Survey and monitoring of black petrels on Great Barrier Island 1997

SCIENCE FOR CONSERVATION: 78

Elizabeth A. Bell and Joanna L. Sim

Published by
Department of Conservation
P.O. Box 10-420
Wellington, New Zealand

Science for Conservation presents the results of investigations by DoC staff, and by contracted science providers outside the Department of Conservation. Publications in this series are internally and externally peer reviewed.

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ISSN 1173–2946
ISBN 0-478-21707-2

This publication originated from work done under Department of Conservation Investigation no. SCO 3082, carried out by Elizabeth Bell, Wildlife Management International Ltd, PO Box 14-492, Wellington, and Joanna Sim, SPREP, PO Box 240, Apia, W Samoa. It was approved for publication by the Director, Science and Research Division, Science Technology & Information Services, Department of Conservation, Wellington.

Cataloguing in Publication
Bell, Elizabeth Anne.
Survey and monitoring of black petrels on Great Barrier Island 1997/ Elizabeth A. Bell and Joanna L. Sim. Wellington, N.Z. : Dept. of Conservation, 1998
1 v. ; 30 cm. (Science for conservation, 1173–2946 ; 78.)
Includes bibliographical references.
ISBN 0478217072
1. Procellaria parkinsoni. 2. Petrels–New Zealand–Great Barrier Island. I. Sim, Joanna. II. Title. III. Series: Science for conservation (Wellington, N.Z.) ; 78.
598.42099324 20
zbn98-024861

CONTENTS

Abstract

The black petrel (*Procellaria parkinsoni*) is a vulnerable endemic seabird, which breeds only on Little and Great Barrier Islands, New Zealand. During late January and February 1997, within the main breeding area around the highest point on Great Barrier Island, Hirakimata (Mount Hobson), 100 burrows that had adults present were selected as long-term study burrows. The burrows were either accessible through the entrance or easily excavated to reach their contents. Eighty four of these burrows were used by breeding pairs, and the remainder by non-breeding adults. The three 1600 m^2 census areas set up in 1996 around the summit were monitored over the 1997 breeding season. A total of 54 burrows were located within the census grids and 36 were being used by breeding pairs. A preliminary estimate extrapolating from the grid burrows shows the population consists of 4500 breeding birds and at least 685 non-breeding birds.

Predation was noted in seven long-term study burrows, six eggs were either crushed or pushed out of the burrows by fighting adults, six eggs were infertile, and two eggs were also abandoned, with an overall breeding success rate of 75%.

There were 191 adults found in the long-term study burrows with 39 already banded and 152 banded this season. Another 26 adults (4 already banded) were caught at launch sites around the summit area. Sixty-nine chicks were banded (with 64 from the long-term study burrows). Most captured birds were weighed. The average adult weight at incubation was 775 g, the average weight of known non-breeders was 683 g and the average chick pre-fledging weight was 1076 g.

No direct evidence of long-line fishing effects was found in the Great Barrier Island breeding area, although one adult was found with a previously injured (now healed, but malformed) bill which is suspected to be an old fishing injury. Fishing industry observers have seen black petrel by-catch this season although many of the birds were released unharmed. It continues to be important to study the Great Barrier Island black petrels to determine the dynamics of the population, in particular survivorship, mortality, productivity and breeding success.

1. Introduction

A monitoring study of the black petrel (*Procellaria parkinsoni*) was conducted in the 1996–97 breeding season as a continuation of the previous season's preliminary work (Bell & Sim 1998). Changes in the previous year's aims have led to this study, which is the first collection of long-term data for determining the dynamics of the Great Barrier Island black petrel population. Regular monitoring of this population will help to determine the effects of long-line fishing, predation and habitat disturbance, provide a more accurate population

estimate, and ensure any population changes will be detected in sufficient time to implement conservation management strategies. In the future, this information can be used to determine any effects the long-line fishing industry might have on the population.

The smallest species of its genus, the black petrel is a vulnerable New Zealand endemic seabird (Collar *et al*. 1994, Imber 1987). Previously widespread on the North Island and northwestern South Island ranges, black petrels now only occur on Little and Great Barrier Islands (Imber 1976, 1987; Scofield 1989).

On Great Barrier Island, black petrels are generally found in forested areas over 300 m above sea level, with the main breeding area around the highest point, Hirakimata (Figure 1, Imber 1987). Breeding success is affected by rat and cat predation (Imber 1987, Scofield 1989) with possible impact by the domestic and foreign long-line fishing industry.

2. Objectives

This study aims to provide data to establish current population trends of the Great Barrier Island black petrel, and to determine causes and timing of mortality.

In summary, the objectives are:

1. To select up to 100 burrows with adults present as long-term study burrows. Band all adults present in the burrows (when possible) during the first monitoring session and all the remaining fledgling chicks during the April visit.
2. To determine breeding success in the long-term study burrows. Causes of breeding failure, such as predation or disappearance of parents, are to be noted.
3. To monitor the three census areas established in 1996 in different parts of the main black petrel breeding area on Great Barrier Island. Band and recapture as many breeding and non-breeding birds present as possible. Produce a population estimate by extrapolating from the grid areas to the main Hirakimata breeding area.
4. If possible, to search other areas thought to be suitable for black petrel breeding.

