

Breeding waders and their conservation on the wetlands of Tiree and Coll, Inner Hebrides



K.B. SHEPHERD and DAVID STROUD

Breeding wader populations on a range of machair and other wetland biotopes on the Hebridean islands of Tiree and Coll were surveyed in 1987 and 1988. Six species breed, five of them (Lapwing, Redshank, Oystercatcher, Ringed Plover, Dunlin and Snipe) in nationally important numbers. Habitat selection was investigated on nine sample survey sites, and extrapolated results indicate that a total of 6020 pairs of waders bred on Tiree, and 1330 on Coll. Several wetland and machair habitats held large numbers of breeding birds. Of particular importance were small areas of marsh and fen, wet machair, Phragmites beds, coarse wet pasture and old decaying runways set in areas of dry machair. The extent of European machair has been surveyed for breeding waders in the last five years. Tiree and Coll, together with the southern isles of the Outer Hebrides, hold internationally important populations, and are important in maintaining the range of several species within the British Isles (as required by international legislation). Agricultural operations, specifically drainage and intensification of grassland management, could be damaging to currently prime wader habitats. As well as protection of key areas, long-term conservation of these populations would be achieved by support for traditional forms of crofting which, over past centuries, has created the agricultural landscape on these islands.

Machair is the Gaelic name for coastal grasslands which develop under an extremely limited range of conditions in Europe. They occur where offshore, calcareous shell-sand is washed and blown onshore to form low coastal landforms, and are frequently associated with traditional systems of low-intensity agriculture and crofting tenure (Caird 1979). Their topography results in extensive winter flooding, some areas remaining wet throughout the year thus providing a range of breeding and feeding opportunities for wildfowl and waders.

In Europe, machair grasslands occur in the Atlantic seaboard of the British Isles, from isolated areas in Shetland and Orkney in the north, to the extreme west of Ireland; however, they attain their greatest development in the southern islands of the Outer Hebrides (Ritchie 1976). Small areas occur also in some Inner Hebridean islands such as Colonsay, Islay and Iona although the greatest extent in this island group occurs on the islands of Tiree and, to a lesser extent, Coll.

Between 1983-87, the Wader Study Group and the Nature Conservancy Council (NCC) undertook breeding wader surveys on the machair of the southernmost Outer Hebrides

(Fuller *et al.* 1986, Fuller & Percival 1988, Jackson 1988). The surveys found internationally important wader populations and demonstrated that their conservation should be of major significance in future land-use considerations. Information from Tiree and Coll (C.J. Cadbury unpubl., Fuller 1982, Reed *et al.* 1983) suggested that machair on these islands was characterised by a breeding wader community similar to the Outer Hebrides, although the machair is not agriculturally managed in the same fashion (Vose *et al.* 1959, Harrison 1989). A range of other wetland habitats occur on the islands (Wormell 1989), of which damp acid grasslands and heath-dominated vegetation are the most abundant. Centuries of human use has stripped away most peat on Tiree for use as domestic fuel and the resulting vegetation communities are much modified compared with those of moorlands and blanket bogs elsewhere (e.g. Stroud *et al.* 1987).

In 1986, the EEC proposed an Agricultural Development Programme (ADP) for the Inner Hebrides, running for five years from April 1988. The ADP acknowledges conservation principles (SDD 1988) but nevertheless has scope to cause local damage to features of



Figure 1. The islands of Coll and Tiree, Scotland showing location and extent of survey sites. Scale is 3 km.

conservation importance. This is especially so where drainage of wetlands will adversely affect conditions attractive to large numbers of breeding waders and other waterfowl. For this reason, identification of features of conservation interest is essential so that advice can be given to assist the fulfilling of the conservation principles.

A comprehensive survey of breeding wader populations of Tiree and Coll was therefore undertaken a) to quantify numbers and distribution; b) to identify important wader habitats and record variation in breeding density within and between these; and c) to provide advice on the conservation implications of any proposed land-use changes. Surveys were carried out by the Moorland Bird Study of NCC's Chief Scientist Directorate in 1987 and 1988 and fully reported by Shepherd *et al.* 1988, Shepherd 1988 and Stroud 1989. This paper summarises the main findings.

