# Regionwide Matuku-hūrepo (Bittern) Survey 2023

Survey Date:
13 October – 15 October 2023

Report Prepared by Renee Denby
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PREDATOR FREE
HAURAKI COROMANDEL
COMMUNITY TRUST

**Acknowledgements**

Thank you to all the volunteers who participated in our inaugural Matuku Survey. We are truly appreciative of the time and effort taken to go out on those early mornings and evenings to listen and look for matuku. Your commitment to protecting these endangered birds is invaluable.

To the team at Natural Solutions, Hamish Kendal and Meg Graeme, we cannot thank you enough for the immeasurable support and guidance you have provided that enabled us to get this survey up and running. To Department of Conservation Science Advisor, Harry Caley, we are exceptionally grateful for your expert knowledge and advice on how best to monitor these birds.

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# 1. Introduction

### 1.1 The Field Support Team

Predator Free Hauraki Coromandel Community Trust (PFHCCT) was established in 2017 to support community conservation groups on the Coromandel Peninsula. The project covers the 286,000 ha from Moehau to Te Aroha Maunga and encompasses over 60 conservation groups. Our goal is to see the Hauraki Coromandel region become predator free and we aim to do this by helping community conservation groups in their predator control and biodiversity enhancement endeavours. One such tool that has been implemented by PFHCCT is the formation of the Field Support Team who assists conservation groups with on-the-ground support including establishing new trap lines, communicating with local and regional governing bodies, and biodiversity monitoring. A key goal of PFHCCT, through the Field Support Team, is to implement regionwide biodiversity monitoring of selected significant species. Through the work that the Field Support Team has undertaken over the past year, they noticed a real enthusiasm from volunteers for the protection of the matuku-hūrepo (*Botaurus poiciloptilus)* and thus, that nationally critical species was selected for this survey.

### 1.2 Matuku-hūrepo

The matuku-hūrepo, also known as the Australasian bittern, is a wetland bird native to Aotearoa, Australia, and New Caledonia (Heather & Robertson 2015). There are fewer than 1000 birds believed to remain in New Zealand subsequently assigning them with the conservation status of nationally critical (Heather & Robertson, 2015; Robertson, et al., 2021). They live in the raupo and reeds of primarily freshwater wetlands but can also be found in other wet areas such as damp pasture (Heather & Robertson, 2015). Matuku-hūrepo, hereafter referred to as matuku, are very cryptic birds in both their behaviour and appearance. Their brown, mottled plumage allows them to effortlessly blend into their surroundings as they move through their habitat stealthily, often freezing when disturbed with their necks stretched up tall and their bill pointed to the sky (Figure 1) or conversely, they may drop down into the reeds to disappear (Heather & Robertson, 2015). Their secretive behaviour coupled with the fact that they live in areas that can be difficult to survey means that they are a challenging species to study (O'Donnell & Robertson, 2016).

**Figure 1. Matuku-hūrepo in a freeze pose (Whitehead, 2022).**

### 1.3 Threats to Matuku

There are many threats to matuku that contribute to their worryingly low population numbers but likely the most significant threat is habitat loss. Approximately 90% of the wetlands in New Zealand have been destroyed since human settlement to make way for farmland and townships; displacing the wetland species that live there (Figure 2) (Ausseil, et al., 2008; O'Donnell & Robertson, 2016; Heather & Robertson, 2015). The quality of the remaining wetlands is also a cause for concern. Changes in land use in the catchments surrounding wetlands regularly results in runoff that has detrimental effects for the vegetation and animals that live in wetlands (O'Donnell & Robertson, 2016). Matuku have a varied diet, feeding primarily on fish but also eels, freshwater crayfish, frogs, insects, lizards, molluscs, spiders, and worms (Williams, 2013; Heather & Robertson, 2015). The presence and abundance of these food sources in wetlands where matuku feed is dependent on the quality of the wetland itself. Therefore, if the water and surrounding vegetation in the wetland is of poor quality, there will be little for the matuku to eat. Additionally, matuku must also compete with rats for the food that is available. One consequence of food scarcity and habitat degradation is that matuku have been observed eating plague skinks (*Lampropholis delicata*) that sun themselves on roads as well as foraging in roadside drains. Unfortunately, a number of matuku have been hit by vehicles when foraging on roadsides, resulting in injury or death (RNZ, 2023; O'Donnell & Robertson, 2016). Ultimately, matuku have very few places to live and of those remaining wetlands, even fewer are suitable habitat for feeding and breeding.

