Monitoring Gibson's wandering albatross, 1997/98

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ABSTRACT

This paper reports on progress made between 1 July 1997 and 30 June 1998 on measuring survival, productivity and recruitment of Gibson's wandering albatross (*Diomedea gibsoni*). Productivity for the 1997 breeding season was 68% and this was also the average for the previous four years. To assess recruitment, 144 chicks were banded, making a total of 413 chicks banded since annual banding for this purpose began in 1994. The first of the banded birds was recorded back at the island after four years. Annual adult survival of 97.5% for the five years between 1991 and 1996 was estimated from the return of banded birds to the study area. Part of the island, incorporating about 12% of all albatross nests on the island, was permanently marked with poles and surveyed to monitor population trends.

Keywords: Gibson's wandering albatross, *Diomedea gibsoni*, breeding success, recruitment, adult survival, nest census, Auckland Islands.

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1. Introduction

Gibson's wandering albatross (*Diomedea gibsoni*) have been a regular bycatch on both foreign and New Zealand southern bluefin tuna fishing boats since long-lining began in the early 1960s (Murray et al. 1993). As wandering albatrosses are long-lived (> 40 years), breed late (> 10 years), and produce a chick only once every 2–3 years, the increased mortality caused by bycatch has the capacity to threaten the species.

A number of concurrent programmes are attempting to examine and resolve this issue: a variety of underwater bait-setting and other mitigation devices are being developed and tested; observers are placed on boats to accurately document the extent and patterns of bycatch; the zones of greatest potential conflict are being identified through satellite telemetry of foraging albatross, and the impact of the bycatch and any mitigation of it on albatross populations are being monitored.

This report describes progress during the 1997/98 year on monitoring the main Gibson's wandering albatross population on Adams Island in the subantarctic Auckland Island group. This work focuses on estimating survival, productivity and recruitment rates so that the population can be modelled and sustainable bycatch levels estimated. Trends in population size are also monitored.

It is one of a series of annual progress reports on this research (Walker et al. 1991,1995; Walker & Elliott, 2002) and, like the earlier reports, it describes only the work carried out in the previous year. Comprehensive analysis is being carried out and is to be published when sufficient data have been collected.

Although wandering albatrosses spend most of their lives at sea, the most economical way to assess the fisheries impact is during the short period they concentrate on a small subantarctic island to breed. Every summer, nearly half of the Gibson's wandering albatross population gathers on Adams Island in the subantarctic Auckland Islands group to breed, and adolescents also gather there for pre-breeding displays. During this period, population parameters can be assessed, and satellite transmitters can be attached to follow the birds' life at sea.

During 1997/98 there were two visits to Adams I. Gus McAllister and Janice Molloy made the first visit, from 1 to 14 November 1997 with transport on the motor yacht *Breaksea Girl*. During this visit, 1997 productivity was assessed, and all the chicks produced in 1997 in a study area were banded to allow assessment of recruitment.

A second, much longer visit, was made from 14 January to 22 February 1998 to assess adult survival and to monitor population trends. The team comprised Jacinda Amey and Gus McAllister, and the Bluff-based cargo ship *Marine Countess* provided transport.

2. Population dynamics

Since 1991 a population study aimed at measuring productivity, survival and recruitment has been conducted on Adams I., where about 95% of Gibson's wandering albatross breed. The main study area comprised 53 ha on the southern slopes of Adams I., just west of Amherst Stream (Fig. 1). While much of the study area is bounded by obvious topographical features, during January 1998 white plastic electric fence poles were placed along the less well-defined northern, western and The Hump boundaries.

A temporary 25 ha study area was marked out this year with the specific goal of checking that the breeding success measured in the main study area is representative of birds nesting in other parts of the island. This second area is in the middle of a dense colony of wandering albatrosses just west of Fly Harbour ('Fly Basin Square') (Fig. 1) and was demarcated entirely by white electric fence poles as there were no obvious topographical boundaries. This study area is near the second group of tarns on the spur between Fly Harbour and spot height 631, approximately 500 m from the rock outcrop at spot height 434. The north-eastern corner of the square is next to the tarns and is marked with a red painted pole. White plastic electric fence poles are placed at approximately 50 m intervals for 500 m along compass bearings of 230° and 140° from the red-painted corner pole. Lines at 140° and 230° respectively from the ends of these 500 m lines and marked by white poles complete a square.

