them is somewhat puzzling. Again our observations are not yet sufficiently extensive to address these questions.

At both Curlew Lake and at the headwaters of the Pikmiktalik River, Bristle-thighed Curlew densities were approximately 1 per km². These are rough breeding density estimates since at both sites we encountered (and counted) curlews which were apparently not breeding.

Our studies of the Bristle-thighed Curlew in the southern Nulato Hills will continue in 1986. We have 3 primary objectives for the second field season: 1) to describe more fully the distribution of the Bristle-thighed Curlew and the Whimbrel on a regional basis in terms of geographic range and habitat use, 2) to develop a sampling protocol which will allow us to quantify behavioural interactions between the two species, and 3) to refine our censusing techniques so as to produce an accurate breeding density estimate for *Numenius* curlews on the YDNWR.

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A COMPARISON BETWEEN COUNTS AT ROOST SITES AND ON FEEDING GROUNDS OF OYSTERCATCHERS AND CURLEWS IN SPAIN

by J. Dominguez

INTRODUCTION

The possibility that there are differences at study sites between the numbers of waders counted at roosts and on their feeding grounds, and its implications, has received rather little attention. Goss-Custard (1981) compared the 2 counting methods for Oystercatchers *Haematopus ostralegus* at 2 estuaries in Britain, and Barrett and Barrett (1984) made a similar comparison between roosting and feeding ground counts of several species at one part of the Firth of Forth estuarine complex in Scotland. This note documents roosting and feeding site counts at an estuary in north-west Spain.

METHODS

During the 12 months from September 1984 to September 1985, I made monthly counts of Oystercatchers and Curlews *Numenius arquata* on the Ortigueira estuary in Galicia, north-west Spain. During low water both species fed on wide sand and mudflats, some covered with eel-grass *Zostera*, the largest being 920 ha. Feeding birds were usually scattered over the tidal flats, rather than in tight flocks. At high tide Oystercatchers roosted on a small bare sandy island. Curlews sometimes roosted on this island, and sometimes on others covered with low vegetation.

Both high water and low water counts were made on the same days. Counts of birds on the feeding grounds were made within 3 h of low water, from a car at various vantage points around the estuary. All intertidal areas were counted, but this sometimes took up to 3 days of low tides to achieve (see also Figure 1). Roost counts were made within 1 h of high water, and on a day when low water counts were made.

RESULTS AND DISCUSSION

Eleven pairs of counts for Oystercatchers and 7 pairs for Curlews are shown in Figure 1. Some

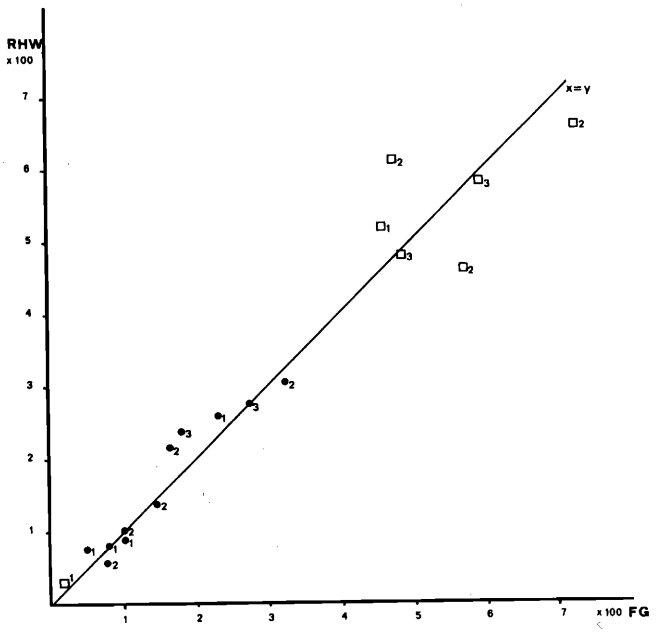

Figure 1. Counts of Oystercatchers (●) and Curlews (□) at feeding grounds (FG) and at roosts (RHW) in the Ortigueira estuary. The number next to each symbol gives the number of low water periods needed to achieve a complete count.

counts had to be excluded from the analysis because of inaccurate roost counts: roosts were sometimes disturbed by people. Curlews were imposssible to count accurately when they roosted amongst vegetation.

Analysis of variance for each species showed that there were no significant differences between counts of roosting and feeding birds on the same days for either Curlews ($F_{1,6}$ = 2.9x10^{-3} P>0.05) or Oystercatchers ($F_{1,10}$ = 0.95 P>0.05). Goss-Custard's (1981) results for Oystercatchers were similar, but Barrett and Barrett (1984) found only poor agreement between roosting and feeding counts of Oystercatchers, largely because of the immigration of roosting birds from feeding grounds outside their study area. However Barrett and Barrett's counts of feeding and roosting Curlews were similar.

Counting on more than one low tide period to achieve full coverage of feeding grounds did not seem to affect the accuracy of the estimate, since there remained no significant difference between numbers feeding and roosting when only there days were considered ($F_{1,11}$ = 1.3x10^{-3} P>0.05). However some individual counts did differ considerably between low water and high water. Difference of between -19.3% and +61.0% (mean +19.2%) were found for Curlews, and between -25.7% and +47.0% (mean +14.0%) for Oystercatchers. Such variation is greater than that found for Oystercatchers on the Exe estuary (+1.0 to +12.0%, mean 6.0%) but similar to that on the Wash (-25.0 to +24.0%, mean 15.0%) (Goss-Custard 1981). Goss-Custard suggested that the variation he found on the Wash was a consequence of its large intertidal area, that it was counted by several different observers, and that feeding and roosting counts were made up to 11 days apart. However none of these factors can be used to explain the difference between my counts, since the Ortigueira is a discrete estuary, counted on the same days by one observer.

Rappoldt *et al.* (1985) found that counts of scarce species (less than 100 birds at a site) are subject to a large systematic error (the area error) caused by an observer overlooking individual birds isolated from the main flocks. This leads to a consistent underestimate of numbers. This area error may be the explanation of differences between my roosting and feeding counts, since the largest errors for each species (+47.0% for Oystercatcher, +61.1% for Curlew) were for populations of <100 birds (most of the other counts were of larger populations). Counts of these larger flocks were less variable between roosting and feeding numbers. The higher average roost counts than feeding counts for each species also suggests that some feeding individuals were being overlooked.

Although counting conditions on the Exe estuary were similar to those on the Ortigueira, low water and high water counts on the Exe showed closer agreement. This is probably because the low water feeding grounds of Oystercatchers there were restricted and easy to count, and because populations were larger (>1000 birds in all but one case). Since Rappoldt *et al.* (1985) found that the area error was small for such populations, the poorer agreement at the Ortigueira between roosting and feeding counts may stem largely from a greater area error as a consequence of the small population sizes.

My results indicate that counting on either roost sites or feeding grounds can give equally satisfactory estimates of population size on discrete estuaries such as the Ortigueira. However, as Goss-Custard (1981) points out, considerable caution should be excercised before applying such results more widely to other species or estuaries, without additional checks on counting accuracy.

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