Corroboration of the North American Breeding Bird Survey for Eastern Bluebirds

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ABSTRACT

We tested whether the Breeding Bird Survey (BBS) index of abundance for Eastern Bluebirds (*Sialia sialis*) in the upper Midwest U. S. was correlated positively with the actual number of birds breeding in our study area near Green Bay, WI, over 27 years from 1968 to 1994. Despite concerns about the accuracy of BBS trend estimates, our results indicate that the BBS index is a reasonably accurate indicator of real changes in the size of our study population. Bluebirds are suited well to BBS censusing techniques because of their roadside nesting habitats, but other species that occupy grasslands or forest edges may also fit this mold. Thus, we suggest that data contributed by volunteer and amateur ornithologists to calculate the BBS index to abundance will often provide accurate information on the status and fluctuations of populations of conservation interest.

INTRODUCTION

The Breeding Bird Survey (BBS) is used by the U. S. Department of the Interior to estimate population trends of most North American species, but it is based on data collected by volunteers and amateurs with different skills and experience. As a result, the potential for differences among observers to introduce error into BBS estimates has been analyzed statistically in great detail (Robbins et al. 1986; Geissler and Sauer 1990; Sauer et al. 1994; Link and Sauer 1996). We took a different approach and tested directly the hypothesis that the BBS is an accurate predictor of real changes in population size of Eastern Bluebirds (*Sialia sialis*) in the upper Midwest U.S. To do so, we compared the number of adult female bluebirds that nested during 27 years, from 1968 to 1994, in our 70 km^2 study area near Green Bay, WI, to the number of birds detected annually on the BBS in Wisconsin and in Region 3 (WI, MI, MN, IL). We expected that BBS indices for these areas would be correlated positively with population size in our study area because juvenile Eastern Bluebirds disperse regularly within Wisconsin and among Wisconsin, Michigan and Illinois (Bauldry et al. 1995). Eastern Bluebirds are appropriate to answering the general question of how to monitor reliably populations of special concern. Bluebirds became a species of national concern after undergoing a precipitous drop in population size during the 1970s (Sauer and Droege 1990), but have since recovered from this decline in the upper Midwest (Sauer and Droege 1990, Bauldry et al. 1997). Thus, if the BBS provided reliable data, changes in the BBS index from 1968 to 1994 should be closely and positively correlated to observed changes in the number of female bluebirds breeding in our study area. Support for this prediction would constitute an independent corroboration of the BBS, based on counts of individually marked birds.

METHODS

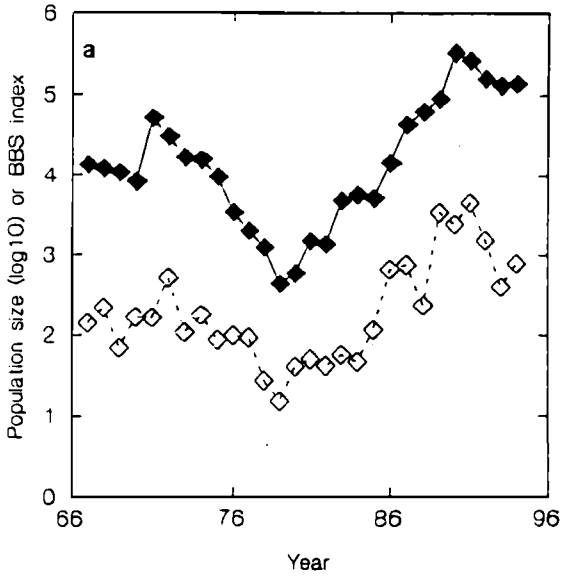
Our study methods, used since 1968, are described in detail elsewhere (Bauldry et al. 1995, 1997; Radunzel et al. 1997). Briefly, about 700 nest boxes were monitored annually by VMB and up to 20 helpers each year. Helpers alerted VMB to the location of pairs of bluebirds that nested in boxes in their respective areas. Additionally, VMB searched the entire study area on a regular basis by car to search for nesting bluebirds. VMB visited all boxes to check for signs of nesting activity and, when birds were present, to determine the timing of egg-laying and size of clutches. Nests were also visited to record number of eggs hatched and fate of each attempt, and to band young and adult birds. Artificial nest sites for bluebirds first were provided in large numbers in our study area in the early 1960s. VMB began sole supervision

