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East Greenland Barnacle Geese in Scotland, spring 1988

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The East Greenland population of Barnacle Geese, which winters in northern and western Scotland and western Ireland, was censused by combined ground counts and aerial survey in late March 1988. The Scottish component of the population had increased since the last census, in 1983, from 20,820 to 26,950. This 29% increase had taken place solely at the main haunt, Islay (15,245 to 20,292). A 71% increase in Ireland has taken the total population from 26,467 in 1983 to 34,544 in 1988.

Protection under the Wildlife and Countryside Act 1981 has been the main reason for the increase. Elsewhere in Scotland the distribution, scattered over 34 different islands, showed some marked changes, in particular a decline in the Outer Hebrides and an increase on the islands off the north and west coasts. These changes are discussed in relation to the amount of sheep grazing and suitable grassland on these islands. Photography was used to verify many of the aerial counts, and revealed an acceptable level of accuracy.

Introduction

The three populations of Barnacle Geese *Branta leucopsis* breeding in arctic USSR, Svalbard and East Greenland winter respectively on the North Sea coasts of Continental Europe, the Solway Firth (Scotland/England) and in north and west Scotland and western Ireland. Extensive marking with individual leg rings and conventional metal rings has shown virtual separation of the three populations, with just a handful of birds in any year moving from one to another (Ogilvie & Owen 1984).

Censusing of the three populations is most easily done in winter, the Arctic breeding areas being extensive and of varying accessibility. Wintering populations on the Continent and on the Solway are concentrated and regular counts can be made. The third population, from East Greenland, is highly scattered in winter, from Orkney in the northeast of Scotland to the Blasket Islands, in Co. Kerry, southwest Ireland. Although the majority of the population winters on the island of Islay, birds have been found at over 100 different haunts within this extensive range, all but a few being offshore islands which are mostly uninhabited.

Away from Islay, the only practical method of determining how many geese are inhabiting this extensive range is to count them from the air. Visiting even a proportion of the haunts by boat within a reasonable time would be a major undertaking. Percival (1988) and Newton & Percival (1989) showed from studies of individually marked geese that there is some movement during the winter between Islay and Tiree/Coll, and perhaps other haunts, so it is essential that any census is carried out in as short a time as possible.

The technique of counting this

population from the air was pioneered in the late 1950s (Boyd 1968) and is now well established (see Methods). For reasons of cost, however, such surveys have been carried out only at about five-year intervals (e.g. Boyd 1968, Ogilvie & Boyd 1975, Ogilvie 1983a).

On Islay, where 50 – 70% of the total population winters, ground counts have been carried out every winter since the mid-1950s, often twice a winter and more recently monthly (Ogilvie 1983b; Easterbee & Bignal 1983 – 1988, Bignal *et al* 1988). These counts monitor a major segment of the population which, as the aerial surveys have shown, dominates changes in the population total. Age-ratio counts are also carried out on Islay each autumn to assess breeding success.

Elsewhere, there is a long series of ground counts from the principal Irish haunts of Inishkea, Co. Mayo (Cabot & West 1983) and Lissadell, on the mainland near Sligo (Irish Bird Reports). Sporadic counts have taken place at some Scottish haunts, more regularly in recent years, notably Colonsay, Coll and Tiree, and islands in the Orkney group (Scottish Bird Reports). These counts have, however, never been sufficient to enable any judgements to be made concerning the status of that part of the population that winters away from Islay.

The Barnacle Goose is the subject of special conservation measures concerning habitat protection under Article 4 of the EEC Directive on the Conservation of Wild Birds, which obliges member states to take account of "trends and variations in population levels" ensuring "their survival and reproduction in their area of distribution". It has long been known that there are considerable annual variations in the breeding success of Arctic nesting geese, which can have a major effect on population totals. Breeding success variation in the East Greenland Barnacle Geese, as with other species, is linked to meteorological conditions on the wintering grounds, as well as at staging areas used on migration and the breeding grounds (Fox & Gitay 1990).

The relatively small size of the population, its restricted distribution and its variability in breeding success, all make the East Greenland Barnacle Goose vulnerable to hunting as well as to modification or loss of habitat.

There has been conflict in some parts of Islay between farmers and conservationists concerning the large wintering flocks of Barnacle Geese there. In the late 1970s, an increase in formerly low levels of shooting brought about a marked reduction in numbers (Ogilvie 1983b). In 1981, the Wildlife and Countryside Act gave the species full protection. Shooting under licences issued by the Department of Agriculture and Fisheries, Scotland, to prevent serious agricultural damage was at a lower level than before and numbers have increased again (see below). In 1983, the Royal Society for the Protection of Birds purchased a large part of one of the most favoured feeding areas, at Loch Gruinart, and began management specifically for geese.

The 1968 Countryside Act empowers the Nature Conservancy Council to offer management agreements to owner/occupiers within Sites of Special Scientific Interest (SSSIs). Three SSSIs have been designated on Islay as Barnacle Goose sanctuaries and farmers within these have management agreements which provide payments and, in some years, free fertiliser in return for maintaining a required area of reseeded rotational grassland and agreeing not to shoot or deliberately scare the geese.

The three SSSIs, which include the RSPB Loch Gruinart Reserve, attract and hold an increasing proportion of the island's Barnacle Geese (Percival *et al* 1988, Easterbee & Kinnes 1989). These important changes on the major wintering haunt may be affecting the pattern of numbers and distribution elsewhere and merit further investigation.

Several of the traditional wintering haunts of Barnacle Geese away from Islay also qualify for protection as EEC Special

Protection Areas and "Ramsar" sites of International Importance. They qualify by virtue of the number of geese present and the proportion these represent of European or world populations, providing a need for regular information on these haunts.

Since Barnacle Geese prefer short grassland swards on which to feed, the suitability of offshore islands is determined largely by the presence of sheep or cattle. Historically, these were taken out to graze through the summer on many of the small, uninhabited islands off the west coast of Scotland. In recent years, twice-yearly compulsory dipping of sheep may have contributed to the abandonment of some islands for grazing, as previously, only one single end of season round-up would have been required to remove stock from an island. Aerial survey hence provides an opportunity to assess vegetation quality on the islands.

This paper reports on a census of Barnacle Geese at all known Scottish wintering haunts from Orkney to Islay in March 1988 (including the Northern Ireland coast where no birds were found). This was carried out at the same time as a similar aerial census in the Irish Republic by the Wildlife Service (Walsh & Merne 1988) thus providing information on the total East Greenland population.

Methods

The aerial survey was carried out (by ADF & MAO) between 21 and 28 March 1988 using a Cessna 172, four-seater, high-wing monoplane. Despite much cloud and some rain, flying was possible on all but one day. Because of poor conditions on the first survey, most of the Outer Hebridean chain was covered twice; only the second flight results have been used. Bad visibility initially prevented coverage of areas north of Jura during the main survey, but out and back flights from Glasgow were made to survey this area and the Northern Ireland coast.

Every island on which Barnacle Geese had been recorded on previous surveys was overflown as well as every other island on which the vegetation looked suitable for geese. It is quickly apparent from the air if an island has areas of grass on which the geese can feed or is covered in rank vegetation or bare rock to which they are unlikely to be attracted. Likely-looking areas on the mainland coast, and on the coast of the larger, inhabited islands, such as the Uists, Benbecula and Skye were also covered.

An assessment was made of the number of sheep or cattle present on each island, and the proportion of the island that appeared to be short grassland sward. Although subjective, it, as well as the stock counts, should be comparable with a similar assessment made by MAO during the 1983 aerial survey.

Full details of the aerial survey technique are given in Boyd (1968), but briefly each suspected haunt was approached at a height of no more than 250 m (800 feet) at a speed of *c.* 150 km/hr. This flushed the geese which became much more visible as a moving flock than when stationary on the ground. The pilot then endeavoured to position the plane so that the observers, one sitting next to him, the other behind, could see the flock well enough to count it, and if possible take photographs. This could involve tight circling or rapid turning to keep up-sun of the geese. Glare off the sea can render the geese nearly invisible.

Photographs cannot be relied on solely to provide counts. Apart from obvious hazards such as camera malfunction or loss of the film, it is not always possible to be certain that the whole flock is within the frame. There are also some flocks which cannot be photographed because of problems with light or background. Thus a visual count, or counts, were always completed before any photographs were taken. Colour slides were projected on to sheets of white paper and pencil marks put on each identifiable bird (overlapping birds within a flock pose some difficulties and we took the higher of the counts of any repeat

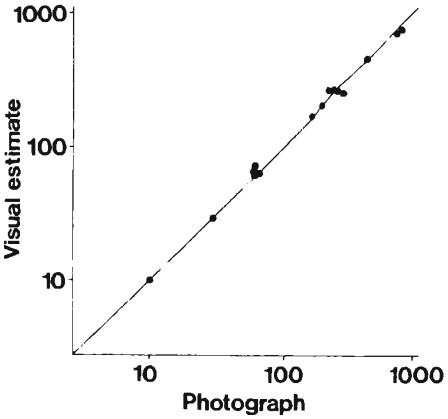

FIGURE 1. Plot of visual estimates against photographic counts of Barnacle Geese; the 15 pairs of data representing 15 different flocks. Note axes are logarithmically transformed; the line indicates perfect agreement between the two methods.

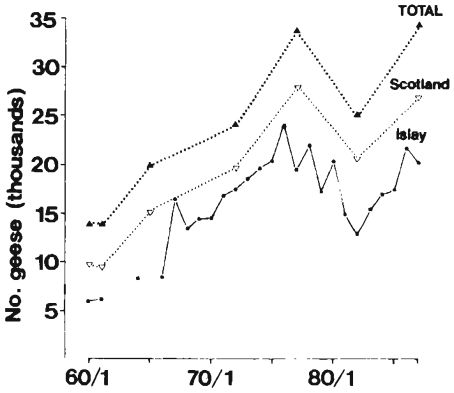

FIGURE 2. Total population estimates of East Greenland Barnacle Geese based on six aerial censuses, 1961-1988, plus annual Islay ground counts for the same period. The Islay counts are for each winter until 1982/83 (Ogilvie 1983a); subsequently they comprise mean winter levels calculated from monthly counts (Bignal et al 1988). ▲ Scotland and Ireland ▽ Scotland ● Islay.

photographs of the same flock), then the marks were tallied. In 15 cases, we could check a visual count against a photographic count. The mean difference was 0.4% (SE 2.2), which indicated no significant difference between the two techniques (Fig. 1).

The aerial survey information has been combined with the mean of two ground counts on Islay (Easterbee & Bignal 1988) on 28 and 29 March. A small flock of 55 geese found from the air on an islet off the southeast coast of the island has been added to the Islay total.

Results

A total of 6658 Barnacle Geese was counted in the course of the Scottish aerial survey, with ground counts of 19,730 and 20,745 on the two days on Islay (Easterbee & Bignal 1988). The average count including the additional offshore flock is thus 20,292, 75% of the Scottish total. In addition, 7594 were counted in Ireland (Walsh & Merne 1988), giving a population total of 34,544. Both the Scottish and Irish totals have increased substantially since the last census, in 1983, although the whole of the Scottish increase is confined to Islay (Fig. 2).

A breakdown of the counts for 1988, and previous aerial surveys, is shown in the Appendix. The various sites where geese were found away from Islay have been grouped into what are believed to be reasonably discrete areas, following Ogilvie & Boyd (1975). The groupings follow natural boundaries so far as possible (for instance, all the islands in the Sound of Harris are treated as one unit, or are restricted to single, well-separated haunts such as Eilean Mor, off Knapdale).

Geese were found in March 1988 at 34 sites (Appendix and Fig. 3); that on Garbh Reis, in the Sound of Jura, is a previously undocumented site and is sufficiently isolated from neighbouring sites to be treated separately. Previous surveys have found geese at between 38 and 58 sites (Ogilvie 1983a). The various groups can be

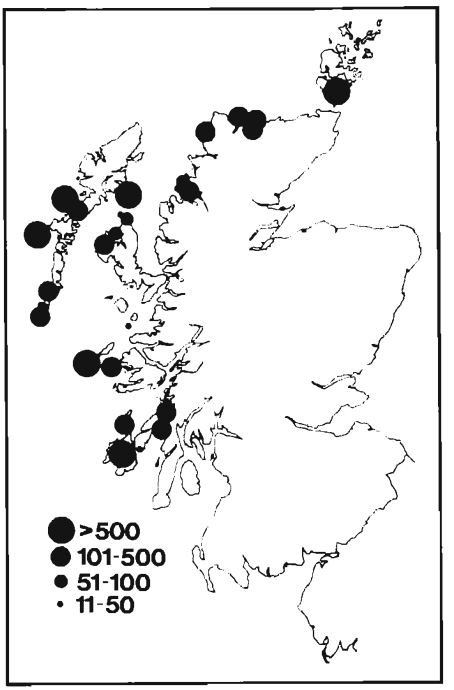

FIGURE 3. Distribution of East Greenland Barnacle Geese wintering in Scotland, late March 1988. Three sites (one south of Barra and two in the Sound of Harris) with under ten geese are omitted from the map, while counts at different sites in the Treshnish (4 flocks), Monach (2) and Shiant Islands (2) have been amalgamated for convenience.

further amalgamated into three main regions: the Inner Hebrides; the Outer Hebrides; and islands off the west and north coasts of the Scottish mainland. Beginning with Islay, the status of the Barnacle Geese in each region is now considered, along with the results of the survey of sheep and grass availability.

Islay

Islay held 59% of the total British and Irish population in March 1988, compared with 56–63% for the previous 15 years (Appendix). Changes in the numbers on Islay in this period have accounted for between two-thirds and three-quarters of the changes in the total population, and have completely swamped any increases or decreases elsewhere in Scotland (Fig. 2).

The 1983 census was held when the Islay population was at its lowest for over 10 years. During the late 1970s and early 1980s, shooting and disturbance of the geese on Islay greatly increased and this resulted in a significant decline in wintering numbers associated with an increase in annual mortality (Ogilvie 1983b). Breeding success in this period was also below average, probably as a consequence of the increased hunting pressure preventing geese reaching peak condition before their spring migration.

The numbers of Barnacle Geese wintering on Islay have recovered in the mid-1980s almost entirely as a result of the conservation and management changes that have taken place on Islay since the 1981 Wildlife and Countryside Act. The average number of geese being reported shot annually under licence is 628 (1983/84 – 1988/89 inclusive), which is less than half the estimated 1400 being shot in the late 1970s (Ogilvie 1983b). Very considerable areas of favoured feeding on the island are sanctuaries where no goose shooting takes place, and where pasture has been rotationally ploughed and reseeded.

Concerns by Islay farmers that the creation of managed sanctuaries for the Barnacle Geese would lead to a substantial increase in numbers over and above past peaks seem not to have been warranted. A programme of deliberate scaring in winter of 1978/88, combined with limited shooting under licence, was successful in reducing numbers outside the sanctuaries by persuading the geese to shift into them.

Inner Hebrides

Overall numbers in this area changed little between 1978 and 1988 (Table 1). There has been some increase in numbers present on islands close to the Kintyre and Knapdale

TABLE 1. Regional totals of Barnacle Geese in aerial surveys, 1961 – 1988.

Region	Mar 61	Apr 62	Mar 66	Mar 73	Apr 78	Mar 83	Mar 88
Inner Hebrides	993	1274	1694	784	1606	1646	1591
Outer Hebrides	2676	3016	4051	3183	3848	4199	3100
West & North coasts	571	476	863	759	1102	945	1967
TOTAL	4240	4766	6608	4736	6556	6780	6658

peninsula and in the Sound of Jura, including a flock of 195 on Garbh Reis. However, in 1988, numbers detected were low at Oronsay adjacent to Colonsay, on the Treshnish Islands off the west coast of Mull, and on Tiree and Coll (where the birds fly freely between the two islands and which are therefore treated as a single haunt (Newton & Percival 1989).

