

Greylag Goose

Anser anser
(Iceland population) in Britain and Ireland
1960/61 – 1999/2000

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Waterbird Review Series

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ISBN 0 900806 45 1

This publication should be cited as:

Hearn, RD & CR Mitchell. 2004. *Greylag Goose* Anser anser (*Iceland population*) in Britain and Ireland 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Published by:

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Design and typeset by Sally Mackenzie and Paul Marshall
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Printed by Crowes Complete Print, 50 Hurricane Way, Airport Industrial Estate, Norwich, Norfolk NR6 6JB

Front cover: Greylag Goose by Niall Benvie
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SUMMARY

This report examines changes in the abundance and non-breeding distribution of the Icelandic breeding population of Greylag Goose *Anser anser* during the period 1960/61–1999/2000. It also evaluates the historical status of this population, reviews current monitoring, population dynamics, ecological knowledge and conservation issues, and describes numbers, trends and site use at the key resorts in Britain and Ireland.

It is thought that the Iceland population of Greylag Goose breeds entirely within Iceland, although small numbers breeding in the Faeroes may also be from this population. They spend the non-breeding season almost entirely in Britain. Small numbers remain in Iceland and the Faeroes, while others winter in Ireland and southern Norway.

Co-ordinated censuses of this population began in 1960. From then until c. 1990, the population underwent a period of growth from around 30,000 to 110,000. Subsequently, it has declined to around 80,000.

During the winter the geese feed primarily in agricultural habitats, selecting stubbles, pastures, cereals and root crops. They return to nearby inland waterbodies and sheltered coastal bays to roost.

At times, the grazing of valuable crops may bring the geese into conflict with agricultural interests, although the extent of this problem has yet to be quantified.

The geese are hunted throughout their range. A comprehensive harvest monitoring system in Iceland shows that large numbers are shot there each autumn. Similar numbers may also be harvested in Britain, although no monitoring system currently exists. Over-harvesting is the principal threat to this population.

Two resident populations of Greylag Goose also occur in Britain. Changes in the abundance and distribution of these and the Iceland population means that greater overlap in range now occurs, presenting problems for current and future monitoring effort.

During the 1950s, most Iceland Greylag Geese wintered in southern Scotland, but this distribution has since shifted so that the majority is found in the north and northeast. A small number of favoured

land-fall sites are used by birds arriving from Iceland, particularly the Moray Firth and other sites in northeast Scotland. As winter progresses, these disperse to the south, occurring in both southeast and southwest Scotland and, in small numbers, in England and Ireland. In recent years, large numbers have also moved north to over-winter in Orkney. Some birds concentrate in northeast Scotland again before departure in spring to Iceland although many birds also appear to migrate direct from their wintering sites.

A total of 26 sites in Britain and Ireland currently support internationally important numbers of wintering Iceland Greylag Geese (1,000 or more birds), based upon the mean peak winter count for the period 1995/96–1999/2000. Information on numbers, trends and site use at these key resorts is provided within this review.

Most survey effort is concentrated on co-ordinated late autumn counts. Consequently, it is likely that the importance of sites that hold larger numbers of Greylag Geese at other times during the winter is not fully recognised.

Greylag Geese are protected by a number of national and international laws, conventions and directives. They are classified as Vulnerable on the Red List of Icelandic Birds, and are on the 'Amber' list of 'The Population Status of Birds in the UK'. A total of 22 Special Protection Areas (SPAs) have been designated for this population in the UK, supporting 57.5% of the total population at the time of designation. Recent changes in winter distribution, however, mean that this SPA suite now supports, on average, a lower proportion of the population.

For future conservation and management of this population to remain effective, greater long-term commitment is needed towards monitoring programmes and research. In particular, there is a need for a better understanding of the delimitation between migratory and sedentary Greylag populations wintering in Britain and Ireland; to design and implement methodological improvements to the autumn census; to improve estimates of annual reproductive success; to enhance current marking effort; to improve monitoring of bag sizes; and to improve our understanding of the impact of hunting on the dynamics of this population.

1 THE ICELAND GREYLAG GOOSE

1.1 Introduction

Thirty-two years have now passed since the last assessment of the status and distribution of the Icelandic breeding population of Greylag Goose *Anser anser* in Britain (Boyd & Ogilvie 1972), although Ogilvie & Boyd (1976) updated this to some extent with a regional analysis of population size for the period 1969–1975, and, more recently, Rowcliffe *et al.* (2000) used demographic data to undertake a Population Viability Analysis. Over the past 40 years, information on the numbers and distribution of Greylag Geese counted during annual autumn censuses has been presented in annual reports produced by The Wildfowl & Wetlands Trust (WWT) (e.g. Hearn 2000). This report uses these data, and additional counts provided by regional experts, to assess the changes in numbers and distribution of the Iceland Greylag Goose since 1960 and provide current estimates of population levels.

This report is split into two sections. The first provides a summary of our present knowledge of the status, ecology and conservation of Iceland Greylag Geese. This has been gathered largely from the text by Mitchell & Sigfússon (1999), written for *Goose Populations of the Western Palearctic* (Madsen *et al.* 1999), since this also summarises such information. New information is also provided here, however, in order to update Mitchell & Sigfússon (1999).

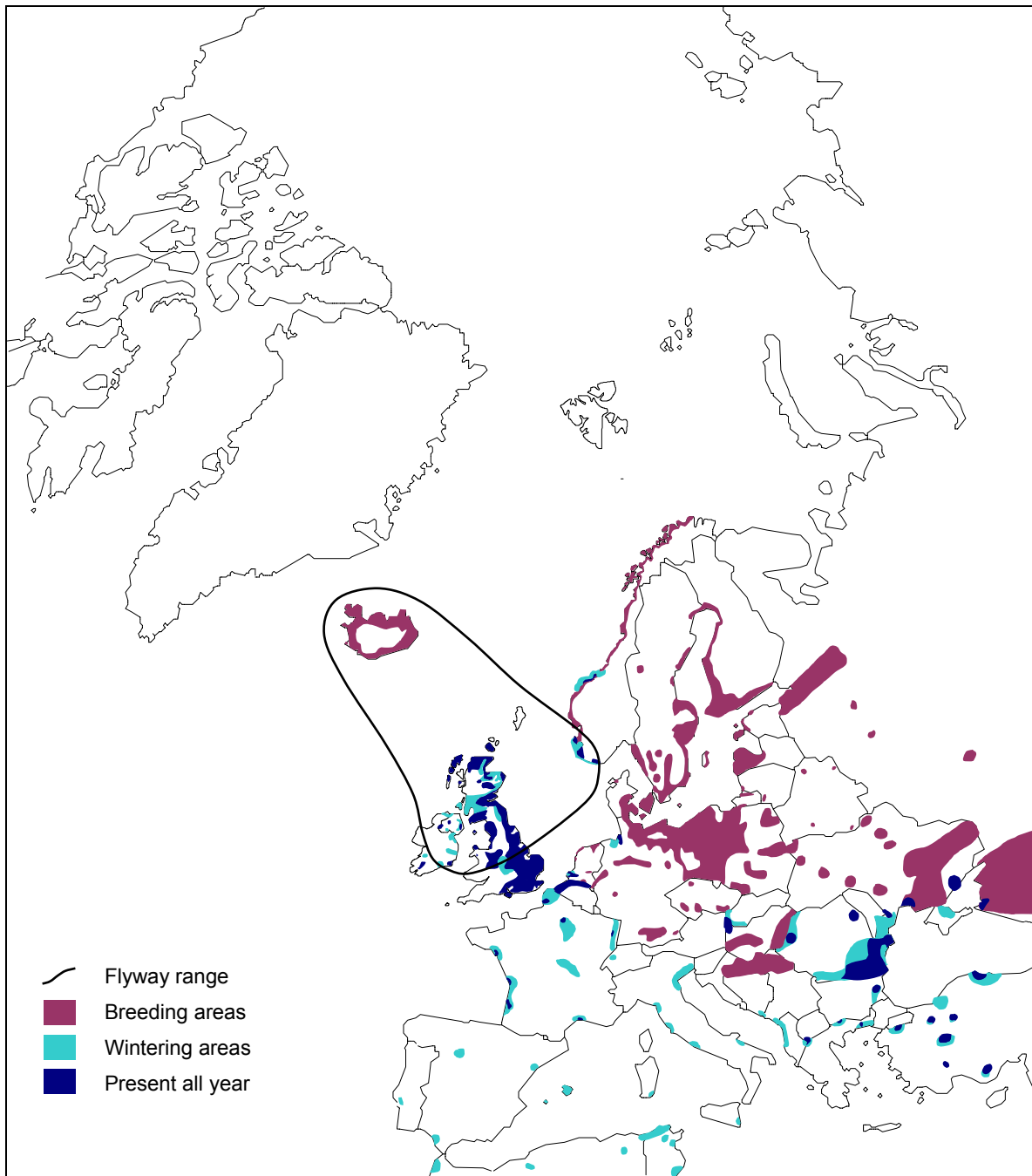
The second section explores the results of the monitoring of Iceland Greylag Geese in Britain and Ireland from 1960 onwards on a regional basis. An introduction to each region is followed by more-detailed information for internationally important sites, i.e. those that supported at least as many birds as the 1% threshold for the population during the most recent five-year period (1995/96–1999/2000). As the thresholds for international and national importance are the same for this population, no nationally important sites are presented. For further information on 1% thresholds, see Wetlands

International (2002). The current international threshold, and that used in this report, is 1,000 (Wetlands International 2002). This was also current at the time of the final year discussed in this report (1999/2000), (Kirby 1995, Rose & Scott 1997). It should be noted, however, that the Iceland population of Greylag Goose has not numbered 100,000 individuals since 1990 and the recently revised national threshold for Great Britain now stands at 819 (Kershaw & Cranswick 2003). The site assessment is based largely upon counts of roosting birds; feeding geese are rarely counted adequately because of logistical constraints. Data concerning trends in numbers and phenology are presented, along with information about the status, use and habitats of the site.

1.2 Background

The Greylag Geese breeding in lowland areas of Iceland migrate each autumn to spend the non-breeding season almost exclusively in Britain and Ireland (Fig. 1). Within their wintering range they frequent primarily farmland, taking advantage of estuarine sandbanks, rivers, reservoirs and other freshwater bodies for roosting (Owen *et al.* 1986a). Large concentrations can occur in early autumn, especially in north and east Scotland, facilitating annual autumn population estimates. There is considerable redistribution later in the winter, especially to traditional haunts further south within Scotland and to northern England, although important changes in these patterns have occurred in recent years. A small number of birds also move into Ireland, and others have recently been identified in southern Norway. Birds at the southern limit of the wintering range begin their northward migration through Britain in late winter, leaving from early April to arrive in the southern lowlands and other coastal areas of Iceland.

Figure 1. Breeding and wintering areas of Greylag Goose *Anser anser* and approximate flyway range of Iceland population (adapted from Scott & Rose 1996, Snow & Perrins 1998 and Mitchell & Sigfússon 1999)



1.3 Population monitoring and assessment

Little information is available to show how common wintering Greylag Geese were during the 19th century. It seems, however, that they were uncommon in south and east Scotland at that time, but that numbers began to increase rapidly from around 1890 onwards, particularly around the Solway and the Tay (Berry 1939). Similar, but smaller, increases were also noted at that time in the Moray Basin and around the Forth, although they remained scarce in Fife, Lothian and the Borders. In Deeside, no noticeable change in status was noted; small numbers wintered there throughout this period.

Numbers stabilised in most areas by the mid-1930s, although some local shifts in distribution were noted around that time. Along the Solway, most Greylag Geese had moved inland by this time because of excessive disturbance along the firth, and in Tayside the vast flocks almost disappeared as a result of over-shooting (Berry 1939).

At around this time, increases were also noted on the breeding grounds in Iceland, and these are perhaps a better reflection of the population trend than local changes in abundance on the wintering grounds, when birds are typically more mobile. In Boyd (1959), Finnur Guðmundsson commented that ‘a spectacular increase and extension of range of Greylag Geese in Iceland has taken place in recent years. The population seems to have started to increase soon after the turn of this century, but has been particularly striking in the last 25–30 years’.

Further increases appear to have taken place in the 1950s, and it was during this decade that Hugh Boyd, of the then Wildfowl Trust (now WWT), was instrumental in putting together a reliable system for estimating the size and distribution of the population on its wintering grounds.

Co-operation between a network of volunteer counters and professional reserve wardens ensured regular and simultaneous coverage of the species’s range throughout Scotland and England, primarily during the autumn. This system is still in operation today and forms the basis for estimates of population size.

1.3.1 Counts

1.3.1.1 Autumn counts

Autumn counts of geese were started during the early 1950s. Surveys of a sample of major sites were followed by increasingly extensive ground surveys during the mid-1950s. In November 1957 and 1958, comprehensive aerial surveys were combined with the ground counts to achieve the most complete coverage to date (Boyd 1959). It was not until 1960, however, that the first co-ordinated census was undertaken (Boyd 1963).

Annual autumn roost counts have been undertaken in Britain each November ever since. At this time, soon after arrival in Britain, up to 90% of the geese may be concentrated onto as few as 30 roost sites, making accurate counting relatively straightforward. Later in the winter the birds are more dispersed, and complete population counts become much harder. Counters assess the number of roosting geese at each site either at dawn or just before dusk (see Hearn 2000). In a small number of areas where roost sites are poorly known, inaccessible or infrequently used, daytime counts of feeding birds are also made to supplement the roost counts.

Since 1990, a second autumn count has also been undertaken in October. This was implemented primarily after recommendations by Newton *et al.* (1990) that a better assessment of Pink-footed Geese *Anser brachyrhynchus*, which arrive in Britain earlier than Greylag Geese, could be obtained at this time. For Greylag Geese, this additional count has provided valuable information on the timing of arrival into Britain.

1.3.1.2 Midwinter counts

The focus on autumn counts means that relatively little is known about the distribution of Iceland Greylag Geese outside this period. Consequently, a series of midwinter counts were conducted in 1993/94–1995/96 to address this issue (see Mitchell 1997). The same methods as for the autumn counts were used but, on average, just 54% of the peak autumn count was recorded. Whilst this provided useful information on the distribution of just over half of the population at this time of year, it was not possible to account for a large proportion of the population, even when taking the estimated hunting mortality between the two census periods into account (Mitchell 1997).

1.3.1.3 Spring counts

The focus on autumn counts also means that knowledge of spring distribution is poorer. Co-ordinated counts during the spring to supplement the autumn census have been carried out more frequently than midwinter counts, in 1963–1967, 1982–1986, 1988–1990 and 1994–1996, but, as with midwinter counts, a large proportion of the population could not be accounted for (Boyd & Ogilvie 1972, Mitchell 1997). Nevertheless, these data still provide a valuable assessment of the distribution of approximately half of the population at an important time for the geese. It is during the spring that they are feeding most intensively in preparation for spring migration and breeding. Also at this time they may come into greater conflict with farmers, as they compete with livestock for the spring growth in grass leys at a time when hunting is closed (Kear 1963). Consequently, knowledge of their spring distribution plays a vital role in their conservation and management.

1.3.1.4 Other counts

The Wetland Bird Survey (WeBS), a national scheme monitoring waterbird numbers throughout the UK, provides some additional counts of Greylag Geese. Most of these counts, however, are carried out during the daytime, when geese are feeding away from roost sites. Consequently, the use of these counts for estimating Greylag Goose abundance and distribution is rather limited, a fact which originally stimulated the development of roost counts.

Detailed roost counts have been carried out at some individual sites for many years (e.g. monthly counts at Loch Leven since 1966; almost daily counts at Dinnet Lochs from 1989 to 1997). In addition, some local feeding and distribution studies have involved detailed roost monitoring (e.g. Bell *et al.* 1988, Bell & Newton 1995, Hearn & Mitchell 1995, Stenhouse 1996). Local studies such as these also provide most of the information available on the feeding distribution of Greylag Geese away from their roost sites, since no nationally co-ordinated survey attempts to monitor this.

In Ireland, counts of Greylag Geese, and other waterbirds, were sporadic prior to the mid-1960s and these data are not readily available. Along with the formation of the Irish Wildbird Conservancy (now BirdWatch Ireland) in 1969, the start in 1967 of the International Waterbird Census (IWC), an annual, internationally co-ordinated count conducted in mid-January (co-ordinated by Wetlands International), prompted a great rise in interest in counting

waterbirds in Ireland. The first comprehensive, nationally co-ordinated survey took place between 1971/72 and 1974/75 and presented for the first time a detailed overview of the distribution and status of Irish wintering waterbirds. A follow-up survey was carried out in 1984/85 to 1986/87 (see Colhoun 2001 for further details).

In 1986, WeBS was extended to include Northern Ireland, emphasising the need for a comparable scheme in the Republic of Ireland that would address the short-term nature of previous surveys. Consequently, in 1994/95, the Irish Wetland Bird Survey (I-WeBS) was established. Since then, I-WeBS has continued to develop and now provides extensive coverage of wetlands throughout Ireland. Since 1998, counters there have participated in the Icelandic-breeding Goose Census (IGC), providing further detail on the number of Greylag Geese present at key roost sites at the time of the co-ordinated counts.

Few counts have been made in Iceland, although the number of breeding birds has been monitored using standardised methods in three areas over a varying number of years (H.W. Stefánsson pers. comm., Þ. Björnsson pers. comm., Petersen & Thorstensen 2001).

1.3.2 Productivity

Before the completion of the post-juvenile moult, first-winter Greylag Geese can readily be identified from adults. Furthermore, first-winter geese remain in families with their parents throughout their first winter. These factors facilitate the monitoring of annual reproductive success in the wintering quarters, as it is possible to estimate the proportion of first-winter birds in flocks and the average brood size of successful parents.

Such estimates are made annually as part of the IGC, although there are many potential sources of bias with this methodology, such as differences between successful and failed breeders in phenology, habitat choice, behaviour and distribution at various scales (Lambeck 1990). Variations in observers' ageing skills and the timing of such estimates in relation to hunting (they are made after the start of hunting in both Iceland and Britain) provide additional complications. Furthermore, the timing of breeding, migration and post-juvenile moult in this population combine so that only a brief window of opportunity exists in which to conduct this work. The entire population does not arrive in Britain until late October, and productivity estimates should be carried out before mid-November. Estimates made

after this date may underestimate the proportion of first-winter birds, as many are adult-like by that time.

In order to combat these problems, observers are instructed to collect data from various habitats and flock types and to sample as much of the flock as possible. Currently, most estimates are carried out by staff from WWT, and these numbers are supplemented with data from a small number of experienced volunteer observers.

Few productivity data are available from Iceland. Studies of brood size during the gosling period were conducted in 1987 and 1988 (Patterson & Giroux 1990), and other local monitoring has been carried out, primarily in the Lagarfljót/Uthérad/Hróarstunga area of eastern Iceland (H.W. Stefánsson pers. comm.). Data were also collected during ringing expeditions in 1996–2000.

1.3.3 Ringing

Autumn ringing in Britain in the 1950/60s (see Boyd 1959), together with colour-ringing in northern Scotland since 1992 and Iceland between 1996 and 2000, underpins our knowledge of the migration routes, phenology and winter distribution.

