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ABSTRACTS OF TALKS

The Dunlin population wintering in Tunisia is male-biased

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The Dunlin *Calidris alpina* population wintering in Kneiss, Gulf of Gabès, Tunisia, was sampled with mistnets and counted in February 1994. Of the captured birds, 2% had been ringed previously at central and eastern European catching sites. The total number present was very similar to a count in February 1984 suggesting a rather stable winter population. The 713 Dunlin caught were sexed on the basis of measurements and the multivariate technique POSCON. The accuracy of sexing was checked with a small sample of accidentally-killed birds. Both samples were significantly male-biased (male-female ratio *c.* 60:40). A considerable proportion of the captured birds (*c.* 42 %) was assigned to the central Siberian breeding population (*C. a. centralis*) on the basis of measurements and POSCON. Weight variation was significantly explained by variation in structural size, by time of catching relative to high water and by date relative to new moon. The latter effect was highly significant in males and not significant in females. The possible implications of this effect and the biased sex ratio will be discussed.

The effects on waterfowl of constructing gas pipelines on intertidal areas

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When large pipelines are laid across estuaries they involve considerable disturbance to the sediments, often over a large area. BTO has been commissioned by British Gas to monitor the effects on birds of laying a pipeline in Morecambe Bay and investigate the length of time that it takes for the area to recover.

Ornithological data were collected for all the intertidal areas of the estuaries by counts carried out at low water. More detailed data were collected along the routes of the pipeline by counts carried out through the tidal cycle. The pipeline routes were divided into count areas using linear transects. Prior to the construction of the pipeline, low tide and all day counts were carried out between November 1991 and March 1993 to establish baseline information about the proposed pipeline route. Counts restarted in autumn 1993 immediately after pipeline construction was completed and are continuing.

Analysis of autumn 1993 data showed that in the immediate short term, pipeline construction had caused changes in autumn mudflat usage by both Oystercatcher *Haematopus ostralegus* and Curlew *Numenius arquatus*; the two main species present in autumn. These changes were due to shifts in the spatial distribution of these species across the study site with the usage of the mudflat above the pipeline being much lower than before the pipeline was installed.

Revised population estimates for waders in Great Britain

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Revised population estimates are presented for waders wintering in Great Britain from data provided by the Wetland Bird Survey, the Winter Shorebird Count and the Winter Atlas. The new population estimates are compared with previous totals and the causes of between-year fluctuations discussed.

Using radio-telemetry to find wader chicks: preliminary experiences from high-artic Canada

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In 1993 and 1994 we have been using small (1.4 g) radio-transmitters fitted to breeding adult Knots *Calidris canutus* and Turnstones *Arenaria interpres* caught on nests and with young chicks at Alert, Ellesmere Island, Canada (83°30'N). Our initial experiences will be summarised. The transmitters have proved of considerable utility for remotely tracking adults, and for following up adult locations to monitor brood survival and growth by direct observation and recapture of chicks.

Under the conditions of very low breeding densities and high brood mobility (broods especially of Knots can move over 1 km per day) relocating broods has formerly been a matter of occasional chance meetings. Even with the transmitters it is, however, time-consuming and not always easy to relocate broods even in relatively low-relief topography. To be certain of the fate of broods it is necessary to catch and radio-tag both parents at egg or young chick stage, since only one parent, normally the male, remains with the chicks in some (Turnstone) or almost all (Knot) cases. Otherwise a lone adult could indicate either loss of chicks or relinquishing of guard duties to the other parent.

The main limitations of the technique are its high cost and the difficulty of getting signals in undulating or hilly areas. It will be most useful in places where ground is flat and chicks are highly mobile.

What happens when the tide goes out? An introduction to the new UK Low Tide Count scheme

Julianne Evans, British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, UK.

The UK's new National Low Tide Count scheme, which has recently been incorporated within the Wetland Bird Survey, is introduced. The research and conservation applications for the data are discussed using examples from the first two years of the scheme.

Sex-related differences in the autumn migration speed of Curlew Sandpiper

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Most wader species show a high degree of sexual dimorphism in bill size, as well as sexual differences in the timing of migration. In the non-breeding season, foraging efficiencies of females Curlew Sandpiper *Calidris ferruginea* are higher than that reported for males, probably due to the different size of their bills. We studied the possible effect on the speed of autumn migration of this sex-related difference. In order to test this, we estimated the daily mass gain and the staging time in a refuelling area in the south of Europe. Field work was carried out in the Ebro Delta (NE Spain) during the postnuptial migration in 1992 and 1993. The daily mass gain (1.7 g/day) and the sex related differences in the staging time indicates that this species is a foraging-time limited migrant.

The staging time of males was longer than of females, resulting in a higher female migration speed. This difference could explain the predominance of uniparental care among the waders with long distance migrations. According to this, we expect that the sex with a lower migration speed should

leave the breeding grounds earlier in order to arrive at the wintering areas at the same time. This is the case of Curlew Sandpiper, as it has been reported. However, more information is required for other species, in order to test this relationship.

Curlew Sandpipers on Taimyr and in the Wadden Sea, 1994: high predation in a lemming peak year?

Klaus Günther, Ingerlil Hertzler & Olaf Zeiske, Brauweg 12, 37073 Göttingen, Germany.

Since 1989, International Arctic Expeditions to the Taimyr Peninsula in Northern Siberia have been undertaken to study the breeding biology of arctic birds, which partly migrate through the Wadden Sea. In 1994, two of us participated in one of these expeditions to Medusa Bay, 20 km south of Dickson in western Taimyr. Breeding density and breeding success of waders in relation to lemming and predators densities were measured in a study area of 7.5 km^2.

Weather conditions were quite good and lemming and predator densities were high. In spite of that, breeding success of waders was not high in all species. Curlew Sandpipers *Calidris ferruginea* especially suffered from high predation rates. Some mobile broods of Curlew Sandpipers were found later, and fledging success of these was high. Males left the breeding area until 10 July. Females partly joined them or left the area later, usually leaving the breeding area very quickly after loosing their brood. Successful females stayed with their chicks until they fledged. At the beginning of August juveniles started migrating with or without females.

These data are compared with arrival dates and percentage of juveniles from the main resting site of Curlew Sandpipers in the Wadden Sea in autumn 1994.

This study was supported by the Stifterverband für die Deutsche Wissenschaft.

How many? How long? Where from? - Ringed Plovers on their way through the Schleswig-Holstein Wadden Sea

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Counts in the rhythm of the spring tide carried out in 30 areas in the Schleswig-Holstein Wadden Sea in the years 1987 to 1993 give an impression of the phenology of migrating Ringed Plovers *Charadrius hiaticula*. One peak appears at the end of March (1,100 birds), another in the second half of May (12,000 birds). During autumn migration there is just one peak in the first half of September (16,000 birds). Turnover calculations showed that there is a fair chance that the maximum number of staging Ringed Plovers in autumn has to be multiplied by a turnover factor of 2.3 (for the Eiderstedt peninsula) to give an impression of the total flow through of Ringed Plovers. The application of this factor for the entire Schleswig-Holstein Wadden Sea makes it likely that at least 37,000 Ringed Plovers pass through in autumn. This factor surely differs at different roost sites and depends on the type of calculation and therefore has to be taken with some caution.

More detailed counts in autumn 1993 (Eiderstedt peninsula) indicated that spring tide counts are too rough to give an impression of the migration patterns. Total and juvenile counts, resightings of colour-marked birds and the analysis of biometric data showed a corresponding phenological pattern with three adult and at least two juvenile peaks. The analysis of biometric data makes it likely, that during the first peak in August mainly birds from western and northern Europe migrated through. This peak was followed by a short passage of Nearctic Ringed Plovers at the end of August. In September birds from somewhere between Scandinavia and Siberia/Taymyr passed by.

