

A Replication of a Breeding Bird Census

by Paul F. J. Eagles and Terry N. Tobias

What happens when two observers independently conduct Breeding Bird Censuses in the same plot in the same year?

Introduction

MEASURING AVIAN POPULATIONS is difficult, at best, and apparent changes that occur over time, in a specific place, may be owing to one or several factors. If the change is not real, then it may be the result of an artifact in the survey method used or differences inherent in the surveyors. The following effort was undertaken in an attempt to determine the validity and limitations of the censusing technique prescribed for Audubon Breeding Bird Censuses.

THE WILLIAMS SPOT-MAPPING methodology (Williams, 1936) for the measurement of populations of birds has become popular in North America and in Great Britain. For breeding populations it is recommended that a minimum of eight censuses be taken in open habitat and ten in closed habitat (Robbins, 1970). This large number makes it difficult for complete replicates to be taken that will allow the standard statistical tests to be used to assess the variations inherent in the sampling. In order to overcome this difficulty, the following exercise was conducted.

To explore the variation inherent in spot-mapping, an experiment was undertaken in which one research plot was surveyed independently by two observers, using standard methods.

Methods

Standard methodology for the Williams spot-mapping technique was used (Williamson, 1964; Hall, 1964; Robbins, 1970). Each observer conducted one census per week, in the early morning, for an 8-week period from the third week of May through the second week of July. The plot was set up with a 100m grid that ran in an E-W alignment. The starting points of the surveys alternated between the NE and

SE corners. A description of the old field plot is found in Census 76 below.

The observers were almost identical in age, height, field identification experience, and visual and aural acuity. Tobias had concentrated in previous breeding seasons on nest-finding. Eagles had previously conducted spot-mapping censuses (Eagles, 1975a, b, c, d)

The censuses and the subsequent data analysis were conducted independently).

Results

76. OLD FIELD WITH DECIDUOUS REGROWTH AND YOUNG CONIFER PLANTATIONS. — **Location:** Ontario; Hamilton-Wentworth Region; Flam-borough Township; NW of Rockton; 40P/8 (Galt; 685975; Klaas Christmas Tree Farm. **Continuity:** New **Size:** 42.0 ha = 103.8 acres (rectangular, 500 X 840m, measured with tape on the ground). **Description of Plot:** A mixture of conifer plantations and natural deciduous regrowth in old fields. Sedge meadow with shrubs up to 2m in height (3.5%) was dominated by willow (*Salix* sp.) and Quaking Aspen (*Populus tremuloides*) with an understory of a large number of moisture tolerant grasses, sedges and other herbaceous plants. Hedgerows, with trees varying from 1 to 15 m in height forming long lines (3.6%), were a mixture of Sugar Maple (*Acer saccharum*); Hawthorn (*Crataegus* sp.); Prickly Ash (*Zanthoxylum americanum*); Black Cherry (*Prunus serotina*), Basswood (*Tilia americana*); Lilac (*Syringa vulgaris*) and with a few dead elm (*Ulmus* sp.) and planted Norway Spruce (*Picea abies*). Old plantations, with trees over 5 years of age and varying between 1 and 10 m in height (24.5%), were composed of Scotch Pine (*Pinus sylvestris*), White Spruce (*Picea glauca*); Red Pine (*P. resinosa*) and White Pine (*P. strobus*). Old field, with young plantation trees under 5 years of age and 1 m in height (68.4%), contained numerous young trees (with Hawthorn and Prickly Ash being the most common), herbaceous plants plus many other species of grasses and sedges. A buried oil pipeline, that was doubled in 1976, passed through the plot. The 20m-wide disturbed strip was being recolonized by a number of early-succession-stage, herbaceous plants. **Edge:** Similar habitat on the N, W and S. There was an upland deciduous forest on the SW corner, a paved road on the edge and a 30-year old conifer plantation just E of the road. **Topography:** Gently rolling with 2 low ridges running NE-SW through the plot **Elevation:** 265-268 m. **Weather:** Average monthly

