The Canadian Field-Naturalist

Note

A highly anomalous Red-winged Blackbird (*Agelaius phoeniceus*) song

Brandon P.M. Edwards[1,*], Allison D. Binley[1], Willow B. English[1], Emma J. Hudgins[1], and Samuel S. Snow[1,2]

[1]Department of Biology, Carleton University, Ottawa, Ontario K1S 5B6 Canada
[2]Department of Ecology and Evolutionary Biology, Yale University, New Haven, Connecticut 06520 USA
[*]Corresponding author: brandonedwards3@cmail.carleton.ca

Edwards, B.P.M., A.D. Binley, W.B. English, E.J. Hudgins, and S.S. Snow. 2022. A highly anomalous Red-winged Blackbird (*Agelaius phoeniceus*) song. Canadian Field-Naturalist 136(1): 1–4. https://doi.org/10.22621/cfn.v136i1.2877

Abstract

Red-winged Blackbird (*Agelaius phoeniceus*) is a highly vocal species with a repertoire of similar, yet acoustically distinct songs. These songs may be altered drastically if, as a nestling, the male goes deaf or becomes acoustically isolated. In deaf Red-winged Blackbirds, these dramatic song alterations may present as songs bearing slight resemblance to the introductory phrase of their normal song. Here, we present a Red-winged Blackbird song observed in Ottawa, Ontario, Canada, that is far outside any normal variation in Red-winged Blackbird songs. Given the individual's age and the consistency of the anomalous song, it is possible that this is a deaf bird.

Key words: Red-winged Blackbird; song development; song anomaly; deaf; deafness in birds; song physiology; bioacoustics

Red-winged Blackbird (*Agelaius phoeniceus*) is a common and widespread species native to North America. The males' raucous "*konk-la-reeee*" song (Nero 1984) and impressive "song spread" display—raising their red epaulets, hunching their shoulders, and spreading their tail (Nero 1956; Orians and Christman 1968; Yasukawa 1979)—can be heard and seen throughout the breeding season in a variety of habitats (Nero 1984). Marler *et al.* (1972) describe this song as the Red-winged Blackbird's "full song" or "stereotypical song", because it is the only one that remains stable on a long-term basis. Male Red-winged Blackbirds can have a repertoire of upwards of nine distinct songs, all containing an introductory phrase (variations of the "*konk-la-*" component) and a trill phrase (various modulations and tones of the "*reeee*" component; Marler *et al.* 1972; Yasukawa *et al.* 1980). Figure 1 shows two examples of Red-winged Blackbird songs within the normal range of variation. Several other examples are archived in the Macaulay Library (Anonymous 2022).

Similar to many other songbirds, Red-winged Blackbirds learn their stereotypical songs by copying modelled behaviour early in life (Kroodsma and Baylis 1982). Song development in Red-winged Blackbirds follows a trajectory characterized by three phases typical of other passerines: a highly variable, noisy, and unstructured "subsong"; a less noisy, less variable "plastic song", which may change from day-to-day; and the stereotypical "full song", which remains consistent over repeated breeding seasons (Marler *et al.* 1972). Song development is hindered in males that become deaf or are acoustically isolated as nestlings. Deaf nestlings will develop a song that has little to no resemblance to a full song, whereas males that are acoustically isolated as nestlings will develop an abnormal song with some resemblance to a full song (Marler *et al.* 1972).

On 17 April 2021 at 0843 eastern daylight time (EDT), we observed a male Red-winged Blackbird singing a distinctive and unusual two-note song that was not within any normal variation of Red-winged Blackbird songs. This bird was at the entrance to a marsh complex in Ottawa, Ontario, Canada (45.3449°N, 75.8606°W), known locally as "Nortel Marsh". The bird was perched atop a tree and singing the two-note song regularly while performing its "song spread" display. We recorded the song on a cellphone (Galaxy S9 SM-G960W; Samsung Electronics Co. Ltd., South Korea) using the free Android

A contribution towards the cost of this publication has been provided by the Thomas Manning Memorial Fund of the Ottawa Field-Naturalists' Club.

