AUTUMN MIGRATION DYNAMICS OF THE DUNLIN *(Calidris alpina)* AT THE REDA MOUTH (SOUTHERN BALTIC)

Włodzimierz Meissner and Małgorzata Strzałkowska

ABSTRACT

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The study was conducted between 1996 and 2000 at one of the most important stopover sites for waders migrating along the southern Baltic coast. Everyday counts and trapping were performed between mid-July and the end of September. This period covered almost the whole period of adult migration, and a little more than a half of the total period of passage of juveniles. The majority of adults passed the study area between mid-July and the third decade of August. After this period adults were still observed among migrated Dunlins, but their number was rather small. In all seasons except 1996 second-year Dunlins migrated earlier than older birds, however migration periods of both groups overlapped to a large extent. First juveniles were recorded among migrating Dunlins as early as in the second decade of July. They belonged to the Baltic subspecies *C. a. schinzii.* The number of juveniles showed conspicuous increase not earlier than in the last decade of August, when birds of *C. a. alpina* arrived. The intra-seasonal changes in numbers of adults and juveniles showed a clear wavy structure. Two waves seem to be the most common pattern of juvenile migration in the Baltic area. Different factors which might influence the observed variation of migration patterns are discussed. Among them the most important aspects seem to be differences in migration timing between adult males and females and different geographical populations. Also local environmental conditions and weather situation on a route preceding a particular study site might influence the migration timing.

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Key words: Dunlin, autumn migration, phenology, southern Baltic.

INTRODUCTION

The Dunlin is one of the most numerous waders migrating in autumn through the Baltic area (Meissner and Sikora 1995). It was estimated that about 1-2% of adults and more than 10% of juveniles of the East Atlantic migratory population rest at southern Baltic coasts (Kube *et al.* 1994).

The migration dynamics of the Dunlin in this part of Europe was depicted in several papers (*e.g.* Teichmann and Conrad 1984; Brenning 1987; Gromadzka 1987; Kube *et al.* 1994; Dierschke 1995, 1996; Meissner and Sikora 1995). However, many of them presented only many-year dynamics based on five-day periods (pentades) or even decades (Teichmann and Conrad 1984, Brenning 1987, Pettersson 1994, Meissner and Sikora 1995) or results from a single year (Dierschke 1995, Kube *et al.* 1991). Thus, differences in migration patterns among seasons were not analysed, despite the fact that in many waders they can be quite conspicuous (Dierschke 1996, Meissner and Koziróg 2000, Meissner 2005). Only Dierschke (1996) showed daily migration dynamics for each year between 1993 and 1996 at Hiddensee (south-western Baltic coast), but with no separation to adults and juveniles. Pettersson (1994) described the migration pattern of the Dunlin in southern Sweden based on catching results instead of data from regular counts. Obviously, the number of trapped birds depends on different factors, like weather conditions, choosing proper sites to place traps, *etc.* and migration dynamic obtained from catching data might be biased (Meissner 1988, Meissner and Ściborski 2002, Meissner and Huzarski 2006).

The main aim of this paper is to analyse the migration pattern of the Dunlin at one of the most important Baltic stopover sites, with special emphasis on its variability.

MATERIAL AND METHODS

The fieldwork was conducted between 1996 and 2000 at the mouth of the River Reda (54°39'N, 18°30'E) in the Puck Bay – the westernmost part of the Gulf of Gdańsk (Fig. 1). The study area consisted of small sandy islets, a narrow sandy beach and the electric power station ash dumping place. Birds were counted every day about midday at all parts of the site, where they could feed or rest. The fieldwork lasted from mid-July to the end of September, but dates differed slightly among seasons. To standardise this, a reference period was established at 15 July – 29 September, when counts and trapping with standard walk-in traps (Meissner 1998) were conducted every day. According to the results of the field study performed in Puck Bay in Jastarnia (about 15 km from the Reda Mouth), this reference period covered almost the whole period of adults' migration, but only a little more than a half of a total period of the passage of juveniles (Meissner and Sikora 1995). Thus, due to incomplete data the migration of juveniles was not analysed in detail.

