

AUTUMN MIGRATION OF WADERS (*Charadrii*) IN THE MIDDLE VISTULA VALLEY IN 2004-2005

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ABSTRACT

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Studies were conducted in 2004-2005 in the period: 3 July – 26 August. The study area was located in the middle Vistula valley, near village Pawłowice, about 20 km north to the town of Dęblin (51°36'N, 21°38'E). The area covers a 2.5 km long section of not regulated river with ca 2 km² of sandy beach. This site is an attractive resting and foraging place for migrating waders. Altogether 25 species of migrant waders were observed there. The dominants were: Lapwing (*Vanellus vanellus*) – 52.5-59.3%, Common Sandpiper (*Actitis hypoleucos*) – 9.8-18.9%, Wood Sandpiper (*Tringa glareola*) – 10.5-11.1%. For the Lapwing, Greenshank (*Tringa nebularia*), Ringed Plover (*Charadrius hiaticula*), Little Ringed Plover (*Charadrius dubius*), Common Snipe (*Gallinago gallinago*) and Ruff (*Philomachus pugnax*) the pattern of migration dynamics in the middle Vistula valley was similar to some earlier observations done in this area on the turn of the 1970s. In the Common Sandpiper in the 1970s-1980s no distinct migration peak was recorded, while in 2004-2005 one migration wave extended in time was observed. Migration of the Wood Sandpiper in the 1970s-1980s was characterized by a single migration peak, but in 2004-2005 migration pattern of this species had distinctly two peaks.

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Key words: waders, autumn migration, migration dynamics, species composition, middle Vistula valley

INTRODUCTION

The occurrence of waders in Poland is relatively well described. An increasing interest in this group of birds and new studies allowed for presentation of interesting aspects of their migration through the area. Most intensive studies on waders have been conducted on the Baltic coast in the Gulf of Gdańsk region (Gromadzka 1982, Gromadzka and Przystupa 1988, Meissner and Sikora 1995, Meissner and Włodarczak 1998, Sikora and Zieliński 2000). Inland waders have been observed during studies on waterbirds conducted on: dam reservoirs (Nowysz-Wesołowska 1976, Stawarczyk and Grabiński 1980, Janiszewski *et al.* 1998), lakes (Kot 1981),

fishponds (Wasilewski 1973, Goławski *et al.* 2002) and rivers (Luniak 1971, Lewartowski 1989, Kunysz and Hordowski 1992, Stajszczyk 1994, Rzępała *et al.* 1999, Wiehle *et al.* 2002).

In the region of the middle Vistula valley the studies on wader migration were conducted in 1957-1965 by Luniak (1971). In the later period investigations on this group of birds were carried out in 1979-1985 by the Students' Scientific Circle from the Agriculture and Pedagogical University in Siedlce. Except of two M. Sc. diploma works (Chalimoniuk 1992, Sankowska 1993) the collected data were not presented wider. The aim of this study was to present the current pattern of the post-breeding migration of waders in the middle Vistula valley and to compare the present results with the data collected 20 years ago.

MATERIAL AND METHODS

Observations were conducted *ca* 1 km to the west of village Pawłowice, located about 20 km to the north of the town of Dęblin (51°36'N, 21°38'E; community Stężycza, Lublin voivodeship, central Poland). This site is situated in the middle part of the Vistula course, on the Central Mazowsze Lowland (Kondracki 2001). The study area includes the natural, not regulated 2.5 km long section of the river with a steep western bank and a sandy beach on the eastern bank, limited by the flood embankment, of the area *ca* 2 km². Poor vegetation with such dominant species as: Persicaria (*Polygonum persicaria*), Red Goosefoot (*Chenopodium rubrum*), Greater Yellow-Cress (*Rorippa amphibia*) and seedlings of the White Willow (*Salix alba*), covered *ca* 1/5 of the area. The study was conducted in 2004-2005: in 2004 from 1 July to 28 August, and in 2005 from 3 July to 31 August. Birds were counted along the constant route about 2.5 km long. Observations were made three times a day – at dawn (4.30-6.00 *a.m.*), then at 12.00 and 6.00 *p.m.* Each count was done by one of eight experienced observers. Observation points were established depending on the actual surface appearance, location of temporary ponds and emerging islands in the Vistula stream. In the period 3-5 August 2004, due to the very high water level and flooding of the whole counted area, observations were made only from the river embankment and they comprised counts of birds passing within the observation range conducted at standard hours. For both seasons of studies the reference period (Busse and Kania 1970) was established from 3 July to 26 August. Within this period the median, and first and third quartile were calculated for each of observed wader species.

