Monitoring Gibson's wandering albatross, 2000/01

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ABSTRACT

This paper reports on progress made between 1 July 2000 and 30 June 2001 on measuring survival, productivity and recruitment of Gibson's wandering albatross (*Diomedea gibsoni*), and identification of their most important foraging areas. Productivity for the 2000 breeding season was 52.1%, and the average for the last nine years was 66%. In 2000, 66 chicks were banded, making a total of 752 chicks banded since annual banding for assessment of recruitment began in 1994. Data on the return of banded adults to the study area enabled estimation of adult survival between 1991 and 1999 of 96.8%, with female survival lower than that of males. A total of 675 nests with eggs were counted in February 2001 in three representative blocks on Adams I. The average number of nests in these blocks for 1998–2001 was 672 (range 488 to 781). Satellite tracking of eight birds throughout 2000 showed the seas most frequently used by both breeding and non-breeding birds were the central and southern Tasman Sea and to a lesser extent, the seas off the east coast of New Zealand and around the Chatham Islands. As some individual albatross have their favoured foraging areas, large numbers of albatross need to be tracked to reliably assess patterns of ocean use.

Keywords: Gibson's wandering albatross, *Diomedea gibsoni*, breeding success, recruitment, adult survival, nest census, satellite tracking, at-sea distribution, Auckland Islands.

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1. Introduction

The great albatrosses (*Diomedea* spp.) are among the most spectacular sights of the Southern Ocean, with their huge wingspans (> 3 m) and graceful, soaring flight. Half of all the world's wandering albatross species nest in the New Zealand subantarctic on windswept islands far from human influence. However, most of their lives are spent at sea, and significant numbers have been killed as a bycatch of fishing activity since long-line fishing started in the Southern Ocean in the 1960s.

The well-studied South Atlantic and South Indian Ocean species of wandering albatross declined by more than 50% between 1964 and 1994 as a result of increased adult and juvenile mortality caused by fisheries bycatch (Croxall et al. 1990; de la Mare & Kerry 1994; Weimerskirch & Jouventin 1987; Weimerskirch et al. 1997). In New Zealand the endemic species of wandering albatross, Antipodean and Gibson's wandering albatrosses (*Diomedea antipodensis* and *D. gibsoni*) have been regularly observed as bycatch on both foreign and New Zealand southern bluefin tuna fishing boats (Murray et al. 1993), but there has been no information on whether the level of bycatch was having a significant impact on their populations.

In 1995, the New Zealand Government commissioned research on both Gibson's and Antipodean wandering albatrosses and levied the New Zealand tuna fishers (the Conservation Services Levy) to help pay for it. The main aim of the research was to determine whether the levels of bycatch were sustainable, and this required the collection of data on productivity, survival and recruitment. Wandering albatross are long-lived (> 40 years), mature late (> 10 years), and produce a chick only once every 2–3 years. These features not only make their populations particularly susceptible to increased mortality caused by fishing activity, but makes study of their population dynamics difficult and slow.

The second aim of the research was to identify ocean areas where albatross activity was concentrated and overlapped with fisheries.

From work on wandering albatrosses elsewhere, it was known in advance that it would take at least a decade to obtain reliable estimates of survival and productivity, and 15 years for recruitment. Similarly, population trends would emerge only after many years of annual counts of nests, as the albatrosses' biennial breeding causes considerable inter-annual variation in the number of birds nesting.

This paper reports on progress made in studying the population dynamics and foraging distribution of Gibson's wandering albatrosses during the Department of Conservation's financial year 1 July 2000 to 30 June 2001. Albatross nesting takes a full year, and this paper describes the end of the breeding cycle for birds that started nesting in January 2000, and the beginning of the breeding cycle for birds that started nesting in January 2001.

It is one of a series of annual progress reports on this research (J. Amey unpubl. 1997; J. Amey & G. McAllister unpubl. 1998; Hamilton et al. 2002; Walker & Elliott 2002a, 2002b; Walker et al. 1991, 1995a, 2002) and like the earlier reports, it describes only the work carried out in the previous year. Comprehensive analysis is being carried out and published when sufficient data have been collected (e.g. Walker & Elliott 1999; Walker et al. 1995b).

2. Overview of the study

The Auckland Islands, in the south-west Pacific Ocean, comprise six islands and several islets. Most Gibson's wandering albatross nest on Adams I., the southernmost island in the group. A few nest on southern parts of the main Auckland Island and there is a small population on Disappointment Island.

Adams I. (50°53′ S, 166°10′ E) is approximately 20 km long and 7 km wide, with a 600 m high range running east–west along its length. The island has a narrow band of forest and scrub near sea level, with tussock then bare fellfield above. There are no introduced predators and no human habitation. While albatrosses nest on most ridges off the main range of Adams I., there are two large concentrations of birds, both on the southern slopes of the island—the Astrolabe-Amherst colony and Fly Basin colony (see map in Walker & Elliott 1999).

The survivorship and breeding history of about 900 individually marked birds that regularly nest in a 60 ha study area within the Astrolabe–Amherst colony have been followed since 1991. Each year all birds visiting the study area are identified so that survivorship can be calculated. Each nest is mapped so that its success can be judged a year later, and any chicks produced are banded for later estimation of recruitment. The number of pairs nesting in three areas on the island are counted annually to assess population trends.

The foraging areas used by Gibson's wandering albatross were monitored in 1995 and again in 1999 and 2000 by attaching satellite transmitters to a small sample of birds while they were nesting and tracking their subsequent movements at sea.

3. Population dynamics

3.1 METHODS

3.1.1 Breeding success

To assess breeding success in 2000 we counted the chicks present at the end of the year in two areas in which the number of nests with eggs had been counted

the previous February. The two areas were in different parts of the island to assess spatial and micro-climate variation in breeding success, and one was less visited than the other to assess the possible impact of disturbance.

The two areas were our study area (60 ha) in the Amherst-Astrolabe colony, and Fly Basin 'Square', a 25 ha square block within the dense colony of albatrosses just west of Fly Harbour. While much of the study area is bounded by obvious topographical features, white plastic fence poles mark the less well-defined northern, western and southern boundaries. Fly Basin Square is demarcated entirely by white fence poles as there are no obvious topographical boundaries.