3. Methods

The three census areas were set up along the Palmers, Kauri Dam and South Fork Tracks around Hirakimata during the 1996 black petrel breeding season (Bell & Sim 1998; Figure 2). These census grids were re-surveyed to locate any

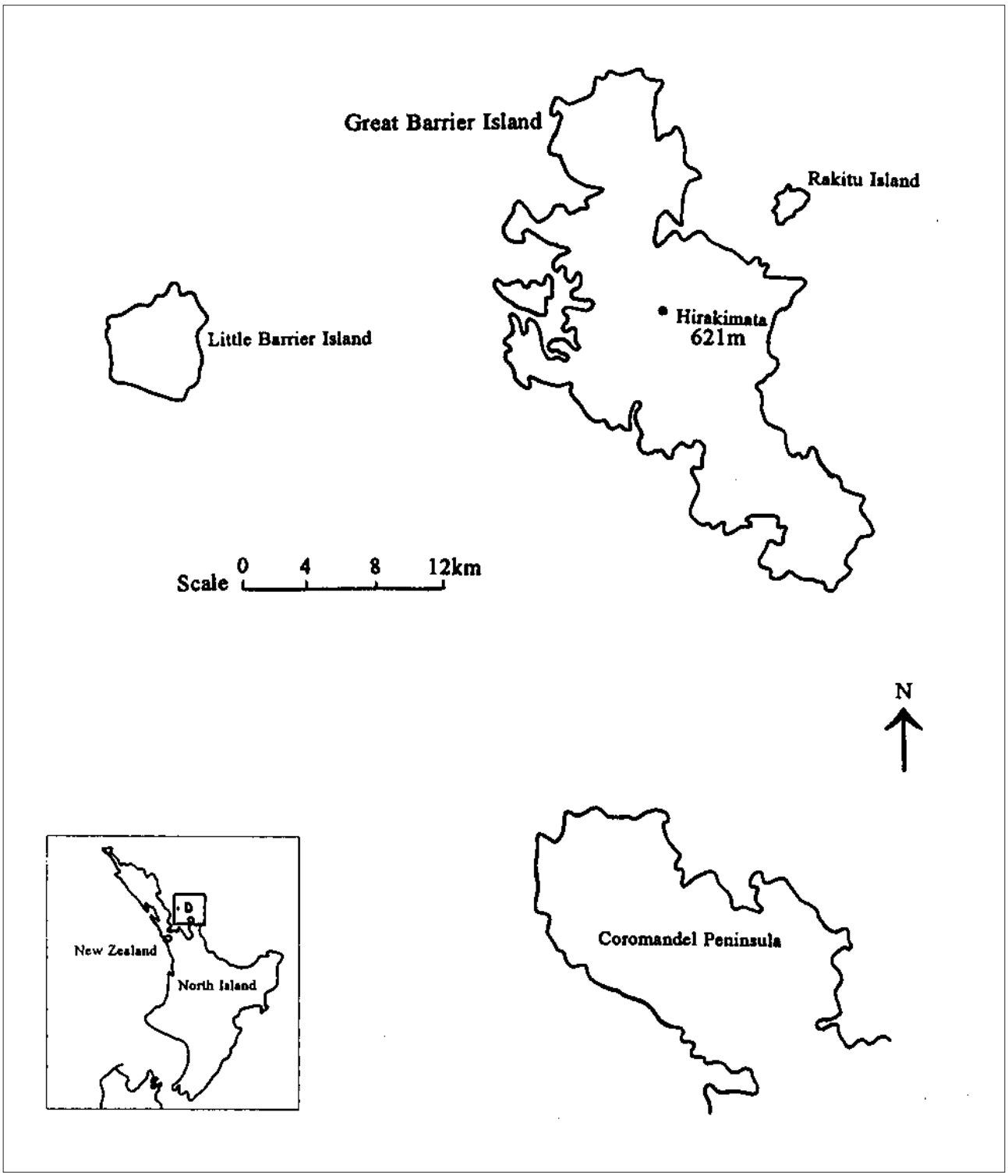

FIGURE 1. LOCATION OF GREAT BARRIER ISLAND.

new burrows, and the previous year's burrows were checked by Dr Mike Imber to ensure consistency in burrow identification between the Great Barrier and Little Barrier Island populations. The results from the 1996 breeding season were updated for incorrectly identified burrows. The information gathered from the census grids was used to produce a population estimate for black petrels around the Hirakimata summit area (30 ha).

