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MIGRATION DYNAMICS AND SEASONAL VARIATION IN THE BIOMETRICS OF THE EURASIAN CURLEW (*Numenius arquata*) MIGRATING THROUGH THE LOWER VISTULA VALLEY (N POLAND) IN AUTUMN

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ABSTRACT

Krupa R., Meissner W., Krupa M., Sereda A. 2009. *Migration dynamics and seasonal variation in the biometrics of the Eurasian Curlew (Numenius arquata) migrating through the lower Vistula valley (N Poland) in autumn*. Ring 31, 1: 41-51.

The aim of this study was to present data on the phenology of autumn migration of the Eurasian Curlew passing the lower Vistula valley and to determine whether there is a difference in biometrics between early and late migrants, which may reflect different timing of migration of birds from different parts of the breeding range. Studies were conducted in the lower Vistula valley in 2003-2008. Median date of migration fell into 9-13 August pentade. The migration dynamics showed major day-to-day changes in bird numbers and almost all of observed flocks migrated without staying in the study area. Moreover, only one bird was caught twice during the season. It indicates that lower Vistula valley is not an attractive stopover site for Eurasian Curlews. There were significant differences in the total head lengths, bill lengths and body masses of birds caught in different ten-days periods with larger and heavier birds occurring towards the end of the study period (ANOVA, Neuman-Keuls test: $p < 0.05$ in all cases). The gradual increase in the total head and bill lengths and probably also in body mass indicates that bigger birds from the eastern part of the breeding range migrate later than smaller birds, which breed in the west. There were no significant differences in wing length, tarsus length and tarsus with toe length (ANOVA, Neuman-Keuls test: $p > 0.05$ in all cases). Subspecies *N. a. arquata* and *N. a. orientalis* have similar wing length and in this study there were no significant differences for this measurement between following decades of the studied period. Collected data suggest that the wing length, which had clearly bimodal distribution, should be the best linear measurements for sexing at least juvenile Eurasian Curlews.

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Key words: Eurasian Curlew, migration phenology, biometrical analysis, northern Poland

INTRODUCTION

Two subspecies of the Eurasian Curlew, which differ in biometrics, migrate through Europe during autumn migration. The eastern subspecies *N. a. orientalis*, breeding westwards from the Ural mountains, is much bigger than the western subspecies *N. a. arquata*, which breeds in the most part of Europe (Glutz von Blotzheim *et al.* 1977). However, there is no sharp boundary between the extremes and some intermediate populations occur in south-eastern Europe and western Siberia (Glutz von Blotzheim *et al.* 1977, Cramp and Simmons 1983). Curlews from the nominative subspecies winter mainly in a vast area between central, western and southern Europe and northern Africa, whereas birds from *orientalis* subspecies in middle and southern Africa (Glutz von Blotzheim *et al.* 1977).

The autumn migration of the Eurasian Curlew is prolonged in time. Females start to depart from the breeding grounds in the third decade of June, but more intensive passage is observed in central Europe usually from the end of July. Migration usually finishes in October (Glutz von Blotzheim *et al.* 1977). Eurasian Curlews migrate through Poland in quite large numbers, but until recently they were ringed occasionally and biometric data were lacking (Gromadzka 1998, Meissner *et al.* 2002, Włodarczyk *et al.* 2002, Ściborski *et al.* 2005, Meissner *et al.* 2006). Due to a very small number of ringed birds the occurrence of *orientalis* subspecies in Poland has not been confirmed. However, there have been some records from Hungary, Albania, Romania, Bulgaria and Greece (Glutz von Blotzheim *et al.* 1977).

In Poland during migration Eurasian Curlews are observed more numerously along the Baltic coast (Meissner and Sikora 1995, Meissner *et al.* 1999) and at large dam reservoirs (Stawarczyk *et al.* 1996, Dyrcz *et al.* 1998, Janiszewski *et al.* 1998). In large river valleys of central and southern Poland this species is much less numerous (Kunysz and Hordowski 1992, Kruszyk and Zbroński 2002, Bocheński *et al.* 2006, Kozik 2006). However, there is almost no data on the species migration phenology recorded in many year periods, even in sites where migration is well pronounced.

