Ornis Fennica 74:131–139. 1997

Autumn migration and biometrics of the Common Sandpiper *Actitis hypoleucos* caught in the Gulf of Gdańsk

Włodzimierz Meissner

Meissner, W., Department of Vertebrate Ecology & Zoology, University of Gdańsk, Al. Legionów 9, PL-80-441 Gdańsk, Poland

Received 16 January 1997, accepted 11 February 1997

Autumn migration and biometrics of the Common Sandpiper were studied at the Gulf of Gdańsk during twelve seasons: 1983–1994 (from mid-July to the end of September). Based on ringing recoveries, the mean direction of autumn migration of adults was 214° (± 22°) and juveniles 221° (± 14°) — but the difference is not statistically significant. Bird numbers peaked in the first half of August, when juveniles appeared. Adults had a significantly longer bill and shorter tarsus plus toe and wing than juveniles, although those differences were very small. The body mass of the Common Sandpipers varied from 35 g to 71 g and, on average, juveniles were significantly heavier than the adults. Juveniles of the Common Sandpiper migrating in the second half of July had longer bills than those migrating in the second half of August. Late migrants were heavier than birds arriving in the second half of July and in the first half of August.

1. Introduction

Our knowledge about the migration of the Common Sandpiper *Actitis hypoleucos* is rather poor, though it is a common wader species in Europe. Analysis of recoveries has shown that Common Sandpipers in autumn generally migrate over Europe in a southwest direction (Cramp & Simmons 1983, Stiefel et al. 1985). The first migrants arrive in the Gulf of Gdańsk usually in the beginning of July. They reach maximum numbers in the first half of August (Gromadzka 1987, Meissner 1996). The timing and phenology of the autumn migration in the Gulf of Gdańsk region do not differ much from elsewhere (Bruch & Löschau 1973, Fiala 1973, Harengerd et al. 1973, Reichholf 1979, Kowalski 1985, Warthold 1986, Meltofte 1987, Girard 1989, Hötker & Kölsch 1993), but there is still a lack of data on the biometrics of the Common Sandpiper migrating and wintering in different areas. Large aggregations of this species are rare because it migrates in small flocks (Glutz et al. 1977, Stiefel et al. 1985). Thus, studying the Common Sandpiper is time consuming. The main aim of this work is to describe the direction of the autumn migration and the biometrics characteristic of Common Sandpipers passing through the Gulf of Gdańsk region in autumn.

2. Material and methods

From 1983 to 1994, the Waterbird Research Group KULING organised studies at three sites: at the mouth of the Reda river, at Rewa and at Jastarnia (Fig. 1). At Jastarnia, birds were trapped and counted at the municipal sewage plant, on the wet and dry meadow and on the narrow sandy beach. At Rewa, the study took place on the small sandy peninsula and in the mouth of the river Reda on

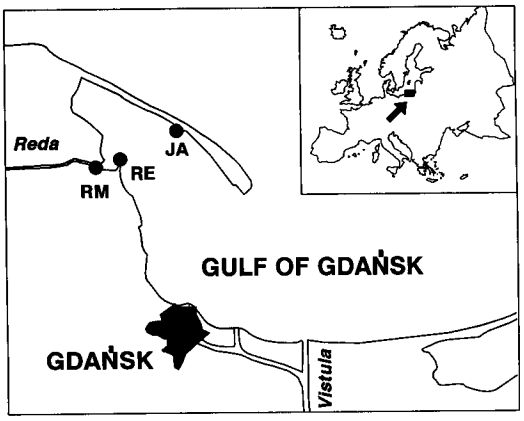

Fig. 1. Study area. JA = Jastarnia, RM = mouth of Reda river, RE = Rewa.