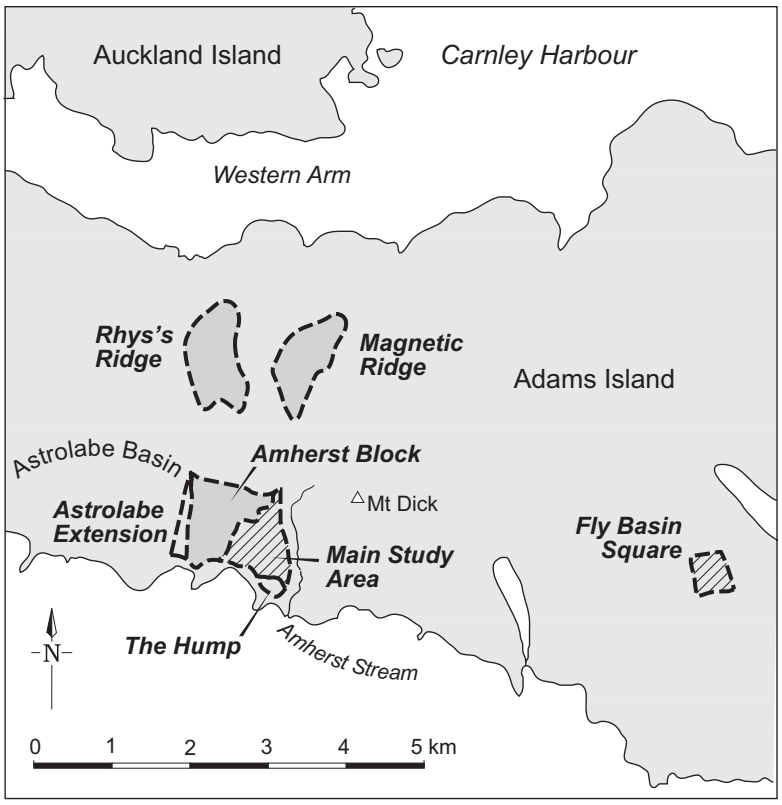

Figure 1. Census blocks and study area location on Adams Island

In 1997/98 we started banding birds with highly visible coloured, plastic (darvic), numbered bands in addition to metal bands. These bands are much easier to read than metal ones and they increase the chances of reading band numbers both on land and at sea. They also reduce the amount of disturbance to study area birds since the birds do not have to be approached as closely for the bands to be read. Different coloured darvic bands were used on adults and chicks to make future assessment of recruitment easier, and the colours used were different from those used on *D. antipodensis* to facilitate easy species differentiation at sea.

2.1 METHODS

Between 1 and 14 November 1997, all the study area nests that had eggs in February 1997 were visited and all chicks present were banded with both metal and black darvic bands.

On 23 January 1998 we searched for all of the previous seasons nests, confirmed their identity from their metal tags and assessed their final outcome using the following criteria:

Successful nests had some or all of the following signs:

- a large area of trampled and urea-burnt vegetation,
- flimsily constructed chick nests near the original nest,
- small pieces of down scattered around,
- a large and healthy chick that appeared about ready to fledge.

Unsuccessful nests had some or all of the following signs:

- large pieces of eggshell seen in or around the nest,
- nests were overgrown,
- nest had chick bones present,
- nest had a recently dead chick.

Once all the previous season's nests had been found and assessed, the metal nest tags were removed, along with 400 of those from earlier years' nests.

Between 16 January and 18 February 1998, 16 day trips were made to the study area and the bands of all banded birds encountered in or near the study area were read, any unbanded nesting birds were banded with both metal and red darvic bands, any already metal-banded study area birds had red darvic bands put on them, and nests were marked with numbered metal tags and their positions mapped using compass and tape measure.

On 16 February 1998 the number of nests with eggs in the Fly Basin Square was counted by strip-searching the area and painting the ground beside each nest after it had been counted. In November 1998, nesting success in this low and sheltered area will be measured and compared with that in the higher, more exposed main study area.