Either side of the aerial survey there were much higher ground counts from Oronsay of 382+ (5/6 March), 200 (Oronsay, 21 March although no count was made on Colonsay that day) and *c.*400 (16 April; J. & P. Clarke in litt), than the 125 found from the air on 21 March.

There were also several incomplete ground counts on Tiree giving minimum estimates of: 362+ (8 March), 446+ (9 March; D.A. Stroud), 760 (10 April), 400+ (13 April) and 462+ (16 April; K. Shepherd). These counts compare with 550 on Tiree and none on Coll counted from the air on 26 March.

Newton & Percival (1989) showed that individually marked geese moved between Islay and Tiree and Coll, the only islands among those listed that are easy to visit regularly. However, such movements seem mainly to involve birds arriving on Islay during the autumn migration (cf. Easterbee *et al* 1987) and then back-tracking the comparatively short distance to winter on Tiree or Coll, with only a little wandering to or from Islay in the course of the winter.

There was a slight increase in the number of islands with suitable grass between 1983 and 1988 (Table 2), the most striking change having taken place on the Garvellachs, four small islands which lie between Jura and Mull. In 1983, there were no sheep and the vegetation appeared rank and rough. In 1988, there were approximately 150 sheep on the four islands, all of which had areas of good grass.

Outer Hebrides and Skye

The islands round Skye which hold Barnacle Geese are all to the northwest of the main island and much closer to haunts in the

TABLE 2. Comparison between 1983 and 1988 aerial surveys in numbers of islands with geese, with sheep, and with suitable grazing. Additional totals for 1988 are islands not surveyed in 1983.

Region	1983				1988			
	With geese	With sheep	Grazing good	Grazing poor	With geese	With sheep	Grazing good	Grazing poor
Inner Hebrides	7	18	28	34	10	18	35	27
Outer Hebrides	24	19	52	37	16	38+9	58+7	31+5
W & N coasts	10	8	15	22	8	2+9	15+11	22+4
TOTAL	41	45	95	93	34	58+18	108+19	80+10

Outer Hebrides than to those in the Inner Hebrides, and are consequently placed in the former region.

The total counted in this region fell by just over 1000 between 1983 and 1988 while the number of islands with geese dropped from 24 to 16 (Tables 1 and 2). This was unexpected as, apart from a high count in March 1966, there had been a steady increase in numbers in the region since the first survey in 1961. There were declines in all but two of the island groups holding more than 250 in 1983, particularly noticeably in the Barra-Barra Head, Sound of Harris and Trodday groups (Table 1).

The only observable change in any of the groups since 1983 was the presence of a substantial house being built on the main island of the Ascrib group off Skye which could have contributed to the drop in numbers.

There has been a marked increase in the number of islands with sheep and a smaller increase in those with reasonable grass (Table 2), both of which might be expected to benefit the Barnacle Geese unless simultaneous measures are being taken to discourage them.

North and west coasts

The numbers of Barnacle Geese have more than doubled in the last five years (Table 1), though two less islands held geese in 1988 (Table 2). Numbers had increased at all island groups, but in particular at the Hoan Islands and Orkney. Since the discovery in the late 1970s of a flock of Barnacle Geese wintering in the Orkneys, numbers there have increased sharply. The flock frequents Switha, Swona and other islands in Scapa Flow (P. Reynolds, pers. comm.).

Geese have been irregular visitors to the Hoan Islands (Appendix), the count in March 1988 matching the previous peak in 1966. The presence of a large flock of geese on the main island, Eilean Hoan, may have been due to the island being managed for the geese by the RSPB since 1980 through increased sheep grazing (R. Dennis, pers. comm.); our subjective assessment of the grass quality changed from 'good' in 1983 to 'excellent' in 1988. None of the counts at the other island groups exceeded previous maxima, though all showed an increase on 1983. Overall, there was a sharp decline in islands with sheep since 1983 (Table 2), although those with reasonable grazing (which hold most of the geese) remained unchanged.

Discussion

The relatively small population of Barnacle Geese wintering in Scotland and Ireland has fluctuated in recent years, declining by 22% between 1978 and 1983, then increasing by 31% to the present. This increase is represented by a 29% increase in Scotland (exclusively on Islay) and a 71% increase in Ireland.

It is unlikely that any important Barnacle Goose haunts were missed during the March 1988 aerial survey. Not only were all traditional sites covered, but also all those for which there has been even a single count in past aerial surveys, plus many additional areas with suitable feeding habitat.

Islay continues to be by far the most important wintering area within the entire range of the East Greenland Barnacle Goose population. Mean overwintering numbers increased from 15,535 in 1983/4 to 20,384 in 1987/88 (Bignal *et al* 1988). The current, much-improved management regime there seems capable of sustaining at least the present numbers.

Despite considerable fluctuations in the numbers on Islay over the period of the last three surveys, there is little evidence that this has had any effect on the numbers elsewhere in Scotland. The striking increase in Ireland has been attributed, in part, to a long-term improvement in the protection offered to the species in the Republic (Walsh & Merne 1988).

The recent stability of numbers in the Inner Hebrides, including all the haunts nearest to Islay and therefore perhaps the

most likely to vary when numbers on Islay vary, contrasts with the sharp decline in the Outer Hebrides and an equally sharp increase on the islands off the west and north coasts of Scotland.

Cabot & West (1983) suggested that the Inishkea Islands, Co. Mayo, with the second largest group (2000 – 2500) of Barnacle Geese after Islay, have long since reached their carrying capacity, based upon more than 20 years of annual counts. If stability in numbers over a long period can indeed be interpreted in this way, then it may well be that the same is currently true of the majority of the Inner Hebridean haunts. However, one new haunt was discovered in the course of the survey and the Garvellach Islands have been considerably improved as potential goose habitat in the last five years, perhaps allowing for an increase in numbers in this region in the future.

The decline in the Outer Hebrides region is puzzling, since sheep densities appear to have increased and a more detailed examination of possible factors is needed in this area.

The sharp increase in the north and west coast islands region is in part due to direct management for the geese on the important haunt of Eilean Hoan as well as to the continuing increase in Orkney. This latter island group contains several uninhabited but sheep-grazed islands which look suitable for geese.

A major weakness of almost the entire sequence of aerial surveys of this goose population is that they have nearly all taken place at the same time of year, namely late March and early April. The reason for this is purely logistical. After the first survey in December 1959, it was concluded that the length of daylight and weather situation were both much more suitable for aerial surveys in the spring than in mid-winter. Even so, it has been quite usual on past surveys, to spend as many days grounded by bad weather conditions as actually flying.

The long series of counts on Islay (Ogilvie 1983b, Easterbee & Bignal 1983-1988, Easterbee & Kinnes 1989) have shown that there is, in some years, an increase in numbers there in March and April. Easterbee *et al* (1987) showed that, in the autumn of some years at least, virtually all the Greenland population may stage on Islay. Thus the optimal period for a true assessment of the overwintering distribution of geese lies between December and February. Ogilvie (1983a) suggested that the spring influx could be a pre-migratory movement of birds to Islay in search of better feeding than is available to them on their wintering site, while the use of sites such as Garbh Reis may also reflect such movements rather than correspond to new wintering sites.

It can therefore be seen that the counts of all the haunts away from Islay are not necessarily fully representative of their true mid-winter holding capacity and more information is undoubtedly needed concerning the distribution of Barnacle Geese in Scotland at other times of winter to compare with the late March-early April situation when the birds may be redistributing prior to their spring migration.

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(Revised ms received 3 March 1990)

APPENDIX. Numbers of Barnacle Geese counted during aerial surveys 1959 – 1988. Figures in brackets are interpolated means of counts from previous and subsequent years. * Figures relating to Islay come from ground counts at the time of aerial survey of other resorts (details in Ogilvie 1983a).

	Sites in group	Dec 1959	Mar 1961	Apr 1962	Mar 1966	Mar 1973	Apr 1978	Mar 1983	Mar 1988
INNER HEBRIDES									
Trodday	1	0	18	0	0	0	70	0	0
Brosdale	2	140	107	124	45	0	0	0	25
Eilean Mor (Kintyre)	1	0	14	44	196	110	436	210	295
Garbh Reis	1	0	0	0	0	0	0	0	195
Eilean Mor (Jura)	1	10	4	0	16	(8)	0	0	0
Oronsay/Colonsay	1	0	0	230	18	40	45	180	125
Soa	1	0	0	0	61	35	0	2	0
Treshnish	5	299	470	390	795	419	610	620	378
Tiree/Coll	3	25	380	484	534	143	390	619	550
Small Isles	2	0	0	2	(29)	(29)	55	15	23
SKYE AND OUTER HEBRIDES									
Isay	4	130	140	395	380	297	290	250	245
Ascribs	3	0	122	204	272	132	140	172	100
Trodday	4	60	108	47	236	143	94	225	70
Barra-Barra Head	11	49	142	171	443	80	154	371	91
Sound of Barra	6	86	452	415	360	336	455	375	340
South Uist	1	110	250	0	0	0	0	0	0
Monachs	3	480	519	860	1035	640	760	638	715
Sound of Harris	20	174	599	498	575	980	1330	1555	1007
Taransay	2	15	120	7	120	125	0	0	0
Gaskir	1	110	10	70	122	0	130	0	0
Shiants	3	290	214	317	483	450	420	580	532
Loch Roag	2	0	0	0	19	0	20	33	0
Loch Erisort	2	0	0	32	6	0	55	0	0
NORTH AND WEST COASTS									
Longa	1	56	15	20	0	(5)	10	0	0
Foura	1	0	0	11	0	(0)	0	0	0
Summer Isles	6	73	0	57	146	(122)	98	54	87
A Chleit	2	37	33	0	33	0	49	0	0
Chrona/Meall More	4	172	100	9	55	96	121	75	130
Roin Mor	2	21	64	0	74	190	65	61	160
Hoan Islands	2	(212)	180	244	425	6	220	0	432
Rabbot/nan Ron	3	(157)	179	135	130	350	339	255	350
Orkney	2	0	0	0	0	0	200	500	808
SCOTLAND (excl ISLAY)	103	2706	4240	4766	6608	4736	6556	6790	6658
ISLAY		2800	5500	4800	8500	15000	21500	14000	20292
IRELAND		2771	4161	4404	4718	4398	5709	4432	7594
GRAND TOTAL		8277	13904	13970	19826	24134	33815	25222	34544
PERCENTAGE ON ISLAY		33.8	39.6	34.3	42.8	62.7	63.6	55.5	58.7

Probable long-term sympatry of Common and Scottish Crossbills in northeast Scotland

A.G. KNOX

Common and Scottish Crossbills are now known to breed side-by-side in the Scottish Highlands. It is possible that Common Crossbills started to nest only in recent decades, when large areas of introduced conifers planted after the First World War began to mature. Historical information from northeast Scotland reveals that the species has probably nested alongside the Scottish Crossbill for some considerable time. This lends support to the argument that they should be treated as separate species.

Introduction

Crossbills *Loxia* spp. have a widespread but irregular distribution throughout the Scottish mainland. Two forms breed: the Scottish Crossbill *L. scotica* and the nominate race of the Crossbill *L. curvirostra* (here called the Common Crossbill). They both nest in coniferous forests.

The Scottish Crossbill is confined to the Highlands of Scotland mainly centred in Deeside, Strathspey, the eastern end of the Great Glen and the forests to the north and west. It is resident within this broad area (hereafter called the Highlands), although the birds often move from wood to wood between years (Knox 1986, 1987, 1990a).

The Common Crossbill is found across the Palearctic, from the Iberian Peninsula to eastern Siberia, and is highly irruptive (Svärdson 1957, Newton 1970, 1972). Common Crossbills can occur anywhere in Britain during their periodic invasions from the Continent (Sharrock 1976, Knox 1986). After a large irruption, Common Crossbills usually breed widely in suitable habitat. Small woods are normally occupied for only one or two breeding seasons, but Common Crossbills may be present in larger forests for decades, although often moving within each forest between years. These populations appear to depend for their continued existence on further immigration from the Continent, or elsewhere in Britain.

For a long time after it was originally described in 1904 the Scottish Crossbill was regarded as a subspecies of *L. curvirostra* (Knox 1975). Species are usually defined on the basis of reproductive isolation (Mayr 1970; see McKitrick & Zink 1988 for recent ideas on species concepts). As long as the Common Crossbill did not breed within the range of the Scottish Crossbill it was considered acceptable to treat the two forms as allopatric* subspecies. Until the early 1970s, the only claimed breeding of the Common Crossbill in northern Scotland was at Drumtochty, Kincardine, in 1903 (Harvie-Brown 1906), outwith the range of the Scottish Crossbill (Witherby *et al.* 1938, Baxter & Rintoul 1953).

* *Allopatric* populations occupy mutually exclusive geographic areas. *Sympatry* is defined as the occurrence of two or more populations in the same area; more precisely, the existence of a population in breeding condition within the cruising range of individuals of another population (Mayr 1969).

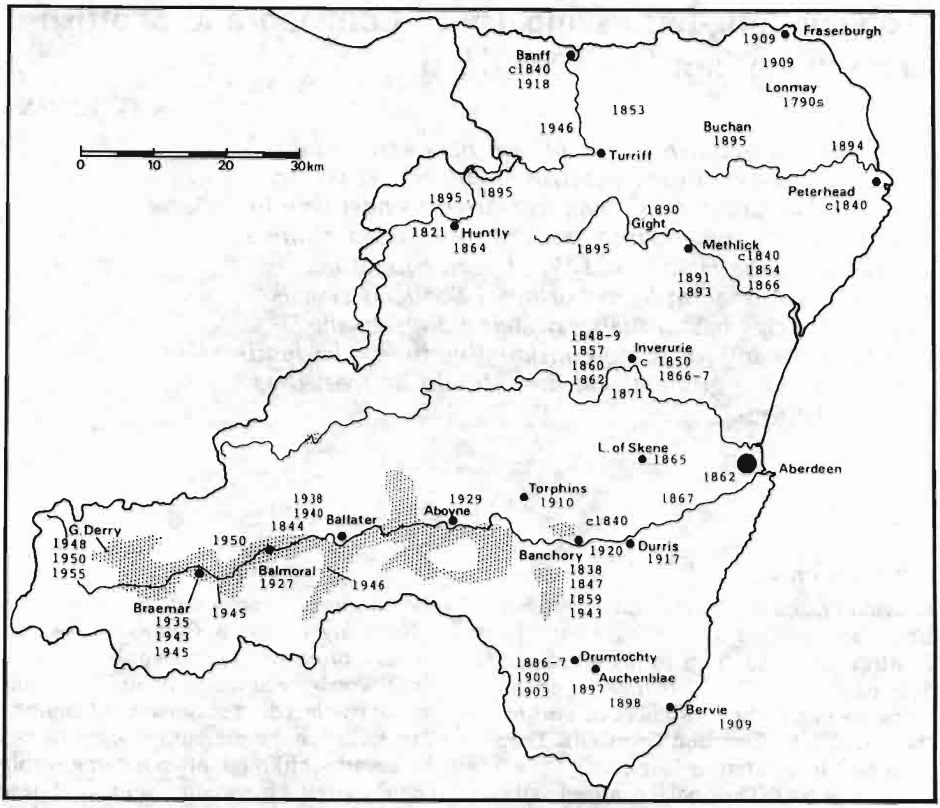

FIGURE 1. Map of northeast Scotland (the Grampian Region less the Moray District), showing locations and dates of historical records of crossbills. *Those without precise locations are not plotted. For further information see Appendix. The rivers marked are, from the north, the Deveron, Ugie, Ythan, Don and Dee. The recent distribution of the Scottish Crossbill is shown shaded (i.e. woods in which birds were found by the author between 1974-86). In recent years, Common Crossbills have been found in scattered woods throughout the northeast (Knox 1990a).*

But how realistic was this assumed allopatry? From 1974 to 1986 I studied crossbills in northeast Scotland (defined in Fig. 1), concentrating on Deeside, but obtaining additional information from the whole of the region. Full details are published elsewhere but, over the 13 years between 1974 and 1986, both Scottish and Common Crossbills occurred every year in forests along the valley of the River Dee (Knox 1990a). Scottish Crossbills nested each year. Common Crossbills nested in Deeside, sometimes in the same woods, in at least nine of those years. They also nested in nearby woods outwith Deeside, in a further two years. Identification of some of the breeding birds was confirmed for the first time, by specimens examined in the hand and by tape-recorded vocalizations.

