J. Ornithol. 140, 73–79 (1999)

ISSN 0021-8375

Body dimensions and mass of breeding and hatched Black-tailed Godwits (*Limosa l. limosa*): a comparison between a West Siberian and a Dutch population

Niko M. Groen[1] and Alexander K. Yurlov[2]

[1]Institute for Systematics and Population Biology, University of Amsterdam, P.O. Box 94766, 1090 GT Amsterdam, The Netherlands; [2]Institute of Animal Systematics and Ecology, Siberian Branch of the Russian Academy of Sciences, 11 Frunze Street, Novosibirsk 630091, Russia

Summary

The breeding biology and habitat preference of the Black-tailed Godwit (*Limosa l. limosa*) was studied in the West Siberian forest-steppe in May and June 1995. The godwits prefer reed and sedge marsh and edges of ponds and depressions. They breed in small aggregations together with other waders such as Lapwing (*Vanellus vanellus*), Marsh Sandpiper (*Tringa stagnatilis*), Redshank (*Tringa totanus*), Common Snipe (*Gallinago gallinago*) and Great Snipe (*Gallinago media*). A remarkable resemblance of breeding birds was noticed between the Siberian steppe and the 'meadowbird' community as found in The Netherlands in the 1950's. Comparisons of biometrics between Siberian and West European Black-tailed godwits showed significant differences. Black-tailed Godwits from Siberia are in all aspects larger than their European conspecifics. Egg volumes and hatchling weights decreased in the course of the season. Breeding success in 1995 was low owing to intense predation by Hooded Crow (*Corvus corone cornix*) and Magpie (*Pica pica*).

Key words: meadowbird community, egg volume, hatchling weight, breeding success, predation

Zusammenfassung

Maße und Gewichte von brütenden und geschlüpften Uferschnepfen (*Limosa l. limosa*): ein Vergleich zwischen Westsibirien und den Niederlanden

Im Mai und Juni 1995 wurden das Brutverhalten und die Habitatwahl der Uferschnepfe (*Limosa l. limosa*) in der Waldsteppe beim Ubinskojer Sees (80°E, 55°40'N) in Westsibirien untersucht. Bevorzugt wurden Schilf- und Seggenmoore und die Ränder von Tümpeln und andere Niederungsbereiche, zusammen mit anderen Limikolen wie Kiebitz (*Vanellus vanellus*), Teichwasserläufer (*Tringa stagnatilis*), Rotschenkel (*Tringa totanus*), Bekassine (*Gallinago gallinago*) und Doppelschnepfe (*Gallinago media*). Auffällig war eine große Ähnlichkeit zwischen den Brutvögeln der sibirischen Steppe und der „Wiesenvogelgesellschaft" in den Niederlanden in den fünfziger Jahren. Sibirische Uferschnepfen sind in allen biometrischen Maßen größer als ihre westeuropäischen Verwandten. Eivolumen und Schlüpflingsgewicht zeigen einen Rückgang im Laufe der Brutzeit. 1995 war der Bruterfolg aufgrund starker Predation durch Nebelkrähe (*Corvus corone cornix*) und Elster (*Pica pica*) gering.

Introduction

The Black-tailed Godwit (*Limosa l. limosa*) is a typical inhabitant of permanent grasslands, e.g. steppes, plains and temporary meadows in river valleys and other well-watered areas (Voous 1960). It is now widespread in low densities throughout most of the middle latitudes of the Palaearctic. In the open man-made peat and soft soil areas of the western and north-western Netherlands it has reached considerably higher densities than in its native habitats, e.g. Iceland (Gerritsen & Groen 1995) and West Siberia (this paper). Apparently the natural ecology of the species predisposed it to conditions created by moderately intensive dairy farming in peat areas. Modern agricultural practices and developments are now threatening the survival of the population in intensively cultivated habitats in The Netherlands.