2.2 RESULTS

2.2.1 Breeding success

From 213 nests in the study area in 1997, 146 chicks were banded in November 1997, of which 144 (68%) fledged. Table 1 presents breeding success figures for the last 6 years.

In February 1998, 223 new nests were tagged and mapped (Fig. 2) and their nesting success will be assessed next summer. Seven of these nests had failed before the last visit to the study area on 18 February (Appendix 1).

On 16 February 1998, 248 nests were counted in Fly Basin Square, and the outcome of these nests will be assessed in December 1998. Because nests were counted here five weeks after the mean laying date, the original number of occupied nests will be extrapolated using the egg-loss rate over the same period in the main study area.

TABLE 1. BREEDING SUCCESS OF GIBSON'S WANDERING ALBATROSS NESTING IN THE STUDY AREA ON ADAMS ISLAND SINCE 1994.

YEAR	NO. OF NESTS MONITORED	BREEDING SUCCESS (%)
1991	88	67
1993	139	78
1994	122	68
1995	191	63
1996	221	61
1997	213	68
Average		68%

2.2.2 Adult mortality

In 1998, 223 pairs of birds nested within the study area. Of these, 55 were new birds that were banded for the first time, and eight were not checked for bands, either because the nest failed before the bands of both partners had been read, or because the nest was found too late in the trip to read the bands of both partners. In addition the bands of 32 non-breeding birds that were visiting the study area were read.

Adult survival was estimated using the methods of Cormack (1964, 1972), which reliably estimate annual survival only for periods more than two years before the last visit to the island (Table 2).

2.2.3 Recruitment

In December 1994, 26 of the chicks in the study area were banded, and since then all chicks produced in the study area have been banded before fledging (Table 3). On 14 February 1998, the first of the banded chicks was recorded alive back in the study area, four years after it was banded and only 150 m from its natal nest.

