Different timing of the migration of “eastern” Dunlin in the Baltic and Adriatic

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We compare the timing of autumn migration of Dunlins showing plumage characters of easternmost C. a. alpina and westernmost C. a. centralis. We call the latter “eastern” Dunlins and distinguish them when they arrive in Europe by both the presence of adult-buff coverts and a complete set of newly grown primaries.

Eastern Dunlins arrived on the Polish Baltic coast in the second ten days of August, about 20 days earlier than on the Adriatic. During late August and September, the proportion of eastern Dunlins in the Baltic was 19.9% of adults, while in the Adriatic the proportion was significantly lower at 6.9%.

We suggest that eastern Dunlins, heading to the central and western Mediterranean, stop in the Black Sea to complete their primary moult, so delaying arrival on their wintering grounds. The proportion of eastern Dunlins in the Baltic is higher than in the Adriatic, probably because their main migration route leads them from Siberia through the Baltic to wintering grounds around the North Sea. Only a small proportion of them cross eastern European inland heading for the Black Sea and Mediterranean. Biometrics suggest differences between the wintering grounds of the sexes, with females outnumbering males along the East Atlantic flyway and vice versa in the Mediterranean.

INTRODUCTION

The nominate subspecies of Dunlin Calidris alpina alpina breeds in a vast area between Scandinavia and North Central Siberia. Eastwards from the Yenisey River it intergrades with C. a. centralis (Engelmoer & Roselaar 1998). The eastern border of the Dunlin population migrating through Europe remains unknown, but there is evidence that some of them originate from an area east of the Ob River (Gromadzka 1989).

There is a quite clear tendency for the number of Dunlins in active moult while incubating or rearing chicks to increase from west to east across their Eurasian breeding range (Gromadzka 1989, Engelmoer & Roselaar 1998, Holmgren et al. 2001). Birds from E Siberia complete their primary moult before autumn migration (Engelmoer & Roselaar 1998) as do Dunlins from N Alaska (Holmes 1971). The Yamal Peninsula seems to be an intermediate area where some birds show no primary moult when breeding while others do (Gromadzka 1989). Birds from the Taimyr probably finish primary replacement before or just after they start to migrate (Holmgren et al. 2001).

Generally, white wing coverts in winter plumage are diagnostic of adult Dunlins and buffish wing coverts diagnostic of juveniles. However, some adults in winter plumage may have “adult-buff” wing coverts with buffish or orange-reddish tips that are grown in late summer or autumn (Gromadzka 1986, 1989) and it has been shown that these are birds that start moulting while still on the breeding grounds (Gromadzka 1989). Engelmoer & Roselaar (1998) claimed that the presence of these coverts is a typical character of C. a. centralis. These adult-type buff coverts can be distinguished from juvenile coverts because they lack a dark sub-terminal band (see details in Gromadzka (1986)).

We compare the timing of autumn migration of Dunlins showing plumage characters of easternmost C. a. alpina and westernmost C. a. centralis. We call the latter “eastern” Dunlins and distinguish them when they arrive in Europe in July–September by both the presence of adult-buff coverts and a complete set of newly grown primaries (i.e. a primary moult score of 50).

METHODS

Data from the autumn migration seasons (July–Sept) of 1991–1999 were analysed. Dunlins were caught in Puck Bay in S Baltic and at three different sites along the Adriatic coast: Lagoon of Venice, Cervia salt-pans and Margherita di Savoia salt-pans (Fig. 1). In Puck Bay, trapping was conducted daily using walk-in traps, whereas on the Adriatic Dunlins were caught in mist-nets at night using a tape lure, mainly during short term expeditions. Birds were aged following Prater et al. (1977), and special attention was paid to the presence or absence of adult-buff coverts. Clearly identified second-year birds were omitted from the analysis because they only occurred in small numbers and the timing of their migration
and moult was different (Gromadzka 1986). Hence, our samples comprised almost wholly third-year birds or older (EURING code 6). However, some second-year birds that could not be aged due to completed moult of inner median coverts into winter plumage (EURING code 5) may have been included. Primary moult was recorded following Ashmole (1962) on a 6-point scale, where 0 = old primary and 5 = fully grown new primary. Moult score was used as a measure of the progress of primary replacement and was not adjusted to take into account the different mass of each primary. Other biometrics recorded were wing length (maximum chord), total head length, bill length and tarsus-plus-toe length. To ensure accuracy, these parameters were measured twice by two teams working independently. Where the two measurements differed, the mean was used in the analysis.