To compare the number of migrants in subsequent seasons, the total numbers of birds recorded during counts in all days of each reference period were used. Due to an unknown turnover rate of birds staying in the study area, this sum does not reflect the real number of Dunlins that migrated in a given season. The median retrapping intervals in studied seasons varied between 1 and 2 days in adults and between 3 and 4 days in juveniles (WRG KULING unpubl.) and it was assumed

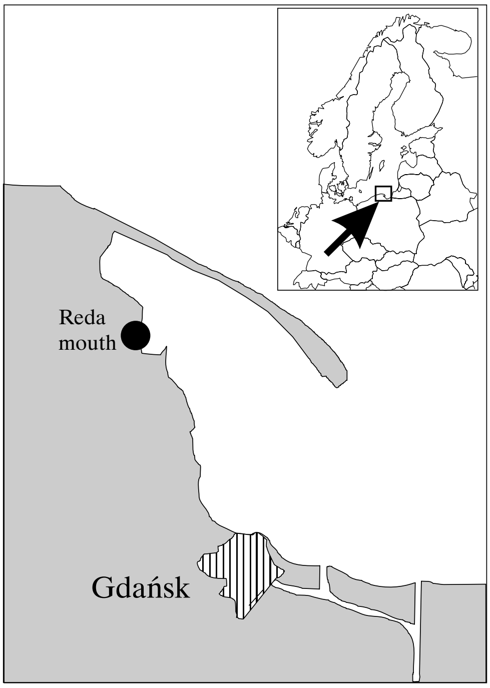

Fig. 1. Location of the study area

that variation in the length of birds' stay among seasons was not that great to have a crucial influence on the observed large differences in totals of counted birds in subsequent seasons. Thus, these numbers were used as a measure of migration intensity. The total number of Dunlins differed in consecutive autumns, therefore in every season the number of birds in subsequent days were converted into the percent scale, where 100% was the total number of a particular age class recorded within the reference period.

The analyses of migration dynamics were performed separately for two age classes: adults and juveniles. All birds in the breeding plumage or with visible traces of the breeding plumage were treated as adults, and in this category second-year Dunlins (immatures) were also included. Thus, in fact the group of adults consisted of two age categories, which may differ in migration timing, because the majority of immatures do not take part in breeding (Soikkeli 1967) and might migrate earlier than older birds. However, Pettersson (1994) did not find any discrepancy in median dates of migration of these age classes in southern Sweden. To confirm possible differentiation in migration timing between the second-year and older birds, trapping results were used. Second-year Dunlins were recognised by the presence of juvenile inner median coverts (Prater *et al.* 1977, Gromadzka 1986).

All statistical procedures were performed using STATISTICA 6 (StatSoft 2001).

RESULTS

Number of Dunlins in different years

The numbers of juveniles showed great fluctuations between years with the highest numbers recorded in 1999 and the lowest in 1998 and 2000. The numbers of adults were noticeably higher in 1996 and 1997 than in other seasons (Fig. 2). There was no significant correlation between the numbers of adults and juveniles recorded in subsequent seasons within the reference period (Kendall rank order: *tau* = -0.20, $p > 0.05$).

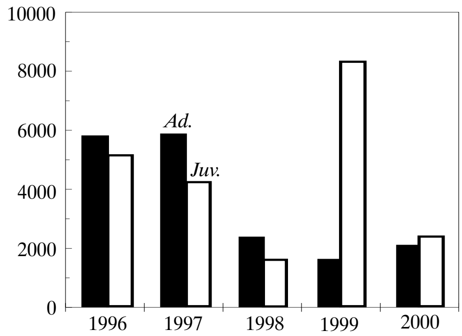

Fig. 2. Numbers of adult and juvenile Dunlins recorded at the Reda Mouth within the reference period in autumns 1996-2000

Dynamics and phenology of migration

Adults

The majority of adults passed the study area before the third decade of August. Only in 1998 high numbers of adult Dunlins were present until the beginning of September. After this period adults were still observed among migrating Dunlins, but their number was rather small. Within the phase of intensive migration (the second half of July – end of August) migration pattern of adult Dunlins presented a conspicuous variability in consecutive seasons. The sets of subsequent days with high numbers of birds (migration waves) were separated by days with a low number. The 5-days running average showed that three such waves could be seen in all seasons more or less distinctly, except for the autumn of 2000, when the bulk of adults passed the Reda Mouth between the end of July and mid-August in one wave (Fig. 3).

