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Acoustic recorders for detection of cryptic avifauna: A trial of two coastal wetlands in the Waikato Region

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Acoustic recorders for detection of cryptic avifauna: A trial of two coastal wetlands in the Waikato Region

Red Admiral Ecology

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Cover photo: Waikawau Wetland manuka tangle fern association.

Survey planned and completed by Patrick (Paddy) Stewart. Acoustic analysis by Paddy and Brydie Lauder.

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29 February 2016

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Contents

Summary

An autonomous survey of two wetland sites was completed by Red Admiral Ecology for the Waikato Regional Council in the spring/summer of 2015/16.

Fernbird, spotless crake and Australasian bittern were detected at the isolated Toreparu Wetland Site, situated on the West Coast north of Aotea Harbour. The acoustic recorders (ARs) detected a minimum of three spotless crake, two fernbird and seven male bittern. Based on observations while deploying the recording equipment we consider the fernbird detection rate to be unreliable, estimate that at least one spotless crake per kilometre of wetland margin was present and that booming male bittern data indicates minimum densities of one pair per 24 ha.

Fernbird and Australasian bittern were detected at Waikawau Wetland (Site 2) in the north-eastern Coromandel Peninsula. At least three booming males were detected. No minimum density estimate was calculated due to the fragmented nature of habitat at the site, and the substantially variable frequency of booms between AR stations. Banded rail were detected about the saltmarsh margin.

These results indicate that with fine tuning, inventories of Australasian bittern can be completed across the fragmented wetland landscape using automated ARs. Smaller, more conspicuous species such banded rail and fernbird can be detected either with ARs or while deploying the equipment, but for spotless crake there is uncertainty whether the proportion of these species can be accurately detected.

1. Introduction

1.1 Objectives

The objective of this work was to develop a protocol for surveying cryptic wetland avifauna species in support of the Waikato Regional Councils' on-going Biodiversity Inventory Project. A Proof of Concept was carried out by assessing the distribution of cryptic wetland avifauna species at two wetlands:

1. Toreparu Wetland - An intact coastal wetland in the western Waikato.
2. Waikawau Wetland - A fragmented mosaic of wetland habitats on the Coromandel Peninsula, with a history of predator control and community observer monitoring.

1.2 Brief background

Presently cryptic avifauna distribution data across the Region is restricted to observations from professionals and the public that has been gathered informally over ad hoc timeframes. It is unclear whether this data under or over represents actual distribution on the ground. Often rural landowners have knowledge of some species which is not represented in present GIS data sets. Long term population status and dynamics of these species is poorly understood.

Excluding the large RAMSAR wetland sites Whangamarino and Kopuatai, three broad sampling scenarios for the Region have been considered, including:

1. The lowland lake margins and oxbow margins in the Waikato River basin.
2. Small – Medium sized (100 – 300 ha) relatively intact wetlands such as Awaroa and Toreparu (Site 1).
3. Small fragmented wetland mosaics which are typically < 10 ha, prevalent within the pastoral landscape and coastal zone.

Habitat

Toreparu Wetland

Lying within the Kawhia Ecological District (37°56' S, 174°49' E), Toreparu wetland comprises approximately 220 hectares of modified wetland. The upper reaches are dominated by grey willow, as well as supporting some dense stands of mature cabbage tree. Manuka was occasionally observed about margins and interspersed by dense swards of raupo, especially in upper reaches of side arms. The cabbage tree/grey willow association grades to open marsh downstream of AR 1 (FIGURE 1). Vegetation below this area has been modified by a recent flood event which had scoured vegetation from tributaries and banked it up in the main wetland. Several small areas of open water were also observed outside of the main stream channel.

Waikawau Wetland

Situated in the Colville Ecological District (36°36’ S, 175°31’ E), the 10 ha Waikawau wetland has previously been designated a Key Ecological Site. Vegetation is a mosaic of dense tangle fern associations, patches of raupo, manuka, cabbage tree and until recently grey willow nearer the estuary.

In addition, the largest areas of restored wetland in Waikawau Bay were selected as outlying fragmented sites. These areas are shown as ARs 15 and 16 in FIGURE 2. These open wetlands were created from low lying unproductive farmland approximately fifteen years ago by the Department of Conservation.

2. Methods

2.1 Field method

A total of five avifauna species were targeted (TABLE 1). Banded rail is typically detected in and about estuarine environments on mainland New Zealand so it was expected unlikely to be detected by our AR deployments at Toreparu wetland.

