relative to the intensive study, but the discrepancy was never greater than 18% for any species.

In 1985 the surveys were carried out by Dave Chandler, Rob Fuller, Steve Percival, Mike Pienkowski and Andy Walker. Digger Jackson made the validation tests of the method possible by finding the nests. The Wader Study Group is grateful to the Nature Conservancy Council for funding the wader surveys in 1985.

REFERENCES

Fuller,R.J., Green,G.H. & Pienkowski,M.W. 1985. Surveys of breeding waders in the Southern Isles of the Outer Hebrides - a progress report. *Wader Study Group Bulletin* 43: 14-15.

Jackson,D.B. & Percival,S.M. 1983. The breeding waders of the Hebridean machair: a validation check of the census method. *Wader Study Group Bulletin* 39: 20-24.

Reed,T.M. & Fuller,R.J. 1983. Methods used to assess populations of breeding waders on machair in the Outer Hebrides. *Wader Study Group Bulletin* 39: 14-16.

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WSG PROJECT ON THE EFFECTS OF SEVERE WEATHER ON WADERS: SIXTH PROGRESS REPORT

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

The 1985/86 winter was the second severe winter in succession in Britain. At the time of writing we have not yet received all the information from observers, so this report can only be a preliminary view. Could all observers with outstanding record forms please return them to us as soon as possible, so that we can can complete a full assessment of the effects of last winter's weather on waders.

The 1985/86 winter was similar to the 1984/85 winter, in that it was much more severe in the south of Britain than in the north. A prolonged period of severe weather lasted from mid-January until the beginning of March, during which time the ground remained continuously frozen although temperatures seldom dropped much below 0 °C. Most winds were easterly although light, but at the end of February there were several days of both sub-zero temperatures and strong winds. In Scotland, although there was a long period of snow cover inland, coastal areas were snow-covered only for short periods, with very few days when intertidal areas froze. Although the weather was severe, no statutory wildfowling ban was introduced in Britain, since the severe weather began too late in the winter: there was thus insufficient time for the ban to come into effect before the end of the coastal wildfowling season in late February.

So far we know of 2 estuaries where large scale mortality occurred: on the Wash and the Stour in eastern England. On these 2 sites at least 558 waders were found dead. These comprised 55% Redshanks *Tringa totanus*, 36% Grey Plovers *Pluvialis squatarola* and 3% each of Knots *Calidris canutus*, Dunlins *C. alpina* and Curlews *Numenius arquata*. The high proportion of Grey Plovers amongst the waders found dead is in marked contrast to other recent severe winters in Britain (Davidson and Clark 1985). Only one Oystercatcher *Haematopus ostralegus* was found at these sites. This too contrasts with previous severe winters, when the Oystercatcher was amongst the species found dead most frequently during severe weather in eastern England (Davidson and Clark 1985).

Few waders were found dead during the first part of the severe weather, and it was not until late February, when it became windy as well as cold that most birds died. Examination of the body condition of waders that died in early 1986 (for methods see Davidson and Clark 1985) found that, as in previous severe winters, most birds died after extensively depleting their fat and protein reserves. Their breast muscles, which form a substantial part of the protein store, were very emaciated at death. There were no significant differences between the breast muscle indices of juveniles and adults of the same species, or between different species (X^2, $P<0.05$). Although there was no reported evidence of increased mortality through starvation in Scotland, there was an increase in the mortality of waders attributable to predation by raptors during the periods of snow cover at Schoughall, in south-east Scotland (N. P. Ashmole pers. comm.).

Almost half of the Grey Plovers found dead on the Wash were juveniles, although cannon-net catches of Grey Plovers there usually contain very few juveniles (P.L. Ireland, pers. comm.). This suggests that mortality was especially severe amongst juveniles. Table 1 shows that

Table 1. Sex-ratios (number of males to each female) in samples of Grey Plover found dead during severe weather in the winters of 1984/85 and 1985/86. Sample sizes are given in brackets.

Origin	Juveniles	Adults
N. shore of the Wash 1984/85	(1)	* (6)
N. shore of the Wash 1985/86	2.93 (55)	1.81 (59)
S.shore of the Wash 1985/86	12.00 (13)	- (3)
Stour 1985/86	2.00 (6)	4.00 (5)

