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NON-RANDOM DISTRIBUTION IN ROOSTING FLOCKS OF WADERS MARKED IN A CANNON NET CATCH.

by Robert W. Furness and Hector Galbraith

In autumn 1979 some 4500-4700 Redshanks Tringa totanus roosted in a single compact flock on the inner Clyde estuary, Scotland. On 20 October 1979 we caught 1124 (24%) of these in a cannon net. The catch represented a complete section of the roosting flock from high on the shore to the water's edge. Almost all were adults (507 of 521 which were aged = 97%). During ringing 333 birds were chosen at random and dye-marked with picric acid. Subsequent observations showed that most of the flock remained on the estuary until late March and no other Redshanks moved into the area until spring passage in mid-March (Furness and Galbraith 1980).

The flock used a number of roosts in the area, probably depending on the extent and nature of disturbance factors in this highly developed estuary. Usually more than 95% of the flock was to be found on only one roost. On three occasions (22 October, 15 November 1979 and 15 February 1980) ideal weather conditions, combined with luck, enabled very close observation of a large flock at the main roost.

Observations were made using 10x40 Leitz binoculars from a vehicle parked behind a motorway crash barrier less than 10m from the roosting birds at Langbank, Renfrewshire. As a result it was possible to count samples of the flock and record the number of dyed individuals in each group. Counts were made starting at one end of the flock. The first ten birds were counted and the number of dye marked individuals recorded. The next ten were counted and so on. On each occasion the count terminated long before reaching the end of the flock because more birds arrived or the flock was disturbed and some took off.

Results

A null hypothesis that the proportion of dyed birds in the three counts was the same gave expected counts of 56, 33 and 49 dyed individuals. Actual counts were 57, 29 and 52 respectively. The results do not differ significantly ($\chi^2 = 0.7$) so can be combined to give a single sample. Overall, 138 of 1787 observations were of dye marked birds so the probability of any one bird being dye-marked was 0.0772. Groups of ten birds should contain an average of 0.772 dyed individuals. The expected number of groups with 0, 1, 2.....10 dyed individuals can be calculated from the Poisson distribution. If the dyed birds are randomly distributed our observed counts should match this series. Actual counts and the expected number (under the hypothesis of random distribution) are shown in Table 1. The hypothesis is clearly rejected ($\chi^2 = 15.7$, $p < 0.01$), showing that dyed birds were not randomly distributed through the roosting flocks. Instead they tended to occur in clumps more often than expected by chance.

Table 1. Observed and expected frequencies of dye-marked birds per group of ten in Redshank roosts at Langbank.

Number dye-marked in group of ten	Expected frequency if randomly distributed	Observed frequency	χ^2
0	81.8	97	2.8
1	63.1	40	8.5
2	24.4	28	0.5
3	6.3	9	1.2
4 or more	1.2	3	2.7
	177	177	15.7

Discussion

It is difficult to understand what these results mean. The discrepancy arises because there were more groups with no dye-marked birds or with several dye-marked birds and fewer than expected with only one. Pienkowski and Dick (1976) pointed out that cannon net catches may be biased because roosting waders often segregate into age and moult groups. In this study segregation must be within-flock as only one flock is involved. The birds continued to be non-randomly distributed within the roosting flock even four months after dye-marking so the behaviour is clearly stable over long periods of time.

A number of explanations are possible.

1) The dyed birds may have elicited aggressive reactions from unmarked birds,tending to drive them to peripheral parts of the roost and into the company of other dyed individuals. This was not seen to happen and there was no indication that the proportion of dyed birds was higher on the edge of the flock. Their roosting behaviour did not change over the winter and there was no indication of disproportionate numbers of dyed Redshank leaving the inner Clyde area. But if this does happen it would have important implications for the use of dye-marking to study population turnover and movements.
2) The catch may have consisted of a distinct sub-group of the flock which tended to associate throughout the winter. Examination of wing lengths and moult scores showed no sign of this and field observations confirmed that the low proportion of young birds in the catch was representative of the whole flock, but it remains a possibility.
3) The flock may consist of many small groups of birds which tend to associate together throughout the winter.
4) Particular birds may habitually roost in a particular spot in relation to the physical surroundings or in relation to the flock itself.

We conclude that roosting flocks are not random associations of birds gathered in areas where they can wait undisturbed for the tide to recede, but are structured organisations. The structuring requires investigation. It may go beyond segregation by age and moult conditions and could involve long term subtle associations which cannot be explained at present. Perhaps individual marking of birds in a small population of waders with a distinct roost would provide some answers to this problem.

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