RESULTS

Species composition and migration dynamics

During the period of studies 25 species of waders were recorded. A decided dominant was the Lapwing (*Vanellus vanellus*), which in both seasons comprised over a half of all observed waders (Table 1). The second most numerous species was

the Common Sandpiper (*Actitis hypoleucos*), which comprised *ca* 9-19%. The proportion of the Wood Sandpiper (*Tringa glareola*) slightly changed between the studied years and was about 11%. Such species as Ringed Plover (*Charadrius hiaticula*), Greenshank (*Tringa nebularia*), Common Snipe (*Gallinago gallinago*), Ruff (*Philomachus pugnax*) and Little Ringed Plover (*Charadrius dubius*) formed about 1.6-4.5% of the assemblage of waders. The proportion of the remaining species in the domination structure did not exceed 1%. The Grey Plover (*Pluvialis squatarola*), Broad-billed Sandpiper (*Limicola falcinellus*), Knot (*Calidris canutus*), Turnstone (*Arenaria interpres*) and Red-necked Phalarope (*Phalaropus lobatus*) were recorded sporadically (they constituted below 0.1% of all observed waders).

Table 1

Species structure and numbers of waders in years of study.

D – dominance of each species, + – dominance below 0.1%.

	2004			2005			2004-2005
	Total*	Largest flock	<i>D</i> (%)	Total*	Largest flock	<i>D</i> (%)	<i>D</i> (%)
<i>Vanellus vanellus</i>	5688	458	59.3	5574	300	52.5	55.9
<i>Actitis hypoleucos</i>	944	21	9.8	2003	30	18.9	14.4
<i>Tringa glareola</i>	1064	49	11.1	1114	19	10.5	10.8
<i>Charadrius hiaticula</i>	430	21	4.5	474	12	4.5	4.5
<i>Tringa nebularia</i>	462	20	4.8	334	8	3.2	4
<i>Gallinago gallinago</i>	275	18	2.9	206	14	1.9	2.4
<i>Philomachus pugnax</i>	75	6	0.8	301	18	2.8	1.8
<i>Charadrius dubius</i>	131	9	1.4	200	14	1.9	1.6
<i>Calidris alpina</i>	62	12	0.7	113	6	1.1	0.9
<i>Tringa ochropus</i>	99	7	1	68	3	0.6	0.8
<i>Calidris temminckii</i>	108	26	1.1	50	5	0.5	0.8
<i>Tringa totanus</i>	92	4	1	37	2	0.4	0.7
<i>Numenius arquata</i>	44	16	0.5	30	9	0.3	0.4
<i>Calidris ferruginea</i>	23	10	0.2	38	3	0.4	0.3
<i>Haematopus ostralegus</i>	44	6	0.5	10	3	0.1	0.3
<i>Calidris minuta</i>	20	6	0.2	23	7	0.2	0.2
<i>Tringa erythropus</i>	11	2	0.1	20	3	0.2	0.2
<i>Limosa limosa</i>	8	1	0.1	5	2	0.1	0.1
<i>Numenius phaeopus</i>	5	5	0.1	1	1	+	+
<i>Pluvialis squatarola</i>	3	1	+	2	1	+	+
<i>Limicola falcinellus</i>	1	1	+	4	4	+	+
<i>Calidris alba</i>	3	1	+	1	1	+	+
<i>Calidris canutus</i>	3	1	+	0	0	+	+
<i>Arenaria interpres</i>	0	0	+	2	1	+	+
<i>Phalaropus lobatus</i>	0	0	+	1	1	+	+
Total	9 595	701	100	10 611	467	100	100

* Total in the standard period 3 Jul.-26 Aug.

