

THE BREEDING WADERS OF THE HEBRIDEAN MACHAIR : A VALIDATION CHECK OF THE CENSUS METHOD

by D.B. Jackson and S.M. Percival

"Ignorance is strength" - George Orwell, "1984"

The recent WSG survey of the Outer Hebridean machair (Green 1983) aimed to obtain population estimates for certain of the breeding wader species, and to assess their relative distribution between sites and between habitats on this nationally important area (Fuller 1978). Working in conjunction with a similar NCC project, all the islands' major areas of machair were surveyed. How accurate are the results?

THE DETAILED STUDY ON WHICH CALIBRATION IS BASED

Work that we did (in the same year as the WSG/NCC Survey) on South Uist on habitat selection and breeding success of Ringed Plover *Charadrius hiaticula* and Dunlin *Calidris alpina* (in prep.) included intensive study at three sites: Stilligarry, an area of 24 ha of typical cultivated dry machair; Rubha Ardvule, a 20.5 ha machair headland; and two plots of 7 ha and 8.5 ha at Loch Bee on dry-damp transition machair, respectively. Each area was visited regularly between 18 May and 17 June, and attempts were made to find every nest. Although the sample size is small, our data are the most accurate population estimates available for these areas (see below), and provide a base for a validation of the extensive survey.

Our intensive observation of birds on the study sites complemented the nest-finding data, improving the estimate of the breeding population for areas in which we were not confident that we had found every nest. Colour-marking of 34 adult Ringed Plovers and 38 adult Dunlins aided this and also enabled us to show how much the adults moved around their breeding area, a point which could add bias to the census results. It also gave useful information on the behaviour of failed breeders and second breeding attempts in a few pairs. It seems likely that our intensive study obtained accurate figures of the populations in these study areas. This is supported by a levelling-off of graphs of total numbers of pairs identified against number of visits well before the end of the intensive study period. Such graphs are given for Ringed Plover and Dunlin as Figures 1 & 2.

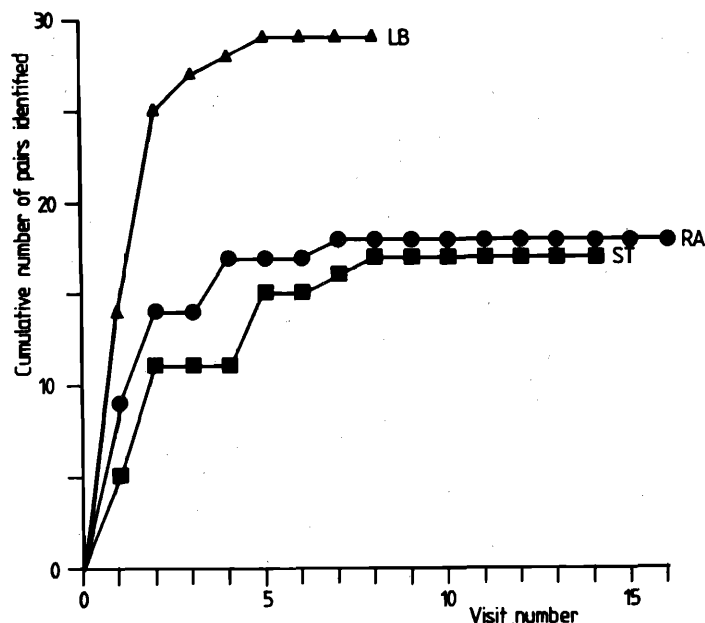


Figure 1. Cumulative number of pairs of Ringed Plovers identified in detailed studies at Rubha Ardvule (RA), Stilligarry (ST) and Loch Bee (LB). A pair was classed as identified only when its separate identity was established. Methods used included nest finding, individual marking of adults, and detailed observation of behaviour.

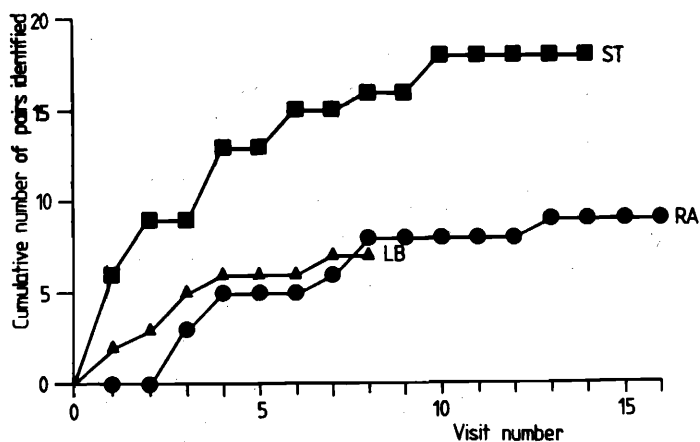


Figure 2. Cumulative number of pairs of Dunlins identified in detailed studies at Rubha Ardvule (RA), Stilligarry (ST), and Loch Bee (LB). Definition and methods as Figure 1.

