Notornis, 2005, Vol. 52: 125-132
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Antipodes Islands birds in autumn 2001

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Abstract Observations of birds on Antipodes Islands during 24 April - 6 June 2001 represent a season of the year for which data are lacking. Activity ashore of non-breeders of summer-breeding gadfly petrels *Pterodroma* spp. and black-bellied storm petrels (*Fregetta tropica*) continued until late May or even June. Data were obtained on the non-breeding behaviour, breeding cycle and burrow occupancy rates of grey petrels (*Procellaria cinerea*); only 50% of their burrows were occupied by breeding pairs. White-capped albatross (*Thalassarche steadi*) fledglings on Bollons Island were counted. There had been an autumnal immigration of some Passerines. Birds seen at sea on the voyages from Akaroa, Banks Peninsula and returning to Port Chalmers, Dunedin included the rarely-sighted Chatham taiko (*Pterodroma magentae*).

Imber, M.J.; Bell, B.D.; Bell, E.A. 2005. Antipodes Islands birds in autumn 2001. *Notornis 52 (3)*: 125-132

Keywords Albatrosses; petrels; storm petrels; Antipodes Islands; south-west Pacific; autumn; behaviour; seabirds at sea

INTRODUCTION

The avifauna of Antipodes Island group (49° 42′ S, 178° 47′ E) is known from numerous visits by observers restricted to the months October-March (Warham & Bell 1979; Tennyson *et al.* 2002). There is no information for the rest of the year. Thus, a research expedition to survey the grey petrel (*Procellaria cinerea*) population on Antipodes Island in autumn 2001 (Bell 2002) also enabled information to be gathered on the entire avifauna during this unstudied season. Observations on birds were also recorded during the voyages to and from the archipelago.

METHODS

The expedition took place between 19 April 2001 (departure from Akaroa, Banks Peninsula, South Island) and 9 June 2001 (arrival into Port Chalmers, Otago Peninsula, South Island; Fig. 1). The voyages each took three days, and observations at sea were made with assistance of 8x30 binoculars, mainly from amidships. No attempt was made to count birds methodically. Sea fog hindered observations after noon on 20 April 2001. The first full day's observations on the return voyage were severely limited by seasickness.

Received 1 April 2005; accepted 25 April 2005
Editor M. Williams

Observations on Antipodes Island (Fig. 1) were made in conjunction with the grey petrel studies. Grey petrel burrows were surveyed in four 50 x 50 m quadrats, two 300 x 2 m transects and 110 transects of 1000 x 1 m covering all of the main island (Bell 2002). In the two 300 x 2 m transects we identified burrow ownerships as accurately as possible (by burrow diameter, identity of any occupants, presence of down or feathers). A burrowscope was used in the quadrats to inspect longer burrows where any occupants could not be seen or reached from the entrance. This consisted of a *c.* 2 m long flexible hose (vacuum cleaner type) with a miniature television camera at one end, and illumination provided by a ring of small infra-red lights around the lens. It was pushed into the burrow; this was connected by a cable to a television monitor and battery in a waterproof case.

The avifauna was also observed at night to identify non-breeding petrels, mainly near the hut above Anchorage Bay, up the Hut Stream valley, and in Ringdove Stream valley. Attempts to attract black-bellied storm petrels (*Fregetta tropica*) were made using a whistle (long-short-short blasts) near the hut and in Ringdove valley. Albatrosses on Bollons Island (Fig. 1) were observed and counted using binoculars from near the Antipodes Island hut, 3 km away.

Taxonomy follows Turbott (1990), except that for albatrosses which follows Robertson & Nunn (1998), Abbott & Double (2003) and Burg & Croxall (2004).

RESULTS

Birds observed from Akaroa to Antipodes Islands, 19-21 April 2001

Penguins

About eight blue penguins (*Eudyptula minor*) were seen near the Banks Peninsula coast.

Albatrosses

Antipodean albatrosses (*Diomedea a. antipodensis*) were seen after we had crossed the continental shelf edge near 44° 20′ S, 173° 15′ E, and were seen frequently on days 2 and 3 from 45° 56′ S, 174° 28′ E. A few of the paler birds were possibly Gibson's albatrosses (*D. a. gibsoni*). A few northern royal albatrosses (*D. sanfordi*) were seen after leaving Akaroa Harbour until crossing the continental slope, but none thereafter. Southern royal albatrosses (*D. epomophora*), mainly in plumage stages 3 to 5 (Harrison 1983), were common late on day 1 as we crossed the shelf edge and slope, were absent on day 2 as we crossed the Bounty Trough, but were frequent again on day 3 near the Bounty Platform, becoming the most abundant albatross when we were over the Bounty Platform late in the day.

