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Numbers of Whimbrel breeding in Shetland in 1989-1994 and previously

C P DORE, P M ELLIS & E M STUART

The Shetland breeding population of Whimbrel has never been completely surveyed in one year. This paper brings together the most recent data on Whimbrel in Shetland from several sources, including systematic bird surveys listing breeding Whimbrel since 1983. Apparently the breeding population of Whimbrel in Shetland has changed little since 1983-86 and is fairly stable at 479 pairs which represents 98% of the UK breeding population. However, due to the many variations in survey techniques and the large number of different observers, conclusions are tentative. Because surveys have involved several different techniques, a complete population survey followed by periodical monitoring is recommended.

Introduction

This paper brings together the most recent data on Whimbrel *Numenius phaeopus* in Shetland from a variety of sources. Most UK Whimbrel breed in Shetland (Richardson 1990) and a number of Sites of Special Scientific Interest (SSSIs) have been notified by the Nature Conservancy Council, now Scottish Natural Heritage, primarily or in part to protect their breeding habitat. The Shetland population of Whimbrel is small at 479 pairs, 0.1% of the Holarctic population (Cramp & Simmons 1983), but, within the UK, the Shetland population is important. However, the entire breeding population of Whimbrel in Shetland has never been completely surveyed in one year.

Methods

This paper collates information on Whimbrel collected during wader and skua surveys in Shetland between 1983 and 1994. For 1989-94 and 1983-86 data from 7 and 5 sources were used. Sources not mentioned specifically in the text are listed in Appendix 1. For each of 2 time periods (1983-86 and 1989-94) when duplicate surveys were done, the most recent data are used. Richardson (1990) incorporates information for 1982-86 from several sources and we compare them with later surveys (1989-94).

Both Richardson (1990) and Arnott *et al* (1992) state that the optimum time for surveying Whimbrel is 1-20 June after which the majority of chicks have hatched and some of the Whimbrel have left their nesting sites. All the surveys on which this report is based were carried out during this part of the breeding season. However, it is now known that peak laying dates for Whimbrel are around 10-15 June and that some Whimbrel begin to leave their nesting areas after this period. It is now recommended that Whimbrel surveys should finish by 15 June (M Grant pers comm).

Count methods differed considerably between surveys. RSPB standard upland survey methods involved observers walking transects 250m apart and mapping the apparent centre

of territory of breeding pairs recorded (Peacock *et al* 1985). NCC standard upland survey techniques used transects 200m apart (Rothwell *et al* 1988). RSPB skua surveys, which also recorded Whimbrel, used different distances between transects depending on the topography of the land and the density of nesting skuas. At times, these transects were up to 500m apart (Bird *et al* 1986). The 1992-94 SNH survey involved dividing sites into 0.5km^2 (500 x 500m), walking for 25 minutes in each square to scan the area and recording the presence and behaviour of birds (Arnott *et al* 1992, Bates *et al* 1994).

Difficulties also arise in the interpretation of survey results. Recent surveys (Arnott *et al* 1992, Bates *et al* 1994) have relied on the Brown and Shepherd (1993) methodology, which uses a strict definition of breeding behaviour, and may not be appropriate for Whimbrel. It is considered that this has led to lower numbers of breeding Whimbrel being recorded.

Results

Table 1 shows the numbers of breeding Whimbrel in different areas of Shetland in 1989-94 and 1983-86. The total population found in 1989-94 was 479 pairs, approximately 98% of the estimated UK breeding population. This was 21 pairs fewer than in 1983-86. Table 2 shows the numbers for similar areas found by Richardson (1990). Richardson's total is 8 fewer than that of 1989-94 and 29 fewer than that of 1983-86.

Richardson (1990) found the north isles of Unst and Fetlar to be the most important areas, together holding 43% of the population. The data for 1983-86 and 1989-94 presented here give similar figures of 36% and 37% respectively for these 2 islands. Richardson's (1990) figure for Yell was 8%, similar to our data for 1983-86 and 1989-94. The west Mainland accounted for 18% of the population in Richardson (1990); we found 19% in 1989-94 and 22% in 1983-86. The next most

Table 1 ***Estimates of the number of pairs of breeding Whimbrel in Shetland in 1982-86 by Richardson (1990) and in 1983-86 and 1989-94***

Area	1982-1986	%	1983-1986	%	1989-1994	%
Unst	110-115	25	102	20	106	22
Yell	31-37	8	39	8	38	8
Fetlar	73-79	18	81	16	70	15
Whalsay	18	4	18	4	19	4
North Mainland	41-48	10	61	12	57	12
Central Mainland	55-58	12	65	13	59	12
West Mainland	65-87	18	109	22	89	19
South Mainland	15-23	4	13	3	26	5
Bressay			5*	1	51	
Burra			7*	1	10	2
Other Islands	5-6	1				
Total	413-471		500		479	

* estimate

important areas are the north and central Mainland, where Richardson (1990) found 22%. In 1983-86, we found 25% and, in 1989-94, 24%. However, due to the many variations in techniques and the large number of different observers involved, this population estimate requires further clarification, although it is noteworthy how similar the proportions are from survey to survey.

Discussion

Table 1 shows that there appears to have been little change in the numbers of Whimbrel breeding in Shetland since 1983 with 500 in 1983-86 and 479 in 1989-94. Table 1 also shows that similar proportions of the total population were recorded in different areas of Shetland during the 3 surveys. Table 1 shows that a small numerical decrease appears to have occurred on Fetlar. However, no change has occurred in the numbers of Whimbrel breeding in areas outside the statutory bird sanctuary over the last 10 years, where any change would be expected to be most pronounced (RSPB unpublished wardens' reports). Inside the sanctuary Whimbrel breed at high density and are difficult to count. The apparent change may be due largely to differences between surveyors. It is believed that the apparent differences between the 1983-1986 data and the total given by Richardson (1990 Table 2) are due to his omitting some of the 1986 data (M G Richardson, *pers comm*).

The total figure for Whimbrel of 479 breeding pairs in 1989-94 is thought to be the most reliable estimate of the breeding population of Shetland Whimbrel currently available. Because the Shetland breeding population of Whimbrel has never been surveyed in one year and previous surveys have used different methods, it is recommended that a more accurate method of surveying breeding Whimbrel should be developed and that a complete population survey of Shetland and other known breeding areas in Scotland be carried out. Population monitoring should then be introduced to determine long term changes in the status of this important species.

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Appendix 1

Whimbrel surveys since 1982 not referred to in the text

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Hawkins I. 1990 Fetlar 1990 report. Unpublished report to RSPB.

Herfst M & Richardson M G. 1982 Whimbrel and wader distributions on Unst, Shetland, 1982. Unpublished report to NCC.

Smith S 1992. Black Park annual report, 1992. Unpublished report to RSPB.

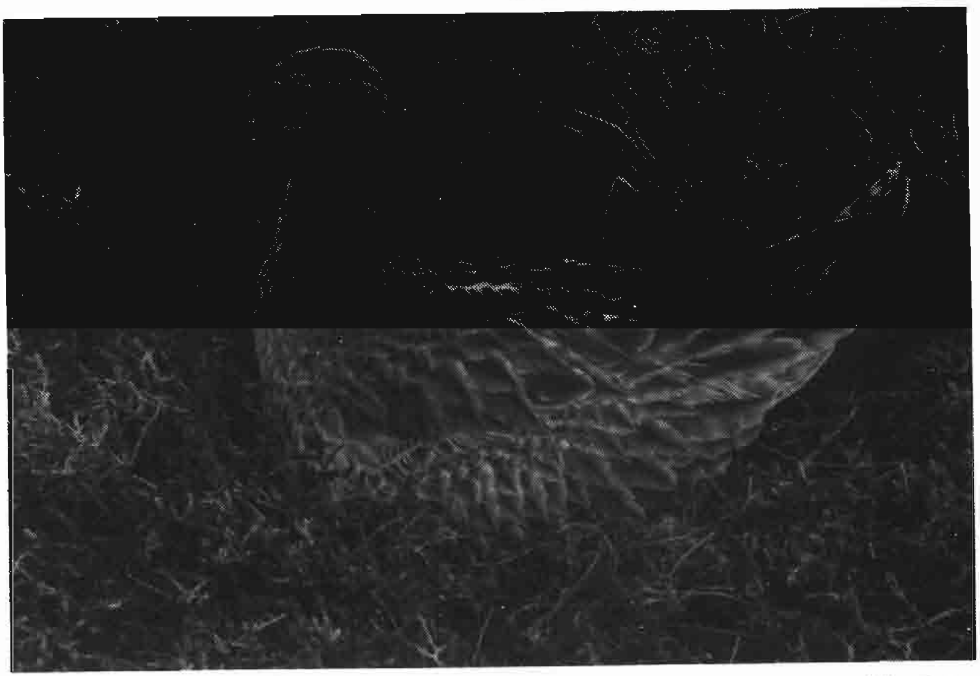
Wynde R M & Richardson M G 1985. Moorland and coastal bird surveys, 1985. Unpublished report to NCC.

Other sources of data not in report

1994. RSPB/SNH survey of a small number of sites throughout Shetland.

1992. RSPB Shetland wide skua survey during which any obvious Whimbrel territories were noted.

1989. Survey of Unst specifically for Whimbrel by M G Pennington.



Whimbrel *Wm Paton*

Breeding waders in the Cairngorms Straths ESA in 1995

N PICOZZI, D C CATT & R P CUMMINS

Baseline counts of Lapwings, Oystercatchers, Redshanks and Curlews were made in 1995 on 25 farms in the recently designated Cairngorms Straths ESA. Preference indices for crop types showed that Lapwings preferred bare ground and rushy pastures, Oystercatchers bare ground, Redshanks old grasslands and rough grazings, and Curlews rough grazings. ESA requirements which have potential benefit for these species are described. Numbers of Redshanks were low, but those of Lapwings and Oystercatchers were comparable to earlier counts on 'key' sites on Scottish farmland.

Introduction

Modern intensive farming methods have been identified by the BTO and the RSPB as a major contribution to the decline of waders and songbirds. Waders such as the Lapwing *Vanellus vanellus* and Redshank *Tringa totanus* have been particularly hard hit by the drainage of wet areas, both large and small (Galbraith *et al* 1984). Indeed the Lapwing, once a familiar sight on British farmland, is now a Red Data Book candidate, as are the Redshank and Curlew *Numenius arquata* (Batten *et al* 1990). The Oystercatcher *Haematopus ostralegus* is much less dependent on wet areas, and surveys have shown an increase in both range and numbers on farmland in recent years (Gibbons *et al* 1993).

To encourage less intensive farming practices, 10 areas in Scotland have been designated as Environmentally Sensitive Areas (ESA) by the Scottish Office. The scheme has potential benefit for wading birds. Under the scheme, farmers within the boundaries of an ESA have the option of registering for payments which help compensate for loss in revenue which may result from less intensive practices. There are 2 tiers in the scheme. Tier 1 covers all the farm and is compulsory. Tier 2, which is optional, provides higher payments for positive enhancement measures. The standard requirement of Tier 1 is to avoid damaging rough grazings, unimproved pastures, reverted improved land, wetlands, water margins, native woodland, amenity woodland and scrub by land clearance, ploughing, new drainage, modifying existing drains, levelling, reseeding or cultivating (CS/ESA 1 1993). Tier 2 payments are additional and vary depending on the measures to be undertaken, some of which are mandatory, others optional. They include encouraging regeneration of native woodland by fencing, conserving wetlands and herb rich meadows, and leaving unsprayed headlands around arable crops. An approved Management Plan clearly defines for 10 years ahead just what measures will be carried out each year (reviewable after 5 years).

In 1995, we visited 25 farms in the recently designated (1993) Cairngorms Straths ESA to count Lapwings, Oystercatchers, Redshanks and Curlews. The aim was to establish a baseline, before the prescriptions

could take effect, against which future counts can be compared.

Methods

Selection of farms

Five farms for which management plans had been prepared were chosen at random in each of the 5 main regions (upper Deeside, upper Donside, Strath Avon, upper and lower Speyside) to ensure that the whole ESA was represented.

Counts of waders

Lapwings, Oystercatchers, Redshanks and Curlews were counted on each farm on as much of the inbye land, ie land which is, or has been, cultivated and which is usually enclosed by a fence or a dyke, as it was possible for 2 observers to assess in 3-4 hours (at least 44 ha). In particular, any wetland site that was designated under Tier 2 was included, as were the fields adjacent to such sites. Hill grazings, usually dominated by heather *Calluna vulgaris*, were not visited. Three counts were made on the 25 farms. The first covered the period when the birds were establishing territories (11 April - 3 May), the second covered the main nesting period (9 - 23 May) and the third was to estimate breeding success (12 - 29 June). To complete these counts, it was necessary to visit 2 or 3 farms in a day. We therefore chose to work on those species which could be counted reliably at any time of day; we did not include Snipe *Gallinago gallinago* because they cannot be counted with any degree of accuracy except in the early morning or late evening. Their requirements for the wettest ground are similar to those of Redshank, for which we felt reliable counts could be made as they usually flushed and called when an observer was still some distance away.

The methodology of O'Brien and Smith (1992) was adopted, to be consistent with earlier studies. Where possible, counts were made from a vantage point, of displaying birds on the first visit, and of nesting birds and birds with chicks on the later visits. As it was not always possible to find a suitable vantage point for counts and some birds could have been missed, transects at 100 m intervals were then walked through fields, whenever conditions allowed, to flush birds. The total number of Lapwings seen was halved to give an estimate of the number of pairs present (see O'Brien and Smith 1992). Oystercatchers, Curlews and Redshanks were usually seen in pairs but if seen singly were assumed to represent pairs. The data presented in this paper refer only to breeding birds. Flocks of passage or non breeding birds are excluded because of their itinerant nature.

Definitions of land use

For the purposes of this study, the following definitions for land class (based on those in CS/ESA 1 1993) were adopted:

1. *Bare ground* land under tillage in spring for cereals, grass, root crops or oil seed or forage rape. This land was either newly ploughed or had been used for root crops or rape the previous year.

2. *Hay/silage* fields which were sometimes grazed in the early spring but then fertilised with dung, slurry or inorganic fertiliser for the production of hay or silage.

3. *Short term grass and leys* fields used primarily for grazing and lambing, which were

in regular short term rotation.

4. *Long term grass and permanent pasture* grazed grassland with a variety of low herbs, neither in regular cultivation nor part of a long term rotation. This was usually on ground that would have been difficult to cultivate.

5. *Rough grazings* land containing semi natural vegetation including rough grassland, used, or suitable for use, as grazing. Land, often along stream sides, with more than 50% of rushes, usually in rank clumps, was included here.

6. *Rushy pasture* land, previously improved by agricultural management, which now had plants indicative of unimproved pasture. In general this meant the presence of invasive clumps of rushes which occupied less than 50% of a field. These fields were normally still being grazed by sheep and occasionally by cattle.

All the farm maps were digitized using the ARC/INFO Geographical Information System (1989). From this, the areas of each field were readily obtained and the proportions of each crop type calculated.

Habitat preference

Preference for a particular crop type by each bird species within each farm was calculated according to Duncan's (1983) preference index (Pi); values greater than 0.3 indicate preference, and less than 0.3 avoidance:

$$Pi = \log_{10} \frac{\text{Proportion (\%) of birds using the crop type}}{\text{Proportion (\%) of land available}} + 1$$

Two sets of indices were calculated from the first 2 counts for each species. The first method (A) considered that, if a species was present on a farm, but absent from one or more particular crops, the preference index for those crops should be included in the calculations as 0 (*ie* $Pi = \log_{10} 1$). The reasoning is that if, say, Lapwings were present on a farm, they could in theory have selected any of the crop types there; this method takes into account both the crop types that they did select, and those they did not. A disadvantage of the method is that there may have been more crop types than birds, in which case not all crop types would have an equal chance of selection. The second method (B) overcomes this objection by treating absence as a missing data value and so looks at the relative preferences for the habitats which the birds actually used.

Statistical analyses

The indices were not distributed normally and so differences from the expected value for crop preference by waders were tested for significance by non parametric Wilcoxon tests (SAS (1990) NPAR1WAY PROCEDURE). The preference indices for each crop were first grouped by region. The differences between regions were not statistically significant and so data for all farms in the ESA were treated as a whole.

Results

Habitat preference

Results for the 4 species are summarized in Figure 1, in which the mean statistically expected rank order of preference for a crop has been subtracted from the mean of the observed ranked orders of preference. A positive result indicates preference, a negative result indicates that the proportion of all the pairs on the farm that were on that crop was less than would have been expected

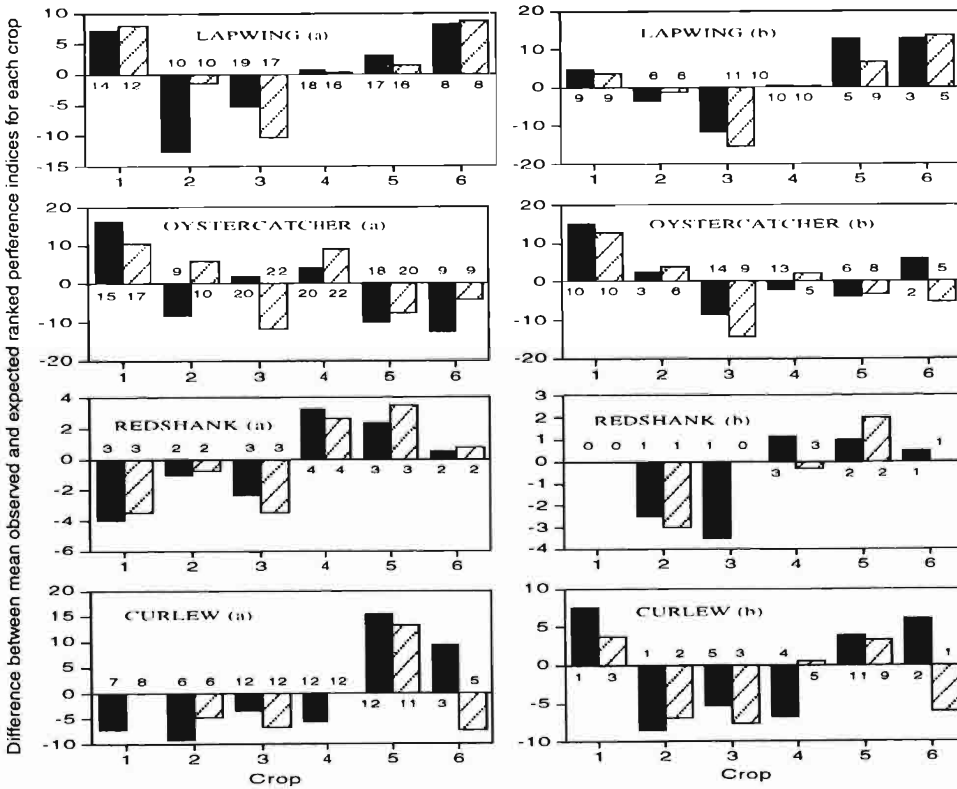
from the available amount of that crop type ie it was apparently avoided. The results of the statistical tests, indicated in the following text by superscript, are given in the Appendix.