Between 1950 and 1966, some 2,400 Greylag Geese were marked with metal rings in Scotland by WWT. This generated 438 recoveries, which greatly advanced understanding of the movements (Boyd 1959) and dynamics of this population. Since 1992/93, over 2,050 Greylag Geese have been caught at Loch Eye (Ross-shire) and fitted with either an individually marked plastic leg ring or neck collar. Smaller numbers have also been caught at sites in Aberdeenshire and Perth & Kinross. Together with reports of birds ringed in Iceland between 1996 and 2000, over 13,000 sightings and recoveries have been generated.

Fewer Greylag Geese have been ringed in Iceland. Fifty were ringed there between 1932 and 1938, of which 13 were recovered (eight in Scotland and five in Ireland) (Boyd 1957). More recently, some 605 birds were caught at Lake Tjörnin, Reykjavík, between 1988 and 1995, of which 324 were colour-marked with plastic leg rings during 1992–1994. A small number of these birds have subsequently been recovered or resighted in Scotland or Ireland, but the majority are sedentary and remain in Reykjavík during the winter (Ó. K. Nielsen pers. comm.). More recently, the first concerted effort to mark large numbers of Greylag Geese in Iceland was initiated. Between 1996 and 2000, 628 adult and 734 Greylag

goslings were ringed; most (93%) were colour-marked using the same methods as at Loch Eye.

1.3.4 Hunting bags

The Greylag Goose is legal quarry across its range, although restrictions, particularly in the form of close seasons, operate throughout. Further details concerning hunting and its management are provided in section 1.5.2.

The quality of bag monitoring varies greatly between Iceland and Britain. In Iceland, a mandatory licensing system was introduced in 1995, requiring all hunters to renew their hunting licence annually. Licences are renewed only upon submission of a record of the number of each species taken in the previous year (Sigfússon 1996). The reporting of hunting bags is carried out anonymously, thus encouraging high compliance, through a system that uses a perforated card for permit renewal and bag reporting. This card is split upon receipt, and legislation prevents the two parts from being associated at a later date, thus ensuring anonymity for the hunter. Since this system began, an average of 11,589 hunting licences have been issued each year and 92.4% of licensees returned an annual report. In addition, a study of the age ratio of the hunting bag for Greylag Goose was carried out between 1995 and 2000. Goose wings were collected from hunters and from a company preparing wild geese for sale to restaurants and supermarkets and aged as either adult or first-winter.

In Britain, no national monitoring of bag size is carried out. The British Association for Shooting and Conservation (BASC) has, however, monitored the shooting of geese by its members for many years. Its approach is currently being applied to the development of a nationally co-ordinated system in Scotland, in conjunction with the Scottish Executive.

1.3.5 Population assessment

Early analyses of ringing data confirmed the discreteness of the Iceland population from other Greylag Goose populations in the Western Palearctic, including the sedentary Scottish-breeding population (Boyd 1959). Some overlap does occur during the winter between these populations, however, and, increasingly, between Icelandic migrants and re-established birds (i.e. those introduced from Scottish-breeding stock to other parts of Britain, and which now comprise a seemingly separate, sedentary population) in other parts of Britain and Ireland.

1.3.5.1 Abundance

The data derived from the annual autumn census show that the population increased from c. 30,000 birds in the early 1960s to just over 100,000 in the late 1980s (Fig. 2). This increase was attributed to the safeguard of important winter roosts, improved winter feeding conditions and a decline in overall mortality (Fox *et al.* 1989). Changes in legislation in Britain, beginning with the Protection of Birds Act (1954), reduced the number of ways in which Greylag Geese could be taken or shot and made the sale of dead geese illegal. At the same time, a national network of protected roosts was becoming established, and Greylag Geese began to take advantage of the higher quality forage available on improved grasslands and, more recently, on autumn-sown cereals. These changes occurred largely concurrently, and the net effect was to reduce winter mortality, thereby increasing the population size.

During the 1990s, however, there was a steady decline in numbers to c. 80,000 birds, although this now appears to have levelled off (Hearn 2002). This decline is believed to have been driven largely by unsustainable hunting levels in Iceland (Mitchell & Sigfússon 1999), although the contribution of other factors is poorly understood. As a result, this population has been placed on the Red List of Icelandic Birds (classified as Vulnerable, following 1994 IUCN criteria) (Anonymous 2000).

1.3.5.2 Productivity

Despite the periods of change in abundance, there appears to have been little long-term change in reproductive success (Fig. 3), although as over 70% of the variation in reproductive success is related to meteorological variables on the wintering grounds in spring prior to departure and on the nesting grounds (Fox *et al.* 1989) there is much variation between years. Between 1960 and 1999, the proportion of first-winter birds varied between 45.5% and 5.9% (mean 19.9%, 1.34 s.e.) (Fig. 3). Although there was a significant negative trend during this period ($R^2 = 0.18$, $F_{1,38} = 8.4$, $P < 0.01$), prior to 1970 sample sizes were small (often fewer than 1,000 birds aged), and, since that year, the proportion of young has varied much less, between 33.0% and 7.6% (mean 17.9%, 1.11 s.e.). In this period there was no significant trend ($R^2 = 0.01$, $F_{1,28} = 0.4$, $P = 0.55$).

During these periods, the mean brood size of successful parents varied between 3.9 and 1.3 first-winter birds (1960–99; mean 2.4, 0.08 s.e.) and 2.9 and 1.5 (1970–99; mean 2.3, 0.06 s.e.) (Fig. 3).

In Iceland, studies of changes in brood size during the rearing period in 1987 and 1988 showed a substantial decrease from the average clutch size to the average brood size during the first period (post-hatching), but no subsequent decrease in older broods (pre-fledging and pre-migration) (Patterson & Giroux 1990). In 1987, post-migration broods in Scotland were significantly smaller than the pre-migration broods in Iceland, but not 1988. In 1987 there was also a significant difference in pre-migration brood size between northeast (where farmers frequently remove partial clutches for consumption) and south Iceland. Loose crèches were also observed and typically contained four broods.

1.3.5.3 Hunting mortality

Hunting bag estimates from Iceland show that Greylag Geese are by far the most frequently shot species of goose there. Based upon autumn counts from Britain, annual bags amount to approximately one third of the post-breeding population (Fig. 4a), although see Frederiksen *et al.* (2004). First-winter birds form a far greater proportion of the bag than they do of the whole population (Fig. 4b), although the timing of field assessments mean that this difference is likely to be less than suggested by available data. Between 1995/96 and 1999/2000, the proportion in the Icelandic bag varied from 0.37 to 0.41 (mean 0.39, < 0.01 s.e.), compared to 0.12–0.20 (mean 0.16, 0.02 s.e.) in autumn flocks.

In Britain, crude estimates of bag size suggest that around 15,000–25,000 Greylag Geese are shot each year (Reynolds & Harradine 1994, 1996). This is supported by a more recent estimate of 20,000–25,000 produced using Icelandic bag statistics, ring recoveries and population models (Frederiksen 2003).

1.3.5.4 Survival

Crude estimates of mean survival can be derived from census data and age ratios, following the method of Ogilvie & Boyd (1976); this method was also used by Fox *et al.* (1989) and Rowcliffe *et al.* (2000). These show that annual survival varies considerably between years, and overall mean estimates for each 10-year period since 1960 (Table 1) suggest that survival was highest during the 1970s and 1980s and lowest during the 1990s.

Figure 2. The number of Iceland Greylag Geese counted during autumn censuses, 1960/61–1999/2000

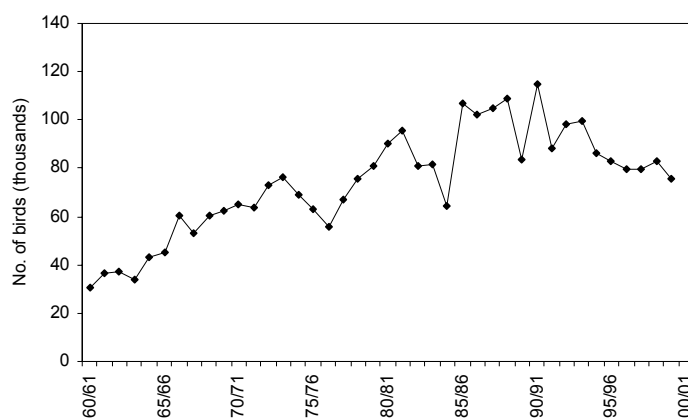


Figure 3. The proportion of first-winter birds (bars) and mean brood size (dots) of Iceland Greylag Geese, 1960/61–1999/2000. Note: no brood size data were collected in 1986 or 1987

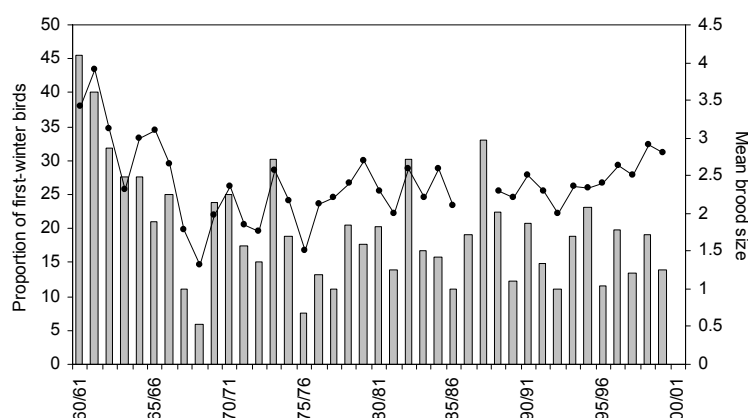


Figure 4a. The total numbers of Greylag Geese shot in Iceland, 1995/96–1999/2000

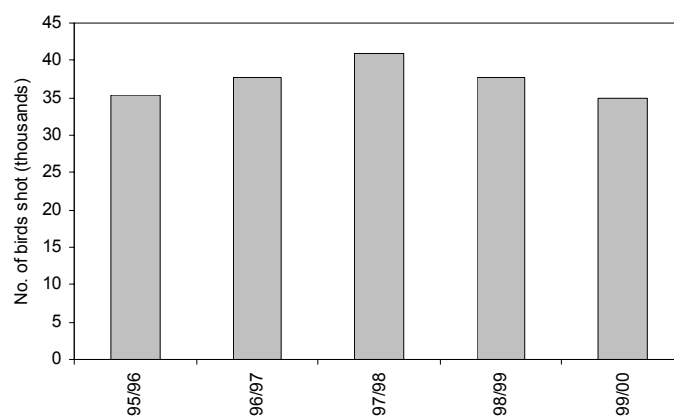


Figure 4b. The proportion of different age classes (black – juveniles; grey – adults) in the Greylag Goose bag in Iceland, 1995/96–1999/2000

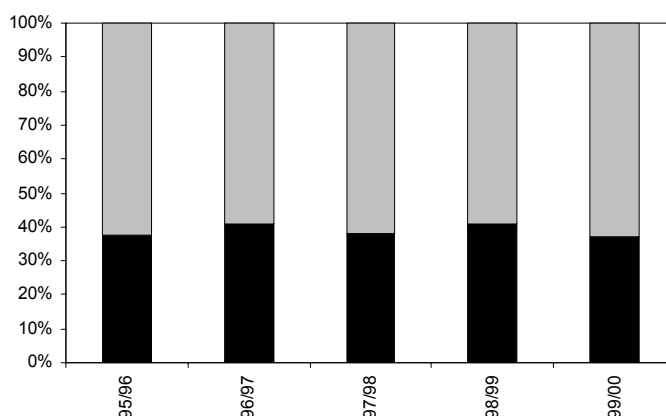


Table 1. Mean crude survival rates of Iceland Grey Lag Geese, 1960–1999.

Period	Mean	s.e.
1960–69	0.83	0.04
1970–79	0.86	0.03
1980–89	0.85	0.08
1990–99	0.81	0.03

This corresponds well with the observed population trend, but some basic problems with the data used to calculate individual annual survival estimates are highlighted by these analyses, as in four years (1967, 1976, 1984 and 1989) there is a survival rate of >1 . This could have been caused by a low population estimate in those years, or a high population estimate or low productivity estimate in the following year. In each of these years, however, the population estimate was considered to be low because of poor conditions encountered during the census. Adjusted population estimates for these years were calculated by Rowcliffe *et al.* (2000) (Fig. 5) and, using these figures, small decreases in survival were suggested by the data during the 1960s and 1980s (Table 2). It is possible, however, that similar anomalies exist in other years when survival is <1 , but these are harder to detect as the derived survival estimate is theoretically possible.

Table 2. Mean survival rates of Iceland Grey Lag Geese, 1960–1999, using adjusted population estimates from Rowcliffe *et al.* (2000).

Period	Mean	s.e.
1960–69	0.82	0.04
1970–79	0.86	0.03
1980–89	0.83	0.04
1990–99	0.81	0.03

Regardless of these adjustments, however, there are further problems associated with survival estimates calculated in this way. These arise because of elementary difficulties in monitoring certain population parameters of Iceland Grey Lag Geese. These are discussed further in section 1.3.5.5, but in order to overcome some of the effects of these problems in future modelling an independent set of survival estimates was calculated by Frederiksen *et al.* (2004) using re-encounters of colour-marked individuals and recoveries of dead birds.

Both seasonal and annual survival were estimated for the period 1992–2000, although first-winter survival for the summer-to-autumn interval was possible only for the period 1996–2000, when ringing took place in Iceland.

First-winter survival from ringing until arrival in Britain (summer-to-autumn interval) varied considerably among years, from 0.51 in 1999 to 0.78 in 2000; mean survival was 0.636 (95% C.L. 0.555–0.710). Adult survival over the same interval varied from 0.75 in 1994 to 0.92 in 2000, with a mean of 0.827 (95% C.L. 0.801–0.849). The mean for 1996–2000 was 0.844 (95% C.L. 0.816–0.868). During the autumn-to-spring interval, first-winter survival ranged between 0.54 in 1992/93 and 0.80 in 2000/01. Mean survival for the entire study was 0.695 (95% C.L. 0.647–0.739) and 0.748 (95% C.L. 0.701–0.790) for 1996–2000. Adult overwinter survival varied from 0.73 in 1992/93 to 0.90 in 2000/01, with a mean of 0.833 (95% C.L. 0.805–0.858); the 1996–2000 mean was 0.869 (95% C.L. 0.842–0.892). Survival during spring to summer was constant for all ages at 0.991 (95% C.L. 0.985–0.995) (Fig. 6).

Frederiksen *et al.* (2004) also calculated annual survival from summer to summer and autumn to autumn, with surprisingly different patterns (Fig. 7). Survival from summer to summer was apparently more variable than from autumn to autumn. First-year survival varied from 0.34 in 1999/2000 to 0.62 in 2000/01, with a mean of 0.472 (95% C.L. 0.408–0.536). First-winter autumn-to-autumn survival varied from 0.46 in 1992/93 to 0.64 in 1997/98, with a mean of 0.569 (95% C.L. 0.528–0.610); the 1996–2000 mean was 0.626 (95% C.L. 0.583–0.667). Annual adult survival varied from 0.62 to 0.75 when calculated from autumn to autumn and from 0.57 to 0.82 when calculated from summer to summer. The mean for all years was 0.683 (95% C.L. 0.652–0.712), and the 1996–2000 mean was 0.727 (95% C.L. 0.695–0.757).

Figure 5. Annual counts, adjusted to bring survival estimates within realistic bounds, plotted against counts prior to adjustment. The diagonal line indicates no adjustment to the counts. The four years in which significant adjustments were required are indicated (o). From Rowcliffe *et al.* (2000). Reproduced with permission from J. M. Rowcliffe

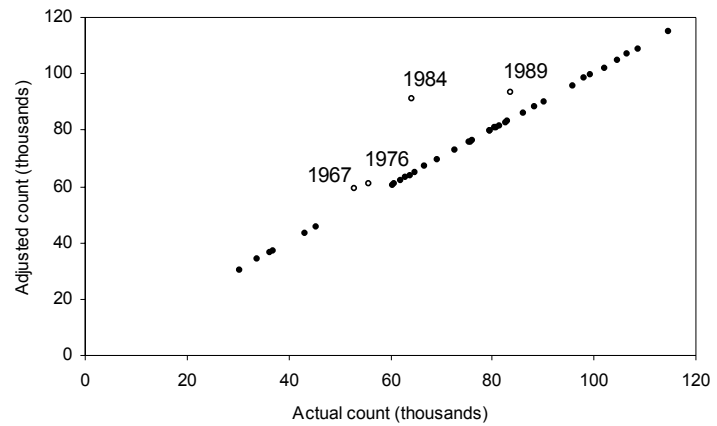


Figure 6a. Summer-to-autumn survival of Iceland Grey Lag Geese (estimates are shown with 95% confidence limits) (triangles – adults; squares – juveniles). Reproduced with permission from Frederiksen *et al.* (2004)

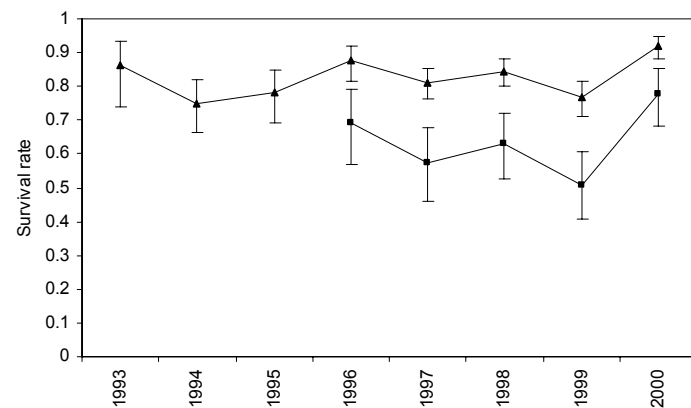


Figure 6b. Autumn-to-spring survival of Iceland Grey Lag Geese (estimates are shown with 95% confidence limits) (triangles – adults; squares – juveniles). Reproduced with permission from Frederiksen *et al.* (2004)

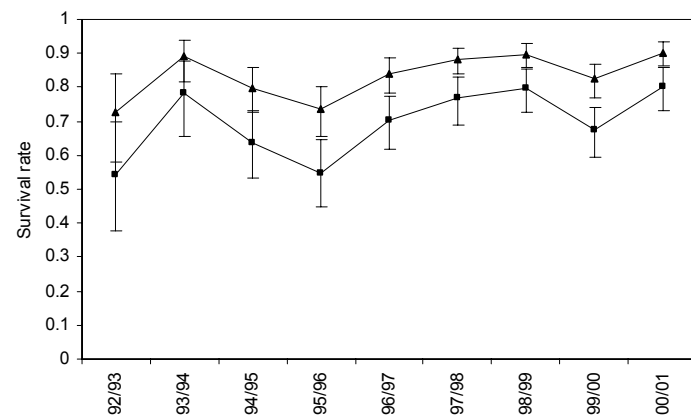


Table 3. Estimates of annual survival of Iceland Greylag Geese. 'First-year survival' denotes survival during the first year after fledging, not survival of first-winter birds ringed in autumn. Method: 'Crude' denotes estimates based on population counts and age ratios in autumn, according to Ogilvie & Boyd (1976); these estimates represent weighted means of adult and first-winter survival. 'Combined' denotes the use of both recovery and resighting data. Table adapted from Frederiksen *et al.* (2004).

