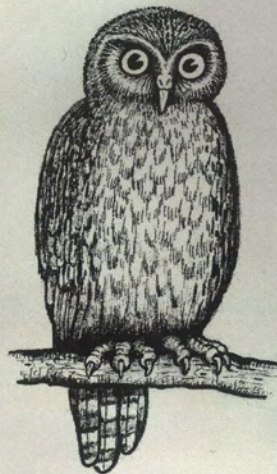


Morepork (*Ninox novaseelandiae*) distribution and conservation on Banks Peninsula

by

Carina Pohnke, Alison Evans & Mike Bowie



Lincoln University Wildlife Management Report No. 55

**Department of Ecology
Faculty of Agriculture and Life Sciences**

New Zealand's specialist land-based university



Lincoln University
Te Whare Wānaka o Aoraki
CHRISTCHURCH • NEW ZEALAND

ISSN: 1177-6242 (Print)
ISSN: 1179-7738 (Digital)
ISBN: 978-0-86476-393-8 (Print)
ISBN: 978-0-86476-394-5 (Digital)

Lincoln University Wildlife Management Report No. 55

**Morepork (*Ninox novaseelandiae*) distribution and conservation
on Banks Peninsula**



by

Carina Pohnke¹, Alison Evans² & Mike Bowie¹

¹Department of Ecology, Lincoln University, PO Box 85084, Lincoln 7647

²Bank Peninsula Conservation Trust, PO Box 146, Tai Tapu 7645

Email: mike.bowie@lincoln.ac.nz

Prepared for:
Banks Peninsula Conservation Trust & the Department of Conservation

May 2015

Executive Summary

Objectives

1. Determine the distribution of morepork on Banks Peninsula, using presence and absence data.
2. Identify the home range and breeding success of morepork fitted with radio transmitters in Kaituna Valley.
3. Identify habitat preferences of morepork on Banks Peninsula.

Methods

1. The distribution of morepork on Banks Peninsula was assessed using the following methods:
 - a) Acoustic monitors. These were the main tool used to identify the presence and absence of morepork in reserves across Banks Peninsula.
 - b) Playback using pre-recorded morepork calls.
 - c) Collecting data from the public. Checking historic records, performing citizen science techniques in form of coordinated monitoring for morepork calls (Morepork Mondays), media releases and collecting data of morepork sightings and calls making use of various methods (Naturewatch Website, E-mail, Text messaging).
2. The home range of two morepork (a male and a female breeding pair) was studied by fitting radio transmitters and tracking their movements in relation to the surrounding habitat. Their breeding success was also recorded by checking the nest at critical times.
3. Morepork habitat preferences were assessed with the use of tracking tunnels to look for differences in food sources and predators.

Results

Overall, morepork are present across the whole of Banks Peninsula, though some reserves appear to be better morepork habitat. Based on public reports, morepork were predominantly detected around residential areas, however the community feedback causes a bias on those results. Results from acoustic monitors indicate that forest patches on the southern and eastern part of Banks Peninsula appear to be preferred morepork habitat. The nest of the morepork pair in Kaituna Valley contained fertile eggs, though the pair abandoned it. The pair was found inside the reserve during the day, but left to surrounding areas at night time. Despite the presence of several predators and low amounts of food sources, Kaituna Valley Reserve is still occupied by morepork. Other reserves with higher levels of food sources indicated morepork absence.

Conclusion

This project successfully combined the use of several data collection methods to create a comprehensive spatial distribution map. Morepork appear to be wide-spread, but patchily distributed across the peninsula, and the number of individuals may still be relatively small.

Additional research is required to detect their presence in more remote locations. The morepork monitored in Kaituna Reserve were foraging outside of the reserve, which suggests that small remnants are not sufficient to maintain a breeding pair. These birds did not successfully breed despite the presence of fertile eggs. Defining suitable morepork habitat may not mainly depend on the presence of predators and food sources (small rodents). Additional research is required to identify what characteristics determine the quality of a morepork habitat. The use of nesting boxes, as well as predator control may increase their survival rate.

Recommendations / Future work

Playbacks should be performed at dusk, to allow observing any morepork that may be attracted by playing recorded calls, as they do not always respond verbally. Further use of tracking tunnels may provide information for potential differences in food source and predator presence between morepork habitat and non-occupied areas. This information can aid to determine which predators require control and how effective it is. Further research on identifying morepork presence is needed in the northern parts of the peninsula to create a comprehensive distribution map that includes additional remote areas. The Banks Peninsula Conservation Trust is in the process of approaching schools to raise awareness and building nesting boxes.

TABLE OF CONTENTS	Page
1. Executive Summary	2
2. Project Description	5
2.1 Introduction	5
2.2 Project Aim	5
3. Methods	7
3.1 Methods used for Objective 1	7
3.1.1 Acoustic Monitors	8
3.1.2 Playbacks of recorded calls	8
3.1.3 Reports from Public	8
3.2 Methods used for Objective 2	9
Radio Tracking	
3.3 Methods used for Objective 3	9
Tracking Tunnels	
4. Results	10
4.1 Acoustic Monitors	10
4.2 Playbacks of recorded calls	11
4.3 Reports from Public	12
4.4 Radio Tracking	14
4.5 Tracking Tunnels	15
4.6 Overall Morepork Presence	17
5. Discussion	18
5.1 Acoustic Monitors	18
5.2 Playbacks of recorded calls	18
5.3 Public Reports	19
5.4 Radio Tracking	19
5.5 Tracking Tunnels	19
5.6 Overall Morepork Presence	20
6. Limitations	20
7. Conclusion	21
8. Future of the Project	21
9. Recommendations	22
10. Acknowledgements	23
11. References	24
12. Appendices	25
12.1 Appendix A: Locator Map	25
12.2 Appendix B: Morepork Monday Flyer	26
12.3 Appendix C: Acoustic Monitors – Raw Data	27
12.4 Appendix D: Public Reports – Raw Data	28

1. Project Description

2.1 Introduction

The morepork (*Ninox novaeseelandiae*) project on Banks Peninsula was initiated in July 2014 and is expected to continue until 2017. The aim of this project led by the Banks Peninsula Conservation Trust (BPCT) is broadly to identify the habitats occupied by morepork and based on those findings, improve predator control in targeted areas as well as prohibiting the use of toxins. This work will contribute to improving the breeding and survival success of morepork and therefore increase their abundance in a fragmented and modified habitat on Banks Peninsula.

Ninox novaeseelandiae is an iconic native bird that only occurs in New Zealand and Norfolk Island (Department of Conservation [DOC], 2015; New Zealand Birds Online, 2015). *Ninox novaeseelandiae* are also known under the Maori name Ruru (DOC, 2015). Though morepork are a well-known bird species, not much research has been done in terms of their survival success in a fragmented environment.

The diet of *Ninox novaeseelandiae* consists mainly of invertebrates and small rodents (Clark, 1992). Morepork are nocturnal and well-known for their unique call. As a forest bird, they are mainly found in remote areas and are considered to be scarce in heavily modified land, as in Canterbury and Otago (Birding West Coast, n.d).

