

Between-year changes in the wintering sites of Ruddy Turnstones *Arenaria interpres*: a response to diminished food resources?

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Individual Ruddy Turnstones *Arenaria interpres* have previously been found to be highly faithful to their wintering sites both within and between years. Here we describe between-year shifts (of 64–77 km) in the wintering sites of five birds colour-ringed in NE England. A local population decline following the cessation of sewage discharges suggests that four of these atypical movements might have been a response to diminished food resources. A fifth bird moved to the area with the presumed diminished resources, but then returned to its original wintering site.

INTRODUCTION

Ruddy Turnstones *Arenaria interpres* have previously been reported to be strongly site-faithful both within and between winters (Symonds *et al.* 1984, Metcalfe & Furness 1985, Whitfield 1985, Metcalfe 1986, Burton & Evans 1997, Eaton 2001, Pearce-Higgins 2001, Rehfish *et al.* 2003). Individuals typically forage within restricted home ranges throughout the winter (e.g. median 5.4 ha: Metcalfe 1986; median 6.6 ha: Burton 1995), roost within a few kilometres of feeding sites (e.g. <5 km: Burton 1995; <3 km: Pearce-Higgins 2001) and return to these same sites in subsequent winters.

However, these and other previous studies investigating site-fidelity in waders, using ring-recapture, colour-ringing or radio-tracking, may be limited in their conclusions because they either were short in duration or covered small study areas. Here, we describe records of shifts of Ruddy Turnstones between different wintering sites on the coast of NE England resulting from separate studies spread over more than 10 years. Possible reasons for these and other similar movements are discussed.

STUDY AREAS AND METHODS

The Ruddy Turnstones that winter in NE England have been the subject of a number of studies supervised by the late Peter Evans at the University of Durham over the last three decades. Individuals were first colour-marked (with unique permutations of colour-rings) in the Teesmouth/Hartlepool Bay area in the mid-1970s (Brearey 1980) and this programme of colour-ringing continued through the 1980s. Between the winters of 1991/92 and 1993/94, a further 61 Ruddy Turnstones were colour-ringed to supplement the marked population as part of a behavioural study based at Hartlepool.

A separate study began in winter 1995/96 investigating the impacts of changes in sewage disposal on Ruddy Turn-

stones and other waders wintering on the Northumberland coast, 50–80 km to the north. A total of 229 Ruddy Turnstones was colour-ringed as part of this study between the winters of 1996/97 and 2000/01.

The movements reported here result from the regular observations undertaken in the Hartlepool and Northumberland study areas (Fig. 1) and come from sightings made during winter (Nov.–Feb.) and thus exclude records of birds seen in autumn or spring when migration may have been under way. At Hartlepool, resighting data were collected between 1991/92 and 1993/94 during weekly monitoring of waders in a study area stretching from North Gare Sands (54°38'N, 1°10'W) to Blackhall Rocks (54°45'N, 1°16'W) and through other associated studies (Burton 1995). Less frequent observations were made in 1994/95 and subsequently in 1999/2000 during a study investigating the impacts of the closure of sewage outfalls on Hartlepool Headland (Eaton 2000).

In Northumberland, observations of colour-ringed Ruddy Turnstones were collected between 1995/96 and 2004/05 through twice monthly monitoring of the waders along 36 km from St. Mary's Island (55°04'N, 1°27'W) to Amble (55°20'N, 1°34'W) and also other associated work in this area (Eaton 2001, Fuller 2003). Less frequent observations were undertaken in 2002/03.

Parts of both study areas are included in the Northumbria Coast Special Protection Area (SPA), which was designated for its internationally important populations of wintering Ruddy Turnstones and Purple Sandpipers *Calidris maritima*, as well as its breeding Little Terns *Sterna albifrons* (Stroud *et al.* 2001). Much of the rest of the Hartlepool study area is also included in the Teesmouth and Cleveland Coast SPA.

To determine if recorded movements reflected changes in the numbers of Ruddy Turnstones at Hartlepool, monthly Wetland Bird Survey (WeBS) count data for Hartlepool Bay were modelled (in SAS using Generalized Linear Models:



GLMs) to produce indices showing numerical change between 1991/92 and 2002/03. Numbers of Ruddy Turnstones were related to tide height (which was important in determining numbers at the main roost site at Hartlepool West Harbour: Burton *et al.* 1996), month and year, the latter two variables being treated as categorical. The model assumed a Poisson distribution and specified a log link function; overdispersion was addressed by the application of a scale factor estimated from the square root of the Pearson's Chi-squared statistic divided by its degrees of freedom (Crawley 1993).