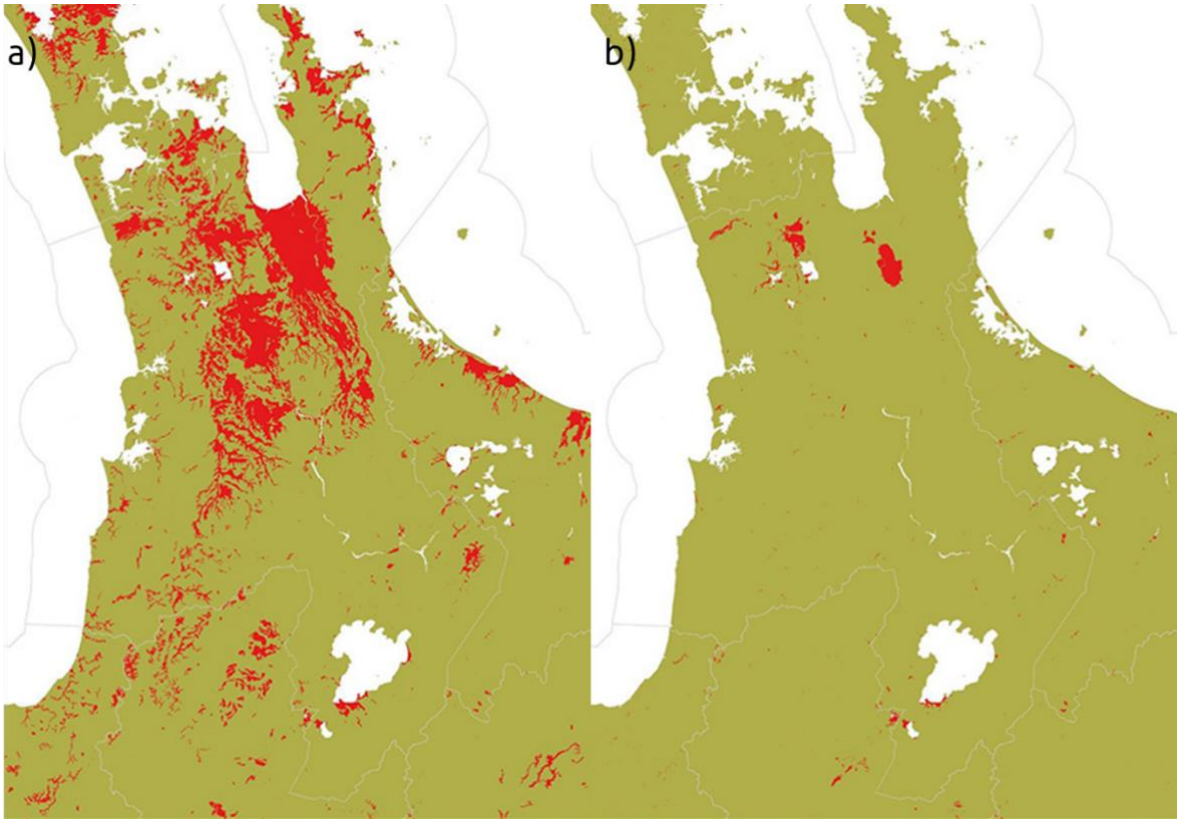


**Figure 2. Wetlands in the central North Island, New Zealand (a) before human settlement and (b) present day (Sharpe, 2018).**

Like most of the native manu in Aotearoa, matuku are vulnerable to introduced mammalian predators such as stoats, cats, and rats (O'Donnell, 2011; Williams, 2013). Native predators such as the kāhu (harrier hawk, *Circus approximans*) also prey on matuku eggs and nestlings (Heather & Robertson, 2015). Female matuku and their young are particularly susceptible to predation when they are on the nest (O'Donnell & Robertson, 2016). Females alone incubate the eggs for around 25 days and once hatched, the nestlings remain in the nest with the mother for approximately seven weeks (O'Donnell, 2011; Williams, 2013). For all this time, they are relatively defenceless. In a healthy, thriving wetland, a mother matuku should only need to be off the nest for a few minutes at a time to collect enough food for herself and her young. However, they have been observed off the nest for more than an hour which leaves ample time for the eggs or chicks to be located by predators (Kendal, 2023). Very few matuku nests have been found or studied which means that little is known about this time in their development. However, the lack of recruitment back into the population strongly suggests that they are struggling to raise their young to adulthood (O'Donnell, 2011; Williams, 2013).

### 1.4 Wetland Conservation in the Hauraki-Coromandel Region

Conservation work, primarily led by volunteers in community conservation groups, is widespread in the Hauraki Coromandel. There are extensive areas under protection, with a focus on predator control in forested areas that have North Island brown kiwi (*Apteryx mantelli*) (PFHCCT, 2023). In general, on the peninsula, wetlands are not as heavily protected as forests as far less is known about these habitats and they are not as well popularised with communities. Despite wetland protection not being the principal target of many groups, the majority of these groups have trap lines surrounding their local wetlands to protect the plethora of endangered animals and native plants that live there which may include matuku. The removal of invasive plant species and planting of native vegetation is also commonplace among many conservation groups (Wadey-

Barron, 2022). The efforts of these groups to protect the biodiversity in forests in the Hauraki Coromandel has been successful (PFHCCT, 2023).

### 1.5 Regionwide Matuku Survey

Anecdotally, matuku have been consistently observed on the Hauraki Coromandel Peninsula for many years but the number of individuals currently on the peninsula is unknown. In 2017, it was estimated that there were approximately two dozen males in the region (Stewart, 2017). As female matuku do not boom, they are considerably more difficult to observe and count, thus, most studies focus on the presence of male birds out of necessity (O'Donnell, 2011). The 2023 PFHCCT Regionwide Matuku Survey was realised through local volunteers' enthusiasm for learning more about this cryptic bird and how to better protect them. Although it is not conceivable to execute a census of the matuku population on the peninsula due to both resource availability and the birds' cryptic behaviour, a survey to discover where they may be breeding was conceptualised.

### 1.6 Objectives

The objectives of this survey were to:

- Conduct simultaneous surveys across various sites on the peninsula to determine whether there are multiple birds on the peninsula or if it is a few birds frequenting many wetlands.
- Make hypotheses about where there may be breeding pairs.
- Provide data to external sources that can use this to search for nest sites.
- Establish a baseline survey that can be repeated annually to track population distribution.
- Raise awareness about matuku.

# 2. Methods

The Department of Conservation (DOC) protocols for monitoring Australasian bittern were used as a guide to create methods for this survey (O'Donnell & Williams, 2015). DOC team members were consulted on how best to adapt these for our purposes.