The number of pest mammals is considered to have a high impact on the survival rate of morepork. Previous studies show that even though morepork are at risk of suffering from secondary poisoning, they still occur in larger numbers where the amount of mammals are controlled by the use of brodifacoum poisoning compared to non-managed sites in New Zealand (Fraser & Hauber, 2008). They commonly nest in tree holes or in holes in the ground and around rocks (DOC, 2015), which especially makes the female and her eggs as well as chicks very vulnerable to predators during the breeding season. Morepork also compete with possums for nesting holes, which reduces their chances to find suitable breeding locations.

Nationally, morepork are not considered to be endangered (BirdLife International, 2014). According to the red list of the International Union for Conservation of Nature and Natural Resources (IUCN), the global population size of *Ninox novaeseelandiae* has not been quantified, however the numbers are considered to be stable (BirdLife International, 2014). Though morepork are classified as not threatened (DOC, 2015), they are rarely found on Banks Peninsula. To increase the numbers of morepork in this area, this project aims to identify what habitats they occupy in a fragmented environment and what aspects are important to ensure their breeding and survival success in the future.

2.2 Project Aim

The overall aim of this project is to increase the abundance of morepork on Banks Peninsula and improve their breeding success in the long-term. At this stage, the research focused on

detecting the presence or absence of morepork rather than identifying the size of the population across Banks Peninsula. However, those findings can be used as a basis for future work.

This study focused on three objectives:

1. *Determine the distribution of morepork on Banks Peninsula using presence and absence data.*

To determine the distribution of morepork on Banks Peninsula, several methods were used, including acoustic monitors, playbacks of recorded calls and various ways of communication with local residents.

2. *Identify the home range and breeding success of morepork fitted with radio transmitters in Kaituna Valley.*

By having a morepork pair fitted with transmitters, their activity could be monitored at any time to identify their home range and find nesting sites.

3. *Identify habitat preferences of morepork on Banks Peninsula.*

Tracking tunnels aided in identifying characteristics of good morepork habitat by detecting predator presence in the reserves.

All collected data was processed with ArcGIS to spatially display the morepork distribution on Banks Peninsula. Study sites and currently occupied habitats were displayed on a geographical map, which point out possible places for more detailed research. Making use of GIS, the spatial distribution of this species can easily be identified and used for future work. The data source indicating morepork presence was differentiated between scientifically detected information in comparison to responses from the general public. This data can subsequently be used to target predator control and install nesting boxes to increase their survival rate. Knowing the locations where morepork are present is crucial information for more comprehensive research on defining the characteristics of preferred habitats that may impact their survival rate. The findings of this project provide the baseline data that can be compared to future distribution studies to identify whether morepork disperse to new locations over time through the work of the Banks Peninsula Conservation Trust.

2. Methods



Figure 1: Location of study site, Banks Peninsula, Canterbury, New Zealand.

To identify the distribution of morepork on Banks Peninsula (Figure 1) and address the objectives of this project, a combination of several methods was used.

2.1 Methods used for Objective 1: The distribution of morepork on Banks Peninsula

3.1.1 Acoustic monitors.

Acoustic monitors (Figure 2) were the main tool for identifying whether morepork are present in particular reserves. Using recorders is a non-disruptive method, which increases the chances to pick up calls, as the birds are not manipulated by external factors (Plicht, Petru, Lastimoza & Suarez, 2009). Acoustic recorders allow collecting field data over several days without needing to be in the field in person. The monitors recorded all sound within line of sight from 6pm to 6am. They were installed on trees and left outside for seven to ten days (Figure 2). A total of 27 sites were studied for morepork presence by putting out acoustic monitors. The sites were chosen carefully based on the presence of old trees, which provide good nesting sites for morepork (DOC, 2015). The collected audio data was analysed using the software 'Freebird', which provided the opportunity to scan through the visual frequencies and to listen to potential morepork calls.



Figure 2: Acoustic monitor attached to tree at study site, Living Springs, Canterbury, New Zealand, 2014.

3.1.2 Playback using pre-recorded morepork calls.

Where results from the acoustic monitors were inconclusive for morepork, pre-recorded morepork calls were played at the study sites to provide additional evidence of presence or absence. The calls were played at night over speakers to encourage any nearby morepork to respond by calling back or moving closer to the speaker, providing the possibility to observe them visually. As soon as morepork presence was detected, the playback was stopped to prevent additional distress on the owls.

3.1.3 Collecting Data from the general public.

To receive additional data of morepork locations, historic records of morepork observations were checked. This included verbal communication with long-term residents and interacting with the public in various ways.

A citizen science technique was applied to perform coordinated monitoring for morepork calls in form of a public survey (Morepork Monday) that encouraged residents to spend an hour each Monday night listening out for calls within their area (Appendix B).

Additionally, media releases were undertaken to raise awareness about the project and current situation of morepork on Banks Peninsula. Articles about the morepork project and its aims were published in the local newspaper to provide updates on new findings and request reports from the public on morepork locations.

There were various options for the general public to provide information on morepork locations to the Banks Peninsula Conservation Trust. Data was collected through the use of text messages, filled out survey forms, verbal communication and observation listings on the Naturewatch website.

3.2 Methods used for Objective 2: Radio tracking to identify activity and home range of morepork

Radio Tracking.

A morepork pair in Kaituna Valley Reserve were caught at the start of the project (spring 2014) and had transmitters attached to them (Figure 3). This made it possible to locate the morepork pair at any given time. Radio tracking allowed to identify their habitat range within Kaituna Valley and locate their nesting site. Transmitters are expected to remain attached to the birds for 18 months.



Figure 3: One of the morepork in Kaituna Valley Reserve that have transmitters attached to them, Kaituna Valley, Canterbury, New Zealand, 2014.

3.3 Methods used for Objective 3: Identifying good morepork habitat characteristics

Tracking Tunnels.

Once the presence or absence of morepork was identified across a satisfying amount of study sites (total of 75 sites), tracking tunnels were used to provide a non-disruptive method to identify any possible predators and food source availability (small rodents) in reserves (Gillies & Williams, 2013). During this study period, two sites were set up with tracking tunnels: Kaituna Valley Reserve (morepork presence) and Otepatotu Reserve (morepork absence). Each site had 10 tracking tunnels set up and were left for 3 weeks before ink cards baited with peanut butter were placed inside. The cards were left in the field for 2 consecutive nights at both sites.

