Monitoring Antipodean wandering albatross, 1995/96

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CONTENTS

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ABSTRACT

This report describes the third consecutive year of census, banding and breeding studies of the Antipodean wandering albatross (*Diomedea antipodensis*) on Antipodes Island, and the foraging flights of 15 breeding birds during the incubation period in 1996. The average number of pairs of birds breeding on the island during the three years of counts was 5180, suggesting a total population of about 9000 breeding pairs. Two thousand chicks were banded as the first part of an assessment of recruitment. One hundred and eighty-six birds banded in 1994 had returned to a 29 ha study area at the north end of the island, but survival estimates cannot be calculated for another two years. The median laying date was 26 January, but the last eggs were laid on about 15 February. Males and females are easily distinguishable from measurements, males being larger than females. Breeding success has been measured for two years and has averaged 75%. Of 105 pairs of birds that had previously bred in the study area, only three used the same nest, and the average distance between nesting attempts was 17–20 m and depended on breeding success. All of the females and a few of the males that were monitored by satellite foraged north of Antipodes I., but most of the males foraged to the south.

Keywords: Antipodean wandering albatross, *Diomedea antipodensis*, breeding success, recruitment, adult survival, nest census, satellite tracking, at-sea distribution.

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1. Introduction

Long-term studies of the wandering albatross (*Diomedea exulans*) populations at South Georgia in the South Atlantic and Crozet Islands in the Indian Ocean found that populations there declined substantially between 1964 and 1990 (Weimerskirsch & Jouventin 1987, Croxall et al. 1990).

Both studies identified reduced survival as the main cause of the decline and attributed it to incidental mortality associated with long-line fishing. Wandering albatrosses are long-lived (> 40 years), breed late (> 10 years) and produce only one chick every 2–3 years. These characteristics make wandering albatross less able to sustain increased bycatch mortality than many other seabird species.

The Antipodean wandering albatross (*Diomedea antipodensis*) is endemic to the New Zealand subantarctic. Most birds breed on Antipodes I., except for about ten pairs which nest on Campbell I. (pers. obs). The species is relatively frequently caught by tuna long-line fishing boats, particularly off East Cape, New Zealand: 31% of all banded Antipodean wandering albatrosses found dead between 1969 and 1994 suffered fisheries-related deaths (unpubl. data, New Zealand Banding Office).

Assessing the impact of fisheries bycatch has been hampered by a lack of knowledge of the breeding timetable, population size, and population dynamics of the species.

Although their breeding grounds are the easiest places to study wandering albatrosses, they spend more time at sea than they do on land. Once fledged, chicks may spend about five years at sea without touching land, and do not spend a great deal of time on land until they breed, at about ten years of age. Even adults only come ashore to breed once every second or third year and, during their breeding years, spend only three months ashore incubating eggs and small chicks, with the remaining nine months making repeated trips to sea to feed their chicks.

Little is known of the albatross movements at sea, though they are sometimes seen following boats and washed up dead on beaches. Their main food is squid, which they apparently mostly catch after it has died. Their huge wings (3 m span) enable relatively low-energy gliding flight, which allows them to cover huge areas of ocean looking for sparse prey.

The main prey of southern blue-fin tuna is also squid, so the ranges of tuna and albatross often overlap. To catch tuna, fishers set long (up to 100 km) lines baited with frozen squid, which sometimes float for a short time as lines are set. Wandering albatross are attracted to these squid baits, and some birds are hooked and drowned as the line sinks.

Concern about the ability of the Antipodean wandering albatross to withstand present levels of bycatch resulted in the instigation of an albatross study programme on Antipodes I., with expeditions in 1994 and 1995, which began population monitoring. This report outlines the findings of further expeditions, in the summer of 1995/96.

1.1 OBJECTIVES

To determine whether bycatch is having a significant impact on the Antipodes Island albatross population.

To collect sufficient information on albatross population dynamics to enable the calculation of sustainable levels of bycatch.

To identify areas of ocean most important to wandering albatross at all stages in their life cycle.