The aim of this study was to present data on the phenology of migration of the Eurasian Curlew passing in autumn the lower Vistula valley and to determine whether there is a difference in biometrics between early and late migrants, which may reflect different timing of migration of birds from different parts of breeding range.

MATERIAL AND METHODS

Studies were conducted in the lower Vistula valley at village Lisewo Malborskie (54°06'N, 18°50'E) near the city of Tczew (Fig. 1) in 2003-2008. The study area comprised about 400 ha of pastures between a dyke built for flood defence and the main river. Every day waders were counted along a 1.5 km long section of the river including the adjacent pastures. Moreover, Curlews migrating over the study area were counted all day long. The fieldwork lasted between the beginning of July and mid-September, but dates of beginning and finishing differed slightly among seasons. In

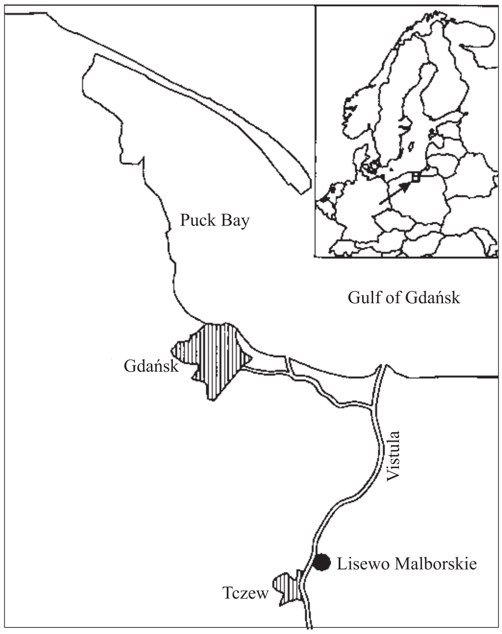

Fig. 1. Location of the study area

order to compare the total numbers of migrants in each year, a reference period was established (Busse and Kania 1970) at 5 July – 7 September, when counts were conducted every day in all seasons. For this period, the dates of the median (50%), the first (25%) and third (75%) quartile of the total number of migrants, were calculated.

Curlews were caught at night in mist-nets using a tape-lure. During the period of low water level birds were caught on temporarily emerging sandy islets. When the water level was very high and meadows were partly flooded, nets were placed on the meadows. Wing length (maximum chord method – Evans 1986), total head length (Green 1980), and tarsus with toe length (Piersma 1984) were measured to the nearest 1 mm; bill length (Prater *et al.* 1977) and tarsus length (Svensson 1992) were measured with accuracy of 0.1 mm. Birds were also weighed to the nearest 1 g. The subcutaneous fat reserves of the axillary region were estimated according to a five degree scale. In total, 10 adult and 170 juvenile curlews were caught and measured. The biometrical analysis was made only for juvenile birds.

In the analysis of biometric differences among birds migrating at different time, decades (joined pentades from standard scheme – Berthold 1973) were used. Decades were signed with their first dates. The significance of differences among birds migrating in subsequent decades was tested using ANOVA test with Neuman-Keuls *post-hoc* test (Zar 1996). All statistical procedures were performed using STATISTICA 6 (StatSoft 2001).

RESULTS

Phenology and dynamics of migration

The total number of birds recorded within the reference period differed in subsequent seasons, with the highest numbers recorded in 2005 and the lowest – in 2007 (Fig. 2).

