

METHODOLOGICAL PROBLEMS WITH EVALUATION OF LONG-TERM POPULATION DYNAMICS BASED ON BIRD STATION RINGING DATA

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EXTENDED SUMMARY

(Original paper: Busse P., 1990. Studies of long-term population dynamics based on ringing data. RING 13:)

When a long-term population dynamics study is based on the station ringing data numerous biases could be expected. These are of very different origin: they depend on the locality of a station in relation to the migration pattern of a species, methods of data collection and methods of evaluation of these data.

Looking from the point of view of monitoring problems, one can imagine an model ringing station: (1) located inside a large area covered by homogeneous and stable habitat, where broad front migration occurs, and having (2) highly standardised methods of data collection. A real European bird ringing station is, however, rather far from this ideal model.

LOCALISATION OF THE STATION

Most stations are situated in places where concentration of migrants is expected - on islands, at the sea coast or on mountain passes. Such places allow more birds to be caught, but the number of migrants there is more sensitive to random fluctuations due to weather conditions.

The important requirement of the location of the station in homogeneous and stable habitat is fulfilled very rarely. Homogeneity of habitat allows us to assume the equal catching value of all nets used at the station, which is helpful when the number of nets is not exactly stable. Nets located in varied habitat are not of equal value with regard to the catching of various species, so recalculation of catching results per net or per standard length of nets is automatically biased to different extents for various species. The second mentioned parameter of the habitat - its stability - would be fulfilled fully only at the station located in climax stage habitat. This is practically never the case, as such habitats are very unsuitable for catching birds. It is clear that succession leads to changes in the suitability of the habitat for different bird species, which can cause substantial bias in long-term trend estimation. The problem is solved at the stations in two different ways: (1) artificial standardisation of plant cover at the station area, or (2) movement of the catching area inside a bigger area of similar habitat according to succession. Both typical solutions have their own advantages and disadvantages.

METHODS OF DATA COLLECTION

The most important elements of the field methods are as follows:

- 1) Sufficiently long, standard and continuous period of work,
- 2) Standard number and quality of catching devices,
- 3) Enough numerate and qualified staff.

A two month long period of work is necessary to cover the time of migration of the species in any particular year. Yearly fluctuations in migration time are at the level of ten days, so a two and a half month period of work is sufficient for the species. When more species are studied simultaneously this period would be insufficient.

If the work of the station is carried out every year throughout the standard period the data are directly comparable. In practice there are some deviations from the standard time. In such cases the resultant data are not directly comparable to other years and it is necessary to have an extrapolation of bird numbers to the standard time. The extrapolation could be done on the basis of the average cumulative curve of migration of the species. Due to fluctuations of migration time, variation around the average curve is rather big, especially in the central part of the migration time, so the extrapolation is allowed only for a few marginal five-day periods.

The considerations presented as above are based on an assumption of continuous work of the station - the work is carried out day by day throughout the whole standard period. Any sampling cannot give reasonable data for monitoring purposes - accidental and uncalculable deviations would be much too big. The same is true for any uncontrolled gap in the period of work: a single peak day of migration contains sometimes as much as about 30 % of birds caught in a particular year. That fact leads some of the authors to conclude that peak day values are accidental (depending on the weather) and that they should be damped mathematically before calculation of indices of true population size. However, the conclusion is doubtful and should be further checked: it was suggested that the peak catches are a natural result of high variance connected with high population level.

Extrapolation of catches when the number of nets varies between days or seasons is in common use. However, everybody using such recalculations must be aware that this operation is a source of biases, which could be big and hard to estimate. Especially dangerous are frequent changes in the number of nets and placement of those in use - these can disturb the migration dynamics curve very much and enlarge biases of other extrapolations. Because of that a fixed number of nets and continuous catching are strongly recommended, the latter because of different diurnal activity of migrants during low, moderate and peak migration days.

EVALUATION OF THE STATION RINGING DATA

Yearly (seasonal) station ringing totals corrected, as discus-

sed above, can be presented as raw data curves, where they are plotted against the years of the study. The other method of presenting the data is use of percentage indices of population size, calculated from the raw data in relation to a level chosen as a basic one. When comparisons of the curves from different stations or populations are expected the latter method is recommended, especially when mean population level is accepted as a basis for calculations.

More general trends in population dynamics can be shown as curves based on raw data but smoothed by means of a moving average calculated according to different formulae. From the point of view of population dynamics studies it is important to know whether the yearly fluctuations deform long-term population trends. Examination of some tens of smoothed curves drawn from migrating Passerines leads to the conclusion that in most cases even big year-to-year fluctuations do not alter the general shape of the smoothed curve.

In population dynamics studies the level of year-to-year variation is an interesting parameter, which can be analysed as a special measure of population processes. When this problem is studied one meets a methodological problem with the calculation of the measure of variation. Standard deviation and coefficient of variation are not good measures in that case as they depend not only on year-to-year variation but also on a long-term trend - a shape of the curve and mean size of population - influence the value of these indices of variation. There can be proposed the calculation of another index of variation - the coefficient of fluctuations (C.F.), based on the idea that variation should be expressed as a measure of deviations from the smoothed curve of long-term population dynamics.

Although the study of year-to-year variation of population level is important, most students are primarily interested in the description of long-term population trends and they use a regression analysis as the main method. Different variants of calculations are used which usually give similar results, with differences in robustness only. Regression analysis seems to be a statistical method adequate for the problem of long-term population trends studies, but it must be stressed that population dynamics is much more complicated than simple linear or log-linear trends to which use of that method reduces the problem. Most population dynamics studies, carried out over a long enough time, shows that wave-like, or cyclic population dynamics patterns predominated among studied species of birds. This very-common phenomenon forces caution in the interpretation of the results of regression analyses based on short time-span studies. In population dynamics studies even ten years' data seems to be too short a sample for general conclusions on the welfare of the species. Local, short-term trends can be drastically different from a really long-term trend.

INTERPRETATION OF THE RESULTS

It could be generally agreed, that station ringing data collected and evaluated with all the cautions discussed above give sufficiently good information about real number dynamics of migrants passing through the station. However, here is the next methodological problem: "what population is represented by the studied group of migrants?". The problem is important, as looking for causes of year-to-year variation in population level and interpretation of whole-population dynamics needs fixing of the breeding and wintering areas of the population studied. In some cases it is possible to find them by ringing recoveries analysis alone, in others more complex bird migration studies must be included. It should be stressed here that apparently natural assumptions on native areas of migrants taken as a basis for correlation analyses are frequently doubtful as to correctness, which leads to poor correlations between ringing station data and breeding bird censuses.