Migration dynamics of the Lapwing in 2004 and 2005 were similar (Fig. 1). Two distinct increases of numbers occurred. In 2004 the first increase fell within the first half of July with the peak on 15 Jul. – 213 indiv., the second one – between the third decade of July and the first decade of August with the peak on 8 Aug. – 503 indiv. In 2005 the first number increase took place in the second and the third decades of July with the peak on 29 Jul. – 227 birds, and the next one occurred in mid-August, when 361 Lapwings were recorded on 13 Aug. in one migration peak. Difference between years was about two-week shift of peaks of numbers. At the beginning of July 2004 a decrease in numbers of Lapwings were visible, which suggested that one additional peak occurred in the end of June.

The Common Sandpiper was twice more numerous in 2005 than in 2004 (Table 1). Periods of intensive passage in both studied years overlapped (Fig. 1) and were observed in the second half of July. The single migration peak in 2004 occurred on 21 Jul. (59 birds), and in 2005 on 27 Jul. (136 indiv.).

The numbers of the Wood Sandpiper did not differ significantly between seasons 2004 and 2005. This species was characterized by two increases in numbers (Fig. 1). At the beginning of July 2004 a decrease in numbers of this species was observed, which suggested that the first peak of its migration occurred at the end of June. The next increase in numbers occurred in the first decade of August, with the peak on 7 Aug. (114 indiv.). In 2005 a rapid increase in the number of Wood Sandpipers was recorded at the beginning of July, with the peak on 15 Jul. (92 indiv.). The second peak of migration occurred in the second and the third decade of July, with the maximum on 6 Aug. (70 indiv.).

The Ringed Plover was more numerous than the Little Ringed Plover during the whole period of studies (Table 1). In 2004 it was more numerous in August, but in 2005 – in July. In 2004 two distinct peaks of the number of Ringed Plovers were observed (Fig. 1). They occurred subsequently in short-time intervals. The first number increase occurred in the second half of July and the beginning of August, with the peak on 1 Aug. – 28 indiv. Shortly after this peak, the second increase occurred in the first half of August, with the peak on 12 Aug. – 19 birds. In 2005 the numbers of the Ringed Plover suddenly started to increase in the second decade of July and the only migration peak in that season occurred on 25 Jul. – 39 indiv.

The Greenshank was more numerous in 2004 than in 2005 (Table 1). Migration dynamics of this species were similar in both years (Fig. 1). In 2004 the increase of its numbers occurred in the first decade of August, with the peak on 7 Aug. – 37 indiv. In contrast, in 2005 two maxima of the Greenshank's numbers were observed. The first peak occurred in the second and the third decade of July, and the second peak – in the first decade of August, with the maximum on 5 Aug. – 19 birds.

In the Common Snipe two migration waves could be distinguished in both seasons (Fig. 1). The increase in its numbers in 2004 began in the first half of July, with the peak on 11 Jul. – 17 indiv. Later on, a slow and gradual decrease of Great Snipe numbers occurred and lasted till the end of July. In the first half of August the numbers increased again with the peak on 8 Aug. – 28 indiv. In 2005, similarly as in 2004,

