THE EFFECTS OF SEVERE WEATHER IN JANUARY AND FEBRUARY 1985 ON WADERS IN BRITAIN

by N.C. Davidson and N.A. Clark

WSG Project on the effects of severe weather on waders: fifth progress report.

INTRODUCTION

The winter of 1984/85 was the most severe in Britain and western continental Europe since 1981/82. There were two periods of severe weather. The first began on 2 January 1985 and lasted for 22 days. In Britain it was especially severe in south-east England. Heavy snowfall and prolonged freezing conditions were accompanied by generally light winds. Prolonged freezing conditions extended as far south as the Mediterranean coast of France, and in the Camargue thousands of Flamingoes *Phoenicopterus ruber*, herons and egrets died. The severity of the conditions in Britain resulted in the Secretary of State for the Environment introducing Statutory Wildfowling Bans in England and Wales on 16 January and in Scotland on 18 January. These wildfowling bans lasted until 29 January in England and Wales, and 30 January in Scotland. Restrictions on wildfowling were also made in most continental European countries. After nearly 2 weeks of milder weather, a second severe spell began on 9 February 1985 and lasted until 20 February. In Britain, this second spell again was most severe in East Anglia and south-east England. It differed from the severe weather in January in having several days of severe easterly winds associated with low temperatures and heavy snowfalls.

1984/85 was the first severe winter since the start of the WSG Project on the Effects of Severe Weather on Waders. The information collected by participants in the project, both during the 1984/85 winter and the previous milder winters, has proved extremely valuable in assessing the impact of severe weather on wader populations, and we thank all these participants for their efforts in often unpleasant conditions. We have used the information collected during the project as the basis of reports to the Nature Conservancy Council and the Working Group on the Implementation of Wildfowling Bans in Severe Weather, detailing the impact of the severe weather on waders.

This report summarises information on the impact of the two periods of severe weather, in January and February 1985, on coastal waders (Charadrii) in Britain. The WSG project has been run since winter 1982/83 and aims to collect comparative information on the impact of severe weather on waders, from examination of mortality patterns and sub-lethal effects during both mild and severe winters. Data is collected largely by the counting and collection of tideline corpses and the catching of the waders. The project aims to achieve representative sample coverage of coasts throughout Britain (and also Europe), rather than attempting complete coastal coverage. Full details of the objects of the project, and the methods of data collection, are described in Davidson and Clark (1982).

4 aspects of the impact of the severe weather in early 1985 on waders are covered in this report:

1. the seasonal pattern of mortality;
2. the geographical distribution of mortality;
3. the body condition (fat and protein reserves) of corpses; and
4. sub-lethal effects.

The analysis covers waders that extensively use coastal habitats during severe weather, and so includes Golden Plover *Pluvialis apricaria* and Lapwings *Vanellus vanellus*, but excludes essentially inland waders such as Snipe *Gallinago gallinago* and Woodcock *Scolopax rusticola*.

Finally we give details of changes in the running of the project for winter 1985/86.

SEASONAL MORTALITY PATTERNS

During mild winters, mortality of waders in Britain occurs chiefly between December and March, with peak mortality in February (Figure 1). Mortality in 1984/85 reached a peak also in February (Figure 1), but the pattern differed

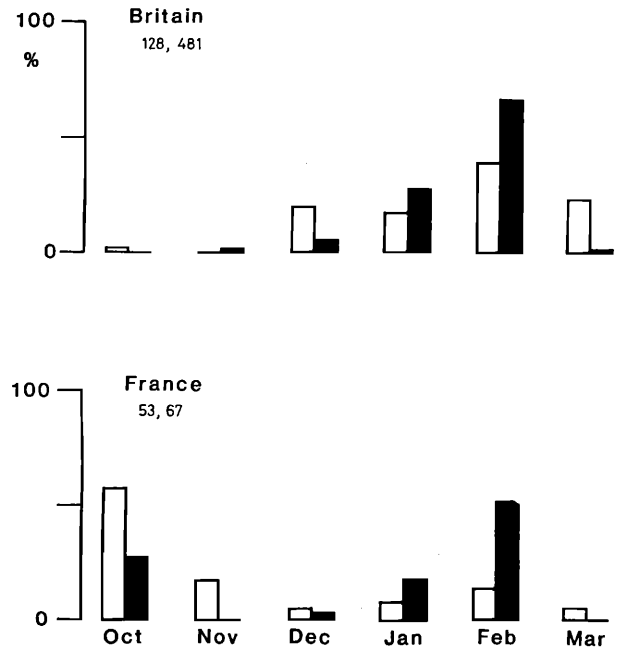

Figure 1. Seasonal occurrence of tideline corpses (all waders) in 1983/84 (open boxes) and 1984/85 (solid boxes) in Britain and northern France. Numbers give sample sizes for 1983/84 and 1984/85.