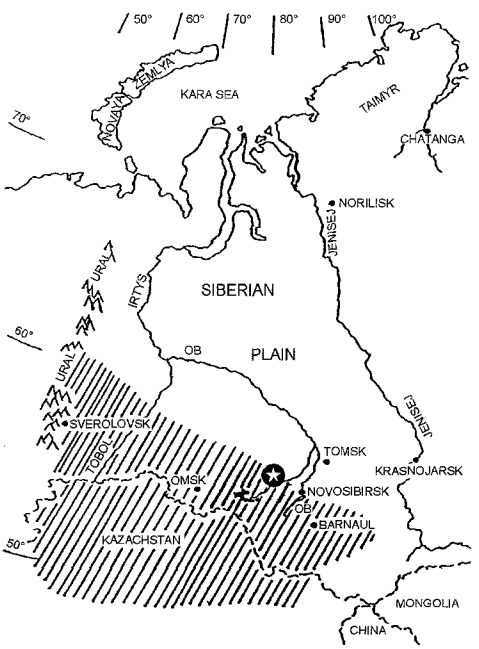

Fig. 1. Siberian plain with study area (✪) east of Lake Ubinskoje. Breeding range of Black-tailed Godwit shaded. No detailed maps of the study area available. Scale 1 cm = 220 km.

Abb. 1. Die sibirische Tiefebene mit dem Untersuchungsgebiet (✪) östlich des Ubinskojer Sees. Das Brutgebiet der Uferschnepfe ist schraffiert. Eine detaillierte Karte stand nicht zur Verfügung. Maßstab 1cm = 220 km

Study area and Methods

Habitat description

The study area, in the forest-steppe zone, is within the West Siberian plain (Fig. 1), a vast lowland of some 6,000,000 km^2 that remained after the retraction of an inland sea that existed in the late Tertiary. The landscape consists of many small ponds and dips, reed and sedge marshes with Birch (*Betula* spec.) and Poplar (*Populus* spec.) trees on the rims, and Willow (*Salix* spec.) in depressions. The soil is saline, which is reflected in a low biomass with typically saline species like Rushrye-grass (*Elytrigia juncea*), Marsh arrow-grass (*Triglochin palustris*), Sea-wormwood (*Artemisia maritima*) and Sea-lavender (*Limonium vulgare*).

Data were collected in May and June 1995 on the east bank of Lake Ubinskoje (80°E, 55°40'N) approx. 185 km to the west of Novosibirsk (West Siberia). The study area is situated close to the northern limits of the forest-steppe zone. Some 3.5 km^2 was primarily searched for breeding Godwits.

Methods

Nests were sought for by flushing the birds from their nests and watching them return. After a nest was located, the eggs were replaced by dummies and a spring trap was placed over the nest (see Groen 1993). During the absence of the birds several features of the eggs were noted, the incubation stage was determined by using the incubometer (van Paassen et al. 1984). After a bird was trapped, it was immediately released from the trap to avoid stress. Measurements of bill, head+bill (total head) and the tarsus were taken with callipers to the nearest 0.1 mm, total body weights with a pesola to an accuracy of 1 g and wing length with a ruler to the nearest 1 mm. All adult godwits were marked with an individual combination of colour rings and an aluminium ring of the Moscow Zoological Museum.

Basic features on their breeding biology, e.g. egg dimensions, timing of breeding and hatchling weights of Siberian godwits are compared with a breeding population of godwits from the Schaalmeerpolder (52°31'N, 4°47'E), The Netherlands. These data were gathered during a long-term study

on a colour-marked population in the province of Noord-Holland, The Netherlands (Buker & Winkelman 1987, Groen 1993).

Statistics

Overall body dimensions of females were estimated by applying a principal component analysis using measurements of bill, wing and weight. Sexes of adult breeding birds are separated by applying a discriminant analysis. Egg volume was measured according to Preston (1974) and Hoyt (1979) by the formula $V = LB^2_{max}$, where V= egg volume in mm^3, L = long axis in mm, B = transverse axis or maximum diameter in mm. Nesting success was calculated using the Mayfield method (1975) according to Beintema & Müskens (1987).

Habitat

A simple habitat description for the immediate vicinity of the nest was made and distances between nests were measured. Insect abundance was measured by using yellow plastic strips of 25 × 10 cm covered with an adhesive that was placed among the vegetation (three at a time and facing different directions). Every twenty-four hours the strips were replaced and all trapped arthropods counted and classified into three body length groups (0–4, 5–8 and > 8 mm).