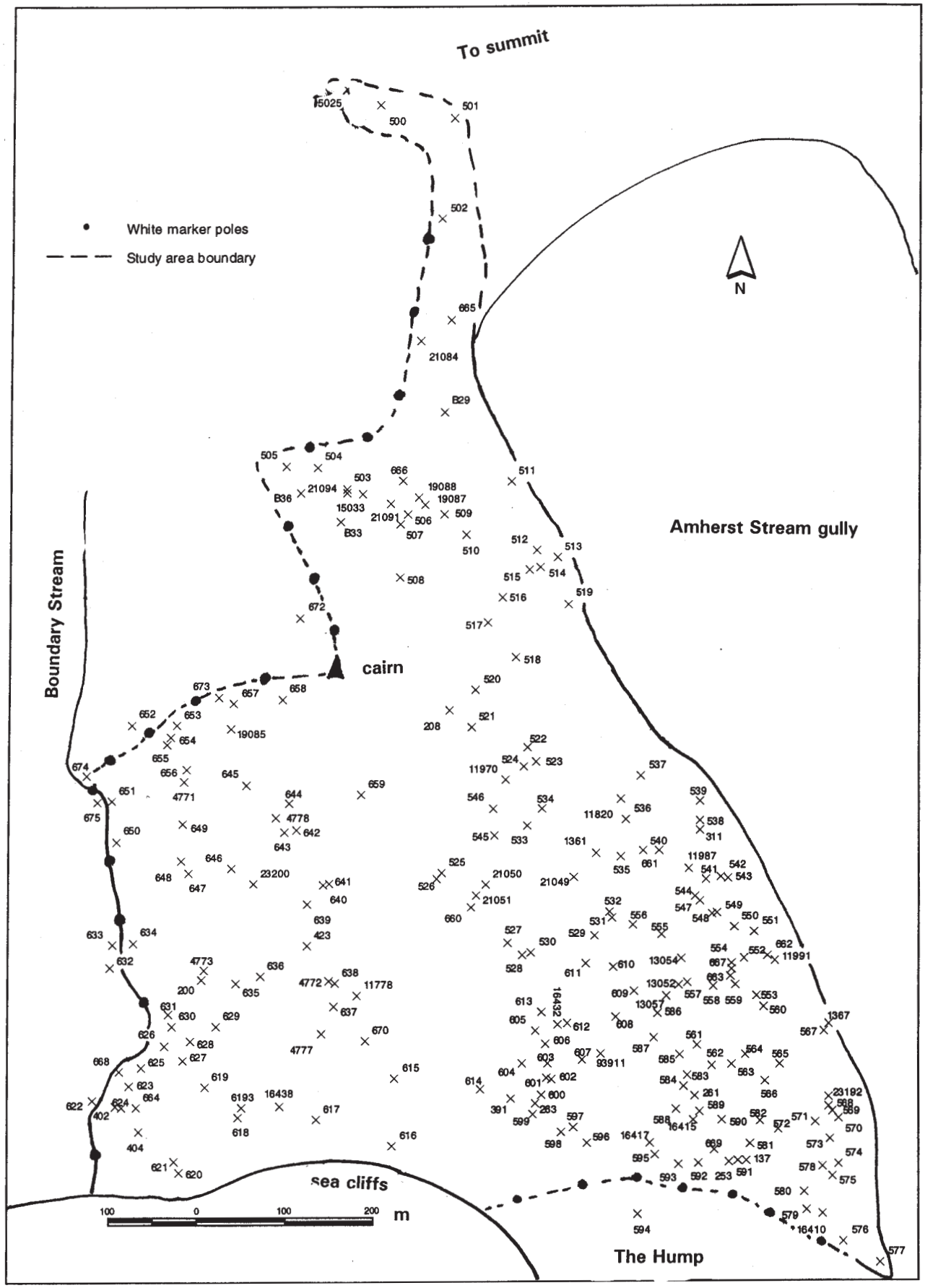

Figure 2. Gibsons wandering albatross nests in the main study area on Adams Island in 1998.

TABLE 2. ESTIMATED ANNUAL SURVIVAL OF ADULT GIBSON'S WANDERING ALBATROSSES RETURNING TO THE STUDY AREA ON ADAMS ISLAND. STANDARD ERRORS ARE IN BRACKETS.

YEAR	ALL BIRDS	KNOWN MALES	KNOWN FEMALES
1991-93	0.96 (0.02)	0.98 (0.02)	0.95 (0.03)
1993/94	0.97 (0.02)	0.98 (0.02)	0.95 (0.03)
1994/95	0.99 (0.01)	1.00 (0.01)	0.99 (0.02)
1995/96	0.98 (0.02)	0.99 (0.02)	0.98 (0.03)
Average	0.98 (0.01)	0.99 (0.01)	0.97 (0.02)

TABLE 3. FLEDGLING GIBSON'S WANDERING ALBATROSSES BANDED ON ADAMS ISLAND 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	
Total	413	694

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

The average age of first return is likely to be about 6 years old, and the average age of recruitment to the breeding population about 11.5 years: reliable estimates of recruitment are some time off.

3. Population trends

Collecting information on population size in a deferred breeding species such as the wandering albatross is slow, since birds return to breed only once every 2–3 years. Between 1991 and 1997 a series of annual whole-island counts were carried out. Results from these show that each year an average of 5831 pairs bred on the island. As this is a reasonable estimate of the total population size, future counts are expected to be mostly of only a representative portion of the island and will be intended to monitor population change rather than assess population size.

3.1 METHODS

Four representative areas were chosen for future census work. Two ridges on the northern side of the island, Rhys's Ridge and Magnetic Ridge (Fig. 1) are typical of the low-density albatross nesting areas found on much of the island. The area between Amherst Stream and Astrolabe basin, including the main study area and an area called The Hump (Fig. 1), supports a medium–high density of albatross nests, while Fly Basin Square contains a high density of albatross nests.

The two northern ridges are well defined and their albatross colonies discrete, though they include some areas not worth counting as they have no albatrosses. These include very steep areas; bare areas above 500 m a.s.l.; and areas of tall tussock and *Dracophyllum* and *Coprosma* scrub below 300 m on Magnetic Ridge and below 200 m on Rhys's Ridge.

The other two census blocks are part of much larger albatross colonies. Fly Basin Square was marked using white electric fence poles as previously described. The Amherst–Astrolabe block is defined on the east by Amherst Stream, on the south by the sea cliffs, on the north by fellfield unsuitable for nesting, and on the west by a line of white electric fence poles placed at approximately 50 m intervals in a line from the obvious indentation in the coast along the rather indefinite boundary between the Astrolabe and Boundary Stream catchments (Fig. 2).