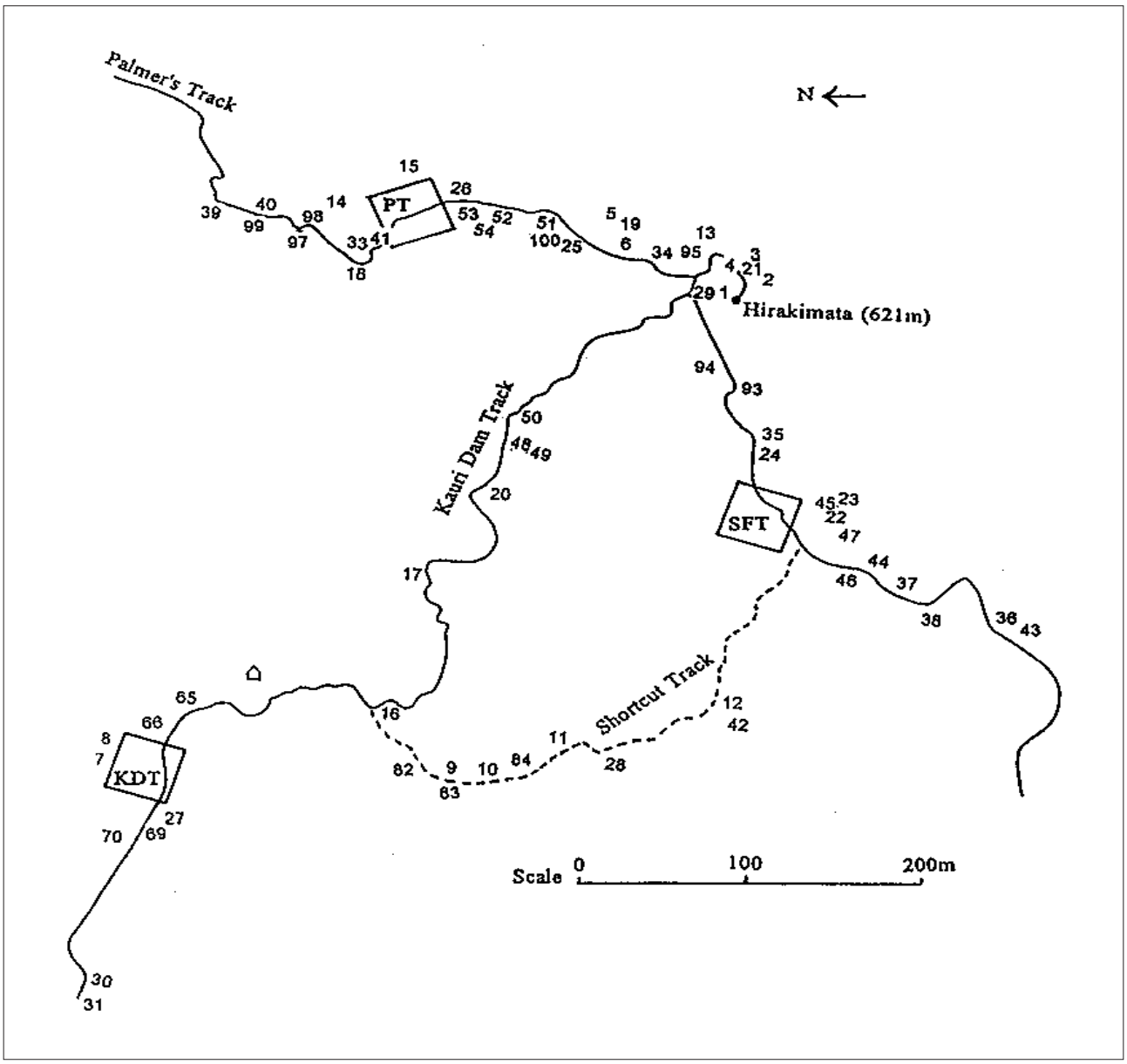

FIGURE 2. LOCATION OF THE BLACK PETREL CENSUS GRIDS ON GREAT BARRIER ISLAND AND 100 STUDY BURROWS. NOTE THAT PT GRID CONTAINS STUDY BURROWS 32, 55-64, 96; KD GRID STUDY BURROWS 67, 68, 71-81; AND SF GRID, STUDY BURROWS 85-92.

During late January and February, 100 study burrows were selected from burrows within the census grids and along the track system connecting the grid sites (Figure 2). These burrows were selected only if there was an adult or chick present, and were accessible either through the entrance or an easily excavated opening (this opening was sealed by a square of plywood and covered with soil, vegetation and leaf litter). Excluding those within the census grids, most of the study burrows were found approximately within 5 m of any track. During the first monitoring session, any adult present was removed from the burrow, banded and weighed. Any eggs or chicks in the burrows were noted, and the lack of eggs or chicks identified non-breeder birds. The study burrows were monitored in April and all remaining fledgling chicks were banded and weighed. This information was used to determine breeding success and to begin collecting long-term population dynamics data to determine survivorship, mortality, and productivity.

Rat traps were set during both visits, with bacon rind, lamb fat, or peanut butter used as bait. Rats were trapped around the hut. Observations were also made on feral cat and rat predation and pig rooting.

4. Results

A total of 54 burrows was found in the three census grids; 19 in Palmer's Track grid, 16 in South Fork Track grid and 19 in Kauri Dam Track grid (Table 1, Figure 2). Thirty six were breeding burrows and eleven non-breeding burrows.

TABLE 1. TYPE AND NUMBER OF BURROWS WITHIN THE CENSUS GRIDS.

	Kauri Dam		Palmers		South Fork		Total	
	1996[1]	1997	1996[1]	1997	1996[1]	1997	1996[1]	1997
Potential[2]	3	3	2	1	2	2	7	6
Empty[3]	3	0	2	0	1	1	6	1
Breeding	8	10	8	14	5	12	21	36
Non-breeding	2	6	3	4	3	1	8	11
Total	16	19	15	19	11	16	42	54

[1]These data (from Bell & Sim 1998) have been corrected after conversations with Dr Mike Imber with regards to burrow identification and type. This gives a corrected breeding success figure for 1996 (see Table 2).

