Scottish Birds

THE JOURNAL OF THE SOC

Vol 28 June 2008

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Golden Eagle chick in nest © Clive R McKay

***Scottish Birds* – The Journal of the SOC**

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Scottish Birds, the official journal of the SOC, publishes original material relating to ornithology in Scotland. Papers and notes should be sent to The Editor, *Scottish Birds,* SOC, Scottish Birdwatchers' Centre, Waterston House, Aberlady, East Lothian EH32 0PY.

Scottish Birds is published each year in June. *Scottish Birds* is issued free to members of the SOC, who also receive the quarterly newsletter *Scottish Bird News*, the annual *Scottish Bird Report* and the annual *Scottish Raptor Monitoring Scheme report*.

Published by: The Scottish Ornithologists' Club, Scottish Birdwatchers' Centre, Waterston House, Aberlady, East Lothian EH32 0PY. Scottish Charity Reg. No SC 009859

Design by: Pica Design, 51 Charlton Crescent, Aboyne, Aberdeenshire AB34 5GN.

Printed by: Meigle Colour Printers Ltd, Block 1, Tweedbank Industrial Estate, Galashiels TD1 3RS

Rookeries in Caithness in 2007

ROBIN M SELLERS, HUGH CLARK & STAN LAYBOURNE

A full survey of Caithness rookeries was undertaken during the 2007 breeding season. This found a total of 34 rookeries varying in size between one and 791 nests, the majority built in stands of Sycamore, and containing a total of 6556 nests. This represents an increase of 7% over the previous survey of the county's Rooks in 1975. There was, however, much individual variation between rookeries in how numbers had changed between the 2 surveys. One large 1975 rookery was completely deserted and 3 others showed declines of over 50%. Human persecution was certainly responsible in one instance and disturbance of some kind was implicated in the others.

Introduction

Rookeries are either absent or occur at much lower densities in the Highlands than elsewhere in Scotland, except on the coastal hinterland along the north western side of the Moray Firth between Inverness and Wick. Between the latter place and Thurso densities are more typical of those in the Lowlands, and Caithness represents the most northerly part of Britain with good numbers and high densities of breeding Rooks *Corvus frugilegus* (Gibbons *et al* 1993, Thom 1986). The last complete survey of Caithness rookeries was carried out in 1975 as part of the national census undertaken in that year (Castle 1977, Sage & Vernon 1978), since when at least one large rookery is known to have disappeared, whilst Manson (2002) mentions that there is anecdotal evidence from local landowners that numbers generally have decreased in recent decades. Given that there are reported to have been recent declines in Sutherland (Bremner & Macdonald 1996) and East Ross (McGhie 2000), we undertook a complete survey of Caithness rookeries during the 2007 breeding season.

Methods

Locating rookeries is fairly straightforward but to ensure as complete coverage as possible we checked all stands of mature broad leaved trees in Caithness including those planted around farm buildings, some 69 sites in total. We placed particular emphasis on all sites used in the 1975 survey, and a number of others identified in preliminary surveys carried out in the breeding seasons of 2004, 2005 and 2006. We also checked some, but by no means all, of the conifer plantations that have sprung up in the county in recent decades, although there is no history of Rooks using such sites in Caithness. Given that we were unable to find any nests in those plantations that we did check, we felt justified in not investigating them all. Isolated nests or small groups of nests can be difficult to find, and, with the exception of the isolated nest at Shebster (see below), all single nests that we checked during the survey were those of either Carrion Crows *C corone* or Hooded Crows *C cornix* or their hybrids. It is possible that one or 2 others were overlooked, but we think it very unlikely that this had a significant effect on the final population estimate.

With 2 minor exceptions, the number of nests in each rookery was determined in the period 19–22 April 2007, representing a reasonable compromise between counting early enough to avoid problems of visibility after the leaf buds have fully opened, and late enough to include

Rook with nestlings © Bobby Smith

the last nests to be constructed. The 2 exceptions were the small rookeries at Shebster and Gerston which were counted in the last week of April and the first week of May respectively. For comparison the 1975 survey was carried out mainly in the third week of April, with a couple of counts made in the second and fourth weeks of April, and a few in May. So far as practical, counts of nests in broad leaved trees were made from below, whilst those in conifers were made from a more oblique angle or, where practical, looking horizontally into the tops of the trees. We have assumed that all nests counted were actively occupied and report the counts as 'nests'. Whenever possible we sought information from local residents about the recent history of their rookeries, particularly with respect to disturbance and/or persecution as well as nuisance levels and other imputs.

For the purposes of analysis we have defined a rookery as any group of Rook nests separated by more than 500 m from the next nearest group. This differs from the definition used in the 1975 national survey where separation by 100 m was the criterion employed, but reflects the results of more recent research on Rook ecology (*eg* Griffin & Thomas 2000, Mason & Macdonald 2004). We have, however, been careful to identify those groups of nests separated by 100 m to permit comparison with the results of the 1975 survey.

A detailed inventory of the material collected during the survey, together with a list of other sites checked and a summary of the 1975 results is given with the Supplementary Material (see Sellers *et al* 2007), copies of which have been lodged with the SOC's Waterston Library in Aberlady and the Carnegie Library in Wick.

Results

The 2007 survey of breeding Rooks in Caithness found a total of 6556 nests in 34 rookeries; other details are summarised in Table 1. Sage & Vernon (1978) considered that their totals for the 1975 National Rookery Survey were probably an underestimate of the true population, possibly by as much as 10%. Although we were able to make virtually all our counts at about the optimum date, there are several other sources of error, not least the difficulty of distinguishing individual nests in large, dense colonies, and we suspect that our count has an uncertainty only a little better than that of the 1975 survey.

Table 1. ***Rookeries in Caithness in 1975 and 2007***

Rookery	Map ref	Number of nests [a]			
		1975		2007	
Barrock House	ND2862/2863	767	(2)	307	(1)
Barrogill Mains	ND2973	122	(2)	166	(2)
Bower	ND2363	0		28	(1)
Braal Castle	ND1360/1460	520	(2)	481	(2)
Buckies	ND1163	31	(1)	161	(1)
Calder Mains	ND0959	198	(1)	184	(1)
Castletown	ND1967/1968/2067/2068	756	(6)	791	(3)
Clayock	ND1759	0		8	(1)
Durran Mains	ND1962	0		19	(1)
Forse [nr Lybster]	ND2134	110	(1)	94	(1)
Forss House [nr Thurso]	ND0368	3	(1)	743	(1)

Table 1. ***continued***

Rookery	Map ref	Number of nests [a] 1975		2007		
Geise	ND1165	49	(1)	6	(1)	[b]
Gerston	ND1259	0		13	(1)	
Halkirk	ND1259/1359	0		16	(2)	
Hempriggs House	ND3547	*c*70	(1)	290	(1)	
Knockdee	ND1760/1761	0		94	(2)	
Lochend	ND2668	12	(1)	75	(1)	
Loch Scarmclate	ND1859/1860	628	(4)	0		[c]
Lybster	ND2436/2536	323	(1)	213	(2)	
Lynegar	ND2256/2257	150	(1)	311	(1)	
Mains of Watten	ND2556	36	(1)	231	(1)	
Oldhall House	ND2056	304	(1)	357	(1)	
Olrig	ND1866/1867	601	(3)	165	(2)	[d]
Reaster House	ND2564	0		30	(1)	
Roadside	ND1560	0		73	(1)	
Shebster	ND0163	0		1	(1)	
Skinnet	ND1261	0		29	(1)	
Stirkoke Wood	ND3251	0		259	(1)	
Swiney	ND2335	0		29	(1)	
Thurdistoft	ND2067	43	(1)	64	(1)	
Thurso	ND1167/1168	540	(4)	480	(4)	
Upper Dunn	ND1956	2	(1)	0		
Watten	ND2454	52	(1)	194	(1)	
Wester Watten	ND2355	95	(1)	162	(1)	
Westfield	ND0664	492	(3)	190	(1)	
Wick	ND3650/3651	220	(7)	292	(8)	[e]
Total nests		**6124**		**6556**		
Total rookeries		**24**	**(48)**	**34**	**(52)**	

(a) The figures in brackets show the equivalent number of rookeries assuming that a rookery is defined as a group of nests separated by at least 100 m from the next nearest group; (1) implies that the rookery is the same whichever definition is used.

(b) Rookery deserted part way through 2007 breeding season, probably due to disturbance resulting from construction of a footpath immediately below the rookery.

(c) In 1975 one rookery (100 m separation definition) straddling the boundary between ND1859 and ND1860 was counted as 2 rookeries; we have preferred to consider it as a single rookery (100 m separation definition).

(d) There was a shift of several hundred metres in the location of the Olrig rookery between the two surveys.

(e) 2–3 nests in Thurso Road, Wick were knocked down 3–4 weeks before the survey; we assume that these birds moved to breed elsewhere in Wick and therefore they have not been included in the total for Wick.

Rookeries (500 m definition) varied in size between one nest and 791 nests (range 2–767 nests in 1975), with the 3 largest holding 2015 nests (31% of all nests) and with 86% of nests occurring in the top 50% of rookeries. The largest individual group of nests (that is separated by at least 100 m from the next nearest group) in 2007 was the Forss House rookery with 743 nests, whilst the largest in 1975 was the section of the Thurso rookery around Ormlie Lodge and Miller Academy with 471 nests. There was a substantial decrease in the mean size of rookeries (500 m definition) between the 2 surveys from 255 nests in 1975 to 193 nests in 2007; the mean size of the rookeries on the 100 m definition, however, remained almost the same at 128 nests in 1975 and 126 nests in 2007.

Rookeries were mainly distributed in a broad band across northern Caithness, the majority of them being found between Thurso and Wick (Figure 1). There was a clear association with the principal arable and stock rearing parts of the area; none was associated with hill pasture, moorland or the flow country of south and west Caithness. The mean nearest neighbour distance between rookeries was 2.3 km (range 0.7–6.1 km). The coastal strip south west of Wick held just 3 relatively isolated rookeries, all near Lybster, some 15 km from the next nearest in Caithness, that at Hempriggs House, and 27 km from the next nearest to the south west, one of c 50 nests at Helmsdale in East Sutherland. On the north coast of Caithness east of Dunnet Head there was just a single rookery, that at Barrogill Mains, occupying the only stand of broad leaved trees in north Caithness between Dunnet Head and Duncansby Head. Similarly the lack of rookeries along the coastal strip in the north east of the county between Duncansby Head and Wick reflects the absence of any broad leaved trees here. It is also noteworthy that the few rookeries in the north west of Caithness were somewhat more widely spaced than those in either the central or eastern part of the county.

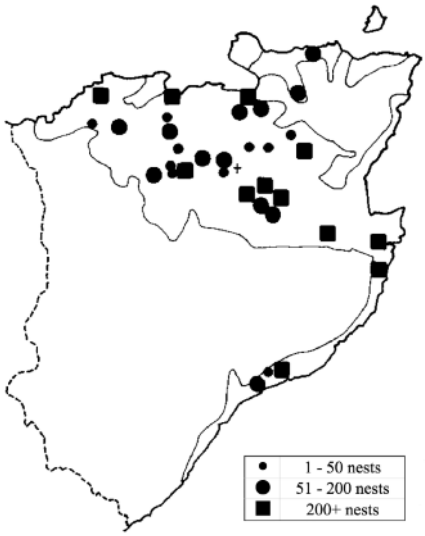

Figure 1. ***Distribution of Rookeries in Caithness in 2007 (Extent of arable and stock rearing land based on Omand 1972; + shows site of deserted Loch Scarmclate rookery)***

The majority of nests were in Sycamores, one of the commonest and most widespread broad leaved tree species in Caithness. At least 8 other tree species were used for nesting as indicated in Table 2. Of these spruce, Wych Elm and Beech were the most important, accounting for about 11% of nests. The majority of rookeries were built in trees planted around farmsteads or the larger type of country house: there were 26 such rookeries, and they contained 64% of all nests. A second group of rookeries containing 28% of nests was found in small stands of trees in the county's main population centres: Castletown, Halkirk, Thurso, Watten, Wick and one part of the Lybster rookery. The only ones in woods away from human habitation were those at Stirkoke Wood, Knockdee and Olrig, which together accounted for 8% of nests. No rookeries

Table 2. ***Tree species used by Rooks nesting in Caithness in 2007***

Species	**Total nests**	**%**
Sycamore *Acer pseudoplatanus*	5676	86.5
Spruce *Picea* spp [a]	295	4.5
Wych Elm *Ulmus glabra*	221	3.4
Beech *Fagus sylvatica*	203	3.1
Ash *Fraxinus excelsior*	84	1.3
Horse Chestnut *Aesculus hippocastanum*	51	0.8
Pine *Pinus* spp [b]	21	0.3
Silver Birch *Betula pendula*	5	0.1
Total	**6556**	

(a) Includes both Norway Spruce *P abies* and Sitka Spruce *P sitchensis*.
(b) Includes some Scots Pines *P sylvestris*

were located on high ground and the majority were at altitudes of less than 50 m asl. The highest was the isolated nest at Shebster at 80 m asl; the next highest were the neighbouring rookeries at Lybster and Swiney, both 75 m asl.

Discussion

Population trends

The figure of 6556 nests for the size of the breeding population of Rooks in Caithness found in this survey is some 7% higher than that found in 1975, and suggests that fears concerning population declines in the area are unfounded. Indeed, the population appears to have increased gradually throughout the past half century, for a survey in 1945–46 found a total of 5371 nests (Sage & Vernon 1978) and another in 1971 some 5700 nests (D Stark quoted in Manson 2002). Overall these figures represent an average growth rate of 0.4% per annum. No complete census of Caithness Rooks was undertaken in the 19th century, but from the partial information summarised by Harvie-Brown & Buckley (1887) it appears that there were fewer rookeries then and that individual rookeries were smaller. The largest they were aware of was one at Westfield with 250 pairs, whilst the majority of those for which they quote a size held between 20 and 200 pairs. Limited though the evidence is, it appears that the Caithness Rook population may have been on the increase for as much as a century and a half.

Rookery distribution

In both the 1975 and 2007 surveys rookeries were found only in the main arable and stock-rearing part of the county which runs roughly east to west across the northern half of the county and down the county's east coast (Fig 1). Even within this zone, however, they were absent from peripheral areas, for instance around Reay in north west Caithness or the coastal strip in the south east of the county, from areas where broad leaved trees were absent for instance between Wick and Duncansby Head and between Hempriggs and Lybster or in short supply such as the north coast between Dunnet Head and Duncansby Head. Perhaps the most striking feature of rookery distribution in Caithness, however, is their close association with country houses or farmsteads. Partly, of course, this simply reflects the availability of places for nesting, but many appear to be of considerable age (well over a century), and it may be, as Cocker (2007) has described, that the pattern was established in Victorian times when

Table 3. ***Changes in the size of Caithness rookeries 1975–2007***

Change in rookery size 1975–2007	Number of rookeries				
	Not in existence in 1975	1–50 nests in 1975	51–200 nests in 1975	200+ nests in 1975	Total
deserted	-	1	0	1	2
>20% decrease	-	1	0	4	5
≤20% change	-	0	2	3	5
>20% increase	-	12	0	0	12
established	12	-	-	-	12

it was fashionable for the landed gentry to plant trees close to their residences specifically to attract Rooks.