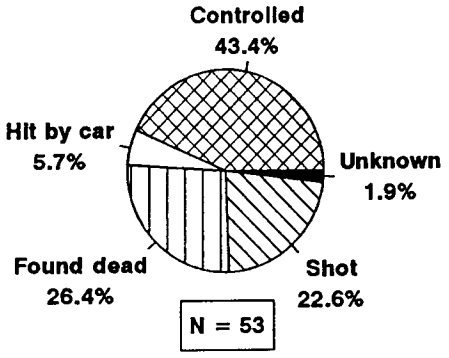

Fig. 2. Circumstances of recoveries of the Common Sandpiper.

sandy beaches or periodically emerging sand islands (on both sides of the river mouth). More detailed descriptions of the study areas were given in previous papers (Brewka et al. 1987, Sikora & Meissner 1992, Meissner & Sikora 1995).

Data were collected at three ringing sites of the Waterbird Research Group KULING (Fig. 1). The mouth of the river Reda and Rewa are very close to each other, so data from those sites were combined. Field activity started every year in mid-July and was finished usually at the end of September (only in 1983, in mid-September). Waders were caught in walk-in traps. The traps were moved frequently because of changes in water level. There are no lunar tides in that area, but the direction and strength of the wind cause very rapid changes in the water level on some days. The traps were placed so as to increase the likehood of catching birds. They were checked every two hours from dusk to dawn. Each bird caught was aged (Prater et al. 1977). Wing length (maximum chord, Evans 1986), total head length (Green 1980), bill and nalospi length (Prater et al. 1977) and tarsus plus toe length (Piersma 1984) were measured. All measurements were taken to the nearest 1 mm using a ruler with a stop. Birds were also weighed to the nearest 1 g with a Pesola spring balance. Every year the accuracy and the repeatability of measurements taken by different ringers were checked as described by Busse (1984).

In total, 242 adults and 714 juveniles of the Common Sandpiper were measured from 1983 to 1990. The biometric data of adults and juveniles were analysed separately. The significance of differences was tested using the parametric t-test, the nonparametric Mann-Whitney U-test and, among birds migrating in subsequent periods, by a multiple range test based on confidence levels (in ANOVA). The homogeneity of variances was examined with the Bartlett test and the fit with the normal distribution was checked using the chi-square test.

Fifty-three long-term recoveries (collected up to the end of 1994) of the Common Sandpiper caught at the Gulf of Gdańsk were used to show the direction of migration. Only 3 adult birds were recovered during the same autumn. In the analysis of the recoveries, the group of adults consists both of birds ringed as adults and as juveniles but recovered in subsequent years.

The direction of migration of a particular bird was determined using the formula based on a loxodrome (Imboden & Imboden 1972). The mean direction and angular deviation of recoveries were calculated according to Zar (1984). The significance of differences in mean direction and angular dispersion between age groups were tested using the Watson U^2 test and the Mann-Whitney U-test (Zar 1984).

3. Results

3.1. Recovery rate and distribution of recoveries

In total, 5 373 Common Sandpipers have been ringed in the Gulf of Gdańsk region up to the end of 1994 (Gromadzka 1982, 1994, pers. comm.,