[2]This is a burrow not used for breeding, but has been investigated or preliminarily dug out by a black petrel. Not used in breeding success estimate, but used in "usable" burrow estimate.

[3]These burrows have been used in previous seasons for breeding, but no activity this year. Data included in breeding success estimates.

TABLE 2. BREEDING SUCCESS AND CAUSES OF MORTALITY, LONG-TERM STUDY BURROWS

Number of burrows	100
Eggs - laid	84
- rat predation	7
- crushed/pushed out (fight)	5
- abandoned	2
- infertile	6
Chicks - hatched	64[2]
- died from disease (suspected avian pox)	1
- fledged[1]	63[2]
Overall breeding success	75%

[1]All chicks still present at the end-April visit. It is assumed all will fledge safely.

[2]Two chicks were found together in a burrow (98). It is assumed that one had become disoriented after practising outside and wandered into the closest burrow. Searches of the area did not locate its burrow. Only one chick was used in the breeding success estimate.

The 100 long-term study burrows were selected from the census grids and randomly along the tracks by the presence of adults during January and February. After monitoring, 84 were found to be breeding burrows and 16 were non-breeding burrows.

After the final monitoring check in February of the long-term study burrows, there were 6 eggs and 64 chicks remaining. Also two eggs had been abandoned, seven eggs predated by rats, five eggs crushed or pushed out of the burrow by fighting adults, and six infertile eggs had been laid. In April, 64 chicks were present (75% breeding success, Table 2).

As the long-term study burrows were accessible either through the entrance or the excavated opening, all adults present were caught, banded

(unless already banded) and weighed. There were 152 unbanded adults and 39 already banded adults. The average adult weight was 755 g, and the average weight of breeding adults was greater than non-breeding adults (775 g compared to 683 g, Figure 3).

During February, 30 adults were caught as they left from two launch sites (Kauri Dam launch rock and Hirakimata summit platform) and four birds were already banded. One of the adults caught at Kauri Dam launch rock was from a long-term study burrow.

In April, 64 chicks present in the long-term study burrows were also weighed. During this visit, other burrows were also surveyed around the Hirakimata area and any chicks located outside the study areas were also banded and weighed. The average weight of randomly aged chicks was 1076 g (138% of the breeding adult weight, range: 690–1500+ g). Figure 3 shows the weights of adults and chicks.

By extrapolating from the three census grids to the 30 hectare area around Hirakimata, the black petrel population is estimated at 5188 birds (Table 3). This is made up of 2250 breeding pairs (i.e. 4500 birds) and 688 non-breeding birds.