The chicks in the study area were counted on 6–7 Oct 2000, 3–5 Jan 2001 and 31 Jan–1 Feb 2001 to determine fledging success. The number of successful nests in the Fly Basin Square were counted on 30 Dec 2000. Chicks (or nests which had recently fledged a chick) in the Fly Basin Square were counted using our normal census 'sweep' technique (see Walker & Elliott 1999), whereas nests in the study area had been mapped in the previous summer and were individually relocated.

To allow comparison of results between the 2 areas, the number of nests with eggs in the Fly Basin Square on 31 Jan 2000 was adjusted to include nests which had already failed that year, using extrapolations from the failure rate in January 2000 in the study area. Likewise, in measuring the success of the 2000 season nesting attempts, the 30 Dec 2000 Fly Basin Square count was compared with the 3–5 Jan 2001 study area count, rather than with the final fledging success in the study area.

To facilitate assessment of 2001 breeding success we counted the nests with eggs in the Fly Basin Square on 26 Jan 2001, and we mapped all the nests with eggs in our study area during repeated visits between 1 Jan and 6 Feb 2001.

3.1.2 Recruitment

To enable future assessment of recruitment, we banded all the chicks present in the study area on 6–7 Oct 2000 with both numbered metal and darvic bands.

3.1.3 Adult survival, productivity and incubation behaviour

Between 1 Jan and 6 Feb 2001 we made regular visits to the study area and:

- read the bands of all birds encountered in or near the study area;
- marked nests with eggs and mapped their positions using GPS;
- measured and banded with numbered metal and darvic bands any unbanded birds nesting in the study area;
- repeatedly checked every nest and potential nest to determine laying dates and incubation shift lengths.

3.2 RESULTS

3.2.1 Breeding success in the 2000 season

We monitored 131 nests in or near our study area in the 2000 season. However, as a satellite transmitter was attached to one of the parents at eight of these

nests and this might have affected their breeding success, we excluded these nests from breeding success estimates. A further three nests were excluded because the eggs were accidentally broken by researchers. Of the remaining 119 nests in the study area, only 57 (52.1%) were successful. In addition, two chicks (Table 1) still alive when we left the island in early February were small and undeveloped and might subsequently have died, thereby reducing fledging rate still further.

In January 2001 the remains of three chicks (R49932 Black-389; R49903 Black-360; R49861 Black-333) banded the study area in 1999 were found near their old nests. The failure of these birds to fledge reduces our earlier estimate of breeding success in 1999. Breeding success since 1991 is presented in Table 2.

On 31 Jan 2000, 159 nests were counted in the Fly Basin Square and, from accuracy checks, we estimate that 2% were missed and there were 162 nests. By 31 Jan 2000, 1 (0.8%) of the 127 nests in the study area had failed. Therefore, we estimate that eggs were laid in 164 nests in the Fly Basin Square at the beginning of the breeding season.

From 164 nests with eggs estimated to have been laid in the Fly Basin Square on in Dec 1999 and Jan 2000, 119 were judged to be successful on 30 Dec 2000, a breeding success of 73% (Table 3). Over the same period in the study area, from 119 non-transmitter bird nests with eggs, 64 nests were judged successful on 5 Jan 2001, a breeding success of 54%. This differs markedly from results of the previous season, when breeding success in Fly Basin Square was very similar to that in the study area (60.3% and 64.7%, respectively) (Table 4).

TABLE 1. GIBSON'S WANDERING ALBATROSS CHICKS, BANDED IN THE STUDY AREA IN OCTOBER 2000, WHICH WERE SMALL AND UNLIKELY TO FLEDGE.

NEST NO.	METAL BAND	DARVIC BAND	COMMENTS
457	R56505	Black-469	Downy neck and belly on 31 Jan 01
575	R56514	Black-478	Downy neck and belly on 31 Jan 01

TABLE 2. BREEDING SUCCESS OF GIBSON'S WANDERING ALBATROSS NESTING IN THE STUDY AREA ON ADAMS I. SINCE 1991.

YEAR	NO. OF NESTS MONITORED	BREEDING SUCCESS (%)
1991	88	65
1993	135	78
1994	120	69
1995	191	64
1996	206	65
1997	213	68
1998	223	64
1999	206	61
2000	119	52
Average		65%

TABLE 3. NEST COUNTS IN FLY BASIN SQUARE, 30 DEC 2000.

No. of sweeps (2 persons/sweep)	8
Counting time (people hours)	8 hours 50 mins
No. of chicks	104
No. of nests where chick had fledged	15
Total no. of successful nests	119

TABLE 4. BREEDING SUCCESS OF GIBSON'S WANDERING ALBATROSS NESTING IN THE FLY BASIN SQUARE AND THE STUDY AREA BETWEEN 30 JAN 2000 AND 5 JAN 2001.

PLACE	NESTS COUNTED IN JAN 2000	BREEDING SUCCESS 2000 (AND1999)
Fly Basin Square	165	75% (60.3%)
Study area	120	54% (64.7%)

Counts in the Fly Basin Square were carried out after 12.6% of chicks had already fledged, and they were compared with counts in the study area on 5 Jan 2001 when 22% of chicks had fledged. However, we are able to accurately judge the success of nests either when they still have chicks or just after fledging when there is still much sign of the chicks' recent presence.

In January and February 2001, 217 new nests were tagged and mapped for assessment of their breeding success next summer (Fig. 1, Appendix 1). Of these, 210 were inside the study area and seven were within 52 m of the study area but were laid in by birds that had previously nested in the study area. Twenty of the 217 nests had failed before our last check of the nests on 5 Feb 2001 (Appendix 1).

In the Fly Basin Square on 26 Jan 2001 we counted 201 nests with eggs, and at least seven nests that had already failed. By this date in the study area there were 200 nests with eggs, as 14 had already failed and three were still to be laid in.

3.2.2 Adult mortality

Between 1 Jan and 6 Feb 2001 we read the bands of 509 previously banded birds in the study area. We banded 36 previously unbanded adults that were nesting in the study area for the first time (Appendix 2). There were 27 nests in the study area at which we read the bands of only one of the pair. Eighteen of these nests failed before we were able to read both partner's bands, and nine were laid in very late in the season and only one bird had incubated before we left the island. Some of these 27 birds were recorded as non-breeders in the study area before eggs were laid.

Of the 499 darvic-banded wandering albatrosses recorded between 1 Jan and 6 Feb 2001, 24 had lost their darvic band (Appendix 3).