Period	Annual survival		Method	Source
	First-year	Adult		
1960–1987		0.82	Crude	Fox <i>et al.</i> (1989)
1960–1997		0.85	Crude	Rowcliffe <i>et al.</i> (2000)
1992–2000		0.82	Crude	WWT unpublished data (from Frederiksen <i>et al.</i> (2004))
1992–2001		0.68	Combined	Frederiksen <i>et al.</i> (2004)
1996–2001	0.47	0.73	Combined	Frederiksen <i>et al.</i> (2004)

1.3.5.5 Population modelling

A number of attempts to model the growth in this population have been carried out (Ogilvie & Boyd 1976, Fox *et al.* 1989, Rowcliffe *et al.* 2000, Frederiksen *et al.* 2004) but the first three of these models used crude survival estimates derived from autumn counts and estimates of productivity, and thus they could only predict continued population growth at the rate described by the autumn counts, since the survival estimates were not independent of the counts (Frederiksen *et al.* 2004).

The survival estimates of Frederiksen *et al.* (2004) are independent of census data, and they can therefore be used to verify the reliability of the population estimates and trends. They were used in conjunction with hunting bag estimates from Iceland to develop a set of population models for the period 1996–2000 that allowed such an independent assessment of population size and trend to be made, consequently enabling the accuracy of current counting effort and the impact of hunting on the population to be assessed.

The models highlighted a number of inconsistencies with the data used. First, the population estimates and Icelandic bag estimates were incompatible, i.e. these measures could not both be correct. The hunting bag estimates suggested a population twice as large as that counted, or vice versa. Further, for the population to remain stable with the estimated survival rate, the proportion of first-winter birds must be greater than recorded, at around 30%.

Frederiksen *et al.* (2004) considered it likely that the proportion of first-winter birds in autumn flocks was underestimated as a result of relatively low detection at this time of year, due primarily to plumage similarities between adults and first-winter birds. This would be compounded further by the removal

of a disproportionate number of first-winter birds by hunters prior to the autumn assessments of age ratio.

Where the discrepancy between population size and hunting bag estimates lies is less clear, as no independent verification of either has been carried out. It is possible that Iceland Greylag Geese occur in areas not currently covered by the autumn census, but it is also possible that the Icelandic hunting bag is currently overestimated. In reality, a combination of smaller errors from both of these sources is most likely, although this remains speculation.

Certainly, the likelihood of Iceland Greylag Geese not being detected as part of the current autumn census has probably increased in recent years as a result of the change in winter distribution that occurred during the 1990s (see section 1.4.3.1). Colour-marking during the 1990s revealed the presence of Icelandic birds in areas outside the area considered to be their traditional range, for example southern Norway and Yorkshire. Whether wintering in these areas is a new development as a result of the recent redistribution or a more established tradition only recently revealed through an increase in colour-marking effort is, however, unknown.

Consequently, some doubt must exist as to whether this population has declined in recent years since this observed trend could be an artefact of an increasing proportion of birds wintering away from traditional sites covered by the autumn census. Rowcliffe *et al.* (2000) investigated this by testing the IGC dataset to determine whether increased dispersion could have accounted for the observed decline during the 1990s. They tested whether (1) there had been an increase in the number of sites holding Greylag Geese, (2) whether individual counts of Greylag Geese had declined, and (3) whether a smaller proportion of the population occurred in large concentrations. The first prediction was supported but the second and third were not, leading Rowcliffe *et al.* (2000) to

conclude that the observed decline was real and not an artefact of increased dispersion. The possibility must remain, however, that some Iceland Greylag Geese are not counted during the autumn census, although it is unlikely that this could account for all of the ‘missing’ birds, based on the models of Frederiksen *et al.* (2004).

Another, and probably more serious, source of error is the overlap in distribution between Icelandic migrants and sedentary Greylag Geese also found in Britain. These populations, in particular the re-established birds now found over much of mainland Britain, have also increased in abundance and distribution in recent years. Consequently, effective monitoring of Iceland Greylag Geese is increasingly hampered by uncertainty about which population Greylag Geese wintering in Britain belong to. In some areas where more than one population is found, mixed flocks are known to occur, making separation almost impossible.

Solutions to these problems must be identified if effective monitoring of Iceland Greylag Geese is to continue. Recommendations to this effect are provided in section 3.

1.4 Annual cycle

1.4.1 Breeding season

1.4.1.1 Range

When breeding, Greylag Geese are found in much of the lowland coastal areas of Iceland (Fig. 8). Key concentrations are found in the Lagarfljót/Úthérad/Hróarstunga area (Norður Múlasýsla), Breiðafjörður (Austur-Barðastrandasýsla/Dalasýsla) and Heraðsvötn (Skagafjarðarsýsla) (see Einarsson 2000).

Within this range, distribution is somewhat patchy because of the birds’ dependence on a combination of secure aquatic and open grassland habitats. In addition, human impacts and Arctic Foxes *Alopex lagopus* have further influenced this distribution: the restricted breeding range that was still evident in the 1950s may have been in part the result of human exploitation during the early part of that century (Einarsson 1983).

The breeding distribution (and population size) began to increase in the early 20th century, particularly from the 1930s onwards, and continued to increase until around 1970. During this time, Greylag Geese spread into several previously

unoccupied parts of the country (Boyd 1959, Rooth 1971). This trend has continued in more recent times (Johannsson & Gudmundsdóttir 1995), however the species remains absent from the northernmost parts of the western fjords, probably due to high densities of Arctic Fox.

In 1948, breeding Greylag Geese became re-established in the Faeroe Islands, after having previously been extirpated by hunters. The origin of this population is most likely to be from released birds, although whether birds from Iceland have also bred here is unknown. The population is now thought to number approximately 200–250 pairs, although island-wide censuses have never been conducted (J.-K. Jensen pers. comm.). Greylag Geese ringed in the Faeroes have been recovered in Scotland and Denmark. They also began to breed in Shetland in 1985, and suggestions have been made that these birds are of Icelandic origin (Pennington 2000), although this has not been proven.

1.4.1.2 Phenology

In typical years, clutch initiation begins in late April, just a few weeks after the birds’ arrival from the wintering grounds, with the majority of pairs beginning to lay around mid-May (Cramp & Simmons 1977). Incubation lasts 27–28 (exceptionally 30) days and soon after hatching, when the young are 10–20 days old and as the adults become flightless, families typically form larger groups, often of several hundred adults and goslings. Goslings fledge after around 50–60 days, usually in the first half of August.

1.4.1.3 Dispersal

Once breeding pairs have settled into their territory, little movement takes place. In most cases, broods are reared close to the original nest site and successful adults also moult in this location. Failed or non-breeders may make short movements at this time of year to more preferred moulting locations (see 1.4.1.6).

1.4.1.4 Habitat

Greylag Geese breed in wetlands where inaccessible swamps, reed beds and lake islets offer security. Most of these areas comprise extensive, open, fresh waters with dense emergent vegetation and ready access to suitable grazing pasture, meadows and wetlands. The geese are also common on many marine islets, however, where freshwater habitats are scarce or even absent.

1.4.1.5 Ecology

During the summer, Iceland Greylag Geese feed in marshes and lake margins and on farmland, including pastures, where plant material that is accessible from the ground or water surface is selected, including roots and tubers, green leaves and stems, flower heads and fruits. The green leaves and other soft material are clipped off with the side of the bill, but pieces from large roots and tubers are scraped off with the terminal nail of the upper mandible. They feed mainly by grazing on land, but also while floating on water by up-ending to pull up submerged material.

The main foods include the roots of *Scirpus*, *Lemna*, *Potamogeton*, *Sparganium*, *Glyceria*, *Equisetum*, *Phragmites*, *Phalaris* and *Leersia*. On farmland, Greylag Geese eat various agricultural grasses, including *Lolium*, *Phleum*, *Poa*, *Festuca* and *Bromus*, and less frequently the leaves, roots, or seed-heads of *Polygonum*, *Stellaria*, *Chenopodium* and other weeds. Other summer foods recorded occasionally include the fruits of *Vaccinium* and *Rubus*, and leaves and shoots of *Eriophorum*.

They also frequent moorland habitats, particularly during the moult and brood-rearing periods. Their diet at these times is, however, poorly known.

1.4.1.6 Moulting migration and moulting areas

Breeding adults moult during the brood-rearing period and therefore most remain close to the original breeding site; the moult typically takes place during July. Failed and non-breeders gather slightly earlier than breeding adults to moult, typically in June and July. There is little evidence of any significant moulting migration in this population, although some large gatherings of moulting non-breeding birds have been recorded in Iceland, although little has been published about them. These include Breiðafjörður, Hunafloi, and Lake Miklavatn (Skagafjörður), where c. 5,000 non-breeders have been recorded (Skarphéðinsson & Guðmundsson 1990), Axarfjörður and the Lagarfljót/Úthérad/Hróarstunga area, where many thousands of birds also occur in some years. Some may migrate to the Faeroes to moult – peak counts typically occur during this period – although this has not been confirmed.

1.4.2 Autumn migration

1.4.2.1 Range

There is little evidence of staging in autumn prior to migration to the wintering grounds, thus the range remains as in the breeding season. Localised redistribution after completion of the moult undoubtedly occurs in some areas, probably in response to local food availability, although this has not been quantified and is likely to be limited.

1.4.2.2 Phenology

Despite the changes in population size and distribution that have occurred during the past 40 years, the timing of the autumn migration has changed little over this period. Iceland Greylag Geese arrive in Britain during October and November, with peak arrivals in mid to late October. Exceptionally, some birds may arrive as early as late September (Thom 1986) and certainly very few remain in Iceland by the beginning of November (Boyd & Ogilvie 1972, H.W. Stefánsson pers. comm.). The majority make their first stop at one of a small number of key arrival sites, where their appearance can be quite marked. For example, 36,525 were counted at Dinnet Lochs in October 1995 (Mitchell 1996), representing some 44% of the peak count that year and the largest recorded concentration of this population. Other key arrival points include a number of sites in the Moray Basin, particularly Loch Eye, near Tain.

Numbers continue to build in early November so that almost the whole population is present by the middle of that month. In some years the arrival takes place earlier, and almost the entire population has reached Britain by the first autumn census in mid-October. Such arrivals took place in three years (1992, 1998 and, to a lesser extent, in 1993) during the 1990s (see WWT reports).

1.4.2.3 Dispersal

Post-migration dispersal is described in section 1.4.3.3.

1.4.2.4 Habitat

As the migration takes place without the use of any staging areas, no specific habitats are used at this time. Post-migration habitat use is described in section 1.4.3.4.

1.4.2.5 Ecology

Studies have not been made of the migration from Iceland to wintering locations. Thus, it is not known at what height, for how long or in what direction Iceland Greylag Geese make this flight.

Furthermore, it is not known whether all birds use traditional arrival sites in Scotland or whether some fly directly to their wintering sites.

1.4.3 Winter

1.4.3.1 Range

Iceland Greylag Geese winter primarily in Scotland and are found most commonly in the north, northeast and east-central regions, with others in the south and southwest. Smaller numbers also occur in northern England, Ireland, southern Norway, the Faeroes and Iceland. They may have once also frequented parts of Wales (Boyd 1963), although the origin of these birds is unknown and they had disappeared by the late 1950s (Boyd 1959). Their status in some areas, notably the far north and southwest of Scotland and much of northern England and Ireland, is confused by the proximity of birds from the northwest Scotland or re-established populations (see 1.3.5.5).

Knowledge of the winter distribution of Iceland Greylag Geese is biased towards the autumn, as few censuses have been conducted outside this period. It is clear, however, that the present winter distribution has changed markedly over the past 40 years. During the late 1950s, most of the population was found in the southern half of Scotland (Boyd 1959), between Dumfries & Galloway and Angus. The distribution in England was still limited, but birds were also found at a number of sites around Morecambe Bay. By 1970, a clear redistribution northwards was becoming evident (Boyd & Ogilvie 1972), although not all regions fitted this general pattern. By the mid-1980s, the population had shown marked changes in its regional distribution (Owen *et al.* 1986b), with the proportion of the population in the former stronghold of east-central Scotland declining from c. 60% in the 1960s to 30–40%, despite a notable increase in overall population size during this period (Fig. 9).

As the importance of east-central Scotland decreased, the numbers of geese in north and northeast Scotland increased significantly. Several principal autumn roosts in these regions are now far more important than they were in former times (e.g. Dinnet Lochs, Loch of Skene, Loch Eye) in terms of

both actual numbers and the proportion of the total population they support.

This redistribution northwards has continued to the present day, however, so that now the sites in northeast Scotland that formally gained importance during the withdrawal from east-central areas have themselves begun to support fewer birds. In contrast, the number of birds in Orkney has increased markedly, from c. 3,000 in the early 1990s to a peak of 20,475 in 1999/2000 (27% of the November census total) (Hearn 2000).

In Ireland, numbers fluctuated considerably during the 20th century, reaching peaks of up to 5,000–6,000 during the 1940s (Merne 1986) and the 1990s (Colhoun 2001). The distribution during these two peak periods changed significantly, however: most birds were found in Wexford during the 1940s but are now concentrated at more northerly sites, such as Lough Swilly in Donegal and Stabannan/Braganstown in Louth.

Few Greylag Geese remain in Iceland during the winter. Christmas counts reveal that c. 500 birds have been present most winters over the past 10–15 years. These are found mainly in and around Reykjavík, with the majority at Lake Tjörninn, in central Reykjavík. Smaller numbers occur on the Reykjanes Peninsula, just south of the capital city and, more recently, up to 116 were counted at Hafnarfjörður - Álftanes, just outside Reykjavík. In 1998, Greylag Geese were recorded from a total of 12 locations during the Christmas count. Away from Reykjavík, 'a few tens' of birds were reported from Þykkvibær, near Hella in coastal Rangárvallasýsla.

Recently, it has become apparent that small numbers of Iceland Greylag Geese are present in Norway during the winter on a regular basis. Since 1999/2000, sightings of at least 16 birds marked in Iceland and Scotland have been made there, mainly in a wintering flock of up to 600 in the Jæren/Lista area of Rogaland, southern Norway (A. Follestad pers. comm.). Small flocks are also found during winter elsewhere in coastal Norway and it is possible that these may also be part of the Iceland population.

Figure 7a. Annual summer-to-summer survival of Iceland Grey Lag Geese (estimates are shown with 95% confidence limits) (triangles – adults; squares – juveniles). From Frederiksen *et al.* (2004). Reproduced with permission from Frederiksen *et al.* (2004)

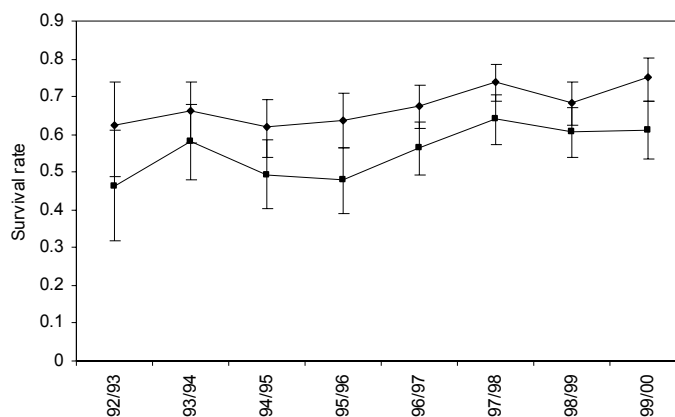


Figure 7b. Annual autumn-to-autumn survival of Iceland Grey Lag Geese (estimates are shown with 95% confidence limits). Reproduced with permission from Frederiksen *et al.* (2004).

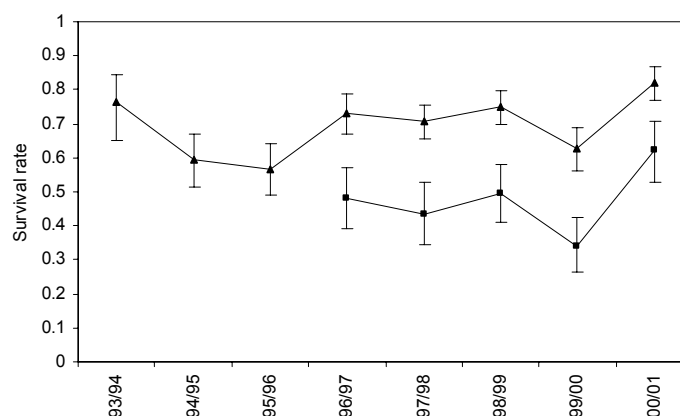


Figure 8. The breeding distribution of Greylag Geese in Iceland based on a 10-km grid (filled circles – confirmed or probable breeding; open circles – old (>20 years) breeding or irregular breeding) (data from the forthcoming Icelandic Breeding Bird Atlas; map reproduced with permission from K.H. Skarphéðinsson)

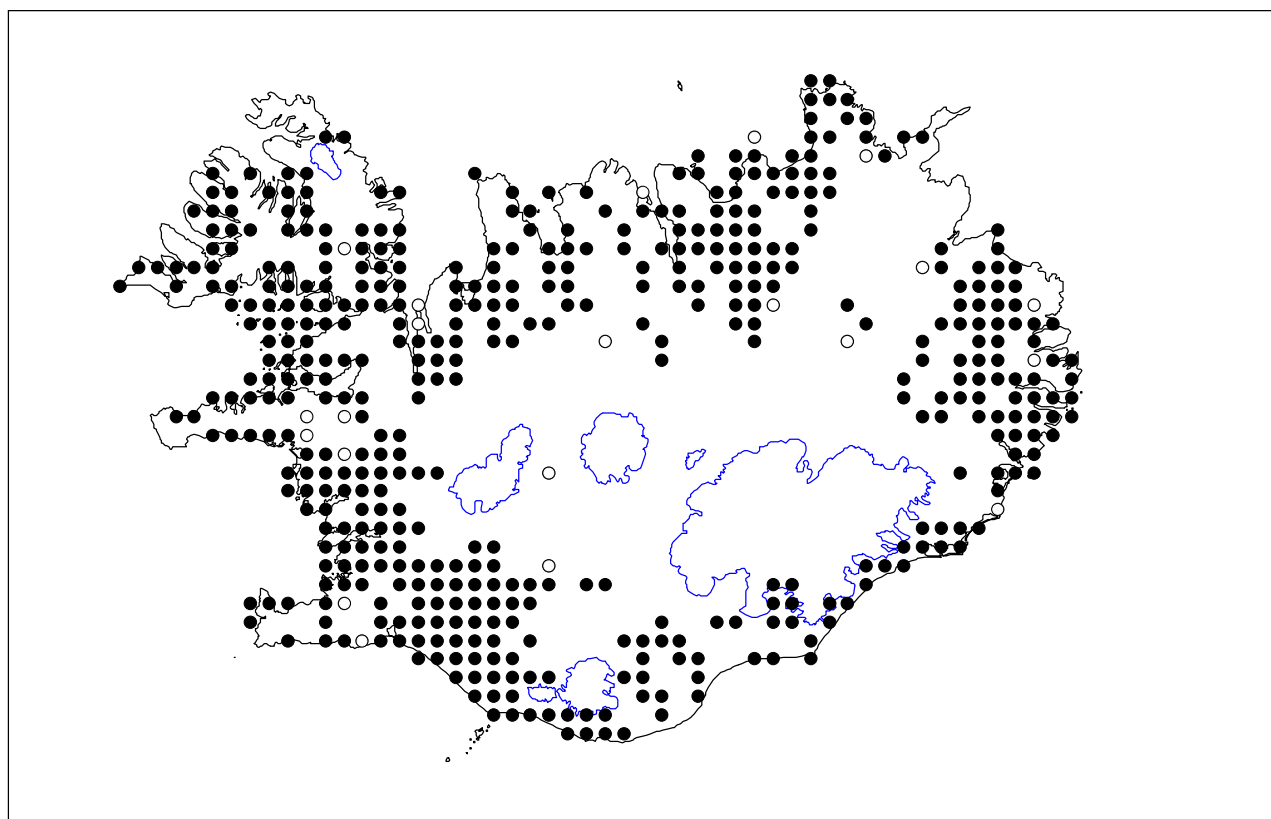
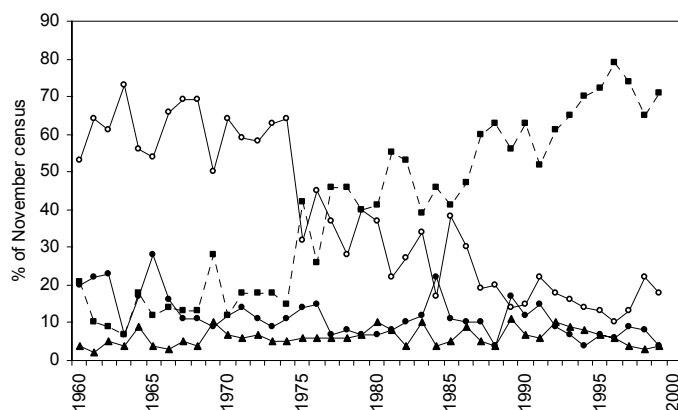


Figure 9. The proportion (%) of the Iceland Greylag Goose population in different parts of Britain between 1960 and 1999, based on the annual November count: East-central Scotland (○), North Scotland (■), Southeast Scotland (▲) and Southwest Scotland (●) (southwest Scotland contains a few sites in northwest England, and southeast Scotland contains a few sites in northeast England). Updated version of figure 8.6, Mitchell & Sigfússon (1999)



In winter 1999/2000, an exceptional number of Greylag Geese were found in Norway. Several thousand birds were thought to be present along the whole coastline and, while there is no proof that these were Icelandic birds, this is thought to be extremely likely (A. Follestad pers. comm.).