Changes at individual rookeries 1975–2007

The small overall change in the population between the 1975 and 2007 surveys belies much larger changes at individual rookeries, as summarised in Table 3. Between the 2 surveys 2 were lost including the very large one at Loch Scarmclate and 5, including 4 large ones showed reductions of well over 20% (>50 % in the case of 3 of the 4 large rookeries). On the other hand 12 of the rookeries found in 2007 had been established since the previous survey, and, though many were fairly small, they included the substantial one at Stirkoke Wood (259 nests in 2007). There had, moreover, been increases of over 20% at another 12 rookeries. In general we have little direct evidence on the causes of the declines; however, the large reduction in numbers at Barrock House has undoubtedly been due to human intervention for control measures have been undertaken here in recent years, in response to the noise and mess that the birds have created, and we suspect that this is true of several of the other rookeries that have decreased markedly in size, especially those such as Westfield, Olrig and Lybster which are close to human habitation. The Westfield rookery appears to have been deserted for a while in the late 1980s for no breeding Rooks were found in ND05, the 10 km square in which Westfield is located, at the time of the 1988–91 Breeding Atlas Survey (*cf* Gibbons *et al* 1993). However there was a rookery here in 1991 according to the Caithness Bird Report for that year; perhaps the year in which it was re established. The growth of the Forss House rookery (first recorded in 1975 when there were 3 nests - see Table 1) may be related to the disruption at Westfield. By contrast disturbance at the Braal Castle rookery, which was subject to much shooting in the 1970s and 1980s (S Laybourne, pers obs), did not result in any significant long term population decline.

Other, more recent cases of disturbance have been recorded from Lybster, where a small, slightly separate part of the rookery in the centre of the village was eliminated after felling of the trees there between the 2006 and 2007 breeding seasons, and from Halkirk where part of the rookery was similarly treated in the same winter period. These birds may well be those which formed the small rookery at Gerston, which is only about 700 m away. Furthermore that part of the Thurso rookery in Sir John's Square was eliminated following pollarding of the trees there in c 2005. Considerable disturbance to those parts of the Thurso rookery around Ormlie Lodge and Miller Academy took place in the late

1980s when the trees here were heavily pruned and some cut down. We are also aware that shortly after our counts at the Roadside rookery in 2007 several trees containing Rook nests were cut down. Something similar happened in Thurso Road, Wick, when 2–3 nests were knocked down some 3–4 weeks before we carried out our survey there.

Whether human disturbance was responsible for the desertion of the Loch Scarmclate rookery, which was located in woodland some distance from the nearest houses or farm buildings, is less clear. No shooting has taken place here during the past 2 decades or so according to the local landowner. It is noteworthy, however, that several new, comparatively small rookeries have been established within a few kilometres of the site, including those at Clayock, Knockdee, Durran Mains and possibly at Roadside too, the sort of pattern to be expected if disturbance was responsible for the desertion of the Loch Scarmclate rookery. Indeed careful examination of the data in Table 1 reveals that within c 10 km of 4 of the 5 sites at which there have been large declines in numbers, the Rook population has shown net increases of at least the same magnitude. The exception concerns the relatively isolated group of 3 rookeries near Lybster. If there has been some shift of birds from these to other rookeries then it was presumably to the next nearest group, those around Wick, a minimum of 15 km away. Consistent with this several rookeries in the latter area have shown substantial increases in the recent past. We conclude that disturbance if not outright persecution continues to be a feature of the lives of Caithness Rooks.

Persecution by man is by no means a new phenomenon in Caithness. Harvie-Brown & Buckley (1887) noted that *gamekeepers... in Caithness, almost more than any other county in Scotland, wage war upon egg-destroying vermin*. They go on to note that the rookery at Braal Castle was persecuted in the nineteenth century to the extent that the birds abandoned the site and bred in the heather a short distance away. The surprise perhaps is that no less than 11 of the 15 rookeries mentioned by Harvie-Brown & Buckley are still in existence and 2 others are within a kilometre or so of existing rookeries and were probably precursors of them; it is probably no coincidence that both the original sites were at large country houses. We cannot be certain that all 11 of these rookeries have been continuously occupied ever since, or, like that at Braal Castle, have been vacated for a time following persecution and subsequently recolonised. Persecution remains a threat to the Rooks of Caithness, but at its current levels it appears not to be having any significant impact on breeding numbers. Within the constraints imposed by the availability of suitable breeding and feeding places, it appears, however, to be an important factor in defining rookery size and distribution.

Acknowledgements

We are indebted to the many landowners who gave us permission to counts Rooks on their properties, to Eric Maughan for drawing our attention to the single Rook nest at Shebster and Donald Omand for pointing out to us the small rookery at Gerston.

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Revised ms accepted December 2007

Behaviour and diet of non breeding Snowy Owls on St Kilda

W T S MILES & S MONEY

We report numbers of individual Snowy Owls, their behaviour, and diet on Hirta, St Kilda, between late May and early August 2007. Five different individuals were identified and movement of different individuals to and from Hirta was regular. Compared with previous records, sightings in 2007 were very frequent and the number of different birds recorded was high. Favoured roost sites were perches sheltered by natural or ancient artificial stone structures, with good vantage. Territorial, courtship or nesting behaviour was not observed on any occasion. Prey species recorded in the diet were few. Most commonly found were remains of the endemic subspecies of St Kilda Field Mouse and adult Atlantic Puffins, including a 27 year old ringed bird. A Great Skua chick was the only other prey species found in pellets.

Introduction

Snowy Owls *Bubo scandiacus* are scarce vagrants to Scotland (Forrester *et al* 2007). Records are almost annual and are most frequent from the Northern and Western Isles (*Scottish Bird Reports* 1970–2001, Thom 1986). Individuals have arrived in all months of the year, but there is a clear peak in April and May (Forrester *et al* 2007). Long staying Snowy Owls are not infrequent, but the only records of nesting in the UK are a pair which bred annually on Fetlar, Shetland, between 1967 and 1975 (Tulloch 1968, Sharrock 1976, Pennington *et al* 2004). Diet of these birds was studied by pellet analysis and consisted primarily of Rabbits *Oryctolagus cuniculus* and wader chicks (Robinson & Becker 1986). Worldwide, Snowy Owls prey mostly on small mammals, although feeding on birds is not at all uncommon (eg del Hoyo *et al* 1999, Hakala *et al* 2006). There have been very few studies of the diet of non breeding Snowy Owls in Scotland. Systematic collection of pellets is difficult in this situation, as migrant owls may not stay for long, can range over very large areas, and numbers of individuals present are not always easy to assess (*Scottish Bird Reports* 1970–2001). Ageing and sexing single owls in the field is not always straightforward, except in the case of adult males (Forrester *et al* 2007). On St Kilda, 12 Snowy Owls have been recorded in 9 of the 45 years from 1962 to 2006 (Harris & Murray 1978, Murray 2002, Murray pers comm 2007). In 2007, there were exceptional numbers of Snowy Owls on St Kilda, involving several different individuals. This study was carried out on Hirta, St Kilda, between late May and early August 2007, and aimed to make an accurate record of the number of individuals present, to observe their behaviour and use of habitat, and to record their diet.

Methods

The study was conducted on Hirta, the largest island in the St Kilda archipelago (57°49'N, 08°35'W), an area of 628.5h with elevation to 426m. Habitat is primarily vegetated sea cliffs and maritime heath and grassland, dotted by ruins of many hundreds of cleits - stone shelters historically used by St Kildans for drying and storing seabirds. Data were collected between 20 May and 6 August 2007. The number of individual Snowy Owls on Hirta was assessed by direct observations, detailed field notes of plumage, and digital photographs of all birds

encountered, also used to help judge birds' sex and age. Particular attention was paid to the exact positions and extent of black spots and barring in the plumage.

Positions of roosting birds were noted daily, as an indication of where best to search for indigestible prey remains (regurgitated as pellets) and of habitat use by roosting Snowy Owls. Observations of other Snowy Owl behaviour, such as interactions with each other and with other species, were made incidentally and recorded by detailed field notes and, where possible, digital photography.

Diet was assessed from pellets, collected from the areas on Hirta where owls were seen to roost. Roosts were systematically checked for pellets every 6–8 days, even in periods when no owls were known to be present on Hirta. Pellets ranged in condition from warm, wet and slimy (very fresh) to dry, bleached and cracked (at least a few days old). Distinction of Snowy Owl pellets from those of Great Skua *Stercorarius skua* and Great Black-backed Gull *Larus marinus* was very easy, based on pellet size, Snowy Owl pellets were more than twice the size of pellets dropped by skuas and gulls, cylindrical compared to the oval shape of those of skuas and gulls and the texture of feather and

Table 1. ***Summary of different individual Snowy Owls seen on Hirta, St Kilda, between 24 May and 6 August 2007***

Bird	Duration seen on Hirta / Sex & age	Summary of plumage features used to distinguish individual
1	24 May–31 May (M 1st year)	Black spotting on forehead and crown. Nape, neck & neck sides clean white. Large white bib. Dense, narrow black barring on under parts. Heavy black barring across scapulars, mantle, back and wing feathers.
2	4 June–19 June F adult	Black spotting on forehead, crown, nape and neck sides. Black barring on under parts. Small white bib. Very large black sub terminal crescents on tips of almost all feathers across mantle, back, scapulars and wings.
3	4 June–29 June M adult	All plumage clean white except for occasional very small black spots on outer primaries and very occasional black spots on scapulars. Extremely faint and sparse narrow brown barring on lower belly.
4	8 July–1 August M sub adult	All plumage clean white except for very infrequent small black spots and bars on scapulars, mantle, back and wing feathers. Heavy black barring on tertials.
5	10 July–5 August M sub adult	Faint brown spotting on forehead. Crown, nape, neck & neck sides clean white. Very large white bib. Dense, very faint, narrow brown barring on under parts. Black barring across scapulars, mantle, back and wing feathers.

fur remains tended to be more finely ground and compacted in Snowy Owl pellets. Skulls were absent from many pellets, and so regurgitated remains were mostly identified from a combination of tarso-metatarsi, pelvises, jaws, vertebrae, claws, feathers, fur and skin remains. Age classes of bird prey were determined, where possible, by comparison of the size, shape and skin colour of relatively undigested and complex remains, such as complete leg and foot arrangements from differently aged Atlantic Puffins *Fratercula arctica*. Presence in a pellet of one or more identifiable remains of an individual animal was considered representative of one occurrence as prey, identical remains of 2 individuals of the same species representative of 2 occurrences, etc, even if other major skeletal elements were missing. The proportion of total prey, expressed as percentage mass of all individuals recorded from pellets for each prey species, was calculated using mean adult and unfledged juvenile weights published by Boyd (1956) and Cramp *et al* (1985).

Figure 1. ***Adult male Snowy Owl (Individual 3, Table 1) at a typical roost site on Hirta sheltered by boulders and high on the ridge of a hill. Feet and talons were occasionally seen used in defence against Great Skuas***

Results

By comparison of field observations, notes and photographs, a total of 5 different Snowy Owls were identified on Hirta between 24 May and 5 August 2007 (Table 1). The study lasted 77 days and owls were seen on 63 days. Two birds were present together from 4 to 19 June (an adult male and adult female) and 10 July to 1 August (2 sub adult males), but on other dates only single birds were seen. Display or nesting behaviours (eg Murie 1929, Sutton & Parmelee 1956, Watson 1956, Tulloch 1968) were not observed on any occasion. Birds' age and sex were judged by reference to information on plumage characters from previous studies and photographic identification resources (eg Josephson 1980, Cramp *et al* 1985, British Birds Interactive 2007). In most cases we were confident in determining males from females. Age was more difficult to assess from plumage. Two birds did not show adult plumages but younger plumages were not easily assignable to an exact age class (eg first year, second year, etc), so were categorised 'sub adult'. Age and sex is parenthesised for Individual 1 (Table 1) because it showed plumage characters almost entirely typical of a first year male yet not absolutely distinct from characters shown by some females.

Snowy Owls were most frequently seen roosting on, or within, stone structures: either natural crevices among crags and boulders (eg Figure 1) or perched within the ruins of cleits. Only occasionally were Snowy Owls seen roosting away from these very sheltered habitats, when perched out on relatively open grassland in shallow dips or hollows in the ground. Roost sites were relatively few, some were heavily used, and they were localised, mostly away from

the coast (Figure 2). By far the majority were high up on the slopes of hills, in good vantage positions. Only once was a bird seen roosting at the base of a hillside, within one of the cleits in Village Bay. On the occasions when 2 Snowy Owls were seen on Hirta simultaneously, roost sites were sometimes relatively close together, down to a minimum estimate of 10 metres. No aggressive or territorial behaviour was observed between individuals and they seemed highly tolerant of each other. Interactions between Snowy Owls and other bird species were seen infrequently and rarely involved owls that were roosting. Snowy Owls were occasionally seen in flight during daylight and were then often mobbed by Great Skuas, Ravens *Corvus corax* and Hooded Crows *Corvus cornix*. Great Skuas far outnumbered corvids on Hirta, and Snowy Owls were mobbed relatively heavily by skuas, sometimes involving over 20 individuals (never more than 10 Crows or 2 Ravens) chasing any one owl. Surprisingly, actual contact between birds during mobbing was very rare. Mobbing of a roosting Snowy Owl was seen on only one occasion and involved a Great Skua pair mobbing a male owl (Individual 4) perched in a relatively exposed position in open grassland, presumably within the skuas' nesting territory.

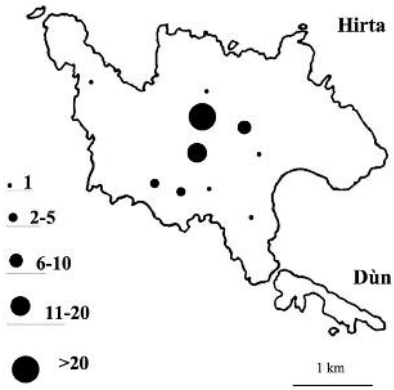

Figure 2. ***Distribution of Snowy Owl roost sites observed on the islands of Hirta and Dùn, St Kilda, between 24 May and 6 August 2007. Size of circles indicates the number of times roost sites were seen in use***

A total of 24 pellets were found and all contained remains of at least one identifiable prey species (Table 2). Remains from more than one prey species were found in 4 pellets, 3 containing a mixture of adult Atlantic Puffin and St Kilda Field Mouse *Apodemus sylvaticus hirtensis* remains and one a mixture of adult Atlantic Puffin and juvenile Great Skua remains. Prey species found most frequently in pellets were St Kilda Field Mouse (32 individuals from 14 pellets) and adult Atlantic Puffin (12 individuals from 12 pellets). Least frequent were remains from one juvenile Atlantic Puffin and from one juvenile Great Skua. Although mice predominated in the diet in terms of numbers, the much larger size of puffins means that the Snowy Owls obtained a far greater proportion of prey, in terms of total mass of individuals consumed, from puffins than from mice (Table 2).

Discussion

The number of individual Snowy Owls recorded during the study was surprisingly high, relative to previous records on Hirta since 1962. These, and the duration of sightings on Hirta, were indicative of a relatively high turn over and movement of Snowy Owls to and from St Kilda between late May and early August in 2007. Outside of the period of this study, there were records of Snowy Owls on St Kilda in 2007 in April, early May, late August and September. However, those records were not detailed or systematic in recording the identification of individuals, duration of stay, behaviour, or diet, so are extremely difficult to relate to this study. They do, however,

Table 2. ***Summary of diet of non breeding Snowy Owls on Hirta, St Kilda, from 24 May–6 August 2007***

Prey species	Number of pellets (n=24) in which prey species occurred	Number of individuals	Proportion of total prey (% no individuals)	(% mass individuals)
St Kilda Field Mouse *Apodemus sylvaticus hirtensis*	14	32	69.6	16.8
Atlantic Puffin (adult) *Fratercula arctica*	12	12	26	63.5
Atlantic Puffin (juvenile) *Fratercula arctica*	1	1	2.2	3.6
Great Skua (juvenile) *Stercorarius skua*	1	1	2.2	16.1

emphasise the exceptionally frequent occurrence and movement of Snowy Owls on St Kilda in 2007. Identification of individual owls was only possible in this study from daily observations, detailed field notes, and digital photographs of all birds encountered. Without these, it is possible that numbers may have occasionally been underestimated in the past. When identifying individuals, careful consideration was given to effects of plumage bleaching, wear and moult, especially as the study progressed into July and August, when these processes have greatest effect (Josephson 1980, Cramp *et al* 1985). Even so, plumage details of Snowy Owls encountered in this study, particularly the exact position, shape and size of dark spots and bars, appeared highly specific to individuals. This supports observations of individual variation from other studies and Scottish records of Snowy Owls (Tulloch 1968, Josephson 1980, Forrester *et al* 2007). It is possible that comparison of detailed photographs of Snowy Owls' plumage could be used with caution to identify individuals and their movements within the UK. This would be particularly useful in areas with relatively frequent records of Snowy Owls, for example to identify inter island movements and numbers of Snowy Owls within the Western Isles. Despite identification of individual Snowy Owls in this study from plumage, we still found it difficult to age and, to a lesser extent, sex birds on plumage criteria. Sexual dimorphism was especially difficult to judge in the field. However, size differences between the sexes and plumage differences between age classes are not always discrete (Earhart & Johnson 1970, Josephson 1980).

