

METHODS USED TO ASSESS POPULATIONS OF BREEDING WADERS ON MACHAIR IN THE OUTER HEBRIDES

by T.M. Reed and R.J. Fuller

This paper describes the field methods and analytical techniques used in an extensive survey of the breeding wader populations on the machair of the Outer Hebrides in 1983. The survey was performed jointly by the Nature Conservancy Council (NCC) and the Wader Study Group. (WSG) (Green 1983).

In order to carry out such a large-scale survey within a very short time (c. 13,100 ha were to be surveyed) it was imperative that a simple, effective technique be used. The species surveyed were Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula*, Lapwing *Vanellus vanellus*, Dunlin *Calidris alpina*, Snipe *Gallinago gallinago* and Redshank *Tringa totanus*.

The following method was employed throughout the entire study area.

FIELD METHODS

Observers worked in pairs (teams) and were allocated a series of field sites. These sites ranged in size from approximately 2 to 8 km². Approximately 4 km² could be surveyed by one team in one day depending on bird density. On each visit both observers walked parallel transect lines 150 m or 100 m apart. The wettest areas of machair, where densities of birds were highest, were surveyed on 100 m transects. The locations and behaviour of all wader species seen were recorded on 1:10,000 maps using modified British Trust for Ornithology (BTO) Common Birds Census codes (Appendix 1). On subsequent visits the same transect lines were walked, but from the opposite direction to the previous visit, as indicated in Figure 1.

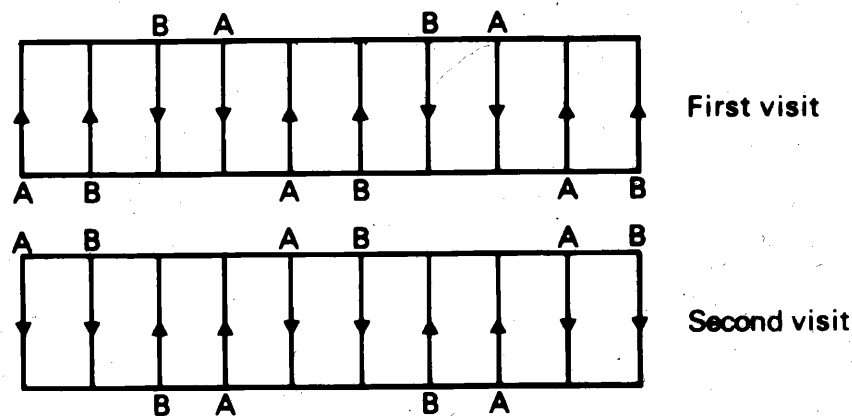


Figure 1

Diagram to illustrate the directions walked by two observers (A and B) on consecutive visits to a hypothetical study site. Any possible differences between observers could be minimised by observers walking different lines on the two visits. However, in broken or difficult terrain it is often easier to walk the same line as on the previous visit.

The number of visits to each field site varied from one to four but all sites were visited at least once during the first three weeks of June. Single visits during this period usually gave a realistic estimate of the breeding population (Jackson and Percival 1983, Reed, Williams and Webb 1983).

Bad weather conditions can adversely affect recording efficiency (Robbins 1981); therefore visits were not attempted in either strong winds (approximately more than force 5-6) or in rain heavier than a drizzle.

On individual field maps, observers recorded the start and finish times of each individual transect, plus a record of the weather during the course of the visit. At the end of each pair of transect lines, observers met to cross-check records, to reduce the likelihood of double recording. Records were subsequently transferred to a single summary map for the visit, with attendant details of weather, visit time and directions of lines walked.

ANALYTICAL METHODS

A simple set of rules was produced to analyse the data in a consistent manner for any given area. These rules were based on some preliminary studies (Fuller, Green and Pienkowski 1983), and on a large amount of field experience gained by the survey workers, and are a refinement of previous methods used by Fuller (1978, 1981). The aim of the rules was to interpret field registrations in terms of "breeding pairs". Each species was considered in turn and behavioural characteristics checked against field data before decisions were made on minimum distances for pair designation or exclusion. Where more than one visit was made to sites, no attempt was made to pool the data to define territories: the extremely high densities and mobility of the birds precluded such an approach.

Ringed Plover and Dunlin

Both species are small, vocal, highly mobile waders occurring at high densities on the Hebridean machair. The following rules were used to estimate breeding populations, and serve as guidelines for the other species surveyed. "Site" is used to define the entire study area while "area" refers to that part of the study area in the vicinity of the observer.

Birds represent a breeding pair, or pairs, as follows:

- a) 1 bird recorded alone 50 m or more from other birds = 1 pair.
- b) 2 individual birds within 50 m of each other = 1 pair.
- c) 2 birds together, or 2 birds recorded as a pair = 1 pair.
- d) 3 or 4 birds together = 2 pairs.
- e) 1 - 4 birds flying into, out of, or through the area, or into the site = 1-2 pairs.
- f) 5 or more birds remaining in the area, either on the ground or circling around (vocal birds only) = 3+ pairs.

The following were excluded from estimates of breeding populations:

- g) 5 or more birds in a flock on the ground without vocal registrations (i.e. assumed non-breeding).
- h) 5 or more birds in a flock flying into, out of, or through the area or site.
- i) Any bird(s) which flew out of or through the site in one direction for more than 150 m without landing.
- j) Nests were not included in the estimate of breeding numbers. Some nests discovered lacked adults in the immediate area; inclusion of the nest would have led to inflated population estimates if birds already recorded elsewhere on the site were the nesting pair.