Campbell albatrosses (*Thalassarche impavida*) and possibly black-browed albatrosses (*T. melanophris*) were seen only on day 3 (< 20), but too distantly to distinguish specifically. White-capped albatrosses (*T. steadi*) were numerous from soon after leaving Akaroa Harbour until dusk over the continental slope, but were not recorded thereafter. Three Salvin's albatrosses (*T. salvini*) were seen over the continental shelf and one west of Bounty Islands. Several Pacific albatrosses (*T. sp. nov.*) were seen over the shelf and one 100 km north-west of Antipodes Island. Light-mantled sooty albatrosses (*Phoebetria palpebrata*) were seen occasionally (< 20) from 47° S 175° E over deeper waters.

Shearwaters

Many hundreds of sooty shearwaters (*Puffinus griseus*) were seen from outside Akaroa Harbour until early on day 2 at sea, but were in small numbers at long intervals thereafter. Up to 25 little shearwaters (*P. elegans*) were seen singly throughout day 3 approaching Antipodes Island, all appearing very grey dorsally due to recent moult.

Diving petrels

One was seen off Banks Peninsula, one in mid-ocean and a few north-west of Antipodes Island, all probably common diving petrels (*Pelecanoides urinatrix*).

Petrels

Grey petrels were the most abundant procellariid seen, the first after crossing the shelf edge near 44° 30′ S, 173° 25′ E, then regularly about every 5 min. on day 2, and constantly in view on day 3. White-chinned petrels (*Procellaria aequinoctialis*) were seen regularly, but in small numbers, on days 2 and 3, the majority being close to Antipodes Islands.

Fulmars

Cape pigeons (*Daption capense australe*) were in virtually constant attendance after leaving Akaroa Harbour, with 5-10 typically present. Only a few northern giant petrels (*Macronectes halli*) were seen, all on days 2 and 3.

Prions

Fairy prions (*Pachyptila turtur*) were seen frequently from Akaroa Harbour entrance to the shelf edge; then only singly at intervals till day 3. The pale-faced subantarctic form of fairy prion was seen frequently on the third day, often following astern.

Gadfly petrels

Soft-plumaged petrels (*Pterodroma mollis*) were by far the commonest gadfly petrel seen, the first at 44° 12′ S, 173° 10′ E, 30 km offshore and over the continental shelf. They were frequent in ones and twos on day 2, and common on day 3 when they outnumbered white-headed petrels (*P. lessonii*) by about 3:1. About 15 of the latter were seen on day 2, and they were numerous on day 3. A Chatham taiko (*P. magentae*) was seen at 44° 18′ S, 173° 15′ E, 53 km southeast of Banks Peninsula over the shelf edge, and another was possibly seen at 45° 56′ S, 174° 28′ E early next day. Neither grey-faced petrels (*P. macroptera gouldi*), nor mottled petrels (*P. inexpectata*) nor Cook's petrels (*P. cookii*), seen along this route in spring-summer (MJI, BDB pers. obs.), were identified.

Storm petrels

One grey-backed storm petrel (*Garrodia nereis*) was seen just after we had crossed the shelf edge; eight were seen on day 2; 5-10 on day 3. One Wilson's storm petrel (*Oceanites oceanicus*) was seen on day 2, passing north-eastwards. Black-bellied storm petrels (*Fregetta tropica*) were by far the commonest storm petrel, 50-100 being seen on day 2 and more on day 3 when they were common and regular.

Lari

Two brown skuas (*Catharacta skua lonnbergi*) were seen singly, apparently moving northwards. A black-fronted tern (*Sterna albostriata*) was seen 40 km offshore on day 1. After leaving black-backed gulls (*Larus dominicanus*) behind on the continental shelf, no Lari but skuas were seen.