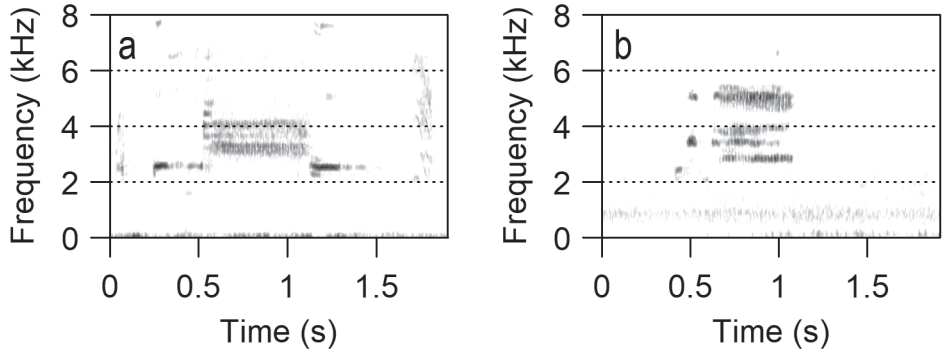

FIGURE 1. Spectrograms of two Red-winged Blackbird (*Agelaius phoeniceus*) songs within the normal range of song variation. Song a was recorded by A.D.B. in Delta, British Columbia, Canada, 24 July 2021. Song b was recorded by B.P.M.E. in Guelph, Ontario, Canada, 1 July 2017.

application MyRecorder v1.01.41.0414.

On 25 April 2021 at 0612 EDT, B.P.M.E. heard the same song again at the marsh and quickly rediscovered the same individual giving this distinctive song, this time while it was sitting atop a utility pole at the entrance. B.P.M.E. recorded its song again using the same recording equipment. During the 10-min session on 25 April and the roughly 5 min observed on 17 April, the bird gave no other song or call.

Both recordings were processed using the free software, Audacity 3.0.0 (https://www.audacityteam.org/). Background noise was removed using the *noise reduction* function and selecting a sample of white noise from the clips to filter out. The transformed recordings were subsequently amplified by 6–10 dB, depending on the clip. The sound files were then converted to spectrograms using the R packages "tuneR" (Ligges *et al.* 2018) and "seewave" (Sueur *et al.* 2008). Figure 2 shows spectrograms for four bouts of the song across the two days. A sound clip of the 25 April encounter was archived in the Macaulay Library (https://macaulaylibrary.org/asset/330098611).

Several indicators suggest that this is, indeed, the "full song" of this individual. The timing at which the observations took place (i.e., mid-April during spring migration) indicates that this individual cannot be a juvenile hatched in the current year that is still developing its song. The use of the "song spread" territorial display also suggests that the bird is at least a year old (Wright and Wright 1944), at which point it would have developed its full song (Marler *et al.* 1972). In addition, the song remained consistent across a span of several days (Figure 2a versus 2b,c,d), and consistent on the same day (Figure 2, b versus c versus d).

In all four recordings presented here, the tones are roughly in the 2 kHz range (±100 Hz). In a typical Red-winged Blackbird's full song, although the introductory phrase comprises several tones simultaneously, several introductory phrases contain at least one tone in the 2-kHz range. It is possible that the two-note song presented here is a small portion of a slow version of an introductory "*konk-la-*" phrase that lacks the complexity of the simultaneous notes.