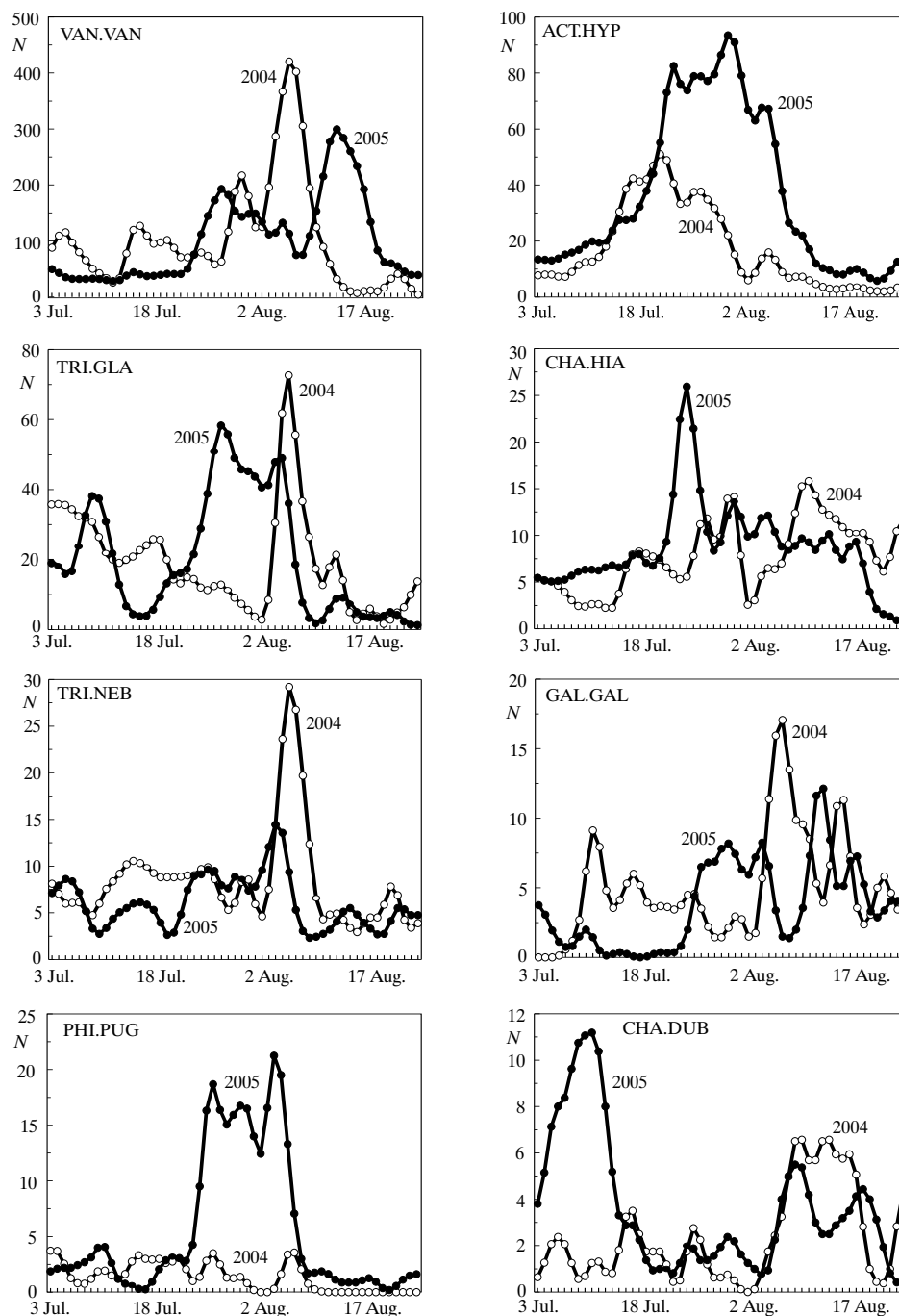


Fig. 1. Migration dynamics (smoothed by moving average) of some species (VAN.VAN – *Vanellus vanellus*, ACT.HYP – *Actitis hypoleucos*, TRI.GLA – *Tringa glareola*, CHA.HIA – *Charadrius haticula*, TRI.NEB – *Tringa nebularia*, GAL.GAL – *Gallinago gallinago*, PHI.PUG – *Philomachus pugnax*, CHA.DUB – *Charadrius dubius*) in 2004 and 2005

two peaks of numbers were distinguished. However, they were not so clearly divided in time. The first increase in numbers took place on the turn of July with the peak on 30 Jul. – 12 indiv., while the second increase occurred in the second decade of August and had a peak on 14 Aug. – 18 indiv.