Lapwing Selection among crop types showed similar patterns using methods A or B. Overall differences in the selection of crop types were not significant using method A[1], but were using method B[2]. Bare ground, rushy pastures and rough grazings, were favoured by nesting birds, but leys were avoided.

Oystercatcher Differences for selection between crop types were significant using method A[3] and method B[4]. The clearest preference was for bare ground. Short term grassland and leys were mainly avoided by nesting birds.

Redshank There were too few birds (16 pairs on 8 fields on the first count, 13 on 6 fields on the second) for results to reach significance. However, the results were generally consistent. The main preference was for old grassland and rushy pastures. Leys and hay/silage fields were avoided.

Fig 1 ***Selection for crops by Lapwings, Oystercatchers, Redshanks and Curlews on the first (solid) and second (hatched) counts using 2 methods (see text). A positive result indicates slection, a negative result avoidance. Crop 1 = bare, 2 = hay/silage, 3 = leys, 4 = old pasture, 5 = rough grazing, 6 = rushy pastures. Number of farms in the sample shown on the X axis***



Curlew Both methods showed a significant, or near significant, preference among crops on the first and second counts using method A[5] or method B[6]. Method A indicated a preference for rough grazings.

Breeding success and density of pairs

An extensive survey based on just 3 visits to a farm over a 10 week period gave an imprecise estimate of breeding success since it was not possible to assess the performance of known pairs. The fields in which pairs were seen with young may not have been those in which the birds nested. Lapwings for example often take their broods into fields with sheep, cattle or ponies after 1-2 weeks, so the number of broods in such fields does not necessarily relate to the number present there in spring as nesters. The data for breeding performance given here are therefore only a guide and based on the maximum number of pairs of each species seen on each farm in spring on the first or second visit, whichever was the greater, and the number of broods, or adults giving distraction displays, seen on the third visit (Table 1).

Discussion

Habitat preferences and the implications of the ESA prescriptions for wading birds

The 2 methods of treating the preference indices gave broadly similar results. However, method B (based only on those crops that birds occupied) showed clearer apparent preferences than method A. It is possible that differences between the 2 methods were due partly to the coarse habitat definitions and partly to the choice of a field as a unit for describing habitat. For example, the presence of wet patches was not taken into account and this may have affected the choice of field. Nevertheless, the main findings are in broad agreement with previous studies of waders on Scottish agricultural land (Galbraith and Furness 1983; Galbraith *et al* 1984; O'Brien 1995). These authors showed that the greatest densities of most wading species were on poorly drained rough grazings rather than improved grazings or cereal fields. Barrett and Barrett (1984) also showed that unimproved pasture in east Sutherland held

Table 1 ***Number of pairs of Lapwings, Oystercatchers, Redshanks and Curlews seen on 25 farms totalling 1710 ha in the Cairngorm Straths ESA in 1995 and the proportion (%) of these pairs with well grown or fledged young in late May and June. Comparative densities from an earlier study on Scottish agricultural land are shown***

Species	Pairs in spring	Pairs with young (%)	Mean density/km^2	Density at key sites [a]	Density at random sites[b]
Lapwing	244	65	14	11	2
Oystercatcher	140	60	8	5	2
Redshank	16	82	1	3	1
Curlew	40	43	2	4	0

[a]Average density/km^2 at 'key' wader sites and [b] on farmland sites selected at random on Scottish farmland in 1992 (O'Brien 1995)

greater numbers of breeding waders than other habitats. All land on the farms we visited in the Cairngorms Straths ESA will be covered by Tier 1 prescriptions, a standard requirement of which is to avoid damaging grasslands by new drainage or modifying old drains (see Introduction). This requirement alone is almost certain to safeguard, and perhaps increase, the amount and suitability of land for waders.

Reverted improved land (rushy pasture), rough grazings and bare ground were the preferred habitats of Lapwings in this survey. Short-term grassland and leys were the least preferred options for Lapwings as nest sites, though leys with livestock were important feeding areas for broods. The Tier 1 prescriptions are likely to be beneficial to Lapwings as they will favour the retention of damp pastures. Nests on bare ground were often destroyed by farming operations, mainly because they were not easily seen.

Oystercatchers showed a clear preference for bare ground as nest sites. They could benefit from the Tier 2 arable option, under which cultivation is restricted to the period between 28 February and 15 May, except for root crops, where nests must be marked and avoided during operations. We found that farmers marked Oystercatcher nests and avoided them wherever possible, even when not entered for this option. Their nests were much more conspicuous than those of Lapwings.

The numbers of Redshanks were very low with only 16 pairs found on 1710 ha. Although the sample was small, a preference for rushy and older pastures was indicated. The importance of wetlands, which can be subject to the enhanced payments under Tier 2, is more critical for this scarce species than for the other 3 considered here.

Both sets of results for Curlews indicated a preference for the rough grazings. Leys and silage fields were used, but less than expected from the area available. The greatest proportion of records were from rough grazings (11 of 24 observations of Curlews on the first count, 9 of 23 on the second count). The preference indicated for bare ground in Figure 1 using method B may be misleading since it was based on a small number of birds (1 out of 24 records on the first count and 3 out of 23 on the second count). The Tier 1 prescription to avoid damaging rough grazings by poaching, feeding practices, overgrazing and tracking by vehicle should benefit Curlew and other birds nesting there.

Breeding success

It would be unwise to read too much into the results for breeding success and no other broad survey of this nature has attempted to give such data. Lapwings present particular problems as they may lay up to 4 replacement clutches following egg loss, so that there is a wide range of ages in June, with the first broods already having fledged and present in flocks. The data given here suggest a reasonable breeding success for Lapwings. Galbraith (1988) calculated that a pair should produce 0.8 young to sustain the population. At least 65% of the pairs in the ESA produced one or more young. The minimum requirement therefore was probably met. There are no comparable data for Oystercatchers, Redshanks or Curlews.

Densities compared with other studies

The most recent survey of waders on Scottish agricultural land (O'Brien 1995) counted birds on 236 1 km^2 sites selected at random, and 171 other sites considered to be of 'key' importance for waders (only one of these, a

farm in Donside, was selected in the current survey). Average densities per 1 km^2 for Lapwings and Oystercatchers on the key sites were slightly less than those on the study farms (Table 1), although the farms were selected at random. Our baseline counts were the first part of a 10-year programme to monitor the effects of the scheme on wader populations. They suggest that, overall, Lapwing and Oystercatcher populations on the group of farms in this study were comparable with the best recognised sites on Scottish farmland. This is encouraging, as the ESA designation and participation in the scheme were too recent to have had any effect. However, the densities of Redshanks and Curlews on key sites were greater than those found here, and further emphasise the cause for concern over Redshanks expressed by Galbraith et al (1984). Curlews were more likely to be present on the hill grazings which were not part of our survey.

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Nicola Penford and Alison Espie of FFWAG greatly assisted us with their advice in setting up the project. We are indebted to the farmers for access to their land. Robert Moss's comments on the text and advice on the statistical treatment of the data are gratefully acknowledged. This survey, which formed a small part of a wide ranging survey into many aspects of the ESAs in Scotland, was funded by SOAEFD.

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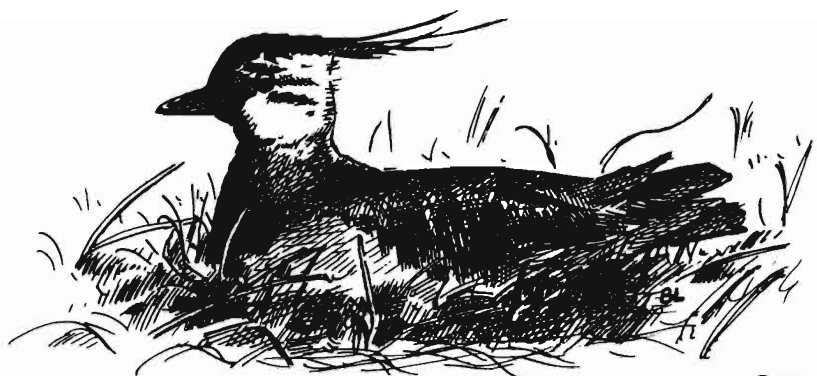
Appendix ***Results of statistical tests; the reference indicates the superscript figures given in the text. For details of methods A and B, see text***

Reference	Species	Analytical method	Result	
			Count 1	Count 2
1	Lapwing	A	$X_5^2 = 6.22$ p = 0.28	$X_5^2 = 6.40$ p = 0.27
2	Lapwing	B	$X_5^2 = 13.72$ p=0.02	$X_5^2 = 18.42$ p=0.006
3	Oystercatcher	A	$X_5^2 = 13.29$ p=0.02	$X_5^2 = 11.20$ p=0.047
4	Oystercatcher	B	$X_5^2 = 17.85$ p=0.003	$X_5^2 = 16.25$ p=0.006
5	Curlew	A	$X_5^2 = 23.05$ p=0.001	$X_5^2 = 14.34$ p=0.014
6	Curlew	B	$X_5^2 = 13.75$ p=0.017	$X_5^2 = 9.78$ p=0.082



Lapwing *Barry Larking*

Human induced increases of Carrion Crows and gulls on Cairngorms plateaux

ADAM WATSON

Formerly, Carrion Crows were rare and gulls mostly scarce on plateaux in the Cairngorms. Walkers increased on Cairn Gorm in the late 1950s following easier access, and more Crows were seen, eating scraps. Since 1961, new roads and lifts led to many walkers on the nearby plateau. Crows and gulls increased there, often eating scraps. Crows robbed many Ptarmigan nests. Crows and gulls were scarce on parts of the plateau where I saw nobody, and on plateaux with no public roads or lifts, where I saw far fewer people than on Cairn Gorm plateau. Crows became scarcer since 1992, after more trapping on nearby low ground.

Introduction

Carrion Crows *Corvus corone* and gulls *Larus* haunt low land, usually avoiding alpine land above 750 m. After a road was built to Cairn Gorm ski area in 1960 and a chairlift in 1961, many people went there and to the nearby plateau (Morris *et al* 1974). More Crows and gulls visited the ski area than nearby land with few people, often eating food scraps (Watson 1979).

This paper records Crows and gulls on plateau A and other alpine land in summer (1 May-10 October) 1943-88, until other bodies began full time work. My hypotheses were that numbers in different summers on A, on A's different parts, and on A and other plateaux, would be unrelated to numbers of people in these summers and areas. All 3 proved to be rejected.

Study areas and methods

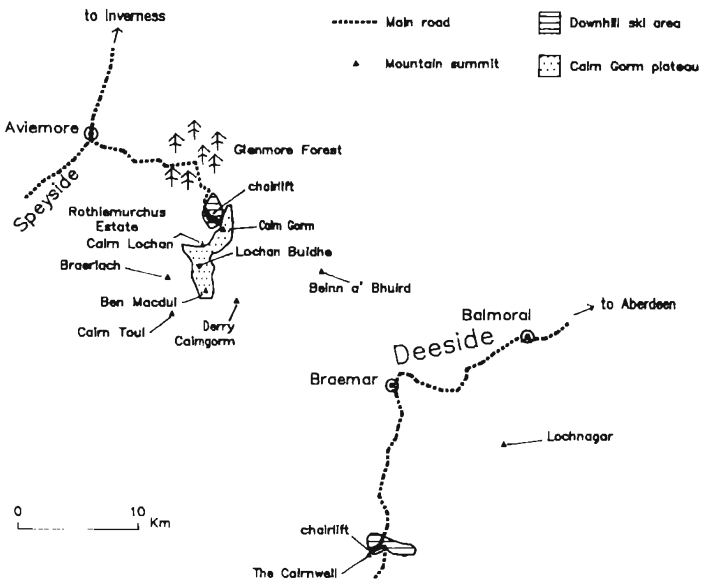
Area A is a 17.6 km^2 plateau on Cairn Gorm and Ben Macdui (Fig 1) the foremost UK site for subarctic wildlife. Other plateaux in the Cairngorms massif between Spey and Dee (some in Fig 1, others and number of observer visits in Watson 1991) had no public road or lift. I also made notes on the Mounth from Lochnagar to Cairnwell ski area.

Watson (1979,1991) described count methods. Locations were noted to avoid counting the same birds more than once a day. I corrected for ties in r_s tests. To save space, P is < 0.001 in tests with no P value stated, and 'numbers' means numbers seen per summer day per year.

Results

Numbers of people

In the late 1950s, walkers increased on Cairn Gorm, following easier road access and other developments (Watson 1984). By the late 1950s, numbers had risen on A too (Watson 1991; 1956-59 v. 1943-55 annual means. n=4 & 13, Mann-Whitney U=8, P=0.05). After the main developments began in 1960, numbers rose successively each year bar one, to a 1974 peak (Watson 1991).



Successive rises then ended, with 6 in 1974-88 but 8 declines including a run of 4 in 1981-85 after a subsidiary 1981 peak. However, numbers stayed much higher than in the 1960s. The main change was that successive year to year increases ended.

On other plateaux and other alpine land in the Cairngorms massif, where there were no public roads or lifts, people did increase, reflecting the popularity of hill walking. The increase on A was far greater (Watson 1991), associated with easy access by roads, chairlifts, and paths.

Crows on A

In 1932-49, D Nethersole-Thompson (*in litt*) saw a Crow on less than one summer day in 10 on alpine land on the Spey side of the Cairngorms, but saw Crows eat walkers' scraps at Cairn Gorm and on A's north part in the late 1950s, and in 1959 take Ptarmigan *Lagopus mutus* and Dotterel *Charadrius morinellus* nests (Nethersole-Thompson & Nethersole-Thompson 1961).

Before the developments, Table 1 shows no year with Crows seen and 17 years without, but afterwards 21 with and 6 without (Fisher exact P). Annual mean numbers of Crows and people in 1943-88 were related (n=46. r_S=0.83). Watson (1981) noted that in 1971-80 the percentage of summer days with Crow sightings increased with year (r_S=0.96, P<0.01). The tendency to increase then ended. Numbers in 1981-88 were lower than in 1975-80 (n=8 & 6. Mann-Whitney U=4, P=0.008, though higher than in 1961-74 (U=8, P=0.01). The biggest totals seen in a day in each year in the 1970s exceeded those in the 1960s or 1980s (Table 2).

Since 1970, I have seen Crows on most parts of A south to Ben Macdui summit, but mainly on north parts on and near Cairn Gorm. I

Table 1 ***Mean number of Crows and gulls seen per summer day per year and n of observer day visits on Cairn Gorm plateau before and after a public road and chairlift were built at Cairn Gorm ski area in 1960-61***

	Crows	Gulls	n
1943	0	0	1
1944	0	0	1
1945	0	0	1
1946	0	0	2
1947	0	1.3	7
1948	0	0.1	12
1949	0	0.2	6
1950	0	0.3	6
1951	0	0.1	8
1952	0	0.3	8
1953	0	0.3	4
1954	0	0.2	9
1955	0	0.1	7
1956	0	0.3	7
1957	0	0.4	5
1958	0	0.7	3
1959	0	0.3	3
1960	0	1.0	4
1961	0	2.0	4
1962	0	0.7	4
1963	0	1.0	4
1964	0	1.7	3
1965	0	3.0	2
1966	0	2.0	2
1967	1.1	0.6	7
1968	0	0.8	6
1969	0.3	1.3	6
1970	2.5	1.2	6
1971	1.3	1.0	12
1972	0.6	1.1	18
1973	0.7	2.0	25
1974	5.3	0.9	16
1975	4.0	8.5	24
1976	2.5	3.4	17
1977	3.1	7.7	17
1978	3.7	3.1	11
1979	5.6	0.5	9
1980	2.6	0.3	9
1981	1.3	6.3	18
1982	1.2	1.1	14
1983	1.2	0.2	11
1984	1.3	0.2	6
1985	1.4	0.1	7
1986	1.8	1.1	6
1987	4.0	0.7	6
1988	1 0	0.7	6

Cairn Lochan (0.7), Ben Macdui summit and west of Cairn Gorm (0.6), and lower elsewhere.

After Lochan Buidhe hut was built in August 1967, people often stopped there (Watson 1991) and left scraps. The hut was removed on 6-8 June 1975. The proportion of Crows seen there in 1967-74 (28% of 143 sightings on all of A) exceeded that in 1976-88 (5% of 322). As these would include birds seen more than once, any statistical analysis involving a P value would be invalid because of inflated totals, but the point is clear without it. As the part at the hut site covered only 0.16% of A, Crows obviously still favoured that part after the hut's removal. Even after, people still stopped there, where 2 paths met near an attractive lochan.

