AUTUMN MIGRATION AND WINTERING OF DUNNOCK (*Prunella modularis*) IN HUNGARY

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ABSTRACT

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The study was conducted in the north side of the Ócsa Landscape Protection Area (47°19'N, 19°13'E), between 1983 and 1990, during 7 seasons from the beginning of the autumn migration period to the end of wintering.

Capture-recapture data of migration and wintering birds showed that migration was unimodal between the end of September and the end of October. The majority of migrant birds arrived during the first half of the migratory period and spent only a short time in the area. Birds arriving after the middle of October spent the whole winter in Ócsa in some years while not in others. An analysis of weather data has shown that the weather of the previous year determined the relative proportion of migratory and non-migratory birds in the following year.

We concluded that the migratory and resident strategies co-existed in one population. Differential mortality of migrant and resident birds can maintain an equilibrium between the two strategies.

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Key words: Dunnock, migration, wintering, Carpathian basin, weather

INTRODUCTION

The main continental populations of the Dunnock breeding in the north migrate to winter to the Mediterranean area (Zink 1975, Cramp 1988). Breeding in the Carpathian basin is sporadic, though numbers have been increasing in recent years. The species is a frequent migrant during spring and autumn, and over-winters in varying numbers. There is only small amount of recoveries which suggest Polish and Scandinavian origin and wintering on the Apennine Peninsula of migrants.

Dunnocks wintering in the Mediterranean area show unusually high site attachment as well as site fidelity during winter (Benvenuti and Ioale 1980, Sultana and Gauci 1982 in Cramp 1988, Ioale and Benvenuti 1983). Attachment is probably

formed by an imprinting-like mechanism (similar to other species) during a sensitive period at the beginning of winter, as it has been proven by several displacement experiments (Ralph and Mewaldt 1975, 1976; Ketterson and Nolan 1990; Schwabl *et al.* 1991). Winter territoriality is also characteristic for Dunnocks wintering on the British Isles (Birkhead 1981). Dunnocks wintering in the northern parts of their wintering area behave differently, their level of site attachment is lower, and they may spend subsequent winters in different areas (Zink 1975).

The Carpathian basin lays outside typical wintering area of the species. Birds wintering here meet unpredictable environmental conditions during continental winters, what renders site fidelity pointless, since returning individuals may face completely different circumstances from year to year.

Our study examines the Dunnock's migration in the Carpathian basin as well as the yearly differences in the number of birds wintering in the netting area.

MATERIAL AND METHODS

The study was conducted in the north side of the Ócsa Landscape Protection Area (47°19'N, 19°13'E), between 1983 and 1990, during 7 seasons from the beginning of the autumn migration period to the end of wintering (September-March).

Birds were captured with mist-nets in a bog edge and in a hedge between agricultural fields and reed-beds. The nets' position were the same during subsequent years. Captures were conducted two days per week. During the 7 years altogether, 1325 individuals were captured: 170, 125, 153, 231, 269, 117 and 170, respectively.

Data were analysed from the following aspects:

1. The process of migration was studied based on the number of captures and recaptures.
2. Within the migratory time two periods were separated, before and after 15 October, according to the pattern of recaptures. The proportion of recaptures was computed for each period.
3. The proportion of recaptured birds in the second period (potential wintering birds) was plotted against the mean winter temperature of the same and the previous year. Weather data was obtained from a monitoring station 15 km away from the study area.

RESULTS

Autumn migration in the study area starts on the turn of September. The distribution of captures shows apparently one wave migration, however birds can be grouped into two groups according to the length and pattern of their staying in the area. These two groups can be easily separated every year, the division line being always in the third week of October (Fig. 1).

According to the distribution of recaptures, birds arriving at the beginning of the migratory wave leave the area quickly until the second half of October. Majority of

the birds arriving in the second half of the migratory period stay in the area for the whole winter, their number and proportion, however, varies from year to year. After November practically no new birds arrive. Some birds wintering in the area were recaptured several times until the beginning of February.