3. Results

4.1 Acoustic Monitors

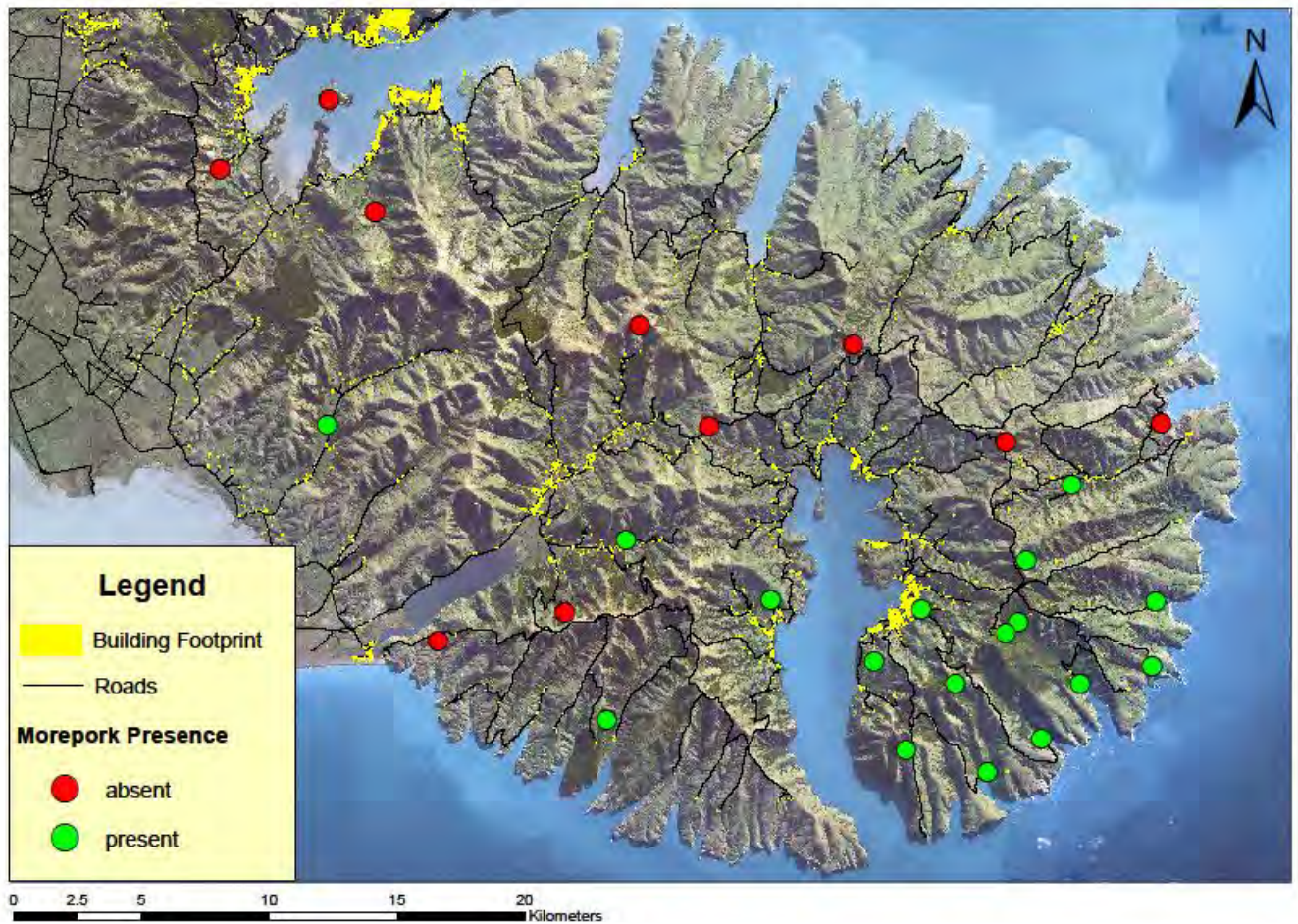


Figure 4: Scientific study sites on Banks Peninsula that were studied for morepork presence with acoustic monitors.

A total of 27 acoustic monitors have been put out into various reserves across Banks Peninsula. Of those 27 sites, 17 showed morepork presence and 10 indicated the absence of morepork (Figure 4). After displaying the results with GIS, clear patterns appeared, showing that morepork presence increases towards the southern and eastern parts of the peninsula.

4.2 Playback of Recorded Calls

Table 1: Playback sites and findings.

Playback Site	Response of Morepork
Okuti Valley (Testing Method)	Positive
Orton Bradley Park	Positive
Living Springs	Negative
Montgomery Park	Negative
Otepatotu Reserve	Negative

Playbacks have been performed at a total of five sites. Okuti Valley was used as a site to test the method, as it was known that morepork are present in this area. Additional four sites got double-checked for morepork presence of which only one site (Orton Bradley Park) resulted into a positive response by the owls. The other three sites still indicated morepork absence according to the results from the playbacks of recorded calls (Table1).

4.3 Reports from Public

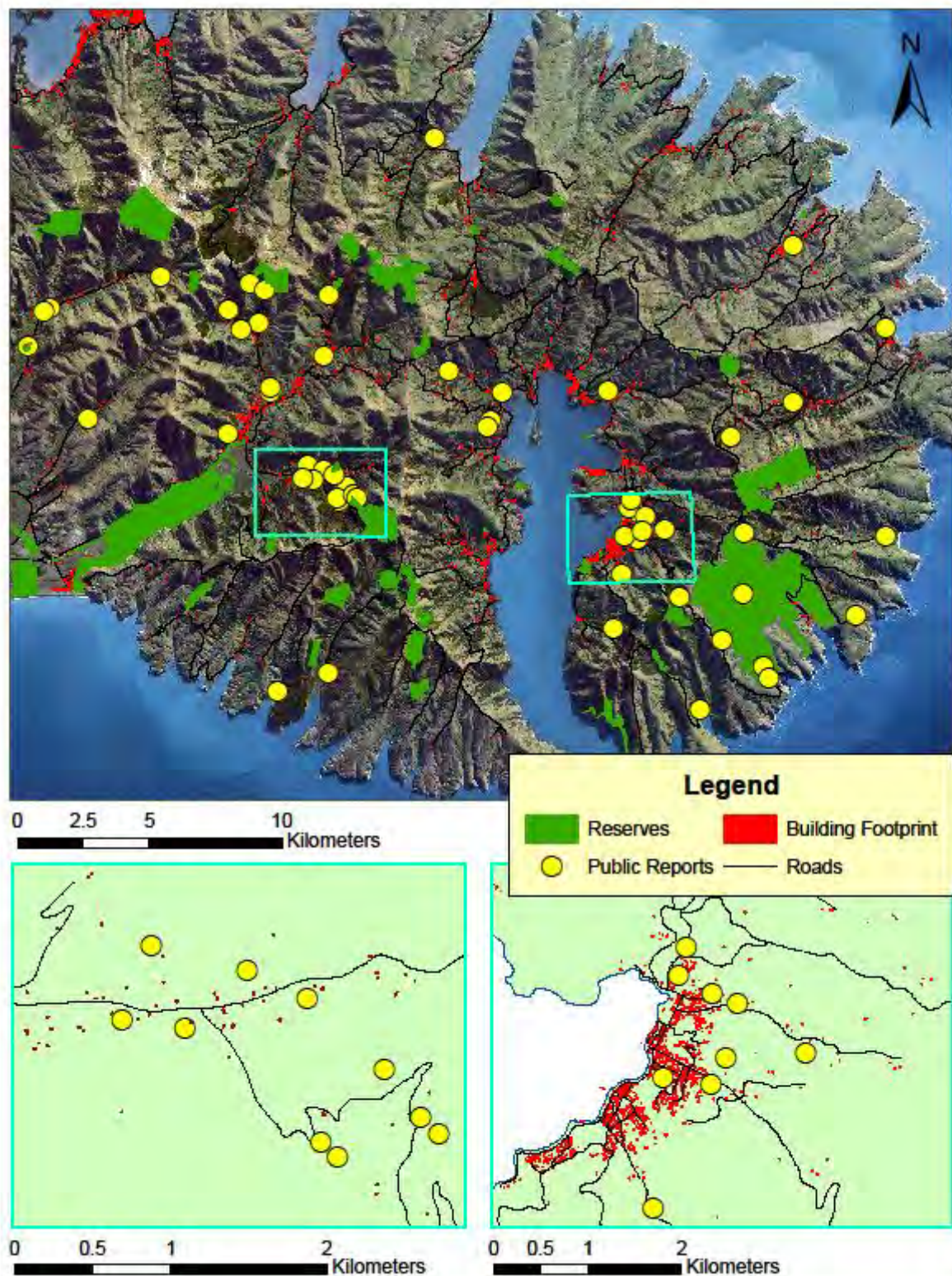


Figure 5: Public reports of morepork detection on Banks Peninsula. Reports include visual morepork observations and/ or morepork calls (top). Enlargements of Okuti and Reynolds Valley (bottom left), and Akaroa (bottom right) showing morepork reports.

