

BIRD MONITORING AT THE TUMURAU WETLAND, RANGITAIKI PLAINS, EASTERN BAY OF PLENTY



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BIRD MONITORING AT THE TUMURAU WETLAND, RANGITAIKI PLAINS, EASTERN BAY OF PLENTY



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1. INTRODUCTION

Tumurau Lagoon and its associated wetland complex (c.140 hectares) is located on the western side of the Rangitaiki Plains, approximately eight kilometres east of Edgecumbe, in the eastern Bay of Plenty. Albeit degraded by changes in hydrology, pest plant invasion, fire, surrounding land use, and introduced pest animals, Tumurau is the largest of only a few remaining sizeable remnants of a formerly extensive wetland that has been otherwise drained for its fertile soils and developed for horticultural and agricultural purposes. Only c.3.1% of the original wetland extent remains on the Rangitaiki Plains (Beadel *et al.* 2011), and Tumurau is the best and largest example of wetland vegetation and habitats remaining in Te Teko Ecological District. The wetland is also significant in terms of its indigenous vascular flora, with nationally Threatened, At Risk, and regionally significant species present (as per de Lange *et al.* 2013, Beadel *et al.* 2009). The wetland also provides habitat for Threatened and At Risk avifauna species (as per Robertson *et al.* 2017) and the lagoon is an important breeding ground for water birds and is highly valued for duck shooting.

Tumurau is private land and is protected under a Conservation Covenant, under the Conservation Act 1987, since 1992. Vegetation and habitat types, as mapped in 2010, are described in detail in Wildland Consultants (2010).

Bay of Plenty Regional Council has classified Tumurau as a High Value Ecological Site (HVES) in Te Teko Ecological District and, in conjunction with the private landowners and custodians of Tumurau, wish to continue restoration work. Operational works within the project area to date include the construction of a weir, fencing, control of royal fern, and substantial effort to control willows using aerial spraying and ground-based methods. Willow control has resulted in significant changes to vegetation structure and composition compared to the vegetation pattern mapped in 2010.

Bird monitoring is required, to determine bird abundance in the wetland and to monitor any changes over time, particularly as vegetation recovers following willow control. Bay of Plenty Regional Council therefore commissioned the establishment of a permanent bird monitoring network in Tumurau, with the first counts carried out in 2014 (Wildland Consultants 2014), and every four years thereafter.

This report outlines the results of the 2018 survey, and provides a brief comparison with the 2014 results. More detailed statistical analysis is not feasible until several more years of data are available.

2. EXISTING INFORMATION ON AVIFAUNA

A region-wide 1980s survey of wildlife and wildlife habitats in the Bay of Plenty Region ranked Tumurau (Braemar Lagoon and Matuku Wildlife Management Reserve) as being of 'High' conservation value (Rasch 1989). Threatened or At Risk avifauna (as per Robertson *et al.* 2017) recorded at that time included matuku (Australasian bittern/*Botaurus poiciloptilus*; Threatened-Nationally Critical), weweia (New Zealand dabchick/*Poliocephalus rufpectus*; At Risk-Recovering), mātātā (North

Island fernbird/*Bowdleria punctata*; At Risk-Declining), and pūweto (spotless crane/*Porzana tabuensis plumbea*; At Risk-Declining). In addition, Rasch (1989) reported that North Island brown kiwi (*Apteryx mantelli*; At Risk-Declining) had been recorded there in the past.

3. METHODS

3.1 Timing

Bird monitoring was undertaken at Tumurau between 15 October and 25 October 2018, which is an optimum time of the year for undertaking the survey and monitoring of pūweto/spotless crane and matuku/Australasian bittern (O'Donnell 2012; O'Donnell and Williams 2014). Monitoring took place over two separate trips: 15-19 October and 24-25 October. With the exception of the marsh crane evening playback (see Section 3.5 below), counts were carried out between 0730 and 1700 hours throughout the day, as was also the case in 2014.

3.2 Location of bird count listening stations

Bird count listening stations were the same as those used in 2014 (Figure 1). Observers navigated to each station using a hand-held GPS unit, then located the marker that had been established in 2014. All but one of the markers were located¹, although some proved difficult to find in the dense vegetation. Representative photographs were taken at each station, and these are presented in Appendix 1.