Mussel beds as an attractive feeding habitat for Whimbrels and Curlews

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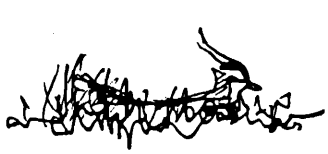
Beds of Blue Mussels *Mytilus edulis* in the Wadden Sea are species-rich communities, which are used by several bird species as foraging habitats during low tide. To examine the importance of mussel beds for foraging birds a study was carried out in the Könighafen bay on the island of Sylt in the Northfrisian part of the Wadden Sea in summer and autumn 1993. Standardized area counts were used to estimate the birds' densities. Additionally, single birds were observed while foraging, with the prey's species and length recorded. Samples of macrofauna were also taken to estimate the available prey spectrum.

The birds most frequently foraging on the mussel beds were Oystercatchers *Haematopus ostralegus* and Herring Gulls *Larus argentatus*. Redshanks *Tringa totanus* and Whimbrels *Numenius phaeopus* were also common on the beds. Both Whimbrels and Curlews *Numenius arquata* preferred mussel beds as foraging sites and the main prey item for both species was Shore Crab *Carcinus maenas*. Yet, they used different places on the banks and took different sizes of the crabs.



Hatching and breeding success of Avocets

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Most Avocets *Recurvirostra avosetta* nest in colonies. Hatching success of Avocets may be studied easily, because there are not major difficulties in finding the nests and following their fate. After hatching, families disperse from the colonies, and tracking the chicks becomes increasingly difficult. Chicks prior to fledging, however, again become more conspicious.

In our study of breeding success near Hüsum in northern Germany, we counted the number of chicks estimated to be older than 30 days. The breeding success of the local population was calculated by dividing this total number of chicks prior to fledging by the number of breeding pairs.

In seven years of study there was little variation of hatching success between years (between 60% and 71% in six out of seven years). Annual breeding success fluctuated between 0.05 and 1.5 chicks per pair. Hatching success and breeding success were only weakly and non-significantly correlated (r=0.36). Breeding success was largely determined by the weather, whilst predators and storm tides had the strongest influence on hatching success.

For monitoring the annual reproductive output of Avocets estimates of breeding success instead of hatching success are needed. Estimates of breeding success can be derived most easily by counting the number of breeding pairs and the number of chicks prior to fledging. This exercise, however, requires study sites which are free of family immigration or emigration, and are small and accessible enough to allow accurate counts of the chicks.

Time and energy budgets of Avocet *Recurvirostra avosetta* - a progress report

Gregor Kölsch & Hermann Hötker, Gerhardstr. 96, 24105 Kiel, Germany.

Time budgets of Avocets have been studied in wintering quarters in Senegal and at different places of the Wadden Sea from spring to autumn. Avocets foraged 13% to 59% of their time during the day. Variations between places and days of time spent foraging could partly be explained by differences in prey size and by light conditions in the night before the observations: after dark nights (new moon) Avocets foraged longer during daytime.

Breeding time metabolic rates of six Avocets measured in the field using doubly labelled water averaged 5.02 Watts (2.26 times

expected BMR). Heated taxodermic mounts are used to assess the costs of thermoregulation. Continuous weighing of breeding birds on the nests hopefully will reveal information on nocturnal activity patterns.

Structure of Lapwing breeding range in Russia

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To reveal the structure of breeding range in Lapwing *Vanellus vanellus* throughout Russia, all the published data on species distribution and population densities, as well as the original data of the author from several regions of European Russia have been analysed. This enabled the mapping of Lapwing breeding range in Russia: localization of "core-areas" with the highest breeding densities, latest changes in the species distribution, and peculiarities of range structure determined by regional differences in the scales of agricultural development. A first attempt has been made to extrapolate the total number of the species population in Russia. Population trends in the whole country and in local parts of the breeding range are discussed also.

Organochlorine compounds in waders from the Wadden Sea

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The Wadden Sea is an important area for waders on the East Atlantic Flyway. It is a major pre- and postnuptial moulting and "refuelling" site. But it is also an area affected by pollution. Persistent chemicals like PCB or some insecticides are accumulated in the benthos. Therefore birds contaminate themselves by feeding on the benthos. These compounds are mainly stored in their adipoise tissue. The contamination of birds breeding in this area can be monitored by analysing their eggs, but there are only a few reports about persistent chemicals in waders.

We have tried to investigate the importance of persistent chemicals for the Dunlin *Calidris alpina* in the Wadden Sea as a representative migrating wader. Special attention has been paid to influences between migration, body mass and contamination level.

WSG-project "Inland Wader Counts" - progress report

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The Wader Study Group "Inland Wader Count" project has been carried out since 1979. Although it started just in Switzerland, Austria and Germany, the project has now collated regular counting data from 14 European countries.

The main aims of the projects are to study migration patterns of waders in inland Europe, to monitor migratory populations and to study habitat selection at stop-over sites. Running for about 15 years we have sufficient data to risk the analysis of at least the main questions of the project. In this progress report we will present some results of this work which will be part of a more comprehensive report. Moreover we will discuss the future of the project.

Are African wintering waders really forced south by competition from northern conspecifics?

Hans Meltofte, Zoological Museum, Universitetsparken 15, 2100 Copenhagen, Denmark.

Ever since the first groups of "waderologist" decades ago visited the wintering sites of waders in Banc d'Arguin, the general conception has been that the living conditions on the West African coast were far from as luxurious as in the Wadden Sea and the British estuaries. Food resources were relatively much poorer and competition seemed high. Similarly, studies on *e.g.* Grey Plover *Pluvialis squatarola* in Britain suggested that subdominant juveniles were often forced further south due to competition from conspecifics.

But what do the actual migratory and moult patterns of the African winterers point to? In late summer, they overfly large intertidal areas in West Europe, areas that are not occcupied by the northern winterers until late autumn. In addition, adults pass at a time when large numbers of juveniles have not yet arrived on the European staging and moulting areas. If strong competition for moulting and wintering grounds takes place in temperate Europe, then adults from all populations should occupy these areas, forcing the less competitive and later arriving juveniles to continue their migration further south, *e.g.* to West Africa.

Differences in body size between populations, inferring differences in competitive force, can neither explain the observed distributions, since in a number of species the smaller males winter north of the larger females.

Furthermore, if conditions on the West African coast were poor, why don't many more of the African migrants stay to moult at least some of their primaries in Europe, as do many of the "inland" waders before proceeding to Africa? And why don't more of them return to north-west Europe already in March in the same way as do Black-tailed Godwits *Limosa limosa*, Oystercatchers *Haematopus ostralegus*, Curlews *Numenius arquata* and some of the Redshanks *Tringa totanus* that have wintered in West Africa? Intertidal food resources in West Africa do not seem to be a limiting factor during "winter", and many species are able to increase their food intake considerably during the pre-migratory spring fattening.

The apparent difficulties that some wader populations have in building up sufficient body reserves on the West African intertidal flats for spring migration could equally well be a consequence of competition for wintering here and do not necessarily indicate that these areas are less favourable than tidal flats in north-west Europe.

These patterns and questions will be presented and discussed in relation to recent theories on breeding and migratory strategies in birds.