Birds on Antipodes Islands

Penguins

The last 50-100 moulting rockhopper (*Eudyptes*

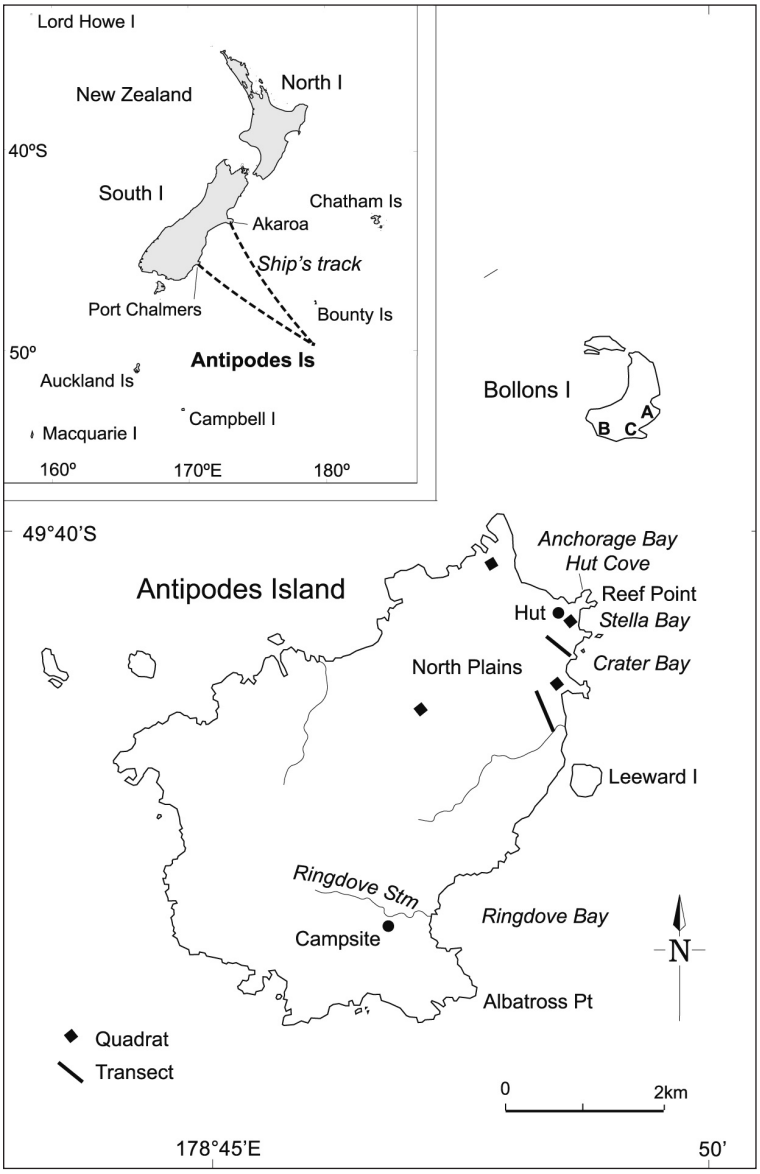

Figure 1 Antipodes Islands showing places mentioned in the text, and the positions of the Hut and the Ringdove valley campsite (filled circles), the four grey petrel census quadrats (filled squares), and the two detailed burrow transects (lines). The sites of the *Thalassarche* albatross colonies on Bollons Island are marked A, B and C. The inset map shows Antipodes Islands in relation to New Zealand and other island groups, and the routes of *MV Ranui* to and from Antipodes Islands in April and June 2001.

chrysocome) and erect-crested (*E. sclateri*) penguins were in a large cave at Anchorage Bay (Fig. 1) near where we landed on 24 April, but all had gone within a week leaving the Anchorage Bay colony (hereafter referred to as the penguin colony) deserted.

Antipodean albatross

Chicks hatched and became unguarded during our visit, the first unguarded being seen on 27 April. All had hatched and few were still guarded on 27 May. Some died and were scavenged by brown skuas but, despite their small size, we saw no molestations of live chicks by brown skuas or giant petrels. The non-breeding groups (gams) included a number of the 2000 fledglings banded in 1995.

White-capped albatross

On 25 April and subsequently we counted 14 chicks and about three sites still occupied initially by non-breeders or failed breeders, all at site A on Bollons Island (Fig. 1) (Tennyson *et al*. 1998). The first two fledglings evidently departed on 4-5 June, when

many of them were wing-flapping on nests, as they had been for a few weeks. Sightings of 3-4 juveniles at sea on 8-9 June further confirmed that fledglings had begun leaving.

Black-browed albatross
The sites B and C solely occupied by this species' nests on Bollons Island (Tennyson *et al.* 1998) were totally deserted when we first scanned them on 25 April, indicating that its breeding season had finished. None of this species was at site A.

Light-mantled sooty albatross
Fledglings were wing-flapping, moving off nests and departing, particularly in the second half of May. All appeared to have gone by 2 June.

Shearwaters
Less than 10 sooty shearwater fledglings were seen, all but two on the ground and several of them killed by skuas. Two in burrows had evidently been killed by the grey petrels with which they shared burrows (Bell 2002). No little shearwaters were seen or heard.

