NUMBERS, DISTRIBUTION AND INTERSPECIFIC RELATIONS OF BREEDING WADERS IN NATURAL BIEBRZA FEN AND ADJACENT RECLAIMED MARSH

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The Biebrza river marshes (*c.* 1 000 km²) in area are situated in north-east Poland, and are the largest natural fen mire in Europe. Both alluvial meadows close to the river, and open fens further away, support considerable wader populations (see Table 1). The area has the largest population of Great Snipe *Gallinago gallinago* in Central and Western Europe: 17 leks with *c.* 370 males. There is also a recently declining population of 200-300 breeding females of Ruff *Philomachus pugnax*. The area is also the only inland breeding site of Dunlin *Calidris alpina* in Poland, and the only Central European breeding site of Jack Snipe *Lymnocryptes minimus* (Okulewicz and Witowski 1979, Dyrcz *et al.* 1984).

Even where the habitat, with respect to plant structure and composition, was at least superficially homogenous, the nests of waders were distributed unevenly. The nesting waders formed loose aggregations, locally reaching high breeding densities (Table 2). The large area of reclaimed Wizna marsh is situated in the vicinity of Biebrza fen. Small fragments of this marsh are still wet, with pools of stagnant water in spring. In such places some waders still breed (Table 3). However their nesting-density is 5-10 times lower than that in the natural fen. Most parts of drained Wizna

marsh are rather dry and support only two species of waders, Black-tailed Godwit *Limosa limosa* and Lapwing *Vanellus vanellus*, which breed at a very low density (Dyrcz *et al.* 1985).

On Biebrza fen we selected a plot with a high wader density. It represents natural fen situated far from settlements or changed landscape. The plot was a rectangle of 300 m x

Table 1. The number of breeding pairs of some Charadriiform birds in the Biebrza marshes in 1978-80.

Great Snipe	
Gallinago media	370 males
Ruff	
Philomachus pugnax	200-300 females
Curlew	
Numenius arquata	51-76
Black-tailed Godwit	
Limosa limosa	*c.*1 000
Redshank	
Tringa totanus	195
White-winged Black Tern	
Chlidonias leucopterus	416-475
Little Gull	
Larus minutus	55

Table 2. Waders of open Biebrza fen on a sample plot of 42 ha with wringing water, 20-60 cm high *Carex* spp. and an extensive moss ground layer.

Species	No. of breeding pairs		Pairs per 10 ha	
	1977	1978	1977	1978
Limosa limosa	46	71	10.5	16.1
Gallinago gallinago	35	26	8.0	5.9
Vanellus vanellus	19	13	4.3	3.0
Philomachus pugnax	10	19	2.3	4.3
Tringa totanus	2	5	0.5	1.1
Lymnocryptes minimus	2	-	0.5	-
Total	114	134	26.1	30.4

Table 3. Waders of reclaimed wet meadows with pools of stagnant water. Data from a plot of 22.5 ha in Wizna marsh.

Species	No. of breeding pairs		Pairs per 10 ha	
	1977	1978	1977	1978
Limosa limosa	8	2	3.6	0.9
Vanellus vanellus	5	3	2.2	1.3
Gallinago media	1	1	0.4	0.4
Total	14	6	6.2	2.6

1 400 m (42 ha) marked in a grid by poles every 50 m. All poles and some other landmarks were marked on a map, as was the position of every nest found. A team of 3-6 persons paid eight visits during the breeding season, each visit lasting 1-3 days, in an attempt to find out all wader nests. On the plot we found an interrelation between predation rate and group defence of wader nests (Dyrcz et al. 1981). The appearance of egg remnants in the nests robbed by Harriers Circus spp. is characteristic and we were usually able to tell whether a clutch had been destroyed by a harrier or "something else", and to establish that 80% of predation losses were caused by harriers. This is in general agreement with our more sporadic direct observations. Whenever the harrier flew into open area where there were Black-tailed Godwit nests, one or two Godwits attacked it, sounding a loud alarm. At this signal 5-20 Godwits flew from the near neighbourhood and attacked it from behind. This made the harrier accelerate its straight flight and forced it to leave the vicinity. The attacking Godwits then returned to their nests and the predator was intercepted by further Godwits until it left the entire breeding area of the Godwits.

We found also that losses from predation among bold waders (Black-tailed Godwits and Lapwing) were lower in the middle of the breeding season when nest concentration was high, than at the end of the season when many breeding pairs had already left the plot (Table 4). Black-tailed Godwits which bred at highest densities suffered less from predation than other species. As the nests of this species were most conspicuous, at least for human eye, the only reason for low losses seemed to be the boldness and group defence tactics of the birds. Moreover, the bold species formed a "protective umbrella" for timid waders such as Snipe Gallinago gallinago, Redshank Tringa totanus and Ruff, which bred close to the aggregations of Black-tailed Godwit nests (Table 5). The nests of timid waders which were situated closer to the nests of aggressive waders suffered less from predation than more remote ones.

The comparative observations carried out on the drained Wizna fen revealed that the nest losses from predation among waders amounted to 92% (Table 6). One of the reasons for such high losses might be very low nesting density and lack of "protective umbrella". The ultimate reason for the low density might be scarce food and lack of good cover. All this can be interpreted as the existence of some kind of feedback which additionally impoverishes wader populations in drained marshes.

