

Preliminary survey and population monitoring of black petrels (*Procellaria parkinsoni*) on Hauturu-o-Toi/Little Barrier Island, 2014/15



Preliminary survey and population monitoring of black petrels (*Procellaria parkinsoni*) on Hauturu-o-Toi/Little Barrier Island, 2014/15.

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ABSTRACT

This report covers the preliminary survey and population monitoring of black petrels, *Procellaria parkinsoni*, on Hauturu-o-Toi/Little Barrier Island. On Hauturu-o-Toi/Little Barrier Island, 123 study burrows were monitored, of which 90 were original study burrows established in 1997 by Mike Imber. Twenty-seven automated acoustic devices were placed out across Hauturu-o-Toi/Little Barrier Island in December 2014 and were retrieved in May 2015. Black petrel calls were recorded at four locations: Track 7, Track 3, the Thumb (on both recording devices) and along Track 8. Three surveys methods using random transects, census grids or seabird-detector dogs were trialled to determine the best method for an island-wide survey to determine the population density and range of black petrels on Hauturu-o-Toi/Little Barrier Island.

Keywords: black petrel, *Procellaria parkinsoni*, monitoring, transect, population estimate, breeding success, acoustic device, Hauturu-o-Toi/Little Barrier Island, New Zealand

1. INTRODUCTION

The black petrel, *Procellaria parkinsoni*, is a medium-sized endemic seabird which is only known to breed on Hauturu-o-Toi/Little Barrier Island (36°199'S 175°082'E) (LBI) and Great Barrier Island (Aotea Island) (36°187'S 175°4125'E) (GBI), New Zealand (Heather and Robertson 1996).

The main breeding area on LBI is along the main ridge between the Thumb and Mt Orau (Track 8). Monitoring work on black petrel was completed by Mike Imber in 1971-75, 1978/79 and 1981-84 in 22 study burrows (Imber 1987), in 1985-1988 in 60 study burrows (as part of the transfer of black petrel chicks from GBI to LBI; Imber *et al.* 2003) and from 1997-1999 in 97 study burrows. Limited burrow checks also occurred in 2000 and 2004. A two-year tracking project was also completed between 2007-2009 using some of the original Mike Imber burrows (Dr. Johanna Pierre, pers. comm., Bell *et al.* 2011c, Bell *et al.* 2013a). This study will assist in identifying current population status of black petrels of LBI and determine the population trend by comparing it with Imber's earlier work.

2. OBJECTIVES

The main objective of this study was to estimate the population trend, fecundity and age-class survival of black petrels on LBI and to estimate the black petrel population size and describe the population trend by comparing the estimate to relevant existing data. The black petrel population monitoring was undertaken via burrow monitoring and the banding of adults and fledglings to establish adult mortality, fecundity, breeding success, recruitment and age-class survival to describe the population trend.

In summary, the study objectives were to:

- Collect data that will allow estimation of the black petrel population size and describe the population trend by comparing the estimate to relevant existing data. Key tasks conducted under this objective were:
 - Identify the range of the black petrel population using automated acoustic recorders across the island.
 - Re-establish the Mike Imber study burrows within the main breeding area, monitor these study burrows and band all adults present in the burrows during March 2015 and band all remaining fledglings during April/May 2015.
 - Determine breeding success in the study burrows and record causes of breeding failure.

- Monitor and re-survey the study area for new burrows and band and recapture as many breeding and non-breeding birds present as possible.
- Capturing and banding as many birds as possible during the breeding season to determine juvenile (pre-breeder) survival, fecundity, age of first return to the natal colony, age of first breeding attempt, age of first successful breeding attempt and adult (breeder) survival.
- Confirm the breeding status of adults during each visit to the colony (i.e. to monitor the study burrows at the beginning, middle and end of the breeding season), and where possible, identify the sex of the resident adult.
- Determine a population estimate and trend by extrapolating from study burrows with additional information from the acoustic recordings.