Body mass regulation in Redshank *Tringa totanus* during the non-breeding season

P. Ian Mitchell, Ian Scott & Peter R. Evans, Durham University, Dept. of Biological Sciences, Durham DHI 3LE, UK.

In the paper we tested the hypothesis that Redshank were unable to regulate their body mass and fat reserves in accordance with the probability of severe weather and food shortages during the non-breeding season (see Pienkowski *et al.* 1979). We compared seasonal body mass changes in captive Redshank fed *ad libitum* with those of wild Redshank over-wintering at Teesmouth, north-east England and demonstrated that in the wild, Redshank can internally regulate body mass independently of food supply, contrary to previous findings (Davidson 1982). In addition, by using Total Body Electrical Conductivity (TOBEC) we showed that birds are capable of weighing themselves, in that overall body mass is regulated rather than fat and protein levels being controlled independently.

Black-winged Stilt *Himantopus himantopus* in the Sado estuary: changes in habitat use and internal movements

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During the last four years surveys were carried out at the Sado estuary and the surrounding rice fields in order to understand the distribution of the Black-winged Stilt within the area. Counts were made in the second half of April (beginning of the breeding season), the second half of June

(centre of the breeding season) and in late July/early August (end of the breeding season). The birds were allocated to delimited sites and to habitat types. Colour marked birds provided information on movements within the estuary.

Results show a considerable amount of variation for colony location both from one year to the other and from the beginning to the end of the season. Rice fields can hold an important part of the local breeding population but the birds show a clear preference for those located near the salinas complexes. Inactive salinas are prefered for breeding but the active salinas play a more important role during juvenile dispersion. Fish farms proved to be unimportant for the stilts.

The loop migration of Curlew Sandpiper with special reference to the Sivash, Black Sea

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Loop migration is well known for various species using different routes in autumn and spring, but the reason is not always clear. Studies on *Calidris* species and *Limicola falcinellus* in recent years at Sivash, Crimea, Black Sea, showed the international importance of this Waddensea like wetland. Early studies documented a loop migration for Dunlin *Calidris alpina* with birds using the Waddensea in autumn, but passing through Sivash in spring.

Now similar patterns also have been proved for Curlew Sandpiper *Calidris ferruginea*. An analysis of recoveries for this species shows that all Sivash spring birds are linked to the East Atlantic Flyway in autumn and winter in West Africa. Spring passage follows a route via Tunisia to Sivash, where the birds moult before returning to the northern Siberian breeding sites. Curlew Sandpiper passing through Sivash in autumn winter in Central, South and Eastern Africa and probably return in spring via Caspian Sea.

The third species expected to follow the same migration pattern is the Sanderling *Calidris alba*. Further research is needed here.

No seasonal change in clutch size and confounding pattern in size of eggs in Lapwing

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We studied clutch size and egg size in Lapwing *Vanellus vanellus* between 1992-1994. We found that size of clutches did not change in the season but partial predation caused decline in the observed pattern. Although length, egg breadth and egg volume declined during the breeding season, egg weight had no seasonal pattern. Lack of seasonal decline of egg weight came from shorter eggs had higher special weight (egg weight x egg volume -1). Results imply that females do not change their investment into clutches during the season. We suggest that in studies that deal with seasonality of female investment into eggs, egg volume and egg weight can not consider as similar measures although they have high correlation.

Seasonal variation in brood survival of Kentish Plover *Charadrius alexandrinus*

Gábor Noszály & Tamás Székely, Behavioural Ecology Research Group, Dept. of Evolutionary Zoology and Human Biology, Kossuth University, pf.: 3, 4010 Debrecen, Hungary.

We studied the survival and fledging success of Kentish Plover broods between 1988 and 1994. Kentish Plovers bred in two habitats in Hungary, in alkaline grasslands and in bottom of dried fishponds. Brood survival and fledging success were not different between these two habitats. However, brood survival varied over the breeding season. Survival of broods was higher early in the season than later on (daily survival = 38.4 - 0.25 x date of hatching). Also, broods that fledged young hatched earlier in the season (20 May ± 14.4 (SD) days) than the ones which did not fledge young (6 June ± 19.4 days). These relations were still significant, when the potentially confounding factor such as egg size and parental quality were statistically controlled for. Our results suggest that reproductive value of clutches varies over the breeding season: early breeders are rewarded by high brood survival.

Monitoring Red-necked Phalaropes in Shetland

Mark O'Brien, Royal Society for the Protection of Birds, 17 Regent Terrace, Edinburgh EH7 5BN, UK.

Within the UK the Red-necked Phalarope *Phalaropus lobatus* is a rare and declining breeding bird. Management of breeding mires, undertaken by the Royal Society for the Protection of Birds, based on research in the early 1980s has maintained, but not increased a population of between 12 and 18 breeding males in Shetland. Elsewhere the bird has virtually disappeared. A project, aimed at "fine tuning" the management requirements is presently in progress. In this talk I aim to show how previous methods of determining the size of the breeding population may have been flawed, how it could be improved, and how a "constant effort" method of assessing fledging success can be calibrated by comparing with the observations of individually colour marked birds. The implications of this will be considered.

Resource partitioning and competition between shorebirds wintering on the Tees Estuary

Matthew Parsons, Department of Biological Sciences, University of Durham, South Road, Durham DHI 3LE, UK.

Grey Plover *Pluvialis squatarola*, Curlew *Numenius arquata* and Bar-tailed Godwit *Limosa lapponica* are potential competitors on Seal Sand, Teesmouth N.E. England. This is because they rely on the same prey species, namely *Nereis diversicolor*, occur on the estuary in high densities at the same time of year, and occupy broadly the same sediment types within Seal Sands.

Dietary overlap between species was high only between certain age/sex classes. Between 44 and 77 percent of the larger size class of *Nereis* was consumed in a favoured feeding area over one winter. Implications for competition are discussed. Interspecific aggression rates were very low compared to rates within species. Temporal segregation between Grey Plover and Curlew occurred on a favoured feeding site within a low water period. Segregation resulted from different micro-habitat choice by the two species, rather than avoidance, since Grey Plovers exhibited identical behaviour at times of year when densities of Curlews were low.

Competition between the three large species during the study was not important. Partitioning of prey size, temporal partitioning of feeding areas, and use of different sediment types enabled their co-existence.

Towards an integrated model for wader population monitoring: the case of the Dunlin *Calidris alpina*

Hans-Ulrich Rösner, WWF-Watten-meerstelle, Norderstr. 3, 25813 Hüsum, Germany.

There are many data being collected which are related to the development of the populations. However, rarely more than one of the many influencing parameters which are involved here are actually measured. The talk describes six important and measurable parameters which could possibly be combined for an integrated view:

- hatching success in the breeding areas;
- number or proportion of juveniles at short-term staging sites;
- number or proportion of juveniles at large staging areas;
- proportion of immatures in subsequent years;
- proportion of new breeders in the breeding population; and

- counts of the actual population size.

The focus is on the presentation of those parameters as a requirement for a true population monitoring. Some real data about the Dunlin on the East Atlantic Flyway will be put into the presented framework. However, this shall claim in no way that an integrated population monitoring already exists.

Is it possible to use remote sensing for monitoring breeding success of arctic waders?

Hans-Ulrich Rösner, WWF-Watten-meerstelle, Norderstr. 3, 25813 Hüsum, Germany.

The lemming/arctic birds-hypothesis is well-known. In the beginning it was entirely based on a 'remote sensing' of the number of juvenile geese and waders at temperate and South African coasts. These numbers were considered to reflect the breeding success of the respective species.

Earlier it was hypothesized that such numbers could be monitored best at the areas of main concentration of many of these birds, such as the Wadden Sea (talk at the WSG conference 1991). Because only very few birds are caught in this area, the only possibility to obtain such data are field observations. However, a major problem of using these data for monitoring is caused by extremely differing distribution patterns of adult and juvenile birds within the area.