The Scottish Crossbill was found only in woods along the main valley and tributaries of the Dee, from Glen Derry to Banchory. The single exception was a mixed flock of Common and Scottish Crossbills seen at Lonach, in upper Donside, in early spring 1986, but there was no indication of

nesting. Over the whole period, Scottish Crossbills were almost exclusively found in either old Caledonian Scots pine *Pinus sylvestris* forest (see Steven & Carlisle 1959), or plantations over 80 years old.

In contrast, Common Crossbills occurred at scattered localities throughout lower Deeside, lower Donside and the low ground in the east of the region. Their breeding range overlapped with the Scottish Crossbill from Banchory to Ballater in Deeside, but Common Crossbills were usually scarce over most of this area. Although they were sometimes present in the same woods as Scottish Crossbills, Common Crossbills were more often found in younger stands of introduced conifers. Outside the breeding season, Common Crossbills sometimes occurred further up Deeside, but Scottish Crossbills were never identified beyond their breeding range.

Preliminary results of this study led to the suggestion that the Scottish Crossbill was better treated as a separate species (Knox 1975, 1976; see Voous 1977, 1978).

The Scots pine, juniper *Juniperus communis* and yew *Taxus baccata* are the only conifers native to Britain. The Common Crossbill is usually found on the Continent in forests of Norway spruce *Picea abies*. Substantial plantings of this and other exotic species took place following the establishment of the Forestry Commission after the First World War (Anderson 1967). It is therefore possible that the birds started to nest in northeast Scotland (or elsewhere in the Highlands) only since these large forests matured in recent decades. The aim of this study was to see if it could be determined for how long Common Crossbills might have been breeding alongside, or within the range of, the Scottish Crossbill in northeast Scotland.

Methods

The collections of the Royal Museum of Scotland and the British Museum (Natural History) were searched for specimens of crossbills taken in the northeast or elsewhere in the Scottish Highlands. The literature was also examined for references to crossbills in the northeast prior to 1960, and the former distribution of suitable habitats was inferred from the history of forestry in the area.

Results and Discussion

Over the last two centuries, the ancient Caledonian pine forests of the northeast have never extended much beyond their present limits, although most individual woods are now smaller and some will have been lost altogether. Plantations were common even in the late 18th century, but much felling and replanting has taken place subsequently and planted woods now cover a larger area (Robson 1819, Steven & Carlisle 1959, Anderson 1967, Davies 1979). The general distribution of the different conifer woods has not changed greatly in the last 200 years. In recent decades, the Scottish Crossbill has never been found in the lowland woods of the northeast, even in years when the Common Crossbill has been absent. There is no reason to believe that the habitat preferences of either species have changed greatly over the last two centuries. It therefore seems likely that most historical records of crossbills in the northeast, apart from those from middle and upper Deeside, refer to Common Crossbills.

There are records of crossbills in the area back to the late 1700s, although most date from the middle of the 19th century (Fig. 1 and Appendix). This parallels the availability of historical information about most birds in Scotland (e.g. Baxter & Rintoul 1953), rather than suggesting that crossbills became commoner in more recent times. Prior to 1900, most records are from the lowland parts of the northeast where there would have been more observers than further inland. There are several instances of breeding during the 1800s, perhaps the most significant being at Manar and Keith Hall (both near Inverurie), the Loch of Skene, Huntly, Methlick and the nearby Haddo House. These are all well outside the present range of the Scottish Crossbill (Fig. 1).

Although not possible to prove conclusively, it seems likely that these and other records from sites outside the middle and upper Dee valley mostly or all refer to Common Crossbills. Occurrences from within the present range of the Scottish Crossbill may have been of either form, but those from the older pine woods probably refer to Scottish Crossbills.

It would have been surprising if Common Crossbills had not been breeding in the northeast. Common Crossbills have been irrupting into Britain for 700 years or more (Paris, quoted by A. Newton 1896). They have nested in England and even in southern Scotland for as long as reasonable records exist (since at least the early 1800s; Witherby *et al.* 1938). The collections of the Royal Museum of Scotland and the British Museum (Natural History) contain several skins of Common Crossbills taken in the nesting season from within the present range of the Scottish Crossbill, although none bears conclusive data on breeding. That sympatric breeding was not reported before presumably reflects the difficulty of telling the birds apart in the field (Knox 1990b); the Scottish Crossbill was not even described as a separate form until 1904.

It therefore seems that Common and Scottish Crossbills have almost certainly been living side-by-side for many generations. Since sympatry is unlikely to be a recent and transient phenomenon, this lends support to the argument that they should be treated as separate species.

APPENDIX

Historical records from within the present range of the Scottish Crossbill

Pre-1900

Male and female crossbills, presumably locally taken, were presented to the Montrose Natural History and Antiquarian Society by Mr James Brown, of Level, between Balmoral and Ballater, in 1844 (M.N.H.A.S. minute book, Montrose Museum). William MacGillivray knew crossbills well in upper Deeside, where they occurred in the parishes from Glen Muick (near Ballater) to Braemar. The birds were present at all seasons in rambling flocks in the pinewoods, remaining for uncertain periods and seeming to be nowhere stationary (MacGillivray 1855). In the 1880s crossbills were said to be breeding in Deeside (J.A. Harvie-Brown *in litt.* to Drummond Hay 1886).

1900 – 1960

Fifty or 60 birds claimed probably to be Common Crossbills were seen at Balmoral in 1927 from the first week of August to the 26th (Witherby 1927, H.F.W. 1927, Baxter & Rintoul 1953). This was a year of a large irruption. Scottish Crossbills were also said to be present in their usual small numbers until early July when young were observed (Witherby 1927). There was said to have been another invasion in Deeside in 1929 (Ritchie 1929) and four birds flew across the Dee to Aboyne on 20 July (Anon. 1929). In the 1930s there were two records of claimed breeding of Scottish Crossbill in Deeside: a male, two females and two young were seen at Braemar on 7 July 1935, and a family party was seen at Ballater on 17 July 1938 (Baxter & Rintoul 1953).

Several specimens of *scotica* were collected at Ballater in late August and early September in 1940, including a male moulting out of its streaked juvenile plumage. The skins are at the BM(NH). B.W. Tucker was at Braemar in July 1943 and found many crossbills in all the woods. He thought that they were mostly Common Crossbills (Tucker *in litt.* to Pennie 1956). There was no irruption that year, although there had been one in 1942 (Newton 1972).

Crossbills were present in Deeside every year from 1945 to 1955 (Nethersole-Thompson 1975, p. 245). Numbers were often high in Deeside in years when they were low in Strathspey, and *vice versa*. The pattern broke down in 1953 when there were very few crossbills in either area.

In 1955, Adam Watson noted that crossbills were numerous in Deeside throughout the year, and that they were often seen in other parts of Aberdeenshire. He commented on the scarcity of published breeding records, although he suspected that crossbills bred every year. Watson gives details of several instances of breeding: two fledged young near the Lion's Face, Braemar, on 21 July 1945; one fledged young being fed in Braemar village on 24 July 1945; a nest with four

or five very small young eight feet up in a small Scots pine near Birkhall, Ballater on 19 April 1946; one fledged young in Glen Derry on 13 June 1948; many fledged young, including some still downy, in woods at Derry Lodge on 9 June 1950; one downy young being fed in Glen Derry on 29 June 1950, and a fledged young with traces of down being fed in Glen Derry at the end of May 1955 (Watson 1955). When he was able to examine birds closely in the field, Watson considered the bills usually to have been heavier than *curvirostra* and similar to *scotica*.

On 19 February 1950 eight crossbills, probably Scottish, were seen in Glen Sluggain, near Braemar (Tewnion 1951). Crossbills claimed to be Scottish were seen in Deeside in summer 1958 (Anon. 1959).

Historical records from near the edge of the present range of the Scottish Crossbill, or unspecified areas

Pre-1900

A flock of crossbills, from which several birds were shot, was reported in the *Aberdeen Journal* on 21 July 1810. The species was said to be rare, the last flock having been seen about 17 years earlier (c. 1793). Crossbills are included on the *New Statistical Account* (N.S.A.) list of birds for the parish of Banchory-Ternan (N.S.A. 1834 – 1845). Specimens were obtained in the Banchory area in 1838 and the autumn of 1847 (Adams & Adams 1859). A decade later in the same area, crossbills were believed to be permanently resident and increasing (Adams & Adams 1859). Shortly afterwards, the species was considered to breed regularly in Aberdeenshire (More 1865). The first acceptable record of a Scottish Crossbill is a skin from Aberdeenshire, collected by George Sim on 12 December 1872, now in the BM(NH). The nest with eggs of a pair of Aberdeenshire crossbills was found on 13 April 1874 (Dewar 1874). A decade or so later, crossbills were again said to be resident in Aberdeenshire (J.A. Harvie-Brown *in litt.* to Drummond Hay 1886).

1900 – 1960

There was an irruption in 1910, and an immature crossbill was found at Torphins on 9 August (Eagle Clarke 1910). A female and two young birds were seen feeding on rowans *Sorbus aucuparia* at Durris in October 1917 (MacDonald 1918). In 1920, it was reported that crossbills with young were seen in the neighbourhood of Crathes, near Durris, almost every summer, and that it was believed that the birds nested in the woods there (MacDonald 1920). 1930 was yet another irruption year, with many crossbills in Aberdeenshire (H.F.W. 1930). A pair nested successfully at Arbeadie, Banchory, in 1943, being seen with two newly-fledged young from 25 April. Crossbills were also seen at Tilquhillie, Banchory, in March and April that year (Pennie 1956).

Historical records from areas outside the present range of the Scottish Crossbill

Pre-1900

Crossbills appear on a list of birds occurring in the parish of Lonmay in the early 1790s (O.S.A. 1791 – 1799). On 4 July 1821, crossbills were seen feeding near Gordon Castle, Huntly, Aberdeenshire, and young may have been heard (Nethersole-Thompson 1975). Crossbills are included on lists of birds for the parishes of Methlick, Peterhead and Banff (where they were said to be occasionally met with) published in the late 1830s and early 1840s (N.S.A. 1834 – 1845). Three males and three females were shot at Craigston, near Turriff, on 25 December 1853 (Edward 1854) and the following year, great numbers appeared at Methlick where they had previously been scarcely known, but since when they were often seen (Wilson 1899).

In the winter of 1848 – 49, several pairs were shot from flocks feeding in larches *Larix* spp. at Manar, an estate near Inverurie, where large flocks appeared in 1857. On 7 May 1860 a nest with four eggs was found at the top of a larch there, and another nest, with newly-hatched young, was discovered very high in a larch on 5 April 1862. Both nests were subsequently deserted, the eggs being taken from the first, and the young dying in the other after being 'forsaken'. A nest with young was found at Keith Hall, near Inverurie, in February about 1850, and birds appeared plentifully in the same wood from 6 August 1866 to 1 May 1867 (J. Walker ms., quoted in Sim n.d.).

In an article published in 1859, Thomas Edward (whose work was based mainly on the part of Banffshire near the town of Banff, rather than the portions far inland) noted that although crossbills had been a rarity in Banffshire twenty years earlier, they were no longer scarce. He believed that they nested, and had done so for some years (Edward 1859). He also reported seeing what he thought was a Parrot Crossbill near Banff, but this may have been a Scottish Crossbill which was then undescribed.

Single male and female crossbills were killed near Aberdeen in January 1862 (Smith 1863). In early spring 1865, a nest was found in a fir tree in a wood beside the Loch of Skene; a nest with eggs was found by Wilson at Methlick in the following year and, on 11 June 1867, a crossbill was shot from a flock at Pitfodels, near Aberdeen (Sim 1903). A pioneering study of bird distribution in Britain was published in 1865 in which it was noted that Edward had found the nest of the crossbill in Banffshire (More 1865). Crossbills apparently bred near Huntly in 1864 (Nethersole-Thompson 1975). A few years later, crossbills are included on a list of the breeding birds of Inverurie parish (Garrow 1871).

In an account of the birds of the parishes of Methlick and Tarves (Muirhead 1891), crossbills were reported to frequent the pine woods about Haddo House, near Methlick, in great numbers in winter and spring. A pair was seen at Gight on 1 May 1890, and the author believed that crossbills doubtless bred in the district although he knew of no nests (presumably unaware of the one found by Wilson in 1866, the details of which were not to be published until 1903). Only two years later, a nest with four eggs was found at Haddo, in early April 1893 (Harvie-Brown & Buckley 1895, Sim 1903).

In 1895, Serle reported that crossbills were winter visitors to Buchan, although they were plentiful about Gight. A small flock had been seen at Ravenscraig, near Peterhead, in October 1894 (Serle 1895). In Banffshire, crossbills were then increasing and said to be spreading rapidly east to Rothiemay, the Bin (both near Huntly), and into the Ythan and Bogie valleys (Harvie-Brown & Buckley 1895). Further south, in the Mearns, about 100 birds frequented Drumtochty Glen in the irruption years of 1886-87 (Nethersole-Thompson 1975). Some 30 – 40 crossbills were seen at Auchenblae on 7 February 1897 (Laidlaw 1898) and, on 23 July 1898, family parties were found at nearby Fordoun (Laidlaw 1899). At the turn of the century, crossbills were said to nest in Drumtochty Glen, and doubtless at other places in Kincardineshire (Simpson 1900).

1900 – 1960

A pair of Common Crossbills was reported to have nested at Drumtochty in 1903 (Harvie-Brown 1906) but, while this is quite possible, reasons for the identification of the birds were not placed on record. The Scottish Crossbill was not described as a separate race until 1904.

During the large irruption of 1909, a number were caught at Fraserburgh and at sea, where hundreds were reported drowning (Harvie-Brown 1910). About 20 landed on a steamer off Bervie and stayed for several hours (Baxter & Rintoul 1910). Later in the same year, 7 were seen at the Sinclair Hills on the Philorth Estate, near Fraserburgh on 15 December (Stewart-Menzies 1910). The following year, 1918, crossbills were said to be scarce at Banff (Rintoul & Baxter 1919).

Crossbills bred at Forglen House, near Turriff, in 1946 when three or four fledged young, still being fed, were seen on 12 June (Watson 1955).

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Brood feeding and division of parental care by Crested Tits

D. HOPE

Seven Crested Tit nests were observed during the three weeks prior to their young fledging. Five of the broods were also observed during the 17 days after leaving the nest. As the chicks approached fledging an increasing proportion of feeding visits was made by one adult; at four nests this was the male, at three nests the female. After fledging, the same parent continued to feed fledglings in two families, but both parents were seen feeding fledglings in at least one other case. Parental feeding visits were seven times more frequent to individual fledglings than to individual nestlings. Parents apparently continued to make feeding visits to fledglings at this rapid rate for at least 17 days, even though the fledglings' own foraging attempts steadily increased. Aggression between siblings increased as their foraging activities increased.

Introduction

Although the Paridae (tits) are one of the better studied families of small passerines (Perrins 1979), little is known about the immediate post-fledging period. The nestlings of most species of tits are fed by both parents and, on fledging, they remain dependant on the adults for a further 2–3 weeks (Hinde 1952). However, Deadman (1973) suggested that brood care by Crested Tits *Parus cristatus* differed from other Paridae in that the period from fledging to independence (*c.* 25 days) was long and that one adult deserted the brood at fledging leaving the remaining adult to look after the fledglings alone.

