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**Assessing population change of  
breeding Ringed Plovers in the UK  
between 1984 and 2007**

**Authors**

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## 1. INTRODUCTION

The 2007 Breeding Little Ringed Plover (*Charadrius dubius*) and Ringed Plover (*C. hiaticula*) Survey was the first UK-wide survey of these two species since 1984. That survey revealed a total of c. 8,540 pairs of Ringed Plover in Britain (Prater 1989). England held about 2,390 pairs, Wales an estimated 220 pairs, Northern Ireland 130 pairs and Scotland c. 5,800 pairs, i.e. two thirds of the total population. The 1984 survey also revealed a population of 608-631 pairs of Little Ringed Plover (confined to England and Wales: Parrinder 1989). The latest population estimate of 825-1,070 summering pairs comes from the 1988-91 *New Atlas of Breeding Birds in Britain and Ireland* (Gibbons *et al.* 1993).

The 2007 survey not only provides the opportunity to update population estimates for the two species, but also to assess how the species' populations have changed and the likely influences. Breeding Little Ringed Plovers and Ringed Plovers are particularly prone to disturbance, as with other plover species (Liley 1999, Lafferty *et al.* 2006, Tratalos *et al.* 2005, Liley & Sutherland 2007, Montalvo & Figuerola 2006, Yasué & Dearden 2006, Long *et al.* 2008), and it is thus likely that the species will have fared relatively less well where human population densities are greatest. In this report we examine large-scale spatial variation in population change of Ringed Plover between 1984 and 2007 and investigate whether population change in England and Wales was related to human population density. Change is evaluated by comparing the numbers of pairs recorded on sites surveyed in both 1984 and 2007. This approach is less suitable for assessing population change of Little Ringed Plovers, as their breeding habitats are far more ephemeral. Thus sites occupied in 1984 may have become unsuitable for breeding, for example due to vegetation growth, but birds simply redistributed to other newly created local sites.



## 2. METHODS

The 2007 Breeding Plover Survey used a dual approach of surveying both a set of 'Key sites' and 'Sample tetrads'. The latter were covered to provide estimates of the number of plovers away from these Core sites and thus ensure completeness of the overall population estimates.

Key sites were identified as sites that were known to be previously occupied, either from recent bird reports or the 1984 survey. Here we use data from those sites surveyed both in 1984 and 2007 to examine change at a county level.

The 2007 survey was organised through the BTO's Regional Network. For Ringed Plover, volunteer observers made two survey visits to each site between 15 April to 14 May and 15 May to 30 June. For Little Ringed Plover, three visits were made between 15 April to 14 May, 15 May to 14 June and 15 June to 15 July. For each species, observers were asked to count the adults present (and plot registrations on a map) and estimate the number of breeding pairs.

In total, around 65% of the 4,171 key sites and 63% of the 1,521 sample tetrads were covered for Ringed Plover. For Little Ringed Plover 67% of the 1,137 key sites and 64% of the 1,357 sample tetrads were covered.

For the current analyses, we compare data on the numbers of pairs of Ringed Plover on key sites surveyed in 2007 to counts from the same sites in 1984. In undertaking this analysis, it should be noted that in the 1984 survey, data were not available on the spatial extent of all sites. For coastal sites, start and end points of count sections were usually provided; however, for inland sites only central grid references were given. Thus in identifying the key sites for the 2007 survey (and matching totals from sites covered in both surveys) it was necessary to make some assumptions about their spatial extent.

Data on the numbers of pairs of Ringed Plover on sites surveyed both in 1984 and 2007 are first summarised by county. We also examine whether changes in numbers on coastal and inland sites were related to the human population in the county. Previous studies have shown that, particularly on the coast, recreational disturbance may affect the species' distributions and numbers (and breeding success: Liley 1999, Tratalos *et al.* 2005, Liley & Sutherland 2007). Generalised Linear Models related the proportional change in the number of pairs of Ringed Plover on each site to the human population density in the county (taken from the 1991 population census: Office for National Statistics 2003) and also the change in human population density between the 1991 and 2001 censuses. Models (run using Proc GENMOD: SAS Institute Inc. 2002-2004) assumed a Poisson error distribution and a log-link function for the count in 2007, used the natural logarithm of the count in 1984 as an offset and were corrected for overdispersion. Analysis was restricted to England and Wales to minimise the possibility that any relationship was simply due to, for example, a latitudinal trend in population change rather than human population density and because of the very different pressures facing breeding Ringed Plovers in Scotland (e.g. Jackson & Green 2000, Jackson *et al.* 2004).