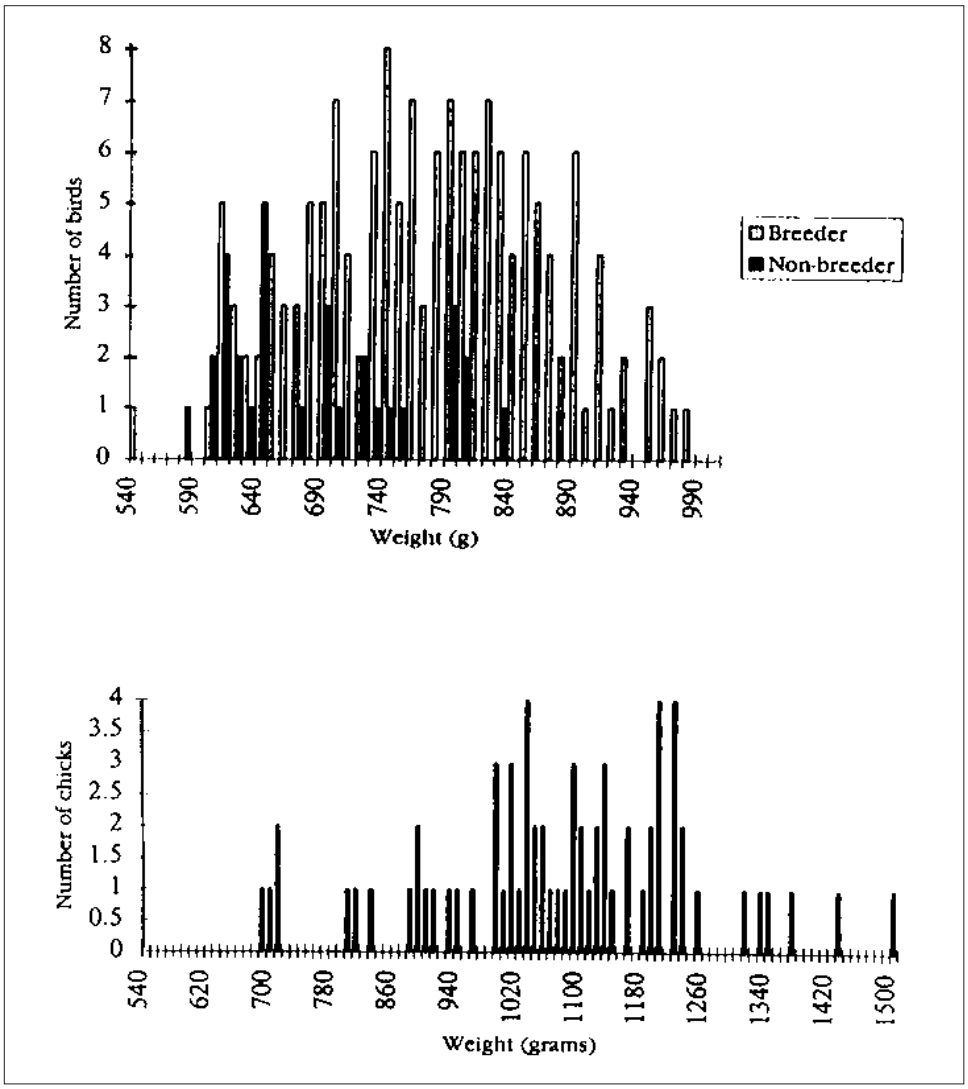

FIGURE 3. FREQUENCY DISTRIBUTIONS OF BLACK PETREL WEIGHTS, 1997. UPPER, ADULTS; LOWER, CHICKS.

TABLE 3. POPULATION ESTIMATE OF BLACK PETRELS AROUND THE HIRAKIMATA AREA.

	Density (birds/ha)		Total habitat size (ha)	Population estimate	
	Breeder pairs	Non-breeders[1]		Breeder pairs	Non-breeders
Corrected 1996 estimate					
Kauri Dam	50	12.5	10	500	125
Palmers	50	18.75	10	500	187.5
South Fork	31.25	18.75	10	312.5	187.5
Total	131.25	50	30	1312.5	500
Grand total (Breeders and non-breeders)[1]				3125	
1997 Estimate					
Kauri Dam	62.5	37.5	10	625	375
Palmers	87.5	25	10	875	250
South Fork	75	6.25	10	750	62.5
Total	237.5	68.75	30	2250	687.5
Grand total (Breeders and non-breeders)				5187.5 (5188)	

[1]The number of non-breeding birds is likely to be a minimum estimate as they migrate to South America in March. The census grids were increased to 1600 m^2 in April 1996 from the original 400 m^2 and any non-breeders previously present in the larger areas during February would have been missing in April searches.

Also extrapolating from the census grids, the "usable" burrow density was 113 burrows/ha. Of these, 75 burrows/ha are used for breeding, 23 burrows/ha for non-breeding, 2 burrows/ha were empty and 13 burrows/ha were potential burrows (i.e. a 1:6.5 ratio of empty/potential burrows to occupied burrows, or 1:3 ratio of non-breeder to breeder burrows).

Rat numbers were high. During late January and February, six rats were caught over thirteen nights, but in April no rats were caught. The ship rat, *Rattus rattus*, was the only species caught. In February, feral cat-predated corpses of two Cook's petrel (*Pterodroma cooki*) were found along the Tramline Track, but no other sign was found around the summit area. Pig sign was not seen.

People often visit Hirakimata over the black petrel breeding season. Around the study period in January and February, there were 1185 and 670 visitors, respectively, and in March there were 1071 people (with high numbers over the Easter break at the end of March). The petrels, even those with burrows directly adjacent to the track, did not appear to be disturbed by such high numbers of visitors.

5. Discussion

The three census areas established in 1996 were re-evaluated during the 1997 breeding season and the data were corrected. Several burrows in each grid were removed from the study, as they were now considered to be unlikely breeding burrows. In 1996, there were 42 burrows within the grids (21 breeding burrows, 8 non-breeding, 6 empty, and 7 potential) compared with 54 burrows in 1997 (36 breeding, 11 non-breeding, 1 empty, and 6 potential). Extrapolating from this, estimates of the Great Barrier Island black petrel population are from 3125 birds (in 1996) to 5188 (in 1997).

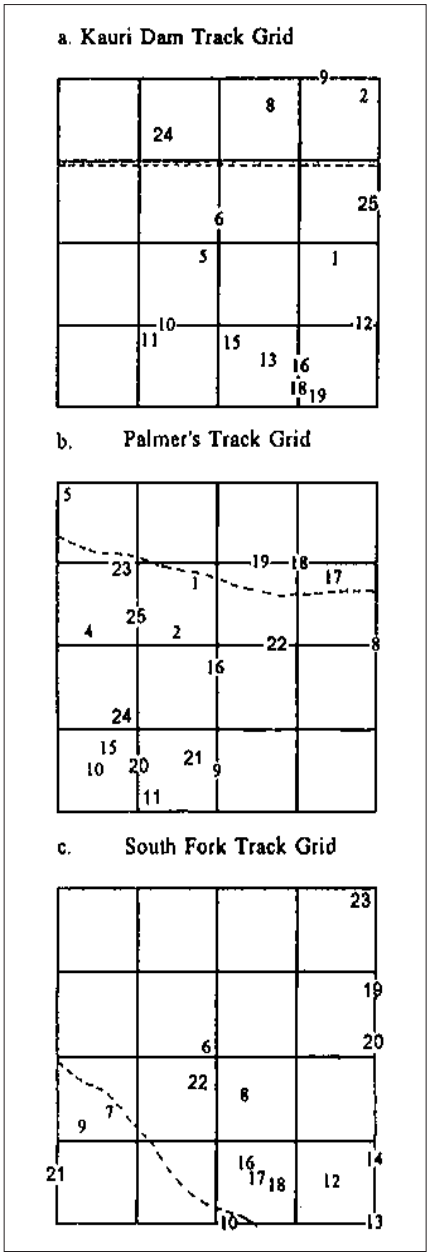

FIGURE 4. LOCATION OF THE BURROWS FOUND IN EACH GRID SITE (WITH NEW NUMBERS, AS IN APPENDIX 9.2).

