

Report for Missouri Birding Society Graduate Research Scholarship
The relationship between local abundance and song repertoire size in Bewick's Wrens (*Thryomanes bewickii*)

Zach Vickers, Missouri State University

Bewick's Wrens (*Thryomanes bewickii*) are songbirds whose wide geographic range varies greatly in local abundance. Additionally, Bewick's Wrens are 'oscine' songbirds: as such, they learn their songs from conspecifics (males of the same species) as well as their fathers. In this way, the song patterns (or components of song patterns) of Bewick's Wrens are culturally transmitted. In all parts of their range, the birds sing multiple song types (Figure 1), constituting a 'song repertoire'. For this project, I tested the hypothesis that there is a positive relationship between local abundance and song repertoire size in this species. In other words, song repertoires should increase in size alongside increasing amounts of conspecifics per unit area. Bewick's Wrens in populations of low local abundance have by definition fewer nearby conspecific tutors from which to learn and imitate song types. The compositions of repertoires vary among individuals, and more individuals should theoretically translate to a larger pool of song elements, phrases, or types from which to learn. This 'cultural diversity' could be thought of in analogy to genetic diversity. For instance, a song, or a component of a song - like an allele - may be more prone to extinction in a small population than a larger population.

The repertoires of singing male Bewick's Wrens were recorded across Missouri, Oklahoma, and Texas (Figure 2). Bewick's Wrens are far less abundant in Missouri than they are in central Texas, and birds in northern Texas and southwest Oklahoma exhibit intermediate abundances between these two areas. Birds were recorded with either shotgun or parabolic microphones and portable sound recorders, and I categorized each individual's songs by examining their spectrograms in the Raven Pro software created by the Cornell Lab of Ornithology. Jay McEntee and Shelby Palmer, also of Missouri State University, contributed to sound recordings made in Missouri and central Texas.

My findings show that Bewick's Wrens in areas of low local abundance have small song repertoires compared to birds in medium and high abundance areas, but there is not much difference in song repertoire size between birds of medium and high abundance areas (Figure 3). Importantly, all birds in the areas of lowest abundance are migrants breeding in Missouri during the summer and wintering elsewhere, whereas all other recorded individuals reside in permanent-resident populations. This suggests the need for future study on the role that migration may play in explaining the variation in song repertoire sizes of Bewick's Wrens across geographic space. Additionally, song types are just one measure of 'complexity', and further investigation of other measures of complexity in this species, such as syllable or phrase diversity, may be illuminating.

I would like to thank Missouri Birding Society for contributing funding for this project, as it greatly helped cover the costs of camping/lodging, gas, batteries, and other expenses used for this project.

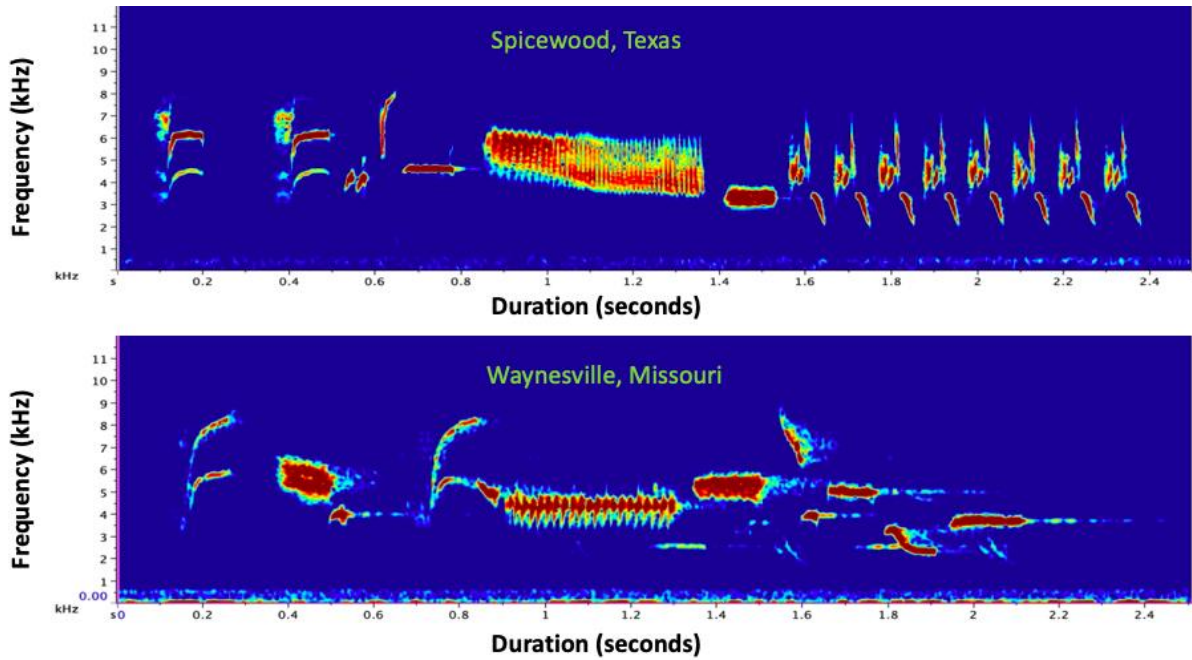


Figure 1. Two spectrograms of song types of individuals recorded in Spicewood, Texas and Waynesville, Missouri, respectively. Spectrograms are visual depictions of sound.

