# ABSTRACTS OF TALKS GIVEN AT THE WADER STUDY GROUP ANNUAL MEETING, HAAMSTEDE, THE NETHERLANDS, 19-20 NOVEMBER 1983

## French Breeding Wader Survey

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This paper dealt with the current status and numbers of breeding waders (except for Woodcock *Scolopax rusticola*, Stone Curlew *Burhinus oedicnemus* and Pratincole *Glareola pratincola*) in France. No serious survey has been made since 1961, and a national breeding wader survey will be carried out in 1984. An estimation of breeding wader populations in France was presented, based chiefly on regional censuses, recent bibliography and a 1979 EEC enquiry. Estimates are summarised in Table 1. The French breeding wader population is between 31 000 and 35 800 pairs, 74% of which are Lapwings. Some species are increasing, probably as a consequence of better survey coverage of the country, and also the end of the hunting in March. The 1984 National Wader Census will give more information about the current status of breeding species in France.

Estimated numbers of pairs of breeding waders in France are:

Oystercatcher *Haematopus ostralegus* 700; Black-winged Stilt *Himantopus himantopus* 800-900; Avocet *Recurvirostra avosetta* 1150-1450; Ringed Plover *Charadrius hiaticula* 75-90; Little Ringed Plover *Charadrius dubius* 2100-2600; Kentish Plover *Charadrius alexandrinus* 1020-1060; Lapwing *Vanellus vanellus* 23 000-26 000; Ruff *Philomachus pugnax* 5; Curlew *Numenius arquata* 950-1100; Black-tailed Godwit *Limosa limosa* 25-34; Redshank *Tringa totanus* 690-780; Common Sandpiper *Actitis hypoleucos* 1000+ ?; Snipe *Gallinago gallinago* 400-600; Dotterel *Eudromias morinellus* 1-2.

## Food of chicks of meadowbirds

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Food of pulli of meadowbirds (i.e. Lapwing *Vanellus vanellus*, Black-tailed Godwit *Limosa limosa*, Redshank *Tringa totanus*, Oystercatcher *Haematopus ostralegus* and Ruff *Philomachus pugnax*) was investigated by means of qualitative analysis of droppings.

Analysis of faeces of Redshank posed a problem. A large proportion of the droppings contained virtually no recognisable fragments. This was not the case with younger chicks. Full grown Redshanks regurgitate pellets. Presumably they start doing so at the age of ten days, as from that day no big fragments appear in the droppings, which by then are useless to determine the food. Two older Redshank chicks were actually observed producing pellets.

For several broods, droppings were collected from 2 or more members of the family at the same time. This offered the opportunity to assess differences in food in relation to habitat selection. For each case, frequencies of food items were calculated within a brood and within all other droppings. The probability that a food type will be found in any other chick of a species is generally lower than of encountering it again in a member of the same brood. Differences between broods and others seem to decrease in the order Lapwing, Black-tailed Godwit, Ruff. Oystercatchers were excluded because the chicks are fed by their parents. The conclusion is that fields where Ruff chicks feed resemble each other more closely than fields used by young Godwits. Fields with young Lapwings are very heterogeneous. This is consistent with what is known about habitat selection of meadowbirds.

Oystercatcher chicks are mainly fed with larvae of Tipulidae, Lumbricidae and Coleoptera. All other food types are unimportant. The food selection of Lapwing and Godwit pulli is more or less complementary. Young Lapwings feed mainly on Lumbricidae, larvae of Tipulidae and Stratiomyidae, *Scatophaga* (dungfly), Carabidae and *Aphodius* (dungbeetles). They search for their food on the ground and in the top layer of the soil. Young Godwits feed in the vegetation, their food consisting mainly of Diptera, Hymenoptera, Curculionidae (weevils), Elateridae (clickbeetles) and larvae of Tenthredinoidae (sawflies). The food of Redshank (a few data of very young chicks!), and Ruff, is more or less intermediate.

## Wader numbers on lowland agricultural land in England, Wales and Scotland

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Over the last few years there have been two extensive surveys of breeding waders carried out in the UK covering five species: Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata*, Redshank *Tringa totanus* and Oystercatcher *Haematopus ostralegus*. In England and Wales, a survey of Breeding Waders of Wet Meadows was carried out in 1982 (Smith 1983) and in Scotland a survey of Waders Breeding on Agricultural Land, organised by Hector Galbraith, was completed in 1983.