Reports from the public have been received from across all of Banks Peninsula. When mapping out the locations of morepork sightings and calls, some patterns become visible (Figure 5). There is a cluster of reports within the Akaroa area, which also has a high building footprint compared to surrounding areas. Another location that has a relatively high number of reports is in Okuti and Reynolds Valley (Figure 5). Most reported observations were very close to roads and buildings.

4. 4 Radio Tracking

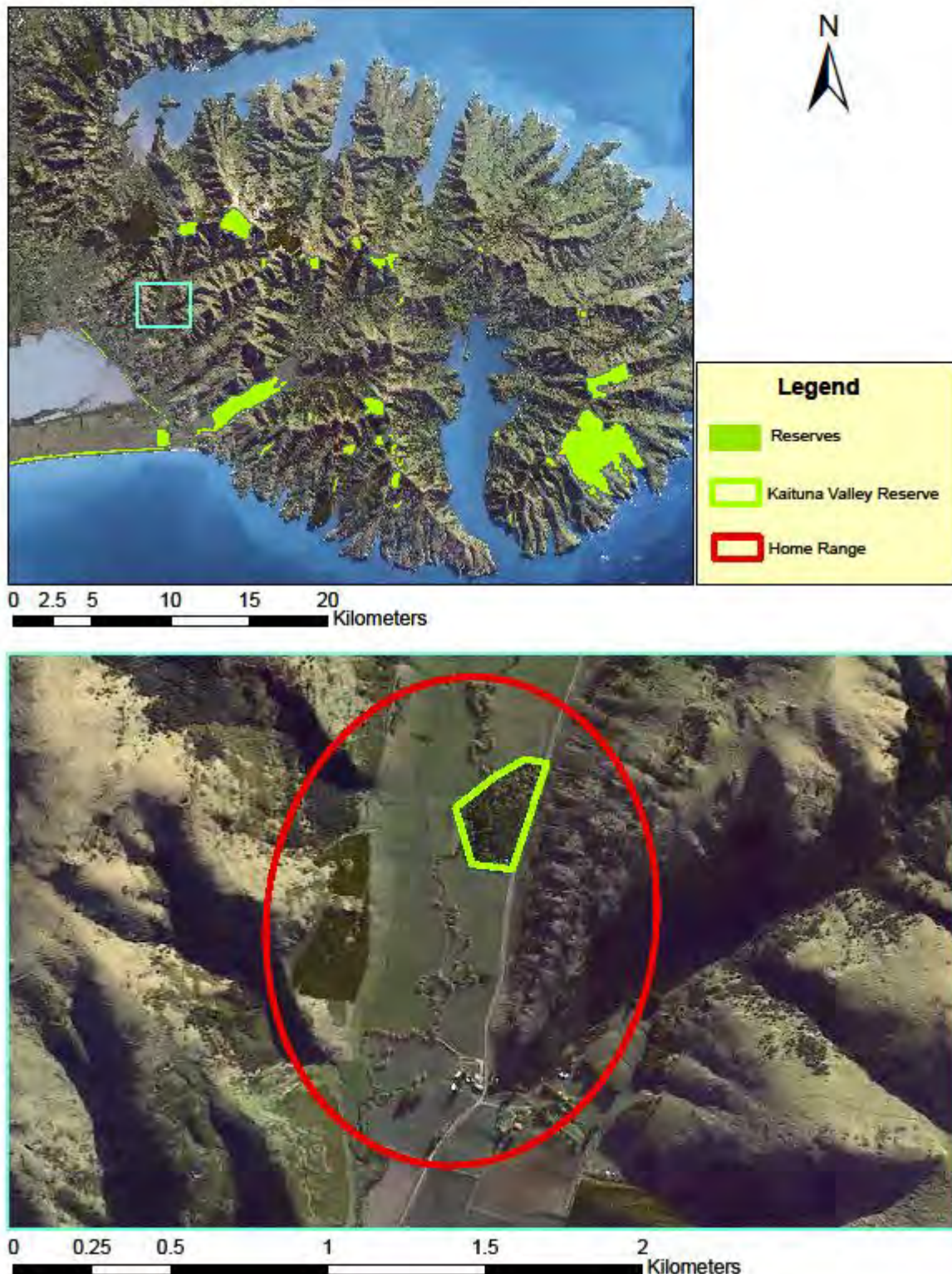


Figure 6: Home range of morepork pair in Kaituna Valley that is fitted with transmitters. Inserts show Kaituna Valley Reserve (green area) and identified home range (red area). Detected home range is based on the female's flight activity.

The identified home range of the female morepork in Kaituna Valley is approximately 152 hectares in size around the DOC reserve (Figure 6). During the day, both morepork could always be found within the reserve. As the transmitter of the male morepork had stopped working, only the activity of the female could be tracked. At night time, the female was found to remain on nearby farmland and in pine tree areas to the west of the reserve. At times, it was also noted that the female returned to the reserve area in between her flight activities. At the beginning of the project, both morepork were often located in the same area within the reserve. After climbing the tree in that particular location, it was found that the morepork pair had nested, however they had abandoned their nest by that stage and left three cold, fertile eggs behind. The opportunity to install a camera by the nest to closely monitor their activity was abandoned.

4.5 Tracking Tunnels

Table 2: Results from tracking tunnels in Kaituna Valley Reserve (morepork presence) and Otepatotu Reserve (morepork absence). Indicated numbers represent the amount of ink cards that displayed each species presence, with a maximum number of 10 per study site.

Species	Kaituna Valley Reserve	Otepatotu Reserve
Hedgehog	5	1
Mice	-	1
Rats	3	4
Possum	2	1
Cat	-	1
Invertebrates	1 (insects in grass area)	2 (Cockroaches, weta)



Figure 7: Tracking tunnel pulled out of the ground, with ripped ink card outside the tunnel, Kaituna Valley Reserve, 2015.

It is important to note that many ink cards at both sites were found outside the tracking tunnels and had bite marks on them (Figure 7), which indicates a high presence of possums. However, not many cards presented possum footprints, which makes it difficult to determine their level of presence.