The first group's quick migration through the area is also suggested by lower proportion of recaptures in this period (5.1-16.7%). Birds spend short time in the area, the maximum is 20 days. On the other hand, the proportion of recaptures in the second group is higher (8.5-24.3%), and the length of their staying is longer – some of them spend here more than 100 days (from the end of October to February). The proportion of over-wintering birds in the second group does not show any significant correlation with the mean temperature of the same winter ($r = 0.37$, $p > 0.05$) (Fig. 2), but it is significantly correlated with that of the previous one ($r = 0.83$, $p < 0.05$) (Fig. 3).

DISCUSSION

Dunnock is a polytypic species with 7 subspecies, of which only *Prunella modularis modularis* can be found in the study area. This subspecies breeds in Central and Northern Europe from France to the Ural Mountains, from Scandinavia to the Alps and the Southern Carpathians (Cramp 1988). According to wing shape studies, Scott (1962) has found 4 populations within this subspecies (*P. m. modularis*) in Europe. Nitecki's (1969) studies conducted on the Polish coast have found that Dunnocks migrate in 3 waves. Comparing his results of wing shape measures with those of Scott, he suggested the first and third wave coming from Scandinavia, while the second one – from the Baltic area.

At Ócsa, migration takes place in one wave. Although migrants most probably fly to the Apennine Peninsula, migration peak here is in approximately the same time as in Lombardy, North Italy (Schubert *et al.* 1986).

Within the migratory wave, a difference of stop-over length can be found between birds arriving in the first and the second half. However, the groups do not differ in their wing-formula (Csörgö in press), therefore the variance is not caused by population differences or populations do not differ in this respect.

Among the various migratory strategies, partial migration is the most complex and, in many aspects, the least known type (Alerstam 1993). The reason of its development is that advantages (spending the adverse period of winter in an area with better environmental condition) and disadvantages (major energy use of migration, increased predation, different ecological circumstances of the wintering area) do not favour either migrant or resident strategies in species' individuals living in certain areas. One part of these individuals migrates, another – does not, but difference may often be found only in the distance of migration route. Different behaviour can be found in the different ages, sexes of the same population (Lack 1943-44, 1968). The migratory behaviour of an individual is determined by the joint effect of several factors (Berthold 1984). „Probably an equilibrium of genetic, behavioural