Adult survival was estimated using the method of Cormack (1964, 1972) incorporating the modifications suggested by Croxall et al. (1990) for biennially breeding albatrosses (Table 5).

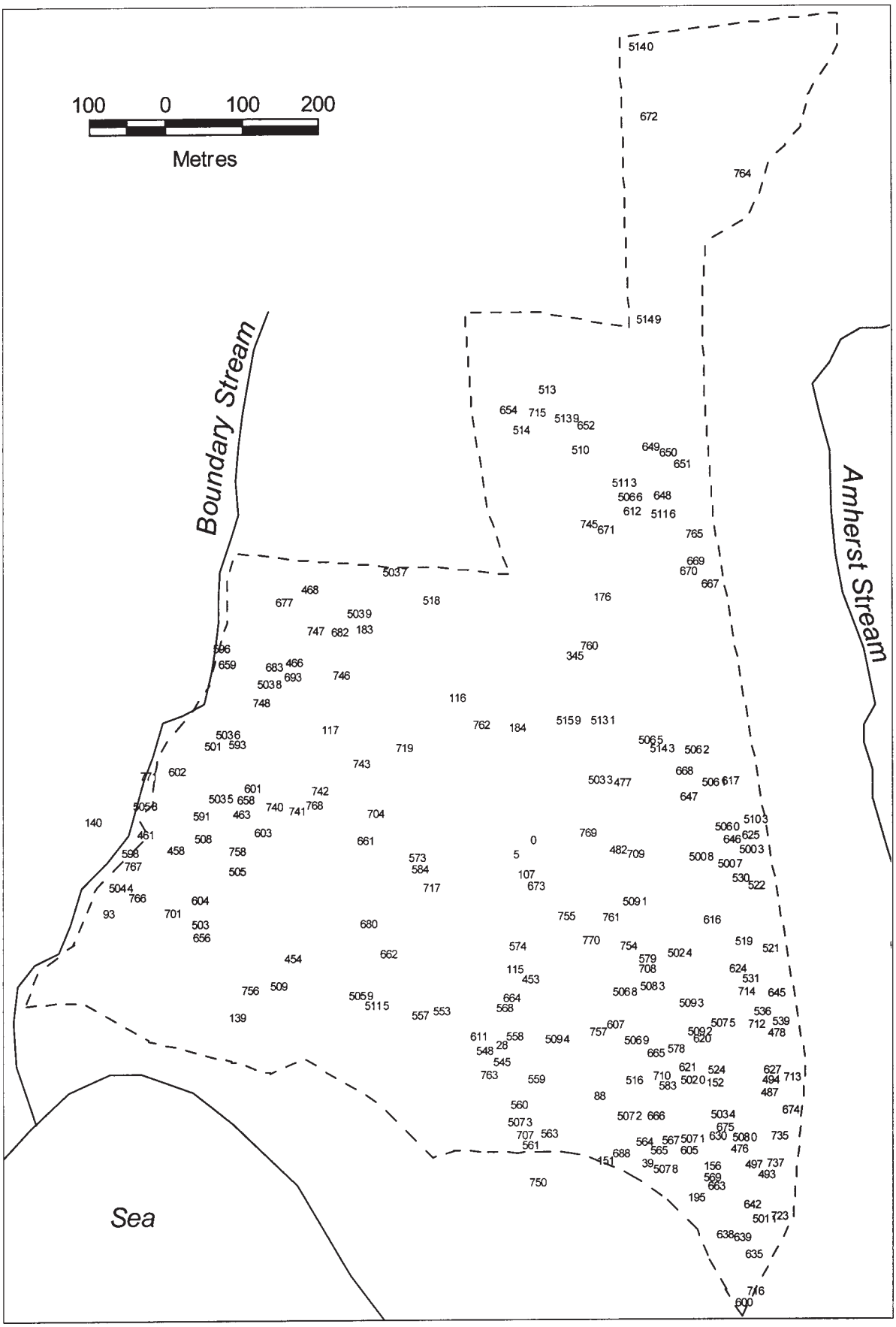

Figure 1. Gibson's wandering albatross nests in the study area on Adams I., Jan–Feb 2001.

TABLE 5. SURVIVAL OF ADULT GIBSON'S WANDERING ALBATROSSES THAT HAVE NESTED IN THE STUDY AREA ON ADAMS I. SINCE 1991. STANDARD ERRORS ARE IN BRACKETS.

YEAR	BOTH SEXES	MALES*	FEMALES*
1993	0.980 (0.015)	0.999 (0.011)	0.969 (0.026)
1994	0.969 (0.012)	0.955 (0.018)	0.978 (0.015)
1995	0.958 (0.012)	0.987 (0.010)	0.950 (0.018)
1996	0.983 (0.008)	0.987 (0.010)	0.991 (0.008)
1997	0.961 (0.013)	0.976 (0.016)	0.959 (0.019)
1998	0.970 (0.014)	0.969 (0.020)	0.971 (0.019)
1999	0.954 (0.020)	0.956 (0.027)	0.955 (0.028)
Average	0.968 (0.011)	0.976 (0.017)	0.968 (0.014)

* Males and females were not reliably distinguished until 1997.

3.2.3 Recruitment

In October 2000, 65 fledglings were banded in the study area and another one was banded there in January 2001. Table 6 shows the number of chicks banded since 1993 for assessment of recruitment.

We found 14 non-breeding birds that had been banded as fledglings in previous years (Appendix 4). Three of these birds were 6 years old while the remaining 11 were 7 years old when we recovered them.

Gibson's wandering albatrosses start returning to Adams I. when about five years old but cannot be reliably detected until they breed at about 10 years old. We will not be able to estimate recruitment until about 2006.

TABLE 6. FLEDGLING GIBSON'S WANDERING ALBATROSSES BANDED ON ADAMS I. SINCE 1993.

YEAR	STUDY AREA	OUTSIDE STUDY AREA
1993[a]	2	
1994[a]	26	
1995[a]	119	319
1996[b]	122	375
1997[c]	144	
1998[c]	144	
1999[c]	129	
2000[c]	66	
Total	752	694

[a] banded with metal bands only. [b] banded with metal and orange darvic bands. [c] banded with metal and white darvic bands.