The collected ink cards from Kaituna Valley depicted hedgehog presence in 50% of the tracking tunnel and rats were found in 30% of them. Possum footprints were clearly found on two cards, but their abundance may be higher. One tracking tunnel was set up in grassland at the edge of the reserve, which depicted insect marks, but no other footprints.

At Otepatotu Reserve, predator control is taking place in form of bait stations. However, the results from the ink cards showed the presence of ship rats in 40% of the tunnels, while hedgehogs, mice, possums and wild cats were each only found in one tracking tunnel. 20% of the ink cards also displayed invertebrate marks of cockroaches and weta.

4.6 Overall Morepork Presence

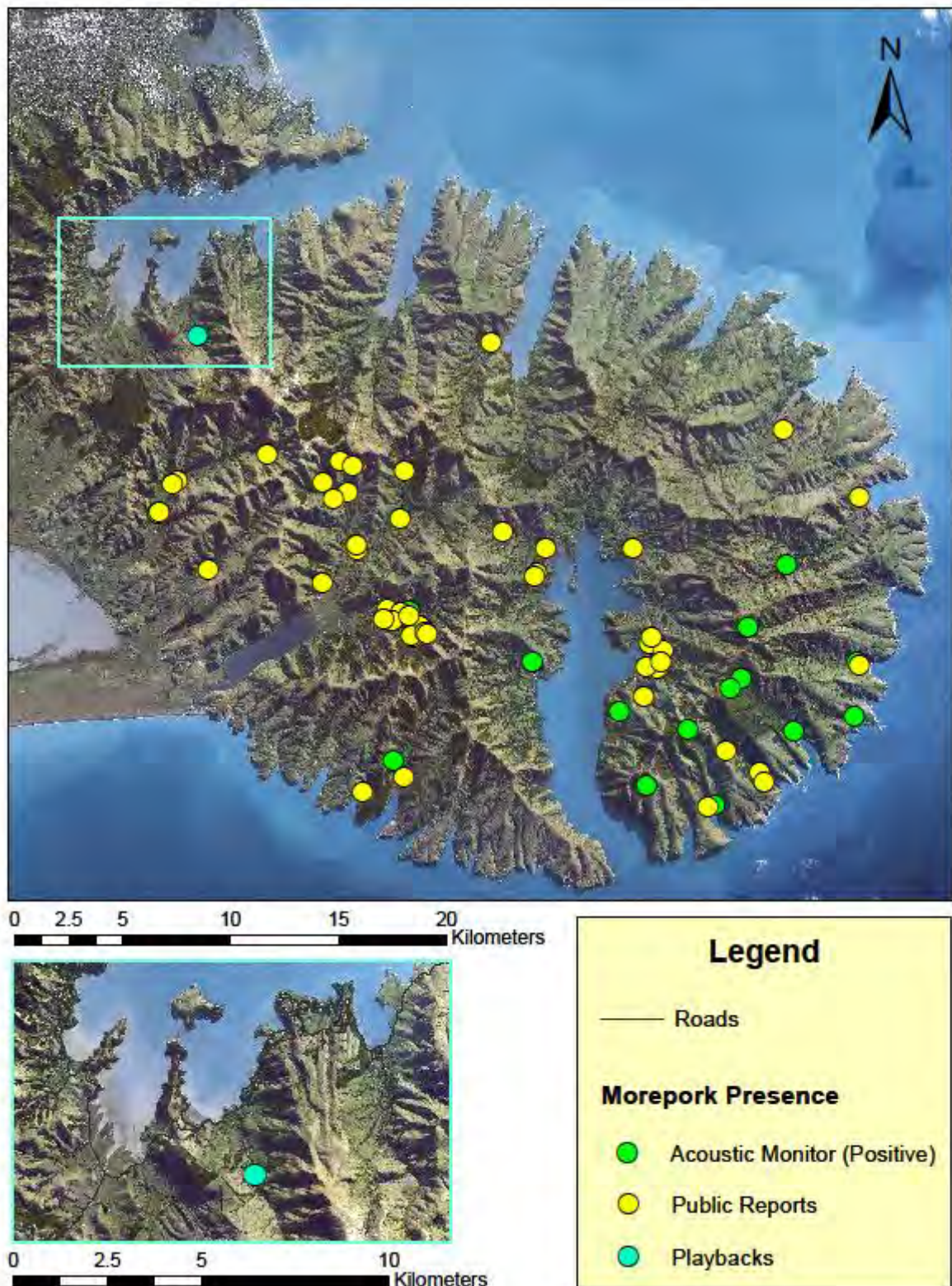


Figure 8: Overall morepork presence on Banks Peninsula, showing every detected morepork-present habitat, based on all methods combined. Insert shows playback location at Orton Bradley Park (bottom left).

All detected habitats combined display a distribution of *Ninox novaeseelandiae* across the peninsula. Four locations depict scientific as well as public detection, which are positioned at Okuti Valley, Flea Bay, Goughs Bay and Peraki Bay Scenic Reserve (Figure 8). All other locations only have evidence of one method indicating morepork presence. Additionally, only one study site (Orton Bradley Park) was identified as morepork habitat by the use of playbacks. The northern part of the peninsula indicated lower numbers of morepork-detections, however this may reflect the lesser amount of monitoring in this area.

4. Discussion

This study focused on identifying the location of morepork habitats and detecting their distribution on Banks Peninsula. All data collected from the various methods were processed with GIS to visibly depict the areas where morepork can be found. This in turn allows the finding of patterns that can give indications for further morepork presence or absence in surrounding forest that could not be studied yet. It also provides information on what habitat characteristics may determine the presence of *Ninox novaeseelandiae*.

5.1 Acoustic Monitors

The clear patterns found from the results of the acoustic monitors (Figure 4) may be due to various reasons. One reason might be that the southern half of the eastern part of Banks Peninsula is more remote and has a low population density compared to other areas, apart from one residential cluster in Akaroa (Figure 4). Though, considering the amount of morepork observations by the public, the proximity to residential areas might not be as important as other factors in terms of good morepork habitat characteristics. The cluster of observations around Akaroa may just reflect the number of people able to report observations and in fact may only be a pair of morepork. Another possible cause for higher morepork abundance in those particular parts of Banks Peninsula could be the size of the reserves or distances to other forest areas. In other terms, the habitat might not be as fragmented in this area compared to western parts of the peninsula. However, this requires further research to identify any major differences in habitat characteristics.

5.2 Playback of recorded calls

The idea of performing playbacks came from noticing how well the morepork responded to recorded calls whilst catching the pair at Kaituna Valley. Considering that acoustic monitors may not pick up on all sound, encouraging the owls to call out or fly closer to the source of sound appeared to be a good way to check sites that are thought to be non-occupied habitat. The technique was tested in Okuti Valley where morepork are known to be present and resulted in great response. Though, when applying the technique at other sites, only one out of four sites that initially implied morepork absence (Orton Bradley Park) could be disproved by performing playbacks through the detection of morepork calls (Table 1). The fact that morepork presence at Orton Bradley Park was only identified by performing playbacks, indicates that morepork may not always be present at that location, but rather occupy a wider habitat range. For the other three sites (Living Springs, Montgomery Park, Otepatotu Reserve) this provided additional evidence for the absence of morepork.

