Biometrics, length of stay and body mass increase of migrating Common Snipes *Gallinago gallinago* in the Gulf of Gdańsk

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Between 1983 and 2000, a total of 1774 Common Snipes were caught and measured in the Gulf of Gdańsk at the Polish Baltic Sea coast. The mean measurements obtained in this study were larger than those provided by other authors. Reasons of this difference are discussed. Among linear measurements only the wing length of Common Snipes caught in the Gulf of Gdańsk in different seasons varied significantly. In 1991 birds had relatively the longest, whereas in 1989 and 1999 the shortest wings. This could be caused by differences in food availability at the breeding grounds during chick growth. The median length of stay of Common Snipes was rather short and varied insignificantly between 5 and 8 days, but several birds were recorded after two weeks. Birds caught in 1989 at Jastarnia showed almost no change in body mass, even if they stayed over 1 month in the study area. This was probably caused by abnormal conditions in the study area, where meadows were extremely dry. In other seasons many individuals showed a decrease of their body mass, but in general there was a tendency towards a moderate increase over the stopover time. The mean body mass of birds caught during this study (98.8 g) was lower than at the majority of other sites in Europe and also lower than at the breeding grounds. Among birds putting on weight, the average increase was only 1.1 g/day and the highest increase was 14 g in 3 days (4.7 g/day). These patterns of body mass change, body mass increase rate and length of stay are very similar to results obtained in north-western Germany and Switzerland. This confirms that Common Snipes in autumn move through Europe slowly and with very small fat reserves, which is typical for migrants applying the B-strategy sensu ALERSTAM & HÖGSTEDT (1982).

Key words: *Gallinago gallinago*, autumn migration, biometrics, body mass changes, Baltic Sea coast.

1. Introduction

In autumn, the Common Snipe passes numerously the European inland (GLUTZ VON BLOTZHEIM *et al.* 1977). An analysis of ringing recoveries showed that the majority of Common Snipes migrating through the southern Baltic originate from Fennoscandia, eastern Baltic and also from the north-western and western Russia (GLUTZ VON BLOTZHEIM *et al.* 1977; BAUMANIS 1985). Negligible ringing activities in Russia make presumptions about eastern range of birds appearing in Europe very speculative. Birds which stop over in the Gulf of Gdańsk depart in south-western and western directions (MEISSNER 2000). Their European wintering grounds extend over a vast area from Great Britain through the Iberian Peninsula and France to Italy. At least some birds spend the winter in Africa (GLUTZ VON BLOTZHEIM *et al.* 1977; BAUMANIS 1985).

The main aim of this study is to describe the biometrics and migration strategies of the Common Snipes migrating through the Gulf of Gdańsk in autumn.

2. Material and methods

Birds were caught between 1983 and 2000 mainly in walk-in traps (MEISSNER 1998) placed on the Gulf of Gdańsk coast at three sites: at Jastarnia, in the Reda river mouth and at Rewa (MEISSNER & REMISIEWICZ 1998) (Fig. 1). Occasionally, mist-nets were also used. Every year the fieldwork started in mid-July and was finished at the end of September. This period covered almost the entire Common Snipe migration in the study area (MEISSNER & SIKORA 1995).

Each caught bird was aged (GLUTZ VON BLOTZHEIM *et al.* 1977), although ageing before 1990 was not reliable. The percentage of adults among the birds caught in the years 1991-2000 was only 5.1% (n = 800).

Wing length (EVANS 1986), total head length (GREEN 1980), bill length (PRATER *et al.* 1977), tarsus length (SVENSSON 1992) and tarsus plus toe length (PIERSMA 1984) were measured. Before 1991, total head and bill length were measured to the nearest 1 mm with stopped ruler, later on with callipers to the nearest 0.1 mm. To combine less and more precise measurements, the latter were rounded to the nearest 1 mm. Birds were also weighed with accuracy of 2 g, but in 1999-2000 to the nearest 1 g. Body masses were

grouped in 5 g classes. Weight data from Common Snipes caught at least twice in the same season (retraps) were used to calculate body mass changes during birds' stay.

