A methodological model for the estimation of bird populations over large areas

For the estimation of bird population sizes over large areas, we developed a methodological approach . This thesis describes and discusses the use of this approach in depth. Quantitative figures for bird population sizes within large geographical areas are important foundations for avifaunal research and are also employed in related fields (evaluation procedures, species and habitat protection). In recent times, such population estimates have been increasing in importance, particularly in the context of regional, national and international monitoring programmes. Therefore, the search for new techniques or the improvement of existing ones for the estimation of population sizes over large areas is highly important and of great interest, not just for the rarer species but also for the fairly common and abundant ones.. Until now, reliable estimates at federal state or national level have often been unavailable, existing figures being subject to unknown, frequently considerable, errors. Current population figures are believed to represent serious underestimates for many of the more common species. Two bird species from different groups, Chaffinch (*Fringilla coelebs*) and Common Buzzard (*Buteo buteo*), were chosen as study objects with model character. In the case of the former species, audial records were accrued and in the case of the latter species, visual records. We were thus able to evaluate the approaches for two very different species by means of using different methods of data collection. The investigations described in the present work were carried out within the last ten years, the relative densities and thus the population sizes for the German federal state of North Rhine-Westphalia (NRW) being determined for the years 2004-2006. The relationship between relative density and abundance was determined mostly using data collected in and around Cologne. For both species, the calculation of the large-area population sizes (NRW) is described in depth. The methodological approach can be compressed into the following steps: 1. Determination of abundance and of relative density on small sample plots; 2. Ascertainment of the relation between the two densities; 3. Determination of the mean relative density for NRW; 4. Calculation of the mean abundance for NRW from the mean relative density; 5. Projection of this mean abundance figure onto the total area of NRW to yield a state-wide total. Two questions are focussed on particularly in this work. Firstly: Is it feasible to quickly establish the relative mean density of the common species by means of spot sampling (transects)?; Secondly: Is it possible to calculate the mean abundance from the mean relative density so as to allow the extrapolation over the total area of NRW?

In the determination of the relationship between relative density and abundance, a high degree of precision was found for both species. This fact is associated with the standardisation procedure being optimised to this end and with the very different densities on the individual sample plots.

The relative densities in NRW for the Chaffinch comprised 42.6 songs per 10 km transect length and for the Common Buzzard 7.96 birds per 10 km transect length and 100% range of visibility. The mean abundance figures calculated employing regression formula or conversion factors came to between 4.3 and 5.1 territories per 10 ha for the Chaffinch and between 29.8 and 38.3 territories per 100 km^2 for the Common Buzzard. After projecting these values over the whole of NRW, the population sizes amounted to 1.47 - 1.74 million and 10,150 - 13,050 territories respectively.

Using the approach described in our work, it was possible to determine the mean relative density over large geographical areas for both species, to convert these into

abundance values and to extrapolate these figures. Comparisons with other scaled-up population figures show that the proposed model yields relatively exact values for large areas at relatively little cost in terms of time and effort, i.e. the method can be practically applied with success and is thus viable.