

Does How We Measure Birdsong Influence Our Understanding Of Edge Effect?

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Introduction

- Humans are building more roads in forests and creating edges: clear separations of two different land cover types. Some birds avoid forest road edges, others prefer these areas.
- A problem with past studies is they used unlimited-distance counts to explore avian response to edge. This counts birds singing far away from the survey location making it harder to detect edge effects.
- Autonomous Recording Units (ARU) can be used to better pinpoint bird locations based on song amplitude. Limiting sampling radius (using only louder songs closer to ARUs) to count birds reduces the number of detections but gives better certainty about edge effects.
- We used ARUs to investigate how edge effects on 3 bird species changed depending on how we measured the sampling area.



Figure 1: A male Tennessee warbler

Methods

- We manually tagged three bird species in ARU recordings in Wildtrax: Swainson's thrushes (SWTH), white-throated sparrows (WTSP) and Tennessee warblers (TEWA). Used 1 minute clips from ARUs set up at 0m, 50m, 100m and 150m away from 19 roads.
- Wildtrax is an animal tracking website that uses ARU recordings. It can turn audio recordings into spectrograms: a visual representation of sound frequencies detected over time (Figure 2.)
- With the time of day and year controlled, we determined which ARU the birds were closest to by tracking which ARU(s) recorded the songs as well as the volume of each song; the louder the song, the closer the bird was to the device.
- We then analysed the data of birds recorded using all, above-average and very high volumes to assess the decibel level's influence on our interpretation of the data.