COMPARISON WITH WSG CENSUSES

Census transects as used by WSG (Reed & Fuller 1983) were made (by N.E. Buxton and M.E. Moser) in the detailed study areas in the second week of the WSG survey period. This check cannot, therefore, apply directly to all WSG censusers, but separate studies examine the consistency of field recording and map interpretation (Fuller, Green & Pienkowski 1983, Webb, Reed & Williams 1983).

Table 1 compares the results of WSG-type transect surveys with those of our intensive studies. (To ease comparisons, percentage differences are given of WSG-censuses from estimates of the detailed survey. It should be noted, however, that some of the percentages based on small samples may be misleading.) There is reasonably good agreement between the WSG and intensive totals for these sites, generally over a variety of bird densities. The Loch Bee sites were less satisfactory than the other sites for checking the WSG survey for three reasons:-

- They were considerably smaller than those at Rubha Ardvule and Stilligarry.
- They had a high edge:area ratio, especially at Loch Bee South. Both these make it likely that birds actually nesting on the study plot will have been outside the boundaries (but quite close to their nests) when counted (or vice versa).
- There were few landmarks on this extensive and uniform area, making it difficult to plot accurately transect registrations. An attempt was made to allow for this, by examining bird densities in the areas surrounding the study plots. Little variation was found, but this could still be a source of error.

Table 1. Comparison of numbers of pairs of breeding waders estimated in four areas by the WSG-survey technique with the estimates based on intensive study.

		Rubha Ardvule	Stilligarry	Subtotal	Loch Bee (N)	Loch Bee (S)	Total
Ringed Plover <i>Charadrius hiaticula</i>	Population estimate from intensive study	18	18	36	14	11	61
	WSG-Survey estimate	17	16	33	8*	10	51
	% Difference	-6%	-11%	-8%	-43%	-9%	-16%
Dunlin <i>Calidris alpina</i>	Population estimate from intensive study	9	18	27	1	6	34
	WSG-Survey estimate	7	10	17	1	9	27
	% Difference	-22%	-44%	-37%	0%	+50%	-21%
Oystercatcher <i>Haematopus ostralegus</i>	Population estimate from intensive study	27	10	37	-	-	37
	WSG-Survey estimate	28	9	37	-	-	37
	% Difference	+4%	-10%	0%	-	-	0%
Redshank <i>Tringa totanus</i>	Population estimate from intensive study	12	3	15	-	-	15
	WSG-Survey estimate	13	2	15	-	-	15
	% Difference	+8%	-33%	0%	-	-	0%

* plus 8 pairs just outside study plot

The comparisons at Stilligarry and Rubha Ardvule provide the most useful comparisons. Stilligarry is a site very typical of the machair habitats, especially of South Uist. Rubha Ardvule is a peninsula where the potential for movement by birds into or out of the study area is minimal (see information on movements by birds, below). Therefore, sub-totals for Rubha Ardvule and Stilligarry are given in Table 1, as well as totals including the Loch Bee sites.

Errors in the transect-based census method can come from both over- and under-recording. Too high an estimate may be obtained by double-recording individuals, or recording non-breeding birds (e.g. feeding parties of birds breeding elsewhere, passage birds, fledged young) as breeders. Under-recording could result from, for example, birds being absent temporarily from their breeding site or having left the area after breeding failure, or just simply being missed by the observers. The degree of over- and under-recording will be dependent on several variables, particularly a) bird density: it is less easy to follow individuals in high density areas (particularly when they are drawn in from the surrounding area to mob the observer) so there will be more double recording; b) habitat: some species are less conspicuous in certain habitats, for example, Ringed Plovers in areas with a high density of daisies; c) observer consistency: variation in the observer himself and between different observers; and d) weather: birds are more easily recorded on still, bright days. Further points relating mainly to particular species are considered below.