TABLE 1: WETLAND ACOUSTIC SURVEY TARGET SPECIES.

Common name	Scientific name	Threat status
Banded rail	*Gallirallus philippensis*	At Risk/Declining
North Island Fernbird *	*Bowdleria punctata*	At Risk/Declining
Australasian Bittern	*Botaurus poiciloptilus*	Threatened/Nationally Endangered
Spotless crake	*Porzana pusilla*	At Risk/Relict
Marsh crake	*Porzana tabuensis*	At Risk/Relict

**denotes endemic species*

Multispecies acoustic surveys are inherently difficult due to factors such as different habitat preferences, territory size and variation of bird vocalisations between species. Australasian bittern are the most threatened of the five target species so the AR deployment was targeted towards this species and field sites based on best practice protocols (O'Donnell and Williams, 2015). Where practical, we deployed ARs at 500m intervals, but at times limited access and more favourable acoustic sites resulted in intervals slightly more or less.

Toreparu Wetland

At Toreparu wetland ten Department of Conservation produced omni-directional acoustic recorders (ARs) were deployed by Paddy Stewart, Heater Thompson and Rebecca Eivers, between 17 December and 30th December (FIGURE 1). Landscape features were used as acoustic barriers to minimise any overlap between neighbouring stations. ARs 1- 6 were deployed for two hours each day (05:00 – 07:00) and ARs 7 – 10 for ten hrs (21:00 – 07:00).

