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USE OF MIST NETS FOR MONITORING LANDBIRD FALL POPULATION TRENDS, AND COMPARISON WITH OTHER METHODS

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Abstract. In Central Europe, a long-term trapping program based on mist netting has been carried out since 1972. In this "MRI-program," about 40 migratory landbird species are studied annually throughout the fall migratory period. Netting figures from this strictly standardized program are used to monitor trends of populations. Comparisons with other data show that the method can detect trends similar to those from breeding-season studies. Some illustrative examples are presented.

Key Words: migration, mist net, MRI-program, population monitoring.

In 1972, the Max Planck Research Centre for Ornithology, Vogelwarte Radolfzell, initiated a long-term bird trapping program that focuses on a variety of research fields, including migration studies. One of its main purposes is to monitor trends in population size. The program is based on mist netting of about 40 migratory landbird species during the complete fall migratory period. The program was named "Mettnau-Reit-Illmitz-Program" ("MRI-program"), after the large trapping stations in Germany and Austria where it was initially launched. It was extended to five stations in 1992 in eastern Germany and Russia. Up to 1993, about 400,000 individuals (first traps and retraps) were captured. One of the essential characteristics of the MRI-program is to keep the basic conditions for trapping birds as constant as possible, and it is the most standardized long-term trapping program in the world.

Several studies have used annual MRI trapping totals to detect long-term population trends. Trends from the MRI-program for the 10-year period 1974–1983 (Berthold et al. 1986), and from the Mettnau station for the 20-year period 1972–1991 (Berthold et al. 1993) and the 25-year period 1972–1996 (Berthold et al. 1998) were validated through comparison with trends from other studies. Here we show examples for four species.

METHODS

Nets are set up every year on June 30 and used continuously until November 7. Only in 1987 was there no trapping activity, due to flood conditions. All operations of the nets, handling of birds, and data collection have been described in detail elsewhere (Berthold et al. 1991, Kaiser and Berthold *this volume*). All aspects of operations were strictly standardized, even to the extent of nets being set at the same height above the ground each year, and with the same distances between shelf strings.

The study areas are large, mostly with climax vegetation. In addition, vegetation is trimmed to a constant height around the area of the nets.

Because netting is so standardized, there is no need to present results as effort-corrected capture totals, and we use total birds captured within the species-specific fall migration period as the annual index of abundance. Long-term trends in annual indices were calculated as the slope of the regression of annual total number of birds captured on year (Berthold et al. 1993).

RESULTS

Here we compare population data for four species from the MRI-program with independent data from other sources.

The Robin (*Erithacus rubecula*) is one of the few passerine species with no reported recent decline in a central, western, or northern European population. In fact, its populations are considered exceptionally stable (Bezzel et al. 1992, Bauer and Berthold 1997). This is reflected in extremely constant indices according to the Common Breeding Birds Census (CBC) in Britain since the middle 1960s (Marchant et al. 1990; Fig. 1). A strikingly similar pattern was found in the annual netting totals of the MRI-program, with one of the lowest variations from year to year (coefficient of variation 18.96%; Fig. 1).

The Redstart (*Phoenicurus phoenicurus*) is known to be a species with decades-long and essentially continuous decline in large parts of Europe (Hildén and Sharrock 1982, Bauer and Berthold 1997). Only recently have some European populations appeared to stabilize or even increase slightly (e.g., Marchant et al. 1990). Such a long-term decline with a tendency to a possible recent stabilization is also shown in the netting figures from the MRI-program (Fig. 2).