Common diving petrels
They were visiting burrows in moderate numbers. We found their burrows, many showing signs of occupation, on most grey petrel transects, particularly near ridge-tops. In the two detailed transects, 26% of 134 burrows belonged to this species. In the quadrats their burrows were second in number to those of grey petrels.

Grey petrels
The survey of the entire island determined the size of the population to be 53,000 ± 20,000 breeding pairs (Bell 2002). In the two detailed transects 13% of 134 burrows belonged to grey petrels. In the quadrats, placed deliberately in grey petrels' preferred habitat, about 75% of burrows belonged to grey petrels, with diving petrels' and white-headed petrels' burrows the only others of significance. There were a few white-chinned petrel burrows at the top of Stella Bay quadrat, and two dead sooty shearwater chicks in Crater Bay quadrat.

Grey petrels arrived throughout the day but particularly from 1400 to 1630 h, with darkness from 1700 to 0700 h, and departed from 0700 to 0900 h. They called from the ground, at and near burrow entrances, moderately during the first few hours of darkness and then were virtually silent till about 0400 h, after which there was a period of intense calling until dawn. Moonlight depressed the volume of calling. It is possible that many non-breeders arrived after 0300 h to augment the pre-dawn chorus. Those arriving by day were not molested by skuas, unlike white-chinned petrels in spring and summer. In only one place on the island did we find remains of four adults killed by skuas.

The four 50 x 50 m quadrats contained 30-86 grey petrel burrows (mean = 55.3 ± 12.6 SE), with 19 - 44 (mean = 30.3 ± 5.2 SE, 55%) actually occupied, nearly all by incubating birds. The unoccupied burrows nearly all showed signs of occupancy; typically moulted contour and coverts feathers of grey petrels, freshly added nest material and often fleas (Siphonaptera). All captured adults showed body and/or wing covert moult. The Stella Bay quadrat had a particularly high proportion of non-breeding burrows (Bell 2002), and in this area the volume of pre-dawn calling was noticeably intense.

The first chick was seen alone on 9 May and considered to have hatched about 6 May (Bell 2002). There were even proportions of eggs and chicks around 31 May, indicating that hatching peaked then. No mortalities of chicks were noticed, suggesting that mice (*Mus musculus*), which were abundant at the time, were not a threat to this petrel.

White-chinned petrels
In the two detailed transects, 11% of burrows were of this petrel. However, on the North Plains, which is one of this species' preferred habitats, 64% of burrows in a 500 x 2 m transect belonged to it. Very few adults were seen arriving in late afternoons to feed chicks, and none after 7 May. We heard no nocturnal vocalisations, indicating that non-breeders' activities had ceased before 24 April. Fledglings were departing throughout our stay, and down at two burrow entrances on 31 May showed that some would not depart till June. Initially these fledglings were the main prey of skuas during our visit, until fledgling white-headed petrels became available to skuas in May.

Fulmars and prions
Northern giant petrels and cape pigeons were engaging in courtship activities and occupying nest sites throughout our visit. A flock of the former congregated on and near shore in Anchorage Bay (maximum: about 150 on 1 May), apparently feeding on or among kelp. Fairy prions were also visiting their coastal breeding sites in numbers that varied daily from none to scores.

Gadfly petrels
Burrow counts in two detailed transects gave 44% white-headed petrel burrows and 5% soft-plumaged petrel burrows. The 500 x 2 m North Plains transect gave 36% white-headed petrel burrows, and there were also significant numbers of their burrows in the grey petrel quadrats. Evidently this largest gadfly petrel is the most abundant petrel on Antipodes Island, probably representing about

40% of the burrowing petrels. On the other hand, soft-plumaged petrels still seemed restricted to the northern part of the island, and may represent no more than about 1-2% of the island's burrowing petrels, though they are evidently increasing. The colony beside Hut Stream, under *Polystichum vestitum* fern, *Coprosma* shrubbery, and sedges which provide security against skuas, had spread considerably upstream since 1978 and even since 1995. At night on 21 May, 15-20 fledglings were seen on fern crowns on the western banks of Hut Stream but only two on the other side, showing that they still prefer that side (MJI pers. obs.). Both species' fledglings were leaving during May. We found no fledglings of soft-plumaged petrels but many of white-headed petrels killed by skuas.

Non-breeding gadfly petrels of both species were active throughout our visit. We found a white-headed petrel digging a burrow on 7 May and a moulting adult just killed by a skua on 31 May. Both species were aerially vocalising at night into June, but soft-plumaged petrels were the most vocal on 6 June after moon-set and just hours before we departed.