temperature and rainfall at Waterloo-Wellington Airport with 50-year average in brackets. Temperature in C. - May 14.4° (12.5°); June 16.1° (18.3°); July 20.0° (20.6°). Rainfall in mm - May 48.2 (83.3); June 83.0 (81.3); July 125.9 (89.2). **Coverage:** *Eagles* - May 25, 31; June 8, 15, 22, 28; July 6, 13; 8 trips: 0540-1040 hours, EDT. Total man-hours: 33. *Tobias* - May 27, 31; June 9, 13, 23, 28; July 5, 12; 8 trips: 0530-1030 hours, EDT. Total man-hours: 32.83. **Census:** The analysis was done independently by the 2 observers. Both sets of data are given in the order - *Eagles* then *Tobias*. Field Sparrow, 22 (52, 21), 19.5 (46, 19); Song Sparrow, 20.5 (49, 20), 16.5 (39, 16); Savannah Sparrow, 19 (45, 18), 17.5 (42, 17); Grasshopper Sparrow, 16.5 (39, 16), 16.5; Chipping Sparrow, 11.5 (27, 11), 8.5 (20, 8); Am. Goldfinch, 7 (17, 7), 9 (21, 9); Clay-colored Sparrow, 6.5 (15, 6), 6.5; Starling, 4 (10, 4), 3 (7, 3); Yellow Warbler, 4 (10, 4), 4.5 (11, 4); E. Kingbird, 3 (7, 3), 4.5 (11, 4); E. Meadowlark, 2.5, 5.5 (13, 5); Red-winged Blackbird, 2, 1.5; Mourning Dove, 1.5, 1; Willow Flycatcher, 1.5, 2; Gray Catbird, 1.5, 2; Am. Robin, 1.5, 2; Rufous-sided Towhee, 1.5, 2; Killdeer, 1, 2; Upland Sandpiper, 1, 1; Bobolink, 1, 0; Com. Grackle, 1, 0.5; Brown-headed Cowbird, 1, 6 (14.5, 6); Vesper Sparrow, 1, 1; Marsh Hawk, 0.5, 1; Am. Kestrel, 0.5, 0; Black-billed Cuckoo, 0.5, 0.5; Com. Flicker, 0.5, 0.5; Blue Jay, 0.5, 1; Com. Crow, 0.5, 0; House Wren, 0.5, 0; Red-tailed Hawk, +, 0. **Total:** 34 species; 138.5 territorial males (330/100 ha, 133/100 acres), 29 species; 139 territorial males (331/100 ha, 134/100 acres). **Visitors:** *Eagles* - Sharp-shinned Hawk, Chimney Swift, Ruby-throated Hummingbird, Downy Woodpecker, Least Flycatcher, Tree Swallow, Black-capped Chickadee, Red-eyed Vireo, Com. Yellowthroat, N. Oriole, Henslow's Sparrow. *Tobias* - Goshawk, Red-tailed Hawk, Am. Kestrel, Am. Woodcock, Rock Dove, Chimney Swift, Ruby-throated Hummingbird, Red-headed Woodpecker, Hairy Woodpecker, Alder Flycatcher, Least Flycatcher, Tree Swallow, Com. Crow, Black-capped Chickadee, House Wren, E. Bluebird, Com. Yellowthroat, Bobolink, N. Oriole, Cardinal, Rose-breasted Grosbeak. **Remarks:** The authors felt that if the 2 censuses were combined into 1, all the species recorded as breeders by *Eagles* but visitors by *Tobias* would attain breeding status. Also the following species that were recorded as visitors by both observers would be given breeding status: Oriole, 1; Ruby-throated Hummingbird, 0.5; Com. Yellowthroat, 0.5; Least Flycatcher, +; Tree Swallow, +. The totals would then be: 39 species; 142 territorial males (338/100 ha, 137/100 acres). This research was part of a baseline study conducted in order to develop management plans for Environmentally Sensitive Areas as designated in Regional Office Plans. The work was supported by a grant from the Ontario Ministry of the Environment. Thanks to Mr. and Mrs. A. Klaas for the permission to study their property.