4. Population trends

Collecting information on population size in a deferred breeding species such as Gibson's wandering albatross is slow, since birds return to breed only once every two or three years. Between 1991 and 1997, a series of annual whole island counts were carried out. Results from these show that in those years an average of 5831 pairs bred on Adams I. (Walker & Elliott 1999). Since 1998, counts of only a representative portion of the island have been undertaken to monitor population change.

4.1 METHODS

On 22–25 Jan 2001, all albatross nests with eggs were counted within the Amherst–Astrolabe block, on 26 Jan in Fly Basin Square, and on 29 Jan on Rhys's Ridge (see Walker & Elliott (2002b) for a description of the blocks and Hamilton et al. (2002) for the count technique).

Once an area had been counted we tested the precision of the census by walking straight transects along compass bearings at right angles to the census sweep lines and checking all nests within 5 m of the transect for paint marks which indicated that the nests had been counted.

Nests in the study area were counted between 1 Jan and 6 Feb 2001 by marking and mapping every nest during repeated visits.

4.2 RESULTS

Details of the counts are presented in Table 7. The number of nests with eggs counted in the three census blocks in 2001 are compared with those in earlier counts in Table 8 and Fig. 2.

Although there has been an increase in the number of birds counted in the Amherst–Astrolabe block since 1991, the increase is not significant (F = 4.01721, d.f. = 1, 7, P_r = 0.085).

In the precision checks of the blocks, 11–13% of the total number of nests in each block were recounted, and no unpainted nests were found. This indicated we had very accurately counted the number of nests with eggs in our original counts.

TABLE 7. GIBSON'S WANDERING ALBATROSS NEST CENSUS RESULTS, ADAMS I., JAN–FEB 2001.

Locality	No. of sweeps	Count time[1]	No. of chicks	Un-banded on egg	Un-banded BOG[2]	Banded on egg	Banded BOG	Total checked for bands	No. of bands found	Total BOGs	Total no. of nests w. eggs
Rhys's Ridge	16.5	12	4	63	12	1	0	76	1	12	64
Amherst–Astrolabe											
Study area (SA)[3]	-	-	-	-	-	-	-	-	-	-	*210*
The Hump	*4*	*2*	*5*	*18*	*7*	*1*	*1*	*27*	*2*	*8*	*19*
SA–Astrolabe	*13*	*16*	*31*	*171*	*91*	*10*	*7*	*279*	*17*	*98*	*181*
Block total	33.5	18	36	189	98	11	8	306	19	106	410
Fly Basin Square	10	9	31	193	112	0	0	305	0	112	201
Total											675

[1] Person hours. [2] Birds on ground (without nests). [3] Not including study nests outside boundaries.

TABLE 8. GIBSON'S WANDERING ALBATROSS CENSUS RESULTS FROM REPRESENTATIVE BLOCKS ON ADAMS I., 1998–2001.

Locality	Year	Count time[1]	No. of chicks	Total no. checked for bands	No. of bands found	Total no. of BOGs[2]	Total no. of nests
Rhys's Ridge	1998	15	2	71	0	13	60
(low density)	1999	11.3	1	78	1	18	60
	2000	21	5	72	1	29	45
	2001	12.2	4	76	1	12	64
Amherst–Astrolabe	1998	20.6	9	343	8	83	483
(medium density)	1999	15.7	20	299	18	59	446
	2000	22	34	230	14	65	284
	2001	18.1	36	306	19	106	410
Fly Basin Square	1998	9.7	7	397	0	149	248
(high density)	1999	10	39	296	2	59	237
	2000	13	22	295	2	136	159
	2001	8.9	31	305	0	112	201
Totals	1998	45.2	18	811	8	245	781
	1999	37	60	673	21	136	743
	2000	56	61	597	17	230	488
	2001	39.2	71	687	20	230	675

[1] Person hours. [2] Birds on ground (without nests).

Figure 2. Number of Gibson's wandering albatross nests with eggs counted in January in three areas on Adams I. since 1991.

5. Monitoring at-sea distribution

5.1 METHODS

In February 1999, satellite transmitters were harnessed to five male and five female Gibson's wandering albatrosses nesting on Adams I. Four of the birds were checked in May 1999 and their transmitters had either fallen off or were removed at that time and a further two were seen on Adams I. in January 2000. However, the remaining four birds had not subsequently been seen, so efforts were made in January 2001 to relocate those birds on Adams I. to check their health.

In February 2000, eight satellite transmitters were again attached to four male and four female Gibson's wandering albatrosses nesting on Adams I. (see Hamilton et al. 2002). The flights of these birds were monitored throughout 2000 using the ARGOS satellite system, and we had hoped to check, and if necessary remove, the transmitters if the birds returned to the island in January or February 2001.

5.2 RESULTS

5.2.1 Telemetry, 1999 season

None of the four birds not seen since 1999 were back on Adams I. in January 2001, though two of their partners were (Table 9).

5.2.2 Telemetry, 2000 season

One of the eight birds from 2000 season deserted a few weeks after the transmitter was attached (Table 10), but continued to carry its functioning transmitter for a year while foraging as a failed breeder, before returning to

TABLE 9. HISTORIES AND DETAILS OF 10 GIBSON'S WANDERING ALBATROSSES TO WHICH TRANSMITTERS WERE ATTACHED IN FEBRUARY 1999.

NAME	METAL BAND	PTT NO.	SEX	PERIOD TRACKED	BREEDING OUTCOME	COMMENTS
Tussock	R42618	9981	M	25 Jan–25 Apr 99	Early fail	Deserted 30 Mar 99. Partner seen as BOG 7 Jan 00. Neither seen Jan 2001.
Jupiter	R42684	9985	M	25 Jan–5 Mar 99	Early fail	Neither partner seen since.
Fram	R42605	9998	F	25 Jan–2 May 99	Early fail	Deserted 12 Apr 99. Partner seen as BOG in Jan 2000 and Jan 2001.
Oreobolus	R42642	9902	F	28 Jan 99–27 Apr 00	Fledged chick	Partner seen as BOG 14 Jan 01.
Manu	R42775	9923	M	28 Jan–23 Jun 99	Early fail	Deserted 14 Apr 99. Back on Adams I. with partner Jan 2000 but did not lay, not cheked for PTT. Neither partner seen in Jan 2001.
Penny	R42711	9974	F	25 Jan–31 Mar 99	Early fail	Deserted 2 Mar 99. Back on Adams I. with partner Jan 2000 but did not lay, not checked for PTT. Partner seen 13 Jan 01 as BOG.
Draco	R42656	9892	M	25 Jan–16 Apr 99	Large chick failure	PTT gone when checked May 99. Neither partner seen since.
Sarah	R42690	9954	F	28 Jan–3 Mar 99	Fledged chick	PTT removed May 1999. Pair back nesting on Adams I. Jan 2001.
Mrs Pete	R42657	9900	F	25 Jan–4 May 99	Fledged chick	PTT removed 4 May 99. Pair back nesting on Adams I. Jan 2001.
Zeuss	R42668	9958	M	25 Jan 99	Fledged chick	PTT removed 1May 99. Pair back nesting on Adams I. Jan 2001.