Greylag Geese have been known to winter in Norway since at least the mid-1980s (Nygård *et al.* 1988), and the sudden increase in observations of marked birds since 1999/2000 is thought to be a reflection of the increase in marked birds among the Iceland population around this time, rather than the development of a new wintering location. The Norwegian breeding population of Greylag Geese numbers some 7,000–10,000 pairs (Follestad 1994), and up to 22,000 non-breeding birds moult there (Follestad *et al.* 1988). Yet despite more than 2,700 birds having been marked there by the end of 2000 (A. Follestad pers. comm.), none of these birds have been seen near Jæren/Lista later than 26 November. The Jæren/Lista wintering flock is present from early winter through until March/April.

In the Faeroe Islands, many small flocks of Greylag Geese can be found around the islands during the winter; the total is estimated at around 750–1,000 birds (J.-K. Jensen pers. comm.). Many of these are certainly Faeroese, but some may be Icelandic. The number present varies considerably from year to year; they were particularly numerous in 1999/2000.

1.4.3.2 Phenology

The timing of arrival at the wintering grounds is described in 1.4.2.2 and the departure in 1.4.4.2.

1.4.3.3 Dispersal

In east-central Scotland, detailed studies during the mid-1990s detected little discernible passage during either the autumn or spring (Bell & Newton 1995). Resightings of individually marked birds during the 1990s, however, show that after arrival in Britain there is considerable and rapid onward dispersal into traditional winter haunts by many individuals (Swann & Brockway 2002, Swann *et al.* in press). For birds arriving around the Moray Firth, where many have been captured during the autumn, this has tended to be a southerly and easterly movement into favoured areas such as Aberdeenshire and Perthshire, with smaller numbers moving southwest to regions such as Dumfries and Galloway, Ayrshire and Ireland. More recently, there has also been an increasing tendency to move north into Caithness and Orkney at this time of year, a development that has coincided with a large-scale shift in distribution,

notably to Orkney. For some birds, this northerly movement seems rather temporary, as a more gradual movement south then follows as winter progresses (Swann *et al.* in press).

By mid-winter, the geese have dispersed throughout their wintering range. At this time, the amount of movement decreases and tends to be more localised (Swann *et al.* in press) as birds search for suitable foraging areas and move between these and roosting sites. More widespread movements at this time of year tend to be associated either with periods of harsh weather or the depletion of food resources. This latter aspect can be particularly noticeable in years with high grain abundance in stubble fields, when Greylag Geese may remain closer to arrival areas for longer, until such food resources have been exhausted. Harsh weather conditions may cause more rapid movements at this time, although Greylag Geese are able to withstand periods of snow cover by grubbing through the snow to gain access to food resources (R.L. Swann pers. comm.). Consequently, whether or not harsh weather causes Greylag Geese to disperse may vary according to other factors, principally food abundance.

By the spring, some birds are still rather mobile and others move back to northern Scotland prior to departure for Iceland. It seems from sightings of colour-marked birds, however, that the majority of individuals depart for Iceland direct from their final wintering location, rather than moving north through Britain beforehand (Swann & Brockway 2002).

Thus, it would seem that more than one wintering strategy exists within the population, although this is not fully understood. Preliminary analyses of colour-mark resightings suggest that individual birds are likely to remain faithful to their own particular strategy. A proportion of the population shows a high degree of between-year site fidelity to a particular location, or a small number of proximate ones. Other birds seem to visit a large number of sites, although they may be equally site-faithful to them. A third group does not appear to be particularly faithful to specific wintering areas between years: of 120 individuals seen in one midwinter period, 41% had relocated to a different location in mid-winter of the subsequent year (Swann & Brockway 2002).

1.4.3.4 Habitat

The original winter habitat of Greylag Geese is thought predominantly to have been coastal *Scirpus* beds (Owen 1976). This habitat is likely to have been found on most British estuaries, as well as at the

Wexford Slobs, another former stronghold for this species. Little of this habitat remains in Britain today, however, and, in addition, the inland fens and marshes that were also former strongholds have now largely been drained for agriculture.

Increasingly, from the end of the 19th century, the species has moved inland to feed on arable farmland and improved pastures, taking advantage of reservoirs and other freshwater bodies, as well as estuaries, for roosting (Owen *et al.* 1986a). Some use of natural food sources was still being made in the mid-20th century (Kear 1963), although by then almost all foraging occurred on agricultural lands.

1.4.3.5 Ecology

The winter feeding ecology of Iceland Greylag Geese shares many similarities with that of the closely related Pink-footed Goose. Yet whilst there is a positive correlation between the ranges of these two species at larger spatial scales (Bell & Rees 1994), at finer scales more subtle differences in their ecology and behaviour limit interspecific competition, although Greylag Geese are dominant over Pink-footed Geese in conflicts for food (Kear 1963).

Today, Greylag Geese utilise a wide range of agricultural food types, many of which are of economic value to farmers. The diet changes seasonally, driven largely by temporal changes in the availability of different habitats and crop types (e.g. Stenhouse 1996). Upon arrival, cereal stubbles are used almost exclusively during the autumn (e.g. Stenhouse 1996), with birds switching to winter cereals and improved grasslands from November onwards. At varying points in the winter, depending on the availability of these and other foods, Greylag Geese may utilise root crops such as potatoes, carrots and, in particular, turnips. This often occurs when other foods are scarce, such as during periods of snow (Newton & Campbell 1973, Stenhouse 1996), although in some areas turnips were positively selected (Stenhouse 1993) and carrots were strongly favoured at any time (Owen 1990). In spring, sown grass and, to a lesser extent, permanent pasture and winter-sown cereals are the most important food resources.

Most foraging occurs during the daytime; at Loch Leven, no more than 6% of foraging was undertaken at night (Newton & Campbell 1973). Greylag Goose feeding flocks tend to be smaller than those of Pink-footed Geese, although in key areas they can still number several thousand individuals. Temporal patterns in flock size are difficult to determine from the available literature: at Loch Leven, most flocks contained 21–100 birds during October and the

spring and 101–500 during mid-winter (Newton & Campbell 1973). In contrast, flocks in the Moray Firth were larger during the autumn and spring, dipping during mid-winter (Stenhouse 1993). Differences in the location of these two areas, and the phenology of birds there, may account for such observed differences in flock dynamics.

Feeding distribution is determined by a number of factors. Key to distribution is the proximity of suitable roost sites. Most studies report that Greylag Geese feed closer to the roost than do Pink-footed Geese (e.g. Boyd & Ogilvie 1972). Newton *et al.* (1973) found 90% of feeding Greylag Geese within 5 km of the roost and only 2% more than 10 km away (compared to 66% and 15% for Pink-footed Geese). Bell (1988), however, found that Greylag fed further from the roost than Pink-footed Geese; 68% were between 8 km and 22 km away (median 10.7 km) compared to 82% of Pink-footed Geese found within 8 km (median 4 km). Certainly, when conditions are favourable Greylag Geese may travel up to 35 km from the roost in search of food (Bell 1988 pers. obs.). As winter progresses, birds forage closer to the roost. Bell (1988) reported a median distance of 12.3 km in September–November, 10.0 km in December–February and 5.7 km in March–April.

In addition, Greylag Geese show a strong preference for large, open fields that offer a clear view of potential predators (Newton *et al.* 1973, Stenhouse 1996), although smaller fields may be used in mid-winter (Stenhouse 1993). They are also more tolerant of disturbance, both at the roost and at feeding areas, than are Pink-footed Geese (see Bell *et al.* 1997). Roads influence the distribution greatly: geese in northeast Scotland were not found within 100 m of the nearest road and the median distance was 400 m (Keller 1991).

It appears, therefore, as Bell (1988) suggested, that foraging patterns depend on many factors, such as local feeding conditions, inter-roost distances and the number of birds present, rather than on inherent behavioural responses to the species's ability to commute over long distances on a daily basis. Within this framework, however, distribution is also influenced by the degree of safety offered by suitable feeding locations (Newton *et al.* 1973). This includes environmental factors, such as the topography of the area, and anthropomorphic factors, such as proximity to roads and levels of disturbance. Consequently, only a small proportion of the farmland fields available to geese in an area are actually used each winter (Newton *et al.* 1973). Some studies have shown high fidelity to individual fields. For example, at Loch Leven, 75% of fields in

which geese were seen once held them a second time, and in 90% of those the birds were seen more than twice (Newton & Campbell 1973). This fidelity is often exhibited over a short period of time, resulting in selected fields being used for a period of several successive days rather than randomly throughout the winter, a consequence of the gradual depletion of foodstuffs within the field. Stenhouse (1996), however, found that Greylag Geese around the Moray Firth selected new fields at a steady rate throughout the winter and that very few fields were used more than once. Those that were used more than three times were always adjacent to a roost.

Greylag Geese tend to leave roosts later each morning and return earlier in the evening than do most Pink-footed Geese. Where they share their roost with Pink-footed Geese they tend to remain separated, using different parts of the waterbody (Newton & Campbell 1973, R.D Hearn pers. obs.). Increasingly during the 20th century Greylag Geese have used different roosts altogether, although this was apparently not the case during the 19th century (Newton *et al.* 1973). Greylag Geese are more inclined to roost on ephemeral floodwaters and smaller areas of freshwater than are Pink-footed Geese, particularly during the spring.

1.4.4 Spring migration

1.4.4.1 Range

Immediately after their arrival in Iceland, major concentrations of Greylag Geese are found in the southern lowlands (c. 17–21°W) and at other coastal localities, in particular the Lagarfljót/Úthérad/Hróarstunga area, where up to 10,000 are thought to occur in late April (maximum count 8,330 in 1995, H. W. Stefánsson pers. comm.).

1.4.4.2 Phenology

As with autumn arrival, the timing of spring migration appears to have changed little over the past four decades. Birds at the southern end of the wintering range may start to move north again as early as February, with numbers building to pre-migration peaks in Orkney and Caithness in March (Mitchell *et al.* 1995), although recent evidence from colour-marking has revealed that at least some birds regularly remain as far south as Yorkshire into April. It is possible that such individuals depart directly for Iceland from these southerly wintering areas (Swann *et al.* in press). Departure from Britain tends to be more protracted than the autumn arrival, and Boyd (1959) reported this occurring between mid-March

and April. The earliest arrivals in eastern Iceland are typically recorded in the first week of April, building throughout that month (Fox *et al.* 2000, H. W. Stefánsson pers. comm.), although in some years the first birds are seen in late March.

1.4.4.3 Dispersal

Some local dispersal from arrival sites to breeding locations undoubtedly occurs, given the concentrations at arrival sites in the south and east, however this has not been quantified.

1.4.4.4 Habitat

Prior to movement to the local nesting grounds, Greylag Geese are found in a mixture of stubbles, semi-natural wetlands and intensively managed grasslands containing species such as *Phleum pratense* and *Deschampsia caespitosa* (Fox *et al.* 2000, H.W. Stefánsson pers. comm.).

1.4.4.5 Ecology

No studies of Greylag Goose ecology have been conducted during this phase of the annual cycle, although it is believed that, whilst foraging, the geese select species similar to those given in 1.4.1.5.

1.5 Conservation and management

1.5.1 Legislation and other conservation measures

1.5.1.1 International

Conservation status

Under BirdLife International's Species of European Concern (SPEC) classification (Tucker & Heath 1994), the Greylag Goose is listed as non-SPEC, and its European Threat Status is classified as Secure. This classification system does not recognise biogeographic populations, however, and so does not reflect the status of discrete populations found within the overall range.

Iceland Greylag Geese, and their habitats, are protected by a number of international conventions and directives. Their status under these in each of the three main countries forming the flyway is shown in Table 4.

Habitat protection

The principal legislation for the protection of sites in the European Union is the EC Wild Birds Directive (79/409/EEC), which requires Member States to classify Special Protection Areas (SPAs). In the UK, the SPA suite for Iceland Greylag Goose comprises 22 sites where it has been listed as a qualifying species, supporting on average 57.5% of the biogeographic population (57.0% and 18.2% of the British and Northern Irish populations, respectively) (Stroud *et al.* 2001).

In Britain, 15 Ramsar sites have been designated at least partly for their importance to Iceland Greylag Geese. Today, however, only seven of these continue to support internationally important numbers of this population. Of the 24 sites that support more than 1% of the wintering population (Table 5), 14 are designated as both a Ramsar site and an SPA, and a further three are designated as SPA sites. In Iceland, there are two sites designated as Ramsar sites, but neither of these support Greylag Geese.

Further international site protection is provided through the Convention on the Conservation of European Wildlife and Natural Habitats.

Species protection

The Convention on Migratory Species, and in particular its Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), provides the most comprehensive protection for this population, at least in Britain. AEWA requires Parties to 'take measures to conserve migratory waterbirds, giving special attention to endangered species as well as to those with an unfavourable conservation status'. These measures include research and monitoring activities to identify population status through counts and ringing, monitoring of hunting, and co-operation with other relevant organisations to support such work. There

are further requirements for the implementation of national legislation, single species action plans, habitat conservation, management of human activities, and education and information.

Further international protection of Greylag Geese is provided through the EC Wild Birds Directive and the Convention on the Conservation of European Wildlife and Natural Habitats.

1.5.1.2 Britain and Ireland*Conservation status*

The Iceland Greylag Goose appears on the 'Amber' list of *The Population Status of Birds in the UK* because 50% or more of the UK non-breeding population occurs at 10 or fewer sites, and because 20% or more of the northwest European population occurs in the UK during the non-breeding season (Gregory *et al.* 2002).

It also appears on the 'Amber' list of *The Birds of Conservation Concern in Ireland* because more than 50% of the Irish non-breeding population is found at ten or fewer sites (Newton *et al.* 1999).

Habitat protection

The principal site protection designation in Britain is the Site of Special Scientific Interest (SSSI) and in Northern Ireland the Area of Special Scientific Interest (ASSI), derived from the Wildlife & Countryside Act (1981) and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985, respectively.

National Nature Reserves (NNR) are areas of national and sometimes international importance that are owned or leased by the appropriate statutory conservation body, or bodies leased by them, or are

Table 4. The status of Iceland Greylag Goose under international legislation

	Status	Parties		
		Britain	Ireland	Iceland
Convention on Migratory Species (Bonn Convention)	Appendix II	Yes	Yes	No
African-Eurasian Migratory Waterbird Agreement (AEWA)	B1	Yes	Yes ¹	No
EC Wild Birds Directive (79/409/EEC)	Annex II/1 and Annex III/2	Yes	Yes	No
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)	Appendix III	Yes	Yes	Yes
Convention on Wetlands of International Importance (Ramsar Convention)		Yes	Yes	Yes

¹ Signed but not yet ratified

managed in accordance with Nature Reserve Agreements with landowners and occupiers. Legislative protection for these sites derives from the Wildlife & Countryside Act 1981 and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. Under these provisions, operations likely to damage the nature conservation interest of SSSIs are subject to control. In the Republic of Ireland, site protection is offered under the Wildlife Act 1976.

Sites are largely nocturnal roosts, since most monitoring is carried out at such locations. Feeding areas (especially farmland) are not significantly represented within the protected site network.

Species protection

In Britain, the Iceland Greylag Goose, along with other Greylag Geese, is legal quarry between 1 September and 31 January inclusive (with an extension until 20 February in areas below the high-water mark). Under the Wildlife & Countryside Act (1981) shooting is prohibited between 1 February and 31 August inclusive. Furthermore, the sale of dead geese is prohibited, and this reduces the number shot as it is not possible to exploit this species as a commercial food.

Management options for Greylag Geese have recently been proposed for consideration by the Scottish Executive (Scottish Executive 2000). As this population is finely balanced between long-term increase and long-term decline (Rowcliffe *et al.* 2000), the main recommendation states that 'increased mortality from hunting should be avoided and monitoring of current hunting mortality and population levels should be co-ordinated'.

1.5.1.3 Iceland

Conservation status

The Icelandic population has been placed on the Red List of Icelandic Birds (classified as Vulnerable, following 1994 IUCN criteria) (Anonymous 2000). The species remains legal quarry, however, with hunting permitted from 20 August to 15 March inclusive.

Habitat protection

In Iceland, site protection for Greylag Geese is relatively limited, although they benefit indirectly from the protection of sites for other species under the Nature Conservation Act (e.g. Miklavatn, which is an important area for breeding, non-breeding and moulting Greylag Geese).

Einarsson (2000) lists 10 Important Birds Areas (IBAs) in Iceland for the Greylag Goose. Of these,

four are listed for their breeding population and eight for their non-breeding population (two sites are noted for both), but only two are formally protected in any way. Breiðafjörður is designated as a Marine Conservation Area and is overseen by the independent Breiðafjörður Conservation Committee. A conservation plan has been prepared for the area, and this has been endorsed by the Ministry of the Environment. Miklavatn-Skógar is designated as a Nature Reserve. The remaining eight sites are all currently unprotected.

Species protection

The Act on the Conservation, Protection and Hunting of Wild Birds and Wild Terrestrial Mammals (1994; known as the Bird and Mammal Protection Act) specifies a number of measures that protect Greylag Geese. Although it remains possible to harvest the species, two measures to limit this harvest are in place. Firstly, a close season operates from 16 March to 19 August inclusive, to ensure that fully-grown birds are protected during the breeding season. Secondly, egg collection for personal consumption is limited through a legal requirement to leave at least two eggs in each nest from which some harvest is taken.