of data collection in 1967, and the number of nest boxes increased from 500 to approximately 700 during the first two years of study. The number of boxes monitored has remained about constant thereafter, and the number of female bluebirds breeding each year has not exceeded 124. Thus, it is unlikely that the maximum number of bluebirds counted annually, or variation in this number over the course of the study, was affected markedly either by the number of boxes available for bluebirds or by changes in monitoring effort. About 90% of 2,460 nesting attempts produced nestlings that survived to be banded, and 1345 adult females and 1182 adult males were captured and banded at their nest sites at this stage. All adult females were captured on the nest during their first known nesting attempts each year, and all unbanded females also were banded at this time. Many adults were captured more than once each year, but we counted adult females only once each year to estimate population size. Despite continuous nest searches, only seven nests were found in natural cavities. Thus, we estimate that over 90% of all bluebirds present in our study area bred in boxes that we monitored and were banded by the end of each breeding season. If this assumption is correct, our estimates of population size reflect closely the true population size of bluebirds nesting in our study area. We compared BBS indices and female numbers using Pearson correlation and linear regression, after transforming the number of breeding females by $\log_{10}$ to normalize the data. The BBS index is also log-normally distributed (Geissler and Sauer 1990).

RESULTS AND DISCUSSION

Our results show that BBS indices of Eastern Bluebird population size for WI and Region 3 were each correlated closely and positively to the observed number of females breeding in our study area from 1968 to 1994 (Fig. 1, Table 1). Overall, a regression of number of breeding females on the BBS index for each area suggests that the observed number of females breeding in our study area can be predicted to within about 20%, 95 times out of 100 (Fig. 1). However, we also note that the correlation between number of locally breeding females and the BBS index was better in the last half of the study period, particularly for Region 3 (Table 1). Thus, BBS indices may have become more accurate in the last 14 years, trends in our study area may have paralleled those in the upper Midwest more closely during this period, or both explanations may apply.

Figure 1. The BBS index for (a) WI and (b) Region 3 each plotted against number of female bluebirds breeding in the study area from 1968 to 1994. Regression equations for population size, as predicted by BBS indices are: population size = 1.60 (± 0.26) + 1.10 (± 0.11) x WI index, $r^2 = 0.80$, $F_{1,26} = 102.43$, $p < 0.0001$); and population size = 0.92 (± 0.09) + 1.24 (± 0.29) x region 3 index, ($r^2 = 0.80$, $F_{1,26} = 105.75$, $p < 0.0001$).



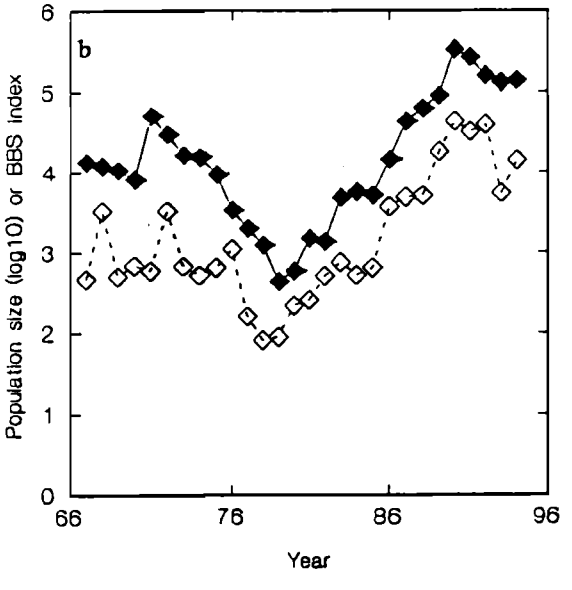


Table 1. Correlation coefficients for BBS indices versus the number of female bluebirds breeding in the study area from 1968 to 1994.

	Sample Period		
Area	**pre-1980**	**post-1979**	**1968-94**
Wisconsin	0.84**	0.89**	0.89**
Region 3	0.73*	0.96**	0.90**
years	14	14	28