Results

Habitat

The nominate race *limosa* inhabits the steppe of West Siberia as far as 60°N in the subtaiga forest zone. Within their distribution range godwits appear in different habitat types, from moist boggy marshes with pools and small lakes to the arid steppe zone in the south (Johansen 1961, Hayman et al. 1986, Ravkin et al. 1994, this study). Territories are always established near ponds or marshes. In the forest-steppe they prefer the damp, marsh-like sections that stay humid during the breeding season. Only a few breeds on the fringes of the more arid plains with their low vegetation cover and consequently poor concealment of their nests. Other than in plains the vegetation in the marshes and other well-watered areas was high at the end of the breeding season (1–1.25 m), and so nests were thoroughly concealed. In contrast to the plains the marshes are predominantly covered with sedges (*Carex* spec.) and Reed (*Phragmites australis*).

Breeding

Only 3.5 km^2 in the vicinity of the field station at lake Ubinskoje was intensively searched for nests in 1995. A total of thirty-six nests in four clusters was discovered (range 2–16 nests/cluster, mean 7.8 nests/cluster). Godwits normally arrive in the forest-steppe in the third decade of April (Yurlov, own observation). The onset of the breeding season is from the 2nd decade of May and lasts till the 1st decade of June (Fig. 2). The average clutch size was 3.50 (n = 36). Egg volumes decreased in the course of the breeding season ($R^2 = 0.2045$, P= 0.023, Fig. 3) and in accordance with this, the hatchling weights ($R^2 = 0.1883$, $p < 0.05$). The observed variance in egg dimensions for egg-length, egg-breadth and egg-volume may be attributed for 69.2 %, 72.0 % and 79.4 % of cases, respectively to differences between the clutches (Table 1). Distances between nests within clusters were on average 30.4 m (n = 42, the average breeding territory size about 2900 m^2. Breeding success in 1995 was low with a daily survival rate of 0.921 (n = 33) for the Black-tailed Godwit and a general daily survival of 0.9372 (n = 62) for all species under observation.

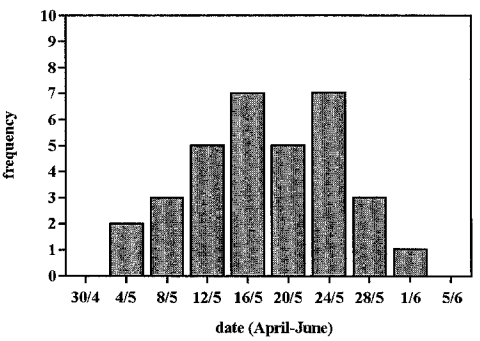

Fig. 2. Timing of breeding (first egg).
Abb. 2. Legebeginn (erstes Ei).

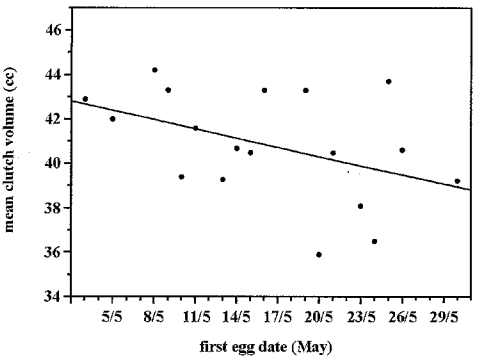

Fig. 3. Mean volume of grouped (interval 1 day) clutches in relation to start of laying (n = 32 clutches).
Abb. 3. Mittleres Gelegevolumen in Abhängigkeit vom Legebeginn (n = 32 Gelege).

Predation

Predation on nests was severe. Both aerial and terrestrial (visual) predators like Hooded Crow (*Corvus corone cornix*), Magpie (*Pica pica*), harriers (*Circus macrourus, C. pygargus, C. aeruginosus*), Badger (*Meles meles*), Red Fox (*Vulpes vulpes*) and small Mustelidae were present. This resulted in a daily survival of 0.921 (n = 33), comparable to the daily survival rate found in the Dutch reference population (Groen & Buker 1991) which varied between 0.822 (N= 150) in 1988, and 0.966 (n = 51) in 1988 and was mainly due to predation by Black-headed Gull (*Larus ridibundus*) and Mustelidiae.

Biometrics

Black-tailed Godwits from West Siberia are in all aspects bigger than their European conspecifics (Table 2). Differences are most striking among the females especially for bill and wing. Comparisons within the males also reveal significant differences in size but they are not as pronounced as in the females.

