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This document is part of a collection that serves two purposes. First it is a public archive for data and documents resulting from evolutionary, ecological, and behavioral research conducted by the Ketterson-Nolan research group. The focus of the research is an abundant North American songbird, the dark-eyed junco, *Junco hyemalis*, and the primary sources of support have been the National Science Foundation and Indiana University. The research was conducted in collaboration with numerous colleagues and students, and the objective of this site is to preserve not only the published products of the research, but also to document the organization and people that led to the published findings. Second it is a repository for the works of Val Nolan Jr., who studied songbirds in addition to the junco: in particular the prairie warbler, *Dendroica discolor*. This site was originally compiled and organized by Eric Snajdr, Nicole Gerlach, and Ellen Ketterson.

Context Statement

This document was generated as part of a long-term biological research project on a songbird, the dark-eyed junco, conducted by the Ketterson/Nolan research group at Indiana University. For more information, please see IUScholarWorks (<https://scholarworks.iu.edu/dspace/handle/2022/7911>).

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Decoding an enigmatic signal: short-range song in Dark-eyed Juncos (*Junco hyemalis*)



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ABSTRACT

The study of song has largely focused on high amplitude, long-range songs (LRS) associated with male-male interactions and mate attraction. In addition to LRS many species also sing a low amplitude, often more complex short-range song (SRS) during courtship that is distinct from LRS and can exhibit substantially different structure. Little is known about the standing variation in SRS between males or its importance in mate choice and female stimulation. We presented mated, free-living male Dark-eyed Juncos with a caged female conspecific placed near the nest and playback of a female precopulatory trill to elicit courtship behavior and SRS. During the female presentation and playback we recorded SRS from the focal male and later quantified both frequency and temporal characteristics of SRS. We also estimated repertoire size for each male and determined the amount of shared and unique song types within the individuals sampled. These results will be discussed in the context of mate choice and signal design.



Photo Courtesy of Ted Dapper



Photo Courtesy of Ted Dapper

INTRODUCTION

-Birdsong can be divided into two distinct classes: high amplitude songs and low amplitude songs

-These two song classes can differ substantially in structure and function, however, low amplitude signals have received much less attention¹

-Low amplitude songs experience relaxed selection on sound transmission and production, which can promote an increase in complexity^{1,2}

-Dark-eyed Juncos sing two distinct songs: high amplitude, long-range song (LRS) and low amplitude, short-range song (SRS)³

-Previous work has shown that repertoire size is substantially larger in SRS, but no significant differences exist in frequency range of LRS and SRS³

HYPOTHESES

-SRS will contain a significantly wider range of frequencies and a larger repertoire size due to relaxed selection on song transmission and/or production

-Song sharing in SRS of free-living juncos will be limited based on the high diversity of song types observed