Methods

Based on available information on habitat distribution (P. Wormell pers. comm.), sample sites were chosen which covered the full range of habitats across both isles (Fig. 1). Each was

surveyed for breeding waders using methods similar to those of the JNCC/BTO Common Birds Census, plotting onto 1:10,000 scale maps the locations and activities (cf. Reed & Fuller 1983) of all birds seen on each of four visits. In 1987, surveys were undertaken between 20 April-28 June, whilst in 1988 site visits were made between 9-23 April. During each visit, all parts of the sites were systematically searched, in agricultural areas on a field-by-field basis, whilst other areas were surveyed by using transects 150 m apart (but deviating to cover areas hidden from sight or areas of habitat potentially concealing birds). Emphasis was placed on scanning areas before approaching and allowing disturbed birds to settle so locations could be precisely mapped on the detailed maps. This was particularly important in very high density areas. Care was taken not to double-record individual birds as indicated by Shepherd *et al.* 1988.

Breeding birds were identified in the field by observation of at least one of the following: song/display; bird carrying nest-material; location of nest or young; repetitive alarm-calling or distraction display indicating nearby presence of nest or young; or birds carrying food.

At the end of the season, all visit maps for each site were examined in combination in

Table 1. Characteristics of biotopes mapped on Tiree and Coll as potential wader breeding habitats.

Habitat	Vegetation	Micro-topography	Management	AREA (ha) ON TIREE COLL	
Dunes	Pioneering <i>Ammophila</i> on yellow dunes - grey dunes with calcareous grassland species	Sandy hills and hillocks with blow-outs	Mainly winter stock grazing	205	710
Machair	Botanical composition resembles grey dune pastures				
Dry machair	Dry substrate in summer	Variable and created by drainage and grazing	Mainly winter stock grazing	1685	230
Wet machair	Increased frequency of Ranunculaceae and decrease in <i>Festuca rubra</i> cf. dry machair area	Variable, more uneven as wetness increases. High incidence of tussock forming species	Mainly winter stock grazing: many ditches may occur	145	30
Agricultural land	Enclosed agricultural land, probably all originally derived from machair habitats, and all base-rich				
Plough	Bare soil	Sandy or stoney depending on substrate	Future cereals or root crops	150	15
Uniform dry pasture	Botanically herb-rich on dry substrates	Uniform short sward	Grazing	1270	160
Coarse dry pasture	Shallow soils in rocky areas: dry substrates dominated by tussocky grasses	Uneven and often poached by animals	Poor grazing areas	440	180
Uniform wet pasture	As above but with more wetland species. Often occurs as late successional stage of drainage of wetter biotopes	Often poached but generally uniform conditions	Grazing	200	250
Coarse wet pasture	High incidence of <i>Juncus</i> and <i>Cirsium</i> spp. <i>Caltha palustris</i> dominant with tussocky grasses and sedges	Wet substrates and uneven swards	Poor grazing areas	650	185
Agriculturally intensified pasture	Dominated by <i>Lolium perenne</i>	Generally uniform	Hay and silage production in summer	215	5
Acid heath biotopes	Generally overlying rocky areas and mimic montane dwarf-shrub biotopes				
Short wet heath	Wet dwarf shrub heath	Vegetation <20 cm	Common grazings. Usually over-grazed or over-burnt	410	15
Short dry heath	Dry dwarf shrub heath	Vegetation <20 cm	Common grazings. usually over-grazed or over-burnt	610	225
Deep heath	Dominated by <i>Calluna</i> , <i>Erica tetralix</i> , <i>E. cinerea</i> , <i>Vaccinium</i> , <i>Empetrum</i> and <i>Eriophorum</i> spp.	Vegetation height 20 cm-1 m, sometimes deeper	Low intensity grazing	255	2030
Wet acidic grassland	Dominated by <i>Molinia caerulea</i> , <i>Nardus stricta</i> , <i>Juncus squarrosus</i> , <i>Tricophorum</i> and orchid spp.	Badly drained acid soils	Grazing intensity modifies floristics	120	1020
Dry acidic grassland	Dominated by <i>Nardus</i> , <i>Molinia</i> , <i>Deschampsia</i> , <i>Calluna</i> absent or sub-dominant	Well drained dry acid soils	Grazing, intensity modifies floristics	490	670
Modified blanket bog	Blanket bog with variable depth of peat substrate. Variable proportions dwarf shrubs, <i>Eriophorum</i> , <i>Molinia</i> and bog pools	Uneven	Past peat-cutting or other human impact has modified	15	950
Other biotopes					
Reed beds	Dominated by <i>Phragmites australis</i>	Ditches and more extensive waterlogged soils	None	25	25
Iris beds	Dominates by <i>Iris pseudocurus</i>	Often in wet field corners	None	200	220
Marsh and fen	Very wet with standing water, dominated by floating/emergent vegetation e.g. <i>Menyanthes trifoliata</i> , <i>Caltha palustris</i> , and <i>Juncus</i> spp.	Variable, includes overgrown ditches	Some limited grazing	105	0
<i>Juncus</i> beds	Continuous areas of <i>Juncus</i> spp. in wet areas. Usually <i>J. effusus</i> , or <i>J. inflexus</i> with <i>J. conglomeratus</i> occasional	Uneven	Often results from grazing of other biotopes	195	35
Old runways	War-time runways st in dry machair	Break-up and decay have created shingle-like areas	None	2	0
TOTAL AREAS				7487	7030