RESULTS

On the Baltic coast, nearly half of adult Dunlins during post-breeding migration had no active primary moult and had either not started (moult score 0) or had finished (moult score 50; Fig. 2). The birds with active moult (moult score 1–49) comprised 54% of adults caught. On the Adriatic coast, a greater proportion (81%) was in active moult. The difference in moult patterns between the two areas is particularly well pronounced in birds in the later stages of active moult (moult scores 30–49) with proportionately more in the Adriatic than the Baltic (Fig. 2). Moreover in the Adriatic the proportion of birds that had not started moult was much lower than in the Baltic.

In both regions, Dunlins with adult-buff coverts were usually found mainly among those that had finished primary moult (Fig. 2). In the Adriatic, they comprised 40.6% of birds that had completed their moult, in the Baltic 35.4%, a similar proportion ($\chi^2 = 0.50$, $p = 0.480$). However, there was a significant difference in the proportion of birds with adult-buff coverts among those that had not finished growing their

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![Fig. 1. Map of the study areas. PB = Puck Bay, LV = Lagoon of Venice, CS = Cervia salt-pans, MS = Margherita di Savoia salt-pans.](image)

![Fig. 2. The distributions of moult scores in adult Dunlins caught in the Baltic (top) and in the Adriatic (bottom). Black bars = birds with no adult-buff coverts, white bars = birds with adult-buff coverts.](image)

![Fig. 3. The percentage of eastern and non-eastern Dunlins among adults in Baltic (top panel) and Adriatic (bottom panel) coasts during autumn migration (ten-day periods). The number above each bar is sample size. No Dunlins were caught in the first ten days of August in the Adriatic.](image)
outer primary (moult score 49). In the Baltic, 29.0% of such birds had adult-buff coverts compared with only 6.1% in the Adriatic ($\chi^2 = 7.67, p = 0.011$).

The first eastern Dunlins arrived on the Polish Baltic coast in the second ten days of August, about 20 days earlier than on the Adriatic (Fig. 3). Their proportion increased in August, but was more or less stable in September at around 20–24%. In the Adriatic, the proportion of eastern Dunlins was greatest in the last ten days of September, when they comprised 13.7% of all adults (Fig. 3). On the Baltic, from the last ten days of August to the end of September eastern Dunlins comprised 19.9% of adults while in the Adriatic only 6.9%, a significant difference ($\chi^2 = 33.8, p < 0.001$).

The progress of active primary moult of birds in the Baltic and Adriatic was quite similar (Fig. 4). In the second and third ten days of September, the majority were close to finishing. Eastern Dunlins caught in the Baltic were significantly larger than birds which had no adult-buff coverts and/or had finished primary moult, but there were no such differences in Dunlins on the Adriatic (Table 1).

**DISCUSSION**

We assumed that Dunlins reaching the Baltic coast with all primaries renewed in August and September started migration soon after the end of primary moult or just before it. The primary moult of Dunlin on the breeding grounds takes about 48–50 days (Greenwood 1983, Kania 1990). The reported duration of incubation varies between 20 and 24 days and chicks fledge after 18–21 days (Cramp & Simmons 1983). If birds started primary moult in the early stage of incubation (as in NE Taimyr – see Holmgren *et al.* 2001), they could have finished or almost finished just before migration. Hence, such birds arrive in northern Europe with fully moulted primaries.