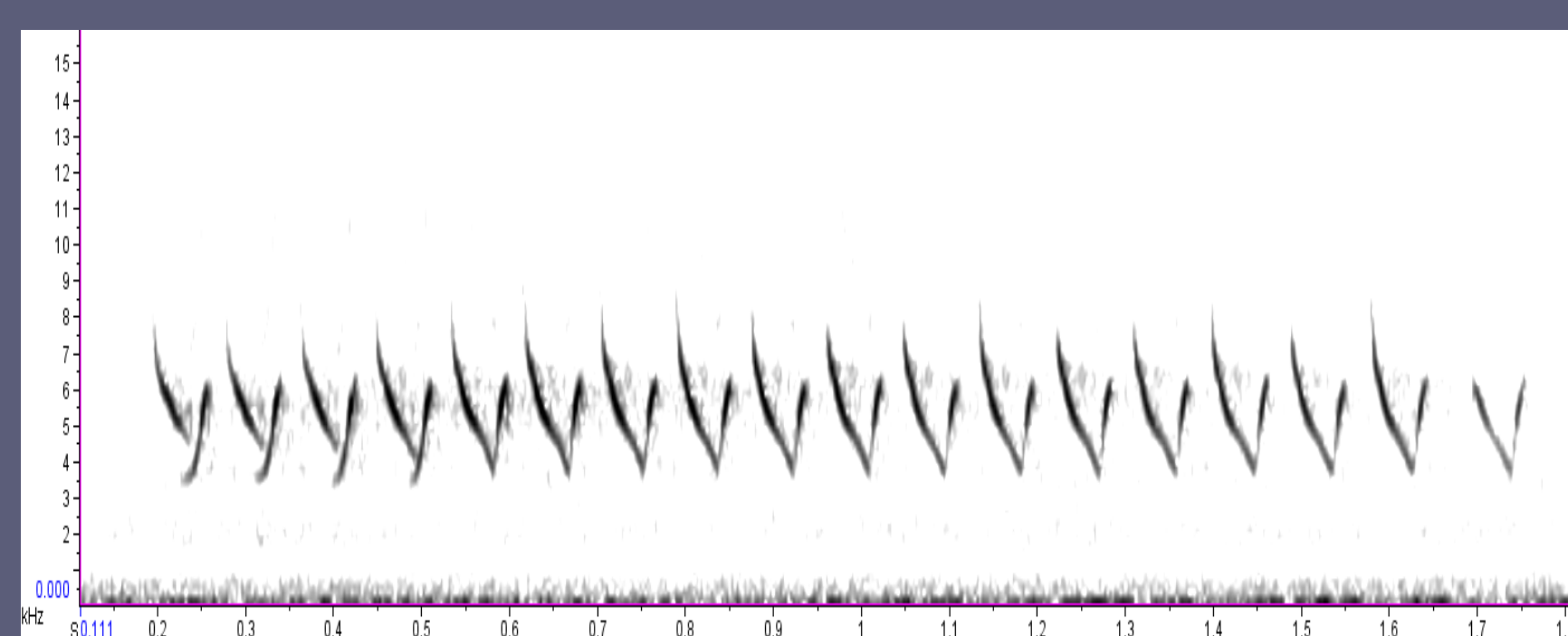
METHODS

-SRS was recorded by presenting free-living, territorial males with a caged female lure and a playback of a female precopulatory trill

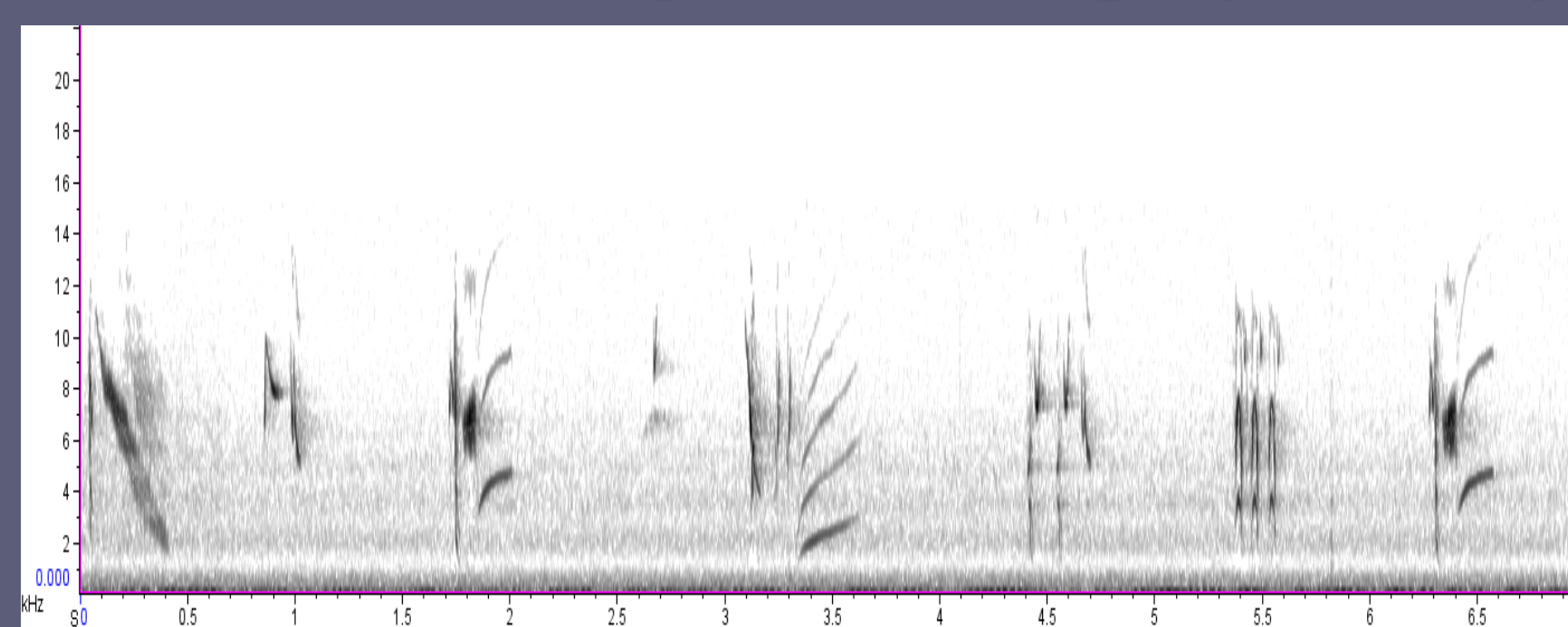
-Spectrograms were analyzed for minimum frequency, maximum frequency, and repertoire size using Adobe Audition 1.5

