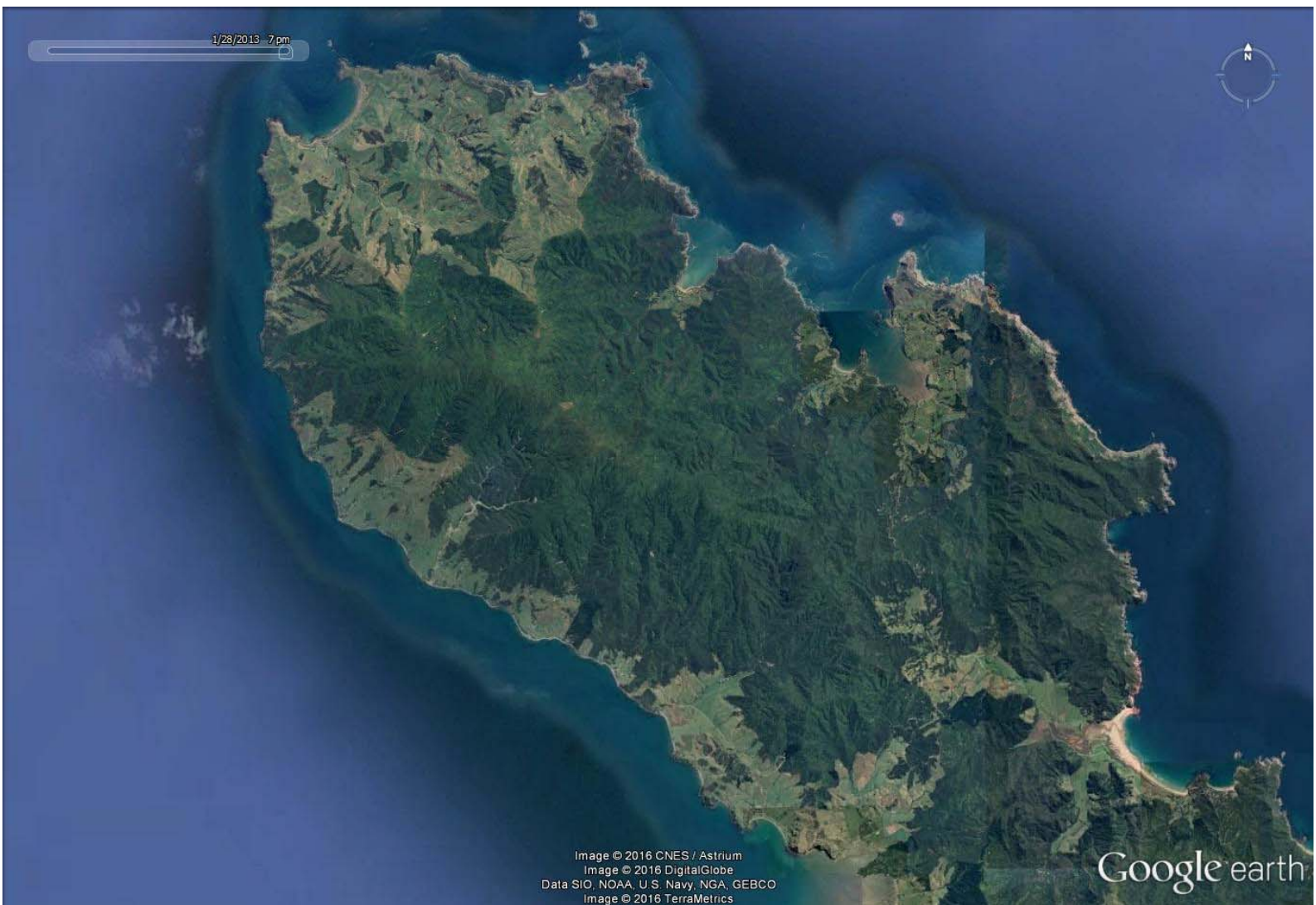


Black petrels (*Procellaria parkinsoni*) population study on Moehau Range, Coromandel, 2015/16



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Frontispiece: Moehau range, Google Earth, downloaded 9 August 2016.