Discussion

The similarity of the total male density between the two studies is startling: *Eagles* — 139 territorial males; *Tobias* — 139 territorial males.

There was a difference between the number of breeding species found: *Eagles* — 34; *Tobias* — 29. The additional five breeding species

included by *Eagles* were counted as visitors by *Tobias*. Most of this difference in the number of breeding species was owing more to *Tobias*' addition of peripheral species to the visitor category, rather than to a real difference. He did not use the convention that "if the total territory for any species is less than one-fourth it should be indicated by a plus (+) instead of a number" (Hall, op. cit.). If he had adopted this convention, four species would have been assigned a + (American Kestrel, Red-tailed Hawk, Common Crow, House Wren) and *Tobias* would have recorded 33 breeding species instead of 29.

COMBINING THE TWO INDEPENDENT censuses into one resulted in the addition of five more species to the breeding list and confirmed five species as breeders that had been a point of difference at the 8-trip level. These changes resulted from the addition of registrations to bring the total up to or above the level of three which was the minimum suggested by Robbins (1970).

The fact that a species can be assigned a + on the basis of less than three registrations is significant (see *Eagles*' interpretation of his Red-tailed Hawk data). The convention of accepting a minimum of three records out of a possible eight should be flexible if strong mitigating evidence is observed.

The censuses should be spread evenly throughout the 8-week period, as opposed to concentrating them in the middle of the breeding season. This is essential in order to record early nesters such as Starling and Common Grackle, as well as late nesters, such as American Goldfinch.

Problem Species (in order of listing in Census 76)

During the discussion of each species, detailed data on the sightings will be given as follows (5, 1.0; 2, V). This means that *Eagles* saw the bird on five separate trips and assigned it the status of 1.0 territory while *Tobias* saw the bird on two trips and give it the status of visitor.

Song Sparrow — (8, 20.5; 8, 16.5). This discrepancy is owing to differences in interpretation. *Tobias* placed strong emphasis on the need for recording two males singing simultaneously for the assignment of territorial boundaries. *Eagles* placed emphasis on the

convention "at least two pairs of non-contemporary registrations" (Robbins, 1970).

American Goldfinch — (8, 7; 8, 9). This species nests in Ontario, from the middle of July through to the middle of September (Eagles, 1976). Therefore the census period ended just as goldfinch nesting normally begins. Territories are set up considerably in advance of egg laying (Middleton, pers. comm.). Eagles found that the registrations did not cluster well and therefore standard methods could not be used. He assumed that all birds seen on the plot during the censuses would later nest on the plot and took the average number of birds per trip, divided by 2, to give the number of pairs on the plot. Tobias used the last three censuses only, to look for registration clustering because evidence suggested that territorial formation prior to these was very weak. He found 9 clusters.

Eastern Meadowlark — (8, 2.5; 8, 5.5). This species does not appear to defend a well-defined territory. The delineation of territories was complicated by two factors. First, numerous individuals were observed flying considerable distances (over 300m), the routes of which apparently traversed more than one territory. Secondly, the males and females appear identical in the field, and both seem to be quite active, which makes the interpretation of numerous registrations difficult. The two observers found a total of three nests which means that there was a minimum of three territories, probably of a total of about five.

Bobolink — (5, 1.0; 2, V). There was one male which ranged widely over the upland fields. Given the convention that a male must have registrations 3 out of 8 times (Robbins, 1970) this species was assigned: 1 territory by Eagles; visitor by Tobias; and confirmed as a breeder by the two combined censuses.

Brown-headed Cowbird — (8, 1; 8, 6). This non-territorial species presented considerable interpretation problems. Eagles used the criterion "the number of females observed" (Hall, op. cit.) which gave an average of 1.0 females/day. This is probably a low estimate because there was an average of 5.25 birds/day (males and females) seen. Tobias attempted to use Hall's criterion but felt that it was producing a low estimate because on two separate occasions, two females were seen simultaneously.