5.3 Public Reports

Public reports of morepork sightings and sounds have helped to create a more comprehensive geographical map displaying their presence on the peninsula. Including data from residents is a great way of receiving a lot of information in a short period of time and detecting any changes over the years from long-term residents. Some locals have added information on when they first started hearing them or whether there was a time no morepork have been around (Appendix D). This is useful information, which can be difficult to collect with scientific methods.

Though, the results have to be analysed with care, as they mainly indicate morepork presence in residential areas or in close proximity to roads (Figure 5). As a forest bird, morepork are known to prefer more remote habitats (Birding West Coast, 2015).

5.4 Radio Tracking

Radio tracking the morepork pair in Kaituna Valley created great opportunities to find out more about the behaviour of morepork. It made it possible to frequently find their location during the day as well as at night time. The identified home range may differ to the real home range of this morepork pair, especially as the male's activity could not be tracked. However, the results still indicate that these two birds have enough resources to survive within this valley and do not need to fly further for any reason (Figure 6). Additionally, the nesting site was located, though it had been abandoned by this pair. Reasons for that are unknown, although extreme rainfall and stormy weather prior to finding their nest may have forced them to leave.

5.5 Tracking Tunnels

At Kaituna Valley Reserve, hedgehogs and rats were predominant. No mice were found within the reserves (Table 2). This depicts a high number of predators, without many food sources in form of small rodents. Possums were also present in this reserve, as footprints were found on two out of ten ink cards. Due to the number of cards that were found outside the tracking tunnels (Figure 7), this number is considered to be higher. Despite these results, a morepork pair is successfully occupying this habitat. The findings from the radio tracking show that the pair moves outside the reserve at night, presumably to go hunting. The results of the tracking tunnels emphasize the need for the morepork to leave the reserve to obtain sufficient food resources. As the abandoned nest of this pair still contained three fertile eggs that had not been predated, the number of predators in this reserve may still be low enough to be considered as suitable habitat, which the pair occupies during the day.

Otepatotu Reserve was identified as a morepork absent reserve. The results from the tracking tunnels indicate high presence of predators in form of rats, however only one of each hedgehog, possum and cat was found in the reserve. Invertebrate marks and one set of mice footprints were also found in a couple of ink cards (Table 2). Overall, this indicates that the bait stations may not be successful on controlling the amount of rats, though other predators are only present at low numbers. At the same time, invertebrates that are good food sources

for morepork are present along with some mice. As no morepork were found in this reserve, the presence of rats might be too high for morepork to survive in this area. There is also the potential for other aspects to be of greater importance in determining suitable habitat, as more food sources were found at Otepatotu Reserve in comparison to Kaituna Valley Reserve where morepork are known to be present.

5.6 Overall Morepork Presence

The overall morepork distribution on Banks Peninsula, based on all methods used in this study, appears to be well-spread across the whole of the peninsula (Figure 8). There are some clear patterns between the results of different methods in regards to the location of morepork habitats. Many reports from the public indicate morepork presence in residential areas and along roads (Figure 5), while the scientific results focus on reserves and more remote areas (Figure 4). This indicates that using both methods (public information as well as scientific detection) obtains more results and allows for the creation of a more comprehensive spatial distribution map, which would not be possible by only using one of these methods. There are clear spatial differences in the results (Figure 8), which shows that these two methods complement each other well. Each method has a bias to it, such as close proximity to residential areas for public reports and limitation to chosen reserves for scientific detection. This bias gets reduced by combining the results of both methods.

Seeing the overall spatial distribution found in this study, morepork appear to be more abundant on the peninsula than initially expected. Though, this research focused on detecting morepork habitats in general without identifying the population size. This means that even though morepork are present in those areas, they might only occupy the habitat in small numbers. More comprehensive research is required to identify the population size and to be able to detect any change in the number of individuals over time, based on the work of the Banks Peninsula Conservation Trust. Additionally, the outer bays currently do not display many morepork-present locations, which may be due to a couple of aspects. Firstly, those areas have been neglected in the scientific study due to time constraints and accessibility issues, and secondly, they depict a very low building footprint, which reduces the chances of receiving reports from the public for those locations. Based on this, further research is required in those remote areas to complete the current distribution map.

5. *Limitations*

When looking at the results, it is important to consider that they may differ from the actual distribution of morepork across Banks Peninsula. The acoustic monitors only pick up noise from line of sight, therefore the monitors may fail to record calls depending on the size, terrain and location of the reserve. Background noise can also interfere with the recordings caused by bad weather, busy roads, nearby farms or streams. Therefore the role of playing recorded calls in the field is crucial to gain a better understanding of the abundance of morepork in areas where they are considered to be absent. Using acoustic monitors in the first instance is still a recommended approach, as it does not cause any disturbance to the wildlife.

The study sites have been chosen in regards to the presence of old trees that provide good possible nesting sites for morepork. Though, some reserves that appear to be great potential morepork habitat are not as easily accessible. Therefore the results may indicate some bias of morepork presence closer to populated areas and roads rather than more remote areas on Banks Peninsula, which are considered to be preferred by this species (Birding West Coast, 2015)

The displayed morepork habitat maps differentiate between scientifically detected presence and feedback from the public, as the latter may not be as reliable as the scientifically collected data.

Additional research is also required to identify the habitat range of morepork. For this project, only two morepork had been fitted with transmitters in Kaituna Valley Reserve, which does not provide sufficient data for generalised information on the habitat range of morepork in a fragmented habitat. As the transmitter of the male had stopped working, the gathered information is only based on the activity of the female, which may differ to the male's home range.

6. Conclusion

Ninox novaeseelandiae are forest birds and due to habitat fragmentation, have become scarcer in Canterbury and Otago over time. Looking at the results from this study, morepork seem to have adapted well to an environment that does not provide continuous, large areas of forest. Through the combination of several data collection methods, a comprehensive spatial distribution map could be created. Morepork appear to be wide-spread, but patchily distributed across the peninsula, and the number of individuals may still be relatively small. Additional research in the northern parts of the peninsula is required to detect morepork presence in more remote areas. The information collected on their presence also indicates that some areas on Banks Peninsula appear to be preferred by morepork compared to others. This will require further research to identify those differences and ensure that more suitable habitat is created in the future. The morepork pair in Kaituna were found to be active outside the reserve area, which indicates that small forest patches can be occupied by morepork, but might not be sufficient to sustain them, and requires them to leave frequently to access resources. The results suggest that a reserve may still be suitable habitat irrelevant to the amount of food sources available within it, if the surrounding area contains sufficient resources to sustain the morepork and the number of predators is limited. Nesting boxes and predator control may increase their overall survival rate on Banks Peninsula.

7. Future of the Project

The morepork pair in Kaituna is still fitted with transmitters which provides the opportunity to perform on-going monitoring on their activity. This season the pair abandoned their nest,

but due to the possibility of observing them during the next season, there is the opportunity to find their new nesting location, if applicable. If the pair does begin to nest again, a camera can be installed to gain more detailed information about their activity during that time. Additionally, it might be possible to catch the male again to replace the transmitter to be able to monitor his activity in comparison to the females. This is of special interest during the nesting period, when the female spends most of her time in the nest (Hogg & Skegg, 1961).