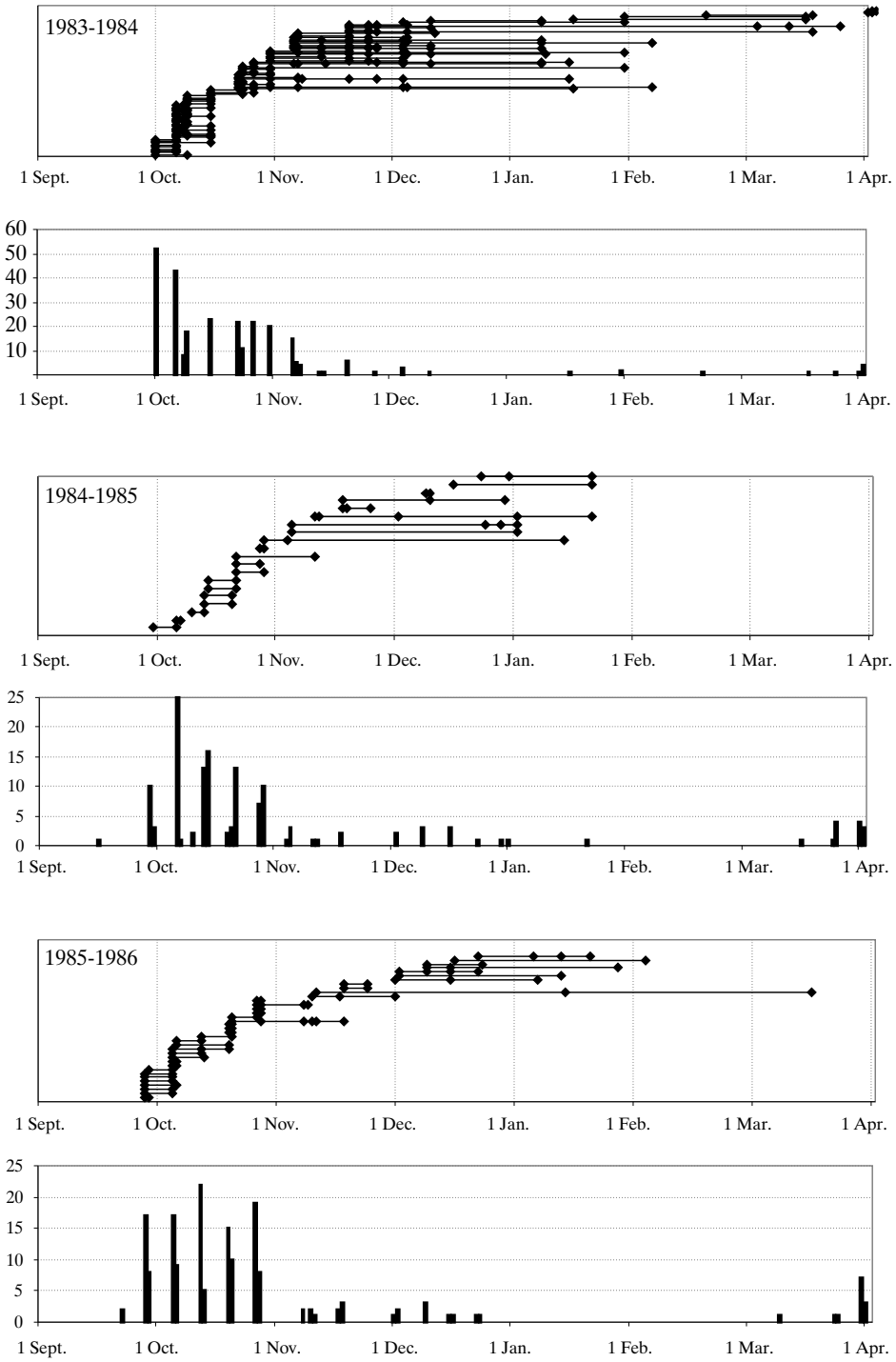
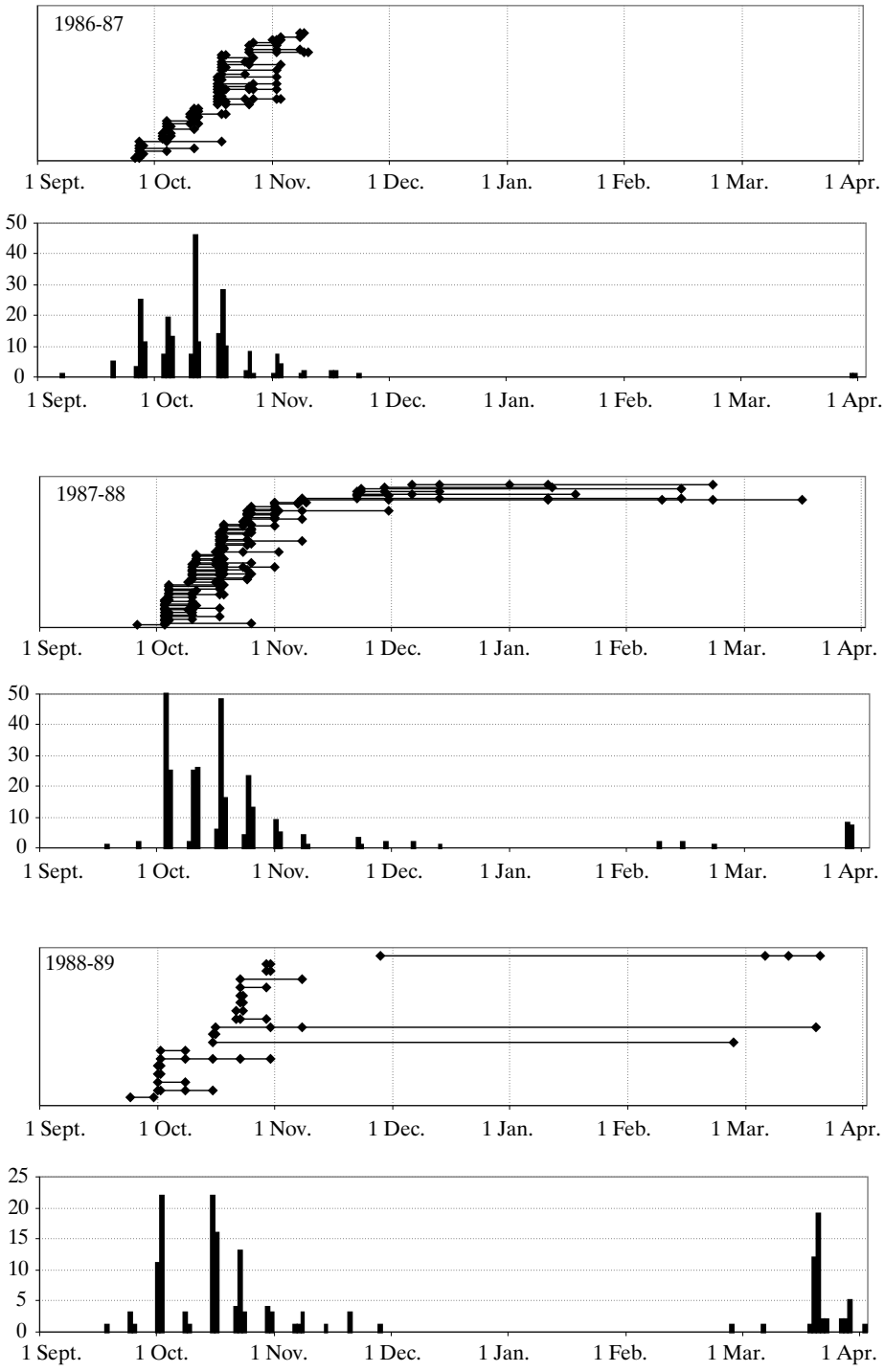
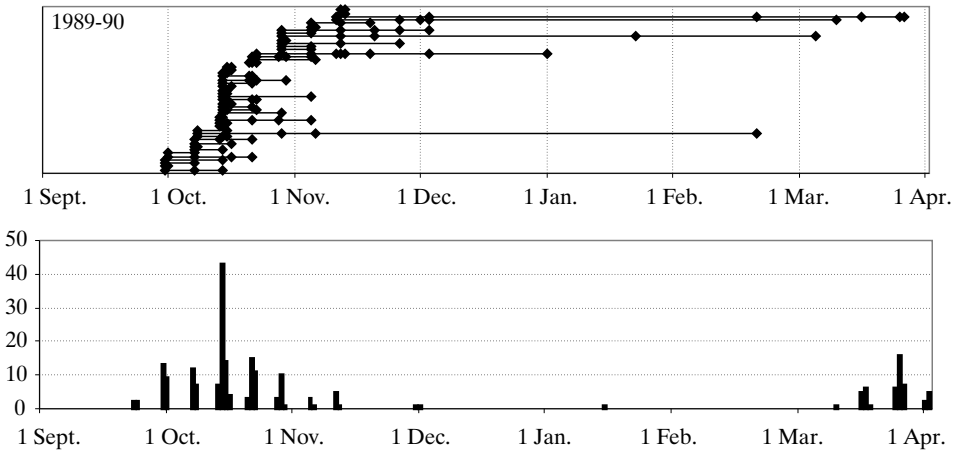