In all seasons except 1996 second-year Dunlins migrated earlier than older birds, however, migration periods of both groups overlapped to a great extent (Fig. 4). The proportion of second-year birds differed significantly among all studied seasons (χ^2-test: $\chi^2 = 83.87, p < 0.0001$), but there were no differences between years 1996-1999 (χ^2-test, $\chi^2 = 2.03$, $p = 0.566$). It means that the proportion of the second-year Dunlins in 2000 was significantly higher than in other years (Fig. 5).

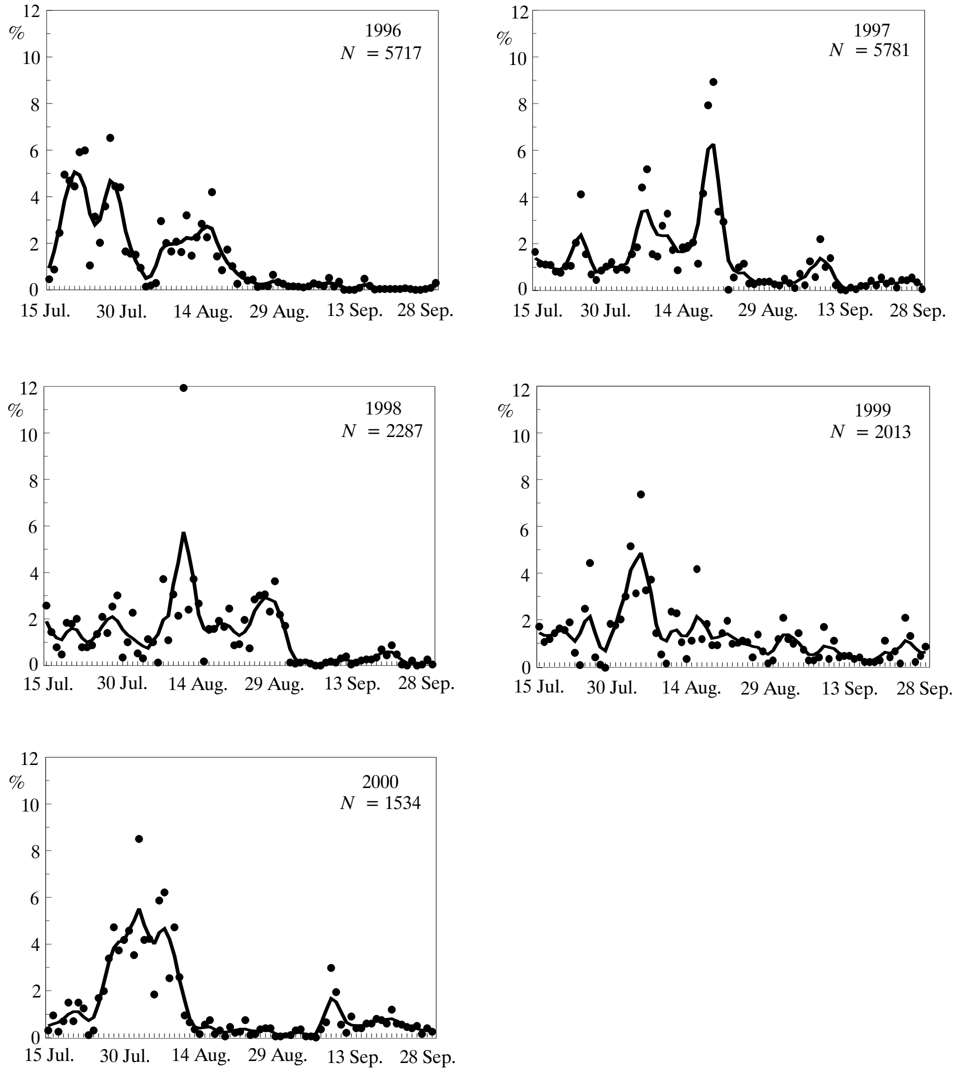

Fig. 3. Migration dynamics of adult Dunlins at the Reda Mouth in subsequent seasons. Results of everyday counts shown as dots, line – 5-days moving average, *N* – sample size.

Median dates of adults' migration in consecutive seasons were negatively correlated with proportions of second-year Dunlins among caught birds (Spearman rank correlation coefficient: r_s = -0.90, p = 0.04). There was no correlation between the number of juveniles observed within the reference period and the median date of adults' migration during a given autumn (Spearman rank correlation coefficient: r_s = -0.30, p = 0.62).