Furthermore, the Act also provides for the licensing of hunting in Iceland and, whilst this does not provide direct protection since no controls to limit the number taken are currently in place, it does provide the means to collect valuable data that facilitate effective management, and thus conservation, of this population (see 1.3.4). Certain measures to further restrict the level of harvest may also be enforced through this legislation, if necessary. These include shortening of the hunting season, the closure of specific areas to hunting, the introduction of a bag quota system and the full protection of the species by removing it from the quarry list. In addition, landowners can refuse to permit hunting on their land.

1.5.2 Hunting

1.5.2.1 Britain and Ireland

Goose shooting in Britain and Ireland typically takes the form of either morning or evening 'flights' at birds moving between feeding and roosting sites, or shooting over decoys in feeding areas.

Inland goose shooting, typically over decoys, is usually organised by local Goose Guides, many of whom are affiliated to the BASC, and tends to involve larger parties of clients from outside the local area, including many from abroad. In 1997/98, some

4,150 hunters shot geese on 10,000 hunter days with a Goose Guide in Scotland. Of these hunters, only 1% were from Scotland, 60% were from elsewhere in the UK, 35% from Europe and 4% from the rest of the world. Furthermore, it was estimated that they spent over £2 million in local economies and that Goose Guides make annual payments to landowners of around £200,000 for access to goose shooting (Rayment *et al.* 1998).

In contrast, coastal goose shooting is more typically associated with British hunters, both those from the local area and those travelling from elsewhere within the UK to take advantage of the public right to recreation, including wildfowling, on the Scottish foreshore (Rayment *et al.* 1998). This form of goose hunting is normally free of charge and carried out unaccompanied; it therefore contributes considerably less to the local economy.

Since the only licence currently required by a shooter is the one relating to the ownership of a gun, rather than the right to shoot, there are relatively few reliable figures on the level of participation in wildfowling in Britain, particularly in recent years. In 1981/82, an estimated 580,000 people participated in game, wildfowl and rough shooting, with approximately 160,000 (28%) of these shooting ducks and geese (Harradine 1983). At that time, a BASC membership survey indicated that most goose shooting (almost 70%) took place during January (Harradine 1983). More recently, total expenditure by all shooters in Scotland was estimated to have contributed in the region of £78 million to the Scottish economy in 1989, and supported some 7,212 full time equivalent (FTE) jobs (McGilvray *et al.* 1990).

Whilst it is not currently possible to quantify the contribution of Iceland Greylag Geese to these figures, the vast majority of goose shooting in Britain will involve either this species or Pink-footed Geese, since all other migratory geese in Scotland are protected from hunting during the winter.

1.5.2.2 Iceland

Greylag Geese form by far the largest constituent of the annual goose hunting bag in Iceland (see 1.3.5.3), because of their habit of remaining in the relatively accessible lowland areas for about two months after the start of the hunting season. Consequently they are an important quarry for Icelandic hunters, a small number of whom take a large number of birds each autumn for commercial sale. Most hunters, however, take only a small number for personal consumption. In 1998, more than half of Greylag hunters in Iceland shot only 1–5 geese, whereas 50–60% of the

total bag was taken by the 15% of hunters shooting more than 20 birds. The largest number shot by a single hunter was in excess of 900 birds (Frederiksen 2001).

Although there is currently no limit to the hunting bag and the sale of dead geese is permitted, recent efforts by the Icelandic Wildlife Management Institute to discourage the hunting of Greylag Geese may have accounted for the decrease in numbers shot between 1997 and 1999 (Fig. 4a). There may be a need, however, to implement mandatory restrictions should these measures fail to arrest the long-term decline in this population. These might include a shortening of the open season, restrictions on the number killed or the cessation of the sale of dead geese (A. Sigfússon pers. comm.).

1.5.3 Agricultural conflict

1.5.3.1 Britain and Ireland

In the winter, Iceland Greylag Geese now feed almost exclusively in agricultural habitats. Many of these crops are of economic value and this brings the geese into direct conflict with farmers. Such conflict was already recognised in the early part of the 20th century (Berry 1939), but it was not until the 1960s, following an intensive period of agricultural intensification, that the issue became more serious. There has been no attempt to quantify this, however, and the number of complaints from farmers attributable to Iceland Greylag Geese is largely unknown. A comprehensive review of the literature available on this subject is provided by Kirby *et al.* (1999).

Goose damage appears to be most acute during the spring. On autumn stubbles, waste potatoes and other crops of no value, they do little harm and are generally tolerated by farmers. From mid-winter onwards, however, they increasingly graze improved pastures and winter-sown cereals. Such crops are of value to the farmer as direct sources of income and fodder for livestock. Geese may reduce yields, compete with livestock or cause physical damage to the crop or soil.

The main problem is probably the direct consumption of forage and subsequent reduction in yield. This may reduce the amount of forage available to livestock as well as cause delays in turning livestock out for the spring. In the latter part of April and early May, farm stock are being let out onto specially prepared 'spring bite' grassland, expensively managed and fertilised. Greylag Geese prefer this young grass to older leys and they

congregate on these pastures, in some cases significantly reducing the yield (Patton & Frame 1981). Losses of silage yields can also be significant, at least in economic terms, although not as great as the losses of 'spring bite' (Patton & Frame 1981).

Greylag Geese have also been recorded causing significant losses (up to 50%) in the yield of cereals (Patterson *et al.* 1989). Significant increases in the amount of weeds in grazed fields and uneven ripening of crops where parts of fields have been grazed, causing problems with the timing of harvest, have also been reported in relation to cereal crops (Patterson *et al.* 1989).

Other problems reported in respect of other goose species that may also be applicable to Greylag Geese include reduced stocking densities (due to losses in yield), loss of yield due to late fertiliser application, damage to soil structure and the puddling of ground, although the evidence supporting claims of damage to soil is inconclusive, except where waterlogging occurs (Kirby *et al.* 1999).

Overall, the results of studies examining the effects of goose grazing are highly variable and suggest that goose damage accounts for only 10–45% of the variation in yield loss (Patterson 1991, Kirby *et al.* 1999). Patterson *et al.* (1989) even reported one field where goose grazing caused an increase in the yield of winter barley, although this was regarded as unusual (Kirby *et al.* 1999).

Yields are affected by a complex interaction of factors that influence the response of the vegetation to grazing. These include time of year, type of crop, weather conditions, soil conditions, crop growing conditions, time of grazing, and intensity and stage of plant development.

While farmers have tolerated geese for many years, concern and the number of complaints have been growing, particularly where numbers of geese are high and have shown local increases, such as Orkney. In Scotland, a number of Local Goose Management Schemes (LGMSs) exist in order to manage conflict between geese and farmers. Farmers receive payments as compensation for damage caused by geese to crops. LGMSs provide alternative, non-lethal means of reducing or compensating for goose damage. They exist primarily to manage the conflict between farmers and specially protected goose populations, such as Greenland White-fronted Geese *Anser albifrons flavirostris*. There is a general presumption against introducing schemes for populations not requiring special protection, although such schemes may be appropriate on areas immediately surrounding large,

established roosts, where these form part of properly managed reserves and where significant damage to crops and grass is caused by heavy concentrations of geese on agricultural land.

One such scheme is currently in operation under this principle on farms close to the Loch of Strathbeg (Aberdeenshire); this concerns primarily Pink-footed Geese, although Greylag Geese are also covered by the scheme. A pilot scheme operated there between 1994 and 1997 and had two objectives: (1) to demonstrate that the feeding behaviour of migratory geese could be managed by the provision of refuge areas coupled with a co-ordinated scaring programme; and (2) to demonstrate that farmers in those areas most heavily affected by goose grazing could be persuaded to enter into a management agreement that would help to resolve the conflict.

On this basis, a Goose Management Scheme was approved by the National Goose Management Review Group (NGMRG) in 2002 and 2003. The scheme aimed to reconcile the conservation of the migratory geese using the Loch of Strathbeg with the needs of the farmers in the area by managing the goose population to minimise the economic losses of farmers who suffer goose damage. It operated during the spring within an 87 km² core area around the loch, comprising three management categories – Feeding Zone, Buffer Zone and Scaring – with participants able to apply for compensation under one or more categories.

In 2003, the total allocated to the scheme was £52,250.00. It operated with 20 farmers (of a total of 59 in the scheme area), with 525 ha in the Feeding Zone and 576 ha in the Buffer Zone. These zones supported 175,925 goose days, estimated from dropping counts, or 28.5% of the local roost population in March and 46.5% in April. Payments to farmers in these zones totalled £45,905.98, an average cost of £0.25 per goose day. Participants in the Scaring Zone received a one-off payment, up to the value of £250.00, for the purchase of scaring equipment (with the exception of shotguns or firearms).

Outside the Feeding and Buffer Zones both active and passive scaring are encouraged and spring shooting of the geese is allowed under licence. Sport shooting is also permitted during the open season as this does not coincide with the operational period of the scheme. The scheme has been welcomed by farmers and was over-subscribed in 2003, with applications totalling 1,102 ha and approvals granted for 760 ha. Sixty-three percent of respondents to the evaluation questionnaire believed that the scheme helped keep geese off their other crops and 83%

would offer fields again. For further information see Scottish Natural Heritage (2003).

1.5.3.2 Iceland

In Iceland, most of the complaints from individual farmers are about Greylag Geese, although they are considered unlikely to cause significant agricultural damage (Mitchell & Sigfusson 1999). In the last decade, fewer than 10 licences have been issued

annually to shoot Greylag Geese for the purpose of preventing damage to cultivated land before 1 May. In 1995–1996, the number of licences issued doubled although there was no evidence of increased damage. The interaction of Greylag Geese with agriculture was studied in Iceland by Kear (1967) and Fridriksson *et al.* (1976).

2 SURVEY OF WINTERING AREAS

The following section provides a detailed site-by-site review of the status of Iceland Greylag Geese wintering in Britain. For all sites in this review, the principal source of data was the Goose Census (IGC, see section 1.3.1 for further details). These data have been supplemented by counts made as part of the Wetland Bird Survey (WeBS), a monitoring scheme for non-breeding waterbirds in the UK (see Pollitt *et al.* 2003) and other supplementary counts submitted for this review by volunteer counters and site managers throughout the wintering range. Political or geographically discrete regions containing sites of current or recent importance for wintering Iceland Greylag Geese are considered and split into the following sections:

Background

A brief overview is given of the region's landscape, the availability of suitable habitat for Iceland Greylag Geese found there, and general information on goose monitoring.

Historical status

An overview is given of the status of Iceland Greylag Geese up to 1960, when the current review period begins. Additional information for the period 1960/61–1999/2000 that is not provided elsewhere is also given here.

Internationally important sites

Detailed accounts of internationally important sites are presented (see also Table 5, Fig. 10). Sites are selected using the current threshold for international importance (1,000, Kirby 1995, Rose & Scott 1997, Wetlands International 2002). Each site account contains information on status, site safeguards, habitat, trends, site usage and threats. For definitions of international site safeguards and selection criteria/guidelines used, see Ramsar (1999) for Ramsar sites, Stroud *et al.* (2001) for SPAs and Heath & Evans (2000) for IBAs.

For each site, a figure is presented showing the peak counts recorded in each season since winter 1960/61, and the overall population trend. Years in which no counts were made at a site are highlighted by a circle. Figures illustrating the phenology of use are presented for those sites with adequate data. Columns represent the mean count made in each month between 1995/96 and 1999/2000. Bars represent maximum counts over this period.

Other sites

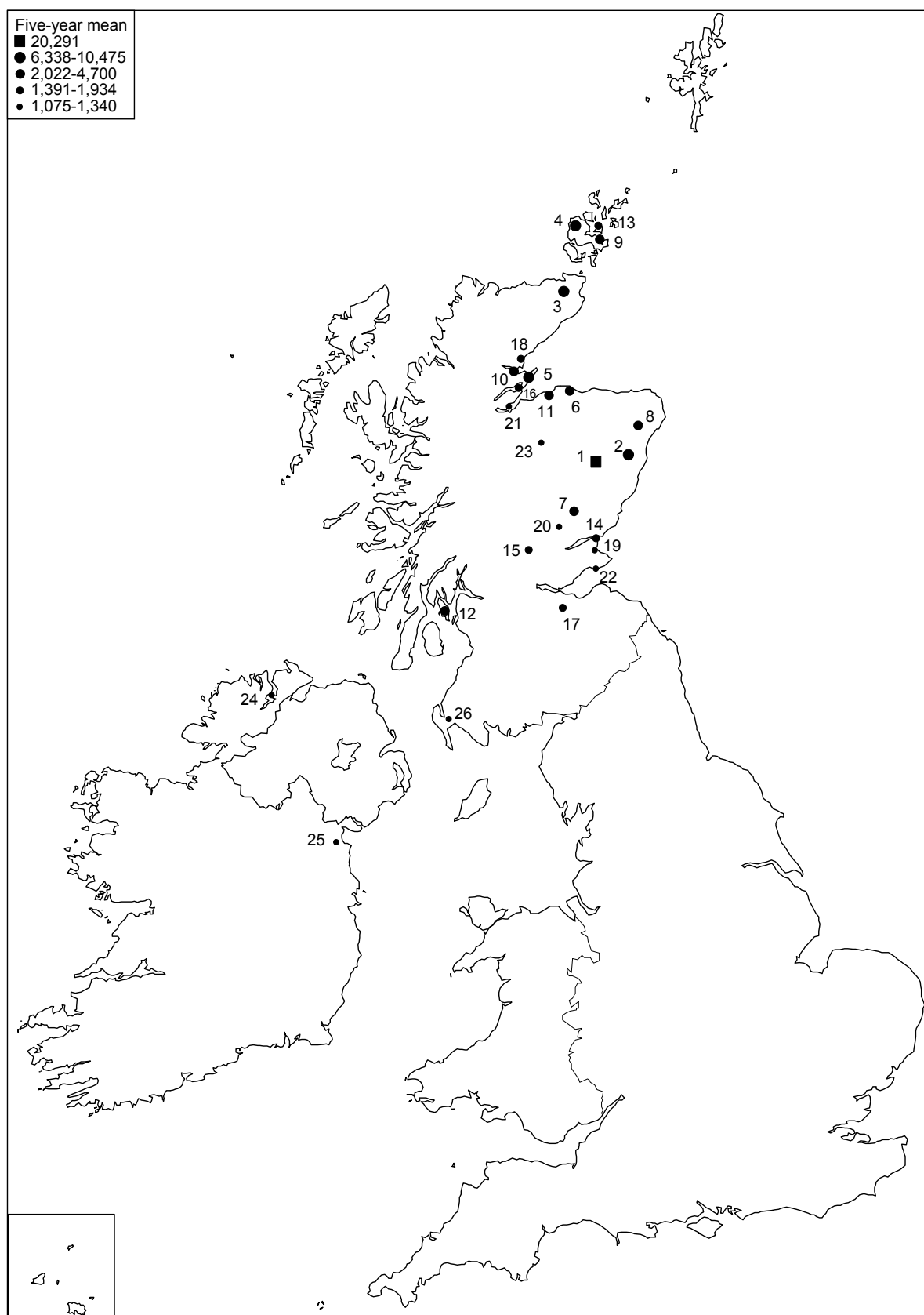
Brief accounts of sites that were previously of international importance but no longer support such numbers, or have supported large numbers for short periods of time, are presented.

Key references

This section lists relevant literature and published monitoring data on Iceland Greylag Geese from each region.

Table 5. Sites of international and national importance for Iceland Greylag Geese in Britain and Ireland (arranged in descending order of importance)

	Site name	5-year mean (1995/96-1999/2000)
1.	Dinnet Lochs	20,291
2.	Loch of Skene	10,475
3.	Caithness Lochs	9,540
4.	West Mainland, Orkney	8,606
5.	Loch Eye	6,338
6.	Loch Spynie	4,700
7.	Loch of Lintrathen	2,930
8.	Haddo House Lochs	2,808
9.	East Mainland, Orkney	2,583
10.	Dornoch Firth	2,397
11.	Findhorn Bay	2,344
12.	Isle of Bute	2,022
13.	Island of Shapinsay, Orkney	1,934
14.	Firth of Tay	1,932
15.	Drummond Loch	1,757
16.	Cromarty Firth	1,508
17.	Threipmuir and Harlaw Reservoirs	1,426
18.	Loch Fleet	1,391
19.	Eden Estuary	1,340
20.	Marlee Loch	1,319
21.	Munlochy Bay	1,299
22.	Kilconquhar Loch	1,247
23.	Lochs Garten and Mallachie	1,240
24.	Lough Swilly	1,218
25.	Stabannan/Braganstown and Dundalk Bay	1,214
26.	Stranraer Lochs	1,075

Figure 10. Internationally and nationally important sites for Greylag Goose in Britain and Ireland (see Table 5 for key to sites)

2.1 Britain

2.1.1 Orkney

2.1.1.1 Background

Orkney is made up of 90 islands, holms and skerries, only a fifth of which have human inhabitants. The islands extend for 74 km from north to south, 61 km from east to west and have a total area of 97,250 ha. The climate is cool and equable, on account of the strong maritime influences. The mean July temperature is 12.8°C and the mean winter temperature is 4°C (Booth *et al.* 1984). Rainfall is variable, with average levels of 90–200 cm. Away from the coastline, the topography consists of low rolling hills, with nowhere outside of Hoy above 300 m. The predominant habitats are rough pasture and more improved grasslands for sheep and cattle grazing and moorland, interspersed with lochs, machair and dune systems.

Because of the large number of waterbodies in Orkney, co-ordinated IGC counts are carried out during the daytime, at feeding sites, rather than at roost sites. Consequently, the importance of individual waterbodies as roost sites is currently poorly understood. The following section consists, therefore, of accounts for key feeding areas, with anecdotal information on principal roost sites where this is available.

2.1.1.2 Historical status

In the early part of the 20th century, the Greylag Goose had never been recorded as more than a casual visitor on migration (Berry 1939). Earlier comments by Baikie & Heddle (1848) and Buckley & Harvie-Brown (1891) (both cited in Booth *et al.* 1984) seemed to support this statement, although Omond (1925) (also cited in Booth *et al.* 1984) considered it to be common in snowy winters during the late 19th century. As recently as the early 1980s, Greylag Geese were still considered a common passage migrant but only a localised winter resident, occurring in small numbers (Booth *et al.* 1984), with a maximum count of 525 in December 1982 at Loch of Harray. During the 1990s, however, the number of wintering birds increased dramatically and more than 20,000 were present in autumn 1999 (Fig. 11).

During the 1990s, co-ordinated counts carried out as part of the IGC revealed that the majority of Greylag Geese occurred in West Mainland. They showed that during 1990–97 an average of 67% of the Greylag Geese in Orkney occurred there, but in the next two

years this proportion fell sharply (Fig. 12). This suggests that West Mainland may be reaching carrying capacity, making conditions elsewhere in Orkney more favourable for newly settling birds. Indeed, whilst numbers at the two other key locations for Greylag Geese in Orkney, East Mainland and Shapinsay, have largely increased in line with the general trend, the proportion occurring away from these three key areas has increased notably since 1997 (Fig. 12).

2.1.1.3 Internationally important sites

i) West Mainland

Five-year mean 95/96–99/2000: 8,606

Site conservation status

SSSI (Lochs of Harray and Stenness)

IBA (Lochs of Harray and Stenness: criteria B1i, C3)

Site description and habitat

A large site comprising a patchwork of improved grasslands and other agricultural habitats, interspersed with numerous waterbodies, and covering the area of Mainland to the west of Kirkwall. The two main waterbodies are Loch of Harray (HY2915), a large (930 ha) and shallow (mean depth 3 m) freshwater loch that becomes brackish at the junction with the Loch of Stenness (HY2812), which is entirely brackish and classed as a lagoon. Both are situated at <10 m asl. Other key waterbodies within this site are Loch of Skail (HY2418), Loch of Boardhouse (HY2725) and Loch of Swannay (HY3128).