Fig. 1. Number of daily captures (below) and stopover lengths (above) along the consecutive winters.


1986-87
1 Sept.
1 Oct.
1 Nov.
1 Dec.
1 Jan.
1 Feb.
1 Mar.
1 Apr.
50
40
30
20
10
0
1987-88
1988-89
25
15
5



and environmental factors exists under the control of natural selection" (Lack 1968).

Although the role of genetic determination has already been suggested by Nice's (1937) studies with the Song Sparrow *(Melospiza melodia*), proof was only given by later laboratory experiments (Berthold 1981, 1986, 1990; Berthold and Querner 1981; Biebach 1983). According to these, proportion of migrants was higher in offspring of pairs of birds with migrant predisposition than among offspring of migrant-nonmigrant or nonmigrant-nonmigrant pairs.

The effect of environmental factors was shown by Dhondt's (1983) studies of the Stonechat *(Saxicola torquata*). According to his result, „the number of wintering birds correlates significantly with the temperature of the previous winter". In case of a hard winter, migrants have higher survival chances, therefore their proportion will be higher in next year's breeding population. In case of a mild winter, residents or birds migrating only smaller distances may have higher reproductive success, since they can occupy breeding territories first. The relative success of both migrant and resident strategies is determined by winter weather, and according to the genetic predisposition of surviving individuals, the proportion of migrants and residents in the following generation will shift.

