Acoustic monitoring of roroa (great spotted kiwi) in the Taramakau and Kelly Range 2018-2021

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Summary

Acoustic recorders were deployed at 13 locations in the Taramakau Valley and five on the Kelly Range in February/March 2021 to determine call rates of roroa (great spotted kiwi, *Apteryx maxima*[1]). Recordings were also made at these stations in 2018/2019. Together these recordings are the start of an acoustic monitoring programme which will add to the long running (human) call count monitoring of roroa in the Taramakau. Five nights' recordings were analysed from each station. Between 2018 and 2021, there was an apparent increase in call rate in the Kelly Range, but this may be an artefact of the timing of recorder deployment between years. No consistent change was seen between 2019 and 2021 in the Taramakau. Suggestions to improve the acoustic monitoring programme are made.

Introduction

Kiwi call count surveys were established to monitor populations of roroa, great spotted kiwi (*Apteryx maxima*) in the Taramakau Valley, Arthur's Pass in 1993. Surveys are repeated every five years, with at least 48 listening hours completed throughout each monitoring season. The Taramakau is one of six sites in the national call count monitoring scheme for roroa (Colbourne *et al.* 2020). In February 2019, 13 acoustic recorders were deployed in the Taramakau as part of a survey to determine the distribution of roroa (Toy & Toy 2019). These covered a longer length of the valley than the human call counts and, since the detection range of acoustic recorders is less than that of human hearing (Colbourne *et al.* 2020), enabled comparison of call rates with other locations in the roroa acoustic recorder survey. There had been no roroa monitoring in the Kelly Range to the south of the Taramakau, but five acoustic recorders were deployed there in October 2018 as part of the roroa survey. In 2021 recorders were deployed at the same 13 sites in the Taramakau and five sites in the Kelly Range as part of an expanded roroa monitoring programme.

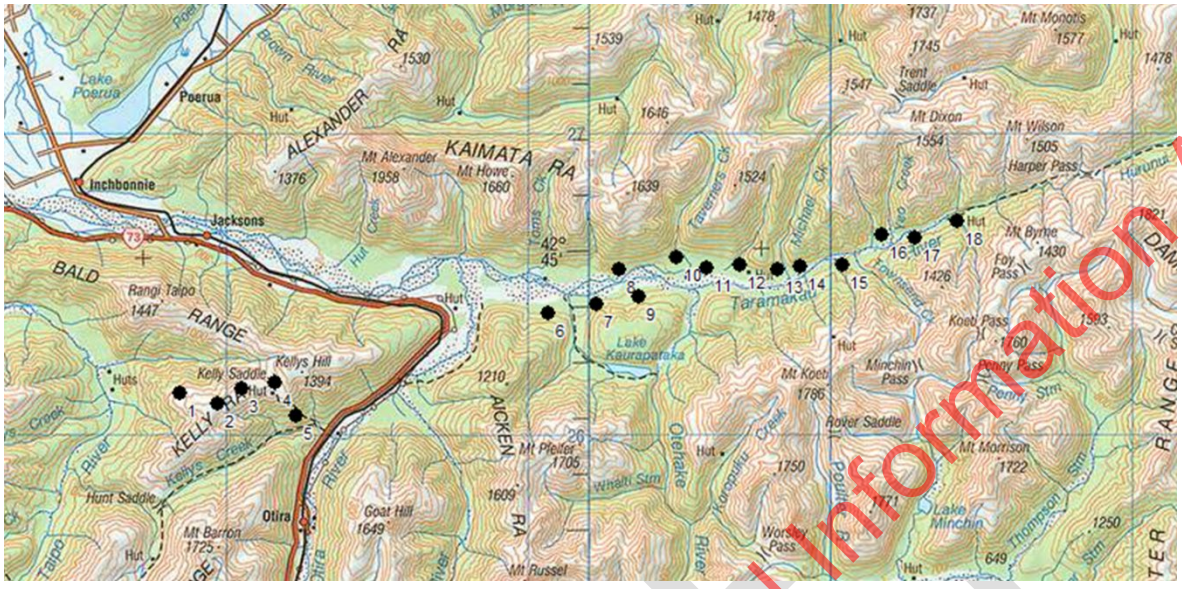
Methods

DOC acoustic recorders were deployed for around three weeks. Recording locations are shown in Figure 1 and listed in Appendix 1. Recorders were placed an average of 1.1 km apart, but two pairs of recorders were less than 1 km apart: 'Attached to warratah by track 1' and 'Attached to warratah by track 2' (920 m apart); 'Upstream of Michael Creek' and 'Michael Creek' (760 m apart). Most recorders were deployed in nearly the same locations in 2021 as in 2018-2019; small differences may be GPS error, but those at Taverner's Flat and Kiwi Hut were more than 40 m from their 2018-2019 locations in 2021 and these are likely to be real differences.

