



## Annual Bird Ringing Totals and Population Fluctuations

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## Annual bird ringing totals and population fluctuations

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Ringling of migrant birds has taken place at Ottenby, Öland, southeast Sweden since 1947. The effect of the winter weather in northwestern Europe on the wren *Troglodytes troglodytes*, of precipitation in the Sahel zone on the common whitethroat *Sylvia communis* and of the use of alkyl mercury compounds in Swedish agriculture on the yellowhammer *Emberiza citrinella* are clearly seen in the ringing figures. These examples illustrate the usefulness of ringing statistics for migrant birds in environmental monitoring.

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### Introduction

Bird ringing figures have been used in attempts to study short term fluctuations or long term trends in populations of migratory birds (e.g. Berthold 1972, 1973, 1974, Busse 1973, Hildén 1974, Dalberg Petersen 1976). However, in such studies the sources of error are many and may include: (a) changes in trapping routines and the trapping equipment used, such as the number and position of mist nets, (b) changes in the environment at the ringing site, and (c) changes in the general weather situation from year to year. These factors, which of course are not in any way related to the actual size of the populations studied, clearly influence the number of birds actually trapped (Berthold 1976). They are also very difficult, if not impossible, to correct for properly although attempts have been made (Busse 1973, Dalberg Petersen 1976). According to Berthold and Schlenker (1975) more or less total standardization of the work is necessary to make ringing figures comparable from year to year. Berthold et. al. (1976) presents some drastic examples of what may happen if such standardization is not applied.

The Ottenby Bird Observatory is situated on the southernmost tip of the island of Öland, which lies off the southeast coast of Sweden. It is located within the small residential area (100 × 150 m) around a light-house. This small area is well vegetated, but surrounded

by open meadows with the nearest forest or shrub vegetation at a distance of 2 km. Regular ringing of birds in autumn began in 1947 and in spring in 1950. Although no attempts have been made to standardize the ringing activity in the sense of Berthold and Schlenker (1975), the trapping at Ottenby has at least always taken place within the same small area, and the trapping routines and the environment in which trapping has taken place have been roughly constant. Fig. 1 shows a marked increase in the numbers of birds ringed through the years. There are two possible reasons that must be considered: (a) the numbers of birds passing at Ottenby have actually increased (cf. Järvinen and Väisänen (1977) who found that almost every second of the 56 most common land bird species in Finland had doubled its population during the last 30 years), (b) the trapping efficiency has increased, especially through the introduction of mist nets. Both of these factors have probably contributed to the increasing numbers of birds ringed, whereas the lengthening of the trapping season (Fig. 1), only affects the figures for early and late migrants, before 15 April and after 31 October (cf. Edellstam 1972).

Weather factors obviously affect ringing success. The days with high ringing figures often reflect an abrupt change in weather, from favourable to unfavourable for migration. The leading-line effect with respect to Ot-

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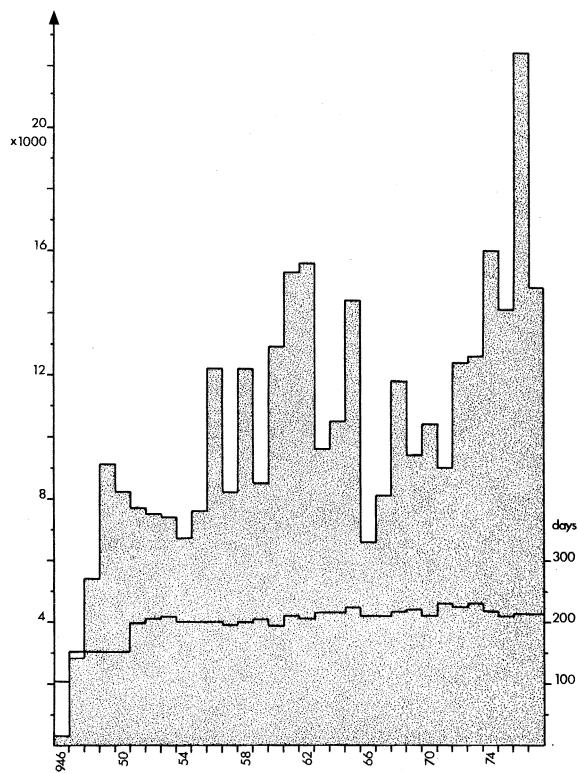


