PATTERNS OF POPULATION TURNOVER IN RINGED PLOVERS AND TURNSTONES DURING THEIR SPRING PASSAGE THROUGH THE SOLWAY FIRTH IN 1983

by Mike Moser and Mike Carrier

INTRODUCTION

The monthly counts of the Birds of Estuaries Enquiry have provided invaluable information for the assessment of the relative conservation importance of different estuaries for shorebirds (Prater 1981). Such counts give a true measure of the usage of an estuary by waders only if population turnover between counts is slight. This may be the case for most waders in winter, but during passage periods population turnover may be rapid. During these periods, therefore, the numbers of waders present on an estuary on a given day will be far lower than the number of individuals which actually visit the estuary between two counts on different days. It is on this latter measure that the relative importance of each estuary must be assessed.

This paper presents the preliminary results of a study of the passage of Ringed Plovers Charadrius hiaticula and Turnstones Arenaria interpres through the Solway Firth in the spring of 1983. The patterns of turnover of the two species highlight some of the problems of monitoring wader populations during such periods. More detailed analyses of turnover rates will be presented elsewhere, both for these species, and for Dunlin Calidris alpina and Sanderling Calidris alba, following a second season of data collection. Spring passage studies of these species were the subject of a WSG project in 1979 (Ferns 1980a, 1980b, 1981a, 1981b, 1981c). This project was very successful in identifying the timing of spring passage through Britain, and the origins of the birds involved. From the results in 1979 it was impossible to examine the nature of the passage of individual birds through the British estuaries. This paper presents the patterns of turnover within a single estuary (the Solway Firth), while the patterns of turnover and movements between estuaries will be the subject of a joint BTO/WSG project in 1984 (see elsewhere in this Bulletin for details).

METHODS

Catching and Marking

Waders were caught with cannon-nets on a high tide roost at Annan Waterfoot (Figure 1). Each captured individual of the study species was ringed, fully processed and marked on the undertail coverts and rump with a red plumage dye. This enabled these birds to be identified when scanning flocks for marked and unmarked individuals in the field. In addition to the dye, each bird was given a coloured leg flag (see Goodyer et al. 1979). Flags of different colours were used for each catch, so that a bird seen in the field could immediately be assigned to a particular catch.