3.3 Five minute bird counts

Five minute bird counts were undertaken, following the methods outlined in Hartley and Greene (2012). Two five minute counts were undertaken at each station, several days apart where possible.

3.4 Spotless crane counts using call playback

Call playback solicitation of spotless crane was undertaken at each of the 35 bird count stations, after the conclusion of each five minute bird count. Spotless crane calls were played for one minute, using an MP3 player and amplifying speaker, followed by a listening period of up to two minutes, followed by additional spotless crane call playback and a short period of listening. Marsh crane calls were then played, followed by 1-2 minutes of listening. Two such counts were undertaken at each station.

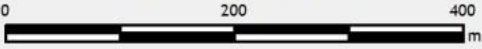
¹ Station 1 is the only exception - the vegetation here had been cleared adjacent to the roadside, therefore this marker was not replaced.



Legend
 ■ ABR/ABM locations
 ○ Stations
 — 1-31 Vegetation types (refer to Wildland Consultants 2010)
 — Property boundary

Data Acknowledgment
 Aerials: Environment Bay of Plenty 2011
 Report: 3538
 Client: Environment Bay of Plenty
 Ref: 01 15 45
 Path: E:\gis\TumurauLagoon_Whakatane\mxd\2014
 File: \Figure bird monitoring.mxd

Figure 1. Tumurau Lagoon bird monitoring stations, October-November 2014



Wildlands
 www.wildlands.co.nz, 0508 WILDNZ
 Scale: 1:6,000
 Date: 07/03/12
 Cartographer: FM
 Format: A3R

3.5 Marsh crake

Marsh crake (*Porzana pusilla affinis*) call playback, using an MP3 player and amplifying speaker, was undertaken at night, within 90 minutes of sunset (suggested to be one of the peak daily calling periods; O'Donnell 2009), along the vehicle track to the outflow weir at the northern end of the lagoon.

3.6 Waterbird counts

Two counts of waterbird species were undertaken on 16 October and 19 October 2018, using a spotting scope, from the jetty at the northern end of the lagoon, i.e. the same method used for the counts in 2010 and 2014 (Wildland Consultants 2010, 2014).

4. FIVE MINUTE BIRD COUNTS

4.1 Overview

Twenty-two indigenous bird species (c.f. 18 in 2014) and 21 exotic bird species (c.f. 13 in 2014) were recorded during the five minute bird counts. Mean numbers counted of each species at each count station are presented separately in Table 1 for each count session, as well as pooled, for both 2014 and 2018. The percentage of count stations at which each species was detected is also presented in Table 1.

Of the 22 indigenous species, 12 have shown an overall increase in mean counts per station since 2014, two show no change, and eight show a decrease (Table 1). As yet, there is insufficient data to allow for meaningful statistical analysis, and these changes may not be statistically significant. In some cases, it may only be a difference of one individual between years. Of the 21 exotic species, 12 have shown an increase in mean counts per station since 2014, four show no change, and five show a decrease.

4.2 Most commonly detected indigenous species at count stations

In 2014, the indigenous species with the highest numbers of counts were riroriro/grey warbler, piwakawaka/fantail, tauhou/silvereye, kotare/kingfisher, and warou/welcome swallow. In 2018, the most common indigenous species were putangitangi/paradise shelduck, riroriro/grey warbler, piwakawaka/fantail, tauhou/silvereye, and warou/welcome swallow (all in decreasing order of relative abundance).

4.3 Most commonly detected exotic species at count stations

In 2014, the exotic species with the highest numbers of counts were chaffinch, goldfinch, and yellowhammer. In 2018, it was Canada goose, chaffinch, pheasant, and goldfinch (all in decreasing order of relative abundance).

Table 1: Mean numbers of birds counted at Tumurau Wetland, percentages of count stations where detected, and total stations where detected, using five minute bird counts, October-November 2014 and October 2018. The most commonly-detected and widely distributed species in 2018 are highlighted.