The talk describes data from the seasons which followed the breeding seasons of 1991 to 1994. It will make clear if the aim of that study can be achieved.

Numbers, habitat choice and breeding success of Lapwing *Vanellus vanellus* in agricultural landscape in the Czech Republic

Miroslav Sálek, Department of Ecology, Faculty of Forestry, Agricultural University, Kamycká 957, 165 21 Prague, Czech Republic.

In spite of few data documenting numbers of Lapwing in the Czech Republic, there is evidence for a decrease in the breeding population by as much as 80% during the period from the 1950s to the 1980s. Starting in 1985, more detailed studies on the Lapwing population in Basins of South Bohemia ($48^0$00'-$49^0$20' N and $14^0$10'-$14^0$50' E) are provided where about 1,600 sqkm of meadows and pastures are still managed.

Comparing the averages of 1985-1993, a 46% decline of the Lapwing population was recorded on a sample area of 17 sqkm of agricultural land. Breeding density of Lapwing is 3.9 pairs per 100 ha of agricultural land, *i.e.* lower values than averages from all Central Europe (compiled from many authors). Meadows and beds of occasionally drained fishponds are used as preferred foraging habitats. Land situated less than 60 m from foraging habitats and having low and sparse vegetation are preferred as breeding habitat (12.0 nests/km^2 compared wwith other sites with 1.0 to 4.8 nests/km^2). However, these habitats have a small total area (ploughed fields, beds) or very high clutch failure rate (spring fields). The main egg laying period falls between 27 March and 10 April and chicks hatch after intensive field work has started. The total mean survival rate of clutches (Mayfield method) was 39.5 %. Of all nests, 21.7% were predated and 13.9% were destroyed by fieldworks.

During breeding seasons 1988 and 1989, we ringed only 107 chicks corresponding to 28% of all hatched eggs. Just before fledging only 10% of the ringed chicks could be found. The numbers of checked chicks decreased strictly with increasing weight. Chicks suffer under lack of suitable refuges for their survival in May and June.

Why do Bar-tailed Godwits *Limosa lapponica* leave the northern part of the Wadden Sea in autumn?

Gregor Scheiffarth, Institut für Haustierkunde, University of Kiel, Am Botanischen Garten 9, 24118 Kiel, Germany & Institut für Vogelforschung, An der Vogelwarte 21, 26386 Wilhelmshaven, Germany.

Bar-tailed Godwits use the Wadden Sea as a stop-over site on the migration between their arctic breeding grounds and the temperate or tropical wintering sites. Birds wintering in the tropics leave the Wadden Sea at the end of August to reach the winter quarters as soon as possible. On the other hand, some birds wintering in temperate zones stay in the northern part of the Wadden Sea until January, when almost all the Bar-tailed Godwits leave the area.

These birds may leave, since foraging conditions become unfavourable in the course of autumn. Analysis of feacal pellets revealed a drop in the proportion of the preferred prey, *Arenicola marina*, in the diet from 90% in August to 0% in February. At the same time, the proportion of small polychaetes with a much lower energy content increased. In parallel the proportion of time spent feeding per tidal cycle increased from 38% in August to 58% in February.

The study was supported by the Federal Ministry of Research and Technology.

Fledging success of Kentish Plover in the German Wadden Sea

Rainer Schulz, Institut für Haustierkunde, Universität Kiel, Am Botanischen Garten 9, 24118 Kiel, Germany.

A total of 373 nestlings and juveniles were caught from 1989 to 1994. Many were colour ringed individually. Until fledging the birds mostly fed at sandy flats hidden by sparse vegetation. Observations were quite difficult there.

After fledging the juveniles moved immediately to moulting sites of adult birds near sandy tidal flats. There the colour ringed birds could be spotted easily. Survival of juveniles depended on predation and weather conditions.

How does change in body composition affect the BMR of individual shorebirds?

I. Scott, P. I. Mitchell & P. R. Evans, Durham University, Dept. of Biological Sciences, Durham DHI 3LE, UK.

The basal metabolic rate of a number of individual captive Redshank *Tringa totanus* was monitored throughout the non-breeding season. These measurements were related to change in body mass and body composition (as determined by the use of total body electrical conductivity TOBEC). Intraspecific BMR was found to scale best with predicted lean mass whilst within-individual with predicted mass of fat. The within-individual allometric equations relating BMR to body mass tend to have mass exponents that are greater than unity.

Body mass changes in breeding waders on Northern Taimyr

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Body mass changes during breeding season were studied in seven species of high arctic waders (*Arenaria interpres, Pluvialis fulva, P. squatarola, Calidris alba, C. canutus, C. minuta* and *C. ferruginea*) in 1982-84 and 1990-92 at Northern Taimyr.

All species decreased their body mass markedly in brood-rearing period, comparing with the period of incubation. Prenesting birds are lighter than incubating birds in Sanderling, Little Stint and Lesser Golden Plover, while prenesting Knots and Turnstones have mean body masses close to those of incubating birds.

Sandpipers had lesser masses in the late seasons of 1983 and 1992 in comparison with other years with normal phenological conditions. The between season differences

were the greatest in the prenesting period, when waders can have the most serious difficulties with food supply.

Zoogeographical studies on waders of the Russian Arctic: first results of Russian-Swedish Expedition "Tundra Ecology - 94"

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During summer 1994, eighteen remote sites of the Russian Arctic were visited by the team of Russian and Swedish ornithologists. Most of these areas have not been visited by ornithologists during the last 50 years. Full descriptions of the wader fauna will be made and breeding densities will be estimated on plots and transects. Comparison of breeding densities and habitats use by widely spread wader species (Dunlin, Little Stint, Turnstone, Grey and Lesser Golden Plover) are planned in different geographical areas of the Russian Arctic. Biometric data should be collected at all the sites with special attention to New Siberian Islands, Central Yakutia, Kolguyev and Bely Islands. First preliminary analyses in comparison with other populations will be presented for Knot, Sunderling, Turnstone and Grey Plover. Some corrections of breeding ranges will be made for several wader species, especially at the north of Kanin Peninsula and coasts north of the Yana delta which have never been visited by ornithologists before.

The principal zoogeographical peculiarities of wader distribution in the Russian Arctic will be made based on the expedition data and on the existing Russian literature sources.

Brood desertion in Kentish Plover: an experimental test of parental quality and remating opportunities

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Brood desertion by females is more common in shorebirds than desertion by males. Two hypotheses may account for the sex-bias in frequency of desertion: males may gain more by staying and caring for the brood than females, and/or females may gain more by deserting and remating. I tested both hypotheses on Kentish Plover Charadrius alexandrinus by removing either male or female parent at hatching. In Kentish Plover either parent can desert brood shortly after hatching. Single male parents were more successful in brood care than single females at least until the chicks fledged. Male parents tended to take higher risk than females in approaching a potential predator. Male-cared for chicks grew faster than female-cared for ones. Frequency of remating was not different between males and females, though females found new mates sooner than males. The experiment offers a possible explanation why female desertion and polyandry are viable reproductive decisions in shorebirds.

Breeding success of Baltic Dunlin on Tipperne, Denmark

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A breeding biology project on Baltic Dunlin was commenced in 1990. The aim is to find the exact demands concerning choice of nesting and chick rearing habitats, the dynamics in predation, and the importance of cattle grazing and trampling, in order to be able to establish proper mangement in the cultural grasslands, to where the Baltic Dunlin is confined.

A total of 200 pairs breed on the Tipperne Peninsula; 50 in three intensive-study plots, another 60 in areas with less intensive research.

