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Note

The "perrrck" vocalization of Ruffed Grouse (*Bonasa umbellus*)

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Abstract

The vocal repertoire of Ruffed Grouse (*Bonasa umbellus*) has been known for decades, but because of the rarity of vocal recordings in the field, few data exist on spectral characteristics of their vocalizations. Here, we provide a spectrogram and analysis of a vocalization rarely heard in the field: the "perrrck" call, which is ~0.5 s in duration and has a fundamental frequency of 613 Hz with several harmonics. We compare this call with the more commonly heard "peet" call, which is much shorter and of higher frequency. Although the function of the perrrck call remains unknown, our analyses show that Ruffed Grouse vocalizations vary in frequency, despite their purportedly weak syrinx.

Key words: Ruffed Grouse; *Bonasa umbellus*; vocalization; vocal repertoire

Ruffed Grouse (*Bonasa umbellus*) is a heavily managed gamebird species in North America, but many aspects of its behaviour remain understudied. For example, it produces several different vocalizations, but data and spectrograms (and, more important, spectral analyses) for most of these vocalizations are lacking, and some are only vaguely described (Bump *et al.* 1947; Atwater and Schnell 1989; Rusch *et al.* 2020). Unlike most other grouse species, the courtship display of Ruffed Grouse largely lacks vocalizations, except for a "hiss" produced by males when they cease drumming and engage in a tail-fanning visual display (Hjorth 1970). The "peet" (or "peta") call is the most commonly produced and heard vocalization (Bump *et al.* 1947; Atwater and Schnell 1989). Peets are typically produced before and after a grouse flushes (Bump *et al.* 1947; Atwater and Schnell 1989), which suggests that it may function as an alarm or distress call (Atwater and Schnell 1989). Despite their relatively weak syringeal musculature (Atwater and Schnell 1989), Ruffed Grouse can produce a range of sounds (Bump *et al.* 1947); however, they do so infrequently in the wild and so detailed information on the acoustic structure of their vocalizations is lacking.

Here we describe a circumstance in which we were able to record a rare vocalization in a male Ruffed Grouse, the "perrrck" call (Bump *et al.* 1947). In addition, we complete a spectral analysis of the perrrck call in comparison with the peet call, providing the first quantitative data on this rarely produced vocalization.

As part of a long-term study on Ruffed Grouse drumming behaviour near Buck Lake, Alberta (52.97°N, 114.77°W), A.N.I. conducted a series of playback experiments in April and May 2012–2014. Briefly, each consisted of positioning a speaker 35–40 m from a male's drumming structure and broadcasting the drumming sound of an unfamiliar male. Further details of the playback study and field site are provided in O'Neil *et al.* (2018).

On 11 May 2014, a playback trial began at 0750 (MDT) directed towards a male Ruffed Grouse that was actively drumming on a log. After presentation of the first drumming recording, this male stopped drumming and approached the speaker. He circled the speaker several times, occasionally emitting peet vocalizations. After the 9th drumming playback, he partly fanned his tail out and began producing a vocalization that we had not previously encountered over 10 breeding seasons. The bird continued to vocalize for 12.5 min while slowly walking around the speaker at a distance of 1–5 m. Based on the sound produced and slight tail fanning behaviour, we believe this is the perrrck vocalization described by Bump *et al.* (1947), which is also referred to as "cherp" by Atwater and

Schnell (1989). A.N.I. then removed the speaker from the area, while the male grouse remained stationary under a small Black Spruce (*Picea mariana* (Miller) Briton, Sterns & Poggenburgh) and continued to vocalize.

Although the sound pressure level was not recorded, it was difficult to hear the perrrck vocalization beyond 10 m. The male's behaviour was recorded on a Canon SX30 IS PowerShot (Canon USA Inc., Melville, New York, USA) digital camera (Iwaniuk 2024) and a WAV audio file extracted from the video. Spectrograms were then created and measured in Praat (version 6.2.15; P. Boersma and D. Weenink, University of Amsterdam, Amsterdam, Netherlands, http://www.praat.org/).

Spectral analysis was conducted and averaged across 20 bouts of vocalization by the same male Ruffed Grouse. The perrrck call averaged 0.47 ± 0.04 s in duration (± SD), had an inter-call interval of 0.21 ± 0.01 s, and a fundamental frequency of 613 ± 23 Hz. In addition to the fundamental frequency, the perrrck contained four harmonics centred on the following frequencies: 1225 ± 46 Hz, 1845 ± 69 Hz, 2460 ± 83 Hz, and 3102 ± 139 Hz (Figure 1a).

