EDITORIAL: SANDERLING STUDIES

Apart from the usual items and a range of articles we have brought together several contributions about Sanderlings Calidris alba for this issue. If this leads to further studies on Sanderlings we shall be delighted. The time is opportune. Several articles point to the interest in local movements of Sanderling flocks and the species is one of the highest priorities for study in the WSG project on Movements of Wader Populations in Western Europe. Furthermore the Sanderling is a common coastal wader and compared with other common species we know remarkably little about its migrations in the W.Palaearctic. This is partly because of its remote arctic breeding grounds and long non-stop migrations and partly because of its non-breeding distribution on open shores, away from estuaries and the activites of most wader ringing groups. More studies on Sanderlings would be welcome. We have even changed our cover design for this 'Sanderling special', thanks again to Ray Bishop.

STUDIES ON SANDERLING AT TEESMOUTH, NE ENGLAND

by P.R.Evans, D.M.Brearey and L.R.Goodyer

Introduction

The coastal rocks and beaches, both south and north of the estuary of the River Tees, Co. Cleveland, support up to c.1200 Sanderling Calidris alba from late July to late May each year, i.e. throughout the 10 months of the year when the birds are absent from their arctic breeding grounds. Some of their main feeding grounds fall within an area covered by the South Gare and Coatham Sands "Site of Special Scientific Interest", designated by the Nature Conservancy Council in 1969 (Fig.1). Unfortunately, this area is also scheduled for reclamation, to provide land for Stage 3 of the British Steel Corporation's Redcar works, under the terms of the 1976 Co. Cleveland Structure Plan. Against this background we began a study in autumn 1976 of the biology and behaviour of Sanderling at Teesmouth. The main aims were (i) to measure minimum year-to-year survival rates and the degree of site-faithfulness of wintering birds (ii) to identify their foods and habitat requirements at different times of the year, and (iii) to obtain information on biometrics and movements of birds using the Tees. Allied to this, D.M.B. undertook a special study of foraging behaviour, using cine-film and tape-recorded commentaries; this study forms an important part of his doctoral thesis (Brearey, in prep.).