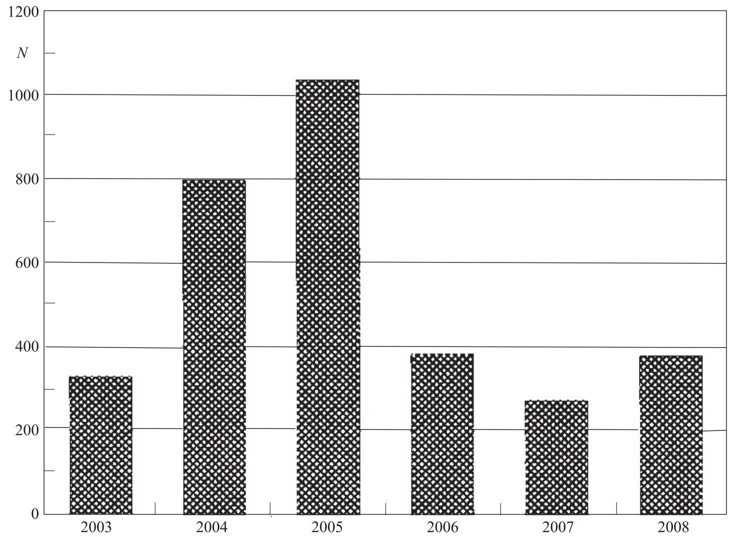

Fig. 2. Numbers of Eurasian Curlews recorded in the lower Vistula valley within the reference period in 2003-2008

The dynamics of migration showed rapid changes in number of birds in following days (Fig. 3). Moreover, the migration pattern in the studied seasons was quite different. In 2003 the passage started in the first days of July, when a flock of 40 individuals was noted. In 2005 the migration began also at the beginning of July, but bird numbers at that time were much lower. In 2004 and 2006 the passage of Eurasian Curlews started later, in mid-July and at the beginning of August, respectively (Fig. 3). The highest numbers of migrants were noted in the last decade of July (2004), at the turn of July (2003 and 2005) or at the beginning of September (2006). In 2007 and 2008 the intensity of migration was very low and no clear pattern was observed. Median date of migration calculated for all the seasons jointly fell into 9-13 August pentade, the first quartile into 30 July - 3 August pentade and third quartile into 19-23 August pentade. The most intensive passage was observed in 8-9 September 2006, when flocks of 400 and 350 birds migrated through the study area, respectively. Adults were caught in small numbers up to 25 August and their proportion among all ringed birds was the highest in the second half of July (Fig. 4).