For comparison, a spectrogram of the more common peet call, downloaded from Xeno-canto (a wildlife sound sharing website based in the Netherlands) was analyzed (Figure 1b). The peet vocalization was from a single individual recorded in Minnesota, USA (Marvin 2014). In contrast to the perrrck call, the peet call was repeated rapidly. Each peet (averaged over 20 bouts) was of shorter duration (0.08 ± 0.01 s), shorter inter-call interval (0.12 ± 0.03 s), and higher fundamental frequency (5663 ± 132 Hz) than the perrrck. Structurally, the peet was also different in that it had a frequency sweep extending from 321 to 6133 Hz and lacked harmonics (Figure 1b), whereas the perrrck was a constant tone with several harmonics (Figure 1a).

Apart from the drumming display (Garcia *et al.* 2012; O'Neil *et al.* 2018), spectrograms of other Ruffed Grouse vocalizations are largely lacking in the literature (Rusch *et al.* 2020). Past research suggests (Bump *et al.* 1947) this is because Ruffed Grouse do not commonly vocalize in the wild. In fact, Bump *et al.* (1947) state that solitary Ruffed Grouse rarely vocalize and that maintaining habituated grouse in aviaries is what enabled them to document the different vocalizations. Territorial interactions in the wild appear to be rare; in 10 years, only one territorial interaction was observed (by A.N.I., unpubl. data). However, playbacks can stimulate agonistic displays in some males and may have contributed to the production of the perrrck call we have described.

The most common vocalization, the peet call, is often produced when Ruffed Grouse perceive a threat (Atwater and Schnell 1989; Bump *et al.* 1947). It is particularly prevalent in the fall among young birds that have not fully dispersed from their natal group (A.N.I. pers. obs.). The frequency modulation of the peet (Figure 1b), a vocalization typically produced by young-of-the-year, would likely make it easier for other grouse to localize, supporting a potential function as a distress or alarm call among brood mates (Atwater and Schnell 1989), but in the absence of experimentation, this remains speculative.

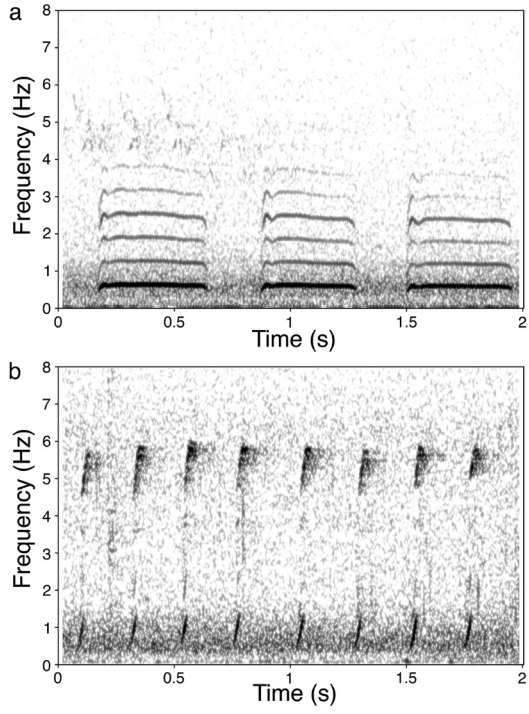

FIGURE 1. Spectrograms of two Ruffed Grouse (*Bonasa umbellus*) vocalizations: a. "perrrck" call and b. "peet" call. The perrrck call was extracted from a video recording (Iwaniuk 2024) and the peet call is from Xeno-canto (Marvin 2014).

In contrast to the peet, the perrrck was markedly different in spectral structure and tempo (Figure 1a). Bump *et al.* (1947) describes the perrrck as being similar to the call of a Red Squirrel (*Tamiasciurus hudsonicus*) that is sometimes heard by deer hunters. It is unclear which squirrel vocalization the researchers are referring to because none of them appears to be similar in frequency or structure to the grouse's perrrck vocalization (Embry 1970).

As an indicator of how infrequently the perrrck was heard, 64 males were used in the playback study (O'Neil *et al.* 2018) with over 70 h of observations in total, but only one male produced the perrrck.

The perrrck vocalization was also not found in hundreds of hours of audio recordings of dozens of males recorded between 2011 and 2020 (O'Neil *et al.* 2018; Déaux *et al.* 2020; Martin 2021). The rarity of this vocalization makes it impossible to determine its function, although it is reasonable to conclude that it does not play a role in courtship given the hundreds of hours of recordings from the breeding season that we have examined. Now that we have a recording of the perrrck call, it could be played back to other Ruffed Grouse as an initial attempt to determine its function. Regardless of the function of the perrrck call, based on our spectrographic analyses, it is clear that Ruffed Grouse can produce a range of frequencies, but they do so rarely.

Author Contributions

Writing – Original Draft: A.N.I.; Writing – Reviewing & Editing: A.N.I. and B.B.; Observations: A.N.I.; Conceptualization: A.N.I.; Formal Analysis: A.N.I. and B.B.; Visualization: A.N.I. and B.B.

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