There were no significant differences in measurements taken at Jastarnia and Reda mouth (t-test, $p > 0.05$), so data from both sites were combined. In total, 1,774 birds were measured between 1983 and 2000. Every year the accuracy and repeatability of measurements taken by different ringers were checked as described by BUSSE (1984).

To find differences among birds passing the Gulf of Gdańsk earlier and later during the season, time of capture was divided into five half-month periods. Variation of measurements among years and among subsequent half-month periods was analysed by two-way ANOVA (ANOVA II). The number of Common Snipes caught and measured in subsequent periods of separate years differed considerably and in several cases empty cells occurred, which makes computation of two-way ANOVA impossible. Thus, two different approaches were used. The first one maximised the number of analysed seasons, whereas the second maximised the number of half-month periods.

The body mass of each bird was adjusted for body size. Principal component analysis (PCA) was conducted on wing length, total head length and tarsus plus toe length for obtaining a single value representing overall size of the bird. Only one significant factor was extracted with loadings of 0.72 for wing length, 0.74 for total head length and 0.82 for tarsus plus toe length. These three measurements were taken simultaneously in 778 birds. Bill length was excluded from this analysis, because this measurement was highly correlated with total head length ($r = 0.94$). Moreover, R^2 value for the model including bill length instead of total head length amounted to 0.56 and was somewhat lower than in the chosen model. Thus, the equation for calculating size factor was as follows:

$$S = (0.412\ wl) + (0.425\ thl) + (0.472\ tt),\ R^2 = 0.58$$

where S = body size, wl = wing length, thl = total head length, tt = tarsus plus toe length.

Subsequently, body mass was regressed against calculated body size. The following regression line equation was obtained:

$$BM = (4.27\ S) + 99.82,\ R^2 = 0.18,\ p < 0.0001$$

(BM = body mass)

The slope of this equation was applied for calculating size-adjusted body mass (BMA):

$$BMA = BM + 4.27\ (130.9 - S)$$

where 130.9 is the mean size factor calculated for all of 778 Common Snipes in the sample.

The mean length of stay of Common Snipes was calculated by retrap intervals. Eighty percent of all retraps were caught in the seasons 1983, 1996 and 1997 in Reda mouth and in 1989 at Jastarnia (Table 2). Thus, the data on median length of stay and body mass increase were taken only from these seasons. To compare the median length of stay and the median body mass increase in retraps the median test was used, because many cases were located close to the starting point of the scale (STATSOFT 1997). All other statistical methods used in this study followed ZAR (1996).