In addition to these areas, a small area called 'Astrolabe extension', to the west of the Amherst–Astrolable block, was counted this season. This area includes all the land between the new electric-fence-pole marked western boundary of the Amherst–Astrolable block, and a boundary used for counting in previous years, and was counted to enable comparison between counts.

Each block was counted by two observers walking 20 m apart, up and down the block, parallel to the longest boundary. The person on the edge of the uncounted land marked the boundary with spray paint, and the observers followed back along this line on the subsequent 'sweep'. Once a nest had been counted, a mark was made with spray paint on the ground nearby. Most birds on nests were checked for bands, and all nests were checked for eggs. Most birds on the ground without nests were also checked for bands. The location of all banded birds was recorded, along with a Gibson Plumage Score (Gibson 1967).

Once each area had been counted the reliability of the census was checked by walking straight transects along compass bearings at right angles to the census sweep lines, checking all nests within 5 m of the transect for paint marks which indicated that the nest had been counted.

3.2 RESULTS

A total of 914 nests were counted in the four representative areas (Table 4). Counts in three of these areas are comparable with counts undertaken in previous years (Table 5).

TABLE 4. GIBSON'S WANDERING ALBATROSS NEST CENSUS RESULTS, ADAMS ISLAND, 1998.

Locality	Date	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
Amherst–Astrolabe											
Study area (SA)		-	19	-	-	-	-	-	-	-	213
The Hump	5 Feb 98	1:24	2	28	14	1	1	44	2	15	29
SA–Astrolabe	1,3-5 Feb 98	19:14	7	228	65	3	3	299	6	68	231
Astrolabe ext.	20 Feb 98	4:14	5	102	39	2	0	143	2	39	104
Rhys's Ridge	25 Jan 98	14:54	2	58	13	0	0	71	0	13	60
Magnetic Ridge	10 Feb 98	13:44	1	29	33	0	0	62	0	33	29
Fly Basin Square	16 Feb 98	9:42	7	248	149	0	0	397	0	149	248
Totals		61:92	24	693	313	6	4	1016	10	317	914

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

TABLE 5. COMPARISON OF NUMBERS OF WANDERING ALBATROSS NESTS IN THREE REPRESENTATIVE AREAS ON ADAMS ISLAND BETWEEN 1991 AND 1998.

LOCALITY	BLOCK NO.	1991	1993	1994	1995	1997	1998
Amherst–Astrolabe							
Study area	1		146	134	182	213	223
The Hump	2				29	28	29
Study area–Astrolabe	3						231
Astrolabe extension	3a					308[d]	104
Astrolabe	4	1056[a]	908[b]	915[b]	1147[c]	873	934[e]
Subtotal		1056	1054	1049	1358	1422	1521
Magnetic Ridge	26	15			22	34	29
Rhys's Ridge	28	43			44	60	60

[a] Includes Blocks 1–4. [b] Includes Blocks 2–4. [c] Includes Blocks 3–4. [d] Includes Blocks 3 + 3a.
[e] Extrapolated from 1997 counts.

In the transect checks, 96 nests were counted again, and no unpainted nests were found, indicating the original count was very accurate and recorded all the nests that were present. The transect checks included between 9% and 31% of the nests in a block (Table 6).

TABLE 6. CENSUS RELIABILITY TRANSECT CHECKS OF MARKED WANDERING ALBATROSS NESTS ON ADAMS I.