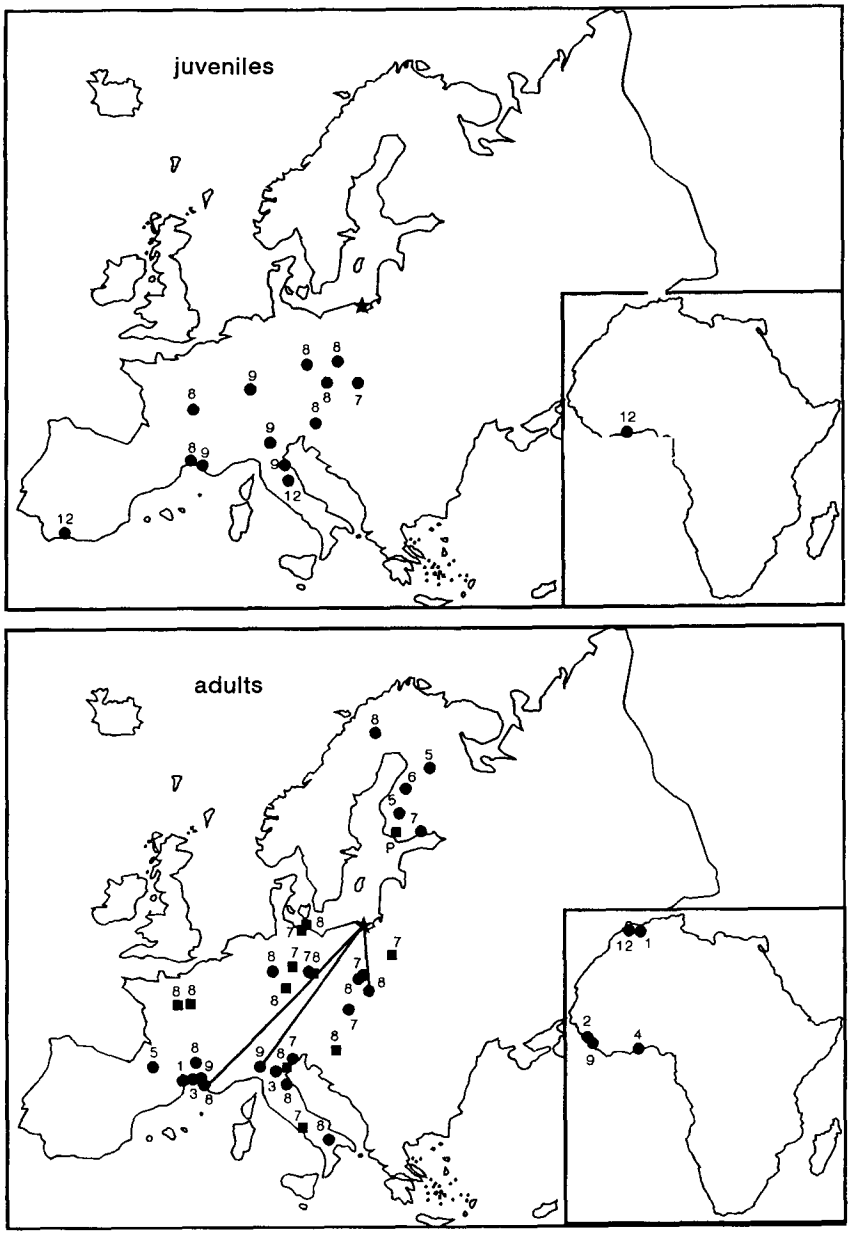

Fig. 3. Recoveries of the Common Sandpiper collected up to the end of 1994. Upper juveniles (n = 14), lower adults (n = 39). Asterisk = Gulf of Gdańsk. Black dots = birds ringed in the Gulf of Gdańsk. Squares = birds ringed elsewhere and retrapped in the Gulf of Gdańsk. Direct recoveries of adults are indicated by straight lines. Number indicates the month in which the bird was ringed or recovered in a given place. P = bird ringed as a pullus.

Meissner & Kozakiewicz 1995) and 53 long-term recoveries were obtained. This gives a 1% recovery rate. The reasons for recoveries are shown in Fig. 2. It is worth noticing that 43% of the recovered birds were retrapped and only about 23% were shot. These results are quite different from those obtained by Stiefel et al. (1985), who mentioned that over 49% of birds had been shot, 21% had been found dead and only 22% had been retrapped.

Only 6 recoveries concern Common Sandpipers caught north of the Gulf of Gdańsk. The distribution of recoveries of adult and juvenile Common Sandpipers is given in Fig. 3. There is no significant difference in the mean angle of migration direction between the age groups departing from the Gulf of Gdańsk region (adults 214°, juveniles 221°) (Watson U^2 test, $p > 0.05$). It is worth noting that juvenile Common Sandpipers during their first migration showed a smaller angular dis-