Figure 2. Loch a'Phuill survey site on Tiree showing locations of breeding wader territories (closed circle = Lapwing (72), square = Redshank (20), triangle = Oystercatcher (23) and open circle = Dunlin (5)).

order to determine the number and locations, of pairs of breeding waders. This was taken as the largest number recorded on any single visit. However, during the visit when peak numbers were found there were occasional pairs that, although detected on other visits, were not seen. Thus, any pairs that were clearly additional to ones recorded on that visit were added to the maximum count on the basis of evidence from other visits to give an aggregate total.

Sites were specifically surveyed for Snipe between 24 May-9 June 1988, when they were visited twice soon after dawn and twice in the evening (when greatest drumming activity occurs: Green 1985, Reed 1986). All sites were visited by two observers who walked 100 m apart and recorded detailed locations of drumming birds, nests, and flushed and calling birds. Habitat use was determined by observations of drumming Snipe landing, observations of flushed and calling birds, and locations of nests. Care was taken not to

double-record in areas of high density. Further details of bird survey methods are given by Shepherd *et al.* 1988.

A total of 1450 ha was surveyed on Tiree and 1420 ha on Coll representing *c.*20% of each island. Not all was machair, and on Coll especially, a large extent of heath and moorland was surveyed. Vegetation maps were compiled for the whole of both isles. Twenty categories were used in the analysis: dunes, dry machair, wet machair, *Phragmites* beds, iris beds, marsh/fen, *Juncus* beds, plough, uniform dry pasture, coarse dry pasture, uniform wet pasture, coarse wet pasture, agriculturally intensified pasture, short wet heath, short dry heath, deep heath, wet acid grassland, dry acid grassland, modified blanket bog and old runways. These are briefly described in Table 1 and further details are given by Shepherd *et al.* 1988. It is important to note that the biotope classification was devised specifically to investigate selection by breeding waders. Thus biotopes such as coastal cliffs,



Figure 3. Loch a'Phuill survey site on Tiree showing boundaries of mapped wader habitat types (full details of habitats given by Shepherd *et al.* 1989). Note the intimate habitat mosaic in the north and east of the site associated with areas of crofts, whilst the south and east of the site has more uniform dune and dry machair habitat. These relate to areas of higher and lower wader densities respectively (Fig. 2).

open water etc., important for other groups of birds, were not included as they did not contain breeding waders. Beaches were not surveyed, although these habitats were of importance for breeding Ringed Plovers and Oystercatchers.