### 2.1 Site Selection

We reached out to a small number of community conservation groups that had previously expressed an interest in matuku monitoring to ask if any volunteers would be interested in surveying a wetland in their area. As matuku are present in such low numbers, any wetland that could potentially be a breeding or feeding area for a bird was considered for a site. For this first year of the survey, the number of sites was initially expected to be a maximum of approximately 15. However, there was such great interest from volunteers that we were able to include 24 crewed sites and five automated acoustic recorder (AAR) sites (Figure 3).

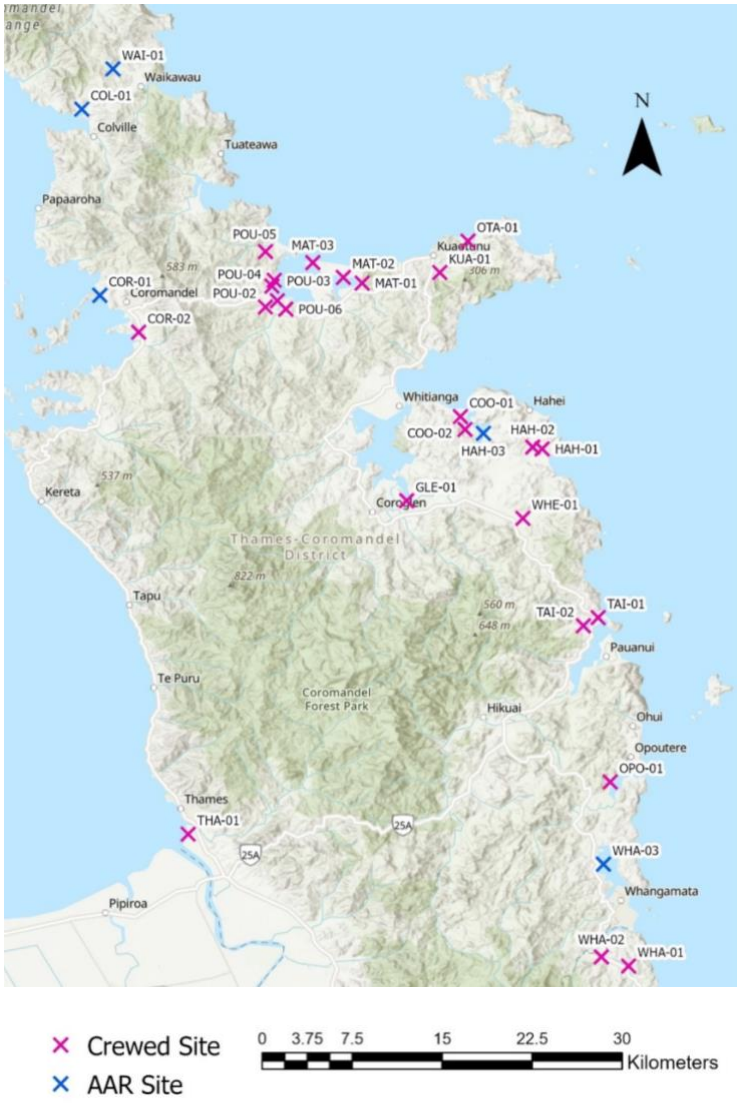


**Figure 3. Crewed and automated acoustic recorder (AAR) survey sites across the Coromandel Peninsula.**

### 2.2 Volunteer Training

We ran a training evening in Whitianga on the 5th of October 2023 with the option to attend online. The training covered the instructions for completing the survey and identifying matuku booms which fortunately are very distinct. We also discussed the situation facing matuku and the importance of monitoring their populations. Survey participants were given an instruction booklet and datasheets (Appendices 1 and 2) at the training. For those that could not make it in person, these were delivered to them the following week.

### 2.3 Survey Timing

The timing for the survey was set for mid-October to coincide with the peak egg-laying period of female matuku. One survey event is generally sufficient to achieve a snapshot of the wetland sites in an area, but multiple survey events were planned in case unpredictable weather prevented any of them from going ahead and the more information we could gather, the better. The survey was set for the weekend starting on Friday 13 October with six survey events to take place over three days.

The peak matuku booming period at dawn occurs for the one and a half hours before sunrise and the peak booming period at dusk occurs for the 30 minutes before sunset to one hour after sunset (O'Donnell & Williams 2015). After consulting with DOC Science Advisor, Harry Caley, we agreed that one hour rather than one and a half hours was sufficient observation time for our purposes. Local sunrise on the survey dates was at approximately 6:30 am and local sunset was at approximately 7:30 pm. We determined that the dawn survey events would be from 5:30 am to 6:30 am with dusk survey events from 7:00 pm to 8:00 pm. Thus, there were three each of dawn and dusk survey events from Friday 13 October to Sunday 15 October. Generally, it is recommended that when surveying with observers, the dusk survey events are preferred, however, our volunteers are very enthusiastic about matuku conservation, and many were happy to survey in both the morning and evening. Consequently, all volunteers were informed that they could survey at both dawn and dusk over the three days, however, the dusk survey event on Saturday 14 October was chosen as the one Principal Survey Event. While all six survey events would be used to make inferences about matuku, the Principal Survey Event would provide the most accurate snapshot of matuku presence on the peninsula as everyone would be observing for the same hour. Volunteers were also encouraged to note any incidental observations of matuku outside of the survey times but during the survey weekend.