After re-surveying the grids, the burrows were still found in clusters (Figure 4). Generally these burrows are in optimum habitat, with friable soil in easily accessible areas, with a close 'launch site'. In February 1997, burrows were occupied at a higher ratio (1:6.5) than found in previous studies. Imber (1987) and Scofield (1989) both had ratios of about 1:1 empty to occupied burrows.Also, the ratio of non-breeding burrows to breeding burrows was 1:3 compared with 1:1 from both Imber (1987) and Scofield (1989). The corrected 1996 data also give greater ratios than Imber and Scofield (1:3 non-breeding to breeding burrows and 1:2 empty to occupied burrows). The empty to occupied ratio in 1996 was much lower than in 1997. This difference in occupation rate is probably due to a higher number of returning birds in the 1997 breeding season. This was also apparent from the large number of calling birds during February (pers. obs.).

In 1997, one hundred long-term study burrows were selected. Several of these burrows were chosen from the previously identified census grid burrows and the track system "alphabet" burrows (Bell & Sim 1998). Eighty four of these burrows were used for breeding and the remainder were occupied by non-breeding birds. Seven eggs were lost by rat predation (8%), five were crushed by fighting adults (6%), two were abandoned (2%) and six were infertile (7%). One chick was also found dead inside a burrow; it was a suspected case of avian pox. This means an overall breeding success rate of 75% compared with 50% in 1977, 60% in 1978 (Imber 1987) or 62% in 1988–89 (Scofield 1989), so 1997 appears to have been a good breeding year despite a range of mortality factors.

The rat predation rate was larger than in the 1996 season (7% compared with 3%) and was twice as much as that found by Imber (1987) but similar to that of Scofield (1989). Although this is only a small percentage, rat predation could become much greater if the rat population continues to increase around the summit area. It is necessary to monitor changes to the rat population regularly. Rats were seen on occasion in the daytime and six rats were caught over both visits (in 13 nights). Scofield (1989) gave a rat index of one capture/98 trap nights, but we suspect this is lower than what

actually occurs. A further index using techniques from Cunningham & Moors (1993) should be completed in several areas around Hirakimata.

It was interesting to find five eggs crushed inside the burrow or pushed out of the burrow by fighting adults. There appeared to be some competition for optimum burrow sites this year. It was also noted that several different adults were caught in the same burrows. One burrow, for example, had five individuals present on different occasions. This may have been caused by disturbance, as the burrows were checked regularly, which may have scared potential partners away.

There were 191 adult black petrels found in the long-term study burrows, with 39 already banded. Most adults were weighed. The average adult weight (of all adults combined) was 755 g (compared with 770 g from Scofield 1989). The average weight for a breeding adult was 775 g compared with 683 g for a non-breeding bird. This difference is due to physical requirements for incubation and chick feeding. In April, 64 chicks were present in the study burrows, and all were banded and weighed. Five other chicks around Hirakimata were also banded and weighed. The average weight of randomly aged chicks was 1076 g. Although this is lighter than Scofield's maximum average weight from the 1988–89 season (i.e. 1201 g), it was taken on a single occasion from a range of chick development stages rather than from a continuous weighing regime over the entire growth period. The first fully feathered chick was located on 6 April.

Two Cook's petrels were predated by a feral cat during February, so a cat(s) must still be present around the black petrel breeding area. No cats were seen. Constant trapping over the breeding season (especially during fledging, May to June) occurs and should continue.

As in the 1996 breeding season, high numbers of visitors to the black petrel breeding area had little to no impact on the breeding success. The construction of raised walkways around the summit has decreased damage to the environment and to the burrows. Extra walkway construction is recommended, particularly on Palmer's (Windy Canyon) and Kauri Dam Tracks in places where erosion has increased. More interpretative material around the summit area (perhaps sited on the summit platform) would educate visitors about the habitat and black petrels, and deter them from littering or fouling the area.

There was no direct evidence of the effects of long-line fishing in this study, but one adult was found with a previously injured (now healed, although mal-formed) bill which is suspected to be an old fishing injury. Black petrel by-catch has been recorded in this season's domestic long-line fishing industry (Ian West, pers. comm.), and 11 adults were killed last year (Sandy Bartle, pers. comm.).

As black petrels (like most procelliforms) have delayed maturity, low reproduction rates, and high adult survivorship, any changes in adult numbers will affect the population greatly (Murray et al. 1993). The domestic long-line industry operates during the black petrel breeding season and any by-catch would greatly affect the population, particularly if the caught adult was foraging for food for a chick. Chicks cannot survive if only being fed by one adult. Continued black petrel by-catch will drastically affect this species. Long-term study of adult survivorship, mortality, productivity, and breeding success is needed to determine the overall effects of black petrel by-catch in the long-line fishing industry.