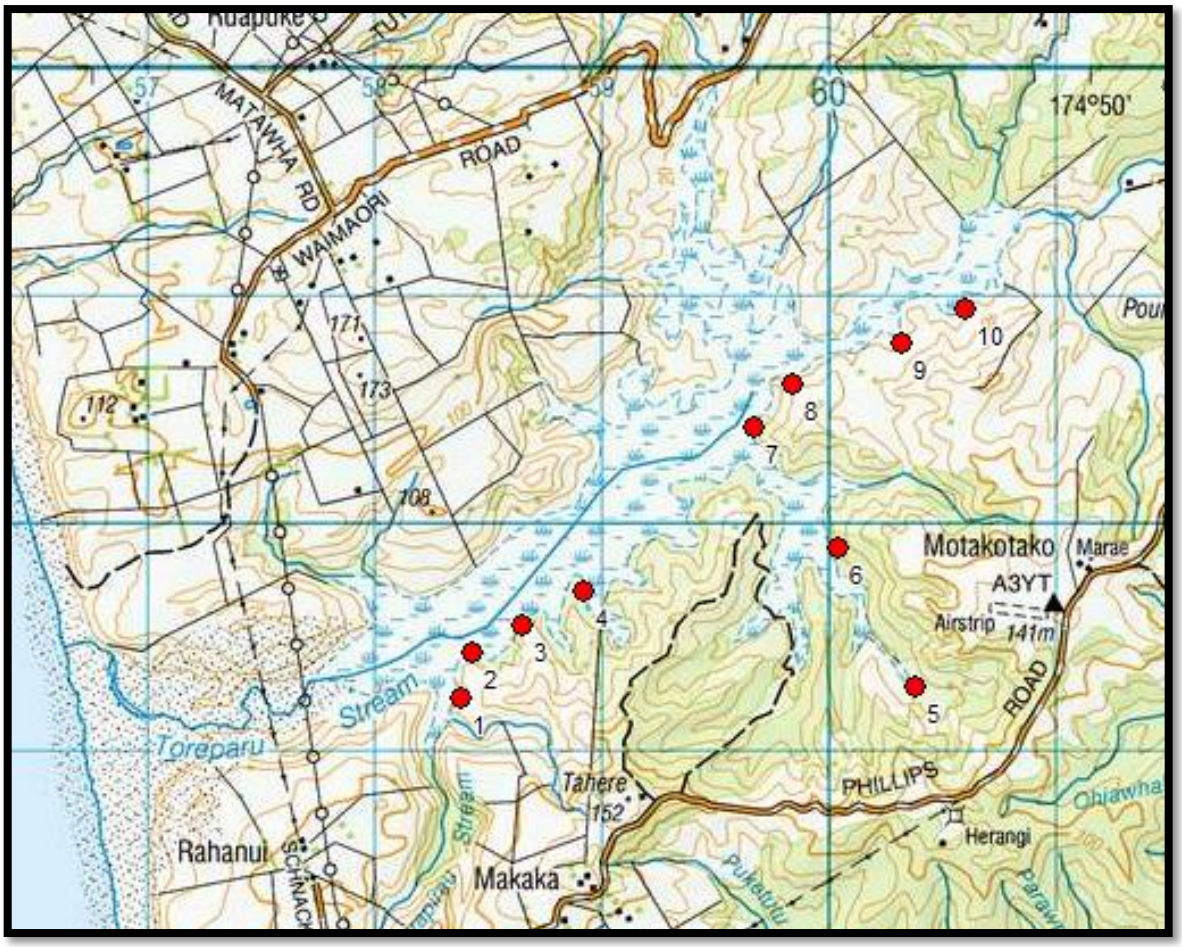

FIGURE 1: LOCATION OF AUTOMATED ACOUSTIC STATIONS, TOREPARU, DECEMBER 2016.

Waikawau Wetland

Waikawau data was collected in two sessions. Five ARs (12 – 16, FIGURE 2) were deployed from October 30 - November 10 to coincide with annual observer bittern monitoring by the Moehau Environment Group. ARs 12 and 13 were deployed on shrubland slopes above the wetland; and AR 14 was nearby above the estuary margin. ARs 15 and 16 were deployed on slopes above the open wetlands. These recorders collected data from 05:00 – 07:00 each morning for twelve days. AR 13 was not used for bittern data analysis due to the close proximity off AR 12.

After reviewing the spring Waikawau wetland data for marsh crake it was considered the early morning sampling time to be unsatisfactory for this species and subsequently four ARs were redeployed in January (ARs 11 – 13). The ARs were programmed to run for ten hours each night from 21:00 to 07:00, three at "low" setting (0 - 4 kHz) and a fourth at 'high (0 – 16 kHz). Two ARs were deployed at AR station 11, one at 'low' setting and the other at 'high'.