Storm petrels

A few grey-backed storm petrels were seen visiting at night; for example, two on 19 May. One black-bellied storm petrel was seen by spotlight near the hut but attempts to attract others by whistling there failed. However, between 6 and 15 were whistled up in Ringdove valley on each night of 5, 6, 24 and 26 May. Five of these were caught on 26 May: they were not fledglings, nor apparently were they chick-rearing adults as their plumage was not worn and they did not regurgitate. They seemed to be non-breeders, possibly failed breeders, visiting unusually late in the breeding season. Calling was heard on 5 May. Despite constant vigilance we failed to confirm any certain burrows, such as small burrows with down and feather sheaths outside where fledglings might have been present.

Charadriiformes

Antipodes snipe (*Coenocorypha aucklandica meinertzhagenae*) were frequently heard calling, particularly towards dusk, and were seen in several places. Skuas were still present on 5 June but in reduced numbers compared to the numbers previously observed in spring-summer (BDB, MJI pers. obs.). About 60 Antarctic terns (*Sterna vittata bethunei*) were feeding in Ringdove Bay on 23 April, the majority being adults still in breeding plumage. On 28 May and 6 June single terns in non-breeding plumage, probably Antarctic, were seen in Anchorage Bay. On 8 May a flock of 16 black-backed gulls, including several juveniles, was at Reef Point.

Parakeets

Antipodes parakeets (*Cyanoramphus unicolor*) were feeding extensively by crimping *Poa foliosa* stems. On 26 May a pair was seen feeding on the remains of a fledgling white-headed petrel's corpse left by skuas. In contrast, numerous Reischek's parakeets (*C. novaezelandiae hochstetteri*) were feeding amongst the muddy debris of the deserted penguin colony; scratching in the mire presumably for invertebrates. No Antipodes parakeets were seen doing this; neither were Reischek's parakeets seen scavenging corpses.

Passerines

Many Antipodes pipits (*Anthus novaeseelandiae steindachneri*) were seen feeding among the debris of the penguin colony. Dunnocks (*Prunella modularis*) were often seen, mainly at the penguin colony or near the hut (up to 5/day) but also at the south coast (a pair). On 5 June a pair of adults was still feeding two juveniles. On several occasions dunnocks were seen in the penguin colony searching for food among the detritus kicked back by foraging Reischek's parakeets. Blackbirds (*Turdus merula*) were seen more frequently than on previous expeditions (BDB, MJI pers. obs.). A male resident on Hut Cove beach with elephant seals (*Mirounga leonina*) had an exceptionally orange bill, perhaps due to its littoral diet obtained among kelp. At least four, including females and a juvenile, were identified in the vicinity of the hut. There were only two sightings of song thrush (*T. philomelos*). A party of five silvereyes (*Zosterops lateralis*) was seen several times near the penguin colony and near the hut, and three were seen by Dougall Stream on 27 April. Chaffinches (*Fringilla coelebs*) were seen singly near the hut twice, and a female and juvenile together in the penguin colony on 2 May. An invasion by goldfinches (*Carduelis carduelis*) was discovered (Imber 2004). Redpolls (*C. flammea*) were seen and heard widely more than 10 times but only in pairs or singles. A flock of 11-12 starlings (*Sturnus vulgaris*) was seen at Reef Point several times.

Birds observed between Antipodes Island and Otago Harbour, 6-9 June 2001

Albatrosses

Wandering albatrosses in moderate numbers were the only *Diomedea* sp. seen on 6-7 June, and were last seen on 8 June. Northern royal albatrosses were frequent, some accompanying us, on 9 June as we approached their Taiaroa Head colony. Two southern royal albatrosses were seen on 8 June and about 15 were mainly 30-40 km offshore on 9 June. White-capped albatrosses were seen on 8-9 June, particularly in the same area as southern royal albatrosses; there were 3-4 juveniles and 8 adults, the former distinguished by their grey

collar and darker, blackish-tipped bill. Southern Buller's albatrosses, all adults, were seen on 8-9 June, being the commonest albatross on 9 June and coming as close to the coast as northern royal albatrosses and fairy prions. An adult Campbell or a black-browed albatross was seen on 8 June and a juvenile on 9 June. A grey-headed albatross (*Thalassarche chrysostoma*) juvenile was seen on 8 June and two adults on 9 June. One light-mantled sooty albatross was seen on 8 June.

Shearwater
One juvenile sooty shearwater, with very dark plumage, was flying north on 9 June.