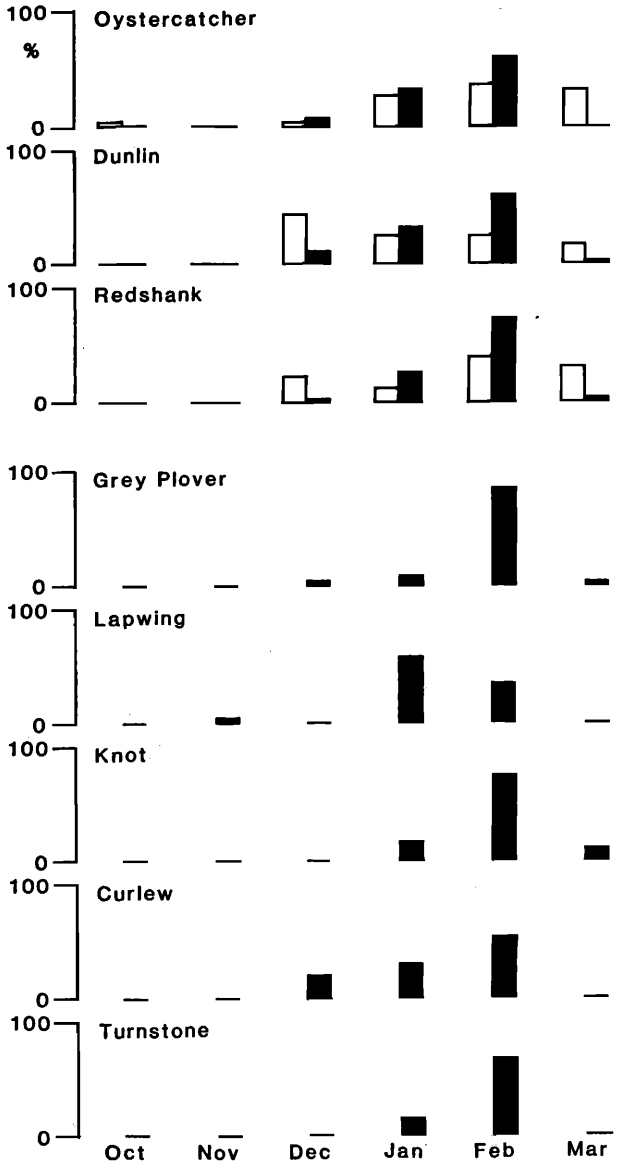

Figure 2. Seasonal occurrence of tideline corpses of 8 species of waders in 1983/84 (open boxes) and 1984/85 (solid boxes). Only species for which the sample for each year was >10 are included.

significantly from the previous winter (X^2 = 128.61 P<0.001): in 1984/85 a much higher proportion of mortality occurred during January and February (94.2% of mortality in 1984/85 compared to 57.0% in 1983/84). There was a similar, significantly different (X^2 = 25.99 P<0.001), mortality pattern in northern France. In that area there was also high mortality in early winter from wildfowling. During mild winters, this mortality was higher than that in midwinter. In 1984/85 this pattern was reversed (Figure 1).

The seasonal mortality pattern for single species in Britain (Figure 2) followed the overall pattern shown in Figure 1. In the 3 species (Oystercatcher *Haematopus ostralegus*, Dunlin *Calidris alpina* and Redshank *Tringa totanus*) for which there were sufficient samples for between-year comparisons the mortality pattern differed significantly between 1983/84 and 1984/85 (each X^2, P<0.001). In these 3 species, and in 4 others (Grey Plover *Pluvialis squatarola*, Knot *Calidris canutus*, Curlew *Numenius arquata* and Turnstone *Arenaria interpres*) peak mortality occurred in February 1985. In all these 7 species, the February 1985 mortality was more than 50% of mortality in the 1984/85 winter. In contrast, most mortality (58%) of Lapwings occurred in January.

As in many previous periods of severe weather (e.g. Dobinson & Richards 1964, Davidson & Evans 1982), and also during mild winters (Davidson & Clark 1984), more Redshanks than other species were found dead. In 1984/85, 49% of corpses found were Redshanks, 15% were Dunlins and 11% were Oystercatchers. Other species contributed less than 6% each to the total mortality.

GEOGRAPHICAL DISTRIBUTION OF MORTALITY

Figure 3 shows sites from which comparable data on the incidence of wader mortality were collected in 1983/84 and 1984/85. In January 1985, higher mortality than in the previous January was reported largely from the east and south-east coasts of England. However, some sites in western and northern Britain also had higher mortalities than in the previous year. Heavy mortality of waders also occurred in northern France, and in the Netherlands (E. Marteijn pers. comm.).