Threat Status	Species	Survey Round 1 (n=35)				Survey Round 2 (n=35)				Whole survey (n=70)								Change ¹
		2014		2018		2014		2018		2014		2018		% Counts Detected		Stations detected		
		Mean per Station	SE	Mean per Station	SE	Mean per Station	SE	Mean per Station	SE	Mean per count	SE	Mean per count	SE	2014	2018	2014	2018	
Threatened-Nationally Critical	Matuku (Australasian bittern)	0.54	0.09	0.23	0.07	0.63	0.11	0.20	0.08	0.59	0.07	0.21	0.05	0.53	0.20	26	11	↓
At Risk-Declining	Mātātā (NI fernbird)	0.09	0.05	0.29	0.12	0.06	0.04	0.29	0.11	0.07	0.03	0.29	0.08	0.07	0.19	4	12	↑
	Pūweto (spotless crane)	-	-	0.06	0.04	-	-	0.03	0.03	-	-	0.04	0.02	0.00	0.04	-	3	↑
At-Risk-Naturally-Uncommon	Kawau (black shag)	0.00	0.00	0.11	0.05	0.11	0.07	0.06	0.04	0.06	0.03	0.09	0.03	0.04	0.09	3	6	↑
At Risk Recovering	Weweia (NZ dabchick)	-	-	0.00	0.00	-	-	0.03	0.03	-	-	0.01	0.01	0.00	0.01	-	1	↑
Not threatened	Kahu (Australasian harrier)	0.20	0.09	0.74	0.21	0.23	0.08	0.43	0.11	0.21	0.06	0.59	0.12	0.17	0.37	10	22	↑
	Black swan	-	-	0.06	0.06	-	-	0.06	0.04	-	-	0.06	0.03	-	0.04	-	3	↑
	Riroriro (grey warbler)	1.80	0.17	1.20	0.12	1.23	0.18	1.03	0.12	1.51	0.13	1.11	0.09	0.79	0.80	34	32	↔
	Kawau paka (little shag)	0.00	0.00	-	-	0.06	0.06	-	-	0.03	0.03	-	-	0.01	0.00	1	-	↓
	Pīwakawaka (NI fantail)	0.91	0.17	0.71	0.14	0.80	0.16	0.63	0.12	0.86	0.12	0.67	0.09	0.51	0.51	26	22	↔
	Kōtare (kingfisher)	0.83	0.16	0.23	0.09	0.57	0.12	0.26	0.07	0.70	0.10	0.24	0.06	0.51	0.21	27	13	↓
	Kereru (NZ pigeon)	-	-	0.00	0.00	-	-	0.03	0.03	-	-	0.01	0.01	-	0.01	-	1	↑
	Pāpango (NZ scaup)	0.00	0.00	-	-	0.03	0.03	-	-	0.01	0.01	-	-	0.01	-	1	-	↓
	Pūtangitangi (paradise shelduck)	0.17	0.09	4.54	2.93	1.91	1.37	1.20	0.86	1.04	0.69	2.87	1.53	0.10	0.24	6	15	↑
	Pūkeko	0.37	0.11	0.43	0.12	0.09	0.05	0.40	0.11	0.23	0.06	0.41	0.08	0.19	0.31	11	17	↑
	Pīpīwharau (shining cuckoo)	0.17	0.08	0.06	0.04	0.11	0.05	0.00	0.00	0.14	0.05	0.03	0.02	0.13	0.03	8	2	↓
Tauhou (silvereye)	0.74	0.16	0.49	0.14	1.06	0.19	0.80	0.17	0.90	0.12	0.64	0.11	0.56	0.39	29	22	↓	
	Karoro (southern)	-	-	0.06	0.06	-	-	0.00	0.00	-	-	0.03	0.03	-	0.01	-	1	↑

¹ ↑=increase, ↓=decrease, ↔=no change, based on both mean counts per station and stations detected, between 2014 and 2018.