Petrels
Grey petrels were again the most abundant bird seen on the voyage, from near the island to about 20 km off Taiaroa Head. On 8 June at about half-way, a 5-min bird count gave nothing but five grey petrels. No white-chinned petrels were seen throughout the voyage.

Fulmars and prions
The usual, probably rotating, 6-12 Cape pigeons followed us throughout the voyage. A few northern giant petrels were seen every day. Only two fairy prions were noted until nearing the coast, when hundreds were seen off Taiaroa Head.

Gadfly petrels
White-headed and soft-plumaged petrels were common on 6-7 June, nearly all the former with grey heads indicating that they were juveniles. Both species were rare (< 20 daily) on 8-9 June, the last seen being a soft-plumaged petrel 45 km offshore.

Storm petrels
Apart from a few black-bellied storm petrels seen within 40 km of Antipodes Island, the only storm petrel recorded on the voyage was one black-bellied storm petrel flying northwards 50 km off Taiaroa Head.

Gannets
Three Australasian gannets (*Morus serrator*) were seen off Taiaroa Head, including one 15 km offshore.

No penguins, diving petrels or skuas were recorded on the voyage, and the only terns were many white-fronted terns (*Sterna striata*) off Taiaroa Head.

DISCUSSION

Albatrosses

The observation of 14 white-capped albatross chicks on Bollons Island is consistent with previous observations indicating about 20 breeding pairs there (Tennyson *et al*. 1998). The breeding site is difficult to observe, being on a cliff ledge at *c*.150 m above the sea and 3 km from the observation point on Antipodes Island. As the similarity of plumage of black-browed and white-capped albatrosses has caused discrimination problems in the past in this interspersed colony, the absence of the former during our visit was helpful to obtaining an accurate count of the latter.

Knowledge of exact dates in the breeding cycle of white-capped albatrosses is very deficient (Marchant & Higgins 1990; Tennyson *et al*. 1998). Our observation of earliest fledglings departing and at sea between 4 and 9 June provides dates for that aspect of their cycle, and is consistent with deductions of earliest laying being by 8 November (Tennyson *et al*. 1998).

Observations at sea of royal and wandering albatrosses conformed to the reported preferences of the former to feed around the continental shelf edge, and the latter oceanically over deeper seas (Imber 1999). White-capped albatrosses may share royal albatrosses' feeding range east of New Zealand at least.

Grey petrels

The breeding chronology of grey petrels on Antipodes Island was very similar to that reported elsewhere, suggesting that this species breeds remarkably uniformly at all its circumpolar colonies (Jouventin *et al*. 1985; Newton & Fugler 1989; Zotier 1990; Bell 2002). Thus laying has begun by 8 March, peaks about 1 April, and finishes around the end of April. Hatching begins about 5 May, peaks at the end of May, and finishes around the end of June. The chick-rearing period is the most variable, with a range of 130-163 days (n = 5), and mean of 147 ± 14 days (Zotier 1990). Thus, fledgling departures extend from mid-September to early December, the mean date being 17 October ± 17 days (n = 19) in 1986 (Zotier 1990). Zotier, who studied a Kerguelen Islands colony, believed that all seven chicks studied in 1987 departed before 22 September at 95-125 days old, but we consider that this is physiologically impossible. White-headed petrels evicted some grey petrel chicks when they returned to the colony in September, and skuas then killed these chicks (Zotier 1990). We suspect that all the presumed departures in 1987 were actually undetected eviction-predations, and that the biennial breeding behaviour of white-headed petrels (Chastel 1995) may have in some way contributed to their greater impact on grey petrels in 1987 than in 1986.

The nocturnal vocalising behaviour of grey petrels, with its silence around midnight and crescendo before dawn, is identical to the behaviour of many shearwaters: e.g. sooty shearwaters. Black petrels (*Procellaria parkinsoni*) do not exhibit the pre-dawn crescendo of calling (MJI, EAB pers. obs.), but

their populations are small compared to that of grey petrels on Antipodes Island, and this vocalising difference may be attributable to a relative scarcity of non-breeders in black petrels' populations.

The high proportions of non-breeding burrows (45% in all quadrats, and 64% in one quadrat) are comparable to results from a Westland petrel (*P. westlandica*) study (Waugh *et al*. 2003) where 62% were 'unoccupied' burrows and only 21% held breeders. Both species are winter breeders but the relevance of this is unclear. In black petrel populations annually less than 30% of burrows were not occupied by breeders (EAB, MJI pers. obs.). Nearly all the grey petrel burrows showed signs of use during the current season. One explanation might have been biennial breeding but Chastel (1995) did not find this in his Kerguelen Islands study, where most grey petrels bred annually. An effect of elevated mortality due to long-line fisheries by-catch is possible (Bartle 1990; Murray *et al*. 1993). Further research on their breeding biology is required to shed light on this aspect of their population structure.