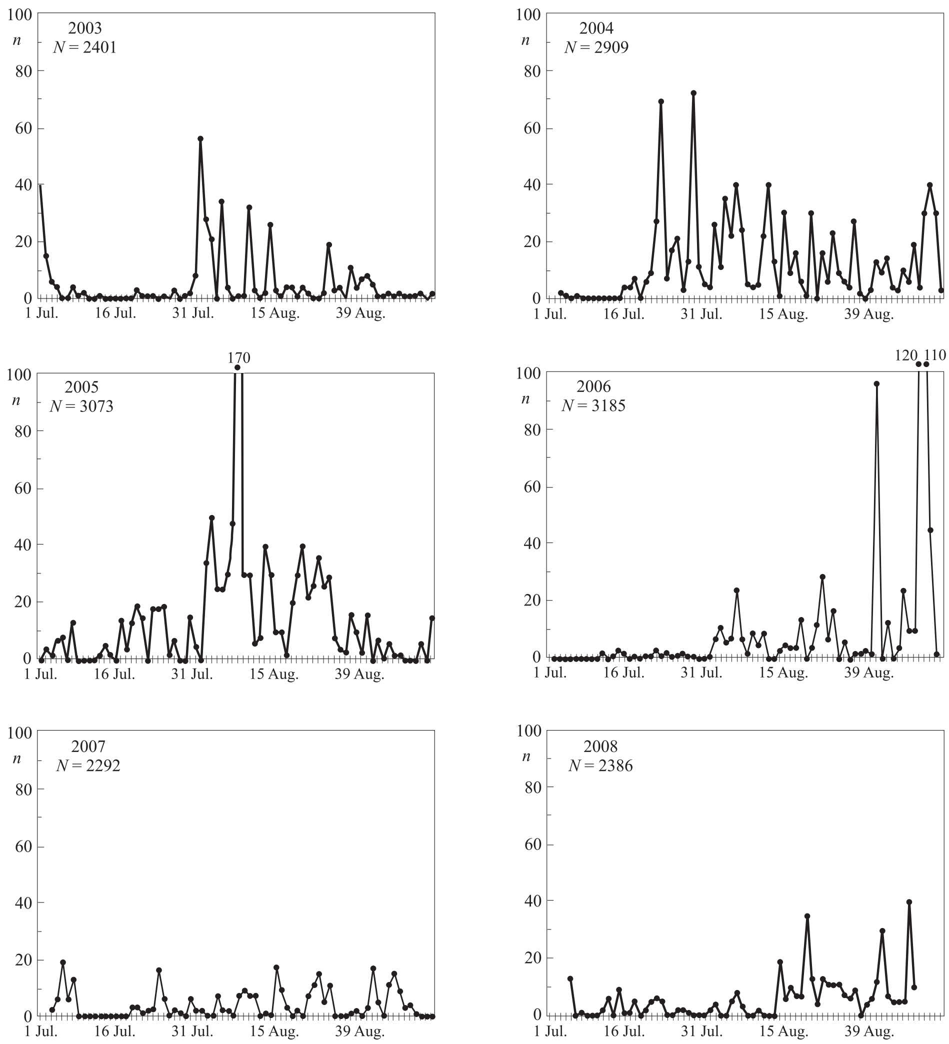

Fig. 3. Dynamics of autumn migration of the Eurasian Curlew in the lower Vistula valley in subsequent seasons.

Biometrics

Distributions of the tarsus length and body mass were unimodal. The distribution of wing length showed clear bimodality, whereas in tarsus plus toe length, total head length and bill length distributions two indistinct peaks appeared (Fig. 5). Mean values of all the measurements are presented in Table 1.

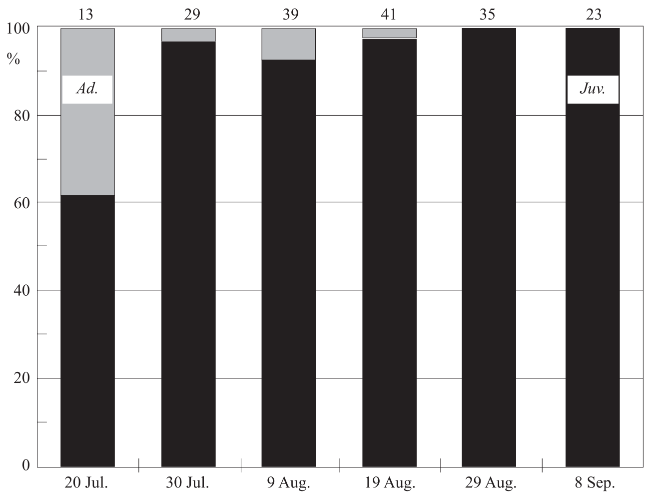

Fig. 4. Shares of adult (*Ad.*) and juvenile (*Juv.*) Eurasian Curlews caught in subsequent decades of autumn migration. Numbers above bars indicate sample sizes.