2. Overview of the study

The Antipodes Islands lie 730 km south-east of the New Zealand mainland at 49°41′ S and 178°48′ E (Fig. 1). They are the most south-eastern of the five island groups that make up the New Zealand subantarctic, all of which are Nature Reserves administered by the Department of Conservation (DOC). The Antipodes comprise a main island of 2025 ha (about 7 km × 5 km), five smaller islands, and several islets and stacks.

The main Antipodes I. is ringed by a steep eroded coastline, with few points for landing. Above the cliffs the island is largely rolling country, rising to two central high points: Mt Galloway 336 m and Mt Waterhouse 361 m. The islands of the group are remnants of a volcano, with conspicuous basalt cliffs and eroded remains of volcanic plugs.

The vegetation is dominated by tussock grassland, mostly *Poa littorosa.* In places the *Poa* grows to 2 m tall on pedestals. There are no trees and only small areas of the low woody shrub *Coprosma antipoda*. In damp places there are bands of thick, almost impenetrable shield fern (*Polystichum vestitum*). Seepages on higher slopes are covered in the megaherbs *Pleurophyllum criniferum* and *Anisotome antipoda,* with *Stilbocarpa polaris* on slips.

The climate is cool and windy.

The island has been little influenced by people, with the only alien species being a few herbaceous plants, some self-introduced passerine birds, and the house mouse (*Mus musculus*), which becomes abundant in late summer.

Albatrosses nest all over the island but avoid areas of tall vegetation and the bare exposed tops of hills and ridges. Nests are most common in relatively short tussocky vegetation that offers some protection from the prevailing westerlies yet are close to clearer ground from where the albatrosses can take off.

Two separate expeditions were made to Antipodes I. in the spring and summer of 1995/96; the first was from 30 October to 26 November 1995 and the second from 21 January to 9 March 1996. During the first visit, the breeding success of the previous season's nesting was assessed, and a large number of chicks were banded for future measurement of recruitment. The second expedition looked at adult survival, the number of pairs breeding, and the timing of egg laying, and monitored the foraging locations of breeding and non-breeding adult albatross using satellite telemetry.