Threat Status	Species	Survey Round 1 (n=35)				Survey Round 2 (n=35)				Whole survey (n=70)								Change ¹
		2014		2018		2014		2018		2014		2018		% Counts Detected		Stations detected		
		Mean per Station	SE	Mean per Station	SE	Mean per Station	SE	Mean per Station	SE	Mean per count	SE	Mean per count	SE	2014	2018	2014	2018	
	Black backed gull)																	
	Spur winged plover	0.06	0.06	0.09	0.05	0.00	0.00	0.09	0.05	0.03	0.03	0.09	0.03	0.01	0.09	1	5	↑
	Tūt	0.09	0.09	0.03	0.03	0.17	0.08	0.00	0.00	0.13	0.06	0.01	0.01	0.09	0.01	6	1	↓
	Warou (welcome swallow)	0.51	0.19	0.94	0.24	0.40	0.17	0.23	0.09	0.46	0.12	0.59	0.14	0.23	0.29	12	16	↑
	White faced heron	0.03	0.03	-	-	0.03	0.03	-	-	0.03	0.02	-	-	0.03	-	2	-	↓
Introduced and Naturalised	Australian magpie	0.03	0.03	0.31	0.10	0.00	0.00	0.31	0.10	0.01	0.01	0.31	0.07	0.01	0.26	1	15	↑
	Blackbird	0.31	0.08	0.26	0.09	0.34	0.08	0.43	0.13	0.33	0.06	0.34	0.08	0.33	0.24	19	12	↓
	California quail	-	-	0.03	0.03	-	-	0.03	0.03	-	-	0.03	0.02	-	0.03	-	2	↑
	Canada goose	0.71	0.45	3.54	1.75	0.94	0.58	2.37	1.15	0.83	0.36	2.96	1.04	0.14	0.56	7	24	↑
	Chaffinch	1.14	0.16	1.03	0.18	1.63	0.16	1.91	0.24	1.39	0.12	1.47	0.16	0.79	0.73	32	31	↔
	Domestic/feral chicken	-	-	0.03	0.03	-	-	0.00	0.00	-	-	0.01	0.01	-	0.01	-	1	↑
	Dunnock (hedge sparrow)	-	-	0.09	0.06	-	-	0.34	0.11	-	-	0.21	0.06	-	0.16	-	11	↑
	Eastern rosella	0.03	0.03	0.06	0.04	0.03	0.03	0.00	0.00	0.03	0.02	0.03	0.02	0.03	0.03	2	2	↔
	Goldfinch	0.71	0.20	1.17	0.21	0.46	0.16	0.91	0.16	0.59	0.13	1.04	0.13	0.36	0.64	19	32	↑
	Greenfinch	-	-	0.11	0.07	-	-	0.46	0.16	-	-	0.29	0.09	-	0.17	-	10	↑
	Feral pigeon	0.06	0.04	-	-	0.06	0.04	-	-	0.06	0.03	-	-	0.06	-	4	-	↓
	House sparrow	-	-	0.03	0.03	-	-	0.34	0.15	-	-	0.19	0.08	-	0.10	-	7	↑
	Myna	0.37	0.10	0.23	0.11	0.14	0.08	0.57	0.16	0.26	0.07	0.40	0.10	0.20	0.23	14	14	↔
	Mallard	0.23	0.12	0.60	0.30	0.09	0.06	0.20	0.09	0.16	0.07	0.40	0.16	0.09	0.17	6	10	↑
	Pheasant	1.03	0.12	1.20	0.14	0.43	0.10	1.23	0.14	0.73	0.09	1.21	0.10	0.59	0.83	31	35	↑
	Redpoll	-	-	0.00	0.00	-	-	0.09	0.06	-	-	0.04	0.03	-	0.03	-	2	↑
	Skylark	0.34	0.09	0.14	0.06	0.37	0.10	0.00	0.00	0.36	0.07	0.07	0.03	0.31	0.07	15	5	↓
	Song thrush	0.26	0.09	0.17	0.06	0.29	0.09	0.17	0.06	0.27	0.06	0.17	0.05	0.24	0.17	15	12	↓
	Spotted dove	-	-	0.06	0.04	-	-	0.03	0.03	-	-	0.04	0.02	-	0.04	-	3	↑
	Starling	0.03	0.03	0.00	0.00	0.00	0.00	0.09	0.09	0.01	0.01	0.04	0.04	0.01	0.01	1	1	↔
Yellowhammer	0.46	0.11	0.26	0.09	0.31	0.10	0.40	0.12	0.39	0.07	0.33	0.08	0.31	0.26	18	15	↓	

5. PŪWETO (SPOTLESS CRAKE) AND KOITAREKE (MARSH CRAKE) COUNTS

In 2014, broadcast playing of pūweto calls, followed by koitareke calls, immediately after each five minute count, elicited responses from pūweto at two stations, and none from koitareke. In 2018, pūweto responded at three stations, but again no koitareke were detected.