### 2.4 Data Recording

During each survey event, volunteers were listening and looking for matuku for the designated hour. They were to record the time the observation was made, if the bird was heard or seen, and the direction and distance it appeared to be. In addition, if they were able to, volunteers were asked to identify whether it was the same bird or multiple birds. For the most part, it is difficult to determine whether booming is coming from one or multiple birds but in some instances it is possible. The datasheets had a column that allowed volunteers to note whether it was the same bird or not by noting, for example, Male A or Male B. We also asked volunteers to make any notes about observations that may indicate the presence of a female matuku. Such incidences include seeing two birds together, particularly of different sizes, or a bird flying to or from the direction of a booming male.

The DOC datasheets for the triangulation of matuku were used as a base for this survey's datasheets (O'Donnell & Williams 2015). A lot of information on the DOC datasheets was not relevant for this survey so a simplified version was created to

make data recording as straightforward as possible for volunteers (Appendix 2). Additional information was added to the datasheets to get a better understanding of the wetland itself, including the condition of the wetland and other bird species present.

### 2.5 Automated Acoustic Recorders

Five automated acoustic recorders were loaned to us from Waikato Regional Council. These were placed at sites that were of interest to us but that had no volunteers available to crew them. DOC AR4 acoustic recorders were deployed to these sites. They were installed on small trees at the edge of the wetlands at a height of approximately 1.5 m from the ground. The recorders were programmed to record for all six of the survey periods and set to record on the low setting to capture the low frequency of matuku booming.

### 2.6 Acoustic Data Processing

AAR soundwave data was analysed using Raven Lite software. Sites with matuku presence were mapped and the survey periods were split into 10-minute segments to analyse where matuku observations were overlapping in each area.

# 3. Results

### 3.1 Survey Observations

Matuku were observed at 16 of the crewed survey sites and at three of the AAR sites (Figure 4). They were observed in the areas in and/or surrounding Colville, Cooks Beach, Coroglen, Coromandel Town, Hahei, Kūaotunu, Matarangi, Ōpoutere, Otama, Waikawau, Whangamatā and Whangapoua. All but one of the sites that observed matuku heard booming. Site WHA-02 Otahu only saw matuku flying in and out of the wetland.

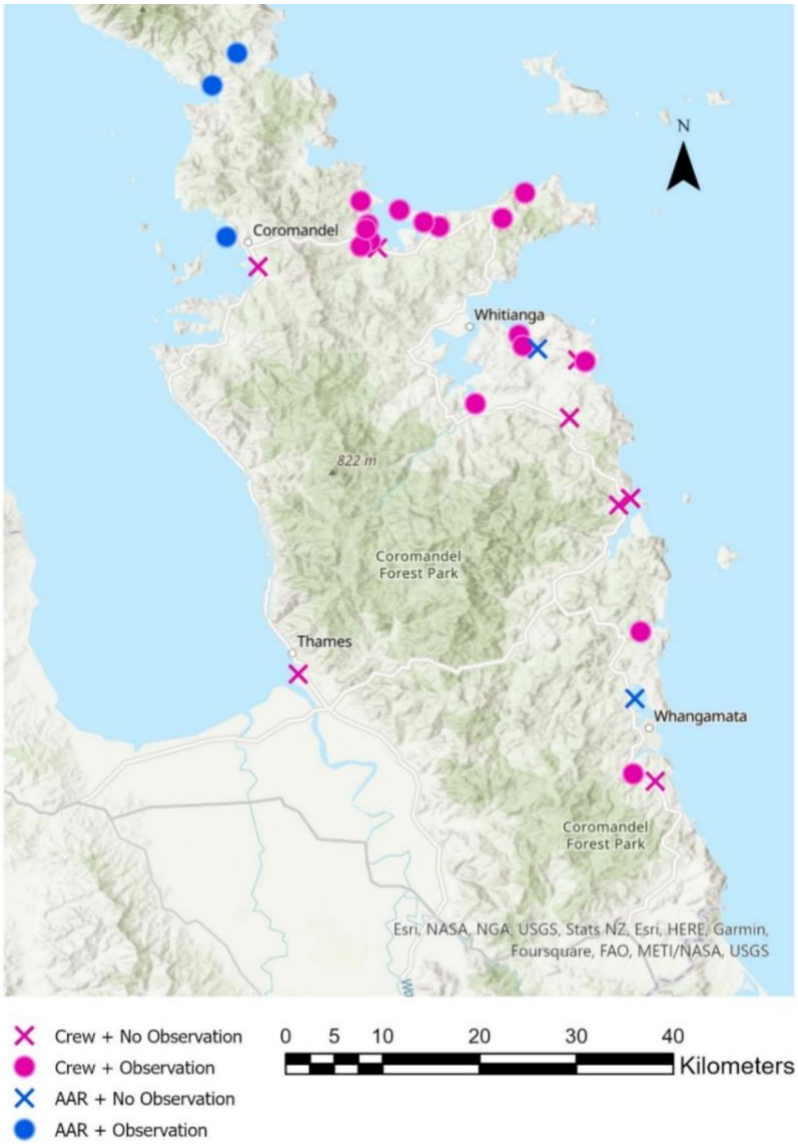


**Figure 4. Sites with and without observations of matuku that were either crewed or deployed with an automated acoustic recorder (AAR).**

Throughout the six survey events, observations of matuku were made at several sites at the same time (Figure 5). 25 out of the 29 sites were surveyed on the evening of the Principal Survey Event. During this event, matuku were observed simultaneously at five survey sites, although several of these could have been observing the same individual bird. On Sunday 15 October at dusk, matuku were observed simultaneously at six survey sites.