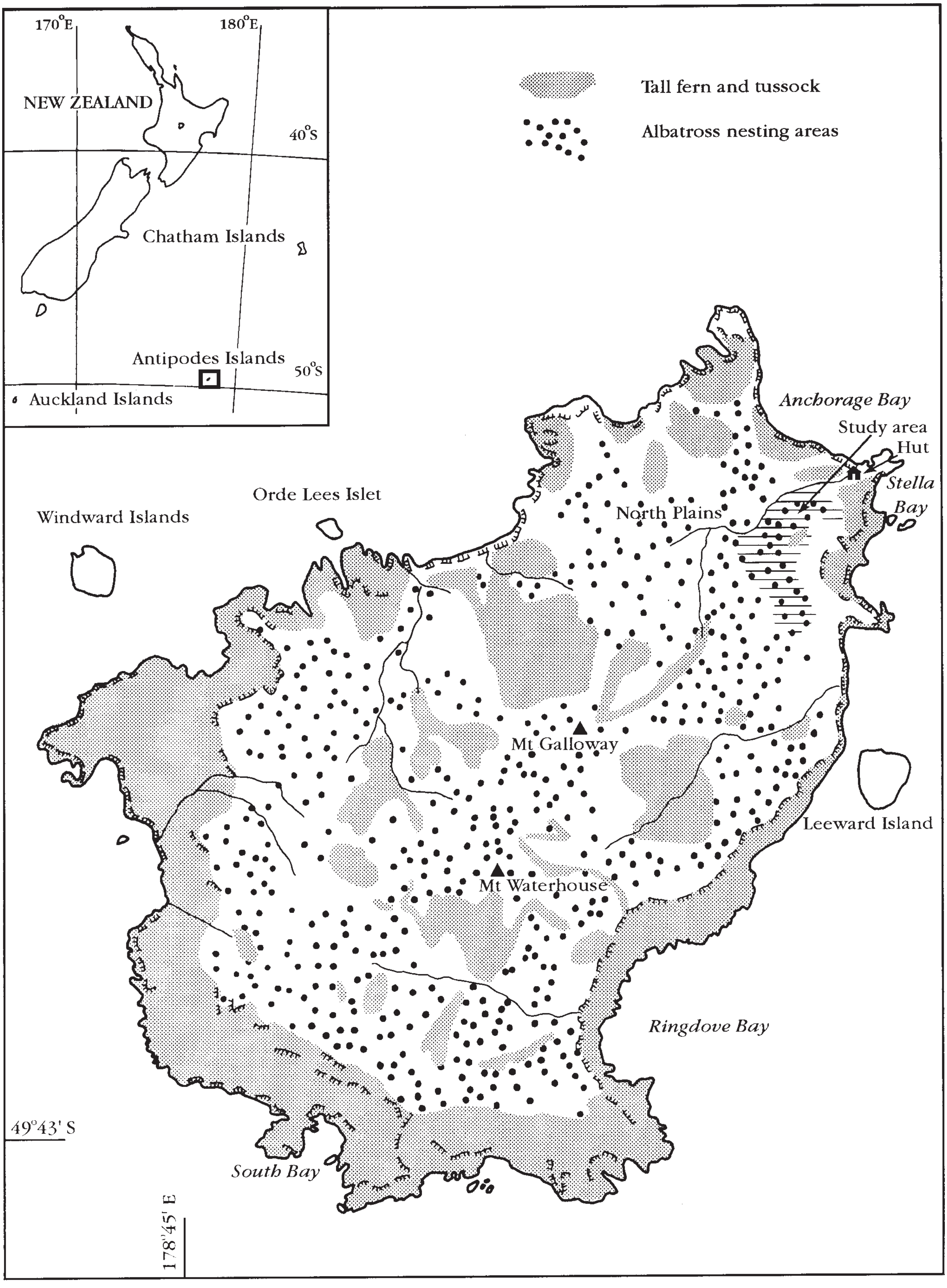

Figure 1. Distribution of Antipodean wandering albatross nesting sites on Antipodes Island.

3. Population dynamics

3.1 BREEDING SUCCESS

3.1.1 Nesting success

In February 1994 (Amey et al. 1994) and 1995 (J. Amey, unpubl. data) all the occupied nests in the study area were marked with metal tags and their positions mapped. The success of these nests was judged in the following February trip when each nest was inspected for signs that chicks had fledged. Successful nests were judged to be those that had a large area of stamped and urea-burnt vegetation around the nest, lots of down and additional chick nests. Failed nests had none of these, or they had the remains of a dead chick.

In addition, the success of the 1995 nests was assessed during November 1995 just before fledging. All chicks present were banded and counted, and any empty nests were examined closely to determine the reason and timing of failure. The nests were examined again in February 1996 to count the number of chicks that had fledged.

From the 156 occupied nests marked in February 1995, 116 (74.4%) chicks fledged. This is very close to the 74.8% success (83 chicks from 111 nests) recorded for the 1994 nests (J. Amey, unpubl. data).

During our inspection of nests during February 1996, our assessment of the success or failure of nests was the same as that derived from the banding of chicks in November and the finding of dead chicks in February. We are therefore confident that the nesting success rates measured in 1995 and 1996 are comparable.

3.1.2 Timing of egg-laying and incubation shift length

Near the beginning of the 1996 breeding season we placed numbered metal tags near every nest within the study area that looked newly constructed. These nests were then checked daily for the first two weeks and thereafter every 3–4 days, and any new nests found during these checks were also marked and subsequently re-checked. At each check the presence or absence of an egg and the identity of the bird were recorded.

Laying began before we arrived on the island, and about 20% of nests had eggs when we first checked on 21 and 22 January 1996. The median laying date was 26 January, but the last egg was not laid until about 15 February.

This is almost three weeks later than laying dates recorded for Gibson's wandering albatross, which nests on the Auckland Islands about 900 km south-east of Antipodes I. (Walker & Elliott 1999).

We were not able to precisely measure incubation shift length because we could not confidently identify birds on the nests until they were all banded and because we did not check the nests at daily intervals throughout the study. However, from 17 February to 8 March we had at least one bird at each nest banded and we checked the nests once every 3–4 days. Birds were unlikely to have changed over at the nest twice between our visits, so we assumed there had been no change-over if the same bird was on the nest at our first and second visits, and that there had been one change-over if there was a different bird. We then calculated an average shift length by dividing the number of change-overs by the sum of the days that all nests were under observation.