The discriminate functions differ greatly for the sexes; the group centroids are 2.292 for females and -2.917 for males with no (0 %) misclassifications. Relations between overall body dimensions of the female on the basis of a principal component analysis (PC1) for wing (r = 0.65) and bill (r = 0.85) showed no significant relations for egg-volume (R^2 = 0.0916), and first-egg date (R^2 = 0.1044).

Chicks were ringed in the nest (n = 8 nests, 26 chicks) shortly after hatching. A remarkable decline in hatchling weights was noticed in the course of the season (R^2 = 0.1883, p = 0.026, Fig. 4).

Discussion

Range

Although the nominate race reaches its eastern distribution limits in the Central Palaearctic (Prater et al. 1977) we identified, on the basis of plumage and biometrics, no 'Eastern' Black-tailed Godwits (*Limosa l. melanuroides*) on the breeding grounds in West Siberia. The river-bed of the Jenisey river seems to function

Table 1. Variance within and between clutches of Godwit from West Siberia and The Netherlands. pop. = population, s.d. = standard deviation, sib. = West Siberia, neth. = The Netherlands.
Tab. 1. Unterschiede innerhalb und zwischen den Gelegen von Uferschnepfen Westsibiriens und den Niederlanden. pop. = Bestand, s.d. = Standardabweichung, sib. = Westsibirien, neth. = Niederlande.

Variable	Mean	s.d.	Min.	Max.	variance		p	n	pop.
					within	between			
Egg length (mm)	55.25	2.07	50.3	61.8	30.8%	69.2%	< 0.001	118	sib.
	55.31	2.22	48.6	61.3	34.3%	65.7%	< 0.001	102	neth.
Egg breadth (mm)	38.02	1.32	33.4	40.7	18.0%	82.0%	< 0.001	118	sib.
	38.12	0.98	35.2	40.1	23.9%	76.1%	< 0.001	102	neth.
Egg volume (cm^3)	79.95	6.35	60.02	92.28	20.6%	79.4%	< 0.001	118	sib.
	80.45	5.79	62.45	94.20	23.1%	76.9%	< 0.001	102	neth.

Table 2. Biometrics of breeding Black-tailed Godwit from West Siberia and The Netherlands (t-test for differences between populations and sexes).
Tab. 2. Maße brütender Uferschnepfen in Westsibiriens und den Niederlanden (t-Test für Unterschied zwischen Beständen und Geschlechtern).

		West Siberia				The Netherlands				
		Range	Mean	s.d.	n	Range	Mean	s.d.	n	p-value
Bill	♂	104.7–128.0	113.9	6.8	15	95.2–117.0	104.6	4.8	176	< 0.001
	♀	90.1–105.9	99.9	4.8	11	81.0–102.6	89.6	4.1	133	< 0.001
Wing	♂	228–240	233.1	3.8	15	211–237	222.9	5.0	176	< 0.005
	♀	210–226	218.2	4.8	11	197–225	212.1	5.5	133	< 0.005
Tarsus	♂	83.5–95.7	89.0	2.9	15	75.7–79.0	76.9	1.77	4	< 0.005
	♀	73.4–85.8	79.3	3.8	11	68.0–76.3	72.6	3.1	7	< 0.005
Weight	♂	297–347	330.8	15.3	15	258–356	318.5	19.3	176	< 0.005
	♀	247–292	265.0	12.9	11	221–300	255.6	13.6	133	< 0.005

as a divide between the nominate race *Limosa l. limosa* and *Limosa l. melanuroides*.

Origin and distribution

Sarudnyj & Smirnow (in: Johansen 1961) described in 1918 the race *Limosa limosa robustiformis* from Turkmenistan. These were probably migratory birds from West Siberia with a noticeably longer bill and tarsus than the nominate race. Comparisons with eight males from the Leningrad Zoological Museum, however, revealed a trend but no significant differences (Johansen 1961). Prater et al. (1977) mention a clinal increase in size in the nominate race from west to east, their data however only show differences in bill and tarsus while all birds from West Siberia fit in the ranges for wing, bill and tarsus of the nominate race. Data from this study, derived from Siberian breeding birds, show a striking difference in biometrics from godwits in the reference group (The Netherlands). On the assumption that *islandica* and *melanuroides* both originate from the nominate *limosa*, we should revise Praters (1977) phrase "there is a clinal increase in size from West to East". On the basis of our data this phrase should be: there is a clinal decrease in body dimensions from the Siberian population both to the west and to the east.