No koitareke responded to the evening playback along the vehicle track at the northern edge of the lagoon in either 2014 or 2018.

Table 2: Detections after broadcasts of pūweto (spotless crane) and koitareke (marsh crane) calls.

Site	Date	Time	Survey Round	Species	Seen/Heard	Number
3	24-10-18	13:15	1	Pūweto	Heard	2
25	24-10-18	11:30	2	Pūweto	Heard	2
26	15-10-18	13:35	1	Pūweto	Heard	1

6. INCIDENTAL OBSERVATIONS

Numerous incidental observations were recorded, particularly for mātātā (fernbird) and matuku (bittern). These observations, combined with detections during five minute bird counts and call playback counts, are shown in Figures 2-4 to give an indication of the observed distributions of mātātā, matuku, and pūweto throughout Tumurau.

In 2014, matuku appeared to be distributed within three main areas: the northwestern shoreline, the southern-central part of the wetland, and around the small lagoon to the southeast of the main lagoon. The 2018 distribution appeared to be largely similar (Figure 2). In 2014, possible nesting activity was noted close to Station 9. In 2018, matuku were detected very close to a location between Stations 7 and 8, and numerous matuku trails were located throughout this area, indicating this is a consistent area of high matuku activity.

The distribution of pūweto appeared to be quite different between the two years. In 2014, pūweto were only detected around the northern shoreline, whereas in 2018 (Figure 3) they were detected around the southern shoreline of the lagoon, in the southern central part of the wetland, and the southeastern part of the wetland.

In 2014, mātātā were distributed throughout approximately 27 hectares of the central part of the wetland. In 2018, this appears to have expanded significantly, with mātātā now distributed from the southern margin of the wetland to the southern shoreline of the lagoon (Figure 4).



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Report: 4804
 Client: Bay of Plenty Regional Council
 Ref: 01-1962
 Path: E:\gis\TumurauLagoon_Whakatane\mxd\Tumurau_bittern.mxd
 File: Tumurau_bittern.mxd

Figure 2: Locations of bittern at Tumurau Lagoon, October 2018.



Wildlands
 www.wildlands.co.nz, 0508 WILDNZ

Scale: 1:5,000
 Date: 26/11/2018
 Cartographer: TP
 Format: A3



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Legend

Method

- ▲ Incidental
- ★ Playback

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	Report: 4804
	Client: Bay of Plenty Regional Council
	Ref: 01 1962
Path: E:\gis\TumurauLagoon_Whakatane\mxd	
File: Tumurau_crake.mxd	

Figure 3: Locations of spotless crane at Tumurau Lagoon, October 2018.



Wildlands
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Scale: 1:5,000
Date: 12/12/2018
Cartographer: TP
Format: A3



Legend

Method

- 5 Minute bird count
- ▲ Incidental

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Report: 4804
 Client: Bay of Plenty Regional Council
 Ref: 01 1962
 Path: E:\gis\TumurauLagoon_Whakatane\mxd\ Tumurau_fernbird.mxd
 File:

Figure 4: Locations of fernbird at Tumurau Lagoon, October 2018.



Wildlands
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Scale: 1:5,000
 Date: 12/12/2018
 Cartographer: TP
 Format: A3

7. WATERBIRD COUNTS

Numbers of waterbirds counted from the jetty are presented for the six counts undertaken in 2010, 2014, and 2018 (Table 3). The 2010 counts were carried out in late summer, meaning that comparisons cannot be drawn between these counts and those carried out in spring 2014 and 2018.

Table 3: Numbers of water birds counted from the jetty at Tumurau Lagoon in 2010, 2014, and 2018. ↑=increase, ↓=decrease, ↔=no change.