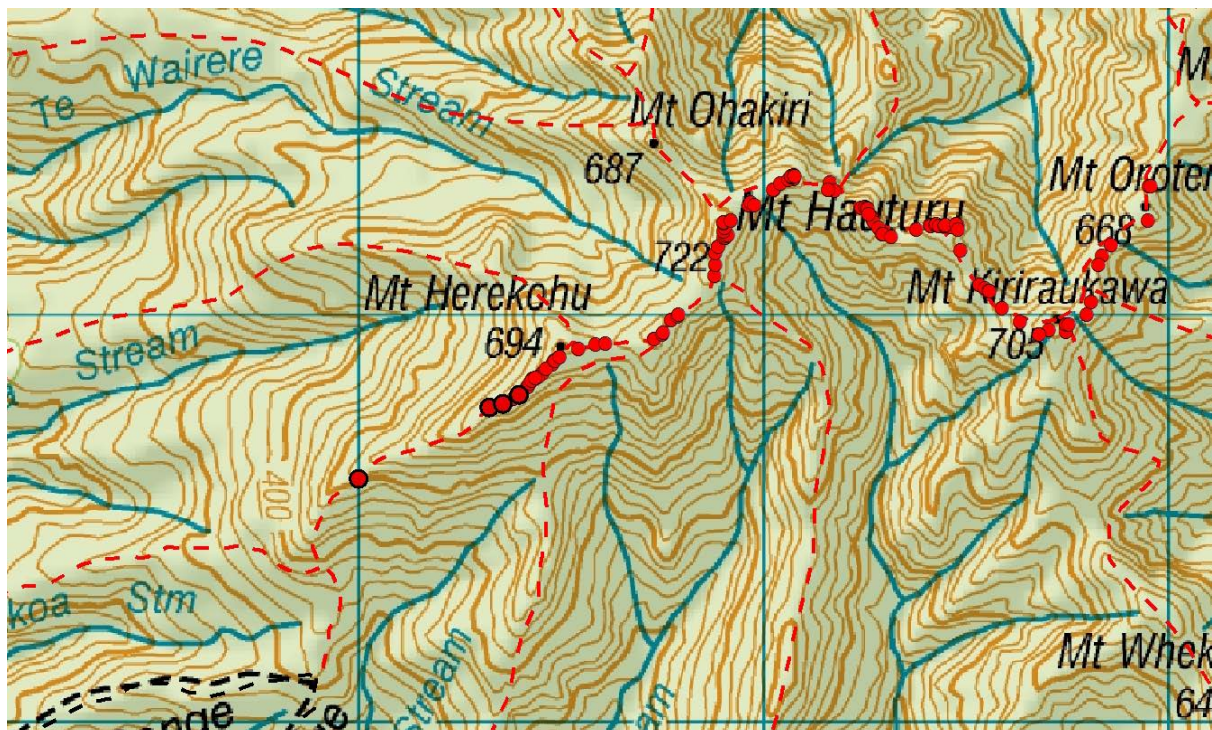
3. METHODS

3.1 Study burrows

The study area (Track 8, between The Thumb and Mt Orau; Figure 1) was visited four times during the breeding season; 1-6 December 2014, 20-26 January 2015, 23-31 March 2015 and 14-21 April 2015.

During the January and March visits, the study burrows ($n = 123$, Figure 1) were either re-numbered from the historic Mike Imber burrows or randomly selected from those along the track system (i.e. within 5 m of either side). The historic Mike Imber study burrows were established between 1971 and 1997 (Imber 1987, Imber *et al.* 2003).

Figure 1 Location of the black petrel (*Procellaria parkinsoni*) study burrows on Hauturu-o-Toi/Little Barrier Island.



To ensure accurate monitoring, the study burrows were accessible either through the main entrance or via an opening that had been excavated through the burrow roof or wall into the chamber. This opening was covered by a piece of wood or a rock, which was camouflaged with soil and debris. Any occupying adult was removed from the burrow, banded (or the band number recorded if a

recapture) and returned to the burrow. The presence of eggs, eggshell fragments or chicks was noted and the absence of this sign was used to identify non-breeding birds.

All remaining fledgling chicks were banded during the April 2015 visit. This information was used to determine breeding success.

The locations of study burrows were mapped by entering GPS co-ordinates into GIS-mapping software (Manifold™).

3.2 Preliminary surveys

Random transect surveys were completed on LBI in April 2015. These transects were completed to determine which method would be best to survey the island to assess the population size on LBI. Two methods were trialled: using three searchers along main tracks and using two searchers with seabird-detector dogs.

Three transects were completed within the known black petrel habitat along the main tracks near Mt Ngarahu and one transect was completed along Track 8 between The Thumb and Summit. Random GPS start points were selected for each transect and each transect followed the formed track. All transects were 400 m in length. A 2-m strip was searched by two people for burrows on either side of a centrally marked line along each transect. To maintain a consistent search effort, each transect was searched in 10-m lengths. To minimise the edge effect, burrows on the east or north side of the central line were counted if any part of the burrow entrance was within the 2-m strip, and burrows on the west or south side of the central line were counted only if the entire burrow entrance was within the 2-m strip.

