# WADER BREEDING PERFORMANCE IN DIFFERENT HABITATS - A REVIEW

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Several species of waders nest in more than one habitat within their breeding range, even at broadly similar latitudes. Such multiple habitat use may have evolved other thousands of years or may be of recent origin, often in response to modifications of habitats by man. Possibly, loss of areas of preferred nesting habitat has led to "overspill" into other habitats.

How do we identify the most suitable (preferred) habitat for each species or population? In evolutionary terms, birds should attempt to nest in that habitat in which they can maximize their *lifetime* reproductive output of young that live to breed, *i.e.* the number of breeding attempts multiplied by the number of young (N) that live to breed from each attempt. An index of the latter is usually taken as the number of young that fledge (F), so that N = kF. But note that (k) might vary according to the habitat in which the young are reared. The number of breeding attempts will be determined by the adult's expectation of reproductive life, which is related to the product (S x B) or survival on the non-breeding area (S) and on the breeding area (B). Clearly (B) may vary according to the habitat in which the bird chooses to breed, *e.g.* because of variation in predation rate on adults. (S) may also vary with breeding habitat, as Fretwell (1972) found with Field Sparrows. If a bird remains in the *same* habitat for breeding and non-breeding (though not necessarily in the same location) it may have higher (S) than a bird that changes its habitat in the non-breeding season. Perhaps this applies to Oystercatchers and Ringed Plovers amongst waders?

Note that the same lifetime reproductive output could be achieved in several ways:

*e.g.*
Case 1
Good (S) x Good (B) x Poor (F)
Case 2
Moderate (S) x Good (B) x Moderate (F)
Case 3
Moderate (S) x Moderate (B) x Good (F)

Measurement of (F) alone may not be sufficient to define the quality of the habitat. Ideally (S) and (B) also need to be measured. In Case (3) above, good fledging success compensates for higher mortality on the breeding habitat than is found with Case (2), in which moderate fledging success is sufficient to balance lower adult mortality, *i.e.* the turnover rate is lower.

If fledging success at each breeding attempt is not necessarily a good measure of habitat suitability, perhaps it can be a better predictor if linked with the population density found in each habitat?

From Fretwell's (1972) models of habitat use, two extreme scenarios can be developed. His "ideal free distribution" predicts higher densities but equivalent breeding performance in the more suitable habitat *in a given year.* (Comparisons must be made within years as poor habitats will be used only in years of high population numbers.) Fretwell's "ideal despotic distribution" also gives rise to differences in density amongst habitats but predicts higher breeding success in higher density habitats (which are of higher quality, so more birds attempt to settle within them, thereby making defence of large territories impossible).

Territorial behaviour is assumed in this case to be density - limiting, but it might be used merely as a means by which birds assess density and then choose where to settle (as in the ideal free distribution); or it could be a means of spacing within a habitat once the overall numbers of birds settling have been decided by some other means.

The "ideal" distributions are confounded by nesting site fidelity, a topic discussed by O'Connor (1985). This leads to poorer quality habitats being occupied even in years of low overall population size, and hence to breeding success being lower in poorer than better habitats. With the ideal free distribution operating, nesting success in all habitats will be equal only if enough first-time breeders are present to overspill into all habitat types, and if such birds breed as successfully as more experienced birds. O'Connor has argued that in territorially limited populations, site fidelity should be found primarily in short-lived species in which the costs of trying to transfer froma poor to a better habitat exceed the benefits. In waders, however, which are long-lived species, site fidelity seems common except in species utilizing transient habitats. Thus the measurement of density, as well as breeding success, does not assist markedly in assessment of habitat suitability - even if it were possible to measure density easily. Hilden (1979) reviewed breeding densities in *Calidris* sandpipers and found higher densities in general in the smallest habitat patches.

Breeding performance in waders is probably affected by breeding density only in-so-far as it affects the availability of food resources for breeding adults (and possibly chicks) and the concentration of predators. Losses of eggs and chicks to predators can be high, though variable from year to year, depending on the timing of breeding in relation to predator activity and on alternative prey availability.