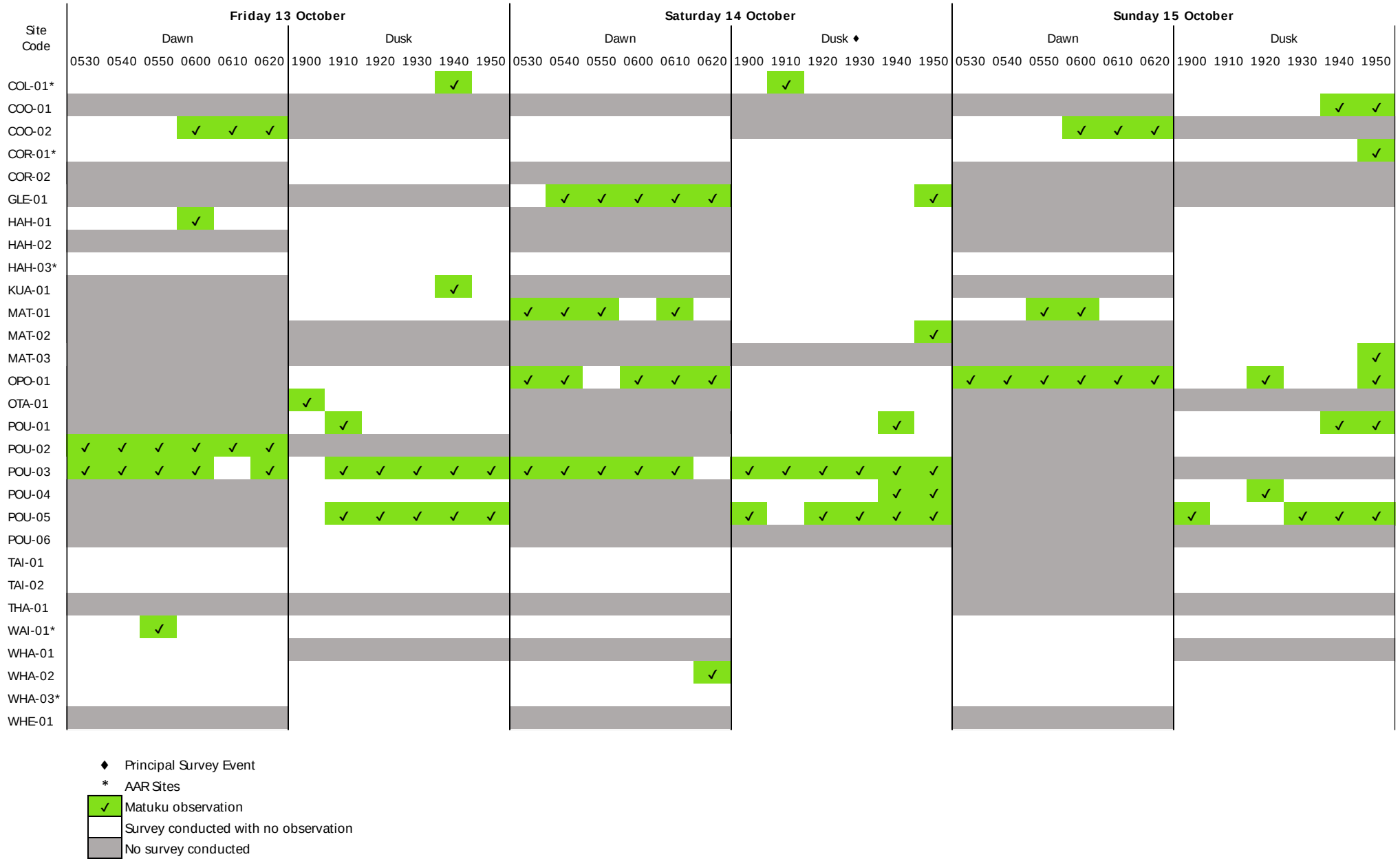




**Figure 5. Each survey event, from Friday 13 October to Sunday 15 October, split into 10-minute time slots to see where observations overlapped at each of the sites.**

### 3.2 Incidental Observations and Other Birds

There were a number of incidental observations of matuku throughout the survey weekend. Several sites observed matuku at times either side of the one-hour survey time slot but all of these also recorded matuku during the survey hour except for one site, WHA-02 Otahu. This site recorded matuku outside of the survey hour on three occasions: 13 October at 0722, 14 October at 1800 and 15 October at 0649.

A distressing incidental sighting occurred on 12 October at approximately midday when a matuku was hit by a car in Matarangi. The next day at around the same time, the matuku was retrieved by volunteers and while doing this, they spotted another matuku flying overhead.

Other birds that were observed at survey sites include, but are not limited to:

- Kāhu | harrier hawk (*Circus approximans*)
- Kōtare | kingfisher (*Todiramphus sanctus*)
- Moho pererū | banded rail (*Gallirallus philippensis*)
- Mātātā | fernbird (*Poodytes punctatus*)
- Matuku moana | white-faced heron (*Egretta novaehollandiae*)
- Pūkeko (*Porphyrio melanotus*)
- Pūtangitangi | paradise shelduck (*Tadorna variegate*)

### 3.3 Potential Female Observations

On three occasions, observations of matuku suggested potential female presence:

1. Site POU-02 Waingaro Wetland, 13 October dawn survey: matuku booming was heard consistently when a second matuku flew overheard that did not boom once it had landed.
2. Site WHA-02 Otahu, 14 October dawn survey: a noticeably smaller bird was sighted.
3. Site OPOP-01 Ōpoutere, 15 October dawn survey: two males booming constantly.