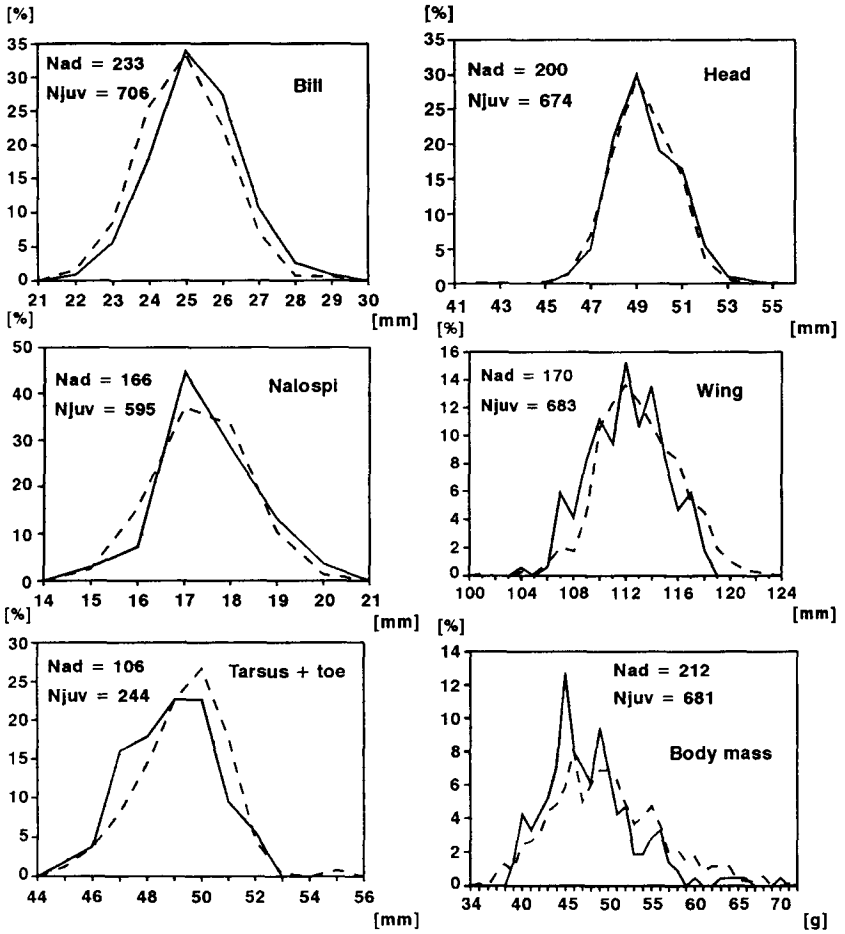

Fig. 4. Frequency distribution of different measurements in juvenile (dashed line) and adult (solid line) Common Sandpipers. Data from the mouth of Reda river, Rewa and Jastarnia are combined.

persion (s = 14°) than adults (s = 22°) and this difference is significant (U-test, $p < 0.05$).

The highest average speed of migration, 314 km per day, was recorded for a juvenile bird retrapped near Brno, Czech Republic, 2 days after ringing at the Vistula mouth.

3.2. Biometrics

All measurements beside nalospi in adults and body mass in both age classes fitted a normal distribution. Almost all measurements showed as a single peak (Fig. 4). Only body mass distribution in juveniles and adults and wing length distribution in adults showed many peaks. Adults had a significantly longer bill and shorter tarsus plus toe and wing than juveniles (Table 1), but the differences are very small. The body mass of Common Sandpipers varied from 35 to 71 g and juveniles were significantly heavier than the adults (Table 1).

Juveniles and adults were divided into five groups according to the time of capture. There are no significant differences in biometrics among those groups except the bill length and body mass in juveniles. Juvenile Common Sandpipers migrating in the second half of July had longer bills than those migrating in the second half of August (ANOVA $F_{3,702} = 3.37$; $p = 0.018$) (Fig. 5). Late migrants (September) were heavier than birds migrating in the second half of July and the first half of August (ANOVA $F_{3,677} = 7.50$; $p = 0.0001$) (Fig. 5).