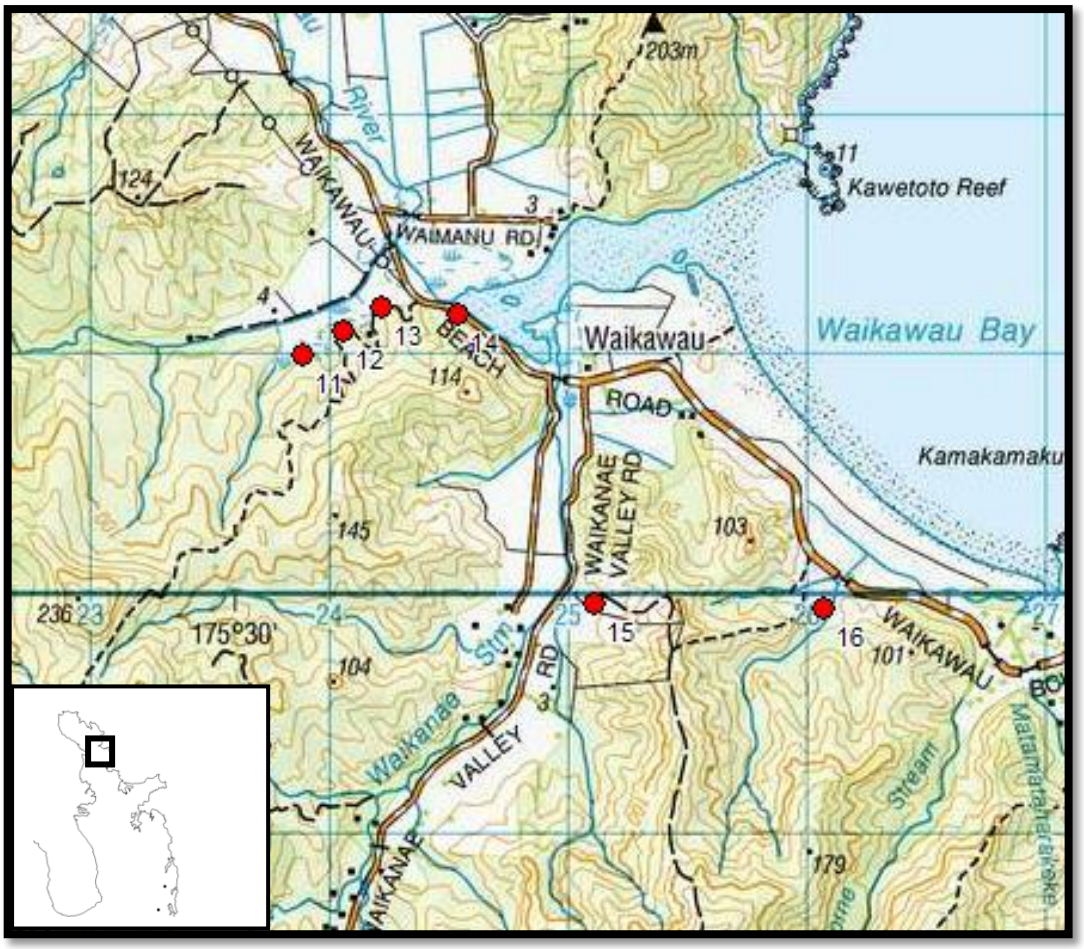

FIGURE 2: LOCATION OF AUTOMATED ACOUSTIC STATIONS, WAIKAWAU, 2015- 2016.

2.2 **Data analysis**

The 15 minute sound files were manually inspected in RAVEN PRO 1.5© (Charif et al. 2010) at default settings, except that we selected a 512-sample Hann window to improve spectral resolution. Data files for 1.5 hours/day were searched over three separate mornings. A further two mornings data was interrogated if no detections were made from the initial three morning period. A digital log was exported from Raven for data analysis.

3. Results

3.1 Distribution of threatened species

Marsh crake were not detected at either wetland and banded rail on the estuarine margin of Waikawau wetland only. Data in TABLE 2 shows the minimum number of birds detected at each wetland.

TABLE 2: MINIMUM NUMBER OF TARGET AVIFAUNA SPECIES DETECTED AT TOREPARU AND WAIKAWAU WETLANDS SPRING/SUMMER 2015-2016

Common name	Toreparu	Waikawau
Spotless crake	3	0
Banded rail	0	1
North Island fernbird	1	2
Marsh crake	0	0
Australasian bittern	7	3

3.1.1 Fernbird

This endemic species was detected at two of the Waikawau wetland sites where densities of the species are known to be very high. At Toreparu wetland this species was only detected from one AR station, but from three stations by fieldworkers while deploying the ARs.

3.1.2 Spotless Crake

At Toreparu wetland two spotless crake we detected during the all night recording sessions (ARs 6 and 9) and one during the early morning sessions (AR 5). This indicates that spotless crake may have been missed at ARS 1 – 4 as these units only recorded early morning diurnal sessions. The three detections made from four overnight recorders spread over approximately 3 km of wetland margin equate to one detection/km.

3.2 Toreparu Wetland bittern count

Sound files from seven of the ten ARs were suitable for bittern boom detection. AR 2 failed, noise from a low volume side-stream adversely affected AR 5 and low frequency interference from farm machinery affected AR 10. Bittern were detected from all seven ARs utilised for data analysis and inspection of time location data indicates these were separate birds.

It is possible that two birds were detected from ARs 1 and 3, but we were unable to verify these additional ‘possible’ birds. Accounting for gaps in the layout it appears that we sampled approximately two thirds of the wetland area for bittern.

Compensating for the 33% not sampled we estimate densities to be approximately one male/24ha. This is derived by; over 220 ha/7 birds detected +2 assumed birds to account for the 33% of wetland not sampled.

3.3 Toreparu Wetland bittern activity levels

A total of 133 boom sequences were detected from 31.5 hrs of data. One hundred and three of these were prior to sunrise. Boom frequency from high activity ARs tended to decrease around sunrise (FIGURE 3). No clear pattern was observed from low activity stations. Activity from AR 9 would not have been detected if we ceased data collection at sunrise.