Roost sites sheltered by natural and artificial stone structures were apparently favoured above roost sites on more open ground. This may have been due to more sheltered sites affording protection from very bad weather conditions which are frequent on St Kilda and from skuas and corvids which mob the owls. Large areas of the open grassland and maritime heath on Hirta are occupied by breeding Great Skuas (>180 pairs) and owls may have been deterred from using these areas by the highly aggressive behaviour of skuas defending their nesting territories. Snowy Owls seen being mobbed in

flight and, on one occasion, on the ground by skuas, did not seem very reactive to the treatment, and mostly avoided dive bombing from skuas simply by briefly ducking down out of the way. However, no owl was ever seen in a position very close to skua eggs or chicks. Defensive behaviour by adult skuas is usually most intense when the clutch and chicks are under greatest threat (Furness 1987). Perhaps owls are more reactive to this degree of mobbing intensity, and are then deterred effectively. Only very rarely was actual contact observed between a Snowy Owl and skuas mobbing it, and only when owls were in flight. On these occasions the owls' reaction was spectacular. After the moment of contact, and typically when the next mobbing dive was made, the owl would flip over, momentarily fly upside down and bare or swipe its talons up at the attacker. This usually caused mobbing to cease immediately. The only other major response seen to be made by Snowy Owls in response to mobbing behaviour was loud wing clapping in flight. This, however, was apparently very rare and only seen on 3 occasions. Owls were occasionally flushed accidentally by humans from particularly secluded roost positions. In this case, they usually moved to a new roost position close by, did not fly far and never to a different island in the archipelago. The owls were silent in flight and never heard making any vocalisations. Roosting Snowy Owls were generally very visible, despite their sheltered locations, but it is conceivable that owls occasionally roosted undetected on Hirta and therefore the duration that individuals were present may be underestimated. The likelihood of such inaccuracy is probably low, however, given that after the first day that any individual owl was not seen on Hirta, it was never sighted again during the study period. Snowy Owls were never seen on Soay, Dun or Boreray, but observer coverage was incidental and limited by access restrictions and suitable vantage points from Hirta.

Other than sheep and humans, the St Kilda Field Mouse is the only terrestrial mammal present on Hirta, and it was not surprising that the species formed a high proportion (69.6%) of the total individuals found in Snowy Owl pellets. The mouse is an endemic subspecies to the archipelago but its population size is not well known. Snowy Owls have been shown to favour mammalian prey if available (eg Murie 1929, Gross 1944, Robinson & Becker 1986) so the fact that adult puffins formed the majority of prey by mass may indicate that density of mice on Hirta was inadequate to allow owls to feed entirely on a mammalian diet. It should be noted, however, that the sample size of pellets was small although representative of several owls. The small number of pellets found at roost sites also suggests that prey remains may have been regurgitated away from these areas, possibly on the hunting grounds where they were likely to lie undiscovered. Frequency of body parts of prey found in pellets was variable between prey species. Skeletal remains of mice were representative of the entire body (including skulls and jaws), while skeletal remains of puffins were much less representative, typically comprising complete leg and foot arrangements, ribs, spine and occasional other body parts, but never remains of the head. This supports other studies that suggested prey handling by Snowy Owls differs according to prey species (eg Wiggins 1953, Williams & Frank 1979). In this case, mice were apparently swallowed whole but puffins were swallowed in pieces less than, or equal to, body size minus the head. One of the greatest surprises of the study was a metal BTO ring found on a puffin tarsus in a Snowy Owl pellet. This puffin had been ringed as a newly fledged juvenile on Hirta in 1980. Surprisingly, Snowy Owl pellets did not contain remains from any of the other 17 species of seabird that breed on Hirta, apart from a single Great Skua chick. Prey selection by Snowy Owls of burrow nesting and nocturnal seabirds, such as alcids and storm-petrels, has been recorded in

North America (Williams & Frank 1979). Puffin colonies on St Kilda are in close proximity to very large colonies of Leach's Petrels *Oceanodroma leucorhoa*, European Storm-petrels *Hydrobates pelagicus* and Manx Shearwaters *Puffinus puffinus*, so perhaps remains from other species would have been found in Snowy Owl pellets had the sample size been larger in this study. Foraging behaviour of Snowy Owls was never directly observed. Owls were seen roosting at all times of the day and it seems likely that prey was caught mostly at night. Predation of puffins, however, may have occurred more towards dusk and dawn, when puffins are more active at their colonies than they are during the night, when most are underground or out at sea (Harris 1984). We found no evidence of Snowy Owls attempting to catch nocturnal seabirds, such as storm petrels and shearwaters. Predation of nocturnal seabirds by Great Skuas is generally a very unusual occurrence, but is relatively common on St Kilda where skuas feed extensively on Leach's Petrels (Votier *et al* 2006). The owl pellet containing skua remains was found before most juvenile skuas on Hirta had fledged. Finding remains from a juvenile Great Skua in a Snowy Owl pellet was therefore surprising, as when young skuas are under threat from predators the parents are generally adept at defence. It begs the question of whether this juvenile skua was eaten because it had been left undefended at night by parents away hunting storm petrels. Species of prey found in Snowy Owl pellets in this study are only seasonally abundant on Hirta, as in winter the majority of seabirds are absent and mouse numbers are much reduced (Quine 2000, Mitchell *et al* 2004). Previous records of Snowy Owls on St Kilda include one from 14–28 November 1962 (Harris & Murray 1978, Murray 2002), which presumably would have had to survive mainly on mice, as few seabirds would be present on the archipelago in November. From pellet analysis in future, it would be interesting to know what exactly is eaten by Snowy Owls present on the islands in winter.

Acknowledgements

WTSM was funded by NERC and NTS through a CASE studentship to Glasgow University. SM was employed by NTS in 2007 as the St Kilda Seabird and Marine Ranger. Thanks to Martin Culshaw, Johanne Ferguson, Christina McAvoy and Roddy McCleod for access to their digital photographs and references, as well as to Terry Fountain - for many images, including Figure 1. Thanks to Stuart Murray for his helpful suggestions and St Kilda Snowy Owl records from 2000 to 2006. Helpful comments on the draft were given by Bob Furness, Richard Luxmoore and Roger Riddington.

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Revised ms accepted February 2008

Responses of owls and Eurasian Kestrels to natural and human induced spatio temporal variation

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Introduction

Most owl species and also many raptors including Eurasian Kestrels *Falco tinnunculus* (hereafter kestrels), buzzards and harriers feed mainly on voles of the genera *Microtus* and *Clethrionomys* in North Europe (Marti *et al* 1993, Korpimäki and Marti 1995, Valkama *et al* 2005). Three to 5 year population cycles of voles are characteristic in Northern Europe, where these cycles cover thousands of km^2 in pristine arctic and boreal ecosystems, and in man made forest plantations and agricultural areas. These northern multi annual population cycles of voles are different from those in temperate areas of Europe for the following reasons. First, the amplitude of the cycles is much higher in the north (50–500-fold) than in the temperate (10-fold) areas of Europe. Second, the spatial synchrony extends over 80–600 km in the north, whereas it has been documented to extend over only 8–20 km in the south. Third, there are steep summer declines of voles in the north but not in the south. Fourth, in the low phase of the cycle, vole densities are an order of magnitude smaller in the north (<1 vole per ha) than in the south (25–50 per ha) (Korpimäki *et al* 2004, 2005b). Fifth, population densities of herbivorous voles and mice, and even of insectivorous shrews, fluctuate in close synchrony in North Europe (Korpimäki *et al* 2005a). In addition, population densities of voles often fluctuate in synchrony with small game animals, such as forest grouse and hares, in particular in northern parts of Finland and Sweden (Lindén 1988).

A 3 year population cycle of voles has been prevalent in our study area, the Kauhava region in western Finland, during the last 30 years (Korpimäki *et al* 2005a). In the low phase of the cycle, vole densities are very low during the breeding season of owls and kestrels but start to slowly recover in late summer. In the increase phase of the cycle, vole densities are intermediate during the egg laying period of owls and kestrels but fast increases occur in the course of the summer. In the decline phase of the cycle, vole densities are still intermediate in early spring but decline to low numbers at the end of the nestling and fledging periods of owls and kestrels (Fig 1 in Korpimäki and Hakkarainen 1991). Multi annual, high amplitude population cycles of voles in Northern Europe are mainly driven by delayed density dependent mortality, caused by mammalian and avian predators and by a shortage of winter food of voles (Korpimäki and Norrdahl 1998, Korpimäki *et al* 2002, 2005a, Huitu *et al* 2003). These high amplitude cyclic fluctuations also induce highly varying food situations with predictable fat and lean periods for birds of prey subsisting mainly on voles. To cope with this natural temporal variation in main food abundance, birds of prey should be able to take full benefit from fat periods by producing large clutches and raising large broods with high quality offspring, whereas they should be able to survive over lean periods by shifting to alternative prey and/or by moving over long distances to find a breeding site with plenty of voles.

Predators may respond to fluctuations in prey abundance either numerically or functionally (Solomon 1949). The former response is due to changes in natality, mortality, immigration and emigration, and is largely determined by the

mobility (natal and breeding dispersal), survival, reproductive rate and generation time of the predator. The availability of the main and alternative prey, the ability to shift to alternative prey, inter specific competition for food, and intra guild predation may determine the functional response of the predator (Andersson and Erlinge 1977, Korpimäki and Norrdahl 1989b, 1991).

We have been mainly studying responses of Tengmalm's Owls *Aegolius funereus,* Short-eared Owls *Asio flammeus,* Long-eared Owls *A otus* and kestrels to these highly fluctuating densities of their main prey (voles). In addition, we have also done research on numerical and functional responses of larger birds of prey, including the Ural Owl *Strix uralensis*, the Eagle Owl *Bubo bubo*, the Common Buzzard *Buteo buteo* and the Northern Goshawk *Accipiter gentilis*, that have a more diverse diet. The main focus of the studies on these large birds of prey has been the interactions that they have with their main and alternative prey species, such as small mammals and small game animals (forest grouse and hares) (Korpimäki *et al* 1990, Korpimäki and Norrdahl 1997, Reif *et al* 2001, 2004, Tornberg *et al* 2005, 2006, Valkama *et al* 2005). An additional focus has been intra guild predation and competition among different sized avian predators, including their competitive and predatory interactions with mammalian predators (Korpimäki 1987a, Korpimäki and Norrdahl 1989a, Hakkarainen and Korpimäki

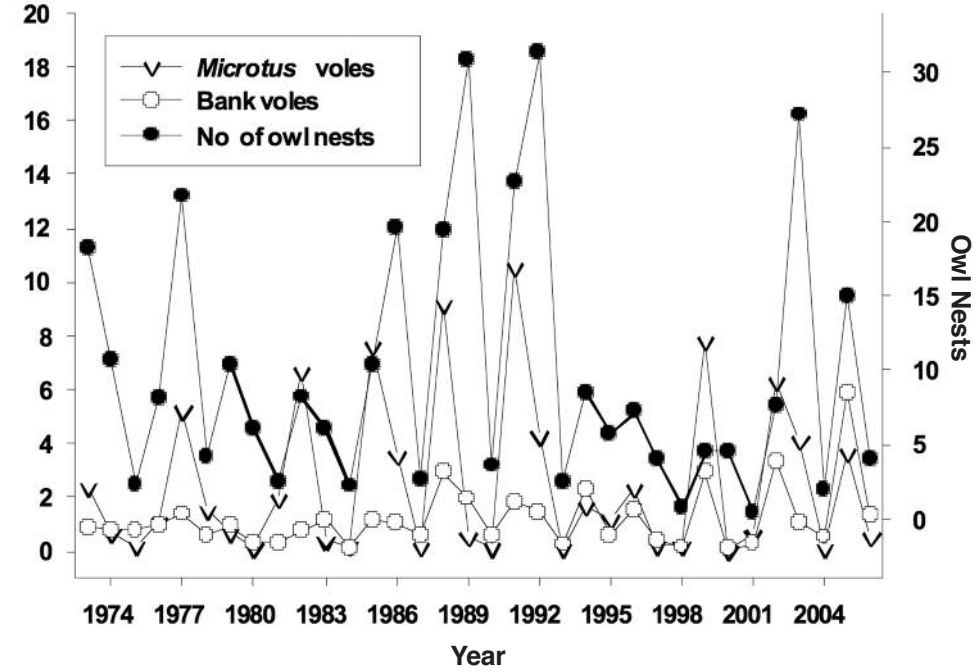

Figure 1. ***Number of Tengmalm's Owl nests per 100 nest boxes and density indices of Microtus voles (the Field Vole M agrestis and the Sibling Vole M rossiaemeridionalis) and Bank Voles during 1973–2006. Data from Korpimäki (1987b), Laaksonen et al (2002) and E Korpimäki (unpublished)***

1996, Suhonen *et al* 2007). Here our main aim is to review our research on numerical responses of Tengmalm's Owls and kestrels, for which we have long term data on variation in breeding densities, reproductive success, dispersal and survival. In addition, we will review factors affecting lifetime reproductive success (LRS) of Tengmalm's Owls and interactions of Tengmalm's Owls with their larger (Ural and Eagle owls, goshawks) and smaller (the Pygmy Owl *Glaucidium passerinum*) allospecifics.

Main results

Breeding densities

Owls and kestrels mainly responded numerically to highly fluctuating food conditions. Breeding percentage of Tengmalm's Owls in 500 nest boxes varied from 1% to 33% during 1973–2006 (Figure 1). Breeding density of kestrels varied from 0.9 to 11.7 nests/10 km^2 during 1977–2006 (Figure 2), that of Short-eared Owls from 0 to 11.5 nests/10 km^2 during 1977–2006, and that of Long-eared Owls from 0 to 4.0 nests/10 km^2 during 1977–1988 (Table 2 in Korpimäki and Norrdahl 1991, Table 5 in Korpimäki 1992a, and unpublished). Breeding densities of these 3 owl species and kestrels were closely positively correlated with the density indices of voles in the prevailing spring (Korpimäki 1994). The number of non breeding Tengmalm's, Short-eared and Long-eared Owls and kestrels was very low (Table 2 in Korpimäki and Norrdahl 1991).