# 4. Discussion

### 4.1 Matuku Observations

Matuku were observed at 19 sites across 12 townships in Hauraki Coromandel and importantly, they were observed at sites across the peninsula at the same time which indicates that there are multiple birds present in the region. Matuku are very mobile birds and regularly use many wetlands, streams and drains as feeding sites (Williams, 2013). This means that anecdotal observations of birds across large areas does not always signify that there are multiple birds but rather that it could be one or two birds frequenting all sites. One aspiration for this survey was to ascertain whether this was the case in Hauraki Coromandel. There were a few sites that were close to each other where the same bird was likely heard at several sites such as across the Whangapoua catchment but in the cases where matuku were observed at the same time in different townships such as at dawn on Saturday 14 October when they were observed at Coroglen, Matarangi, Ōpoutere and Whangapoua, it is reasonable to conclude that these were different birds. It is excellent to confirm that there are at least multiple male matuku on the peninsula and this is valuable information to use as a baseline for comparison of surveys in future years. We hope to continue to observe male matuku in these wetlands as well as observing them in additional sites but equally, the lack of booming in future surveys at any of the sites where they were observed this year would give us cause for concern. However, it is important to note that male matuku are not the most reliable indicator of a healthy population. They are more common than females and they do not rear the young and are therefore far less vulnerable to predation (O'Donnell et al, 2013; Williams, 2013). Females are also solely responsible for raising the chicks to adulthood which is fundamental for population stability and growth. Thus, while we hope to continue to see the number of male matuku grow, observations of female matuku are far more crucial for estimating the overall population's success.

### 4.2 Possible Female Matuku

The three observations that were indicative of possible female matuku all occurred at different locations. The first observation, at Whangapoua, saw a second bird fly overhead and once landed, the bird did not boom. It is possible that this was a female matuku that heard the male that had been constantly booming at that site and flew in to investigate. The second observation, at Otahu, saw a clearly smaller bird fly overhead. A few sightings occurred at this site over the survey weekend, thus the one smaller bird was noticeable. It was originally thought to have been a juvenile however at this time of year, there would not be any juveniles around, suggesting that it could have been a female (Heather & Robertson, 2015). The last indication of potential female presence was the consistent booming of two males in Ōpoutere which can occur when males are competing for a female in the vicinity. This information on the potential presence of female matuku has been passed on to the Department of Conservation to support them in their search of matuku nests using a thermal imaging camera on a drone.

### 4.3 Matuku Absence

Although we have been able to confirm the presence of male matuku on the peninsula we cannot confirm their absence from sites at which they were not observed. At the various sites where there were no matuku heard or seen, it is of course possible that there are matuku in the wetland, but they were hidden and silent over the survey period (O'Donnell et al, 2013; O'Donnell & Williams, 2015). It is also important to note that a few sites only heard matuku at dawn thus by limiting the Principal Survey Event to one evening we have likely restricted our results. For example, site MAT-01 Matarangi Bluff only heard booming at dawn and if not for the volunteer's enthusiasm to survey at dawn as well as at dusk, we would not have

observed any birds at that site. Consequently, it is possible that similar accounts could have occurred at other sites where volunteers were not able to survey at both dawn and dusk.

### 4.4 Other Bird Species Observations

Several sites did not observe matuku in this survey but many of them reported observations of other threatened manu such as moho pererū (banded rail) and mātātā (fernbird). If we hope to see matuku in these wetlands in future surveys and continue to observe them in the wetlands where they were observed this year, predator control needs to be maintained and intensified. The protection of wetlands regardless of the current presence or absence of matuku is crucial for their further dispersal and establishment in the Hauraki Coromandel region. Matuku need safe and healthy wetlands in which to feed, live and breed. Thus the effort that volunteers continue to put into predator control around wetlands will hopefully ensure that they are habitable for matuku.

### 4.5 Limitations and Recommendations

One limitation of this survey is that some volunteers were not able to complete the Principal Survey Event as they had other commitments. Four of the 29 sites did not complete the survey event at dusk on Saturday 14 October. We did not want to discourage anyone from participating so it was decided that participants could survey any of the survey events for which they were available because that is still useful information. Since many volunteers surveyed at each of the dusk survey events, the sites that did not participate in the Principal Survey Event had other sites to compare to regardless. We recommend that future surveys include a Principal Survey Event at dawn as well as dusk. A few sites only had matuku booming at dawn, and their presence would have been missed if the volunteers had not opted to survey at dawn. Since many sites already had observers surveying at dawn, this would not be an unreasonable expectation for next year's survey.

Wetlands are often in very public places and some volunteers noted that there were people around fishing and participating in other water activities in the evening which made it difficult to survey. This is not something that we are able to avoid but by surveying at dawn as well as dusk we may be able to increase our likelihood of observing matuku.

Automated acoustic recorders are excellent for listening for matuku booming but they do not give us as much information about the observations as volunteers can. A volunteer can hear the approximate direction and distance that booming is coming from and if there are potentially two males in one wetland. They are also able to see if there are any matuku in the wetland or flying above the wetland. This information is necessary to help recognise that females are present. We will continue to use AARs in wetlands that we are interested in observing but have no volunteers available to crew them, however, it would be great if we could have volunteers at a few sites in the northern Coromandel. There are matuku known to be in the area and the recorders picked up on their booming thus it would be useful to have a volunteer there to discern more information about the possibility of a nesting pair.