Concerning the breeding success most efforts have been made to determine the hatching rate. As very few chicks are seen outside the nest, and only a small and unpredictable number of juveniles are seen on the mudflats after fledging, only indirect measures - mainly the presence of chick-warning parents - can be used to estimate the chick survival. The first 11 days all chicks are attended by at least one parent, and the rate of surviving clutches (with at least on chick) 11 days after hatching seems to be a useful relative measurement of the extent of chick survival. The year-to-year and site-to-site variation in chick survival is much lower than the similar variation in hatching success, indicating that the possibility of hatching is the main limitation in the breeding success on Tipperne.

The population is too large and confusing to use return rates of first breeders as a measure of breeding success. But even when all breeding birds in an area can be checked annually, a population dynamics model based on an analysis of return rates should include ways of determining the ectent of a "fluid" population and the exact level of philopatry, as even small over-estimates of adult mortality have a major effect on calculations on maintenance of the population.

Distribution, migrations and natural history of Great Knot in Russia

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Great Knot *Calidris tenuirostris* breed in poorly explored montane tundra of the north-east of Asia. As a result the species' breeding range is badly known. At the moment breeding is confirmed for 16 sites, and 13 more records of probable breeding are known. The Great Knot is a coastal wader during migration. In spring during main passage the majority of Great Knots cross the Russian Far East in several days around the 20 May almost without stops. Only rather few "emergency" stopovers are known there. Autumn migration starts from the beginning of July, and large concentrations are known in July and August on coastal mudflats of both eastern and western sides of the northern half of the sea of Okhotsk, where the birds probably gain weight for a further long non-stop flight. Contrary to adults, juveniles can be found regularly in fairly large numbers also further south.

According to studies in 1993 and 1994 in mountains of the upper Anadyr River, Chukotka Republic, Great Knots are monogamous with strong site tenacity (at least 75% of marked adults returned in 1994 to the former breeding area, n=12) and probably with strong mate fidelity (a single pair with both marked adults reunited in 1994). Egg laying in the population took place mainly in the first third of June; the majority of chicks hatched in the first days of July. Incubation period was 21 days recorded for one clutch. Both parents incubate a clutch in turn, but only one parent (most probably the male) cares the youngs. Chicks grow slowly: they fledged at 20-21 days in 1993, but only at 23-25 days in 1994. Young birds of a brood quite often keep together after fledging and in several cases they have departed from the natal area in a company with the parent. Few belated Great Knots remain in the breeding area after the beginning of August. Breeding was fairly successful in both seasons with most pairs raising young. Mean brood size at fledging or in several days afterwards was 2.5 young in 1993 and 2.3 young in 1994.

Factors affecting nest densities of shorebirds in Arctic Alaska

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Densities of birds breeding in the vicinity of Prudhoe Bay, along the Beaufort Sea coast of Alaska have been studied since 1981. Nest densities of site-tenacious species, including Semipalmated Sandpiper, Dunlin and Red Phalarope, were found to fluctuate synchronously. Hatching success of all species breeding in the area fluctuated synchronously. Nest density of Semipalmated Sandpiper, the most numerous breeding shorebird, was dependent on nest success two years earlier

(p= 0.04). This relationship suggests that variations in hatching success correspond directly into future changes in the size of the breeding population. Yearly variation in hatching success appears to be related to nest predation by Arctic Foxes *Alopex lagopus* during years of low microtine abundance; however, we have not been able to demonstrate this relationship quantitatively. Indirect support for this hypothesis comes from the observation that nest success is highest during years of high Snowy Owl abundance and low during the first year of Snowy Owl absences, presumably corresponding to lemming peaks and crashes.

Variations in hatching success, ultimately determined by lemming population fluctuations and resultant prey switching by Arctic Foxes, appear to be the primary determinant of subsequent nesting density (and presumably population size) of site-tenacious shorebirds. However, several other factors contribute to variations in nesting densities. Examples that appear to contribute to fluctuations in our data series include: 'catastrophes' such as El Niño events in phalarope nonbreeding areas; adverse weather in the breeding area resulting in nonbreeding by portions of the populations, particularly for early nesting species such as Dunlin; and locally depressed breeding success due to movements of Caribou *Rangifer tarandus* herds.

Time and energy budgets of Grey Plovers *Pluvialis squatarola* during spring and fall migration in the Wadden Sea of Lower Saxony

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The Wadden Sea is of major importance for migrating waders as it is the only refuelling station on their migrations between wintering sites and breeding grounds, and vice versa. Amongst the most common waders visiting the Wadden Sea during spring and fall migration is the Grey Plover.

Aims of this study are (a) to estimate the daily energy requirements of Grey Plovers during their staging in the Wadden Sea and (b) to discern the extent to which these requirements may be met by daylight feeding and which importance night feeding is expected to have. - The study was carried out in the Lower Saxonian Wadden Sea where a larger number of Grey Plovers stages each migrating season.

To estimate energy requirements time budgets were established by scan sampling. In addition the energy intake was estimated by observations of individual birds. The balance between daily metabolic costs and energy intake are to be presented. Seasonal aspects will be accounted for.

Tradition or flexible response - Curlew Sandpipers *Calidris ferruginea* on post breeding migration via the East Atlantic Flyway show different migration strategies with clear sexual tendencies

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Annually, more than 20,000 adult Curlew Sandpipers stop at the outer Elbe Estuary, German Bight. Colour ring controls indicate that males show a much stronger tendency to use the same stop over site in two consecutive years than females do. Males also tend to congregate in one particular area, whereas females are more scattered along the shorelines. Possibly these tendencies are due to the breeding system of Curlew Sandpipers: males leave the breeding sites first, most of them in early July, at the latest. Stable time schedule seems to enable many of them to keep up refuelling traditions for permitting long distance flights. In this case they have to reckon with a 4000 km flight to the Elbe Estuary, probably non-stop. Females can not predetermine the end of the breeding season. Mostly they have to turn to short distance flights probably by choosing the most favourable sites from a selection of known staging post. Males who failed the first 4,000 km non-stop trip seem to switch to short distance flight strategies. Females, who leave breeding sites early and in good conditions, take advantage of the long distance alternative.

Monitoring the breeding success of high arctic waders on moult score scans at stop over sites?

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At the Elbe Estuary, German Bight, moult score scans turned out to indicate the breeding success of Curlew Sandpipers *C. ferruginea.* The speed of change in mean moult score corresponded with the number of juveniles in 1992-1994. Successful females seem to switch to short distance flights and reduce moult activities due to the lack of longer stops. They arrived late and showed a high proportion of their breeding plumage. The more successful breeders arrived, the more slowly mean moult score developed. Possibilities to use such a method as an additional indicator in other species have to be discussed at the workshop.

POSTER ABSTRACTS

Dynamics of Curlew Sandpipers *Calidris ferruginea* during autumn migration on the Wash, England

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This paper examines the age and sex composition of Curlew Sandpipers on autumn migration through the Wash, England. The majority of birds were juveniles. The adult sex ratio is approximately 2:1 male:female. The juvenile sex ratio is not significantly different from 1:1.

The pattern of Norfolk counts shows that Curlew Sandpipers occur in small numbers in most years, and have large influxes every few years. The numbers of birds caught on the Wash generally follows this pattern, though only a few were caught in some years of peak local abundance. Adult passage is earlier than juvenile passage through the Wash. These results agree with Norfolk observations and would be expected as the adults leave the breeding grounds first.