ABSTRACT

An important factor for addressing the estimation of the total black petrel (*Procellaria parkinsoni*) population is to identify any additional breeding sites away from Great Barrier Island/Aotea and Hauturu-o-Toi/Little Barrier Island. The Moehau Range, Coromandel was identified as one possible area for black petrel as shown by historical presence. Nocturnal seabirds are ideal candidates for acoustic monitoring because they are highly vocal at their colonies, particularly during the breeding season. Black petrels call on the ground when trying to attract mates to their burrows between October and February, with peak activity between November and January. Seventeen automated acoustic recording units were deployed on the Moehau range between 30 November 2015 and 31 January 2016. No black petrel calls were recorded, but Cook's petrel (*Pterodroma cookii*) flight calls were recorded.

Keywords: black petrel, *Procellaria parkinsoni*, population estimate, acoustic recording units, Moehau range, 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 2015). The National Plan of Action for Seabirds called for an accurate estimate of the total population size of black petrels (MPI 2013). In order to complete this, all breeding sites must be identified and monitored. On-going research occurs at the known black petrel breeding colonies on Great Barrier Island/Aotea and Hauturu-o-Toi/Little Barrier Island (Bell *et al.* 2015a; Bell *et al.* 2015b). The Moehau range on the Coromandel Peninsula was identified as a possible breeding location as shown by historical data (Imber 1987), proximity to the current largest breeding colony on Great Barrier Island/Aotea and anecdotal sightings of 'large, black birds' flying over the Coromandel Peninsula in recent years and the timing of these sightings suggest black petrels or another seabird.

Nocturnal seabirds are ideal candidates for acoustic monitoring because they are highly vocal at their colonies, particularly during the breeding season. Seabirds have distinct calls and the signature of these calls can be distinguished to species using acoustic analysis software. Black petrels call on the ground when trying to attract mates to their burrows between October and February, with peak activity between November and January. Automated acoustic recording units will be used to detect and record calls at a number of sites along the Moehau range.

The Moehau range is made up of long ridges, steep and broken slopes, floodplains, streams, estuaries and harbours, rising through coastal, lowland and sub-montane zones to the summit (McCraith 2002, Amooore & Denyer 2006, Kessels *et al.* 2010). The Coromandel Peninsula is made up of volcanic rocks which overlay Jurassic sediments, greywacke or conglomerates with intrusions of diorite quartz on the Moehau range which results in clayey and infertile soils over varying depths depending of steepness over much of the area (Mackadam 1950, Amooore & Denyer 2006, McLeod and Briggs 2009, Kessels *et al.* 2010). The climate is mild and moist with annual rainfall of 1250–2500 mm and summer droughts (McEwen 1987). Te

Moehau (892 m a.s.l.) is the highest point. Te Moehau has particular significance to Maori as the legendary burial place of Tama Te Kapua leader of the Arawa canoe during its migration to New Zealand (McCraith 2002). The summit of Te Moehau is waahi tapu as a sign of respect to the resting place of Tama Te Kapua and the area is administered by the Moehau Nga Tangata Whenua Trust Board (McCraith 2002). Access to Te Moehau is restricted for cultural and ecological reasons (Kessels *et al.* 2010).