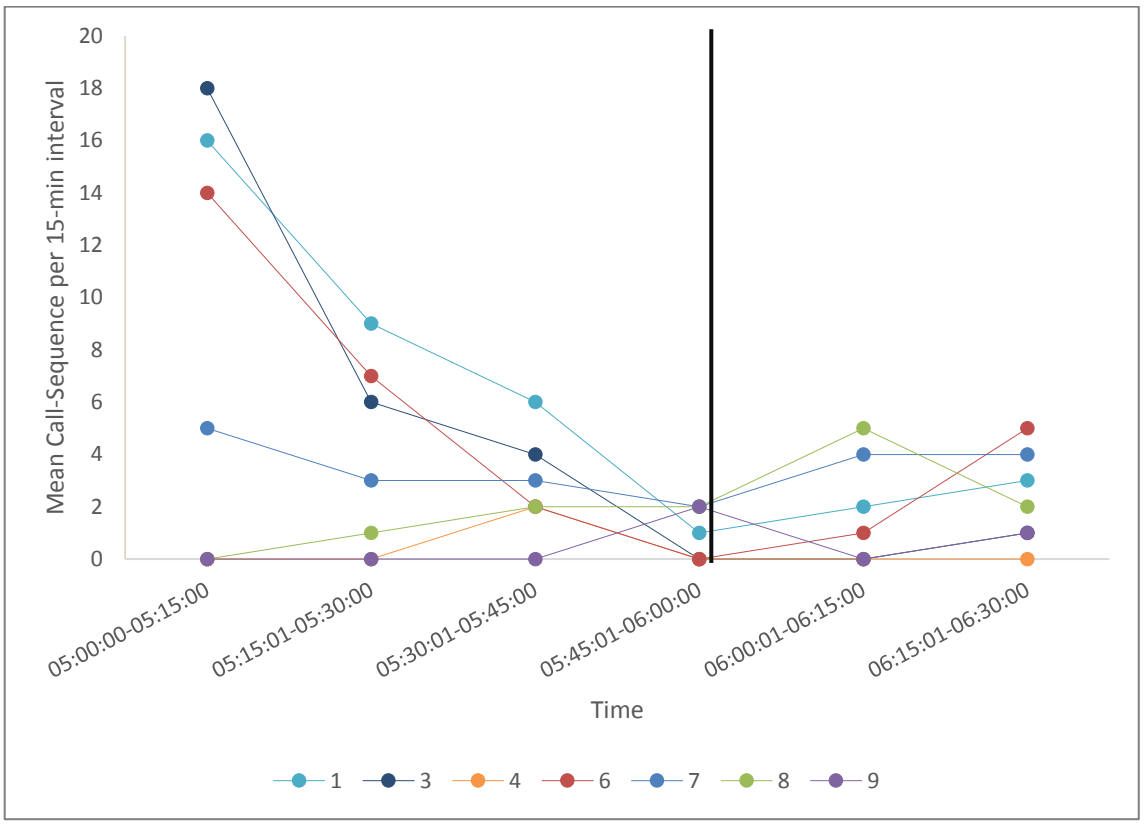

FIGURE 3: BITTERN ACTIVTY LEVELS RELATIVE TO SUNRISE (VERTICAL LINE), TOREPARU WETLAND SUMMER 2015

Activity levels tended to decrease in the upper reaches of the wetland (AR 8 and AR9, refer to FIGURE 4).