Fig. 1. Below: Days per year that work has been carried out at Ottenby Bird Observatory. The distinct increase in 1951 indicates the extension of work to the early spring season. The later more gradual increase mirrors a further prolongation of the seasons, with earlier opening and later closing dates. Above: Annual totals of birds trapped in the observatory garden (mainly passerines). Waders, ducks and birds of prey caught elsewhere are not included.

tenby of the north-south running coasts of Öland is strong in autumn, especially during less than optimal weather conditions, but small or nonexistent during spring. This obviously applies also to night migrants, of which there is often a marked second influx 2–3 h after dawn, when birds are actually seen descending into the garden – after having travelled some distance in full daylight. Thus during spring the ringing figures are probably more dependent on the local weather. As they are also smaller in most cases than the autumn figures they are obviously less suitable as indicators of fluctuations in population size.

A program aimed at evaluating the ringing figures for different species at Ottenby during the last about 30 yr has recently started. The objective is to test if these figures, for single species or groups of species, can be used in environmental monitoring (cf. Berthold and Schlenker 1975). This paper presents three case studies where single environmental factors seem to play, or to have played, a critical role in determining population levels. These cases are: (1) The wren *Troglodytes troglodytes* versus cold or mild winters in northwestern

Europe, (2) the common whitethroat *Sylvia communis* versus rainfall in the Sahel zone of Africa, and (3) the yellowhammer *Emberiza citrinella* versus the use of certain pesticides in agriculture.

### Wren *Troglodytes troglodytes*

As a small insectivorous bird the wren is known to suffer greatly from severe winters (Dobinson and Richards 1964, Parslow 1967, Batten 1969, 1971, Ginn 1969; cf.

