latericorns left pale yellow areas as though fluid had been forced away. Bennett (1860: 73) noted that Wanderers freshly hauled on to the ship's deck, had bills of a beautiful pink colour, except at the tips, which were yellowish white. The intensity of the pink hue of the bill subsided when the bird was reposing on the deck, and in the dead bird the beak became pallid. Such changes partly account for the different descriptions of beak and eyelid colour given by various observers, e.g. by Chapman (1891). Flushing may be related to heat shedding during or following strenuous exercise.

Throughout our stay groups of presumed non-breeders, the so-called " gams," were seen. Such groups, typically of three or four birds, sometimes more, tended to form in the afternoon and became very numerous over the higher ground by evening. Occasional gams were seen as early as 0745 hours. The gams appeared to comprise several males and fewer females, which performed many of the displays described by Matthews (1929) and others. We also saw occasionally an aerial display (Warham 1976) in which the wings were stiffened and downturned while the head was swung from side to side. This display appeared to be homologous to a similar action used by *D. epomophora* and *Macronectes* spp. (Warham 1962; 1976).

The activities of the albatrosses had a perceivable effect on the vegetation. Near their nests the ground cover was depressed by trampling and there were often well marked trails about 30 cm wide through the vegetation in areas where nests were plentiful. These trails ran up to and along the crests of the many short ridges which were probably used as departure points during calms.

Breeding and Density

Wandering Albatross nests were scattered over almost the whole of the island from the top of Mt Galloway (404 m), across the tussock-clothed rolling moors and down to about 100 m a.s.l. None was nesting on the flat top of Leeward Island (80 m a.s.l.) nor did we see any Wanderer activity on Bollons Island. Blank areas on the map (Fig. 1) indicate what we believe is habitat unsuitable for nesting, including steep coastal places, areas of heavy fern and tussock, and *Coprosma*-choked gullies. The sites chosen seemed to be where fairly open patches in the vegetation led to ridges or hillocks suitable for take-off.

Similar areas at lower heights, which were often more sheltered, were avoided.

R. J. Stanley gathered some information on the distribution of the albatrosses and their nests, old and new, on the North Plains. He marked out 20 quadrats of area 10 000 ft^2 (929 m^2) and counted and classified the birds and nests within each quadrat. The quadrats were not selected at random over the whole area. Dense *Polystichum* and *Coprosma* were avoided, and the quadrats were chosen to represent the rather varied habitats being used by the albatrosses. These habitats ranged from fairly level and open areas with light grass and fern to others on steeper ground with patches of *Polystichum* and heavy tussock. In general, the more open and lightly vegetated the ground, the greater the density of nests. Those that had been vacated recently could be identified by the absence of invading plants, the presence of trodden-down eggshells and/or down and " frass " from feather follicles. Old nests with old skeletons were mostly those where the chicks had died before fledging. The results of these counts are summarised in Table 2.

TABLE 2 — WANDERING ALBATROSS NESTS ON NORTH PLAINS, ANTIPODES ISLAND — 7 FEBRUARY TO 1 MARCH 1969

Category	Total for 20 quadrats	Range per quadrat	No/ 10 000 m^2
Birds on nests without egg	18	0 - 2	9.7
Birds on nests with egg	17	0 - 2	9.1
Chicks on nests	3	0 - 1	1.6
Old nests	175	4 - 16	94.2
Recently vacated nests	11	0 - 1	5.9
Old nests with skeletons	6	0 - 3	3.2

These figures suggest that in February 1969 there were on average about 26 recent nests and 97 old nests per 10 000 m^2 on the North Plains. The adults seldom, if ever, re-use their nests, and so 97 old nests can be regarded as the accumulation of about 3.7 (97/26) years' breeding. A complicating factor is the habit of some chicks to build their own, sometimes quite substantial nest away from the parental one in the months before they fly (Warham, unpubl.).

In late January and early February 1969, some chicks were still in down but most were well feathered and some probably flew by the end of January. At the same time the eggs of the new season's breeders were being laid, and so by 6 February many Wanderers were incubating. A sample of 14 eggs had mean dimensions 125.1 $\pm$ 5.12 x 78.1 $\pm$ 2.63 mm.

Precise data on the spread of laying were not obtained, but the timing of laying seems to have been similar to that at Campbell Island, judging by the figures in Bailey & Sorensen (1962). Yet the Auckland Island Wanderers seem to lay earlier on average, for Bailey & Sorensen quote C. A. Fleming's field notes recording 21 nests with eggs, some

incubated for up to a week, on 22 January 1943 at Adams Island. Likewise Chapman (1891) found eggs common at Adams Island on 12 January 1890 when 400 were collected, whereas at Antipodes Island a few days later (17 January), despite an abundance of birds, only 20 eggs were seen.

Tickell (1968) tabulated known laying dates for Wanderers at various islands and pointed out that the evidence suggested that the northern populations (at Antipodes, Campbell and Gough Islands) lay later than the southern ones (at South Georgia, Marion and Macquarie Islands). However, the position is complicated by the Auckland Island birds which, although nesting further north, lay earlier than those at Campbell Island.

Some fully feathered down-free chicks were still present when we left. In 1969 it was not unusual to find chicks dying on their nests towards the end of the season, often while in full feather. Two such birds weighed only 2.9 and 3.0 kg. Skeletons of chicks were also fairly frequently seen in deserted nests, suggesting that normally many young well-developed birds die. The skeleton was found of an adult which had evidently swallowed a piece of a weather balloon measuring 20 x 60 mm that had blocked the gullet.

Population Size

Even from offshore the number of birds seen leaving and flying to the island showed that the population of this albatross was a large one. North-westerly winds produced a channelling effect among the birds flying past Reef Point and a constant stream passed over the Expedition Base to and from the North Plains. Up to 40 birds could be seen in the air at one time and movement did not end at nightfall as our spotlight often picked out Wanderers sailing through the sky.

In an attempt to estimate the number of birds, the island was divided into blocks which could be readily identified by topographical features. The albatrosses were counted from a vantage point which gave a good view of the whole block. At times, however, counts had to be made from considerable distances.

Each nest with an attendant adult was taken to represent a pair of Wanderers, whether the nest had one (sitting or standing), a pair, or even three adults. Gams were excluded, as were nests containing chicks, which belonged to the previous summer's layings. Whenever possible, counts were made before 1500 hours as the number of unemployed birds built up steeply from then until dark. Furthermore, the total number of albatrosses ashore increased during our stay, presumably due to an increase in non-breeders towards the end of egg-laying. Hence counts made earlier in our visit probably contained a higher proportion of actual breeders than counts made later.

As a check on accuracy, two areas (outlined by dotted lines in Fig. 1) were examined closely, counts made from vantage points being

followed by ground searches to find every bird and occupied nest. These checks showed that counts from vantage points revealed only two-thirds of the birds actually present. The rest were hidden by tussock and fern. Only one-third of those found during the ground searches represented breeding pairs with well-built nests or egg; therefore only half of the visual count represented breeding pairs. The checks were made towards the end of our stay when total numbers were higher and a greater proportion of sub-adults was believed to be ashore.

The total count from visual checks was 1867 pairs which, using the above criterion, would represent about 930 nesting pairs. As the proportion of breeders could have been higher in the early counts, it is possible that as many as 1000 pairs may breed in any one year. On the other hand, we had no means of knowing how many had lost their egg or chick during the 1968 guard stage and were nesting again in 1969. Allowing for these unknowns, our best estimate for the total breeding population is between 1500 and 1800 pairs, of which only half will breed each year.

From the visual counts, we estimated that some 1800 non-breeders were present, a figure that could be low as gams were excluded. Also some birds could have been at sea when the counts were made — hence the increase in the late afternoon. The 1800 non-breeders were probably mainly 5-8 year olds ashore annually before breeding, as the biennial rhythm does not start until a bird has nested successfully. The total population of these non-breeders may be conservatively placed at between 2000 and 2500 birds.

Allowance must also be made for juveniles up to four or five years old not yet coming on land. Judging from the situation with the Royal Albatross, the number of juveniles is probably similar to that of the non-breeders, i.e. between 2000 and 2500 birds. Using these assumptions, the non-breeding and juvenile segments of the population are at least as high as, if not higher than the breeding segment. Perhaps the Antipodes Island birds, like several other subantarctic Wandering Albatross populations, are still recovering from exploitation during the sealing era.

Our estimate of the total Wandering Albatross population of these islands is thus between 7000 and 8500 birds (i.e. 1500-1800 pairs, 2000-2500 non-breeders and 2000-2500 juveniles).

Banding

During the Expedition 793 Wandering Albatrosses were banded, of which 37 were chicks, 150 adults with eggs and the remainder adults without eggs; some of the last could have laid later. We saw none of the 20 chicks banded above Ringdove Bay by the 1950 party (E. G. Turbott, *in litt.*). The one already-banded bird that we did find (0-1174) had been banded by E. W. Dawson on 29 January 1965, when he landed in the course of an oceanographic cruise.

Three birds banded by us have since been recovered. R-18908, thought to be " unemployed " when banded on 23 February 1969 (not a chick as stated in Robertson 1972a), was recovered alive off Malabar Head, New South Wales on 9 August 1969, while chick R-18931, banded on the same date, was also recovered alive off Malabar on 25 September 1971 (Robertson 1973). These records show that the assemblages of Wanderers off south-eastern Australia include birds from the Antipodes Island population. Another example, R-18693, banded on 1 February, was found dead at Taiaro Island, Tuamoto Archipelago, in late December 1971. This recovery has also been published (Robertson 1972b), but the bird was not banded on a nest; it was " unemployed " at the time.