In England and Wales, over 1200 grassland sites were surveyed covering an area of approximately 240 000 ha, largely concentrated in the south and east. In total 6721 pairs of Lapwings, 1979 drumming Snipe, 540 pairs of Curlews, 2218 pairs of Redshanks and 537 pairs of Oystercatchers were reported. Lapwings were the most widespread wader and occurred on 66% of the sites surveyed. Snipe and Redshanks were very thinly spread in the lowlands and only occurred on 31% and 34% of the sites respectively. These two species were concentrated in a few exceptional areas. For instance in total 48% of the Snipe and 36% of the Redshank were on five areas - the Ouse Washes, Nene Washes, North Kent Marshes, Derwent Ings and Somerset Levels. Curlews and Oystercatchers were not well covered by the survey and only small numbers were reported.

In Scotland, because of the large area to be surveyed and the relative paucity of observers, a sample survey was carried out. Up until October 1983 a total of 50 000 ha had been surveyed and 3352 pairs of Lapwings, 377 drumming Snipe, 662 pairs of Curlews, 540 pairs of Redshanks and 1365 pairs of Oystercatchers were reported. Dunlins and Ringed Plovers were also counted - 323 pairs and 141 pairs respectively. The 1983 data are still being analysed and the full results will be published shortly (H.Galbraith in prep). However initial data show that Snipe and Redshank, the two key species, were found to be particularly associated with pasture and rough grazings - the habitats that are most susceptible to agricultural change.

The overall conclusions of the surveys are that in the lowlands of England and Wales breeding waders, particularly Snipe and Redshanks ,are already very restricted in their distribution. In Scotland, total numbers are far higher but Redshank and Snipe are nesting on a habitat that is very susceptible to agricultural change.

Reference

Smith, K.W. 1983 The status and distribution of waders breeding on wet lowland grasslands in England and Wales. *Bird Study* 30: 177-192.

## Reproductive strategies of Ruffs, Waders, and the other birds

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Courtship and mating of the Ruff *Philomachus pugnax* usually occurs on leks (Hogan-Warburg 1966, Van Rhijn 1973). In these communities certain males (resident males) defend small territories. On the border, certain other males may try to obtain such territories (marginal males). Because of interchangeable roles both groups are classified together as independent males, which are distinguished by fighting and threat in their behaviour and by dark-coloured nuptial plumages. Certain other males (satellites) which rarely fight or threaten, are marked by light-coloured plumages. The satellites are tolerated on the residences and seem to be equally successful in mating as independent males (Van Rhijn 1983). It is very likely that genetic factors are associated with this role-differentiation.

On the Dutch breeding grounds, the number of copulating Reeves (females) is much higher than the number of males on leks, but the number of nesting females seems to be much lower (Van Rhijn 1983). In view of the fact that the Dutch leks are situated along an important part of the migration route of the Ruff, these findings may be interpreted as a tendency of Reeves to copulate on migration. Such copulations would only result in fertilizations if spermatozoa can survive until ovulation, about one day before egg-laying (e.g. Lake 1975). From the duration of sperm survival in other birds and the duration of the Reeve's migration to northern Scandinavia, the possibility of fertile copulations on migration cannot be rejected. Support for the incidence of such copulations can further be obtained from male-female distributions in different geographical areas (e.g. Koopman *et al.* 1982). In the southern breeding areas proportion of males is much higher than 50%, but in the northern areas it is much lower. To explain these latitudinal changes in the sex-ratio, I would suggest that tundra habitats are suboptimal for adult males and temperate habitats suboptimal for chicks.

In this paper an attempt will be made to reconstruct the phylogeny of the complicated social system of the Ruff. Additionally some ideas about the evolution of social systems in all birds will be included.

Out of the 16 families comprising the order Charadriiformes (Cracraft 1981), the Scolopacidae are most strongly dependent on cold breeding habitats in the north. Within this family, the subfamily Calidrinae (Voous 1973), including the Ruff, is the most extreme representative of this breeding strategy. All 24 calidridine sandpiper species breed in the boreal, subarctic, and arctic regions. Such cold breeding habitats were abundantly present during the glacial periods of the Pleistocene (Larson 1957). During the interglacial periods, however, the tundra areas were restricted to very small refugia, and during the tertiary epochs the climate in the northern hemisphere was so warm that real tundra areas were absent. Yet paleontological data reveal that many representatives of Scolopacidae occurred in these warmer periods (e.g. Brodkorb 1967). Thus, it is unlikely that the most important common character of Calidrinae is related to other properties of recent breeding areas, for instance food.