6. Recommendations

- Monitoring of the black petrel population (using the long-term study burrows) should continue at Great Barrier Island for at least a further four breeding seasons.

  This will ensure enough data will be collected for determining the population dynamics of black petrels, in particular survivorship, mortality and breeding success, and the effects of predation, long-line fishing and other environmental factors.

- The Great Barrier Island breeding population should be visited during October/November (for one to two weeks) to monitor pair bonding and pre-breeding behaviour. This would allow a large number of adults to be banded easily (and hence be identifiable), as the birds are generally outside burrows at this time. This could be established as a mark-recapture programme to determine a better population estimate.

- The January/February study session should remain five weeks long, as this gives a clearer picture of breeding behaviour and results, and the April period should remain as one week.

- Each year a rat index line should be completed to determine species present, total rat densities, and densities within distinct areas.

- Constant cat trapping over the black petrel breeding season, November to June, especially during pre-laying (November) and the fledging period (May to June), should continue.

- The walkway system should be continued down Palmer's (Windy Canyon) and Kauri Dam Track.

7. Acknowledgements

This project was funded by the fishing industry with a Conservation Services Levy via the Science and Research Division of the Department of Conservation. Phil Todd and Don Woodcock (DoC, Great Barrier Island) assisted with transport around Great Barrier and logistical support while in the field. Phil Todd, Tina Wyatt, Jennie Callesen, and Reg Cotter assisted in the field. Brian Bell read and commented on the manuscript. Dr Mike Imber (DoC) assisted in the field, gave advice on both field work and analysis, and provided useful comments on the manuscript.

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9. Appendices

9.1 DETAILS OF 100 STUDY BURROWS

Burrow	Adult		Outcome
	Band	Weight	
1	H-31266	850g	Chick, H31410, 1010g
	H-28558	790g	
2	H-27516	850g	Rat predation
	H-31210	790g	
3	H-31267	540g	Chick, H-31412, 890g
	H-31109	860g	
4	H-27542		Chick, H-31413, 1130g
	H-31234	890g	
5	H-31268	710g	Chick, H-31419, 1030g
	H-31207	840g	
6	H-31269	790g	Chick, H-31417, 900g
	H-31216	725g	
7	H-31272	890g	Chick, H-31447, 880g
	H-30854	905g	
8	H-31273	950g	Chick, H-31188, 1090g
	H-31103	910g	
9	H-31275	850g	Rat predation
	H-31145	890g	
10	H-31276	730g	Chick, H-31191, 1120g
	H-28217	810g	
11	H-31277	720g	Chick, H-31192, 1100g
	H-31294	840g	
12	H-31279	700g	Chick, H-31195, 710g
	H-31171		
13	H-31281	730g	Chick, H-31414, 1030g
	H-31298	900g	
14	H-31284	690g	Chick, H-31431, 1330g
	H-31202	680g	
15	H-31287	830g	Chick, H-31436, 930g
	H-31245	855g	
16	H-31296	785g	Non-breeder
17	H-31297	780g	Rat predation
	H-31108	860g	
18	H-31203	635g	Non-breeder
	H-31204	670g	
19	H-31208	760g	Infertile
	H-31162	770g	
20	H-31209	750g	Abandoned
21	H-31235	770g	Infertile
22	H-31214	720g	Non-breeder
23	H-31232	845g	Chick, H-31403, 1280g
	H-23024	760g	
24	H-31215	760g	Abandoned
	H-31142	650g	
25	H-31217	740g	Chick, H-31418, 1050g
	H-31166	700g	
26	H-31218	730g	Chick, H-31423, 1340g
	H-23014	830g	
27	H-31222	810g	Chick, H-31182, 1160g
	H-31146	870g	

Burrow	Adult		Outcome
	Band	Weight	
28	H-31232	755g	Chick, H-31193, 1080g
	H-31114	865g	
29	H-30859	650g	Chick, H-31409?,1110g
	H-28204	700g	
30	H-31236	820g	Chick, died
	H-31149		
31	H-31237	810g	Chick, H-311449, 1500g
	H-31101	785g	
32	H-31126	610g	Non-breeder
33	H-31244	685g	Chick, H-31432, 1220g
	H-31123	605g	
34	H-31248	610g	Chick, H-31416, 960g
	H-31121	680g	
35	H-31249	670g	Chick, H-31441, 1230g
	H-13641	915g	
36	H-31106	800g	Chick, H-31197, 830g
	H-31129	890g	
37	H-31107	610g	Chick, H-31199, 1370g
	H-31144	760g	
38			Chick, H-31198, 1040g
39	H-31110	740g	Chick, H-31425, 1250g
	H-28591	660g	
40	H-31111	615g	Chick, H-31427, 1160g
	H-31122	640g	
41	H-31112	610g	Non-breeder
42	H-31115	700g	Chick, H-31194, 1220g
	H-31140	620g	
43	H-31116	745g	Chick, H-31196, 1430g
	H-31143	750g	
44	H-31130	795g	Non-breeder
	H-31139		
45	H-31117	630g	Chick, H-31402, 990g
46			Chick, H-31200, 1200g
47	H-31131	970g	Chick, H-31401, 1190g
	H-31138	760g	
48	H-26991	690g	Non-breeder
49	H-31243	670g	Chick, H-31440?, 1050g
	H-31133		
50	H-31256	820g	Chick, H-31411, 1310g
	H-31282	845g	
51	H-31289	700g	Non-breeder
	H-31290	795g	
52	H-31255	670g	Chick, H-31421, 1030g
	H-31288	830g	
53	H-31135	610g	Chick, H-31422, 940g
	H-30884	660g	
54	H-31150		Non-breeder