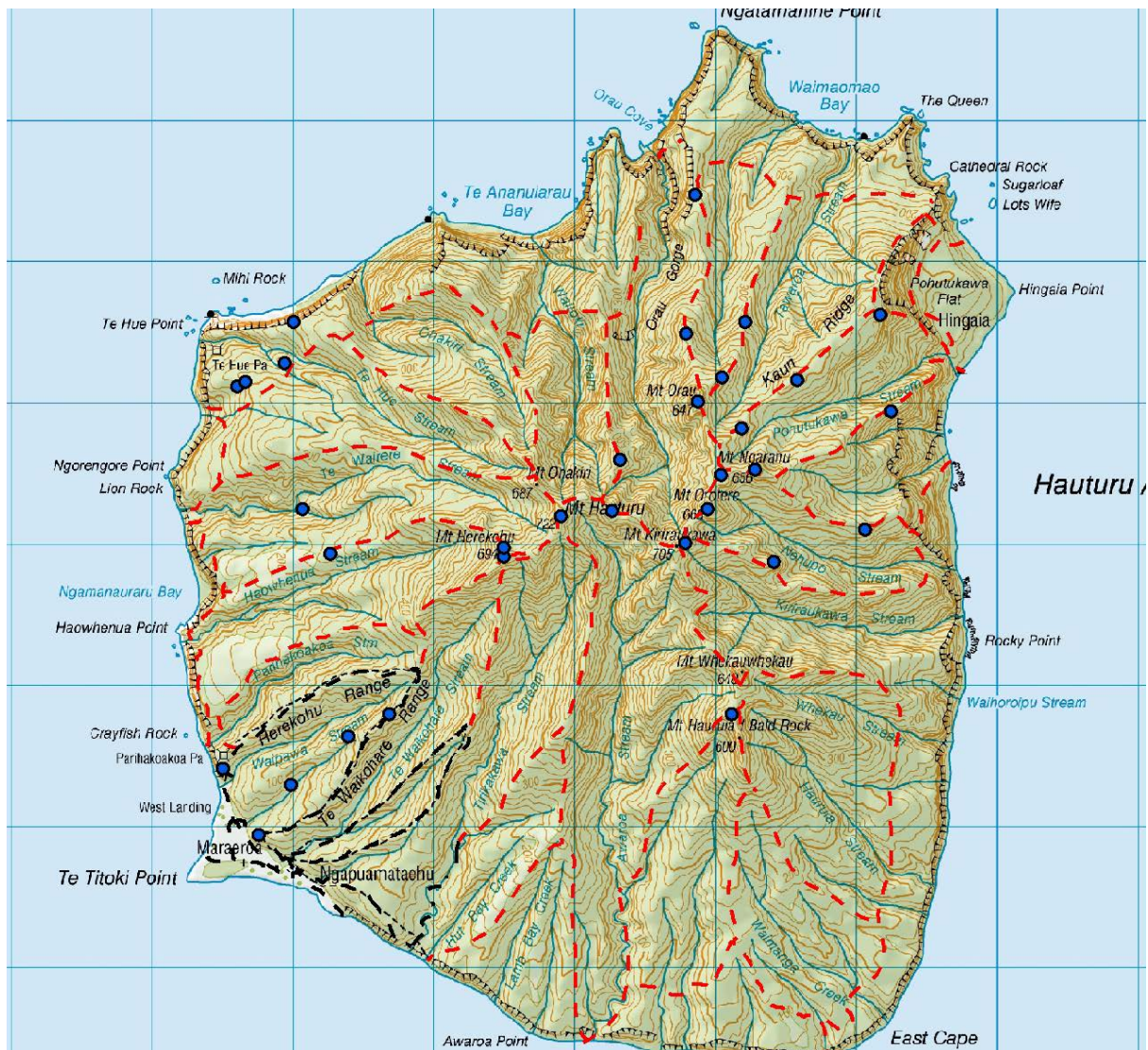
Four random transects were completed running east to west at 90° to the main ridge line centred across the ridge. Each transect was approximately 50 m apart attitudinally between 329 m and 488 m (at 329 m, 362 m, 451 m and 488 m). Each transect was 100 m long and a 5-m wide strip was searched by two people and two seabird detector dogs for burrows on either side of the central line.

Any burrows located within the search area was recorded (and its position was marked by GPS) and searched for the presence of an adult, egg or chick, The same procedure as outlined in Section 3.1 was followed for any bird caught in the transect burrows. Petrel sign (i.e. droppings) or burrows outside the 4-m or 10-m width of each transect were noted. Details of vegetation (species and density), slope, aspect and general information on burrows were recorded.

3.3 Automated acoustic recording devices

Twenty-seven automated acoustic recording devices (Wildlife Acoustics Songmeter SMZ2 or the smaller DOC ARU units) were placed out across LBI in December 2014 (Figure 2). These devices were set up to record all sounds from one hour after dark (2145 hr NZST); the DOC ARU units recorded for one hour and the Wildlife Acoustic Songmeter units recorded for 2 hours.

Figure 2 Location of the automated acoustic devices deployed on Hauturu-o-Toi/Little Barrier Island, December 2014-May 2015.



3.4 Thermal imagery

Preliminary examinations of black petrel burrows using a thermal imagery camera was undertaken in April 2015. Thirty black petrel burrows were checked with the camera to assess whether the thermal image would suggest occupancy. The camera lens was placed into the burrow entrance and a single image taken of the burrow contents. cursory evaluation shows occupied burrows have a higher average maximum temperature (21.98°C) compared to unoccupied burrows (13.4°C). Note: the images are visual representations and can't be compared to each other for analysis (they show the maximum range within each image)

4. RESULTS

4.1 Study burrows

Ninety of the 97 historic Mike Imber study burrows were located on LBI. The remaining seven could not be located by searches by people or with the seabird detector dogs suggesting these burrows were no longer active. An addition 33 burrows were added to the study area. There are a total of 123 study burrows along Track 8 between The Thumb and Mt Orau. Of these, 55 contained breeding

birds, 18 contained non-breeding birds and 50 were non-occupied or had been taken over by Cook's petrel (*Pterodroma cookii*) (Appendix 1). There were 8 failures which corresponds to a breeding success of 85.5%. Of the failures, 2 were abandoned eggs, 2 were crushed eggs, 1 was a dead embryo, 1 was a dead chick (deformed bill) and one chick disappeared between the March and April trips.