Numbers and trends

Peak counts of feeding birds show a rapid increase in numbers during the 1990s, in line with the Orkney trend. At West Mainland this was particularly rapid between 1993/94 and 1997/98 (Fig. 13).

Site use

The lochs and farmland within West Mainland are used for both feeding and roosting. In general, feeding birds select stubbles in the autumn, switching to grassland thereafter.

Within West Mainland, counts of individual waterbodies made predominantly for WeBS give some indication of their importance. The two key sites are Loch of Harray, maximum count of 2,765 in February 1998, and Loch of Skail, maximum of 1,263 in February 1997. The first of these sites typically held 100–300 during the 1970s, increasing to 500–1,000 during the 1980s. Peak counts in the 1990s did not fall below 1,100 and usually occurred during the late winter and spring, although large

numbers were not unusual in the autumn. At the Loch of Skail, counts have been available only since the early 1980s. Numbers there began to increase later than at Harray, and have been consistently around 1,000 since the mid-1990s.

Away from the major roosts of Harray and Skail, the majority of waterbodies on West Mainland have held roosting Greylags, with some approaching international importance. Since the mid-1980s, Loch of Stenness (HY2812), the saline lagoon into which Loch of Harray flows, has supported 300–700, with higher counts occurring more frequently in the most recent years. During 1996/97, three counts over 1,000 were recorded, peaking at 1,210 in March 1997. Mill Dam of Rango (HY2618), between the major roosts of the Loch of Harray and Loch Skail, has supported up to 540 Greylags, although birds roost here very infrequently. The Loch of Clumly (HY2516) has held fluctuating numbers, peaking at 920 in October 1997. Numbers at Loch of Bosquoy (HY3018) show a similar pattern, peaking at 250 in March 1997. Loch of Sabiston (HY2922) has held geese on a more regular basis over the past few years, with 882 present in March 1993. Similarly, Loch of Isbister (HY2523) supports more consistent numbers of Greylags, although the peak count (1,450, November 1996) is considerably greater than the current five-year peak mean (563). In the late 1980s, Loch of Boardhouse (HY2725) had never held more than 60, but now typically holds a winter peak of around 600. Similarly, at the Loch of Hundland (HY2926) and Loch of Swannay (HY3127) five-year peak means are 348 (maximum 902) and 518 (maximum 780) respectively. Away from this cluster of lochs in the northwest of Mainland, the Loch of Kirbister (HY3608) supported roosting Greylag Geese on a number of occasions during the 1990s, with a maximum of 150 in November 1995.

ii) East Mainland

Five-year mean 95/96–99/2000: 2,583

Site conservation status
None

Site description and habitat

A patchwork of improved grassland and other agricultural habitats, interspersed with freshwater lochs and coastal bays.

Numbers and trends

Peak counts of feeding birds during the 1990s show a sudden increase in numbers between 1997 and 1998 (Fig. 14). The key waterbody in East Mainland is the Loch of Tankerness, with a maximum count of

1,400 in March 1997. This site held more than 100 Greylags for the first time as recently as 1986. Since then, the number of roosting birds has increased, with over 700 present for much of the winter during 1996/97–1999/2000.

Site use

Greylag Geese in this area are concentrated on farmland around the Loch of Tankerness and in the Deerness area. The key roost site is the Loch of Tankerness.

iii) Island of Shapinsay

Five-year mean 95/96–99/2000: 1,934

Site conservation status
None

Site description and habitat

A patchwork of improved grassland and other agricultural habitats, interspersed with freshwater lochs.

Numbers and trends

Peak counts of feeding birds show a rapid increase during the 1990s, particularly between 1991/92 and 1996/97, with a peak count of 2,440 in November 1996 (Fig. 15). The status of these Greylag Geese is uncertain, however, with a proportion thought to be re-established.

Site use

The key site on Shapinsay is Mill Dam RSPB reserve and Balfour Mains Pool (HY4717), with a maximum of 1,870 in November 1996. Greylag Geese also roosted at Laird Water (HY5019) on a regular basis throughout the 1990s, with a peak of 780 in February 1991. Feeding birds disperse to farmland throughout Shapinsay, with some birds possibly commuting to East Mainland.

2.1.1.4 Other sites

A number of other islands support Greylag Geese during the winter months.

Hoy and South Walls held up to 190 birds during the 1990s and these birds typically roosted on a small pool, the Loch of Greenhill (ND3189). On South Ronaldsay, roosting Greylag Geese have been recorded at three sites. They occur most frequently at Liddel Loch (ND4583), where they have been recorded at some point during most winters since 1990, with a maximum of 400 in February 1995. Nearby, Graemston Loch (ND4584) held up to 130 during the 1990s and Loch of Lythe (ND4485) up to 356 in January 1998.

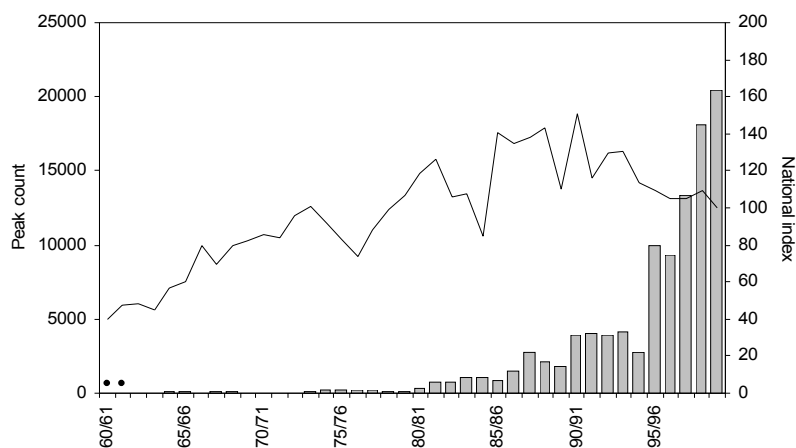


Figure 11. Greylag Geese at Orkney, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

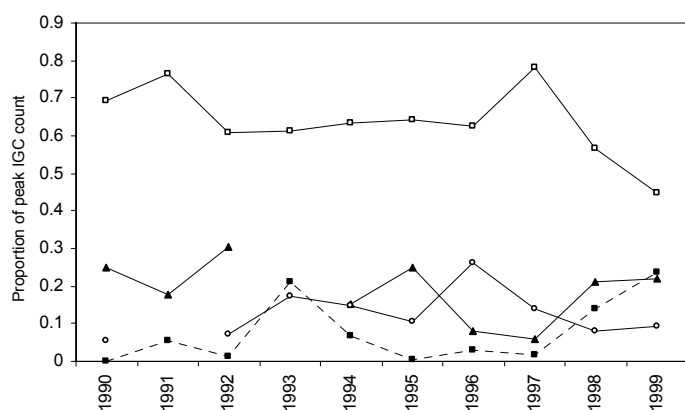


Figure 12. The proportion of Greylag Geese in different areas of Orkney during the peak co-ordinated autumn count, 1990–1999 (West Mainland (□), East Mainland (▲), Shapinsay (○) and elsewhere (■))

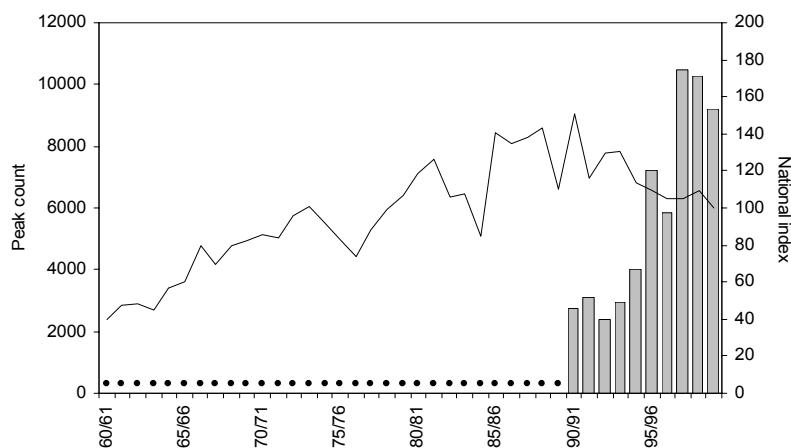


Figure 13. Greylag Geese at West Mainland, Orkney, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

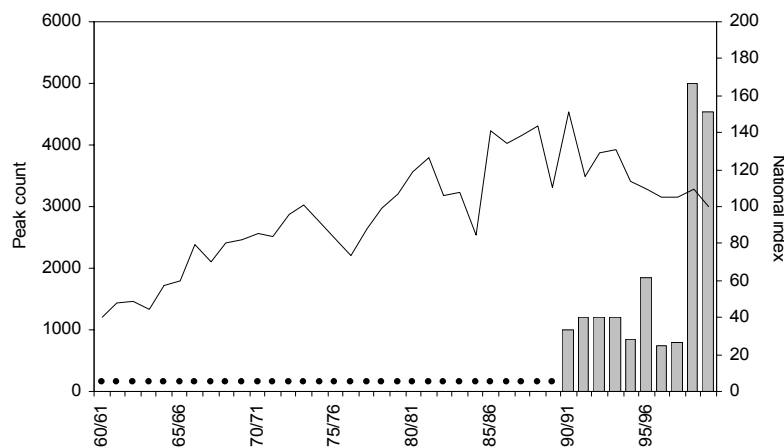


Figure 14. Greylag Geese at East Mainland, Orkney, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

Fewer Greylag Geese are found on the more northerly Orkney Isles. On Westray, roosting birds at the Loch of Saintear (HY4347) peaked at 200 in October 1995. Likewise, on North Ronaldsay fewer than 200 have been counted during field searches. On Sanday, they have been recorded at North Loch (HY7545) and Bea Loch (HY6540), with counts of c. 100 during the 1980s. On Stronsay, several hundred have usually been present each winter in recent years, although a flock of 120 in late winter 1989/90 and a field count of 310 in January 1994 are the only counts greater than 50 held by WWT.

2.1.1.5 Key references

Booth *et al.* (1984)

2.1.2 Caithness and North Highland coast

2.1.2.1 Background

The Caithness lowlands are rich in shallow freshwater lochs, mostly less than 2-m deep and with a fair amount of marginal cover. They are surrounded by fertile farmland, interspersed with areas of moss and bog (Owen *et al.* 1986a).

In this region, co-ordinated IGC counts are carried out in feeding areas during the day, thus the importance of individual waterbodies as roost sites is currently not well known. WeBS data provide some information for these waterbodies, but do not necessarily reflect selection by roosting birds.

2.1.2.2 Historical status

Numbers of wintering Greylag Geese increased greatly during the 1970s and early 1980s (Owen *et al.* 1986a). Prior to 1973, the Caithness and Sutherland breeding population was the sum of the wintering population. Since then, increasing numbers of Icelandic migrants, which had previously only staged in the area before moving to areas further south, have remained for the duration of the winter. However, the majority of birds using the region are still passage migrants.

2.1.2.3 Internationally important sites

i) Caithness Lochs

Five-year mean 95/96–99/2000: 9,540

Site conservation status

SPA (Caithness Lochs: selection stage 1.2)

Ramsar (Caithness Lochs: non-qualifying species)

SSSI (Broubster Leans; Loch of May; Loch Calder; Loch Heilen; Loch of Wester; Loch Scarmclate; Loch Watten)

IBA (Caithness Lochs: criteria A4i, B1i, C3)

Site description and habitat

The numerous freshwater lochs in the Caithness lowlands are ideally positioned to attract Greylag Geese on autumn migration. The lochs are situated in an area of fertile farmland interspersed with tracts of moss and bog; most are shallow, with mean depths of less than 2 m. There are more than a dozen major sites within a span of 30 km, covering an area of about 1,200 ha. The sites, although interrelated, were put into three groups by Owen *et al.* (1986a): the northern group, near Dunnet Bay, consists of Loch Heilen (77 ha), St. Johns Loch (79 ha), the Loch of Mey (25 ha) and the Loch of Bushta (9 ha); the western group, to the south and west of Thurso, is centred on Loch Calder (341 ha) and includes Loch Olginney (36 ha) and the marshes at Broubster and Westfield; and the third group, lying to the south and east of the Wick valley, contains Loch Scarmclate (77 ha), Loch Watten (376 ha), the Loch of Winless (7 ha), the Loch of Wester (45 ha) and Loch Hempriggs (88 ha).

Numbers and trends

In the 1960s, only a few hundred Greylag Geese migrating from Iceland stopped in the Caithness area. Since the mid-1970s, however, an increasing number of geese that previously passed through the area have started to remain for much of the winter, with an average of 4,000–6,000 and a maximum of 12,731 in October 1998 (Fig. 16). The Caithness Lochs site includes counts made at Loch Hempriggs (ND3447), maximum of 591 in April 1997, Loch of Wester (ND3259), maximum of 203 in November 1997, Loch Watten (ND2256), maximum of 4,500 in November 1992, Loch Heilen (ND2568), maximum of 1,600 in December 1987, St Johns Loch (ND272), maximum of 1,200 in December 1980, Loch of Mey (ND2773), maximum of 1,300 in December 1993, Loch Scarmclate (ND1859), maximum of 3,000 in October 1982, Loch Olginney (ND0857), maximum of 1,551 in November 1997, and Loch Calder (ND0760), maximum of 946 in October 1985.

Site use

Birds arrive from late October onwards and numbers peak in November before falling during mid-winter after dispersal. Up to 4,000 are typically present in March during spring migration.

The lochs and farmland within Caithness are used for both feeding and roosting. Feeding birds generally select stubbles in the autumn, switching to grassland thereafter. Key feeding areas include the Wick Valley between Watten and Upper Gillock, the environs of Loch Watten and Loch Scarmclate, Harpsdale and Westfield.

2.1.2.4 Other sites

Killimster Loch (ND3056), a small (11 ha) base-rich loch with a large area of species-rich marginal fen, supported an isolated peak count of 2,500 birds in November 1996. No other data are available to determine the long-term importance of this site.

Caithness lochs frequented by smaller numbers of Greylag Geese include Loch Winless (ND2954), with a maximum of 400 in March 1982, and Loch Banniskirk (ND17567), with 600 in November 1974.

2.1.3 Moray Basin

2.1.3.1 Background

The Moray Basin is enclosed by mountains along its southern and western boundaries, stretching from Brora in the north to Buckie in the east. It includes the drowned river valleys of the Beaully and the inner Moray Firth, the Cromarty Firth and the Dornoch Firth, which together provide important areas for Greylag Geese. All have extensive saltmarsh and intertidal flats of sand and silt, and are surrounded by low-lying arable and pasture land that provide ideal feeding areas for geese.

To the north of the Dornoch Firth lie Loch Fleet and Loch Brora. These sites can also hold reasonable numbers of Iceland Greylag Geese, as well as acting as early autumn gathering areas for northwest Scotland Greylag Geese from Sutherland and Caithness. The narrow coastal strip of mixed farmland nearby is a good feeding area for birds from both of these populations.

Between Inverness and Buckie, in the east, there are several areas where Greylag Geese are found at all times of the winter, most notably around Loch Flemington and Castle Stuart, Findhorn Bay and Loch Spynie. Adjacent to these lochs and bays is an extensive area of mixed agricultural land providing excellent feeding grounds.

A number of reserves have been established in recent years, including an NNR over parts of Nigg Bay and Udale Bay in the Cromarty Firth, an LNR

on Munlochy Bay and Findhorn Bay in the Inner Moray Firth, an SWT reserve on the tidal basin of Loch Fleet, and an RSPB reserve at Nairn and Culbin Bar.

Historical status

In the early part of the 20th century the Greylag Goose was an irregular visitor to the area, with only small flocks seen on migration in autumn, staying as long as the weather was mild (Berry 1939). On the Beaully Firth, however, they increased enormously during the 1920s and early 1930s to become resident throughout the winter, with 'many thousands' present from November to April (Berry 1939). By the mid-1980s, the species was abundant during autumn and winter (Cook 1992), and many roosts, such as Loch Eye, experienced a dramatic increase in numbers during this period.

2.1.3.2 Internationally important sites

i) Loch Eye

Five-year mean 95/96–99/2000: 6,338

Site conservation status

SPA (Loch Eye: selection stage 1.2)

Ramsar (Loch Eye: qualifying criterion 6)

SSSI (Loch Eye)

IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

Loch Eye (NH8379) is positioned midway between the important roost sites of Nigg Bay, on the Cromarty Firth, and the Dornoch Firth. It is a large (165 ha), shallow freshwater loch with a mean depth of just 1.2 m. When conditions are suitable, the bed of the loch is carpeted with prolific growths of *Potamogeton* and other submergent plants. Except for patchy reed-swamp and herbaceous plants, the stony shore is mostly exposed. The surrounding land is a mixture of arable and pasture, with some coniferous and deciduous woodland.

Numbers and trends

Records of Greylag Geese at Loch Eye go back to the late 1950s. Between 1960 and the mid-1970s, the peak count averaged 500–2,000. At the end of the 1970s, however, there was a dramatic increase, rising to a peak of 13,000 in 1977, although this count is not shown in Fig. 17 as the month is unknown. A remarkable 38,000 birds were recorded in November 1981, which remains the highest count recorded at the site and, at the time, represented 39.7% of the total population. Throughout the 1980s, numbers remained high but variable, ranging from 4,000–

16,000 birds. Since the early 1990s, however, a decline has been evident (Fig. 17).

Site use

Despite the importance of the loch in autumn, the number of Greylag Geese using the site drops considerably from late autumn, with fewer than 500 on average from December to March (although no roost counts were available for these months in recent years) (Fig. 18). Nevertheless, sightings of marked birds have shown that there is a high turnover of individual geese throughout the winter and it is therefore apparent that the site remains important for a greater proportion of the population than counts alone would suggest. In addition, the number of birds using Loch Eye does not always represent the total present in the area, as temporary roosts are used increasingly from mid-winter onwards. Use of the area during the spring is variable, but a general increase in numbers is apparent during late March and April, with occasional counts of several thousand birds.

Loch Eye is the preferred roost for Iceland Greylag Geese when they first arrive in the Moray Basin, but they quickly disperse to other roosts nearby. At this time the birds tend to feed on stubbles close to Loch Eye, but by November to mid-December they have dispersed more widely, feeding as far west as Tain, north up to Wilkhaven and south to the Nigg Bay area. Occasionally they may wander as far as Delny, near Invergordon, or Ardross, north of Alness. They may also cross over to the Black Isle and feed in the Cromarty-Udale Bay area, using the latter as a roost. In mid-winter, when they switch to foraging in improved grasslands, they are again found close to Loch Eye and also around North Cadboll and Balaldie. These areas remain important until late spring, with those around Fearn Station and between Tain and Bogbain also becoming important at this time of year.