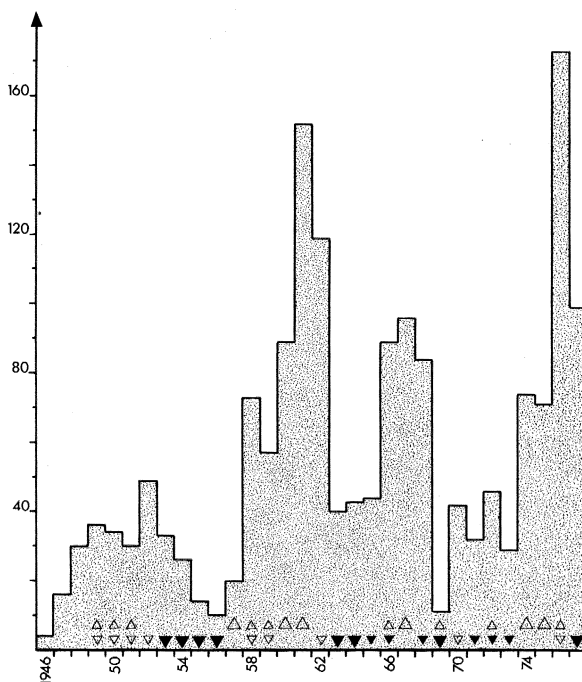


Fig. 2. Autumn ringing figures at Ottenby 1946–77 for wren *Troglodytes troglodytes*. Triangles indicate temperatures in winter quarters during Jan, Feb and March; based on monthly average data from Great Britain (London), France (Paris) and western Germany (Frankfurt am Main, Stuttgart, Trier) from 1949 onwards. Triangles pointing upwards indicate periods with weather warmer than the long-time average. Those pointing downwards indicate weather colder than average, and filled triangles indicate temperatures below 0°C. Small triangles mean that the period with severe or favourable weather did not exceed one month, or did only affect part of the wintering area. Large triangles normally indicate more long-lasting periods, but may in some cases stand for only about one month, but then with extremely severe conditions. Whereas both cold and warm periods may have occurred during winters with only small triangles, this was rarely the case during winters with large triangles, which thus indicate more stable conditions. Even though the ringing figures for the very first years at the observatory may not be fully representative, it should be mentioned that the winter 1946–47 was a very severe one (Ticehurst and Hartley 1948). The correlation between temperatures in winter quarters and number of ringed wrens is significant (Fisher's Exact Test,  $p < 0.01$ ). "Cold" and "warm" refer to cases with a single symbol; + or – means a change of more than 10% compared with ringing figures in the preceding autumn: warm: +4, –0; cold +2, –10.

also Hildén 1974). The Fennoscandian population of this bird spends the winter in central, western and northwestern Europe. Birds ringed at Ottenby have been recovered in France and Great Britain, and other Swedish wrens have also been found in Denmark, Germany, Holland and Belgium (e.g. Österlöf 1971, 1973, 1975a, 1976, 1977). There is also a single recovery from southern Spain (Rendahl and Vestergren 1959).

Fig. 2 shows the ringing figures for the autumn (July–November). Spring figures (March–June) are much smaller than autumn figures, and are probably also influenced by the opening date of the observatory, and have thus been excluded. Fig. 2 also indicates the general type of weather experienced in central, western and northwestern Europe during the preceding winter; based on data from one station each in Great Britain, France and western Germany (NOAA 1949–76).

Distinct declines in the numbers ringed at Ottenby during autumn are correlated with one or more preceding winters with periods of hard weather. In the same way can distinct increases in the autumn ringing figures be correlated with previous mild winters (Fig. 2).

A comparison between Figs 1 and 2 indicates a correspondence between high (or low) trapping figures for wrens and high (or low) total trapping figures. This is probably due to the fact that a very large part of these total trapping figures are made up of birds belonging to species like goldcrest *Regulus regulus* and robin *Erithacus rubecula*, which presumably are similarly affected by the winter weather in western Europe.

### Common whitethroat *Sylvia communis*

The common whitethroat populations of large parts of Europe crashed between the breeding seasons of 1968 and 1969. The decline registered by the Common Bird Census of the BTO in Britain (Batten 1971) was 77%, that in spring at Vogelwarte Helgoland was 87% (Vauk in Berthold 1973) and that at Vogelwarte Radolfzell in the autumn 1969 – after the breeding season – was 53% (Berthold 1972). This crash and the further very distinct decline in numbers of whitethroats through the following years, which was largely paralleled by the populations of birds like redstart *Phoenicurus phoenicurus* and sedge warbler *Acrocephalus schoenobaenus*, have been widely discussed (e.g. Glue 1970, Berthold 1972, 1973, 1974, Winstanley et al. 1974, Stolt and Österlöf 1975, Dalberg Petersen 1976). Most evidence seems to indicate that this decline was caused by the period of successively increasing drought within the Sahel zone of Africa from the 1960's until 1973 (climatic data in Dalby and Harrison Church 1973, Winstanley 1973a, b, Winstanley et al. 1974, Rapp 1976, WMO 1976, UN 1977). In these semiarid or arid areas the amount of the annual precipitation, which falls between May and October, is extremely important for the availability of food throughout the winter. Those species showing a decline