Species	2010		2014		2018		Change 2014-18
	19-2-10	19-2-10	17-10-14	5-11-14	16-10-18	19-10-18	
Kawau (black shag)		1	13	7	4	3	↓
Black swan	12	5	15	16	40	31	↑
Canada goose	(80)	(80)	13	12	35	53	↑
Australian coot				1			↓
Weweia (NZ dabchick)	3	4	3	7	2	6	↔
Kawau paka (little shag)	2	4					↔
Mallard	225	271	3	6	30	55	↑
Pūtangitangi (paradise shelduck)	281	274	14	6	80	62	↑
Kāruhiruhi (pied shag)		1					↔
Pāpango (NZ scaup)			2	1		1	↔
Grand Total	523 (603)	560 (640)	64	56	191	211	

Waterbird numbers at Tumurau fluctuate widely within and between years (Wildland Consultants 2014); hence caution is needed when comparing the 2018 results with other years. Of the seven waterbird species detected in 2018 (c.f. eight in 2014), counts of four species have increased between surveys (black swan, Canada goose, mallard, and pūtangitangi/paradise duck), two show little change (weweia/dabchick and pāpango/scaup), and two have decreased (kawau/black shag). Australian coot were detected during the 2014 counts (one bird), but not during the 2018 counts, although they were seen outside of counts in 2018.

8. DISCUSSION

8.1 Bird species assemblage at Tumurau

Overall, bird species diversity appears to have increased since 2014, with a total of 43 bird species recorded in 2018 counts, compared to 31 in 2014. However, the majority of these additional species are exotic species (eight of the additional 12). Of the indigenous species, 55% show an increase in the mean number of birds per count from 2014 to 2018. Notable increases are those of kahu (harrier), matata (fernbird), and pūtangitangi (paradise shelduck), all of which have doubled.

Thirty-six percent of indigenous species show a decrease in the mean number of birds per count from 2014 to 2018. Notable decreases include matuku (bittern, see discussion below) and kōtare (kingfisher). In 2014, kōtare were one of the most common indigenous species, but counts are much lower in 2018. This may be attributed to the change in vegetation reducing available breeding sites for this cavity-nesting species, and trees to use as perch sites while hunting. Further surveys will indicate if this decline is ongoing, or an erratic result from one survey.

8.2 Pūweto/spotless crane response rates

In 2014, pūweto were only detected around the northern and eastern edges of the lagoon. In 2018, they were only detected around the southern edge of the lagoon, and again in three fairly distinct locations in the southern part of the wetland. The spatial distribution of pūweto is quite different between the two years, perhaps reflecting the lower detection probabilities for this species, as it seems unlikely that their distribution would have changed significantly over this time period.

8.3 Matuku/bittern

Matuku counts during the five minute bird counts were much lower in 2018 than in 2014 (means per count of 0.59 in 2014 and 0.21 in 2018). They were also detected at fewer stations in 2018 (11, compared with 26 in 2014). However, comparisons between approximated locations of booming matuku between the years show that birds are present in similar areas, suggesting that the spatial distribution of matuku has not changed. It is possible that the differences in counts between the years could be attributed to a difference in booming rates, perhaps related to seasonal differences, rather than reflective of a real decline. However, it is also plausible that the decline is real, given that this is a Threatened-Nationally Critical species known to be in steep decline nationally. Maintaining, or increasing predator control should assist in reducing any decline that may be occurring at Tumurau.

8.4 Mātātā/fernbird

In 2014, mātātā were detected at four stations during five minute bird counts, whereas in 2018 they were detected at twelve. Mātātā now appear to be widespread throughout the southern part of the wetland, particularly to the west, but are not yet found around the lagoon other than the southern edge. These results suggest that mātātā have increased in number and spatial distribution within the wetland. It will be interesting to see if these changes continue.

8.5 Waterbird counts

As noted above, inferring trends from the waterbird counts requires some caution. Nevertheless, shag counts were lower in 2018 than in 2014, with only kawau (black shag) sighted in 2018, and in lower numbers than in 2014. Numbers of Canada goose, black swan, mallard, and pūtangitangi (paradise shelduck) were all considerably higher in 2018, compared to the same time of year in 2014. The number of weweia (NZ dabchick) and pāpango (NZ scaup) seen was similar between years, with a total of six weweia seen in 2018, compared to seven in 2014, although most of these were seen while traversing the lagoon by kayak, rather than in counts from the jetty.