Between 17 February and 8 March we recorded 201 change-overs in 3001 nest-days of observation. The mean incubation shift length for this period was 14.9 days.

3.1.2 Morphometrics and weight loss during incubation

To find a way to reliably sex birds, bill, toe and wing measurements were taken from 314 birds in the study area, and their plumage was scored using the Gibson Plumage Index. A smaller sample of 100 males and 84 females were weighed.

Birds on nine nests were weighed every 2–3 days to measure the rate of weight loss during incubation and the weight gained during foraging trips.

A full analysis of morphometrics and of fluctuations in weight during incubation will be given in a later paper.

3.1.4 Nest site fidelity

The distance between consecutive nesting attempts of most of the pairs nesting in the study area in 1996 was measured by locating the site of each pair's previous nesting attempt and measuring the distance between it and their current nest using a 50 m tape.

None of the 78 pairs that nested in 1996 after successfully raising chicks in 1994 re-used their old nest site, and the average distance they moved was 19.15 m (SD = 10.2).

Of 27 pairs which nested unsuccessfully in 1995 and were nesting again in 1996, three used the same nest site, and the rest moved an average of 16.72 m (SD = 9.76).

These figures differed markedly from wandering albatross nesting on South Georgia, where 20% re-use the same nest and the rest move an average of 7 m (maximum 23 m), and Iles Crozet, where 23.3% use the same nest (Marchant & Higgins 1990).

3.2 RECRUITMENT

In November 1995, 2000 albatross chicks on Antipodes I. were banded just before they fledged. All the chicks were on nests north of a line from Orde Lees Islet, through Mt Waterhouse to Ringdove Bay; they included 118 chicks in Block 1, the albatross study area (McClelland 2001).

Because of variability in fledgling survival between years, it is intended to continue to band all chicks produced in the study area, for later measurement of recruitment. Because of a long pre-breeding period in the great albatrossess, birds from this first large banded cohort will probably not attempt to breed till about 2005.

3.3 ADULT SURVIVAL

Methods

Amey et al. (1994) banded both partners of 111 pairs in a study area near the hut on Antipodes I. Each summer subsequently, all birds nesting within the study area have been checked for bands, as well as all non-breeders seen. Additionally, all unbanded nesting birds in the study area were banded, and all nesting pairs were measured and their nests tagged and mapped.

Results

Calculating adult survival of biennially breeding birds from band returns is complicated by the fact that failed breeders usually return after one year and successful breeders after two, but a few birds may not return for 3–4 years. By the time the last surviving birds have returned to the study area, some birds that returned early will have died. Rothery & Prince (1990) and Cormack (1964, 1972) provide methods of estimating survival for species with these characteristics, but a further two years of mark-recapture data is required before survival for the birds banded on Antipodes I. in 1994 can be reliably estimated.

4. Population size and trends

4.1 METHODS

In February 1994, Jacinda Amey, Gerry Clarke and Gus McAllister divided the island into 28 blocks based on visible topographic features (Fig. 2) and counted all birds incubating eggs within each block using the methods of Walker et al. (1995) (Amey et al. 1994; Clarke et al. 1995). They repeated the counts in February 1995 (J. Amey, unpubl. data) and we repeated them in February 1996.

In 1996 the ground count was undertaken on 14 days between 9 February and 4 March. In each block four observers walked in parallel between 35 and 100 m apart in roughly straight lines across part of the block (a 'sweep') counting all birds sitting on eggs in their path. The person on the outer edge of the sweep marked the edge with spray paint, so that subsequent sweeps did not count the same ground again. Birds on Leeward I. (see Fig. 1) were counted using binoculars from the nearest point on Antipodes I.

We also counted and kept a separate tally of all birds we encountered on the ground, but not on nests.

In an attempt to assess the survival and quantify age-related plumage changes of birds banded on Antipodes I. in 1969, 1978 and 1985, and birds banded off the coast of SE Australia since 1958, we checked nearly every bird we counted for the presence of metal leg bands. Whenever a banded bird was encountered its band number was recorded and plumage scored using the Gibson Plumage Index (Gibson 1967).

