

Research Summary
2016
Population Demographics of the Cerulean Warbler (*Setophaga cerulea*) in the Delaware Water Gap National Recreation Area

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Years Ongoing: 2014 & 2015

Expected Completion: December 2017, with possible extension based on research results.

Funding Source: Delaware Valley College Professorship Grant, Delaware Valley University Undergraduate Research Fund

Objectives:

1. Quantify and monitor population numbers in known Cerulean Warbler habitat.
2. Determine basic population demographic information such as age class representation of breeding males via molt patterns determined during bird banding.
3. Compare effectiveness of survey techniques between traditional spot-mapping and audio lure assisted spot-mapping.

Approach/ Methodology:

Banding Procedure.-- Using mist nets along with a decoy and audio-lure system I banded 16 male Cerulean Warblers on the study plots with both a federal band and a unique combination of color bands. This serves to determine the number of individuals on the plots as well as movements of individuals within the plots. Working with a banded population also assists in defining demographic aspects of the population and, in particular, site fidelity.

Vocalizing males were located. We then played a recording of the Cerulean Warbler call back to the individual. If the individual appears to be aggressive towards the call we set up one mist-net approximately two meters off the ground. An audio-lure, consisting of a MP3 player and speakers, along with a decoy were placed near the net. The audio-lure was turned on until the bird is captured or a maximum of five minutes had passed. After capture, the audio-lure will be turned off and the decoy removed from sight to reduce stress on the bird. Each bird was banded with a numbered federal band and a unique combination of colored bands so that each individual can be identified. In addition, we collected morphological measurements (weight, wing length, tail length), sex, age, and amount of fat deposits. Fat deposits will be scored from 0-3 (Mulvihill et. al 2004).

Monitoring Population Density and Distribution.-- In 2015, we surveyed a 5.2 km transect within the Delaware Water Gap National Recreation Area (DWGNRA) for breeding Cerulean Warblers. Transect placement was along Freeman Tract Road within DWGNRA, an improved gravel road along the Pennsylvania side of the Delaware River in Monroe County. This is a known area of relatively high Cerulean Warbler density and is characterized as mature second-growth forest (Curley et al. 2012).

We quantified Cerulean Warbler density using territory mapping (Bibby et al. 2000). Two different approaches were implemented for comparison analysis. The first approach employed standard rules and symbology as defined in Bibby et al. 2000. The second approach included audio-playback to elicit male response. This method is referenced in Bibby et al. 2000 as a suitable augmentation to the standard rules approach. Data collected was separated and considered independent for each method.

The audio-playback used was from The Sibley eGuide to the Birds of North America application for iPhone, “songs #2_NY”. The iPhone used for audio lure was at maximum volume, and connected to a portable Bose speaker, also set to maximum volume. At 150 m intervals, determined via GPS (Garmin Montana 650t), the audio lure was played 3 times once facing forward in relation to the transect line. Then, turning 120 degrees to the left followed by another 120 degrees to the left. Each bout of audio-playback was limited to 10 seconds in length, for a total of 30 seconds of audio lure played at every 150 m stop. Initiation of first audio-playback was alternated between 0 m, 50 m, and 100 m points to allow for uniform audio-playback along the entire transect for the breeding season.

Eight surveys, per territory mapping method, were conducted over a 6-week period during the height of the Cerulean Warbler breeding season (May 15 to June 20). No surveys, per method, were conducted on consecutive days. When logistically required, both the standard and audio-playback approach could be completed on the same day contingent on the standard method observed receiving a 15 min advanced start to allow for independence of survey results. Start points for the surveys were alternated per visit between 0 m and 5200 m to reduce temporal bias. Surveys were conducted beginning approximately one-half to one hour after local sunrise, and all surveys ended before 10:30 EST and the entire transect line was surveyed within a single morning. No surveys were conducted on days with significant precipitation, strong sustained winds, or heavy fog. During repeated visits to the survey plot, the location and behavior of each

bird observed was recorded onto the plot map (Robbins 1970). Singing or sighted males were mapped in relation to the transect line, and particular attention was accorded to counter-singing males and other aggressive behavior due to their importance in territory delineation. At the end of the season, the eight plot maps were consolidated into one master map for each territory mapping method.

Territory Delineation

Two observations, per spot-mapping method, on two different days were used to define the presence of a territory (Bibby et al. 2000), although the majority of territories were represented on subsequent visits. When available, counter-singing was used to differentiate separate territories within clustered areas. Standard territory mapping results and audio-playback results were analyzed independently of each other.

Statistical Analysis

We used the program R 3.2 for statistical analysis (R Core Team 2015). We compared mean detection cues per survey bout with a Welch's t-test for non-parametric data.

Results:

Banding

Fourteen male Cerulean Warblers were banded in 2016. Additionally, we had 5 color banded birds from previous seasons return to the study location. This resulted in a total banded population of 19 males.

Monitoring Population Density and Distribution

The standard territory mapping methods yielded 37 Cerulean warbler territories along Freeman Tract Road in 2016. Mean cues per survey bout was 23.88, with a maximum number of 29 cues. Audio lure spot-mapping methods yielded 52 Cerulean warbler territories along Freeman Tract Road in 2015. Mean cues per survey bout was 33.13, with a maximum number of 40 cues.