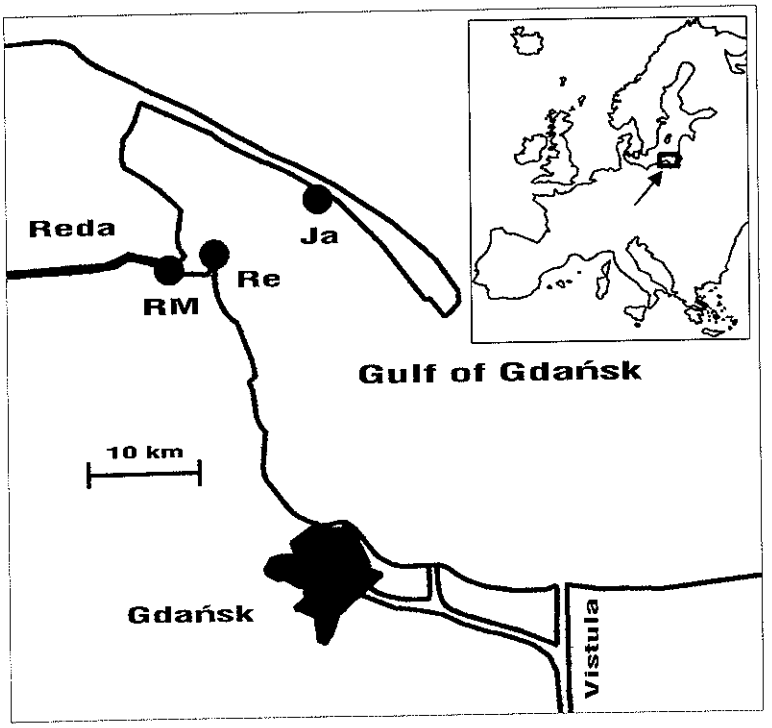

Fig. 1: Localisation of the ringing sites of WRG KULING within the study area in the Gulf of Gdańsk. – *Lage der Beringungsorte der Arbeitsgruppe KULING im Untersuchungsgebiet der Danziger Bucht.* RE – Rewa, RM – Reda mouth, JA – Jastarnia.

3. Results

Comparison of mean measurements of adults and juveniles caught in 1991-2000 showed that differences between both age classes are not statistically significant (Table 1). Thus, in this paper both age classes were combined.

All distributions except bill length were unimodal (Fig. 2). There were no significant differences in bill length, total head length and tarsus plus toe length among years and half-month periods (Tab. 2). Only in the case of wing length there were significant differences among years in both approaches to the two-way ANOVA. There was no significant interaction between the two factors in any of measurements. Post-hoc SPJOTVOLL & STOLINE test revealed that birds caught in 1991 had significantly longer wings than those from seasons 1986, 1988, 1989, 1996, 1997 and 2000 (Fig. 3). Moreover, the average wing lengths in the Common Snipe measured in 1988

and 1989 were smaller than in years 1983 and 1984.

The adjusted body mass varied significantly among years and among half-month periods (Table 2). After excluding data obtained in 1989 (the lowest average adjusted body mass) significant differences among years disappeared (ANOVA II, $F_{(1,247)} = 2.3$, $p = 0.13$), but significant differences between two half-month periods of August remained significant (ANOVA II, $F_{(1,247)} = 4.21$, $p = 0.04$). When taking into account only seasons with sufficient sample sizes for more than two half-month periods (years 1986 and 1989), differences were significant (ANOVA, $F_{(2,168)} = 7.37$, $p = 0.001$ and $F_{(3,202)} = 3.13$, $p = 0.03$, respectively). Results of the NEWMAN-KEULEs post-hoc tests showed that in 1986 birds caught in the first half of September were heavier than those from both half-month periods of August ($p < 0.05$), whereas in 1989 significant differences occurred between the second half of August (the lightest birds) and the second half of July (the heaviest birds) ($p < 0.05$). Moreover in 1989 birds caught in the first half of September were heavier than those from the second half of August, although this difference was only marginally significant ($p = 0.06$).

The median length of stay of Common Snipes varied insignificantly between 5 and 8 days (Table 3; median test, $\chi^2 = 4.8$, $p = 0.19$). However, body mass increase was different between seasons (median test, $\chi^2 = 11.8$, $p < 0.01$). After excluding data from year 1989 (the lowest median), differences became insignificant (median test, $\chi^2 = 1.2$, $p = 0.76$). Common Snipes caught in 1989 at Jastarnia showed almost no changes in body mass, even if they stayed more than 1 month in the study area (Fig. 4). In other seasons many individuals showed a decrease of body mass, but in general there was a tendency to a moderate increase over the stopover period. Among birds of which the weight was taken, the average increase was only 1.1 g/day and the highest increase was 14 g in 3 days (4.7 g/day).