During a study of broods of Crested Tits in the Abernethy Forest, I collected data on the contribution made by each parent to feeding the chicks before and after fledging, as well as the development of foraging by the fledglings themselves and aggression between siblings. My aims were to examine in more detail the division of brood feeding by the parents before and after fledging, and to study the relationship between parental feeding and fledgling development in the immediate post-fledging period.

Methods

The study was carried out in *c.* 5 km^2 of the Abernethy Forest, Inverness-shire. Crested Tits were present in mature plantations of Scots pine *Pinus sylvestris* and in the unmanaged remnants of Caledonian pine forest. I studied seven pairs with nests in both woodland types. At least one adult from each nest was colour-ringed and the sex known; both adults were ringed and sexed at Nest 5 (Fig. 1).

Data were collected from mid-May 1987 (shortly after hatching) to 17 days after the chicks fledged. I visited each nest at least once every three days and observed for one hour. The order in which nests were visited was randomised so that observations at any one nest were not biased towards any particular time of day. During each one-hour observation period I recorded the

number of times an adult arrived to feed the young. Where possible the sex of this bird was noted. Each nest was observed for a minimum of 5 hours between the time the young hatched and fledged.

After broods had left the nest, I attempted to locate as many of the study families as possible. It proved very difficult to locate the family parties however, and only five of the fledged broods were located during the first 17 days after leaving the nest.

Once I had found a family I attempted to observe it for one hour, recording the number of times young were fed by their parents, foraged for themselves or had an aggressive encounter with a sibling. As it was impossible to watch the whole brood, after first counting the total number of fledglings present, one was chosen at random and watched for a period of 30 min, using the focal animal technique (i.e. if the target bird was lost to view, observations were immediately switched to another member of the brood and recording continued). After 30 min, a new individual was watched using the same technique. As the observations were not independent, the number of parental feeds, fledgling forages and chases were combined to give an hourly rate for each activity.

A parental feed was defined as a parent putting an item of food into the gape of a fledgling; when two distinct items were given, separated by a pause of more than two seconds, this was counted as two feeds. Although fledglings were sometimes partially hidden from view by foliage, feeding was usually accompanied by loud begging calls from the young, particularly when food was delivered and this was sometimes used to help define feeding incidents.

Foraging by a fledgling was characterized by a distinct peck at a branch or pine needle; when a series of pecks was punctuated by a pause of more than two seconds, two separate foraging incidents were recorded. Whenever there was any uncertainty over a parental feed or foraging by a fledgling, neither was scored. Thus the frequencies presented below will be minimum values.

The most obvious and frequent interaction between fledglings within a brood was chasing. Therefore the number of chases involving the focal bird was also noted and used to gauge the level of aggression between siblings.

Fifteen hour-long periods of observation were made of the five families. Three additional observations were also made where the identity of the adult and number of fledglings was obtained but the family was lost to view before one hour of focal animal measurements could be made. Most observations were made on three families as the other two were difficult to locate consistently. As the number of observations collected on individual families was generally insufficient to analyse separately, the dates on which observations were made were expressed as the number of days before or after fledging (the day of fledging being zero) and data from different families were combined. The results of statistical tests are given in the Appendix.

Results

Nestling period

Despite a wide variation in the number of feeding visits per hour made to the nest by adults on any one day, the overall frequency increased steadily as the nestlings grew, from an average of six visits per hour during the three days after hatching, to 15 visits per hour in the three days before fledging.[1]

The contribution to feeding visits made by each sex over the nestling period as a whole varied widely (Table 1). During the first 5 – 10 days feeding visits were made by both sexes. However, even at this stage one parent made consistently more of the visits at six nests (Fig. 1). This inequality became more pronounced as the chicks approached fledging but was not due to a sex difference. At four nests males made most of the feeding visits while females became

TABLE 1. Percentage of visits by male and female Crested Tits to feed their young at seven nests.

Nest	No. of 1-hr observation periods	Visits to the nest % by male	% by female	*n*
1	7	50	50	46
2	5	80	20	52
3	9	80	20	85
4	9	75	25	104
5	10	25	75	102
6	10	20	80	88
7	10	2	98	161

predominant at the other three. In the last four days before fledging both adults fed the nestlings in only 21% (n = 14) of the observation periods, compared to 83% (n = 40) in the previous 13 days. If the pairs were taking it in turns to feed broods, swapping over two or three times a day, the apparent predominance of one adult in nest feeding could have resulted from nests only being watched for periods of one hour. However, on five occasions, three of the nests were observed twice in the same day and the identity of the dominant nest feeder was the same during both sets of observations.

Fledgling period

When they left the nest, broods tended initially to be scattered in the canopy within a 10 – 20 m radius of the nest tree. The young called almost continuously and the parent brought food to them. After a day or two the family parties began to move through the forest more as a unit, with the young following the parent. By the end of the first week the young called less frequently, and only when the parent was in their immediate vicinity. At times fledglings appeared to be abandoned by the adult (between feeding bouts) for up to 30 min; similar behaviour has been noted for other tits by Hinde (1952). When this happened the fledglings tended to fall silent and remain motionless in the canopy, making them very difficult to locate. This could have resulted in an unintentional bias towards sampling those broods which were being actively fed.

At fledging, brood sizes were estimated as five young in four cases and four young in the fifth case (Nest 3, Fig. 1). Ringed adults were observed with less than the full brood on 11 occasions and the full brood on seven occasions (Fig. 1). Groups of fledglings were only ever seen accompanied by one parent.

The rate at which parents made feeding trips to nestlings increased markedly after fledging. The average number of feeding visits for four families during the three days prior to fledging was 15 visits per hour per brood, or 3 visits per hour per nestling, assuming that only one chick was fed on each nest visit. This compared with 21 feeds per hour per fledgling during the four days after fledging (average for the same four families) – a sevenfold increase in the number of feeding visits made per hour by each adult.[2] Although feeding rates recorded on any one day varied widely, the high initial level of parental feeding appeared to be maintained over the subsequent days.

A fledgling was first seen to forage for itself on the third day after fledging and the number of such attempts per observation period increased steadily between days 8 and 17.[3] There was no correlation between the number of times that the parent fed a fledgling and the number of times the fledgling searched for food itself.

Chasing of one fledgling by another was first seen 10 days after leaving the nest and increased thereafter. The number of chases per hour involving the 'focal' fledgling was positively correlated with the number of times that a fledgling attempted to forage for itself.[4] Although Crested Tit and Coal Tit *Parus ater* family parties were seen near to each other on a few occasions, there was no overt aggression between them. Different Crested Tit families were never seen together.

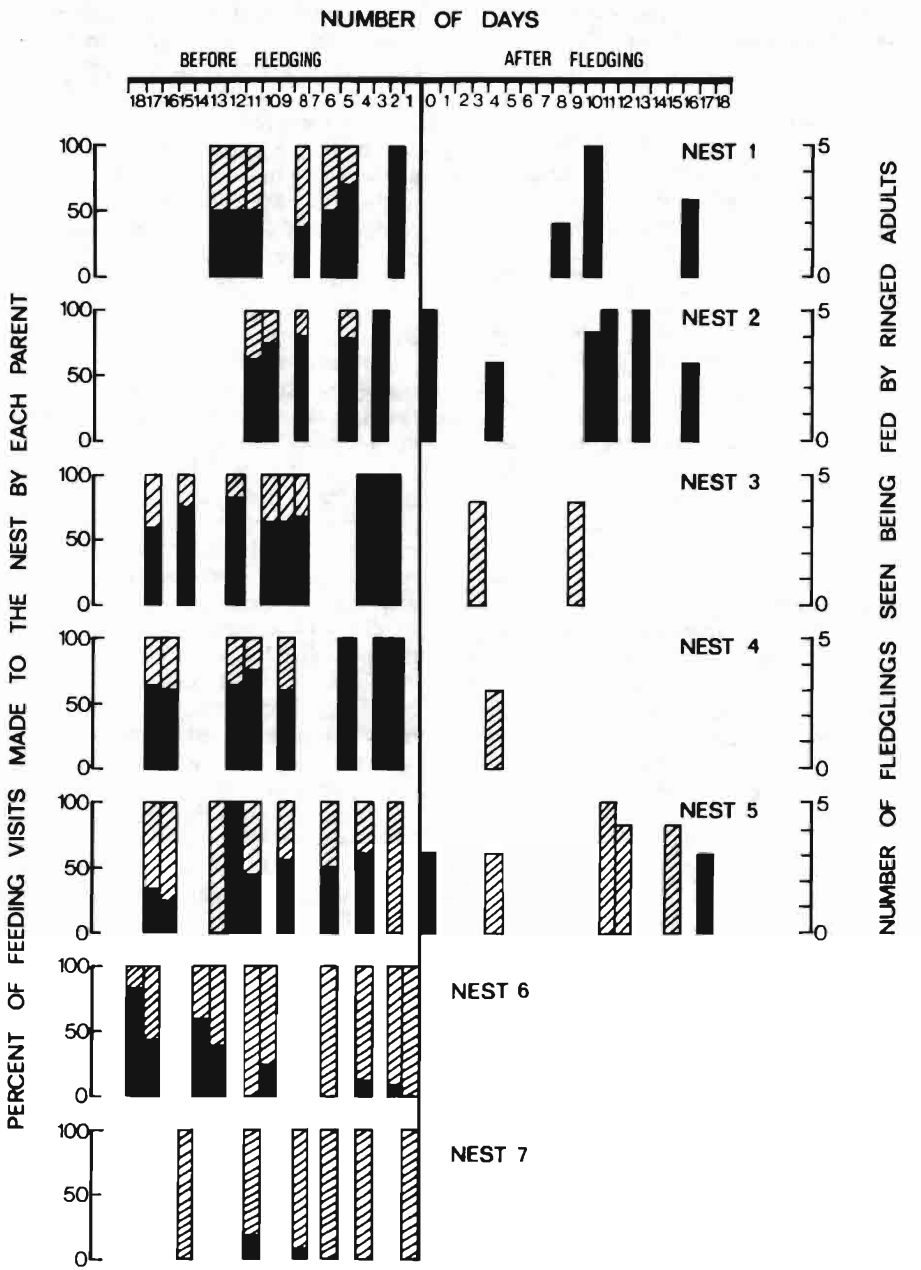

FIGURE 1. Contributions to brood feeding made by males (solid) and females (hatched) during the nestling and fledging periods.

Discussion

The main finding from this study was that one parent took on a progressively greater share of nestling feeding, so that just prior to fledging all the visits to the nest were being made by one member of the pair. The observations were not consistent with polygamous behaviour as in some cases it was the male and in others the female which ceased to feed nestlings. Furthermore, observations of a larger number of ringed birds from the same vicinity produced no evidence that any birds were attending a second brood (H. Young pers. comm.).

Although male and female Great Tits *Parus major* provide food for nestlings at different rates (Smith *et al* 1988), the cessation of nestling feeding by one of the pair has not been recorded for any other species of British tit (Perrins 1979). Such behaviour in the Crested Tit seems paradoxical in view of the increased number of feeding visits made to the nest as fledging approached. However in Dutch, English and Japanese pine woods, the increasing demands for food made on parents by nestlings may be offset, at least in part, by increases in both the availability and size of prey at this time (Kluyver 1950, Gibb & Betts 1963, Royama 1966).

Parental care of the young after fledging was also found to be more complicated than previously thought. Deadman (1973) noted that the groups of fledglings he located were all attended by a single adult and interpreted this to mean that one adult ceased to participate in brood care totally from around the time of fledging onwards. I found that the parent which had ceased to provide food for nestlings returned to feed fledglings in at least three cases (Nests 3, 4 & 5). In the case of the family with both adults ringed (Nest 5) both sexes were observed feeding fledglings on separate days.

Furthermore, assuming that I did not overlook any fledglings, some form of brood division appeared to have been taking place. Adults from nests 1, 2 & 5 were seen with incomplete broods during the first eleven days after fledging, and then with complete broods on subsequent days, so mortality or dispersal of young had not occurred upto this stage. However these alternative explanations cannot be ruled out as reasons for the small brood sizes recorded in the latter part of the fledgling period.

I could not tell whether broods were split and tended by one adult alternately, or divided between the pair, but the observations on the family from Nest 5 (Fig. 1) may indicate that broods were divided differently between the pair on different days. Although brood division does not occur in other British tit species (Perrins 1979) it has been noted in other passerines, including the Robin *Erithacus rubecula* (Harper 1985) and the Song Sparrow *Melospiza melodia* (Smith 1978).

The increase in the rate of parental feeding visits made to individual chicks after fledging could have been because adults fed more small prey items to fledglings than to nestlings, as was inferred by Royama (1970) in a study of food selection by Great Tits. Fledglings may be fed more frequently because adults are able to take chicks closer to sources of food, reducing travelling time and hence increasing the profitability of feeding smaller food items. Also, even though the feeding rate per chick is higher after fledging, the higher potential work load for adults may be offset by smaller brood sizes.

In one of the few other studies to examine parental care of fledglings and the transition to independent feeding, Davies (1976) found that adult Spotted Flycatchers *Muscicarpa striata* showed increasing unwillingness to feed fledglings, as well as reducing the size of food items. No evidence of such behaviour was seen in my study. However, the apparent maintenance of high feeding rates by parents may have been caused by a bias in the sampling towards those broods which were being actively fed. Also if the adults were leaving the fledglings for increasingly long periods of time, as has been shown to occur with other tit species

(Hinde 1952), then decreases in parental feeding effort as the family party period progressed could have gone undetected.

Aggression between siblings began during the second week after fledging, as in other species of tit (Hinde 1952). The coincidence of increased aggression with the rise in fledgling foraging is presumably a result partly of increasing contact (through increased mobility) and increasing competition, as dispersal of these family groups approaches.

Acknowledgments

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APPENDIX. Results of statistical tests

1. Least squares regression of the number of parental nest feeding visits per hour (F) to number of days before fledging (d) is $F = 14.81 - 0.57d, r^2 = 0.23, n = 73, P < 0.05$.
2. The number of parental feeds per fledgling per hour ($n = 5$) is significantly higher than number per nestling per hour ($n = 9$) in the four days after compared with the four days before fledging. Mann Whitney U test, $U = 0$, $P < 0.05$.
3. Fledgling foraging rates compared with the number of days after fledging. Rank Spearman Correlation, one-tailed test, $r^2 = 0.91$, $n = 15$, $P < 0.05$.
4. Fledgling foraging rates compared with increasing aggression. Rank Spearman Correlation, one-tailed, $r^2 = 0.73$, $n = 15$, $P < 0.05$.

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Maximum dive depths attained by auks feeding young on the Isle of May, Scotland

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Guillemots made at least one dive of 35 m or more during a feeding trip. In contrast, the deepest dives of Razorbills and Puffins were mainly 20 – 30 m.

Introduction

Most information on the depth to which seabirds dive comes from birds caught in fishing nets. Such records were once considered suspect as the birds could have been caught when the nets were being set or hauled but are now thought to indicate where in the water column birds were feeding (Piatt & Nettleship 1985, Wilson & Bain 1984).

Direct measurements of dive depths are, however, obviously desirable and simple capillary tube gauges have been used to measure the maximum depths attained by auks (Burger & Simpson 1986, Burger & Wilson 1988). Unfortunately, repeated submergence of such gauges to a constant depth can result in spurious estimates (Burger & Wilson 1988) so the birds must be recaught and the gauges removed before birds have made too many dives. This is often difficult to achieve without causing unacceptable disturbance in the breeding colonies. Seabirds on the Isle of May, Firth of Forth, are very tolerant of people and during the deployment of depth gauges on Shags *Phalacrocorax aristotelis* there in 1989 (Wanless *et al.* in press) it was found that capillary gauges could be read *in situ* through a telescope so that a maximum depth could be recorded after a single feeding trip. This note presents data on maximum depths attained by Guillemot *Uria aalge*, Razorbill *Alca torda* and Puffin *Fratercula arctica* using this method.