BLACK-BROWED MOLLYMAWK *Diomedea melanophrys*

Although Captain Bollons long ago stated that no mollymawks bred at Antipodes Island (Hutton *in* Ogilvie-Grant 1905), we had hoped that we might find this bird nesting on the previously unexplored western cliffs. We found none despite the many apparently suitable sites. Large numbers of Black-brows followed in our wake as we left Campbell Island on 26 January heading north, but none remained as we neared Antipodes Island the next day.

E. G. Turbott *(in litt.)* refers to a small colony of this species mixed with Grey-headed Mollymawks that he saw from a boat on 11 November 1950. The birds were on the south-west side of Bollons Island, mostly singletons on cliff ledges, but a group of about ten was on the top of the island. R. A. Falla (pers. comm.) recalls a total of about 30 birds with at least two identifiable Grey-headed Mollymawks, sitting around on a spur, separate from the Black-brows. Bearing in mind Bollons's comments, it would seem that this small colony has become established fairly recently.

We had no boat but saw a few apparent Black-brows flying round the south-east of Bollons Island on 3 February. From Reef Point with a 36 x telescope on 1 March we also saw a bird, probably of this species, standing on the south-east slopes of Bollons Island not far from what appeared to be about six mollymawk chicks.

Kinsky (1970) followed Fleming (1953) in listing this albatross as breeding at Antipodes Island. Both ascribed the birds to the subspecies *impavida,* well known as nesting at Campbell Island and having a very distinctive honey-coloured eye (see Fig. 132 in Serventy *et al.* 1971). However, we know of no specimens taken at Antipodes Island: the only positive evidence for this subspecies seems to be the sighting in November 1950 of a few *impavida* flying just offshore (R. A. Falla, pers. comm.).

GREY-HEADED MOLLYMAWK *Diomedea chrysostoma*

Not seen by us at or near the island and the only references that associate this bird with the Antipodes that we know of are the

comments of Turbott and Falla mentioned above. Falla (1965) queried this species in his list of seabirds breeding south of New Zealand.

SALVIN'S MOLLYMAWK *Diomedea cauta salvini*

Two Shy Mollymawks, thought to be of this subspecies, were seen with giant petrels off the south-coast penguin colonies.

LIGHT-MANTLED SOOTY ALBATROSS *Phoebetria palpebrata*

A plentiful species but much less so than the Wandering Albatross. Chicks were being reared in nests on cliff ledges, some being as low as 20 m a.s.l. Adults were also seen sailing along the slopes of Bollons Island where chicks thought to be of this species were seen by telescope.

Light-mantled Sooty Albatrosses seemed particularly numerous around Ringdove and Stack Bays and near the creek opposite Orde Lees Islet where there appeared to be a wealth of good nesting sites among the encircling ramparts of cliff which protrude just below the general level of the plateau. Of four males collected by R. H. Beck on 16 and 17 February 1926, at least two were nesting and the others had enlarged testes.

NORTHERN GIANT PETREL *Macronectes halli*

Most previous visitors have recorded giant petrels, but the existence of two species of *Macronectes* was not then established. Most of those we saw were *halli* but it is most probable that examples of *M. giganteus* occur offshore from time to time as they do near other southern islands of New Zealand, and we saw one white-headed *giganteus* on 11 February.

The birds seen on the colonies by us, and the six specimens collected by Beck and Hicks all appear to be typical *halli*. The only bird that we collected (NMNZ 15941), a female from an empty nest on 25 February, was similar to other birds seen at nests. The bill was olive-green overall, lighter at the base and with the upper and lower nails dull reddish brown without prominent dark markings. The feet were grey, the claws darker; irides grey slightly flecked with blackish. The brood patch was completely feathered. The body plumage was generally grey-brown, the feathers of the crown slightly darker, but those of the cheeks, throat and around the base of the bill were more freckled due to the feathers having creamy-white centres but dark edges and tips. The chin and throat were the palest regions of the body. The contour feathers and wing coverts were a mixture of old (brown) and new (grey) feathers, while those of the belly were grey with paler edges, creating a somewhat scaled effect. The ovary measured 21 x 14 mm, largest oocyte 3 mm diameter. Although the colours of the bill plates altered after death, the measurements of the specimen after nine years' preservation had not significantly altered, except for a slight shrinkage of the wing.

Another bird examined in the hand on 12 February was in almost completely fresh plumage, being mostly shiny dark grey with only a few brownish feathers on the body and on crown, nape and jugulum. This bird's tail was a mixture of old and new feathers and there was a down-covered brood patch. The bill was greenish horn tinged brown, with the upper nail flushed reddish brown above and with a dark mark on the inner aspect. One eye was entirely grey, the other grey flecked with black. Such asymmetry of iris colour is common with *M. halli* (Warham 1962), although not referred to by Conroy *et al.* (1975) in their discussion of eye colours in *Macronectes.* According to the labels, the irides of the birds collected in 1926 were " whitish."

A third example examined on 1 February had similar bill colours to the first, but many of its body feathers were faded, creating a piebald effect. The bird's crown was an intimate mixture of grey, rusty brown and pale grey feathers. There was no brood patch and the bird was of very light weight, almost indifferent to us, and may have been dying.

All three birds were in various stages of wing and tail moult. The first had almost completed the regrowth of wings and tail; in the second, all the primaries were regrowing except the outermost (longest), which was still sheathed, while the tail was a mixture of old and new feathers. In the third bird, the four outermost primaries were old and abraded, the inner ones in various stages of regrowth and the tail contained a mixture of old and new feathers.

Some dimensions of these birds taken in life were: weight 3500, 4950 & 2300 g; wing length 448, 445 & 491 mm; tail length 168, — & 170 mm; bill length 87, 102 & 96 mm; bill width at gape 33, 34 & 31.5 mm; tarsus 84, 95 & 87 mm; middle toe with claw 140, 154 & 139 mm. From the sizes of their bills the last two specimens appear to have been males. The wing lengths of all three are short because of moult.

Macronectes halli is a common visitor to the main islands of New Zealand and typical adults with pale eyes and dark grey plumage, like that of the second specimen above, occur in harbours and in Cook Strait. Some of these come from Antipodes Island for we caught on a breeding colony a bird banded in Tory Channel, Cook Strait, on 23 July 1958, 10½ years before (Robertson 1972a).

When we arrived, the breeding of this petrel was virtually completed and only a few fully feathered chicks in their blackish brown plumage remained on or near the nests. Their bills were olive-brown with a brownish tinge to the nails. They were timid and most fled when we approached them. Adult birds were still encountered on empty nests from time to time and so this species, like *M. giganteus* (Warham 1962), evidently visits its nests after breeding.

The breeding season of *M. halli* at Antipodes Island seems to be similar to that at Macquarie Island where many chicks left in early February (Warham 1962). If so, laying would occur in the last

week of August and the first week of September, and this agrees with Captain Bollons (*in* Ogilvie-Grant 1905) who stated that they began to breed early in September. The BMNH egg from the island dated 1 November 1890 referred to by Bourne & Warham (1966) may have been abandoned and have escaped skua predation among heavy tussock or nesting material. None of the chicks we saw could have come from October or November eggs.

We found Northern Giant Petrels' nests in small open colonies or groups of about 20 nests. Most of these groups were above penguin colonies where the ground sloped steeply seawards, affording convenient departure points (see Fig. 1). Most nests were well made from tussock grass and placed some 3-5 m apart. At North Cape and elsewhere they tended to be sited among quite deep vegetation, and so incubating birds must often have been hidden from one another.

Cockayne (1904) noted that the ground around the giant petrel colonies was bared, heavily manured, and supported a plant community dominated by *Senecio antipoda,* which he thought was restricted to this habitat. However, in 1969 this plant was also found in open places and less disturbed situations elsewhere (E. J. Godley, pers. comm.).

We banded 29 chicks and 50 adults and think that the breeding population would be about 320 pairs.

As obtains elsewhere, parties of Northern Giant Petrels waited close inshore by the penguin colonies, evidently to take young penguins as they fledged. None was actually seen to do that but the female collected had her gizzard and proventriculus crammed with penguin feathers. Up to 40 of these petrels, seemingly all *halli,* hung around off the large Anchorage Bay and Orde Lees colonies, parties of up to 20 were seen off Alert and South Bays, but none was noted off Stella Bay, perhaps because the penguin colonies there were rather small. Here and elsewhere, the petrels rested among the *Durvillea* kelp and on rock platforms at low water and fed on dead penguins near the shoreline.

Birds on the water were seen to use the mutual billing display usually associated with courtship and the threat display involving cocked tails and waved heads of birds contesting the ownership of a food source (Warham 1962). The aerial display first described from Macquarie Island where it was rarely seen was at Antipodes Island seen and heard quite frequently, even though the giant petrel population there must be much smaller than that of the two species at Macquarie, where *halli* is much less common than *giganteus.* Both have a similar aerial display (Warham 1976).

CAPE PIGEON *Daption capense*

Seen at sea all round the Main Island, at times in quite large groups, the largest a flock of about 40 feeding in rough seas off Reef Point on 6 February. We identified no birds on eggs or with

chicks, and know of no egg or chick taken at this island, but Cape Pigeons were seen flying into cliff fissures at several places around the coast, e.g. in gullies just south of North Cape, and we also saw a few birds sitting in coigns of the much eroded western flank of Leeward Island. White streaks radiating from some of these places suggested the presence of nests. Turbott *(in litt.)* also noted that the 1950 party saw these petrels landing on Leeward Island and on the north side of Albatross Point on 5 November and on Bollons Island on 10 November.

Beck and his colleagues collected some birds on 22 February 1926 at the island itself and a series on the same day about 65 km to the south. The birds from Antipodes are listed under subspecies *australis (=australe)* in New Zealand checklists, a race created by Mathews (1913) on account of its darker dorsal coloration.