The forest on the Moehau range is important habitat, particularly for conifer species and is also the northern limit for a number of species (Molloy 2001, McCraith 2002). It contains at least 269 species including Kauri (*Agathis australis*), Hall's totara (*Podocarpus hallii*), kahikatea (*Dacrycarpus dacrydiodes*), mahoe (*Melicytus ramiflorus*), rewarewa (*Knightia excelsa*), wheki (*Dicksonia squarrosa*), kohekohe (*Dysoxylum spectabile*), miro (*Prumnopitys ferruginea*), northern rata (*Metrosideros robusta*), pukatea (*Laurelia novae-zelandiae*), mingimingi (*Leucopogon fasciculatus*), hangehange (*Geniostoma ligustrifolium*), kanono (*Coprosma grandifolia*), climbing rata (*Metrosideros* spp.), silver fern (*Cyathea dealbata*), five-finger (*Pseudopanax arboreus*), hound's tongue fern (*Microsorium pustulatum*), rangiora (*Brachyglottis repanda*) and mangemange (*Lygodium articulatum*) (Adams 1889, Cranwell & Moore 1936; Chambers & Mason 1950; Moore 1973, Gardner & Smith-Dodsworth 1984, Rate 2009).

The full suite of invasive mammals have been recorded on the Moehau range including rats (*Rattus* spp.), mice (*Mus musculus*), possums (*Trichosurus vulpecula*), feral cats (*Felis catus*), mustelids (*Mustela* spp.), feral pigs (*Sus scrofa*) and hedgehogs (*Erinaceus europaeus*) (King 1990, Rate 2009).

The Coromandel Peninsula, including the Moehau range, is classed as biodiversity hot spot (within the Colville Ecological District and Moehau Ecological Site) with stag beetle (*Geodorcus* spp.), weta (*Hemiandrus* spp.), land snails, bats, lizards, kakariki (*Cyanoramphus* spp.), kaka (*Nestor meridionalis*) and kiwi (*Apteryx mantelli*), and Archey's (*Leiopelma archeyi*) and Hochstetter's frog (*Leiopelma hochstetteri*) recorded in the area (Amoore & Denyer 2006, Kessels *et al.* 2010).

Landowners and community groups are engaged in protecting and restoring sections of the Moehau range and its catchments (Amoore & Denyer 2006, Kessels *et al.* 2010). These groups are working on predator control, kiwi conservation and management, water protection and revegetation projects.

2. OBJECTIVES

The main objective of this study was to assess the current range and population status of black petrels in New Zealand by investigating historical locations.

In summary, the study objectives were:

- To identify the presence of black petrels on the Moehau range, Coromandel using automated acoustic recorders.