In addition to these analyses, British Trust for Ornithology ring-recovery data were obtained to determine whether other similar movements had previously been recorded for wintering Ruddy Turnstone; i.e. among birds caught (in the UK) within the defined winter period (Nov.–Feb.) and then recovered (either dead or alive) in the same or a subsequent winter.

RESULTS

Four Ruddy Turnstones colour-ringed at Hartlepool between 1985 and 1993 were seen in Northumberland in the winters of 2000/01 and 2001/02 (Table 1). All of these individuals had been resident at Hartlepool during at least one of the winters between 1991/92 and 1993/94.

The first individual (XS32036), ringed in November 1985, was recorded frequently at Hartlepool in 1991/92 and 1992/93 and was assumed to have been faithful to this area during those winters. In 1993/94, however, it was absent from its usual range for over three months in midwinter and during this time was seen 23 km to the north. A second individual (XR89199), ringed as a first-winter bird in February 1992, appeared faithful to Hartlepool both for the remainder of that winter and in 2002/03, but was not seen in the area subsequent to this. Two further individuals (SX04573 and SX04580), ringed in September 1993, also appeared faithful to the Hartlepool area in 1993/94; one of these was also recorded at Hartlepool during the less frequent surveys in 1994/95 and 1999/2000.

A fifth individual (SX83268), first metal-ringed at Amble in the Northumberland study area in March 1997, and then colour-ringed there in October 1998, was seen at Hartlepool in December 1999 (Table 1). Prior to this movement, this individual had appeared to be resident in the Amble/Hauxley area, having been recorded there frequently in winter 1998/99 and having returned there in November 1999. After being seen at Hartlepool, it was subsequently recorded in its original ringing area in 2000/01, 2001/02, 2003/04 and 2004/05.

All of the records represent between-winter movements between the Hartlepool and Northumberland study areas rather than instances of birds seen on autumn or spring passage from their usual wintering areas. It should be noted, though, that because each of the first four birds was only recorded once in Northumberland and monitoring had been discontinued at Hartlepool, it is unknown whether they might have subsequently returned there.

DISCUSSION

Although most Ruddy Turnstones are faithful to the same restricted home ranges within and between winters, previous studies have shown that a few individuals may occasionally move up to 20–30 km outwith their usual wintering areas. Burton & Evans (1997), for example, reported instances of

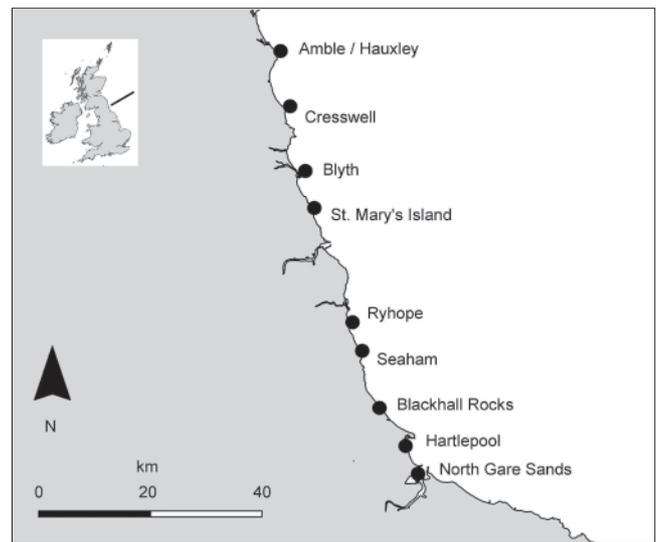


Fig. 1. The locations of the two study areas at Hartlepool (from North Gare Sands to Blackhall Rocks) and in Northumberland (from St. Mary's Island to Amble) together with other places named in the text.

individuals ringed in the Hartlepool study area being seen within a winter at Seaham and Ryhope, 19 and 23 km north of their usual ranges (see Table 1). Similar movements have been recorded by other studies in S Scotland and NE England (Summers *et al.* 1975, Whitfield 1985, Eaton 2001, Fuller 2003).

The extent of within-winter movements in Ruddy Turnstones is normally associated with the reliability of food supplies. In areas with more regular food supplies, individuals tend to have smaller home ranges (Whitfield 1985, Fuller 2003). Within-winter movements away from established home ranges also tend to increase in late winter and spring as food resources become depleted (Whitfield 1985, Metcalfe 1986).

