

Comparing Song Repertoires in Urban vs. Rural Northern Cardinals

Brooke Goodman and Daniel T. Baldassarre

Department of Biological Sciences, SUNY Oswego

Introduction

- Northern Cardinal (*Cardinalis cardinalis*) (Figure 1) song is masked by anthropogenic noise and urban males adjust their song frequencies accordingly (Spier 2019).
- Song frequency and length is positively correlated with urbanization, but the effect of urbanization on repertoire size is unknown (Narango & Rodewald 2015).
- Cardinals sing between 8-12 songs types (Saless 2016). Increased song repertoire size may give urban cardinals a competitive advantages in noisy environments.
- **Here we introduce a method for quantifying cardinal song repertoire size to determine if urban males sing more song types in response to anthropogenic noise.**



Figure 1: Northern Cardinal
<https://uago.at/-6GJL>



Figure 4: An ARU deployed on a male cardinal's territory

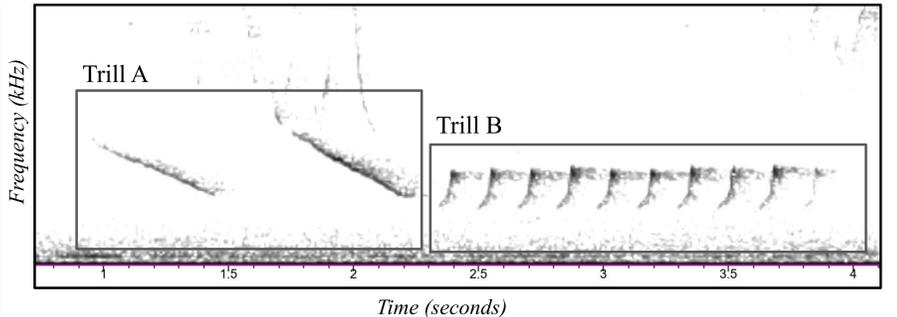


Figure 5: Spectrogram of song 1 sung by male NYY (RCFS, rural), composed of two trills, Trill A and Trill B

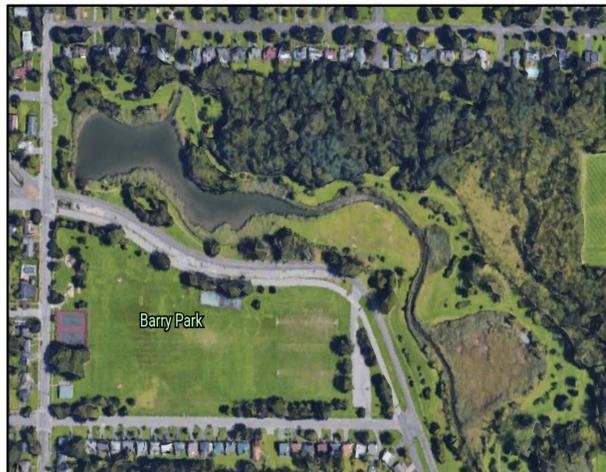


Figure 2: Barry Park in Syracuse, NY



Figure 3: Rice Creek Field Station in Oswego, NY

Fieldwork

- June-August 2020: captured and banded birds at Barry Park, Syracuse (BP, urban, Figure 2) and Rice Creek Field Station (RCFS, rural, Figure 3).
- Recorded 30 hours of audio per male using Automated Recording Units (ARU, Figure 2).
- Sample sizes: BP = 12 males, RCFS = 11 males
- An average of 76.67 songs were detected by the ARU daily.

Analyses

- ARU recordings are analyzed using Kaleidoscope Pro Software, which can be trained to recognize and cluster about 12 song types using a classifier.
- A classifier is built using 5-12 examples of the target songs, and separate classifiers must be made for the different field sites due to differences in song types.
- Songs are differentiated from each other by trill and syllable usage.
- Songs can be composed of one or multiple trills (Figure 5) and trills can be repeated throughout a birds repertoire.
- Not all vocalizations are songs, and deciding if a vocalization is a song depends upon how often it is sung.

Future Work

- Create classifiers for both RCFS (rural) and BP (urban)
- Analyze ARU recordings of and build repertoires for all 23 individuals
- Compare size of song repertoires of urban vs. rural cardinals
- Explore relationship between song and male fitness by analyzing nest success and territory quality

References

- Narango, D. L., & Rodewald, A. D. (2015). Urban-associated drivers of song variation along a rural-urban gradient. *Behavioral Ecology*, 1-9. doi:doi:10.1093/beheco/arv197
- Saless, R. (2016). Acoustic structure, singing behavior, and vocal performance trade-offs in the Northern cardinal (*Cardinalis cardinalis*). FAU Masters Thesis Proposal.
- Spier, S. (2019). Traffic noise and sexual selection: studies of anthropogenic impact on bird songs and undergraduate student reasoning of evolutionary mechanisms. UNL Masters Thesis.