Combination of wader distribution maps (Fig. 2) and habitat maps (Fig. 3) for each of the sample sites, allowed comparison of breeding densities for each species between all habitats. Total wader populations were estimated for each isle by calculating the total area of each biotope and extrapolating using the densities of waders found in the sample survey sites.

Results

Wader breeding densities within habitats

Table 2 gives breeding densities for each wader

species in each wader habitat as well as overall breeding densities for all species combined. Habitats are listed in decreasing order of overall breeding densities.

Lapwings *Vanellus vanellus* were more ubiquitous than other waders (Table 2). Particularly high densities (>29 pairs/km²) were found on dry machair, wet machair, coarse wet pasture, plough and short wet heath, with moderate densities (16-28 pairs/km²) on marsh/fen, coarse dry pasture and uniform dry pasture and lower densities (<16 pairs/km²) on most other habitats. No Lapwings bred in reed-beds or on the old runways at Tiree Airport.

The highest breeding densities (>10 pairs/km²) of Redshanks *Tringa totanus* were found in wetter habitats, particularly marsh/fen, wet machair, reedbeds (actually breeding in the sparse, short *Phragmites*, not the denser beds), coarse wet pasture and iris beds. A few pairs

Table 2. Breeding densities (pairs/km²) of waders found within habitats surveyed on Tiree and Coll. Habitats are listed in order of decreasing overall wader densities, and those containing above average densities for individual species are indicated by an asterisk.

Wader habitat	Overall wader density	Lapwing	Redshank	Oystercatcher	Ringed Plover	Dunlin	Snipe
Old runways ¹	2500.0			100.0*	2400.0*		
Marshes and fens	750.9	22.9*	128.4*	9.2*		90.4*	326.9*
Wet machair	220.9	29.2	8.4*	9.2*		71.5*	61.5*
<i>Phragmites</i> beds	163.8		15.3*				99.0*
Coarse wet pasture	135.5	36.5*	12.4*	8.5*	1.3	5.6	47.9*
Short wet heath	107.2	29.0*			14.5*	49.2*	14.5
Wet acidic grassland	93.8	3.3	2.4	0.9		11.9*	50.8*
Dry machair	66.8	37.7*	3.7	8.0*	1.7	10.7*	3.7
Plough	57.4	30.6*			26.8*		
Uniform wet pasture	45.0	10.2	1.2	3.8*			
Coarse dry pasture	40.3	17.6*	4.4*	8.8*	4.4*		2.6
<i>Juncus</i> beds	40.0	6.1	3.1	6.1*			15.4
Dry acidic grassland	37.0	8.1	2.0	5.4*		2.7	11.5
Iris beds	29.0	10.6	10.6*	2.6		2.4	2.7
Uniform dry pasture	22.9	16.3*	1.8	3.7*	0.4	0.7	22.3*
Short dry heath	18.7	7.8	3.1	7.8*			
Intensified pasture	17.5	7.0	3.5	7.0*			
Blanket bog	15.0	0.4	0.4				7.1
Dunes	6.8	4.9	1.2	0.6			
Deep heath	6.8	0.6	0.1			0.5	3.7
Overall mean density		11.8	4.1	3.2	2.2	8.5	17.1

¹Located on dry machair.

bred in drier habitats but most of these were associated with small pools nearby. Some adults led newly hatched chicks to distant feeding areas >1 km from nests. A number of marked concentrations of pairs with young occurred in wetland areas, particularly those with iris beds providing cover. These were often coastal.

A very high density (100 pairs/km²) of breeding Oystercatchers *Haematopus ostralegus* was found on abandoned wartime runways at Tiree Airport, the broken concrete there providing excellent camouflage for nests and eggs. However, much use was made of adjacent dry machair and perhaps the old runways should be regarded as only a habitat component in this location. The species showed no particular preference for other habitats.