-Repertoire sharing was assessed by visual inspection and comparison of song types present in a 60 sec recording from each male sampled

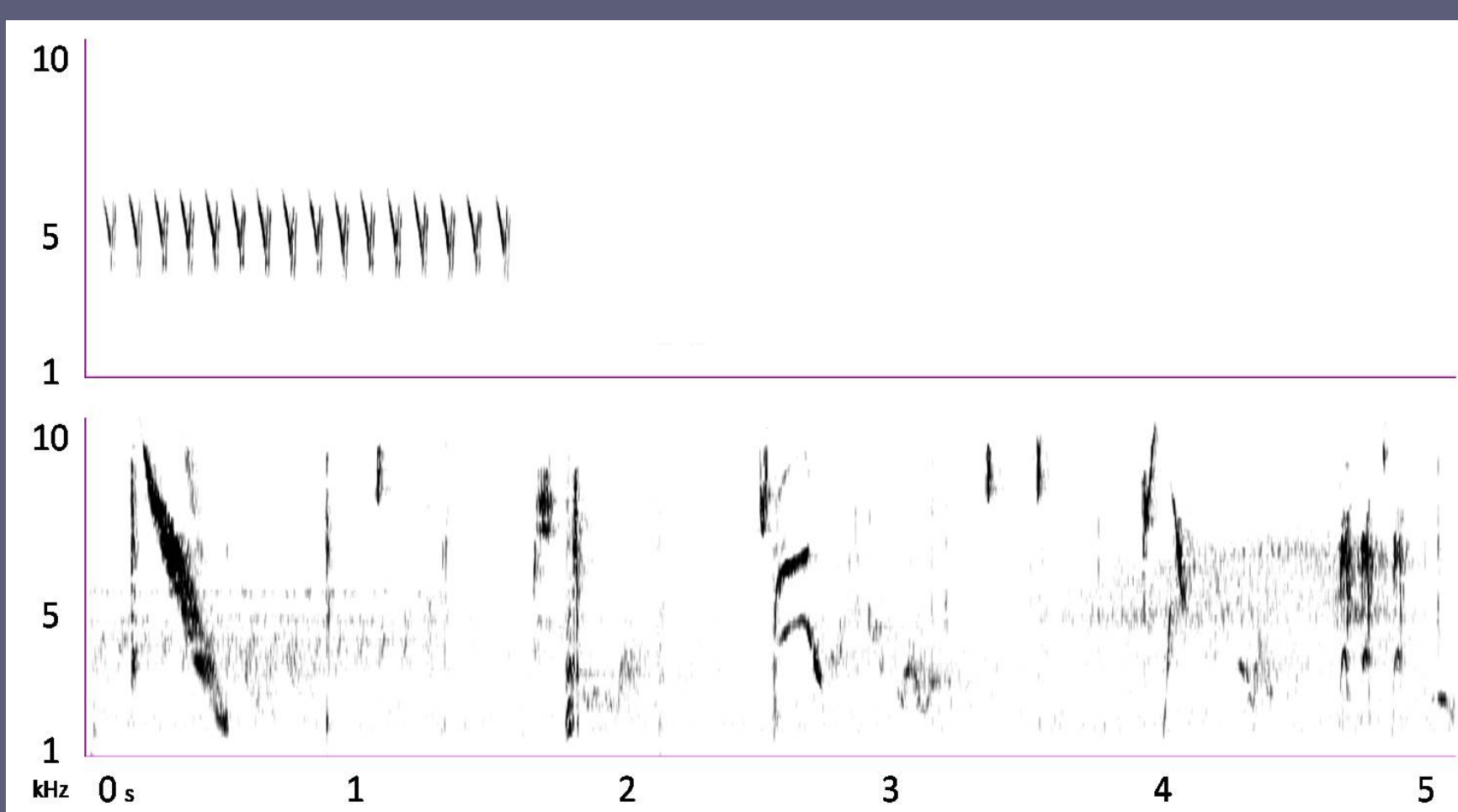
Long-range Song (LRS)