Ringed Plover

At Stilligarry, Rubha Ardvule and the south plot at Loch Bee, the accuracy of the WSG survey is excellent (a 10% underestimate). The result at the north study plot at Loch Bee, however, gives a considerable underestimate of the population. Here the observers seem to have under-recorded to a significant degree. This appears to be related to the small size of the detailed study area (Table 1).

The intensive study showed that movements of adults away from their nest or chicks were small (62% and 94% of observations of each respectively were within 50m of the nest or chicks - see Fig. 3). At Stilligarry there was a tendency for adults and chicks to move to ploughed areas to feed, though even here the mean distance moved by a brood from its nest was only 90m. (It is possible that transect workers, in contrast, may "push" birds along. However, given the normal behaviour of breeding Ringed Plovers in making much noise, this would probably lead to over-recording by the census technique - and this has clearly not happened.) Failed breeders usually remained in the vicinity of their failed nests (60% of observations were within 50m of the nest) and most relaid. No evidence was found to suggest that there were significant numbers of non-breeders present during the study period.

Dunlin

The population estimates for Dunlin from the survey appear to be somewhat less good than those for Ringed Plover. By the time of the WSG survey period at least 50% of the breeding birds had failed. Failed breeders usually departed from their breeding territory soon after failure, and females in some areas leave their chicks within a few days of hatching (Soikkeli 1967). It is, therefore, likely that a significant proportion of the breeding population had left their territories by the date of the WSG survey. This is not to suggest that the survey should have been conducted earlier because this would have resulted in a poor detection rate (see Reed, Williams & Webb 1983).

Dunlin are less detectable on the breeding grounds than most of the other species, so one would expect a greater degree of under-recording. They have smaller territories and do not move such long distances to mob observers, compared to most of the other waders on the machair. It is likely that the incidence of double-recording will be relatively low except at the highest densities.

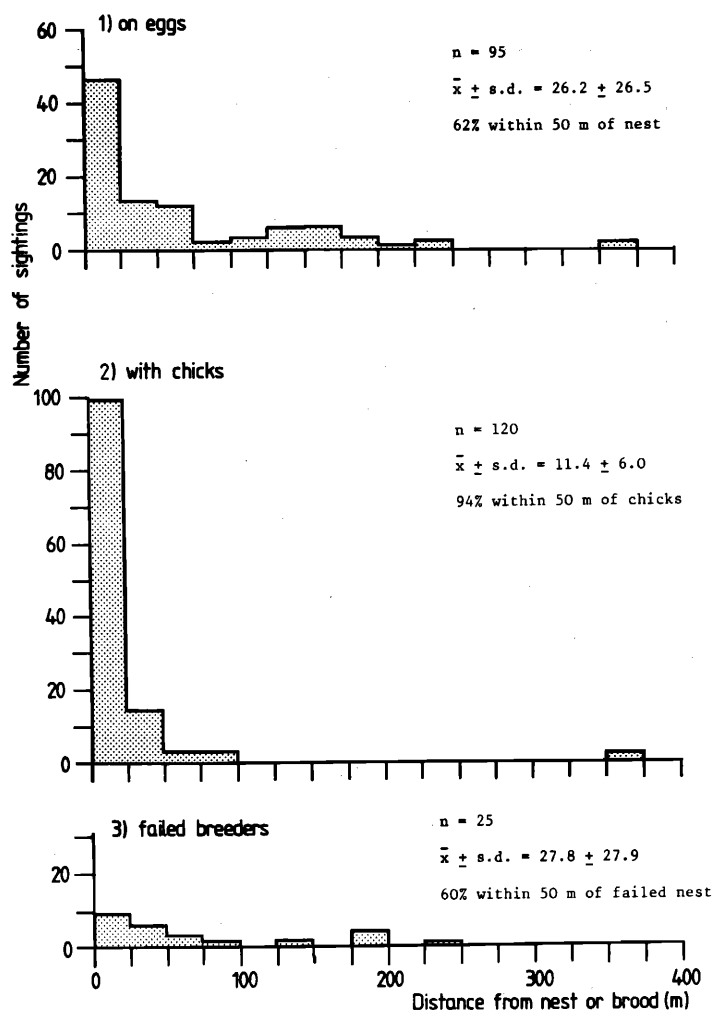


Figure 3. Sightings of individually marked Ringed Plovers in relation to distance from nest or brood (from Percival, unpublished).