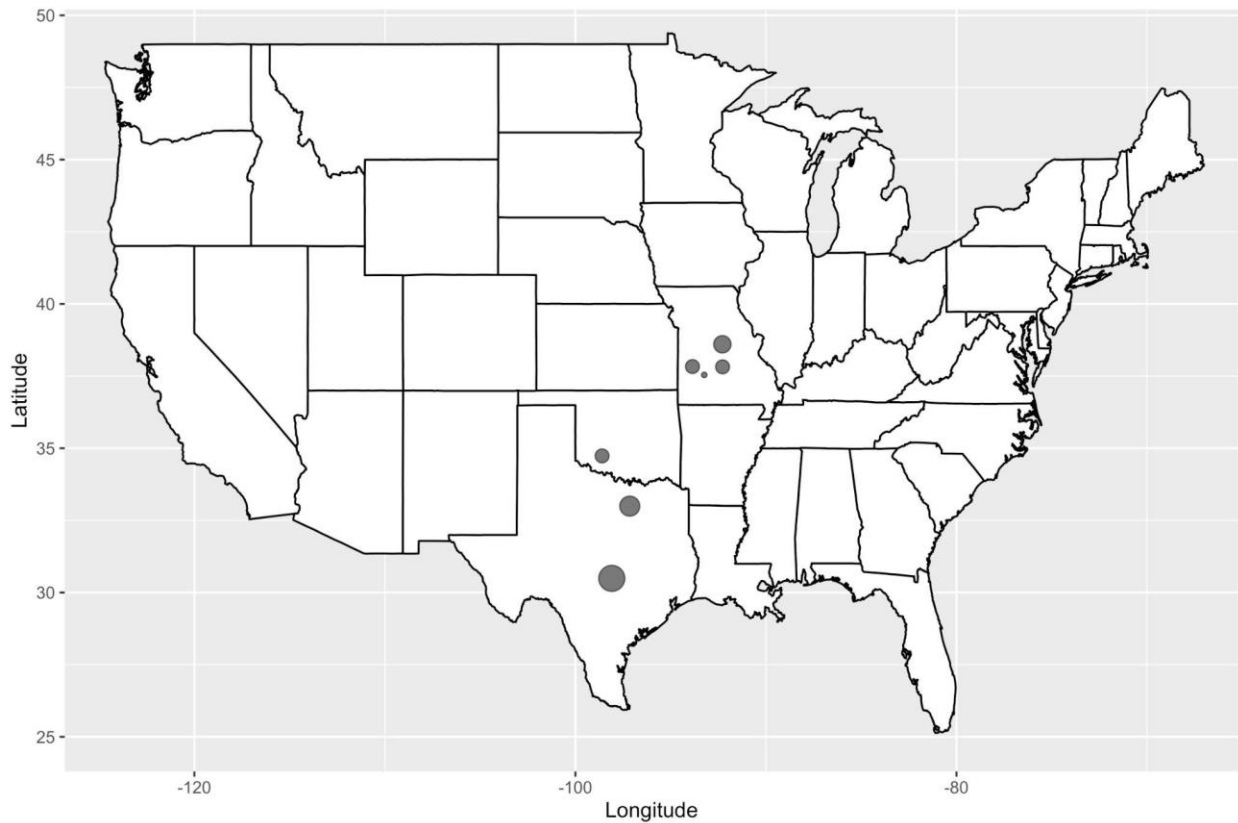


Figure 2. Recording locations of individuals. The sizes of dots represent the amount of individuals sampled (range = 1:7).