The percentage of adult males showed no significant trend through the migration period. However, the percentage of juvenile males increased significantly through the migration period (Wilcoxon p = 0.02). The earlier migration of juvenile females than their male counterparts is surprising. This result indicated that juvenile females may mature more quickly, hence leave the breeding grounds first, or may migrate at a faster rate.

The numbers of Curlew Sandpipers ringed in Britain are recovered on autumn migration in subsequent years are few. Juveniles show a tendency to take a more easterly route. However, some adults were recovered in Britain and France, and may be faithful to the westerly migration route.

Migration and wintering of Knots in Italy

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Italy is unfortunately not one of the main areas visited by Knots. Just recently it appears that we have a wintering "population", settled at a single site in the southern part of the Po Delta (74 birds, Jan. 1994). Historical evidence has been traced indicating that this site was occupied by similar numbers around 1950. On the opposite coast of the peninsula especially along northern Tyrrhenian Sea, a regular passage of birds (flocks sized up to 40) has been recorded since the last century in late spring (usually May). Presence in other months (*e.g.* those during the post-breeding

migration) is less important but more widespread. A general pattern of occurrence throughout the year was obtained from reported sightings and collected specimens. The analyses of biometrics of small samples of museum specimens and living birds revealed that at least two different groups of birds are involved: short bills occurring in the post-breeding season and winter (almost exclusively with juveniles), long-bills in late spring. Body-mass values of the latter group are consistent with those expected after a long-distance flight, *i.e.* originating from West/South African wintering grounds. Presence of Knots in spring is known also for other parts of the northern Mediterranean coast, like Greece and particularly the Camargue (up to 537 birds).

The day- and night-time activity of Oystercatchers *Haematopus ostralegus* breeding in the Wadden Sea

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Though foraging behaviour of Oystercatchers has been studied extensively, quantitative studies of the activity budgets - including night-time activity - of free-living birds are lacking. This is mainly due to the fact that visual observations are often limited to certain areas, *e.g.* to the breeding or to the feeding territory and to the daytime, even when using a light intensifier. To overcome these problems we developed a radio-telemetry system which enables us to measure the entire daily patterns of different activities automatically and to quantify day- and night-time activity. Additionally, during incubation, we monitored the body mass of the radio-marked birds using nest balances. Therefore, the combination of both methods enables us to calculate the feeding efficiency.

The telemetric data indicate that the level of the overall locomotor activity as well as of the feeding activity at night was as high as during the day. Furthermore, a preliminary analysis of the birds' body mass establishes similar amounts of food consumption during day and night. Hence it follows that the feeding efficiency during night-time was as high as during day-time. Furthermore, radio tracking results in similar home-ranges during day and night. The findings support the need for detailed nocturnal studies of waders.

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Assortative mating in the Kentish Plover *Charadrius alexandrinus*

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Here we test the possible correlations between some morphological characteristics within a sample of reproductive pairs of Kentish Plover *Charadius alexandrinus*. The data was collected in 1994 in the Llobregat and Ebro deltas (north-east Spain). The measured traits includes several estimators of body size, wing shape and secondary sexual characters. The information registered of 18 first laying pairs showed a random mating for variables related to body size (wing, bill, tarsus, *etc.*). However we detected a high positive correlation between the size of the spots in the edges of the breast of one bird with that of their partner. It exists also a negative relationship between variable related to bill size and the size of the spot of the two members of a pair. The random pairing according to body size contrasts with that found in other waders. However, in all the other studied species, out of Kentish Plover, there exists a high degree of sexual dimorphism in size. This could be the main cause of the absence of sexual preferences for body size in this less dimorphic species. The brown breast spots of females could be considered as a male secondary sexual character, that was expressed in females to a lesser degree. This possibility was confirmed by the assortative mating detected with respect to spot size.

Moulting strategies and body masses of migrating Dunlin through the Ebro Delta, NE Spain

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The biometrics and body mass regulation strategies of moulting Dunlin *Calidris alpina* were investigated in North East Spain. The Ebro Delta is the only known area in which Dunlin simultaneously use two different moult strategies. Here, we compared the characteristics of these two different populations. Birds with large wing gaps (staging moulters) showed larger wings and tarsus than birds with small gaps (moulting migrants). We did not find, however, any differences in structural body size between the two groups. Staging moulters were heavier than moulting migrants. This is in contrast to the expectations of the predation risk hypothesis and contrary to the relationship between gap size and body mass found in other areas used only by moulting migrants. The higher occurrence of long flights when moulting, the daily energetic budgets and the lower wing size could explain the lesser body mass found in moulting migrant Dunlin.

Sexual size dimorphism in waders breeding in north-east Yakutia

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Investigations were carried out in May - August 1984, 1985, 1987, 1988 and 1990 at the Lower Kolyma district in Yakutia. The sexual size dimorphism in body mass of 15 species of waders breeding in north-east Yakutia was studied. The allometric equations for female body mass as a function of male body mass in different groups depending on social system were calculated. Relationships between sexual size dimorphism and mating system, and between sexual size dimorphism and parental behaviour were found. The smaller sex has the main responsibility for parental care. If both sexes care for chicks equally they do not have size dimorphism. Normal size dimorphism occurs in species with polygyny; whereas reverse size dimorphism occurs in species with polyandry.

The longevity of free-living waders and its relationship with wader social organisation

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Literary data on the longevity of 36 wader species of the Western Palearctic were used. The allometric equation for the longevity in free-living waders (Tmax, years) as a function of their body mass (m, g) was calculated: $Tmax = 5.58\ m^{0.206}$, $n = 36$, $r = 0.48$, $r^2 = 24\%$.

This equation differs significantly (t-test, $p < 0.05$) from previous ones for other birds species. The relationship between the longevity in waders and their mating system was found. On average the monogamous species live longer than polygamous species (t-test, $p < 0.05$). Polygynous species live longer than polyandrynous species (but their differences are not significantly: $p > 0.05$). A relationship between the longevity in waders and their parental care systems was also found. In average the species in which both parents care for chicks jointly live longer than species in which one parent care for chicks alone (t-test, $p < 0.05$). Species in which only female care for chicks live longer than species in which only male care for chicks (but differences are not significantly: $p > 0.05$). The longevity in multiple-clutch species do not differ significantly from monogamous species or from species in which both parents care for chicks jointly.

Sex differences in the migration, moult and wintering areas of British-ringed Ruff

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A total of 351 Ruff have been caught by the Wash Wader Ringing Group at sites around the Wash (south-east England). The distribution of wing lengths is bimodal for both adults and juveniles with no overlap between the two groups (males 177-210 mm, females 144-169 mm). There is no evidence that juveniles differ in size from adults but there is a significant difference in the sex ratios of the two age classes with juveniles being heavily female-biased and adults being male-biased.

There are significant differences in the timing of passage through the Wash of the age-sex classes. Adults (both males and females) move through earlier than juveniles. There is no significant difference between the sexes within adults, but amongst juveniles female passage peaked significantly earlier than that of males.

Adult Ruff are in active primary moult whilst on the Wash and there are differences in the timing and pattern of moult between the sexes. The moult scores at different times through the autumn for the males and females suggest that males start moult earlier than females. Male Ruff also have significantly more feathers in active moult and a significantly larger gap in the wing than females.

Recoveries of Ruff ringed in Britain in autumn (July - October) and reported in winter (November - March) were examined. There is a highly significant difference in the wintering locations of the sexes with males tending to winter in Europe and North Africa and females in West Africa. There have been 12 recoveries in the breeding season (May and June) of Ruff ringed in Britain in autumn. Of these eight were in the former Soviet Union with the others being in the Netherlands, Germany, Poland and Sweden.