TABLE 10. HISTORIES AND DETAILS OF EIGHT GIBSON'S WANDERING ALBATROSSES TO WHICH TRANSMITTERS WERE ATTACHED IN FEBRUARY 2000.

NAME	METAL BAND	PTT NO.	SEX	PERIOD TRACKED	BREEDING OUTCOME	COMMENTS
Apollo	R42980	9900	M	18 Feb–3 Sep 00	Failed at large chick stage	Neither he nor his mate returned to Adams I. in Jan 2001.
Blizzard	R46408	9892	M	18 Feb–16 Jun 00	Chick alive but under-developed, 6 Feb 01	Deserted nest in May 2000. Partner seen feeding chick 6 Oct 00, 5 Jan 01, 5 Feb 01.
Maui	R46470	6113	M	18 Feb–28 Jul 00	Failed at egg stage	Deserted nest at hatch (25 Mar 00). Partner incubated new egg near old nest 6 Jan–6 Feb 01 but he was not seen.
Anzac	R42796	10086	M	21 Feb–7 May 00	Failed at egg stage	Neither partner seen in Jan 2001.
Pimelia	R47010	9954	F	18 Feb–30 Apr 00	Failed at egg stage	Deserted during first flight after PTT attached. Partner seen near their old nest on 3 and 28 Jan 01.
Dayna	R47054	9958	F	18 Feb–22 May 00	Failed at egg stage	Deserted nest after hatch. Partner seen on Adams I. 2 Jan 01.
Tori	R42917	6115	F	18 Feb 00–15 Jan 01	Failed at egg stage	Deserted nest after hatch 14 Apr 00. Returned to island and PTT removed 15 Jan 01. Laid new egg 18 Jan 01.
Flora	R46499	17393	F	20/2/00-31/7/00	Failed at end of guard	Deserted nest 3 May 00. Partner on Adams I. 10 and 28 Jan 01.

Adams I. and laying another egg in January 2001. Seven other birds' transmitters stopped 3–7 months after attachment (Table 10). Only two birds (both males) continued their nesting attempt throughout the period tracked.

The seven albatrosses carrying non-functioning transmitters in 2000 did not return to Adams I. in January 2001 as expected. Because of this high loss rate, the single still-functioning 2000 season transmitter was removed from the albatross carrying it, although both bird and transmitter looked in good condition when seen on Adams I. on 14 January 2001.

All of the females tracked spent all of their time north of Adams I., mostly in the mid-Tasman Sea, but they also regularly visited the Chatham Rise. Though they sometimes circumnavigated New Zealand, travel between the two areas was usually via North Cape.

Though males also foraged in both the Tasman Sea and the Chatham Rise, they mostly used more southern waters than females and commuted between these areas via southern Stewart Island. They also spent time off Tasmania, South Australia, and New South Wales. None of the birds tracked used waters to the south of Adams I.

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7. References

Cormack, R.M. 1964: Estimates of survival from the sighting of marked animals. *Biometrika 51*: 429–438.

Cormack, R.M. 1972: The logic of capture-recapture estimates. Biometrics 28: 337–343.

Croxall, J.P.; Rothery, P.; Pickering, S.P.C.; Prince, P.A. 1990: Reproductive performance, recruitment and survival of wandering albatrosses *Diomedea exulans* at Bird Island, South Georgia. *Journal of Animal Ecology 59*: 775–796.

de la Mare, W.K.; Kerry, K.R. 1994: Population dynamics of the wandering albatross (*Diomedea exulans*) on Macquarie Island and the effects of mortality from longline fishing. *Polar Biology 14*: 231–241.

Gibson, J.D. 1967: The wandering albatross (*Diomedea exulans*): results of banding and observations in New South Wales coastal waters and the Tasman sea. *Notornis 14*: 47–57.

Hamilton, S.; Wiltshire, A.; Walker, K.; Elliott, G. 2002: Monitoring Antipodean wandering albatross, 1999/2000. *DOC Science Internal Series 78*. Department of Conservation, Wellington. 25 p.

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.

Walker, K.; Elliott, G. 1999: Population changes and biology of the wandering albatross *Diomedea exulans gibsoni* at the Auckland Islands. *Emu 99*: 239–247. [Edited and republished as: Walker, K.; Elliott, G. 2002. Population changes and biology of the wandering albatross *Diomedea exulans gibsoni* at the Auckland Islands. *DOC Science Internal Series 68*. 19 p.]

Walker, K.; Elliott, G. 2002a: Monitoring Antipodean and Gibson's wandering albatross, 1996/97. *DOC Science Internal Series 75.* Department of Conservation, Wellington. 14 p.

Walker, K.; Elliott, G. 2002b. Monitoring Gibson's wandering albatross, 1998/99. *DOC Science Internal Series 70*. Department of Conservation, Wellington. 20 p.

Walker, K.; Dilks, P.; Elliott, G.; Stahl, J-C. 1991: Wandering albatross on Adams Island, February 1991. *Science & Research Internal Report 109*. Department of Conservation, Wellington.

Walker, K.J.; Elliott, G.P.; Davis, A.; McClelland, P. 1995a: Wandering albatross on Adams Island, February 1993. *Science and Research Series 78*. Department of Conservation, Wellington.

Walker, K.J.; Elliott, G.P.; Nicholls, D.G.; Murray, M.D. 1995b: Satellite tracking of wandering albatross (*Diomedea exulans*) from the Auckland Islands: Preliminary results. *Notornis 42*: 127–137.

Walker, K.; Elliott, G.; Amey, J.; McAllister, G. 2002a: Monitoring Gibson's wandering albatross, 1997/98. *DOC Science Internal Series 69*. Department of Conservation, Wellington. 19 p.