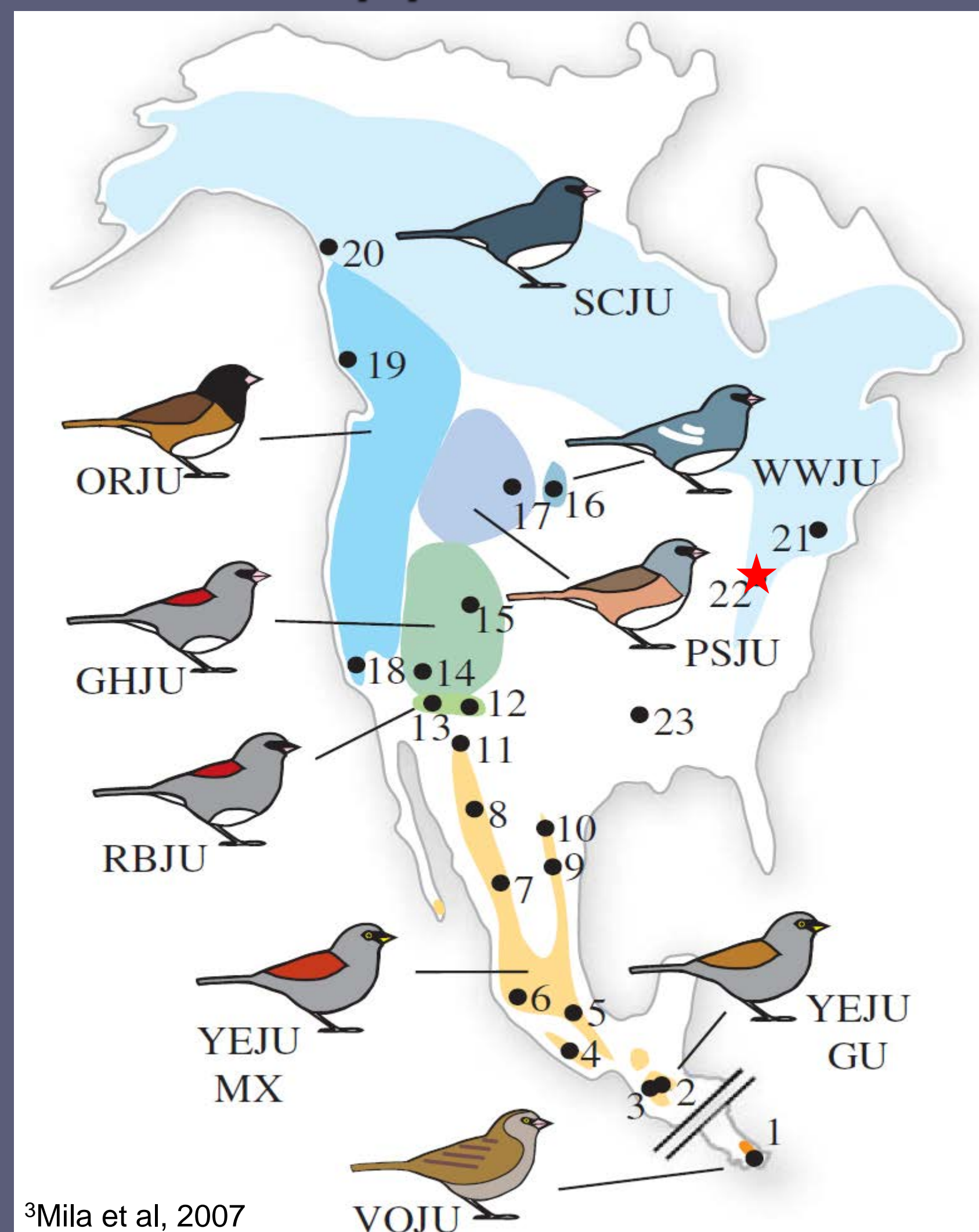
Short-range Song (SRS)