This data was compared to the 1997 data from Mike Imber (Table 1). There has been an apparent decline in both breeding (by 5%) and non-breeding activity (by 5%) over the eight years. The number of non-occupied burrows or those taken over by Cook's petrels has increased by 9% over the eight years.

Table 1 Comparison in burrow occupancy and breeding success in the original 97 Mike Imber black petrel (*Procellaria parkinsoni*) study burrows on Hauturu-o-Toi/Little Barrier Island between the 1996/97 and 2014/15 breeding seasons.

Study burrow	1996/97	2014/15
Used by Cook's petrel	5 (5.2%)	11 (11.3%)
Non-occupied (total)	43 (44.3%)	52 (53.6%)
Non-occupied (black petrels only)	37 (38.1%)	41 (42.3%)
Breeding	39 (40.2%)	34 (35.1%)
Non-breeding	16 (16.5%)	11 (11.3%)
Occupied (black petrels only)	55 (56.7%)	45 (46.4%)
Total	97	97

Due to permitting issues, adult black petrels could only be removed from the burrows in March and April 2015. As a result, only three banded birds were caught in the study burrows in March 2015 (Appendix 1). Of these, one was banded in 1997, one in 2007 and one in 2008 and all were banded as adults. Four other burrows had unbanded birds viewed from the entrance; all of these birds were incubating eggs or small chicks.

There were 47 chicks banded from within the study burrows this season, of which 29 were in the original Mike Imber burrows (Appendix 1). There was an additional 9 chicks banded from random burrows around the island.

4.2 Acoustic monitoring

There was 4230 hours of sound recordings collected from 27 automated acoustic recording devices between 2 December 2014 and 21 April 2015. Black petrel calls were recorded at five locations; The Thumb (two recorders along the Thumb Track and at the Thumb itself), Track 8, Track 3 and Track 7 (Table 2). Calls were also heard at Mt Orau, Orau Helipad, Mt Ngarahu and Mt Oroterere while listening at night from Orau Hut and high points along Track 8 in December 2014 and January 2015.

Table 2 Presence or absence of black petrel (*Procellaria parkinsoni*) calls recorded on automated acoustic recorders on Hauturu-o-Toi/Little Barrier Island, 2014/15.

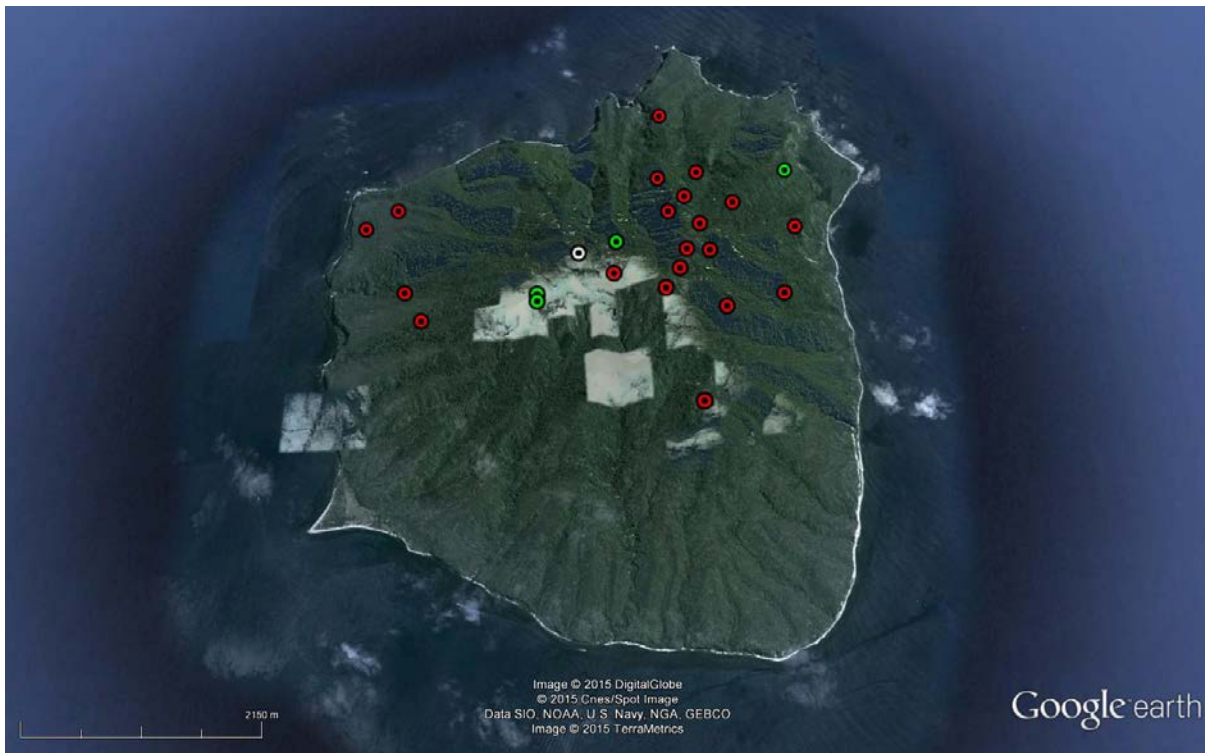
Where: Yes = black petrel calls recorded, No = no black petrel call recorded and TBC = to be completed.