Table 4. Breeding density of "bold" wader species and nest losses due to predation on the sample plot in Biebrza fen.

		Occupied nests	Nests/10 ha	% lost to predators	X^2
1977	1 - 15 May	48	11.4	17	21.2; P<0.001
	20 May - 5 June	6	1.4	83	
1978	1 - 15 May	67	16.0	7	5.6; P<0.02
	25 May - 10 June	13	3.1	31	

Table 5. The fate of "timid" wader species nests, and their distance from occupied Black-tailed Godwit nests during 1978. s = successful nests; d = nests destroyed by predator.

Species		Average distance from the closest Godwit nest (m)	Student's t-test
Gallinago gallinago	s	37	3.0; P<0.01
	d	83.5	
Philomachus pugnax/Tringa totanus	s	39.5	3.5; P<0.001
	d	95	

Note: Data was from 72 nests of Black-tailed Godwit, 27 nests of Snipe, and 20 nests of Ruff and Redshank together.

Table 6. The total density of the breeding population of Black-tailed Godwits and Lapwings, and the fate of broods.

Sample plot	Pairs/10 ha	No. of successful broods	No. of destroyed broods	% of destroyed broods	
Natural	16.1	76	14	15.6	X^2 = 33.8
Drained	5.8	1	11	91.7	P < 0.001

REFERENCES

Dyrcz,A., Okulewicz,J. and Witowski,J. 1985. Bird communities on natural eutrophic fen mires in the Biebrza river valley, NE Poland. *Die Vogelwarte* 33: 26-52.
Dyrcz,A., Okulewicz,J., Witowski,J., Jesionowski,J., Nawrocki,P. and Winiecki,A. 1984. Birds of fens in Biebrza Marshes – Faunistic approach. *Acta Orn.* 20: 1-108.

Dyrcz,A., Witowski,J. and Okulewicz,J. 1981. Nesting of "timid" waders in the vicinity of "bold" ones as an antipredator adaptation. *Ibis* 123: 542-545.
Okulewicz,J. and Witowski,J. 1979. Jack Snipe *Lymnocryptes minimus* (Brunn., 1764), again a bird breeding in Poland. *Przegl. Zool.* 23: 255-257.

BIOMETRICS IN WADERS

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In most ringing programmes it is now standard to measure waders that are trapped for ringing. This paper summarises an evaluation of which measurements are useful in distinguishing between different sexes and/or different populations of a species. We conclude that as yet we are far from making precise statements for many species, and that the number and identity of the appropriate measures differ between species. For now we recommend measurements of at least bill-length and wing-length for all species, and where appropriate the extra measurements listed here for each species. A co-operative world-wide approach to the collation of measurement data collected from live breeding birds is proposed.

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For many years wader measurements have been collected, to trace the breeding origins of the birds and to differentiate between both sexes. In most cases, maximum wing-length, bill-length and tarsus-length are measured, and much effort has been given to standardize the measuring techniques (Evans 1964, 1986). When we started to analyze our results from large-scale trapping in the Dutch part of the Wadden Sea we faced the problem that it was not clear which populations and which groups could be distinguished from each other from external measurements.

In general, the problem was that although the measurements of two populations might be statistically discernable from each other, this does not mean that both populations can necessarily be identified outside their breeding areas. This is a particular difficulty when there may be more than just two populations or groups; and at times there could be up to 10 more populations in the area. Unfortunately, along the East Atlantic flyway, and especially at a crossroads like the Wadden Sea, this is reality.

A second problem is that nearly all differences in measurements between populations or sexes (in dimorphic species, sexual geographical differences can even out each other) are statistical differences, which can often involve a rather broad overlap. In such a case, many individual birds have a measurement which cannot help to distinguish its breeding origin. Therefore, if such overlap could be reduced by incorporating more measurements, we would then be able to collect more more information from the same amount of data. So we looked for a multivariate approach, using wing-, culmen-, and tarsus-lengths, instead of a univariate approach (wing or culmen or tarsus). This approach would give us the tool we needed to predict the chance that an individual bird belongs to a certain group/population. This paper summarises our progress so far, and suggests some future directions.

We agreed rather quickly that a reference collection was required. As a bird present in the Wadden Sea could originate from a wide area from Arctic Canada in the west to Central Siberia in the east, measurements of many breeding populations need to be sampled. It was not possible to collect this information in the short term from live birds trapped on their nests, because few birds are trapped on the nests, and the data comes from scattered observations over enormous areas and collected by a few widely dispersed research-workers over a long time span. Therefore, there was no other choice than to use museum data of birds collected in several breeding areas. Many of these specimens were already measured by CSR, but this data file is still growing, thanks to the help of the Zoological Museums in Moscow, Tring, Bonn, Copenhagen, Leningrad, Reykjavik, Toronto, Leiden and Amsterdam.

The ideal situation is that we can distinguish all different populations and both sexes of a species with as little effort as possible. This means that the number of groups distinguished needs to be as large as possible and that the number of measurements that need to be taken must be as small as possible. Using