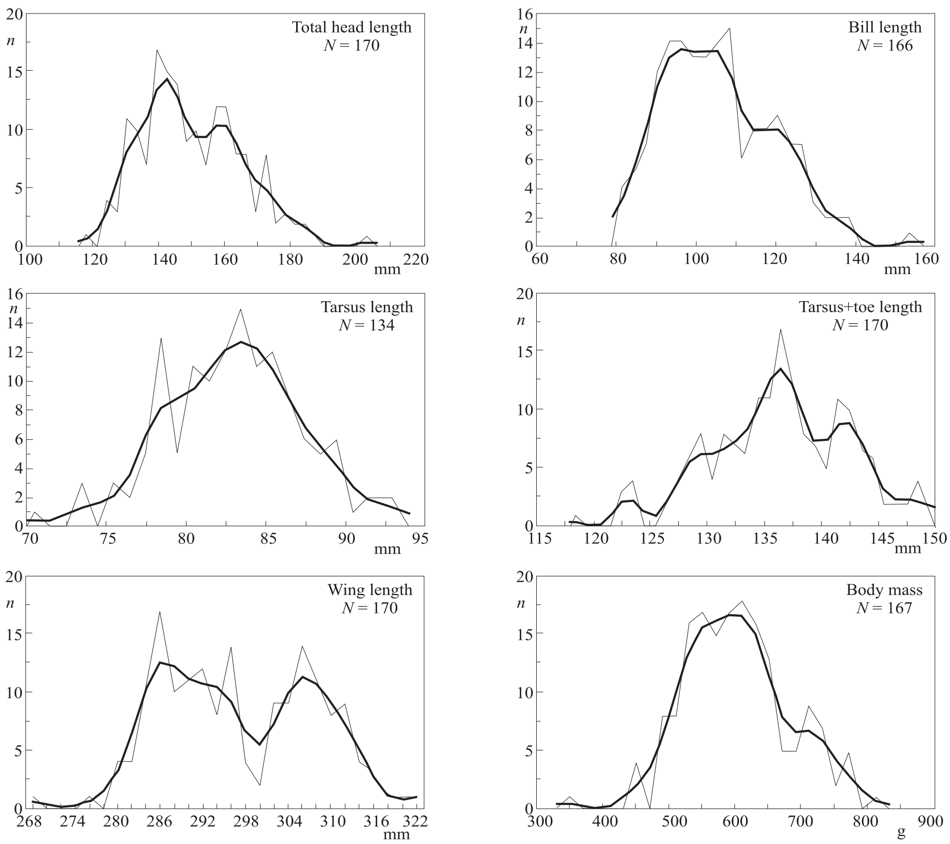

Fig. 5. Frequency distribution of different measurements in juvenile Eurasian Curlews caught during autumn migration. Thin lines - raw data, thick lines - data smoothed by moving average.

Table 1
Measurements of juvenile Eurasian Curlews caught in the lower Vistula valley

Measurement	*N*	Mean	*SD*	Range
Total head length (mm)	170	150.8	15.3	119-203
Bill length (mm)	166	105.87	14.01	80.1-153.5
Tarsus length (mm)	134	83.06	4.23	70.6-92.8
Tarsus plus toe length (mm)	170	136.8	6.13	119-149
Wing length (mm)	170	300.5	10.9	269-325
Body mass (g)	167	602.5	78.4	351-801

All caught birds had very low fat reserves with no fat depot visible in axillary region. The mean fat score was 0.8, the median – 0. Moreover, there was no relationship between the date and fat score in birds caught within reference period ($r = 0.13$, $N = 148$, $p = 0.20$). Thus, it was assumed that fat depots had no crucial influence on differences in body mass of birds in subsequent decades.

There were significant differences in the total head length (ANOVA: $F_{5,170} = 5.25$, $p < 0.001$), bill length (ANOVA: $F_{5,166} = 5.65$, $p < 0.001$) and body mass (ANOVA: $F_{5,167} = 6.45$, $p < 0.001$) of birds caught in different ten-days periods (Fig. 6), with larger and heavier birds occurring towards the end of the study period (Neuman-Keuls *post-hoc* test: $p < 0.05$ in all cases). There were no significant differences in the wing length (ANOVA: $F_{5,170} = 0.55$, $p = 0.77$), tarsus length (ANOVA: $F_{5,134} = 0.79$, $p = 0.56$) and tarsus with toe length (ANOVA: $F_{5,170} = 0.82$, $p = 0.54$) between the early and late juvenile migrants.