Location	ARU	December	January	February	March	April
Mt Ngarahu	LC1	No	TBC	TBC	TBC	TBC
Upper Track 8	LC2	No	TBC	TBC	TBC	TBC
Lower Track 8	LC3	No	TBC	TBC	TBC	TBC
Track 9	LC4	Corrupted	Corrupted	TBC	TBC	TBC
Track 9, near AY32	LC5	No	TBC	TBC	TBC	TBC
Track 10	LC6	No	TBC	TBC	TBC	TBC
Track 8	LC7	No	TBC	TBC	TBC	TBC
Track 8	LC8	Yes	TBC	TBC	TBC	TBC
Track 11	LC9	No	TBC	TBC	TBC	TBC

Location	ARU	December	January	February	March	April
Track 12	LC10	No	TBC	TBC	TBC	TBC
Near Track 13	LC11	No	TBC	TBC	TBC	TBC
Track 8	LC12	No	TBC	TBC	TBC	TBC
Track 7	LC13	Yes	TBC	TBC	TBC	TBC
Track 3	LC14	Yes	TBC	TBC	TBC	TBC
Bald Rock	LC15	No	TBC	TBC	TBC	TBC
Track 3	LC16	No	TBC	Not set	Not Set	Not set
Wairere Stream	LC17	No	TBC	Not set	Not Set	Not set
Te Hue Track	LC18	No	TBC	Not set	Not Set	Not set
Te Hue Stream	LC19	No	TBC	Not set	Not Set	Not set
Merty's Track	SM1	No	TBC	TBC	TBC	TBC
Orotere	SM2	No	TBC	TBC	TBC	TBC
Orau Helipad	SM4	No	TBC	TBC	TBC	TBC
Mt Orau	SM5	TBC	TBC	TBC	TBC	TBC
Parihakoakoa Pa	SM7	Not set	Not set	TBC	TBC	TBC
Thumb Track	SM7	Yes	TBC	Not set	Not set	Not set
Summit	SM8	Corrupted	Corrupted	TBC	TBC	TBC
Thumb	SM10	Yes	TBC	TBC	TBC	TBC
Total	27	5	-	-	-	-

Figure 3 Location of the automated acoustic devices that recorded black petrel calls on Hauturu-o-Toi/Little Barrier Island, December 2014-May 2015.

Where ● is no black petrel calls recorded, ● is black petrel calls recorded and ● is a faulty recorder.



4.3 Preliminary surveys

Three ridge transects and four random transects using seabird detector dogs were completed in April 2015 to assess the best method for surveying the island. Census grids were not trialed due to the difficult terrain at the request of the DOC LBI Ranger.

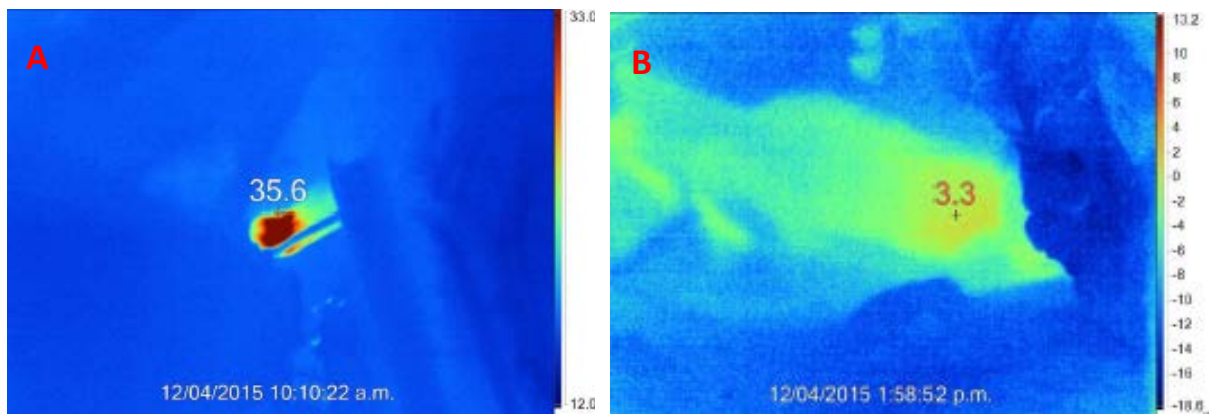
The ridge transects followed established tracks for 400 m; one transect on lower Track 11 had 7 black petrel burrows (all empty), one transect on higher Track 11 had 5 black petrel burrows (3 breeding, 1 non-breeding and 1 empty), and one on Track 8 between the Thumb and Summit had 20 burrows (8 breeding, 5 non-breeding and 7 empty). The transects on Track 11 were searched by three people and the transect on Track 8 were searched by five people and two seabird detector dogs.