All northern breeding areas are marked by fairly predictable large peaks in the availability of flying Diptera (e.g. MacLean & Pitelka 1971). Such rather short peaks could have occurred in other climatological circumstances, for instance in a swampy environment after a river-flood or during the rainy season. These emerging flying insects may be an important food resource for the small altricial chicks, which are not fed by their parents, and which are unable to stick their small bills deep into the substrate to search for other preys. There are a number of other characters in Scolopacidae and Calidrinae in particular, which can be related easily to use a swampy environment, with brief large peaks of flying insects, and longer periods in which their larvae can be found. Rather long legs and bills enable the adults to search for these larvae. The possession of tactile organs (Herbst corpuscules) in the bony tip of the bill greatly aids prey detection by touch (Bolze 1968).

Whereas climatological preferences and morphological features seem to be rather constant between species, social behaviour is extremely variable. Apart from the Ruff, lek behaviour is also shown by the Buff-breasted Sandpiper *Tryngites subruficollis*. It is unlikely that alternative male strategies occur in this species, but fertilization of females before they reach the breeding grounds might be possible in some cases. Promiscuity occurs also in a few other species, such as the Pectoral Sandpiper *Calidris melanotos*, but in these cases it is not associated with the occurrence of densely packed leks, as in the Ruff. In all these species parental care is performed only by the female. In contrast to this there is a large group of monogamous species with biparental care. The Knot *Calidris canutus* is an example of this group in which both parents cooperatively incubate their clutch of eggs and tend their chicks. In some other species both male and female care for eggs and chicks, but not together. In these species, exemplified by Temminck's Stint *Calidris temminckii* (Hilden 1975), females lay several clutches in quick succession, usually two. Females only care for the last clutch, whereas males will care for the earlier clutches. Successive clutches are not necessarily fathered by the same male. Finally, there is at least one species, the Sanderling *Calidris alba* (Pienkowski & Green 1976), which is marked by two different kinds of social organization: in the Canadian arctic the rapid multiple clutch system has been described, but in northeast Greenland a monogamous biparental care system seemed to predominate.

All these various mating patterns must have been derived from one common ancestral type. Most authors accept that the monogamous biparental care system must be the common ancestral type for all bird species. From the present data about the order Charadriiformes I formed the idea that all recent patterns may have been derived from a system with male care and perhaps with rapid multiple clutch polygamy. Three arguments for this can be given.

First, almost all species of the family Scolopacidae are marked by a sexual size dimorphism in which the female is larger than the male. This size dimorphism is most pronounced in species with sex-role reversal, in most cases associated with a rapid multiple clutch polygamy. Sexual size dimorphism in the other Charadriiformes might be a relic of such ancestral mating strategy.

Second, males may stay longer than females with chicks, but females never stay longer than males in species within the Scolopacidae with biparental care.

Third, complete sex-role reversal is poorly distributed in the classes of birds. It occurs in many ratite birds, in some gallinaceous birds, and in the mutually related orders Charadriiformes and Gruiformes. This must be an indication that such a character cannot easily evolve. Its relative abundance in the Charadriiformes therefore suggests that the character is inherited by common descendance, and not independently evolved in different lineages. Since paternal care occurs in at least two of the suborders: Charadriomorpha and Scolopaci (Cracraft 1981), I am inclined to think that this character was already present in the common ancestor of the whole order.

I want to consider now how paternal care could have evolved from a stage without any such care, and to what extent the process differs from the evolution of maternal care. There is one fundamental difference between the possibilities: the female is necessarily present when the eggs are laid, and the male might disappear after copulation. There are two situations which may lead to associations between male and female from copulation up to egg-laying or longer (van Rhijn in press b). First, the female might join with a male because he defends indispensible resources. Second, the male might guard the female in order to prevent other males from copulating with her, so as to maximize the effect of his own copulations with that particular female. The optimal behaviour for a male, however, depends on what the other males are doing. If most males defend resources, it will be more difficult to establish a territory than when only a few males defend such resources. Similarly, the more males there are guarding, the less likely it will be that an unguarded female will have the opportunity to copulate with many males. Consequently, the evolution of male-care is always superimposed on a mixed strategy of forming lasting bonds with females, or not.