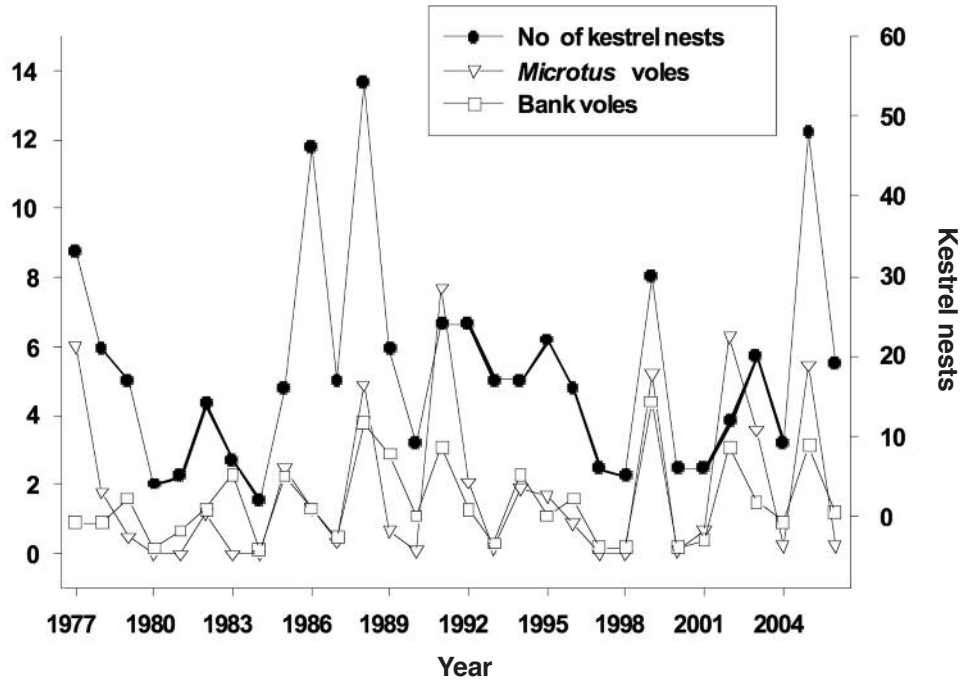

Figure 2. ***Number of Kestrel nests found in the Alajoki region (47 km^2), Kauhava and Lapua, western Finland and density indices of Microtus voles (the Field Vole M agrestis and the Sibling Vole M rossiaemeridionalis) and Bank Voles during 1977–2006. Data from Korpimäki and Norrdahl (1991) and E Korpimäki (unpublished)***

Plate 1. ***Short-eared Owl © Mikko Hänninen***

The age structure of breeding population also differed substantially among the vole cycle phases in Tengmalms's Owls and kestrels: hardly any one year old Tengmalm's Owls were breeding in the low phase of the vole cycle, whereas they were the majority of breeders in decrease years, after a year of successful reproduction in the increase phase (Laaksonen *et al* 2002). The percentage of one year old breeders was higher also in the kestrel in decrease years of the vole cycle (mean 17.8% of males and 28.2% of females) as compared to low and increase phases (6.0% and 5.7% of males, and 21.6% and 17.6% of females, respectively, Laaksonen *et al* 2004).

Reproductive success, dispersal and survival

Yearly mean clutch size of Tengmalm's Owls varied from 3.5 to 6.5 eggs (Korpimäki and Hakkarainen 1991 and unpubl) and that of kestrels from 4.3 to 6.0 eggs during 1977–2006 (Korpimäki and Wiehn 1998 and unpublished). Yearly mean clutch sizes of owls and Kestrels were closely correlated with vole density indices in current spring (Korpimäki and Hakkarainen 1991, Korpimäki and Wiehn 1998). Hatching spans of Tengmalm's Owl broods averaged 6–7 days and increased with clutch size (Valkama *et al* 2002). The most common hatching span of kestrel broods was 2–3 days (Wiebe *et al* 1998). When controlling for clutch size, the degree of hatching asynchrony of owl and Kestrel broods varied in the course of the vole cycles: chicks of the broods hatched more synchronously in low vole years than in increase and decrease vole years (Wiebe *et al* 1998, Valkama *et al* 2002).

Breeding dispersal of female Tengmalm's Owls from the breeding site of the previous year was more extensive in the decrease than in the increase and low phases of the vole cycle, but this was not found for owl males (Korpimäki 1993), which mostly occupied the same territories after their first breeding attempts (Korpimäki 1988b). Analyses of long term dispersal and survival data from kestrels showed largely similar results: more females returned to breed close to (<5 km) the previous year breeding site in the increase than in the other phases of the vole cycle, but no cycle phase related differences were found in males (Korpimäki *et al* 2006, Vasko 2007). Annual adult survival of male Tengmalms's Owls varied from approximately 25% to approximately 75% and was closely positively related to vole density indices in winter (Fig 1 in Hakkarainen *et al* 2002). Juvenile survival of Tengmalm's Owls was apparently higher in the increase phase than in the other phases of the vole cycle, because the proportion of fledglings that in subsequent years recruited to the breeding population was twice as high for young fledged in the increase as in the other phases of the vole cycle (Korpimäki and Lagerström 1988). Similar results were also obtained for recruitment of Kestrel fledglings: approx. 19% of clutches laid in the increase phase of the vole cycle produced recruits to the breeding population in subsequent years, whereas the corresponding percentage was only 8% in decrease phase and 3% in the low phase of vole cycle.

Male Tengmalm's Owls that initiated their breeding lifespan in the increase phase of the vole

cycle had higher lifetime reproductive success (LRS) than those initiating their career in the decline phase (Korpimäki 1992b). LRS of male owls was reduced in territories with a higher proportion of farmland (Laaksonen *et al* 2004), mainly because their fledgling production in any one breeding attempt was reduced in territories with high proportion of farmland in years when vole populations were declining (Hakkarainen *et al* 2003). LRS of male owls increased with the proportion of old growth forest in the territory, which appeared to be due to higher numbers of breeding attempts in these territories (Laaksonen *et al* 2004). Survival of male owls increased with the cover of old forest, although the extent of old forest within owl territories was relatively small (mean approximately 12%, range 2–37%) in our study area. This association however varied among years and appeared especially in increasing vole years (Hakkarainen *et al* 2008). Higher survival in old forests is likely to be due to better protection against larger birds of prey (eg Ural Owls and Goshawks), and/or to better availability of alternative prey (eg Bank Voles *Clethrionomys glareolus*, shrews, Willow Tits *Parus montanus* and Crested Tits *P cristatus*, etc), particularly in winter.

Intra guild predation and inter specific competition

Eagle, Ural and Tengmalm's Owls coexist in North Europe and mainly feed on small rodents. Eagle and Ural Owls can even kill smaller birds of prey but cannot enter the small entrance hole nest boxes of Tengmalm's Owls. This raises the question, whether inter specific competition due to larger owl species reduced breeding density and reproductive success of Tengmalm's Owls. Breeding Tengmalm's Owls occupied control nest boxes in areas of no permanent Eagle and Ural Owl territories, and nest boxes within Eagle Owl territories more than nest boxes within Ural Owl territories. Most breeding attempts of Tengmalm's Owl near Ural Owls already failed during the

Plate 2. ***Tengmalm's Owl © Erkki Korpimäki***

Plate 3. ***Male Kestrel © Erkki Korpimäki***

courtship period. The observational data also revealed that the breeding frequency of Tengmalm's Owl nest boxes was reduced nearby (<2 km) Ural Owl nest sites. The mean start of egg laying was delayed by 11 days near Ural Owl nests, where male Tengmalm's Owls were also younger and mated more often with short winged females than further away from Ural Owl nests. Our results suggest that inexperienced male Tengmalm's Owls are forced to establish their territories in the vicinity of Ural Owls where they also attain subdominant females. The areas near Ural Owl territories appeared to be suboptimal habitats for Tengmalm's Owls. Therefore, Ural Owls reduce the breeding population size of Tengmalm's Owls by reducing the suitable habitats (Hakkarainen and Korpimäki 1996).

Tengmalm's and Pygmy Owls are the only common birds of prey which prey on small mammals and passerine birds in our study region in winter and they have broadly overlapping diets (eg Kellomäki 1977, Korpimäki 1988a, Suhonen 1993). Pygmy Owls store small mammals and birds in holes and nest boxes during late autumn and winter (Schönn 1980, Solheim 1984). To test whether competitive and predatory interactions among smaller owls also limit food store size in late autumn and winter, we erected Pygmy Owl nest boxes (45-mm entrance diameter) for food hoarding close and far (>2 km) from Tengmalm's Owl nest boxes (>80 mm entrance diameter). We found food stores of Pygmy Owls in similar frequency both near and far from Tengmalm's Owl nest boxes (41 vs 42% of plots), but in near plots the number and biomass of prey stored by Pygmy Owls were significantly lower (Suhonen *et al* 2007). These results suggest that there is competition for food between these 2 small owl species and/or that food storing behaviour of Pygmy Owls is interfered by larger Tengmalm's Owls that can also sometimes even kill Pygmy Owls. These 2 studies are the first experimental demonstrations that competitive and predatory interactions induced by larger owls may decrease the fitness of smaller birds of prey. In particular, competitive and predatory interactions by Ural Owls have harmful effects on Tengmalm's Owls and thus decrease the habitat quality of smaller Tengmalm's Owls. Tengmalm's Owls in turn probably decrease the habitat quality of the smaller Pygmy Owls.

Conclusions and future prospects

Temporal variation in vole abundance was the main determinant of breeding density and success, quality of offspring, survival of adult males, breeding dispersal distances, recruitment rate of offspring and LRS of Tengmalm's Owls. In addition, temporal variation in vole abundance also largely determined the breeding density and success, quality of offspring, breeding dispersal distances and recruitment rate of offspring of kestrels, but long term data from adult survival and LRS of kestrels still wait for further analyses. Therefore, these 2 bird of prey populations offer a prime example of how predators can adapt to largely fluctuating food conditions that vary in a predictable manner in Northern Europe.

Human induced spatial changes in the environment (ie clear cutting of old growth coniferous forests by modern forestry) may decrease food availability for Tengmalm's Owls and alter inter specific interactions among birds of prey because less refuge sites remain available. In particular, intra and inter specific competition for food may strengthen and intra guild predation among birds of prey may become more common due to the changes in the landscape, which further reduces the habitat quality and population size of smaller forest dwelling owls.

Since reduction in the area of old coniferous forests decreased the survival and LRS of Tengmalm's Owls, we predict long term declines of Tengmalm's Owl populations in

northern European boreal forests. This was also found in nation wide monitoring study of birds of prey in Finland (Honkala and Saurola 2006). On the contrary, large scale clear cutting of North European boreal forests increases the grassy habitat for voles (Hakkarainen *et al* 1996), which could benefit kestrels that hunt mainly in open country. A long term increase in population size of kestrels found in nation wide monitoring study of birds of prey in Finland (Honkala and Saurola 2006) may thus be partly explained by changes in habitat structure. These results show that recent human induced large scale habitat manipulations can substantially alter the breeding population sizes and inter-specific interactions among birds of prey, and thus have profound effects on the composition of assemblages of birds of prey.

Acknowledgements

We would like to thank the PhD students and postdoctoral researchers Petteri Ilmonen, Vesa Koivunen, Kai Norrdahl, Pasi Tolonen, Jari Valkama, Michael Griesser, Juan A Fargallo, Karen L Wiebe, Jürgen Wiehn and Robert L Thomson, as well as field technicians and voluntary assistants Mikko Hast, Ossi Hemminki, Mikko Hänninen, Timo Hyrsky, late Sakari Ikola, Jorma Nurmi, Reijo Passinen, Ville Pöyri, Erkki Rautiainen, Jussi Ryssy and Rauno Varjonen for great help in the collection of long term data. The studies were financially supported by the Academy of Finland, the Emil Aaltonen Foundation, the Finnish Cultural Foundation and the Jenny and Antti Wihuri Foundation.

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Revised ms accepted February 2008

Post breeding movements of Sandwich Terns in the Firth of Forth

JOHAN BOS

Many Sandwich Terns spend the post breeding period in the Firth of Forth. By reading the inscriptions of rings with the help of a telescope, information about the origin and movements of 45 birds was obtained in the period 2000–2004. Most of these birds were ringed at the Farne Islands or further north in Scotland, from Orkney to Fife. The remaining birds were ringed in Ireland, the Netherlands, Belgium and Denmark.

Introduction

The Sandwich Tern *Sterna sandvicensis* is a regular breeding bird along the coasts of Scotland. It is, of course, a migratory bird, and its wintering areas are generally found along the coasts of western Africa (Wernham *et al* 2002). The breeding period covers usually the months from May till July. It is well known that the terns, before they migrate south to their wintering quarters, spend time in the northern zones, presumably taking advantage of food supplies. This period, referred to as the post breeding period, may span several months, with the last birds leaving in October.

The Firth of Forth is one of these areas visited by many Sandwich Terns in the post breeding period, in numbers exceeding thousands at peak times (Thomson *et al* 2003). Large groups of terns can gather at communal roosts, but often small flocks of fledglings and adults can be seen fishing at sea. Family ties are strong and are maintained along the way to the wintering quarters, and it is very common to see adults feeding their young in this period. Presumably the Forth is particularly attractive to Sandwich Terns because of the combination of food supply and good roost sites, such as islands and lagoons. Sandwich Terns do not breed regularly anymore in the Forth, and numbers have fluctuated: 100–500 nests/pairs in 1988–94 (Murray *et al* 1998), 0–5 in 1995–98 (Murray *et al* 1998, Kelly 1999), 122 in 1999 (Kelly 2000) and ca 300 pairs in 2000 (Thomson 2003).

When I noticed that Sandwich Terns in the Forth used regular roosts during incoming tides, and that many of the terns were ringed, I saw an excellent opportunity to discover more about their origin and movements. Were these really local birds, on their way to the African coast, or were they coming from further afield? How long did they stay? Did they always use the same roost? By reading the inscription of the rings with the help of a telescope, one could find out such information in a relatively straightforward way.

Methods

I carried out observations over 5 seasons, from 2000 to 2004, usually in the period July to November, along the south coast of the Forth from Cramond to Musselburgh. Observations were made during incoming tides, usually one or 2 hours before the tide reached its highest point. The locations I regularly checked were: Cramond, at the the sewage outfall area, Musselburgh at the mouth of the River Esk and the large ash lagoon, and Joppa Rocks, where most of the data for this study was gathered.

During incoming tides, the Joppa Rocks were regularly used as a temporary roost by Sandwich Terns, often accompanied by waders. The brick wall that separates the sea from the main land made an excellent hide to get a good view of the birds without disturbing them. The roosting birds stayed here only a few hours, just until the rocks disappear under the water, and then moved to other roosts such as the Musselburgh ash lagoon. The rocks are close enough to read the inscriptions on metal rings with a telescope; I used a Swarovski AT80 HD with 20–60 zoom. The inscriptions were immediately jotted down in a notebook At home all the inscriptions were entered in a database with information about the age of the bird (juvenile or adult), the position of the ring (left/right, upside down or right side up, presence of colour rings). Rings whose the inscriptions could be read in full were reported to the BTO who forwarded ringing details.

The total number of observation days was 70. These were distributed over the 5 year period as follows: 2000: 17, 2001: 17, 2002: 9, 2003: 9, and 2004: 18. Most of the visits took place in September (31), then October (18) and August (14), followed by July (4) and November (3).

Results

Origin

I obtained resighting data from 45 different Sandwich Terns with metal rings (Table 1). From 32 of these, the inscriptions could be completely read and for these birds the ringing information was retrieved via the various national ringing centres. From 13 birds the inscription of the rings could only be partially read. The majority of the rings, 39 of 45, were BTO rings used by ringers in Britain or Ireland. In addition, there were 3 birds with rings from Belgium, 2 with rings from the Netherlands and one from Denmark.

Table 1. ***Completely and partially read rings on Sandwich Terns***

Origin	Complete	Partial	Total
Britain/Ireland	30	9	39
Belgium	1	2	3
Netherlands	0	2	2
Denmark	1	0	1

The 30 terns with the BTO rings were ringed in England (23), Scotland (6), and Ireland (1). The English ones were mostly ringed in Northumberland, about 100 km away at the Farne Islands (11) and Coquet Island, Amble (10), and in Cleveland (2). The Scottish terns were ringed in Orkney (2), Grampian (2), Highland (1), and Fife (1). The Irish bird was ringed at Lady's Island Lake in Wexford. Figure 1 shows a map with the ringing locations of all the Sandwich Terns resighted in Lothian.