Weimerskirch, H.; Jouventin, P. 1987: Population dynamics of the wandering albatross, *Diomedea exulans* of the Crozet Islands: causes and consequences of the population decline. *Oikos 49*: 315–322.

Weimerskirch, H.; Brothers, N.; Jouventin, P. 1997: Population dynamics of wandering albatross *Diomedea exulans* and Amsterdam albatross *D. amsterdamensis* in the Indian Ocean and their relationships with long-line fisheries: conservation implications. *Biological Conservation 79*: 257–270

Appendix 1

BIRDS AT NESTS IN OR NEAR THE STUDY AREA ON ADAMS I., FEBRUARY 2001

NEST	MALE		FEMALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
0	47579	Red-377			
5			47303	Red-059	
28	42798	Red-195	47014	Red-332	
39	50045	Red-986	56574	Red-932	
88	42754	Red-415			
93			46653	Red-226	Failed 13 Jan 01
107	42879	Red-633	42902	Red-525	
115	46829	Red-214	46810	Red-431	
116	56580	Red-950	56571	Red-934	
117	46794	Red-355	49686	Red-560	
139	47537	Red-552	46609	Red-850	
140			46416		Outside study area
151	56578	Red-945	56569	Red-924	
152	Unbanded		unbanded		Failed 28 Jan 01
156	56594	Red-973	49696	Red-730	
176	47576	Red-655	47554	Red-640	
183	46766	Red-261	49674	Red-466	
184			46662	Red-375	
195	42962	Red-703	42865	Red-925	
345	47555	Red-750	48074	Red-817	
453	42681	Red-213	42790	Red-430	
454	46437	Red-630	46495	Red-550	
458	47057	Red-519	47019	Red-504	
461			42770	Red-675	Failed 22 Jan 01. Outside study area
463	42916	Red-242	46425	Red-350	
466	46442	Red-264	46520	Red-356	
468	49692	Red-683	49854	Red-577	Failed 5 Feb 01
476	47509	Red-614	47600	Red-837	
477	49875	Red-761	49859	Red-657	
478			47595	Red-662	
482	49885	Red-823	49694	Red-697	
487	42955	Red-613	46465	Red-534	
493	46806	Red-146			
494			56591	Red-970	
497	42653	Red-142	42740	Red-319	
501			50047	Red-993	
503	47514	Red-223	47539	Red-343	
505	42700	Red-548	42769	Red-549	
508	46533	Red-348	46424	Red-234	
509	56583	Red-951	56579	Red-947	Failed 22 Jan 01
510	43010	Red-030	46781	Red-286	

NEST	MALE		FEMALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
513	42611	Red-021	42612	Red-366	
514	43008	Red-942	50037	Red-902	
516	42668	Red-782	42996	Red-645	
518	46765	Red-276	46673	Red-477	
519	47043	Red-094	49577	Red-389	
521	42733	Red-392	42952	Red-137	
522	50030	Red-876	50009	Red-852	
524	46526	Red-133	42956	Red-312	
530	47044	Red-390	49578	Red-101	
531	46504	Red-393	43087	Red-112	
536	46505	Red-594	43090	Red-593	
539	46753	Red-634			
545	47529	Red-946	47583	Red-927	
548	46663	Red-187			
553			42997	Red-921	Failed 13 Jan 01
557	47538	Red-625			
558	42676	Red-784	42756	Red-705	
559	46494	Red-192	42682	Red-923	
560	42881	Red-184	42999	Red-421	
561	42670	Red-556			
563			47503	Red-954	
564	46807	Red-838	46759	Red-807	
565	42749	Red-572	42663	Red-808	
567	56577	Red-943	56593	Red-972	
568	56582	Red-952	56576	Red-940	
569	42748	Red-702	42662	Red-573	
573	43062	Red-250	46606	Red-457	
574	56590	Red-965	56581	Red-953	
578	42958	Red-129	49600	Red-916	
579	56588	Red-962	56599	Red-984	
583	43097	Red-171	47006	Red-414	
584	46761	Red-770	46605	Red-631	
591	42773	Red-237	42705	Red-897	
593	42990	Red-748	47541	Red-803	
596	47519	Red-802	47543	Red-539	Outside study area
598	42795	Red-628	42697	Red-939	Outside study area
600	48085	Red-587	48091	Red-622	
601	46660	Red-579	46796	Red-546	
602	47022	Red-805	47059	Red-581	
603	46427	Red-949	56598	Red-983	
604			42690	Red-629	42690's nest. Failed 17 Jan 01
605	46593	Red-701	46594	Red-821	
607			42671?		Egg broken when found 8 Jan 01
611	46809	Red-194	43000	Red-423	
612	42615	Red-757	42716	Red-689	
616	47045	Red-305	49579	Red-103	
617	50023	Red-871	50038	Red-903	
620	49650	Red-570	49851	Red-569	
621	42968	Red-754	46822	Red-406	
624	47047	Red-117	49593	Red-394	
625	47041	Red-491	49574	Red-092	
627	47596	Red-913	49599	Red-914	

NEST	MALE		FEMALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
630	42856	Red-642	47598	Red-156	
635	42744	Red-621	42657	Red-537	
638	49860	Red-664	47310	Red-936	
639					Egg broken when found 6 Jan 01
642	42739	Red-152	42652	Red-320	
645	47309	Red-107	49591	Red-352	
646	46801	Red-813	46789	Red-695	
647	42634	Red-078	42728	Red-895	
648	47575	Red-722	48081	Red-687	
649	46501	Red-027	43067	Red-368	
650	42781	Red-723	42603	Red-678	
651	47548	Red-034	49556	Red-287	
652	42715	Red-026	42873	Red-283	
654	47569	Red-482	43041	Red-020	
656	50046	Red-987	56584	Red-956	
658	47517	Red-975	47021	Red-707	
659	49248	Red-266			
661	56600	Red-985	46496	Red-826	
662	46762	Red-792	46604	Red-646	
663	47002	Red-144	46821	Red-619	
664	42868	Red-197	47513	Red-334	
665	47052	Red-167	49589	Red-794	
666	47511	Red-744	47522	Red-957	
667	47590	Red-038	49258	Red-289	
668	50043	Red-887	50029	Red-882	
669	43047	Red-036	46431	Red-260	
670	43044	Red-721	46678	Red-685	
671	46783	Red-041	46676	Red-290	
672			47550	Red-741	Failed 19 Jan 01
673	49652	Red-298	47304	Red-067	
674	42648	Red-894			Failed 5 Feb 01
675	47599	Red-143	43019	Red-402	
677	46791	Red-650	46574	Red-651	
680	46412	Red-553	43052	Red-510	
682	47582	Red-626	46575	Red-677	
683			46519	Red-578	Failed 23 Jan 01
688	42859	Red-177	47005	Red-328	
693	49882	Red-845	49878	Red-778	
701	42694	Red-786	42765	Red-551	
704	47034	Red-353	47585	Red-252	
707	47011	Red-503	49698	Red-733	
708	46825	Red-567	43095	Red-709	
709			42896	Red-382	Failed 31 Jan 01
710	47588	Red-781	48087	Red-746	
712					Egg broken when found 14 Jan 01
713			56586	Red-958	Failed 21 Jan 01
714	49687	Red-505	49659	Red-395	
715	49560	Red-796	47036	Red-779	
716	42659	Red-828	42746	Red-150	
717	42619	Red-647	42903	Red-632	
719	42712	Red-516	49648	Red-544	
723	42742	Red-404	42655	Red-147	