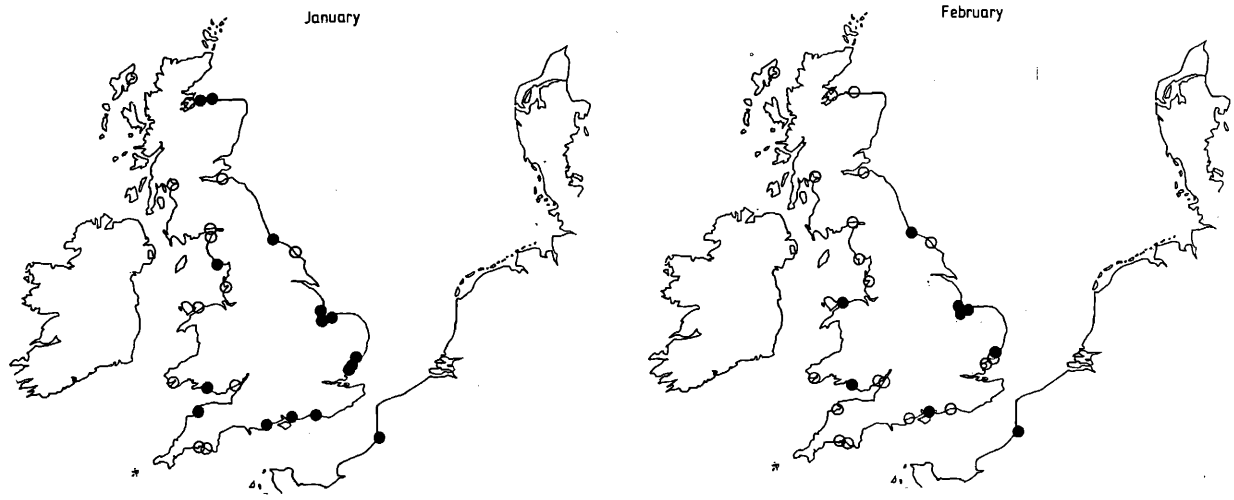

Figure 3. Geographical distribution of mortality of coastal waders in early 1985. Solid symbols show sites where higher mortality was reported for 1985 than the same month in 1984; open symbols show sites where no such increased mortality was reported.

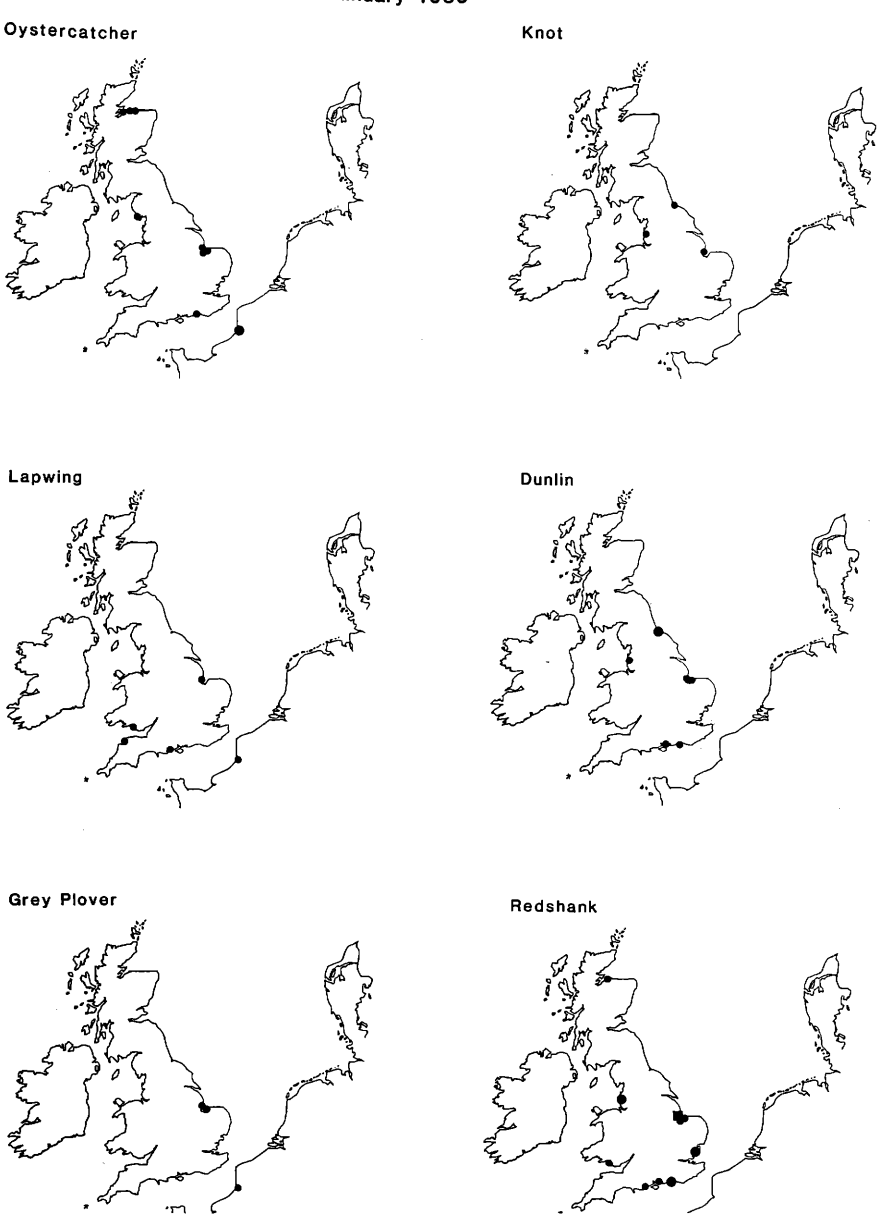

Figure 4. Distribution of mortality of 6 wader species in January 1985. Sites covered were as in Figure 3. Symbols show the number of corpses reported: • 1-5, ● 6-20, ■ >20.