This might signify that in the case of male-care, more clutches will become unattended than in the case of female-care. The logical next step in the evolution of parental care is that the female stays with the clutch after desertion by the male. Thus, in most cases the male will care for the offspring, but on some occasions the female will act as a substitute. Then it is only a small step to develop the double clutch strategy, such as in Temminck's Stint. When most males in a population are supplied with first clutches, females are forced to care for second clutches when ecological conditions permit them to lay several clutches.

The double clutch strategy is perfectly suited to exploit the short peaks in the abundance of flying insects. Furthermore, it may offer a starting point for the derivation of social systems within the subfamily Calidrinae. Here I follow the line only to the present system of the Ruff (Van Rhijn in press a). My reasoning emphasises that the double clutch strategy gives the female the opportunity to use two different sets of criteria for mate selection. For the first clutch, the optimal choice would be a male with good parental qualities; for the second clutch a male with good genes. These alternative sets of criteria might result in a disruptive selection within the male population: caring males, and males which only compete for copulations. In the Ruff I also distinguished two types of males: independent males and satellites. The independent males do compete for copulations on leks. The satellites do not compete so clearly, but neither do they care for nests. Nevertheless, satellites possess a number of features which suggest that they could have been derived from caring males. They often accompany female flocks, and they copulate relatively early in the season. There are some indications also that satellites migrate further north than independent males.

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## Wader populations and food resources in the Ria Formosa = Faro

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This work was carried out in the winter 1982/83, in Ria Formosa (7° 52'; 7° 33'W) along the coast of southern Portugal. We were aiming to evaluate the size of the resources available. The area is a lagoon-like system, stretching for 60 km, with a maximum width of 6 km, resulting from the formation of a littoral sand dune belt. The area has approximately 11 000 ha, composed of channels, mudflats and salt-marshes. To make comparisons possible, the methods used to collect data were similar to those used in other areas in Europe and Northwest Africa (NOME 1982).

At high tide, the total counted was 21 000 birds. Dunlin *Calidris alpina*, Bar-tailed Godwit *Limosa lapponica*, Grey Plover *Pluvialis squatarola* and Curlew *Numenius arquata* were the most abundant. Some species were spread throughout the Ria, such as Curlew, Redshank *Tringa totanus* and Dunlin, while others were confined to particular roosts, such as Bar-tailed Godwit in some islets, Little Stint *Calidris minuta* and Avocet *Recurvirostra avosetta* in salines and Oystercatcher *Haematopus ostralegus* in the sand dune belt. During low tide, counts of feeding waders through the tidal cycle were made in 27 study plots on the two main substrates, mud and muddy-sand. Some species showed a clear preference for one of the substrates (e.g. Bar-tailed Godwit on muddy-sand and Dunlin on mud), while others fed in both substrates, but at different times. Macrobenthos was sampled in the same 27 plots and the biomass (AFDW) was calculated for four groups: small and large polychaetes, crustaceans and molluscs. In muddy-sand substrates, the mean biomass values were higher, particularly because of the contribution by molluscs and crustaceans. The mean value of AFDW were higher than in other areas of either Europe or Africa (NOME 1982), and a total of more than one hundred species were found.

In comparison with other estuarine areas, the overall bird density was low in relation to the biomass. The birds eat, during the winter, 0.7% of the biomass available, while in Mauritania this predation is up to 96% (NOME 1982). Considering that this low predation is associated with wader migration strategies, we can assume that the Algarve wetlands of the Ria Formosa may be of great importance during spring migration for the wintering north-west Africa waders.

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## Arrival of waders at Scoresby Sund, Northeast Greenland

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Populations of Ringed Plovers *Charadrius hiaticula*, Golden Plovers *Pluvialis apricaria*, Turnstones *Arenaria interpres*, Knots *Calidris canutus*, Dunlins *C. alpina* and Sanderlings *C. alba* at Scoresby Sund were studied in 1973, 1974 and 1975. The main influx of these waders took place at the end of May and the beginning of June, and northward migrating birds were observed until the second week of June. Territorial and courtship displays were observed from late May until early June. Pre-breeding groups and single birds were found near the coast and thawing ponds until mid-June. During a spell of bad weather in the third week of June waders gathered again near the coast. Among them were breeding birds that had left their nests.