Food selection of Eider Ducks in the tidal flats of Lower Saxony

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In the tidal flats of Lower Saxony numbers of Eider Ducks *Somateria mollisima* have increased very much in the last 20 years. Nobody would complain, if there had not been cases, in which Eider Ducks and mussel growers competed for the same mussels. Thus, there was a public interest to get to know the proportion of the Blue Mussel *Mytilus edulis* in the diet of Eider Ducks in Lower Saxony. Food composition was studied monthly at six different islands by analysis of faeces. Further, spatial and temporal variation of food composition was studied at a smaller scale: at different roosts situated around one island and with a higher frequency of analysis.

Summarizing all monthly analysis of this study the proportion of Blue Mussels in the diet of Eider Ducks amounted to 45%. The most important prey item was *Cerasto-derma edule* (50% of the food). There was a considerable spatial and temporal variation in the food composition between the roosts of the different islands. *Macoma balthica* seemed to be eaten only in the West.

Around the island of Mellum *Cerastoderma edule* was the main food item. Number of prey species differed clearly between places. Differences were correlated with sex ratio.

Satellites, sediments and shorebirds

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Whenever a large-scale deve'opment, such as a barrage or a marina, has been proposed for an estuary, it has always been difficult to predict its effect on local waterfowl populations. A joint three year ITE and BTO research initiative, now in its second year, involves the use of remote-sensed imagery of sediments and low tide counts on 25 estuaries in the U.K. We hope that this may provide conservationists and developers with the information they need to determine the likely impact of developments on estuarine birds. The aims and methods of the project are introduced.

A remote-sensed estuarine image and some preliminary results are presented.

Safety of catching adult waders at the nest - data are still wanted!

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Careful catching of adult waders at the nest in most cases seems to be safe for them. Nevertheless in one project 19% of 122 captured Redshank *Tringa totanus* abandoned their nests (whereas only 0.6% of 168 caught elsewhere) (Kania 1992).

Your experience can reduce the costs which have to be paid by birds to enable gaining skill by the beginners!

Between the Ipswich WSG Conference (October 1993) and this meeting only six persons have shared their data and opinions. Follow them! Your contribution will be used for elaboration of the problem in the planned field methods manual. For more details see *WSG Bulletin* 72: 20-22.

Behaviour of meadow birds towards aircraft close to an airport

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In a meadow area bordering the airport of Bremen we investigated the effects of airtraffic on birds, especially Lapwings *Vanellus vanellus* and Black-tailed Godwits *Limosa limosa*. During the breeding season and during autumn the distribution of the birds was mapped. In addition, the reactions of the birds to aircraft were observed.

The breeding distribution of several wader species appeared to depend on habitat quality and not on the frequency of aircraft flying over the area. Roosting and feeding Lapwings in autumn avoided the area directly in front of the runway where the aircraft pass over very low. However, the uneven distribution of roosting and feeding birds of different species can better be explained by habitat structure than by the effects of air traffic.

Lapwings and Black-tailed Godwits breeding near the airport rarely showed any visible reaction to planes. In 75 % of the cases where the birds raised their heads or flew up the causal factors were natural stimuli, in the rest of the cases such behaviour was caused by walking humans or airoplanes.

Roosting birds in autumn flew up in 21% of all cases an airoplane passed over. Here on average 50 % of the individuals of the flock flew up for 20 seconds. Helicopters had a stronger effect than other aircraft. Although Lapwings and Starlings *Sturna vulgaris* seemed to be more sensitive than gulls or crows, this was related to flock size. The frequency of flight reactions of Lapwings and Starlings to aircraft increased with increasing flock size, and Lapwings and Starlings occured in bigger flocks than the other species.

Time budgets of migrating waders in the Wadden Sea: first results of the interdisciplinary project Ecosystem Research Lower Saxonian Wadden Sea

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Each year 7-10 million estuarine birds use the Wadden Sea as a staging and moulting area. For many arctic and subarctic breeding

species the Wadden Sea is by far the most important refuelling station in the West Palearctic in both spring and autumn. Therefore, the energy demands for the feeding birds are high. However, there are differences between spring and autumn migration. The energy demands of the most species are higher in spring than in autumn, on the other hand prey density and availability are lower in spring than in autumn.

We analysed the activity patterns and time budgets of the five most common waders staging in the Wadden Sea: Oystercatcher *Haematopus ostralegus*, Grey Plover *Pluvialis squatarola*, Curlew *Numenius arquata*, Dunlin *Calidris alpina* and Bar-tailed Godwit *Limosa lapponica*. Time budgets provide many insights into the overall relation and adaptation of a species to its environments.

The behaviour of all investigated species was largely determined by the tidal rhythm. The main foraging period lasted from 3-5 hr before low tide up to 3-4 hr after low tide, and feeding activity was higher before than after low water. In spring birds spent between 1 and 3 hr longer foraging per tidal cycle than in autumn. During the last weeks before their departure from the Wadden Sea to the breeding and wintering areas, respectively, most species increased the time they spent feeding.

The study was supported by the Federal Ministry of Research and Technology.

Comparison of breeding ranges structure of nomadic and conservative tundra waders (Curlew Sandpiper and Dunlin)

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The breeding ranges of two tundra wader species: Curlew Sandpiper *Calidris ferruginea* and Dunlin *C. alpina* were compared in order to find differences in spatial distribution. These species are quite close in taxonomy, size and habitats but they have different breeding strategies and as a result, different breeding ranges structures.

Data on distribution of both species were collected in the framework of the CAFF inventory programmes carried out by the International Arctic Expedition of the Russian Academy of Sciences. Two maps are presented: one with all known breeding records and the map of the breeding range made by extrapolation on different landscape and vegetation maps. Analyses of breeding densities, spectrum of breeding habitats and dynamics of these parameters were made to determinate the breeding range structure. The following structural parts of breeding ranges were determinated.

For Dunlin (a conservative species)
1. the core area (optimum);
2. the area of "normal" breeding (suboptimum); and
3. the area of breeding by single nests out of the main breeding range.

For Curlew Sandpiper (a nomadic species):
1. the core area coinciding with the "normal" breeding area. (Densities and breeding habitat spectrum are variable but always moderate or high); and
2. the area of sporadic, irregular breeding.

The following differences were found:
a) The breeding range of Curlew Sandpiper has a rather large belt of sporadic breeding, embracing the core area from the south; the species uses it in some years.
b) The core areas of the two species are allopathric, with slight overlap.

The analyses of the structure of breeding ranges lead us to conclude that different breeding strategies in tundra wader species are clearly reflected in different types of large-scale territory use.

Distribution and breeding biology of Pintail Snipe *Gallinago stenura* in eastern European tundra

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The Pintail Snipe is a Siberian species. The western border of its range reaches 60° E in tundra. Along the Ural Mountains its distribution extends to 64° N, 60° E. Records of displaying males are known from the coasts of Kara Sea (Amderma and Ust'-Kara, 70° and 69° N). In comparison with 1950s the species now expanded its breeding range a bit to the west.

In the tundra zone Pintail Snipe is a characteristic bird of zonal shrub tundras dominated by *Betula nana*. In comparison with the co-existing Common Snipe *Gallinago gallinago*, Pintail Snipe prefers drier habitats.

According to studies in 1982-1992 in the region Pintail Snipe numbers fluctuated highly between years, reaching 36.5 individuals/km^2 (1987) in the large dwarf birch tundra subzone.

All nests found were located on borders of vegetation associations. All six complete clutches contained four eggs. Broods prefered watershed tundras with mosaic of vegetation associations. The analysis of species distribution according to habitats and bird numbers demonstrates that shrub tundra is the optimal habitat for Pintail Snipe, explaining its current spacing.