LRS v. SRS

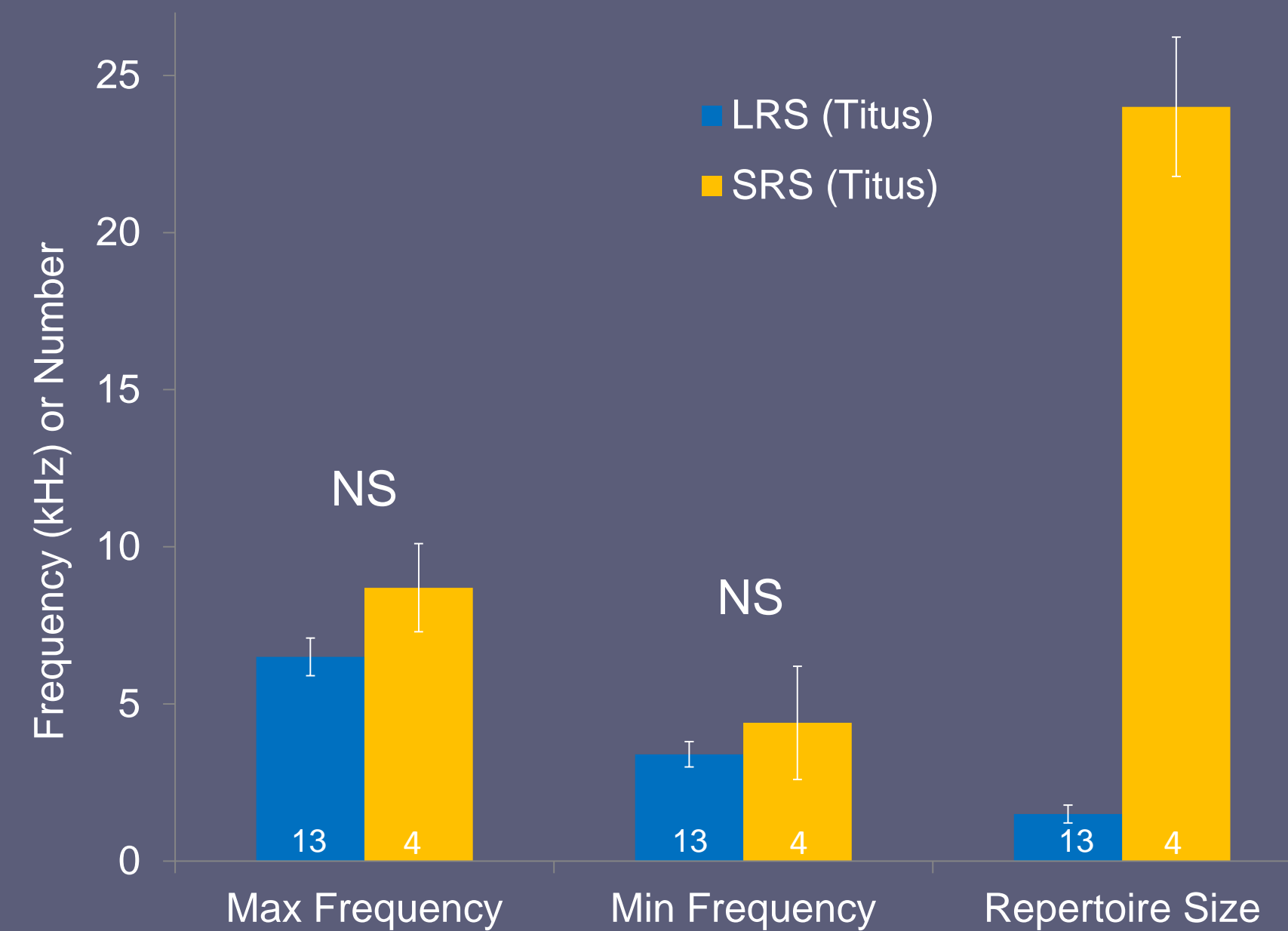


Junco spp. Distribution

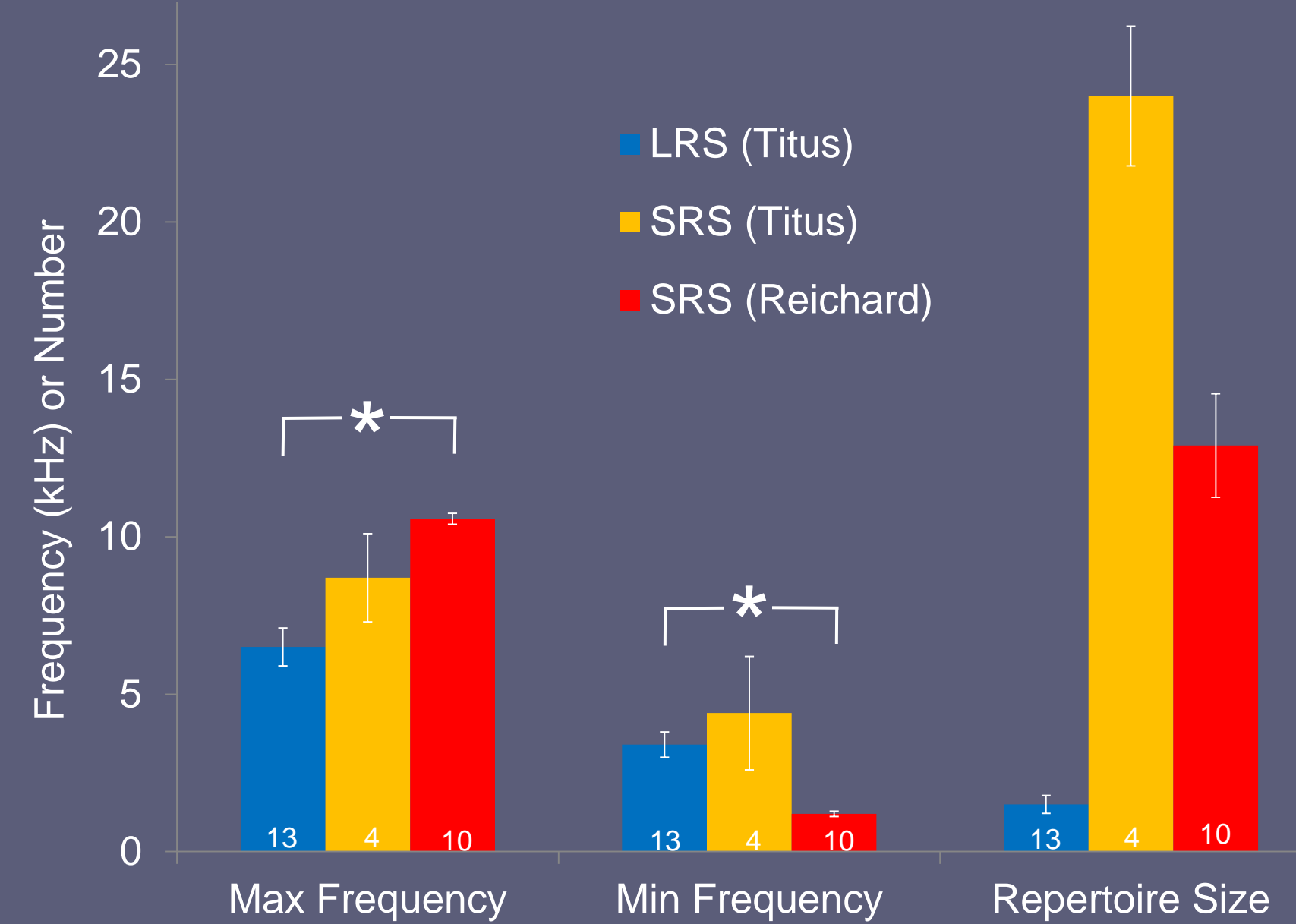


³Mila et al, 2007

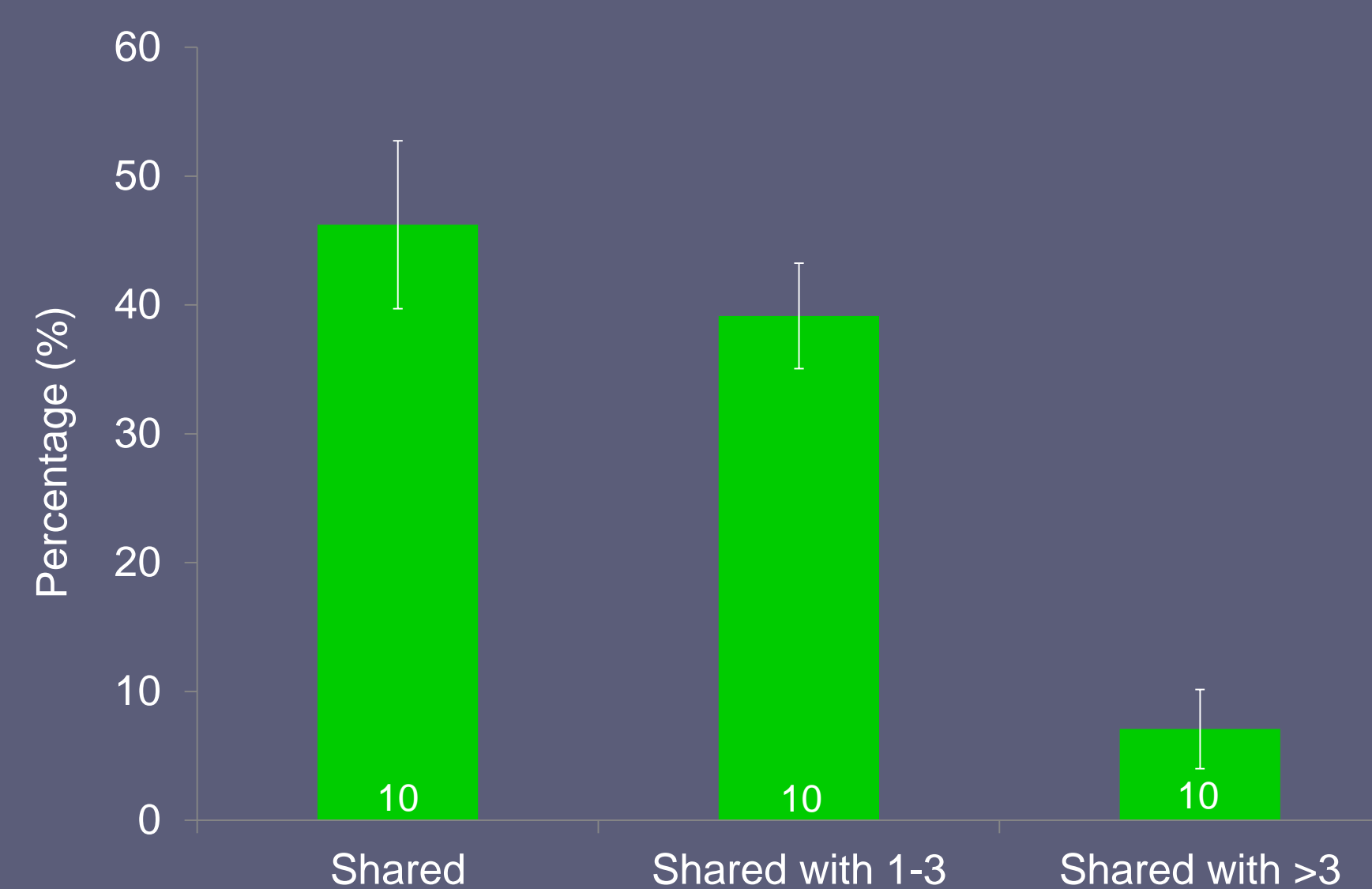
LRS v. SRS (Titus 1998)



LRS v. SRS (New Data)



Repertoire Sharing



Recording SRS



RESULTS

- No significant difference in maximum or minimum frequency based on previous data (n(LRS)=13; n(SRS)=4).

-Significant difference in maximum and minimum frequency based on this study ($p < 0.001$, $n = 10$)

-Smaller repertoire size for SRS in this study

-Majority of song sharing in SRS occurs with less than three other individuals

DISCUSSION

-The frequency range of SRS is substantially different from LRS, which contradicts previous work.

-We found a smaller average SRS repertoire in our study, but this is likely related to different recording methodology

-Low song sharing indicates a high level of variation between males and a low likelihood of universal song types

-SRS is transmitted over relatively small distances (< 5 m), thus selection on song transmission is likely limited

-The increase in complexity during SRS may be attributed to a relaxed production constraint associated with low amplitude singing

-Females may also be selecting for elaborate SRS which is sung most often during courtship

-Little is known about geographic variation in SRS...

LITERATURE CITED

- ¹Dabelsteen, T., et al. 1998. Bioacoustics. 9:89-105.
- ²Cardoso, G., et al. 2007. Behavioral Ecology. 18:1051-1057.
- ³Titus, R. 1998. Auk. 115: 386-393.
- ⁴Mila, B., et al. 2007. Proc Roy Sci B. 274: 2653-2660.

ACKNOWLEDGEMENTS

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