Methods

Following the method of Burger & Wilson (1988), gauges were made from 100 mm lengths of flexible, plastic tubing (1.6 mm internal diameter) lined with a thin layer of soluble indicator (icing sugar). The tube was sealed at one end and marked with a transverse, thin black line every 10 mm. Gauges weighed c. 1 g (0.1 – 0.25% of the weight of adults of the three species) and had a cross-sectional area of 2 mm^2 (0.2 – 0.4% of the cross sectional area of adult auks).

Tubes were attached (under licence) with a single small cable-tie to a few central upper-back feathers of 13 Guillemots, 12 Razorbills and 10 Puffins which were all feeding chicks on the Isle of May between 19 and 28 June 1990. The nest-sites of these birds were checked every few hours until the bird with a gauge had completed a single foraging trip, after which the length of undissolved indicator remaining in the tube was read using a x60 telescope from a distance of 5 – 30 m. We have no measure of the accuracy of our readings, but they were probably +/– 1 mm (equivalent to +/– 1-4 m over the depth range attained).

The maximum depth (metres) attained during the whole time that the gauge was deployed is given by:

$$d = 10.08 \left(\frac{Ls}{Ld} - 1\right)$$

Where Ls and Ld are the initial and final lengths of indicator in the tube (Burger & Wilson 1988).

Results

Ten (of 13) Guillemots and 11 (of 12) Razorbills were still carrying their depth gauges when they returned from their first feeding trip either on the day of release or early the next morning. Despite frequent checks, none of the Puffins was seen at the colony until the day after their gauges were attached. Six birds were resighted after 20 h, but three others were not seen for 36 h. These three and the one bird that returned without its tube were excluded from the analyses. Reading the lengths of indicator remaining proved easy for Razorbill and Puffin but as some Guillemots preened the upper ends of tubes under the back feathers we could determine only minimum depth values for six individuals.

TABLE 1. Maximum dive depths (m) of individual auks. + indicates a minimum value as the rest of the tube was hidden by the bird's feathers.

	Maximum depth of dive (m)		
	Guillemot	Razorbill	Puffin
	52+	32	33
	49	30	28
	49	26	28
	43	26	23
	40+	23	23
	40+	23	21
	35	23	
	23+	23	
	23+	23	
	10+	18	
		14	
Median	40+	23	25.5

There was strong evidence that Guillemots dived deeper than either Razorbills or Puffins. The four unequivocal Guillemot depths were all 35 m or more, as were three of the six minimum values (Table 1). In contrast, none of the records for Razorbills or Puffins reached 35 m; the deepest dives of these species were mainly between 20 and 30 m.

Discussion

Methodology

Visually assessing the length of undissolved indicator when the depth gauge was still on the bird rather than recatching an individual and measuring the length directly, substantially reduced the amount of disturbance to breeding birds and also allowed data to be collected from a bird too wary to be recaptured. The cable tie method of attachment was quick and easy to use in the field and ensured that gauges stayed attached for only a short time (or at the worst until the bird moulted), thus minimizing any disturbance to the birds carrying them. The only disadvantage was that some Guillemots preened the upper ends of their tubes under their feathers making it impossible to obtain an accurate reading.

Certain aspects of the feeding behaviour of diving birds have been shown to be affected by recording devices (Wilson *et al.* 1986) but effects can be limited by reducing the weight and cross-sectional area of the instrument. The gauges used in this study were both light and streamlined and should, therefore, have had little effect on diving performance. Burger & Wilson (1988) demonstrated that this design of gauge was likely to give inflated estimates if subjected to repeated submersions to the same depth. We also noted that repeated checks of the same gauge showed that the indicator was gradually lost; after several days spurious readings were obtained. Of the data presented in Table 1 those for the Puffin were most likely to be subject to this bias because birds were not resighted for 20 h.

The reason for this is unclear, but previous work on Puffins suggested that their behaviour at the colony may be upset by carrying devices. Concurrent observations of birds without gauges indicated that on average, an adult fed its chick 3 times/day (C. Wernham pers. comm.). Puffins tend to make many short dives during a feeding trip (Wanless *et al.* 1988) so during the time that birds were away they could potentially have made many dives.

Maximum depth and interspecific differences

None of the birds in our study approached the maximum depths of 68, 140 and 180 m so far recorded for Puffin, Razorbill and Guillemot respectively (Piatt & Nettleship 1985, Burger & Simpson 1986, Jury 1986). However, most of the sea within a 30 km radius of the Isle of May (which is the probable feeding range of auks during chick rearing (Bradstreet & Brown 1985)) is less than 60 m deep so there was little scope for birds to make very deep dives.

Dive durations of Isle of May auks indicated that Guillemots made significantly longer dives than Puffins or Razorbills (Wanless *et al.* 1988) which implied that Guillemots could potentially go deeper than the other two species. Our results from the maximum depth gauges also indicated that auks fed at different depths, with Guillemots generally diving to more than 35 m while maximum dive depths of Puffins and Razorbills were mainly between 20 and 30 m. Data from maximum depth gauges cannot elucidate whether the depth recorded is representative of the majority of dives during a trip or whether a bird just made one exceptionally deep dive in the course of a diving sequence, perhaps in pursuit of a fish. However, the differences we recorded are in line with those from other studies which also indicated that Guillemots made deeper dives than Puffins and/or Razorbills (Burger & Simpson 1986, Piatt & Nettleship 1985, Piatt in press).

Combining data on diving depths with information on the bathymetry in the feeding area may provide evidence of where in the water column a species normally feeds. Since most of the sea around the Isle of May is less than 60 m deep, our results suggest that Guillemots must have approached the seabed at least once while they were diving. Hislop & MacDonald (1989) also concluded that Guillemots fed near the seabed in the Moray Firth. The situation is less clear for Razorbills and Puffins. If these species were foraging in the same areas as Guillemots then the data suggest that they would have been feeding in the upper half of the water column. If, however, Razorbills were feeding in water less than 30 m deep, as suggested by Carboneras (1988) and Wanless *et al.* (1990), they too could have been foraging near the seabed.

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Movements of Cormorants from the Lamb, Firth of Forth

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Recoveries of Cormorants ringed as chicks on the Lamb in the Firth of Forth were concentrated in eastern Scotland from Grampian to the Borders. Others were recovered on the west coast of Scotland, the northwest and east coasts of England, and Northern Ireland, the Netherlands, France and Portugal. There were no age-related differences in the directions and distances travelled in winter. First-year birds were more likely to be shot than those more than one year old, though the percentage shot appears to have declined during the last 30 years.

Introduction

The breeding colonies of the Cormorant *Phalacrocorax carbo* in Scotland are restricted to a few localities, and in south-east Scotland their main stronghold is on the Lamb, an island off the Lothian coast near the mouth of the Firth of Forth (Mills 1965). Breeding was first recorded there in 1957 and the colony has a population of around 100 pairs (Harris *et al.* 1987).

The pattern of movements of Cormorants from their colonies has been studied by ringing chicks at many British colonies (Coulson 1961, Mills 1965, Balfour *et al.* 1967, Coulson & Brazendale 1968) but there had been very little ringing on the Lamb colony until the 1970s when the Tay Ringing Group made several ringing trips. This paper presents their results and updates a previous report by Oliver (1974).

Methods

The study was based on 196 recoveries from 767 birds ringed as chicks during the last 10 days of June 1970–1977 inclusive. All recoveries refer to dead birds. As 13 years have elapsed since the last birds were ringed, the recovery data are probably complete. The seasons autumn, winter, spring and summer refer to the months August – October, November – February, March and April, and May – July respectively. Recoveries of birds in year classes 1 (less than 12 months old), 2, 3 and 4 or over were treated separately.

Results

The seasonal and spatial pattern of recoveries is shown in Table 1. Dispersal of first-year birds was rapid with autumn recoveries as far away as southern England and France. In winter, recoveries were concentrated on the east coast of Scotland from Grampian to the Borders (Fig. 1), but there were also recoveries from the west coast of Scotland, the east and west coasts of England and from N. Ireland and the Continent. For each age group most recoveries occurred in winter (Table 1) and the median straight-line distances between the recovery location and the Lamb were 72, 105, 75 and 111 km for birds in their first, second, third and fourth (or more) year respectively. The percentage of recoveries to the north of the Lamb were 60, 47, 63 and 52% for the four age groups respectively. There were no significant age-related differences for the distances[1] or directions (north vs south)[2] to the recovery sites in

TABLE 1. Recoveries in autumn (A), winter (W), spring (Sp) and summer (Su) of four age classes of Cormorants ringed as chicks on the Lamb, Firth of Forth.

Location	1st Year				2nd Year				3rd Year				4th + Year				Total	%
	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su		
SCOTLAND																		
North		1	1											2			4	2
Northeast	2	18	2			2	1			1				4	1		31	16
Central	4	12	3			1				2				4	1		27	14
Southeast		1	1													1	3	1
Southwest	2	3	1			1			2			1		2	1		13	6
Firth of Forth	12	6	2	3	1	4			1	2	2		4	8	1	6	52	26
ENGLAND																		
Northwest	1	1				1	1			2	1			1	1	1	10	5
Northeast	2	4	3	1		4					2		1	3			20	10
Southeast	1	7			2	1			1					3			15	8
South	3	2	5	2						1				1		1	15	8
N. IRELAND		1															1	1
FRANCE	1					1								1			3	1
PORTUGAL		1															1	1
NETHERLANDS		1															1	1
TOTAL	28	58	18	6	3	15	2	0	4	8	5	1	5	29	5	9	196	
Percentage	14	30	9	3	2	8	1	0	2	4	2	1	2	15	2	5		100

TABLE 2. Seasonal distribution and cause of death of different age groups of Cormorants from the Lamb.

Cause of death	1st Year				2nd Year				3rd Year				4th + Year				Total	%
	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su		
Shot	2	24	4		2	3				1				4		1	41	21
Nets	4	2		1		1								1		1	10	5
Oil	3	1	1			1							1	2			9	4
Hit wires		2	1												1		4	2
Choked														1		1	2	1
Sick			1														1	1
Unknown	19	29	11	5	1	10	2		4	7	5	1	4	21	4	6	129	66
TOTAL	28	58	18	6	3	15	2	0	4	8	5	1	5	29	5	9	196	
Percentage	14	30	9	3	2	8	1	0	2	4	2	1	2	15	2	4		100

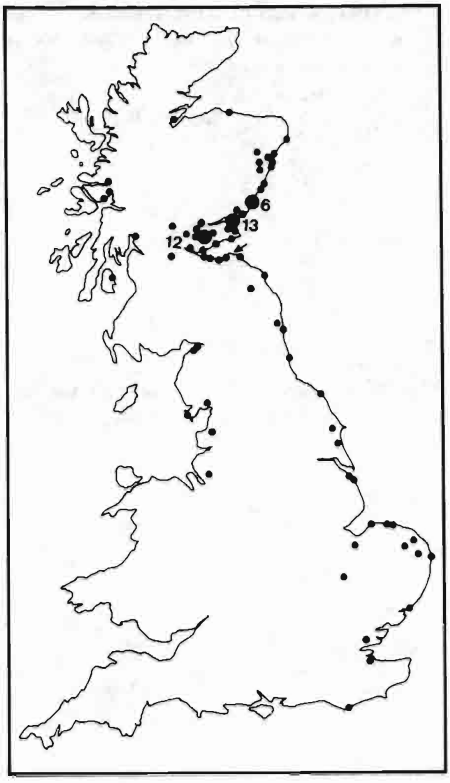

FIGURE 1. The distribution of winter recoveries of Cormorants from the Lamb (arrowed). *Numbers indicate the number of recoveries at locations marked by larger circles. There were also recoveries in France (2), Portugal (1), the Netherlands (1) and Northern Ireland (1).*

winter. Thirty-four per cent of the birds were recovered on rivers and lochs, including 12 on Loch Leven.

The cause of death was unknown for most of the recoveries. Of the other categories where cause of death was known, most were shot (Table 2); first-year birds were more likely to be shot than were older birds.[3]

Discussion

Coulson & Brazendale (1968) found that Cormorants from different colonies tended to winter in different but overlapping areas, due in part to the geographical location of each colony, but they thought that genetic differences could also influence dispersal. The nearest large colony to the Lamb is on the Farne Islands, from which the winter ringing recoveries show a more southerly component compared with those from the Lamb (Coulson & Brazendale 1968). The fact that winter dispersal appears to be unrelated to age was also noted by Coulson (1961).

Cormorants are shot by managers of fish stocks or fish farmers who believe that Cormorants affect fish populations. The percentage of recoveries of ringed Cormorants reported shot has been declining on the east coast. Coulson & Brazendale (1968) reported that 84% of recovered birds had been shot in 1940 – 49 (the worst decade since 1910), 55% in 1950 – 59 and 38% in 1960 – 64. Thus, the value of 21% for the 1970s and early 1980s (this study) suggests a continued decline in shooting. Most of the recoveries referred to the 1970s so this reduction was unlikely to have been influenced much by the 1981 Wildlife and Countryside Act which changed the status of the Cormorant to a protected species, though it is still possible to kill Cormorants under licence.

Acknowledgments

We thank fellow members of the Tay Ringing Group who took part in the ringing trips, and the RSPB for permission to ring the birds. M. Marquiss and R.E. Green commented on the draft.

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APPENDIX. Results of statistical tests.

1. Kruskal – Wallis one way ANOVA Chi-square = 0.08, ns
2. Chi-square = 1.3, 3df, ns
3. Chi-square = 7.7, 1df, $P < 0.01$

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Short Notes

Differences in weight:wing length relationships of Razorbill chicks at Hermaness and Fair Isle in 1989

In recent years several species of seabird have suffered a reduction of breeding output in Shetland (Heubeck, M. & Ellis, P.M. 1986. *BTO News* 143: 10; Heubeck, M. 1988. *BTO News* 158: 1–2; Heubeck, M. 1989 (Ed). *Seabirds and Sandeels.* Shetland Bird Club, Lerwick). In general, failures have been more severe in surface feeders such as Kittiwake *Rissa tridactyla* and Arctic Tern *Sterna paradisaea,* whereas species which dive to catch their prey appear to have been less affected (Harris, M.P. & Riddiford, N.J. 1989. *SB* 15: 119–125; Heubeck 1989). It has also been apparent that the level of decline has not been uniform throughout Shetland and some colonies have been more severely affected than others (Heubeck 1989). This note presents data on weight:wing length relationships of Razorbill *Alca torda* chicks at two Shetland colonies in 1989 – Hermaness National Nature Reserve on Unst, and Fair Isle, 160 km to the south.

As the exact ages of chicks measured was unknown, wing length was used as an indicator of age and its growth assumed to be unaffected by external conditions. Typically the Razorbill chick wing continues to grow throughout the three weeks between hatching and fledging (a term used for convenience, even though the chick cannot fly when it leaves the nest), whereas weight increases up to day 12 and then levels off or even decreases (Barrett, R.T. 1984. *Seabird* 7: 55–61; Birkhead, T.R. & Nettleship, D.N. 1985. *The Atlantic Alcidae.* Academic Press, London).

Wing lengths were measured to the nearest millimetre by taking the maximum chord length (excluding any down on feather tip) using a stopped wing rule. Weights were taken to the nearest gramme using a Pesola balance. Data from Hermaness were collected on 4 and 14 July, with *c.*50% of chicks estimated to have fledged on the latter date. Two other visits were made, on 27 June when most chicks were less than two days old, and 27 July, when all but one chick had fledged. Data from Fair Isle were collected between 19 June (when some well-grown chicks were present) and 11 July (when most chicks had fledged), with most chicks weighed and measured on five dates between 22 June and 1 July (69 chicks). Forty-three chicks were weighed and measured and six were reweighed on Hermaness; 84 were weighed and measured on Fair Isle.