From early February, Greylag Geese also regularly feed around the inner Cromarty Firth. Up to 500 or more feed on grass fields adjacent to the firth between Dingwall and Maryburgh, or along the River Conon, particularly between Marybank and Arcan Mains (where a high count of 1,000 was made in January 1998). In some years, when there is a great deal of disturbance at the latter sites, these birds may feed on the Black Isle at various sites from Dingwall towards Culbokie. The Glenurquhart Farm-Bannans area, at the north end of the Black Isle, is also occasionally used by a few hundred birds in late winter or spring, depending on levels of disturbance. Birds from here typically roost at Udale Bay.

ii) Loch Spynie

Five-year mean 95/96–99/2000: 4,700

Site conservation status

SPA (Loch Spynie: selection stage 1.2)

Ramsar (Loch Spynie: qualifying criterion 6)

SSSI (Loch Spynie)

IBA (Loch Spynie: criteria A4i, B1i, C3)

Site description and habitat

Loch Spynie (NJ2366) lies between Elgin and Lossiemouth and is surrounded by a mixture of agricultural habitats and forestry plantations. It covers approximately 30 ha, some of which has been encroached upon by reed beds (Owen *et al.* 1986a).

Numbers and trends

An unbroken run of November counts since 1960 demonstrate the increasing importance of the loch over the years. During the period 1960/61–1979/80, there was a stable roosting population of just under 2,000 birds. Since the mid-1980s, this number increased significantly, peaking at 12,000 in October 1989. Throughout the 1990s, peak counts were generally between 3,000 and 7,000 (Fig. 19).

Site use

Numbers are highest in November, dropping to around 2,000 for much of the winter, although a lack of counts in February and March mean that less is known about the use of this site outside of the autumn (Fig. 20).

Throughout the autumn and winter the birds tend to forage in fields within 6–7 km of the loch. At first they concentrate on stubble fields, switching to traditional grass fields and, more recently, abandoned carrot fields during the winter. The main sites are the Ardivot-Salterhill-Silverhill triangle, the fields east of the A941, just south of Lossiemouth, and the fields just east of the River Lossie. In some winters, the areas around Lochhill-Urquhart (northeast of Lhanbryde) and Coeskie (near Garmouth) are also important (e.g. 2,000 in January 1996, 1,100 in January 1998), although it is not known whether these birds roost at Loch Spynie. Similarly, from December to April the area around Miltonduff (southwest of Elgin) and between Pittendreich and Easter Cloves can hold up to 1,000 birds. Although these may roost at Spynie, local farmers indicate that they often remain on locally flooded fields. In spring, the area around Clackmarras is sometimes also used by Greylag Geese (350, March 1997).

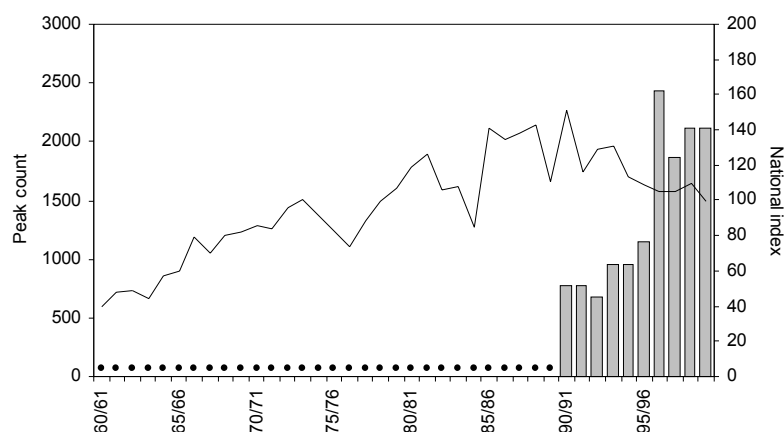


Figure 15. Greylag Geese on Shapinsay, Orkney, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

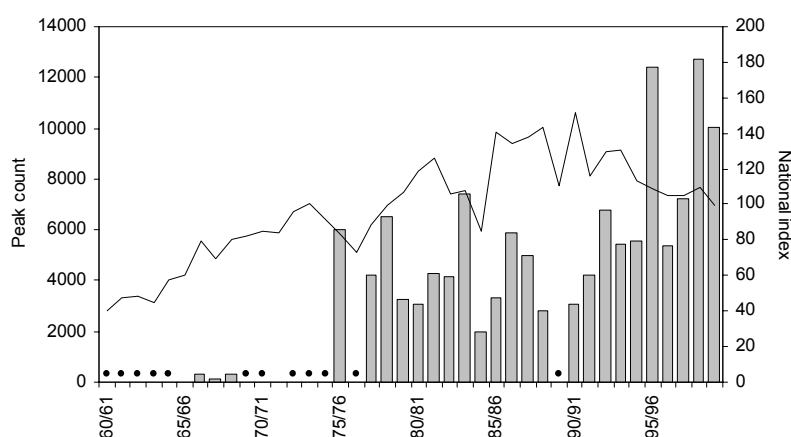


Figure 16. Greylag Geese in Caithness, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

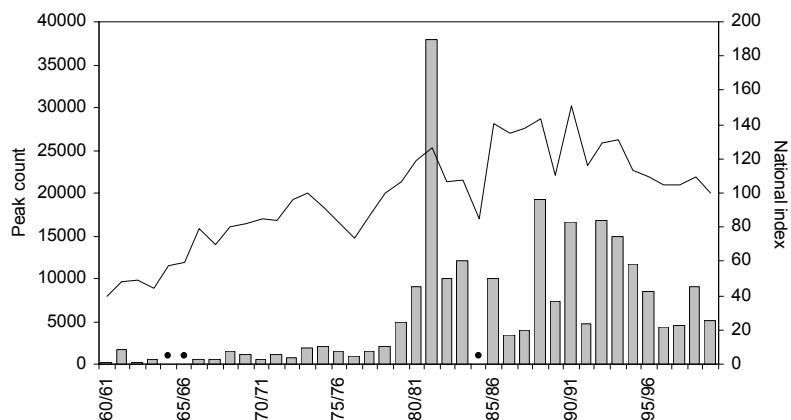


Figure 17. Greylag Geese at Loch Eye, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

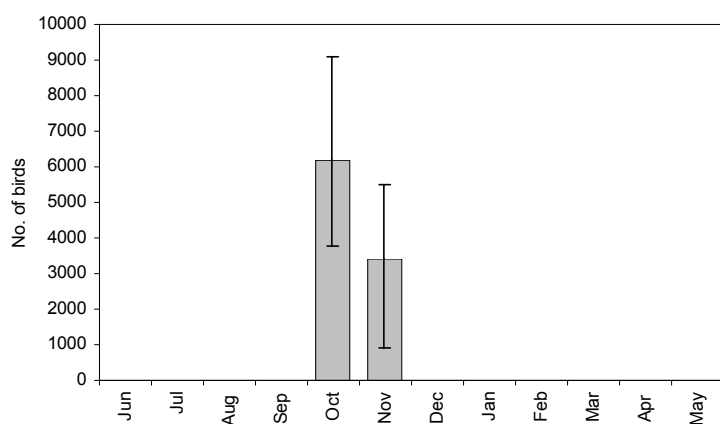


Figure 18. Greylag Geese at Loch Eye, 1995/96–1999/2000: mean peak counts by month (error bars donate minimum and maximum peak counts during the period).

iii) Dornoch Firth

Five-year mean 95/96–99/2000: 2,397

Site conservation status

SPA (Dornoch Firth and Loch Fleet: selection stage 1.2)

Ramsar (Dornoch Firth and Loch Fleet: qualifying criterion 6)

SSSI (Dornoch Firth)

IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

The Dornoch Firth (NH7384) is comparable in size and shape to the Cromarty Firth. Unlike the other firths in the Moray Firth complex, however, the Dornoch has less grass and arable land immediately surrounding its shores, and that which does exist is concentrated into a very narrow strip, generally less than 1-km wide, and interspersed with conifer plantations.

Numbers and trends

In the past, the Dornoch Firth was less important than the Cromarty and Beauly Firths for roosting Greylag Geese, but it now supports considerably more birds and is of greater importance than the Beauly, supporting between 500 and 2,000 geese for much of the winter (Fig. 21). In most years, the flocks that utilise the Dornoch Firth are relatively stable in numbers, with apparently lower turnover than other areas of the Moray Firth. The peak count for the Dornoch Firth is 4,389 in October 1986, although flocks of up to a thousand birds can be present at several sites in the area, with the grass fields near Cuthill supporting up to 1,500. Some of these birds may roost away from the Dornoch, however, returning there each day to feed.

Site use

Past surveys have concentrated on the most productive area of the firth, the outer 10 km, especially around Loch Evelix, but during the last decade it has become apparent that there are a number of other sites throughout the length of the firth that are utilised by Greylag Geese, including those around Bonar Bridge, Chreich and Cuthill, as well as the more traditional sites of Ardmore Bay and Evelix. Some of these areas, notably those further inland, support wintering northwest Scotland Greylag Geese from Sutherland, in addition to Icelandic migrants. Inver, Tain and Edderton Bays, the Morrich More and the land stretching up to the town of Dornoch are also used by these birds at times.

From late October, 1,000–2,000 Greylag Geese feed on the stubbles in the Cuthill/Evelix/Pulrossie area, sometimes reaching as far west as Chreich. These birds use Loch Evelix as an initial roost site, although quickly establish the use of various other sites. Numbers often decline as the autumn progresses, although the dispersing birds are quickly replaced by newcomers in most years, maintaining the population at around 1,500. In other years, when numbers have dropped by late autumn, it is noticeable that there is a build up from January, when between 300 and 1,300 birds are again found using the area. The use of grass fields and the shore around Bonar Bridge is variable, with numbers between 200 and 1,000, peaking at 1,150 in December 1998. These birds often remain until spring, interchanging with Chreich and Wester Fearn. During the spring, the areas around Dounie-Ardmore Bay, Edderton Sands and Ardjachie Point, near Tain, on the south side of the firth, all regularly support a few hundred geese, feeding on the adjacent grasslands and shoreline. Greylag Geese also use the Dornoch Links infrequently during April.

iv) Findhorn Bay

Five-year mean 95/96–99/2000: 2,344

Site conservation status

SPA (Moray and Nairn Coast: selection stage 1.2)

Ramsar (Moray and Nairn Coast: qualifying criterion 6)

SSSI (Culbin Sands, Culbin Forest and Findhorn Bay)

IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

At Findhorn Bay (NJ0462), the twin channels of the Findhorn and the Muckle Burn empty into a shallow, land-locked harbour with extensive intertidal flats that comprise nearly 700 ha. A saltmarsh surrounds the outfall of the two rivers on the southern shore. Adjoining arable land provides feeding grounds for geese (Owen *et al.* 1986a).

Numbers and trends

From the mid-1960s to the mid-1970s there were typically fewer than 1,000 geese roosting in the bay. A subsequent increase reached a maximum of 6,077 in April 1990. Since then, numbers have declined to 1,500–3,000 in most years (Fig. 22).

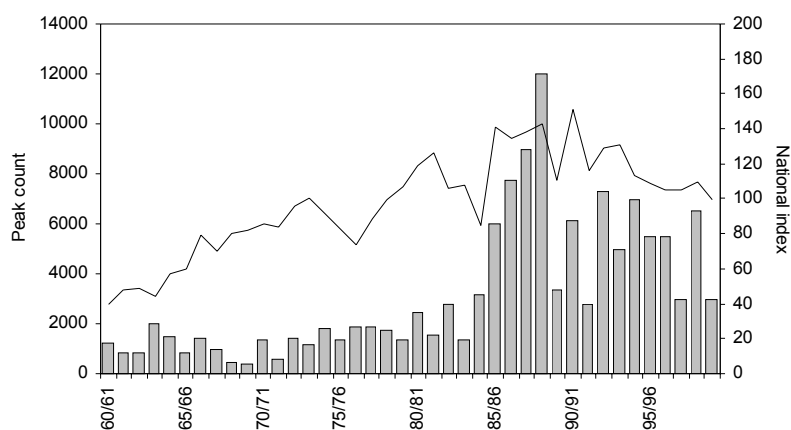


Figure 19. Greylag Geese at Loch Spynie, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

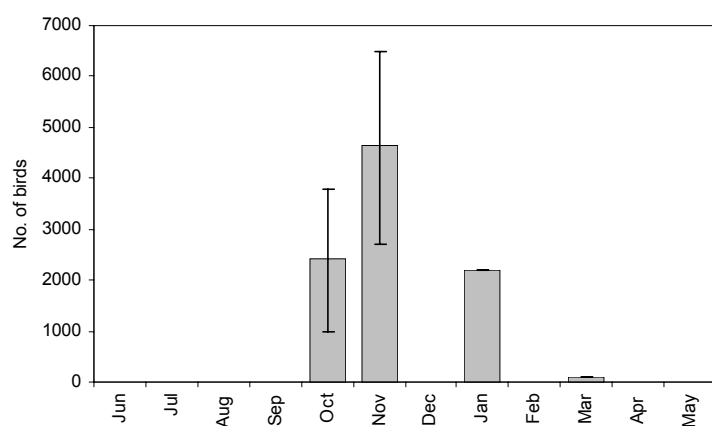


Figure 20. Greylag Geese at Loch Spynie, 1995/96–1999/2000: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

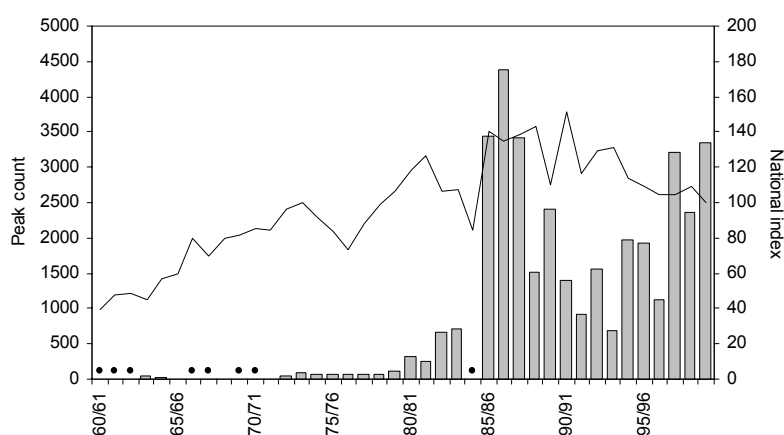


Figure 21. Greylag Geese at the Dornoch Firth, 1960/61–1999/2000 peak counts (bars) and British index (line) (circles denote years with no known data)

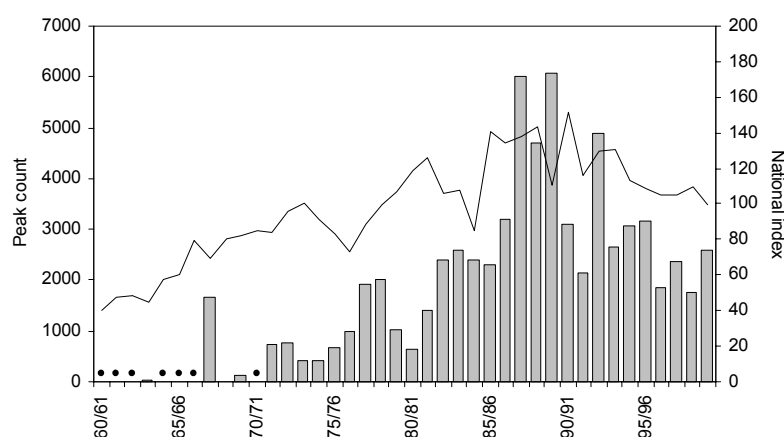


Figure 22. Greylag Geese at Findhorn Bay, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

Site use

During the autumn, birds utilise the stubbles around Forres, particularly the area between Kinloss and Burghead bounded by the A96 and B9013. This area remains important throughout the winter and spring, with up to 2,000 feeding there during December and around 1,000 in January–March. The wet grassy fields between East Grange and Coltfeld and the Easter Coltfeld area near the Maltings are used heavily for much of the winter, with some use also made of the area north of Standingstone. In April, a few hundred birds make use of the saltmarsh at the southern end of the bay.

v) Cromarty Firth

Five-year mean 95/96–99/2000: 1,508

Site conservation status

SPA (Cromarty Firth: selection stage 1.2)

Ramsar (Cromarty Firth: qualifying criterion 6)

SSSI (Cromarty Firth)

IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

The Cromarty Firth (NH7467) covers some 12,500 ha and stretches inland for nearly 30 km. It contains a range of valuable coastal habitats, including a number of shallow, sheltered intertidal bays and a deepwater channel that exists for half its length has facilitated the development of a deepwater port at Invergordon.

The firth is surrounded by a narrow strip of arable land including forestry on the northern shore, with similar mixed farming extending further inland in Easter Ross and on the Black Isle. The towns of Dingwall, Alness and Invergordon lie along the firth, with smaller villages found especially along the shore of the Black Isle.

Numbers and trends

Co-ordinated counts carried out across the Firth as part of the IGC show that the number of Greylag Geese roosting there varies considerably between years. During the 1990s, it ranged from 462 in 1995/96 to 7,370 in November 1994 (Fig. 23).

Within the Cromarty Firth, peak counts at Udale Bay were generally in the mid to low hundreds for much of the 1960s and 1970s, but more recently roosting flocks of over 1,000 have been recorded, up to a maximum of 5,000 in November 1993. Nigg Bay also holds occasional larger flocks (maximum of 2,500 in November 1979), although counts of fewer than 500 are more typical. Dingwall Bay is used less frequently during the autumn, with most counts

under 200. During late winter and spring, however, use of Dingwall Bay as a roost increases, and a peak count of 2,500 was recorded in April 1983.

Site use

The main sites for Greylag Geese on the Cromarty Firth are Udale Bay (NH7166) and Nigg Bay (NH7771). Smaller numbers frequent Dingwall Bay (NH5659).

vi) Loch Fleet

Five-year mean 95/96–99/2000: 1,391

Site conservation status

SPA (Dornoch Firth and Loch Fleet: selection stage 1.2)

Ramsar (Dornoch Firth and Loch Fleet: qualifying criterion 6)

SSSI (Loch Fleet)

IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

A shallow, land-locked basin, sheltered from the sea by dunes around its narrow mouth. In total, the site covers some 650 ha, with the foreshore accounting for approximately 500 ha. The substrate is predominantly sandy (Owen *et al.* 1986a).

Numbers and trends

Prior to the 1980s, there were few records of Greylag Goose from this site, but since then there has been a dramatic increase in bird numbers, particularly since 1986/87 (Fig. 24). Most years, between 800 and 1,500 are present during the autumn, with a maximum of 2,970 in October 1998. During mid-winter and spring, far fewer birds use this site, with only a few hundred often present during January and almost none after that.

This site is also used by northwest Scotland Greylag Geese, and these are included in the counts presented here.

Site use

From late August, northwest Scotland Greylag Geese begin appearing in the fields to the north of Loch Fleet. They are joined in October–November by large numbers of Icelandic birds. Numbers decline as the winter advances and the birds switch from stubbles to grass. Many of the northwest Scotland birds interchange feeding between this site and the Brora area. Birds also feed in Strathfleet and around Kirkton. By spring, most northwest Scotland birds have left and only a few Icelandic migrants remain.

vii) Munloch Bay

Five-year mean 95/96–99/2000: 1,299

Site conservation status

SPA (Inner Moray Firth: selection stage 1.2)
Ramsar (Inner Moray Firth: qualifying criterion 6)
SSSI (Munloch Bay)
IBA (Moray Basin, Firths and Bays: criteria A4i, B1i, C3)

Site description and habitat

Munloch Bay (NH6752) is a sheltered bay on the northern shore of the Inner Moray Firth.