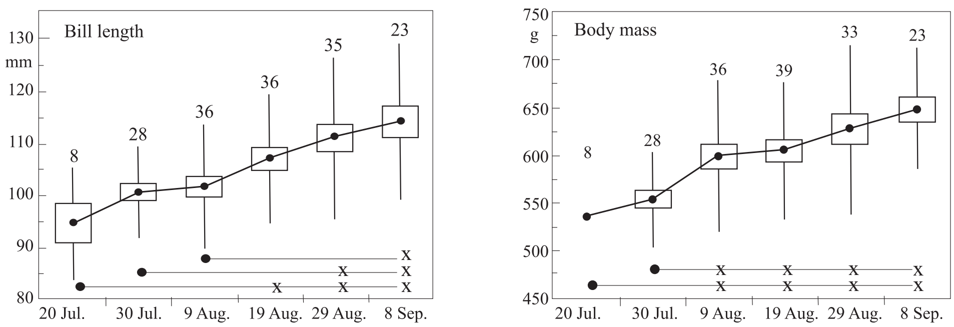

Fig. 6. Changes of bill length and body mass of juvenile Eurasian Curlews caught in subsequent decades of autumn migration. Mean values – line with dot markers, standard errors (*SE*) – rectangles and standard deviations (*SD*) – vertical lines are given. Numbers above bars indicate sample sizes. The "x" signs indicate significant differences between groups of migrants (bill length according to ANOVA and Neuman-Keuls *post-hoc* test: $p < 0.05$; body mass according Kruskal-Wallis test and Dunn *post-hoc* test: $p < 0.05$), starting from the group pointed by a circle.

DISCUSSION

Peaks of the Eurasian Curlew migration were occurring in central Europe at different dates with no clear shift from north to south. The migration pattern with two peaks of bird numbers in August and September was noted at Lake Rakutowskie in central Poland (Zieliński and Studziński 1996) and Lake Malliner in north-eastern Germany (Beitz 1985). Two peaks of migrating birds in August-September and, less marked, in October were observed in Cholgyni in western Ukraine (Meissner *et al.* 1999). In south-western Poland two maxima of the Eurasian Curlew numbers were recorded in August and October (Stawarczyk *et al.* 1996). However, in north-western Germany and near Kielce in central Poland the high numbers of Eurasian Curlews were noted between September and November with no clear peak (Harengerd *et al.* 1973, Wilniewczyc *et al.* 2001). A pattern with the maximum number noted in August was observed in Berlin and Lusatia in eastern Germany (Bruch and Löschau 1971, Krüger *et al.* 1972), in the lower and middle Odra valley (Kube 1988, Bocheński *et al.* 2006) and in the Reda mouth in northern Poland (Meissner *et al.* 1999). Still in many sites, where regular counts were conducted, Eurasian Curlews appeared in very low numbers (*e.g.* Kunysz and Hordowski 1992, Janiszewski *et al.* 1998, Bocheński *et al.* 2006, Kozik 2006). In Lisewo Malborskie the migration dynamics also differed greatly among the studied seasons. Such a variation of migration pattern suggests that in this species the migration timing may depend on local factors, *e.g.* weather conditions or food abundance at stopover sites.