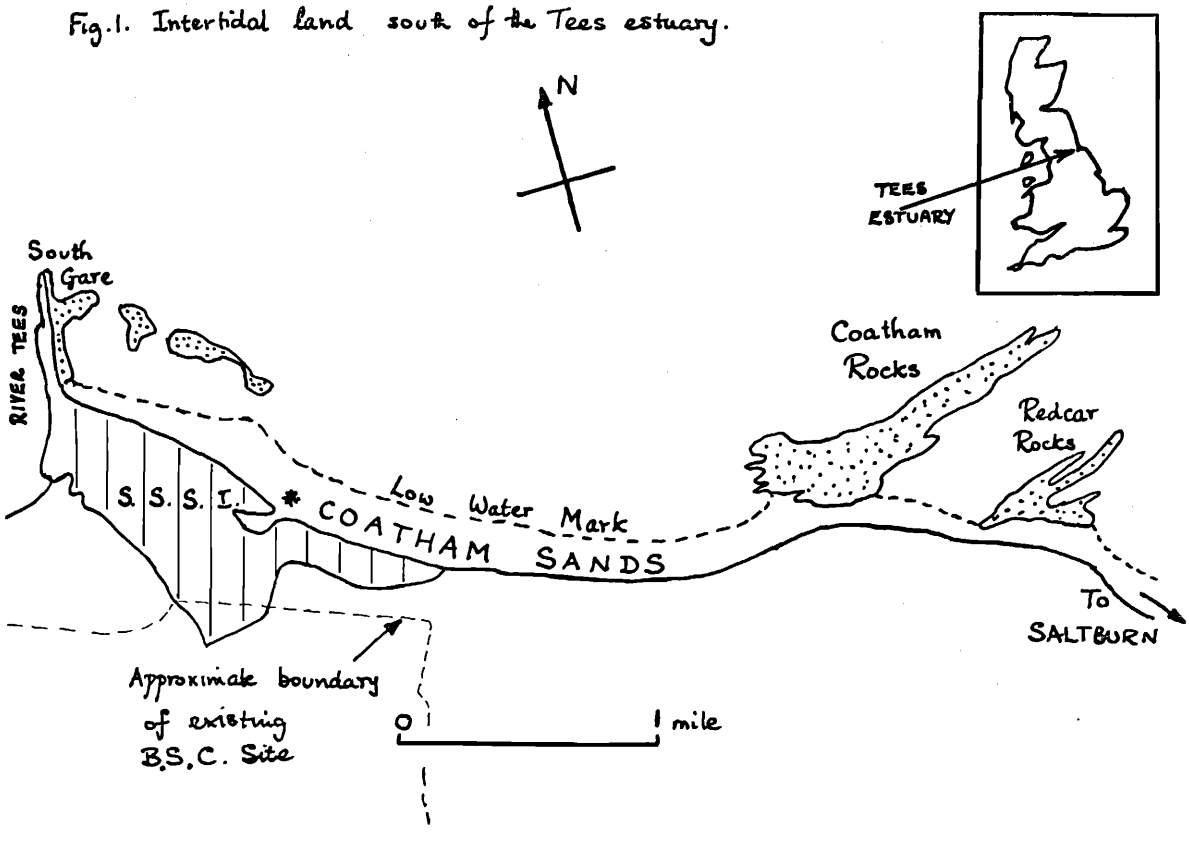
Methods

Sanderling have been caught by cannon-netting and clap-netting since March 1976. Most birds were ringed with unique combinations of colour rings as well as B.T.O. rings, and since July 1980 have been dye-marked as well, with picric acid on the whole of the underside. Counts and searches for marked birds on the south side of the estuary have been made by L.R.G. since autumn 1976, and on the north side since 1978, whenever possible at weekly intervals. Most counts have been made from a vehicle driven along the sands, at those stages of the tidal cycle when birds are most concentrated into a few areas (see later). Densities of potential invertebrate prey have been measured at intervals throughout the winters of 1977/78 and 1978/79 on the south side of the estuary, and more recently on both sides of the river.

Results (i) Survival rates

A high degree of site faithfulness is shown by individual Sanderling, such that each Tees-marked bird has usually been seen at Teesmouth at some time during each winter, if it is alive. However, some individuals are seen much more regularly than others. Using even single reliable sightings during a winter as evidence of survival, the following minimum survival rates have been obtained:

Fig.1. Intertidal land south of the Tees estuary.



| | No. Marked birds present in autumn/winter | No. seen again during following autumn/winter | % survival |
|---|---|---|---|
| 1976-78 | 93 | 85 | 91 |
| 1978-79 | 55 | 37 | 67 |

The higher mortality during the severe weather early in 1979 stands out, as does the normally high survival in other milder winters.Unusually, a few marked Sanderling were found dead early in 1979 (Evans, in press).

(ii) Foods and feeding routine

The chief foods of Sanderling at Teesmouth are the polychaete worm Nerine cirratulus and several species of Crustaceans: the amphipods Bathyporeia spp., the isopod Eurydice pulchra, and probably also Haustorius arenarius and Periculoides longimanus, which have been recorded in some of the invertebrate samplings.

During each tidal cycle, Sanderling change their feeding sites progressively along a two-mile stretch of beach, spending the low-water hours at Redcar or (on spring tides only) at Coatham Rocks, then moving northwards, usually reaching the bay in front of the British Steel Corporation site an hour or two before high water (Fig.1). This movement along the beach is reversed as the tide falls. From August to October and again from March to June, Sanderlings roost over high water, usually close to the site marked * on Fig.1; in mid-winter they continue to feed then, particularly on neap tides. In autumn, until early December, they often roost over low water itself at Redcar Rocks, but especially in January and February this roost period is dispensed with. Birds then move on to the beach near Redcar Rocks to feed immediately after low water.

Although their prey are present along the whole length of Coatham Sands, the prey densities are not uniform. In 1977/78 certain sites regularly held higher densities than others. Furthermore, there is a zonation of prey between high- and low-water marks. Nerine occurred chiefly in a band some 20-50 m wide, lying downshore from about 50 m below high-water mark (HWM), whereas densities of Bathyporeia spp. were highest some 50-60 m below HWM in late autumn and early spring, but 90-100 m below HWM in winter.

Sanderling usually obtain their crustacean prey in the vicinity of the tide-edge, since they rely on movement of these prey to detect them; they obtain most Nerine from wet sand, using tactile search methods. The birds' feeding routine along Coatham Sands allows them to exploit the highest densities of available food at each particular stage of the tide. Thus, as the flooding tide began to cover the Nerine zone about 3 hours after low water, birds began to feed in winter 1977/78 on the beach just north of Coatham Rocks, where Nerine densities were highest in that winter. Although Nerine densities further north were not quite so high, there may have been an advantage to birds to move north steadily, to avoid crowding along the tide-edge, which could have reduced each bird's chances of obtaining food. By 4½ hours after low water, the Nerine zone is covered and birds concentrate in the limited areas of beach where Bathyporeia and Eurydice densities are highest. In autumn and spring 1978 this was the area in front of the B.S.C. works, where food was available almost up to the high-water mark. However, in mid-winter, when the main Bathyporeia and Eurydice zones had shifted downshore, the densities of these two prey at the higher tidal levels were no greater in front of the B.S.C. works than further south along Coatham Sands, and most Sanderling stayed to feed over high water on whatever prey was available in the area which (at lower tidal levels) held the highest densities of Nerine.