Table 1: Comparison of mean measurements of juvenile and adult Common Snipes in the Gulf of Gdańsk. – *Vergleich von mittleren Maßen von juvenilen und adulten Bekassinen in der Danziger Bucht.*

Measurement	Juveniles			Adults			Results of t-test	
	Mean	SD	N	Mean	SD	N	t	p
Total head length *Kopflänge*	98.0	3.2	722	98.0	3.0	37	0.05	0.962
Bill length *Schnabellänge*	69.4	3.1	731	69.6	3.1	37	-0.47	0.640
Tarsus length *Tarsus*	33.64	1.28	619	34.00	1.37	24	-1.37	0.172
Tarsus + toe length *Tarsus plus Zehen*	70.0	2.8	169	68.9	1.9	21	1.82	0.071
Wing length *Flügellänge*	137.8	3.0	744	138.1	3.1	39	-0.58	0.564

4. Discussion

Data from museum skins presented by GLUTZ VON BLOTZHEIM *et al.* (1977), PRATER *et al.* (1977) and CRAMP & SIMMONS (1986) allowed to reveal differences in some measurements between adults and juveniles of the Common Snipe (especially in females). However, other biometrical analyses conducted on

Table 2: Results of two-way ANOVA of different measurements of the Common Snipe caught in the Gulf of Gdańsk (n.a. = not available). – *Ergebnisse* der *Varianzanalyse (2 Faktoren) von verschiedenen Maßen der Bekassine in der Danziger Bucht.*

Measurement	Factor	Results for maximum number of years		Results for maximum number of half-month periods	
		F	p	F	p
Wing length *Flügellänge*	Year	$F_{(8,1189)} = 2.98$	0.003	$F_{(4,985)} = 5.43$	0.0003
	Half-month period	$F_{(2,1189)} = 2.50$	0.08	$F_{(3,985)} = 2.43$	0.06
	Interaction	$F_{(16,1189)} = 1.48$	0.10	$F_{(12,985)} = 1.39$	0.16
Total head length *Kopflänge*	Year	$F_{(6,1050)} = 1.30$	0.25	$F_{(4,975)} = 1.48$	0.21
	Half-month period	$F_{(2,1050)} = 2.01$	0.13	$F_{(3,975)} = 1.25$	0.29
	Interaction	$F_{(12,1050)} = 1.39$	0.16	$F_{(12,975)} = 1.17$	0.30
Bill length *Schnabellänge*	Year	$F_{(6,1058)} = 1.96$	0.07	$F_{(4,985)} = 1.85$	0.12
	Half-month period	$F_{(2,1058)} = 1.89$	0.15	$F_{(3,985)} = 1.79$	0.15
	Interaction	$F_{(12,1058)} = 0.89$	0.55	$F_{(12,985)} = 1.18$	0.29
Tarsus + toe length *Tarsus plus Zehen*	Year	$F_{(2,395)} = 0.22$	0.80	n.a.	n.a.
	Half-month period	$F_{(2,395)} = 0.51$	0.60		
	Interaction	$F_{(4,395)} = 0.65$	0.63		
Adjusted body mass *bereinigte Körpermasse*	Year	$F_{(2,334)} = 7.59$	0.006	n.a.	n.a.
	Half-month period	$F_{(1,334)} = 9.05$	0.0001		
	Interaction	$F_{(2,334)} = 0.99$	0.37		

Table 3: Data about retraps of Common Snipes in the Gulf of Gdańsk in different seasons. – *Wiederfänge von Bekassinen in der Danziger Bucht. JA – Jastarnia, RM – Reda mouth.*

Season	Number of retraps *Anzahl Wiederfänge*	Percent of retraps among all ringed birds *Anteil Wiederfänge (%) aller beringten Vögel*	Median length of stay [days] *mittl. Aufenthaltsdauer in Tagen (Median)*	Median unadjusted body mass change [%/day] *Änderung des Körpergewichts (Median, in %/Tag)*
1983 RM	28	18.4	8	0.6
1989 JA	25	9.0	5	0.0
1996 RM	36	10.3	5	0.3
1997 RM	29	14.7	5	0.4

living birds showed that differences between adults and juveniles in average measurements were insignificant or very small (GREVE & GLOE 1974 – except wing length; GLUTZ VON BLOTZHEIM *et al.* 1977; OAG MÜNSTER 1975; CRAMP & SIMMONS 1986; WŁODARCZYK & KACZMAREK 2000), which is confirmed in this study.