Differences in the onset and peak period of egg-laying were highly correlated with snow-melt conditions in respective years and areas. Waders bred earliest in relatively early snow-free inland valleys and latest along the outer coast. They bred earlier in 1973 and 1974 than in 1975.

Taking into consideration all areas and years, the period between first and last dates of egg laying was five weeks for Ringed Plover, four for Golden Plover, three for Sanderling and Dunlin and two for Turnstone and Knot. In all these species,the earliest clutch was completed in the second week of June.

Weights, measurements, habitats, densities, breeding success and post-nesting movements are reported in: de Korte,J., Bosman,C.A.W. & Meltofte,H., 1981. Observations on waders at Scoresby Sund, East Greenland. *Meddr. om Gronland, Bioscience* 7: 1-21.

## Changes in the Oosterschelde and their impact on waders

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In the southwest Netherlands the Oosterschelde estuary will be protected against storm floods partly with dams and partly with a storm-surge barrier, which will reduce the tidal amplitude and currents. These works will influence agriculture, aquaculture, fisheries, and also the social and recreational functions of the area. Nature is affected in various ways. With respect to birds, two major questions are raised:

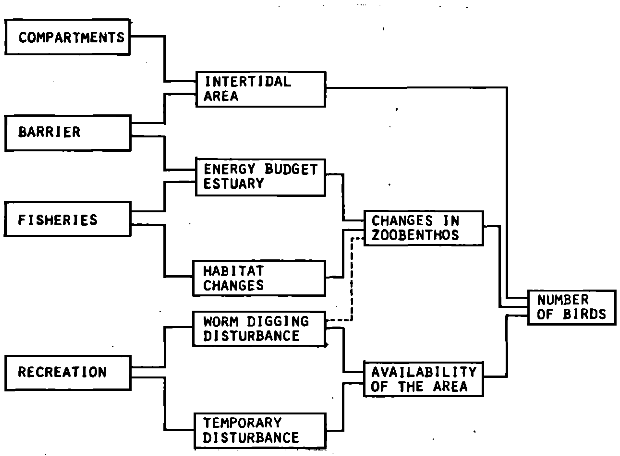
a) What changes will occur as a direct result of the works? and
b) What changes will occur mainly as a consequence of indirect changes?

To reduce costs, the building of the dams has been postponed. This means that for a time only the storm-surge barrier will be complete. The tidal amplitude will be about 35 cm less than in the final situation. The dams can be built with either sand or stone. Sand is less expensive (a difference in total cost of about 30 x $10^4$ Dutch Guilders), but a closure using sand is possible only when existing currents have been reduced drastically. This can be accomplished using the surge barrier. By manipulating the surge barrier between open and completely closed in various time schedules, tidal cycles of 18, 24 and 36 hours instead of the normal 12.25 hours can be created. The barrier is designed for use during heavy storms, although from the beginning many people have proposed other uses. In the event of storms the decisions to be taken are: at what time, at what water level, and for how long, must the barrier be closed?

For environmental reasons it has been agreed to allow manipulation of the barrier under almost all conditions. It can be open or closed at any time. Every closure affects the ecosystem of the Oosterschelde. Tidal currents are stopped, so that exchange of water will decrease or cease. Waves erode edges at only one tidal level, and so cause increased erosion. A closure for longer periods at high water levels in the basin will prevent the birds from feeding intertidally. Closure at lower levels, to provide feeding areas for birds, are difficult to achieve and will cause damage to zoobenthos and fish stocks.

The best strategy seems to be closure as late as possible before a storm, so that higher water levels, and shorter and less frequent closures are achieved. There are many possible reasons for which the barrier could be closed, including engineering works, oil spills, people in danger, freezing of oysters, scientific research. The major effect will be the same as closure under storm conditions, but may involve additionally higher or lower temperatures of water or intertidal areas, drying-out of intertidal areas and salt-marshes, and more or less feeding time for birds or fishes. The main advice from ecologists is to avoid interruption of the tides since every interruption of the rhythm will decrease the quality of the natural system.