WHITE-HEADED PETREL *Pterodroma lessoni*

One of the commonest petrels. Nests with chicks or eggs were seen mostly near Reef Point, but the birds appeared to be widely distributed over the island as evidenced by their calling after dark and by the plentiful skeletal remains of presumably skua-killed birds. Many wing girdles still had flesh attached, and R. H. Taylor heard and saw these petrels being attacked by skuas on the ground at night.

Despite their abundance, no White-headed Petrels were seen at sea from the island by day, but there is a long series in the AMNH collected by the Whitney South Sea Expedition on 16 February 1926 about 65 km north of the island. Likewise, at Macquarie Island, where it is common also, the bird is not seen from land by day (Warham 1967).

The breeding cycle at these two stations seems to be similar. Eggs inadvertently excavated when clearing for the camp site on 28 to 30 January contained very advanced embryos or were hatching. One egg measured 69.4 x 48.9 mm. Beck's chicks taken on 23 February 1926 were in down. At Macquarie Island, *lessoni* re-appears in late August, lays in late November and early December, hatches its egg in late January and early February and its chicks fly in May (Warham 1967).

The characteristic chattering *ti-ti-ti was* usually one of the most prominent calls after dark. The gruff, slurred notes described by Warham (1967) were also heard, but, as at Macquarie Island, the calling was virtually confined to flying birds. Indeed, grounded ones were seldom seen except when attracted to our lights and such birds were timid when approached.

The number of White-headed Petrels over land appeared to vary considerably from night to night, with more present on dark, misty evenings than on clear ones. This may have been due to a varying influx of non-breeders. No bird was seen in the air until well after dark. The night of 27 February was particularly productive

of petrels and many *lessoni* near our lights were disgorging small squid.

Nine birds had a mean weight of 574 ± 34 g and Table 3 summarises measurements of full-winged live or recently killed un-sexed adults.

TABLE 3 — MEASUREMENTS OF LIVE WHITE-HEADED PETRELS AT ANTIPODES ISLAND

(Number of birds in parentheses)

Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
302.6 ± 5.7 (22)	130.6 ± 5.5 (10)	36.7 ± 1.2 (25)	44.0 ± 1.5 (22)	64.2 ± 2.8 (16)

These dimensions are very similar to those for other populations (Mougin 1975) except for body weights. Our birds were much lighter than the mean for six of 750 g given by Mougin, and also lower than the mean for five unsexed birds from Macquarie Island of 606 g (Warham, unpubl.). The reason for these differences is not clear.

MOTTLED PETREL *Pterodroma inexpectata*

This petrel, widespread in New Zealand seas, is listed as breeding at Antipodes Island in New Zealand checklists, but not in Falla's list (1965). We saw no sign of the bird although it should have been hatching eggs and raising chicks if its breeding cycle is the same as elsewhere (Warham *et al.* 1977).

This bird could have been overlooked in view of the similarity of its calls to those of *P. lessoni,* its rather retiring habits and its restricted calling from the ground. However, the species is a frequent victim of skuas and we could find no skeletons, and so if present, *inexpectata* was evidently rare during our stay. The underwing pattern is striking (see frontispiece in Warham *et al.* 1977), shows well in disarticulated wings, and so its absence from the considerable amount of skeletal debris examined is remarkable if it really breeds on the Main Island.

We have located no specimens collected at Antipodes Island, with the possible exception of AMNH 528010. This is a chick with breast and belly in secondary down, wings and head feathering, the underwing with white lining and a dark band extending diagonally from the carpal joint towards the body, bill black, forehead with feathers pale edged producing a scaled effect. This is presumably the specimen referred to by Murphy & Pennoyer (1952: 23). It is undated and labelled " Large Blue Young Petrel *Oe. gularis,* Antipodes Island, ex Rothschild Museum." This seems to be an undoubted *inexpectata* chick and may well have been one of the many birds collected for Rothschild by H. H. Travers at the southern islands. Whether it really came from Antipodes Island is uncertain. Sir Robert Falla told us that despite the various dates on Travers' specimens, he is believed to have made only one trip to the south himself, had a standing

arrangement with some crew members to get specimens for him, and met the ship at Wellington to receive them. Thus the opportunities for mis-labelling were considerable and AMNH 528010 may well have come from the Snares Islands which were also on the steamers' itineraries and where the Mottled Petrel is common.

Mottled Petrels certainly inhabit seas near Antipodes Island and the AMNH collection includes two males taken by Beck about 64 km to the north on 16 February 1926, apparently in company with *lessoni* (see above). These seas would be well within the range of the Snares and Stewart Island populations of *inexpectata.* Beck also refers in his diary to seeing skeletons on the island on 17 February 1926 — "A few prions, but *inexpectata* and *lessoni* were the usual ones." As our much longer search for skeletal material at the same time of the year yielded no *Pterodroma* except *lessoni,* Beck may have mistaken some *lessoni* (or *mollis*) for *inexpectata.*

SOFT-PLUMAGED PETREL *Pterodroma mollis*

The discovery of this bird flying in some numbers after nightfall was unexpected as its nearest known breeding place at Iles Crozet is about 8300 km to the west and it had not been reported in New Zealand before, even as a beach derelict.

Our first specimen was caught by R. H. Taylor on the night of 12 February and subsequently these birds were seen or heard on most nights not far from our base camp. A few were also heard near the centre of the island but the Soft-plumaged Petrels appeared to be most plentiful above the shallow valley containing the stream draining the North Plains into Hut Cove.

The birds attracted attention by their mournful, low-pitched fluting cries which were distinctively different from the harsh chatterings of the White-headed Petrels. The Soft-plumaged Petrels were very readily dazzled by a hand torch as they circled overhead at high speed and were easily caught when they crashed into the vegetation. Otherwise they were not seen on the ground.

At other breeding stations in the Southern Ocean, for example, at L'Ile de L'Est, Archipel Crozet, the bird burrows in the flanks of valleys at medium altitudes and under the cover of vegetation (Despin *et al.* 1972). This is much the same sort of habitat as that above which we took two males and six females as specimens. No other evidence of its presence was obtained and no skua-killed remains found, although these petrels suffer such predation elsewhere, e.g. at L'Ile de L'Est where bones occur in skua middens even though *P. mollis* is not very abundant there.

Two of our specimens were directly compared at the BMNH with *mollis* skins from Marion and Gough Islands, from Tristan da Cunha, the Desertas and Madeira. In their plumage the Antipodes birds agreed very well with those from the South Atlantic populations

FIGURE 3 — A Soft-plumaged Petrel: note the wide band across the chest and the parti-coloured feet. Photo: John Warham

(subspecies *mollis*), whereas the Desertas birds *(feae)* were darker crowned, had less extensive scaled edges to the feathers of the forehead, and neck collars less well developed. Whereas the mottling on the flanks was more developed, tending to spread towards the midline, the birds from Antipodes, Tristan and Gough lacked any such mottlings. The Madeiran bird (subspecies *madeirae*) had more uniform grey-brown upperparts than the Antipodes Island birds, and lacked the light edges to the feathers of neck and mantle. Thus, in our opinion, the birds we collected belong to the nominate race.

All our specimens were of the light phase, fully described by Serventy *et al.* (1971), and for the first specimen from the New Zealand mainland, by Kinsky (1971). No dark-phase *mollis* was seen although such birds do occur among the South Atlantic populations as re-emphasised recently by Bourne (1975) and there are some skins of intermediate plumage (e.g. BMNH 1953.55.68) from Tristan da Cunha.

The eight specimens we captured had a mean weight of 276.2 ± 27.1 g and their dimensions after eight years as skins are given in Table 4, together with those of skins from the South Atlantic and Indian Ocean colonies measured by one of us at the BMNH.

TABLE 4 — MEASUREMENTS OF SKINS OF SOFT-PLUMAGED PETRELS OF MIXED SEXES FROM ANTIPODES ISLAND, TRISTAN DA CUNHA, GOUGH & MARION ISLANDS
(Number of birds in parentheses)

Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Antipodes I. —				
255.8 ± 3.9 (6)	114.9 ± 4.0 (7)	28.7 ± 0.9 (8)	33.9 ± 0.7 (8)	48.0 ± 1.0 (8)
South Atlantic & Indian Ocean —				
252.8 ± 7.1 (18)	112.4 ± 3.2 (23)	27.7 ± 1.0 (23)	33.9 ± 1.0 (24)	46.2 ± 1.3 (18)
P (Mann-Whitney U-tests) —				
n.s.	n.s.	0.05	–	0.01

The birds in the Antipodes Island sample average slightly larger than those in the bigger sample from more westerly breeding stations, but only in bill and mid-toe-with-claw lengths are the differences significant. The mean body weight at 276 g is also higher than that given from some other samples e.g. Mougin's (1975) figure of 225 g (n = 156), but this evidently included Swales's weights from Gough Island (Swales 1965), which may have included fledglings. On the whole, the evidence suggests that while the Antipodes birds may be slightly bigger, in their plumage they resemble those from other southern populations.

The measurements of the young male found alive in Hutt Valley (Kinsky 1971) agree reasonably well with those of our Antipodes sample except for the bill length (35.8 mm) which is quite outside the range for *P. mollis*. However, Mr Kinsky advised us that this was a printing error: the correct bill length for this specimen when fresh was 27.4 mm and after six years' drying it is now 26.2 mm.

The characteristic calls of these birds, low musical moans, lasted for 1-2 sec and were often repeated several times. An analysis of these calls will be given later (Warham, in prep.). These low flutings and their intercalated squeaks were the only kinds of call we associated with *Pterodroma mollis*.