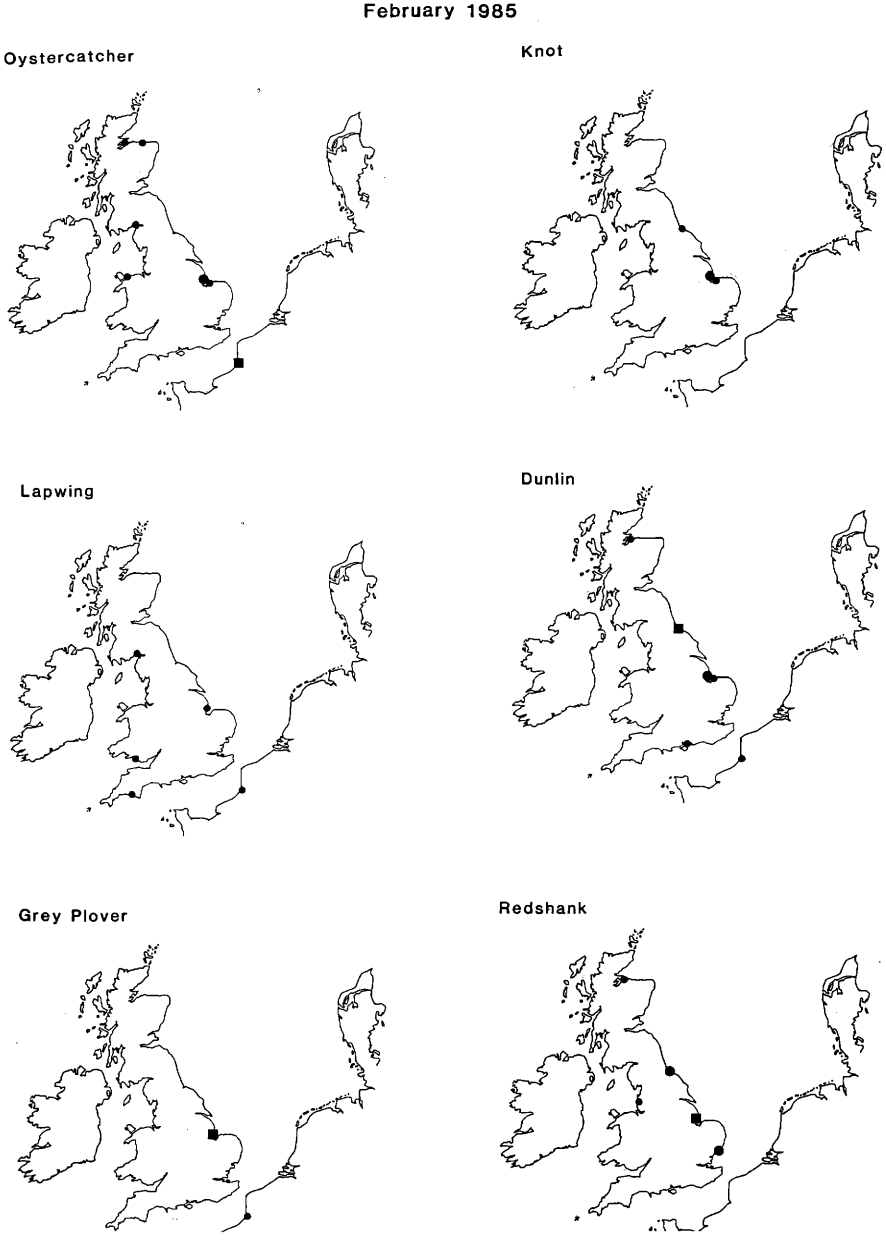

Figure 5. Distribution of mortality of 6 species of waders in February 1985. Legend as Figure 4.

The geographical extent of heavier mortality than during mild weather was even further restricted in February 1985, and centred on the east coast of Britain from Teesmouth to the Thames. Even within this area there was no appreciable increase in wader mortality at some sites. As in January, there was increased mortality at some southern and western sites, but no high mortality was reported from Scotland. The distribution of mortality reflected largely the regional occurrence of the most severe weather.

The distribution of mortality for most species (Figures 4 and 5) followed the overall pattern. Mortality of Oystercatchers and Redshanks was widespread in January 1985, but was more geographically restricted in most other species. Mortality of most species in February 1985 was largely restricted to eastern England. In contrast, mortality of Lapwings in both January and February occurred on both east and west coasts of Britain. Indeed, most reports of mortality in south-western Britain (Figure 3) refer to Lapwings. Mortality of Lapwings was also reported from the Portuguese coast (A. Teixera pers. comm.). Such mortality is consistent with the widely reported south-westerly movements of Lapwings in response to the onset of severe weather (e.g. Dobinson & Richards 1964).