The feeding routine of the Sanderling was also disturbed in January and February 1978, when many thousands of gulls concentrated in the Tees estuary during cold weather and roosted or fed along Coatham Sands. Sanderling finding Nerine on Coatham Sands would often have these stolen by the smaller gulls, and most Sanderling moved to feed on the beach near Redcar, where Nerine densities were lower than on Coatham Sands.

Just before low water of spring tides, at tidal levels below the main zones of Nerine, Bathyporeia and Eurydice, Sanderling fed on Coatham and Redcar Rocks on a variety of prey of suitable size. They also fed on the beach, after easterly winds had dislodged and washed mussel Mytilus edulis spat on to the shore from the offshore rocks.

The feature which makes Teesmouth particularly suitable for wintering Sanderling is the range of prey species, each of which tends to occur in a distinct zone of the shore, so that the birds can exploit them in sequence. Nerine appears to be the key prey species, and the feeding routine of Sanderling is geared chiefly to its density and availability. Added to this, the gentle slope of the Teesmouth beaches allows a large area to be washed by each wave. This provides a large area of wet substratum suitable for tactile searching for Nerine, and a large area in which crustaceans become active, if present, and so become visible to Sanderling. This allows crowding of birds to be reduced to levels at which flocking becomes an advantage, in that more pairs of eyes are looking for each concentrated patch of prey.

The well-marked zonation of Nerine on the shore has been found in other studies of this polychaete worm, in Kent, Holland and western France. The general concensus is that it occurs in a band just below the high water mark of neap tides, and usually on beaches of fairly fine sand, in which the grain size is highly uniform. So far we have failed to obtain quantitative data on densities of Nerine in other parts of Britain, which might indicate whether Teesmouth holds exceptionally high levels of this species (which could explain the high numbers of Sanderling wintering there).

One other feature of Sanderling feeding is worth comment. Birds often take Bathyporeia some 10-30 m ahead of a rising tide, though at and after high water they feed in the retreating waves. Bathyporeia becomes active just before it is reached by the incoming tide, and their tracks can then be seen on the sand surface. Apparently these are the cues to which the Sanderling respond. On the ebbing tide, the birds take crustaceans swimming in the water column itself.

(iii) Movements.

Total counts of Sanderling, on both sides of the Tees estuary, have shown marked fluctuations from week to week,even in mid-winter. Highest counts have usually coincided with the presence of banks of detached seaweed ("wrack") along the otherwise sandy shores, particularly on Coatham Sands, or with the presence of deposits of mussel spat on the beaches. Lowest counts have occurred when gulls have congregated in large numbers on Coatham Sands. In general, in any one winter, as total numbers of Sanderling at Teesmouth have risen, counts on the south side have risen proportionately less, i.e. Coatham Sands appears to be "filled" with Sanderling first in autumn and further influxes are then absorbed chiefly by Seaton Sands and other beaches north of the river. However, some movements of marked individuals between beaches during a single winter have been documented. Of 45 birds marked before autumn 1978, during the 1978/79 winter when beaches both north and south of the estuary were surveyed regularly, 11 were seen only on the south side of the estuary, 12 only on the north side, 6 chiefly on the south side but once on the north, 9 chiefly on the north side but once on the south, and only 7 regularly on both sides. 24 of the birds had been ringed on the south side: 16 of these were seen only or chiefly on the side; 21 of the birds had been ringed on the north side: 17 of these were seen only or chiefly on that side. This information suggests a strong attachment of most birds to one or other side of the estuary.

Although checks for the presence of colour-ringed birds have been made regularly, often at weekly intervals, and (from autumn 1978 onwards) on both sides of the river, certain individuals have been recorded irregularly during a winter while others have been seen consistently. Increases in total numbers on the estuary, and concentrations of birds feeding on wrack banks, have often coincided with the re-sightings of individuals that have been absent (or just possibly overlooked) for several weeks. This has led to the idea that Sanderling populations in winter may contain "residents" and "transients", the latter patrolling stretches of coastline to appraise possible food supplies continually. Evans (in press) has suggested that "residents" could be at an advantage unless their normal food supplies (Nerine and the small crustacea) are washed away by unpredictable changes in beach profile following onshore gales. Under these conditions, "transients" would be able to move immediately to other known feeding sites; "residents" might starve.