The Ruff was observed in higher numbers only in 2005 (Table 1). In 2004 its numbers were low and the migration dynamics was difficult to interpret. In 2005 migration of this species was characterized by a single increase in numbers in the second half of August, with a maximum on 5 Aug. – 35 indiv. (Fig. 1).

The numbers of the Little Ringed Plover in July 2004 were very low. In this year only one migration peak of this species occurred in the first half of August, with the maximum on 14 Aug. – 9 indiv. (Fig. 1). In 2005 the first increase of its numbers fell within the first half of July with the peak on 9 Jul. – 14 birds, and the second increase occurred in the first half of August, with the peak on 11 Aug. – 9 indiv.

The Dunlin (*Calidris alpina*) was the most numerous of *Calidris* stints (Table 1). This species occurred in similar numbers during the whole period of studies. The earliest observation came from 6 Jul. 2005 – 1 bird; the latest record was on 26 Aug. 2005.

The Green Sandpiper (*Tringa ochropus*) was observed regularly during the whole period of studies. In July it was slightly more frequent. The Green Sandpiper was more numerous in 2004 than in 2005 (Table 1). The earliest observation of this species was on 3 Jul. 2004 – 3 indiv. and on 3 Jul. 2005 – 6 indiv. The latest it was recorded on 26 Aug. 2005 – 2 birds.

The Temminck's Stint (*Calidris temminckii*) was the second regularly observed species of calidrids. In 2004 it was twice more numerous than in 2005. Almost all observations of this species came from August. The earliest it was observed on 12 Jul. 2005 – 1 indiv. The latest observations came from 26 Aug. 2004 – 9 indiv. and 26 Aug. 2005 – 1 indiv.

The Redshank (*Tringa totanus*) was more numerous in 2004. However, the number of observed birds could be overestimated due to the presence of the local breeding individuals. The earliest it was observed on 3 Jul. 2004. – 2 indiv., the latest – on 21 Aug. 2004 (1 bird).

The Curlew (*Numenius arquata*) was observed in low numbers both in 2004 and in 2005 (Table 1). Most observations came from August. The greatest flock consisted of 16 indiv. The earliest observed was on 5 Jul. 2005 – 2 indiv. The latest observation came from 26 Aug. 2005 – 16 indiv.

The Curlew Sandpiper (*Calidris ferruginea*) was observed in low numbers during both seasons of studies (Table 1). The largest flock was formed by 10 indiv. In this species most observations came from July. The earliest it was observed on 7 Jul. 2005 – 1 indiv. The latest it was recorded on 20 Aug. 2005 – 1 bird.

In 2004 altogether 44 indiv. of the Oystercatcher (*Haematopus ostralegus*) were observed, but at least some part of these records could concern breeding individuals. In 2005 only 10 birds were seen (Table 1). The earliest it was observed on 3 Jul.

2004 – 3 indiv. and on 3 Jul. 2005 – 2 indiv. The latest observation came from 25 Aug. 2004 – 2 birds.

Both in 2004 and 2005 the Little Stint (*Calidris minuta*) occurred in similar numbers (Table 1). The earliest record was on 30 Jul. 2004, the latest – on 26 Aug. 2004.

The Spotted Redshank (*Tringa erythropus*) was observed in both seasons as single birds or small flocks of 2-3 individuals. It was more numerous in 2005 (Table 1). The earliest observation was made on 16 Jul. 2004, the latest – on 25 Aug. 2004.

The Bar-tailed Godwit (*Limosa limosa*) occurred rarely in years 2004-2005 (Table 1). In total 13 birds were observed on 12 occasions.

Five individuals of the Whimbrel (*Numenius phaeopus*) were observed on 28 Jul. 2004 and 1 bird on 8 Jul. 2005.