Oystercatcher

Oystercatchers tend to occur at lower densities than Dunlins or Ringed Plovers and tend to be seen in discrete pairs. However, pairs range over a larger area than Ringed Plovers or Dunlins, and two individuals of a pair will often stand much further apart. Rules for interpreting Oystercatcher registrations reflect these differences.

The rules for Dunlin and Ringed Plover were adopted with the following amendments:

- a) - d) As for Dunlin and Ringed Plover, with the exception that the distance for single birds or for 2 individual birds (rules a and b) is 125 m.
- e) 1-2 birds flying into, out of, or through the area, or into the site = 1 pair.
- f) 3 or more birds remaining in the area, either on the ground or circling around (vocal birds only) = 2+ pairs.

Records in categories g) to j) were excluded in the same way as the other two species, with the exception that 3 or more birds (vocal or non-vocal) flying out of, into, or through the area/site were excluded compared with 5 or more birds for Dunlin and Ringed Plover. All obvious non-breeding flocks were excluded.

Redshank and Lapwing

Redshanks tended to occur in discrete pairs during the first three weeks of June but were also found in groups of 3 or more in areas of highest breeding density.

Lapwings presented a problem for the survey due to the tendency of individual pairs to form into mobbing groups, with birds often coming in from adjacent areas or even departing from the study area on the approach of an observer (Fuller, Green & Pienkowski 1983). However, records were generally made by scanning ahead so that pairs were recognised before groups formed. Frequently, field counts were made and the total divided by two to estimate pairs.

Estimates for Lapwing and Redshank populations were made in the same way as Dunlin and Ringed Plover except that the distance for single birds or for 2 individual birds (rules a and b) was 75 m, rather than 50 m.

Snipe

Snipe were behaviourally different from the other five wader species, mainly because they are inconspicuous and are only detectable on the ground at very close range. The above rules were not applicable. Snipe were counted by summing the numbers of drumming, "chipping" or alarm-calling birds and using the highest total for any one visit after mid-April. Snipe counts derived from this transect method are undoubtedly an underestimate.

COMMENTS ON ANALYSIS

1. The rules worked well, with few problems, due in part to using large-scale (1: 10,000) maps and high plotting accuracy. The regularity with which most species were recorded in pairs, if the observer was looking at least 50 m ahead, eased problems of analysis. It is likely that the method may be readily used elsewhere in the analysis of lowland breeding wader data. We believe that single visits made in early - mid June, using the above methods, provide an adequate reflection of population sizes of breeding waders in the Hebrides (see also accompanying papers). The main problems are that birds which failed early may have already departed, so one is not necessarily assessing the population which settled in the area, and that seasonal variations in timing of breeding might cause a shift in the optimal census period. It is doubtful whether such shifts are likely to be large enough to cause a major bias in comparing June counts from different years.

2. In areas of exceptionally high density, when birds are continually moving around, it is impossible to keep track of all individuals, especially when several species are being plotted. In these circumstances birds were usually picked up in flight and their path recorded on the map as birds flying through or out of the field of vision (approximately 100 m). These individuals or groups flew directly out of vision, without deviating from their flight lines. Such records were excluded from the breeding estimates.

3. The data collected during the course of the survey were of two distinct types: a) long-term, involving 3-4 visits by an NCC team to each of twelve sites between April and July; b) short-term, involving one or two visits by one of five WSG teams to 30 sites between 4-18 June. Areas surveyed by NCC overlapped partially with those of WSG so that checks could be made on the recording consistency of the different pairs of observers (Webb, Reed and Williams 1983). Although this provided a yardstick for comparison, it presented the problem of which population estimate to accept. Similarly, with repeat surveys carried out between April and July, it was necessary to decide which count to accept for each species on each site. Inspection of seasonal changes in detectability (Reed, Williams and Webb 1983) indicated that, with the exception of Lapwing, species were at their most conspicuous during the period of the WSG survey. Hence a population estimate for the whole island group can be made from the June counts for most species. Where more than one count was available for any area during this period, the maximum population estimate has been taken, unless there was reason to believe that any observers were recording in a significantly different manner from the others. Additionally, where two or more visits were made to an area, the lowest figure was also taken to give an idea of the range in population estimates.

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APPENDIX 1

Recording symbols used in the NCC/WSG 1983 survey of breeding waders in the Outer Hebrides. The following species codes were used:

Oystercatcher	O	Lapwing	L	Snipe	S
Ringed Plover	P	Dunlin	D	Redshank	R

In the following activity symbols, Ringed Plover is used as an example:

Single birds and pairs

P	single bird (NB: 4P = four birds at one spot).
Ppr	two birds believed to be a pair, behaving in a similar manner.
P- - - -P	two single birds in view at the same time.
P-?-P	thought to be same bird.
P-→P	bird moves from one known point to another.
-P→	bird comes from unknown point and settles.
-P→	bird comes from and goes to an unknown point.
P→→	bird goes from a known to an unknown point.

Alarm calls

<u>P</u>	alarm call.
<u><u>P</u></u>	alarm call suggesting presence of young birds nearby.

Display/singing birds

(P)	song/display on ground (including "chipping" Snipe).
(P)↻	song/display in air (including drumming Snipe) over/around one spot.
-P P-	territorial dispute/fight.

Nests and juveniles

P*	nest.
P + *	adult plus nest.
P* (4)	nest with 4 eggs.
P + j	adult plus juvenile.