Gadfly petrels

The extension of courtship activity of non-breeders of both soft-plumaged and white-headed petrels through the period of chick-rearing and fledgling departures was unexpected, given that this activity ceases soon after hatching finishes in the related grey-faced petrel and Chatham taiko. It may be that in the latter warmer-water breeders the non-breeders are excluded from feeding grounds close to colonies by the more aggressive breeders during chick-rearing, whereas in the richer, cooler seas there is sufficient food for chick-rearing breeders and non-breeders within feeding range of the colonies.

The relative abundance of soft-plumaged petrels at sea between New Zealand and Antipodes Islands, compared to the numbers of both gadfly petrels on the islands, suggests that this petrel prefers seas just south of the subtropical convergence; whereas white-headed petrels evidently forage mainly south of Antipodes Islands in colder subantarctic seas, and probably as far south as the Antarctic polar front (Szijj 1967).

The Chatham taiko seen was within the expected latitudes shared with soft-plumaged petrels (Imber *et al*. 1998), though closer to New Zealand than expected. It may be that one of their preferred feeding zones during the breeding season lies along the continental slope on the southern side of the Chatham Rise.

Storm petrels and mice

Despite searches during four visits, each of two – six weeks, for black-bellied storm petrels' burrows on Antipodes Island (MJI pers. obs.), and the species being commonly seen there from November to the end of May, only one burrow has been found (Imber 1983). These storm petrels are obviously more common in the south of the island (where the burrow was found), being seen near the hut in the north mainly in spring (MJI pers. obs.). Probably their productive colonies are on the five mice-free, lesser islands of the group, which could support thousands of breeding pairs. Those attempting to breed on the main island possibly always fail due to predation by mice. Those caught in May 2001 were, unexpectedly, non-breeding at the time, and many may have been failed breeders as the result of predation of their eggs or chicks by mice.

Mice on Antipodes Island scavenge flesh off bones of seabird corpses left by skuas and giant petrels (MJI, BDB, EAB pers. obs.), and may thus have a significant impact on Antipodes parakeets which feed similarly. This parakeet is only half as numerous as Reischek's parakeet on Antipodes Island (Taylor 1985), although the latter was the later coloniser (it is now recognised as being a subspecies of the red-fronted parakeet (*Cyanoramphus novaezelandiae*)). The absence of little shearwaters, and of prions away from coastal caves, on Antipodes Island may also be attributable to mouse predation. Significant predation by mice on large chicks of Atlantic petrels (*Pterodroma incerta*) was observed on Gough Island, south Atlantic (Cuthbert & Hilton 2004).

Eradication of mice from Antipodes Island would probably enable the populations of Antipodes parakeets and both storm petrels to increase; and the conservation of invertebrates, and of the Antipodes snipe that depend on them, would also be greatly enhanced (Marris 2001; McIntosh 2001).

ACKNOWLEDGEMENTS

We are very grateful to our colleagues on the expedition: Saskia Wood, Joanna Sim, Matthew Brown and Anthony Henry, for their companionship and observations. Thanks especially to Richard Allen and the crew of MV *Ranui* for transport and their support. We also thank Helen O'Leary, Graeme Taylor and Peter Moore for comments on this paper. This expedition was funded by the New Zealand fishing industry through the Conservation Services Levy via the Science & Research Unit of the Department of Conservation (DOC). Permits to undertake the research and the expedition were provided by DOC's Southland Conservancy, Invercargill. Special thanks to Mary Leask of Bluff Fishermen's Radio, also DOC Stewart Island and DOC Te Anau, and Mike Bell, for radio communications.

LITERATURE CITED

Abbott, C.L.; Double, M.C. 2003. Phylogeography of shy and white-capped albatrosses inferred from mitochondrial DNA sequences: implications for population history and taxonomy. *Molecular ecology 12*: 2747-2758.

Bartle, J.A. 1990. Sexual segregation of foraging zones in procellariiform birds: implications of accidental capture on commercial fishery long-lines of grey petrels (*Procellaria cinerea*). *Notornis 37*: 146-150.

Bell, E.A. 2002. Grey petrels (*Procellaria cinerea*) on Antipodes Island, New Zealand: research feasibility, April to June 2001. *DOC Science internal series 60*: 5-31. Wellington, NZ Department of Conservation.