Crows on A favoured summits, huts, popular camp sites, paths, human snow holes, and grassland. At sunset they flew north to gather at dusk at 600 m on the moor below Coire na Ciste before flying to roost in Glenmore Forest, and at dawn flew south. I saw none on A from dusk to dawn. The biggest single flocks were 18 on several parts of A, 30 on subalpine land (650-750 m) west of Coire Cas, and 35 on the moor before roosting in December 1991.

After 1960 I saw Crows on A each month in May-September, and, since 1970, each month

Table 2 ***The biggest totals of Crows and gulls seen in a day each year on Cairn Gorm plateau***

	CROW		GULL	
	Median	Range	Median	Range
1960s	0	0.8	3	1-7
1970s	15	6-22	10	7-34
1981-88	4	2-19	5	1-22
CROWS				
1960s v 1970s	Mann-Whitney		U=4, P<0.002	
1970s v 1980s			U=12, P<0.05	
GULLS				
1960s v 1970s			U=5, P<0.002	
1970s v 1980s			U=14, P<0.05	

1970s values exceeded 1960s and 1980s ones in these tests.
The smallest totals seen in a day were 0 each year for Crows and for gulls.

in October-April on days with little fresh snow. All seen on A were full grown except for one with down traces, begging from an adult (see 2 paragraphs below for another case). In winters since the mid 1970s they were seen daily around car parks and buildings on the ski area, even in snowy periods. In 1989 a pair raised 2 young at 650 m in Coire na Ciste, nesting on a pylon of a chairlift operated only in winter. In 1995-96, a few single Crows gave territorial calls beside car parks at Coire Cas and Coire na Ciste.

Crows on A often ate craneflies, leather jackets and moths on the ground, insects stranded on snow, walkers' scraps, and a few corpses of birds, sheep and domestic Reindeer. Sometimes I saw one fly slowly while looking down, the usual behaviour when hunting for eggs, and twice saw one carry an egg.

I found Ptarmigan nests robbed by Crows on all A's parts north of Lochan Buidhe and Cairn Gorm's north slopes west to Creag an Leth-choin, and saw sucked eggs each year since 1971 on these areas. Sucked eggs were noted at up to 20 widely different places in a summer. Robbing north of Cairn Gorm was severe each year in 1975-82 (Watson unpublished). I saw 3 failed attempts to take Ptarmigan chicks, and one chick taken. J Porter (pers comm) saw a Crow kill 3 downy Ptarmigan chicks south of Cairn Gorm, hide them in a hole, and fly off, to return shortly with fledged young which begged for food and were given the chicks. Ptarmigan on Cairn Gorm bred worse since the developments than before, and worse than on other massif plateaux where I saw no

Crows (Watson 1981,1982). A Crow robbed one of 10 Dotterel nests with fresh eggs on A (Watson 1989).

Crows on other alpine land

Watson (1979) recorded Crows on the ski area and other parts of Cairn Gorm's north slope. I noted sightings there each summer in 1979-88, on almost every visit. They often frequented the Ptarmigan Restaurant and were there on each summer evening after people left, though not in late summer 1996 when the Restaurant was closed.

In 1967, a Crow was at 900 m on Ben Macdui's south side. On Derry Cairngorm I saw one in 1967,1969 and 1972, and found a Ptarmigan nest robbed by a Crow in each of these years, but none since. Watson (1991) saw few people on Derry Cairngorm, but it was near popular walking routes, camp sites and huts at Derry Lodge, where Crows lived at all seasons in the 1960s and early 1970s. They roosted in the wood in winter (eg 20 in 1966-67). From 1971, gamekeepers greatly increased their Crow killing as Mar Lodge Estate became keener on grouse shooting. On other plateaux and other alpine land in the Cairngorms massif, such as Beinn a' Bhuird, I saw very few people (Watson 1991) and no Crows.

At Cairnwell I saw no Crows each summer in 1946-61. I noted sightings each summer in 1962-78, after a chairlift was built in 1962 at the ski area and people increased greatly (Watson 1979). In 1967, I saw one on Glas Maol, just east of the ski area's east end. They were commonest in 1971 on Cairnwell, with up to 13 at a time, frequenting also the nearby Meall Odhar, Carn Aosda and Carn a' Gheoidh, and once one on Glas Maol. They took many Ptarmigan eggs (Moss & Watson 1984) and some of Red Grouse *Lagopus lagopus scoticus*. After the estate learned this, gamekeepers increased their Crow killing from early 1972. I saw only 1-2 each summer in 1972-78, and none since 1979, apart from one in 1986 which took a grouse egg and one in 1989. None was seen on alpine land in winter.

In May-June 1963 and 1964, the gamekeeper and I saw a few Crows up to 1100 m on Lochnagar, a popular hill made more accessible by bulldozed tracks. We found 3 Ptarmigan nests robbed by Crows, and 20 more sucked eggs on the ground. Gamekeepers then increased their Crow killing and I saw none on annual visits after 1967.

Ravens on alpine land

Ravens *Corvus corax* are natural on mountains abroad, but none breeds in the Cairngorms massif, where carrion on alpine land is scarce (Watson 1966). D Nethersole-Thompson *(in litt)* 'practically never' saw a Raven on alpine land on the Spey side of the Cairngorms in 1933-64. Each year in 1978-88, however I saw 1-3 at a time on A in July and August, and watched them feed on dead sheep and domestic Reindeer. I saw none on other Cairngorms plateaux, where sheep and reindeer were scarce or absent.

An occasional Raven was seen on the Cairnwell hills and Callater hills in a few summers in 1954-86. On Glas Maol and west to the Cairnwell I saw a pair each summer in 1990-94, and 4-7 in 1995-96. Sheep and Red Deer *Cervus elaphus* summered at high density, corpses of both occurred each summer, and 5 Ravens were at a dead sheep in 1995. So, Ravens on alpine land in the area in Fig I were associated with unnaturally many dead sheep and deer.

They were not entirely carrion eaters. On A in every summer in 1978-88 I saw 1-3 eating walkers' scraps at summits, and in several years on Glas Maol likewise. In 1995 M Marquiss (pers comm) saw one fly to Lochnagar summit to eat plentiful scraps after walkers left.

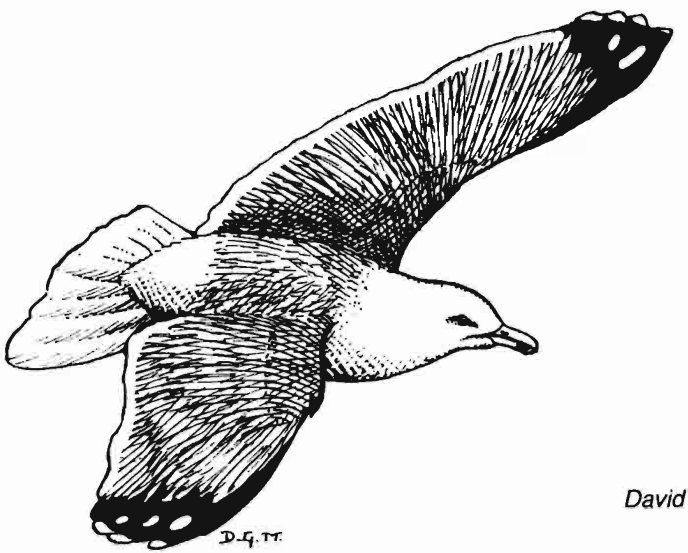
Gulls on A

Each summer in 1933-59, D Nethersole-Thompson *(in litt)* saw a few Black-headed Gulls *Larus ridibundus*. I saw some in each summer since 1947, with Common Gulls *Larus canus* annually since 1969. Out of 754 sightings, 91% were Black-headed, 8% Common and 1% Lesser Black-backed *Larus fuscus*.

Before ski development, Table 1 shows 13 years with gulls seen and 4 years without, but afterwards 27 with and 0 without (Fisher exact, NS). Annual mean numbers of gulls and people were related (n=46, r_S=0.61). Highest gull numbers were in 1975, 1977 and 1981, all peak cranefly years *(Tipula* spp). This may have been secondary, as high gull numbers did not occur during cranefly peaks in earlier years or since 1981. Gull numbers in the 1980s have been lower (1980-88 v. 1971-79, n=9 & 9, U=13, P<0.02). Also, the biggest gull totals in a day each year in the 1970s exceeded those in the 1960s or 1980s (Table 2). This followed an end to successive yearly increases of people, and coincided with some declines of people

I saw no gulls on 7 of A's 30 parts, and nobody on 5 of these (the same ones as for Crows). On 30 parts for all 46 years combined, gull and people densities were related (n=30, r_S=0.78), and gull and Crow densities (r_S=0.71). The highest gull density was at Lochan Buidhe (14.6 per ha in 1971-88), followed by Fiacaill a' Choire Chais (5.4), south of Cairn Gorm and above Coire an t-Sneachda (0.6). Ben Macdui and Cairn Lochan (0.4), and low elsewhere.

Gulls on A favoured lochs, huts, paths, summits south to Ben Macdui, and grassland.



Herring Gull *David Mitchell*

They often caught insects on the ground, and less frequently stranded on snow. I saw one feed on a dead bird. Often they ate walkers' scraps. Occasionally they followed people, such as 69 flying with a party from Cairn Gorm for 1 km on to A (D Gowans, *pers comm*). When 51 marines camped for 3 days in June 1975 to remove Lochan Buidhe hut, 28 Common and 6 Lesser Black-backed Gulls attended, eating copious scraps.

My first date for a gull on Cairn Gorm summit was 17 April, but into A itself 25 May. I saw few in August and the last on 25 August. Most flew north to Glen More in the evening, but in late July and August a few adults and juveniles stayed up overnight. In August 1971 a Fox *Vulpes vulpes* killed 3 Black-headed Gulls in widely distant parts of A at night. I saw no gull eating eggs or chicks on A, but sucked Ptarmigan eggs were found at 2 alpine lochs where Common Gulls nest (Gordon 1907; Nethersole-Thompson & Watson 1974).

Gulls on other alpine land

Watson (1979) recorded numbers on Cairn Gorm ski area and other parts of Cairn Gorm's north slope up to 1978. In 1979-88 they were seen in every summer and on almost every visit around Ptarmigan Restaurant, as well as upper Coire na Ciste south to Cairn Gorm summit. Like gulls on A, they flew north to Glen More at dusk.

Some Common Gulls have nested at the alpine Loch nan Cnapan and Loch nan Stuirteag by Cairn Toul and Braeriach, and a few Black-headed Gulls at Loch nan Stuirteag in 1958 (Nethersole-Thompson & (Watson 1974). A few Black-headed Gulls were on Braeriach each summer in 1933-59 (D Nethersole-Thompson *in litt),* and I saw several of both species eating insects on Cairn Toul and Braeriach each summer in 1943-88. I noted few people there and on other plateaux in the Cairngorms massif (Watson I991), and on the latter no gulls.

Common Gulls have long nested at Loch nan Eun west of Cairnwell, and Loch nan Eun west of Lochnagar, and they and Black-headed Gulls in nearby high glens. I saw both on Lochnagar and Glas Maol each summer after 1943, eating mainly craneflies. This included early years with few people, and later years with many ((Watson 1988). Flocks were big in years of many craneflies. On 4 July 1977, Glas Maol had huge cranefly numbers, up to 20 per m^2. It was hard to walk without standing on them, and so many flew off that their wings rustled. About 300 Common and Black-headed Gulls with 12 Herring Gulls *Larus argentatus* fed on them.

Discussion

Gordon (1912) found that Crows or gulls ate every egg in many Ptarmigan nests deserted after a severe early June snowstorm in the Cairngorms massif, and saw a Crow pair on alpine land at Cairn Toul on such an occasion. In 1953, D Nethersole-Thompson *(in litt)* found many Ptarmigan eggs taken by a few Crows on Sgoran Dubh in the west Cairngorms, after scores of hens deserted their nests in a severe snowfall on 3 June. Clearly, exceptional numbers of deserted nests led to a few Crows visiting alpine land temporarily, in years before many people were there. However, the sustained occurrence of many Crows throughout each summer on alpine land in the Cairngorms is manifestly human induced. This followed ski developments in the early 1960s, easier access, and more people leading to more food scraps.

Many Crows have long bred on Speyside low ground. Alpine land on Cairn Gorm is marginal, as no Crows have bred there. One would expect them to decline there if low ground stocks were reduced. Crows on Cairn Gorm in 1992 were scarcer than in 1987-91, coinciding with increased trapping on neighbouring Abernethy Estate (Cairngorms Working Party 1993). Rothiemurchus Estate greatly increased Crow trapping in 1992 (J Grant, *pers comm* at Cairngorm Estate Liaison Meetings) and Abernethy Estate likewise in 1992-94 (P Mayhew of RSPB at Liaison Meetings). Crows on A were fewer in 1993, and fewer still in 1994 (A Amphlett of RSPB at Liaison Meetings). In summer 1995 I saw only 2 in 8 days on A and in summer 1996 none in 7 days, the fewest since 1968. In December 1995 only 9 gathered before roosting, compared with 35 in December 1991. K S Bryers (*pers comm*) saw 8 in the Reindeer Company's fenced area in May 1996.

As gulls nested at alpine lochs in decades with very few walkers, their presence on alpine land was natural, eg Gordon (1925) saw a few Black-headed Gulls on high land after nesting, and (1963) both species feeding on moths on Braeriach plateau in June. However, on A, which had no colony nearby, the sustained presence of many in summer is clearly human induced.

Both sides at the Lurcher's Gully Public Inquiry in 1981 accepted that Crows and gulls were unnaturally common on Cairn Gorm and A, were typical of low ground and alien to alpine land, and threatened hill birds. One could lessen the cause - tourists' discarded food scraps - by education. Killing Crows and gulls would ignore this, and so would have to be repeated.

Acknowledgements

I thank Dr D B A Thompson and Prof B W Staines for comments.

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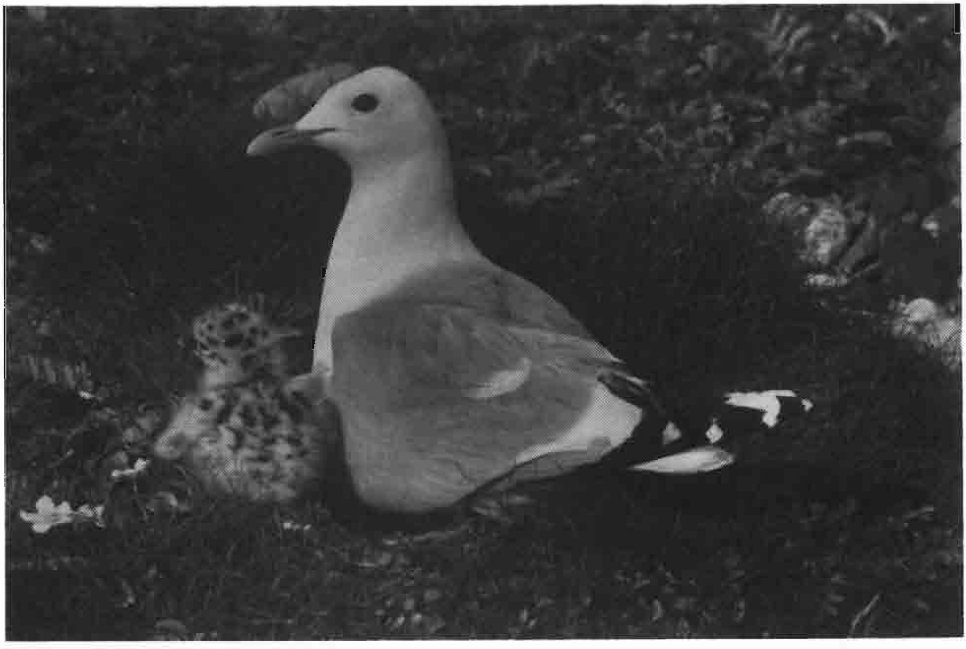

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The Troup Head gannetry

S WANLESS, J MATTHEWS & W R P BOURNE

The gannetry on Troup Head was founded in 1988 and is currently the only mainland gannetry in Scotland. This paper summarises changes in numbers, breeding success and chronology between 1988 and 1995. Numbers of individuals, apparently occupied sites, nests and club birds all increased rapidly between 1988 and 1993, there was a general decline in 1994 but numbers recovered in 1995. The breeding population increased at an average rate of 64% p a in 1988-95 and most of this increase must have been due to immigration. Breeding success averaged 0.53 chicks per nest and was generally lower than that at other British gannetries over the same period. This was possibly due to the high proportion of birds breeding for the first time in any year. There was no evidence that laying had become earlier, or that breeding success had increased, as the colony grew.

Troup Head, 14 km east of Banff on the southern side of the Moray Firth is the only site where Gannets *Morus bassanus* breed on the mainland of Scotland. The first reported sighting of prospecting Gannets was in 1986; breeding was definitely recorded in 1988 but could have occurred the year before (Matthews & North 1989). Since then, the colony has grown dramatically and this paper draws together the counts and observations which have been made up to 1995 in order to document changes in the distribution, numbers, breeding success and timing of breeding of the colony. These results are compared with those from the Bass Rock, East Lothian, the nearest gannetry (Nelson 1978), and Bempton, Humberside, currently the only other gannetry on the British mainland (J Fairhurst in Nelson 1978) and other recently colonised colonies in Scotland (Murray & Wanless 1986).

Methods

During each season from 1988 to 1995, several observers visited the colony, mainly between May and August. The Gannets are extremely difficult to count and observe. Some of the viewpoints are far (0.5 km) from the birds, while other sections can be viewed only by scrambling down steep, unstable slopes above the cliffs. A variety of different counting units have been used by the various observers: a) the number of individuals in the breeding area and/or the number of apparently occupied sites (one or 2 Gannets occupying a site suitable for breeding, irrespective of whether any nest material is present). Both these units give an indication of the total number of birds associated with the colony; b) the number of nests which provides an index of the breeding population (though not all nests have contents); and c) the number of chicks which when expressed as a proportion of the breeding population gives an index of breeding output. Counts have also been made of the number of birds attending clubs and the proportion of these individuals in sub adult plumage.