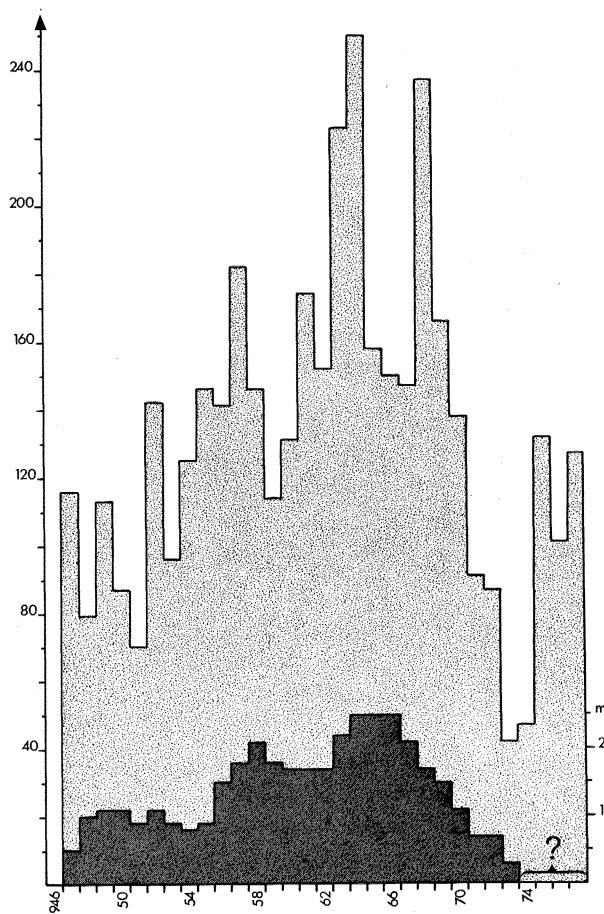


Fig. 3. Autumn ringing figures at Ottenby 1946–77 of common whitethroat *Sylvia communis*. Also shown is the maximum annual water level in Lake Chad (darker area) the preceding year, according to Matlock and Cockrum (1974).

in numbers similar to that of the whitethroat either spend much time in the Sahel putting on fat before and restoring fat after crossing the Sahara or, like the whitethroat itself, may remain there for the entire winter (e.g. Elgood et al. 1966, Moreau 1972, Morel 1973). Thus it is easy to realize how such a period with severe drought may influence the numbers of these birds.

Common whitethroats ringed in Sweden have been reported in autumn or spring from all around the Mediterranean basin; from Spain and France, over Italy and Yugoslavia to Greece and Lebanon, and from Egypt over Libya to Algeria (e.g. Rendahl 1960, Österlöf 1964, 1965, 1969, 1971, 1973, 1976, 1977). However, up to now there is only one recovery from the winter quarters, of a bird found in southern Chad in November (Österlöf 1975b).

The annual ringing totals at Ottenby have varied between 90 and 500, with the spring figures being larger in some years and the autumn figures in others. Thus, contrary to what is the case with the wren and the yel-

lowhammer, the autumn figures do not dominate the annual totals. However, Fig. 3 shows only autumn figures; the spring figures have been excluded for reasons discussed below.

The autumn figures show an increase from the late 1940's up to the mid 1960's, then a decrease until 1973 after which they started to rise again. Both the onset, culmination and end of this cycle was well synchronized with that of the precipitation within the Sahel, as mirrored both by the precipitation curves given by Winstanley et al. (1974), the curves for the discharge of water in the rivers Senegal and Niger (Paris-Teynac 1974, Sircoulon 1974; reproduced in Rapp 1976) and the annual maximum water levels of Lake Chad (Matlock and Cockrum 1974; reproduced in Rapp 1976).

The water level of Lake Chad, which lies within the central part of the Sahel zone, should reflect the water budget of the area rather well, and we have used the above mentioned annual maximum levels (Fig. 3, bottom) for a comparison with the spring and autumn figures for whitethroats at Ottenby the following year (Figs 4 and 5). For the spring figures 1950–73 (except 1966–67 when there were restrictions on ringing at Ottenby) there is no correlation, but for the autumn figures 1947–73 there is a strong correlation ( $r = 0.72^{***}$ ), which indicates a clear relationship between the autumn ringing figures for whitethroats at Ottenby and the ecological conditions in the Sahel the preceding winter. This must mean that not only are the conditions in winter quarters critical for the size of the spring population, and perhaps also for breeding success (cf. Cabot and