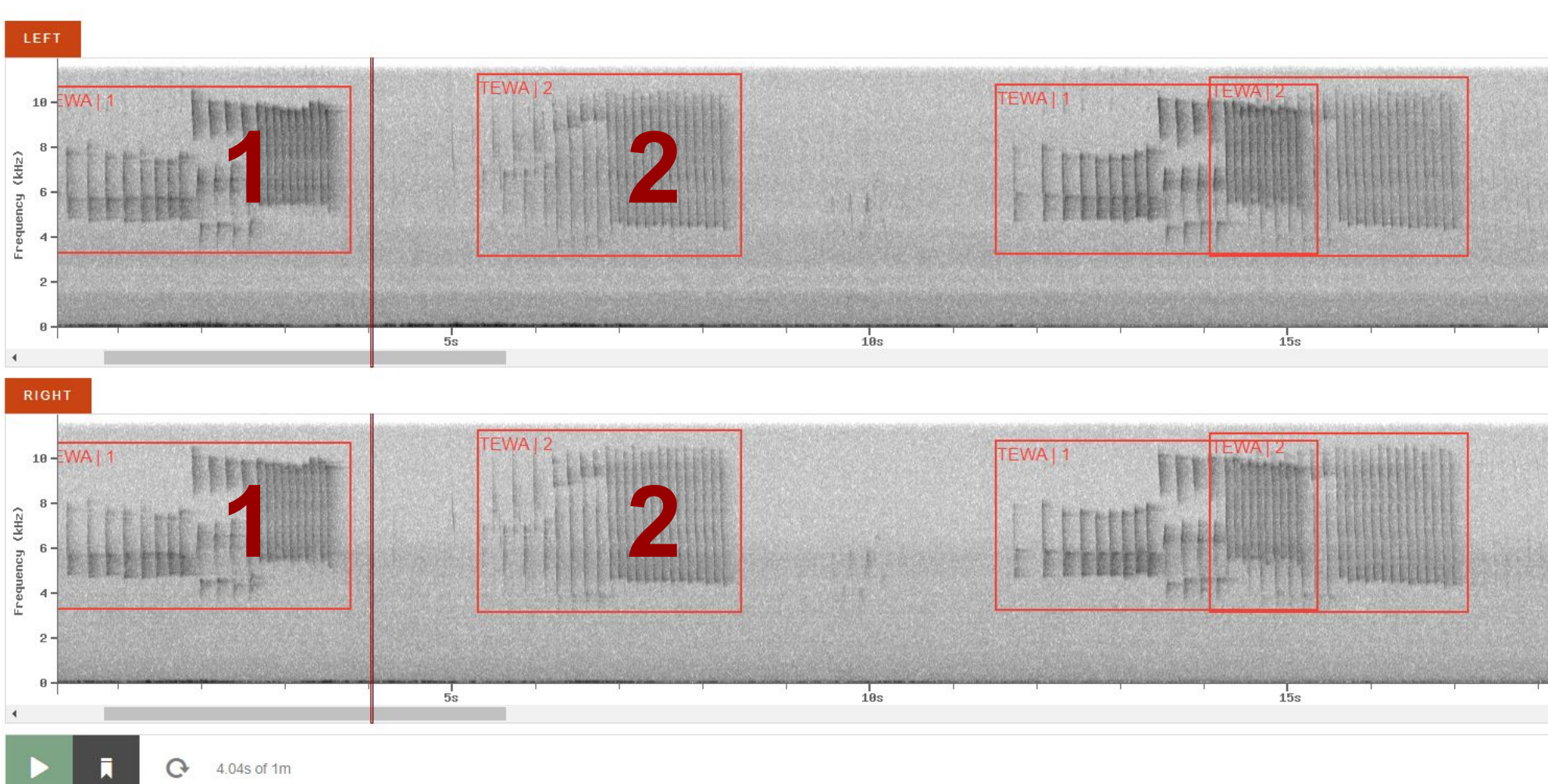
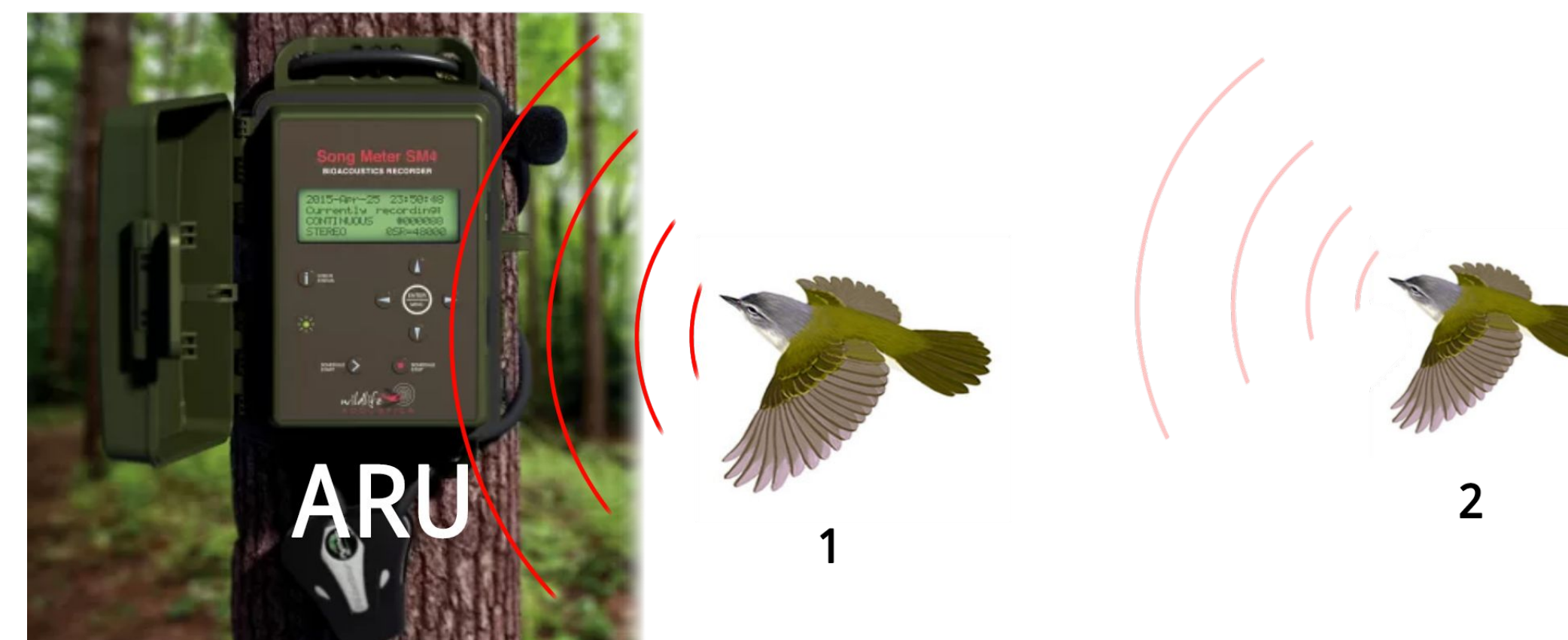


Figure 2a: Tagged TEWA individuals on a Wildtrax spectrogram recording. 1 shows a louder song, meaning this TEWA individual is closer than 2, which is lighter and quieter.