There was a total of 51 resightings, because 6 birds were seen twice. Most of the resightings were in the month of September (33), followed by October (14), July (2), and August (2). The first and last sightings in a calendar year were respectively on 22 July 2001 and 27 October 2001.

The number of resightings distributed over the 5 years of study were: 2000 (21); 2001 (17); 2002 (4); 2003 (7); 2004 (2). In the first 2 years of the study Sandwich Terns seemed more numerous in the Forth than in the following years.

Site Fidelity

Only 6 birds were seen more than once, and no birds were seen more than twice. In all of these cases the period between the 2 resightings was very short. Four times the same tern was seen a day later at the same site, one time 6 days later

(2 and 8 September), and one time 10 days later (4 and 14 October). Never has the same Sandwich Tern been seen in different years. This suggests that the Sandwich Terns do not stay long at one location.

Distance

In what follows the distance between the ringing and resighting locations is measured along a straight line which may not be the actual path the bird took. The smallest distance was 58 km, covered by a Sandwich Tern ringed at Tentsmuir Point in Fife in 1987 and resighted in Joppa in 2001. The largest distance, 854 km, was covered by a Sandwich Tern ringed as a nestling in Denmark in 1992 and seen in Joppa in 2004. As adult Sandwich Terns need not breed near the colony where they themselves fledged it is more meaningful to look at distance information obtained by resightings of birds ringed as nestlings in the same year. Here the 3 largest distances were 309 km (South Ronaldsay, Orkney), 459 km (Lady's Island Lake, Ireland), and 660 km (Zeebrugge, Belgium).

Age

In Britain and Ireland, about 97% of ringed Sandwich Terns later recovered were ringed as

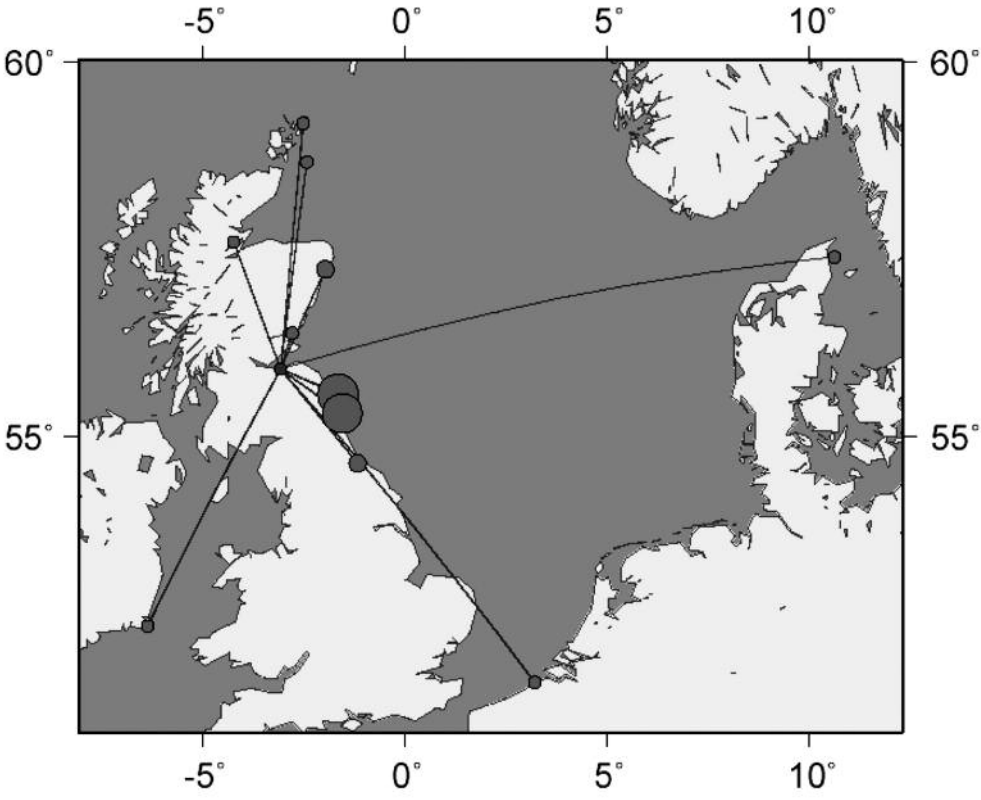

Figure 1. ***Ringing locations of Sandwich Terns resighted in the Forth of Firth in the period 2000–2004. Size of marks are proportional to number of birds [n=32]***

nestlings (Wernham *et al* 2002). The data gathered from the Forth comprised 29 terns that were ringed as nestlings, and their ages at resighting are shown in Table 2. The oldest, 19 years old, was ringed as a nestling at the Farne Islands on 20 July 1984, and resighted at the Joppa Rocks on 9 August 2003. This bird was about to make its journey to Africa for the twentieth time.

Table 2. ***Age distribution of resighted Sandwich Terns in the Forth of Firth***

Age	0	3	4	5	12	14	15	16	19
Number	19	1	2	1	1	1	2	1	1

Colour Rings

Several Sandwich Terns were seen with a combination of colour rings, usually in addition to their metal rings. None of the colour rings had readable inscriptions, and the combinations of colours used did not identify individuals. Moreover, it turned out to be difficult to discover the origin of the few colour ringed Sandwich Terns that were observed apart from colour ringed birds from Grampian and the Farne Islands.

The 19 year-old Sandwich Tern ringed at the Farne Islands had 2 blue celluloid colour rings which, when I saw it nearly 2 decades later, were almost completely faded to a light grey color. I understand newer colour rings hold their colour for longer.

Discussion

The Firth of Forth is well known as an area which attracts large numbers of Sandwich Terns in the post breeding period. Wernham *et al* (2002) noted that post fledging dispersal around the coasts of Britain and Ireland and across the North Sea to the Netherlands and Denmark commences in late June, and that during July and August dispersal occurs in both directions between the Netherlands and Britain. Murray *et al* (1998) report that terns visit the Forth from as far as the Sands of Forvie to the north and the Farne Islands to the south. The data presented in this short paper confirm this, but also show that some terns come from the Netherlands, Belgium, and Ireland.

Observations of tern roosts can clearly provide much interesting information on migrating terns. Unpublished observations mainly of colour ringed Sandwich Terns from the Moray Firth to the Scottish Border showed a similar pattern of origins to this study (A Smith pers comm).

Acknowledgements

Thanks to Mark Grantham (BTO) for answering all my questions on ringed terns accurately and promptly. Further thanks to Raymond Duncan (Grampian), Roderick Thorne (Orkney), and Chris Redfern (Farne Islands) for information about terns that they ringed and I resighted. I also thank Alastair Smith for helpful comments that improved this article. Last but not least, I am extremely grateful to Malvina Nissim who accompanied me on many a ring reading trip and provided invaluable feedback to previous versions of this paper.

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Wintering wader surveys on the Isle of Tiree, Argyll

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Two surveys of the entire coastline of the Isle of Tiree including the coastal sections of the Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) Special Protection Area (SPA) were conducted on 5–10 February 2006, by a team of 15 fieldworkers, using the same methodology as in previous counts. Results of the surveys are detailed here and placed in the context of the results of 5 similar midwinter coastal wader counts conducted on the island since 1985. Differences in count totals between the 2 surveys were small. Maximum whole island counts of key species in February 2006 included: 1191 Ruddy Turnstone, 648 Ringed Plover, 489 Sanderling and 368 Purple Sandpiper. Tiree still holds nationally important numbers of these 4 key wintering wader species. In contrast to counts from sites in Eastern Scotland, none of these species showed significant declines between 1985 and 2006. Tiree remains the premier wintering site for Ruddy Turnstones and Purple Sandpipers in the UK. Taking the maximum whole island count for either survey, the area within the SPA held 5721 waders in 2006 including 1006 Ruddy Turnstone, 578 Ringed Plover, 458 Sanderling and 305 Purple Sandpiper.

Introduction

The island of Tiree is the westernmost of the Inner Hebrides and is a flat, low lying island, roughly 20 km long and 5 km wide, which has long been known for its important bird populations. Its sensitively managed croftland is home to over 25% of the Corncrakes *Crex crex* in the UK, whilst its machairs and wetlands are home to nationally important breeding numbers of waders and internationally important numbers of wintering Greenland White-fronted Geese *Anser albifrons* and Barnacle Geese *Branta leucopsis* (Bowler & Hunter 2007). The importance of its coastline for wintering waders is perhaps less widely known but its mix of broad sandy bays containing rocky outcrops, shelving rocky shores, numerous offshore skerries and sheltered inlets, provides a winter habitat for a wide range of wading birds and other waterfowl (see Madders & Moser 1989, Newton 1989). Five midwinter counts of the waders and waterfowl of the entire Tiree coastline were made between 1985 and 2000. The results of these surveys were compiled in various reports to Scottish Natural Heritage and the findings were used to designate the most important sections of the coastline as part of Sleibhtean agus Cladach Thiriodh (*Tiree Wetlands and Coast*) SPA in 2001. In the light of recent reported declines in some key non estuarine wader species throughout the UK (see Rehfisch *et al* 2003), a repeat survey was organised in February 2006 involving 2 complete counts of the entire Tiree coastline.

Methods

For each count, the island was divided into 37 sections (see Fig 1) as in previous surveys and walked in stages by surveyors. Counts were carried out with care to reduce disturbing birds and to avoid duplication of results both within and between sections. A complete count of the island was conducted on 5–7 February and a second complete count on 8–10 February. All counts

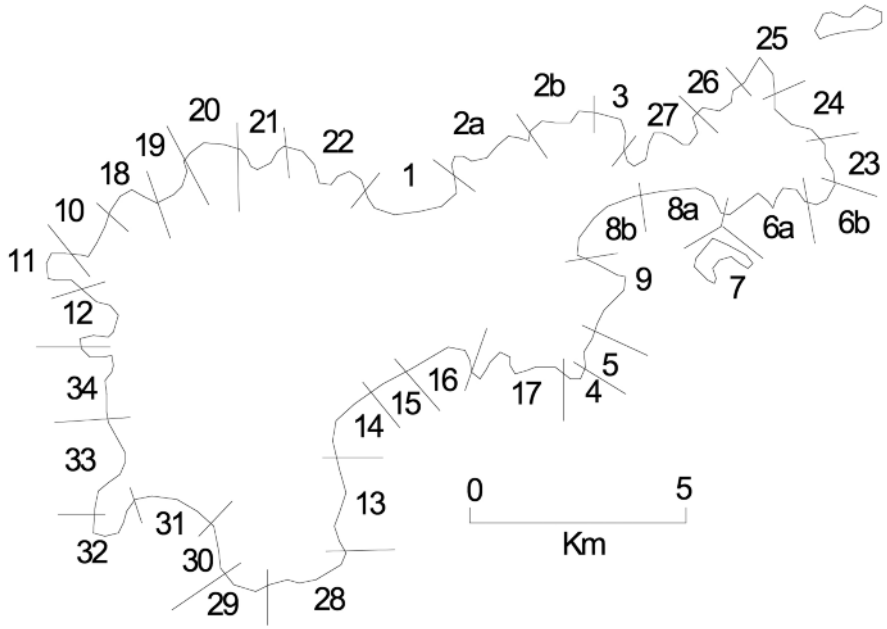

Figure 1. Map of Tiree showing the 37 count sections

were conducted within 3.5 hours of high tide and under favourable weather conditions: wind less than force 4, not during heavy or continuous rain and with good visibility throughout. Unlike mainland sites which are usually counted either side of low tide, the Tiree coast is best counted either side of high tide, as at low tide many extensive offshore skerries become exposed and offer feeding opportunities for waders which are difficult to count by a land based observer.

All waders encountered feeding or roosting below high water mark were recorded for each section. Additional waders that were feeding or roosting just inland of a count section but which were clearly associated with the shore, such as Ruddy Turnstone *Arenaria interpres*, Dunlin *Calidris alpina* and Ringed Plover *Charadrius hiaticula*, were also counted and coded separately as 'inland'. Such inland counts of predominantly coastal wader species were included in the totals in order to obtain a closer estimate of the true island totals for these species.

For each species the highest whole island count of the 2 surveys was taken as the most accurate count. Due to the tidal cycle, Soa (section 7), an offshore island, could only be counted on 10 February during the second survey. The number of birds encountered on that date was also included in the counts for the first survey (see Discussion). Additional species encountered on the surveys such as ducks, divers and Grey Herons *Ardea cinerea* were also recorded for each section.

Additional counts were carried out on a selected number of sections on 11–13 February. The counts were not used in the calculation of whole island census totals, due to the possibility of movement of birds between sections, however they provided a useful check on the maximum number of birds using a particular section.

Results

The highest whole island counts encountered on either survey are shown in Table 1. A maximum total of 6,696 waders of 16 species was recorded, the second highest total count for the island following the peak count of 6,848 waders in February 1995. Numerically the most abundant species were Ruddy Turnstone and European Golden Plover *Pluvialis apricaria* with over 1000 birds, accounting for 17% and 15% of the total respectively. They were followed by Eurasian Oystercatcher *Haematopus ostralegus*, Ringed Plover, Northern Lapwing *Vanellus vanellus*, Eurasian Curlew *Numenius arquata*, Sanderling *Calidris Alba* and Common Redshank *Tringa totanus*, which accounted for 13%, 9%, 9%, 7%, 7% and 7% respectively of the total. Five species: Bar-tailed Godwit *Limosa lapponica*, Grey Plover *Pluvialis squatarola*, Eurasian Woodcock *Scolopax rusticola*, Red Knot *Calidris canutus* and Jack Snipe *Lymnocryptes minimus* were

Table 1. ***Maximum whole island counts of coastal waders on Tiree, February, 2006. Species present in nationally important numbers are in bold (survey number in brackets)***

Max Count (survey)		**Max Count (survey)**	
Eurasian Oystercatcher	889 (1)	Eurasian Curlew	493 (2)
Ringed Plover	**648 (2)**	Common Redshank	483 (1)
European Golden Plover	1023 (1)	**Ruddy Turnstone**	**1191 (1)**
Grey Plover	26 (2)	Woodcock	4 (1)
Northern Lapwing	607 (1)	Snipe	175 (2)
Sanderling	**489 (2)**	Red Knot	1 (1)
Purple Sandpiper	**368 (2)**	Jack Snipe	1 (1)
Dunlin	270 (1)		
Bar-tailed Godwit	46 (1)	**Total**	**6718**

Table 2. ***Differences in totals derived from 2 surveys of waders on Tiree in February, 2006. Species present in nationally important numbers are in bold. Grey Plover, Red Knot, Eurasian Woodcock, Jack Snipe and Bar-tailed Godwits have been excluded due to small counts (less than 100 birds involved). *counts affected by substantial numbers inland. **see Discussion***

Species	**Survey 1**	**Survey 2**	**Difference**
*Common Snipe **	*99*	*175*	*+77%*
Purple Sandpiper **	263	368	+40%
Ringed Plover	607	648	+7%
Eurasian Curlew	473	493	+4%
Sanderling	468	489	-4%
Eurasian Oystercatcher	889	857	-4%
Common Redshank	483	449	-7%
Ruddy Turnstone	1191	1059	-11%
Dunlin	270	221	-18%
*Northern Lapwing **	*607*	*257*	*-58%*

present in small numbers and each accounted for less than 1% of the total wader count. Of these, Eurasian Woodcock and Jack Snipe are not especially associated with the shore and their all island wintering totals are likely to be higher. Common Greenshank *Tringa nebularia* was the only species not recorded in 2006, but this species is less than annual in winter on Tiree (Bowler & Hunter 2007).

Numbers of Northern Lapwing, European Golden Plover and Common Snipe *Gallinago gallinago* have varied greatly over the years on the coastal counts. These 3 species have a predominantly inland feeding distribution on the island and the proportion recorded at the coast is likely to vary considerably between counts.