[1] The species name according to the *Checklist of NZ Birds* checklist is *Apteryx haastii* but it has recently been recommended that this be changed to *A. maxima* at the next revision of the checklist (Shepherd *et al.* 2021)

The recorders were programmed to record from about half an hour after sunset to half an hour before sunrise on the 'low' (8 kHz) setting. However, there was some variable programming so that some recorders came on or went off up to half an hour late or early. Recorders were fixed to small trees about 1.5 m above the ground or, above the tree line in the Kelly Range, to waratahs. Recordings were analysed manually using Freebird Birdcall software. Five nights of recordings with little interference from wind or rain were selected. The spectrograms were slowly scanned and calls were played where the visual record was unclear. The time and strength of each kiwi call (loud, moderate, faint), and whether it was male, female or part of a duet was recorded. If a kiwi appeared to call twice as part of a duet or broken-duet (male-female-male or male- short gap-male) the second call by the same bird was not counted. A subjective ranking of spectrogram clarity (i.e. amount of interference by rain, wind or water noise) was made for each recorder for each night

Figure 1 Locations of recorders. Locations are: 1, Attached to warratah by track 1; 2, Attached to warratah by tarns; 3, Attached to warratah by track 2; 4, Attached to warratah by track 3; 5, East side of track on flattish spur; 6, Clear - Pfeifer Creek; 7, Upstream of Pfeifer Creek; 8, True right downstream of Otehake; 9, True left downstream of Otehake; 10, Taverners Creek; 11, Taverners Flat; 12, Kiwi Hut; 13, Michael Creek; 14, Upstream of Michael Creek; 15, Downstream of Townsend Creek; 16, Yeo - Joseph Creek; 17, Yeo - Locke Stream; 18, Locke Stream



analysed. Since call rates at some of the locations in 2018/2019 were extremely low and since roroa call at all hours of the night, analysing whole nights will provide a more accurate indication of call rate and increase the chance of detecting change over time, than recording only the first four hours after sunset as suggested by Colbourne *et al*. (2020). The presence of other birds calling during the night, particularly morepork (*Ninox novaeseelandiae*), kaka (*Nestor meridionalis*), kea (*Nestor notabalis)*, wēkā (*Gallirallus* australis) and long tailed cuckoo (*Eudnamys taitensis*), was recorded.

Three nights of recordings have previously been analysed for each location from the 2018-2019 survey (Toy & Toy 2019). As roroa call rates are highly variable between nights (Mclennan & McCann 1991; Toy *et al*. in prep.), an additional two nights of these 2018-2019 recordings have now been analysed. Five nights of recordings from 2021 were also analysed.

Location metadata (grid reference, recording dates, recorder identity) were recorded in an Excel workbook. Details of each call were listed in the same workbook. The workbook contains PivotTables and formulae to calculate hours analysed and call rates per hour (for each night and for each site).

The length of the night varies with season, to examine the distribution of the timing of calls through the night, the recording period (30 minutes after sunset to 30 minutes before sunrise) was divided into equal length deciles. The number of calls in each decile was then examined.

Results

The total number of calls in 2018-2019 and 2021 was 539 and 702 calls respectively. 71% of calls across both seasons were male, 23% of calls were part of a duet. The average call rate across five nights at each location varied from no calls to 2.83 calls/h (Table 1, Fig. 2). It appears as if call rate increased in the Kelly Range from 2018 to 2021, but this may be a consequence of sampling season (see Discussion). There was no trend in the Taramakau.

Calls occurred throughout the night (Fig. 3), with more calls in deciles 5-8 and a decline in the last two deciles. Some of the decline in the last decile may be due to variable programming of the recorders.

The presence of other night calling birds is shown in Table 3.

Table 1 Average roroa call rates at each location in 2018-2019 and 2021

Area	Location	2018-2019	2021
Kelly Range	Attached to warratah by track 1	0.10	0.50
	Attached to warratah by tarns	0.00	0.70
	Attached to warratah by track 2	0.32	1.14
	Attached to warratah by track 3	0.14	0.49
	East side of track on flattish spur	0.34	0.36
Taramakau	Clear - Pfeifer Creek	0.47	0.23
	Upstream of Pfeifer Creek	0.38	0.36
	True right downstream of Otehake	0.31	0.18
	True left downstream of Otehake	0.76	0.60
	Taverners Creek	0.90	1.34
	Taverners Flat	2.83	2.61
	Kiwi Hut	1.13	0.76
	Michael Creek	1.10	1.60
	Upstream of Michael Creek	0.87	1.14
	Downstream of Townsend Creek	0.86	0.45
	Yeo - Joseph Creek	0.75	1.43
	Yeo - Locke Stream	0.48	1.24
	Locke Stream	0.31	0.29