Figure 2b: Demonstration of TEWA distance from ARU affecting amplitude (loudness) detected in spectrogram.



Results

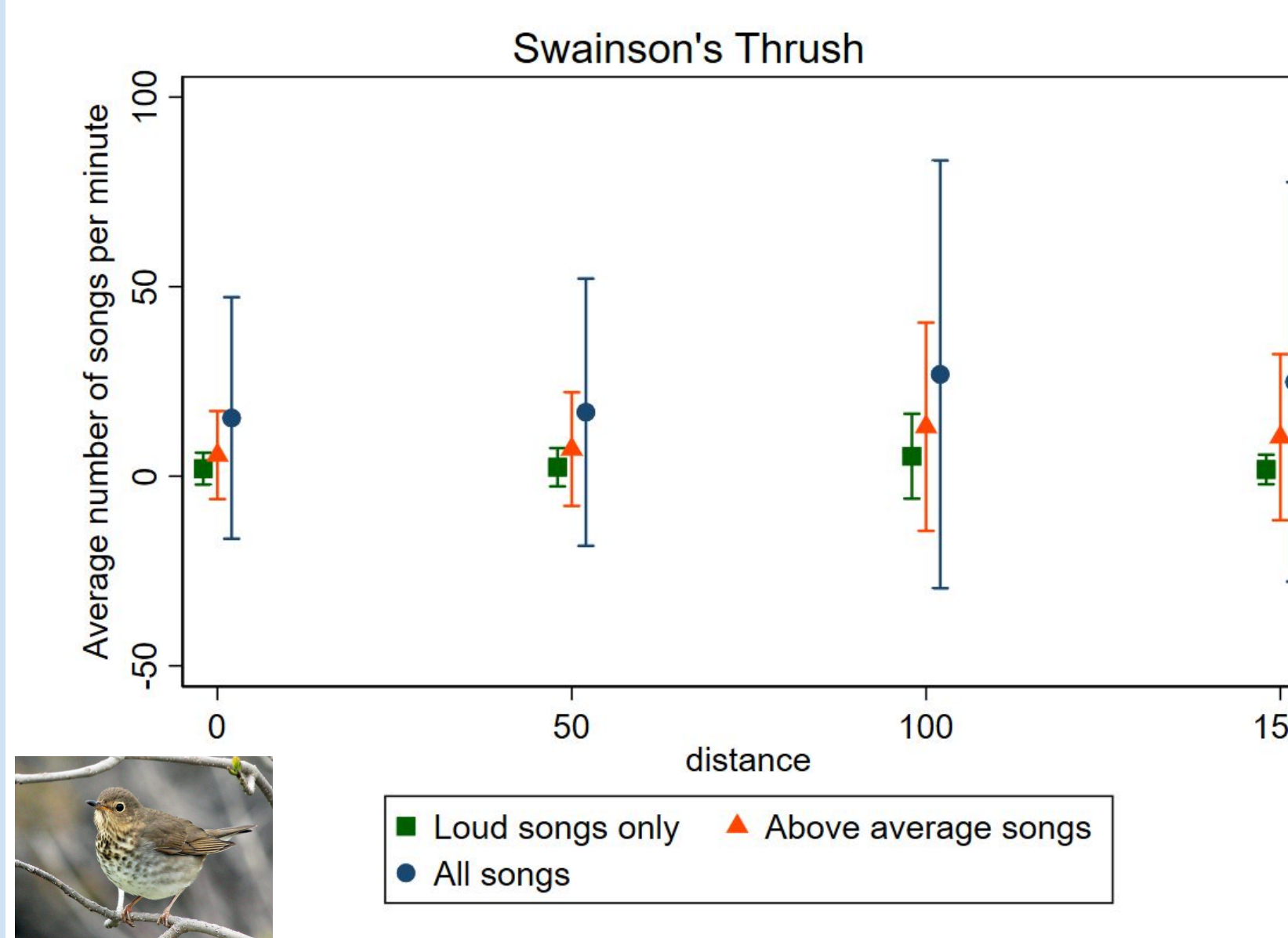


Figure 3: Predicted SWTH song rate vs. road distance from mixed Poisson regression graph. SWTH song rate did not vary with edge distance whether all decibel levels or limited sampling were used.