The count results from the 2 surveys carried out in 2006 were generally very similar (Table 2), particularly when the 3 predominantly inland wader species (European Golden Plover, Northern Lapwing and Common Snipe) are excluded for analysis. The only coastal species to show a major difference between counts was Purple Sandpiper *Calidris maritima* (an increase of some 40% between the 2 survey periods - see Discussion).

The counts made in 2006 are shown in relation to previous whole island surveys in Table 3.

Key Species Accounts

Ringed Plover

Table 3 shows the whole island counts since 1985. The highest count was recorded in 1985 (987) but there has been no significant trend since the mid 1980s (rs=-0.314, ns). Up to 2004/05, Britain had experienced 16 years of decline in this species (Banks *et al* 2006), with a slight upturn in the national index in 2005/06 belying the underlying downward trend (Musgrove *et al* 2007). The 2006 count of 648 birds was below the threshold for a site holding internationally important numbers (730 birds),

Table 3. ***Summary of whole island counts of coastal waders on Tiree, 1985 to 2006***

	1985	1986	1995	1998	2000	2006	Average
Eurasian Oystercatcher	369	345	807	714	443	889	595
Ringed plover	**987**	**555**	**958**	**534**	**561**	**648**	**707**
European Golden Plover	59	9	91	783	201	1023	361
Grey Plover	8	6	0	12	45	26	16
Northern Lapwing	691	176	16	449	1055	607	499
Sanderling	**396**	**305**	**964**	**371**	**589**	**489**	**519**
Purple Sandpiper	**119**	**189**	**377**	**262**	**263**	**368**	**263**
Dunlin	340	295	853	295	609	270	443
Bar-tailed Godwit	60	37	158	22	69	46	65
Eurasian Curlew	496	347	780	901	845	493	643
Common Redshank	503	291	611	415	415	483	453
Ruddy Turnstone	**996**	**861**	**1096**	**905**	**858**	**1191**	**985**
Eurasian Woodcock	1	4	0	1	0	4	1
Common Snipe	73	33	137	183	319	175	153
Common Greenshank	0	0	0	1	0	0	0
Red Knot	0	0	0	0	1	1	0
Jack Snipe	0	0	0	0	0	1	0
Total	**5068**	**3453**	**6848**	**5858**	**6273**	**6696**	**5704**

but Tiree still holds nationally important numbers of this species. In the most recently published WeBS counts (winter 2005/06, Musgrove *et al* 2007), Tiree was the third most important wintering site in the UK for this species.

Ringed Plovers were encountered on 59% of the 37 sections, showing a strong affinity for sandy bays (Fig 1 and Table 4). The average flock size on survey 2 was 34 birds. The highest count on a single section was 172 birds at Gott Bay (section 8b) on 8 February (survey 1).

Sanderling

The highest count was recorded in 1995 (964) but there has been no significant trend since the mid-1980s (rs=0.37, ns). Nationally, numbers have remained relatively stable since the mid 1970s (Musgrove *et al* 2007). The 2006 count of 489 birds was below the threshold for a site holding internationally important numbers (1200 birds), but Tiree still holds nationally important numbers of Sanderling. In the most recently published WeBS counts (winter 2005/06, Musgrove *et al* 2007), Tiree was the eighth most important wintering site in the UK for this species.

Sanderling were encountered on 38% of the 37 sections, showing a strong affinity for sandy bays (Fig 1 and Table 4). The average flock size on survey 2 was 41 birds. The highest count on a single section was 106 birds at Traigh Sorobaidh (section 14) on 13 February (extra counts).

Purple Sandpiper

The highest count was recorded in 1995 (377), a marked increase compared to the mid 1980s. However, over the longer term, there has been no significant trend since the mid 1980s (rs=0.65, ns). Nationally, numbers have significantly declined since the early 1980s (Musgrove *et al* 2007). The 2006 count of 368 birds was below the threshold for a site holding internationally important numbers (750 birds), but Tiree still holds nationally important numbers of Purple Sandpipers. In the most recently published WeBS counts (winter 2006/07, Musgrove *et al* 2007), Tiree was the most important wintering site in the UK for this species.

Purple Sandpipers were encountered on 84% of the 37 sections, showing a strong affinity for rocky shores (Fig 1 and Table 4). The average flock size on survey 2 was 16 birds. The highest count on a single section was 91 birds at Rubha Chraiginis (section 11) on 8 February (survey 2).

Ruddy Turnstone

The highest count was recorded in 2006 (1191 birds) but there has been no significant trend since the mid 1980s (rs=0.14, ns). Nationally, numbers declined significantly after the mid 1980s (Banks *et al* 2006) but appear to have stabilised since 2004/05 (Musgrove *et al* 2007). The 2006 count of 1191 birds was above the threshold for a site holding internationally important numbers (1000 birds in 2004/05) but below the revised threshold of 1500 birds set in 2007. In the most recently published WeBS counts (winter 2005/06, Musgrove *et al* 2007), Tiree was the most important wintering site in the UK for this species.

Ruddy Turnstones were encountered on 92% of the 37 sections during either survey, and were found in most coastal habitats (Fig 1 and Table 4). The average flock size on survey 1 was 37 birds. The highest count on a single section was 317 birds at Clachan Mor (section 22) on 5 February (survey 1).

Individual section maximum counts

Using count data obtained from the 2 whole island surveys, plus the additional counts from 8 of the sections, Table 4 shows the maximum count in each section for 4 species of waders.

Table 4. ***Maximum counts for 4 species of wader from individual sections. For section locations see Figure 1. Highest counts are in bold. * indicates the count was made during the additional count period (11–13 February). Sections in the Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) SPA are indicated***

Section	Ringed Plover	Sanderling	Purple Sandpiper	Ruddy Turnstone
1 SPA	* 62	* 95	1	* 67
2a SPA	3		33	54
2b SPA				1
3 SPA			4	30
4			6	37
5 SPA	32	40	6	10
6a SPA	5		1	83
6b SPA				6
7 SPA			25	44
8a SPA	58	93	4	26
8b SPA	**172**	79	13	54
9	5	2	37	47
10 SPA	77	30	4	21
11 SPA			**91**	81
12 SPA	9	95	1	4
13 SPA		20	28	69
14 SPA	94	* **106**	* 7	24
15			* 4	* 32
16 SPA	96		3	89
17 SPA (part)	43	23	30	96
18			15	67
19				
20			5	3
21 SPA	2		15	29
22 SPA	6		38	**317**
23 SPA			2	35
24 SPA	74	67	23	70
25 SPA	3	2	22	31
26 SPA	18		5	135
27 SPA	50	* 41	12	* 59
28	1		1	6
29				3
30			12	21
31	46			
32				
33	13	31	15	17
34 SPA	12		30	7

Table 5. ***Maximum counts of other species encountered during the wader surveys***

Species	Count	Species	Count
Common Shelduck	138	Great Northern Diver	19
Mallard *Anas platyrhynchos*	269	Great Cormorant	66
Northern Pintail *Anas acuta*	2	European Shag	128
Northern Shoveler *Anas clypeata*	28	Black Guillemot	3
Eurasian Wigeon	483	Grey Heron	30
Eurasian Teal	521		
Common Eider	373		
Long-tailed Duck	17		
Red-breasted Merganser	52		

Waterfowl

All waterfowl encountered either on the shore or offshore (within approx 400m) were recorded during the surveys. The maximum counts derived from either survey are shown in Table 5. Apart from the species obviously associated with inshore coastal waters in winter (eg Great Northern Diver *Gavia immer*, European Shag *Phalacrocorax aristotelis*, Common Eider *Somateria mollissima*, Long-tailed Duck *Clangula hyemalis* and Black Guillemot *Cepphus grylle*) most species counted are also encountered inland on Tiree. Therefore, the counts of the remaining species are additional to inland counts. However, a number of these counts are significant in an island context. The Common Shelduck *Tadorna tadorna* count (138 birds) was the highest ever winter count recorded on Tiree, that of Grey Heron (30) was the second highest ever recorded, whilst those of Eurasian Wigeon *Anas penelope* (483) and Eurasian Teal *Anas crecca* (521) were the highest ever recorded coastal counts for these species.

Discussion

Counts of the 4 most important coastal wader species showed good correlation between the 2 surveys, with counts of 3 of the species being within 11%. The exception was Purple Sandpiper, with the second survey finding 40% more birds than the first, a difference of 105 birds. Comparisons of field notes after the counts showed that 9 birds were seen at section 11 (Rubha Chraiginis) on the first survey and 91 birds on the second, and it is thought that these latter birds were missed on the first survey by feeding out of sight on a tidal islet. Correcting for this undercount would have brought the 2 counts to within 7% of each other (345 compared with 368, a difference of 23 birds).

Unfortunately, due to the tidal cycle, section 7, the Isle of Soa, could only be visited during the second survey. Rather than omit counts from the second survey, the counts encountered during that visit were also included in the totals for the first survey. In comparison to other sections, the number of birds involved was very small. For the 4 most important species, the counts included: 44 Ruddy Turnstone (4% of the overall total), and 25 Purple Sandpipers (7% of the overall total). No Sanderling or Ringed Plover were seen on Soa.

Notably fewer Sanderling and Dunlin were encountered in 2006 compared to the mid 1990s, although there was no significant long term trend for the numbers of Sanderling. Numbers of Dunlin on the survey were low in comparison to counts obtained of single flocks of the species earlier in the winter. For example, 260 Dunlin

were counted at Gott Bay (section 8b) alone on 21 January 2006 and there were 198 at Sorobaidh Bay (section 11) on 13 December 2005, and it seems likely that some birds may have been feeding at inland sites, and therefore missed, during the survey. An alternative suggestion is that some waders that normally winter on Tiree could have shifted to feed on the adjacent island of Coll. In order to check this, Simon Wellock and Val Conway were asked to undertake an assessment of the beaches at the west end of the neighbouring island of Coll concurrently with the second round of survey work on Tiree. Only small numbers of shorebirds were located on the Coll beaches, including 47 Ruddy Turnstone, 105 Ringed Plover, 92 Sanderling and 7 Purple Sandpiper. These are typical figures for wintering shorebirds on Coll and suggest that there had been no major influx of birds from Tiree during the survey period.

Additional counts on a selected number of sections on 11–13 February did not record notably larger counts of waders than on the 2 whole island surveys. This also suggests that no large flocks of Sanderling or Dunlin were missed during the first 2 surveys.

Tiree still holds nationally important numbers of 4 key wintering wader species. In a national context, treating Tiree as a single site, the island is the most important site in the UK for wintering Purple Sandpiper and Ruddy Turnstone, the third most important wintering site in the UK for Ringed Plover (after the Thames estuary and Hamford Water) and the eighth most important site for wintering Sanderling. While there was variation between years, none of the 4 key species showed a significant trend in numbers between 1985 and 2006, which contrasts with the results from other Scottish sites. On the Moray Firth for example, numbers of Purple Sandpiper and Ruddy Turnstone decreased significantly between 1988 and 2003 (Kalejta-Summers 2006), whilst on the Tay estuary, Dunlin have undergone a considerable decline since 1997 (Elkins 2006, 2007). The decline in numbers of Purple Sandpipers and Ruddy Turnstones on the Moray Firth was thought to be related to poor breeding success resulting in low recruitment in the late 1980s and early 1990s (Summers *et al* 2005), and is part of a UK decline in these species, recorded at 16% for Ruddy Turnstone and 21% for Purple Sandpiper between 1984/85 and 1997/98 on a survey of 38% of the UK's non estuarine coastline (Rehfisch *et al* 2003). Reported declines in numbers of Ruddy Turnstone and Purple Sandpiper in East Lothian between the 1970s and 1990s were even higher at 73% for Ruddy Turnstone and 88% for Purple Sandpiper (Dott 1997) indicating that these declines may be more severe in southeast Scotland. The fact that numbers of both species have not declined significantly over the same period on Tiree, suggests that either recruitment has been higher for west coast wintering populations of these species, or that some redistribution has occurred on the wintering grounds.

Numbers of Ringed Plover showed no significant trend over the period 1985–2006, although counts in 1985 and 1995 were markedly higher than in subsequent years. These relatively stable numbers contrast with the national trend, which indicates a decline of more than 30% between 1988/89 and 2005/06 (Musgrove *et al* 2007) and a decrease of 15% on non estuarine coasts between 1984/85 and 1997/98 (Rehfisch *et al* 2003). Numbers of Sanderling similarly showed no significant trend over the period 1985–2006, which reflects their national index, which has remained relatively stable since the mid 1970s (Musgrove *et al* 2007).

The coastal counts of European Golden Plover, Northern Lapwing and Common Snipe underestimate the numbers of these species wintering

on the island, as they predominantly feed on inland grasslands. All island counts in recent winters have revealed that Tiree annually holds nationally important numbers of European Golden Plover (3000–4500 birds in mid winters 2004–2007) and regionally important numbers of Northern Lapwing (2500–4500 birds in mid winters 2004–2007, Bowler & Hunter 2007). Numbers of wintering Common Snipe on the island are poorly known but as Tiree's snipe shooting is still renowned as amongst the best in Europe, these are likely to be high and of national importance. Of the other species, Ruddy Turnstone, Eurasian Oystercatcher, Ringed Plover, Eurasian Curlew, Common Redshank and Dunlin also feed on short turf inland pastures on Tiree to a varying extent during the winter and coastal counts in a given winter may miss some birds. However, these species are predominantly coastal in distribution and the counts should record the majority of birds present.

Some species can be present in even higher numbers on the island during spring and autumn migration periods. Recent high counts include an estimated 2000–3000 Ringed Plovers present on 16 May 2005, some 1500–2000 Sanderling in mid-August 1995 and a minimum of 2010 Sanderling on 17 May 2006 including a flock of 1320 birds at Gott Bay alone (Bowler & Hunter 2007). Similarly, numbers of passage European Golden Plovers have peaked in recent years at around 6,500 birds on the island during spring passage in March/April and on autumn passage in September/October (Bowler & Hunter 2007).

Acknowledgements

We are greatly indebted to all the coordinators and fieldworkers of the earlier surveys not named elsewhere, including Gwen Evans, Greg Corbett and Andy Hachenburg, and to RSPB Scotland and Scottish Natural Heritage for supporting the work financially. Special thanks go to Ross Lilley (SNH) for arranging funding for the survey work in 2006. Many thanks to the additional fieldworkers who helped with the 2006 surveys: Sue Agnew, Clifton Bain, Jan Baylis, Raymond Duncan, Ian Francis, Mick Green, Janet Hunter, Lyndsey Kinnes, Alan Lauder, Ross Lilley and Fiona Newcombe. Simon Wellock and Val Conway undertook counts on Coll.

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Received ms accepted April 2008

SHORT NOTES

Changes in the breeding status of Little Ringed and Ringed Plovers in North Fife

The first recorded breeding of Little Ringed Plovers *Charadrius dubius* in Fife was documented in 1989 (*Scottish Birds* 16: 42–43). The species was present at another site in 1990, but did not breed. For reference, I will call all sites by letters, A, B and so on.

No subsequent nest was found until 1997, when a pair bred at another site C. First discovered on 25 May, 2 newly hatched chicks were ringed on 14 June, and one chick seen to fly on 7 July. The other chick was predated by a Eurasian Sparrowhawk *Accipiter nisus*. The female of this pair associated with a second male at a nearby site D. They formed a territory but no nest was found. On 13 July all 3 adults and the fledged chick were in a group at site C. The male of the successful pair and his chick were last seen on 20 July by which date the other 2 adults had departed. The nest of 1997 was in a marginal grass field, located within a tiny area of gravel, probably caused by a lorry cleaning its container. A muddy pool was situated some 200 metres away to which the chicks were led after hatching and around which they fed.

