

## Introduction:

Urbanization is associated with considerable changes in ecosystem dynamics. These changes may influence the organisms that live in urban environments. Some urban birds produce songs with different characteristics than those of their non-urban counterparts. As song is a crucial aspect of reproduction, changes in song production or structure have the potential to affect breeding success.

Northern Mockingbirds, *Mimus polyglottos*, breed in urban and rural environments, however few studies have investigated whether urban and non-urban mockingbirds differ behaviorally or physiologically.

## Goal:

The goal of this study was to expand our understanding of the effects of urbanization on bird song by analyzing and comparing the song complexity, measured by repertoire size and average number of syllables produced by minute, of urban and non-urban birds

## Results:

Urban birds sang on average  $136 \pm 15$  (mean  $\pm$  s.e.) notes and produced  $159 \pm 8$  notes per minute. Non-urban birds produced on average  $122 \pm 21$  notes and  $137 \pm 24$  notes per minute.

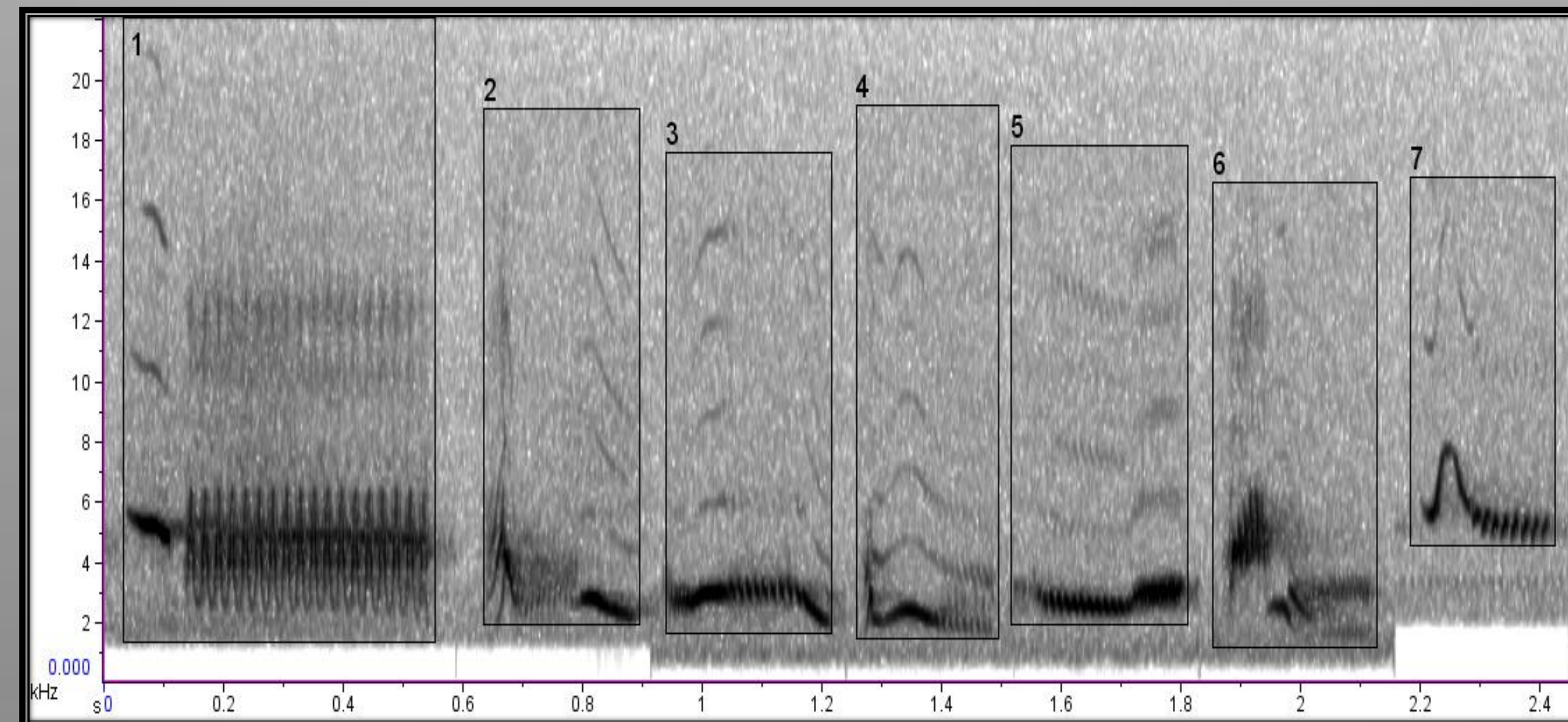
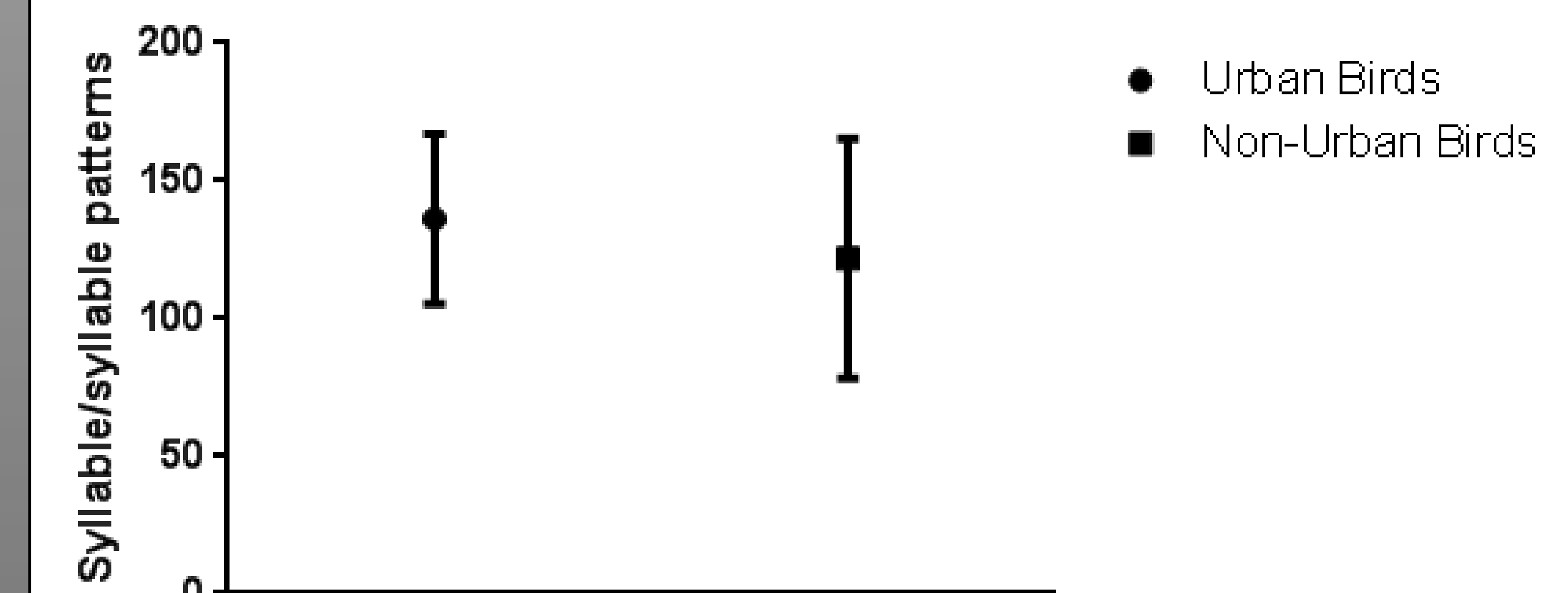
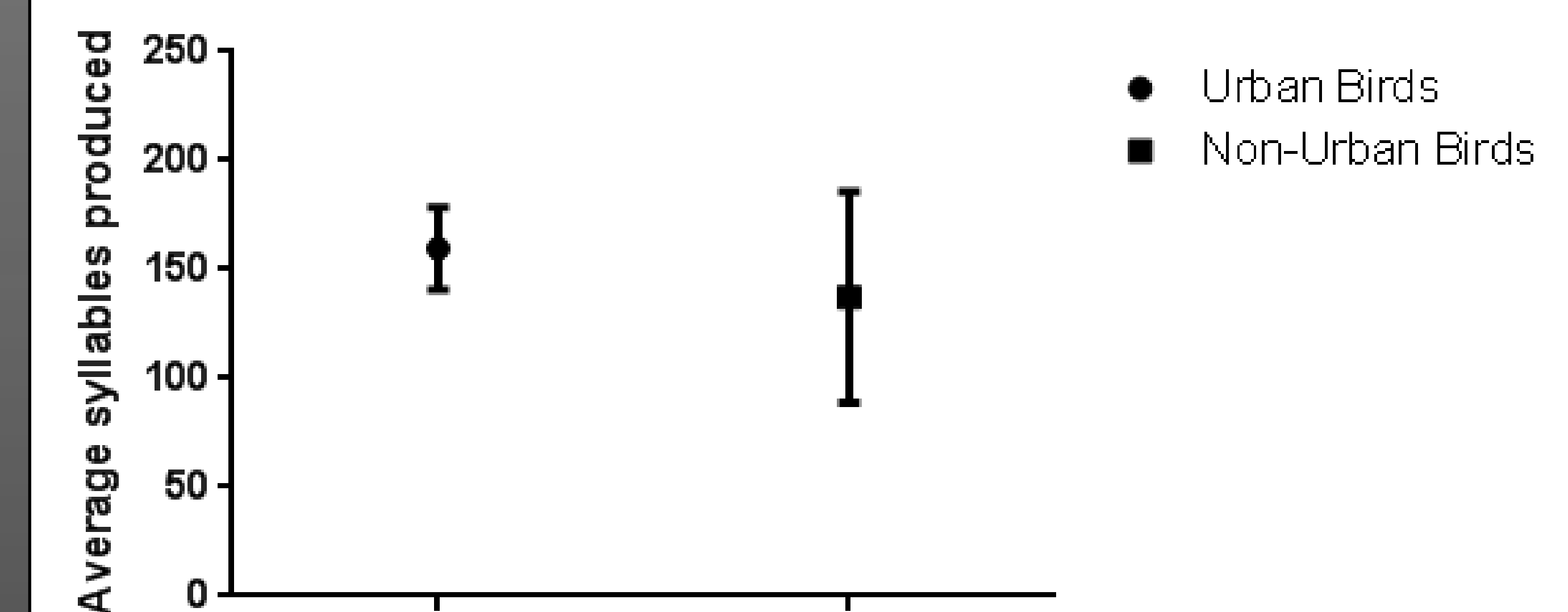