Dunlin frequently feed at long distances from the nest on the machair (up to 850m recorded in the intensive study, see Fig. 4), often in small groups (up to 12 recorded). This probably helps to explain the high numbers recorded by the survey for the south plot at Loch Bee. Birds, including marked individuals which were known to be nesting near the loch shore, often used this plot (which was some 850m from the loch shore) as a feeding area. Larger groups of up to 40, including our marked birds, were regularly seen feeding on the shore of the Loch Bee. Therefore, all birds present in an area will not necessarily be breeding in it. Probable passage birds were present in late May and early June, and there may also have been a non-breeding component of the population. (Note that, except in feeding areas (which unfortunately are not immediately obvious) figures provided by the WSG Survey for Dunlin are conservative estimates, and there is some suggestion that there might be an underestimate of about one third in most areas.)

Oystercatcher *Haematopus ostralegus*

Accuracy is very good; this is not surprising for such a conspicuous species.

There is some problem with non-breeding birds. These usually form large flocks, separate from the breeding population. These were generally obvious on the basis of flock size and behaviour, but sometimes smaller aggregations occurred. The WSG method may interpret these by dividing the total number by 2 to give the number of breeding pairs. This may give an over-estimate if these small groups contain non-breeding birds.

Redshank *Tringa totanus*

Accuracy of results was excellent, although it should be noted that the only calibration area in which this species occurred at high density (Rubha Ardvule) is not typical of the wet machair in which they occur most abundantly.

It is also important to note that this species often moves its chicks considerable distances to favourable feeding areas (Hale 1980). The timing of the WSG survey meant that it was predominantly the chick feeding area, not necessarily the nesting site which was being recorded.

Lapwing *Vanellus vanellus*

No transect data are available for comparison. This species is probably more easily and accurately censused early in the season when on eggs. (This was foreseen when the joint WSG/NCC surveys were planned.) There is then no complication with juveniles and failed breeders.

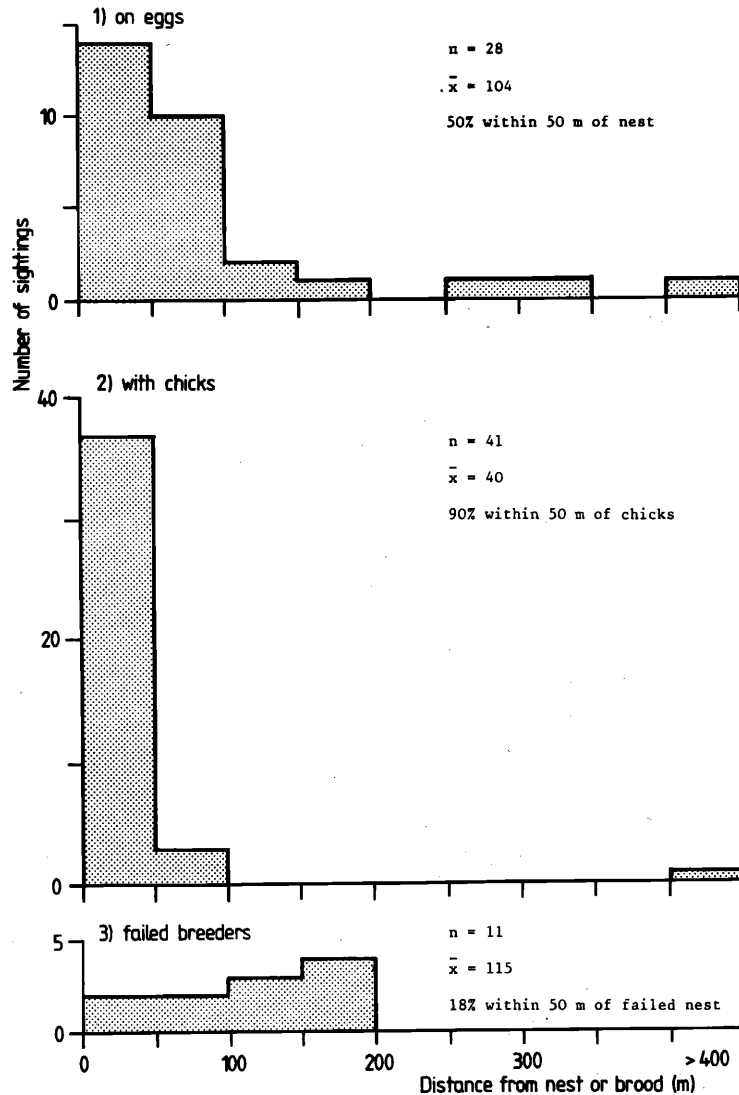


Figure 4. Sightings of individually marked Dunlins in relation to distance from nest or brood (from Jackson, unpublished).