There were 5 single encounters of the Grey Plover (*Pluvialis squatarola*) – during the whole period of studies: on 15 Aug. 2004, 19 Aug. 2004, 24 Aug. 2004, 10 Aug. 2005, 20 Aug. 2005.

One individual of the Broad-billed Sandpiper (*Limicola falcinellus*) was observed on 16 Aug. 2004. In 2005 a small flock of 4 individuals were observed on 19 Aug.

The Sanderling (*Calidris alba*) was observed three times in 2004, but it could be the same individuals counted several times. In 2005 a single bird was observed on 10 Aug.

The Knot (*Calidris canutus*) was observed in the study area only in 2004. One bird was recorded on 27 Jul. and probably one individual was observed twice on 25-26 Aug.

In 2005 single individuals of the Turnstone (*Arenaria interpres*) were observed – on 23 and 24 Aug.

One individual of the Red-necked Phalarope (*Phalaropus lobatus*) was observed on 7 Aug. 2005.

Changes in migration timing of most numerous waders between seasons

For the Lapwing, Common Sandpiper and Wood Sandpiper the median dates of migration within the reference period in 2004 were earlier than in 2005 (Fig. 2). In these three species the difference in the median dates was 4-7 days. In the Common Snipe and Greenshank the median date of passage was very similar in both seasons (1 and 2 days difference, respectively). Both in the Ringed and the Little Ringed Plovers their median dates of passage in 2004 were later than in 2005. In the case of the Ringed Plover this difference was 8 days. The passage of the Little Ringed Plover in 2005 was extended in time and a half of migrants of this species passed through the study area 28 days earlier than in 2004. The species of a concentrated and intensive passage were the Common Sandpiper and the Ruff, and the period in which these species migrated abundantly lasted for about two weeks. The passage of the remaining species of waders was more extended in time.

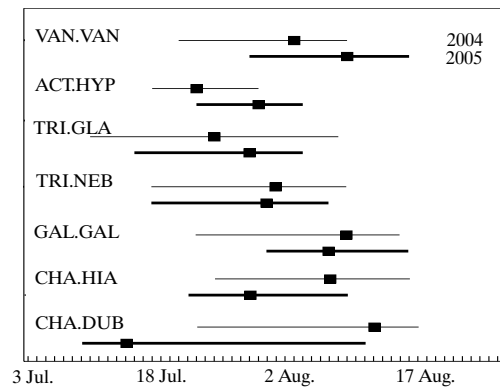


Fig. 2. Comparison of median days (rectangles) and 25%-75% quartiles of migration in 2004 and 2005. Species symbols as in Figure 1.

DISCUSSION

Species composition

In the studied area 25 species of waders were observed (Table 1). Beside these species on 7 Aug. 2005 two Marsh Sandpipers (*Tringa stagnatilis*) were caught, which were not recorded during the counts. They increased the number of the species recorded in the study area to 26. In 1957-1965, Luniak (1971) stated 29 species along the section of the Vistula between the outflow of its tributary – the San, and Warsaw. Three of these species – Great Snipe (*Gallinago media*), Avocet (*Recurvirostra avosetta*) and Stone Curlew (*Burhinus oedipnemos*) were not stated in 2004-2005. On the other hand, one new species – the Red-necked Phalarope, was recorded during the present study. In the upper Vistula valley in 1990-2002, 36 wader species were recorded (Wiehle *et al.* 2002). However, many observations from that paper considered areas adjacent to the river and not directly located along its stream. Also the period of those studies was much longer than in the present paper. During studies in the middle San valley in 1982-1989, 32 wader species were observed (Kunysz and Hordowski 1992), but also in this case not all observations came from the river-bed. In other regions of Poland, where studies on this group of birds have been conducted, the number of species usually exceeded 30. On irrigation fields near Wrocław during studies conducted in years 1960-1987, 31 species were observed (Lontkowski *et al.* 1988). On Jeziorsko reservoir during the period 1986-1996, 36 species were recorded (Janiszewski *et al.* 1998). On the Baltic coast Meissner and Sikora (1995) in years 1984-1989 recorded 36 species as well. The low number of wader species observed in the middle Vistula valley in comparison to other regions of Poland is connected probably with a short (only two-year) period of studies. The study area covered only the river-bed, thus some waders, *e.g.* the Woodcock (*Scolopax rusticola*), were not observed there due to their

different habitat preferences. The Stone Curlew does not occur in the Vistula valley any more, while these birds observed by Luniak (1971) originated probably from the local breeding population.