LOCALITY	BLOCK	DATE OF TRANSECT	NO. NESTS COUNTED, TRANSECTS	PERCENTAGE MARKED	TOTAL NESTS COUNTED IN BLOCK	PERCENTAGE OF COUNT SAMPLED
Hump	2	5 Feb 98	9	100	29	31.0
Study area to Astrolabe	3	5 Feb 98	38	100	231	16.5
Study area to Astrolabe extension	3a	20 Feb 98	17	100	104	16.3
Fly Basin	6	16 Feb 98	23	100	248	9.3
Magnetic ridge	26	20 Feb 98	2	100	29	6.9
Rhys ridge	28	25 Jan 98	7	100	60	11.7

4. Acknowledgements

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Appendix 1

BIRDS AT STUDY AREA NESTS, ADAMS I., FEB 1998

NEST	FEMALE		MALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
137	48092	Red-155	49654	Red-322	
200	46425	Red-350	42916	Red-242	Close to rocky outcrop
208	46444	Red-046	42875	Red-372	
253	47004	Red-417	47050	Red-176	
261	47006	Red-414	43097	Red-171	
263	43000	Red-423	46809	Red-194	
311	49574	Red-092	47041	Red-491	
391	46830	Red-193	46663	Red-187	
402	49669	Red-440	48096	Red-227	Next to stream
404	46653	Red-226	46799	Red-439	Not far from Boundary Creek
423	46497	Red-253	42912	Red-459	
500	48071	Red-278	49553	Red-003	
501	49554	Red-361	47035	Red-005	
502	43001	Red-362	42979	Red-007	
503	42609	Red-279	42610	Red-013	
505	46436	Red-017	42888	Red-280	
506	46650	Red-028	46624	Red-284	
507	42890	Red-285	46468	Red-029	
508	46781	Red-286	43010	Red-030	
509	43003	Red-484	43004	Red-031	
510	46446	Red-369	43068	Red-032	
511	49556	Red-287	47548	Red-034	
512	42975	Red-288	43047	Red-036	
513	47552	Red-037	48073	Red-371	
514	49250	Red-289	47590	Red-038	
515	43070	Red-370	43045	Red-039	
516	49680	Red-485	48089	Red-040	
517	46676	Red-290	46783	Red-041	
518	47553	Red-291	49563	Red-042	
519	46447	Red-292	46517	Red-043	
520	47037	Red-486	43050	Red-044	
521	42880	Red-293	46470	Red-045	
522	42901	Red-487	140-25115	Red-047	
523	46411	Red-295	43076	Red-048	
524	48090	Red-049	49651	Red-296	
525	47561	Red-058	47578	Red-376	
526	47303	Red-059	49681	Red-497	Deserted nest after banding
527	42628	Red-064	42627	Red-378	
528	49583	Red-379	42725	Red-065	
529	46672	Red-299	46752	Red-071	
530	47304	Red-067	49652	Red-298	
531	42854	Red-072	46450	Red-488	
532	48088	Red-381	49580	Red-073	
533	42621	Red-383	42720	Red-075	

NEST	FEMALE		MALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
534	42721	Red-294	42622	Red-076	
535	42728	Red-384	42634	Red-078	
536	47040	Red-386	49572	Red-080	
537	47305	Red-083	49657	Red-387	
538	49592	Red-490	47306	Red-084	
539	42637	Red-388	42636	Red-087	
540	43093	Red-093	43014	Red-492	
541	49653	Red-302	47307	Red-095	
542	43082	Red-303	46503	Red-097	
543	49578	Red-101	47044	Red-390	
544	43059	Red-102	46523	Red-304	
545	46662	Red-375	46786	Red-053	Rape Gully
546	46460	Red-374	42876	Red-052	Egg damaged during handling
547	49579	Red-103	47045	Red-305	
548	47308	Red-104	49658	Red-391	
549	43060	Red-493	42641	Red-105	
550	49591	Red-352	47309	Red-107	
551	42643	Red-110	42733	Red-392	
552	43087	Red-112	46504	Red-393	
553	48079	Red-307	46518	Red-115	
554	49593	Red-394	47047	Red-117	
555	43084	Red-396	46453	Red-120	
556	46751	Red-309	42882	Red-121	
557	46455	Red-310	46506	Red-124	
558	49597	Red-494	47504	Red-125	
559	46466	Red-127	43089	Red-399	
560	46456	Red-496	42951	Red-128	
561	46403	Red-311	46402	Red-130	
562	42906	Red-131	47008	Red-411	
563	42957	Red-132	46509	Red-410	
564	42956	Red-312	46526	Red-133	
565	47506	Red-134	43096	Red-400	
566	49600	Red-135	42958	Red-129	
567	42953	Red-313	46527	Red-136	
568	42737	Red-316	42650	Red-139	
569	46803	Red-140	46755	Red-401	
570	46756	Red-318	47001	Red-141	
571	42740	Red-319	42653	Red-142	
572	43019	Red-402	47599	Red-143	
573	46757	Red-403	46806	Red-146	
574	42655	Red-147	42742	Red-404	
575	42961	Red-148	47521	Red-455	
576	42745	Red-149	42658	Red-405	
577	42746	Red-150	42659	Red-407	Way down the bank
578	42652	Red-320	42739	Red-152	
579	46407	Red-153	46464	Red-321	
580	46511	Red-154	46406	Red-518	On top of rock outcrop
581	49668	Red-408	48093	Red-157	
582	46401	Red-158	42907	Red-409	
583	47007	Red-159	47051	Red-412	In hillocks
584	46508	Red-163	42960	Red-162	
585	42970	Red-323	46568	Red-164	