3. METHODS

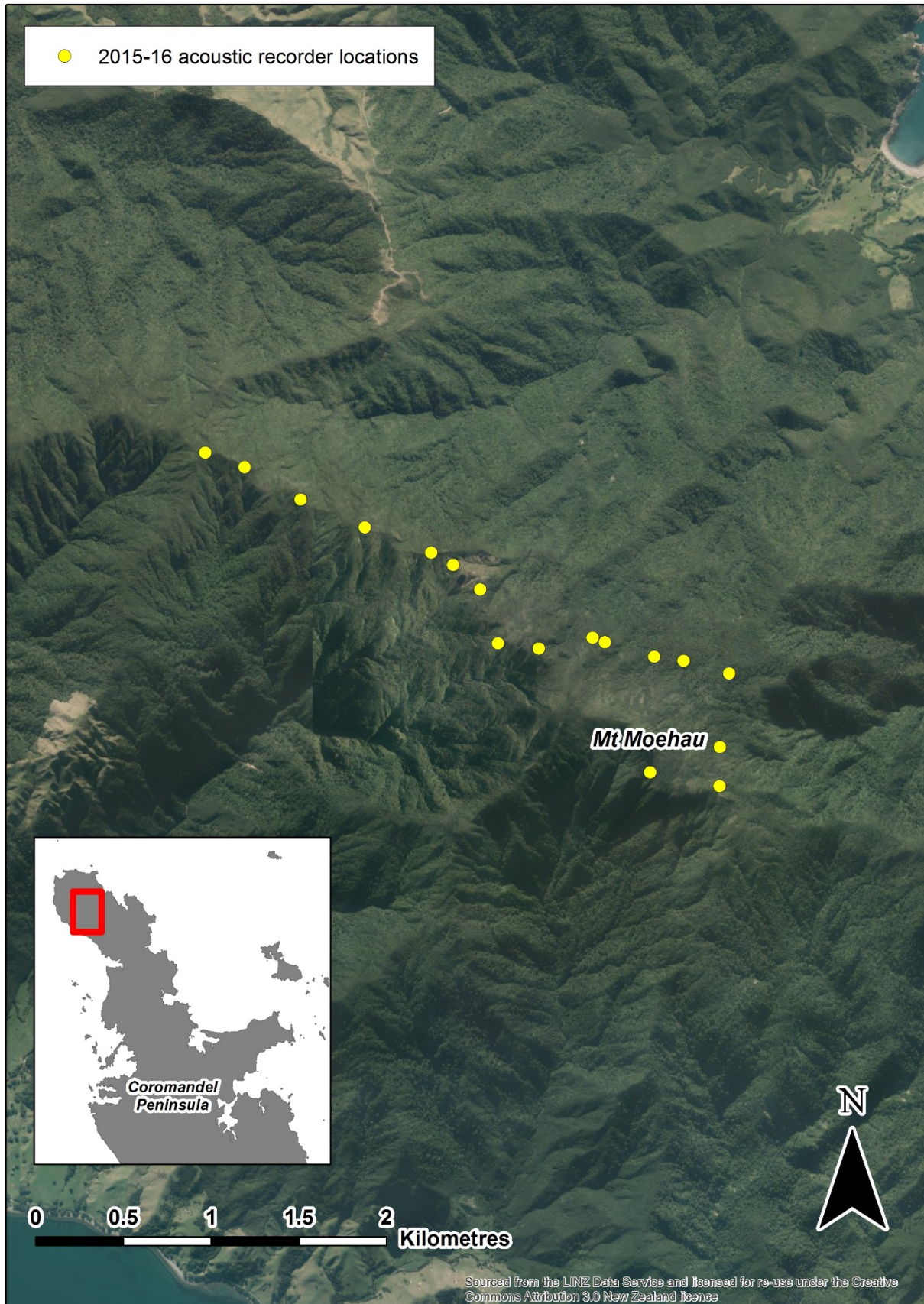
Seventeen Department of Conservation (DOC) automated digital-sound recorders (ARU, Figure 1) were deployed at approximately 400 m intervals over 4 km of the Moehau Range on the Northern Coromandel Peninsula on 30 November 2015 (Figure 2). The deployment route skirted about the southern, western and northern margins of the Te Moehau Waahi Tapu area and then continued along the main range until the descent into unsuitable habitat and terrain towards Port Jackson halted further deployment.

Figure 1 Example of the Department of Conservation automated acoustic recording unit deployed on the Moehau range, Coromandel, 2015/16.



Each ARU collected data for approximately 100-150 m diameter from the device along upper slopes, high points and ridges. Each location was photographed and mapped using GPS (Figure 2). Each ARU were set to record for two hours per site each day (about an hour after dark; c.2130 hr). Each ARU was visited in early January to replace SD cards and batteries. Each ARU was retrieved on 31 January 2016.

Figure 2 Location of the acoustic recorder units on the Moehau range, Coromandel, 2015/16.



4. RESULTS

4.1 Recorder efficacy

Seventeen ARU were deployed on the Moehau range; SD cards numbered 1-17 were in the ARUs between 30 November 2015 and 23 January 2016 and SD cards numbered 41-57 were in the ARUs between 23 and 31 January 2016 (Table 1). This equates to a total of 1054 recording nights and 2108 recording hours (2 hours each night per device) (Table 2). Out of the total recording nights, only 940 nights of data were collected as M1 did not function due to power issues, M4 failed in January 2016 and M10 only ran over the period January 23 to 31 as the data card was not inserted correctly.