Figure 1: Spectrogram of unique syllables (selections 3,4,5,7) and syllable patterns (selections 1,2,6) produced by an urban, male Northern Mockingbird. (Horizontal axis = time 0-2.5sec, Vertical axis=frequency 0-22 kHz)

### Repertoire Size



### Notes Per Minute



## Conclusion:

Our hypothesis was not supported as song complexity did not differ significantly between the urban and non-urban birds. The data did not show a significant difference between the two groups in either repertoire size or number of notes produced by minute.

As song was individually quite variable, this result may reflect small sample sizes (n=4) for each type of bird and repeating the study with larger sample sizes may allow for a more confident conclusion. It is also possible that measuring parameters other than repertoire size and notes per minute is needed to separate urban and non-urban birds.

## Methods:

- Data were collected between June 7<sup>th</sup> and July 5<sup>th</sup> of the 2012 breeding season.
- Data were analyzed using Mann-Whitney U-test.
- Non-urban birds (n=4) were recorded at McDowell Mountain and Lost Dutchman State Parks. Urban birds (n=4) were recorded from three of the four Arizona State University campuses, as well as the ASU Research Park.
- When males were observed continuously singing in a defined territory, 15 minutes of continuous vocalizations were recorded using a portable digital sound recorder.
- Repertoire size was defined as the number of unique syllables and syllable patterns<sup>2</sup> produced during 15 minutes of continuous singing.
- To measure average number of notes produced by minute, five one-minute time blocks were randomly chosen for each 15 min recording. The total number of syllables<sup>2</sup> present in these blocks were counted and averaged for each individual.

## Song Analysis Procedure

- All measurements were made manually and by the same researcher (SJL).
- Songs were analyzed using spectrograms generated by Raven Pro interactive Sound Analysis Software<sup>1</sup>.
- Any low frequency ambient noise (< 4 kHz) was manually removed from each digital recording using the “filter out active selection” function for more accurate measurements.
- A separate spectrogram was created for each individual which consisted of samples of all unique syllables or syllable patterns<sup>2</sup> that an individual produced. These were used for comparison and analysis of vocalizations.



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## References:

- Bioacoustics Research Program. (2012). Raven Pro: Interactive Sound Analysis Software (Version 1.4) [Computer Software]. Ithaca, NY: The Cornell Lab of Ornithology.
- Derrickson, Kim C., 1988, *Variation in Repertoire Presentation in Northern Mockingbirds*, The Condor 90: 592-606.

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