Although few small chicks at Fair Isle were weighed and measured it is still clear that weights of Fair Isle chicks were much higher than those at Hermaness (Fig. 1). At a wing length of 60–65 mm, the mean weight of Hermaness chicks was 91.0 g (n = 12), 50% less than comparable chicks on Fair Isle (mean = 182.5 g, n = 11). Of the six chicks on Hermaness that were reweighed, four failed to gain weight over a ten-day period between 4 and 14 July. Weight changes (g) were +22, +11, 0, −1, −14, and −20. On Hermaness no chicks were found with wing lengths in excess of 66 mm, and as no larger chicks were found alive or dead it is assumed that Hermaness chicks fledged with shorter wing lengths than those on Fair Isle.

There are two possible interpretations of the data; either the weight:wing length relationship of Razorbill chicks always differs between Hermaness and Fair Isle, or the difference was due to Hermaness chicks receiving less or poorer quality food than those on Fair Isle. Although there is no evidence to disprove the former we consider it extremely unlikely. Moreover the weights of Hermaness chicks throughout their development are lower than values published for a range of five other colonies

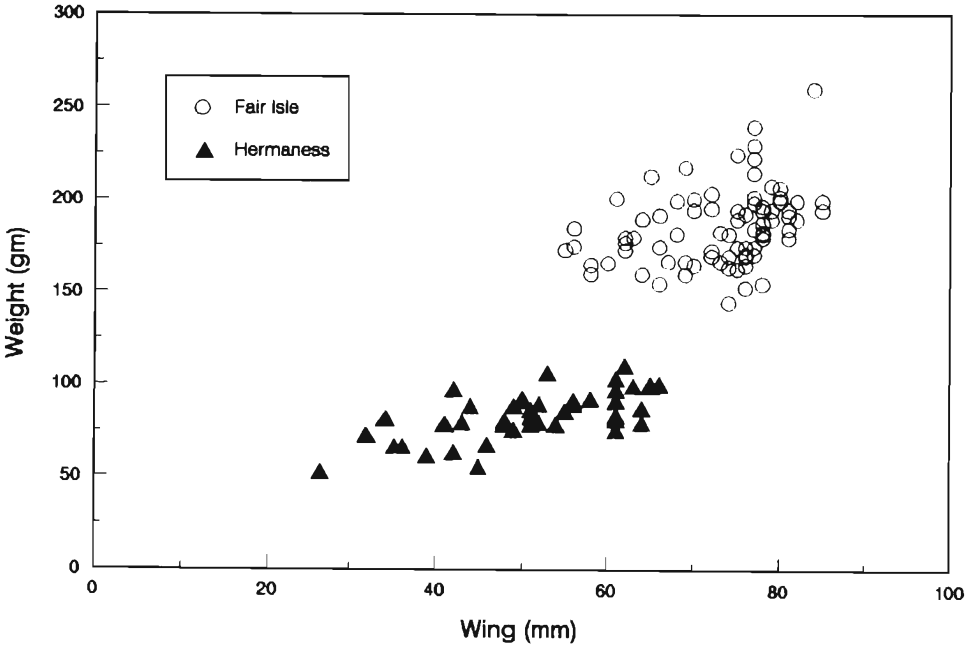

FIGURE 1. The relationship between weight and wing length of Razorbill chicks on Fair Isle and Hermaness, Shetland in 1989.

(Barrett 1984), and if growth of the wing *was* affected by external conditions the difference in weights between Fair Isle and Hermaness chicks would have been even greater.

We do not have measurements of the feeding frequency for chicks at the two colonies, but whereas birds on Fair Isle were seen to feed their chicks entirely on sandeels *Ammodytes sp.* adults at Hermaness frequently brought in small rockling *Rhinonemus sp.* which have a lower calorific value than sandeels (Birkhead & Nettleship 1985; Harris, M.P. 1984. *The Puffin*. Poyser, Calton).

The percentage of rockling in the diet of Puffin *Fratercula arctica* chicks at Hermaness has also increased in recent years in conjunction with a reduction in breeding success (Martin A.R. 1989. *Bird Study* 36: 170 – 180); it appears now that Razorbill chicks there are being similarly affected.

We thank P. Howlett, J. McKee, A.F. Silcocks and the Shetland Ringing Group for much help with the fieldwork, and M.P. Harris, M. Heubeck, M.G. Richardson and S. Wanless for improving the manuscript. The work on Fair Isle was commissioned by the Nature Conservancy Council. Hermaness data were also collected while under NCC contract.

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Pink-footed Goose numbers at arrival sites in eastern and central Scotland

The Icelandic/Greenlandic population of Pink-footed Geese *Anser brachyrhynchus* which winters in Britain has increased substantially in the last decade (annual goose count summaries in *Wildfowl*). The geese are also utilizing new areas and their status has changed dramatically at some sites. They arrive in Britain from the third week of September and by the end of that month and in early October very large concentrations occur at a few sites. In autumn 1988 on the weekend of 8/9 October there were 30,000 Pinkfeet at Loch of Strathbeg, a minimum of 40,000 in Strathearn and 40,000 at West Water Reservoir; Strathearn held 39,000 a week earlier. Numbers then fell sharply in Strathearn and at West Water Reservoir.

In early autumn 1989 a more detailed count was organised for the main Pinkfoot roosts in east and central Scotland (Table 1). Totals of 118,810 and 170,965 were found on 30 Sep/1 Oct and 7/8 Oct respectively. There were very large concentrations at Strathearn, West Water Reservoir and Hule Moss on the first weekend, and by 7/8 Oct a further four sites held over 10,000 geese. All sites showed an increase over the week between the two counts except Meikle Loch.

The pattern of arrival in 1989 was different from the last few autumns with low numbers in the north and exceptional numbers in the Lothians and Borders. The rise in importance of West Water Reservoir in the last few years has been remarkable, and the number at Hule Moss in Berwickshire in autumn 1989 was the largest on record. It is thought that this site also held very large numbers in early October 1988. Observers in all areas commented on major arrivals on 26 and 27 September. There were only 1700 in Strathearn on 25 Sep, while in Strathallan numbers rose by *c.*1000–1500 per day from 27 Sep to 4 Oct when 14,200 were present. Approximately 20,000 were at Strathbeg on 26 Sep but most passed through leaving just 7900 on 1 Oct. Birds also overflew Montrose where there were 4000 on 28 Sep but only 900 on 1 Oct. There was constant movement of Pinkfeet in the Perth area from late September with geese coming and going in all directions.

After 7/8 Oct numbers at Strathbeg increased to 26,950 on 15th and 32,000 on 22nd so the eventual peak here was of similar size but about two weeks later than in the previous four autumns. In Strathearn numbers fell to 16,000 on 22 Oct and only 5100 were present on 4 Nov. However numbers increased to *c.*15,000 at Loch Leven by 29 Oct with a record peak of 18,000 here three weeks later, while

TABLE 1. Numbers of Pinkfeet at arrival sites in east and central Scotland in September and October 1989.

Site	Region	30 Sep/ 1 Oct	7/8 Oct
Loch of Strathbeg	Grampian	7900	17600
Meikle Loch	Grampian	8520	5930
Montrose Basin	Tayside	900	11000
Loch Leven	Tayside	7000	9200
Strathearn	Tayside	28700	31000
Strathallan	Tayside	9200	10800
Upper Forth Valley	Central	220	3400
Cameron Reservoir	Fife	nc	*c.*2000
Aberlady Bay	Lothian	1900	2200
Fala Flow	Lothian	5100	11920
Gladhouse Reservoir	Lothian	320	3930
West Water Reservoir	Borders	29250	36250
Hule Moss	Borders	19800*	25735
TOTAL		118110	170965

nc = not counted
* count on 28 Sep

Cameron Reservoir also held 9500 on 18/19 Nov. West Water Reservoir continued to hold large numbers until late October (23,170 on 21/22 Oct) but then numbers fell to 4150 by 18/19 Nov. In contrast, numbers at Hule Moss had declined to *c.*4500 by 21/22 Oct and only *c.*2500 were present in the area on the weekend of the national count.

These results show that some sites are exceptionally important for Pinkfeet when they first arrive in Scotland. Some, such as Strathearn are of long standing, but others such as Loch of Strathbeg, West Water Reservoir, Hule Moss and Montrose Basin have become progressively more important in recent years. Conversely, some sites (Meikle Loch, Loch Leven and Gladhouse Reservoir) have become relatively less important in early autumn but are used by large numbers later in the winter.

Several sites in Tayside which can each hold several thousand Pinkfeet later in the autumn were not counted on 7/8 October and the above total represents a minimum number of birds present in eastern and central Scotland. Also it is not known how many were on the Solway or in Lancashire at this time though 21,500 were at Martin Mere by 19 October (*BB* 83:78). It therefore seems likely that the total population of Pinkfeet in Britain in autumn 1989 exceeded 200,000 for the first time.

The large number of Pink-footed geese found in early October suggests that a complete count of all sites in mid-October might offer a better assessment of their winter population than currently obtained from the national Wildfowl and Wetlands Trust counts in mid-November. In some years it is possible that some geese may still be in Iceland in the first part of October and numbers could be underestimated. However, counts in mid-November are also open to question as roosting and feeding behaviour can be unpredictable due to disturbance by shooting, temporary flooding and local variability in food supply at this time.

These counts were a cooperative venture involving the Central Scotland Goose Group and the Lothians and Borders Goose Groups. In particular, we thank J.Dunbar, R. Goater, P.R. Gordon, J. Kirk, I. Patterson, R.W.J. Smith, C. Smout, R. Walker and G. Wright for undertaking counts.

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Common Sandpiper stalking and catching small fish

On 26 July 1989 between 1650 and 1705 GMT an adult Common Sandpiper *Actitis hypoleucos* was seen foraging along the edge of a small shingle island in the River Tay at Aberfeldy, Tayside (NN 851 491). The bird was watched at a distance of approximately 50 m in very good light and partly with the aid of 8 × 30 binoculars.

When first noticed the sandpiper was feeding on the far side of the stony islet, which was about 2 m from the bank of a narrow, tree-covered island in the river. Initially, foraging consisted of quick pecks directed at the surfaces of the shingle and/or the shallow water. The bird was moving downstream and when it reached the end of the shingle it crouched and held its head low and horizontally. It then took slow deliberate steps. A sudden dash forward, involving between two and four steps, ended with the sandpiper stabbing its head into the water and emerging with a dark, rapidly-flexing object held crosswise in its bill. From its overall shape and movements the prey

item was clearly a small fish. The bird immediately ran towards the middle of the shingle and stunned or killed the fish by knocking it against the pebbles. The whole fish was then swallowed head first.

The bird continued to hunt in this manner as it moved upstream on the shingle margin directly opposite my elevated position on the south bank. With the aid of binoculars I could see ripples in the water made by small fish as they swam into deeper water in front of the stalking sandpiper. In the same manner as described above, the sandpiper caught and ate another two small fish as it worked its way to the upstream end of the shingle bar. For none of the fish was it possible to identify the species.

The bird stopped foraging at 1705 GMT after which it preened and roosted.

The third fish caught was about as thick, laterally, as the base of the bird's bill and just slightly longer than it. Mean measurements for bill length and bill depth (taken at the proximal end of the nares) of adult Common Sandpipers caught in Glen Clova, Tayside were, respectively, 25.3 mm +/− 0.4 SE (range 24 – 28 mm, n = 10) and 5.6 mm +/− 0.04 SE (range 5.0 – 6.3 mm, n = 52; own data).

Studies in England suggest that terrestrial invertebrates are the main prey of adult Common Sandpipers during the breeding season (Holland P.K. *et al* 1982. *Bird Study* 29: 99 – 110). The shingle areas within the linear riverine territories are mainly associated with the feeding activities of chicks from around 5 days old "up to and beyond fledging" (Yalden D.W. 1986. *Ibis* 128: 23 – 26). In both studies shuffle samples were used to assess potential aquatic prey. This method of sampling is likely to underestimate the availability of motile prey such as small fish. None of the above authors refers to small fish being taken as part of this species' diet during the breeding season.

The diet of the Common Sandpiper is "chiefly immobile or free-flying invertebrates, particularly insects" (*BWP* Vol. III: 594 – 605). It is also said to be "adept at stalking with head low and horizontal" when foraging on insects. The account in *BWP* describes a wide variety of terrestrial and aquatic insect prey, some spiders, crustaceans, molluscs and annelid worms but simply notes that small frogs, tadpoles and small fish are also taken. No information is given on species, mode of capture, frequency or time of year that fish are taken. None of the 117 stomach contents examined, from birds collected throughout the year across the USSR, Europe and North Africa, have contained evidence of small fish.

R.H. Kettles (1973. *BB* 66:397) describes one of two Common Sandpipers, at Staines Reservoir, Middlesex in January 1972, holding a small fish in its bill and "manipulating it against the concrete bank". The bird was not seen to eat the fish and there is no indication given as to whether the fish was alive or dead. Kettles cites a report in the London Natural History Society's Ornithological Bulletin (March 1973) of a Common Sandpiper, at the same location, which "found a small dead fish" and swallowed it "head first like a grebe". This fish was slightly longer than the bird's bill.

It seems that fish are an unusual prey for the Common Sandpiper. However observations of foraging birds on river shingle are generally difficult to make (Yalden D.W. 1986. *Bird Study* 33: 214 – 222) and I would appreciate learning of any similar observations to my own from elsewhere.

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Hunting distance of breeding Merlins in Grampian indicated by ringed wader chicks taken as prey

Little is known about the hunting distance of breeding Merlins *Falco columbarius* or whether the hunting ranges of adjacent pairs overlap (*BWP* Vol. 2). Merlins tracked by radio telemetry hunted at least 4 km from the nest in Wales (C.J. Bibby, pers. comm.) and in Alaska, foraging flights of six breeding males averaged from 3–5 km with the maximum flight greater than 8 km (Schempf, P.F. 1989. *The Raptor* 1: 22–24).

In 1986–88, as part of a study of farmland waders in southeast Grampian (N.P. & D.C.C. 1987, 1988. *Waders of Agricultural Land*. ITE Research Reports Nos. 1 & 2. ITE, Banchory) broods of Lapwing *Vanellus vanellus* chicks were ringed and colour-marked or their parents were colour-marked, to study movements and habitat use. These broods were monitored at one– to two–day intervals, so the age at which chicks disappeared could be estimated within at most two days. During collections of prey in Merlin breeding territories, G.W.R., B.L.C. & A.D. found the rings at two sites, A and B, in May-July from 13 of the Lapwings (Table 1). These territories were 5 km apart and a third, C, was situated midway between them (Fig. 1a).

Merlins from another nesting territory, D, about 15 km away, took two Lapwing chicks in 1988 which had been ringed on farmland adjoining the moor (Fig. 1b). The age of these chicks when killed was estimated by comparing their tarsus length

TABLE 1. Minimum distance between Merlin nest sites and sites from which 15 Lapwing chicks and one Golden Plover chick were taken as prey. + = Golden Plover, * = Lapwings from the same brood, af = arable farmland, hm = heather moor, m = marsh, pp = permanent pasture.