Habitat

The Siberian plains are one of the few places on earth with natural grasslands. Here a combination of climate and soil conditions results in permanent grassland with a relatively low biomass (de Vries 1953, this study). In contrast to the West European man-made habitats, natural habitats are more stable, birds breed in relatively low densities (Voous 1965, Spiekman & Groen 1993, Underhill et al. 1993). Abrupt changes in the environment are scarce and breeding conditions more or less predictable from year to year.

Eggs and breeding

Heritability is probably the most important factor in determining egg size in waders (Väsiänen

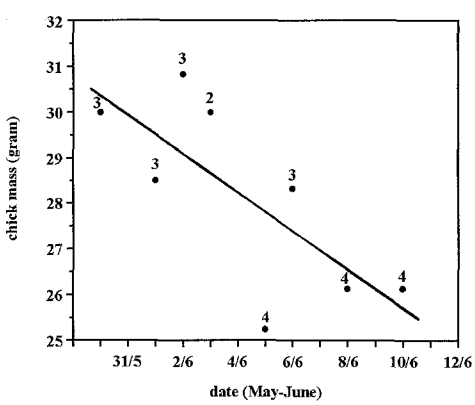

Fig. 4. Relation between chick weight at hatching and hatching date (number of chicks in brood above symbol).
Abb. 4. Beziehung zwischen Gewicht der Küken beim Schlüpfen und dem Schlupfdatum. (Die Anzahl der Küken pro Brut steht über dem Symbol).

et al. 1972, Grant1991) but there is also evidence of phenotypic factors that determine egg dimensions (Galbraith 1988, Yurlov et al. 1994). Table 1 reveals few differences in egg dimensions between the larger Siberian godwits and their smaller conspecifics from The Netherlands. The heritability hypothesis is strongly supported by Grant (1991), who found no correlation between the body size of female Whimbrel (*Numenius phaeopus*), their egg-volumes and new born hatchling weights. Our data show no relation in body mass of adult breeding godwits and the mean egg volume of their clutch, which is in line with Grants (1991) hypothesis.

There seems to be a normal distribution in the timing of breeding with a mean start on 17 May (Fig. 2). Data from The Netherlands show two peaks over the breeding season, in the first decade of April and the first decade of May, of which the latter is caused by replacement clutches. The Siberian data show that there are probably no replacement clutches at all. The observed decrease in egg volumes and subsequent hatching weights of chicks during the breeding season may be attributed to age, because birds breeding for the first time are late (Groen 1993), to replacement clutches (Galbraith 1988), or late arrivals on the breeding grounds.

Breeding birds were not randomly distributed over the area, but clustered in and around damp places and reed marshes. In the absence of agricultural activities and cultivated plots we may assume that the godwits preferred habitat in the West Siberian forest-steppe are the reed and sedge marshes and edges of depressions. The preferred nesting place is often within the sedge-tussock where nests are thoroughly hidden by overhanging sedge leaves.

Predation

According to our observation, in 1995 Crows and Magpies were the major nest predators. They operated from nearby bushes and practised a sort of hit-and-run methods in predating nests. Two of the colonies under observation were totally destroyed within 48 hours. Possibly in response to this predation pressure, birds gather in colonial aggregations and benefit from the combined efforts in defending nests (Green et al. 1990). The increased opportunities for predation caused by the frequent visiting of nests undoubtedly favours predators like Hooded Crow, Fox, Badger and Mustelidiae.

Acknowledgements

We would like to thank the Dutch Ministry of Agriculture Nature Management and Fisheries for financial and logistic support, in particular to Dr. G. C. Boere. To Drs. H. Schekkerman (IBN-DLO) and Dr. L. Zwarts (RIZA) for comments and suggestions on an earlier draft of this article, Mrs Samantha Out has proofread the English text. Niko Groen would like to express his thanks to the West Siberian Institute of Animal Systematics and Ecology for inviting him to work on the steppe and for being their guest at the institute and field-station at lake Chany.

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Accepted: 05 October 1998