Response to Tomiałojć and Verner

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In their commentary, Tomiałojć and Verner (1990) raise a number of points of criticism pertinent to my earlier work (Hamel 1984). I am honored that two colleagues whom I admire greatly have chosen to prepare such comments. In this brief reply, I wish to state my agreement with, hence concession to, certain of those criticisms. I will point out my disagreement with certain other points they raise. Finally, I wish to digress from my earlier paper and address my general concern about large-scale monitoring needs that are perforce carried out by agencies such as mine in a situation of very scanty funds. In the process I identify those papers—mine and my colleagues'—that may be affected by some of those criticisms.

Tomiałojć and Verner disagree with the conclusion in my earlier paper that variable circular-plot and spot-mapping methods yielded comparable estimates of density. They go on to say that in their opinion the earlier study "was marred by weaknesses in design, methods, analyses, and inferences." I will consider first the weaknesses and then the primary conclusion.

THE DESIGN

The design weakness of my work was the failure to replicate the study at the habitat scale. At the time the work was done (1982), it was the only comparison of spot-map and variable circular-plot methods that had been carried out on replicate plots, let alone habitats. I carefully controlled selection of 10 replicate plots in five different counties of Piedmont South Carolina (Hamel et al. 1986). My opinion at the time was that introduction of additional observers, which would have been necessary to increase the sample of sites, was introduction of too much possible variation in technique.

THE METHODS

Spot mapping.—I chose a plot size of 10 ha for the spot-mapping (SM) plots on the guidelines of the International Bird Census Committee (1970). The points my colleagues make concerning the mapping activities are well-taken.

Variable circular-plots.—In spite of my colleagues' comments and Granholm (1983), I remain uncontrite in favoring the longer period for point counts. As the data are gathered, each individual is registered in a time-interval-specific color onto a data sheet with distance bands marked, which reduces the likelihood of double counting and permits field-workers to judge whether a particular bird is a new one or not. The implication of figure 2 (Hamel 1984) is that species are not being registered in shorter counts.

I was more than overly optimistic in my attempts to estimate density by variable circular plot (VCP) methods from insufficient samples of registrations. Four species were registered more than 100 times in the earlier study, Red-eyed Vireo (*Vireo olivaceus*; n = 450), American Crow (*Corvus brachyrhynchos*; n = 153), Eastern Tufted Titmouse (*Parus bicolor*; n = 146), and Northern Cardinal (*Cardinalis cardinalis*, n = 118). I agree with Tomiałojć and Verner (1990) on this point. My ambition was to compare all the species encountered. Thus, I assumed an effective detection distance (EDD) of 122 m in the inadequate sample size cases; this was, in retrospect, a questionable technique. The effect of doing this was to underestimate density for those species for which the band 61–122 m was not the band at which EDD was located.

Tomiałojć and Verner (1990) were puzzled by my technique for calculating a density estimate for individual counts (p. 268). I calculated the estimate by dividing the number of registrations within the EDD by the area of a circle of radius equal to EDD, and added a value less than one bird per area of circle of radius equal to EDD for each registration beyond EDD. This was done to use as many registrations as possible. Frequently, single registrations beyond EDD were the only registrations for a species on a particular count. Had I used all registrations and divided their number by an area of a circle of radius EDD, I would have biased the density upward as they state.

THE ANALYSES

Tomiałojć and Verner (1990) identify four weaknesses in the analyses. First, was my arbitrary assignment of numerical density values to species recorded as "+" and as "visitor." Precise estimates of density are not possible for these species. I concur. Numerical estimates are necessary to utilize spot-mapping data in cross-habitat comparisons (Hamel et al. 1982), so I made assignments of numerical values that would not overestimate such densities relative to the plots on which the censuses were made. Second, repeated measures ANOVA was the appropriate analytical technique for the variable circular-plot data; I did not use it. The impact of such a failure is unknown. Third, Tomiałojć and Verner (1990) favor using percentage differences in the comparisons of the results of two techniques. I disagree and will discuss this point below. Fourth, they fault me for adjustments of VCP density estimates based upon biological knowledge of the species. For example, they cite the case of the