In 2003 a single male came to another site E with a pair present by 2 June. The first clutch was found on 13 June, and eventually 3 pairs bred around a large lagoon. Nine chicks fledged from 12 eggs laid, despite the attentions of a juvenile Peregrine Falcon *Falco peregrinus*, seen to hunt adults on at least 2 occasions. The last records were on 24 August when 2 juveniles were still present. Eleven chicks were ringed under licence, but odd unringed juveniles passed through the site in late summer suggesting breeding elsewhere.

In 2004 site E saw its first Little Ringed Plover arrive on 11 April, mating was seen on 3 May and the first clutch found on 30 May. Four pairs were proved to breed, 10 chicks were ringed under licence, of which 6 flew. One pair probably had early clutches destroyed in vehicle movements and the presumed replacement clutch of 2 was incubated until 21 July, then deserted. The last record of a definite breeder was 27 July when a ringed juvenile present.

In 2005 at site E, the first adult was seen on 26 March, with 5 by 13 April (but only one female), 7 by 21 April and the first clutch by 10 May. Ten adults were present by 26 May, including the incubating bird. Four chicks were ringed here on 31 May still in the nest scrape and almost immediately predated. Carrion Crows *Corvus corone* constantly patrolled the nest site and adult Little Ringed Plovers alarm called when they appeared. A second nest was found on 8 June and a third by 10 June. By 22 June the second nest was predated and within a few days the third was also predated. Control measures of perhaps 2 pairs of crows will be required if plovers are to breed successfully at this site. No chicks fledged but a few unringed juveniles were recorded here in late summer.

In 2006 at site E the first adult was seen on 7 April with 4 by 29 April. Only one pair stayed and a suspected early clutch very probably taken by crows. A replacement clutch was found on 1 July, but the eggs were gone by 9 July and no chicks seen. Both adults departed by 13 July.

Also in 2006 at site F, a new site of dry gravel deposits where people walk dogs, there were 2 adults and one chick about a week old which I ringed under licence on 26 June. On 22 July the single chick could just fly. This was a considerably longer fledging period than chicks which had access to mud. On 25 July one adult and the chick were still present. The adult chased off an unringed

juvenile which flew in from the north and landed. On 27 July the local chick still flew poorly and was not seen to fly well until 30 July when the adult was still present. Both birds were gone by 6 August.

Throughout the period of increased Little Ringed Plover breeding records the Ringed Plover *Charadrius hiaticula* has declined. In the Howe of Fife gravel pits it has ceased to breed regularly, from some 6–10 pairs in 1990s (*Tay Ringing Group Report* 1994–95 pp 13–16). Some of this may be attributed to a reduction in suitable breeding habitat, planning approval to extract minerals requiring the operators to return such workings to farmland when operations are exhausted. This has a negative effect, not only on breeding waders, but on other wildlife, which finds the disturbed, unsprayed land ideal for colonisation. Some sites on which the Little Ringed Plovers have bred would appear to be suitable for the larger species, but although occasional pairs have formed territories, no recent nests have been found. Without having conclusive proof, I suggest that amelioration of the climate is causing this decline, whilst furthering the spread of the Little Ringed Plover. The Ringed Plover continues to attempt to breed in coastal Fife, but with limited success due to human disturbance.

I have spent many evenings and weekends attempting to protect breeding sites of Little Ringed Plovers and can only apologise to the few people I have asked to leave without being able to give explanations. My thanks to the landowners and their employees who have aided this research, often by creating, or not destroying, suitable habitat for these waders to breed on. I always tell them that I am the cheapest night watchman they will ever employ.

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Revised ms accepted April 2007

Intraspecific interaction by Hen Harriers over a cock's nest

Intraspecific interactions between harriers *Circus* sp are greatest early in the nesting season and decrease as the season progresses (Palmer 1988. Handbook of North American Birds, vol 4, London). In the spring of 2007 I watched an extension of this behaviour when 2 adult male Hen Harriers *Circus cyaneus* interacted over a cock's nest.

In April I watched a male Hen Harrier build a cock's nest in a traditional nesting area, site 7, in Galloway. On 2 May this male flew from site 7 directly west for 2 km towards a soaring male above another traditional nesting area, site 1. Both males circled each other, closely, with the site 7 male overhead until both went out of sight in a heat haze. Thirty minutes later the site 7 male returned and landed on his cock's nest. On 15 May at 1048 hours the site 7 male flew up from the nest heading east. At 1126 hours the male from site 1 flew low directly across the moor, landed at the site 7 cock's nest and remained there. Ten minutes later the site 7 male returned and, about 30m from his nest, skydanced low down 8 times. He then swooped on his nest whereupon the site 1 bird flew up. The males circled each other closely, with the site 7 male overhead. Both males then soared until the site 7 male stooped on the other male a km from the cock's nest; they then drifted over a hill and out of sight. The site 7 male returned at 1158 hours and landed on a fence post in his nesting area. Neither male bred or even attracted any females.

Conflicts between male Hen Harriers whose nests are close together is well known (Balfour 1962, *Bird Notes* 30: 145–152) but conflicts between 2 males disputing an unattended cock's nest is unusual.

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Revised ms accepted August 2007

Breeding success of Golden Eagles on the Isle of Rum 1995–2007

The breeding success and productivity of Golden Eagles *Aquila chrysaetos* on the Isle of Rum has been monitored annually since 1995. Over this period there have been 3 occupied home ranges. The results of the monitoring are presented in Table 1.

These results show a considerable improvement in productivity of Golden Eagles on Rum since the early years of the island becoming a nature reserve in 1957. Corkhill (1980, *Scottish Birds* 11:33–43) calculated a figure of 0.29 young per occupied territory per year for 4 occupied home ranges in the years 1957–76. The figure presented in Table 1 of 0.69 young fledged per occupied territory is higher than that found for the whole of Britain (0.36) in the national survey of 2003 (Eaton *et al* 2007, *Bird Study* 54:212–220) and is indeed better than the figure for the area with the highest productivity in that survey of 0.68 young fledged per pair for the Eastern Highlands. In 2003 all 3 pairs of Golden Eagles on Rum fledged a single chick each.

The reason for improved productivity of Golden Eagles on the Isle of Rum remains unclear. The low productivity from 1957–76 was thought to be due to pollutant burdens carried by the eagles because of their tendency to feed on seabird prey (Corkhill 1980, Furness *et al* 1989 in *Raptors in the Modern World* ed Meyburg and Chancellor. WWGBP: Berlin, London and Paris: 495–500). Unfortunately detailed analysis of prey remains and pollutant burdens for the Rum Golden Eagles has not been carried out in the years 1995–2007 . The improved productivity could be due to a change in dietary habits or a reduction in the pollutant burdens of the eagles' seabird prey. It would be interesting to carry out further research to investigate the causes behind the improved productivity of the Rum Golden Eagles.

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Revised ms accepted October 2007

Table 1. ***Breeding success of Golden Eagles in 3 occupied territories on Rum 1995–2007***

	No of years territory occupied	No of years breeding attempt recorded	No of years failed	Total young reared	Young per breeding attempt	Young per occupied territory per year
Territory 1	13	8	3	5	0.62	0.38
Territory 2	13	13	3	14	1.08	1.08
Territory 3	13	10	3	8	0.8	0.62
Total	**39**	**31**	**9**	**27**	**0.87**	**0.69**

Survey of roof nesting gulls in East Sutherland

A survey of roof nesting gulls was carried out in Caithness in 2006 and found a total of 210 ± 20 apparently occupied nests (aon), all Herring Gulls *Larus argentatus* (Clark, Maughan and Sellers 2007, *Scottish Birds* 27:74–76). The birds were distributed in 4 colonies, 2 small and apparently newly formed ones, a third established at least 15 years ago, and a fourth, the largest of them all, of similar age but which had been overlooked during the national seabird survey (Seabird 2000) in 1998–2002 (Mitchell *et al* 2004, *Seabird Populations of Britain and Ireland*, Poyser, London). During the course of the Caithness survey it became apparent that there were more colonies of roof nesting gulls in East Sutherland than had been found during Seabird 2000 (a single, mixed colony at Ardgay; Mitchell *et al* 2004, M Parsons, pers comm). Accordingly I undertook a survey of roof nesting gulls in East Sutherland during the 2007 breeding season.

As with the 2006 Caithness survey, roof nesting gulls in East Sutherland were surveyed in 2 phases, an initial one during the last week of May to locate colonies and make counts of sitting birds when nests are generally at their most conspicuous, and a second survey about 4 weeks later to identify any additional nests based on the presence of chicks, and determine productivity. Chicks frequently move a short distance from their nests and in so doing reveal the presence of nests which may not have been visible during the earlier survey.

The survey found a total of 88 aon of roof nesting gulls (71 aon Herring Gulls, 12 aon Common Gulls *L canus*, and 5 aon Great Black-backed Gulls *L marinus*) in 7 colonies: further details in Table 1. Common Gulls were found at a total of 5 sites, but at none of these did the total number of roof nesting birds exceed 4 aon; 3, those at Ardgay, Bonar Bridge and Lairg, were exclusively Common Gulls, whilst the other 2, at Embo and Dornoch, were within roof nesting Herring Gull colonies. In addition the colonies at Ardgay and Dornoch had some

Table 1. ***Roof nesting gulls in East Sutherland in 2007***

Colony	*Map ref*	*Number of breeding pairs (aon)*		
		Common Gull	*Herring Gull*	*Great B-b Gull*
Brora [a]	NC9003/9004	0	24 [b]	2
Golspie	NC8200, NH8299/8399	0	18	3
Embo	NH8192	1	3	0
Dornoch	NH7989/8089	4 [c]	26	0
Ardgay	NH5990/6090	4 [d]	0	0
Bonar Bridge	NH6091	1	0	0
Lairg	NC5706	2	0	0
Total		**12**	**71**	**5**

(a) In 2006 there were a minimum of 17 aon Herring Gulls and 1 aon Great Black-backed Gulls in this colony (based on single survey carried out at the end of June).

(b) In addition 3 aon nesting on the ground.

(c) In addition at least 3 aon nesting on the ground.

(d) In addition at least 8 aon nesting on ground in railway yard.

ground nesting birds associated with them, and this may have been the case at Bonar Bridge and Lairg, both places where Common Gulls breed on the ground nearby. Four roof nesting Herring Gull colonies were found, one small one at Embo, and 3 larger ones at Brora, Golspie and Dornoch. The colonies at the first 2 of these three larger colonies had a few Great Black-backed Gulls associated with them.

The nest sites used by the birds were quite varied. Of the 12 roof nesting Common Gulls, 5 had made their nests on chimney stacks, 4 on flat roofs and 3 in chimney pots. The Herring Gulls had built their nests as follows: 28 (39%) on chimney stacks, 22 (31%) on flat or gently sloping roofs, 8 (11%) on steeply sloping roofs usually behind standpipes, chimney stacks or other roof structures, 5 (7%) in the 'V' between two sloping roofs, 4 (6%) on flat coping stones and 4 (6%) in chimney pots. The Great Black-backed Gull nests had been built on flat or gently sloping roofs (4 nests) and on a steeply sloping roof (one nest).

Nests in the 3 larger colonies were quite widely distributed, typically around a core area with a higher density of nests. In Golspie this was centred on the High School, the whole colony covering an area of roughly 14 ha. Quite a number of houses to the south of the High School had netting over their chimneys or were fitted with spikes to deter gulls from nesting, usually a sign that nesting has been taking place for some time, and local residents confirmed that birds have bred on the roofs here since the early to mid 1990s. The position in Brora was similar. Gulls formerly bred on the roof of the old Hunter's Mill on the north west side of the town, and colonised the remainder of the town when the mill was demolished around 2000. There remains a concentration of breeding birds in the vicinity of the mill site, including several pairs with nests on the ground despite efforts in recent years to discourage this by pricking the eggs. This colony currently extends over an area of 59 ha. In Dornoch the main concentration of nests was in the town centre, but the colony extends throughout much of the town covering about 39 ha. Only a few buildings showed any signs of measures to discourage nesting. Nevertheless local residents say that gulls have nested on the roofs here since at least the early 1990s. The small colony in Embo, by contrast, was only established about 5 years ago.

Table 2. ***Productivity of Herring Gulls nesting in East Sutherland and Caithness in 2007***

Colony	Map ref	Habitat	Productivity	
			chicks per pr	No. nests
Colonies in East Sutherland				
Brora [a]	NC9003/9004	roofs	1.67	15
Golspie	NC8200, NH8299/8399	roofs	2.22	9
Dornoch	NH7989/8089	roofs	2.00	9
Colonies in Caithness				
Wick	ND3650/51, ND3751	roofs	1.94	17
Castle of Old Wick	ND3648	cliff ledges	1.56	18
Badbea	ND0920	boulder beach	1.06	17

(a) The equivalent figure for 2006 was 2.15 chicks per successful pair (n = 13).

Productivity estimates for the 3 main Herring Gull colonies are shown in Table 2, together with some data from roof nesting and coastal colonies in Caithness collected in 2007 for comparison. As in the earlier study, the roof nesting colonies were generally more productive than those on the coast.

Seabird 2000 reported only one roof nesting colony of gulls in East Sutherland, that at Ardgay and good numbers of Herring Gulls (33 aon) and Common Gulls (13 aon) as well as single nests of Lesser Great Blacked Gull *L. fuscus* and Great Black-backed Gull. There had evidently been a dramatic change in the birds' fortunes by the time of the present study when just 4 aon Common Gulls were found. Of the 4 Herring Gull colonies found in 2007 at least 3 (Brora, Golspie and Dornoch) appear to have been formed in the 1990s, and were evidently overlooked at the time of the Seabird 2000 survey; the fourth, that at Embo has been established since Seabird 2000 was carried out.

Ackowledgements
My thanks to the many people in East Sutherland who shared information with me about their birds, allowed me onto their properties to count birds and in one instance even lent me a ladder so that I could examine a nest on a roof. I am indebted to Simon Foster, Kenny Graham, Hugh Insley, Al McNee, Matt Parsons, David Paterson and Bob Swann for answering my queries about roof nesting gulls in East Sutherland, and to JNCC for allowing access to the Seabird 2000 results.

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Revised ms accepted November 2007

Breeding dates and success of Bass Rock gannets in 2007

There is a suggestion (Nelson J B 2006; 2007 *Scottish Birds* 26:50; 27:68) that Northern Gannets, *Morus bassanus*, on the Bass Rock are nowadays laying later than in former years and that, apparently, a higher proportion of established pairs are failing to breed even though they hold on to their sites. In 2007 JH used the pictures transmitted by cameras on the Bass Rock to the Scottish Seabird Centre to obtain information on laying dates, breeding success and the proportion of adult non breeders.

Six sample plots, each containing between 17 and 32 apparently occupied sites (AOS), in total 135, were chosen within the well established breeding ranks. They were all reasonably visible on the screens in the centre. Each plot was sketched to show prominent features as land marks and the sketches were used during each observation period. Within each plot JH tried to record the dates on which eggs were laid and on which the chicks fledged; 32 sets of observations were made between late April and mid October mostly late in the afternoon when there were fewer visitors at the Centre as it was impracticable to bar visitors from using the cameras. Each observation period took 1–2 hours during which a variable number of the plots were assessed. The dates on which eggs were laid and chicks hatched were estimated by working back from the first occasion on which a chick could be aged, using criteria in Nelson (1964 Ibis 106: 63–77 and 1978 *The Gannet*, T & A D Poyser. Berkhamsted). The results are given separately for each plot since to amalgamate would obscure variation and hinder plot specific comment.