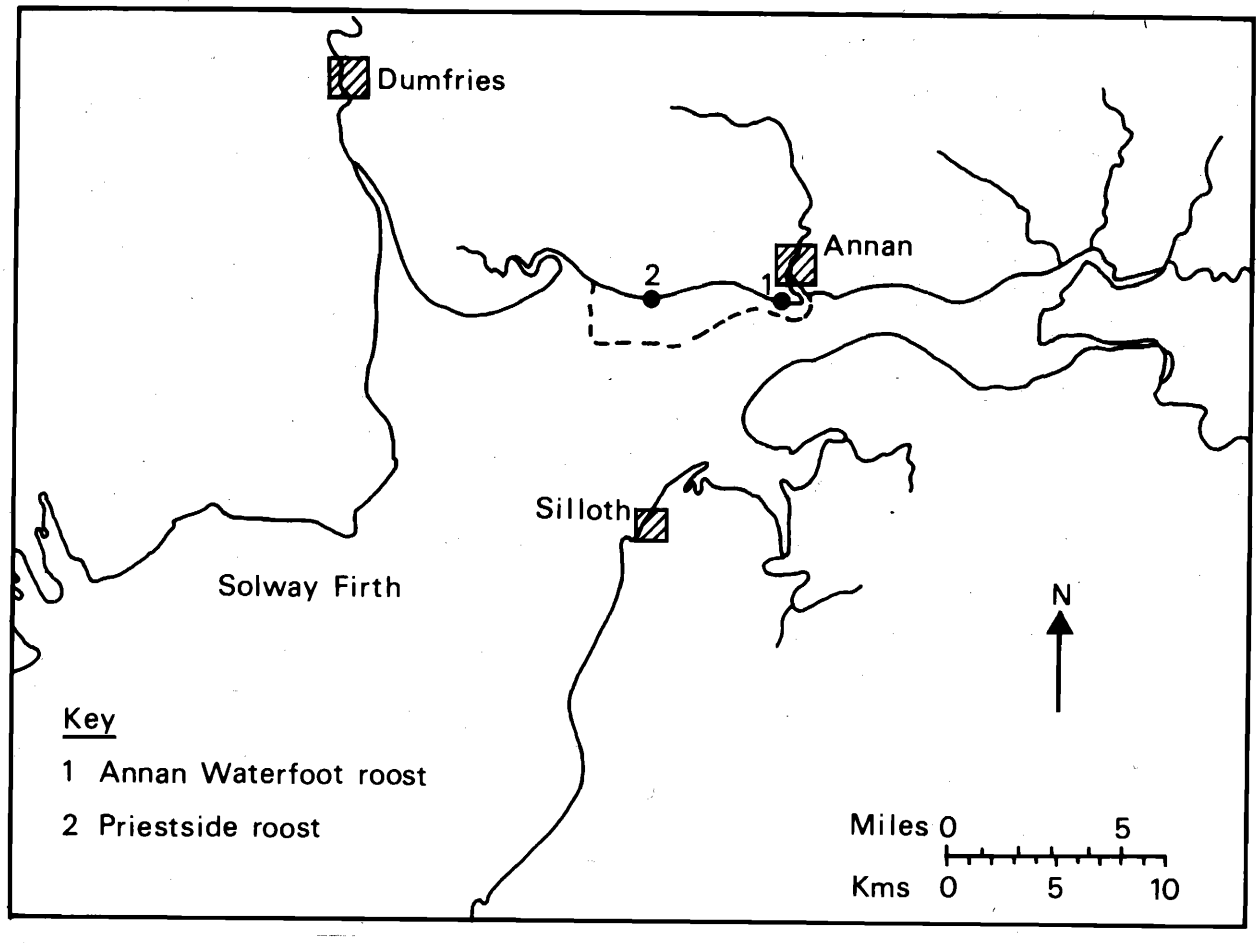

Figure 1. The Study Area, showing the location of the two study roosts. The area within the dotted line was exhaustively searched for marked birds at frequent intervals.

Counts and Field Observations

High water roost counts were made at regular intervals from 31 March 1983 to 3 June 1983, to determine the number of individuals of each species present in the study area. The two major roosts (Annan Waterfoot and Priestside) were, whenever possible, counted on the same tide to avoid duplicating counts of individuals which might have moved between the roosts. Counts were made at Priestside during the second half of the study only. Turnstone and Sanderling did not use this roost, and the numbers present at Annan Waterfoot therefore reflect accurately the number present.

The proportion of dye-marked birds in the study area was measured on the feeding grounds only, because dye-marked individuals were often hidden in the tightly-packed roosting flocks. The entire study area was covered at regular intervals, to check a large sample of birds for dye-marks. The exact location of each flock was noted, and each was scanned by telescope (magnification 20 - 45X) to record the number of marked and unmarked birds.

RESULTS

Table 1 shows the number of individuals of each of the study species which were dye-marked. No aberrant behaviour of these birds was noted on the feeding grounds or roosts, subsequent to each catch. Observations and recaptures of these birds confirmed that the dyes and flags were not lost during the study. Immediately prior to catch two, I measured the proportion of dye-marked Turnstones from catch one in flocks on the feeding grounds. There was no significant difference between this, and the proportion of recaptures from catch one in catch two (χ^2_1 =0.965, 0.05<P<0.95). It thus appeared possible to record accurately the proportions of dye-marked individuals present in flocks on the feeding grounds.

Table 1. Numbers of Turnstones and Ringed Plovers dye-marked during the study. Individuals captured during the same weekend, but on different catches, have been grouped for the analyses.