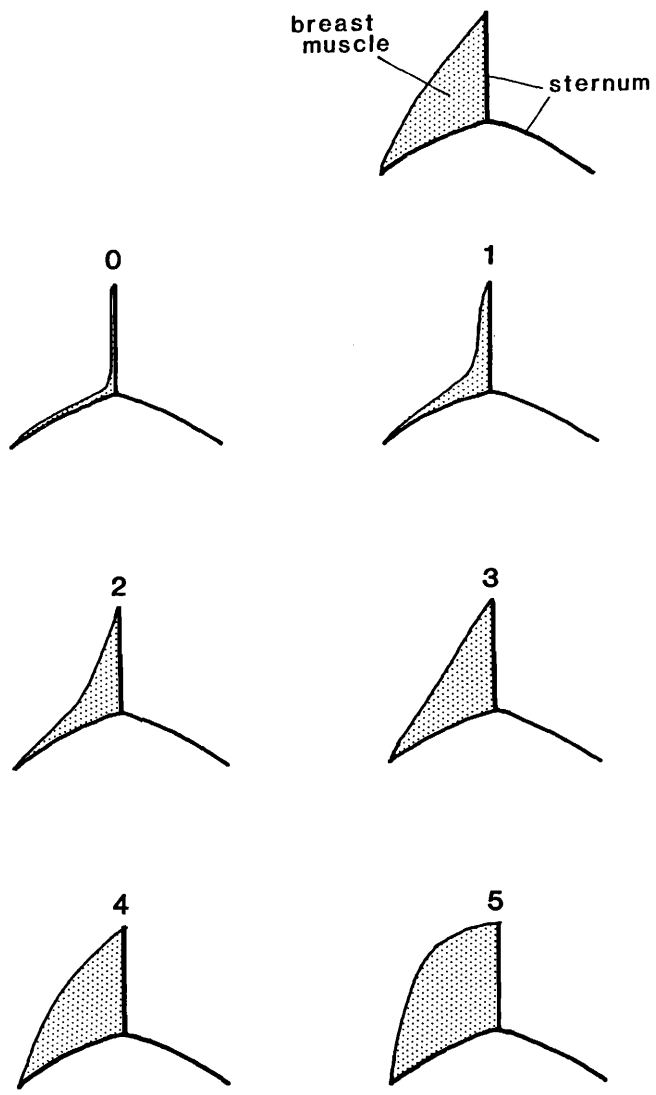

Figure 6. The Breast Muscle Index used to assess protein reserve condition in waders found dead during January and February 1985.

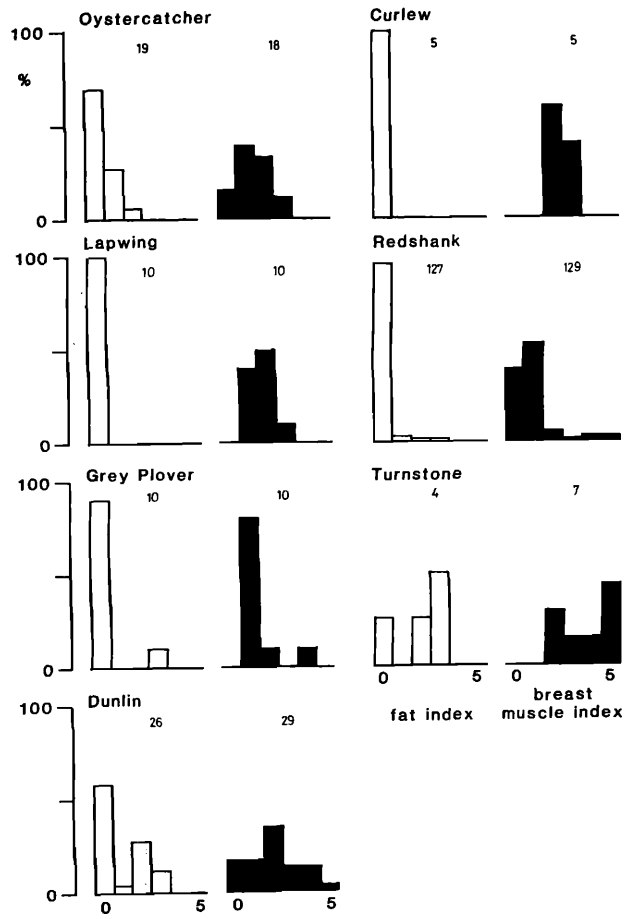

Figure 7. Fat indices (open boxes) and breast muscle indices (solid boxes) of waders found dead during January and February 1985. For description of the breast muscle index see text and Figure 6. Numbers give sample sizes.

BODY CONDITION OF WADERS FOUND DEAD IN JANUARY/FEBRUARY 1985.