On his species map he had four registration clusters and he assigned 1.5 females to each cluster which gave 6 territories. Robbins (pers. comm.) has stated "We think the best way to count cowbirds is to make the best estimate of the average number of 'pairs' on the plot. In other words, to determine the average number of birds present and divide by 2 so that your estimate for cowbirds will be comparable with your estimate for other species." Hall's method probably gives a minimum number of cowbirds present. It makes the assumption that every female will be recorded on every census. This assumption is not applied to other species for whom 3 registrations on 8 trips are sufficient. Both researchers found many more males than females, which may indicate that the females are more secretive than the males during the breeding season. In future surveys the authors will use the average number of males seen on the plot per trip. This assumes that all the males present are seen each day which is probably invalid, causing the figure to be an *underestimate*. It also ignores the fact that male cowbirds wander widely and multiple registrations from one individual probably occur, which would cause an *overestimate*.

American Kestrel — (4, 0.5; 2, V). This was a simple case of the number of registrations determining the status.

Common Crow — (3, 0.5; 3, V). Eagles considered that the foraging observed indicated that the plot was part of a larger feeding territory and therefore assigned the species 0.5 territory. Tobias never observed crows landing or perched on the plot. He consistently saw crows in the plantation to the E where he assumed they nested, and considered them visitors only. The authors decided that data from the combined projects would give the crow 0.5 territory.

House Wren — (3, 0.5; 4, V). The territory in question extended into the deciduous woodlot on the SW corner of the plot. The bird was often heard singing in the woods and all Tobias' registrations were within 10m of the edge of the plot so he assigned it visitor status. Eagles had two registrations deep inside the plot, one over 100m from the woods, so assigned the bird 0.5 territory. The combined research indicated that 0.5 territory should be assigned.

Red-tailed Hawk — (1, +, 1, V). Eagles saw the hawk hunting once in the plot and three times in the field immediately S of the plot. Tobias saw this species hunting once in the plot but six times in the fields S, W and N of the plot. Eagles decided to give this species a + on the available evidence while Tobias decided differently and gave the species visitor status. After combining the censuses the authors decided that this species included the plot as part of a much larger feeding territory and therefore should be given +. Hall (op. cit.) stated "If the total for any species is less than one-fourth [of a territory] it should be indicted by a plus (+) instead of a number."

Great Blue Heron — (6, V; 7, V). The herons were observed flying over in a NW or SE direction. It is probable that they were flying to or from a large heronry that is reputed to exist approximately 5 km NW of the plot. This species illustrates the problem that occurs with species that forage widely from the nest or defend very large territories. In this research, birds were assigned breeding status if they actually foraged on the plot. The herons never landed on the plot because it offered no permanent water. Therefore, they were assigned visitor status even though seen on 13 out of 16 trips. We feel that it would be misleading if the species was assigned a +. It might be worthwhile for authors to include explanatory comments like those above in the remarks section of the census report in order to clarify such situations.

Northern Oriole — (2, V; 5, V). Tobias never heard the male singing and concluded that the adults seen could not be considered breeders. It was decided that 7 registrations on 16 trips should give this species breeding status on the combined census. This species may not be conspicuous near its nest.

Summary

SIXTEEN VISITS INCREASED the number of breeding species 15% (Eagles) and 35% (Tobias) over that recorded in eight visits. The discrepancy between these two figures is owing mostly to the fact that Tobias classified four peripheral species as visitors while Eagles gave the same four species marginal breeding status.

Sixteen visits increased the number of territorial males by 1.5% for both observers, over that recorded on eight visits. The overall den-

sity was identical for both researchers, which may indicate that sampling and interpretation errors for individual species occur randomly and eventually balance out when individual species densities are summed.

Subjective interpretation as to the importance of a registration was a source of difference, especially for species that do not strongly defend territories.

Problem species which required special consideration were discussed.

The majority of the birds which visited the plot during the breeding season were probably breeding in suitable habitat nearby. Therefore, the visitors column is a partial sample of nearby avian breeding communities. Invariably, this column will include some migrants as well.

For birds which forage widely or have large territories, interpretive remarks should be considered, in order to clarify the situation.

This experiment may give other researchers some idea of the degree of error inherent in the Williams spot-mapping methodology.

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