As with Oystercatchers, a very high density of Ringed Plovers *Charadrius dubius* was found on the old runways. Ringed Plovers characteristically nested on stony ground and the terrain provided excellent camouflage for nests and eggs. Much use was also made of adjacent dry machair areas. A high density (27 pairs/km²) was also found on ploughed land which was clearly the species' second-preferred choice of habitat. Lower densities (<15 pairs/km²) were found in several other habitats although actual nest locations were probably associated with small areas of stony or sandy terrain within these.

Dunlin *Calidris alpina* characteristically prefer to breed in moist, boggy or marshy ground, especially when interspersed with pools. The highest densities (>70 pairs/km²) occurred on marsh/fen and wet machair with moderate densities (49 pairs/km²) on short wet heath. Some birds were found breeding in several other habitats but generally associated with small pools or wetter areas.

By far the greatest density of breeding Snipe *Gallinago gallinago* was found on marsh/fen (327 pairs/km²) although high densities were also found in marshy *Phragmites* beds (99 pairs/km²) (where the *Phragmites* was sparse and short). Moderate densities (48-62 pairs/km²) were found on wet machair, wet acidic grassland and coarse wet pasture.

Four pairs of Curlew *Numenius arquata* were found breeding in deep heath and blanket bog habitats on Coll. This species is a recent colonist. It is also increasing in numbers throughout the Western Isles (Buxton 1987), following first records of territorial birds in the Uists in 1984 (Pienkowski unpubl.).

When all wader species were considered together, the old disused runways on Tiree appear to be by far the most preferred breeding 'habitat' holding a density of 2500 pairs/km². However, only a very small area of this habitat exists, holding just breeding Oystercatchers and Ringed Plovers. Furthermore, the birds on these narrow

strips undoubtedly make great use of the adjacent habitats (largely dry machair) for feeding and other activities. Clearly old runways alone would be unable to support all the needs of these species during the breeding season!

The remaining results show clearly that two habitat groups are strongly preferred and responsible for the very high numbers of birds breeding: wetlands and machair. Within these groups, marsh/fen, wet machair, reedbeds, coarse wet pasture, short wet heath, wet acidic grassland and dry machair all hold densities of breeding waders in excess of 66 pairs/km².

The very wet marsh and fen areas, are clearly extremely important, holding at least 750 pairs of breeding waders per km². This habitat is especially important for Snipe, Dunlin, Redshank and Lapwing, and grades into both wet machair and *Phragmites* beds, both of which are important in their own right. Wet machair is especially important for Snipe, Dunlin, Redshank and Lapwing whilst marshy *Phragmites* beds hold large numbers of Snipe and Redshank. Coarse wet pasture is especially favoured by Lapwing, Redshank and Snipe, whilst short wet heath holds high densities of Lapwing and moderate densities of Dunlin. Wet acidic grassland holds a high density of Snipe. Dry machair holds all six breeding species, but its high overall density is largely due to very high densities of Lapwing.

Habitats generally least preferred on Tiree and Coll are deep heath and dunes, with low densities also found on modified blanket bog, agriculturally intensified pastures and short dry heaths (Table 2).

For five broad habitats which are sub-divided into wet and dry variants (machair, coarse pasture, short heath, acidic grassland and uniform pasture), the densities of breeding waders in all cases are significantly greater in the wet type than in the dry type. The average breeding

density in the five wet habitat variants above (120.5 pairs/km²) is over three times greater than on the equivalent dry habitats (average = 37.1 pairs/km²).

Total wader populations

Estimates of extrapolated total wader populations for each island are given in Table 3 and indicate that a total of 6020 pairs of breeding waders occur on Tiree and 1330 on Coll. The derivation of these totals is discussed by Shepherd *et al.* 1988. Table 3 also gives estimates of national populations (JNCC unpublished; Stroud *et al.* 1990) and the proportion of British populations breeding on each island.

It is clear that both islands, and especially Tiree, are of very major importance for a rich assemblage of breeding waders. The populations of Lapwing, Redshank, Oystercatcher, Ringed Plover, Dunlin and Snipe all of national importance (>1% of national total).