	Catch 1	Catch 2	Catch 3	
	30 May/1 June 1983	14/15 May 1983	25 May 1983	TOTAL
Turnstone	90	29	8	127
Ringed Plover	45	246	90	381

The patterns of abundance and turnover differed greatly between the two species, which are treated separately below.

Turnstone

The numbers of Turnstones roosting at Annan Waterfoot throughout the study are shown in Figure 2. Ninety individuals were present at the start of the study (31 March 1983). Numbers were stable until mid-April, when there was a steady immigration of birds leading to a peak count of 295 individuals (9 May 1983), and then fell rapidly within 8 days to fewer than 40 birds (17 May 1983). A final count on 3 June 1983 revealed only 12 individuals.

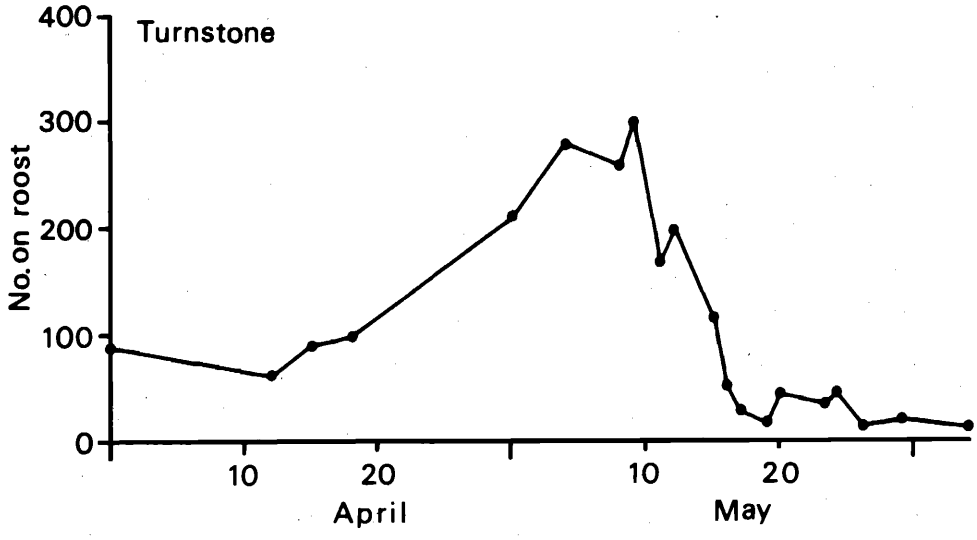

Figure 2. Numbers of Turnstones recorded at the high water roost counts at Annan Waterfoot.

Three catches of Turnstones were made (Table 1), in which 43%, 25% and 30% of the population present on the roost on that day were marked. Only the first two catches provided samples large enough for an analysis of turnover. Figure 3a shows the proportion of marked birds from the first catch which were observed in the study area on subsequent days. The proportions remaining did not decrease significantly during the remainder of the study (t from 0 = 0.307 P>0.10). This suggests that there was no further immigration during this period. There were not enough data for birds from catch 2 to examine statistically the same phenomenon, although the pattern observed followed the same trend (Figure 3b).

Ringed Plover

The counts of Ringed Plovers made at Annan Waterfoot and Priestside are shown in Figure 4. The first large influx at Annan Waterfoot occurred between 18 April 1983 and 30 April 1983. Numbers then remained relatively high, though with some fluctuations, until 24 May 1983, when many birds departed, leaving only 11 individuals by 3 June 1983. Counts at Priestside, made during the latter half of the study only, showed similar fluctuations, and these were very closely correlated with those at Annan Waterfoot (r=0.820, 0.001< P <0.01).