Juveniles

First juveniles were recorded among migrating Dunlins as early as in the second decade of July, but their number showed conspicuous increase not before the last

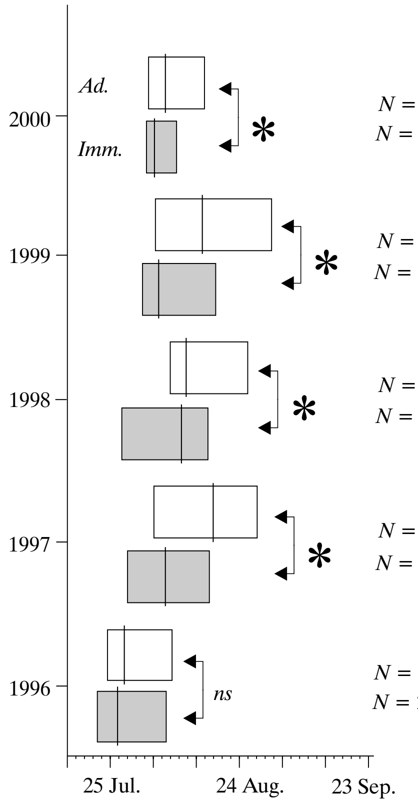

Fig. 4. Phenology of autumn migration of second-year (*Imm.*) and older (*Ad.*) Dunlins caught at the Reda Mouth at subsequent years. Vertical line – median date, rectangle – 25% and 75% of the number of migrants (interquartile range). Significant difference (*U*-test at $p < 0.01$) between both age groups in median dates of migration is indicated by asterisk, *ns* – difference non significant. Numbers on the right side indicate sample sizes.

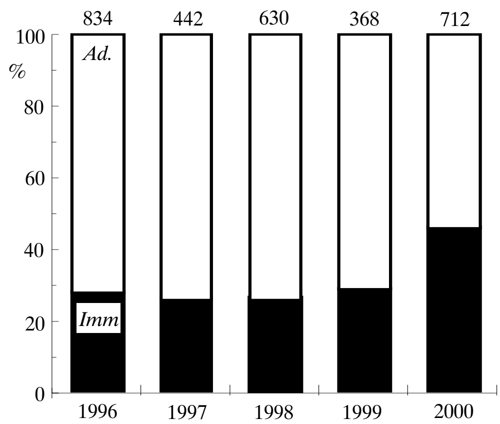

Fig. 5. Percentage of second-year (*Imm.*) and older (*Ad.*) birds among non-juvenile Dunlins caught in following years. Numbers above columns denote sample sizes.

decade of August (1996-1998) or even at the end of the first decade of September (Fig. 6). Within the studied period juvenile birds migrated in two waves in 1996, 1998 and 2000, whereas in 1997 three and in 1999 one wave could be recognised.

