Do You Hear What I Hear?: Determining Detection Distance of Recording Units through Localization

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Introduction

- In determining the biodiversity of birds in any given area, autonomous recording units (ARU's) (Fig. 1) are often chosen over human observers . While an ARU can detect birds for longer time spans among other benefits, it is very difficult to know where a bird is in relation to one unit and area being surveyed.

- Population density estimation is an essential part of programs based in biological tracking. The distance recording units can detect must be known in order to have accurate records as density is heavily reliant on survey area.

- Through a process called sound localization the location of a bird can be determined within a square meter. We used this method on four different species to roughly determine detection distances.

- This will further aid monitoring density of species in various environments.

Methods

- ARU grids of 15 units each were placed throughout the province and used to record Red-eyed Vireos (REVI), Ovenbirds (OVEN), Canada Warblers (CAWA), and American Redstarts (AMRE) that were used to approximate detection distance within the grid and for a single ARU.

- Using the program Praat to view spectrograms (Fig. 3-6) each bird's songs were annotated and run through the localization algorithm. This determined roughly where the birds were in relation to each of the microphones. The coordinates of the birds were given and mapped out inside the ARU grid (Fig. 2).

- In order to determine the detection distance, each microphone was determined to either have or not picked up the songs. This information was proofed through the program Audacity. From there, it was determined how far the ARU's can detect a range of species' vocalizations.

Figure 1. An ARU attached to a tree.

Results

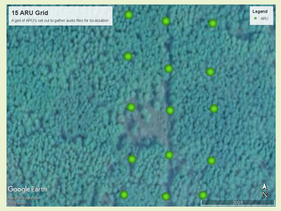

Figure 2. A grid of 15 ARU's in the forest recording bird vocalizations.

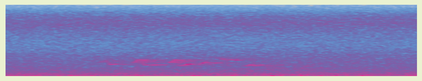

Figure 3. A spectrogram of a REVI

Figure 6. A spectrogram of an AMRE

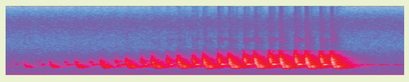

Figure 4. A spectrogram of an OVEN

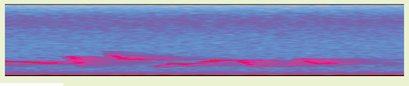

Figure 5. A spectrogram of a CAWA

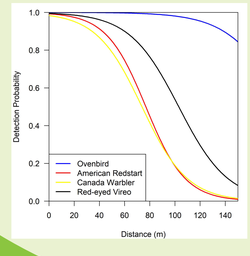

Figure 7. A graph comparing distance between ARU's to detection of OVEN, REVI, CAWA, and AMRE songs.

Discussion

What can be concluded from this study?

Based on Figure 7, it can be concluded that the farther the distance from the microphones, the lower chance a bird song will be detected. This figure also shows that the detection rate decreases the lower the intensity of the bird song. This points to a variation among detection distances in relation to specific species like how the OVEN can be detected for over 140 metres, but the REVI was only detected up to 100 metres with AMRE and CAWA up to 80 metres.

What will this research be used for in the future?

The conclusion that ARU's detection distance is varied based on the species means it may be difficult to find a general average for ARU detection distance and innacurate population density counts. Future research will have to take this into account and use larger data sets.

Acknowledgements

We would like to offer our thanks to our supervisor Richard Hedley and our Principal Investigator Erin Bayne for their unending support as well as Kathleen Enns and Harsimran Bains for sharing their guidance throughout the summer that helped us learn how and why we do research. We would also like to thank the University of Alberta and Biological Sciences Department for the support and space that made this research possible, as well as the WISEST program and Canada Summer Jobs.

Yip, Daniel A., et al. "Sound Attenuation in Forest and Roadside Environments: Implications for Avian Point-Count Surveys." The Condor, vol. 119, no. 1, 1 Feb. 2017, pp. 73–84., doi:10.1650/condor-16-93.1.

Yip, Daniel A., et al. "Experimentally Derived Detection Distances from Audio Recordings and Human Observers Enable Integrated Analysis of Point Count Data." Avian Conservation and Ecology, vol. 12, no. 1, 2017, doi:10.5751/ace-00997-120111.