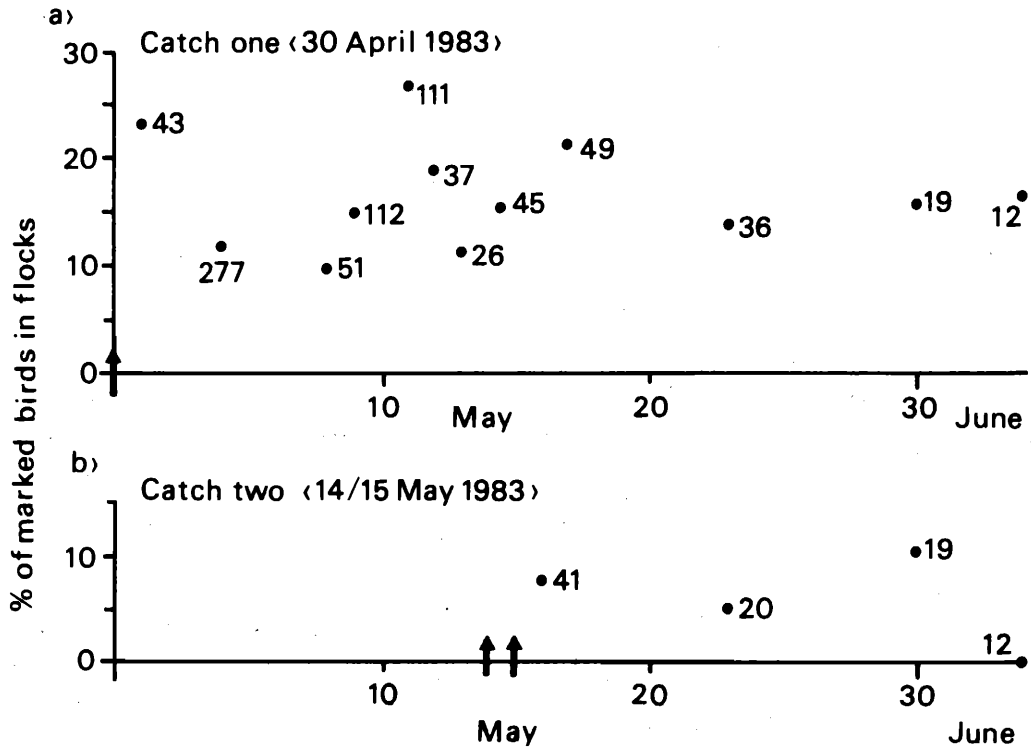

Figure 3. Percentages of marked Turnstones observed in flocks on the feeding grounds, subsequent to the dates of marking (shown by arrows). The numbers refer to the sample size of birds checked for markings.