Figure 2 Roroa call rates at each location in 2018-2019 and 2021

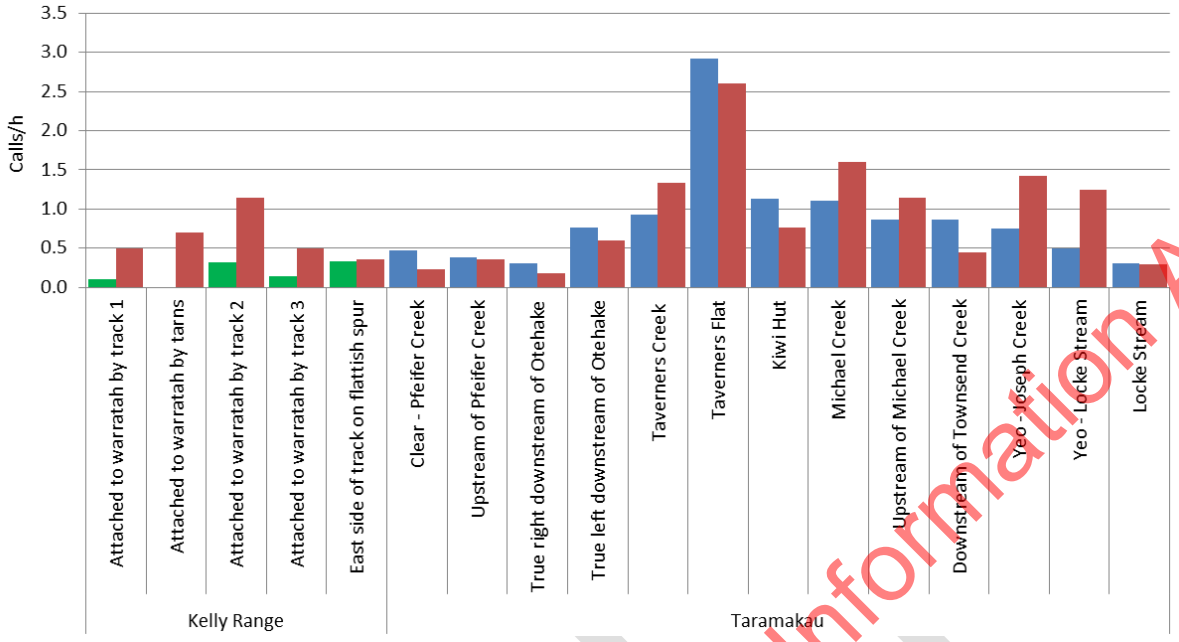


Figure 3 Number of calls in each decile of the night across all locations. Blue is the number of male calls, red the number of female calls.

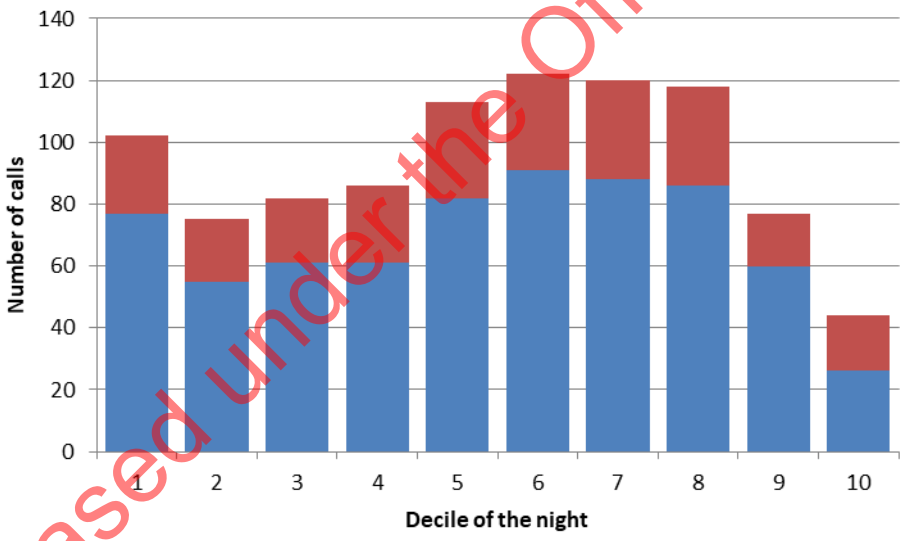


Table 3 Number and percentage of nights analysed in which nocturnal birds other than roroa were detected calling. 25 nights were analysed in each season for the Kelly Range and 65 for the Taramakau valley, a total of 90 nights each season.