In the Whitethroat (*Sylvia communis*) various investigations have found a population crash of

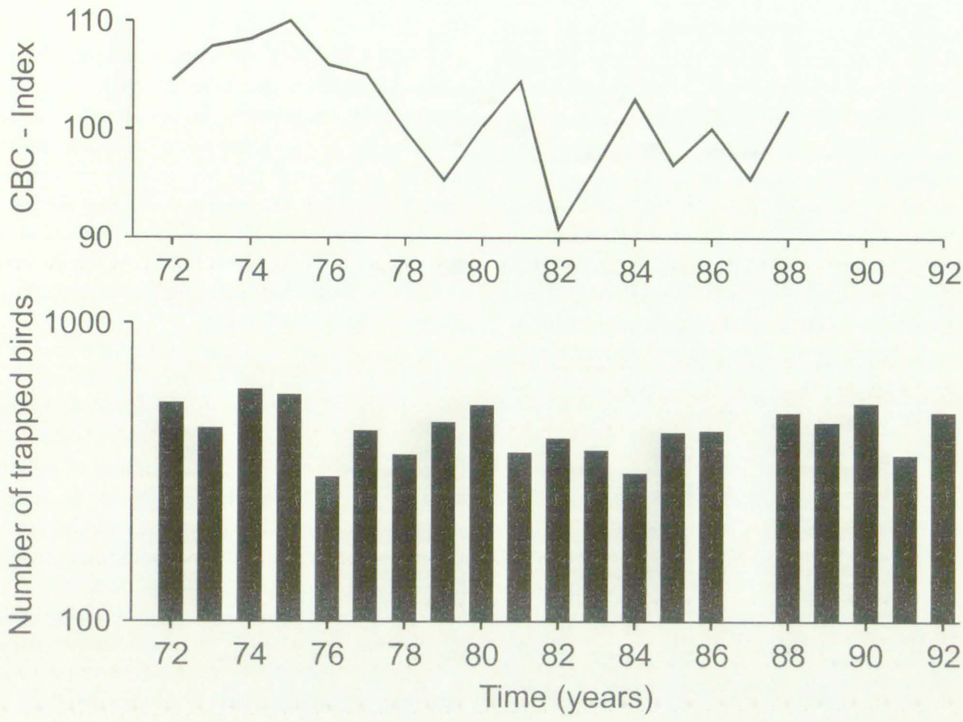

FIGURE 1. Population changes in the Robin. Above: CBC (Common Birds Census) indices from the British Isles (after Marchant et al. 1990). Below: fall netting totals from the MRI-program, Mettnau station, southern Germany (after Berthold et al. 1993).

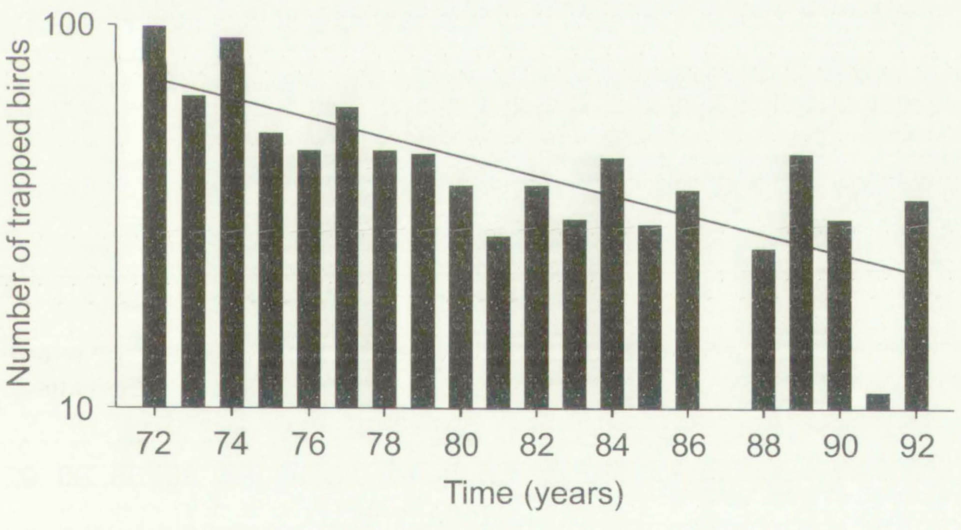

FIGURE 2. Decline in the Redstart, indicated by netting figures (fall totals) and the regression line from the MRI-program, Mettnau station, southern Germany. Slope of the regression analysis = -0.80, N = 909, P < 0.001 (after Berthold et al. 1993).