In the Common Snipe, similarly to many other waders, females are larger than males (GLUTZ VON BLOTZHEIM *et al.* 1977). However, this difference seems to be less pronounced in juveniles (PRATER *et al.* 1977). The lack of a suspected bimodality in distribution of the majority of measurements might be caused by relatively small differences between the sexes, variability of measurements among seasons (wing length) and superdomination of juveniles in the sample. Juvenile waders on autumn migration usually have not yet reached their final dimensions and birds may be at different stages of growth. It is also possible that the analysed sample consists of birds from different populations, which differ in biometrics. These might override differences between males and females. It is worth noting that unimodal distributions of almost all Common Snipe measurements were obtained in Germany (GREVE & GLOE 1974; OAG MÜNSTER 1975), in central Poland (WŁODARCZYK & KACZMAREK 2000) and also in Lithuania (ŠVAZAS *et al.* 2001). The exceptions were tarsus length (in central Poland) and bill length of adults (in north-western Germany).

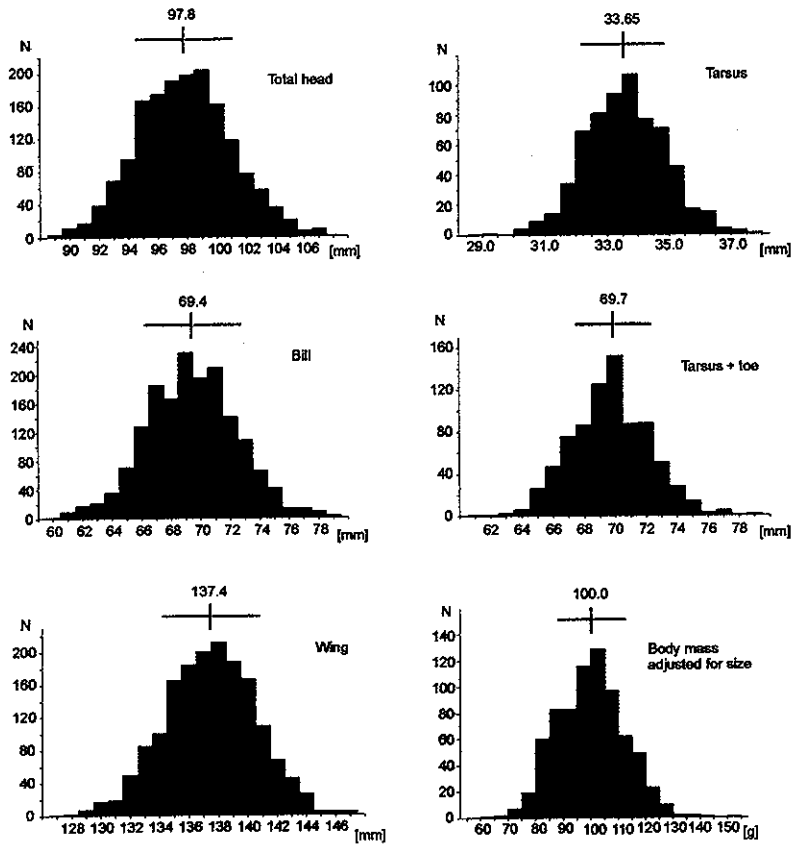

Fig 2: Frequency distribution of different measurements of the Common Snipe in the Gulf of Gdańsk. Data from Jastarnia, Rewa and Reda river mouth were combined. The mean (value and vertical line) and standard deviation was given above the each histogram. – *Verteilung verschiedener Maße der Bekassine in der Danziger Bucht. Die Daten von Jastarnia, Rewa und Redamündung wurden zusammengafasst. Arithmetisches Mittel und Standardabweichung sind angegeben.*