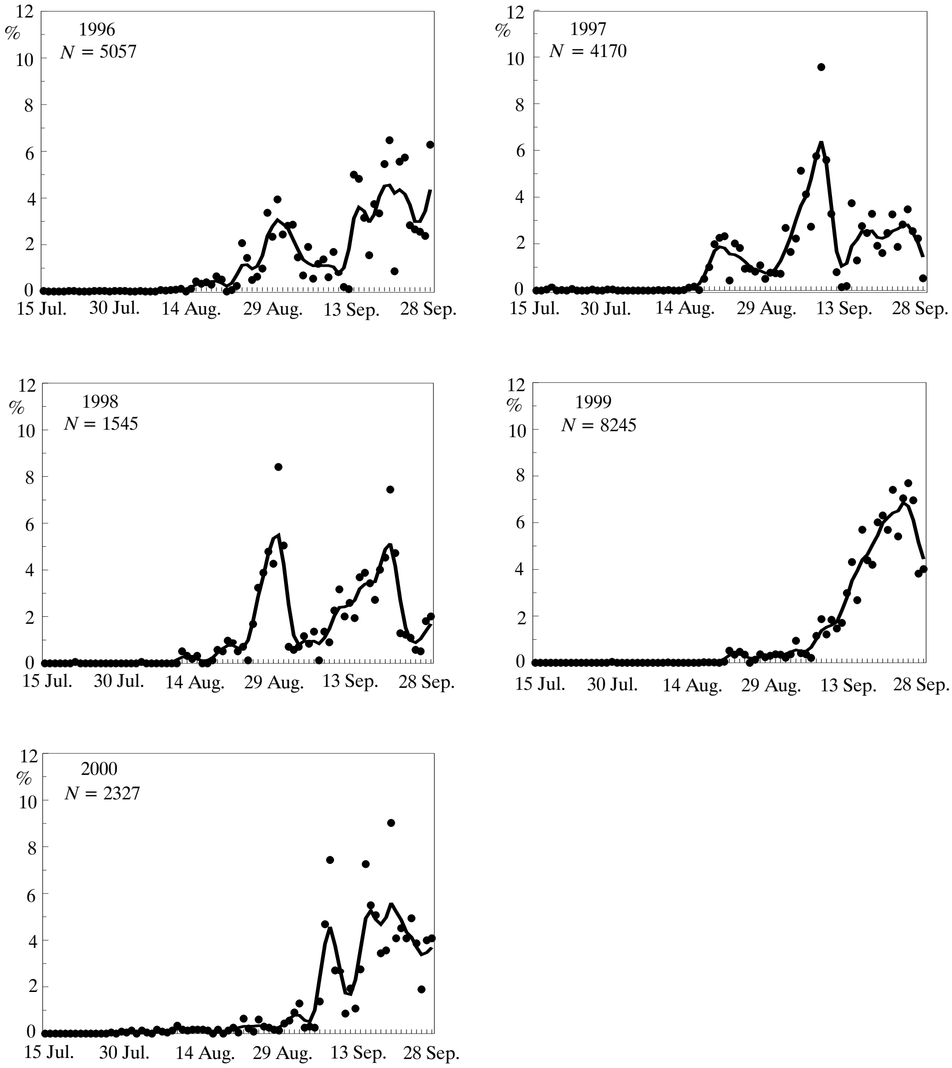

Fig. 6. Migration dynamics of juvenile Dunlins at the Reda Mouth in consecutive seasons. Explanations as in Figure 3.

DISCUSSION

The seasonal wave-like migration pattern has been described not only in passerines (Dolnik 1975, Busse 1996), but also in waders (Brenning 1987, Kube *et al.* 1994, Meissner 2000). It could be caused by different factors, like different migration timing

of various geographical populations, differences in weather situation on a route preceding a particular research site, and local conditions at this site (Busse 1986, Alerstam 1993, Meissner 2000). In Dunlin adult females migrated on average before adult males (Zając 1980) and this phenomenon could be another reason of the wave-like migration pattern. Dunlins passing through the Polish Baltic coast come from a vast area between northern Scandinavia and at least the River Ob in Central Siberia (Gromadzka 1989). The difference in the beginning of egg lying between Dunlins breeding in the region of the White Sea and the Taimyr Peninsula reaches about 13 days (Holmgren *et al.* 2001), thus the more eastern population, the later is the beginning of autumn migration. Adult Dunlins arriving at Baltic coasts in July showed no primary moult and they probably originated from areas west of the Ural Mountains (Gromadzka 1989), but many adults arriving at the Puck Bay in September showed features typical of the easternmost population of *C. a. alpina* or even *C. a. centralis* (Meissner *et al.* 2005).

The breeding success might be another important factor affecting the timing of adults' migration. In the Knot (*Calidris canutus*) in seasons with low breeding success both males and females depart earlier from breeding grounds than in years with high number of juveniles (Meissner 2005). This was not confirmed in the present study, probably due to finishing field studies before the end of the migration period of juvenile Dunlins. In some seasons exceptionally high number of juveniles were recorded on the Polish Baltic coast in October (Gromadzka 1987, WRG KULING unpubl.) and the total number of juvenile Dunlins caught till the end of September might not be the sufficiently precise indicator of the breeding success in a given season.

Dunlins, similar to other waders, can react quickly to differences in local environmental conditions like the water level at the feeding site (Frieling 1966, Reichholf 1972, Meissner 2000). This may be an additional factor causing the differentiation of migration dynamics between seasons. There are no tides in the southern Baltic, but the direction and strength of the wind can cause rapid changes of the water level. When feeding areas remain under water for many days birds move elsewhere, like in the first half of September 1997, when the majority of waders, including Dunlins, leaved the Reda mouth (see Fig. 6). On the other hand, deterioration of weather may force birds to stay longer at a stopover site and this could affect observed migration pattern. However, in autumn strong winds that would impede migration are very rare in the Puck Bay region (Remisiewicz 1996).