Winter 1982/1983 in Hungary was relatively mild and without much snow – thus resident strategy proved to be successful. According to this, in 1983/1984, many birds spent the whole winter in the area. However, subsequent cold winters turned the trend: both the numbers of the birds and the length of their staying decreased. This was most distinct in 1986/1987. In that year, no Dunnocks were captured after November. Winter 1987/1988 was mild again, but despite this, there were only a few over-wintering Dunnocks. In subsequent years, the number of over-wintering birds slowly increased again due to mild winters. The number of birds wintering in the netting area was correlated with the temperature of the previous winter, not with that of the same.

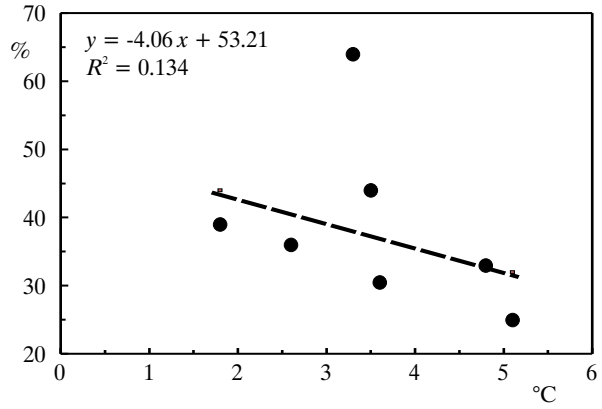


Fig. 2. Correlation between the wintering bird ratio and the average temperature of the current winter.

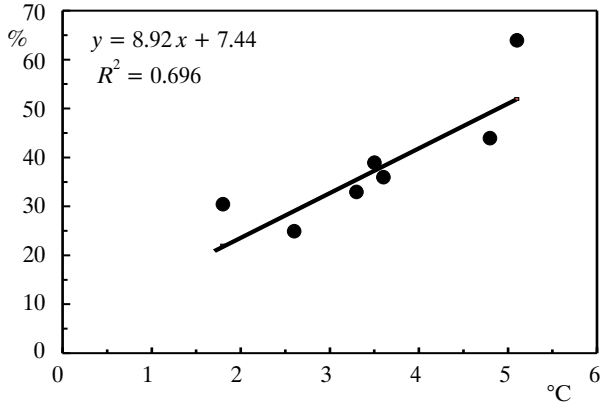


Fig. 3. Correlation between the wintering bird ratio and the average temperature of the previous winter.

In Italy, site fidelity and homing of several passerines were studied (Ioale and Benvenuti 1980, Benvenuti and Ioale 1983) using recaptures and homing success of birds displaced to various distances. The results showed that among studied species, wintering site fidelity was highest in Dunnock. They returned to the same wintering area every year and among displaced birds, Dunnocks had the highest return rate to their territories. Return to the same wintering area year after year is advantageous if environmental conditions are predictable, because feeding and predator avoidance is easier in familiar surroundings. At the same time, site attachment develops only in those species, which regularly winter in the same place, keep feeding territories and fit in the area's bird fauna (Faaborg and Arendt 1984). Dunnock wintering in the Mediterranean area behave this way, too.

The Ócsa results show a different picture: there are no recaptures from previous years and recapture rate in the second migratory group is only around 20% as opposed to the 65% in Italy (Benvenuti and Ioale 1983). This may be explained by the fact that the Dunnock's main wintering area is in the Mediterranean area, and birds

stopping in the Carpathian basin take a risk of unpredictable weather and feeding conditions, which may be offset by the advantage of fast return to the breeding area. Site fidelity in these northern wintering hazardous birds is pointless, since the weather and food abundance of subsequent years is unpredictable. Therefore, no selection pressure works toward site fidelity. The behaviour of Dunnocks wintering on the northern edge of the wintering area is similar to the seed-eating invasive species of the Palearctic (Yunick 1983, Csörgö and Molnár 1991). Costs and benefits of the two strategies change year by year as the winter weather condition fluctuate. This makes it possible that the two alternative strategies can exist beside each other.

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