Surprisingly, mean measurements obtained in this study were larger than provided by other authors, except tarsus length (Table 4). There are at least two possible explanations of these differences. First, the method of taking measurements was not the same at different sites, although it was declared to be the same. For example, some doubts regarding comparability of data on wing lengths from Braunschweiger Rieselfelder have been raised earlier (MEISSNER 1997b). Probably these measurements were taken in a slightly different way than in the present study. Second, in samples analysed here shares

of birds from different populations might be not equal. Geographical populations of the Common Snipe differ with respect to migration routes and localisation of wintering areas, although there is a considerable overlap (GLUTZ VON BLOTZHEIM *et al.* 1977; KÅLÅS 1980; DEVORT 1997). If these populations differ in biometrics, measurements taken in distant regions of Europe would also be different. Significant differences in average measurements between autumn migrants and breeding birds found in Lithuania support this hypothesis (ŠVAZAS *et al.* 2001).

Among linear measurements only wing length of Common Snipes caught in the Gulf of Gdańsk in different seasons varied significantly. In 1991 birds had relatively the longest, in 1989 and 1999 the shortest wings. The variability of average dimensions of juvenile birds among years has been already described in some waders (MEISSNER 1997a, 1999; MEISSNER & WŁODARCZAK 1999; MEISSNER & GÓRECKI in press). It can be caused by the differences in food availability at breeding grounds during chicks growth (MYRBERGET *et al.* 1977; KERSTEN & BRENNINKMEIJER 1995). In the case of the Wood Sandpiper *Tringa glareola* the size of juveniles was positively correlated with breeding success. In seasons with high number of juveniles,

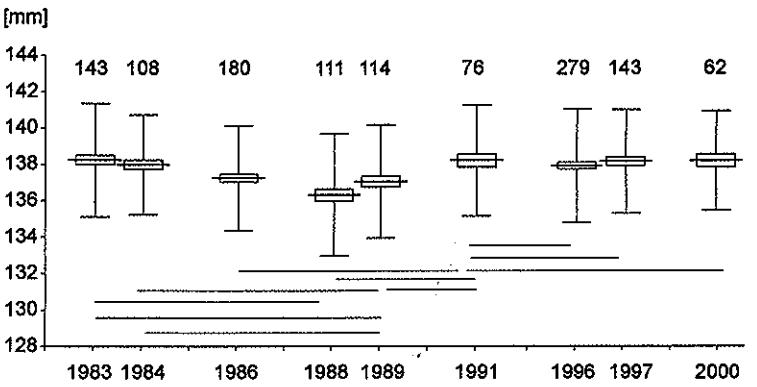

Fig. 3: Differences in the mean wing length in Common Snipes caught in subsequent autumn seasons in the Gulf of Gdańsk. Horizontal line - average, rectangle - standard error, vertical line - standard deviation. Numbers above indicate the sample size. Horizontal lines at the lower part of the figure mark statistically significant difference between seasons (SPJOTVOLL & STOLINE test, $p < 0,05$). – *Unterschiede der mittleren Flügellänge von Bekassinen, die in aufeinander folgenden Jahren im Herbst in der Danziger Bucht gefangen wurden. Horizontale Linie = Mittelwert, Rechteck = Standardfehler, senkrechte Linie = Standardabweichung. Die darüber stehenden Zahlen geben die Stichproben-Größe an. Horizontale Linien im unteren Teil der Abbildung kennzeichnen signifikante Unterschiede zwischen den Jahren.*

Table 4: Comparison of the average measurements of Common Snipes caught in different European localities. A – adults, J – juveniles, M – males, F – females. – *Vergleich von mittleren Maßen gefangener Bekassinen in verschiedenen Gebieten Europas.*