At least one estimate of most of the above units was available for each year 1988-95, thus enabling annual changes to be assessed. Where several estimates were available the highest was used since we judged that lower values were due either to the timing of the count or to an observer's unfamiliarity with the colony. Counts and annual estimates of breeding success have previously been published in JNCC Annual Reports on seabird numbers and breeding success in Britain and Ireland. In a few instances, figures in the present paper differ slightly from these earlier values, due to differences in interpretation. In most years a sample of chicks was aged in August using plumage characteristics (Nelson 1978). Hatching dates of these chicks were back calculated and converted to laying dates by assuming an incubation period of 44 days (Nelson 1978).

Results and discussion

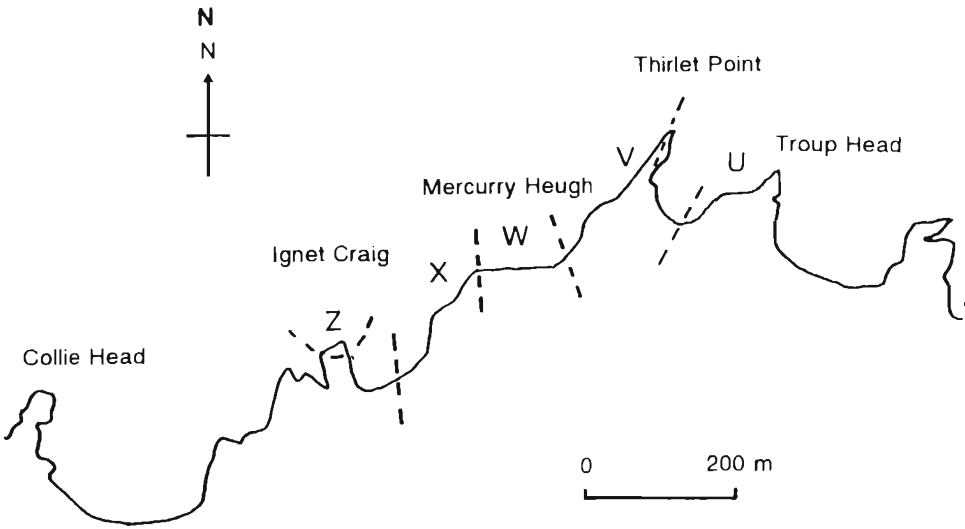
Distribution

The first area colonised by Gannets was the stretch of cliff between Ignet Craig and Mercurry Heugh (section X in Fig 1). In 1989, birds moved onto the east side of Mercurry Heugh (W) and in 1991 there was a further eastern expansion with the colonisation of the section of cliff between Mercurry Heugh and Thirlet Point (V). The west face of Troup Head (U_E) was first occupied in 1992.

Changes in numbers

The maximum number of birds recorded during each season increased dramatically between 1988 and 1993 and then remained at around 1100 until 1995 (Table 1). No precise figures for the number of apparently occupied sites are available for 1988-1990,

Figure 1 ***Location of the Troup Head gannetry showing the counting divisions used***



but subsequent counts showed an increase up to 1993, a slight drop in 1994 and a recovery to the 1992 level in 1995.

Between 1988 and 1993 numbers of nests increased annually (Table 2) and the average rate of increase was a spectacular 86% per annum. This period of rapid increase ended in 1994 when numbers fell by 29%. However, the population recovered in 1995 to well above the 1993 level.

Table 1 ***Peak counts of the number of Gannets present an of apparently occupied sites (AOS) at Troup Head between 1988-95***

	Birds	AOS
1988	25	5+
1989	100+	19+
1990	395	38+
1991	488	200
1992	900	345
1993	1103	577
1994	No count	500
1995	1097	533

Evaluating changes where annual counts have been made by different observers, often using slightly different methods at different times of the season, is difficult since it is impossible to rule out observer and/or sampling error as the source of the difference. While this reservation should be borne in mind, there do appear to be several reasons for believing that the decline in 1994 was real. First, counts made through the season show that the number of chicks present in the period before the first young should have fledged decreased rather than increased; second, the number of club birds associated with the colony was also much lower than normal (see later), and third, section U_E was completely deserted by late August (Table 2). U_E is the most accessible part of the colony. Foxes *Vulpes vulpes* have been seen in the vicinity of Ignet Craig and there was an earth with at least 2 cubs in a crack half way down the cliff west of the gannetry in June 1994. It is therefore possible that the desertion could have been due to Fox predation. However, since decreases were also recorded by several observers independently in some of the other less accessible areas, additional unknown factors may have been involved. The fact that in 1995 numbers recovered to well above the 1993 level suggests that, for some reason, many birds which had built nests in 1993 did not do so in 1994 but they and a substantial number of new recruits nested in 1995. While the reason for this temporary decrease is unknown the pattern is reminiscent of the non breeding events which have periodically been recorded in the Shags *Phalacrocorax aristotelis* on the Isle of May (Aebischer 1986, Aebischer & Wanless 1992) and it is possible that unfavourable feeding and/or weather conditions deterred many Troup Head Gannets from nesting in 1994.

Even with the setback in 1994, the average rate of increase in numbers of breeding pairs over the first 7 years of the colony was 64% pa. This rate was broadly similar to those recorded for the 2 most recently founded Shetland colonies, Fair Isle and Foula, after their establishment, but considerably more rapid than the 6% pa increase initially recorded for the Flannan Isles, Western Isles (Murray & Wanless 1986).

Timing of breeding

No direct observations of laying dates have been made at Troup Head but calculated first egg dates varied between 3-24 April (Table 3). Except for 1991, when the date of the median egg was 20 May, the midpoint of

Table 2 ***Nest counts for sections of the Troup Head gannetry, 1988-95. The locations of the sections are shown in Figure 1***

		Number of nests in section					
Year	**Date**	**U_E**	**V**	**W**	**X**	**Total**	**Count unit**
1988	29 June				5	5	Total nests
1989	13 Aug			2	15	17	Total nests
1990	10 Aug			5	32	37	Well built nests
1991	10 Aug		18	27	49	94	Well built nests
1992	8 June	32	100	45-50	57-59	234-241	Well built nests
	23 July	29	83	42-43	54	208-209	Total nests
1993	28 June	35	104	76	105	320	Well built nests ?
	4 July	49-51	139-142	73-74	67-68	328-335	Total nests
1994	12 June	14	103	64	58	239	Well built nests
	26 July	3	75	75	58	181	Well built nests
	20 Aug	0	26	72	26	124	Well built nests
1995	4 May	31	110	159	58	358	Total nests
	31 May	49	167	175	139	530	Total nests

Table 3 ***Estimated breeding chronology of Gannets at Troup Head, 1988-95. No data are available for 1993***

		Laying date of		
Year	**n**	**First egg**	**Median egg**	**Last egg**
1988	4	13 May	20 May	26 May
1989	8	14 April	28 April	2 June
1990	14	8 April	3 May	27 May
1991	51	18 April	20 May	6 June
1992	100	<23 April	3 May	>25 June
1994	106	24 April	10 May	29 May
1995	?	c. 3-10 April	-	-

Note: *in many years last egg dates were undoubtedly later than indicated*

laying occurred in late April/early May. The latest laying date was typically in late May/ early June. However, since in some years a few birds were apparently still incubating during the August checks and 3 chicks were present in October 1992, actual last egg dates were undoubtedly later than these checks suggest.

First and median egg dates for Troup Head were generally later than those for the Bass Rock (2 March-5 April, 15-20 April respectively), Bempton (25 March-early April, 17-23 April) and Hermaness (late March - early April, late April ?) while the latest egg dates were usually earlier (third week of June-mid July, first half of June and June ? for the Bass Rock, Bempton and Hermaness respectively; Nelson 1978).

At Bempton, Nelson (1978) noted that, as numbers increased, laying date became earlier. Thus mean laying data advanced from early May to mid April. In contrast, at Troup Head there was no evidence of any systematic advancement of laying date with increasing colony size. However, Nelson (1978) found that this temporal trend could be reversed if the proportion of young, inexperienced breeders in the colony increased and this effect could, at least to some extent, explain the lack of any change at Troup Head.

Breeding success

Breeding success averaged 0.53 over the 8 years (Table 4), a value which is markedly lower than the 0.75 recorded in an intensive study during the 1960s on the Bass Rock (Nelson 1978), and which is at the lower end of the range obtained for other British gannetries using similar methods during the late 1980s and early 1990s (Walsh *et al* 1994).

Table 4 ***Breeding success of Gannets at Troup Head 1988-95. Success was calculated as the maximum number of chicks recorded in August expressed as a proportion of the peak nest count***

Year	Number of Nests	Chicks	Breeding success
1988	5	4	0.80
1989	17	8	0.47
1990	37	14	0.38
1991	94	52	0.55
1992	241	121	0.50
1993	335	190	0.57
1994	239	146	0.61
1995	530	184*	0.35*
Mean±SD			0.53±0.13

* *underestimate*

There was no progressive increase in breeding success with increasing numbers, an effect which had been noted at Bempton and in a small isolated group on the Bass Rock (Nelson 1978). The lack of any relationship at Troup Head may be associated with the high proportion of birds breeding for the first time in any year (see later), since this category tends to have a low breeding success (Nelson 1978).

Non breeding club birds

In 1988, the Gannets used as a club a site previously occupied by loafing Kittiwakes *Rissa tridactyla*. The area was situated 10-20 m above and to the west of the ledge first colonised by the Gannets. Counts of this club show considerable variation within a season.

Maximum numbers recorded increased rapidly between 1988 and 1991 but subsequently remained at 300-400 birds, the exception being 1994 when the highest count was only 60 (Table 5). A few birds in sub-adult plumage were present in 1988. The proportion of immatures increased as the colony grew and in 1994 and 1995 this category accounted for 20-25% of the total. Nelson (1978) concluded that an effect of increasing colony size was a progressive rise in the proportion of immature plumaged birds. Such an increase was evident at Troup Head and may, in part, have reflected the return of young birds to their natal colony.

A second club was recorded on Ignet Craig in 1992 (Section Z in Fig 1). The area was definitely occupied in 1994 and 1995 but no counts were reported in 1993. However, whether this was due to lack of usage or to its being overlooked by observers is not clear. There was also a club above Thirlet Point in 1995.

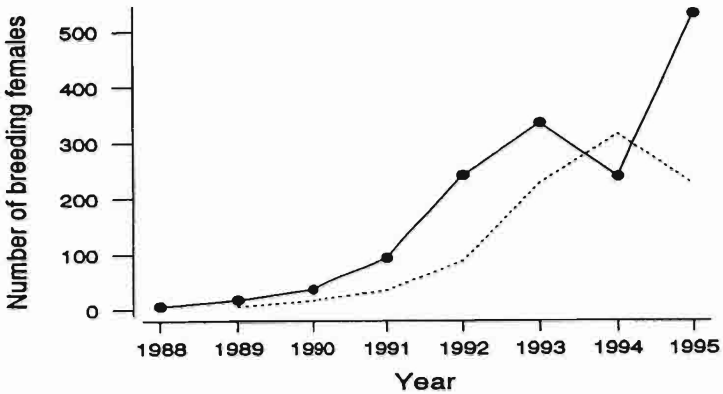
Table 5 ***Maximum numbers of club birds and the percentage of Gannets in sub adult plumage in the Troup Head gannetry 1988-95***

Year	Number of club birds	% sub adults
1988	<24	some
1989	55	some
1990	59	some
1991	314	some
1992	394	9
1993	275	9
1994	60	25
1995	369	20+

Population dynamics

Nelson (1978) estimated that the intrinsic rate of increase of the Gannet was around 3% p a. Like many other colonies in the years following their establishment, the increase in numbers at Troup Head greatly exceeded this intrinsic rate indicating that substantial immigration had occurred. The level of immigration was estimated using a simple population model in which the observed number of females breeding in any year (assumed to be equivalent to the peak number of nests) was compared with the number expected from the previous year's total, after allowing for losses due to adult mortality (assumed to be the same as on the Bass Rock ie 6%, Nelson 1978). The results show that in every year, except 1994, the observed number of females greatly exceeded the predicted value indicating that a high percentage of the birds present in the breeding population each season were new recruits with estimates varying from 32% in 1993 to 66% in 1990 (Fig 2). Furthermore, since Gannets do not normally breed until they are 4 or 5 years old (Nelson 1978), none of the increases up to 1992 were attributable to Troup Head bred birds. A crude estimate of potential numbers of natal recruits was calculated by applying survival rates to 4 or 5 years of age (assumed to be the same as those estimated for Bass Rock birds eg 0.19 and 0.18, Nelson 1978), to the peak chick count in any year. Comparison of these predicted numbers with the estimated number of new recruits each year (Fig 2) shows that between 1992-95<2% of recruits were likely to have been reared at Troup Head. However, once the stronger cohorts from 1992-95 start to recruit, this percentage may increase, assuming that these birds show a high level of colony fidelity.

Figure 2 ***A comparison of observed numbers of breeding female Gannets at Troup Head 1988-95 (·–·) and those predicted from the previous year's total assuming an annual adult survival rate of 0.94 (.....). The difference between the observed and predicted values indicates the number of recruits. The lower than predicted total in 1994 may have been due to non breeding by experienced birds***



The origins of immigrants to the Troup Head gannetry are unknown. Ringing studies at several recently colonised gannetries in Norway have shown that there is considerable variation in the distances moved by immigrants (Barrett & Folkestad 1996). Thus, although some individuals come from nearby colonies, in one case a bird reared at Les Etacs in the Channel Islands recruited into a colony in northern Norway, a movement of 3000 km. To date, no attempt has been made to catch or ring birds at Troup Head but such a study, although technically challenging, might provide interesting information on the identity of Gannets using the colony.

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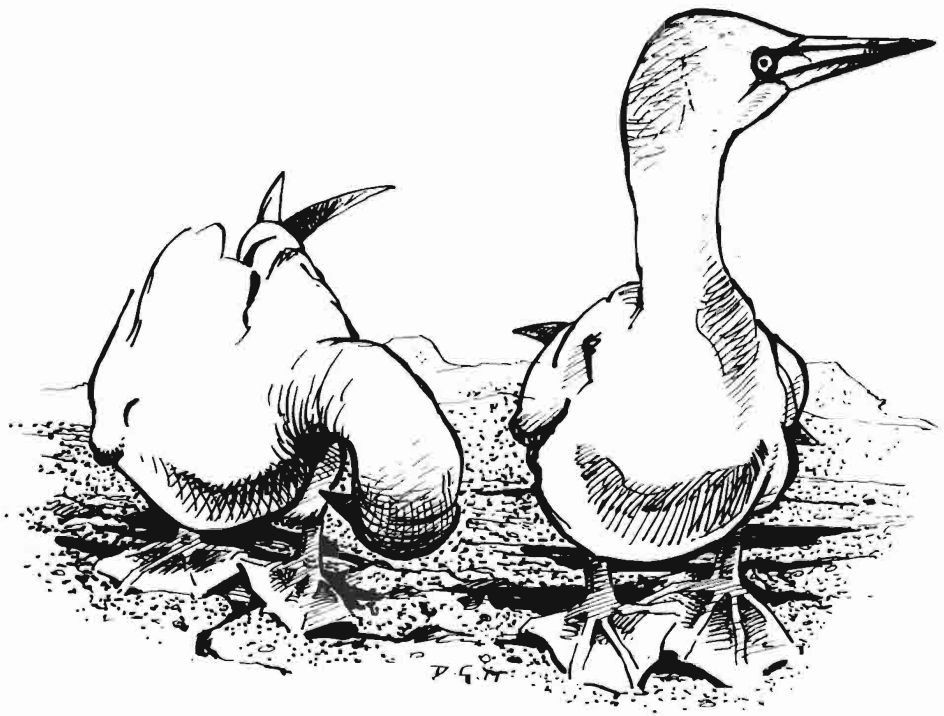


Gannets *David Mitchell*

The feeding behaviour of Greylag and Pink-footed Geese around the Moray Firth, 1992-93

I J STENHOUSE

Feeding Greylag and Pink-footed Geese were studied on the coastal plain of the Moray Firth. In autumn, Greylags selected cereal stubble and germinating winter cereals, and, in winter, cereal stubble, germinating winter cereals, and turnips. Greylag and Pink-footed Geese both selected improved grassland in spring, avoiding grass fields with sheep. Both species preferred large fields, although fields used tended to be smaller in winter than in autumn and spring. Both species used new fields at a similar steady rate throughout the seasons, and were seen on most fields only once.

Introduction

Wild geese have used agricultural land in Britain since early this century, with some species relying almost entirely on arable habitats for feeding for several decades (Kear 1963). However, there is much variation in feeding behaviour between goose species, and often even within a species, from one region to another. Geese in one region may take advantage of a crop which is not available in another eg Pink-footed Geese *Anser brachyrhynchus* in Norfolk spent 75-80% of foraging time on sugar beet tops (Gill 1993). Several populations and regions have been extensively studied (Newton & Campbell 1973, Patterson *et al* 1989, Gill 1993). Management schemes have been initiated in some areas. However, management which proves effective in one region of the country may not be applicable elsewhere. This study from October 1992 to May 1993 investigated the feeding behaviour of migratory Greylag *Anser anser* and Pink-footed Geese around the coastal plain of the Moray Firth.