230 waders found dead during January and February 1985 were in a sufficiently intact state for their body condition to be assessed. For most, fat reserves were estimated as a fat index ranging from 0 (no visible fat deposits) to 5 (extensive thick fat layer over clavicles, breast muscles and abdomen). Protein reserves were assessed as a breast muscle index from 0 (muscles extremely emaciated) to 5 (muscles very plump) (Figure 6). Breast muscle size is a good index of protein reserves in waders (see Piersma *et al.* 1984). In previous cold spells, waders died of starvation after they had exhausted their fat reserves (Davidson & Evans 1982). (The proximate cause of death is likely to be hypothermia due to an inability to metabolise protein fast enough to maintain body temperature.) Figure 7 shows that during January and February 1985, most waders likewise died of starvation after exhausting their fat reserves. However, in 2 species, Dunlin and Turnstone, only part of the sample had died with exhausted fat reserves, and 38% of Dunlins and 75% of Turnstones examined had substantial fat reserves at death.

Breast muscle size was more variable, and many waders died with breast muscles that must still have retained some protein reserve (Figure 7). This supports the view that exhaustion of protein reserves is seldom the direct cause of death of waders during severe weather: rather that breast muscle size at death depends largely on the time at which fat reserves become exhausted.

Results of laboratory analysis of the body condition of Dunlins that died in January and February 1985 are summarised in Figure 8. (For details of methods see Davidson & Evans (1982).) At Teesmouth, both the fat and protein reserves were significantly depleted in comparison to normal mild winter levels in both January and February 1985. The body condition of a sample from Langstone Harbour (Sussex) in January was also seriously depleted. Whilst birds died after using part of their internal reserves there were marked differences in the condition at death of Dunlins at Teesmouth in the 2 severe weather spells. Fat reserves (Student's $t = 3.49$ $P<0.02$) and pectoral muscle size (Student's $t = 4.05$ $P<0.01$) were significantly higher at death in January than February. Dunlins found dead in January carried substantial fat reserves, sufficient for survival for several days (cf. Davidson (1981)). In February, Dunlins died after exhausting their fat reserves (the residual 1-2% fat is structural rather than part of the labile reserve). Similarly, the breast muscles of Dunlins dying at Teesmouth in January were only partly depleted, whilst those in February were extremely emaciated. The average muscle size (0.106 SMI) of this latter group was very similar to the muscle sizes of Redshanks and Oystercatchers that were considered to have exhausted their protein reserves (Davidson & Evans 1982). The condition of Dunlins at Teesmouth in January (and the circumstances under which corpses were found) strongly suggests that these birds died from an inability to mobilise fat reserves fast enough to meet their energy requirements during severe weather, i.e. *before* rather than after exhaustion of their fat reserves.