NEST	FEMALE		MALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
586	46826	Red-165	46523	Red-304	
587	47009	Red-413	47052	Red-167	
588	42908	Red-325	46408	Red-170	
589	46760	Red-172	46805	Red-326	
590	42750	Red-174	42664	Red-327	
591	47003	Red-416	29204	Red-175	Metal right, darvic left
592	47005	Red-328	42859	Red-177	Base of Hump
593	42667	Red-178	42752	Red-329	Base of Hump
594	42789	Red-182	42673	Red-419	On Hump outside study area
595	47010	Red-330	42666	Red-181	Base of Hump
596	42964	Red-331	49585	Red-183	Base of Hump
597	46417	Red-420	46494	Red-192	
598	42999	Red-421	42881	Red-184	
599	47015	Red-422	42685	Red-185	Old tag B123
600	47014	Red-332	42798	Red-195	
601	47513	Red-334	42868	Red-197	
602	46474	Red-335	46415	Red-200	
603	46828	Red-336	42680	Red-201	
604	47013	Red-424	48094	Red-202	
605	43054	Red-203	43053	Red-425	
606	47053	Red-426	47012	Red-204	
607	46493		46414	Red-427	
608	46525	Red-338	49588	Red-207	
609	47046	Red-208	46524	Red-340	
610	47563	Red-428	47592	Red-209	
611	43055	Red-210	46472	Red-429	
612	42683	Red-212	42792	Red-211	
613	46810	Red-431	46829	Red-214	
614	47054	Red-215	47016	Red-432	
615	46800	Red-433	42883	Red-216	In blow-back area
616	46418	Red-341	46529	Red-217	On the edge
617	46419	Red-434	42909	Red-218	Near stream
618	48095	Red-220	49660	Red-436	
619	47539	Red-343	47514	Red-223	
620	46514	Red-437	46531	Red-224	On bottom edge
621	47056	Red-438	47018	Red-225	On bottom edge
622	42766	Red-344	42695	Red-228	Outside study area
623	49670	Red-441	47536	Red-230	
624	42767	Red-345	42696	Red-229	
625	48097	Red-231	47532	Red-442	Beside Boundary Stream
626	46515	Red-232	46423	Red-443	Beside Boundary Stream
627	42699	Red-445	42796	Red-233	
628	46424	Red-234	46533	Red-348	
629	46426	Red-446	46516	Red-236	Close to rocky outcrop
630	42705	Red-349	42773	Red-237	
631	42706	Red-447	42774	Red-238	
632	49671	Red-448	46730	Red-239	Just outside Boundary Creek
633	47025	Red-451	47535	Red-240	Just outside Boundary Creek
634	47584	Red-241	42920	Red-449	Close to Boundary Stream
635	42776	Red-244	42708	Red-500	
636	42919	Red-245	46428	Red-454	
637	46438	Red-456	42910	Red-247	