Species	2018-2019			2021		
	Kelly Range	Taramakau	Total	Kelly Range	Taramakau	Total
Morepork	1 (4%)	51 (78%)	52 (58%)	3 (12%)	42 (65%)	45 (50%)
Wēkā	22 (88%)	51 (78%)	73 (81%)	1 (4%)	42 (65%)	43 (48%)
Kaka	5 (20%)	47 (72 %)	52 (58%)	6 (24%)	44 (68%)	50 (56%)
Kea	10 (40%)	0		11 (44%)	0	
Spur winged plover	2 (8%)	7 (11%)	9 (10%)	1 (4%)	1 (2%)	2 (2%)
Long tailed cuckoo	4 (16%)	24 (37%)	30 (33%)	0	44 (68%)	

Discussion

The season of recorder deployment in the Taramakau was comparable in the first recording period (February 2019) and the second (February 2021). But, there was a major difference in the Kelly Range (October 2018 and March 2021). Roroa call rates may be lower in the spring when kiwi are likely to be incubating, than in the late summer, post-breeding period. The apparent increase in call rate in the Kelly Range may be an artefact of the timing of recorder deployment. However, location 'Attached to waratah by tarns' is particularly interesting as in 2018 no calls were detected in 53:37 hours of recording but in 2021, 37 calls including six duets and three 'near' calls were detected in 52:30 hours of recording. This appears to indicate a change.

The kiwi Best Practice Manual recommends that average call rates from three years recording are used to establish a baseline against which to assess change every five years. Two years are now available for the Tarmakau. As the first season recording in the Kelly Range was in a different season to the second, we suggest that a further two years baseline survey are undertaken for the Kelly Range in February/March.

The following suggestions would make long term monitoring easier:

- Deploy acoustic recorders in the same month each year;
- Permanently mark the recorder deployment locations (if this has not already been done). Recordings should be made at exactly the same location each year;
- Programme the recorders to run from half an hour before sunset to half an hour after sunrise;
- To avoid confusion over the identity of the locations of recordings, standardise names of recorder locations and use these, rather than the name of the recorder, when saving recordings.

In both seasons the high proportion of nights in which kaka were detected calling is noteworthy. There was no change between seasons for kaka, morepork and kea. In both seasons, the latter was detected only in the Kelly Range. In contrast, there was a marked decline in the proportion of nights in which wēkā were detected in both the Kelly Range and the Taramakau. Wēkā are highly vocal and their calls are easily detected on spectrograms. It is likely that this decline in nights detected reflects a decline in population. Wēkā are renowned for their fluctuating populations (Heather & Robertson 2015). They have been at high population levels in the South Island in recent years but appear to be declining elsewhere (S. Toy, R. Toy per. obs.). Long-tailed cuckoos migrate to wintering grounds in the tropical Pacific Islands in February or March (Heather & Robertson 2015). The differences in

number of nights detected between seasons for this species is more likely to reflect the season of the nights analysed in relation to the timing of migration rather than a change in population.

References

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Appendix 1 Locations of recorders

Nearest 'feature'	2021		2018-2019		Distance between 2018/2019 and 2021 locations
	Easting	Northing	Easting	Northing	
Attached to warratah by track 1	1478420	5261440	1478420	5261442	2 m
Attached to warratah by tarns	1479664	5261083	1479664	5261083	0 m
Attached to warratah by track 2	1480429	5261599	1480429	5261595	4 m
Attached to warratah by track 3	1481529	5261812	1481524	5261809	6 m
East side of track on flattish spur	1482248	5260704	1482252	5260713	10 m
Clear - Pfeifer Creek	1490583	5264075	1490572	5264085	15 m
Upstream of Pfeifer Creek	1492193	5264405	1492190	5264411	7 m
True right downstream of Otehake	1492971	5265535	1492963	5265541	10 m
True left downstream of Otehake	1493623	5264640	1493602	5264646	22 m
Taverners Creek	1494863	5265956	1494856	5265945	13 m
Taverners Flat	1495843	5265608	1495900	5265566	71 m
Kiwi Hut	1496961	5265678	1497004	5265678	43 m
Michael Creek	1498201	5265559	1498193	5265577	19 m
Upstream of Michael Creek	1498954	5265656	1498968	5265642	20 m
Downstream of Townsend Creek	1500329	5265718	1500335	5265724	8 m
Yeo - Joseph Creek	1501667	5266675	1501672	5266668	9 m
Yeo - Locke Stream	1502751	5266601	1502747	5266586	16 m
Locke Stream	1504166	5267173	1504175	5267155	20 m