The random transects followed compass bearings for 100 m at four different altitudinal levels and these transects were searched by 2 people and two seabird-detector dogs; all four transects did not have any black petrel burrows.

The use of seabird-detector dogs meant active burrows; i.e. with chicks or adults present or non-breeding burrows that had been active recently, were identified quickly along the transect route. With people assisting the searching meant empty or non-breeding burrows that were not recently active could also be identified.

4.4 Thermal imagery

Preliminary evaluation of the thermal images (example given in Figure 4) showed occupied burrows



had a higher average maximum temperature (21.98°C) compared to unoccupied burrows (13.4°C). Note: the images are visual representations and can't be compared to each other for analysis (they show the maximum range within each image)

Figure 4 Comparison of occupied and non-occupied black petrel (*Procellaria parkinsoni*) burrows on Hauturu-o-Toi/Little Barrier Island, May 2015.

Where A = occupied burrow (Study burrow 117) and B = non-occupied burrow (Study burrow 12)

5. DISCUSSION

The black petrel population on Hauturu-o-Toi/Little Barrier Island has been monitored between 1971-75, 1978-79, 1981-88, 1997-1999 and 2007-2009 (Imber 1987, Imber *et al.* 2003, Bell *et al.* 2011c, Bell *et al.* 2013a).

In the 2014/15 breeding season, there were 47 breeding successes and 8 breeding failures in the 55 breeding burrows out of the 123 study burrows, equating to an overall breeding success rate of 86%.

This breeding success is much higher than reported in the earlier studies on black petrels; 1977 (50%) and 1978 (60%) on Hauturu-o-Toi/Little Barrier Island (Imber 1987) and 1988/89 (62%) on Great Barrier/Aotea (Scofield 1989) and 61-84% on Great Barrier Island/Aotea (Bell et al. 2015). This breeding success rate is also much higher when compared to many other seabird species such as Westland petrel, *Procellaria westlandica*, 39-50% (Freeman & Wilson 2002, Warham 1996). Six failures were at the egg stage and two chicks died (one from a bill deformity and the other disappeared between March and April 2015).

Comparison between occupancy and breeding status within the historic Mike Imber study burrows suggests that the number of black petrels on Hauturu-o-Toi/Little Barrier Island may have declined between 1997 and 2015 as there was a 10% reduction in occupied burrows between these two periods. The number of burrows taken over by Cook's petrel had also increased from 5% to 11%. The increased number of non-occupied burrows could be related to the condition of some study burrows have become unsuitable for breeding (without additional excavation by the birds). Reasons whether a burrow is used for breeding may relate to the characteristics of that burrow (exposure, depth, entrance, moisture) and any changes to those characteristics (flooding, collapse etc., Warham 1996) may cause birds to move from or avoid these burrows and as a result affect breeding success and burrow activity.

Given that three banded birds were recaptured in these historic Mike Imber burrows suggests that fidelity to burrows is high supporting the model results from Great Barrier Island (Aotea Island). Increased capture effort of adults next season would give further information on burrow use, survival and site fidelity. However, there has been an emigration event from Hauturu-o-Toi/Little Barrier Island with a female being caught breeding on Great Barrier Island (Aotea Island) (Bell et al. 2015) and 12 (4.8%) of the early 250 chicks transferred between Great Barrier Island and Hauturu-o-Toi/Little Barrier Island between 1988 and 1990 have returned to their natal area on Great Barrier Island (Imber *et al.* 2003). This suggests that birds from Hauturu-o-Toi /Little Barrier Island may be attracted to Great Barrier Island (Aotea Island) due to the number of birds' resident there (and resulting noise early in the breeding season). This may be particularly important for females as they are attracted to calling males and do not appear to have such a high level of site fidelity until they are an established breeder.

It will be important to continue to monitor these study burrows with a detailed mark recapture programme to determine the adult and juvenile survival, site fidelity and recapture probabilities for black petrels on Hauturu-o-Toi/Little Barrier Island and compare these data to that for Great Barrier Island (Aotea Island) to determine if there are differences between the two colonies.