Given that the observed anomalous song stayed consistent across several recording sessions spanning more than a week and did not appear to transition from a seemingly underdeveloped song into a more developed song, we suggest that this bird could be deaf, rather than acoustically isolated as a nestling. Marler *et al.* (1972) found that acoustically isolated birds still made the full repertoire of sounds, even though they tended to be more variable than birds singing the stereotypical song. That is, the songs of acoustically isolated birds still maintained many of the normal traits of stereotypical songs. However, Marler *et al.* (1972) found that surgically deafened birds sang songs that either maintained little-to-none of the normal traits of a stereotypical song or partly resembled portions of the introductory phrase, which appears to align with the song of this individual. Although male Red-winged Blackbirds are also known to modify their songs in response to anthropogenic noise, most modifications involve only small tonal shifts, decreases in introductory phrase syllables, or changes in trill length (Hanna *et al.* 2011; Cartwright *et al.* 2014; Ríos-Chelén *et al.* 2015).

One alternative cause of the anomalous song in this individual could be a nutritional deficiency while it was a nestling. Nowicki *et al.* (1998, 2002) have hypothesized that a decrease in nutrition as a nestling may lead to impaired brain development, which could lead to lower song quality in passerines. Some evidence supports this theory: Spencer *et al.* (2003) found a decrease in song duration, syllables (both total syllables and variation in syllables), and peak

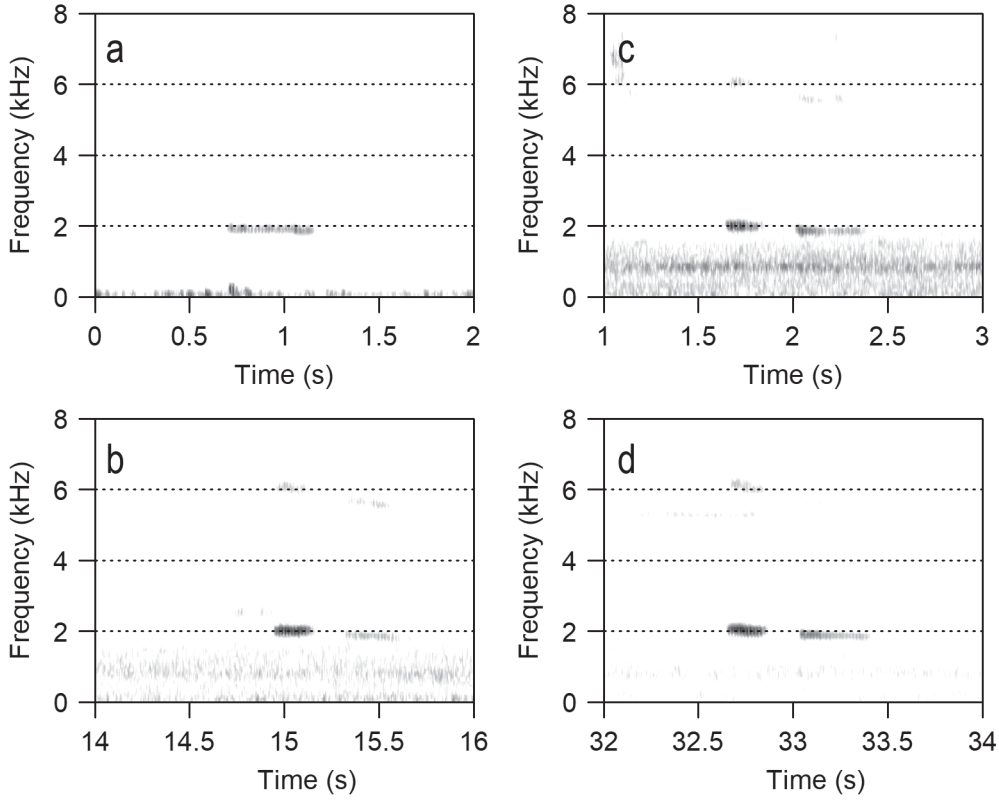

FIGURE 2. Spectrograms of the anomalous two-note Red-winged Blackbird (*Agelaius phoeniceus*) song, with one bout recorded 17 April 2021 (a), and three more bouts (b–d) recorded 25 April 2021. All instances were recorded at Nortel Marsh in Ottawa, Ontario, Canada (45.3449°N, 75.8606°W).

