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SHORT NOTE

Alternative methods for detection of the South Island rifleman (*Acanthisitta chloris chloris*)

JAMES A.J. MORTIMER
4A Avoca Valley Road, Heathcote Valley, Christchurch 8022, New Zealand

The South Island rifleman (*Acanthisitta chloris chloris*) is widely distributed throughout the beech (*Nothofagus* spp.) forests of New Zealand's South I (Robertson *et al.* 2007) and has a conservation status of 'at risk - declining' (Miskelly *et al.* 2008). Riflemen are often detected by sound rather than sight (*pers. obs.*), with their call described as a very high-pitched, sharp *'zipt-zipt-zipt-zipt'* (Heather & Robertson 2000). The high-frequency calls are difficult for some people to hear and may not be detected by those with an inability to hear high-frequency sounds.

Ultrasound detectors (commonly used to detect bat echolocation calls) and digital recorders may provide alternative means of detecting rifleman calls. An ultrasound detector makes high-frequency sounds audible by converting them to lower frequencies, whilst the electronic files created by digital recorders can be viewed as sonograms using sound analysis software. The aim of this study was to investigate the potential of these 2 types of device as alternatives to the human ear for those who cannot hear rifleman calls unaided, with a view to enabling such people to carry out bird surveys without missing this species.

Arthur's Pass National Park was selected for fieldwork, as riflemen are common in the native forests (*pers. obs.*). The study area, located close to Arthur's Pass village (42° 55′ 46″ S, 171° 33′ 41″ E), consisted of forest dominated by mountain beech (*Nothofagus solandri* var. *solandri*), at an altitude of ~900 m above sea level.

Detection of riflemen was tested using 3 methods: (1) ear, (2) ultrasound detector, and (3) digital recorder. A total of 33 five-minute point counts were completed at stations spaced at least 75 m apart on 28 Feb and 9 Mar 2013, between 0800 and 1300 hours during fine weather conditions. Two observers were present for each count. An 'aural' observer used their own hearing to detect riflemen and recorded the times at which calls were detected, direction relative to the observer (0° [straight ahead], 45°, 90°, 135°, 180° [directly behind], 225°, 270° or 315°), and estimated distance from the observer (0-8 m, 9-16 m, 17-25 m, 26-45 m or 46-100 m). There was a different aural observer on each of the 2 survey visits and the results were later pooled for analysis. An 'electronic' observer was also present for each count, listening for rifleman calls using a Pettersson D-230 ultrasound detector (in heterodyne mode, tuned to 10 kHz) through headphones, who also noted times at which calls were detected. The D-230 has a bandwidth of 8 kHz, and when tuned to 10 kHz it detects sounds within a frequency range of 6-14 kHz. The electronic observer also used a hand-held Sony ICD-PX312M digital recorder (with a microphone sensitivity range of 75 - 20,000 Hz) to record each count, for subsequent viewing using the Raven sound analysis software (version 1.0). It is important to note that analysis of the recordings involved visual scanning of the sonograms only.

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Correspondence: *jamesmort@yandex.com*

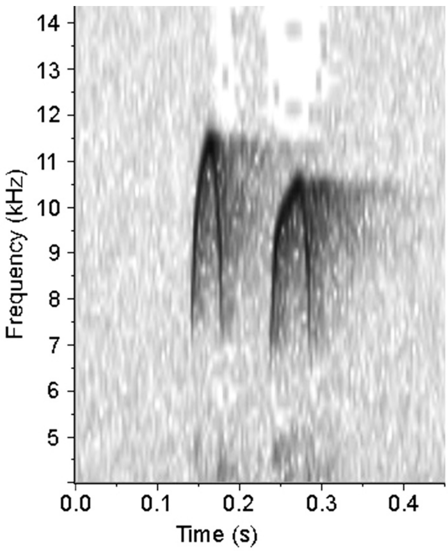

Fig. 1. Sonogram of a typical South Island rifleman call recorded at Arthur's Pass, Canterbury (FFT = 256, overlap = 50%, resolution = 256).

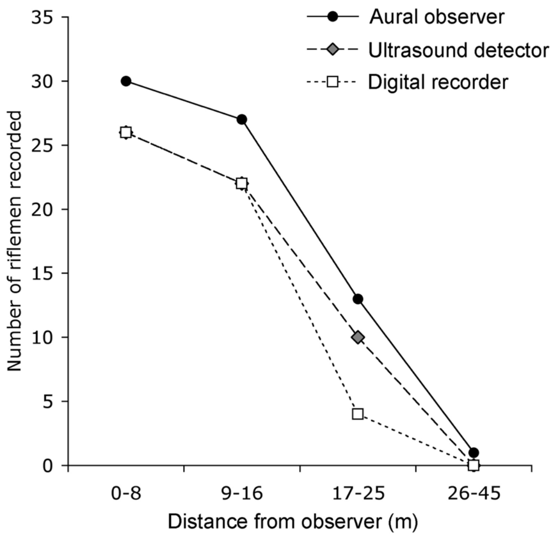

Fig. 2. The total number of riflemen detected for each distance category at Arthur's Pass, Canterbury, by aural observer, ultrasound detector and digital recorder.

It was not possible to record distance or direction information using either of the electronic devices. Analysis was in 2 parts: (1) comparison of detection/non-detection per 5-minute count, and (2) ability of the electronic devices to detect individual birds as recorded by the aural observer, determined by matching the times at which calls were recorded.

Numerous riflemen calls were heard during the study, with a mean count of 2.03 (SE_{mean} = 0.28) recorded by the aural observer. Call frequency (identified from the digital recorder sonograms) was generally between 7-12 kHz, which is consistent with the findings of Krull *et al.* (2009). At least 4 rifleman call types were identified from the sonograms, and the most common type is shown in Fig. 1. Several riflemen were sighted, some of which did not emit any detectable calls during the 5-minute count period.