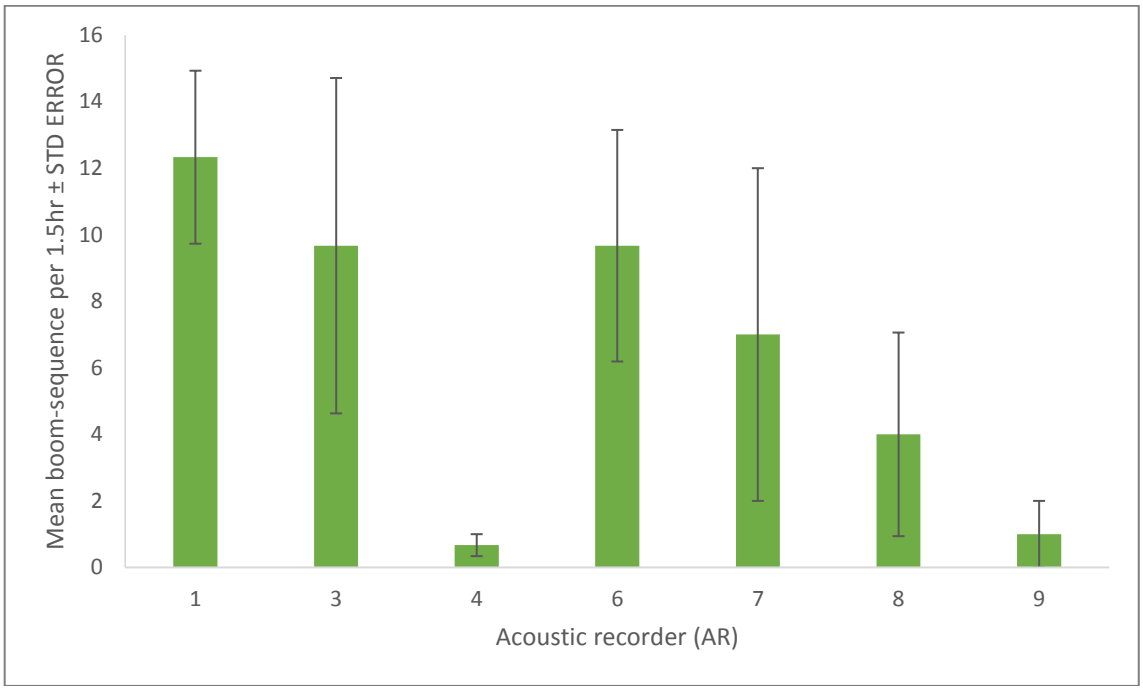

FIGURE 4: BITTERN ACTIVITY LEVELS, TOREPARU WETLAND SUMMER 2015 FROM 31.5 HRS MORNING DATA. (AR 4 SAMPLED A SMALLER AREA)

3.4 Waikawau Wetland bittern count

Bittern were detected from four of the five ARs during the spring deployment (TABLE 3). Two of these birds were detected from AR 12, using different spectral energy levels to separate the two individuals. The third bird was detected from AR 16.

TABLE 3: BITTERN ACTIVITY LEVELS, WAIKWAU BAY, SPRING 2015 FROM 22.5 HRS DATA

Acoustic recorder (AR)	12	13	14	15	16
Number of call sequences	203	40	2	0	3

3.5 Waikawau Wetland bittern activity levels

A total of 248 boom sequences were detected from the five ARs (TABLE 3), but for inventory and analysis purposes we did not use data from ARs 13 and 14 as this activity could potentially have originated from the vicinity of AR 12.

Activity levels were very high about Waikawau wetland (FIGURE 5), but very low about the outlying patches of habitat indicating that birds may not have actually been booming from these locations, but further within the mosaic of patchy habitat across the Waikawau wetland Sites.