NEST	MALE		FEMALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
735	43018	Red-138	46754	Red-315	
737	47001	Red-141	46756	Red-318	
740	42708	Red-500	46667	Red-122	
741	47058	Red-649	47020	Red-333	
742	46581	Red-844	46773	Red-542	
743	47023	Red-790	47060	Red-772	
745	56592	Red-971	56596	Red-979	
746	49855	Red-627	49576	Red-774	
747	46500	Red-977	46435	Red-475	
748	46659	Red-776	46767	Red-843	
750	47526	Red-665			Failed 5 Feb 01. Outside study area
754	47591	Red-063	47562	Red-566	
755	49582	Red-508	48083	Red-692	
756	49660	Red-436	48095	Red-931	
757			56589	Red-964	Failed 23 Jan 01
758	50042	Red-885	50022	Red-863	
760			42880	Red-293	46470's mate
761	46473	Red-528	46452	Red-398	
762	47578	Red-376			
763	46808	Red-716	46827	Red-749	
764	47035	Red-005	49554	Red-361	
765	48073	Red-371	47552	Red-037	
766	49655	Red-347	50041	Red-879	
767	56597	Red-982			
768	56595	Red-976			
769	42624	Red-967	56572	Red-935	
770	47592	Red-209	47563	Red-428	
771	42886	Red-974	47533	Red-992	Outside study area
5003			42638	Red-607	
5007	47568	Red-763			
5008			46790	Red-588	
5011	47521	Red-455			
5020	46509	Red-410			
5024	49580	Red-073			
5033	42720	Red-938			
5034	42858	Red-615			
5035	49877	Red-775	49872	Red-712	
5036	47535	Red-240			
5037	56585	Red-955	56570	Red-930	Failed 13 Jan 01
5038			46742	Red-777	
5039	46479	Red-359	42917	Red-274	
5044	46530	Red-948	46421	Red-926	
5058	46655	Red-582	46797	Red-788	Outside study area.
5059	42909	Red-218	46419	Red-434	
5060	42729	Red-814	43083	Red-589	
5061	47560	Red-592	43006	Red-605	
5062	49572	Red-080	47040	Red-937	
5065	43076	Red-048	46411	Red-295	
5066	43081	Red-726	46502	Red-653	
5068	46524	Red-340	47046	Red-208	
5069			47007	Red-941	

NEST	MALE		FEMALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
5071	47508	Red-700	48080	Red-820	
5072	56575	Red-933	56573	Red-944	
5073	49699	Red-734	49853	Red-624	
5075	46804	Red-532	46823	Red-765	
5078	29204	Red-175	47003	Red-416	
5080	46402	Red-130	42762	Red-963	
5083	49689	Red-978	49688	Red-507	
5091	46451	Red-780	43056	Red-727	
5092	47504	Red-125	49597	Red-494	
5093			56587	Red-959	
5094	46415	Red-200			
5103	49590	Red-301			Failed 6 Jan 01
5113	43068	Red-032	46446	Red-369	
5115	46529	Red-217	46418	Red-341	
5116	47574	Red-558			
5131	49566	Red-501	49884	Red-849	
5139	42608	Red-025	42783	Red-282	
5140	42601	Red-004	42779	Red-002	
5143	47558	Red-798	48076	Red-795	
5149	42979	Red-007			
5159	47556	Red-050			

Appendix 2

ADULT GIBSON'S WANDERING ALBATROSS BANDED WITH NEW METAL BANDS AND/OR NEW DARVIC BANDS ON ADAMS I., JAN–FEB 2001

DATE	NEW DARVIC	OLD DARVIC	NEW METAL 'R' BAND	OLD METAL 'R' BAND	SEX
01 Jan 01	Red-923			42682	F
01 Jan 01	Red-928		56567		M
03 Jan 01	Red-927			47583	F
03 Jan 01	Red-926	Red-926		46421	F
05 Jan 01	Red-925	Red-644		42865	F
05 Jan 01	Red-924		56569		F
05 Jan 01	Red-930		56570		F
05 Jan 01	Red-934		56571		F
05 Jan 01	Red-935		56572		F
06 Jan 01	Red-936	Red-151		47310	F
06 Jan 01	Red-937	Red-386		47040	F
06 Jan 01	Red-938	Red-075		42720	M
06 Jan 01	Red-933		56575		M
06 Jan 01	Red-944		56573		F
06 Jan 01	Red-932		56574		F
06 Jan 01	Red-921			42997	F
06 Jan 01	Red-931	Red-220		48095	F
07 Jan 01	Red-939			42697	F
07 Jan 01	Red-940		56576		F
07 Jan 01	Red-941	Red-159		47007	F
07 Jan 01	Red-942			43008	M
10 Jan 01	Red-943		56577		M
10 Jan 01	Red-945		56578		M
10 Jan 01	Red-946			47529	M
10 Jan 01	Red-947		56579		F
10 Jan 01	Red-948			46530	M
10 Jan 01	Red-949			46427	M
10 Jan 01	Red-897	Red-349		42705	F
10 Jan 01	Red-950		56580		M
11 Jan 01	Red-894			42648	M
11 Jan 01	Red-895	Red-384		42728	F
11 Jan 01	Red-953		56581		F
11 Jan 01	Red-952		56582		M
11 Jan 01	Red-954			47503	F
13 Jan 01	Red-951		56583		M
13 Jan 01	Red-956		56584		F
13 Jan 01	Red-957	Red-643		47522	F
02 Jan 01	Red-929	Red-523		43046	F
14 Jan 01	Red-958		56586		F
14 Jan 01	Red-959		56587		F
14 Jan 01	Red-962		56588		M
17 Jan 01	Red-963			42762	F