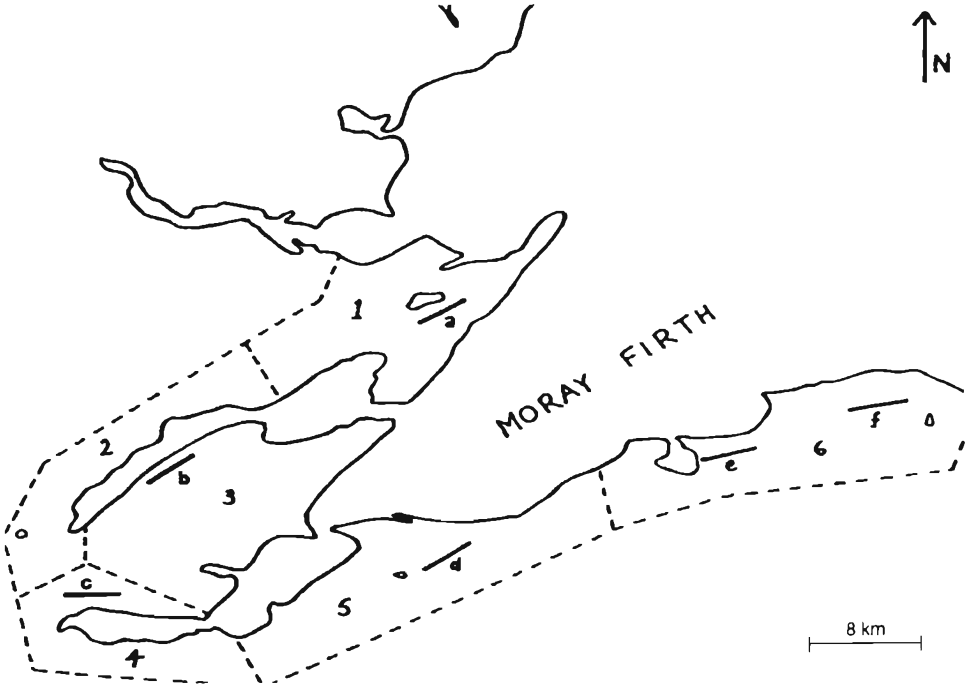
Study area and methods

The study area covered 122,000 ha of the coastal plain of the Moray Firth, from the Dornoch Firth in Ross-shire to Spey Bay in Morayshire (Fig 1). The Moray Firth area comprises a mixture of coastal habitats backed by a wide, flat fringe of rich soils. The climate is relatively mild, and, as a result, cereals are the most important crop, particularly barley which is sold for malting. The local wildfowl roost on inland waters and estuaries, and the study area included 15 goose roost sites (Stenhouse 1993).

The study area was divided into 6 regions (Fig 1). All feeding goose flocks in each region were counted every 2 weeks from roads which provided good viewing points without disturbing the birds.

Six road transects, each 5km long and 400m wide, were used (Fig 1). Crop type was recorded 3 times (autumn, winter and spring) for each field on both sides of the road transect. The major crop type within 200m of the

Fig 1 ***Study area showing count regions (1-6) and road transects (a-f)***



roadside was recorded and the length of each crop along the transect was determined from 1: 25,000 maps. Since the transect was of a fixed width, the area of each crop was assumed to be proportional to the length of each crop along the transect. The proportion of each crop type available was calculated from the total length along the transect of each crop observed divided by the total length of all transects (60km). This provided a sample of the crops available to the birds through the seasons.

Crop type, area, boundary type, and presence of livestock were recorded for fields visited by geese, called 'goose fields'. Similar data were recorded at a nearby field (2 fields away in a random direction) not known to be visited by geese, called 'nongoose fields'. Data for autumn, winter and spring were analysed separately.

Indices of selection of crops were determined using the equation:

$Q = r(1-p) / p(1-r)$

where r is the proportion of birds in a given habitat in a given time period, and p is the proportion of that habitat available on the 6 transects (Jacobs 1974).

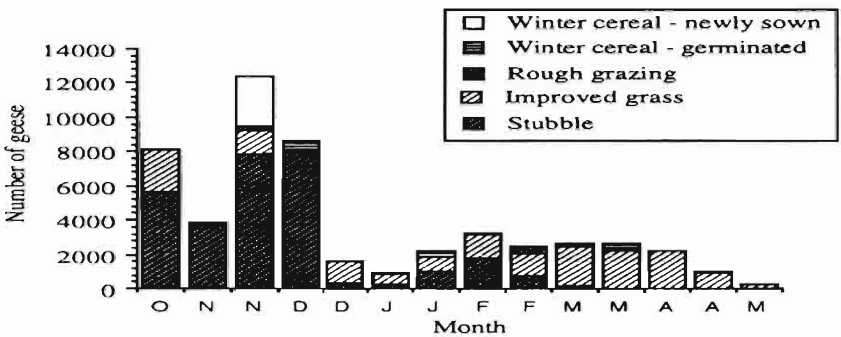
Results

Two hundred and twenty-four observations were made of feeding goose flocks in 9 crop

types in 128 different fields. The total number of birds observed in each crop type during each 2 week count period was calculated. Greylag Geese fed almost entirely on cereal stubbles in autumn and took advantage of newly sown grain in late November (Fig 2). A few records also showed use of turnips during the poorest weather in late December and January. Improved grassland was used throughout, but mostly from late December to spring. Small amounts of germinated winter cereal and rough grazing were also used in spring.

Pink-footed Geese passed through the area quickly in autumn. Improved grassland was used intensively by Pink-footed Geese on their return to the area, and there was some use of cereal stubbles in February (Fig 3). By late March, they began to feed on newly sown grain and the new growth of grass in rough grazing.

Fig 2 ***Crop use by Greylag Geese, showing numbers of birds observed in each crop type for each fortnightly period***



In autumn, a larger proportion of cereal stubble was available than improved grassland, and these 2 crop types provided most available habitat (Table 1). A small proportion of germinating winter cereal was available, and very small proportions of turnips and oilseed rape. In winter, the proportions of cereal stubble available decreased, due to ploughing, while improved grassland remained constant and availability of germinating winter cereal increased.

In spring, proportions of cereal stubble remained very small and improved grassland remained constant. Proportions of germinating winter cereal available increased further, while newly sown spring cereal increased considerably, and some spring cereal germinated. Turnips were no longer available, while the small proportion of oilseed rape remained constant (Table 1).

Because few Pink-footed Geese were present through autumn and winter, counts for both species have been combined for these seasons. Together, Greylag and Pink-footed Geese showed selection for stubble and germinated winter cereal in autumn, and for stubble, germinated winter cereal or turnips in winter. However, the data refer largely to Greylag Geese. In spring, Greylag and Pink-footed Geese showed, independently, selection for improved grass (Table 2).

Fig 3 ***Crop use by Pink-footed Geese, showing numbers of birds observed in ech crop type for each fortnightly period***

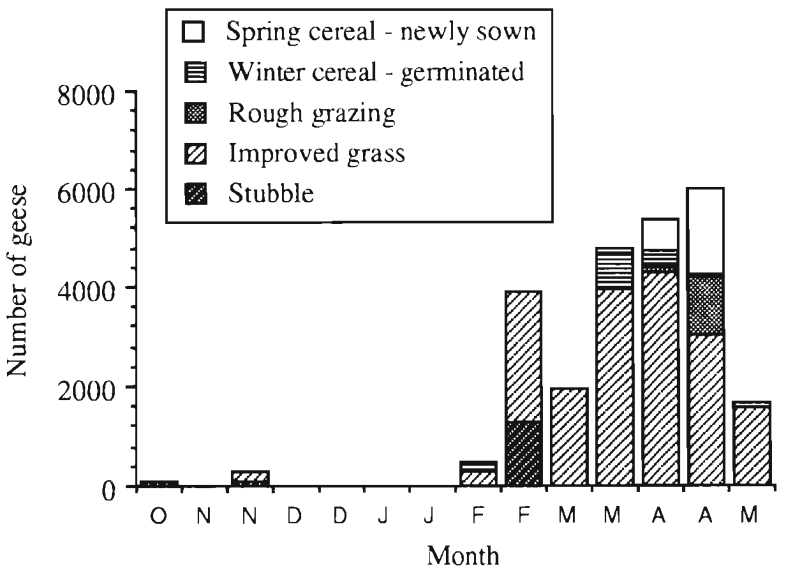


Table 1 ***Proportion of crops available along all transects in autumn 1992, winter 1992/93, and spring 1993***

Crop type	Autumn	Winter	Spring
Improved grass	0.28	0.28	0.28
Rough grazing	0.00	0.00	0.00
Winter cereal (newly sown)	0.00	0.00	0.00
Winter cereal (germinated)	0.10	0.14	0.18
Spring cereal (newly sown)	0.00	0.00	0.26
Spring cereal (germinated)	0.00	0.00	0.08
Cereal stubble	0.37	0.28	0.03
Carrots	0.00	0.00	0.00
Potatoes	0.00	0.00	0.00
Turnips	0.02	0.02	0.00
Set aside	0.00	0.00	0.00
Oilseed rape	0.02	0.02	0.02
Linseed	0.00	0.00	0.00
Other	0.21	0.26	0.15

'Goose fields' and 'nongoose fields' were compared to explore further possible factors that could be important in field selection (Table 3). No significant differences were found between the number of goose and nongoose fields under stubble and other crop types (x^2_1=3.67) in autumn, under grass, stubble and others (x^2_1=4.42) in winter, and under grass, spring cereals and others (x^2_2=5.64) in spring. However, in each case the test statistic was close to the 5% probability threshold. No significant differences were observed between goose and nongoose fields according to boundary type, percentage standing water and nearest occupied building.

Table 2 ***Selection indices by grey geese for different crops. Values over one indicate selection, under one avoidance***

Crop	Autumn	Winter	Spring	
	both spp	both spp	Greylag	Pink-footed
Improved grass	0.31	1.00	126.00	11.71
Cereal stubble	3.02	2.02	-	-
Winter cereal (germinated)	2.68	1.38	0.04	0.29
Spring cereal (newly sown)	-	-	-	0.35
Turnips	-	2.57	-	-

Table 3 ***The number of goose fields and nongoose fields according to crop distribution***

Crop type	Goose fields			Nongoose fields		
	autumn	winter	spring	autumn	winter	spring
Improved grass	2	10	8	6	4	6
Rough grazing	0	1	3	0	0	1
Winter cereal (germinated)	0	4	4	5	9	7
Spring cereal (newly sown)	0	0	15	0	0	10
Spring cereal (germinated)	0	0	1	0	0	1
Stubble	24	11	1	16	14	5
Turnips	0	0	0	1	0	0
Oilseed rape	0	0	0	0	0	1
Plough	4	4	1	2	3	2

There were significant differences between the size of goose and nongoose fields, with goose fields being larger ($F_{1,180}$=3.0, P=0.08). Also, there were significant seasonal changes ($F_{2,180}$=7.9, P<0.001), with goose fields tending to be smaller in winter compared with autumn and spring (Table 4).

Selecting only grass fields, a significant association was found between geese and grass fields without sheep (Fisher Exact Test, 2 tailed, P=0.021). The presence of cattle in the area was so rarely recorded that the data were unsuitable for statistical analysis (Table 5).

Table 4 ***Field areas (ha) for goose fields and nongoose fields***

	Goose fields			Nongoose fields		
Season	**mean**	**SD**	**range**	**mean**	**SD**	**range**
Autumn	11.8	5.2	5-25	9.5	3.2	4-17
Winter	8.0	3.5	3-19	8.7	3.2	4-19
Spring	12.2	6.2	5-32	10.5	4.0	4-25

Table 5 ***The presence of livestock in grass fields used and not used by geese***

	Sheep		Cattle	
	present	**not present**	**present**	**not present**
Goose fields	2	22	0	24
Nongoose fields	7	10	1	16

Greylag Geese were observed in 104 fields, and Pink-footed Geese in 53. Both species were recorded in 29 fields, but not necessarily at the same time. However, where they were recorded at the same time, they usually formed discrete flocks. A total of 128 different fields were used by geese throughout the study period (Fig 4). The number of fields used by Greylag Geese steadily increased through the study, suggesting that Greylags selected new fields at a steady rate. The number of new fields used did not appear to be density dependent, since it remained steady through the seasons, while the total number of Greylag Geese decreased from autumn to winter. The total number of fields used by Pink-footed Geese did not increase through autumn and winter since only a few birds passed through in autumn (Fig 4). However, when Pink-footed Geese returned to feed in the

area in February, the pattern was similar to that of Greylags, with a steady increase in the total number of fields used. Again, the number of new fields used did not appear to be density dependent, and remained steady, while the total number of Pink-footed Geese increased through the spring. Both Greylag and Pink-footed Geese were recorded in very few fields more than once (Fig 5). On the rare occasions when geese were recorded on a field more than 3 times, these fields were always immediately adjacent to a roost site.

Fig 4 ***The cumulative number of fields used by Greylag and Pink-footed Geese over the study period***

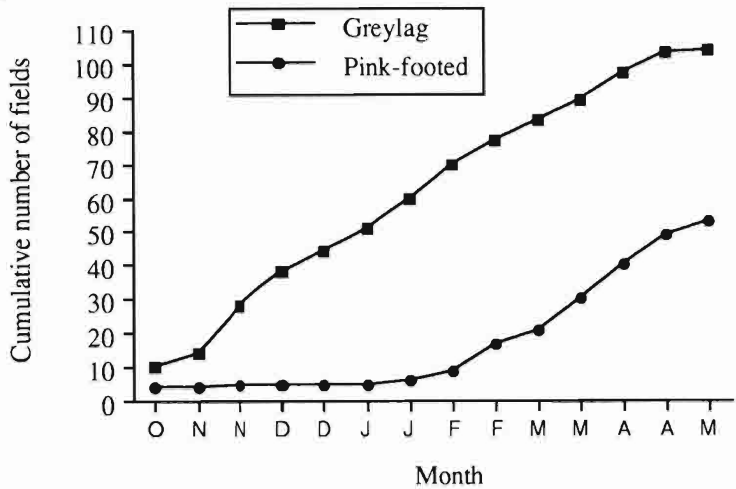
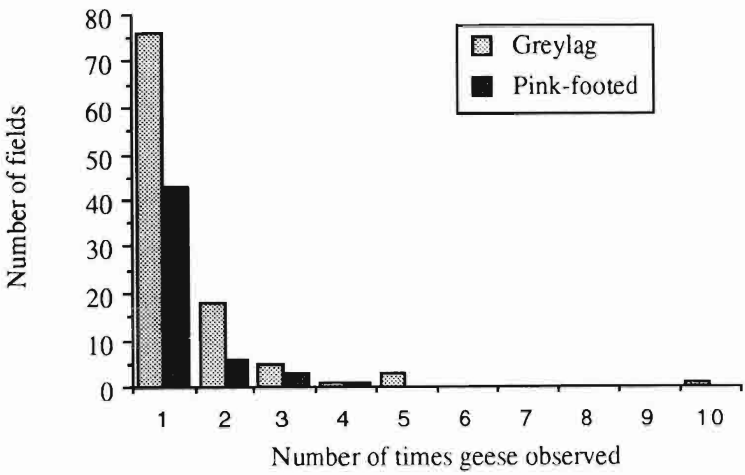


Fig 5 ***The number of times Greylag and Pink-footed Geese were observed in individual fields***



Discussion

The general pattern of goose feeding behaviour around the Moray Firth showed seasonal changes in the birds' diet which followed seasonal changes in food availability. Around the Moray Firth, Greylag Geese concentrated on stubble in autumn and early winter, and both Greylag and Pink-footed Geese concentrated on improved grass in spring. As in previous studies (Newton & Campbell 1973, Foshaw 1983, Bell 1988, Patterson *et al* 1989), little use was made of winter cereals.

Several wildfowl species are known to exploit unusual food resources in response to short term climatic extremes (Kear 1962), and Greylag Geese were observed in turnips on a few occasions in January, coinciding with a cold period and heavy snowfall. Similarly, turnips were eaten by Greylag Geese around Loch Leven only when alternative foods were scarce, after snowfalls (Newton & Campbell 1973). Carrots are recognised as a favoured food of Pink-footed Geese in Lancashire and of Greylag Geese in some parts of Scotland (Owen 1990). Carrots were grown in very few sites within the study area and Greylag Geese were recorded feeding on waste roots left behind after harvest only once.

The feeding behaviour of the 2 species appeared to be similar in terms of consistency of use of fields. Both used a large number of fields briefly and concentrated their activity in very few fields. This suggests that neither species is particularly predictable in their field use beyond a few fields immediately adjacent to major roosts.

Field size and location are recognised as major determinants in field choice (Newton & Campbell 1973, Gill 1993). Field area was found to be important around the Moray Firth, where geese fed in larger fields throughout the seasons, but used smaller fields in winter than in autumn and spring. Large fields provided a better opportunity to avoid field edges, where geese are vulnerable to hunting and disturbance (Owen 1973). The acceptance of smaller fields in winter may reflect short term food shortages forcing use of suboptimal sites.

The comparison between goose fields and transect data indicated distinct seasonal crop preferences. These were not suggested by the more rigorous paired field comparison, perhaps because similar crops are grown close together. However, the data showed that geese avoided grass fields containing sheep, most likely due to the disturbance and break up of flock structure.

Although this study did not attempt to assess the extent of damage, the results do have implications for any future management proposals. The feeding behaviour of grey geese within the study area suggests that any problem of crop damage will be relatively short lived, as well as limited in area. Therefore, the problem is not so much one of repelling geese from farmland as a whole, but of protecting valuable crops for relatively short periods of time (as was previously also suggested by Newton & Campbell 1973).