Immigration between the colonies has implications for population modelling work (as most models assume no immigration), and further surveys and mark-recapture work is needed to maximise the chances of recapturing known birds and returned fledglings. This also has implications for the recovery of the Hauturu-o-Toi/Little Barrier Island population as pre-breeders are more likely to be attracted to Great Barrier Island (Aotea Island) than Hauturu-o-Toi/Little Barrier Island, slowing the population growth there. It is possible that the Little Barrier Island population may not recover until Great Barrier Island (Aotea Island) reaches carrying capacity; however until further information on the Hauturu-o-Toi/Little Barrier Island for adult survival and recruitment is collected, this is difficult to assess. It is important that the black petrel population on Hauturu-o-Toi/Little Barrier Island is monitored further to determine population dynamics, status and trends.

The acoustic monitoring devices recorded black petrel activity at a small number of high points across the island. There was limited activity at each site (i.e. few birds calling) suggesting that the total number of black petrels on Hauturu-o-Toi/Little Barrier Island is low. These results will be used to pinpoint sites for ground surveys to be completed in the future to determine the density of black petrel burrows and occupancy in the area. It is important to place further acoustic monitoring devices out across the high points and other areas on Hauturu-o-Toi/Little Barrier Island to identify

other active black petrel areas that can be assessed by ground surveys. Comparison with recordings taken on Great Barrier Island (Aotea Island) could be used to determine the density of black petrels at each location by comparing the number, volume and level of calls from known density sites on Great Barrier Island (Aotea Island) with those collected on Hauturu-o-Toi/Little Barrier Island. This could provide a quick and accurate measure of black petrel numbers and activity on islands, suspected sites or historic locations across the country (such as Moehau Range, Coromandel).

Trials of different surveys methods on Hauturu-o-Toi/Little Barrier Island resulted in ridge and random transects using a combination of people and seabird-detector dogs searching for burrows was the optimum method to detect black petrel burrows. The use of seabird detector dogs made the search time faster particularly for detecting active burrows (those with birds present), but having people also search for burrows meant empty or non-breeding burrows could also be identified and mapped. An increased effort in transects using people and seabird-detector dogs along most of the track systems and in random locations next season will allow a more accurate population estimate for black petrels on Hauturu-o-Toi/Little Barrier Island and colony boundaries to be determined.

The trial of thermal imagery cameras showed it was possible to determine whether a burrow was occupied or not with the preliminary images showed higher average maximum temperatures in occupied burrows. However these results were complicated by burrow size, length and whether there were any branches in the burrow. It was also noted that the images were visual representations and could not be directly compared to each other for analysis. This could be a valuable non-invasive method to determine occupancy for seabirds, particularly large seabirds such as petrels and shearwaters. Additional trials are planned for the 2015/16 season on both Great Barrier Island/Aotea and Hauturu-o-Toi/Little Barrier Island to obtain further information on occupancy on each island, burrow characteristics on both islands and the suitability of thermal imagery as a monitoring tool.

6. RECOMMENDATIONS

The authors recommend that:

- Monitoring of the black petrel population (using the study burrows) is continued at Hauturu-o-Toi/Little Barrier Island up to, and including, the 2024/25 breeding season. This will ensure that 10 years of comparative data are collected to determine the population dynamics of black petrels, allowing us to develop a generational population model to determine survivorship, mortality and the effects of predation, fisheries interaction and other environmental factors.
- There are three visits to the Hauturu-o-Toi/Little Barrier Island colony; (i) November/December to allow a large number of birds to be banded or recaptured easily, as the birds are often outside the burrows during this period. A high rate of banding and recapture will enable the continuation of the mark-recapture programme; (ii) January/February to continue with the mark/recapture programme and to confirm breeding status of the adults (and study burrows), and (iii) April/May to allow surviving chicks to be banded before they fledge.
- The study burrows should be checked for breeding status during every visit to the study area, to give a more accurate estimate of breeding success and determine sex of adults. This would also provide an opportunity to recapture returning birds banded as chicks.
- A sample of 20 black petrels should carry high-resolution GPS data-loggers over three consecutive breeding seasons to accurately investigate foraging behaviour including distances, locations and flight patterns throughout the breeding period (in particular the apparent high risk period of chick rearing; end January to May). This information should be

assessed in relation to fisheries overlap and compared to data collected on Great Barrier Island (Aotea Island).

- A sample of 20 black petrels should carry time-depth recorders over three consecutive breeding seasons to accurately investigate foraging behaviour including depth, number of dives and location (if deployed in conjunction with GPS loggers) throughout the breeding season (in particular the apparent high risk period of chick rearing; end January to May). This information should be assessed in relation to fisheries risk (in particular fishery type and gear) and compared to data collected on Great Barrier Island (Aotea Island).
- A sample of 20 black petrels should carry light-geolocator data-loggers over two consecutive breeding seasons and the intervening non-breeding period (including migration to and from South America) to accurately investigate foraging distances and locations, water temperature and flight patterns throughout the breeding and non-breeding seasons. This information should be assessed in relation to fisheries overlap and compared to data collected on Great Barrier Island (Aotea Island).
- Further random and ridgeline transects are undertaken across Hauturu-o-Toi/Little Barrier Island annually for the next 5 years increase the likelihood of adult and juvenile recaptures (to improve survival and immigration estimates), provide a population estimate and to determine population trends.
- The exact limits of the Hauturu-o-Toi/Little Barrier Island black petrel colony or habitat should be established and the area calculated by a ground truth survey.