Furthermore, the BPCT is in the process of approaching schools to raise awareness of this iconic New Zealand bird and to get them involved in building nesting boxes. Morepork boxes are also being offered to locals, especially covenants, to provide safer nesting sites.

8. Recommendations

When performing playbacks at night, it can be challenging to notice any nearby morepork, as they do not always respond verbally and are very quiet when they fly. Therefore it is best to perform playbacks at dusk, to optimize the possibility to notice potential morepork by additionally providing the opportunity to observe them as they move closer to the source of sound. Going out on a clear night rather than in rainy weather will also increase the chances to find morepork. When playing recorded calls it is required to do this carefully, not to impose too much distress to morepork present. This is especially vital to retain the possibility of catching them in the future to attach transmitters for further studies or checking their health.

Further research in the northern parts of the peninsula may be useful to create a more comprehensive distribution map in addition to the already collected data.

As the results from the tracking tunnels are not sufficient, further research is required to identify the key characteristics for good morepork habitat. More work can be done with tracking tunnels to gain a comprehensive understanding of differences in predators at morepork present and absent reserves, as the current results of only two study sites is insufficient to make generalised conclusions. In addition, the type of vegetation and altitude can also be assessed to include other aspects that potentially impact the quality of morepork habitats.

9. Acknowledgements

Banks Peninsula Conservation Trust

- For initiating the project

Department of Conservation

- For supplying field equipment
- Special thanks to **Moir Pryde** to assist as the technical advisor for this study and on-going work of the project

Lincoln University

- For providing the summer scholarship research project with financial support

James Sharon Watson Conservation Trust

- For funding the morepork project from the BPCT and making it financially possible for us to undertake the study

Bruce Mahalski

- For permission to use his morepork drawing

10. References

- Agnew, W. (2009). *What made these track?: A guide to assist in interpreting the tracks of small mammals, lizards and insects*. Warkworth, New Zealand: Chappel Printing Ltd.
- BirdLife International (2014, July 24). *The IUCN Red List of Threatened Species: Ninox novaeseelandiae*. Retrieved January 30, 2015, from <http://www.iucnredlist.org/details/62023843/0>
- Birding West Coast. (n.d.). *Birding Detail: Morepork*. Retrieved January 6, 2015, from <http://www.birdingwestcoast.co.nz/birding/Birdingdetail/index.cfm/species/28/>
- Clark, J.M. (1992). Food of the Morepork in Taranaki. *Notornis* 39(2), 94.
- Department of Conservation. (n.d.). *Morepork/ ruru*. Retrieved January 8, 2015, from <http://www.doc.govt.nz/conservation/native-animals/birds/birds-a-z/morepork-ruru/>
- Fraser, E.A. & Hauber, M.E. (2008). Higher call rates of Morepork, *Ninox novaeseelandiae*, at sites inside an area with ongoing brodifacoum poisoning compared with matched non-managed site. *NZ Journal of Zoology*, 35 (1), 1-7. doi:10.1080/03014220809510098
- Gillies, C.A. & Williams, D. (2013). DOC tracking tunnel guide v2.5.2: Using tracking tunnels to monitor rodents and mustelids. *Inventory and monitoring toolbox: animal pests DOCDM-1199768*.
- Hogg, M.J. & Skegg, P.D.G. (1961). Morepork in a nesting box. *Notornis*, 9(4), 133-134.
- New Zealand Birds Online. (n.d.). *The digital encyclopaedia of New Zealand birds: Morepork*. Retrieved January 6, 2015, from <http://nzbirdsonline.org.nz/species/morepork>
- Policht, R., Petru, M., Lastimoza, L. & Suarez, L. (2009). Potential for the use of vocal individuality as a conservation research tool in two threatened Philippine hornbill species, the Visayan Hornbill and the Rufous-headed Hornbill. *Bird Conservation International*, 19 (1), 83-97. doi:10.1017/S0959270908008228

11. Appendices

11.1 Appendix A: Locator Map

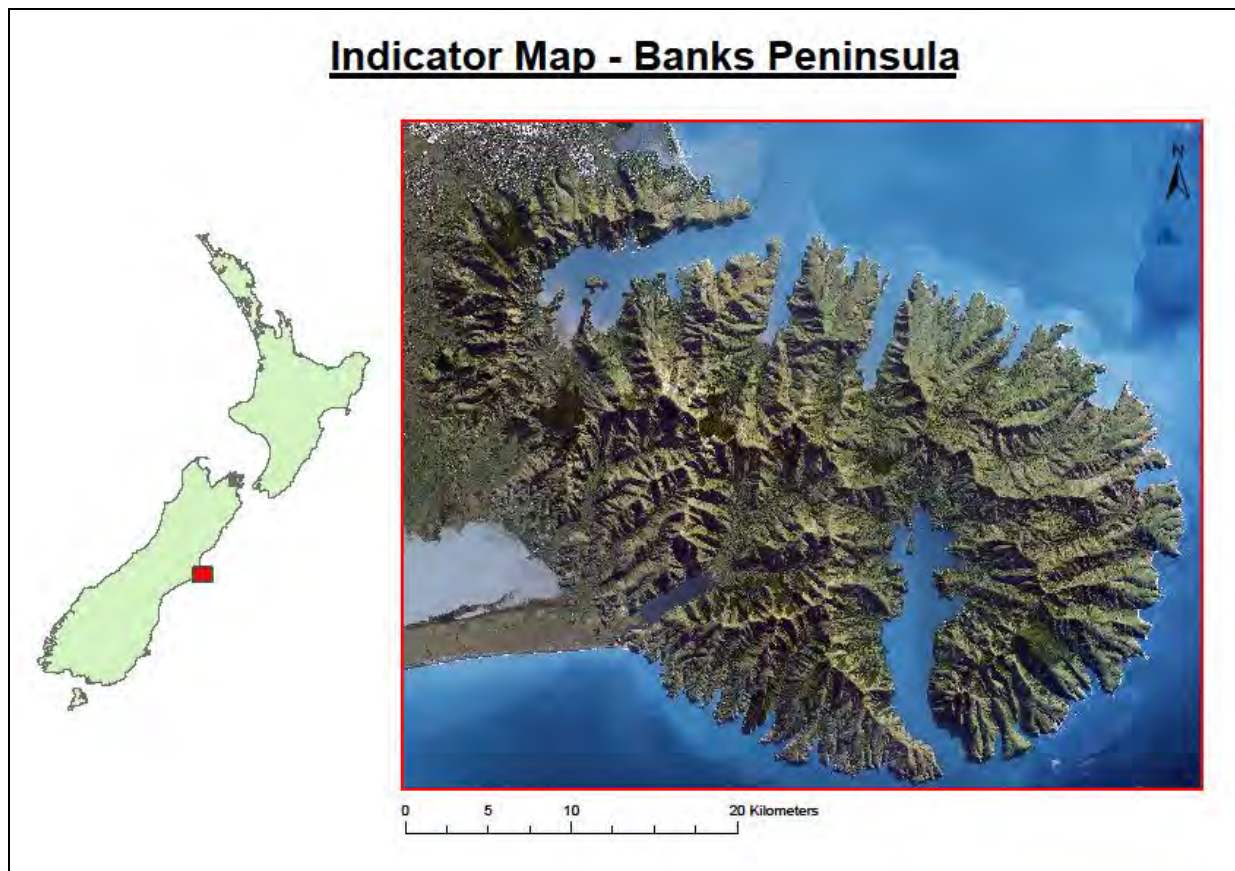


Figure 9: Locator map, showing location of study site within New Zealand. Insert showing satellite image of Banks Peninsula, Canterbury, South Island, New Zealand.