Burrow	Adult		Outcome
	Band	Weight	
55	H-30258	740g	Infertile
	H-31285	790g	
56	H-31151	810g	Rat predation
	H-31152	695g	
57	H-31136	655g	Rat predation
	H-31153	740g	
58	H-31219	630g	Chick, H-31433, 700g
	H-31137	820g	
59	H-31220	610g	Chick, H-31434, 1200g
	H-31125	795g	
60	H-28584	820g	Chick, H-31437, 1090g
	H-31246	805g	
61	H-30878	820g	Chick, H-31438, 1070g
	H-31113	740g	
62	H-30257	710g	Chick, H-31439, 1220g
	H-31288	690g	
63	H-31206	740g	Chick, H-31424, 1060g
	H-31247	835g	
64	H-30861	875g	Chick, H-31435, 1230g
	H-31286	825g	
65	H-27548	620g	Infertile
	H-27535	750g	
66	H-31264	740g	H-31250, 730g, (4 birds)
	H-31221	690g	H-31133, 580g
67	H-31270	610g	Non-breeder
	H-31271	600g	
68	H-30866	710g	Crushed
	H-31154	675g	
69	H-27604	800g	Crushed
	H-31240		
70	H-31292	830g	Chick, H-31183, 1200g
	H-27665	910g	
71	H-31241		Non-breeder
	H-31242		
72	H-31293	840g	Chick, H-31184
	H-31155	635g	
73	H-31300	790g	Chick, H-31186, 1190g
	H-28572	800g	
74	H-31223	785g	Rat predation
	H-31102	885g	
75	H-31147	640g	Non-breeder
76	H-31224	610g	Non-breeder (3 birds)
	H-27702	635g	H-31164, 600g
77	H-31274	690g	Chick, H-31448, 890g

Burrow	Adult		Outcome
	Band	Weight	
78	H-31141	775g	Chick, H-31185, 990g
	H-31163	860g	
79	H-30857	800g	Chick, H-31189, 1130g
	H-13618	980g	
80	H-31225	950g	Chick, H-31446, 1090g
	H-31104	740g	
81	H-31252	780g	Chick, H-31181, 1010g
	H-27666	730g	
82	H-31253	870g	Chick, H-31190, 1140g
	H-30889	680g	
83	H-31127	685g	Crushed, but infertile
	H-31156	790g	H-31170
84	H-31105	680g	Crushed; H-28551, 690g
	H-31128	715g	H-31165, 660g; H-31179
85	H-31213	600g	Chick, H-31442, 990g
	H-31118	740g	
86	H-31259	860g	Rat predation
	H-27678	875g	
87	H-31211	850g	Fight (crushed)
	H-31158	725g	
88	H-31295	710g	Infertile
	H-31212	960g	
89	H-30910	690g	Chick, H-31404, 1120g
	H-31233	930g	
90	H-31260	750g	Chick, H-31405, 1010g
	H-31280	960g	
91	H-31160	640g	Non-breeder
	H-31159	720g	
92	H-31261	800g	Infertile
	H-31119	820g	
93	H-27552		Chick, H-31407, 1030g
	H-30856	780g	
94	H-23018	890g	Chick, H-31408, 1190g
	H-31120	650g	
95	H-30880	780g	Chick, H-31415, 1040g
	H-30873	650g	
96	H-31205	615g	Non-breeder
97	H-31263	760g	Chick, H-31430, 1220g
	H-30872	910g	
98	H-31283	780g	2 Chicks, H-31428, 690g
	H-30890	870g	H-31429, 710g
99	H-31262	810g	Chick, H-31426, 810g
	H-31201	765g	
100	H-27689	830g	Chick, H-31420, 1130g
	H-31277	930g	

9.2 MATCHING GRID BURROWS TO STUDY BURROW NUMBERS

Palmers Track Grid	Kauri Dam Grid	South Forks Grid
PT 18= Study 32	KT 8= Study 67	SF 7= Study 85
PT 8= Study 55	KT 2= Study 68	SF 8= Study 86
PT 9= Study 56	KT 25= Study 71	SF 20= Study 87
PT 21= Study 57	KT 12= Study 72	SF 19= Study 88
PT 20= Study 58	KT 19= Study 73	SF 14= Study 89
PT 15= Study 59	KT 13= Study 74	SF 13= Study 90
PT 16= Study 60	KT 15= Study 75	SF 12= Study 91
PT 1= Study 61	KT 10= Study 76	SF 10= Study 92
PT 4= Study 62	KT 11= Study 77	
PT 5= Study 63	KT 16= Study 78	
PT 10= Study 64	KT 5= Study 79	
PT 23= Study 96	KT 6= Study 80	
	KT 24= Study 81	