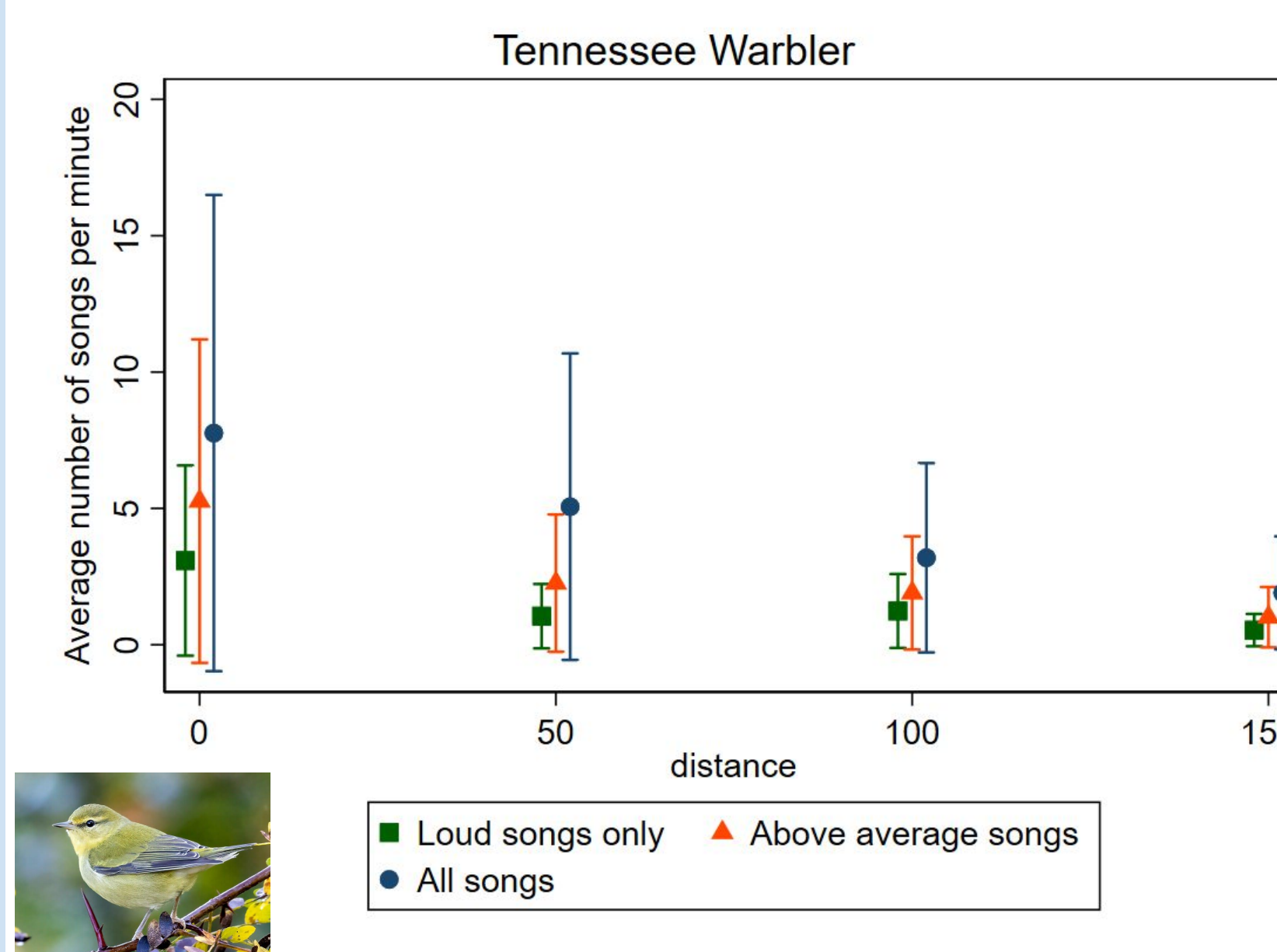


Figure 4: Predicted TEWA song rate vs. road distance from mixed Poisson regression graph. TEWA sang more along road edge whether all decibel levels or limited sampling were used.