Table 1 Outcome of acoustic recorder units on the Moehau range, 2015/16.

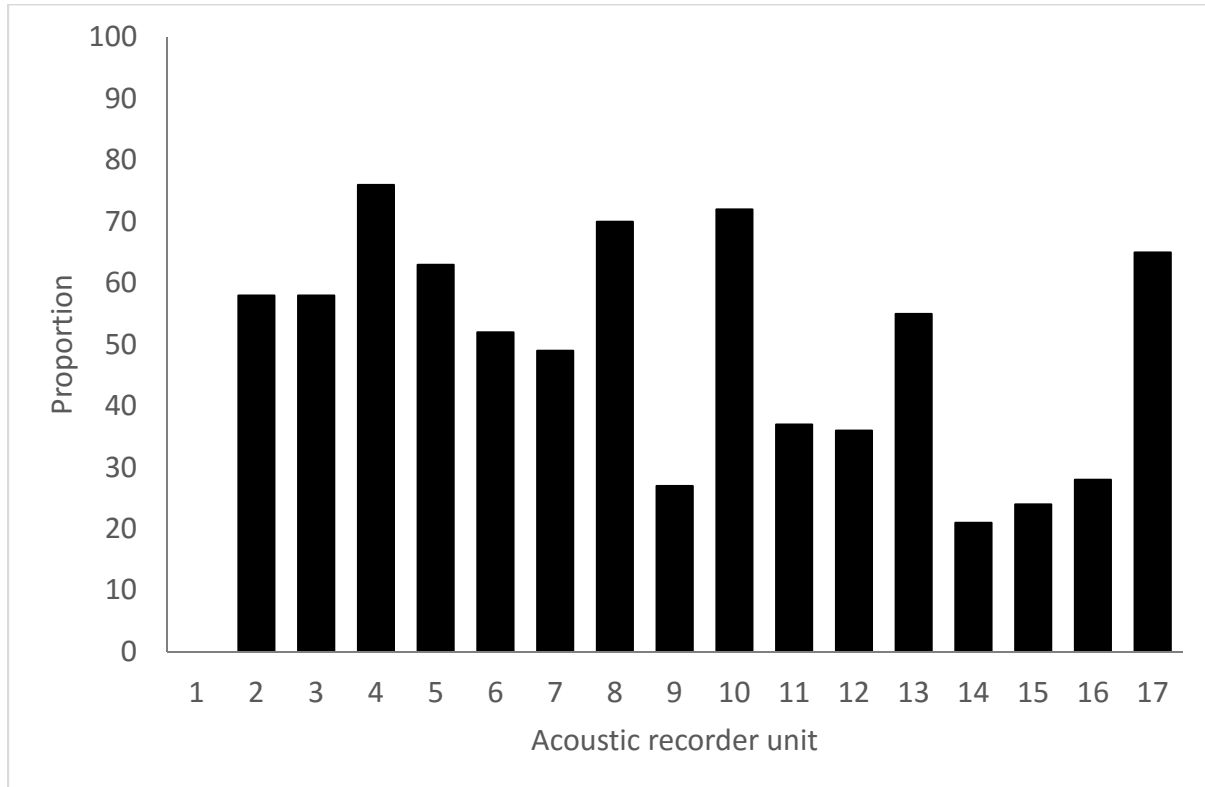
ARU	SD cards	Outcome
M1	1, 41	Failed due to power issues (battery malfunction)
M2	2, 42	Data collected on both SD cards
M3	3, 43	Data collected on both SD cards
M4	4, 44	Data collected on SD card 4 only; SD card 44 failed
M5	5, 45	Data collected on both SD cards
M6	6, 46	Data collected on both SD cards
M7	7, 47	Data collected on both SD cards
M8	8, 48	Data collected on both SD cards
M9	9, 49	Data collected on both SD cards
M10	10, 50	Data collected on SD card 50 only; SD card 10 failed
M11	11, 51	Data collected on both SD cards
M12	12, 52	Data collected on both SD cards
M13	13, 53	Data collected on both SD cards
M14	14, 54	Data collected on both SD cards
M15	15, 55	Data collected on both SD cards
M16	16, 56	Data collected on both SD cards
M17	17, 57	Data collected on both SD cards

Table 2 Potential and actual number of days and hours of data recorded for the acoustic recorder units on the Moehau range, 2015/16.