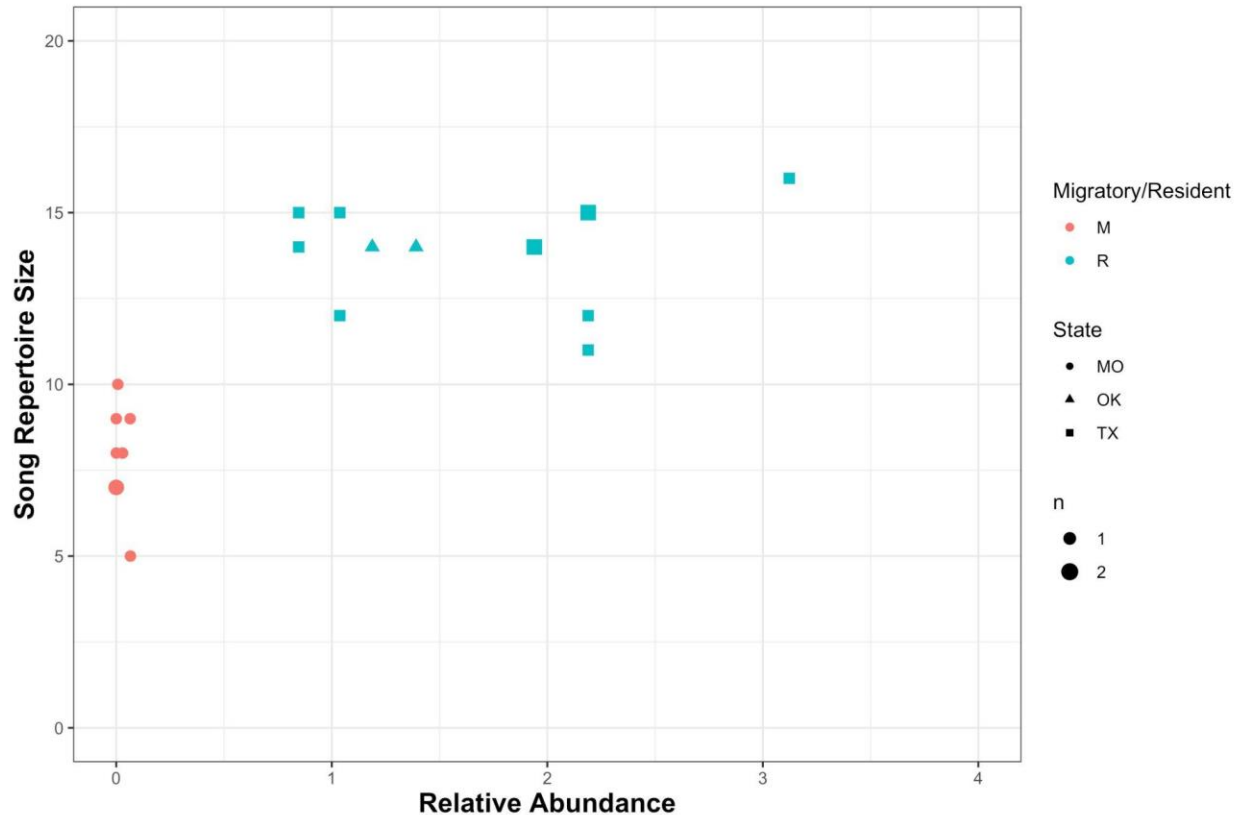


Figure 3. A scatterplot of the song repertoire sizes of individuals recorded across varying amounts of relative abundance. Abundance estimates were extracted from high-resolution seasonal abundance maps generated by eBird/Cornell in 2022. eBird’s definition of “relative abundance” (and how it is calculated) can be found at: <https://science.ebird.org/en/status-and-trends/faq>. Shapes represent which U.S. state individuals were recorded within; orange points represent migratory individuals and blue points represent permanent resident individuals; sizes of points represent sample sizes (range = 1:2).

Table 1. Information on each individual bird recorded. For migratory status, R = permanent resident and M = migratory. Song output is the number of songs recorded by an individual. Repertoire size is derived by “simple enumeration”: the number of unique song types observed for each individual. This was chosen for simplicity of interpretation, but other methods incorporate other variables such as song output and sequencing to obtain an “estimated repertoire size”. For information about how “relative abundance” is defined and calculated, see caption to Figure 3.

bird ID	location	state	relative abundance	repertoire size	song output	migratory status	month/year recorded
Individual1	Spicewood	TX	1.94	14	1279	R	03/2021
Individual2	Spicewood	TX	1.94	14	749	R	03/2021
Mule 2	Spicewood	TX	2.19	15	939	R	03/2021
Mule 3	Spicewood	TX	2.19	12	1049	R	03/2021
Mule 7	Spicewood	TX	2.19	15	1382	R	03/2021
Backup Mule	Spicewood	TX	2.19	11	1534	R	03/2021
Cemetery Bird	Spicewood	TX	3.12	16	1119	R	03/2021
Cedar 2	Cedar Hill	TX	1.04	15	990	R	03/2021
Cedar 3	Cedar Hill	TX	1.04	12	500	R	03/2021
Bob 2	Southlake	TX	0.85	14	1158	R	06/2021
Bob 5	Southlake	TX	0.85	15	425	R	06/2021
MayTower 1	Cache	OK	1.19	14	382	R	05/2021
LostLake 2	Cache	OK	1.39	14	187	R	04/2021
Waynesville 1	Waynesville	MO	0.00	7	1233	M	05/2020
Waynesville 2	Waynesville	MO	0.00	8	536	M	05/2020
Tower Ridge	Bonnotts Mill	MO	0.03	8	1237	M	05/2020
Rainbow	Jefferson City	MO	0.01	10	804	M	06/2020
ElDorado 1	El Dorado Springs	MO	0.00	7	526	M	05/2020
ElDorado 2	El Dorado Springs	MO	0.00	9	875	M	05/2020
Halfway	Halfway	MO	0.07	5	185	M	05/2020
Henwick	Jefferson City	MO	0.06	9	1058	M	05/2020