Discussion

Habitat associations of all species were very similar to those found in the Uists where wetland and machair habitats also hold greatest numbers of birds (Fuller *et al.* 1986). However, in the Uists, much of the machair is subject to an arable-fallow cultivation cycle (Jackson 1988); about 25% of the dry machair plain and up to 10% of the wetter machair areas. Initial single surveys there found that densities of most breeding waders were greater on the arable areas than on fallow. However, longer-term monitoring (Fuller & Percival 1988) has shown that in any one location, breeding numbers are not associated with any particular stage of the cultivation/fallow cycle (i.e. habitat related), but rather constant in particular local areas. These areas

Table 3. Present estimates of British breeding wader populations (from Stroud *et al.* 1990), estimated total breeding wader populations on Tiree and Coll and percentages of national populations (in parentheses) breeding on Tiree and Coll. All totals in pairs.

Species	British population	Tiree	Coll
Lapwing	215000	3000 (1.4%)	500 (0.2%)
Redshank	32500	600 (1.8%)	125 (0.4%)
Oystercatcher	38000	620 (1.6%)	150 (0.4%)
Ringed Plover	8400	250 (3.0%)	30 (0.3%)
Dunlin	9150	350 (3.8%)	20 (0.2%)
Snipe	30000	1200 (4.0%)	500 (1.7%)
Curlew	35500	0	4 -
Total		6020	1330

clearly have differing underlying characteristics which seem to affect wader distributions. Alternatively this may be an effect of natal philopatry such that birds return to areas where they are reared and/or first breed.

Old runways aside, the greatest concentration of breeding waders were found on marshes and fens, wet machair, *Phragmites* beds, coarse wet pasture, short wet heath and wet acidic grassland. It is the traditional island crofting agriculture that has maintained the mosaic of these important areas. Should extensive drainage and intensification occur, these habitats would change into dry pastures, dry heath and intensified pasture - habitats holding much lower densities of breeding birds.

The low-intensity crofting agriculture is based around an extensive pastoralism. Large numbers of cattle are reared, especially on Tiree, and these are grazed on the machair throughout the winter (Harrison 1989). Their grazing and dunging maintains these permanent grasslands in a suitable state for breeding waders. The role of cattle in creating and maintaining micro-topographical features important in nest site selection, and nest and chick camouflage has been highlighted by Jackson (1988). Pastoralism also results in some small-scale arable cultivation for hay and other cattle fodder, as well as limited cereal growing. Although these ploughed areas are largely avoided by waders on Coll and Tiree, they provide suitable conditions for traditional birds of weedy arable fields such as Corn Bunting *Emberiza calandra* and the internationally rare and endangered Corncrake *Crex crex* (Cadbury 1989).

Agricultural intensification also becomes particularly damaging to bird populations where it encourages large-scale uniformity of habitat. Many breeding waders use a variety of habitats during the course of the breeding season, a particularly good example being the Redshank. The species prefers a mosaic of habitats; rank vegetation to provide nesting cover, with suitable wetland feeding sites nearby as observed in the Outer Hebrides (Chandler & Walker 1985, Jackson 1988). Land-use changes which encourage large-scale agricultural uniformity will be less attractive to waders than the maintenance of existing small-scale habitat mosaics. Since there is no information on breeding productivity in different habitats on the islands, and since areas of highest breeding density do not always equate to areas of highest productivity (Stroud *et al.* 1990), this is another reason to approach conservation of these wader habitats at an island-wide scale.

Virtually the whole European extent of machair has been surveyed for breeding waders since 1983. A survey of breeding waders on machair in northwest Ireland between north Donegal and Galway Bay (Nairn & Sheppard 1985) revealed nine species of breeding waders, although densities were much lower than those on Tiree, Coll or the Uists. Furthermore, Oystercatchers were almost absent and there were small numbers of Redshank and Ringed Plover. The machair there differs in being both smaller in total area and much more fragmented than in the Uists. A survey of breeding waders on marsh and marginal grassland areas of Orkney (Campbell *et al.* 1988) revealed low densities compared to Tiree and the Uists and it is clear that comparable machair type habitats are extremely restricted within both the Orkney and Shetland island groups (Berry & Johnston 1980). On Islay, only a limited area of machair occurs and although important as one component of an important mosaic of traditionally managed biotopes (Bignal *et al.* 1989), in absolute terms it only holds small numbers of waders.