Area	Wing *Flügel* [mm]	Bill *Schnabel* [mm]	Total head *Kopf + Schnabel* [mm]	Tarsus *Tarsus* [mm]	Unadjusted body mass [g] *Körpermasse*	Source
Gulf of Gdańsk	137.4	69.4	97.8	33.65	98.8	this study
Jeziorsko (central Poland)	136.8	68.6	97.3	34.0	101.6	WŁODARCZYK & KACZMAREK (2000)
Lithuania (autumn migrants)	136.8			34.2	95.7	ŠVAZAS *et al.* (2001)
Lithuania (breeding population)	134.5			33.8	104.3	ŠVAZAS *et al.* (2001)
Braunschweiger Rieselfelder (northern Germany)	A 136.3 J 133.6	A 66.5 J 65.5			A 113 J 106	GREVE & GLOE (1974)
Münster (nortwestern Germany)	A 136.4 J 136.0	A 68.5 J 68.8		A 33.4 J 33.6	A 110.1 J 115.1	OAG MÜNSTER (1975)
France	M 136 F 137					DEVORT (1997)
Ireland	M (A)131 M (J)131 F (A)131 F (J) 130	M (A) 65.8 M (J) 65.5 F (A) 67.3 F (J) 66.9				CRAMP & SIMMONS (1986)

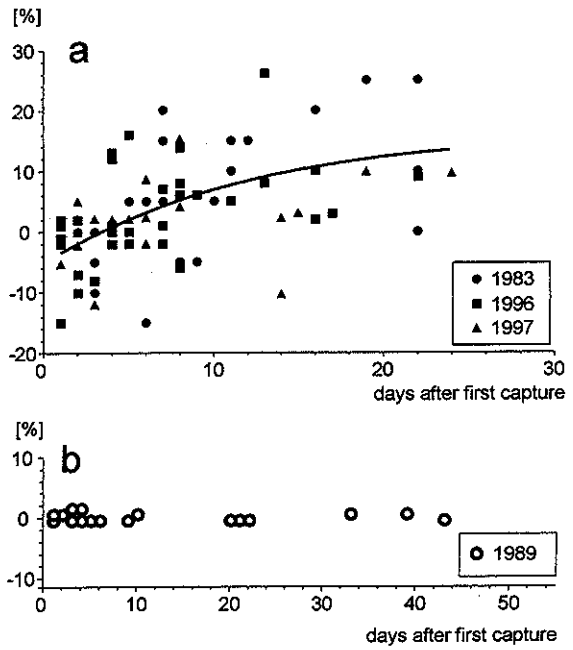

Fig. 4. Unadjusted body mass changes in Common Snipes caught in Reda mouth in seasons 1983, 1996, 1997 (a) and at Jastarnia in 1989 (b). The curve is fitted to data according to the negative exponentially-weighed smoothing procedure. – *Veränderungen der Körpermasse von Bekassinen, die an der Redamündung 1983, 1996 und 1997 (a) und in Jastarnia 1989 (b) gefangen wurden.*

their average wing length was also higher (MEISSNER 1997a). There are no sufficient data in this study to perform such analysis for the Common Snipe.

The body mass of birds is highly variable. It depends on overall size of bird, size of internal organs and the amount of energetic reserves (PIERSMA 1994). Differences between years and within a particular season are most probably a result of changes in the level of fat reserves in birds. It might be caused by differences in richness of feeding sites, weather conditions at the study site and on migration route to this site. Data on unadjusted body mass gathered in Germany, Switzerland and central Poland during autumn migration revealed that it increased along the season (GREVE & GLOE 1974; GLUTZ VON BLOTZHEIM *et al.* 1977; WŁODARCZYK & KACZMAREK 2000). A similar tendency was found in some other waders (ONNEN 1991; LEUZINGER & JENNI 1993; MEISSNER 1997b) and also in this study. The mean unadjusted body mass of birds caught during this study (98.8 g) was lower than at the majority of other sites in Europe and also lower than in the Lithuanian breeding population (Table 3). Moreover, in the Gulf of Gdańsk only 9% of birds weighed over 115 g, which is the average body mass of the juvenile Common Snipes caught in north-western Germany (OAG MÜNSTER 1975). Negligible body mass changes in Jastarnia in 1989 were probably caused by abnormal situation in the study area, where meadows were extremely dry. The median length of the Common Snipe stay in the study area was rather short, but several birds were recorded after two weeks, which is unusual for other waders in the region of the Gulf of Gdańsk (WRG KULING – unpublished data). These pattern of body mass change, rate of body mass increase and length of stay are very similar to those obtained in north-western Germany (OAG MÜNSTER 1975) and in Switzerland (GLUTZ VON BLOTZHEIM *et al.* 1977). This confirms that Common Snipes in autumn move through Europe slowly and with very small fat reserves, which is typical for migrants applying the B-strategy sensu ALERSTAM & HÖGSTEDT (1982) (MEISSNER 2001). However, for the Common Snipe large variability of migration period, migration dynamics and even localisation of winter sites in subsequent seasons has been described (GLUTZ VON BLOTZHEIM *et al.* 1977; MEISSNER 2000). DEVORT (1997, 2000) claimed that the migration speed can vary within a season and earlier migrants pass France quicker than later ones. On top of that, weather conditions on the route and environmental conditions at stopover sites seem to have crucial influence on migration timing of this species (REICHHOLF 1972; DEVORT 1997).