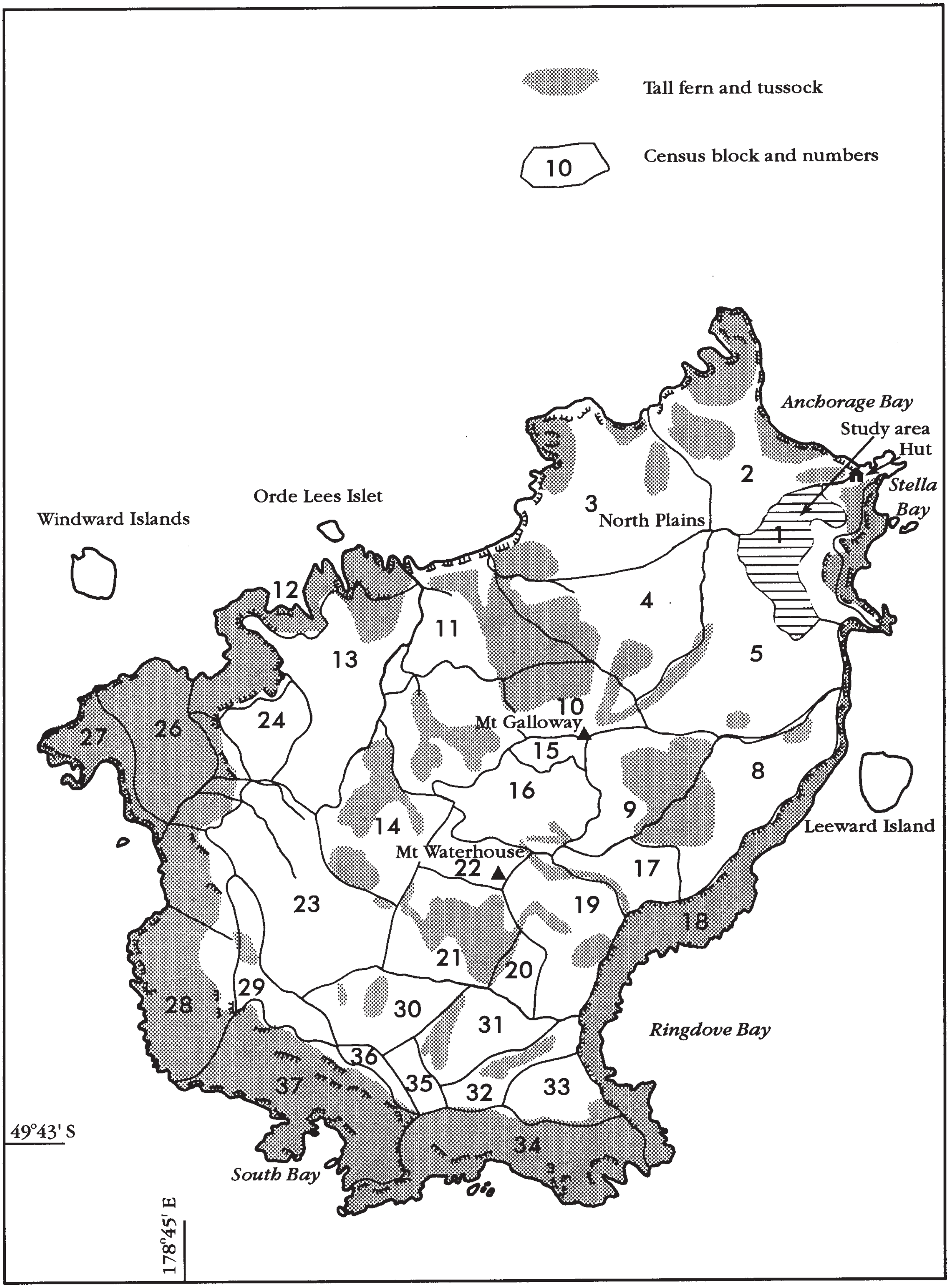

Figure 2. Census blocks used for counting Antipodean wandering albatross on Antipodes Island.

4.2 RESULTS

We counted 5148 incubating birds in 1996 (Appendix 1). In 1994 and 1995, 4635 and 5757 had been counted respectively.