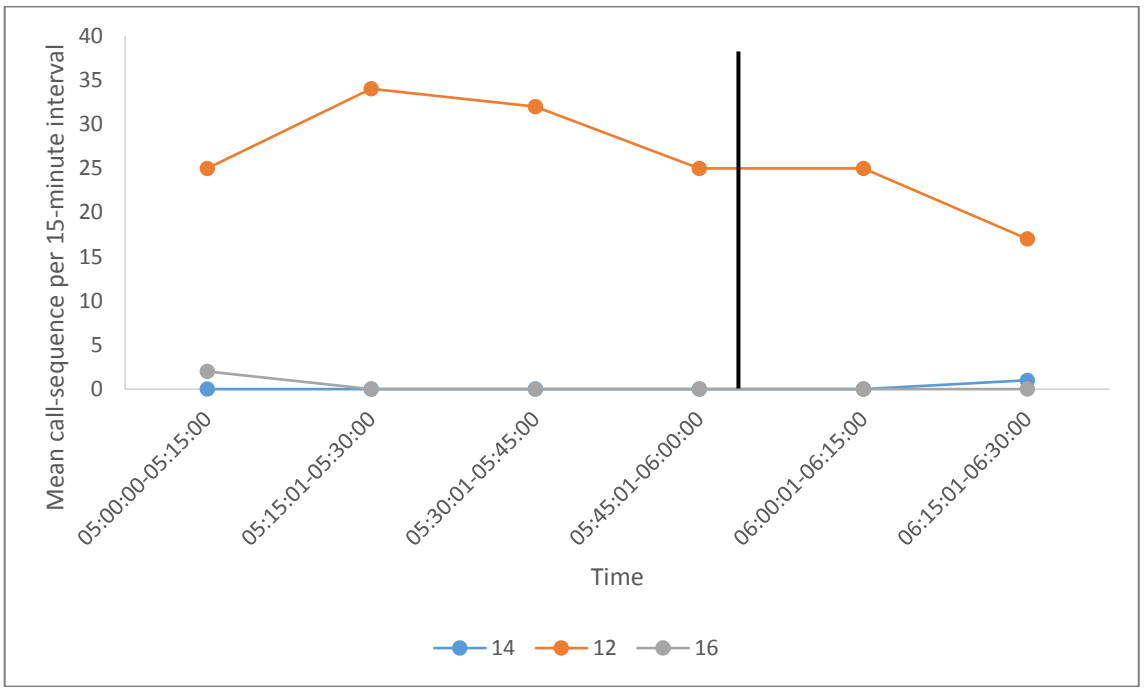

FIGURE 5: BITTERN ACTIVTY LEVELS RELATIVE TO SUNRISE (VERTICAL LINE), WAIKAWAU WETLAND, SPRING 2015

4. Discussion

Australasian Bittern

Australasian Bittern were detected evenly throughout the Toreparu Wetland sites and so it reasonable to estimate minimum density for the wetland. It may also be possible to estimate minimum densities at similar intact sites across the region.

Morning activity patterns appeared relatively predicable at higher frequency boom sites, which is in line with that described by O'Donnell and Williams (2015). AR stations recorded lower levels of activity at the outlying Waikawau Wetland sites and were less predictable suggesting detection may be more restricted for small fragmented wetland areas across the landscape. Analysis should be increased to five complete nights, if nothing is detected after the recommend three morning sessions.

Local anecdotal observations suggest that bittern booming locations tend to change over time at Waikawau (K. Parr, pers comm). Up to three booming bittern have been detected within the Waikawau Wetland about ARs 12 and 13 during previous observer sessions. During the spring in 2015 observers detected one individual and the automated acoustics, two. This information suggests that systematically covering patchy, wetland mosaics is important to increase detection rates in fragmented habitats.

Fernbird

As anticipated the ARs detected fernbird at the Waikawau Wetland sites but they were relatively unsuccessful at Toreparu Wetland. In part this may be because the birds have relatively small territories. This species are vocal when disturbed and subsequently we expect observational data while deploying the ARS will cover some of the AR inadequacies suggested from this survey.

Marsh Crake

Marsh Crake have reliably been detected through field observation at Waikawau Wetland 18 months prior to this survey. The non-detection of these birds even with the retrospective January all night sampling is inconclusive, as this fieldwork may have been too late in the breeding season. Previously known birds could have died out locally, or moved to other habitats which were not sampled.

Spotless Crake

Spotless Crake detected at Toreparu Wetland were likely to be in close proximity to the wetland margins therefore linear units may be more useful for comparing data between larger sites. One option would be to double AR densities if a monitoring option for smaller birds was desired, to approximately 250m spacing. This would indicate what proportion of birds we are detecting at 500m intervals and potentially allow enough spatial resolution to detect increased density if trend monitoring over time was required.

Banded Rail

The non-detection of banded rail does not mean this species was not present at Toreparu Wetland. It may not have been detected due to the distance between AR stations and it is possible that its preferred habitat was not sampled. Banded rail may be present further downstream towards the coast.

Cats were heard at Waikawau Wetland during all night recording sessions. Deploying ARs in tight wetland vegetation likely creates trails for predators and this could be especially important at sites not receiving integrated and sustained predator control. This is relevant as the ARs are unlikely to detect small birds at ranges > 100 m, resulting in us missing birds in larger wetlands. One solution could be to utilize UAVs to deploy ARs at larger, high value wetland sites to assess, for example, marsh crake distribution.

In summary it appears that existing protocol for bittern is suitable for larger sites, but that more effort is required for patchy mosaics of wetland habitat, as well as to detect crake species. Any further work should commence as early as possible in the breeding season, so that all fieldwork is completed by the end of December.

5. Recommendations

- For Australasian bittern at large, intact wetlands - deploy ARs as prescribed in O'Donnell and Williams.

- In fragmented mosaics of wetland habitat – a minimum of two ARs should be deployed in each patch of habitat to improve the likelihood of detecting small species with restricted territories. Additionally, data is still likely to be gathered if one AR fails or there is unforeseen interference.

- ARs should be programmed to run all night maximising the chance of detecting spotless and marsh crake. They should also capture morning and/evening diurnal periods.

- Trials with AR deployment at 500 and 250 m intervals in medium to large wetlands to determine if spotless and marsh crake detections increase with higher density sampling.

- Investigate the feasibility of UAVs to deploy ARs into large areas of sensitive habitat.

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Toreparu Wetland: Rebecca Eivers, Heather Thompson and Jonny Brown.

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