### 3. RESULTS

Changes in the numbers of Ringed Plovers at inland and coastal sites surveyed both in 1984 and 2007 are summarised by country and for England, also county, in Table 1. The overall pattern is one of decline, with the largest decreases at inland sites. This difference might be an artefact, however, resulting from a potentially greater turnover in suitable breeding habitat in inland areas and thus the changes reported for inland sites should be treated with caution.

On coastal sites surveyed both in 1984 and 2007, declines of 43%, 38% and 50% have occurred in England, Scotland and Northern Ireland respectively. In Wales and the Isle of Man, there were lesser declines of just 6% and 9% respectively. Note, for Scotland, this comparison excludes data from North Uist, South Uist and Benbecula – changes in these important areas are reported more fully elsewhere (see discussion).

Inland, declines of 76%, 63% and 100% have occurred in England, Scotland and Northern Ireland respectively. No Ringed Plovers were recorded at inland sites in Wales and the Isle of Man that were surveyed both in 1984 and 2007.

Figure 1 shows how changes in the numbers of coastal and inland breeding Ringed Plovers varied across England and Wales and also how these changes relate to human population density. In general, declines were greater in the south and east of England. The only increases were noted in Avon (coastal), Cheshire (inland), Lancashire (coastal), Cumbria (both inland and coastal) and Tyne and Wear (coastal). Changes were, though, unrelated to either (county) human population density (coastal:  $F_{1,107} = 0.93$ ,  $P = 0.34$ ; inland:  $F_{1,66} = 0.58$ ,  $P = 0.45$ ) or change in human population density (coastal:  $F_{1,107} = 0.39$ ,  $P = 0.53$ ; inland:  $F_{1,66} = 1.13$ ,  $P = 0.29$ ).



#### 4. DISCUSSION

The changes reported here suggest a large decline in the population of Ringed Plovers in the United Kingdom between 1984 and 2007. As the figures are based on changes on individual sites, however, they may overestimate losses. At inland sites, in particular, changes in habitat may have led to losses from sites surveyed in 1984, which could have been compensated for if new habitat (e.g. gravel pits) were created elsewhere.

The declines reflect the results of earlier regional studies. Rooney & Eve (1993), for example, reported an overall decline of 23% (from 541 to 419 pairs) in Norfolk between the 1984 national survey and a county survey in 1993. Here, numbers fell by 23% on beach and sand dune habitats (where the majority of the county population occurs), though increased by 33% on other habitats next to the coast and (allowing for poor coverage) numbers were thought to be stable inland. A decline of 53% (from 2,047 to 954 pairs) was also reported between 1983 and 2000 in the important machair habitats of the Outer Hebrides, a stronghold for breeding Ringed Plover in the UK (Jackson *et al.* 2004). The decline in numbers of Ringed Plover and other waders here, though, have been particularly associated with egg predation by introduced Hedgehogs *Erinaceus europaeus* (see also Jackson & Green 2000).

Information on changes in the populations of breeding Ringed Plovers on the four Scottish Special Protection Areas (SPAs) designated for the species – North Uist Machair & Islands, Papa Stour, Sléibhteann agus Cladach Thriodh (Tiree Wetlands & Coast) and South Uist Machair & Lochs – and North Uist, South Uist and Benbecula as a whole, have been reported separately to Scottish Natural Heritage (Conway *et al.* 2008).

Changes in numbers on the six English sites for which breeding Ringed Plovers are designated features – the Colne Estuary (Mid-Essex Coast Phase 2) and North Norfolk Coast SPAs and the Chesil & The Fleet, Dengie, Hamford Water and North Solent Sites of Special Scientific Interest – will be reported with the new population estimates.

Some broad patterns of change are apparent from the results reported here. In addition to the apparent difference in change between inland and coastal sites, declines were greater in England, Scotland (excluding North Uist, South Uist and Benbecula) and Northern Ireland than in Wales and the Isle of Man. Within England, declines were also greater in the south and east of England and the only increases were noted in west and north (Avon, Cheshire, Lancashire, Cumbria and Tyne and Wear).

Probably due to the broad-scale approach used, no relationships were found between Ringed Plover population change and either human population density or change in human population density. Previous studies have shown that Ringed Plover numbers may be reduced close to sources of recreational disturbance (Liley 1999, Tratalos *et al.* 2005, Liley & Sutherland 2007) and a finer scale analysis might be expected to reveal relationships between population change and proximity to urban areas, for example. During the 2007 survey, data was also collected on the locations of pairs and this information (once incorporated into a Geographical Information System) would allow a much more detailed, but country-wide, analysis of habitat preferences and the effects of disturbance on distribution.