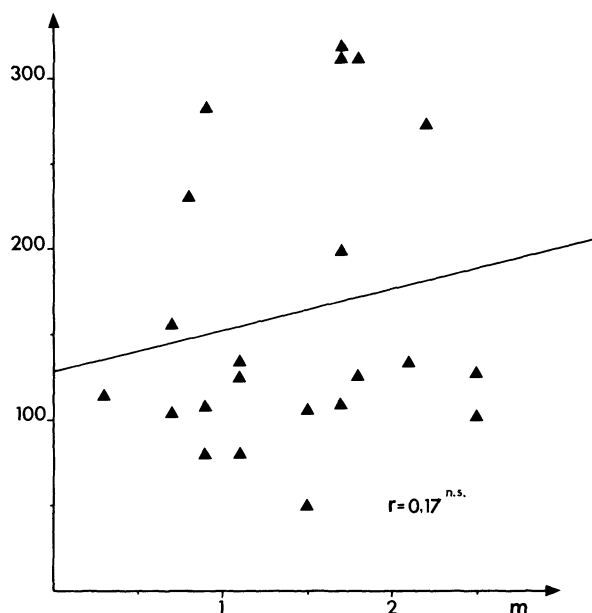


Fig. 4. Relationship between maximum water level in Lake Chad one year and the number of ringed whitethroats *Sylvia communis* at Ottenby the following spring (1950–73, except 1966–67).

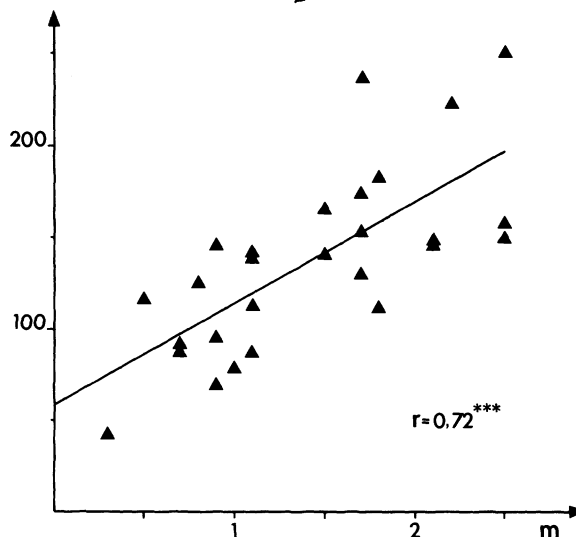


Fig. 5. Relationship between maximum water level in Lake Chad one year and the number of ringed whitethroats *Sylvia communis* at Ottenby the following autumn (1947–73).

West 1973), but that its effect is so strong that it is still conspicuous in autumn (cf. Berthold 1972). Why then the number of birds trapped in spring, when they come more or less straight from the winter quarters (but cf. Persson 1974), do not show the same correlation is strange, but probably explained by the already mentioned fact that spring migration – or rather the appearance of migrants in the observatory garden in spring – is more dependent on the local weather.

#### Yellowhammer *Emberiza citrinella*

The yellowhammer was one of the birds most affected by the use of alkyl mercury compounds for seed dressing in Swedish agriculture. This was indicated by population studies (Otterlind and Lennerstedt 1964, Stolt 1974) and verified by chemical analyzes (Borg et al. 1969, Westermarck et al. 1975). Restrictions on the use of alkyl mercury in agriculture was imposed in 1965 and it was totally banned from Feb 1966. Remaining quantities of already dressed seed were then used through some years following the ban, but on a rapidly decreasing scale, and a striking decline in the degree of contamination of birds was witnessed (Wanntorp et al. 1967, Borg 1968, Odsjö and Olsson 1975, Westermarck et al. 1975).