The majority of studies on wader migration presented only the migration dynamics (Luniak 1971, Wasilewski 1973, Kunysz and Hordowski 1992, Janiszewski *et al.* 1998). Only several publications described proportions of each species in the domination structure (Meisnner and Sikora 1995, Mitrus *et al.* 1998c, Wójcik *et al.* 1999). The results obtained by the cited authors are similar to a large extent to the observations from the middle Vistula valley. Mitrus *et al.* (1998c) emphasized high proportion of the Lapwing, which reached almost 50% of waders' assemblage in the Bug valley. At the middle Vistula it was the most numerous species and its proportion was almost 60% (Table 1). It was similar in the case of the Common Sandpiper, which reached almost 20% in the domination structure in the middle Vistula valley, as well as in the Bug valley. Along the Bug, the participation of the Wood Sandpiper, Greenshank and Common Snipe in the assemblage was *ca* 2-8%, while the Ringed Plover and the Little Ringed Plover were below 2% of the assemblage. The pattern of the domination structure in the valleys of the middle Vistula and the Bug (Mitrus *et al.* 1998c) were similar to that observed in the Puck Bay (Meisnner and Sikora 1995). Exceptional species are only the Lapwing and the Common Sandpiper, which comprised higher proportion of waders along the rivers than on the Puck Bay coast.

The very high proportion of the Lapwing in the domination structure in the middle Vistula valley was partly the effect of a relatively low species diversity and low numbers of the remaining wader species. The Common Sandpiper commonly uses river-beds as stopover sites during its post-breeding migration. Similarly high numbers of this species as at the Vistula were observed only in the Bug valley (Mitrus *et al.* 1998a, c), other rivers – for example the San – were used by the Common Sandpiper to a lower extent (Kunysz and Hordowski 1992). Both species of Ringed Plovers were met more frequently in the Vistula than in the Bug valley. The Common Snipe in the highest numbers in Poland was observed at emptied fishponds (Wilniewicz *et al.* 2001, Goławski *et al.* 2002, Wiehle *et al.* 2002), while in the Vistula valley – after floods (Meisnner pers. comm.). It should be borne in mind that the presented similarities and differences in the domination structure of waders between the regions of Poland could be influenced to some extent by different years of studies, the number of studied years and slightly different periods when observations were conducted.

Migration dynamics

The Lapwing begins its post-breeding migration in late autumn, and concentrations of this species observed earlier are connected with the period of post-breeding nomadic movements (Cramp and Simmons 1985). In Poland the autumn passage of this species consists of several waves, but the main migration peak falls within

October (Tomiałojć and Stawarczyk 2003). Large concentrations of the Lapwing – up to 7500 individuals, observed in October at Jeziorsko reservoir were described by Janiszewski *et al.* (1998). Kunysz and Hordowski (1992) also mentioned October concentrations of up to 9000 Lapwings in the middle San valley. The data from the turn of the 1970s documented an occurrence of peaks of this species in the middle Vistula valley in July-August, with a remarkable increase in numbers in the third decade of August (Student's Ornithological Circle, Academy of Podlasie in Siedlce unpubl.). This corresponds with the present results from 2004-2005. Considering the fact that the migration peak of the Lapwing occurs in October, the number fluctuations observed in the middle Vistula valley in July and August can be influenced by other factors than a directed migration towards the wintering grounds, *e.g.* movements of large nomadic flocks during the studied period or changes of the water level. On the Puck Bay coast, the Lapwing migrated in a different way than in the middle Vistula valley. The migration peak of this species at the Puck Bay occurred on the turn of July (Meissner and Sikora 1995), but these birds did not form such large concentrations as inland.