## 5. Conclusion

Male matuku were observed across many sites on the peninsula and as they were observed at the same time far distances away, we can conclude that there are multiple male birds in the Coromandel. This is important as anecdotal observations can suggest widespread presence but by surveying at the same time, we were able to have this confirmed. Female matuku are more reliable than males for estimating population health as they are considerably more vulnerable to predation and are solely responsible for raising young and recruiting them into the population. Thus, the potential presence of a few females is promising for the Coromandel matuku population. Further research is necessary to understand breeding success of resident females and population recruitment. The presence of other native birds in the wetland sites is encouraging and demonstrates that the work community conservation groups are undertaking to protect these areas is having positive impacts. We hope that in future surveys, we will continue to observe matuku at the sites that they were observed this year but additionally, in other sites where conservation groups are working hard to ensure a habitat suitable for matuku and our other native species.

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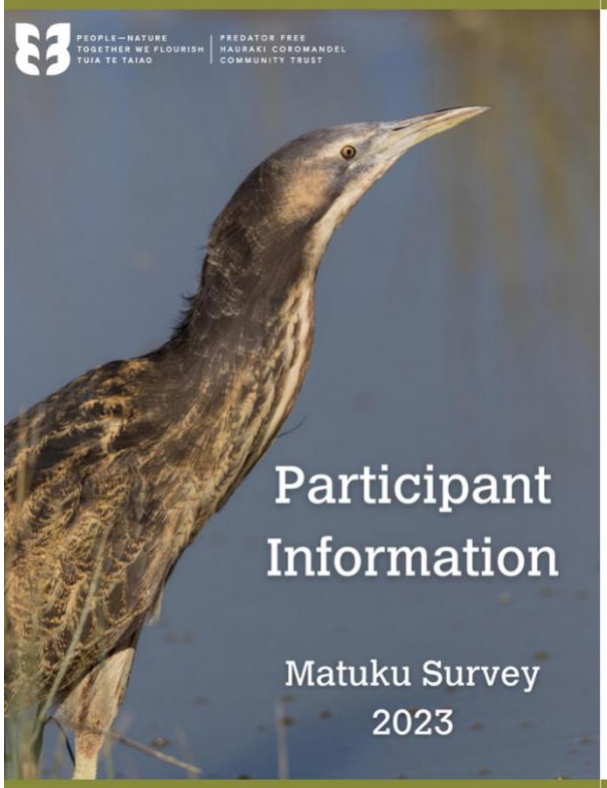
**Appendix 1: Survey Participant Information**




# Survey Info

PFHC's Matuku (Bittern) Survey 2023 will take place over three days from **Friday 13 October to Sunday 15 October.** You can survey at dawn, at dusk or both.

- At dawn: for the one hour before local sunrise.
  - Sunrise will be ~6:30 am, survey from 5:30 am to 6:30 am.
- At dusk: for the 30 minutes before and after local sunset.
  - Sunset will be ~7:30 pm, survey from 7:00 pm to 8:00 pm.

The evening is generally more practical for volunteers so we are encouraging everyone to survey at dusk. However, if you have other commitments and would prefer to survey at dawn, that is perfectly fine. Equally, if you are super keen and want to survey at both dawn and dusk, you are welcome to do so!

We do ask that you keep your surveying consistent over the three days. If you choose to survey at dusk, survey at dusk each day and vice versa with dawn. An exception to this is if you want to add in a bonus survey event, for example, if you are surveying at dusk each day but decide to add an additional survey event at dawn on Saturday, that is welcomed.



## Weather Contingency

If the weather is going to be poor over the set dates, we will choose one evening over the survey weekend that will have the best weather to be our singular survey event. We will get more information from the survey if we are able to complete all three days but we can make do with one survey event. Matuku are very mobile birds so if we need to have just the one survey event, we need to make sure it is the same for everyone. This way we will not have any double up data with birds flying from wetland to wetland. We will let you know as soon as possible if this is going to be the case.

## Gear You Will Need

- ☐ Torch (it will be dark either when you are heading out or going home)
- ☐ Fully charged cell phone
- ☐ Datasheets, one per survey event
- ☐ Pencils
- ☐ Warm clothing
- ☐ Rain jacket
- ☐ Binoculars*
- ☐ GPS*
- ☐ Chair*
- ☐ Gumboots*

*optional



# Instructions

## Before The Survey Events

- Review the instructions for matuku observation and data recording.
- Familiarise yourself with the datasheet.
- Listen to some matuku booms.
- If you have **questions or need help** with any of this, please contact the PFHC team before the survey night. Please use the **fst@pfhc.nz** email as a first point of contact.

## Health And Safety

- Ensure that you have appropriate gear for being out in the field. Spring weather is very changeable, so be prepared!
- Ensure that you are confident that you can safely get to your site and back, if you have any doubts, please let us know.
- Ensure that you have a fully charged cell phone.
- Take plenty of water and some quiet snacks.
- Make sure someone not involved in the survey knows where you are headed and when you plan to be back.
- Keep in contact with the PFHC team when you are out surveying.

## Getting To Your Site

- Message Renee via WhatsApp or text when you are heading to your survey site.
- If the weather conditions prevent you from starting or completing the survey, please message us that you have had to cancel or cut short the survey for that day.
- Leave for your site with plenty of time to get to the site, unpack, and set yourselves up to be ready to start observing at the survey time.
- Familiarise yourself with the location and your surroundings. This is important for getting back out safely and for gauging distances.
- Take photos of your site and send them to us at fst@pfhc.nz.



## Setting Up On Site

- Turn your phone to silent.
- Have everything you need (clothing, equipment, food etc.) unpacked before you start surveying to avoid noise interference later.
- Identify North so that you can use this to estimate the direction of calls later.
- Fill in all the site details and wetland observations on your datasheet before you begin.
- Note anything else you think could be valuable for us to know about the wetland's condition.