Drastic changes will be followed by adaptations of abiotic, biotic and human features of the ecosystem. The sedimentation and erosion patterns will change, with the risk of erosion of tidal flats into the gulleys, whose size has formed to cope with the previous larger masses of water. The biotic community, from phytoplankton to birds, will change to use the new tidal and morphological conditions. Human activities will be of major importance in the future. Many activities, e.g. aquaculture, bait digging, and recreation, will be concentrated on the remaining tidal zones. The ratio of areas of mussel beds, cockle beds, and sea-grass will also change. This will be of advantage to some waders, and disadvantage to others. The figure summarises how the major consequences of construction of the dams and barrier will combine to affect the numbers of birds using the Oosterschelde. Changes in the system have yet to be quantified sufficiently but attempts to do so are in progress.




## Joint Services Expedition – Princess Marie Bay, Ellesmere Island

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In 1980, a Joint Services Expedition visited Princess Marie Bay, Ellesmere Island, in the High Arctic of Canada. A variety of scientific projects were undertaken. The chosen area turned out to be biologically very rich. The Expedition was highly successful in documenting the waders of the area, and obtained new information particularly on the breeding biology of populations of Baird's Sandpiper *Calidris bairdii* and Knot *Calidris canutus*.

The work was extended in 1981 and 1983, when further research was undertaken in recording details of the ecological aspects of the breeding biology, breeding systems and the pre-migratory phase of waders in the High Arctic.

## Predicting the influence of changes in tidal amplitude and loss of habitat on wader populations in the Oosterschelde

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The Oosterschelde is known to be very important for migrating and wintering waders. However a storm-surge barrier is under construction in the mouth of the estuary. This construction will diminish the tidal amplitude and, together with the building of secondary dams, will result in both a reduction of feeding-area and feeding-time within the preferred foraging zones of the waders.

In this paper I look first in general at wader densities present in the area, and then explain the approach adopted to predict the influences of the changing environment on wader populations. It has been shown elsewhere that differences in densities of waders between estuaries is linked to the abundance of prey populations. These relationships also hold within a single estuary. Data from the Oosterschelde also suggest strongly that differences in bird densities reflect differences in benthic biomass, which might in turn be influenced by the salinity. The overall density of waders in the area is, however, very high compared with other estuaries. Whether this is due to food abundance, or other factors such as climate conditions is still unknown.

To predict the influence of the major hydrodynamic changes in the estuary on wader populations we must first divide the tidal flats into biologically useful units. On the basis of numerical classification I can distinguish several communities of benthic invertebrates, each having a specific group of wader species feeding in it. These communities are used as units for further analysis. The next step is to understand the importance of these units for each species: how many birds are feeding there and for how long, and how much of their energy requirements do they get from that community? As an example, data from the Bar-tailed Godwit *Limosa lapponica* were presented. This species feeds on a wide variety of prey items (*Arenicola marina, Lanice cochilega, Nephtys hombergii, Nereis diversicolor, Heteromastus filiformes, Scoloplos armiger, Tharyx marioni, Eteona longa, Macoma balthica, Scrobicularia plana, Cerastoderma edule, Corophium volutator, Crangon crangon, Carcinus maenas,* and Amphipoda). Diet selection was in accordance with Optimal Foraging Theory (OFT). Based on this, the importance of each community for Godwits could be assessed.

However other factors than food may be involved in determining the density of waders. Indeed, data from Oystercatchers *Haematopus ostralegus* indicate that there is a high correlation between their density and the stability of a feeding area, measured as the number of winters for which a musselbed has already existed, when the density of mussels is held constant in a partial correlation analysis.

A model was presented to predict the densities of waders in certain benthic communities based on previous data and an OFT approach. The predictions of the model can be used to advise on the use and manipulation of the barrier, but not to influence planning and building of the barrier, since this is already under construction.

## Networks of wader sites in Western Europe: some results of the WSG Project

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Some results of the project were outlined, taking as the main example the movements of Dunlins *Calidris alpina* around western Europe in the non-breeding season. This was based on results of ringing and visible-marking, detailed by Pienkowski & Pienkowski (1983, *Wader Study Group Bull.* 38: 13-22). Brief examples were also given of other species, including Knot *Calidris canutus*, Sanderling *C. alba* and Grey Plover *Pluvialis squatarola*. Differences in the movement patterns between species were noted, as well as the widespread feature of a generally westward movement in late autumn and an eastward return in late winter. Underlying reasons for this common pattern were proposed (see also Pienkowski & Prokosch 1982, *Seevogel* 3: 123-128; Pienkowski & Evans 1984, *Behaviour of Marine Animals*, vol.6, Shorebirds, Plenum Press, (in press)):