In addition to these mid-winter movements, passage birds occur at Teesmouth in both autumn and spring. A large moulting flock (up to 800 birds in some years) is present in August and September, but even in these months some non-moulting adults pass through. Others depart when moult has been completed, and yet others arrive, at least some of which have moulted at The Wash, as shown by 4 controls at Teesmouth of Sanderling ringed at The Wash in August and September. Movements of juveniles to and through Teesmouth also occur in autumn, but little is known about them as yet. In spring, passage birds arrive in April and May, some staying for several weeks while fattening for the migration northwards. Recoveries of spring passage birds have been reported from the Vendee (France) in October and from Algeciras (Spain) in January. Amongst the spring passage birds caught on the Tees was a control from the Netherlands, where it had been ringed in August. Further details of movements are given by Goodyer and Evans (1980).

Future work

The main efforts in 1981-82 will be to test the reality of the 'resident' versus 'transient' dichotomy. Visits are being made to sites up to 100 miles north and south of Teesmouth to check for the presence of birds colour-dyed and ringed on the estuary. If, as seems possible, some birds are patrolling the coastline to check continually on the food stocks in different sites, we hope to find out over what distances such patrolling occurs. We also hope to identify any differences in behaviour between adults that have moulted at Teesmouth and those that arrive later in the autumn, having moulted elsewhere. In particular, we wish to discover the immediate past history of individuals that remain at Teesmouth (and more particularly of those that are confined to one or other side of the estuary) throughout the winter. We also wish to find out whether juveniles also show 'resident' and 'transient' behaviours. From previous years we have information on sightings of marked birds which will enable us to examine whether, in future, individuals follow the same behaviour patterns as they have done in the past, both in terms of dates of first and last appearance on the estuary, and in the regularity of their sightings during a winter. We also hope for a major shift in beach profile and invertebrate densities to examine the effects on the resident birds during the winter.

References

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## WINTER NUTRITIONAL CONDITION OF SANDERLING IN NORTH-EAST BRITAIN

by N.C.Davidson

Studies of the nutritional condition of shorebirds at Teesmouth and Lindisfarne, north-east England (Evans & Smith 1975, Davidson 1979, 1981) have concentrated on the patterns of fat and protein reserves in estuarine species, particularly Bar-tailed Godwit Limosa lapponica, Dunlin Calidris alpina, Knot Calidris canutus and Redshank Tringa totanus. Lipid indices (fat as a % of total body weight) reach peak levels in midwinter in both adults and juveniles of these species, whereas pectoral muscle indices (used as a measure of protein reserves) are constant throughout the winter in adults, except in Redshank (see Davidson 1981). The pectoral muscle indices of juveniles grow to reach adult levels by January and remain at this level for the rest of the winter. Both fat and protein reserves increase in spring (April/May) prior to northwards migration. Plovers (e.g. Grey Plover Pluvialis squatarola and Ringed Plover Charadrius hiaticula) carry larger fat and protein reserves than 'sandpipers' (Scolopacidae). These patterns of nutritional condition, and their causes, are discussed in more detail by Evans & Smith (1975), Davidson (1979, 1981, in prep.) and Dugan et al. (1981).

There is little available information, either from our studies in north-east England, or elsewhere, on the nutritional condition of shorebirds such as Sanderling Calidris alba and Turnstone Arenaria interpres that feed mainly on coastal sandy beaches outside estuaries. Small samples of Sanderlings from the beaches immediately to the north and south of the Tees estuary, collected mainly in 1977 and 1978, do however, permit some comparisons to be made with the nutritional condition of the estuarine species.

Figure 1 shows the lipid indices of Sanderling samples. As almost all are from late winter and spring (February - May) it is not possible to establish firmly the peak winter lipid levels. All recorded lipid indices of Sanderlings are, however, above the average lipid indices of Bar-tailed Godwit, and, in winter, above those of Dunlin. Winter lipid levels are probably similar to those of Grey Plovers, and peak winter lipid indices in Sanderlings are likely to average in excess of 20%. The rapid accumulation of fat in spring is shown clearly by the sample in late May. Lipid indices remain low in April, suggesting that the start of vernal fattening in Sanderlings occurs later than in Dunlins, which begin fat accumulation in March. This is consistent with a later departure on migration in Sanderlings.

In contrast to the lipid levels carried by Sanderling in winter being similar to plovers rather than the more closely related 'sandpipers', pectoral muscle size, as a proportion of a standard muscle volume (SMV) (see Evans & Smith 1975), in Sanderlings is similar to those of Dunlins and Bar-tailed Godwits (Figure 2). These are markedly lower than those of plovers, whose pectoral muscle indices are up to 0.35 SMV in winter (Davidson in prep.). The pectoral muscles (lean dry muscle weight) of Sanderlings comprise about 6% of the total lean weight, again similar to Dunlins and godwits, compared with 7-8% in plovers (Davidson in prep.).