Year	Merlin nest territory	Habitat of last known location of chicks	Estimated age of chick, days (and date taken)	Minimum distance from Merlin nest to prey location km
1984	D	hm	10 (3/6)	3.8+
1986	A	af	5 (10/6)	5.6
1986	A	m	6 (29/5)	3.3
1986	B	m	32 (5/7)	2.9
1987	B	af	9 (27/6)	3.8
1987	B	af	16 (6/7)	3.3
1988	A	af	12 (9/5)	5.6*
1988	B	af	12 (10/5)	3.4*
1988	B	m	4 (14/5)	2.9
1988	B	af	4 (1/5)	3.6
1988	B	pp	4 (8/5)	2.0
1988	B	pp	5 (7/5)	2.0
1988	B	pp	5 (7/5)	2.0
1988	B	pp	9 (8/5)	2.0
1988	D	pp	15 (2/7)	3.8
1988	D	pp	17 (2/7)	3.8

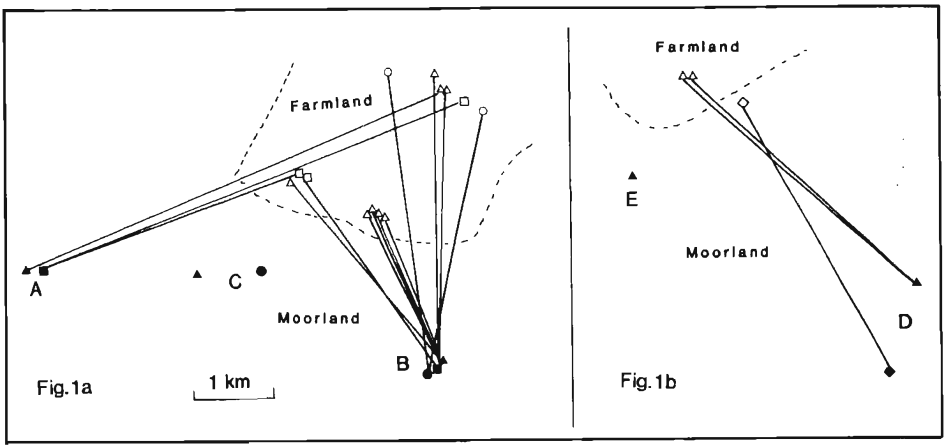

FIGURE 1. Merlin nesting territories A – E and sites from which ringed wader chicks were taken. *Open symbols = site where wader brood last located; solid symbols = Merlin nest site; 1984 = diamonds; 1986 = squares; 1987 = circles; 1988 = triangles.*

with that of chicks of known age (N.P. & D.C.C. unpubl. data). It was assumed that they had not moved far from their ringing site (see Redfern C.P.F. 1982. *Bird Study* 29: 201 – 208). A colour-ringed Golden Plover *Pluvialis apricaria* chick was found as prey in this territory in 1984 and details were known for it (R.A. Parr, pers. comm.) (Fig. 1b).

The ring recoveries showed that Merlins from nest territories A and B hunted the same farmland in 1986 and 1988 (Fig. 1a). In fact, in 1988, each took a chick from the same brood of two Lapwings (Table 1). In 1988 G.W.R. saw the male Merlin from nest territory E fly to the farmland hunted by the birds from nest territory D. We have also seen the male Merlin from nest territory A, on several occasions after a food delivery, fly directly through nest territory C in the direction of the farmland.

All but one of the Lapwing chicks was between 4 and 17 days old, and the mean weights for these ages would have ranged from *c.*15 – 62 g (N.P. & D.C.C. 1988). The 32-day-old Lapwing was caught and weighed the day before it disappeared, and was then only 88 g, which was light for that age.

Overall, the mean estimated age at which unfledged wader chicks were taken by these Merlins was 10.3 days +/− 7.1 s.d. and the mean minimum distance flown to catch them was 3.4 km +/− 1.1 s.d., range 2.0 – 5.6 (n = 16 chicks, Table 1). These hunting flights are similar to those obtained in Wales and Alaska, and the hunting ranges of at least two pairs were shared.

We thank the estates concerned for permission to study the Merlins and waders. We are grateful to R.A. Parr and A. Thorpe for additional ringing data, and L.D. Steele for some assistance with fieldwork. G.W.R. was employed by the R.S.P.B. in 1987 and 1988 during the time Merlin monitoring was undertaken.

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Merlin killing and retrieving a Dipper from a loch

On 22 April 1989 during northerly winds and frequent snow showers, I visited Loch Callater, at 500 m OD, near Braemar in upper Deeside. At 2014 GMT I saw a cock Merlin *Falco columbarius* strike a Dipper *Cinclus cinclus* c.30 m from the shore. As they lost height the Merlin dropped the Dipper into the water, hovered, then flew off in a wide circle. A few minutes later the Merlin returned to the now-motionless Dipper, hovered again and then dropped onto it with wings outstretched. After a pause it managed to lift the Dipper from the loch and struggle to the shore, where it landed. Some Common Gulls *Larus canus* arriving at the loch to roost started to mob the Merlin and it flew away still clutching the Dipper.

There is a previous record of a Merlin lifting prey from water; a female retrieved a Dunlin *Calidris alpina* which it had dropped in the sea when two Carrion Crows *Corvus corone* mobbed it (Galloway B. 1981. *BB* 74: 264).

Merlins mainly hunt open country and very rarely take such riparian birds as Dippers, Grey Wagtails, *Motacilla cinerea* or Common Sandpipers *Tringa hypoleucos* presumably because this habitat is usually too enclosed. Of 3748 prey items recorded by G.W. Rebecca in northeast Scotland between 1980 and 1986 there were only 2 Dippers, 5 Grey Wagtails and 3 Common Sandpipers.

The present observation is of interest because it describes success in killing and retrieving an unusual prey, which presumably the Merlin had taken because its main prey at this time of year, the Meadow Pipit *Anthus pratensis* was scarce in the cold weather. The Dipper, which weighs from 50 to 76 g, is also a rather heavy item for a cock Merlin 160 g to kill, so it is all the more surprising that such a bulky prey could be retrieved from water.

I should like to thank M. Marquiss and G.W. Rebecca for comments on an earlier draft and G.W. Rebecca for permission to quote unpublished data.

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Proximity of successful Ring Ouzel and Mistle Thrush nests

On 12 May 1990 in an area of upland scrub at 300 m OD in the Leithen Valley, Borders Region, I brushed against a rowan *Sorbus aucuparia* and accidentally caused a brood of two nestling Mistle Thrushes *Turdus viscivorus* to "explode" from their nest, which I had failed to notice in the tree. Their sudden departure elicited alarm calls from a nearby pair of Ring Ouzels *Turdus torquatus* (although not from the parent Mistle Thrushes). After a brief search, I located a Ring Ouzel nest containing three well-feathered young, close to the Mistle Thrush nest. Since it has been suggested that Mistle Thrushes may compete successfully against Ring Ouzels for territories in upland areas (Durman, R.F. 1978 *Edinburgh Ringing Group* 5: 24–27; Simms, E. 1978 *British Thrushes* Collins, London), I returned to the site on 21 May, by which time the Ring Ouzel brood had fledged, and took details of the nest sites.

The breeding site was a west-facing disused quarry, the steep slopes of which were largely grassed over, and the flatter top colonised by rowan and silver birch *Betula pendula*, with a dwarf shrub layer of heather *Calluna vulgaris* and blaeberry *Vaccinium myrtillus* and a field layer of grasses. It is in a traditional Ring Ouzel breeding area

(Murray, R.D. 1986. *Borders Bird Report* 1985: 50 – 52; Poxton, I.R. 1987. *SB* 14: 205 – 208).

The Mistle Thrush nest was in the main fork of a rowan, 1.05 m above ground-level, and the Ring Ouzel nest was 1.10 m below the lip of the quarry, on a ledge under the roots of a birch. The ground-distance between the nest-cup centres was 6.45 m and the vertical height difference was 1.05 m. The distance between the nest-cup centres was thus 6.53 m.

Durman (1978), in a treeless study area in the Pentland Hills, Lothian Region, recorded two instances between 1973 and 1977 of the two species nesting within 50 m of each other. In the same study area between 1979 and 1984, two instances were found of both species nesting within 100 m of one another and one instance of them nesting 10 – 15 m apart (Poxton, I.R. 1986. *SB* 14:44 – 48). Durman (1978) reported noticeable aggression between Ring Ouzels and Mistle Thrushes where both were ground-nesters during a period when the Mistle Thrush population in the Pentland Hills seemed high. In the same area, Poxton (1986) saw no aggression, even in the case of the two nests being only 10 – 15 m apart, but the Mistle Thrush population was low at that time (1979 – 1984) following the cold winters of 1978/79 and 1981/82.

This note shows that the two species can nest about 6.5 m apart and not only successfully, but concurrently, since their nest-building, incubation and nestling periods are of similar durations. It may be that the two species can co-exist, even when the Mistle Thrush population is presumably high following a series of mild winters, where one (Mistle Thrush) is able to nest in a tree and the other (Ring Ouzel) on the ground.

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Chaffinch egg hatched by Blue Tit

On 16 May 1989 I found a Blue Tit *Parus caeruleus* incubating nine eggs in the nest of a Chaffinch *Fringilla coelebs*. Five of the eggs had been laid by the tit, the other four by a Chaffinch. The nest was deep inside a hawthorn *Crataegus monogyna* hedge, about 30 cm from the top, beside a busy road at Kirkton, near Dumfries. On 19 May the tit was still incubating the same number of eggs but on 25 May one finch egg had hatched, either that morning or the previous day. On the 27th the young Chaffinch appeared to be thriving and no other eggs had yet hatched. On the 29th the nest contained five newly-hatched tits and two finch eggs but the young Chaffinch had disappeared. One finch egg was found broken below the nest but there was no sign of the missing chick. It was assumed to have died and been removed as Blue Tits will sometimes carry away small dead chicks. (Perrins, C. 1979. *British Tits* Collins, London). Two days later the nest was empty.

Blue Tits have occasionally been recorded using the old nests of other species including Blackbird *Turdus merula*, Song Thrush *Turdus philomelos*, Dunnock *Prunella modularis*, Wren *Troglodytes troglodytes*, House Martin *Delichon urbica*, Rook *Corvus frugilegus* and Greenfinch *Carduelis chloris* (Took, G.E. (and note by Jourdain, F.C.R.) *BB* 27: 72 – 73).

Usurpation has been noted by M.C. Radford (*BB* 45: 30) who watched a pair of Blue Tits drive Great Tits *Parus major* from a nest box containing eggs. However the only record I have found of Blue Tits hatching the eggs of other species concerns Pied Flycatchers *Ficedula hypoleuca* in Wales (Lovegrove R.R. & Hope Jones, P. *BB* 61: 268) where the young flycatchers and tits both fledged successfully.

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Little Ringed Plovers breeding in Fife

On the evening of 17 June 1989 at a disused gravel pit in Fife, I heard an unfamiliar bird-call. It was a Little Ringed Plover *Charadrius dubius,* which I watched back to a stony ridge where I located a nest. The four eggs were considerably smaller than those of the Ringed Plover *Charadrius hiaticula* and were a warm buff colour with dirty 'scratchings'. Both adults were calling near to the nest. About 150 m from the Little Ringed Plover's nest, I found a Ringed Plover's nest on a shingle tongue. Another pair of Ringed Plovers was holding territory some 200 m N of the first nest, but appeared to have failed.

In the early morning of 19 June, the Little Ringed Plover's nest was empty, although the eggs had shown no sign of chipping on 17 June. No eggshells were present in, or around the scrape. The adults were making a new scrape near the original nest site, and on 20 and 21 June I watched them in courtship display. I assumed that their nest had been lost.

On the evening of 22 June, the 'failed' pair of Ringed Plovers was present some 200 m from the empty Little Ringed Plover nest, whilst an adult Little Ringed Plover, much agitated, attacked them. As I watched, a tiny chick stood up, followed eventually by three others. They were very active in the fine weather, running around and feeding, with the adult Little Ringed Plover circling and calling constantly. I ringed all four chicks under licence. They were much smaller than Ringed Plover chicks and were bright buff, with finer bills. When I laid them down and retired 10 m, the adult landed making a soft 'peep' note. The chicks immediately ran to it and were brooded.

On 23 June the Little Ringed Plover chicks were in an area of wet pools in the NW corner of the pit, and from then on fed along the muddy edges. By 27 June, the pit had several pieces of earth-moving equipment in it, which were being used to fill the area with topsoil. The Manager of the nearby works agreed to delay the fill to allow the birds to fledge.

I visited the site daily thereafter and the four chicks remained near the pools. The Ringed Plover brood, which had hatched by 26 June, was established on the dry ridges in the middle of the pit. On 6 July, some gravel at the edge of the ponds used by the Little Ringed Plover chicks, was moved. I watched the brood whilst this operation started and the adults led them away from the site to another area in the SW corner. On 8 July, both family parties of plovers were in the same area, and much interaction took place.

Clearly, the Ringed Plover was dominant, both adults continually harrying the Little Ringed Plover pair with threat displays of bowed head and outstretched wings. After perhaps five minutes of harmony, the Little Ringed Plover male would walk back into the area in which the Ringed Plover chicks were feeding. The larger pair immediately chased the little male, which continued into flight on many occasions. It was fascinating to watch this confrontation, the more agile Little Ringed Plover usually avoiding the larger bird. I observed this behaviour for several hours and once saw the Little Ringed Plover adult knocked to the ground by the chasing pair, which landed on and buffeted him. The flight of both species contrasted markedly, with Ringed Plover using slow wing beats and much gliding, the other having a rapid sandpiper-like action.

By 12 July, the four Little Ringed Plover chicks were fully feathered and the first tentative flight was attempted in strong winds. This was 24 days from assumed hatching date. They still crouched if disturbed, but over the next three days, flights became longer and more controlled. All had departed by 16 July, four days after the chicks' first recorded flight.

Thereafter, they were not recorded at this site. However on 30 July, a ringed juvenile Little Ringed Plover was present at

a lagoon approximately one mile away. It was sharing the pool with two of the Ringed Plover juveniles seen there for several days.

The breeding site is now filled and unusable by the species. These are the first sightings and breeding record of the Little Ringed Plover in Fife, and only the second breeding record for Scotland. The first was in Lanark in 1968 (Stalker D. *SB* 5: 282–3).

A displaying male Little Ringed Plover was present at a nearby pit from 3–23 May 1990, but no female appeared. This site was being filled in by 23 May.

I would like to thank Mr J. Kerr and the Directors of the Sand and Gravel Company for their active co-operation, without which the story may not have had such a happy outcome.

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Nuthatch breeds in Scotland

The mature, well-wooded policies of many Border estates appear to be ideally suited to the Nuthatch *Sitta europaea*. One was seen at The Hirsel, Berwickshire in April 1928 (E.V. Baxter & L.J. Rintoul 1953. *The Birds of Scotland*. Oliver & Boyd, Edinburgh) and there have been occasional reports since then. In the eastern Borders generally, records of Nuthatch have become more frequent in recent years and V.M. Thom (1986. *Birds in Scotland*. Poyser, Calton) thought it likely that, in view of the increase in sightings, they would breed in Scotland.

On 6 May 1989, I found a clutch of six Nuthatch eggs in one of the nest boxes I had put up several years previously at The Hirsel. The box, designed for tits, had an entrance hole of 1⅛" (28 mm) diameter, and was about 2 m above the ground. It was in an oak *Quercus* sp. on the edge of the deciduous woodland lining the banks of a stream valley. The interior of the box had been partly lined with mud and the back and one side had been plastered to the tree. Nest building was well advanced on 22 April, and it is estimated that the first egg was laid on 27 April, and that the young hatched on 16 May. All six young had fledged by 9 June. This is the first known successful breeding record for Scotland. The previous records are of one said to have been caught on the nest in Roxburgh in 1850 (this is unsubstantiated and not accepted) and of a pair which built a nest in Kirkcudbrightshire in 1927 (Thom 1986).

The nest box scheme I operate on The Hirsel is by kind permission of Sir Alec Douglas-Home; my thanks to him for his support and interest.