In comparison to the above studies, the shifts in wintering site of 64 to 77 km recorded here are unusual. Given the number of birds colour-ringed at Hartlepool that would have still been alive at the time of the first four observations, they appear even more notable. Previous studies have estimated annual survival rates for Ruddy Turnstone of between 71–72% (for adults and first-winter birds: Burton & Evans 1997) and 86% (for adults only: Metcalfe & Furness 1985; for adults and first-winter birds: Pearce-Higgins 2001). Using these rates, only between two and 14 of the 61 Ruddy Turnstones colour-ringed at Hartlepool between 1991/92 and 1993/94 would have been expected to have been alive in winter 2001/02 when three of these birds were seen in Northumberland.

With the exception of the Northumberland ringed bird, it is unclear whether the cases reported here represent short-term movements away from an individual's usual home range or long-term switches in wintering site. Other observations, though, show that these records are not unique and together they highlight a degree of 'wanderlust' in wintering Ruddy Turnstones that has perhaps not been recognised hitherto. Other cases include an individual ringed as an adult at Ardrossan, Ayrshire on 6 February 1982 and seen on four occasions 214–219 km away between Blyth and Cresswell in Northumberland between December 1997 and May 1998.



Table 1. Ringing details and recorded histories of colour-ringed Ruddy Turnstones that moved between the Hartlepool and Northumberland study areas between winters.

Ring number	Winter	Observations	Distance from ringing site
XS32036	1985/86	Colour-ringed as an adult on 27.11.85 at Seaton Sands, Hartlepool (54°39'N, 1°10'W)	
	1991/92	Observed on a total of 34 days between 02.09.91 and 08.05.92 in the Hartlepool study area	0–6 km
	1992/93	Observed on a total of 40 days between 05.08.92 and 05.05.93 in the Hartlepool study area	0–6 km
	1993/94	Observed on a total of 15 days between 18.08.93 and 20.11.93 in the Hartlepool study area	0–6 km
		Observed on 03.12.93 at Salterfen Rocks, Ryhope (54°53'N, 1°21'W)	28 km
		Observed on a total of 4 days between 15.03.94 and 19.04.94 in the Hartlepool study area	0–6 km
	1994/95	Observed on 14.12.94 and 26.02.95 in the Hartlepool study area	0–6 km
	2000/01	Observed on 26.02.01 at Hauxley, Northumberland (55°18'N, 1°33'W)	77 km
XR89199	1991/92	Colour-ringed as a first-winter bird on 26.02.92 at Seaton Sands, Hartlepool (54°40'N, 1°11'W)	
		Observed on a total of 18 days between 28.02.92 and 11.05.92 in the Hartlepool study area	0–4 km
	1992/93	Observed on a total of 28 days between 27.07.92 and 16.02.93 in the Hartlepool study area	0–4 km
	2001/02	Observed on 07.12.01 at Amble, Northumberland (55°20'N, 1°34'W)	77 km
SX04573	1993/94	Colour-ringed as a first-winter bird on 23.09.93 at Hartlepool West Harbour (54°41'N, 1°12'W)	
		Observed on a total of 13 days between 08.10.93 and 03.05.94 in the Hartlepool study area	0–3 km
	1994/95	Observed on 25.01.95 and 12.03.95 in the Hartlepool study area	0–3 km
	2001/02	Observed on 01.12.01 at Cresswell, Northumberland (55°14'N, 1°32'W)	64 km
SX04580	1993/94	Colour-ringed as an adult on 23.09.93 at Hartlepool West Harbour (54°41'N, 1°12'W)	
		Observed on a total of 30 days between 29.09.93 and 03.05.94 in the Hartlepool study area	0–3 km
	1994/95	Observed on a total of 3 days between 19.08.04 and 12.03.95 in the Hartlepool study area	0–3 km
	1999/00	Observed on a total of 5 days between 03.10.99 and 23.02.00 in the Hartlepool study area	0–3 km
	2001/02	Observed on 07.12.01 at Amble, Northumberland (55°20'N, 1°34'W)	75 km
SX83268	1996/97	Metal-ringed (unaged) on 21.03.97 at Amble, Northumberland (55°20'N, 1°34'W)	
	1998/99	Colour-ringed on 20.10.98 at Amble (55°20'N, 1°34'W)	
		Observed on a total of 16 days between 30.10.98 and 30.04.99 in the Amble/Hauxley area	0–2 km
	1999/00	Observed on 02.11.99 at Amble	0 km
		Observed on 01.12.99 at Hartlepool West Harbour (54°41'N, 1°12'W)	75 km
	2000/01	Observed on a total of 6 days between 27.10.00 and 07.03.01 in the Amble/Hauxley area	0–2 km
	2001/02	Observed on 08.01.02 at Hauxley	2 km
	2003/04	Observed on 05.02.04 and 07.03.04 at Hauxley	2 km
	2004/05	Observed on a total of 5 days between 29.11.04 and 20.02.05 in the Amble/Hauxley area	0–2 km

Exceptionally, a Ruddy Turnstone ringed as a first-winter bird in Lothian in November 1986 (and retrapped later that winter: N. Clark pers. comm.) was recovered in December 1989 in North Carolina, USA (Mead & Clark 1990, Whitfield 2002). In addition to this movement, analysis of UK ring-recovery data revealed six further movements of the magnitude reported here (i.e. > 60 km) – one of a first-winter bird within a winter (i.e. November to February) and five of adults between winters.