9. CONCLUSIONS

- Mean five minute bird counts differ for many species between 2014 and 2018, but monitoring should continue to determine whether these changes are ongoing.
- Counts of māātātā/fernbird, an At Risk-Declining species, have increased markedly between 2014 and 2018 at Tumurau.
- Pūweto/spotless crake (At Risk-Declining) and matuku/bittern (Threatened-Nationally Critical) show more ambivalent results, which reflect the difficulty in monitoring these cryptic species.
- It is possible that matuku are declining at Tumurau. It may be of benefit to consider annual observer monitoring for this species, to allow trends to be detected more rapidly for this species, or consider the use of monitoring methods such as the annual use of acoustic recorders.
- Koitareke (marsh crake) do not appear to be present at Tumurau after failing to be detected in both 2014 and 2018, although this species is notoriously difficult to detect.
- Continuing predator control at Tumurau, and ensure that it is effective through monitoring, will be of benefit to all Threatened or At Risk avifauna, as well as other species susceptible to predation at Tumurau. This control should target rodents, mustelids, and feral cats for maximum effectiveness.

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COUNT STATION
PHOTOGRAPHS



Station 1



Station 5



Station 6



Station 7



Station 8



Station 9



Station 10



Station 11



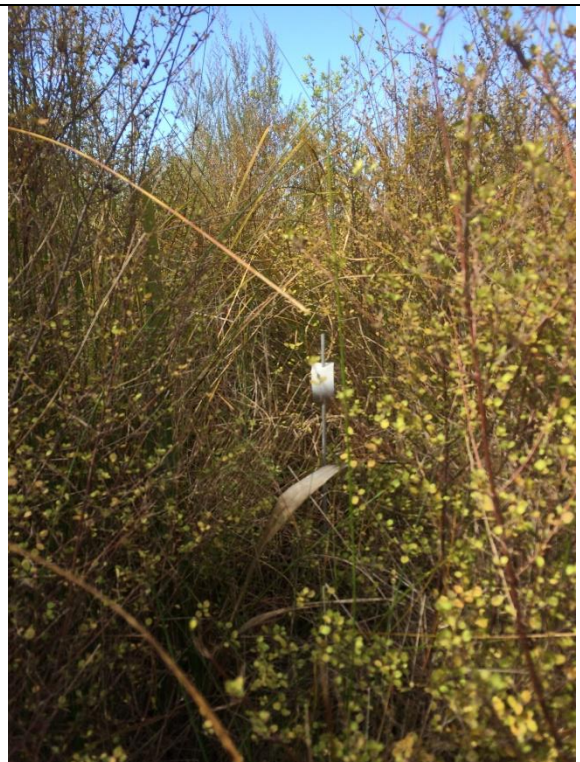
Station 12



Station 13



Station 14



Station 15



Station 16



Station 17



Station 18



Station 19



Station 20



Station 21



Station 22



Station 23



Station 24



Station 25



Station 26



Station 27



Station 28



Station 29



Station 30



Station 31



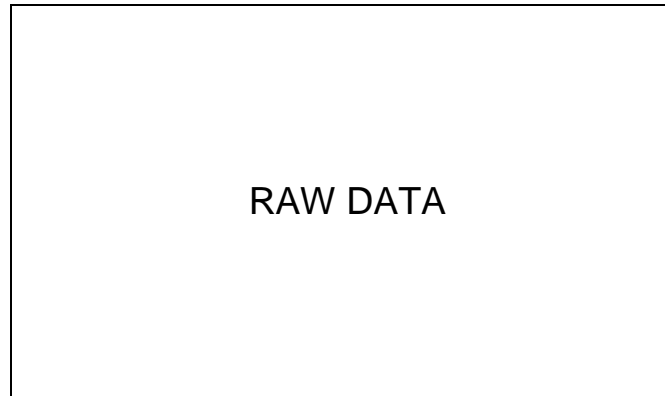
Station 32



Station 34



Station 35



The original raw data is provided as separate PDF documents.



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