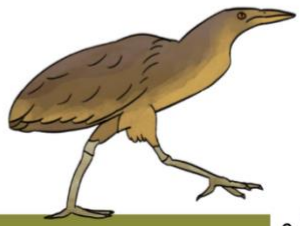
## Matuku Observing

- Observe from the same spot for each survey event.
- Avoid making unnecessary noises. Do not mimic or play matuku booms or calls of any other animals.
- Listen in the dark if the sun has yet to rise or has already set, a torch can deter birds. Once you have heard a boom, you can turn on a torch to fill out the datasheet if you need to.
- Make notes about any significant changes in weather or sound that occur during the survey.



## Recording Matuku Observations

- When you hear a boom or (if you're very lucky!) see a matuku, note the time and tick on your datasheet whether it was heard or seen.
- Note the approximate compass direction that you observed the matuku e.g., N, NE, SW.
- Estimate a distance in metres of approximately how far away you believe the bird to be.
- The perceived direction and distance will be helpful for us later when we are able to use other methods to try and locate matuku nests.
- If you hear any matuku booms or see any matuku outside of the designated survey time, please note them down. We would still love to hear about them! This includes any time during the survey day. For example, if you are driving back home after the survey and you see a matuku, take a waypoint and let us know!





## Identifying Individual Matuku

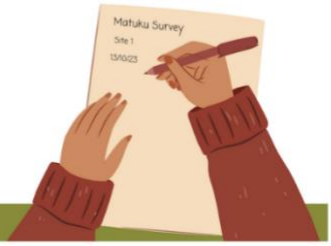
- It can be difficult to determine whether booming that is coming from one direction is multiple birds or a single bird, so if you are not sure, assume it is one bird.
- However, there are some instances when it can be apparent that there is more than one bird. For example:
  - If booming is coming from two completely different directions but you have not seen a bird fly from one area to another, it can be safe to assume it is two different males.
  - If you hear booming in one direction and see a bird fly to that area, it could potentially be a female flying to a male. If this happens, it is very important info!
- If you do suspect you have more than one bittern in your wetland, assign them alphabetical ID's on the datasheet e.g., Male A, Male B.
- If you are unsure about what you see, take notes!

## At The End Of The Survey

- Once you have reached the end of the survey time, pack up all of your gear and head out.
- Once you are safely out, message Renee.
- When you are home, take a photo of both sides of the datasheet and email them to us at: **fst@pfhc.nz.**
  Please make sure that the datasheet is completed in full, that the photo of the datasheet is clear and that all the information on the sheet is legible.

## Datasheet Key

- Time (24hr) – e.g., 1900 is 7 pm.
- Direction – compass direction e.g., N, NE, NW, SE etc.
- Distance - in metres, approximate.
- Matuku ID - if you are able to identify individual birds, ID them alphabetically e.g., Male A, Male B, Female A.






## Datasheet Example

# Matuku (Bittern) Survey

PREDATOR FREE HAURAKI COROMANDEL

**Date:** _____ **AM Survey** ☐ **or PM Survey** ☐ **Day:** ___/3

**Site Code:** _____ **Site Name:** _____

**GPS Coordinates:** _____

**Observers**

Site Host: _____

Other Observers: _____

_____

**Notes**

**Rain**
- ☐ Nil
- ☐ Light
- ☐ Moderate

**Temperature**
- ☐ Cold
- ☐ Mild
- ☐ Warm

**Wind Strength**
- ☐ Calm
- ☐ Light
- ☐ Moderate
- ☐ Strong

**Wind Direction**
- ☐ N ☐ S
- ☐ NE ☐ SW
- ☐ E ☐ W
- ☐ SE ☐ NW
- ☐ Not applicable

**Non-Weather Noise**
- ☐ None
- ☐ Slight
- ☐ Moderate

**Cloud Cover**

_____ %

percent of survey time under cloud cover

**Wetland Condition**
- ☐ Dry
- ☐ Wet
- ☐ Saturated

**Water Clarity**
- ☐ Clear
- ☐ Murky
- ☐ Very dark

**Native Vegetation Present**
- ☐ None
- ☐ Little
- ☐ Moderate
- ☐ All (No exotics)

**People Present**
- ☐ None
- ☐ Few
- ☐ Moderate

**Litter**
- ☐ None
- ☐ Little
- ☐ Moderate

**Site Code:** _____ **Date:** _____ **AM** ☐ **or PM** ☐

PREDATOR FREE HAURAKI COROMANDEL

**Start Time:** _____ **Finish Time:** _____

| | Time (24 hr) | Heard | Seen | Direction (N, NW etc) | Distance (metres) | Matuku ID |
|---|---|---|---|---|---|---|
| 0 | 1945 | ✓ | | NE | 100 | Male A |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
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| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |

**Other Wetland Birds Seen or Heard**
- ☐ Koitareke (Marsh crake)
- ☐ Kōtare (Kingfisher)
- ☐ Kōtuku (White heron)
- ☐ Mallard duck
- ☐ Mātātā (Fernbird)
- ☐ Matuku moana (White faced heron)
- ☐ Moho pererū (Banded rail)
- ☐ Pāteke (Brown teal)
- ☐ Pukeko
- ☐ Pūtangitangi (Paradise shellduck)
- ☐ Pūweto (Spotless crake)
- ☐ Shag (specify if possible)

_____

_____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

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☐ _____

**Notes**

**Appendix 2: Survey Datasheet**