frequency in Zebra Finch (*Taeniopygia guttata*) that were subject to a restricted diet as nestlings, and Schmidt *et al.* (2013) found a decrease in song repertoire, syllable repertoire, and song learning in Song Sparrow (*Melospiza melodia*) that were subjected to a restricted diet as nestlings. However, in both cases, the birds still maintained several normal parts of their species' stereotypical songs, which does not align with the song presented by the Red-winged Blackbird described here. Although this nutritional stress hypothesis is still an ongoing area of research among several bird species (Searcy and Nowicki 2019), it appears so far that a nutritional deficiency reduces song quality to a much lesser extent than deafness in nestlings.

In Red-winged Blackbirds, as with most passerine species, song vocalization is necessary for maintaining territory during the breeding season (Nero 1956; Peek 1972; Yasukawa 1979), and for attracting potential mates (Yasukawa 1979). Song quality in passerines tends to influence female bird response, in that females will respond more favourably to males with higher quality songs and larger song repertoires (Ballentine *et al.* 2004; Nowicki and Searcy 2005). Although we did not collect additional data related to breeding evidence for this individual, it is likely that the extreme difference in song quality compared with a normal range of Red-winged Blackbird song may cause this male to have lower breeding success during its lifetime. Although we believe the cause of the anomalous song in this bird is deafness, an alternative hypothesis could be nutritional deficiencies. As climates and habitats continue to change, it is important to take note of unusual songs, as the causes can reflect environmental conditions and the consequences can contribute to the breeding success, and possibly the evolutionary trajectory, of the species.

Author Contributions

Writing – Original Draft: B.P.M.E.; Writing – Review & Editing: B.P.M.E., A.D.B., W.B.E., E.J.H., and S.S.S.; Conceptualization: B.P.M.E.; Investigation: B.P.M.E., A.D.B., W.B.E., E.J.H., and S.S.S.; Formal Analysis: B.P.M.E.

Acknowledgements

We thank the two anonymous reviewers and Associate Editor for the insightful and helpful comments to improve this manuscript. A.D.B. and W.B.E. are funded through a Natural Sciences and Engineering Council NSERC CGS-D award, E.J.H. is funded through Fonds de Recherche du Québec-Nature et Technologies, and S.S.S. is funded though the W.R. Coe Fund.

Literature Cited

Anonymous. 2022. Birds. Macaulay Library, Cornell Lab of Ornithology, Ithaca, New York, USA. Accessed 30 March 2022. https://search.macaulaylibrary.org/catalog?taxonCode=rewbla&mediaType=a.

Ballentine, B., J. Hyman, and S. Nowicki. 2004. Vocal performance influences female response to male bird song: an experimental test. Behavioural Ecology 15: 163–168. https://doi.org/10.1093/beheco/arg090

Cartwright, L.A., D.R. Taylor, D.R. Wilson, and P. Chow-Fraser. 2014. Urban noise affects song structure and daily patterns of song production in Red-winged Blackbirds (*Agelaius phoeniceus*). Urban Ecosystems 17: 561–572. https://doi.org/10.1007/s11252-013-0318-z

Hanna, D., G. Blouin-Demers, D.R. Wilson, and D.J. Mennill. 2011. Anthropogenic noise affects song structure in red-winged blackbirds (*Agelaius phoeniceus*). Journal of Experimental Biology 214: 3549–3556. https://doi.org/10.1242/jeb.060194

Ligges, U., S. Krey, O. Mersmann, and S. Schnackenberg. 2018. tuneR: Analysis of Music and Speech. The Comprehensive R Archive Network, Vienna, Austria. Accessed 12 August 2021. https://CRAN.R-project.org/package=tuneR.