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Shore Larks nesting in Scotland in 1977

The first definite proof of breeding by Shore Larks *Eremophila alpestris* in Britain came from a nest found in 1977 (Batten L.A. *et al.* 1979. *BB* 72: 376), although the details given below have previously been withheld.

On 25 June 1977 I flushed a Shore Lark almost at my feet. It did not call and landed about 20 m away. Almost immediately there was a loud, sharp single note and a brighter-plumaged bird, presumably the male, landed 4 m in front of me. It then ran towards the first bird in a hunched attitude calling almost continuously. I looked down and saw a nest at the edge of a patch of short rushes. It was made of sedges and grasses and lined with white fibres from cotton grass *Eriophorum* spp. The cup was 68 mm wide inside, 50 mm deep and contained three very pale blue-green eggs marked with dense, pale buff-brown spots

and blotches. The darker markings were less dense than on a Skylark's *Alauda arvensis* eggs. At least one juvenile was seen at the site from 12 August to 7 September. The nesting habitat comprised gravel and flattened, rounded boulders interspersed with patches of short rushes and moss on a mountain top in the Central Highlands.

Previously a male summered in suitable breeding habitat in the Highlands in 1972, and a pair almost certainly nested there successfully in 1973 (Watson A. 1973. *BB* 66: 505 – 8). There were no reports in 1974 and only single males in 1975 and 1976 (Ferguson – Lees I.J. 1977. *BB* 70:15; Sharrock J.T.R. 1978. *BB* 71:23). Unusually many Shore Larks were seen in Scotland during the autumn and winter of 1976 (*SBR* 1976 – 1977). Following the cold, late spring of 1977 two singing males were found in suitable breeding habitat in addition to the breeding pair described here (Batten *et al* 1979). There has been no subsequent summer record.

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An observation of a Heron plunge-dive

Herons *Ardea cinerea* usually take prey from a standing posture on land or in shallow water (Lowe, F.A. 1954. *The Heron*. Collins, London; Cook D.C. 1978. *Bird Study* 25: 17 – 22). A number of less common hunting strategies are also cited by Lowe (1954). He describes Herons observed swimming after prey, picking fish from surface waters in flight like gulls, and plunge-diving for fish. R.V.A. Marshall (1961. *BB* 54: 202) also reports having observed Herons plunge-diving for fish at Abberton Reservoir, Essex. We report here an observation of a Heron both swimming and later plunge-diving in pursuit of ducklings in deep, open water.

The observation was made at 1130 BST on 16 May 1990 on Loch Kinord, Dinnet, NE Scotland. Weather conditions were mild, with low cloud and intermittent drizzle. Wind was light and the loch calm. We first observed the single Heron swimming in water at least 2 m deep (M. Lucas pers. comm.) about 50 m to the west of a large island (Castle Island) which lies at the NW end of the loch. The Heron was sitting high in the water with its neck erect in a similar manner to a Cormorant *Phalacrocorax carbo*. We noticed that the Heron was closing on a flotilla of ten Mallard *Anas platyrhynchos* ducklings (body length about 10 cm) which all dived when the Heron was a few metres away. The Heron lifted easily from the water and flew directly to the west shore of Castle Island where it stood looking back towards the ducklings which had resurfaced and continued to swim towards the same island. After a few minutes it flew directly over to the ducklings and plunge-dived amongst them from a height of 5 – 10 m. On impact with the water it grabbed one of the ducklings and immediately rose from the water and flew back to the same west shore of Castle Island. The duckling was held suspended by its neck at the tip of the Heron's beak. Once back on the shore the Heron swallowed the bird. The remaining ducklings, which had all dived as the Heron hit the water, resurfaced and swam directly to the south shore of Castle Island. The Heron had swallowed its prey before the other ducklings reached the island but it did not make any further attempts on them.

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Long-tailed Ducks wintering off the coast of the Outer Hebrides

Between 31 December 1985 and 5 January 1986, a group of colleagues (P. Bowyer, M. Green, S.A. Hinsley, C.J. Thomas, C. Todd, M.J. Wells) and myself made counts of wildfowl on the sea off the west coast of South Uist and Benbecula between Balivanich and Askernish. The coast was divided into sections, mostly corresponding to natural bays (Fig. 1), and each section was walked by two or more people who conducted counts from the best available vantage points using telescopes. This was done during moderately good weather when birds were visible up to 2 km offshore. Repeated counts on different days in section 4 showed that numbers were quite consistent from day to day during such conditions. Totals of 838 Long-tailed Ducks and 378 Eiders were counted (Table 1), the highest densities being in the central sections of South Uist. In addition, a large number of Long-tailed Ducks (perhaps as many as a thousand) was seen some distance offshore in the northern part of South Uist in heavy seas on 1 January, but it was impossible to obtain a reasonable count of these.

Previous counts of this area in 1971–73 gave totals of 150–300 Long-tailed Ducks (Brown, C. & Jenkins, D. 1973. *SB* 7: 404–405) and, in addition, Elkins (1974. *SB* 8: 201–202) estimated over 700 for the whole of the Outer Hebrides, of which about 300–400 were in Broad Bay on the east coast of Lewis. During an aerial survey in April 1977, 350 Long-tailed Ducks and 1000 Eiders were counted by H. Milne (in litt.). Buxton obtained peak counts of 340 off the coasts of the Uists, Barra and Benbecula, together with 220 off Harris and 200 off Lewis in the period 1979–83, making a total of 760 (Buxton, N. 1983. *Wildfowl in Lewis and Harris, Outer Hebrides*. Report to the Nature Conservancy Council).

In view of the fact that the 20 m depth contour is some 6 km offshore of the Uists (Norton, T.S. & Powell, H.T. 1979. *Proceedings of the Royal Society of Edinburgh* 77B: 141–153), there is scope for a large number of birds to be spread out feeding, completely out of sight from land. These may move closer inshore during bad weather as apparently occurred on 1 January 1986. It has been suggested that more Long-tailed Ducks may winter off the Western Isles than has previously been recognised. Our counts, covering only about 40% of the west-facing coast of the southern isles support this view.

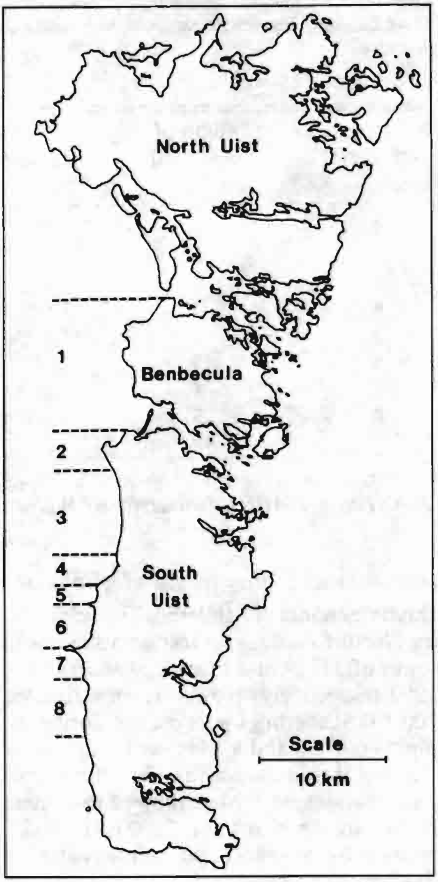

FIGURE 1. Sections of the coast of the Outer Hebrides along which wildfowl were counted in 1985/86.

TABLE 1. Counts of wildfowl off the west coast of South Uist and Benbecula in 1985/86. LTD = Long-tailed Duck *Clangula hyemalis*, E = Eider *Somateria mollissima*, CS = Common Scoter *Melanitta nigra*, G = Goldeneye *Bucephala clangula*, M = Mallard *Anas platyrhynchos*, R = Red-breasted Merganser *Mergus serrator*.

Section no. (see Fig. 1)	Length of coast (km)	Date counted	Species					
			LTD	E	CS	G	M	R
1	13	3 Jan. 1986	160	146		12		
2	6	1 Jan. 1986	79	153	39		11	10
3	7	"	77	5				
4	3	31 Dec. 1985	128	26				
5	2	"	74	42				
6	5	"	187	6				
7	4	"	47					
8	5	5 Jan. 1986	86					
TOTAL	45		838	378	39	12	11	10

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Inter-island flights by Sanderlings at dusk and dawn in Orkney

Daytime counts of Sanderlings *Calidris alba* on North Ronaldsay, Orkney, gave island totals of 11, 17 and 12 on 8, 9 and 10 May 1990 respectively. However, an estimated 200-500 Sanderlings were present during the nights of 7, 8 and 9 May on the beach of Nouster Bay at the south end of the island. Observations on 9 May showed that these birds started arriving at *c.* 2200 BST (dusk), and left by 0400 BST, when it was already daylight.

The only Orkney island that consistently has large numbers of Sanderlings by day is Sanday, mainly on the beaches of the Bay of Lopness and Bay of Newark, 10 – 15 km from North Ronaldsay. Totals of 283, 353 and 436 were counted on Sanday in April 1987, May 1988 and May 1989 respectively by the Tay & Orkney Ringing Groups (unpubl. data). Attempts to locate Sanderlings there at night in April 1987 were unsuccessful. It seems likely that the large numbers of Sanderlings which spend the night on North Ronaldsay involved the birds from Sanday.

If this suggestion is correct it poses two questions. Why don't the Sanderlings spend the night on Sanday, and why do so few occur on North Ronaldsay by day? Sanday has been colonised by rats *Rattus norvegicus* but North Ronaldsay is free of them. Rats can take a large toll of night-roosting birds in certain situations (van der Elst & Prŷs Jones. 1987. *Oryx* 21:219 – 222) so roosting Sanderlings could be vulnerable to such predation on Sanday. Other waders on Sanday also have different distributions by night compared with day; for instance, hundreds of Purple Sandpipers *Calidris maritima* and Turnstones *Arenaria interpres* occur on the outer rocks of the Holms of Ire (islets off Sanday) by night but only tens occur there by day. The reason why Sanderlings leave North Ronaldsay by day may be due to lower food availability. A comparison of the invertebrate densities on the beaches of Sanday and North Ronaldsay would test this idea.

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Capercaillie numbers on three Loch Lomond islands

In the Loch Lomond area of western Scotland reports of Capercaillie *Tetrao urogallus* have become scarce in recent years. Suitable habitat has decreased there as plantations with a rich ground cover have been replaced by dense unthinned and unbrashed stands (J. Mitchell pers. comm.). However recent habitat changes on the islands of Inchcruin, Inchmoan and Inchconnachan in the loch appear to have been slight. The ground vegetation includes lush dwarf shrub growth beneath open-crowned Scots pine *Pinus sylvestris*, and on Inchconnachan, sizeable larches *Larix* sp. On these islands persecution of predators and shooting of Capercaillie has been slight in recent years.

Counts of Capercaillie were made between 1977 and 1989 in late winter. Four to eight counters beat in line and one or two stationary counters watched for flushed birds from strategic sites, often from a boat. When Capercaillie flew into areas where they could have been flushed again, allowance was made by subtracting these birds from the total (maximum) seen to give a minimum estimate. For subsequent estimation of density, an average of the maximum and minimum estimates was used.

Counts were nearly always highest on Inchmoan and Inchconnachan; no Capercaillie or obvious signs of them were found on the 1989 visit to Inchcruin (Table 1). When numbers for the three islands are combined, the 1989 count, equivalent to 14.2 Capercaillie/km^2 was the lowest. The highest count, equivalent to 35.8 Capercaillie/km^2, was in 1981.

The counts indicate that even in a high rainfall area in the west of Scotland high densities of Capercaillie can persist. That mild western sites can support Capercaillie is known from their former occurrence, before forest destruction, in Ireland and by the record of the introduced population on the Isle of Arran (Harvie-Brown, J.A. 1879. *The Capercaillie in Scotland.* Douglas, Edinburgh). However, except in years of unusually good weather, poorer chick survival can be expected in the wetter west (Moss, R. 1986. *Ibis* 128: 65–72).

TABLE 1. Numbers of Capercaillie on three islands in Loch Lomond between 1977 and 1989. When two figures are given, they refer to minimum and maximum estimates (see text).

Date	Inchcruin	Inchmoan	Inchconnachan
20.3.77	4–10	nc	nc
21.3.77	5–10	nc	nc
22.3.77	nc	26	3
12.1.80	3–4	12–13	nc
16.3.80	5	11	16–19
31.3.81	2–6	11–20	19–28
28.3.82	4	7–8	9–11
29.3.89	0	6–16	5–7
Area km^2	0.3	0.5	0.4

nc = no count

Capercaillie have been seen flying between the Loch Lomond islands and the lochside woods, but we do not know to what extent the relatively high counts on the islands reflect immigration to good habitat at a time of considerable habitat loss around the loch. The population in the Loch Lomond area may be in decline as there were none on Inchcruin in 1989, and there are no recent records from the islands of Inchcailloch, Torrinch and Inchtavanach (J. Mitchell pers. comm.). On Torrinch and Inchcailloch breeding was confirmed between 1972 and 1976 (J. Mitchell *Loch Lomond Bird Reports*) and I found fresh signs on Inchcailloch in March 1977 and counted nine on Inchtavannach that year. Neither birds nor signs were recorded there on visits in March 1980, 1981, 1982 and 1989.

I acknowledge a Kilgour Senior Scholarship, Aberdeen University Studentships & CSIC-CICYT support. I thank all who helped especially J. Mitchell.

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OBITUARY

R.D. SMILLIE 1920–90

The news of the death of Ruby Smillie, and shortly after of her husband Jimmy, will have been received with great sadness by members who knew them. After a very short illness, Ruby died on 30 April 1990.

Ruby joined the SOC as a part-time secretarial assistant in February 1963 and retired as Membership Secretary in May 1983. During these 20 years she built up a reputation for her encyclopaedic knowledge of Club members. Her book-keeping and records were meticulous, and she could give up-to-date membership details as soon as she was asked. She needed no computer for speed or accuracy, but cheerfully learnt how to use one after she retired and returned to the office to help Fair Isle with secretarial work. She took a great interest in all Club members, many of whom may not have met her personally, but on mentioning a name she could tell you to which branch they belonged and, more often than not, their address and when they joined.

Ruby was not only an extremely able and efficient membership secretary, but she was renowned for her friendliness and the welcome she gave anyone who called at the Club offices. Many will have met her and Jimmy at conferences when they were both behind the Organizer's Desk, ready to renew old acquaintances and welcome newcomers with a warm and friendly greeting. They were also known to many ornithologists of international repute, whom they met as part of the team which manned the SOC Bookshop on the famous Scottish Bird Islands Study Cruise organised by the Club in 1966 (*SB* 4:272 – 286). Over the years visitors to Regent Terrace, who had been on the Cruise, were delighted to greet Ruby again or to know that she was still working for the Club. She corresponded with some of them for many years afterwards.

Although Ruby was employed by the Club for over 20 years, she was not just a member of staff, but a truly committed Club member, and this was recognised when she was elected as an Honorary Member in 1983 after she had retired. She would have been delighted to know of our continued presence at 21 Regent Terrace, a "home" she had known for so long. Ruby's sudden and unexpected death came as a great shock. Sadly, Jimmy, who will be remembered for his self-effacing manner, dry sense of humour and the tremendous support he gave Ruby, died a few hours after her funeral on 5 May 1990. He had supported the Club and its activities for many years. They will both be remembered with great affection, and our sympathy goes to their family for their grievous loss.

A.D. Peirse-Duncombe

Items of Scottish Interest

The papers and reports on birds in Scotland listed here deal mainly, but not exclusively, with status and distribution. Papers in the widely available journals *British Birds, Bird Study* and *Ringing and Migration* are excluded. Most are available in the Waterston Library for reference. Items marked with an asterisk are available from the SOC postfree to members at the prices quoted.

The librarian is glad to receive reprints or copies of papers on any aspect of ornithology or general natural history.

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