In Italy, the proportion of birds with all new primaries increased gradually throughout September. In August and September, most adults that were in active primary moult finished in October, while the bulk of the wintering population appeared later and had already completed moult (Serra *et al.* 1998). This second group probably reaches the Adriatic coast after stopping over to moult on the northern coast of the Black Sea (Serra *et al.* 1998). In southern France (Camargue), the proportion of Dunlins with all new primaries increased from mid September, but the most pronounced increase was noted in the first ten days of October (Fuchs 1973). Therefore it seems that birds with all new primaries (and among them “eastern” Dunlins) arrive in the western Mediterranean 4–6 weeks later than in the Baltic, where in the last ten days of August they comprise up to 35% of all adults (WRG KULING unpubl. data). Hence, we suggest that “eastern” Dunlins heading to the central and western Mediterranean stopover in the Black Sea to complete their moult; so delaying arrival on their wintering grounds. A lower proportion of adult-buff adults that had almost but not quite finished primary moult (moult score 49) in the Adriatic than in the Baltic supports our hypothesis.

The overall proportion of eastern Dunlins in the Baltic is higher than in the Adriatic. Probably their main migration route leads from Siberia through the Baltic and on to the North Sea and only a small proportion cross Eastern Europe

**Table 1.** Measurements of adult Dunlins on the coasts of the Baltic and Adriatic during July–September: “eastern” Dunlins (birds with adult-buff coverts and completed primary moult) compared with all others.

<table>
<thead>
<tr>
<th>Parameter (mm)</th>
<th>Non- “eastern” Dunlins</th>
<th>“Eastern” Dunlins</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>N</td>
</tr>
<tr>
<td>Baltic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total head length</td>
<td>56.84</td>
<td>2.61</td>
<td>1,607</td>
</tr>
<tr>
<td>Bill length</td>
<td>33.00</td>
<td>3.41</td>
<td>1,608</td>
</tr>
<tr>
<td>Tarsus + toe length</td>
<td>47.6</td>
<td>1.80</td>
<td>196</td>
</tr>
<tr>
<td>Wing length</td>
<td>119.1</td>
<td>3.06</td>
<td>1,343</td>
</tr>
<tr>
<td>Adriatic</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total head length</td>
<td>56.73</td>
<td>2.77</td>
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</tr>
<tr>
<td>Bill length</td>
<td>32.81</td>
<td>2.53</td>
<td>405</td>
</tr>
<tr>
<td>Tarsus + toe length</td>
<td>47.9</td>
<td>1.65</td>
<td>371</td>
</tr>
<tr>
<td>Wing length</td>
<td>118.4</td>
<td>3.01</td>
<td>267</td>
</tr>
</tbody>
</table>
heading to the Black Sea and Mediterranean. Thus, the eastern Dunlins that pass through the Baltic seem to be a rather different group to those wintering in the Mediterranean.

The lack of morphometric differences between eastern and non-eastern Dunlins in Italy is probably a result of a skewed sex-ratio in the sample. On the Adriatic, a proportionally lower number of (larger) females than (smaller) males were caught (Fig. 5). This suggests that males and females of eastern Dunlins migrate through different stopover sites and probably also to different wintering areas (see van der Have et al. 1997). In Dunlin, females leave the breeding grounds before males (Cramp & Simmons 1983) and therefore may start and finish primary moult earlier.

The use of different catching techniques in the two study areas might explain some of the observed morphometric differences. The walk-in traps used on the Baltic are a very effective method for catching waders (Meissner 1998), but might be selective towards the smaller sex. However, this is only likely to apply to larger species, like Bar-tailed Godwit *Limosa lapponica* (Meissner & Sciborski 2002). Mist-netting at night roosts with a tape lure might also lead to biased samples (Figureola & Gustamante 1995). However, in this case we can exclude the possibility that capture method led to a sex-biased sample because the size distribution of mist-netted non-eastern Dunlins is not skewed in the same way (data not shown).

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