In Finland, the country of origin for at least some of the yellowhammers passing Ottenby, alkyl mercury was not and is not used in agriculture. Nor has it been used in continental Europe or Great Britain, where many of the birds winter (Westermarck et al. 1975).

Most Fennoscandian yellowhammers, as mentioned above, probably winter in central and western Europe,

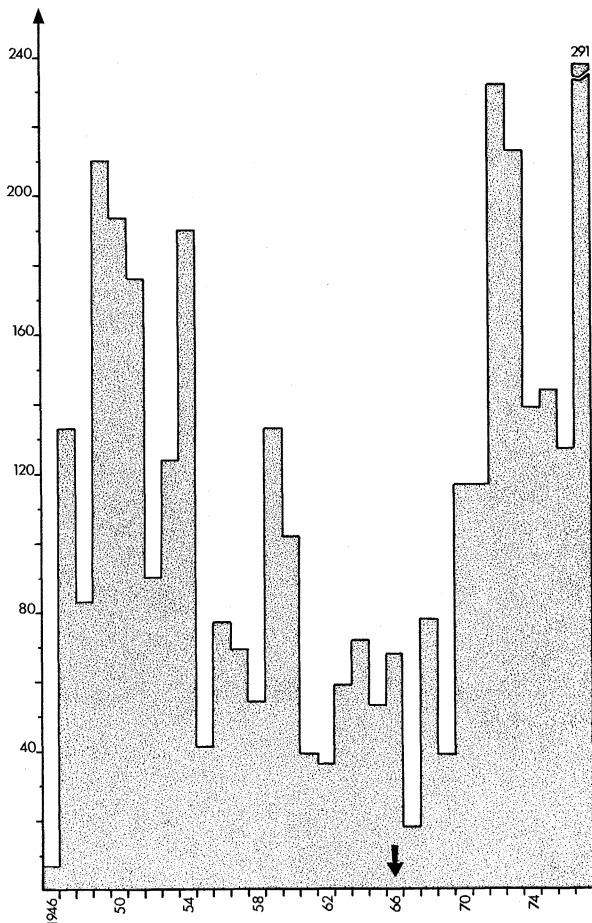


Fig. 6. Autumn ringing figures at Ottenby 1946–77 of yellowhammer *Emberiza citrinella*. The arrow indicates the time of the Swedish ban on the use of alkyl mercury compounds in agriculture.

although quite a few also remain in the north. Many Finnish birds winter in Sweden, and Swedish birds have been recovered in both Norway and Denmark during that time of the year, and are commonly found within Sweden (Rendahl 1959, Österlöf 1964, 1971, 1973, 1975a, 1975b, 1976, 1977). Winter recoveries of birds ringed at Ottenby have been made in Sweden, Norway, Denmark and Germany.

At Ottenby, where a total of more than 3800 yellowhammers have been ringed, the species is a rather scarce migrant in spring, with mostly less than 10 birds ringed each year. In autumn it is much more common and ringing figures fluctuate between 20 and 300. Fig. 6 illustrates the autumn totals, and reveals a distinct negative trend from about 1950 until the mid 1960's. From 1968 the ringing figures started to rise very rapidly, and were by 1972 larger than those of 1950.

It seems very likely that the distinct downward trend in the numbers of yellowhammers ringed at Ottenby from about 1950 to 1967 was caused by the gradually

increasing agricultural use of alkyl mercury, and that the successively increasing ringing figures after the ban reflects the restoration of the population to a healthy and largely uncontaminated level. This development was closely paralleled by other bird populations, e.g. that of the rook *Corvus frugilegus* (Malmberg 1971, 1973).

## Conclusions

What has been said above shows that bird observatory ringing figures can, if they have been gathered under reasonably constant circumstances, be used both to study long term trends and short term fluctuations in the numbers of migrant birds of different species, even if there has not been, or can not be, any total standardization of the trapping. Thus ringing figures are important in monitoring environmental changes.

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