Snipe *Gallinago gallinago*

No data are available for comparison. Our casual observations suggest that the survey results are a gross underestimate of the actual total, since the flushing distance of birds from nests and chicks is very small in comparison with the inter-transect distance.

CONCLUSIONS

For most wader species nesting on the machair, the WSG transect survey has produced reasonable results, in the areas that we were able to check by intensive study. It should not be assumed that it was equally successful for other habitats. In particular, wet marshy areas, of prime importance for Redshank and Dunlin, were not included. It was unfortunate that a more extensive validation could not have been undertaken. However, information from cross checks between surveys is available for other parts of the extensive survey (Reed, Williams & Webb 1983, Fuller, Green & Pienkowski 1983, Webb et al. 1983). Our validation work also fails to take into account any difference in observer recording, since all the transects in our areas were carried out by the same pair of observers. Observer comparability was investigated separately as other parts of the study (Fuller, Green & Pienkowski 1983, Webb et al. 1983, Fuller et al. in prep.).

The WSG method, as used on our intensive study areas, does seem to be a reliable, consistent and convenient way to measure the breeding populations. It certainly achieved its aims in identifying the areas of major conservation interest and in emphasizing the importance of the Hebridean machair as a site for breeding waders.

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THE HEBRIDEAN WADER SURVEY : DID THE OBSERVERS RECORD IN THE SAME WAY ?

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INTRODUCTION

Any large scale survey requires that inter-observer differences in efficiency or recording method are minimised so that population estimates will be comparable between areas (Ralph & Scott 1981).

In this paper we compare the results of the Nature Conservancy Council (NCC) and Wader Study Group (WSG) field teams in the Uists in 1983 in order to determine whether there were differences which may have affected population estimates for survey areas.

METHODS

Data were collected by transect survey and analysed (Reed and Fuller 1983) to produce population estimates for Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula*, Lapwing *Vanellus vanellus*, Dunlin *Calidris alpina*, Snipe *Gallinago gallinago* and Redshank *Tringa totanus* for the whole of the machair and selected adjacent blackland areas.

Included in the survey area were a number of sites censused by both NCC (team G) and WSG field teams (teams A, B, C, D and E). These sites were censused independently within a few days (mean 6.5 + SD 4.9 days) of the other team's visit, and records then compared for Dunlin, Oystercatcher, Redshank and Ringed Plover. Lapwing and Snipe records were insufficiently detailed to allow comparison. We assume here that the NCC team were consistent in their field methods so that this team is used as a standard by which the 5 WSG teams could be compared. This paper is therefore concerned with consistency between observers. The question of validity of the censuses (i.e. how they relate to the numbers of pairs actually present) is considered by Jackson & Percival (1983) and, to some extent, by Fuller, Green and Pienkowski (1983).

Field registrations were divided into five categories:

1. Pair of birds;
2. Two birds together, not recorded as a pair;
3. Two single birds close enough to be considered a pair;
4. Single birds;
5. Groups of three or more birds.

Additionally the number of 'twosomes' (the sum of categories 1, 2 and 3 above) was calculated: removing any bias caused in interpreting records as pairs.

The numbers of birds recorded in each of the above categories by each field team were compared using χ^2 tests. Because one would expect some variation in recording methods between teams, only large differences ($P < 0.005$) have been highlighted.

RESULTS

Grouping all species together (Table 1) showed that the record interpretation of three groups (teams B, D and E) differed little from team G, with team B tending to record a slightly higher proportion of birds as pairs rather than singles, and team E recording a slightly higher proportion of singles than did the other teams. However, teams A, and C differed significantly from team G in all comparisons, apart from the proportion of singles recorded. Estimates of the breeding shorebird population made by these two teams differed markedly from NCC estimates (42.5% and 57.5% respectively (Table 2)). Mean percentages of birds in each recording category (Table 3) suggest broad similarity in record interpretation between NCC and WSG observers, with perhaps a slight tendency for WSG to record more groups and fewer pairs. None of the categories differed significantly when NCC and WSG means were compared by t-test (Snedecor and Cochran, 1967).

Results for all WSG teams were then grouped and compared with NCC results for each species (Table 4).

The results for Dunlin and Ringed Plover were similar for both groups. However, Redshank were grouped far more often by WSG than NCC and Oystercatcher were recorded more as singles by WSG.