(i) use of extensive intertidal areas such as the Wadden Sea and The Wash during the autumn moult period when flight may be impaired, to minimize the chance of predation, most predators being terrestrially based;

(ii) movement westwards after completion of moult to avoid the effects of adverse weather conditions (including lower temperatures further east from the Atlantic Ocean, leading to higher food requirements but lower prey availability; and a higher likelihood on continental coasts, where the tidal range is small, of feeding areas remaining covered during gales because of wind-blown water);and

(iii) an eastward return in late winter or early spring as the continental coast warms more rapidly, reversing the temperature effects in (ii), and allowing exploitation of prey stocks which may be less depleted because of the winter reduction in shorebirds present in these areas.

## The 1984 West Coast Spring Passage Project

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The Birds of Estuaries Enquiry (BoEE) has been very successful in assessing the relative conservation importance of estuaries for waders in winter. However, the methods used in winter are inadequate for assessing the value of spring staging posts for migrants. This is because counts are not made frequently enough to detect the peaks, and because any turnover in the population cannot be measured. For a true measure of the importance of a site, the total number of birds which visit the site on migration should be used.

The great importance of the west coast of Britain for migrating waders in spring was shown by the 1979 WSG Spring Passage Project. More extensive information is needed, however, to assess the network of sites being used by these waders, and on the total numbers of birds involved at each site. A new, joint BoEE/WSG West Coast Spring Passage project is scheduled for April and May 1984. This project will involve catching and temporarily colour-marking waders at each site, as well as intensive counting and searching for colour-marked birds (see *Wader Study Group Bull.* 39: 35-36 for details).

The results of a pilot survey carried out in Spring 1983 on the Solway Firth showed that Turnstones *Arenaria interpres* and Ringed Plovers *Charadrius hiaticula* differed greatly in their pattern of migration on this estuary. Turnstones showed no turnover, and the peak count thus gave a true indication of the number of birds to visit the site was at least twice the number seen from the peak count. The results of this study are presented in greater detail in *Wader Study Group Bull.* 39: 37-41.

## Population fluctuations, breeding success and mortality of Dunlin moulting and staging in the Dutch Wadden Sea

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Dunlins *Calidris alpina* arrive in the Dutch Wadden Sea area yearly in varying numbers, and also with variable proportions of first-year birds, as a result of variable breeding success. This conclusion is based on a long-term census of roosting waders with counts and mist-net samples on the island of Schiermonnikoog and other parts of the Dutch Wadden Sea. Furthermore, the yearly fluctuations in the peak numbers in late summer on Schiermonnikoog correlated very well with the mid-winter peak numbers in Langstone Harbour, an important wintering area in southern England. This indicates that maximum numbers give more reliable estimates of yearly fluctuations than yearly averages over several months, on the condition that counts are available from the periods with peak numbers.

There proved to be a positive relationship between the proportional change in peak numbers and the proportion of juvenile birds in mist-net samples in the period, when peak numbers were present. However, in some years with a low breeding success, there was a disproportionally large decrease in numbers, which probably can be explained by a higher mortality on the breeding grounds and migration routes. The latter hypothesis is confirmed by the significant, positive relationship between breeding success and the yearly survival (of adults only), estimated from the recaptures of birds ringed in previous years.

The most important factor influencing both survival rate and breeding success is probably the condition of the birds just before they return to their breeding grounds. There were indications that higher mean weights in May were followed by higher numbers of juveniles in autumn. Moreover, the same phenomenon proved to be present in Turnstone *Arenaria interpres*.

The previous results lead us now to the hypothesis that spring condition in arctic and subarctic waders is of vital importance to both their survival and breeding success, which throws a new light on the importance of the Wadden Sea area for waders from arctic and subarctic breeding grounds.