* all were males
\- could not be sexed

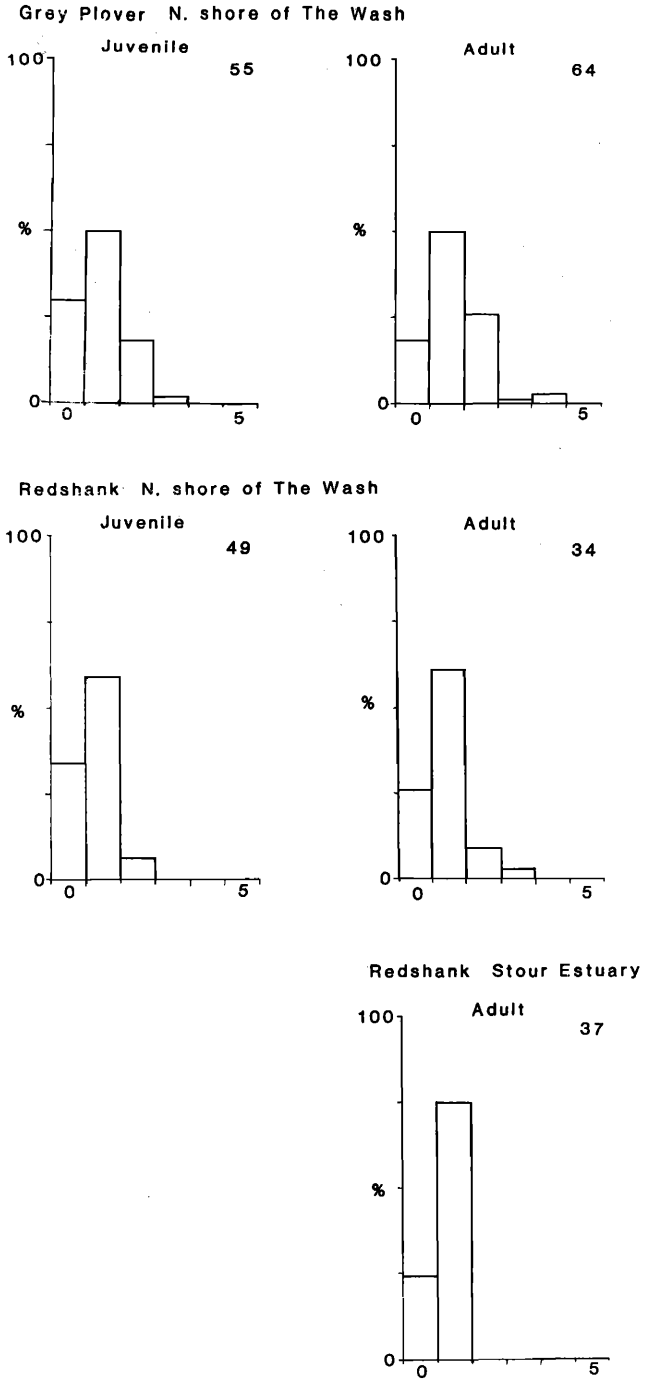

Figure 1. Breast muscle indices (see Davidson and Clark 1985) of samples of waders found dead in February and March 1986. Numbers indicate sample sizes.

for both juveniles and adults the sex-ratio was skewed strongly towards males. This could arise because more males than females overwinter on the Wash, or because males are more susceptible to the effects of severe weather than females. Since there is little size difference between the sexes of Grey Plovers (Prater *et al.* 1977), the overall sex-ratio of the wintering population cannot be readily determined from measurements of live birds.

The sex-ratios in the samples of Redshanks show a rather different pattern (Table 2). The samples of juveniles from the north shore of the Wash have a sex-ratio of near unity, but there were more males amongst the adults collected at the same time. This sex-ratio differed significantly from unity for 1985/86 (X^2=4.51 $p<0.05$). Some juvenile Redshanks wintering on the east coast are known to move to the west coast of Britain in subsequent winters (Furness and Baillie 1981): our data imply that it could be mainly females which change their wintering sites in this way.

Table 2. Sex-ratios (number of males per female) in samples of Redshanks found dead during severe weather severe winter weather in 1984/85 and 1985/86. Sample sizes are given in brackets.

Origin	Juveniles	Adults
N. shore of the Wash 1984/85	1.06 (64)	2.42 (41)
N. shore of the Wash 1985/86	0.76 (60)	1.86 (40)
S.shore of the Wash 1985/86	2.20 (53)	- (3)
Stour 1985/86	- (3)	3.37 (35)

- could not be sexed

A more detailed report on the impact of the 1985/86 severe weather will be published later, once all the information has been analysed. Nevertheless, it is clear from even this preliminary analysis that the patterns of mortality in 1985/86 were markedly different from those of other recent severe winters in Britain, particularly in the large numbers of Grey Plovers that died after exhausting their fat reserves. Such differences emphasise the need for continued assessment of the impact of each period of severe weather, so that we can understand more fully the circumstances under which winter mortality of waders occurs.

Our thanks go to all the field participants, in particular to Rob Watson and his colleagues for collecting very large numbers of corpses, and to Philip Ashmole, Andy Evans, Roger McMichael and Philip and Pat Whitfield who helped process large numbers of rotting birds.

REFERENCES

Davidson,N.C. & Clark,N.A. 1985. The effects of severe weather in January and February 1985 on waders in Britain. *Wader Study Group Bull.* 44: 7-9.

Furness,R.W. & Baillie,S.R.1981. Age ratios, wing length and moult as indicators of the population structure of Redshank wintering on British estuaries. *Ring. & Migr.* 3: 123-131.

Prater,A.J., Marchant,J.H. & Vuorinen,J. 1977. Guide to the identification and ageing of Holarctic Waders. *British Trust For Ornithology, Tring.*

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