*p < 0.005; **p < 0.0001

The close correlations between number of locally breeding females in the Green Bay area of WI and the BBS index for WI or for Region 3 indicate that the BBS can be exceptionally useful for assessing long-term trends in breeding bird numbers. Although bluebirds often occupy habitats that are easily surveyed from roadsides, and thus lend themselves well to the census techniques of BBS volunteers, other widely dispersed species that occupy grassland and successional habitats probably also fit this mold. Several related studies also support this conclusion. For example, Temple and Cary (1990) used volunteers to complete standardized checklists at bird feeders in Wisconsin and showed that year-to-year changes in the frequency of sightings of species by observers typically was correlated with BBS trend estimates. A second study based on data collected by mist-netting, spot-mapping, and the individual identification of territorial birds in the Hubbard Brook Experimental Forest, NH (Holmes and Sherry 1988), gave similar results, as did another study based on mist-netting at Long Point Bird Observatory (Dunn et al. 1997). Taken together, these results also suggest that data collected by volunteer and amateur ornithologists in many cases enhance the ability of the U.S. Department of the Interior to monitor biological resources of national interest (Kenworthy 1995; Rogers 1995; Obey 1996). The current debate about the population status of songbirds that are Neotropical migrants hinges in large part on the reliability of the BBS for estimating population trends (James et al. 1996; Mauer and Villard 1996; Thomas 1996). Our results address this issue by providing a corroboration of the BBS index based on counts of individually marked bluebirds. Other researchers with long-term data on individually marked birds have the opportunity to test the reliability of BBS indices for other species. Because many banders collect such data, we believe that banders could play an important role in improving our efforts in monitoring biological resources of national importance.

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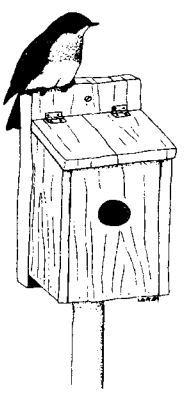

LITERATURE CITED

Bauldry, V. M., D. M. Muschitz, L. A. Radunzel, and P. Arcese. 1995. A 27-year study of Eastern Bluebirds in Wisconsin: Productivity, juvenile return rate and dispersal out side the study area. *N. Am. Bird Bander* 20:111-119.

Bauldry, V. M., Biemborn, D., and Arcese, P. 1997. Return rates of migrating adult Eastern Bluebirds in relation to sex, winter weather and population size. *N. Am. Bird Bander* 68:129-137.

Dunn, E. H., Hussell, D. J. T.,and Adams, R. J. 1997. Monitoring song bird population change with autumn mist netting. *J. Wildl. Manage.* 61:389-396.

Geissler, P. H. and J. P. Sauer. 1990. Topics in route-regression analysis, pp. 54-57 *in* J. R. Sauer and S. Droege, eds., Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish & Wildl. Ser., Biol. Rep. 90.

Holmes, R. T. and T. W. Sherry. 1988. Assessing population trends of New Hampshire forest birds: Local vs. regional patterns. *Auk* 105:756-768.

James, F. C., C. E. McCulloch and D. A. Wiedenfeld 1996. New approaches to the analysis of population trends in land birds. *Ecology* 77:13-26.

Kenworthy, T. 1995. Environment. The Washington Post, final ed., 27 June 1995.

Link, W. A., and J. R. Sauer. 1996. Extremes in ecology: Avoiding the misleading effects of sampling variation in summary analyses. *Ecology* 77:1633-1640.

Mauer, B. A. and M.A. Villard. 1996. Continental scale ecology and Neotropical migratory birds: How to detect declines amid the noise. *Ecology* 77:1-2.

Obey, D. 1996. Dissenting views of the Honorable David Obey. House Report 104-173 on Dept. Interior and Related Agencies Appropriations Bill, 1996.

Radunzel, L. M., D. M. Muschitz, V. M. Bauldry, and P. Arcese. 1997. A long-term study of breeding success in Eastern Bluebirds by year and cavity type. *J. Field Ornithol.* 68: 7-18.

Robbins, C. S., D. Bystrak, and P. H. Geissler. 1986.The breeding bird survey: Its first fifteen years, 1965-1979. U.S. Fish & Wildl. Ser., Res. Publ. 157.

Rogers, K. 1995. Letter to the editor. The New York Times, late ed.-final, 9 July 1995.

Sauer, J. R., and S. Droege. 1990. Recent population trends of the Eastern Bluebird. *Wilson Bull.* 102:239-252.

Sauer, J. R. B. G. Peterjohn, and W. A. Link. 1994. Observer differences in the North American Breeding Bird Survey. *Auk* 111: 50-62.

Temple, S. A. and J. R. Cary. 1990. Using checklist records to reveal population trends in birds, pp. 98-104, *in* J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U. S. Fish & Wildl. Ser., Biol. Rep. 90.

Thomas, L. 1996. Monitoring long-term population change: Why are there so many analysis methods? *Ecology* 77:49-58.