Burg, T.M.; Croxall, J.P. 2004. Global population structure and taxonomy of the wandering albatross species complex. *Molecular ecology 13*: 2345-2355.

Chastel, O. 1995. Influence of reproductive success on breeding frequency in four southern petrels. *Ibis 137*: 360-363.

Cuthbert, R.; Hilton, G. 2004. Introduced house mice *Mus musculus*: a significant predator of threatened and endemic birds on Gough Island, South Atlantic Ocean? *Biological conservation 117*: 483-489.

Harrison, P. 1983. *Seabirds: an identification guide.* Beckenham, Croom Helm.

Imber, M.J. 1983. The lesser petrels of Antipodes Islands, with notes from Prince Edward and Gough Islands. *Notornis 30*: 283-298.

Imber, M.J. 1999. Diet and feeding ecology of the royal albatross *Diomedea epomophora* - king of the shelf break and inner slope. *Emu 99*: 200-211.

Imber, M.J. 2004. Attempted colonisation of Antipodes Island by goldfinches (*Carduelis carduelis*). *Notornis 51*: 163-164.

Imber, M.J.; Tennyson, A.J.D.; Taylor, G.A.; Johnston, P. 1998. A second intact specimen of the Chatham Island taiko (*Pterodroma magentae*). *Notornis 45*: 247-254.

Jouventin, P.; Mougin, J-L.; Stahl, J-C.; Weimerskirch, H. 1985. Comparative biology of the burrowing petrels of the Crozet Islands. *Notornis 32*: 157-220.

Marchant, S.; Higgins, P.J. 1990. *Handbook of Australian, New Zealand & Antarctic birds. Vol. 1A.* Melbourne, Oxford University Press.

Marris, J. 2001. Terrestrial arthropods. *Antipodes Island expedition October – November 1995*: 40-51. Invercargill, Southland Conservancy, NZ Department of Conservation.

McIntosh, A.R. 2001. The impact of mice on the Antipodes Islands. *Antipodes Island expedition October – November 1995*: 52-57. Invercargill, Southland Conservancy, NZ Department of Conservation.

Murray, T.E.; Bartle, J.A.; Kalish, S.R.; Taylor, P.R. 1993. Incidental capture of seabirds by Japanese southern bluefin tuna longline vessels in New Zealand waters, 1988-1992. *Bird conservation international 3*: 181-210.

Newton, I.P.; Fugler, S.R. 1989. Notes on the winter-breeding great-winged petrel *Pterodroma macroptera* and grey petrel *Procellaria cinerea* at Marion Island. *Cormorant 17*: 27-34.

Robertson, C.J.R.; Nunn, G.B. 1998. Towards a new taxonomy for albatrosses. pp. 13-19 *in*: Robertson, G.; Gales, R. (eds.) *Albatross biology and conservation*. Chipping Norton, NSW, Surrey Beatty & Sons.

Szijj, L.J. 1967. Notes on the winter distribution of birds in the western Antarctic and adjacent Pacific waters. *Auk 84*: 366-378.

Taylor, R.H. 1985. Status, habits and conservation of *Cyanoramphus* parakeets in the New Zealand region. pp. 195-211 *in*: Moors, P.J. (ed.) *Conservation of island birds. ICBP technical publication 3.* Cambridge, International Council for Bird Preservation.

Tennyson, A.; Imber, M.; Taylor, R. 1998. Numbers of black-browed mollymawks (*Diomedea m. melanophrys*) and white-capped mollymawks (*D. cauta steadi*) at the Antipodes Islands in 1994-95 and their population trends in the New Zealand region. *Notornis 45*: 157-166.

Tennyson, A.; Taylor, R.; Taylor, G.; Imber, M.; Greene, T. 2002. Unusual bird records from the Antipodes Islands in 1978-1995, with a summary of other species recorded at the island group. *Notornis 49*: 241-245.

Turbott, E.G. (convener) 1990. *Checklist of the birds of New Zealand and the Ross Dependency, Antarctica. 3rd edn.* Auckland, Random Century and Ornithological Society of New Zealand.

Warham, J.; Bell, B.D. 1979. The birds of Antipodes Island, New Zealand. *Notornis 26*: 121-169.

Waugh, S.M.; Cabrera, H.; Wood, G.C.; Davis, L.S. 2003. Burrow occupancy in Westland petrels (*Procellaria westlandica*). *Notornis 50*: 123-127.

Zotier, R. 1990. Breeding ecology of a subantarctic winter breeder: the grey petrel *Procellaria cinerea* on Kerguelen Islands. *Emu 90*: 180-184.