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Red-eyed Vireo. I limited my analysis of that species, as well as others in which large numbers of registrations were made, to registrations solely of singing males because of the bias involved by including registrations of females and young in the analyses. Effective detection distance for singing males is much greater than EDD for females, young, and birds that are detected calling only. Including registrations from a group with much smaller EDD as identical to those from a larger EDD creates an enormous positive bias in density estimates in VCP. Rather than making a Type III error as they imply, I merely based the analysis on only one type of data. Furthermore, I find this approach to be more appropriate than the technique that Verner and Ritter (1988) used to identify their Alternative 14 "best" data set for comparing transect data and SM data.

The Inferences

Because the absolute differences between variable circular-plot and spot-mapping density estimates were low, I inferred that VCP and SM yielded comparable results. Differences in estimates existed in the earlier study at all density estimates from the lowest to the highest. Variable circular-plot estimates were both higher and lower than SM density estimates at all scales. These differences can be examined in absolute or in relative terms. My choice was to look at them in absolute terms. Tomiałojć and Verner (1990) prefer, apparently as a matter of style, to use ratios between density estimates rather than absolute values of the differences. The differences are neither greater, nor lesser, depending upon the magnifying glass that we use to examine them.

I stand by my previous conclusion: in the earlier study VCP and SM yielded comparable density estimates. However, in light of the detailed work of Verner and Ritter (1985, 1988), and additional work of my own (R. P. Ford and P. B. Hamel unpubl. data), I question whether the results that I obtained indicate that VCP and SM provide comparable estimates in general, or simply provided them in this particular case. I suspect, and in this I agree with Tomiałojć and Verner, that my earlier work—in spite of my best efforts to control the test—was a good opportunity for a favorable comparison. I believe this precisely because I was the only observer and had excellent knowledge, based upon the SM work, of the distribution of the birds on the plots, and I was thus in an excellent position to infer the actual numbers of birds that I was observing in the VCP plots. In another case, in which only the VCP was involved, I am not sure what the results would be. I thus advise readers to consider the values presented in Hamel (In press) to be relative abundance estimates rather than density estimates. Similarly, the inability of Durham et al. (1988) to relate community characteristics with vegetative parameters may well relate to the inability of transect techniques to provide density estimates at the community level (cf. Verner and Ritter 1988).

I hope that this exchange of commentaries stimulates others to undertake work to identify the strengths and range of application of field techniques of counting birds. Verner (1985) has gone a long way in that direction. The need for cost- and time-effective means to count birds in such a way that the results are of sufficient quality to compare the abundance of species across habitats, times, and regions is urgent. Spot-map censusing is a recognized standard of comparison. It is a time-intensive technique. Point-counting can be less time-intensive. Transects, such as Finnish line transects (Järvinen and Väisänen 1981), may be techniques of choice for certain regional examinations. We have used them to some advantage in Tennessee (Ford and Hamel 1988, Hamel et al. 1988, J. Wahl unpubl. data). The recently proposed technique of Hutto et al. (1986) has been widely used in the Caribbean and elsewhere. I believe, as do Tomiałojć and Verner, that a small number of accepted standard techniques with recognized limitations, is preferable to a proliferation of new techniques. Those of us in small agencies with mandates to monitor the biological health of areas in our care require techniques that we can apply with an expectation of consistent results. Those in much larger agencies, such as the U.S. Forest Service, similarly have need of techniques useful for monitoring over large areas and long time periods. Please, colleagues, help us find such techniques that we can afford to apply.

I apologize to Tomiałojć for not having responded to an earlier draft of the critique. I thank Verner for considerable assistance to me in acquiring the literature necessary to prepare this response. Our editor showed me a full measure of kindness as well.

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Received 22 September 1989, accepted 19 December 1989.