DATE	NEW DARVIC	OLD DARVIC	NEW METAL 'R' BAND	OLD METAL 'R' BAND	SEX
17 Jan 01	Red-967			42624	M
18 Jan 01	Red-964		56589		F
18 Jan 01	Red-965		56590		M
18 Jan 01	Red-970		56591		F
18 Jan 01	Red-971		56592		M
19 Jan 01	Red-972		56593		F
21 Jan 01	Red-973		56594		M
22 Jan 01	Red-974	Red-789		42886	M
22 Jan 01	Red-975			47517	M
22 Jan 01	Red-976		56595		M
23 Jan 01	Red-977	Red-273		46500	M
23 Jan 01	Red-978	Red-512		49689	M
28 Jan 01	Red-979		56596		F
28 Jan 01	Red-983		56598		F
28 Jan 01	Red-982		56597		M
31 Jan 01	Red-984		56599		F
01 Feb 01	Red-985		56600		M
01 Feb 01	Red-986		50045		M
05 Feb 01	Red-987		50046		M
05 Feb 01	Red-993		50047		F
05 Feb 01	Red-992	Red-711		47533	F
13 Jan 01	Red-955		56585		M

Appendix 3

WANDERING ALBATROSS WITH LOST OR BROKEN DARVIC BANDS ON ADAMS I., JAN–FEB 2001

DATE	LOST DARVIC	NEW DARVIC	METAL BAND	SEX	STATUS	COMMENTS
2 Jan 01	R-523	R-929	R43046	F	Nesting	
2 Jan 01	R-432		R47016	M	BOG	
5 Jan 01	R-644	R-925	R42865	F	Nesting	
6 Jan 01	R-151	R-936	R47310	F	Nesting	
6 Jan 01	R-386	R-937	R47040	F	Nesting	
6 Jan 01	R-075	R-938	R42720	M	Nesting	
7 Jan 01	R-159	R-941	R47007	F	Nesting	
6 Jan 01	R-183.		R49585	M	BOG	
6 Jan 01	R-220	R-931	R48095	F	Nesting	
6 Jan 01	R-789		R42886	M	BOG	
7 Jan 01	R-440					Found part of darvic on ground west of Boundary Stream.
7 Jan 01	R-349		R42705	F	BOG	
7 Jan 01	R-211		R42792	M	BOG	
8 Jan 01	R-752		R46491	M	BOG	
10 Jan 01	R-349	R-897	R42705	F	Nesting	
11 Jan 01	R-384	R-895	R42728	F	Nesting	
11 Jan 01	R-643	R-947	R47522	F	Nesting	
14 Jan 01	R-176		R47050	M	BOG	
17 Jan 01	R-331		R42964	F	BOG	
22 Jan 01	R-789	R-974	R42886	M	Nesting	Found the broken darvic later that day – on west side of Boundary Stream.
23 Jan 01	R-273	R-977	R46500	M	Nesting	
23 Jan 01	R-512	R-978	R49689	M	Nesting	
31 Jan 01	R-756					Found broken darvic on the ground in the study area.
5 Feb 01	R-711	R-992	R47533	F	Nesting	

Appendix 4

NON-STUDY AREA BANDED GIBSON'S WANDERING ALBATROSS RECOVERED ON ADAMS I. IN 2001

Band	Date	Location	Grid ref.	Activity	Head	Back	Wing	Tail	Sex	Date banded	Where banded	Status at banding
29140	29 Jan 01	Rhys's Rdg	287928, 676791	Nesting	6	5	3.5	2				
30555	25 Jan 01	SA-Astrolabe	287347, 674286	BOG	5	5	3.5	3	M			
46358	28 Feb 01	SA		BOG					F	8 Dec 95	SA(19072)	Chick
46365	13 Jan 01	SA		BOG						8 Dec 95	SA(19079)	Chick
46392	13 Jan 00	SA		BOG						7 Dec 95	SA(13099)	Chick
46399	18 Jan 01	SA		BOG	2.5	2	1	1		7 Dec 95	SA(11754)	Chick
46532	22 Jan 01	500 M OSA	287301, 673909	Nesting with new UB male	4.5	4	2.5	1.5		12 Feb 94	SA	Nesting adult
46596	22 Jan 01	SA–Astrolabe	287775, 674055	Nesting	4	4.5	3	1.5	F	6 Jan 95	Just west Boundary Strm OSA	Nesting adult(D31) dummy PTT trials
46694	25 Jan 01	SA–Astrolabe	287545, 674498	BOG	1.5	1.5	1	1	F	7 Dec 95	SA(21058)	Chick
46732	25 Jan 01	30 M OSA above lower cairn	288224, 674423	BOG	3	3	1	1	F	18 Dec 96	SA (nest b66)	Chick
46957	25 Jan 01	SA, below Hump		BOG	3	3.5	3	1.5	M	20 Dec 95	SA ext. 875-741	Chick
46965	05 Feb 01	SA		BOG	2.5	2	1	1	F	20 Dec 96	SA ext. 876-742	Chick
47257	02 Feb 01	South of Mt Dick	290488, 673266	BOG						24 Dec 96	Upper-mid SA ext. 881-744	Chick
47542	25 Jan 01	100 M OSA	287841, 674398	Nesting with new UB male	4	4	2	1,5	F	14 Jan 97	SA	Nesting adult
49359	22 Jan 01	SA–Astrolabe	287686, 674329	BOG	3	4	2	1		12 Dec 95	OSA	Chick
49477	25 Jan 95	SA–Astrolabe	287423, 674417	BOG	2.5	3.5	2	1.5	F	17 Dec 95	OSA	Chick
49723	13 Jan 01	SA, 2000 nest 5176		BOG						06 Dec 95	SA(19079)	Chick
49794	05 Feb 01	SA		BOG						10 Dec 95	West of Boundary Stream	Chick
49806	28 Jan 01	SA		BOG						10 Dec 95	OSA	Chick