## Wading birds in Guinea-Bissau, winter 1982/83

*Leo Zwarts, Achterwei 23, Ee, Friesland, Netherlands*

A Dutch IUCN/WWF-team (leader Ernst Poorter) visited Senegal and Guinea-Bissau in winter 1982/83. About six weeks were spent on the Archipelago dos Bijagos and on the intertidal flats along the mainland coast (for more information about this area: see Fournier & Dick 1981, *Wader Study Group Bull.* 31). It was impossible to do complete counts at high water, since most waders disappeared in the mangroves. That is why we counted the birds at the tidal flights between roosts and mudflats or when they were dispersed over the low water feeding areas. We could use detailed maps (1:50,000) to determine the surface of the counting areas. Assuming that the sampled area (81.3 $km^2$) is representative for all intertidal flats in Guinea-Bissau (1570 $km^2$), we can estimate the total number of waders present there:

Little Stint *Calidris minuta* 350 000, Curlew Sandpiper *Calidris ferruginea* 340 000, Bar-tailed Godwit *Limosa lapponica* 150 000, Ringed Plover *Charadrius hiaticula* 70 000, Whimbrel *Numenius phaeopus* 60 000, Redshank *Tringa totanus* 50 000, Knot *Calidris canutus* 36 000, Grey Plover *Pluvialia squatarola* 27 000, Curlew *Numenius arquata* 12 000, Common Sandpiper *Actitis hypoleucos* 8000, Turnstone *Arenaria interpres* 5000, Kentish Plover *Charadrius alexandrinus 5000, Greenshank Tringa nebularia* 2700, Oystercatcher *Haematopus ostralegus* 2500, TOTAL 1 200 000.

The estimates are too low because no corrections were made for birds which were overlooked during the counts or which were chased out of the counting site by the presence of the counter. The estimated predation pressure in the winter half-year was low for the West-African bloody cockle *Arca senilis*: 1.1 $g/m^2$ present, of which 0.01 $g/m^2$ would be taken by the only bird species preying upon *Arca*, the Oystercatcher. However, the estimated predation-pressure is high for the fiddler crab *Uca tangeri*: 1.1 $g/m^2$ present, of which 0.45 $g/m^2$ would be taken by Whimbrels, Curlews, Ringed Plovers and other waders in the 6 winter months, and is also high for the worms and bivalves: 2.4 $g/m^2$ present of which 0.83 $g/m^2$ would be taken by Bar-tailed Godwits, Curlew Sandpipers, Little Stints and other waders. The estimated biomass of the macrobenthic fauna is about the same as on Banc d'Arguin, but the estimated total predation by the waders is much lower (cf NOME 1982; see *Wader Study Group Bull.* 35:39).

## Wader studies in Egypt

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This talk was based on seven visits between 1977 and 1983, and a survey of literature. A book on Egyptian birds is in preparation; see also Meininger & Mullie (1981a,b), Mullie & Meininger (1983). Some wader species in Egypt were discussed briefly: Egyptian Plover *Pluvianus aegyptius*, Black-winged Stilt *Himantopus himantopus* and Avocet *Recurvirostra avosetta* have disappeared as breeding birds this century. The Painted Snipe *Rostratula benghalensis* is not uncommon in marshes and rice fields in the Nile Delta, the Faiyum and Wadi Natrun. The Senegal Thick-knee *Burhinus senegalensis* breeds throughout the Nile Valley on sandbanks and on flat roofs, even in the centre of Cairo. There are probably several hundreds of pairs of Collared Pratincole *Glareola pratincola* in the Nile Delta. Kittlitz's Sand Plover *Charadrius pecuarius* is uncommon and local. Spur-winged Plovers *Vanellus spinosus* breed everywhere in cultivated areas (thousands of pairs).

Based on counts in the winters 1978/79 and 1979/80, an estimated 70 000-130 000 waders winter in Egypt, the most abundant being Kentish Plover *Charadrius alexandrinus* , Little Stint *Calidris minuta* and Dunlin *Calidris alpina*.

An important autumn migration route for waterbirds is situated along the north coast of the Sinai peninsula. Up to 45 000 passage waders have been counted there in autumn, the most abundant being Kentish Plover, Sanderling *Caldris alba*, Little Stint and Dunlin.

Almost all Egyptian wetlands are heavily threatened by reclamation. At least 700 $km^2$ (25%) of the lakes and 4000 $km^2$ of saltmarsh have already been reclaimed.

In Lake Manzala, 98 000-162 000 waterbirds are killed per season, of which 30 000-50 000 waders. The sales value of waterbirds is less than 0.5% of that of fisheries. Birds, and waders in particular, are very expensive compared to other meat, and are not an important source for ordinary people.

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## Shorebird migration studies in North America

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Abstract not received.