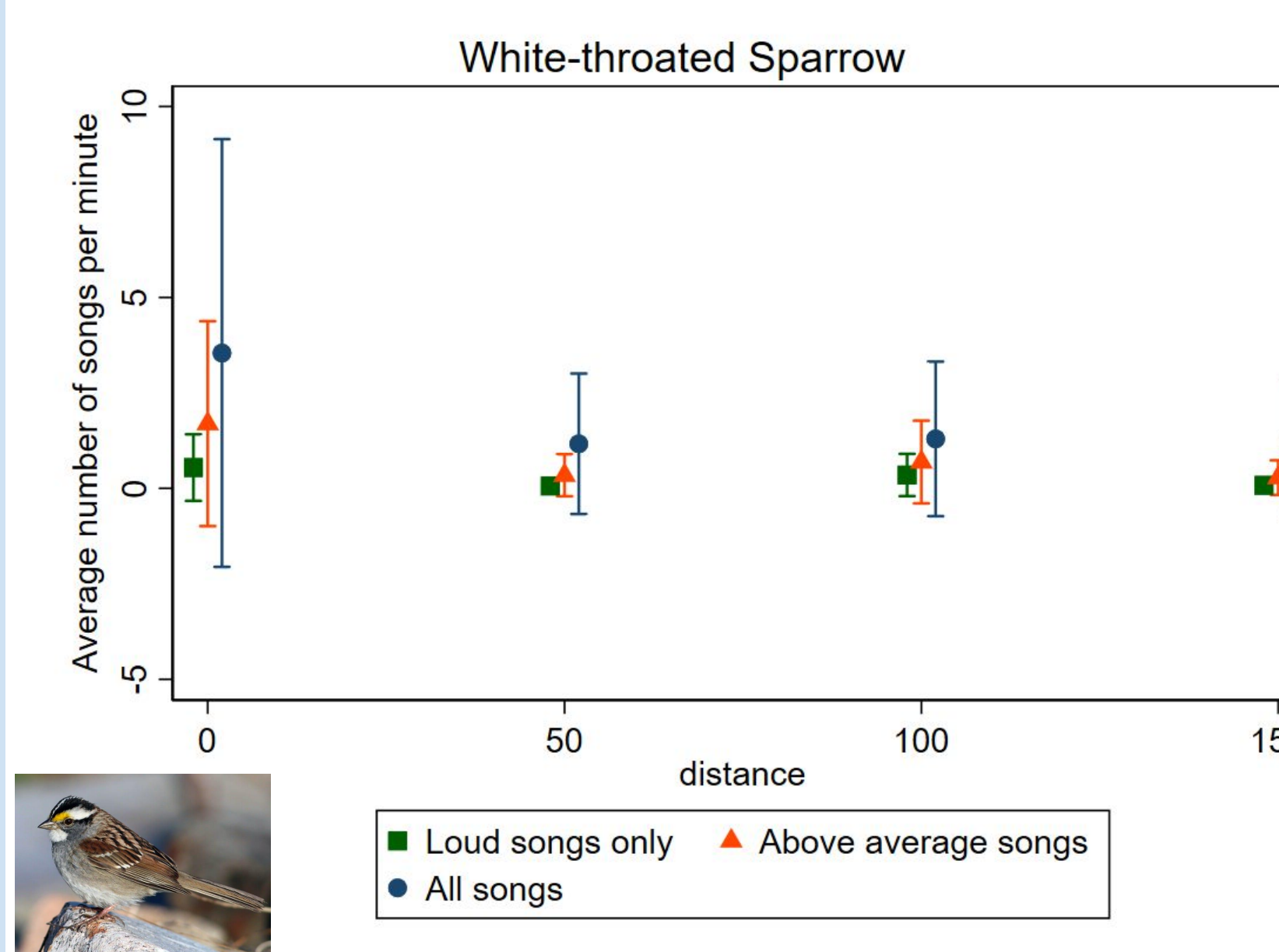
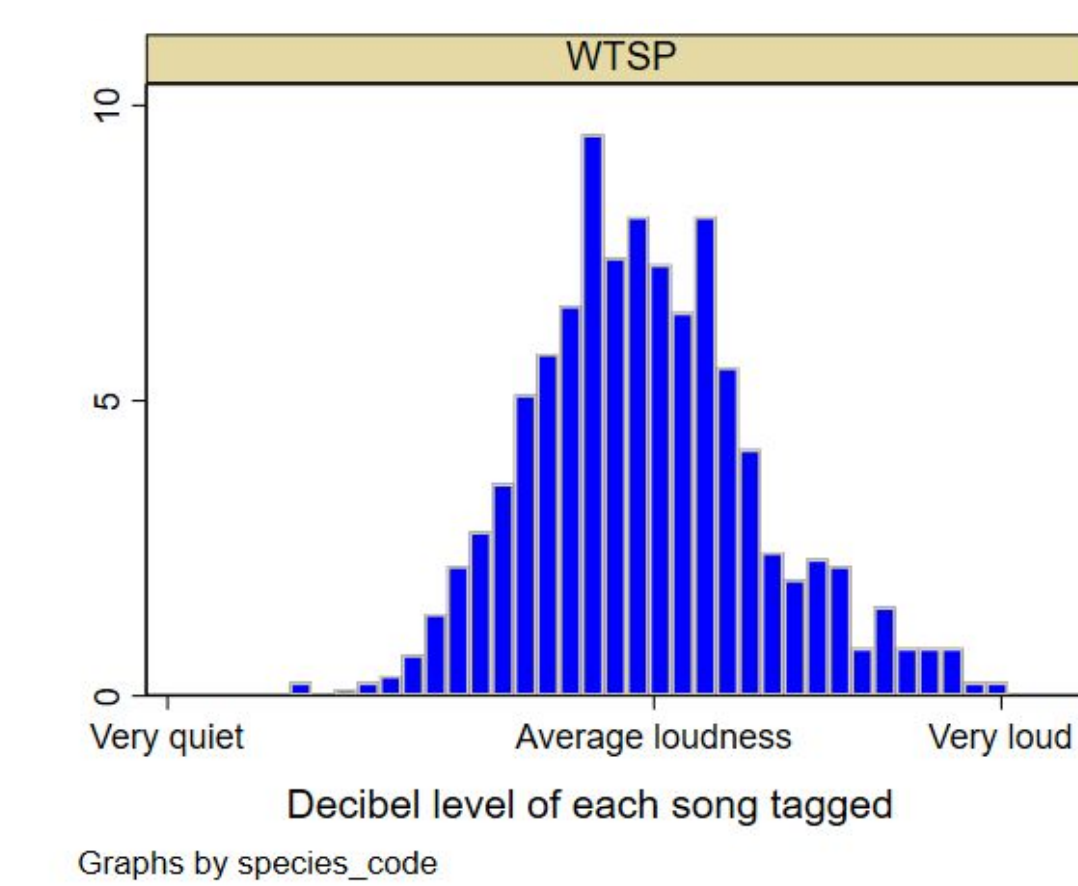