FAIRY PRION *Pachyptila turtur*

Of uncertain status, although listed as breeding by Oliver (1955), Falla (1965) and Kinsky (1970). Hutton (*in* Ogilvie-Grant 1905) stated that it bred but we have found no positive records of birds in nests or of specimens of eggs or identifiable adults actually collected ashore.

On the other hand, there is material taken at sea nearby and Fairy Prions were among the " rain of petrels " attracted by searchlight to the deck of MV *Alert* when anchored off the east coast in thick fog on 4 and 9 November 1950 (E. G. Turbott, *in litt.*). Five of these birds are in the NMNZ collection and the males were in breeding condition. Oliver (1955) referred to a bird taken at the island on 31 July 1924 which he made the type of subspecies *subantarctica* on account of its small and deep bill, and he also stated that those brought back in 1950 were similar. It appears, however, that the smaller, shorter bill of this bird was that of a shrunken juvenile and that *subantarctica* is not a valid subspecies (R. A. Falla, pers. comm.).

Beck shot four unidentified prions quite close to the island on 15 February 1926 and we saw prions feeding offshore on several occasions, e.g. off Reef Point on 11 March. R. A. Falla (pers. comm.) found burrows above Ringdove Bay in November 1950 that had been freshly cleaned out and with feathers that seemed to be those of prions, and also heard prions of some kind crooning from the lower faces of Leeward Island. Beck found prion bones in skua middens. Yet we discovered only a few wing girdles of unidentified prions among the great amount of skua-killed material. Nor did we see any prions in our searchlight beam, even on nights when petrels were plentiful, and none of us identified their characteristic crooning cries: possibly most had bred and gone by the time of our arrival.

It seems unlikely that no prions nest at Antipodes Island, but as they usually experience heavy predation by skuas, the scarcity of skua-killed remains (in contrast to an abundance of larger species) argues against many breeding on the Main Island unless they use crevices in cliffs rather than burrows.

FULMAR PRION *Pachyptila crassirostris*

Also of uncertain status. Falla (1965) and Falla *et al.* (1966) did not list Antipodes Island as a breeding station and Kinsky (1970) queried the bird's status there.

Oliver (1955) stated that *crassirostris* was found nesting on the island in 1902. The only specimens labelled "Antipodes Island" we can find are three in the Canterbury Museum. Two of these (AV 1208, 1247) appear to be the skins that Mathews & Hallstrom (1943) thought were smaller than Kerguelen and Heard Island birds and for which they proposed the name *antipodes*. The first skin is undated and unsexed, the second sexed male and undated and with a note "probably collected by Hutton 1902." Actually, F. W. Hutton seems to have sailed with Lord Ranfurly on his first voyage south when a landing took place on 14 January 1901 (Chilton 1909; Ogilvie-Grant 1905).

The third specimen (AV 3246) is a female without date or collector's name. We can find no suggestion that any of these birds was taken from a burrow, nor that Mathews & Hallstrom's two birds were, as they stated, a pair. Beck collected none at the island. The long series in the AMNH taken by him at sea some 160 km to the north on 27 February 1926 seems most likely to have been from the Bounty Island population, about 24 km from the collecting point. The 1950 party obtained no specimens of this form and neither did we. Yet, as this is a crevice nester, it could easily have been overlooked if it were breeding on the sea cliffs or on the smaller islands and stacks.

GREY PETREL OR PEDIUNKER *Procellaria cinerea*

A winter breeder. The birds returned to the island during our stay, but we probably left before eggs had been laid. Our first bird was found freshly killed on 1 February, one was heard calling from a burrow on the night of 9/10 February, another was heard on the following night, and two flew overhead on the afternoon of 12 February. By 16 February it was usual to see them either arriving or departing in broad daylight. Pediunkers were first identified flying at sea on 21 February, whereas the White-headed Petrel, then equally common on land, was not seen off the island, a contrast noted also at Macquarie Island (Warham 1969). By 4 March, Pediunkers were the most numerous birds flying over the Reef Point area in the late afternoon and on 5 March some 100 Pediunkers and Shoemakers *(P. aequinoctialis)* were circling that general area, with the calls of the Pediunkers forming the dominant chorus after dark. Many were seen offshore from the ship on 12 March. Falla and Turbott *(in litt.)* saw fledglings flapping around in stream beds or in the sea during the first week in November 1950, some still with down adhering to their feathers, and saw one killed by giant petrels. If most chicks leave in late October and early November, then the timing of the breeding cycle at Antipodes

Island approximates that at Tristan de Cunha, where the birds return towards the end of February, the first eggs have been found in April, and the chicks depart in October and November (Elliott 1957).

Barrat (1974) has commented on the possibility that, by breeding in the winter, Grey Petrels at Iles Crozet may be able to occupy burrows used in the summer by Shoemakers and Despin (1976) gave one instance of this. This may not be true of the birds at Antipodes Island for, if the Pediunker lays there in *April,* many Shoemakers will still be rearing chicks.

These two *Procellaria* species were the only burrowing birds regularly flying over land and occasionally alighting in broad daylight. Skeletons of Pediunkers from previous seasons were fairly common on the ground and some were of adult birds, but it was noticeable that those flying around by day made no attempt to avoid skuas, which were never seen to attack them. On the other hand, the larger and more aggressive Shoemakers were often harried, perhaps because many of them were carrying food for their chicks and thus had something to disgorge, whereas the Pediunkers were only involved in pre-laying activities.

The few occupied burrows examined were dug at bases of, or between, tussocks and were fairly dry. Pediunkers appeared to be nesting widely around the island and many were sweeping along cliffs and steep, tussock-clad slopes, pausing momentarily at particular places where, after recircling, they eventually pitched down and promptly dived into the cover, presumably to their nests. Many were seen to alight on the slopes above Ringdove, Stack and Crater Bays, but we also found several nests on flat ground behind Reef Point only some 20 m a.s.l.

The call of this petrel was very distinctive. It consisted of a short, introductory, wheezy moan uttered on the intake of breath that led directly into a sustained, explosive bray. Hutton (1865) likened it to the bleating of a lamb. Some Pediunkers called from burrows by day but the main chorus did not develop until after dark, reaching a peak about one to two hours after sunset, then subsiding, only to increase again before dawn.

Sitting birds squatted on tussock crowns and with mouths wide open, swung their heads from side to side "hosing" their song far and wide. Such birds were easily approached. Presumably many were males but we took only one specimen (on 27 February), a female with a rather enlarged ovary (20 x 10 mm; largest ooctyte 3.5 x 5.0 mm), which appeared to be coming into breeding condition.

This bird's wing quills were fully grown except that the 3rd primary was slightly short and apparently still growing while four tail feathers were also new and growing. Neither it nor any of the other birds measured had bare brood patches. The wings and tails of most of the AMNH birds collected in February 1926 and of those examined

by us were in a similar condition, showing that on their return the breeders have still to complete the growth of their flight quills.

Beck's log for 23 February records that he found a pair of these birds in a hole that they were digging and also one downy young. It seems likely that this was a young *aequinoctialis,* as is clearly a chick in sooty-brown down he collected.

Table 5 gives the dimensions of five unsexed birds measured by us in life and 13 skins of both sexes taken by Beck or Hicks at or close to the island in 1926.

TABLE 5 — DIMENSIONS OF ANTIPODES ISLAND PEDIUNKERS
(Number of birds in parentheses)

Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Live birds —				
334.8 ± 2.8 (5)	116.6 ± 3.0 (5)	46.6 ± 1.0 (5)	60.0 ± 1.9 (5)	82.0 ± 2.6 (5)
Male skins —				
340.2 ± 5.6 (13)	119.3 ± 3.9 (13)	47.5 ± 1.1 (10)	60.1 ± 1.5 (13)	76.7 ± 1.8 (11)
Female skins —				
339.1 ± 8:7 (13)	117.8 ± 3.1 (13)	46.3 ± 1.5 (10)	59.6 ± 1.8 (13)	75.8 ± 1.4 (6)

The five live birds had a mean weight of 1106± 93 g.

These dimensions agree well with those previously published, e.g. in Mougin's summary (1975: 16), but the wings are rather shorter on average as the primaries were still growing. Beck's males are slightly larger in all dimensions than his females, supporting the figures of Barrat (1974: Table 2), which suggest that males average slightly bigger and heavier than females.

One of only five adults banded by us was found freshly dead at the mouth of Karori Stream, west of Wellington, on 8 May 1977, over seven years after banding. The skin (19708) is now in the NMNZ collection.

WHITE-CHINNED PETREL OR SHOEMAKER *Procellaria aequinoctialis*

Shoemakers from Antipodes and the Auckland Islands have only a small amount of white on the chin and were therefore placed in the subspecies *steadi* by Mathews (1912: 114). The birds from Campbell Island are similar and are included in *steadi* by New Zealand checklists.

We found Shoemakers plentiful with breeding at its height. Some flew overhead and occasionally landed in broad daylight, even in sunshine, but most nest reliefs and visits occurred at dusk or after

dark. Repeated circuits were made before alighting. The main outward movement of adults took place at or before dawn.

Near the expedition base at about 20 m a.s.l., several of the Shoemaker's large burrows were found. They were tunnelled into the peat and well concealed among the 2 m high tussock and fern. A pair nesting deep in a small cave was easily observed (see Serventy *et al.* 1971: Fig. 66). However, as with the Pediunker, the major concentrations of burrows and of nocturnal activity were at higher altitudes. One big warren of burrows, some of which contained chicks, was towards the top of Mt Galloway. Here the entrances were unconcealed as the tunnels were dug into bare peaty terraces. This may be the colony referred to by Hutton (1895) who recorded that many burrows had pools of water at their entrances, as they had in 1969 and as seems normal for this species (see Hagen 1952).