It might be expected that declines would be greater on the coast due to recreational disturbance. An earlier study in north-west England (Briggs 1983), for example, reported declines on coastal habitats, with the exception of saltmarsh, but increases on inland river beds. However, declines may have occurred at inland sites counted in 1984 due to changes in the suitability of habitat, for example due to vegetation growth on river shingle and around man-made water bodies. In Lancashire, Ringed Plovers have been lost from river bed sites and, as in much of the England, from gravel pits and reservoirs. The new population estimates to be produced from the 2007 survey should indicate to what extent these losses have been compensated for by increases elsewhere.

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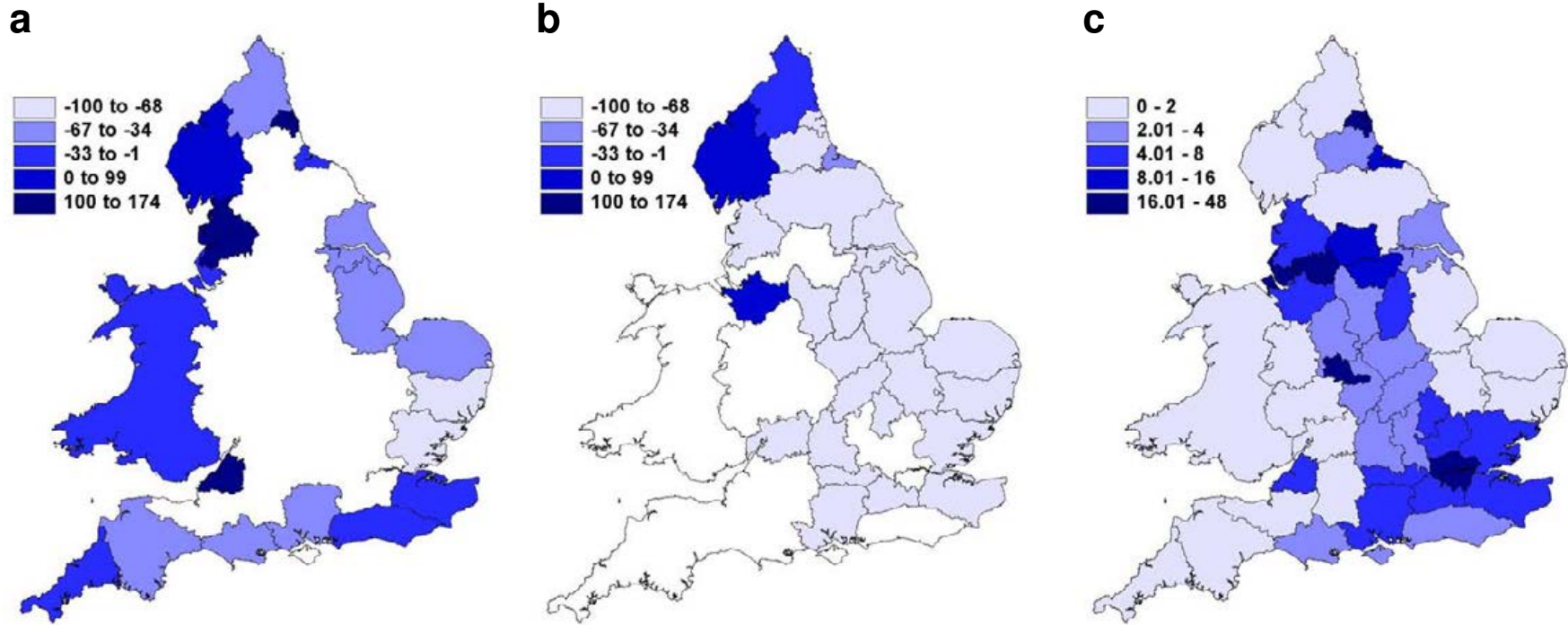
**Table 1.** Summed numbers of pairs of Ringed Plover on sites surveyed in both 1984 and 2007.