Kroodsma, D.E., E.H. Miller, and H. Ouellet. 1982. Acoustic Communication in Birds. Volume 2. Academic Press, New York, New York, USA. https://doi.org/10.1016/c2009-0-03022-0

Marler, P., P. Mundinger, M.S. Waser, and A. Lutjen. 1972. Effects of acoustical stimulation and deprivation on song development in red-winged blackbirds (*Agelaius phoeniceus*). Animal Behaviour 20: 586–606. https://doi.org/10.1016/s0003-3472(72)80024-1

Nero, R.W. 1956. A behavior study of the Red-winged Blackbird. II. Territoriality. Wilson Bulletin 68: 129–150.

Nero, R.W. 1984. Redwings. Smithsonian Institution Press, Washington, DC, USA.

Nowicki, S., S. Peters, and J. Podos. 1998. Song learning, early nutrition and sexual selection in songbirds. American Zoologist 38: 179–190. https://doi.org/10.1093/icb/38.1.179

Nowicki, S., and W.A. Searcy. 2005. Song and mate choice in birds: how the development of behavior helps us understand function. Auk 122: 1–14. https://doi.org/10.1093/auk/122.1.1

Nowicki, S., W.A. Searcy, and S. Peters. 2002. Brain development, song learning and mate choice in birds: a review and experimental test of the "nutritional stress hypothesis". Journal of Comparative Physiology A 188: 1003–1014. https://doi.org/10.1007/s00359-002-0361-3

Orians, G.H., and G.M. Christman. 1968. A Comparative Study of the Behavior of Red-winged, Tricolored, and Yellow-headed Blackbirds. University of California Press, Berkeley, California, USA.

Peek, F.W. 1972. An experimental study of the territorial function of vocal and visual display in the male red-winged blackbird (*Agelaius phoeniceus*). Animal Behaviour 20: 112–118. https://doi.org/10.1016/s0003-3472(72)80180-5

Ríos-Chelén, A.A., G.C. Lee, and G.L. Patricelli. 2015. Anthropogenic noise is associated with changes in acoustic but not visual signals in red-winged blackbirds. Behavioral Ecology and Sociobiology 69: 1139–1151. https://doi.org/10.1007/s00265-015-1928-7

Schmidt, K.L., S.D. Moore, E.A. MacDougall-Shackleton, and S.A. MacDougall-Shackleton. 2013. Early-life stress affects song complexity, song learning and volume of the brain nucleus RA in adult male song sparrows. Animal Behaviour 86: 25–35. https://doi.org/10.1016/j.anbehav.2013.03.036

Searcy, W.A., and S. Nowicki. 2019. Birdsong learning, avian cognition and the evolution of language. Animal Behaviour 151: 217–227. https://doi.org/10.1016/j.anbehav.2019.01.015

Spencer, K.A., K.L. Buchanan, A.R. Goldsmith, and C.K. Catchpole. 2003. Song as an honest signal of developmental stress in the zebra finch (*Taeniopygia guttata*). Hormones and Behavior 44: 132–139. https://doi.org/10.1016/s0018-506x(03)00124-7

Sueur, J., T. Aubin, and C. Simonis. 2008. Seewave: a free modular tool for sound analysis and synthesis. Bioacoustics 18: 213–226. https://doi.org/10.1080/09524622.2008.9753600

Wright, P.L., and M.H. Wright. 1944. The reproductive cycle of the male Red-winged Blackbird. Condor 46: 46–59. https://doi.org/10.2307/1364305

Yasukawa, K. 1979. Territory establishment in Red-winged Blackbirds: importance of aggressive behavior and experience. Condor 81: 258–264. https://doi.org/10.2307/1367628

Yasukawa, K., J.L. Blank, and C.B. Patterson. 1980. Song repertoires and sexual selection in the Red-winged Blackbird. Behavioral Ecology and Sociobiology 7: 233–238.

Received 22 September 2021
Accepted 16 March 2022
Associate Editor: D.C. Tozer