Figure 5: Predicted WTSP song rate vs. road distance from mixed Poisson regression graph. Similarly to TEWA, WTSP are detected singing more when closer to the road edge whether all decibel levels or limited sampling were used.

Figure 6: Example of the average distribution of birdsong volumes using WTSP recordings.



Conclusions

- Using all decibel levels, the ARU method confirms that TEWA and WTSP prefer the road edge over the deeper forest (Figures 4-5).
- Limiting the amplitude and sampling area reduced the magnitude of the road edge effects on song rate, but also consistently increased the certainty in estimated effects.
- The knowledge of the edge effect can be applied to monitoring deforestation or road-building near their habitats by observing if such disruptions give one species an advantage over another. The birds investigated, most notably the Tennessee warbler who eat spruce budworms, all help control insect populations or spread seeds and help maintain forest health.
- Other research shows road traffic decreasing SWTH and TEWA detection and abundance and WTSP detection (but not abundance). Limiting analysis of songs to those close to ARUs lowers uncertainty in the effect of road distance relative to using all the songs recorded.

Works Referenced and Consulted

- ABMI 2022 Wildtrax <https://www.wildtrax.ca/home/resources/guide.html>
- All bird photos downloaded from <https://www.allaboutbirds.org>
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- Moisan Perrier, J., Kneeshaw, D., St-Laurent, M.-H., Pyle, P., & Villard, M.-A. (2021). Budworm-linked warblers as early indicators of defoliation by Spruce Budworm: A field study. *Ecological Indicators*, 125, 107543. <https://doi.org/10.1016/j.ecolind.2021.107543>

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