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Abstracts

## SHORT COMMUNICATIONS

### ESTIMATING POPULATION TRENDS WITH A LINEAR MODEL

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*Abstract.* We describe a simple and robust method for estimating trends in population size. The method may be used with Breeding Bird Survey data, aerial surveys, point counts, or any other program of repeated surveys at permanent locations. Surveys need not be made at each location during each survey period. The method differs from most existing methods in being design based, rather than model based. The only assumptions are that the nominal sampling plan is followed and that sample size is large enough for use of the *t*-distribution. Simulations based on two bird data sets from natural populations showed that the point estimate produced by the linear model was essentially unbiased even when counts varied substantially and 25% of the complete data set was missing. The estimating-equation approach, often used to analyze Breeding Bird Survey data, performed similarly on one data set but had substantial bias on the second data set, in which counts were highly variable. The advantages of the linear model are its simplicity, flexibility, and that it is self-weighting. A user-friendly computer program to carry out the calculations is available from the senior author.

*Key words:* bird populations, monitoring, population monitoring, sampling, statistical methods, trend estimation.