What might have caused these movements? Whitfield (2002) suggested that old birds (at least 10 years) may change their movement patterns within winter; the reasons for this are unclear but could relate to a decrease in competitive ability with age. The Hartlepool and Scottish ringed Ruddy Turnstones that were seen in Northumberland were at least eight years old at the time of these records and some considerably older. It should be noted, though, that one of these birds, which appeared to have been resident at Hartlepool in its first two winters, was absent from this area in its third winter.

Alternatively, the movements might be caused by a change in habitat quality. At Hartlepool, harbour piers used by roosting waders at high tide were redeveloped in the early 1990s and an island built as a replacement roost site. Numbers of waders using this site declined between 1991/92 and 1993/94, probably largely due to human disturbance, though the extent to which this affected the local population is

uncertain. The decline in Ruddy Turnstone numbers at the roost site was not matched by a similar decline on local feeding grounds (Burton *et al.* 1996).

More notable are recent changes to coastal sewage discharges. Prior to the mid-1990s, untreated sewage was discharged into the sea from two outfall pipes along Hartlepool Headland. The resulting organic enrichment (from soluble nutrients and particulate organic matter) is likely to have considerably enhanced concentrations of invertebrate food in the area (Burton *et al.* 2002). These pipes were closed in April 1998 and sewage diverted through a new treatment plant to an outfall 4 km offshore at Seaton Sands, within Hartlepool Bay.

The possible impacts of this change on the population of Ruddy Turnstones wintering in the area were examined in 1999/2000 by Eaton (2000). Although he found that there had been no changes in numbers since 1991/92–1993/94 that could not be attributed to longer-term trends, examination of WeBS count data for Hartlepool Bay shows that, since his study, numbers have declined substantially (Fig. 2). The presence of the four colour-ringed Ruddy Turnstones from this area in Northumberland in 2001 suggests that this decline might have been partly due to emigration of adults. It is notable that no colour-ringed Ruddy Turnstones from Hartlepool were seen in the Northumberland study area in the three winters of intensive fieldwork that were undertaken there prior to 1998. The timing of the declines not long after



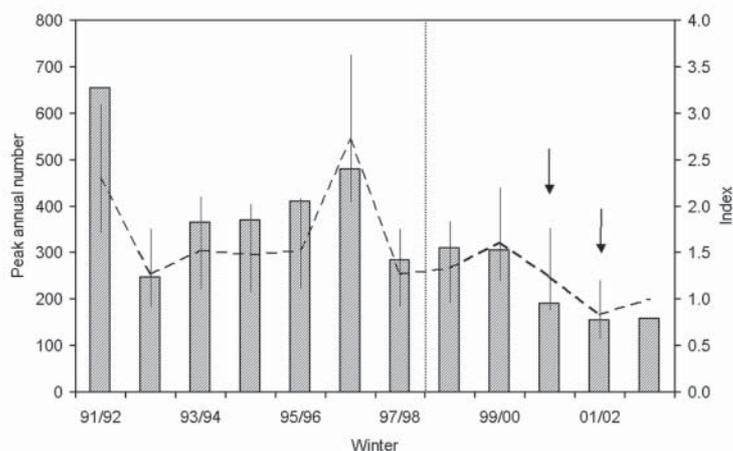


Fig. 2. Peak annual numbers (bars) and population indices (dashed line; with S.E.s (see text for index calculation method)) for Ruddy Turnstones at Hartlepool Bay as recorded by WeBS counts. The dotted line indicates the date that sewage was diverted from outfalls along Hartlepool Headland to a new offshore outfall. Arrows indicate the winters when individual colour-ringed Ruddy Turnstones, originally ringed at Hartlepool, were seen in Northumberland.

the cessation of sewage discharges suggests, therefore, that the movements of Ruddy Turnstones to Northumberland might have been a response to diminished food resources. It is apparent, however, from the movements of the individuals from Northumberland to Hartlepool and Scotland to Northumberland, that some individuals may switch wintering sites (at least temporarily) even when habitat quality has not changed.

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