Two migration waves of juvenile Dunlins seem to be quite common in the Baltic area. This pattern was reported from the German coast in almost all cases when data from a single season were reported: 1975 and 1976 (Teichmann and Conrad 1984), 1977 and 1983 (Brenning 1987) and in 1994 (Dierschke 1995, 1996). At the Reda Mouth two waves of juveniles were recorded in 3 among 5 studied seasons. In 1997 this pattern was unclear, probably due to unusually long period of high water level, which might have been responsible for the rapid decrease of bird number in September. This two-wave pattern is consistent with the idea of Meltofte (1991),

who distinguished two groups of juveniles of slightly different wintering grounds (the British Isles and France) with a little different migration terms.

Among Dunlins migrating in autumn in the southern Baltic region, the nominative subspecies *C. a. alpina* prevail (Gromadzka 1989). Birds from the Baltic breeding population of *C. a. schinzii* pass also the study area (Jönsson 1986), however in small numbers and only in the early phase of migration (Jönsson 1986, Pettersson 1994), thus their occurrence has probably only a minor influence on observed migration patterns. First-year Dunlins recorded on the Baltic coasts in July and at the beginning of August belonged to the local *C. a. shinzii* breeding population (Jönsson 1986, Glutz von Blotzheim *et al.* 1999) and migration of juveniles from *C. a. alpina* did not start before mid-August.

It was confirmed, that in a given season second-year Dunlins usually migrated somewhat earlier than older birds. The proportion of the second-year birds should depend on the number of juveniles in the preceding season if migration route of both age classes were the same. The stated occurrence of the highest percentage of immatures after the season with the highest number of juveniles is consistent with this. Thus, the observed overall migration pattern of adults may depend also to some extent on the breeding success in the earlier season. The significant negative relationship between the median dates of adult migration and the proportions of second-year Dunlins among caught birds indicates that the greater proportion of immatures, the earlier median date of adults.

Hence, many different factors may influence migration patterns in a given season and this is why both the dynamics and the phenology of migration were so variable. Despite this, the migration of Dunlins along southern Baltic coast seems to be well synchronized within a season (Kube *et al.* 1994). More detailed comparison of migration patterns between the study area and other sites is difficult, because in the majority of papers only the averages from all years were presented. It might result in blurring the differences between years. However, the mean migration pattern of Dunlins on the German Baltic coast (Brenning 1987), southern Sweden (Pettersson 1994) and the Polish coast (Meissner and Sikora 1995) showed a great similarity.

The very high number of juveniles recorded in 1999 is consistent with the data from European Russia tundra. In this season early summer was warmer than usual and the breeding success of waders was reported from majority of places as good (Soloviev and Tomkovich 2006). However, juvenile Dunlins show smaller annual fluctuations than high arctic species (Meissner and Sikora 1995, Rösner 1997), because birds reaching Baltic come from a vast area (Gromadzka 1989) and the probability that bad conditions for breeding occur within whole breeding range at the same time is low.

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REFERENCES

Alerstam T. 1993. *Bird migration.* Cambridge Univ. Press, Cambridge.

Brenning U. 1987. *Der herbstliche Durchzug des Alpenstrandläufers (Calidris alpina) im Naturschutzgebiet Langenwerder (Wismar-Bucht/Poel).* Ber. Vogelwarte Hiddensee 8: 4-19.

Busse P. 1986. *Modelling of the seasonal dynamics of bird migration.* Ring 18: 97-119.

Dierschke V. 1995. *Durchzug des Alpenstrandläufers Calidris alpina 1994 an der deutschen Ostseeküste.* Ber. Vogelwarte Hiddensee 12: 123-127.

Dierschke V. 1996. *Unterschiedliches Zugverhalten alter und junger Alpenstrandläufers Calidris alpina: Ökologische Untersuchungen an Rastplätzen der Ostsee, des Wattenmeeres und auf Helgoland*. Cuvillier Verlag, Göttingen.

Dolnik V. R. 1975. [*Migratory disposition of birds*.] Nauka, Moscow. (In Russian).

Frieling F. 1966. *Zum Durchzuges des Bruchwasserläufers, Tringa glareola, in Windischleuba.* Beitr. Vogelkd. 11: 296-301.

Glutz von Blotzheim U.N., Bauer K.M., Bezzel E. 1999. *Handbuch der Vögel Mitteleuropas. 6. Charadriiformes (1. Teil).* AULA-Verlag, Wiesbaden.