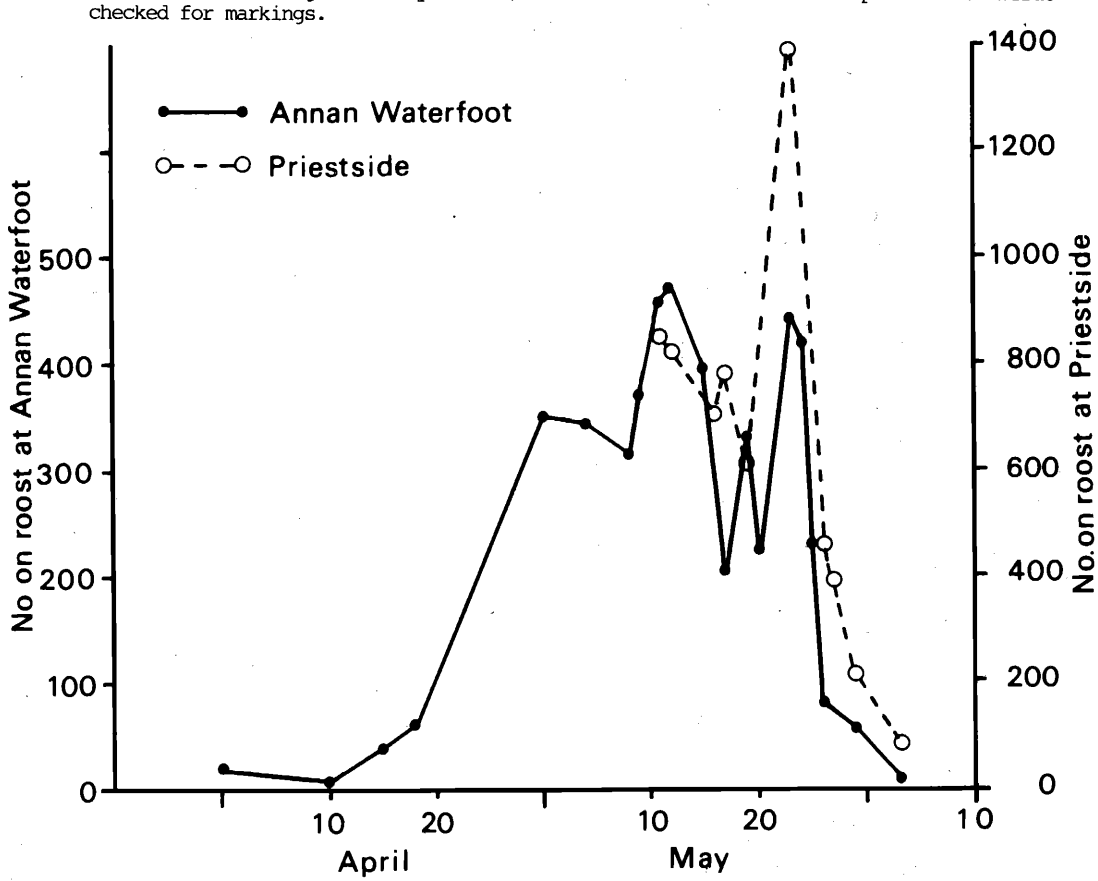

Figure 4. Numbers of Ringed Plovers counted at the high water roosts at Annan Waterfoot and Priestside.

Three catches of Ringed Plover were made at Annan Waterfoot, from which 13%, 62% and 39% of the roosting birds present were marked on each date. The pattern of the proportions of birds remaining from these catches differed greatly from those observed for Turnstones. Although the total number of birds at this roost fluctuated around 350 birds until 25 May 1983, all the birds from catch 1 (30 April 1983) had disappeared by 11 May 1983 (Figure 5b), which coincided with the major departure observed in the roost counts.

DISCUSSION

The two species showed very different patterns of population turnover during the study period. Intensive field-work was needed to collect the information presented above, and an important question is whether it would have been possible to assess the number of birds visiting the roost from counts alone. For Turnstones, there was little evidence of turnover during the study. However, the peak number of birds (ca. 275 - 300) were present