All 3 detection methods were successful in detecting rifleman calls. A comparison was made for detection/non-detection per 5-minute count, using the Jaccard Similarity Index (0 = no similarity, 1 = identical). A comparison between the aural observer and ultrasound detector resulted in an index of 0.96, which indicated a high level of similarity. The result for aural observer and digital recorder was somewhat lower, at 0.82.

The aural observer recorded a total of 71 individual birds throughout the study. The ultrasound detector recorded 58 of these (81.7%), which was significantly fewer (V = 55, *d.f.* = 23, P = 0.0042). The digital recorder detected 52 (73.2%), which was also significantly less than the aural observer (V = 91, *d.f.* = 23, P = 0.0012). Both the ultrasound detector and digital recorder detected a small number of calls that were missed by the aural observer. These were excluded from this analysis because there was no way of determining distance or direction for these calls and therefore individual birds could not be identified. It is worth noting, however, that both electronic devices were potentially able to detect some riflemen that the aural observer could not.

Fig. 2 demonstrates that for all methods fewer birds were detected as the distance from observer increased, and that almost all calls were detected within a radius of 25 m. The aural observer detected a single bird at 26-45 m and no birds were detected beyond 45 m. This is not surprising, since the high-frequency calls of the rifleman would be subject to a high rate of attenuation, and would not be expected to travel as far as the lower-frequency calls of some other species. Waide *et al.* (1988) demonstrated that high-frequency sound attenuated more rapidly than low-frequency sound in tropical forest. The ultrasound detector and digital recorder consistently detected fewer birds than the aural observer. The devices were equally effective at distances of 0-8 m and 9-16 m (where they both recorded 26 and 22 birds, respectively), however at 17-25 m the ultrasound detector was more effective, detecting 2.5 times as many riflemen, indicating that it may have a greater range than the digital recorder.

For each direction, the number of riflemen recorded by the ultrasound detector was usually equal to or slightly less than the aural observer (Fig. 3). The exception was at 45°, at which 71% fewer riflemen were detected compared to the aural observer. The digital recorder detected fewer riflemen than the ultrasound detector for most directions, except for 45°, for which the digital recorder detected more riflemen. At 180 ° (directly behind), all 3 methods detected the same number of riflemen. There was no clear explanation for these differences.

Overall the results demonstrated that both the ultrasound detector and digital recorder were effective at detecting riflemen. However, the ultrasound detector results were more comparable to those of the aural observer, indicating that this was most effective of the 2 electronic devices. For this study only a single model of each type of device was tested, and the results may not apply to other similar devices. In addition, this study was carried out at a single site, at which riflemen were common. It is not known if the alternative detection methods would be as effective at sites with smaller rifleman populations.

A number of limitations associated with using ultrasound detectors and digital recorders became apparent during this study. Firstly, in the absence of an aural observer, it is not possible to determine distance or direction when using an ultrasound detector or digital recorder. This makes it impossible to know how many birds are calling (a requirement of standard 5-minute bird counts). These devices may therefore be limited to detecting presence only. Abundance can be determined from presence-absence data (*e.g.,* Royle & Nichols 2003), however a change to the study design may be required to enable this and if data for rifleman are analysed differently from all the other species recorded, interpretation of the results could be problematic.

Secondly, using headphones with the ultrasound detector prevents the user hearing species other than rifleman. Therefore, when carrying out bird counts the built-in speaker must be used. The 'hiss' produced by the speaker (due to background noise) can be quite loud in some circumstances, forcing the user to reduce the volume and thereby potentially restricting their ability to hear the more distant rifleman calls. In addition to the hiss, the ultrasound detector can be prone to occasional noise resulting from electrical interference.

An additional point to note is that during this study several riflemen were sighted without calls being detected. This is a reminder of the importance of not relying solely on audio cues for detection. Visual scanning of the surroundings is essential, otherwise birds that call infrequently may be missed.

In conclusion, the results of this study indicate that ultrasound detectors and digital recorders may provide viable alternatives to the human ear for detecting presence of riflemen. If such devices are to be used, however, the survey manager must be informed and the limitations must be recognised when the data are analysed.

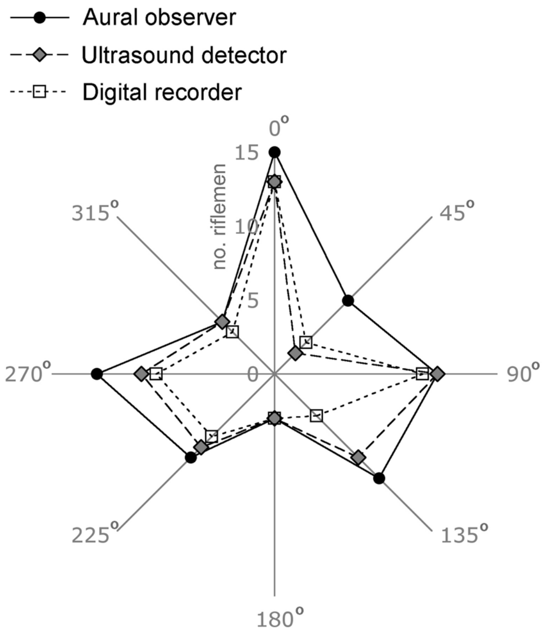

Fig. 3. The total number of riflemen detected for each direction (with 0 degrees directly in front) at Arthur's Pass, Canterbury, by aural observer, ultrasound detector and digital recorder.

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