about 50 to 75% in large parts of Europe since 1968–1969, and a number of local populations have completely disappeared since 1969 (e.g., Berthold 1974, Bauer and Berthold 1997). An exceptionally severe drought in the Sahel zone, south of the Sahara, was recognized as the main cause of this sudden decline (Winstanley et al. 1974). We had just started standardized mist netting in a special "warbler program" on the Mettnau Peninsula in southern Germany in 1968, that is, one year before the population crash of the Whitethroat. These netting activities then merged directly into the MRI-program. They provided the unique opportunity to compare the observed population crash as assessed by our netting figures with the one deduced from the CBC by the BTO in Britain. The patterns of the crash and of the subsequent low population level obtained by the two methods are largely identical (Fig. 3).

The Willow Warbler (*Phylloscopus trochilus*) showed somewhat stable CBC indices in Britain from about 1965 to 1980 (Marchant et al. 1990). Then, it underwent a severe and almost continuous decline of about 60% over the following decade, with only very slight short-term recovery thereafter (Peach and Baillie 1993; Fig. 4). At the Mettnau station, netting rate was fairly constant until 1980, but since 1981 has been gradually dropping. The total decline amounted to 70% between 1981 and 1993. Again, trend in capture rates closely matched the trend in CBC figures for Great Britain (Fig. 4).

DISCUSSION

Factors affecting numbers of migrant birds at a particular stopover site were thoroughly reviewed by Dunn and Hussell (1995). Standardization of effort is important in ensuring that as constant a proportion as possible of the birds that are actually present will be captured on each day and in each year (Ralph et al. *this volume a*). The MRI methodology ensures that this will be the case, such that variation in numbers of birds captured will not simply reflect variation in effort or capture technique.

A crucial aspect of standardization that is often ignored by migration monitoring stations is the need to maintain habitat in the same condition, and vegetation at the same height, from year to year. Even if the same species and number of individuals were present from day to day, growth in vegetation alone could cause changes in the numbers of birds captured. For example, after vegetation grows higher than nets, a higher proportion of birds may fly over nets and avoid capture. Moreover, birds have habitat preferences that will cause them to move elsewhere if there are changes in preferred habitat type and structure (Bairlein 1981; see also Mallory et al. *this volume* regarding capture bias related to habitat structure). MRI stations control vegetation to prevent trends in capture rates over time that could be caused by change in vegetation rather than by change in bird numbers.

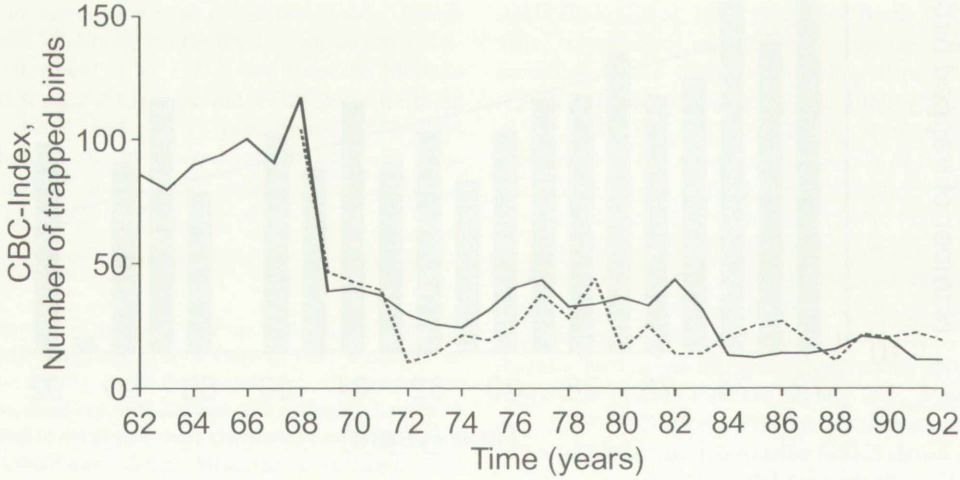

FIGURE 3. Population changes in the Whitethroat. Solid line: CBC indices from the British Isles (after Marchant et al. 1990). Broken line: fall netting totals from the MRI-program, Mettnau station, southern Germany (after Berthold et al. 1993).