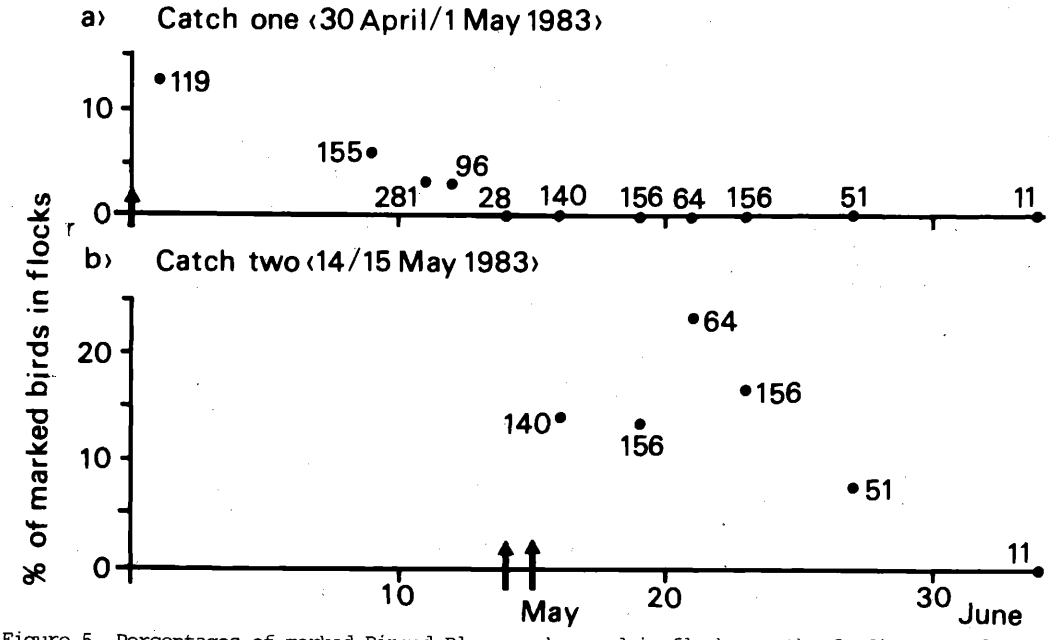

Figure 5. Percentages of marked Ringed Plovers observed in flocks on the feeding grounds, subsequent to the dates of marking (shown by arrows). The numbers refer to the sample size of birds checked for markings.

for six days only. The small amount of information collected in 1979 on the Solway (Ferns 1981a), suggested a similar pattern, indicating a degree of between-year predictability in the movements. It is thus possible that a small number of counts made between 25 April and 15 May each spring could give a reasonable indication of the passage of Turnstones through this roost. More information concerning inter-year variation is, however, required.

The turnover patterns of Ringed Plovers differed greatly from those of Turnstones. The numbers present at each count remained relatively stable from 30 April to 25 May 1983. A series of counts during this period would have indicated a peak of 400 - 450 individuals at this roost. However, observations of dye-marked birds showed that all of the individuals which were marked on 30 April 1983 had left by 14 May 1983, by which date a further 400 new birds were present. Thus, the total number of Ringed Plovers using this roost was at least 800 individuals i.e. twice that recorded from the peak counts.

The proportions of marked individuals of both species in the feeding flocks were consistently lower than would be expected from the numbers marked and counted. For example, 90 (43%) of the total population of 210 Turnstones present were marked on 30 April 1983. The following day, a check of 43 individuals revealed only 23% marked. Approximately 95 more birds moved into the study area in the following week, diluting the expected proportions of marked individuals to 31%. However, during this period, and for the remainder of the study the proportion of marked birds in the flocks remained at ca. 15%. Because it was possible to record accurately the presence of dye-marked birds, this discrepancy must be due to an emigration of marked birds from the study area, following each catch. This pattern was observed for both species, and after each catch. Marked individuals were observed at other roosts, and this dispersion could either be a result of disturbance associated with catching itself, or of natural movements of individuals between the roosts. Evidence supports the latter hypothesis, as Symonds et al (1981), using identical techniques to mark wintering Turnstones on the Firth of Forth, found that they never changed roosts following catches during the winter. Thus, populations may be more mobile within estuaries during the spring. This will be examined in more detail in 1984.

No special effort was made to encourage sightings at other estuaries of marked birds from this study. The detection of such movements will be a major aim of the national BTO/WSG spring passage project in 1984. This information is vital when assessing the relative importance of estuaries for migratory wader populations. Several observations of birds marked in 1983 on the Solway were received from other sites. The single sighting of a marked Ringed Plover from catch 1 on the Ribble Estuary (150km to the south) within two weeks of marking illustrates the complexity of the situation.

ACKNOWLEDGEMENTS

The combined expertise and enthusiasm of the North Solway Ringing Group (particularly Jim Young, Bobby Smith and Brian Turner), Nigel Clark, and several other ringers, resulted in the successful catches reported above. Glaxochem (Annan) once again assisted the project by authorising access to the study area. Paul Shimmings helped with the observations of marked birds. Liz Murray drew the figures, and Dorothy Smallwood typed part of the text. To all, we are very grateful. Drs. C.J. Cadbury, P.N. Ferns, R.J. O'Connor, M.W. Pienkowski and the Editor kindly commented on the text. During the work the first author was financed, as Estuaries Officer for the BTO, by the Nature Conservancy Council, the Royal Society for the Protection of Birds and the BTO itself.