Fuller *et al.* (1986) concluded that breeding wader communities of the Uist machairs were unique in Europe for their species composition and very high densities of breeding birds. Comparable and generally slightly higher overall densities were found on Tiree and Coll. These Hebridean machairs hold large populations, have valuable species assemblages and are important in maintaining the range of several breeding waders (and other waterfowl: Stroud 1989) within the British Isles. They are thus of international conservation importance (Stroud *et al.* 1990).

Comparisons of the detailed relationship between certain agricultural activities and wader densities in different machair areas are confounded by geographical differences in density indicated above. The type of crofting on the Uists differs from that on Coll and Tiree in several respects, and without further work specifically relating agriculture to waders it is not possible to clearly distinguish effects. It is clear, however, from comparisons between habitat types on Coll and Tiree, that more intensive forms of uniform agriculture are less attractive to breeding waders than the mosaics of habitats (often wetlands) resulting from low-intensity crofting.

Machair aside, there are very few other locations in Britain holding comparable densities of breeding waders. Saltmarshes of the Ribble Estuary and the Wash hold over 70 pairs/km² (mainly Redshanks: Hale & Ashcroft 1982) and

some North Kent grazing marshes hold over 50 pairs/km² (Williams *et al.* 1983), but in all these cases birds breed in fairly small areas. The Ouse and Nene Washes, the Derwent Ings and the Somerset Levels are also major lowland wader breeding sites, but on Tiree and Coll densities are even higher and species assemblages are different (cf. Fuller *et al.* 1986).

Elsewhere in Europe, densities of breeding waders commonly found on wetlands on Tiree and Coll would be considered quite exceptional, recorded from only a few areas of Iceland (references in Kirby & Gudmundsson 1987), very rich natural fen systems in Poland (Dyrzc & Witowski 1987) and some areas of the

Low Countries (Beintema 1983).

Nowhere in Europe outwith the Southern Isles, Tiree, and Coll, do Oystercatchers, Ringed Plovers, Lapwings, Dunlin, Snipe and Redshank breed in such numbers and in such close proximity. Their continued conservation is of great importance. It is important to ensure that the traditional forms of crofting agriculture, which have maintained this intimate mosaic of wetland bird habitats, are sustained, for without it, the suitability of most areas for breeding waders will decline. An Environmentally Sensitive Area-type scheme for the Inner Hebrides would benefit conservation by encouraging existing sympathetic crofting practises.

The survey was funded by the Chief Scientist Directorate of NCC as part of its Moorland Bird Study (Project No. Bi202). We are greatly indebted to the many crofters, farmers and landowners for allowing unrestricted access to their land. Without their assistance and consent, this survey would not have been possible.

Field survey was principally undertaken by Mick Green and Andy Knight, with assistance from Keith Bailey, Roger Broad, Mike Everett, James Cadbury, Peter Clement, Jerry Moore, Carl Mitchell, Martin Nugent, John Palfrey and Mike Pienkowski. Mick Green and Andy Knight also assisted with analysis.

Peter Wormell (NCC), Roger Broad (RSPB) and Donald Harrison (West of Scotland College of Agriculture) kindly gave much help and advice during the preparation of the survey. We are particularly grateful to Dr Mike Pienkowski for his support and encouragement during the survey and also to Dr Eric Bignal, Mick Green and Andy Knight for helpful comments on an early draft.

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K.B. Shepherd and David A. Stroud¹, Ornithology Branch, Chief Scientist Directorate, Nature Conservancy Council, Northminster House, Peterborough, PE1 1UA.

¹Currently: Ornithology and Landscape Ecology Branch, Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough, PE1 1JY.