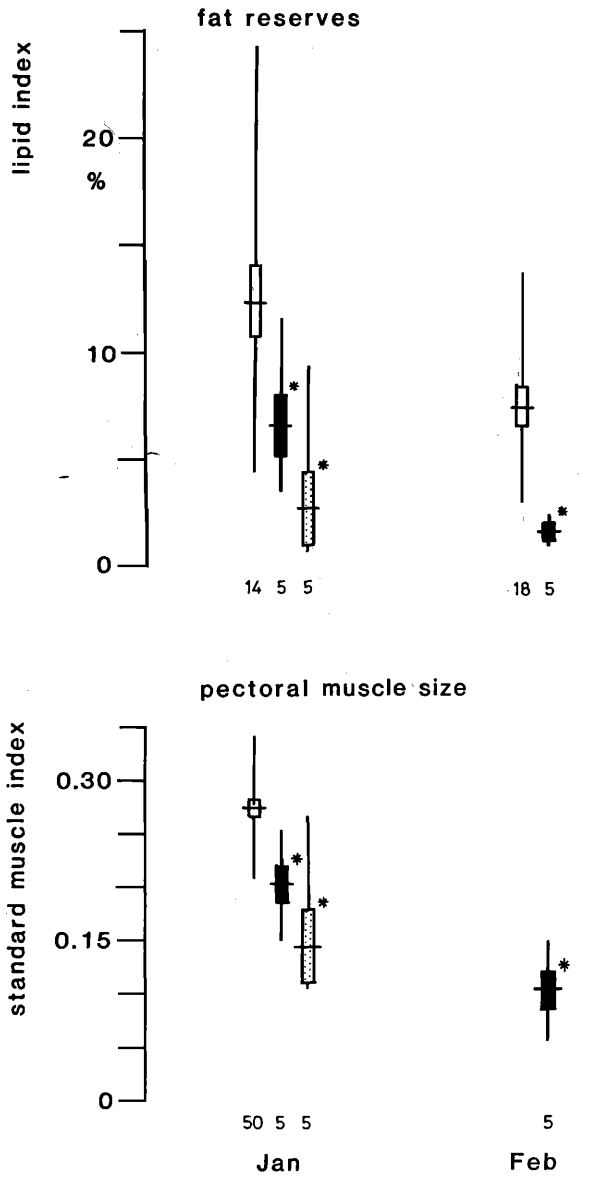

Figure 8. Body condition of Dunlins found dead during severe weather in January and February 1985, in comparison with the mild winter body condition at Teesmouth at the same times of year (data from Davidson 1981). Mean 1 standard error, and range are given. Numbers give sample sizes. Open boxes are Teesmouth mild winters (pectoral muscle size remains unchanged through January and February (Davidson 1981)); solid boxes are Teesmouth in severe weather 1985; and stippled boxes are Langstone Harbour, in January 1985. * indicates a significant difference (Student's t, $P<0.05$) from the relevant Teesmouth mild winter sample. Details of the Standard Muscle Index (SMI) of pectoral muscle size (used as an index of protein reserves) are given in Piersma *et al.* (1984). Lipid index is fat mass as a percentage of total mass.

SUB-LETHAL EFFECTS

Data on the masses of live waders during January and February 1985 from several parts of Britain showed that at most sites, most waders maintained normal levels of body condition, and that by the onset of severe weather in February, most waders had regained any condition lost during severe weather in January. At the onset of the February cold spell, Redshanks on the Wash had an average body mass 35g higher than normal, suggesting that these birds may have responded to deteriorating weather conditions by storing additional fat (cf. a similar response reported for Dunlins by Clark (1983)). Despite these high weights there was substantial mortality of Redshanks on the Wash during the February cold spell (Figure 5). Some Redshanks from North Wales were also close to starvation mass during the February cold spell. Some Dunlins on the Firth of Forth had lower than normal mass by the middle of the February cold spell, but no increased mortality of Dunlins was noted on the Firth of Forth. Also on the Firth of Forth, Golden Plovers had at least partly depleted fat reserves by mid-February, but were unaffected by the severe weather in January.

Most coastal waders are thought to remain on their wintering sites in Britain at the onset of severe weather. During January and February 1985 there was some evidence of at least local movements of Oystercatchers and Black-tailed Godwits *Limosa limosa* on the Suffolk/Essex coast. Birds from adjacent estuaries moved to feed on the Orwell estuary, especially during February, as mudflats froze on adjacent estuaries (Davidson & Evans 1985). Many waders,

especially Dunlins, were forced to leave continental European coasts (E. Marteijn pers. comm.). In January and February 1985 the very high populations of Dunlins and Grey Plovers on estuaries such as the Orwell may reflect movements from these continental coasts. Some Grey Plovers returned to Teesmouth during the severe weather, as during previous cold spells (Townshend 1982). These birds are believed to spend mild winters in the West German part of the Wadden Sea. All these instances are of movements into estuaries on which some of the most severe weather in Britain occurred during early 1985.

CONCLUSIONS

The information provided by the project has allowed one of the most detailed assessments of the impact of a period of severe weather on waders. It has been especially valuable in giving detailed information on the impact on the body condition of waders. The following conclusions can be drawn about the severe weather in early 1985.

1. The severe weather of January and February 1985 had an impact on waders in Britain. Mortality was substantially higher than in recent mild winters.
2. Mortality was higher in February than January. In February, normal regulated fat loads are smaller than in January, so that birds can survive for shorter periods when using those fat reserves (see e.g. Davidson 1981). In addition, weather conditions, especially windchills, were more severe in February than January, so reserves may have been depleted more rapidly.
3. Mortality occurred largely in the areas of most severe weather (eastern and southern England), but mortality occurred at some places also in western and northern Britain. As in previous cold spells, Redshanks, Oystercatchers and Dunlins died in largest numbers.
4. As in previous cold spells, most waders died when they had exhausted their fat reserves, but not necessarily their protein reserves.
5. In January, some Dunlins and Turnstones died before exhausting fat reserves. Thus these birds were at risk from the onset of the severe weather, rather than only after several days of severe weather as in the case of birds mobilising fat until the full depletion of their reserves.
6. The condition of live waders at many sites was largely unaffected by the severe weather, but some Dunlins and Golden Plovers had low mass on the Firth of Forth in February, although no substantial mortality of these species occurred.
7. There were some movements of waders into east coast estuaries during the severe weather. Some were local movements; others probably involved several species moving from more severely affected parts of continental Europe. Lapwings moved south and west to milder areas.

THE PROJECT IN 1985/86

The project will continue to run during the winter of 1985/86. As in previous years data collection should start on 1 October 1985 and continue until 31 March 1986. There will however be some changes in the administration and data collection procedures. We have now examined in some detail the identity and condition of the very extensive collection of wader corpses sent to us during the last 3 years of the project. However changing circumstances and pressures on freezer storage space mean that we will be unable to accept routinely-collected corpses as we have in previous years. The main change in data collection procedures for 1985/86 is that we are now asking participants to leave wader corpses that they find during mild weather. Corpses should however be moved to above the high tide mark so that they are not counted during subsequent searches. The number and condition of corpses found during tideline searches should be recorded on the report forms as in previous years. We do ask, however, that anyone finding unusually large numbers of wader corpses, especially during severe weather, should contact us immediately: it may be possible to make special arrangements for the collection of corpses under these circumstances, since these offer a particularly valuable resource for impact assessment.