A decreasing proportion of adult Eurasian Curlews among birds caught in Lisewo Malborskie in subsequent decades demonstrates that in this species the autumn migration period of adults and juveniles overlap to a great extent. This is a common scheme of changes in the age structure of migrating waders (*e.g.* Hedenström 2004; Meissner 2006, 2007; Włodarczyk *et al.* 2007). In a few seasons the migration in July was not very intensive with small numbers of migrants passing the study area. In that period adults comprised about 40% of trapped Eurasian Curlews, but it is possible that their real proportion in migrants was much higher due to the fact that inexperienced, naive juveniles were much easier to catch in mist-nets than adults (Goss-Custard *et al.* 1981). The low numbers of migrating birds in July may suggest that adults in some seasons might migrate much earlier, *e.g.* in June or they pass the study area using a different route or a different migration strategy. It is possible that juveniles undertake migration with short flight carrying very low fat reserves, whereas majority of adults fly over the lower Vistula valley making longer non-stop flight with higher energetic stores. It is also possible that birds with larger fat reserves ignore tape luring, whereas those with small energetic stores eagerly want to join calling flock mates. Indeed, the mean body mass of juveniles caught in Lisewo Malborskie (602.5 g, SD = 78.4, N = 167) was 92 g lower than the lowest body mass of young birds from Holland recorded in the period from August to December (Glutz von Blotzheim *et al.* 1977). Figureola and Gustamante (1995) found that tape-lured Curlew Sandpipers weighed less than those captured without tape luring.

The majority of birds recorded in Lisewo Malborskie were seen when flying. It cannot be excluded that many birds passed the study area at night and/or at high altitudes and might not been observed. For sure at some nights the migration of Eurasian Curlews took place. There was impossible to estimate their number, but during such nights many voices of flying birds were heard, which suggests that the passage was intensive. Unknown and probably changeable proportion of birds flying during the day and at night may be a reason of a great variation in migration dynamics among subsequent seasons.

The migration dynamics of curlews showed major day-to-day changes in bird numbers and almost all of the observed flocks migrated through the river valley without staying in the study area. Moreover, only one bird was caught twice during the season. It indicates that the lower Vistula valley is not an attractive stopover site for the Eurasian Curlew. During autumn migration this species is often observed in the adjacent areas foraging in arable fields (own data). This habitat seems to be more profitable for curlews than sandy islets and beaches of the river banks.

In the Eurasian Curlew females are bigger than males both in adults and juveniles (Glutz von Blotzheim *et al*. 1977, Prater *et al*. 1977, Cramp and Simmons 1983). According to Cramp and Simmons (1983) the bill length and the tarsus length are the best measurements for sexing this species. However, about 5% and 15-12% of birds could be sexed wrongly when using bill and tarsus lengths, respectively. Prater *et al*. (1977) claimed that the combination of wing, bill and tarsus lengths allowed sexing almost all individuals. The data from Lisewo Malborskie suggest that the wing length, which has clearly bimodal distribution, should be the best linear measurement for sexing at least juvenile Eurasian Curlews and in the combination with bill or total head length may provide a good discriminant function for distinguishing males and females.

The mean bill length of juvenile Eurasian Curlews caught in Lisewo Malborskie (105.87 mm) was much lower than those given by Prater *et al*. (1977) for juvenile males (111.6 mm) and females (141.1 mm) of *arquata* subspecies. Moreover, 39% of birds from our study had shorter bill than the minimum value given by Glutz von Blotzheim *et al*. (1977). Only 25 largest individuals had bill longer than or equal to 122 mm, which is according to Glutz von Blotzheim *et al*. (1977) in the overlapping ranges of *orientalis* and *arquata* subspecies. However, it remains unknown if these differences might be attributed to different method of measuring or to not finished process of bill growth in juvenile birds. The process of bill growth lasts longer in larger wader species than in smaller ones (Meissner and Ściborski 2002) and Curlews caught during their first autumn migration might have not finished the process of bill growth yet. Thus, the occurrence of a few individuals of *N. a. orientalis* among the migrants was possible, but it cannot be proved.

Curlews caught in the lower Vistula valley in subsequent decades differed significantly in total head length, bill length and body mass. The gradual increase of the total head and bill lengths as well as in body mass indicates that bigger birds from the eastern part of the breeding range migrate later than smaller birds, which breed in the west. According to Cramp and Simmons (1983) *arquata* and *orientalis* subspecies have similar wing length and in this study there were no significant differences in this measurement for birds caught in following decades of the studied period.

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