The first chick was found on 2 February. It weighed 205 g and was being brooded. Two days later it was alone and weighed 165 g. Over the next 25 days it received food on at least six nights, but the meals were small and its weight never exceeded 295 g. It died on its 25th day (probably when 28 days old), weighing 179 g. It had several *Ixodes* ticks attached to its feet and nostrils.

On 1 February a Shoemaker, probably a female, was incubating in the cave site. Her egg measured 81.2 x 56.9 mm (125 g) and the same bird remained there until the night of 8/9 February. The chick hatched on 6/7 February (95 g), two days after the shell was first pierced. After being brooded for two days, the chick was left unguarded for a day, then brooded for days 4 and 5 by the other parent before being finally left unguarded. It was tick-free. During the 32 days over which this chick was weighed, it was fed on at least eight nights, fasting for 1-6 days (average 4 days) between meals. Some meals were huge. On the night of 19/20 February, the chick's weight rose from 250 to 490 g, but two days later it was back to 345 g. The maximum attained was 545 g. It weighed 430 g on day 32 when weighing ceased.

The chicks in their protoptile down were a uniform grey, their feet with flesh-grey webs, bill pale grey but slightly creamy towards the tip.

According to Hutton (1895), at Antipodes Island the eggs are laid in December and the chicks fully feathered in May. Adults were coming in at night in early November 1950, but there were already a few in burrows, cackling by day (R. A. Falla, *in litt.*). We saw small to medium-sized young in early February. These dates tie in well with the findings of Mougin (1970) who recorded that at Iles Crozet the last adult left on 7 May and the first returned on 16 September. The incubation period was about 58 days and the nestling period some 94 days. Hence an egg laid about 1 December should produce a chick about 27 January which should fledge about 4 May.

These were noisy birds. Their staccato cacklings vied with the brayings of the Pediunkers: occasionally the Shoemaker's chorus was

the louder. As with the Pediunkers, no Shoemaker was heard calling on the wing.

Daytime-flying Shoemakers were fairly often harried by skuas. Some of the petrels lost tail feathers, some disgorged food, but none was actually seen to be killed, although skeletons of adults lying around suggested that some birds did not escape. They may have been killed on the ground at night. On 25 February at 0530 hours one departing Shoemaker was chased by eight skuas. The petrel showed no obvious signs of alarm, nor appeared to alter its flight style of wing beats interspersed with short glides but, when attacked, the petrel thrust towards the skuas with its bill and rattled it loudly. The petrel escaped serious damage. Another grounded Shoemaker successfully beat off a single skua. Most skuas broke off the engagement when a petrel landed but began again when the petrel took flight. In contrast, at Iles Crozet, Mougin (1970) did not see skuas attacking Shoemakers although there too they fly around before dark. He surmised that they were too well armed and aggressive for the skuas.

The Shoemakers' numbers increased over land at dusk and on 13 February, with very calm seas, a small raft of dark petrels, almost certainly Shoemakers, rested off Reef Point in the late afternoon.

Apart from a few skeletons, we collected no adults. Two skins from the 1950 expedition are in the NMNZ (in spirit). The AMNH collection contains five birds labelled Antipodes Island and collected by Dannefaerd, two of these being dated March 1894 and one, male 527317, dated May 1894, collector H. H. Travers, lacks white on the bill plates and may have been a fledgling. Beck took a series at sea on 16 and 17 February 1926, most of which were presumably Antipodes Island birds as his log shows that he was just offshore.

Seven live birds measured by us weighed 1114 ± 92 g. Details of these, of dead and partly dried birds we found, and of skins in the AMNH are given in Table 6.

TABLE 6 — DIMENSIONS OF SHOEMAKERS FROM ANTIPODES ISLAND
(Number of birds in parentheses)

Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Live birds, mixed sexes —				
401.2 ± 9.1 (6)	129.2 ± 3.1 (4)	51.4 ± 0.5 (5)	65.2 ± 2.4 (6)	90.4 ± 3.4 (5)
Dead birds, mixed sexes —				
387.6 ± 7.0 (7)	125.7 (3)	51.3 ± 1.4 (10)	64.3 ± 1.4 (11)	83.9 ± 3.2 (10)
Male skins AMNH —				
382.8 ± 5.8 (9)	124.8 ± 3.7 (9)	52.6 ± 2.4 (8)	65.3 ± 2.0 (9)	85.2 ± 2.1 (6)
Female skins AMNH —				
376 (3)	127 (3)	52.5 (3)	64.3 (3)	84.1 (3)

The dimensions in Table 6 differ little from those of other populations summarised by Despin *et al.* (1972), and they lie within the range given by Serventy *et al.* (1971), although the live birds were rather long-winged and had rather long mid-toes and claws.

Our birds were fully winged, and consistent in showing little white on the chin, usually just a patch filling the inter-ramal space and extending backwards from the symphysis for 10-20 mm. None showed any sign of a "spectacle," but AMNH ♂ 527312 from Antipodes has feathers of the neck, throat and particularly above and behind the eye and on the crown tipped with white, creating a scaled effect. All but one of Beck's birds had small gonads.

SOOTY SHEARWATER *Puffinus griseus*

Judging by the number seen and heard, Antipodes Island is a much less important breeding station than are many of the islands closer to Stewart Island. We saw Sooty Shearwaters flying out at dawn and heard some calling after dark but, even though we were ashore at the height of the breeding season and at a time when chicks were being raised and many non-breeders visit the land, this was one of the less obvious species.

Beck also did not find the birds in great numbers but saw them offshore on 16 and 21 February 1926 and, as darkness fell on 17 February and dense fog closed in, a flock appeared flying low over the water. Beck's series in the AMNH, taken on 16 February, has not been measured by us. The mean dimensions of three examined in life were: weight 807 g; wing 298.5 mm; tail 91 mm; bill 41 mm; tarsus 57 mm; mid-toe and claw 68.7 mm.

LITTLE SHEARWATER *Puffinus assimilis*

The status of the Little Shearwater at this island has been in some doubt and we were fortunate to see the return of the birds, which are winter breeders, and to collect five specimens. These are the first known to have been taken on the island. R. A. Falla *(in litt.)* refers to seeing "enough old remains of *P. assimilis* to indicate that they had bred," but no live birds were taken by the 1950 party.

Beck collected six specimens on 16 February 1926 (Murphy 1927) at 49°S 179°E (not 179°W as stated by Murphy). Beck's log on 16 February shows that he was in sight of Antipodes Island, and on the evenings of the 15th and 20th he saw these birds frequently as he approached the coast.

We saw none until 26 February when one appeared in the spotlight. On the following night, with many petrels in the beam, five Little Shearwaters were taken. No others were seen ashore, no further spotlighting was attempted, and only two old skulls of this bird were found among the numerous bird remains examined, but many flew near the ship on 12 March as we left.

The plumage of the birds collected agrees well with detailed descriptions of the subantarctic race *elegans* given by Murphy (1927) and by Fleming & Serventy (1943). The white tips to the feathers of the back and to the wing- and tail-coverts are prominent. The dorsal feathers are otherwise slaty-black with little suggestion of a brownish tinge. However, in one of our specimens (NZNM 19165), the white tips on the back are much reduced.

Two of the specimens collected were compared in the BMNH with examples of the subspecies *boydi, baroli, tunneyi, assimilis, kermadecensis* and *elegans.* Our birds agreed best with examples from Tristan da Cunha and Gough Island *(elegans),* although in these the pale edgings to the feathers tended to be less distinct than in the Antipodes Island specimens. The latter agreed precisely with one of Beck's birds *("P. a. kempi")* shot off the island on 16 February 1926 (BMNH 1959/23/3).

In life our birds had blue-grey mandibular rami and latericorns, the rest of the bill being grey-black. The insides of the legs and toes were grey-blue, the outer aspects of the tarsi grey-blue but becoming blackish behind, merging into the black of the outer aspects of the outer toes. The claws were black, the webs pinkish with the soles also pink but deep black along the toes and along the edges of the webs.

Table 7 gives dimensions of our five birds when freshly killed and also after seven years' storage as skins, and of six of Beck's birds shot off the island in 1926.

TABLE 7 — DIMENSIONS OF ANTIPODES ISLAND LITTLE SHEARWATERS

Sex & NMNZ No.		Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)	Weight (g)
19166	male	183	70	24.0	38.5	49.0	235
19168	male	189	71	25.0	40.0	52.0	256
19165	male	189	70	26.0	41.0	53.0	246
20989	male	190	72	24.5	38.5	49.5	229
19167	female	187	72	23.0	41.0	50.0	226
In life		187.6 ± 2.5	71.0 ± 0.9	24.5 ± 1.0	39.8 ± 1.1	50.7 ± 1.5	238.4 ±11.2
Dried skins		184.4 ± 3.3	70.0 ± 0.6	24.9 ± 0.7	39.6 ± 1.1	48.1 ± 2.2	-
Beck's skins		187.0 ± 6.0	69.0 ± 2.2	24.7 ± 1.0	39.6 ± 1.1	47.4 ± 1.2	-

The samples are small, but Beck's birds and ours are of very similar dimensions, and the shrinkage of our birds has not been great during storage — except for mid-toe and claw which averaged 5% shorter than the mean for the live birds. The anomalous difference in bill length seems insignificant. It should be noted, however, that our

birds all had the outermost functional primary the longest whereas in Beck's birds the two outer primaries are either of equal length or the outermost is slightly shorter, suggesting that, had his birds been full-winged, the mean length would have been greater than 187 mm.

According to his labels, all Beck's specimens had small gonads except for one female marked " gonads swelling." Ours all lacked brood patches and the gonads were fairly small, the testes from 7 x 4 mm to 5 x 3.5 mm, the largest oocyte in the two females c. 2 x 1 mm. At least one male was coming into breeding condition with tubules of large diameter, little interstitial tissue and some evidence of spermatozoa.