Migration of the Common Sandpiper can have two or even four peaks (Meissner and Sikora 1995, Mitrus *et al.* 1998a). According to these authors, this is caused by migration of birds at a different age separated in time. Adults migrate earlier than first-year birds. During studies in the middle Vistula valley only a single migration peak of the Common Sandpiper was found, which can indicate an extensive overlap of the migration period of both age classes.

During studies conducted in 1979-1985 Sankowska (1993) showed that the Wood Sandpiper had a single migration peak, which occurred around 15 August. However, she presented the migration dynamics of this species in the pentade system, which combined with averaging of the results of counts from many years could blur the actual migration dynamics pattern of this species. This can occur if differences between seasons in timing of migration peaks are remarkable (Meissner 1996). Studies conducted in the Vistula valley in 2004-2005 showed two-peak migration pattern of the Wood Sandpiper, similar to that observed in other regions of Poland, in Germany and Bulgaria (Kunysz and Hordowski 1992, Meissner and Sikora 1995, Mitrus *et al.* 1998b, Anthes *et al.* 2002, Dalakchieva and Popov 2002). Cramp and Simmons (1985) state that in Europe adult Wood Sandpipers begin autumn migration at the end of June, while immatures – about a month later. This difference in migration timing of both age classes is the main reason for the two-peak migration dynamics of this species.

In the Greenshank, Ringed Plover and Little Ringed Plover one or two migration peaks could be distinguished, similarly as in other parts of Poland (Lontkowski *et al.* 1988, Sankowska 1993, Meissner and Sikora 1995, Janiszewski *et al.* 1998). In the case of both the Ringed and the Little Ringed Plovers their July increase in numbers might have been connected with the presence of their local breeding population. Some of them still bred in the study area in July, and both adults and juveniles able to fly could be counted several times (Kozik unpubl.).

The migration dynamics pattern of waders in the middle Vistula valley was generally similar to migration dynamics of this group of birds in other regions of Poland. Some inconsistencies could result from different frequency of observations and different seasons studied. The observed migration dynamics of waders, similarly as in other bird species, can be influenced by weather and habitat conditions in the study area, at breeding grounds as well as on migration route (Meissner 2001). The fact that the present study included only two seasons, while in a number of papers the averaged pattern of migration considered many-year studies (Kunysz and Hordowski 1992, Meissner and Sikora 1995, Mitrus *et al.* 1998c), could be of some importance.

Changes in migration timing of most numerous waders in consecutive seasons

Meissner and Sikora (1995) stated that changes in migration timing of waders from season to season in some species of waders depended on numbers of immature birds in a given season. The less numerous they are, the later is the median date of migration. This results from the fact that in most waders the immature birds migrate later than the adults. The later time of migration in 2005 in comparison with the preceding year, observed in the middle Vistula valley in three species of waders could be caused by their higher breeding success. However, the collected data do not allow to confirm this hypothesis, as birds were not aged during observations. The Lapwing, Wood Sandpiper and Common Sandpiper breed in the temperate and boreal zone, thus their numbers and differences between seasons could be affected by similar factors. Moreover, Wood Sandpipers and Common Sandpipers that migrate through Poland originate probably from the same breeding grounds (Cramp and Simmons 1985, Meissner 1997a, Meissner 1997b). The differences in migration pattern of both species of Ringed Plovers could be influenced by remarkable and rapid changes of the water level in the Vistula. In 2004 the median of migration of both species fell within August. In that season the study area was flooded and the water covered sandy beaches and islets where both species still bred. Moreover, high water level reduced the amount and size of foraging places by flooding sandy beaches and river banks which are used by these species during migration. Thus, this factor can affect migration dynamics of plovers in two ways. In 2005 the median date of migration shifted, in the Little Ringed Plover – to the second, and in the Ringed Plover – to the third decade of July.

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