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ABSTRACTS OF PAPERS GIVEN AT THE 6TH INTERNATIONAL WORKSHOP ON THE ECOLOGY OF SHOREBIRDS, CARDIFF, 12 - 16 SEPTEMBER 1983

Seasonal changes in the spacing pattern of feeding Dunlins

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Dunlins were studied at two sites on the northern shores of the Severn Estuary, South Wales. Flocks of Dunlins feeding away from the tide's edge were found to be smaller during the mid-winter months than during spring or autumn. The average within-flock density of these flocks also decreased significantly during this period,.This decrease in the average density of birds feeding within the winter flocks was not a result of the decrease in flock size but was found to be consistent within all sizes of flock throughout the season.

Dunlins fed farther from their nearest neighbour in the middle of winter, and the area available for each bird to search unhindered by its nearest neighbour was also at a maximum. Within-flock aggression did not increase during those periods, but it was felt that the decrease in flock density was a direct response to the decreased availability or detectability of prey.

Why are waders like Topsy?

P.N. Ferns, C.J. Thomas & P.C. Hack, Department of Zoology, University College, Cardiff

The eggs of Golden Plovers Pluvialis apricaria and Dunlins Calidris alpina nesting in exactly the same sites in the central uplands of Wales have increased significantly in size in the period between 1900-1926 and 1982/83. During these 70 or so years, Golden Plover egg lengths have increased by 1.5% and breadths by 0.9%, whilst Dunlin egg breadths have increased by 1.3%. These increases are of the same order and size as those recorded by Vaiasanen (1969) for Ringed Plovers in Scandinavia over roughly the same period. Vaiasanen interpreted the latter changes as being due to climatic amelioration which allowed a northward spread of larger Ringed Plovers (which laid larger eggs) from breeding areas further south. A similar increase has occurred in the wing lengths of Scandinavian Redshanks, possibly for the same reason (Hale 1971). However, this explanation is unlikely to hold for Welsh Golden Plovers and Dunlins since both species are close to the southernmost limits of their breeding ranges in this area.

It seems rather curious that all four species of waders which have been investigated seem to be increasing in size (like Topsy). More work is clearly required to determine if this is a general trend amongst European species and, in particular, to discover what has happened in other regions during the same period.

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Habitat selection in breeding waders

P.N. Ferns, Department of Zoology, University College, Cardiff

On the basis of studies of Ringed Plovers Charadrius hiaticula, Turnstones Arenaria interpres, Dunlins Calidris alpina, Sanderlings Calidris alba and Knots Calidris canutus in the high arctic (see WSG Bulletin, 26:24), it is argued that wading birds establish breeding territories in order to provide females with the food resources necessary to form eggs within the territorial boundaries. Territoriality minimizes the expenditure of energy in commuting between a nesting area and a feeding site at a time when the total energy demand is at its peak. The habitats selected for nesting by these five species are different because of differences in their morphology and feeding methods.

Before the breeding territories are established, these waders may feed communally in the few snow free areas which are available. By the time incubation has commenced, further snow free areas may have become available, outside the defended territories, and these too may be exploited communally. Once the eggs hatch, territoriality breaks down completely and the chicks are escorted to the best feeding areas which are usually in low lying, well vegetated, marshy ground and are the last to emerge from the snow. One consequence of all this is that there are marked differences in the nesting habitats of these species but rather little difference in the habitats in which chicks feed.

This could be interpreted as a consequnce of the late snow melt and short summer season in the high arctic, but the idea that breeding territories provide females with the resources necessary for egg formation may have wider applicability. However, it cannot apply to several polygamous species, nor to individuals which nest near the coast and forage intertidally during the early part of the breeding season.