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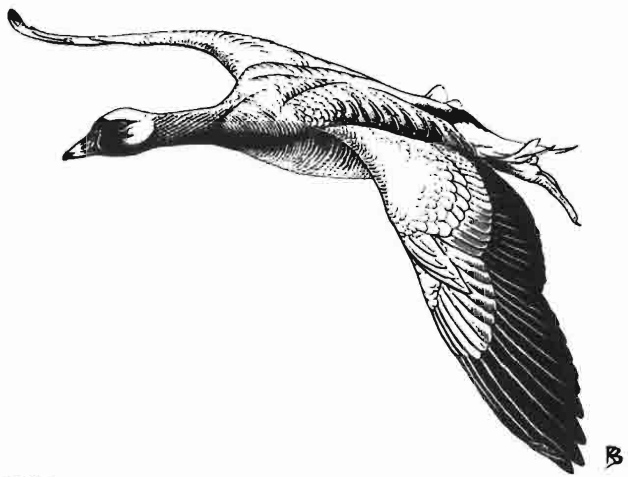

Pink-footed Goose *Keith Brockie*

The numbers of breeding waders in lowland Scotland

MARK O'BRIEN

Populations of breeding waders on lowland areas of Scotland were estimated using a stratified random sample of sites. 648 km^2 of land were surveyed by SOC volunteers and paid fieldworkers. A total of 82,500 pairs of Oystercatchers, 92,000 pairs of Lapwings, 41,000 pairs of Snipe, 35,500 to 55,000 pairs of Curlews and 12,000 pairs of Redshanks were estimated. Numbers are compared with previous population estimates, and reasons for differences discussed.

Introduction

Five species of breeding waders, Oystercatcher *Haematopus ostralegus*, Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Redshank *Tringa totanus*, are commonly associated with farmland habitats in the United Kingdom. The size of Scottish farmland wader populations was estimated in the early 1980s (Galbraith *et al* 1984). This work indicated that considerable numbers of waders were thinly distributed across much of Scotland's farmland. Estimates of Scottish populations of Lapwings, Oystercatchers and Redshanks were made, but the numbers of Snipe and Curlews were considered likely to be high on upland areas, so Scottish population estimates for these 2 species were not attempted. Farmland wader populations on both the Northern and Western isles have been surveyed in more detail, and show higher densities compared with areas on the mainland (Campbell *et al* 1988a,b, Fuller *et al* 1986, Galbraith *et al* 1984). This is confirmed by the density maps in the New Breeding Atlas (Gibbons *et al* 1993).

Recent surveys elsewhere in the UK have given more accurate estimates of wader populations and indicated considerable declines in numbers of some species, giving cause for concern over wader populations on farmland. In 1987, there were estimated to be 123,124 pairs of Lapwing in England and Wales (Shrubb and Lack 1992) and numbers were shown to be falling, especially in the south. Estimates of the numbers of waders in Wales and Northern England have recently been attempted (Green *et al* 1994, Murray *et al* 1994). Welsh populations, in particular, are giving great cause for concern. Data on both the numbers and trends in numbers are also available for areas of lowland wet grassland in England and Wales (Smith 1983, O'Brien and Smith 1992) and Northern Ireland (Partridge and Smith 1992, Partridge 1992). These studies show substantial declines in farmland wader populations over the last few years in the areas surveyed. Similarly, comparing the distribution of waders recorded in the 2 breeding atlases suggests a marked reduction in range, at least for some species (Gibbons *et al* 1993).

The main aim of this project was to update population estimates for waders in lowland Scotland.

Methods

The only practical way of estimating breeding

wader populations in lowland Scotland is randomly to select representative sites for survey. This will miss many sites known to be good for breeding waders. The best approach is to use a stratified random survey where 'identified wader sites' (IWS) and a random sample of the remaining lowland farmland are surveyed. This follows the method used to estimate breeding wader populations in Northern Ireland (Partridge and Smith 1992). A population estimate is then calculated by summing the estimates derived from the IWS and the random sites.

Information on the location and importance of key sites for lowland breeding waders in Orkney, Shetland and the southern isles of the Outer Hebrides has previously been collected (Campbell *et al* 1988ab, Galbraith *et al* 1984, Fuller *et al* 1986). Comparable information for mainland Scotland was not available so Scottish Ornithologists' Club (SOC) regional organisers, British Trust for Ornithology (BTO) regional representatives, RSPB conservation officers and Scottish Natural Heritage (SNH) area officers were asked to list sites that they considered to be important for breeding waders within their areas. This resulted in a list of about 230 key sites for breeding waders throughout mainland Scotland. Each of these key sites was marked on to the relevant Ordnance Survey 1:25,000 map, fields on the map were numbered and copies of the maps provided for use whilst surveying breeding waders. Surveys of the sites were undertaken primarily by volunteers. SOC regional organisers and BTO regional representatives provided much help and support in ensuring coverage.

To determine the location of the random lowland sites, we needed a definition of 'lowlands' and an estimate of its location and total area in Scotland. This was done using the Macaulay Land Capability for Agriculture classification system (LCA, Soil Survey of Scotland 1982b) which integrates information on soil, climate and relief, splitting Scotland into 7 land classes, each of which is split into 1-3 divisions. A comparison of the distribution of IWS and land classes indicated that most were on land classed as between 1 and 5.3, ie from prime agricultural land through to improved grassland. For the purposes of the study this range of classes and divisions was taken to represent the lowlands in Scotland. This definition of lowland covers approximately 36,000 km^2 of Scotland, or 46.7% of the total area of Scotland. It must be stressed that this is a land *capability* rather than a land*use* classification.

Estimating the average density of breeding waders in Scotland - the random squares survey

This part of the survey was split into 5 sections. In 1992, 4 teams of 2 surveyors were employed to survey a random sample of sites on mainland Scotland and the Inner Hebrides. In 1993, 3 teams of 2 surveyors surveyed a random sample of lowland sites on Shetland, Orkney and the Uists. In addition, randomly selected sites were surveyed on Lewis and Harris by RSPB staff based on the islands.

For the purposes of the 1992 survey a lowland site was defined as any one kilometre square where 75% or more of the square was described as lowland (as defined above), using information available on 1:25,000 LCA maps (Soil Survey of Scotland 1982a). All lowland squares from mainland Scotland and the Inner Hebrides, with the exception of those that had already been defined as an IWS, were available for selection in this study. A randomly selected sample of 240 one kilometre squares from this set provided unbiased estimates of the average density of breeding waders on lowland mainland

Scotland, away from the IWSs.

In 1993, a lowland site was defined as any one kilometre square where the predominant land class was described as lowland. This differs from 1992 in that the predominant land class may not cover 75% of the square, since many of the units of lowland land classes on the islands are small relative to the size of the survey unit. Key sites in the islands were not considered separately, so the randomly selected squares can be considered to represent the best estimates of the average density of lowland breeding waders in the islands.

Methods used to survey breeding waders

We used the field by field method to survey breeding waders, previously used in the survey of lowland wet grasslands in England and Wales (O'Brien and Smith 1992) and farmland sites in Northern Ireland (Partridge and Smith 1992). The main difference between our survey and the lowland wet grassland survey in England and Wales is the time of day that visits were made. This survey aimed to visit sites within 3 hours of dawn or dusk. These are the times when highest counts of breeding waders are obtained (Reed *et al* 1985) and it is known that these provide the best estimate of number of breeding Snipe (Green 1985). The disadvantage of dawn and dusk surveys is that the area that can be surveyed in the time is limited to about 100 ha per session.

All surveyors were provided with 3 copies of a map of the survey area together with 3 sets of recording forms. Each map was marked with the site boundary, within which all fields were numbered. Previous studies indicate that 3 evenly-spaced visits will provide an overall picture of the number of waders within a site (Smith 1983). Surveyors were asked to visit sites on 3 occasions, visit 1 between 18 April and 8 May, visit 2 between 9 May and 29 May, visit 3 between 30 May and 19 June.

Surveyors were asked to walk through, and get to within 100 m of any point in, each field, and to look 2-400 m ahead, scanning with binoculars to note the distribution of all waders. All wader registrations were mapped, although only birds considered to be breeding within the survey area were counted (see below).

Standard techniques for interpreting the wader data and calculating the number of breeding waders per site were used (Bibby *et al* 1992, O'Brien and Smith 1992, Partridge and Smith 1992). In detail these were:

a) Oystercatcher: the maximum number of pairs on any one visit was used (Smith 1983).

b) Lapwing: halving the maximum number of individuals recorded on the site between mid April and late May provides the best estimate of the total number of pairs (Barrett and Barrett 1983).

c) Snipe: the maximum number of drumming plus chipping birds on any one visit was used. The number of drumming plus chipping birds recorded within the study area is then multiplied by 1.74 to provide the best estimate of the number of breeding pairs in the study area (Green 1986).

d) Curlew: the maximum number of pairs on any one visit was used. This is recorded as 'Curlew, old' in Table 4. This is the standard method for estimating the number of Curlew and has been used for all surveys published up to the present time (Smith 1982, Partridge and Smith 1992, O'Brien and Smith 1992). Detailed ongoing research, comparing the

number of Curlews recorded using the methods outlined above with the number of nests found on a site, suggests that this may over estimate the number of Curlews (M Grant *pers comm*). An alternative estimate is included in the tables as 'Curlew, new', based on the average number of Curlews recorded on visits 2 and 3. It is thought that this may give a better overall estimate of actual Curlew numbers, although research to determine the best method is still ongoing. A small number of sites was only visited on one occasion, early in the season. The number of pairs of Curlew seen on that one visit was used in both the 'Curlew, old' and 'Curlew, new' estimates.

e) Redshank: the mean density of individual birds (excluding flocks) counted before the first nests hatch (about 20th May) has been shown to be correlated with peak nest density (Cadbury *et al* 1987). A number of sites in the present survey were visited for the second time after the first Redshank nests had hatched. Redshank detectability is considerably higher once the adults are caring for chicks; both birds in the pair perform a distinctive, noisy display. In these circumstances a different method of estimating the number of pairs is required. The number of pairs of Redshank acting as if with young are added to the number of individual Redshanks not acting as if with young on the site.

Extrapolating the survey data to all remaining lowland areas

To estimate the total number of breeding waders in the Scottish lowlands the numbers estimated on the IWS has been added to the numbers estimated through the random sites survey on Scottish mainland lowlands. A small number of IWS were not surveyed for several reasons. To allow for this, numbers estimated on those IWS not surveyed were calculated by multiplying the area not surveyed by the density of each species of wader on the surveyed IWS. The overall population estimate for IWS was calculated by summing the numbers seen and the numbers estimated.

The surveys of random sites provide estimates of the average density of each species on lowlands within each of the study areas. These densities, when multiplied by the area of lowland within the study area and then added together, provide unbiased estimates of the numbers of each of the wader species in lowland Scotland away from IWS.

Table 1 ***Population, densities and numbers of pairs of breeding waders on identified wader sites in lowland Scotland***

Species of wader	Average density (Pr km^{-2})	Maximum density (Pr km^{-2})	Total no. surveyed (No of prs)	Total no. estimated (No of prs)
Oystercatcher	4.9	25.2	1096.5	1521
Lapwing	11.4	55.0	2559.5	3548
Snipe	5.5	60.6	1225.0	1693
Curlew (old)	3.5	20.7	790.0	1093
Curlew (new)	2.8	18.8	616.9	860
Redshank	4.0	28.7	893.5	1240

Table 2 *Numbers of pairs of breeding waders on randomly selected sites in lowland Scotland*

Area of survey	Total (No of prs)	Average density (pr km^{-2})	Percent of squares with birds	Maximum density (pr km^{-2})	Estimated population (No of prs)	95% confidence limits minimum	maximum
a) **Oystercatcher**							
Mainland	449	1.9	54	13	65023	53804	76385
Shetland	504	8.3	97	21	3288	2913	3736
Orkney	1056	15.8	98	29	9867	8875	10850
Uists	568	11.4	94	28	2726	2331	3114
Lewis/Harris	3	0.3	20	2	68	3	154
b) **Lapwing**							
Mainland	514	2.2	53	22	74436	58041	90975
Shetland	299	4.9	82	18	1948	1565	2348
Orkney	580	8.7	95	39	5419	4522	6578
Uists	1127	22.5	96	83	5410	4585	6303
Lewis/Harris	54	5.4	80	25	1204	441	2300
c) **Snipe**							
Mainland	186	0.8	19	10	26963	18954	35971
Shetland	705	11.6	97	45	4599	3887	5396
Orkney	336	5.0	83	24	3137	2398	4039
Uists	684	13.7	94	37	3282	2720	3884
Lewis/Harris	66	6.6	90	14	1488	964	1975
di) **Curlew** (old)							
Mainland	324	1.4	51	10	46921	39299	55406
Shetland	311	5.0	95	14	2029	1758	2300
Orkney	566	6.6	100	26	5288	4579	5956

Area of survey	Total (No of prs)	Average density (pr km^{-2})	Percent of squares with birds	Maximum density (pr km^{-2})	Estimated population (No of prs)	95% confidence limits minimum	maximum
Uists	0	0.0	0	0	0		
Lewis/Harris	0	0.0	0	0	0		
dii) **Curlew** (new)							
Mainland	202	0.9	51		29253	23572	34934
Shetland	215	3.5	95		1400	1187	1629
Orkney	441	6.6	100		4120	3515	4792
Uists	0	0.0	0	0	0		
Lewis/Harris	0	0.0	0	0	0		
e) **Redshank**							
Mainland	33	0.1	9	5	4779	2478	7368
Shetland	165	2.7	75	11	1076	856	1320
Orkney	187	2.8	85	17	1747	1396	2164
Uists	601	12.0	92	33	2885	2488	3312
Lewis/Harris	16	1.6	50	5	349	102	585

We used the 'bootstrap' method to estimate 95% confidence limits around population estimates (Greenwood 1991, also see Appendix for further details). These are presented in Table 2 as the minimum and maximum confidence limits.

Results

a) Estimates from the identified wader sites (IWS)

The combined estimates of breeding wader numbers for 186 surveyed IWS, covering 223.8 km^2 and 46 IWS (86.7 km^2), which were not surveyed, are shown in Table 1.

b) Estimates from the random sites survey

Between 10% and 20% of lowland areas in the Northern Isles and the Uists were surveyed (50-60 randomly selected squares surveyed in each of the island groups), a considerably higher percentage than on mainland Scotland (0.7%) and Lewis and Harris (4.4%). Information on the total number of pairs of breeding waders recorded in each of these survey areas, together with the average density, an extrapolated population estimate and 95% confidence limits around that estimate are shown in Table 2.

c) Overall estimates

The estimates of wader numbers on the Scottish mainland form a very high proportion of the total number of waders in Scotland (Table 3). Only Redshank numbers on the islands approach 50% of all the population estimates.

The revised (new) method of estimating Curlew populations produces a figure which is about 65% that of the original (old) method. Both figures are substantially higher than previous estimates of Curlew numbers in Scotland, despite the fact that they refer solely to the *lowland* Scottish breeding population.

Discussion

Table 3 ***Estimates of the numbers of pairs of breeding waders in the lowlands of Scotland***

	Oystercatcher	Lapwing	Snipe	Curlew (old)	Curlew (new)	Redshank
Mainland (key)	1521	3548	1693	1093	860	1240
- - (random)	65023	74436	26963	46921	29253	4779
Shetland	3288	1948	4599	2029	1400	1076
Orkney	9867	5419	3137	5288	4120	1747
Uists	2726	5410	3282	0	0	2885
Lewis/Harris	68	1204	1488	0	0	349
Total	82493	91965	41162	55331	35633	12076
Min. conf. limit	71309	75644	32856	47729	29764	9761
Max. conf.limit	93890	108329	50568	63571	41183	14791

The population estimates for Oystercatcher and Curlew numbers are considerably higher than previous estimates (Thom 1986, Piersma 1986). Our Curlew estimate for the Scottish lowlands is considerably higher than the previous estimate for the UK as a whole, whilst the Scottish lowland Oystercatcher numbers are more than twice the previous UK estimate (Piersma 1986). Even if we use the more conservative alternative figure for Curlew populations, it is apparent that Scotland has considerably more breeding Curlews than previously recognised, even without considering the substantial populations that are likely to occur in the uplands. These increases may be explained by the more rigorous method of survey used for this project and, in the case of Oystercatchers, the fact that populations have been increasing in the UK and throughout other European countries bordering the North Sea during the last 20 years (Hotker *et al* 1991, Marchant *et al* 1990).

Previous estimates of breeding wader populations in Scotland (Galbraith *et al* 1994) were based on farmland lying below 300 m ASL and were extrapolated across an estimated area of 19,909 km^2, just over half the area included in the present survey (Table 4). These population estimates are markedly lower than those given here, a result to be expected as the authors were extrapolating to a much smaller area of land. When population densities for rough grazing above 300 m in Galbraith *et al* (1984) are multiplied by the difference in areas between the 2 survey it seems that Lapwing numbers were consistent between the 2 surveys, whilst estimates of both Oystercatcher and Redshank numbers increased significantly (Table 4). The numbers of Oystercatchers breeding inland have increased since the late 19th century, both in the UK and on farmland in all countries around the North Sea (Gibbons *et al* 1993). The new Breeding Atlas does not show any evidence of an increase in Oystercatcher range because most of the squares in Scotland were already occupied at the time of the first atlas, but it does suggest that, in mainland Scotland at least, the distribution of Redshank has declined markedly, although increases in range are apparent in Shetland and on Lewis and Harris (Gibbons *et al* 1993). The present survey suggests that half the breeding Redshank in Scotland are on the Northern and Western Isles. Galbraith *et al* (1984) do not provide population estimates for Curlew and Snipe, as substantial proportions of these populations occur above 300 m and in the uplands.

Methods and interpretation can greatly affect estimates of wader populations. Surveys of the type used in the present study have usefully been compared with alternative intensive methods such as nest finding for Lapwing, Snipe and Redshank (Green 1986, Barrett and Barrett 1983, Bibby *et al* 1992). This process is presently being undertaken for Curlew (M Grant *pers comm*). O'Brien and Smith (1992), in comparing the interpretation of wader numbers on lowland wet grasslands in 1982, found that the method used in the present survey increased Lapwing and Redshank numbers by 34% and 35% respectively, when compared with interpretations of the original survey in 1982.