4. Discussion

4.1. Recovery rate

The 1% recovery rate is the same as that obtained in other countries (Stiefel et al. 1985, Mead et al. 1995). The proportion of Common Sandpiper recoveries obtained from shot birds is relatively small when compared with some other wader species (Myhberg 1961, Beintema & Müskens 1982, Bankovics & Priklonski 1985), even if some birds included in the group "found dead" were in fact shot. Moreover, there is a significant decrease in the proportion of shot Common Sandpipers among recoveries in the last twenty years (Table 2). This fact could explain the difference between the recovery causes shown by Stiefel et al. (1985) and this paper, because Stiefel et al. (1985) used recovery data, obtained only up to the late seventies.

4.2. Origin of birds arriving at the Gulf of Gdańsk and direction of their further migration

There is little known about the origin of Common Sandpipers present in autumn in the Gulf of Gdańsk region. Distribution of recoveries suggest that some of them originate from Fennoscandia. Probably many of them have breeding grounds in northern Russia, but ringing activity in that region is negligible and only a few recoveries from such birds exist (Stiefel et al. 1985).

From the Gulf of Gdańsk region Common Sandpipers continue their autumn migration to the south and southwest, which agrees with the results obtained by Stiefel et al. (1985). Some of the birds, however, were recorded as heading

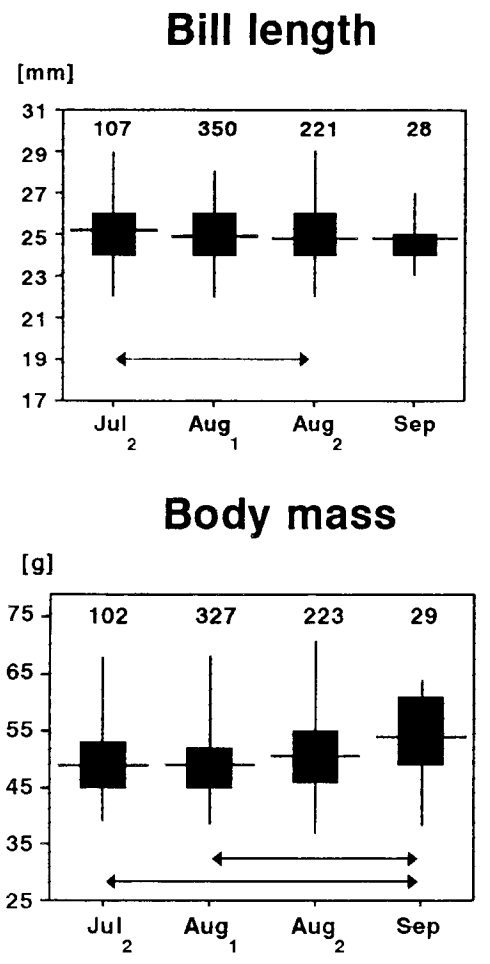

Fig. 5. Mean bill lengths and body mass (horizontal lines), 25% and 75% of the distribution (rectangle) and ranges (line) of bill length and body mass in juvenile Common Sandpipers caught in the Gulf of Gdańsk region in subsequent periods (half of months and in September). Arrow indicates significant difference between two groups of migrants ($p < 0.05$).

Table 1. Comparison of measurements of adult and juvenile Common Sandpipers caught in the Gulf of Gdańsk region.

Measurement	Adults n	Adults mean	Adults SD	Juveniles n	Juveniles mean	Juveniles SD	t-test (t) or Mann-Whitney U-test (z)	
Total head	200	49.4	1.4	674	49.3	1.4	t = 1.09	ns
Bill	233	25.3	1.2	706	24.9	1.8	t = 3.78	**
Nalospi	166	17.5	1.0	595	17.4	1.0	z = 1.38	ns
Tarsus + toe	106	48.9	2.9	244	49.4	3.1	t = 2.43	*
Wing	171	112.2	1.6	683	113.0	1.6	t = – 3.36	**
Body mass	212	47.8	6.3	681	49.7	5.2	z = 4.11	**

ns = not significant, * = $p < 0.05$, ** = $p < 0.001$

southeast from the ringing site (this study and one recovery in Stiefel et al. 1985). There is still little known about waders migrating from the Baltic region to the southeast, but probably Common Sandpipers use that flyway as do many other species (Viksne & Michelson 1985, Gromadzka 1987). The difference between juveniles and adults in the angle of dispersion could be a result of including juvenile birds recovered as adults in the group of adults. It is known, e.g. in the Dunlin *Calidris alpina*, that birds may migrate along different routes during their first and second autumn migrations (Leslie & Lessels 1978, Gromadzka 1983, Brenning 1989).