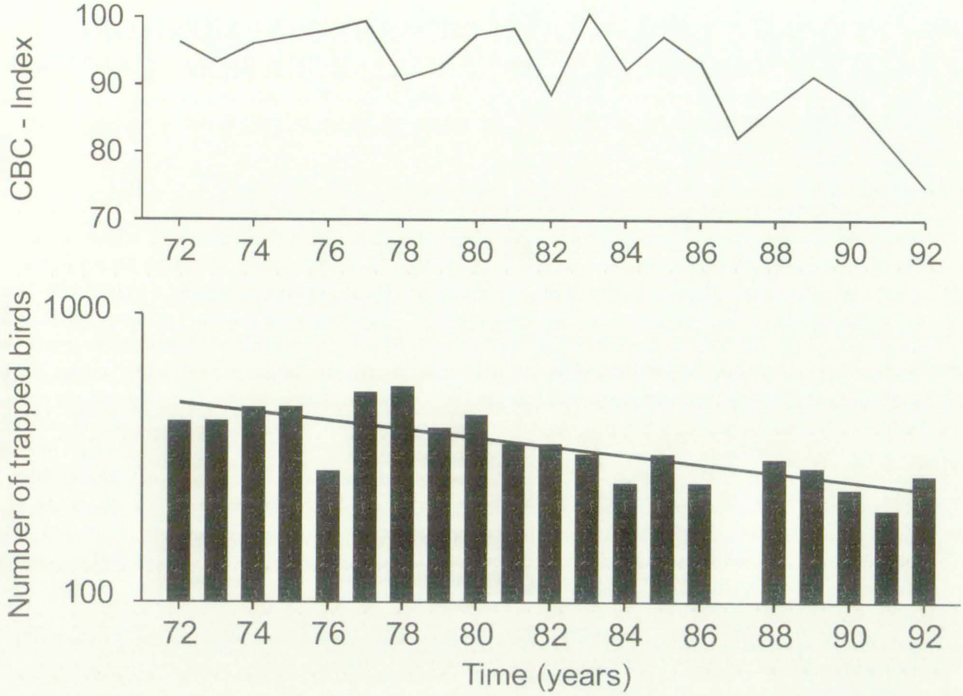

FIGURE 4. Population changes in the Willow Warbler, indicated by netting figures (fall totals) and the regression line from the MRI-program, Mettnau station, southern Germany. Slope of the regression analysis = -0.78, N = 7,240, P < 0.001.

Numbers of migrants captured are also affected by factors other than effort and habitat change, particularly weather (Dunn and Hussell 1995). Although daily sampling reduces the chances that a few days of large migratory flights will not dominate results, log-transformation of daily captures should be routinely used as a minimum treatment for migration counts (Dunn and Hussell 1995). More sophisticated analyses can be used to take into account data on season, weather, and other factors (Dunn et al. 1997, Francis and Hussell 1998), which further reduces variance in the data set and increases precision of population trend estimates (Dunn and Hussell 1995). However, even without any of these treatments, it is clear from the examples in this paper that migration capture data can mirror trends in breeding-population size as determined from independent data sources.

The examples shown compare migration capture data from Germany to breeding-population trends in Great Britain and Germany. Such agreement in the trends as demonstrated would only be expected for species that are changing in the same way over large areas. This will not be true of all species, and one of the unanswered questions for most migration monitoring stations is knowledge of the origin of migrants coming through their sites. In some cases birds from different breeding populations can be distinguished by plumage and measurement differences, and it is important that these data be collected to help identify the breeding populations that are being sampled (Berthold et al. 1991).

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