Table 1. ***Results from sample monitoring plots***

	Date of first egg	Date of last egg	Number known to have hatched	Number fledged	Date last fledged	Fledging success	Productivity
Plot 1							
20 AOS	c25 Apr	c13May	9	9	c1 Oct	100%	45%
Plot 2							
17 AOS	c25 Apr	c16May	8	8	c1 Oct	100%	47%
Plot 3							
21 AOS	c28 Apr	c16May	8	7	c1 Oct	87%	33%
Plot 4							
22 AOS	c28 Apr	c10May	9	9	c1 Oct	100%	41%
Plot 5							
32 AOS[b]	c28 Apr	c19May[c]	18	13	c1 Oct	72%	43%
Plot 6							
23 AOS	c28 Apr	c19May	14	10	c5 Oct	73%	43%

Note a. Productivity is chicks fledged from occupied sites; not breeding success which is chicks fledged from eggs laid.

Note b. 2 adults died in May and no breeding occurred on these sites.

Note c. Excluding a late replacement egg laid c8 July.

Thus from 135 AOS a minimum 66 chicks hatched (48%) out of which 56 fledged (81%); overall productivity (fledged from occupied sites) was 41%.

The figures from the individual plots show that:

- Only 48% of AOS hatched a chick. On the reasonable assumption that egg loss in 2007 was about normal for gannets (ie very low) it seems that a high proportion of site owning pairs did not attempt to breed.
- Of those that did lay, a normally high proportion succeeded in rearing a chick to fledging. Plots 5 & 6 were exceptional in being near the base of the east cliffs and somewhat vulnerable to heavy seas.
- As in 2005 and 2006, the mean laying date in 2007 was significantly later than in the period 1960–90.

These observations appear to support the suggestions (Nelson *loc cit*) that Bass gannets are breeding later in the year and that a higher proportion of site owning and established pairs are not breeding than used to be the case. This is a critically important observation since it raises the possibility that a higher proportion of adults than formerly are below the threshold of fitness for breeding. It would be highly desirable to obtain information on this via an index of fitness such as body weight and fat content.

On only one occasion was a chick seen to be left unattended, which indicates that protection of site/chick is a high priority even when it may be that the availability of food within normal foraging distance is sub optimal.

If there had been a great deal of human intrusion into the colony with consequent egg loss then the figure for productivity and the assumption about withholding breeding would be meaningless, but there is no reason to assume such intrusion.

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Revised ms accepted January 2008

The first Lesser Grey Shrike in Scotland: clarification and correction

One important aspect of *The Birds of Scotland* (Forrester R W, Andrews, I J, McInerny C J, Murray R D, McGowan R Y, Zonfrillo B, Betts M W, Jardine D C & Grundy DS (eds) 2007, The Scottish Ornithologists' Club, Aberlady) was the inclusion of full collection details of the first few occurrences of all rare and other noteworthy species. For 'firsts', in particular, it is important that the documented record is accurate and here we correct an error concerning the first Lesser Grey Shrike *Lanius minor*.

The Birds of Scotland gave as the first occurrence an adult male collected by Jerome Wilson on 25 May 1928 on Fair Isle; this specimen is held at the National Museums Scotland (NMS) (NMS.Z 1928.58). The account also dismissed another Fair Isle record from 1913, citing apparent confusion with Woodchat Shrike *Lanius senator*, and quoting *The Birds of Shetland* (Pennington M, Osborn K, Harvey P, Riddington R, Okill D, Ellis P & Heubeck M, 2004, Christopher Helm) as the source.

During the compilation of *The Birds of Shetland* it was not always possible to refer to original sources. The main sources of historical data for Fair Isle were William Eagle Clarke's *Studies in Bird Migration* (1912), which pre dates this record, Peter Davis' list which appeared in Ken Williamson's *Fair Isle and its Birds* (1965) and Nick Dymond's *The Birds of Fair Isle* (1991). The latter 2 sources only summarised records for Lesser Grey Shrike (and, indeed, Woodchat Shrike) and these totals did not tally with the number of records traced. Davis listed 12 records of Lesser Grey Shrike, whereas 13 were located.

Jerome Wilson's short note on the 1928 event was accompanied by an editorial statement noting it as the second Scottish occurrence with the first also at Fair Isle on 3 June 1913 (Wilson J, 1928 *Scottish Naturalist* 1928: 127). Later, Baxter and Rintoul also noted the latter as first record, with a Woodchat on 4 June (Baxter E V & Rintoul, L J, 1953, *The Birds of Scotland*, Oliver & Boyd). During the editing of *The Birds of Shetland*, however, no further details of the 1913 record could be traced and it was wrongly assumed that the close juxtaposition of occurrences of both Lesser Grey and Woodchat Shrike on Fair Isle on 3 and 4 June 1913 had led to confusion.

In fact the separate occurrences of these birds were explicitly recorded in Clarke's paper on migrants at Fair Isle in 1913, which had been overlooked in the compilation of *The Birds of Shetland* (Clarke W E, 1914, On some migratory birds observed at Fair Isle during the spring and autumn of 1913. *Scottish Naturalist* 1914: 53–55). An adult female Lesser Grey was collected on 3 June and crucially noted as the

first for Scotland, with an adult female Woodchat collected on the following day.

Both these specimens entered the collections of the NMS and were mounted for exhibition. Remarkably, both came to light in the British Bird Hall in January 2008 when specimen lists were being prepared in advance of closure of public galleries as part of redevelopment of NMS. Due to the vagueness of labelling, the historical significance of the mounts had been hitherto missed. This provenance is further confirmed by other literature sources in NMS.

Therefore the correct attribution of the first Lesser Grey Shrike in Scotland is:

Adult female, collected by Jerome Wilson on 3 June 1913 at Fair Isle. Specimen at NMS (NMS.Z 1913.145.5).

Robert Y McGowan, Department of Natural Sciences, National Museums Scotland, Chambers Street, Edinburgh, EH1 1JF

Mike Pennington, 9 Daisy Park, Baltasound, Unst, Shetland, ZE2 9EA

Christopher J McInerny, 10 Athole Gardens, Glasgow, G12 9AZ

Revised ms accepted April 2008

Merlin impaling prey on barbed wire fence

On 19 June 2007 I watched a male Merlin *Falco columbarius* hunting over moorland in Galloway. He stooped on a Meadow Pipit *Anthus pratensis* and caught it. The Merlin flew down to a fence post and managed to impale the Meadow Pipit on to the spikes of the barbed wire fence similar to a Great Grey Shrike *Lanius excubitor* wedging prey. The Merlin then partly plucked the Meadow Pipit for 5 minutes. He flew up with the prey and soared for over 2 km before diving down toward his breeding site.

Hunting perches used in the summer by Merlins include fence posts in Galloway (Dickson 2002, *British Birds* 95: 141–142) but for a Merlin to impale prey on a barbed wire fence is unusual behaviour.

R C Dickson, Lismore, New Luce, Newton Stewart, Dumfries & Galloway DG8 OAJ

Revised ms accepted March 2008

Robert Grier Caldow

1922–2006

Bob Caldow was born in Troon on 29 September 1922, and educated at Marr College in that town. He subsequently won bursaries to Glasgow University, his studies being interrupted by war service, which he undertook at the Nobel Division of ICI between 1944 and 1947. Following the end of hostilities Bob completed his chemistry degree, and then worked in industry until deciding to pursue a career in teaching. His first placing was at Allan Glen's School in Glasgow between 1964 and 1972; from there he progressed to the post of Assistant Head Teacher at Paisley Grammar, remaining there until retirement in 1986.

Bob was a talented and popular teacher, and also passed on his passion for birds to many of his students through the school bird club which he organised. I'll always remember them attempting to squeeze as many bodies as possible into a makeshift hide on the saltmarsh at Erskine. A sense of fun was an important ingredient which Bob added to these outings.

He was elected Glasgow Branch chairman, then a Council member of SOC in 1966. Bob brought warmth to these posts which endeared him to everyone. As youngsters, George White, myself and the rest of the Paisley Moss watchers hung on his every word; this was our Mr Caldow that we turned to for advice when anything unusual turned up on our local patch. He was never too busy to spend time on the phone, or to meet us down at 'the moss' to confirm our latest sighting. Bob was a regular at the SOC conference, an event to which he eagerly looked forward, renewing friendships and exchanging the past year's experiences over a pint.

Bob will be fondly remembered. He was an unassuming man; not many are aware that Bob Caldow was the principal advocate who convinced George Waterston to establish the RSPB Reserve at Lochwinnoch. For much of the 1960s the Barr Loch was Bob's local patch and he dreamed of restoring the ancient drainage system to recreate the glory days when the loch was a huge marsh, with breeding Black-necked Grebes amongst the vast colony of Black-headed Gulls. It will be a lasting tribute to Bob if the RSPB finally achieves this goal.

Bob had a strong and unashamedly sentimental sense of history, and an open admiration for the pioneers of Scottish ornithology; he considered himself privileged to count a number of them amongst his friends. In particular he had tremendous respect for the late Professor Maury

Meiklejohn and one of Bob's lasting achievements was to edit a Clyde SOC tribute to that great elder statesman of ornithology. Published in 1994, it was composed of cuttings collected by Bob from many years of Saturday Glasgow Heralds in which the professor wrote an evocative and often humorous diary of his ornithological excursions, over the initials MFMM.

Bob Caldow's health had been in decline for a number of years and he became seriously ill early in 2006. He died on 26 August 2006. He is survived by his beloved wife Sheena, and sons Martin and Richard.

Iain Gibson

Russell Young

1936–2007

Russell Johnston Young, who was Club Secretary from Oct 2001 until August 2005, died on 19 August 2007 aged 71 after admission to hospital. Russell's time as Secretary covered a substantial part of the period of move from Regent Terrace to Waterston House. The resulting protracted and onerous secretarial burden was met with Russell's characteristic diligence which ensured that the burden was carried and discharged effectively.

In earlier life, Russell had studied for and made a career change from the textile industry of his native Borders - he came from Greenlaw - to primary school teaching. He became headmaster of Strathdevon Primary School, Dollar, a position he held until early retirement for health reasons in 1989. His new career however had realized his innate vocation of teaching. That was especially so of natural history for which he often exceeded the allotted time in his curriculum engendering great response from his pupils. He was always pleased beyond measure when those pupils told him of following up by observation or practice some subject of his natural history teaching. He was rewarded in that way many times.

For Russell, however, teaching was not limited to classroom and pupils. Anywhere, anytime he readily imparted knowledge of the wild or of other subjects. His responses were easily kindled, presented with a smile and humour, and were immediately engaging. He was welcomed and listened to in any company and came into his own on club branch outings; what he said was remembered.

His interests went beyond ornithology and for him were gateways to knowledge. He was a dedicated angler, with abundant craft to counter the guile of the trout, not least in the flies that he made by his own hand. He had a knowledge of fish biology and ecology derived especially from his local River Devon and neighbouring waters. He had been a water bailiff on that river. Botany was in his repertoire. So was gardening, which he practised extensively and successfully. He was a member of his church choir, the Kirkcaldy Gilbert and Sullivan Society and the East Fife Male Voice Choir and a painter of rural subjects.

Fundamentally, Russell was a man who cared. That was manifest in his attention to detail , in the way he shared his interests, in his unfailing consideration to all in his circle, and in his unstinting helpfulness to the needs of acquaintances less fortunate than himself.

He had a long involvement with the SOC attending the Stirling (now Central) branch where he inevitably became chairman. He was the driving force behind the branch's weekend survey of the birds of the River Devon in 1977,

a project which drew club members from outside areas, on which a report was produced, and which was repeated in subsequent years.

In Russell's passing has fallen a bright leaf from the canopy of Scotland's ruralists. That fall saddens all who knew him but they remember a friend of strong and kind character and retain the inspiration of his cheering presence and helpful word.

Sandy Mitchell

Jeff Watson

24 December 1952–19 September 2007

The world's acknowledged expert on Golden Eagles, Dr Jeff Watson, died of cancer at his home in the Black Isle last September. Jeff dedicated a third of his all too short life to studying Golden Eagles, and in 1997 published the definitive book on these magnificent birds, *The Golden Eagle*. Just days before he died, he wrote the foreword to the second edition, which will be published next year.

Raised in Galloway, Jeff's interest in birds was inspired by his father, bird artist and ornithologist Donald Watson. Jeff attended the local primary school at Dalry, Edinburgh Academy, and then Aberdeen University where he to took an honours degree in zoology, graduating in 1974.

Moving to the Seychelles, in the Indian Ocean, Jeff spent 4 years researching the endemic Seychelles Kestrel, for which he was awarded a doctorate by Aberdeen University in 1977. This led to work for the WWF on the conservation of endangered, endemic landbirds. Jeff's work on these islands continued through field visits and active collaboration with conservation groups.

On his return to Britain, Jeff worked for a short time for the Scottish Wildlife Trust. In 1981 he joined the Nature Conservancy Council researching Golden Eagles, in particular the impacts of land uses such as forestry, farming and red deer management on the birds. This developed into a pioneering study of eagles in 9 ecological regions, which set the highest of standards for understanding the effects of land uses on raptors.

Following in the footsteps of the great eagle fieldworkers such as H B Macpherson, Seton Gordon and Adam Watson, Jeff had the essential skills of tenacity, robustness, patience, determination and an ability to cope with weeks of solitude. For years his research base was a camper van, and, with his wife Vanessa, he walked hundreds of miles each year in difficult terrain.

Jeff became the world's foremost authority on the Golden Eagle. He had personal knowledge of most of their nesting territories in Scotland. He also visited other parts of the bird's world range to advise on conservation and management issues. His monograph on the

Golden Eagle, published by Poyser/Academic Press, was praised throughout the world. Beautifully written, it was translated into a Japanese edition last year. The book and Jeff's more recent research have led to many research papers on the conservation and population ecology of Golden Eagles, including DNA fingerprinting of much of the breeding population, and a conservation framework for the species which has attracted international interest. Until days before his death, Jeff corresponded with workers in Kazakhstan, the Republic of Ireland where the reintroduction programme has benefited from the donation of chicks from Highland eyries, Alaska, Idaho and the Appalachian Mountains of North America.

During the last 10 years, Jeff held down the challenging role of Director of Operations (North) in Scottish Natural Heritage (SNH). He had lead responsibility for the designation, conservation and management of Scotland's internationally important Special Protection Areas and Special Areas of Conservation. He led the programme of work which overhauled Scotland's series of National Nature Reserve, and led an ambitious programme of monitoring habitats, species and landforms across Scotland. The recent batches of Scotland's SPAs classified for raptors are a fine legacy, which involved SNH working closely with land managers, raptor fieldworkers and the RSPB. Jeff also led the SNH team which worked closely with the Scottish Executive in support of the passage of the Nature Conservation (Scotland) Act 2004, giving rise to wildlife conservation legislation which has set new standards for the rest of Europe. He represented the UK as a Council Member of Eurosite, and was a Trustee of the National Biodiversity Network.

An outstanding photographer, Jeff produced evocative landscape pictures which have been compared favourably with the hill and raptor paintings by his father. Despite all of these accomplishments, Jeff remained modest, indeed humble, and was genuinely embarrassed if praise came his way. His dealings with the politics of conservation were, at times, troubling, and he often spoke of the agonies of compromising in the face of development pressures. However, many battles were won, often due to Jeff's calm mastery of the facts and cogent arguments. His final battle was with cancer, which he lost after a courageous and determined fight, during which he showed supreme dignity.

Last year, Jeff was awarded the prestigious Conservation Medal by the RSPB, and the Scottish Raptor Study Groups have established an award in the name of Jeff and his father. Jeff is survived by his wife Vanessa, son Ronan and sisters Pamela, Kate and Louise, who cherish special family days watching Golden Eagles amongst the rugged mountains of the Highlands.

Des Thompson & John Lister-Kaye

Advice to contributors

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Sanderling on The Isle of Tiree, Argyll © Edmund Fellowes

Lapwing on The Isle of Tiree, Argyll © Edmund Fellowes

Scottish Birds

Volume 28 **June 2008**

Contents

Published by the Scottish Ornithologists' Club, Scottish Birdwatchers' Centre, Waterston House, Aberlady, East Lothian EH32 0PY.
Scottish Charity Reg. No SC 009859