Table 4 *(see next page)*
Scottish farmland data from Galbraith et al (1984). Extrapolations of Scottish farmland data are based on the assumption that difference in area between the 1983 survey and the present is equivalent to the area of rough grazing above 300 m. See text for details. Uist machair data from Fuller et al (1986). Shetland data from Campbell (1989).

Table 4 also shows previous population

Table 4 ***Previous population estimates for lowland breeding waders in Scotland***

	Scottish farmland	Scottish farmland estimates	Uist machair	Shetland inbye
Area of survey (km^2)	19906	35977	186	330
Oystercatcher	22700	29800	2700	1466
Lapwing	63800	99500	4300	1083
Snipe	-	-	1-2000	243
Curlew	-	-	0	672
Redshank	5000	6500	2600	287

estimates for wader populations on the machair of the Uists and inbye land on Shetland. Comparisons with the data in Table 2 indicate that present estimates for lowlands on the Uists are similar to those obtained in the 1983 survey (Fuller *et al* 1986), although from a wider area. Direct comparisons of changes in wader populations on the Uists suggest that numbers of all species, with the exception of Oystercatcher, have declined since the 1983 survey (Whyte and O'Brien 1995). The previous estimates for wader numbers on Shetland (Campbell 1989) appear to be much lower than those from the present survey. These estimates were made by undertaking a preliminary survey of all areas of inbye land on Shetland, repeat surveying the best looking areas for waders, and applying a conversion factor to the areas not repeat surveyed, based on the difference in wader numbers on the best areas between the first and subsequent visits. Whilst wader densities on the best areas in Shetland are similar to, or higher than, the densities recorded for the present survey, with the exception of Snipe, the extrapolation appears to have seriously underestimated the importance of the other areas, especially for Lapwing, Oystercatcher and Curlew (Gill *et al* 1994). The new Breeding Atlas suggests a marked increase in the distribution of Redshank in Shetland (Gibbons *et al* 1994). In addition, the abundance map suggests that a high proportion of the tetrads in those 10 km squares which have gained Redshank are themselves occupied, suggesting a considerable increase in Redshank numbers in Shetland.

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Lapwing *S C Porter*

A winter survey of Goldeneyes on the River Deveron, north east Scotland

PETER J COSGROVE

A winter survey of Goldeneyes on the main stem of the River Deveron, in north east Scotland, was carried out in mid January 1996. There were 301 Goldeneyes on the river, representing approximately 7 birds per 2 km of river. About a third of the birds were adult males and the rest females or yearlings. Goldeneyes were absent in the upper reaches and most abundant in the lower to middle reaches of the river. The figure of 301 birds qualifies the River Deveron for consideration as a nationally important site for the species, holding nearly 2% of the estimated population in Great Britain. However, the national population has been estimated in the absence of comprehensive river surveys and so the national figures need to be reassessed to take account of all Goldeneye habitats.

Introduction

The aims of the study were to census the winter population of Goldeneyes *Bucephala clangula* on the main stem of the River Deveron, from the sea at Banff to Cabrach, compare the count with other relevant data and to make recommendations for future censusing of local Goldeneye populations.

Methods

The winter census of Goldeneyes was carried out by means of a transect count along the whole length (87 km) of the River Deveron. The count was carried out in mid January, over a period of 4 days (21-24 January, 1996), during a period of similarly mild weather conditions to minimise the possible effects of weather related movements of birds along the river. Counts were usually made in the morning but sometimes continued into the afternoon because of the short day length.

The whole river was walked from Banff to Cabrach, scanning thoroughly at every bend to avoid flushing birds ahead of the field worker. The survey was carried out by 2 teams of 2. Observers covered a stretch of river by walking upstream to a predetermined spot where the other observer had left a car and began his/her walk. Whenever possible, observers moved around birds so as not to flush them. The location of each bird was recorded from grid references on 1:50,000 maps. Goldeneyes were recorded and categorised as either adult males or 'brownheads' ie adult females and first winter birds, using plumage characteristics.

Goldeneye distribution was plotted with respect to river elevation; the whole river being subdivided into 10 km sections starting from the mouth. The mean elevation was estimated (m ASL) from 1:50,000 Ordnance Survey maps.

Results

Three hundred and one Goldeneyes were counted on the main stem of the River Deveron over the 4 day count, giving a density of approximately 7 birds per 2 km of river. Goldeneyes were absent in the upper reaches of the river and most abundant in the lower part of the river (Fig 1). There were comparatively high densities of individuals in the lower to middle reaches of the river until the confluence of the River Isla, near Milltown of Rothiemay 50 km upstream at 80 m ASL, where there was a sharp decline. There were no birds recorded on the upper Deveron between Inschtammack, near Huntly, and Cabrach.

About one third (109) of the 301 Goldeneyes were adult males and the rest 'brownheads'. The proportion of 'brownheads' to adult males remained high in all but one 10 km section of river (Figure 2). The 40-50 km (80 m ASL) section held a greater proportion of adult males than 'brownheads'. Goldeneye were recorded individually and in small flocks of up to 15 birds. There appeared to be no particular bias in the composition of the flocks; both adult male and 'brownhead' only groups, as well as mixed groups, were recorded. The proportion of male to female Goldeneyes in groups of different sizes differed little from the expected sex ratio of the groups calculated from the total population censused (Figure 3).

Figure 1. Goldeneye densities in relation to elevation on the River Deveron in Jan 1996.

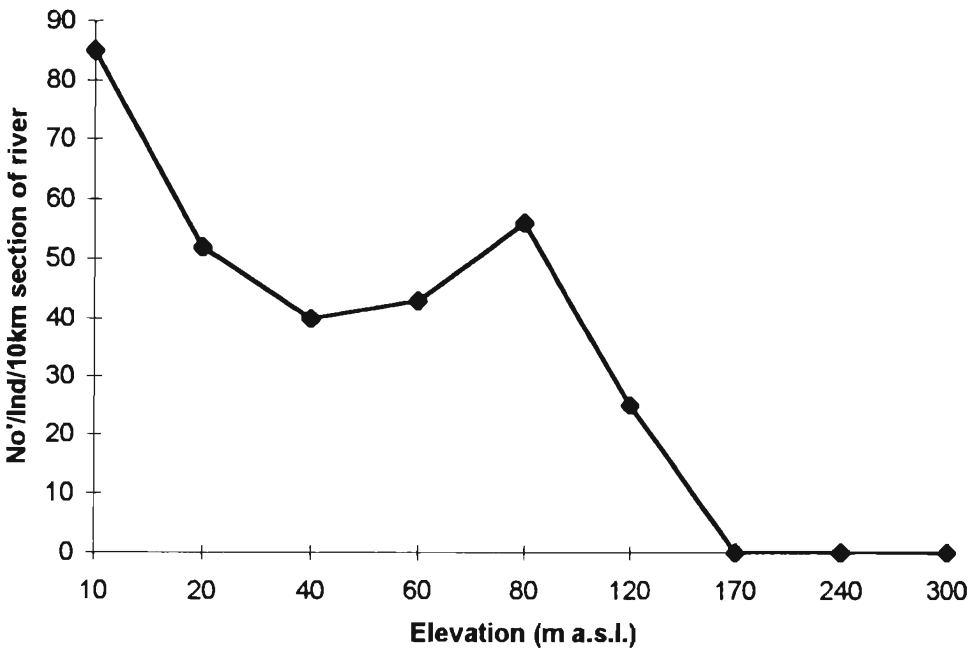


Figure 2. The proportion of adult male to 'brownhead' Goldeneye seen on the River Deveron in Jan 1996.

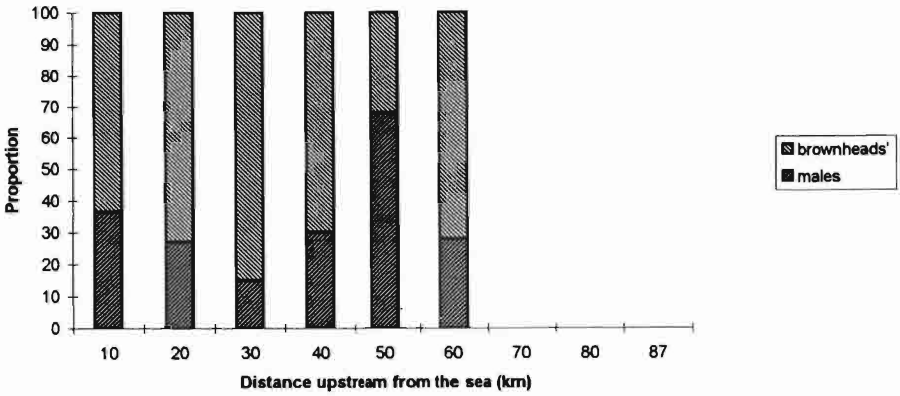
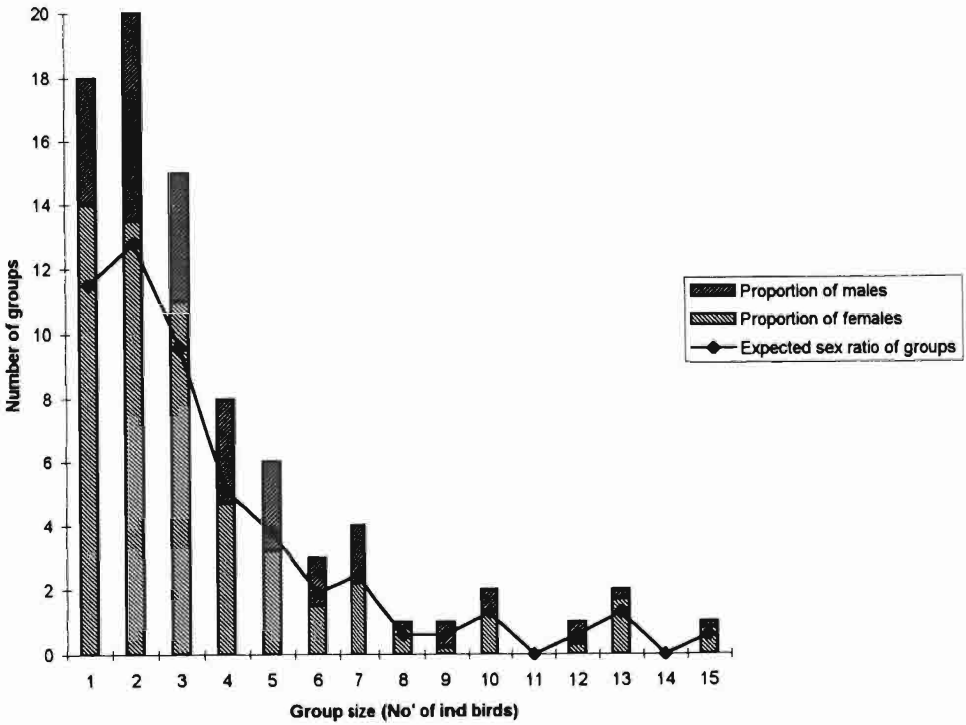


Figure 3. Sex ratio within Goldeneye groups



Discussion

Most Goldeneyes in Britain are reported from either the coast or from still freshwater (Owen et al 1986, Duncan and Marquiss 1993). There have been very few estimates of whole river populations of Goldeneyes; most have been made on sections of rivers, such as on parts of the Tweed in the Borders. Estimates of wintering populations of Goldeneye have been compromised by a lack of systematic counts on rivers. Duncan and Marquiss (1993) documented the numbers of Goldeneyes on rivers and standing waters in northeast Scotland to show the importance of rivers as wintering habitats. Their study, however, did not cover the River Deveron and there appear to be no other published data on the importance of this river for wintering Goldeneyes. Duncan and Marquiss (1993) found a strong tendency for a higher proportion of adult males at sites at lower elevations. This was mainly due to differences between habitats; the greatest proportion of adult males occurred on the lower sections of rivers and on the sea. At tidal river mouth sections and effluent discharges, food is concentrated, and this attracts good numbers of Goldeneyes, particularly males. The River Deveron is a small, relatively clean Salmon *Salmo salar* river where food is probably not very concentrated. Consequently, the site is attractive to females which do not have to compete with the larger, adult males. It is possible that the lack of a higher proportion of adult males on the lowest section of river could be attributed to lack of concentrated feeding sites such as are found on some of the other rivers in northeast of Scotland. Goldeneye numbers in Britain remained stable from the late 1970s to the mid 1980s, and then gradually increased (Waters and Cranswick 1993). Duncan and Marquiss (1993) found high numbers of wintering Goldeneyes on whole river counts in northeast Scotland. From these counts, and others they carried out on still waters in the area, they estimated that 62% of the region's Goldeneyes were on rivers. Numbers varied considerably between years but these differences could not be attributed to weather related movements of birds.

Duncan and Marquiss (1993) suggested that the location of Britain's wintering Goldeneye populations had changed over time, from still water sites and a very few coastal concentrations, to still water sites and some important river sites. This was associated with reductions in effluents discharged into shallow waters (eg Campbell 1984). The figure of 301 Goldeneyes shows that the River Deveron is a nationally important site, holding nearly 2% of the estimated population in Great Britain. The Deveron population, along with those of the Rivers Don and Dee, makes the north east of Scotland a nationally important area for wintering Goldeneyes. However, the national population has been estimated without comprehensive river surveys, so that the national figures and the levels qualifying for national and international significance need to be reassessed following national surveys of all Goldeneye habitats.

The important Goldeneye rivers of northeast Scotland are also important for Goosanders *Mergus merganser* (Marquiss and Duncan 1994). These are shot under licence from the Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD). In winter the 2 duck species forage in the lower to middle stretches of the river. Although Goldeneyes are not shot under SOAEFD licence, they do experience the disturbance resulting from shooting Goosanders and special consideration should be given to the conservation status of co-located species (MAFF 1995). It is not clear how this disturbance affects Goldeneyes, but in the present survey they were just as wary of

humans as Goosanders were on the Deveron. Birds took flight at the sight of humans at least 400 m away and moved long distances.

Other ducks, predominately Mallard *Anas platyrhynchos,* but also Wigeon *Anas penelope,* Teal *Anas crecca* and Mandarin *Aix galericulata,* also use rivers in Britain, so systematic whole river counts should be undertaken along with counts on selected still waters. It is only through more thorough censusing that a complete picture can be made of important wintering habitats not only for Goldeneye but other waterbirds. The Deveron is close to the main Scottish Goldeneye breeding area of Speyside. It is possible that, with increasing numbers of birds wintering on north east rivers, numbers subsequently summering, and potentially breeding, will increase. Comprehensive monitoring of these sites throughout the year will show whether these rivers also become important breeding areas for Goldeneyes.

Acknowledgements

I am grateful to Scottish Natural Heritage who provided funds to help finance the study. Three other fieldworkers helped in the collection of the data: Chas Emes, Ross McGregor and Eleanor Shield. I would like to thank Dr Mick Marquiss who gave helpful advice and commented on the early draft of this paper.

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Revised manuscript accepted May 1996

SHORT NOTES

Feeding association of Dunnock and Blackbird in snow

In early February 1996, there was a fall of about 10 cm of snow at Bridge of Allan, Stirling. A picnic table outside my window acted as a bird feeder. I cleared half the table and left bread and apple scraps but these were covered by more snow to a depth of 2 or 3 cm. Several Blackbirds *Turdus merula* and at least one Dunnock *Accentor modularis* were accustomed to feed in the area; a Blackbird would land on the table and start clearing snow, using bill, and foot scratching, so that food remnants were exposed. After several days of casual observation, I realised that the arrival of a Blackbird on the table was often followed by the appearance of the Dunnock which would follow the Blackbird around and peck into the exposed surface. Both birds often left together at some disturbance. Although both species were often within about 15 cm of each other, there were no signs of antagonism between them. A thaw occurred before I could make detailed observations and the association ceased immediately. There is no comment on this behaviour in *Birds of the Western Palearctic* and Bishton (1986, *Ibis* 128:526-539) did not mention any commensal interactions. Simmons (1985 *Brit Birds* 78:508) noted a Dunnock pecking at the faeces of a Blackbird but this did not happen in my observations. Several Robins *Erithacus rubecula*, Chaffinches *Fringilla coelebs*, and Blue and Great Tits *Parus caeruleus* and *P.major* also visited the table regularly but not when Blackbirds were present. Presumably the behaviour recorded here only happens when snow cover is too thick for Dunnocks to forage but thin enough for Blackbirds to clear it.

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Accepted March 1996

Decline of Sutherland rookeries

In April 1996, DMB took part in the BTO Rookery Survey. In his extensive allocation of tetrads in central Sutherland, he found only one rookery plus 2 others in adjacent areas. He contacted DM who had carried out the last count of Sutherland rookeries in 1975 (Castle M. *Scottish Birds* 9:327-334). We decided to carry out a repeat of the 1975 count, omitting 3 distant rookeries in the Tongue area of north Sutherland, which have been omitted from the following calculations. In 1975, 27 rookeries contained 1808 nests. In 1996 these were reduced to 23 rookeries and 1314 nests. Eight of the 1975 rookeries were either abandoned or the trees had been cut down. Four new rookeries were discovered. This gives an overall reduction of 4 rookeries and 494 nests. We do not know whether the decrease is still continuing and another count is needed to answer this question. Incidentally, the majority of the rookeries are sited along the agricultural strip of the county's east coast.

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Accepted May 1996

Probable first breeding record of Brambling in Britain represented in a museum collection

The first accepted breeding record for Brambling *Fringilla montifringilla* in Britain was in 1920, when a pair with a nest was found at Altnaharra in Sutherland (Hodgkin & Hodgkin 1920. The breeding of Brambling in Scotland, *Scottish Naturalist* 1920 :181-182). E T Booth claimed to have a found a nest with 3 eggs in Perthshire in 1866, but this has never been accepted. Breeding was not confirmed again until 1979, when a nest was found in Grampian (Buckland & Knox 1980, Brambling breeding in Scotland, *British Birds* 73:360-361) but, since then, 7 pairs have been confirmed as breeding, with an additional 35 possible breeding records, by 1990 (C Mead in Gibbons *et al* 1993, *The New Atlas of Breeding Birds in Britain and Ireland* 1988-1991. Poyser).