GREY-BACKED STORM PETREL *Garrodia nereis*

This small petrel is reputed to breed at Antipodes Island according to many authors, e.g. Oliver (1955), Falla *et al.* (1966), but we know of no eggs or chicks taken there and the museum specimens of adults all appear to have been collected nearby at sea. The inclusion of Antipodes Island as a breeding place in the *Checklist of New Zealand birds* (Kinsky 1970), is because of the high probability that the birds taken off-shore were part of a local breeding stock.

Beck and Hicks collected four *Garrodia* on 16 February 1926 and 15 taken by R. A. Falla between 4 and 8 November 1950 are in the NMNZ. On the night of 4 November 1950, in heavy fog, these petrels " rained down " on the deck of MV *Alert*, attracted by the searchlight (E. G. Turbott, pers. comm.).

We saw these birds ashore quite frequently, and like Beck, who noted that the Black-bellied was the commoner off-shore, we found the Grey-backed the scarcer of the two storm petrels over land. Those seen were either sitting on tussock crowns or were picked out and often lured down by our spotlight. The birds were seen only after dark. We found no nests or young, nor did we hear any certain calls. The lack of direct evidence for breeding is understandable, bearing in mind the dense vegetation, the bird's non-colonial nesting and its generally secretive behaviour (Despin *et al.* 1972).

The first bird seen by us on 31 January had a brood patch measuring about 20 x 30 mm. All the others handled had completely or almost completely down-covered brood patches, suggesting that the breeding season was well advanced. If the annual cycle here is similar to that at Chatham Island, 700 km to the north, the successful breeders should have been feeding large chicks in January and February. Bones were found among skua-killed debris.

Seven out of eight sexed birds were males. Eleven of mixed sexes measured in life had a mean weight of 32.1 ± 5.0 g and had the following dimensions (in mm): wing 124.3 ± 4.3; tail 62.2 ± 4.1; bill 13.3 ± 0.3; tarsus 30.6 ± 1.7 and mid-toe with claw 27.3 ± 1.7. These dimensions are in line with those previously published e.g. by Despin *et al.* (1972). Our mean wing length is rather low, particularly

Photo: John Warham

FIGURE 4 — A Grey-backed Storm Petrel.

for birds measured live. This is partly due to two short-winged birds (117 and 118 mm), the mean for the remaining nine being 125.8 mm.

Three of the birds collected were in heavy moult and in one a few primaries were still growing. Otherwise there was little evidence for wing moult in the small sample examined.

BLACK-BELLIED STORM PETREL *Fregetta tropica*

As with Grey-backed, alleged breeding at Antipodes Island appears to have been based on the large numbers seen or captured offshore. Beck took six females and 20 males on 16 February 1926 at 49°S 179°E and noted that with low fog hanging over the island, Black-bellied Storm Petrels were common and feeding offshore, whereas the Grey-backed was scarce. The " rain of petrels " attracted on deck on the nights of 4 and 9 November 1950 (E. G. Turbott, pers. comm.) included Black-bellied, eight of which are in the NMNZ collection. The 1950 party also heard the characteristic whistle from under dense *Polystichum* fern while R. Litt saw one bird flying over the tussock by day (R. A. Falla, pers. comm.).

We caught a number over land. Most were females. We saw none on the ground, found no occupied burrows, and neither heard its far-carrying cries nor saw any skeletal remains. Nevertheless, six out of ten examined had brood patches measuring about 20 x 25-30 mm, suggesting that incubation may have been in progress. Some of the specimens appeared to be close to breeding condition, one male with free spermatozoa in the lumina of its testis tubules. A female with a convoluted oviduct, ovary 10 x 3 mm (largest oocyte 2.5 mm diameter), had probably laid as there were signs of post-ovulatory changes with large atretic follicles present. Stead (*in* Oliver 1955) found two birds on fresh eggs at the Auckland Islands on 1 February. It seems unlikely that laying would be much earlier on Antipodes Island.

Measurements of Beck's 26 skins collected on 13 and 16 February 1926, which were mostly males, were given by Murphy (1936:

TABLE 8 — MEASUREMENTS OF LIVE BLACK-BELLIED STORM PETRELS OF MIXED SEXES

Weight (g)	Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Antipodes I.					
53.9 ± 3.8	164.3 ± 3.8	75.3 ± 2.7	15.2 ± 0.3	41.3 ± 1.7	30.2 ± 1.0
Signy I.					
57.5 ± 1.0	167.7 ± 6.0	78.9 ± 3.7	15.3 ± 0.7	40.1 ± 1.3	29.5 ± 1.3

Photo: John Warham

FIGURE 5 — A Black-bellied Storm Petrel showing the very elongated tarsus.

766) and the dimensions of ten live birds measured by us are given in Table 8, together with those of 36 live birds from Signy Island from Beck & Brown (1971).

Although our sample was small, our birds averaged shorter in the wing and tail then those from Signy Island and thus support Beck & Brown's suggestion that South Shetland birds have longer wings and tails than those of the New Zealand region.

COMMON DIVING PETREL *Pelecanoides urinatrix*

Plentiful but more often heard than seen. They were very readily attracted to light. The bird's low moaning *kua* cries, lasting about one second and slightly rising in pitch, were heard after dark from burrows and, more rarely, from the air. The chorus after dark faded in the middle of the night but resurged before dawn as the outward movement began. The departing birds could not be seen but their wings could be heard as the birds cut through the air like projectiles.

Oliver (1955) and others gave Antipodes Island as a breeding place but we have not found specimens of eggs or chicks. Thirteen birds collected by R. A. Falla between 4 and 6 November 1950 were taken at light and Beck collected one on 23 February 1926. Nevertheless, its abundance and burrow activity show that it does breed on the Main Island. We saw remains among skua castings.

Some of the males collected had quite large testes (up to 10 x 4 mm), with a new tunic below the old and with tubules showing active cell division but no spermatozoa or evidence of testis collapse. The one ovary examined (14 x 3 mm) showed all stages of follicular development, with conspicuous lipoidal cells, and the bird may have laid.

It seems likely that most of the birds collected were breeders as *P. urinatrix chathamensis* breeds in its second year (Richdale 1965). Our birds were presumably raising chicks, as the state of their gonads suggests.

The specimens taken near Antipodes Island have been ascribed to the subantarctic subspecies *exsul* which differs from other forms in minor characters such as its average greater width of bill, the mandibular rami not being quite parallel and the extensive grey suffusion of the jugulum (Murphy & Harper 1921). The birds we took showed these same characters. The mean weight of 19 was 119 ± 11 g. The dimensions of 14 birds measured in life and of these re-measured seven years later as skins are given in Table 9.

TABLE 9 — DIMENSIONS OF ANTIPODES ISLAND DIVING PETRELS

Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Unsexed live birds —				
118.6 ± 3.2	39.4 ± 2.4	16.1 ± 0.8	25.0 ± 1.3	33.3 ± 1.6
Unsexed skins —				
117.3 ± 2.6	38.2 ± 1.3	15.8 ± 0.8	25.2 ± 1.1	32.2 ± 1.2

Evidently some shrinkage has accompanied preservation, but these measurements agree in general with those given by Murphy & Harper for a sample of 28 *P. u. exsul* and, apart from wing lengths (ours average shorter), they also agree with data for 36 skins of *exsul* summarised by Bourne (1968).

BOUNTY ISLAND SHAG *Leucocarbo campbelli*

Apart from the brief statement by Reischek (1889) that when he was off the island on 2 February 1888, " the magellanic shag busied itself upon the water," the sole record of shags at Antipodes Island stems from the 1950 expedition when on 8 November R. K. Dell saw two on a high ledge on the southwest side of Bollons Island. The birds had red on the face, white on the breast up to the throat, and a white wing-bar, and were evidently members of the subspecies *ranfurlyi,* previously known only from the Bounty Islands. The ledge was plastered with white droppings as if in regular use and the pair was on the same ledge two days later (E. G. Turbott, pers. comm.).

The 1969 party kept a sharp look out for shags. If present, these would almost certainly have flown up and down the coasts but none was seen.

MALLARD *Anas platyrhynchus*

A male and a female were feeding in a shallow pool on the flat rocky coastal platform just west of South Bay on 26 February. The male was in eclipse plumage and flew off. The female was in full moult and, being flightless, hid under large boulders nearby. The birds had obviously been living in the area for some time, judging by the excreta around the shore.

ISLAND SNIPE *Ceonocorypha aucklandica*

Apparently only four isolated populations of this snipe now exist, namely subspecies *pusilla* at the Chatham Islands, subspecies *huegeli* on the Snares Islands, subspecies *aucklandica* on the Auckland Islands, and subspecies *meinertzhagenae* on the Antipodes Islands.

Hutton (*in* Ogilvie-Grant 1905) reported the snipe rare on Antipodes Island but like Kirk (1891), we found it widespread from sea level to the summit. Bill probings were seen at the sodden mouths of Shoemaker burrows and on the edges of the penguin colonies. Because of its cryptic colouring and the thick ground cover, the bird was seldom seen. It was more often heard, giving a throaty reiterated *chip, chip* . . . (Fig. 2, A & B). These calls were heard at all times of the day but more often at dawn and dusk, also after dark.