7. ACKNOWLEDGMENTS

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9. APPENDICES

9.1 Results from the study of black petrel burrows ($n = 123$) on Hauturu-o-Toi/Little Barrier Island during the 2014/15 breeding year.

Table 3 Results from the study of black petrel burrows ($n = 123$) on Hauturu-o-Toi/Little Barrier Island, 2014/15.

Occupants of burrows are represented by band number or, if not caught, by a question mark (?). Where known, sex of bird is indicated in parentheses in the Band column: male (M); female (F). An asterisk represents a dead adult.

Burrow	Band		Outcome
1	?	?	Cook's petrel
2	?	?	Cook's petrel
3	?	?	Empty
4	?	?	Chick (41105)
5	?	?	Empty
6	?	?	Empty
7	?	?	Not located (presumed empty)
8	?	?	Empty
9	?	?	Empty
10	36753	?	Chick (41109)
11	?	?	Chick (41111)
12	?	?	Empty
13	?	?	Empty
14	?	?	Not located (presumed empty)
15	28633 (F)	?	Egg (disappeared)
16	?	?	Empty
17	?	?	Not located (presumed empty)
18	?	?	Empty
19	?	?	Cook's petrel
20	?	?	Not found (presumed empty)
21	?	?	Chick (41144)
22	?	?	Empty
23	?	?	Cook's petrel
24	?	?	Empty
25	?	?	Empty
26	?	?	Dead embryo
27	?	?	Chick (41145)
28	?	?	Empty
29	?	?	Empty
30	?	?	Empty
31	?	?	Egg (abandoned)
32	?	?	Non-breeding
33	?	?	Cook's petrel
34	?	?	Chick (41147)
35	?	?	Cook's petrel
36	36149 (F)	?	Chick (41148)
37	?	?	Chick (41149)
38	?	?	Cook's petrel

Burrow	Band		Outcome
39	?	?	Not found (presumed empty)
40	?	?	Cook's petrel
41	?	?	Empty
42	?	?	Cook's petrel
43	?	?	Chick (41143)
44	?	?	Chick (41142)
45	?	?	Empty
46	?	?	Empty
47	?	?	Empty
48	?	?	Empty
49	?	?	Not found (presumed empty)
50	?	?	Chick (41141)
51	?	?	Non-breeding
52	?	?	Chick (41140)
53	?	?	Chick (disappeared)
54	?	?	Empty
55	?	?	Chick (41138)
56	?	?	Non-breeding
57	?	?	Chick (41137)
58	?	?	Empty
59	?	?	Empty
60	?	?	Empty
61	?	?	Chick (41134)
62	?	?	Empty
63	?	?	Empty
64	?	?	Empty
65	?	?	Non-breeding
66	?	?	Empty
67	?	?	Chick (41132)
68	?	?	Empty
69	?	?	Chick (41131)
70	?	?	Non-breeding
71	?	?	Non-breeding
72	?	?	Non-breeding
73	?	?	Chick (41133)
74	?	?	Chick (41130)
75	?	?	Chick (41129)
76	?	?	Chick (41135)
77	?	?	Empty
78	?	?	Empty
79	?	?	Chick (41128)
80	?	?	Empty
81	?	?	Empty
82	?	?	Empty
83	?	?	Empty
84	?	?	Cook's petrel
85	?	?	Chick (41124)
86	?	?	Chick (41126)
87	?	?	Non-breeding

Burrow	Band		Outcome
88	?	?	Cook's petrel
89	?	?	Non-breeding
90	?	?	Chick (41123)
91	?	?	Chick (41122)
92	?	?	Non-breeding
93	?	?	Chick (41121)
94	?	?	Non-breeding
95	?	?	Egg (crushed)
96	?	?	Chick (41119)
97	?	?	Chick (41118)
98	?	?	Chick (41116)
99	?	?	Egg (crushed)
100	?	?	Chick (41115)
101	?	?	Chick (41136)
102	?	?	Chick (41120)
103	?	?	Non-breeding
104	?	?	Non-breeding
105	?	?	Chick (41125)
106	?	?	Chick (41127)
107	?	?	Non-breeding
108	?	?	Chick (Dead)
109	?	?	Non-breeding
110	?	?	Chick (41117)
111	?	?	Empty
112	?	?	Egg (dead embryo)
113	?	?	Non-breeding
114	?	?	Chick (41110)
115	?	?	Chick (41201)
116	?	?	Chick (41113)
117	?	?	Chick (41108)
118	?	?	Chick (41101)
119	?	?	Chick (41102)
120	?	?	Chick (41103)
121	?	?	Chick (41104)
122	?	?	Chick (41106)
123	?	?	Chick (41207)