Major William Stirling of Fairburn (1858-1914) put together a substantial egg collection between 1895 and 1910, the eggs coming mainly from his own estate in Easter Ross and neighbouring districts. In 1983 Captain Roderick Stirling, William Stirling's grandson, generously donated the substantial collection of several thousand eggs, with good supporting documentation, to Inverness Museum and Art Gallery and HMcG worked on a voluntary basis on this collection between 1992 and 1995. The collection contains the first British clutch of Slavonian Grebe *Podiceps auritus* eggs (McGhie 1994, Discovery of the first British clutch of Slavonian Grebe eggs in a museum collection, *Scottish Birds* 17:166-167), and important series of Greenshank *Tringa nebularia*, Siskin *Carduelis spinus* and Scottish Crossbill *Loxia scotica* clutches.

In the course of work on the collection we found a record on the Brambling page in William Stirling's uncompleted manuscript catalogue of the collection, with the following information:

28 May 1899	HM
3 Orrin Side, Fairburn	v

HM refers to one of the tenants of the area between the Rivers Orrin and Conon. The only Orrin Side in Fairnburn is Orrinside (NH 48 51), an area of Birch scrub 50 metres above sea level which agrees well with descriptions of Brambling nesting habitat (eg Newton, *Finches*. Collins 1972). The date is in accordance with the late May dates of the 1920 Sutherland nest and the 1979 Grampian nest. Brambling eggs are, unfortunately, very similar to Chaffinch, *Fringilla coelebs*, and there is broad overlap in size, colour and markings. The 3 eggs, still present in the collection and bearing the set mark 'v', measure 21.25 x 15.15, 20.15 x 14.74 and 21.20 x 15.05mm (to nearest 0.05mm), agreeing well with published measurements. The background colour is greenish blue, with none of the smudging typical of Chaffinch eggs. The eggs are thus more typical of Brambling than Chaffinch in colouration and markings.

Given that the eggs were found in suitable habitat, that colour and size are typical of Brambling, and that William Stirling was a very competent ornithologist, we believe that this clutch represents the first recorded breeding attempt by Brambling in Scotland.

We thank Captain Roderick Stirling for reading a draft of this short note and for his donation of his grandfather's important collection to Inverness Museum and Art Gallery.

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Stephen A Moran, Inverness Museum & Art Gallery, Castle Wynd, Inverness IV2 3ED

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Brambling *Edmund Fellowes*

Mobbing of Waxwing by Chaffinches and Blue Tits

On 31 March 1996 our attention was attracted by the alarm calls of Chaffinches *Fringilla coelebs* and Blue Tits *Parus caeruleus* which were perched in a young ash tree *Fraxinus excelsior* next to a road. More birds were perched in adjacent trees and a total of 30-35 Chaffinches, mostly males, and 5 Blue Tits were counted. We noted that the topmost bird in the tree with most fruits was a Waxwing *Bombycilla garrulus*. Most of the alarm calls came from the finches in this tree. Periodically, the Waxwing made a flycatching flight, returning either to the same tree or to one nearby. The finches scattered noisily from whichever tree the Waxwing entered. They then gradually moved back, surrounded the Waxwing and continued calling until the cycle was repeated. This pattern continued for about 6 cycles over a period of 10 min before the Waxwing flew off to a tree about 100 m away, followed by a few of the finches. The finches and tits did not approach closer than about 2 m to the Waxwing, which did not appear to be perturbed by their activities.

Birds of the Western Palearctic (Vol 5) does not mention Waxwings attracting the attentions of finches and tits in this way, although it does record the North American Waxwing *B. pallidiceps* chasing tits *Parus* and Bullfinch *Pyrrhula pyrrhula*. However, we did not observe any aggressive behaviour by the Waxwing towards the tits and finches on this occasion.

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Accepted May 1996

Waxwing *1st prize in 1996 SOC photographic competition*

Eric McCabe

Nestling predation by Merlins

Merlins *Falco columbarius* usually chase and kill flying prey in the breeding season (Newton *et al* 1984, *Bird Study* 31:49-56). This is borne out by 6 British studies where the bulk of prey remains at nest sites have mostly included flying prey. However, nestling predation, which has been well documented, could also be considered a common hunting strategy then (for example Hard & Enemar 1980. *Var Fagelvarld* 39:25-34).

This seems a high delivery rate. It is over twice as much as was brought to the nest overall (1.39 deliveries/hour) and is 5 times as much overall in the nestling stage as found in Britain and Europe (Dickson 1995, *Scottish Birds* 18:20-23) and in an urban population in Canada (Sodhi *et al* 1992. *Canadian Journal of Zoology* 7:1477-1483).

Nestling prey has also been recorded in Galloway (*Scottish Birds* 2:245) but there was little evidence that nestlings figured in prey deliveries to nests to the extent recorded

Table 1 ***Peak individual hourly feeding rates ('runs') of Merlins in the nestling and post fledging stages of the breeding cycle in Galloway, 1971-92***

Year	Nest Stage	Items brought	Hours observations	Times between deliveries (mins)	Equivalent to prey deliveries/h
1971	N	1	0.5	-	2.0
1972	PF	4	3.75	49, 41,6,53	1.06*
1973	PF	1	2.5	-	0.40
1974	N	2	4.0	95	0.50
1976	PF	2	1.5	80	1.30
1977	PF	3	4.0	63,80	0.75
1988	PF	2	2.25	42	0.80
1992	PF	2	3.50	33	0.57

Notes
N = Nestling; PF = Post fledging
* includes 2 items in 6 minutes delivered by a male

Knapton & Sanderson (1985, *Canadian Field Naturalist* 99:375-377) watched a Merlin's nest containing young in sub arctic Canada and found that 3 small passerine nestlings were brought to the nest in short periods of time during a 2 hour watch (equivalent to 3.0 deliveries/hour) and similar 'runs' of prey deliveries occurred on 4 other occasions. in Canada. Peak individual hourly feeding rates recorded in any one year in Galloway, when fieldwork included the times when nestling prey would be available to Merlins, are shown in Table 1. From this it can be seen there were no 'runs' of prey deliveries except 2 items delivered in 6 min on one occasion in 1972.

It has been suggested that nestling prey may be more important than thought (Sperber & Sperber 1963, *Zool. Bidrag Uppsala* 35:263-268; Bibby 1987, *Bird Study* 34:64-70). This has not been borne out by the 6 British studies where the number of nestling prey remains found at nest sites have only varied between 0% - 4.6% with a mean of 2.2%. My data suggest that the majority view is correct and that nestling prey do not have, overall, a large role to play in the food intake of breeding Merlins. This agrees with Cramp & Simmons (1980 *Birds of the Western Palearctic*, Vol. 2 Oxford 1980) assessment that raptors, generally, seldom prey on nestlings.

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Merlin *Jim Young*

Black-throated Diver feeding on Common Frogs

On 3 May 1996, in Argyll, I watched a Black-throated Diver *Gavia arctica* fishing for about three quarters of an hour until it flew off. In the 49 min during which I watched the bird fishing, it did so continuously, moving around the loch in an anticlockwise direction. The loch is about 450 m long by 130 wide. I watched from about midway along one of the long sides, so that the diver was as close as 40 m and never further than 200 m away. Between each dive, it remained on the surface only long enough to dispose of prey or take a breath before diving again. I timed several of the periods on the surface, and they averaged no more than 7 secs. The average time was not affected by whether the dive had been successful or not. When a dive had been successful, the diver shook the prey in the water on surfacing and then swallowed it. Sometimes it swallowed it before raising its head, but usually it raised its head so that the bill was above the horizontal and then swallowed the prey with a gulp. This allowed me to see what sort of prey had been caught.

I observed 47 dives, of which 20 were successful and one unknown. There were probably a few more dives at the end of the period when the diver moved into very dark water at the far shore. The average length of the dives was a maximum of 55 secs and a minimum of 53 secs. Some successful dives were very short, down to 10 secs. The success of dives varied according to the bird's position in the loch. At the north end, 9 dives failed out of 10, while in the south end 17 failed out of 37.

All the prey items were of similar size. The portion which hung from the closed bill was about 60 to 90 mm long. Thus the prey itself would have been from 70 to 100 mm long. Some of the prey items appeared linear in shape and could have been small fish, but some most definitely had limbs, which flapped when the prey was shaken. The majority of such prey items came from a small area of the loch at the south end, where the diver made 13 successful dives in succession.

On inspection, one 20 m stretch of mossy bank opposite this area was seen to have about 15 clusters of partly dead Frog spawn, about 100 mm above the water. This confirmed that the loch was occupied by many Common Frogs *Rana temporaria*, and it is almost certain that these made up the majority of the prey taken by the diver. The diver had been fishing for a long time before I was in position and counting. It is thus likely that this feeding session provided well above the 20 prey items observed.

Cramp & Simmons 1977 (*The Birds of the Western Palearctic*, Vol 1, Oxford) state that Common Frogs are recorded as being taken by both Black-throated and Red-throated *Gavia stellata* Divers and give weights for Black-throated Divers in summer of 3310-3400 gms for males and 2037-2471 gms for females. Frazer 1983 (*Reptiles and Amphibians in Britain*, Collins New Naturalist) gives sizes for Common Frog in Scotland (snout to vent) of between 80 and 95 mm, and weights of females ranging from 28 gr post spawning to 72 gms, and 49 gms for a 4 year old male. Taking an average of 38 gms, the total weight of the observed prey would be about 760 gms in my 49 min observation period. This represents 34% of the average female Black-throated Diver weight or 23% of the average male weight.

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OBITUARY

Ritchie Seath 1907-1996

Ritchie Seath died on 20 May 1996. He was 89. At the family's suggestion, friends and relatives gave to the SOC instead of sending flowers. As one of the founder members of the SOC, inaugurated on 14 January 1937, he had been proud to receive honorary life membership and a commemorative scroll only a few weeks before his death. Born in Edinburgh on 3 April 1907, he lived over the Forth at Aberdour from 1942. He was a classical scholar at the Royal High School, and graduated Bachelor of Commerce at Edinburgh University in 1928. Among his sporting activities, he was captain of rugby at school, played for the university XV and continued this interest as a referee in the adult game. From university he went into the family printing business, Howie & Seath, founded by his father. He retired on his 70th birthday. During World War II he also worked for the Admiralty at Rosyth. This took him around the country to such places as Scapa, where he formed a close friendship with George Arthur, master baker and guardian of Orkney birds.

In 1935, he married Marguerite Edwards. When she died in 1994 after a long illness, he lived on his own, alert and sharp of mind, if physically slowed a bit by age, until a few months before his short, final illness. He leaves a daughter, a son, grandchildren and great grandchildren.

Ritchie had a lifelong interest in birds. He was knowledgeable and active. Especially in his younger days he made many trips to the Grampians, Sutherland, Wester Ross, Islay, Colonsay, Tiree, Coll and other parts of Scotland, but he did not travel abroad. He was a keen hillwalker in search of birds. There were particular friends he went with, and later his family, but he was not widely known to SOC members. In the 1930s he contributed notes to the *Scottish Naturalist* on Dotterel behaviour and terns and a paper on birds round Kinloch Rannoch, but organised birdwatching and recording were not his scene. Like others of his generation he had a meticulously prepared and documented egg collection, but, when such things became generally unacceptable, they were expunged.

His grand passion was fine bird books, especially with spectacular hand coloured plates. His house was an Aladdin's cave to the lucky enthusiast who got to see it; every bookcase and cupboard revealed new treasures, carefully acquired over the years: Gould's 5 volume *Birds of Great Britain*, his *Century of Birds from the Himalaya Mountains*, and a superb double volume of his *Monographs of the Toucans and the Trogons;* Dresser's 9 volume *Birds of Europe* and Monographs of the Bee-eaters and Rollers; Jardine and Selby's *Illustrations of Ornithology*, and many more.

Then, in 1965, Howie & Seath had to leave its premises in Swinton Row to make way for the St James's Centre. Rather than borrow to finance the move he determined to sell his natural history and classical travel books, and would not be dissuaded from this. The auction realised good prices at Hodgson's in London on 25-26 March 1965. With a grant from the Russell Trust the SOC secured his complete bound set of *Ibis* for the library. Ritchie was a member of the BOU from 1942 until he died. After the sale he most generously went on paying to bind the *Ibis* annually for the SOC for the rest of his life.

He was very pleased when the club recognised his outstanding knowledge of bird books with an invitation to become its honorary librarian. He filled this role from 1965 to 1983 and then continued on the library committee. As well as taking a keen interest in the library and advising the committee, he contributed a series of reviews to *Scottish Birds* in the 1960s and 1970s, mainly of finely illustrated bird books. His commentary revealed a professional understanding of how varied methods of book production affect public perception of the qualities of the artist. Edwin Alexander was a particular favourite for whom he expressed admiration, ranking him with such masters as Joseph Wolf and Archibald Thorburn.

The sale of his books was notably less traumatic than expected. With the business into its new premises, it was not long before he was quietly and selectively picking up fine books again, including some he had just sold. He did not grieve for those he could not replace. He had enjoyed owning them but did not have to hoard them. In 1973, he wrote that "you have to add something good occasionally to keep up interest. Recently I sold some travel books and bought Monographs, even at recent prices, and forgot the cost". In the late 1980s, knowing his family would be faced with selling his books, and now over 80, he sold the valuable ones from his second collection privately.

Ritchie Seath had an interested enquiring mind, centred round birds but extending widely. He appreciated excellence and took pride in the quality of his printing work. He was sensitive to the rampant printing errors and loose ungrammatical writing that are now common and he would mark neat printers' corrections in the margins of his less valuable books, in pencil of course.

He was rather a private person, as book collectors may be; a bit of a loner and with no wish to be a public figure. He did not have a bookplate and disapproved of them. But he was happy to talk about birds and books and help an aspiring collector along the right lines. The writer treasures copies of Lord Lilford's Birds of the British Isles and Ewen Kennedy, No 47 of 75 copies, illustrated by Edwin Alexander, bought in the Seath sale, as well as other volumes acquired with his guidance. He was a man one was happy to have known.

Andrew T Macmillan

Ritchie Seath at 88 , with BOU tie, on the family boat at Inverkip *Mrs Thomson*

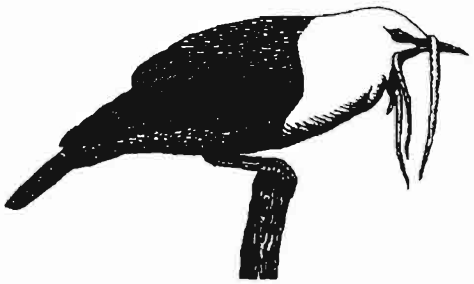
Advice to Contributors

Authors should bear in mind that only a small proportion of the *Scottish Birds* readership are scientists, and should aim to present their material concisely, interestingly and clearly. Unfamiliar technical terms and symbols should be avoided wherever possible and, if deemed essential, should be explained. Supporting statistics should be kept to a minimum. All papers and Short Notes are accepted on the understanding that they have not been offered for publication elsewhere and that they will be subject to editing. Papers will be acknowledged on receipt and will be reviewed by at least 2 members of the editorial panel and, in some cases, by an independent referee. They will normally be published in order of acceptance of fully revised manuscripts. The editor will be happy to advise authors on the preparation of papers.

Reference should be made to the most recent issues of ***Scottish Birds*** for guidance on style of presentation, use of capitals, form of references, etc. **Papers should be typed on one side of the paper only, double spaced and with wide margins; 2 copies are required and the author should also retain one.** We are happy to accept papers on Applemac computer discs. We cannot handle other formats because both the SOC computers and those at our printers are on the Apple system. Please contact Sylvia Laing on 0131 556 6042 to discuss this. Headings should not be underlined, nor typed entirely in capitals. Scientific names in italics should follow the first text reference to each species. Names of birds should follow the official Scottish list (*Scottish Birds* Vol 17 : 146-159). Only single quotation marks should be used throughout. Numbers should be written as numerals except for one and the start of sentences. Avoid hyphens except where essential eg in bird names. Dates should be written:.....on 5 August 1991.....but on the 5th (if the name of the month does not follow). Please note that papers shorter than c700 words will be treated as Short Notes, where all references should be incorporated into the text, and not listed at the end, as in full papers.

Tables, maps and diagrams should be designed to fit either a single column or the full page width. Tables should be self explanatory and headings should be kept as simple as possible, with footnotes used to provide extra details where necessary. Each table should be on a separate sheet. Maps and diagrams should be in Indian ink and be camera ready, but drawn so as to permit reduction to half their original size.

Grey Heron *David Mitchell*

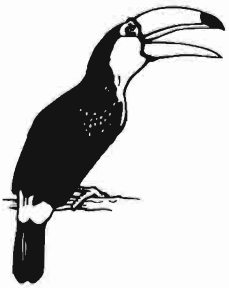


NEOTROPICAL BIRD CLUB

Neotropical bird club launched

A club has been launched to promote the study and conservation of the birds of the Neotropics (South America, Central America and the Caribbean). It is currently seeking founder members to help reach the launch budget of £2000, which is required to get the club running and to publish the two first issues of its intended journal 'Contínga'. Founder members will be asked to pay a minimum of £25, and will be formally acknowledged in the first issue of 'Contínga'. 'Contínga' will provide a colourful and much needed forum for exchange of information on the avifauna of this extremely rich and diverse area, and will contain papers and features on the birds and their conservation as well as news of recent observations and discoveries (at present, new species are still being discovered at the rate of more than two a year). It is hoped that in due course the club will be able to provide direct funding and support for practical conservation programmes.

For further details and membership forms, please contact:
Rob Williams,
Publicity Officer,
Neotropical Bird Club,
c/o The Lodge,
Sandy,
Bedfordshire SG19 2DL



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