4.3. Biometrics

Distribution of all measurements, besides wing length in adults, showed only one peak. Distribution of adult wing length may be a result of a different degree of wear of the longest primary feather and differences in wing length between sexes. Furthermore it could also be an effect of the rather small (N = 170) sample size and wide range of wing length in this species.

Like most wader species, females of the Common Sandpiper are larger than males (Prater et al. 1977, Løfaldli 1981, Holland et al. 1982, Teubert & Kneis 1984). The results obtained by Robson (1977), Løfaldli (1981) and Teubert and Kneis (1984) suggest that the wing length or the total head length are the most useful measurements for identifying the sexes. Probably it is easier on the breeding grounds, within a single local population. During migration, birds from a very large area mix together and often it is impossible to identify the sexes by a single external measurement (Cofta 1986), although in the Bug valley adults migrating in autumn show two distinct peaks in wing length distribution (C. Mitrus pers. comm), similar to birds from northern Saxonia (Teubert & Kneis 1984). It is worth noting that the highest value of wing length distribution of adult Common Sandpipers from the Gulf of Gdańsk (112 mm) falls between two peaks in wing length distribution in adults caught in the Bug valley (C. Mitrus pers. comm.). As was mentioned above, Common Sandpipers leaving the Gulf of Gdańsk probably take at least two different migration routes. Thus, a sample of birds caught in that region could consist of different migrational populations which differ in wing length distribution.

Table 2. Circumstances of recoveries of Common Sandpipers in subsequent twenty years periods.

Period	Shot	Found dead	Retrapped	Others	N
1960–1979	34.5%	24.1%	41.4%	0.0%	29
1980–1994	8.3%	29.2%	50.0%	12.5%	24

Adults have, on average, longer bills and shorter tarsus plus toes and wings than juveniles. The bill and especially its horny part is still growing during the first autumn (Szulc-Olechowa 1964, Nitecki & Zamajska 1979, Holland & Yalden 1991). The neurocranium, which protects the brain, reaches its final dimensions earlier and that is why there is no difference in the total head length between adults and juveniles. The longer tarsus plus toe in juveniles is related to the ossification process of the leg, which takes place fairly early (Strawiński 1964). The decrease in the cartilage content of the tarso–metatarsus joints causes shortening of the tarsus (Cymborski & Szulc-Olechowa 1967, Nitecki & Zamajska 1979). So, this "overgrowth" is transitional and adults have shorter legs than juveniles. Wing length of adults is shorter because the longest primary feather is worn out whereas juveniles migrate with new feathers (Pienkowski & Minton 1973). This effect is enhanced by a higher content of cartilage in carpal and finger joints in juveniles. Contrary results were obtained by Greve and Pannach (1974) in Braunschweiger Rieselfeld (central part of Germany). The adults caught there had significantly longer wings than juveniles. This seems to be quite unusual in autumn, when adults have worn (unmoulted) primaries and their wing should be shorter than in juveniles which have new flight feathers (irrespective of the measurement method), unless the juveniles migrating in Braunschweiger Rieselfeld do not have full-grown primaries. The average wing length of adults there and at the Gulf of Gdańsk is almost the same (122.0 and 122.2 mm, respectively), whilst juveniles from the Braunschweiger Rieselfeld have, on average, shorter wings than birds from this study (110.1 and 113.0 mm). Other authors (Glutz et al. 1977, Løfaldli 1981,

C. Mitrus pers. comm.) obtained measurements which do not differ from those from the Gulf of Gdańsk region. Especially birds migrating along the Bug river in eastern Poland have practically the same average values of wing length, total head length and bill length as the birds in the Gulf of Gdańsk (C. Mitrus pers. comm.).