Estimating the population of breeding waders on lowland Scotland

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The populations of breeding waders in the lowlands of Scotland were estimated using a stratified random sample. Areas of known high wader densities - Outer Hebrides, Shetland and Orkney - were sampled more intensively than mainland Scotland. The mainland was, in turn, split into 'key sites' for waders, surveyed in their entirety, and a random selected sample of the remaining areas. The size of each random sample was 100 ha, 240 squares were selected. Whilst estimated densities of breeding waders were similar to, or lower than, those recorded in a previous survey, the available area from which they were randomly sampled was considerably larger. Consequently population estimates for some lowland wader species, in particular Curlew, are considerably higher than previous estimates. Modified population estimates for the UK as a whole, together with a means of assessing the importance of individual sites, are presented.

Status of Terek Sandpiper *Xenus cinereus* population in Finland

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There is a small breeding population of Terek Sandpipers in Finland, discovered in 1957 after the last occurrence at the beginning of this century. The population breeds in two separate localities in Finland, *c.* 100 km apart from each other. The population has been about 10 to 20 in 1950s and 1960s, *c.* 30 pairs in 1980s and now it has decreased to *c.* 20 pairs in early 1990s. The species breeds in two different types of habitats: less frequently in natural sites *e. g.* in islands with much open meadows intermingled with bushes and trees and more commonly in man-made open areas with different types of surface materials.

The recent decrease is due to several reasons. In breeding areas disturbance due to various human activities, low nestling success after hatching and loss of suitable breeding habitats can be mentioned. The return-rate appears to be slightly low for a wader-species, but movements of adults away from known breeding areas due to poor breeding success cannot excluded.

Wader migration across the German Bight (SE North Sea): visual observations on Helgoland

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Since 1991 the "Ornithologische Arbeitsgemeinschaft Helgoland" organizes observations of bird migration on the island of Helgoland. Preliminary results are presented for five selected species of waders, which pass the island during the migration to and from the Wadden Sea. Much diurnal migration was observed in July and August, when adult birds arrive from their arctic breeding grounds. Few birds were seen during spring migration and juvenile fall migration. Dunlin *Calidris alpina*, Grey Plover *Pluvialis squatarola* and Golden Plover *Pluvialis apricaria* tend to fly in small flocks, but Knot *Calidris canutus* and especially Bar-tailed Godwit *Limosa lapponica* prefer to migrate in larger groups. In all five species the flock size is smaller in summer compared to spring migration.

Birds in the Wadden Sea of Schleswig-Holstein: species and numbers to be expected during the WSG conference

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The poster displays the average seasonal phenology of the most important wetland bird species in the Wadden Sea of Schleswig-Holstein. It is intended to give participants an impression about their surroundings and helps somewhat in the preparation for what can be expected during the excursions.

Sewage works as habitats of waders in Central Russia

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A total of 25 species of waders (93% of regional fauna of waders) have been observed nesting or on migration in the central part of Russia at sewage works of various types and sizes. Lapwings *Vanellus vanellus* (nest density 0.5-1.0 pair/ha), and rarely Redshank *Tringa totanus*, Little Ringed Plovers *Charadrius dubius*, Common Sandpiper *Actitis hypoleucos* and Black-tailed Godwit *Limosa limosa* nest on the sewage farms of sugar refineries, alcohol production, starch processing plants and animal (cows and pigs) farms. A total of 21 species are found of the migration (density in May-June is 1.8-3.5 birds/ha, in July-August is 2.2-8.5 birds/ha). Lapwing, Ruff *Philomachus pugnax* and Wood Sandpiper predominate, Green Sandpiper, Little Ringed Plover, Little Stint *Calidris minutus*, Dunlin *Calidris alpina*, Curlew Sandpiper *Calidris ferruginea*, Common Snipe *Gallinago gallinago* and Redshank are found regularly.

A total of 19 species were recorded on the lagoons of fields filtration. Four species are found in April-May (density until 8.8 birds/ha, Lapwing predominates). Seven species are found in June (density up to 29.8 birds/ha, Lapwing, Wood Sandpiper, Green Sandpiper, Redshank, Ruff predominate). Lapwing, Common Snipe and Redshank nest. A total of 16 species are observed in July-August (density is 20.6-46.1 birds/ha; Wood Sandpiper, Lapwing, Ruff, Common Snipe and Green Sandpiper predominate).

Eight species are observed in September (density up to 90 birds/ha; Ruff, Common Snipe and Green Sandpiper predominate). Sewage works are important habitats of breeding and migrant waders in the region in the present time. Turnstone *Arenaria interpres*, Grey Plover *Pluvialis squatarola*, Ringed Plover *Charadris hiaticula*, Broad-billed Sandpiper, Spotted Redshank *Tringa erythropus* and other waders species were found exclusively on the sewage. The enlargement of these artificial reservoirs will be favourable for arctic waders migrating across the continental region of Russia.

Utilization of tidal flats by shorebirds in the Wadden Sea: where do Bar-tailed Godwits *Limosa lapponica* forage?

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In September 1992 habitat utilization of Bar-tailed Godwits was studied by means of low-tide counts. The study was carried out in the Königshafen, a sandy tidal bay in the northern part of the Wadden Sea (55° 1'N, 8° 26'E, 450 ha).

Low-tide counts on 32 plots sized 50 x 50 m revealed two different tidal utilization patterns. High lying plots were only used during receding and incoming tide whereas low lying plots were used during the whole emersion period. Calculations of low-tide densities showed a marked uneven distribution of the Godwits. In September they predominantly utilized areas with a low content of silt and fine sand which are situated in the lower half of the bay and close to the high-tide roost.

Knowledge of habitat requirements and the subsequent modeling of distributions allows to detect a) areas sensible to human impact (habitat loss) and b) spatial variations in predation pressure, which in turn may extend our knowledge on trophic relations in intertidal areas.

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The spring migration of waders in the Razim-Sinoie-Lagoon, Danube Delta, Romania

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The Razim-Sinoie-Lagoonsystem (in the south of the Danube delta, Romania) consists of several brackish lakes with vast shallow parts and reed beds. It extends over a surface of 900 km^2. Between 1990 and 1994 several excursions were made in every spring in the period from 23 March to 9 May. A total of 37 wader species were observed, some in amazing numbers: >17,000 Dunlin *Calidris alpina*; >18,000 Ruff *Philomachus pugnax* and >15,000 Black-tailed Godwit *Limosa limosa*. The migration phenology of 12 common species is shown and the maximum numbers of all migratory species are estimated.

An interesting phenomenon of Ruff migration was noticed in the second half of April: a high percentage of Ruffs in the coastal lagoons was still wearing the winter plumage while most of the birds at an inland resting site (with a distance of 90 km to the lagoons) were moulted into their breeding plumage. This finding seems to suggest that there are two different populations migrating through east Romania.

For some species *e.g.* Black-winged Stilt Himantopus himantopus, Avocet *Recurvirostra avosetta*, Stone Curlew *Burhinus oedicnemus*, Collared Pratincole *Glareola pratincola* and Kentish Plover *Charadrius alexandrinus* the Razim-Sinoie-Lagoon system is an important breeding area.

Ringing recoveries of NW European Kentish Plover *Charadrius alexandrinus*

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Recoveries of birds ringed in Sweden, Denmark, Germany and the Netherlands were examined. Most adult birds stay near the breeding sites until late August. An important staging area is the French Atlantic coast. Wintering birds are found around the Iberian peninsula and in Guinea Bissau. There are relatively few first spring recoveries. This indicates that many first year birds probably stay in Africa.