11.2 Appendix B – Morepork Monday Flier



A Community Conservation Initiative

Morepork Mondays

(October & November, 2014)

**Help us to find out where
Morepork live on Banks Peninsula.**

We need your help to understand where Morepork are (and are not) living on Banks Peninsula.

How can you help?

It is easy! Just listen out for the call of the Morepork between 8 and 10 pm every Monday evening during October and November. (Don't worry if you miss a week or can't listen all of the time).

The best way to do this is to sit near a slightly open window, go for a walk outside or by sitting near a place you think they might be (e.g., big old trees, bush remnant, pine forest).



Photo: Andrew Thomas

You can use this form to keep a record of the dates that you listened.

Date	Morepork Heard Yes/No
6th October	
13th October	
20th October	
27th October	
3rd November	
10th November	
17th November	
24th November	

Record your details here:

Name: _____

Place where recording/
listening took place: _____

Or: GPS coordinates: E N

Email address: _____

Phone number: _____

Send your form to:

Banks Peninsula
Conservation Trust
P.O. Box 146,
Tai Tapu.

Email it to:

coordinator@bpct.org.nz

Text us:

021 02779363

Figure 10: Survey form of citizen science technique: Morepork Monday.

11.3 Appendix C: Acoustic Monitors – Raw Data

Table 3: Raw data of scientific detection of morepork presence and absence on Banks Peninsula.

Site	Presence	Easting	Northing	Date last recorded
Akaroa	✓			
Armstrong Reserve	Present Oct 14	1600137	5146264	
Ellangowen Reserve	✓	1602923	5150161	2013
Fishermans Bay	✓	1606648	5147159	2011-3
Flea Bay	Present Oct 14	1598600	5145104	
Goughs Bay	✓	1604684	5149582	2011-3
Hinewai	✓	1601911	5147316	2011-14
Kaik Hill	Present Oct 14	1596964	5146286	
Kaituna Valley	✓	1580043	5159517	
Lighthouse Road	✓			2011-3
Living Springs	none found 2014			
Lower Le Bons	X			
Lower Otanerito	✓			2011-3
Middle/upper Le Bons	✓			2011-3
Montgomery Reserve	none found 2014	1589636	5156349	
Mt Fitzgerald	none found 2014			
Mt Pearce	none found 2014	1594858	5160185	
Oashore	none found 2014			
Okuti Valley	✓	1587409	5151122	
Orton Bradley Park	✓			
Otepatotu reserve	none found 2014	1601320	5156042	
Peraki Station	✓			2014
Quail Island	X			
Stony Bay (Armstrongs)	✓			2011-15
Stony Bay Saddle	✓			2011-3
Te Oka Reserve	none found 2014			
Wainui Reserve	Present Oct 14			

11.4 Appendix D: Public Reports – Raw Data

Table 4: Raw data of public reports on morepork locations based on sightings and calls.

Name	Address	Date of reco	Notes	Method of communication
Pam Helps	Aylmers Valley, Akaroa	10/11/14	Have been hearing them regularly on and off for 40 yrs	Text
Anonymous	Woodills Rd, Akaroa	14/11/14	Near start of track	Text
Anonymous	Tirohanga Terrace	11/11/14		Text
Barbara Surtees	63 Grehan Road Akaroa	9/11/14	Big increase over last 2 seasons	Text
Anonymous	74 Rue Balguerie, Akaroa	9/11/14		Text
Anonymous	Old Coach Rd, Akaroa	8/11/14		Text
Anonymous	Moore's Road, Barry's Bay	8/11/14		Text
Lynette Curry	Barry's Bay	7/11/14	Been hearing previous 2 months	Text
Anonymous	Batchelors Road, Little River	17/10/14		Text
Stace	84a Barry's Bay Valley Road	10/10/14	In totara tree	Text
Stu Wright-Stow	Okuti Valley Road	2/01/15	Between Lewthwaites and their property	Verbal
Dawn Pike	Okuti Valley Road	25/01/14	Have had morepork since she was born there 70 yrs ago	Verbal
Simon Fowler	Reynolds Valley Road	23/01/15	Young bird as call not well defined	Verbal
Darryl Johnstone	Reynolds Valley Road	Dec-14	Have been hearing them regularly on and off for 4 yrs	Verbal
Kit Grigg	Smith Street, Akaroa	November, 2014	Have been hearing calls across the valley	Verbal
Alison Evans	160 Reynolds Valley Rd	2004-2015		Verbal
Geoff Ettrick	302 Reynolds Valley Rd	2011		Verbal
Liz Todhunter	Puaha Valley Rd	2008		Verbal
Mel Cutler	234 Okuti Valley Rd	2003-2011		Verbal
David Skilton	Okuti Valley Rd	2006-2011		Verbal
Jo & Dave	Western Valley Rd	2001-2011		Verbal
Steve	Western Valley Rd	2011		Verbal
Tina Troup	Holmes Bay	2002		Verbal
Brian Narbey	Otanerito	2007		Verbal
Hugh Wilson	Otanerito	2007??		Verbal
Marie Haley	Goughs Bay	2011		Verbal
Nial Mugan	Reynolds Valley Rd	2010-2011		Verbal
Dave Hunter	Church Rd, Little River	2011		Verbal
Kaite Hansen	398 Western Valley Rd, Little River	2011		Verbal
John McIlroy	Akaroa	2011		Verbal
Greg and Janine	Okuti Valley Rd, Little River	2011		Verbal
Judy Woodward @ Gordon Rigg's	1190 Okains Bay Rd (Log Lodge)	18-Jan-12		Verbal
Vicky Parr	Top of Kaituna Valley	Jan-12		Verbal
Lorne	Kaituna Valley Rd	2007?-2012		Verbal
Andreas Lageder	25 School Rd, Robinson's Bay	2002-2012		Verbal
Sheryl Stanbury	Church Rd, Little River	2012		Verbal
Russel Turner	Moore's Rd, Barry's Bay	2013		Verbal
Phillipa Gardener	Le Bons Bay	2013		Verbal
Richard Kimberley	Stony Bay Road	2013-2015		Verbal
Jonathan Palmer	Prices Valley	2013		Verbal
Nial Mugan	Kaituna Valley Reserve	2013		Verbal
Ben	Flea Bay	2014		Verbal
Lil Foley	Robin Hood Bay	2014		Verbal
Annelies Pikelharing	Montgomeries Road, Little River	November, 2014		Verbal
Patelo Family	Peraki Station	November, 2014		Verbal
Gerard Neal	Kaituna Valley Road,	November, 2014	Hears regularly in the early morning (5am ish)	Verbal
Ian and Sabina	Whites Road, Little River	November, 2014	Heard regularly in big macrocarpa trees near their house	
Marieke	Morrison's Road, Little River	October, 2014		