Figure 7 shows calls from birds of unknown sex singing near Reef Point. As shown in A, the *chip* was repeated at a rate of 2.2 to 2.4 per second, each lasting about 0.15 sec. Although the calls had some complex overtones, they were basically " simple cries " (Davis 1964), the rise and fall of the frequencies during each *chip* probably resulting from the opening and closing of the bill, although the singers

FIGURE 6 — An Antipodes Island Snipe.
Photo: John Warham

FIGURE 7 — Spectrograms of calls of Antipodes Island Snipe.

could not be seen. Less often, as in Fig. 7 B, interspersed with the *chips* were three to five longer (0.5 sec.) calls which could be rendered as *chew-a-wa* and which, on analysis, showed a distinctive pattern of two linked and arched formants whose harmonics no doubt partly account for this call's more musical quality to our ears.

Both kinds of call showed some resemblance to those of the Common Snipe *(Capella gallinago)* of the Northern Hemisphere. The *chip* of *Coenocorypha* reminded one of us (JW) forcibly of a monsyllabic version of the spring call of *Capella — chip-per, chip-per —* usually given from the ground, often at night. The more complex *chew-a-wa* can be likened to another note of the Common Snipe, appropriately rendered as *chco-wee, choo-wee* by H. G. Alexander (*in* Witherby *et al.* 1941).

The Antipodes Island birds' long grooved bills were grey basally, darkening towards the tip. The tongue was long and lance-shaped. The rather short legs were pale grey, tinged yellowish behind, dark grey on the joints, the claws brown. The eyes were dark brown.

Most snipe when disturbed fled unseen beneath the foliage but some flicked into the air to fly for short distances and then pitched down to dodge out of sight. Despite this, the birds were fairly tame and most of those taken were caught with a hand net.

Island Snipe have very short, rounded wings, the wing span of *meinertzhagenae* being about 35 cm. The wing loading of a female (weight 122 g) was 0.78 g/cm^2, considerably in excess of figures for the Common Snipe (weight 165 g) of 0.45 g/cm^2 (Poole 1938) or 0.40-0.68 g/cm^2 (Fullerton 1911). The high wing loading helps to explain the bird's short flights and its apparent reluctance to fly at all.

No nests were found nor any chicks seen or heard. The only egg known to us is in the BMNH labelled " Antipodes Island ex Rothschild Museum, Tring." It measures 42.8 x 33.1 mm, according to Schonwetter (1963).

The British Museum also has one feathering chick (1939-12-9-43), without date or collector's name but labelled "Antipodes Island." It has down on the back of the head, on the nape and on the throat, bill 32 mm and wing 55 mm. One female collected by us had an unshelled egg in her oviduct, and at 129 g was the heaviest of the birds measured. This and one other female had partly bare brood patches but the others examined had none. Dimensions of the small sample measured in life are given in Table 10, together with data for sexed skins in the AMNH and BMNH.

TABLE 10 — DIMENSIONS OF ANTIPODES ISLAND SNIPE

Sex	Weight (g)	Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Mid-toe & Claw (mm)
Male	87	105	-	57.0	27.5	34.5
Male	88	104	42	60.6	26.0	34.3
Male	97	107	40	59.8	26.5	36.0
Male	105	102	44	59.2	27.0	36.0
Mean Males	94.2	104.5	42	59.2	26.8	35.2
Female	115	113	41	64.0	26.0	36.0
Female	121	106	41	63.5	28.0	37.0
Female	129	102	38	58.3	26.0	35.0
Mean Females	121.7	107	40	61.9	26.7	36.0
Mean of 3 female skins	-	104.7	40	64.0	27.0	34.8
Mean of 12 male skins	-	102.4	40.9	57.8	25.4	33.3

It is still not known whether females are on average heavier in weight and longer in bill and wing than males, as with snipe generally (Tuck 1972).

SOUTHERN SKUA *Stercorarius skua*

The subantarctic form *lonnbergi* was a common breeding bird at Antipodes Island. A downy chick was collected there by R. A. Falla on 9 November 1950 but by the time that we arrived the young of the year were fully fledged. Some, although capable of flight, were still being fed by adult birds. Waite (1909), however, referred to apparently quite small young in February 1907 that attempted to hide when alarmed.

Skuas near Hut Cove had evidently fed on penguin eggs earlier in the year, for collections of shells around the fringes of colonies showed where eggs had been carried for eating. Skuas fed on penguin carcasses on the beaches, often showing territorial aggressiveness to other skuas and, with much wing lifting and calling, usually drove them off. Often these potential rivals were in rather darker plumage and were perhaps younger birds.

No skua was seen to attack live penguins but attacks on Shoemakers and White-headed Petrels have already been described. One skua made a half-hearted stoop at a parakeet.

A pale-headed, straw-coloured bird flew across Reef Point on 31 January. It was not seen well enough to be positively identified but could have been *S. s. maccormicki.*

ARCTIC SKUA *Stercorarius parasiticus*

A " Parasitic Jaeger " passed Beck's boat on 20 February 1926 when he was 3 km off the island.

SOUTHERN BLACK-BACKED GULL *Larus dominicanus*

Not common during our stay and the only evidence of breeding came from the occasional sighting of birds in the spotted plumage of 2-3 year old immatures. No birds of the year were seen. Southern Black-backed Gulls occurred in twos and threes around the coast. The greatest number seen at one time was eight on the sea off Reef Point on 6 February.

ANTARCTIC TERN *Sterna vittata*

In a revision by Murphy (1938), New Zealand Antarctic Terns were assigned to subspecies *bethunei* on account of the consistently shorter tails and feet of birds from Antipodes Island (five collected by Beck), Bounty, Snares and Campbell Islands. We found these terns in small numbers around the coast but the nests seen were all on rather flat, sparsely vegetated ground composed of loose breccia at Reef Point. Two single eggs, one downy chick and one fully feathered chick were seen there on 31 January and dual display flights were already common by then, often taking the birds high into the sky. Several adults and one large fledgling were on Leeward Island on 19 February and there were two more flying juveniles on 10 March at Reef Point. However, on that date four single-egg clutches were being incubated: evidently the breeding season is extended.

These terns plunge-dived often close inshore and apparently took small fish. The largest number seen feeding together was a group of 27 off Reef Point in heavy seas on 8 March.

ANTIPODES ISLAND PARAKEET *Cyanoramphus unicolor*

This distinctive parrot, restricted to this island, was plentiful, tame, and easily caught in a hand net. The birds were active and very inquisitive around the campsite. They flew well. Breeding appeared to have ended when we arrived and some family parties were about, with long-tailed adults feeding short-tailed immatures. The birds are said to nest in burrows underground or at the base of a tussock (Reischek 1889), and several recently used parakeet burrows were found in such situations.

The occurrence of thriving populations of two congeneric parrots on so small an island with a limited range of resources implies the birds' occupation of distinct niches. The ecologies of the two species were studied by expedition member R. H. Taylor (1975). His diagram of the food preferences of the Antipodes Island Parakeet showed that its diet was mainly of leaves, with some berries and seeds. The Red-crowned fed mostly on seeds, with flowers, berries and some invertebrates being of less importance.

It was common to see *C. unicolor* perched among *Poa litorosa* tussock and running individual leaves through its bill to express the juice. The leaves were not severed but each was left as a flattened strap of tissue criss-crossed with beak marks. It also fed in the penguin colonies, where it was seen picking at fat and dried flesh from penguin and petrel corpses on many occasions.

Three pairs were taken to New Zealand in the hope of breeding them in captivity but at Mt Bruce Native Bird Reserve one bird died. A further bird was captured in 1970, a small captive population has been established, and some birds have been distributed for further breeding by institutions and experienced aviculturalists.

This is not the first time that these parrots have been established in aviaries. The species was named from a specimen in the London Zoological Gardens (Lear 1831) and others were taken to New Zealand during the period of the government steamers' biannual searches for castaways. Buller (1893) reported the arrival of some such birds, noting that they often roosted upright, holding on to the wires of their cage by bill and claw. Attempts were even made to establish *unicolor* on Kapiti Island near Wellington (Chilton 1909).

RED-CROWNED PARAKEET *Cyanoramphus novaezelandiae*

The Antipodes Island form *hochstetteri* is one of six extant subspecies occurring from New Caledonia to the Auckland Islands (Forshaw 1973) and, as noted by Forbes (1892), the Antipodes form is larger than the typical race.

Photo: John Warham

FIGURE 8 — An Antipodes Island Parakeet perched among **Poa litorosa.**

It is plentiful at Antipodes Island. Less tame than *unicolor,* it was seen less often than that bird in areas with dense tussock, being more numerous where the sedge *Carex appressa* was in seed. Seeds formed the main food during our stay (Taylor 1975), but, like *unicolor,* the Red-crowned Parakeet was often on the penguin colonies where it scratched for fly larvae in the guano. , These parakeets seemed particularly plentiful about the colonies along the south coast. According to Oliver (1955), it also cleans up eggs eaten by skuas.

Two nests were found (on 6 and 8 February), in the crowns of a tall tussock and a fern clump. Each contained a single down-clad chick. Towards the end of February other Red-crowned parents were still tending young in down, and so the breeding season was evidently later than that of *unicolor* (Taylor, *in* Forshaw 1973).

Three pairs were taken to New Zealand and a thriving captive population has been established.

Hector (1895) compared the sterna and pectoral girdles of the two Antipodes Island parakeets and concluded that there was evidence that the power of flight in *unicolor* had degenerated towards the condition of the Kakapo *(Strigops habroptilus).* We saw little evidence of a reduction in flying ability by *unicolor:* although it was less dashing than *hochstetteri,* this could have been a reflection of the latter's smaller size.

Buller's comment (1892) that the presence of two *Cyanoramphus* spp. on the one island, one only subspecifically distinct and the other specifically distinct, suggests a double invasion with *novaezelandiae* being the more recent arrival, still seems valid.