Country / county	Coastal / inland	1984	2007	Change (%)
<b>ENGLAND (TOTAL)</b>	Coastal	1343	764	-579 (-43)
	Inland	158	38	-120 (-76)
Avon	Coastal	4	11	7 (175)
	Inland	0	0	0
Bedfordshire	Coastal	0	0	0
	Inland	10	0	-10 (-100)
Berkshire	Coastal	0	0	0
	Inland	4	0	-4 (-100)
Buckinghamshire	Coastal	0	0	0
	Inland	0	0	0
Cambridgeshire	Coastal	0	0	0
	Inland	3	0	-3 (-100)
Cheshire	Coastal	0	0	0
	Inland	11	13	2 (18)
Cleveland	Coastal	39	26	-13 (-33)
	Inland	2	1	-1 (-50)
Cornwall and the Isles of Scilly	Coastal	20	16	-4 (-20)
	Inland	0	0	0
Cumbria	Coastal	35	51	16 (46)
	Inland	6	7	1 (17)
Derbyshire	Coastal	0	0	0
	Inland	2	0	-2 (-100)
Devon	Coastal	5	3	-2 (-40)
	Inland	0	0	0
Dorset	Coastal	30	13	-17 (-57)
	Inland	0	0	0
Durham	Coastal	0	0	0
	Inland	1	0	-1 (-100)
Essex	Coastal	22	7	-15 (-68)
	Inland	11	0	-11 (-100)
Gloucestershire	Coastal	0	0	0
	Inland	2	0	-2 (-100)
Greater Manchester	Coastal	0	0	0
	Inland	0	0	0
Hampshire	Coastal	149	80	-69 (-46)
	Inland	14	2	-12 (-86)
Herefordshire and Worcestershire	Coastal	0	0	0
	Inland	0	0	0
Hertfordshire	Coastal	0	0	0
	Inland	2	2	0
Humber	Coastal	35	21	-14 (-40)
	Inland	7	0	-7 (-100)
Isle of Wight	Coastal	0	0	0
	Inland	0	0	0
Kent	Coastal	140	105	-35 (-25)
	Inland	4	0	-4 (-100)
Lancashire	Coastal	6	14	8 (133)
	Inland	30	3	-27 (-90)
Leicestershire	Coastal	0	0	0
	Inland	1	0	-1 (-100)
Lincolnshire	Coastal	92	54	-38 (-41)
	Inland	5	0	-5 (-100)

London	Coastal	0	0	0
	Inland	0	0	0
Merseyside	Coastal	7	5	-2 (-29)
	Inland	0	0	0
Norfolk	Coastal	522	271	-251 (-48)
	Inland	9	0	-9 (-100)
North Yorkshire	Coastal	0	0	0
	Inland	3	0	-3 (-100)
Northamptonshire	Coastal	0	0	0
	Inland	2	0	-2 (-100)
Northumberland	Coastal	49	22	-27 (-55)
	Inland	13	9	-4 (-31)
Nottinghamshire	Coastal	0	0	0
	Inland	1	0	-1 (-100)
Oxfordshire	Coastal	0	0	0
	Inland	5	0	-5 (-100)
Shropshire	Coastal	0	0	0
	Inland	0	0	0
Somerset	Coastal	0	6	6 ( )
	Inland	0	0	0
South Yorkshire	Coastal	0	0	0
	Inland	0	0	0
Staffordshire	Coastal	0	0	0
	Inland	0	0	0
Suffolk	Coastal	170	42	-128 (-75)
	Inland	4	0	-4 (-100)
Surrey	Coastal	0	0	0
	Inland	1	0	-1 (-100)
Sussex	Coastal	16	13	-3 (-19)
	Inland	0	0	0
Tyne and Wear	Coastal	2	4	2 (-100)
	Inland	4	0	-4 (-100)
Warwickshire	Coastal	0	0	0
	Inland	0	0	0
West Midlands	Coastal	0	0	0
	Inland	0	0	0
West Yorkshire	Coastal	0	0	0
	Inland	1	1	0
Wiltshire	Coastal	0	0	0
	Inland	0	0	0
<b>WALES</b>	Coastal	128	120	-8 (-6)
	Inland	0	0	0
<b>SCOTLAND<sup>1</sup></b>	Coastal	1164	716	-448 (-38)
	Inland	135	50	-85 (-63)
<b>NORTHERN IRELAND</b>	Coastal	60	30	-30 (-50)
	Inland	29	0	-29 (-100)
<b>ISLE OF MAN</b>	Coastal	70	64	-6 (-9)
	Inland	0	0	0

<sup>1</sup> Excludes North Uist, South Uist and Benbecula (and thus the North Uist Machair & Islands and South Uist Machair & Lochs SPAs).





**Figure 1.** Percentage change in the numbers of **a.** coastal and **b.** inland breeding Ringed Plovers in England and Wales between 1984 and 2007 (at sites covered in both surveys) and **c.** Human population density from the 1991 census (people / ha).