Dates	Number of devices	Number of hours each device recorded for each night	Total potential days	Total potential hours	Actual days	Actual hours
30 November 2015	17	2	17	34	16	30
1-31 December 2015	17	2	527	1054	496	992
1-30 January 2016	17	2	510	1020	428	916
Total	17	2	1054	2108	940	1938

Only a mean (\pm SEM) of $46.5 \pm 5.2\%$ of the acoustic data were of reasonable quality for analysis due to the wind (range 0-76%, Figure 3). The ARUs deployed to the north of Mt Moehau were in more exposed situations and affected more by wind.

Figure 3 Efficacy of each acoustic recorder unit deployed on the Moehau range, Coromandel, 2015/16.



4.2 Seabird activity

No confirmed black petrel calls were detected over the two month period. There were two faint unconfirmed calls collected but these were too weak for acoustic analysis and did not show the acoustic pattern attributes for black petrels.

Cook's petrel calls was detected on seven different occasions over a two-week period about the southern flanks of Mt Moehau in ARUs M2-M7 (Table 3). Over this same two week detection period wind affected recording sessions from those ARUs 55% of the time compared to 80% for stations M9 to M17.

Table 3 Summary of Cook's petrel (*Pterodroma cookii*) detections on acoustic recorder units on the Moehau range, 2015/16.

ARU	Date	Time
M1	16 December 2015	2130
M2	17 December 2015	2221
M2	24 December 2015	2135
M3	24 December 2015	2135
M5	12 December 2015	2258
M5	16 December 2015	2140
M7	16 December 2015	2143

One of these call sequences was 1.5 hours after sunset on 12 December 2015 and sounded more like a bird calling on the ground (M5; Table 3).

The other calls were flight calls and many could have been the same bird flying past multiple ARUs en-route to sea. For example on 16 December 2015 when calls were on M1, M5 and M6 all within 13 minutes of each other.

5. DISCUSSION

The survey failed to confirm that black petrel are present or prospecting on Mt Moehau. It is also unlikely that given the size of their burrows and general signs of prospecting or breeding activity (i.e. droppings, digging outside burrows and egg shell) that black petrels are present on Moehau without having been noticed previously by the Department of Conservation staff, contractors or researchers working in the area.

Activity levels of Cook's petrel were restricted to the southern flanks of the mountain and it is possible that these birds are nesting further up the mountain. Unfortunately due to a battery malfunction the ARU (M1) at the highest elevation on the Moehau range failed to record any data, so the possibility of Cook's petrels on the ground in this area could not be confirmed. Wind adversely affected recording sessions from the more northern ARUs (M9 to M17) over the same period, so it could simply be that weather prevented the detection of birds in the north at that time.

It is also possible that the calls were from Cook's petrel flying over the range towards Great Barrier Island/Aotea or Hauturu-o-toi/Little Barrier Island. Cook's petrel have been recorded traversing land en-route to colony sites including over Auckland city, Leigh, Warkworth and the Coromandel (pers. obs.).

It is possible that Cook's petrel are present on Moehau, but based on the limited information to hand this would need a more focused effort to determine a colony is present.

The on-going predator control in the area for kiwi protection by the Department of Conservation and community-conservation groups could enable black petrels, Cook's petrels and other seabirds to utilise the area in the future and it is recommended that this acoustic monitoring survey is repeated in 5-10 years to assess any subsequent colonisation by seabird species.

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