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.

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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.).

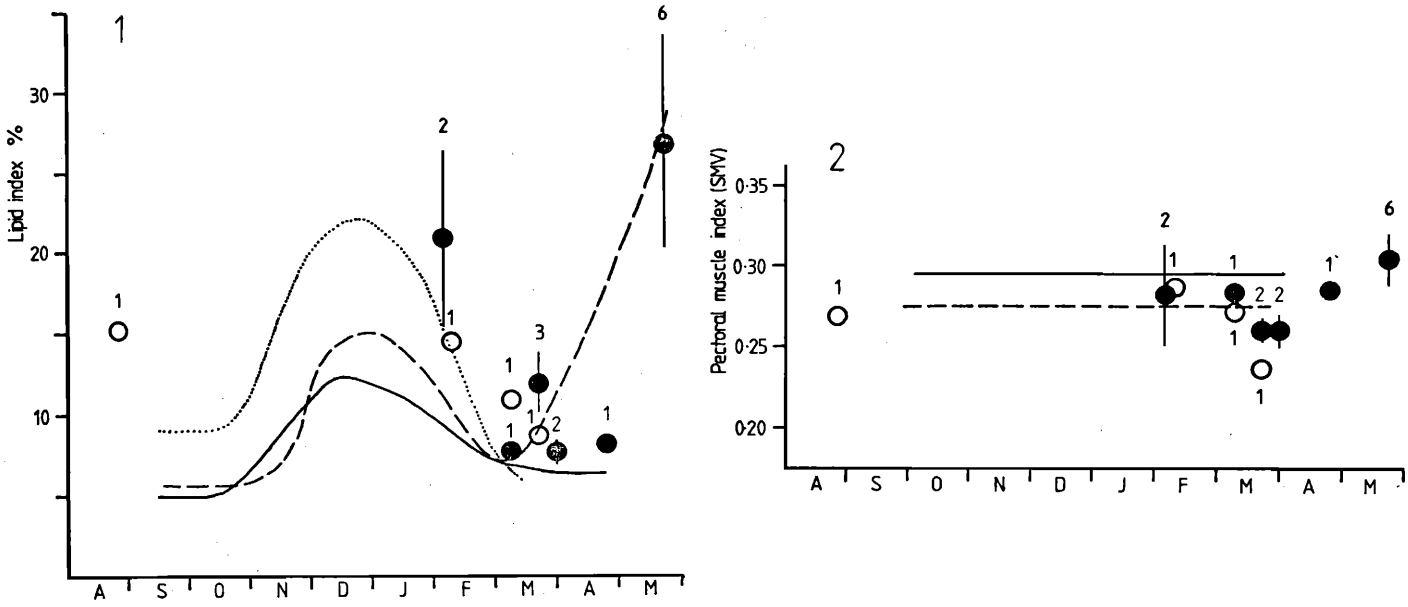

Figure 1. Lipid indices (fat as a % of total body weight) of adult (●) and juvenile (O) Sanderling at Teesmouth. Symbols are means, vertical bars are standard errors, and numbers give sample sizes. Lipid index patterns for other shorebirds in north-east England are shown for comparison and are: Bar-tailed Godwit (———) from Evans & Smith (1975), and Dunlin (- - -) and Grey Plover (.....) from Davidson (1981).

Figure 2. Pectoral muscle indices (lean dry pectoral muscle as a proportion of Standard Muscle Volume [SMV]) of Sanderling at Teesmouth. Legend as in Figure 1.

Winter lipid levels comparable to those of the visually feeding plovers may be partly because Sanderling frequently feed visually (Pienkowski 1980), although they do also feed by touch (e.g. Myers, Williams & Pitelka 1979). As with plovers, and some other estuarine shorebirds, gales may be the most important factor during winter in severely reducing prey intake and so causing the use of lipid reserves in Sanderling (Davidson 1981). However, the way in which gales affect Sanderling is rather different from the main effect of buffeting preventing visual feeding by plovers (Dugan et al. 1981). Gales, and the associated scouring by increased wave action on the sandy beaches where Sanderling feed cause major, but often localised, reductions in available prey (Myers, Connors & Pitelka 1979, Evans 1981). Numbers of Sanderling at Teesmouth fluctuate irregularly (Davidson 1980) and birds are known to move to other beaches at least 10km. away (Evans 1981). Abrupt changes in foraging behaviour, and switches of foraging location after storms also occur in California (Myers, Connors & Pitelka 1979, Myers & McCaffery 1980). Large lipid reserves are probably needed by Sanderling as an insurance against these sudden, irregular, reductions in available food, and to enable them to move to other feeding areas. Additionally, during periods of gales and low temperatures when the energetic requirements for thermoregulation are high, it may be more difficult for Sanderling feeding on open sandy beaches to move to more sheltered feeding areas, as has been recorded in estuarine species (Davidson 1981). This could also be a contributory factor inducing the storage of large lipid reserves. The similar size of the pectoral muscles in Sanderling and other 'sandpipers' suggests that Sanderling encounter conditions when feeding is impossible no more frequently than do such estuarine species as Dunlin.

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