These counts slightly underestimate the population of breeding birds. Our method precludes counting birds twice, but a few birds nesting in tall vegetation are overlooked, and a few nests will have failed and been deserted before we undertook our counts. However, the counting method has been the same in all three years, and the percentage underestimate should be similar in all three counts.

We checked 7687 birds for bands and found 120 birds that had been banded on Antipodes I., and five that had been banded off the coast of Australia. Of the Antipodes-banded birds, 84 had not been recorded on the island since they were banded, and four of the Australian-banded birds had not previously been recorded on the Antipodes.

Usually about 60% of wandering albatrosses breed in any one year, though there can be great year-to-year variation. The 1994–96 series of counts indicate that in total there are about 9000 breeding pairs of Antipodean wandering albatrosses, with about 5180 pairs breeding in any one year

5. Monitoring at-sea distribution

5.1 METHODS

In a joint venture with the Australian group, Albatross Research La Trobe University, we attached satellite transmitters to seven male and eight female Antipodean wandering albatross during their first incubation shifts in late January and early February 1996. Most of the transmitters were attached with harnesses, but one was glued on with quick-setting epoxy resin, and another was attached with 'Tessa' tape. Seven of the transmitters used were 'ST10s' manufactured by Telonics, and two were 'Nano PTTs' manufactured by Microwave Telemetry.

Foraging flights of these birds were monitored using the ARGOS satellite network, and the location of the birds was radioed to us daily. Transmitters were removed from birds within 24 hours of their return to the island, and often re-deployed on another bird that was about to leave the island.

Where possible, birds carrying transmitters were weighed just before they left for a foraging flight, and just after they returned to the island.

5.2 RESULTS

We monitored the flights of the 15 breeding Antipodean wandering albatross. Females tended to forage to the north of males, with all females we tracked spending most time north of the Chatham Islands. Some males also foraged near the Chatham Islands, but most foraged south of the Antipodes. Like Gibson's wandering albatross, some Antipodes birds used the rich zones of current convergence off Kaikoura and East Cape, while others spent considerable time on the edge of the continental shelf and near sea mounts.

Of the 15 birds tracked, nine foraging flights of close to average duration (12 days for non-transmittered birds) were successfully monitored, including six by females and three by males. However, one bird returned to the island after a 41-day flight, nearly three times the average flight length during early incubation, and we lost track of five other birds after they had been away from the island for 33, 38, 42, 44 and 80 days, respectively. The bird away for at least 80 days had clearly deserted, as its last recorded location was off the coast of Chile, and it is likely that some or all of the other four also deserted.

In addition to the desertions and long flights, birds with transmitters that returned to the island put on significantly less weight during foraging flights than did birds without transmitters. Average weight gain for birds without transmitters was 0.062 kg/day (n = 12, SD = 0.049); and that for birds with transmitters was 0.019 kg/day (n = 9, SD = 0.024); t = 2.384, 19 d.f., P = 0.028.

None of the birds with transmitters that returned to the island showed any signs of damage from the harness or transmitter. However, transmitters may have increased the energetic cost of flying such that some birds could not put on enough weight to allow a return to fasting at the nest. Similar trials with transmitters a year earlier at the Auckland Islands had no apparent impact on rates of desertion and flight length (K. Walker & G. Elliott, unpubl. data). There are a number of possible explanations for the difference in outcome of the trials on Auckland and Antipodes Islands including: small sample sizes; slight differences in the methods of transmitter attachment; differences in food availability between the two seasons; and differences between the species.

6. General discussion

Assessing fisheries impact on long-lived, bienially breeding, oceanic birds takes many years. However, because privately financed monitoring started in 1994, substantial progress was made in the first year of partial funding by the fishing industry through the Conservation Services Levy.

Three years of mark-recapture data were collected, and three annual censuses carried out. Another two years' mark-recapture would enable the first estimate of adult survival to be made, and the three years of census will provide a suitable base-line against which counts planned for 2005, 2006, and 2007 can be compared.

A start was made on measuring recruitment, the most difficult population parameter to assess. A large sample of chicks from the 1995 cohort was banded and further samples in 1996 and 1997 are planned. However, it will be a decade before the survivors of these cohorts are recruited into the breeding population.