NEW ZEALAND PIPIT *Anthus novaeseelandiae*

Plentiful, widespread and tame. Reischek (1889) was the first to report pipits at Antipodes Island. He gave it full specific status as *A. steindachneri* on the grounds of its small size and distinctive fulvous-brown colouration. The races of the New Zealand Pipit have not been recently revised but *steindachneri* is now usually treated as only a subspecies. Five specimens collected by members of the Expedition are in the NMNZ collection. Fourteen adults caught by R. J. Stanley had a mean weight of 32.55 ± 2.97 g.

We saw no nests but a group of free-flying young was active near Reef Point on 1 February and one young bird unable to fly was seen elsewhere on 5 February. The pipits tended to feed in open areas, particularly on the beaches, among the penguins or at the foot of the cliff. Pairs were encountered along rocky-bottomed stream beds, on recent slips, rocky outcrops and at old albatross nests. Small moths and other insects were chased and the birds may also have taken insects from penguin carcasses as noted by Oliver (1955). One was seen pirouetting about the feet of an Erect-crested Penguin which was feeding its chick: the pipit snipped up food particles spilled

during the meal and once ran off with a small red crustacean. Another ate small red berries, possibly *Coprosma pumila.*

DUNNOCK *Prunella modularis*

About ten sightings of adult birds in various parts of the island. In view of their cryptic coloration and behaviour and the generally thick cover, Dunnocks may be more common than these sightings suggest. R. H. Taylor saw two adults with two flying young west of North Head on 4 February and one adult with two young near Base Camp on 12 February, so that breeding is confirmed.

SONG THRUSH *Turdus philomelos*

A single bird was seen near Ringdove Bay on 26 February and another was seen briefly but clearly close to the Expedition Base on 11 March.

BLACKBIRD *Turdus merula*

The listing in Falla (1965) was an error.

SILVEREYE *Zosterops lateralis*

About ten seen and one dead in widely separated places, but not common.

GOLDFINCH *Carduelis carduelis*

Not seen by us but Hutton reported two in 1900 on Bollons Island (Ogilvie-Grant 1905).

LESSER REDPOLL *Acanthis flammea*

Redpolls were the commonest self-introduced passerines during our visit. Although they had not been reported previously, we saw a male and three flying chicks near Hut Cove on 6 February, at least four birds on the slopes of Mt Galloway on 3 February, and others at Ringdove Bay, near Orde Lees Island and on the south coast.

STARLING *Sturnus vulgaris*

H. J. Ollerenshaw of the 1950 party saw one bird on Bollons Island (Williams 1953). We saw one on the south coast on 26 February, and R. H. Taylor saw a flock of six near Reef Point on 31 January and five on the south coast on 8 February.

DISCUSSION

For an island of only 2090 ha, with limited terrestrial resources, Antipodes Island supports a good range of birds. Although we identified no occupied nests of Black-browed Mollymawk, Soft-plumaged Petrel, Fairy Prion, Little Shearwater, Grey-backed Storm Petrel, Black-bellied Storm Petrel or Southern Black-backed Gull, they all probably do breed. Apart from the Fulmar Prion, which may breed, there are 25 breeding species. Of these, 20 are seabirds.

Except for the surface nesters, the sizes of the populations

geographical provinces on the basis of their seabird faunas, and that the first three be combined in a higher category of super-province. Earlier authors, working on other groups, have also tended to link these four islands, e.g. Skottsberg (1960) from a comparison of the plants and Knox (1960) from the littoral flora and fauna. However, more up-to-date information on the distribution of littoral and benthic organisms has partly modified previous ideas on relationships and the Antipodes, Auckland, Campbell and Bounty Islands have been grouped into one Antipodean Province by Knox (1975).

The conservation of the Antipodes Island flora and fauna is important, nationally and internationally. The island has three endemic plants — *Coprosma antipoda, Gentiana antipoda* and *Senecio antipodus,* one bird species — *Cyanoramphus unicolor,* and three bird subspecies — *Coenocorypha aucklandica meinertzhagenae, Cyanoramphus novaezelandiae hochstetteri* and *Anthus novaeseelandiae steindachneri.* The natural existence of these birds, and of the smaller petrels, depends on the absence of alien mammals bigger than mice. Unauthorised landings must therefore be prevented and authorised ones must be carefully controlled. No longer, as in the past, can the fauna of islands like this be protected primarily by their isolation and by their lack of adequate anchorages or shelter. The introduction of the 320 km exclusive economic zone may mean more careful monitoring of fishing boats and of other activity near the southern islands than happened in the past, but if oil should be discovered in the Great South Basin, new problems are likely to arise. Oil pollution is one obvious danger, but demands to establish manned navigational or other permanent facilities, probably serviced by helicopter, on islands such as Antipodes that lie near the wells, will put at risk both the vegetation and the birds.

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are extremely difficult to assess. The majority are petrels, but their burrows are patchily dispersed and, in areas heavily covered with fern and tussock or in *Coprosma*-choked gullies, are impracticable to count. However, nowhere were burrow densities comparable with those at some of the islands around Stewart Island or in Bass Strait where nests may average one/m^2 (Warham 1960 and unpubl.). We doubt whether either the biomass or the number of resident birds is as great on these 2090 ha as it is, for example, on the 280 ha of the Snares Islands.

The seabird fauna is reasonably balanced — a large and a small crested penguin; a large and a small albatross; the northern, warm-water giant petrel; large and medium sized summer-breeding and large and small winter-breeding petrels (Shoemakers/Sooty Shearwaters and Pediunkers/Little Shearwaters), and a good variety of smaller petrels. Our inability to find nests of the storm petrels (one medium sized, one small) is not surprising as both nests and birds are notably cryptic. It is more surprising that we saw so little of Fairy Prions, despite the many taken offshore: perhaps it does not breed on the Main Island. Likewise, no prions have been recorded nesting on the main island of the Campbell group, which, though much larger (10 000 ha) and seeming to offer many suitable habitats, is infested with rats. The absence of the Bounty Island Shag is less surprising for the Antipodes coastline lacks inlets, deep indentations or shallows, and so suitable inshore fishing may be lacking. Also missing is the Yellow-eyed Penguin *(Megadyptes antipodes)* which does breed further south at Campbell and the Auckland Islands. Its absence at Antipodes may be due to the scarcity of open sandy beaches adjacent to suitably vegetated nesting sites. The only beach, at Alert Bay, is tiny; the slopes above are steep, with their lower levels occupied by Rockhoppers and appear to be unsuitable for *Megadyptes*. Perhaps for similar reasons this species is also absent from the Snares: the one beach there is but a few metres long.

Two other widespread New Zealand birds might have been expected — the White-faced Storm Petrel *(Pelagodroma marina)* which nests further south in small numbers (at the Auckland Islands), and the Red-billed Gull *(Larus novaehollandiae)*, which also breeds to the south at both Campbell and the Aucklands. We could easily have overlooked the former but not the latter.

We saw little evidence that man has affected the avifauna, despite the activities of the sealers between 1804 and about 1820 and the government's liberation of Snares Crested Penguins, goats, sheep and cattle (Warham & Johns 1975). All seem to have died out naturally. The thriving Wandering Albatross population also suggests that the direct impact of man has been slight, for at Macquarie Island, the presence of many skulls in caves suggests that marooned sealers relied heavily on these birds for food, which may be why their population is still small and evidently recovering only slowly.

The Northern Hemisphere passerines seen have previously shown their dispersive abilities and presumably reached Antipodes Island down wind from New Zealand. Only Redpoll, Dunnock and Starling seem likely to survive without further immigration.

The seabird fauna of the island has closest affinity to those of the two nearest islands with soil cover — the Auckland and Campbell Islands. Although the Aucklands are much bigger and offer more varied terrestrial habitats, only five more seabirds are known to nest there than at the Antipodes. The two island groups have 15 species in common. Slightly less alike are the seabirds of Antipodes and Campbell Islands. The latter supports nineteen species of which thirteen also nest at Antipodes. With an equal number of breeding species, Macquarie Island shares only twelve with Antipodes, while the Snares Islands, with 14 breeding seabirds, shares only seven with Antipodes Island.

Similar comparisons were made by Winterbottom (1971) and, although his species lists were partly defective as he lacked the latest information, we agree with his general conclusions regarding the seabird affinities of the New Zealand southern islands. Thus when Jaccard community coefficients (CC)[1] and Simpson's coefficients (CS)[2] are calculated comparing the Antipodes Island seabird fauna with those of the Aucklands, Campbell, Macquarie and the Snares Islands, the CC(CS) values are 50(75), 50(68), 43(60) and 26(50) respectively.

The higher the value for these two coefficients, the greater the similarity between their faunas, a CC or CS value of 100 indicating complete homogeneity and the CS value being most useful where there are marked differences in the sizes of the compared faunas. The values calculated above are appreciably lower than those calculated by Winterbottom and emphasise that, although the seabirds of Antipodes Island most resembled those of its nearest neighbours, the Aucklands (950 km away), Campbell (850 km away) and Macquarie Islands (1500 km away), the Antipodes Island seabird fauna is nevertheless rather distinct.

This viewpoint is stressed in an elaboration of Winterbottom's analysis by Barrat & Mougin (1974). These authors also pointed out that the seabird faunas of New Zealand's southern islands resemble each other more than they resemble those of more distant Southern Ocean islands, and even proposed that Antipodes, Auckland, Campbell and Macquarie Islands should be given the status of separate zoo-

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1. $CC = \frac{100C}{n1 + n2 - C}$ 2. $CS = \frac{100C}{n1}$

where C = no. of species in common; $n1$ = no. in the smaller fauna and $n2$ = no. in the larger fauna.

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JOHN WARHAM, *Department of Zoology, University of Canterbury, Christchurch 1* and BRIAN D. BELL, *NZ Wildlife Service, Department of Internal Affairs, Wellington.*