As defined by Bibby et al. (2000), a territory must have a minimum of two cues across the eight survey bouts. After assigning territory designations we identified the bout number where each territory achieved the minimum cues required (Table 1). This data was then plotted on a territory accumulation curve to compare rate of territory designations by survey method (Figure 1). In addition to the audio lure method producing a greater number of territories we also

found a statistically significant difference between the number of cues per survey for both survey methods ($P < 0.01$).

Summary:

Banding

This field season allowed us to quantify our first rate of return data. We will now be able to track return rates for future seasons to analyses trends across years. Four of the 19 males from the 2016 banded population were of second-year age classification while 15 were after second-year.

Monitoring Population Density and Distribution

The audio lure method produced more cues per survey and a higher number of overall territories. There appears to be a significant difference between the two methods. Addition field seasons are required to determine patterns over time.

Literature Cited:

- Bibby, C. J., N. D. Burgess, D. A. Hill, and S. H. Mustoe. 2000. Bird census techniques, 2nd ed. Academic Press, London, UK.
- Curley, S., T. Master, and G. George. 2012. Population distribution, density and habitat preference of the Cerulean Warbler (*Setophaga cerulea*) in the Delaware Water Gap National Recreation Area. *Ornitologia Neotropical* 23:351-357.
- Mulvihill, R. S., R. C. Leberman, A. J. Leppold. 2004. Relationships among body mass, fat, wing length, age, and sex for 170 species of birds banded at Powdermill Nature Reserve. Eastern Bird Banding Association, Monograph 1.
- R Core Team. 2015. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Robbins, C.S. 1970. An international standard for a mapping method in bird census work recommended by the International Bird Census Committee. *Audubon Field Notes* 24: 722-736.

Survey Bout	Territories Established – Tradition Spot-Mapping	Territories Established – Audio Lure Spot-Mapping
1	0	0
2	16	28
3	10	11
4	3	5
5	5	2
6	1	4
7	1	1
8	1	1

Table 1. Territories established per survey bout for traditional spot-mapping methods and audio lure spot-mapping methods. This requires a minimum of two cues across the eight survey bouts

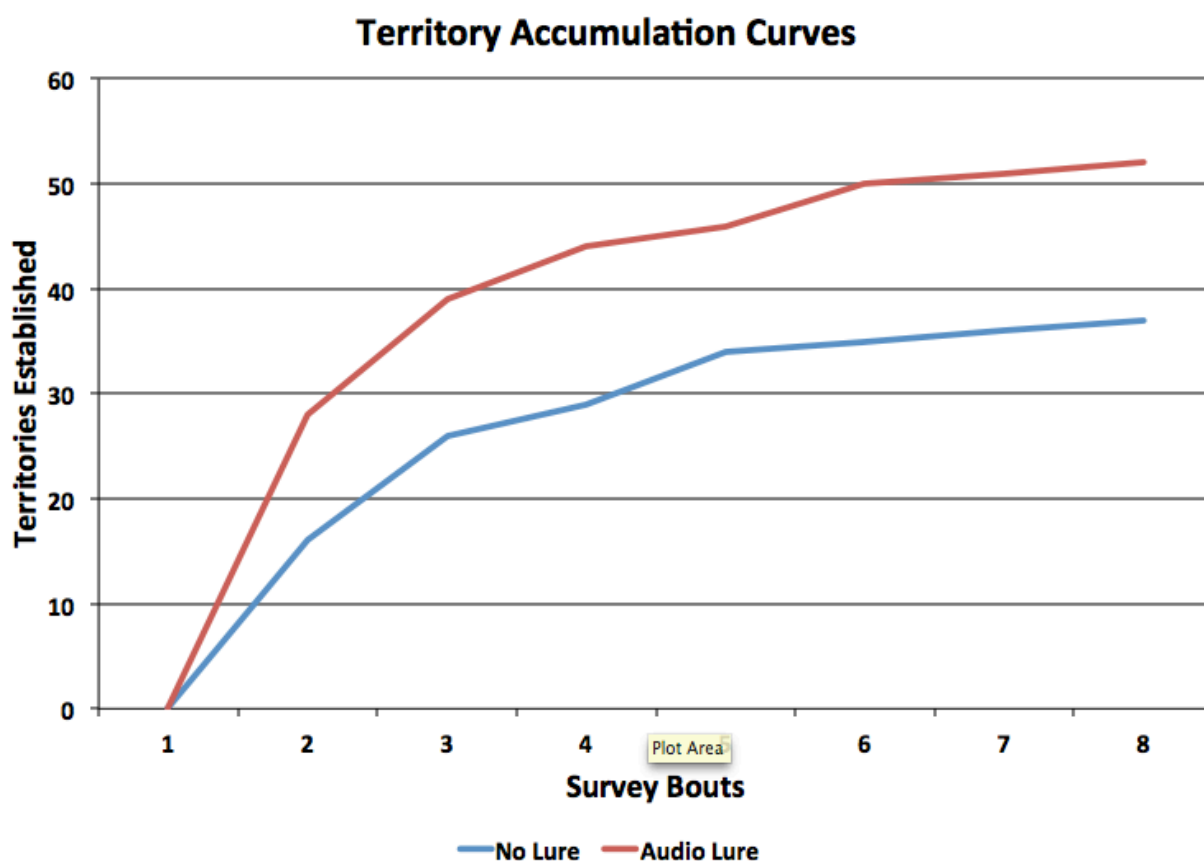


Figure 1. Territories established per survey bout for standard spot-mapping methods versus audio lure spot-mapping methods.