Food shortage may affect egg size and consequent chick survival, as well as the extent of relaying if clutches are lost. The role of the weather in determining breeding output needs to be separated from effects of habitat suitability.

The overall conclusions are that more effort should be spent on measuring adult survival in different habitats, as well as breeding performance, and that much more needs to be known about choice of breeding habitat by first-time breeders, in order to identify the most suitable habitat for each species.

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*(This note is an expanded abstract of a presentation at the 8th International Feeding Ecology Symposium, Ribe, September 1989.)*

## WADER SURVEYS ON THE COAST OF TANZANIA

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Surveys, organized by ICBP in Denmark and Tanzania, were carried out along the coast of Tanzania from the end of January to the beginning of March in 1988 and 1989.

We were four ornithologists in 1988, and that year all coastal sites became accessible, by the combined use of a yacht and a rubber boat. Unfortunately the yacht sank just before the second expedition, so in 1989 one to two ornithologists surveyed, the most southern area and a part of Zanzibar Islands from the land side. The situation of the counted areas are shown in Figure 1.

The coast of Tanzania is composed of a great diversity of habitats, and birds were counted on all types of coastal habitats.

Waders were counted at high tide on some stretches of coast, but the most used method was to count during low tide. By counting around low tide we achieved precise information on numbers per length of coast. The areas surveyed at low tide compose about 160 km of the coast, which corresponds only to about 10 percent of the total coastline.

Numbers are given in Table 1. The guess as to total numbers wintering on the coast of Tanzania has been derived, by extrapolating the mean number of birds per km of coast at low tide, and then compensating for an expected over- or under-representation of the preferred habitats within the surveyed area compared to the whole coast. The given guesses are preliminary.

After comparing total numbers and mean numbers of birds per shoreline in Kenya, South Africa and Namibia with Tanzania, it seems evident that the coast of Tanzania is an important wintering area for at least Crab Plover, Curlew Sandpiper, Terek Sandpiper, Whimbrel, Greater Sandplover and Grey Plover.

Except for the tidal flats and bays on Mafia Island we found no large areas with very high numbers of feeding waders, but all along the coast we found small areas where waders were feeding in high densities.

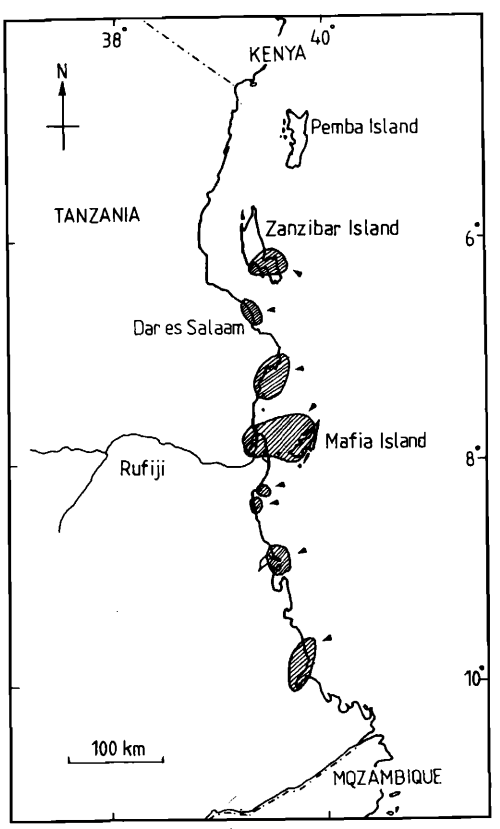


Figure 1. Coastal wader survey areas (shown shaded) on the coast of Tanzania.

It is our hope that a marine reserve, which includes the western and southern coast of Mafia Island, will be established.

Direct threats in the form of habitat desctruction and disturbance were found only in Dar es Salaam.

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