The second change in the project is that pressure of other commitments mean that Nick Davidson will have to take a lesser role in the running of the project than in past years. The administration of the project during 1985/86 will be dealt with largely by Nigel Clark, and all enquiries should be addressed to him at *Department of Zoology, University of Edinburgh, West Mains Road, Edinburgh EH9 3JT, U.K.* Recording forms and details of the project during 1985/86 will be sent to all participants shortly.

As in past years, WSG will be negotiating, with the Nature Conservancy Council, for exemptions for winter 1985/86 from any cannon-netting ban during the period of imposition of a statutory wildfowling ban in Britain. As in the past, such exemptions are permitted by the NCC only for specified groups who have agreed to participate in the WSG project on the effects of severe weather, so that the impact of severe weather on live waders can be assessed. The groups concerned will be contacted directly once exemptions have been finalised.

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THE WINTER SHOREBIRD COUNT: A PROGRESS REPORT

by Ron Summers and Mike Moser

During the winter of 1984-85 the British Trust for Ornithology (BTO) in conjunction with the Wader Study Group organised a survey of the numbers and distribution of waders on the non-estuarine coasts of Britain. This aimed to provide first estimates of the importance of these habitats for wintering waders in comparison to estuaries. In addition to the bird count data, habitat information was also collected to examine the habitat preferences of waders. A more detailed description of the aims and methods of the project was given in *BTO News* 134 (September 1984).

Fieldwork took place between 15 December 1984 and 31 January 1985 and involved *c.* 2000 participants from the BTO and WSG. In remote areas such as north-west Scotland, the survey was carried out by visiting expeditions, while most other areas were covered by local ornithologists. The success of the survey can be gauged partly from the levels of coverage shown in Figure 1. A very high proportion of the non-estuarine coasts of the British Isles was surveyed.

The survey took place during a winter in which very severe weather occurred in southern Britain during mid-January. Thus, while counters in Shetland basked in the cool winter sun, those further south had to struggle through snow and ice to reach the shore. Fortunately, a large number of repeat counts were collected during the survey and we are currently processing these to assess whether large shifts in distribution occurred as a result of the severe weather.

The survey confirmed that many areas of open coasts hold rather few waders. This was generally true for the whole of the mainland west coast of Britain. In contrast, eastern Britain supported higher numbers, with the exception of Norfolk and Suffolk where the predominantly shingle beaches were almost barren. Many typically estuarine species such as Dunlin *Calidris alpina*, Knot *Calidris canutus* and Bar-tailed Godwit *Limosa lapponica* were rare on the open coasts, while others such as Ringed Plover *Charadrius hiaticula* and Turnstone *Arenaria interpres* were found in relatively large numbers.

Analyses of the results are currently in progress and a full report of the survey will be given at the WSG meeting in October 1985.

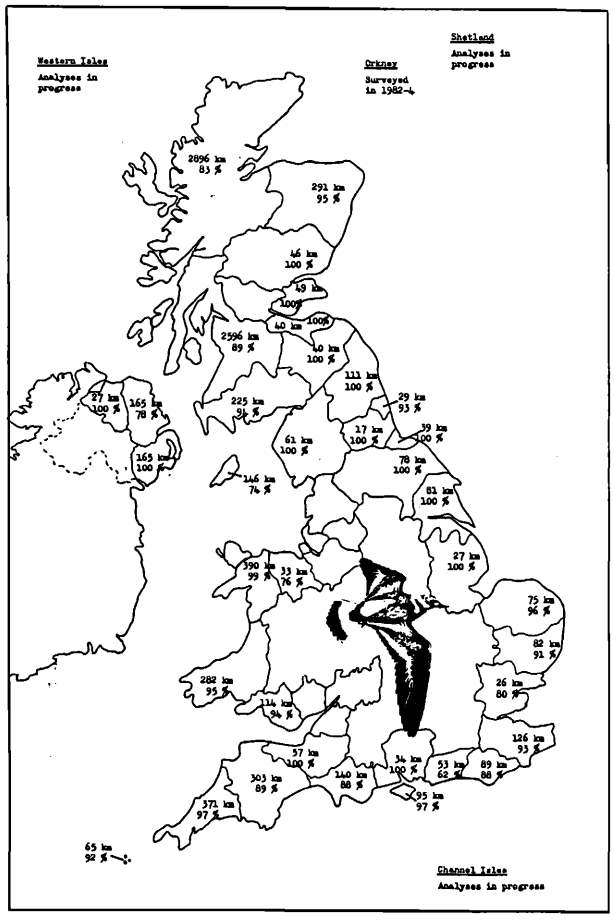

Figure 1. Map of Great Britain and Northern Ireland, showing county coverage achieved for the 1984-85 Winter Shorebird Count. The numbers for each county show the total length of non-estuarine shore (km) and the percentage of this (excluding cliffs) which was surveyed.

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