

A Method for Comparing Song Repertoires in Urban vs. Rural Northern Cardinals

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QUESTION

Is there a difference in song repertoire size of urban vs. rural Northern Cardinals (*Cardinalis cardinalis*)?

INTRODUCTION

- Northern Cardinal song is masked by anthropogenic noise and urban males adjust their song frequencies accordingly (Spier 2019).
- Urban males song frequency is positively correlated with territory quality, but the effect of urbanization on song repertoire size is unknown (Narango & Rodewald 2017).
- 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.**

METHODS

Fieldwork:

- June-August 2020: captured and banded birds at Barry Park, Syracuse (BP, urban) and Rice Creek Field Station (RCFS, rural, Figure 1)
- Recorded 30 hours of audio per male using Automated Recording Units (ARU, Figure 2)
- Sample sizes: BP = 12 males, RCFS = 11 males

Analyses:

- Analyzed ARU recordings using Kaleidoscope Pro software to detect songs and manually cluster similar song types
- Differentiated between song types by analyzing syllable type, usage, and arrangement
- Created advanced classifiers in Kaleidoscope Pro to sort similar song types into clusters



Figure 1: A male cardinal is captured, banded, and released.



Figure 2: An ARU deployed on a male cardinal's territory.

RESULTS

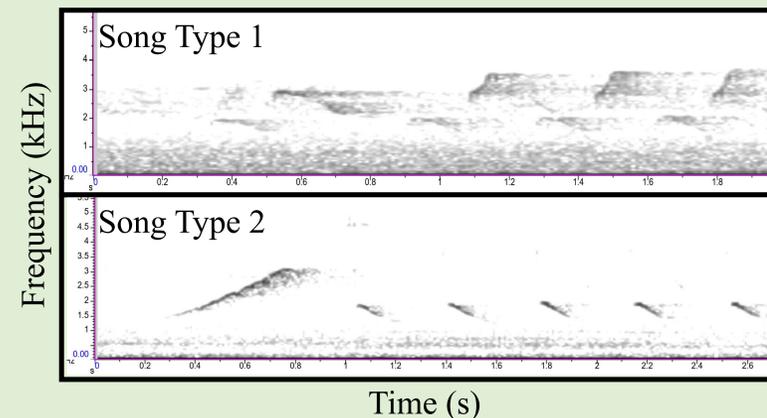


Figure 3: Spectrograms of two exemplar song types sung by male GNY (BP, urban). Song Type 1 was detected an average of 2.3 times per day. Song Type 2 was detected an average of 6.3 times per day.

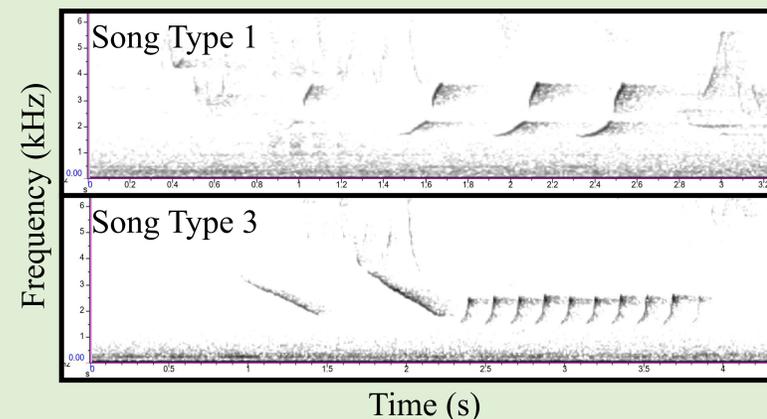


Figure 4: Spectrograms of two exemplar song types sung by male NYY (RCFS, rural). Song Type 1 was detected an average of two times per day. Song Type 3 was detected an average of 25 times per day.

- Male GNY (urban, Figure 1): 12 song types identified
- Male NYY (rural, Figure 2): seven song types identified
- Males shared a total of two song types, including Song Type 1.
- On average, 49.5 cardinal songs were detected per day.

FUTURE WORK

- Analyze ARU recordings of all 23 individuals
- Build song repertoires for each individual
- Compare size of song repertoires of urban vs. rural cardinals
- Explore relationship between song and male fitness by analyzing nest success and territory quality
- Compare background noise at urban and rural sites



Scan to listen to male GNY's song repertoire!

REFERENCES

- Narango, D. L. & Rodewald, A. D. (2017). Signal information of bird song changes in human-dominated landscapes. *Urban Ecosystems* 21(1): 41–50.
- 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.