There were almost no differences in measurements of juveniles migrating in subsequent periods. Only late migrants (from the second half of August) had significantly shorter bills than birds from the second half of July. A similar pattern was found in juvenile Wood Sandpipers *Tringa glareola* migrating through Switzerland (Leuzinger & Jenni 1993). A continuous decrease of average bill length values in juveniles migrating later, suggest that late migrants depart from the breeding grounds with a bill which is not fully grown. It is also possible that this species shows populational differentiation in biometrics among populations and that larger ones migrate earlier. However, it is believed that there are no significant differences in biometry among different geographical Common Sandpiper populations (Cramp & Simmons 1983). On average, body mass increased during the time of migration and September birds were heaviest. This produces significant differences in weight between adults and juveniles (most juveniles migrate later). The fact that late migrating waders have a tendency to carry more fat than earlier migrating ones has been described previously (e.g. Greve & Gloe 1974, Pienkowski et al. 1979, Baccetti et al. 1991, Onnen 1991). The extra fat reserves could be a form of "insurance" against difficulties in meeting food requirements (Pienkowski et al. 1979, Kaiser & Gillingham 1981). In September, the risk of encountering severe weather is greater than in earlier months. On the other hand, the heavier weight of late migrants may suggest that these birds use another migration strategy and make longer "jumps" than early migrants.

Acknowledgements. This study was undertaken by the Waterbird Research Group KULING. I am grateful to all colleagues from WRG KULING, who helped in the fieldwork. Cezary Mitrus provided data on Common Sandpipers caught at Mołożew. I am thankful to the staff of the Gdańsk Ringing Centre for providing the recoveries from the mouth of the Vistula river. Jadwiga Gromadzka and Michał Goc made useful comments and Günter Pannach sent important information about studies in Braunschweiger Rieselfeld. Mikko Mönkkönen, Gudmundur A. Gudmundsson and D. W. Yalden commented on the earlier version of the manuscript.

Selostus: **Rantasipin syysmuutto ja biometria Gdańskin lahdella**

Kirjoittaja tutki rantasipin syysmuuttoa, sen ajoittumista ja muuttavien lintujen biometrisiä mittoja Puolan rannikolla, Gdańskin lahdella (Kuva 1). Rengaslöytöjen perusteella pääosa rantasipeistä muuttaa syksyisin tutkimusalueelta kohti SW tai S, eikä nuorten ja aikuisten lintujen välillä ollut juurikaan eroa muuttosuunnassa (Kuva 3). Osa linnuista kuitenkin ilmeisesti muuttaa kaakkoon. Rengaslöytöjen syyt näyttävät muuttuneen 1960–70-luvulta 1980–90-luvulle tultaessa: selvästi pienempi osuus kontrolleista 1980–90-luvulla koskee ammuttuja yksilöitä (Taulukko 2, Kuva 2). Lintujen määrä lahdella oli korkeimmillaan elokuun alkupuoliskolla, jolloin nuoret linnut saapuivat. Aikuiset ja nuoret linnut poikkesivat toisistaan biometristen mittojen suhteen: vanhojen lintujen nokka + pää oli keskimäärin pidempi sekä nilkka + keskivarvas ja siipi lyhyempi kuin nuorilla yksilöillä (Kuva 4, Taulukko 1). Lintujen paino vaihteli 35 ja 71 gr välillä, ja nuorten lintujen paino oli suurempi kuin vanhojen. Heinäkuun lopulla muuttavien nuorten lintujen nokka oli pitempi kuin elokuun lopulla muuttavien nuorukaisten. Myöhäiset muuttajat olivat painoltaan suurempia kuin heinäkuun lopulla ja elokuun alussa muuttavat (Kuva 5).

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