Gromadzka J. 1986. *Primary moult of adult Dunlins Calidris alpina of different age during autumn migration.* Vår Fågelv., Suppl. 11: 51-56.

Gromadzka J. 1987. *Migrations of waders in Central Europe*. Sitta 1: 97-115.

Gromadzka J. 1989. *Breeding and wintering areas of Dunlin migrating through southern Baltic.* Ornis Scand. 20: 132-144.

Holmgren N.M.A., Jönsson P.E., Wennerberg L. 2001. *Geographical variation in the timing of breeding and moult in dunlin Calidris alpina on the Palearctic tundra*. Polar Biol. 24: 369-377.

Jönson P.E. 1986. *The migration and wintering of Baltic Dunlins Calidris alpina schinzii.* Vår Fågelv., Suppl. 11: 71-78.

Kube J., Rösner H.-U., Behmann H., Brenning U., Gromadzka J. 1994. *Der Zug des Alpenstrandläufers (Calidris alpina) an der südlichen Ostseeküste und im Schleswig-Holsteinischen Wattermeer in Sommer und Herbst 1991*. Corax 15, 2: 73-82.

Meissner W. 1998. *Some notes on using walk-in traps.* Wader Study Group Bull. 86: 33-35.

Meissner W. 2000. *Autumn migration of the Redshank (Tringa t. totanus) in the region of the Gulf of Gdańsk (Poland).* Vogelwarte. 40: 179-188.

Meissner W. 2005. *Variation in timing of the Siberian Knot Calidris c. canutus autumn migration in the Puck Bay region (southern Baltic).* Acta orn. 40: 95-101.

Meissner W., Huzarski S. 2006. *Autumn migration of the Ringed Plover Charadrius hiaticula in the Gulf of Gdańsk region.* Not. Orn. 47: 23-32.

Meissner W., Koziróg L. 2000. *Autumn migration of the Turnstone Arenaria interpres at the Bay of Gdańsk.* Not. Orn. 41: 213-223.

Meissner W., Serra L., Gustowska A., Wołoszyk L., Zenatello M. 2005. *Different timing of the migration of "eastern" Dunlin in the Baltic and Adriatic.* Wader Study Group Bull. 108: 53-56.

Meissner W., Sikora A. 1995. *Spring and autumn migration of waders (Charadrii) on the Hel Peninsula.* Not. Orn. 36: 205-239.

Meissner W., Ściborski M. 2002. *Autumn migration of the Bar-tailed Godwit (Limosa lapponica) in the Gulf of Gdańsk region.* Ring 24, 1: 3-15.

Meltofte H. 1991. *The northern Dunlin puzzle.* Wader Study Group Bull. 62: 15-17.

Pettersson J. 1994. *Ottenby Fågelstationen med det stora kärrsnäppematerialet*. Calidris 3: 92-97.

Prater A.J., Marchant J.H., Vuorinen J. 1977. *Guide to the identification and ageing of Holarctic waders.* BTO, Tring.

Reichholf J. 1972. *Der Durchzug der Bekassine (Gallinago gallinago) an den Stauseen am Unteren Inn.* Anz. Orn. Ges. Bayern 11: 139-163.

Remisiewicz M. 1996. *Influence of weather conditions on the autumn migration of Dunlin (Calidris alpina) at the southern Baltic coast*. Ring 18: 73-88.

Rösner H.-U.1997. *Strategien von Zug und rast des Alpenstrandläufers (Calidris alpina) im Wattenmeer und auf dem Ostatlantischen Zugweg.* Shaker Verlag, Aachen.

Soikkeli M. 1967. *Breeding cycle and population dynamics in the dunlin (Calidris alpina).* Ann. Zool. Fenn. 4: 158-198.

Soloviev M., Tomkovich P. (Eds). 2006*. Breeding conditions survey.* In: *Arctic Birds – Online Database.* http://www.arcticbirds.ru

StatSoft Inc. 2001. *STATISTICA (data analysis software system).* version 6. www.statsoft.com.

Teichmann A., Conrad U. 1984. *Zum Limikolenzug am südlichen greifswalder Bodden auf der Grundlage von Planbeobachtungen.* Orn. Rundbrief Meckl. 27: 8-35.

Zając R. 1980. *Different autumn migration rates of sexes in the Dunlin Calidris a. alpina as determined by means of normal probability paper.* Acta orn. 17: 1-12.