Considerable progress in investigating albatross foraging range was made possible through the largely Australian-funded satellite telemetry programme, but further development of methods of attaching transmitters is required before it will be possible to get reliable information about the foraging patterns of non-breeding albatross.

7. Acknowledgements

The expeditions in 1994 and 1995, which began population monitoring, were privately funded. The further expeditions, in the summer of 1995/96, were funded by DOC, the Australian group Albatross Research La Trobe University, and by a Conservation Services Levy on the fishing industry.

Special thanks to Gerry Clarke, Jacinda Amey and Gus McAlister who worked hard to get the project going and completed the 1994 and 1995 seasons' fieldwork at considerable personal cost.

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David Nicholls and Durno Murray (Albatross Research La Trobe University) provided substantial satellite tracking equipment and expertise, and advice and support over a long period. Brian and Shirley Walker provided the essential radio link for the satellite telemetry.

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Appendix 1

ANTIPODEAN WANDERING ALBATROSS COUNTED ON ANTIPODES IS, JAN–MAR 1996

AREA	DATE	BIRDS CHECKED FOR PRE-1994 BANDS							BANDS NOT CHECKED		TOT. BOG	TOTAL NESTS WITH EGGS		
		ub[1] BOG[1]	b[1] BOG	b egg	ub egg	Total	Bands found	Banded %	BOG	egg		1996	1994	1995
1	20 Jan–8 Mar 96		5	3			9					158	114	156
2	11 Feb 96	49	1	4	133	187	5	2.7		1	50	138	115	126
3	11 Feb 96	81		3	128	212	3	1.4	1		82	131	105	166
4	11, 12 Feb	174	1	22	282	479	23	4.8		3	175	307	260	363
5	9 Feb 96	196	5	28	397	626	33	5.3			201	425	553	490
6	14 Feb 96	4		1	18	23	1	4.3			4	19	26	20
8	15 Feb 96	183	1	17	296	497	18	3.6		1	184	314	268	339
9	16,19 Feb 96	23		3	58	84	3	3.6			23	61	50	68
10	18 Feb 96	42			72	114	0	0.0			42	72	77	106
11	23 Feb 96	20		1	61	82	1	1.2			20	62	29	81
13	23 Feb 96	209		3	294	506	3	0.6			209	297	301	385
14	18,19, 22 Feb 96	276		1	562	839	1	0.1	1	4	277	567	483	553
15	16 Feb 96	71		1	79	151	1	0.7			71	80	73	114
16	16 Feb 96	159		3	297	459	3	0.7			159	300	242	344
17	4 Mar 96	172		4	148	324	4	1.2			172	152	160	210
19	29 Feb, 4 Mar 96	229	1	3	245	478	4	0.8	3	2	233	250	194	232
20	29 Feb 96	54			83	137	0	0.0		1	54	84	80	108
21	22,27, 29 Feb 96	97		1	139	237	1	0.4	1	6	98	146	129	168
22	22, 27 Feb 96	104			173	277	0	0.0			104	173	128	119
23	27, 28 Feb 96	192		2	489	683	2	0.3		6	192	497	463	527
24	27 Feb 96	47			159	206	0	0.0			47	159	159	175
26	27 Feb 96									7	0	7	5	10
28, 29	28 Feb 96	37	2	3	188	230	5	2.2	1	10	40	201	124	224
30	27–29 Feb 96	61		3	129	193	3	1.6			61	132	114	125
31	26–29 Feb 96	69			123	192	0	0.0			69	123	126	173
32	26 Feb 96	91			133	224	0	0.0			91	133	125	185
33	26 Feb 96	49			89	138	0	0.0	1	1	50	90	85	129
34	26 Feb 96	9		1	14	24	1	4.2			9	15	0	0
35	26 Feb 96	24			31	55	0	0.0			24	31	17	28
36	28 Feb 96	9		1	20	30	1	3.3		1	9	22	30	33
Leeward	15 Feb 96									2		2		
Total						7687	125				2750	5148	4635	5757

[1] BOG = bird(s) on ground, ub = unbanded, b = banded.