NEST	FEMALE		MALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
638	42911	Red-251	46440	Red-458	
639	46430	Red-254	42913	Red-460	
640	42793	Red-461	47064	Red-255	
641	49673	Red-462	48099	Red-256	
642	46499	Red-354	46433	Red-257	
643	47061	Red-258	47024	Red-463	
644	46431	Red-260	42914	Red-465	Removed Australian band 140-39876 to make way for darvic
645	49674	Red-466	46766	Red-261	Amongst rocks
646	46774	Red-467	46582	Red-262	
647	49675	Red-468	48100	Red-263	
648	46520	Red-356	46442	Red-264	
649	49676	Red-469	49247	Red-265	
650	49677	Red-470	49248	Red-266	Right on Boundary Creek
651	47062	Red-471	47027	Red-267	Right on Boundary Creek
652	47545	Red-268	47581	Red-472	Just above study area
653	47031	Red-357	49249	Red-269	Just inside study area
654	47030	Red-270	46631	Red-473	
655	49678	Red-474	30489	Red-271	Metal band on right leg
656	46598	Red-358	46780	Red-272	
657	47033	Red-275	49679	Red-476	
658	46673	Red-477	46765	Red-276	Near top cairn
659	46661	Red-478	49567	Red-277	
660	48082	Red-057	47579	Red-377	Bottom of Rape Gully
661	49575	Red-079	42980	Red-385	
662	46668	Red-114			Egg 22 Jan 98. 18 Feb 98 egg broken, adult gone
663	47048	Red-308	49595	Red-126	
664			49655	Red-347	Egg broken, no adult 9 Feb 98.
665	49555	Red-363	46621	Red-502	
666	49587	Red-367			9 Feb 98 broken egg, no adult
667	49659	Red-395	49687	Red-505	
668	47019	Red-504	47057	Red-519	
670	43052	Red-510			
672	49684	Red-511	42871	Red-499	Outside study area, NW of cairn
673	49683	Red-506	49682	Red-498	
674	47544	Red-514	47520	Red-450	On creek boundary, top of study area
675	49685	Red-554	47026	Red-453	Outside study area, beside Boundary Stream
1361	43086	Red-489	46467	Red-077	
1367	42952	Red-137	46457	Red-314	
4771	46435	Red-475	46500	Red-273	
4772	47585	Red-252	47034	Red-353	
4773	43064	Red-243	42989	Red-452	Close to rocky outcrop
4777	49656	Red-351	48098	Red-246	
4778	46432	Red-464	42915	Red-259	
6193	46610	Red-435	46775	Red-221	
11778	46606	Red-457	43062	Red-250	
11820	46670	Red-082	46787	Red-300	
11970	48075	Red-373	47556	Red-050	Head of Rape Gully
11987	49577	Red-389	47043	Red-094	

NEST	FEMALE		MALE		COMMENTS
	METAL 'R' BAND	DARVIC	METAL 'R' BAND	DARVIC	
11991	42855	Red-306	42918	Red-113	
13052	42852	Red-397	43094	Red-123	
13054	46667	Red-122	46602	Red-495	
13057	49688	Red-507	49689	Red-512	
15033	46459	Red-022	43042	Red-483	
16410	47310	Red-151			4 Feb 98 egg broken, bird gone
16415	42672	Red-173	42754	Red-415	
16417	47527	Red-179	42900	Red-418	
16432	42790	Red-430	42681	Red-213	
16438	46608	Red-219	46763	Red-342	
19085	42917	Red-274	46479	Red-359	
19087	43067	Red-368	46501	Red-027	
19088	42873	Red-283	42715	Red-026	
21049	42896	Red-382	43005	Red-074	
21050			42626	Red-054	11 Feb 98 Egg broken, adult gone. Non-return of partner
21051	42878	Red-297	46471	Red-055	Rape Gully
21084	46793	Red-364	43039	Red-010	
21091	42783	Red-282	42608	Red-025	
21094	42612	Red-366	42611	Red-021	
23192	46754	Red-315	43018	Red-138	
23200	49686	Red-560	46794	Red-355	
93911	46475	Red-337	42904	Red-206	Egg shell 2m from nest, failed
Astrolabe1	42614				Astrolabe, on egg, 200 m from study area
Astrolabe2			46532		Astrolabe, 400 m from study area
B29	49557	Red-365	43040	Red-012	
B33	42895	Red-023	42972	Red-481	
B36	43041	Red-020	47569	Red-482	
Hump1	42965				Hump block, on egg, 150 m outside study area
Hump2			140-41394		Hump, beside nest with egg, 200 m outside study area