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7. Zusammenfassung

Meissner, W. 2003: Biometrie, Aufenthaltsdauer und Gewichtszunahme rastender Bekassinen *Gallinago gallinago* in der Danziger Bucht. Vogelwelt 124: 45 – 52.

Im Zeitraum von 1983 bis 2000 wurden 1774 Bekassinen in der Danziger Bucht (polnische Ostseeküste) gefangen und vermessen. Die Mittelwerte der meisten aufgenommenen biometrischen Maße waren größer als die aus anderen Untersuchungen. Die Gründe für diese Unterschiede werden diskutiert. Bei den linearen Maßen variierte in der Danziger Bucht nur die Flügellänge signifikant zwischen den Jahren. Im Jahr 1991 hatten die Vögel die relativ längsten, in den Jahren 1989 und 1999 dagegen die kürzesten Flügel. Diese Unterschiede könnten durch unterschiedliche Nahrungsverfügbarkeit in den Brutgebieten zur Zeit der Jungenaufzucht bedingt sein. Die Verweildauer der Bekassinen im Untersuchungsgebiet war relativ kurz und variierte nicht signifikant zwischen 5 und 8 Tagen, wobei allerdings mehrere Vögel auch noch nach über

zwei Wochen wiedergefangen wurden. Vögel, die 1989 im Teilgebiet Jastarnia gefangen wurden, zeigten keine Veränderungen des Körpergewichts, selbst wenn sie über einen Monat im Untersuchungsgebiet verweilten. Dies war wahrscheinlich durch die ungewöhnliche Situation im Untersuchungsgebiet verursacht, denn die Wiesen waren in diesem Jahr extrem trocken. In anderen Jahren zeigten zwar viele Individuen eine Gewichtsabnahme, im allgemeinen bestand jedoch die eindeutige Tendenz zu einer mäßigen Gewichtszunahme während des Rastaufenthalts. Das mittlere Körpergewicht von Bekassinen, die im Rahmen dieser Untersuchung gefangen wurden, war mit 98,8 g niedriger als in der Mehrzahl anderer europäischer Untersuchungsgebiete, und auch niedriger als in den Brutgebieten. Die Vögel, von denen die Gewichte ermittelt wurden, zeigten eine mittlere Zunahme von nur 1,1 g/Tag und maximal von bis zu 14 g in drei Tagen (4,7 g/Tag). Dieses Muster der Gewichtsentwicklung und der Verweildauer ist anderen Ergebnissen aus Nordwestdeutschland und der Schweiz sehr ähnlich. Die Ergebnisse bestätigen, dass Bekassinen auf dem Herbstzug langsam und mit geringen Fettreserven durch Mitteleuropa ziehen. Dies ist typisch für B-Strategen im Sinne von ALERSTAM & HÖGSTEDT (1982).

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