Numbers and trends

Munloch Bay is used irregularly by roosting Greylag Geese, although the number of birds present has often been high, with a maximum of 5,000 in November 1987 and 1988 (Fig. 25).

Site use

Greylag Geese roosting at Munloch Bay disperse primarily to feed on the Black Isle, particularly around Cullicudden, as well as west to areas around Conon Bridge and Tore.

viii) Lochs Garten and Mallachie

Five-year mean 95/96–99/2000: 1,240

Site conservation status

SPA (Abernethy Forest: non-qualifying species)
NNR (Abernethy Forest)
SSSI (Abernethy)
IBA (Abernethy Forest: criteria B1i, C3)

Site description and habitat

Lochs Garten and Mallachie (NH9718) are isolated waterbodies, surrounded by the largest tract of native pinewood forest in Britain. The nearby Strathspey contains low-lying agricultural habitats.

Numbers and trends

From the mid-1980s to mid-1990s, 1,000–2,000 Greylag Geese used this site during the autumn, with a maximum of 1,987 in November 1995 (Fig. 26). Use of this site outside the autumn census period is less well known. Of the few counts that were made, two single counts of 1,080 in December 1994 and 713 in January 1995 were the highest.

Site use

Almost all birds roosted on Loch Garten, with birds using Loch Mallachie only infrequently. Feeding birds moved to agricultural areas in the Spey and Dulnain valleys.

2.1.3.3 Other sites**i) Beaully Firth**

Counts of Greylag Geese on the Beaully Firth (NH5848) were under 1,000 throughout the 1960s and most of the 1970s. It was not until 1977/78 that peak counts of over 2,000 were recorded, with a high of 7,600 in November 1980. For the next few years, numbers fluctuated considerably, with a peak of 10,000 in November 1987. They remained between 2,500 and 7,000 until 1994/95, but since then there has been a rapid reduction, with the highest count only some 520 in October 1996.

ii) Lower Bogrotten

Lower Bogrotten (NJ4861) is a small artificial lake (approximately 150 m by 50 m) created for shooting, and in recent years the area of open water has diminished as a result of succession. Use of this site by Greylag Geese began only in the early 1990s, but the number of birds quickly increased to a maximum count of 5,620 in November 1993. Regular use persisted until winter 1996/97, but since then it has been sporadic (M. Cook pers. comm.). The mean five-year peak count (95/96–99/2000) was 978.

iii) Loch Brora

To the north of Loch Fleet lies Loch Brora (NC8508), where between 100 and 500 Greylag Geese occurred during the 1990s, with a maximum of 520 in October 1991. This site is, however, frequently used by northwest Scotland Greylag Geese, and it is likely that these counts therefore overestimate the sites importance for Iceland Greylag Geese.

iv) Cromarty Firth area

A number of inland waterbodies in the Cromarty Firth area are used as roost sites from time to time. To the west of Nigg Bay, Bayfield Loch (NH8271) occasionally holds roosting Greylag Geese, with a maximum of 1,650 in November 1996. Use of this site increased during the 1990s, but remained infrequent. At Loch Ussie (NH5057), Greylag Geese were very infrequent prior to the 1990s but, in line with many other sites in the Moray Basin, increasing numbers have used this site since then. After a maximum of 2,037 was recorded in November 1990, numbers have been erratic, with between 120 and 1,200 birds during the mid-1990s, falling further to

Figure 23. Greylag Geese at the Cromarty Firth, 1960/61–1999/2000 peak counts (bars) and British index (line) (circles denote years with no known data)

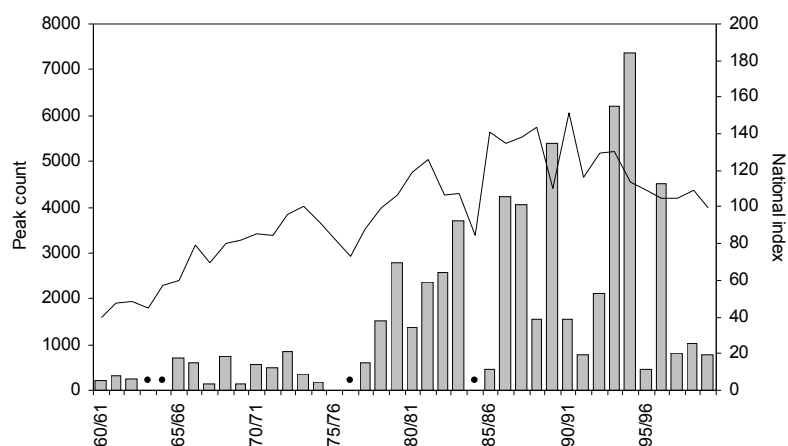


Figure 24. Greylag Geese at Loch Fleet, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

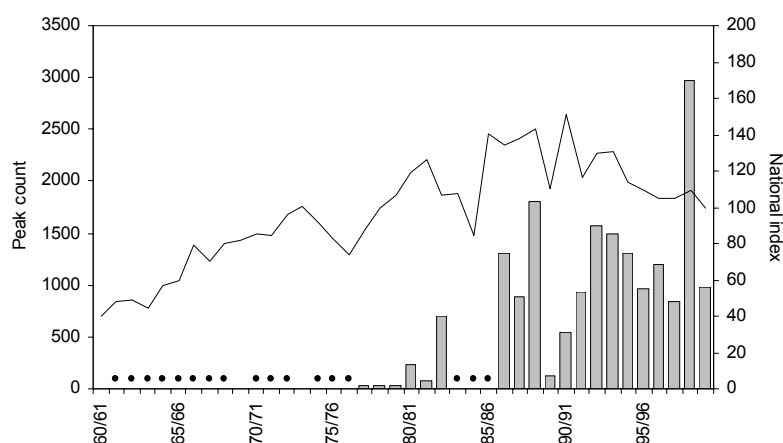


Figure 25. Greylag Geese at Munlochy Bay, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

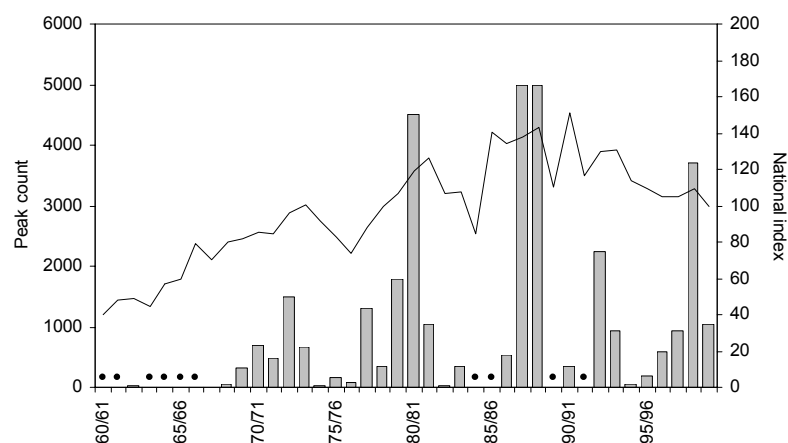
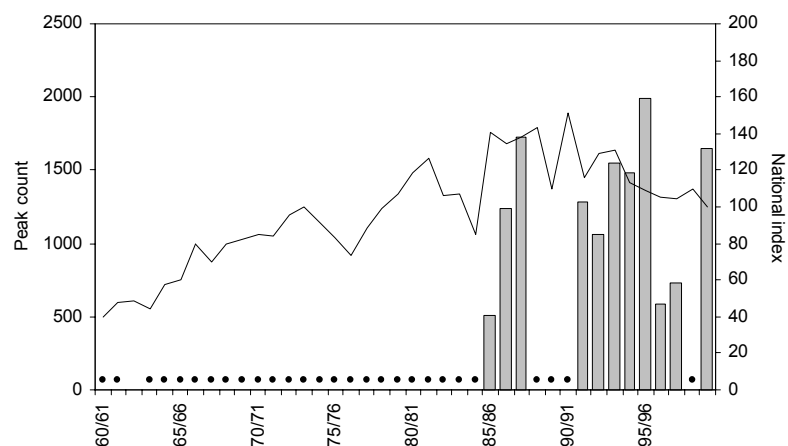


Figure 26. Greylag Geese at Lochs Garten and Mallachie, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



just a few tens during the late 1990s. North of Alness, Loch Achnacloich (NH6673) also supports roosting Greylag Geese on an irregular basis, typically during the spring, with 320 in March 1997 and 258 in February 1998.

v) Inner Moray Firth area

Away from Munlochy Bay, use of the Inner Moray Firth by roosting Greylag Geese is less frequent in comparison to use of the smaller surrounding firths. Numbers were at their highest during the late 1980s, when up to 3,189 were present. More typical flock sizes at this time ranged from 500–2,000. This site was not used in the 1990s. South of Inverness, Loch Ashie (NH6234) has held the occasional large flock, mostly during the 1980s, with a maximum of 2,900 in November 1990.

vi) Inverness to Nairn

Between Ardersier and Nairn lie three small lochs. Loch Flemington (NH8152) has shown fluctuating levels of use by roosting Greylag Geese since the early 1990s, with a maximum of 2,090 in November 1990. The much smaller Loch of the Clans (NH8353) has held roosting Greylag Geese on fewer occasions, with 1,942 in November 1996 and 300 the following year; prior to this, the only flock had been 250 in April 1988. At Lochdhu (NH8655), 200 were counted in January 1974. Small flocks of Greylag Geese have been recorded sporadically at a number of points along the coast between Inverness and Nairn. Flocks typically number 50–400, although at Whiteness Head (NH8058), up to 1,500 were present throughout the winter 1966/67.

vii) Nairn to Findhorn Bay

To the east of Nairn lie Loch Loy (NH9358) and Cran Loch (NH9459). Up to 450 Greylag Geese have roosted on these lochs, with 100–300 wintering regularly throughout the 1960s and 1970s, although none have been recorded there since 1979/80. Small groups up to a maximum of 251 were recorded nearby at Nairn Bar (NH9158) during the 1990s and, less frequently, in the 1960s and 1970s.

viii) Lossiemouth to Buckie

With the exception of an unprecedented 8,000 (likely to have been birds normally roosting at Loch Spynie) in October 1987, Lossiemouth Beach (NJ2470) has been rarely used by Greylag Geese, with just a few small flocks recorded there. Further east, around the mouth of the River Spey, small flocks of up to 100 Greylag Geese were recorded during the 1970s. During the mid-1990s, Loch na Bo (NJ2860) was

used more regularly as a roost, with three flocks of between 250 and 1,000 recorded, mostly in January. Prior to this, no more than nine geese had been seen there. This development as a roost has not been maintained, however, and few birds have been recorded in recent years.

ix) Upper Strathspey

Inland, within Strathspey, there is a small roost at Loch Insh and the Insh Marshes (NH8304), where c. 200–500 birds have roosted for much of the winter since the mid-1980s, although the number was as high as 1,239 in November 1986. Greylag Geese have been recorded roosting at a number of other localities along the River Spey. From Tullochgorum to Boat of Balliefurth (NH9922), counts during 1993/94 found up to 1,115 in November, with smaller numbers present in February and March; birds that probably roosted at Loch Garten. Further upstream, peaks of 541 and 1,362 were recorded between the Spey Dam and Newtonmore in consecutive winters, 1983/84 and 1984/85. Birds were counted only in November and March. Few counts have been made in this area in recent years and it is likely that the status of Greylag Geese in the valley is currently underestimated.

2.1.3.4 Key references

Stenhouse (1993), Stenhouse (1996)

2.1.4 Aberdeenshire

2.1.4.1 Background

Aberdeenshire is dominated by the catchments of the Dee and Don in the south and the Ythan, Ugie and Deveron further north. Although it is a large area, there are few waterbodies suitable as goose roosts and consequently large numbers of geese are concentrated onto just a few sites (Bell *et al.* 1988). The lowlands of the region extend inland for more than 40 km. The farming is predominantly arable, with a high proportion of cereals. Those areas used by geese are mainly low-lying and intensively farmed, although the Dee Valley has fewer suitable areas for geese as it is rather more wooded (Bell 1988).

2.1.4.2 Historical status

In the early part of the 20th century, Greylag Geese were present in small numbers throughout the winter in just a few localities in lowland districts (Berry 1939). When annual November censuses began in 1960, there were roosts at the Loch of Strathbeg,

Loch of Slains and Kemnay (Buckland *et al.* 1990), although numbers in the whole area at this time seldom amounted to more than 2,500 (Owen *et al.* 1986a). Over the next three decades, the distribution and status changed continually, with major new roosts established at the Loch of Skene, Dinnet Lochs and Haddo House Lochs. Major increases in the population of the region occurred in 1964 and 1969, when almost 5,000 and 15,000 birds, respectively, were counted (Owen *et al.* 1986a). By 1988, there were seven major roosts in Aberdeenshire (Bell *et al.* 1988), although the distribution of the birds has continued to vary considerably from year to year.

2.1.4.3 Internationally important sites

i) Dinnet Lochs (Lochs Davan and Kinord)

Five-year mean 95/96–99/2000: 20,291

Site conservation status

SPA (Muir of Dinnet: selection stage 1.2)

Ramsar (Muir of Dinnet: qualifying criterion 6)

NNR (Muir of Dinnet)

SSSI (Muir of Dinnet)

IBA (Muir of Dinnet: criteria A4i, B1i, C3)

Site description and habitat

Dinnet Lochs, comprising the Lochs of Davan and Kinord, are situated at the western extremity of the Deeside lowlands (NJ4800). They lie in a sterile tract of gravel and moraine, and have a total area of 134 ha and mean depth of 1.5 m (Owen *et al.* 1986a). They are flanked by reed-swamp and birch, with stretches of bog along the southern shore of Loch Davan and the southwestern shore of Loch Kinord.

Numbers and trends

Greylag Geese were first recorded along Deeside in the early or mid-1960s, although they did not appear to use the Dinnet Lochs in any number until the late 1970s, when 500 were found roosting on Loch Kinord (Owen *et al.* 1986a). By the end of that decade, however, increasing numbers of roosting birds were present (2,000–3,000) and this number continued to rise throughout the 1980s and 1990s to a maximum of 36,525 in October 1996 (Fig. 27).

Since 1998/99, counts have been considerably lower and suggest a decrease in the number of birds using the site. This apparent decrease coincides with a considerable reduction in the number of counts being made, however, and it is therefore not possible to be certain that the observed decrease is not an artefact of count effort. Nevertheless, a decrease of some degree is considered likely and is in line with numbers at other sites in the region.

Site use

Almost daily counts were conducted each winter from the late 1980s to the late 1990s and showed large fluctuations in the numbers roosting there on a day-to-day basis. This is thought to be due to the birds' feeding in the Howe of Alford and switching their choice of roost between Dinnet Lochs and the Loch of Skene on a regular basis. The largest numbers are typically present in November, but recently increasing numbers have been found from October onwards. The number of geese present at the lochs decreases throughout the winter and spring, with typically only a few hundred birds left by March and April (Fig. 28).

Bell (1988) found that feeding areas for Greylag Geese roosting at Dinnet Lochs were a considerable distance away, with most birds feeding 10–22 km to the northeast, although they were still concentrated into a relatively small area. In the past, the Howe of Tarland, 5 km to the northeast, was an important feeding area but is unable to support the large numbers now roosting at the site and is now used mainly during the spring. At other times, birds have dispersed north to feed in Donside and east to south Deeside.

ii) Loch of Skene

Five-year mean 95/96–99/2000: 10,475

Site conservation status

SPA (Loch of Skene: selection stage 1.2)

Ramsar (Loch of Skene: qualifying criterion 6)

SSSI (Loch of Skene)

IBA (Loch of Skene: criteria A4i, B1i, C3)

Site description and habitat

The Loch of Skene (NJ7807) is a large (119 ha), shallow (mean depth 1.5 m) lake (Owen *et al.* 1986a) located between lower Donside and lower Deeside. It is fringed by reedbed and *Betula-Salix carr.*

Numbers and trends

When co-ordinated autumn counts were initiated in 1960 there were no geese roosting at the Loch of Skene, although a few hundred were using a nearby section of the River Don near Kemnay. The first record of Greylag Geese at Loch of Skene was a count of 150 in November 1964 (Bell *et al.* 1988). An almost uninterrupted run of November counts since the early 1960s shows the increasing importance of this site over the past 35 years (Fig. 29). Counts in the hundreds throughout the 1960s were followed by thousands throughout the 1970s, peaking at 3,050 in November 1977.

In the 1980s, birds began to remain at the loch in larger numbers throughout the winter, with several thousand present in March. By December 1989, a peak count of 13,305 was recorded, soon followed by the highest count at the site to date, 19,150 in January 1991. In the 1990s, numbers fluctuated from 5,000–15,000, with an average winter peak of 12,210 for the first half of the decade and 10,475 for the second half. The trend in numbers at this site closely mirrors that of the whole population.

Site use

Numbers peak during October and November, dropping to an average of around 3,500 in December before rising again in January to around 5,000. Fewer than 2,000 birds are present for the remainder of the winter and spring (Fig. 30).

Most birds feed to the north and northwest, towards lower Donside, where they may overlap with birds roosting at Dinnet Lochs. Smaller numbers flight out to the southeast. Compared to other areas in Aberdeenshire, the feeding distribution of geese around the Loch of Skene is patchier, because of the greater acreage of woodland and shelter belts (Bell 1988). The median distance of feeding Greylag Geese from Skene was estimated at 5.8 km (Bell 1988), although at times the birds have been recorded flying up to 37 km from the roost, to join birds from the roost at Haddo House Lakes.

iii) Haddo House Lakes

Five-year mean 95/96–99/2000: 2,808

Site conservation status

None

Site description and habitat

Haddo House Lakes (NJ8734) are located close to the River Ythan, some 12-km west of the estuary. They consist of two small lakes, each approximately 4 ha in size and largely surrounded by trees.

Numbers and trends

The roost was first noted in autumn 1981, although it is likely that small numbers (<1,000) were present since at least 1974 (Bell *et al.* 1988). A site peak of 11,900 in December 1982 proved to be exceptional. Since then, peak winter counts have averaged just fewer than 4,000, with the lowest (670) in the most recent year (1999/2000) (Fig. 31).

Site use

Haddo House Lakes are surrounded by the largest potential feeding area for geese of any of the roosts in northeast Scotland (Bell 1988). Much of this area is not utilised, however, and nor was it during the

peak numbers of the early 1980s. The birds mostly flight to the west and particularly the northwest, with smaller numbers of birds to the east and southeast and, occasionally the north, northeast and southwest (Bell 1988).

2.1.4.4 Other sites

i) Loch of Strathbeg

The Loch of Strathbeg (NK0758) is the most important roost site for Pink-footed Geese in Britain (Pollitt *et al.* 2003), supporting an average winter maximum of 36,433 in 1995/96–1999/2000. An SSSI, Ramsar and SPA, this site was also an important roost for Greylag Geese during the 1960s–1980s, regularly holding 5,000–10,000 birds throughout the winter during the 1970s and 1980s. During the 1990s, however, numbers fell dramatically to just a few hundred birds (Fig. 32). Internationally important numbers were last recorded in 1993/94, and the peak winter mean for 1995/96–1999/2000 was just 560.

ii) Lower Ythan Valley

In the Ythan Valley, Greylag Geese roost on the estuary (NK0026) or more often at Meikle Loch (NK0230), some 3-km north of the estuary. Numbers were variable between the early 1960s and mid-1980s (Bell *et al.* 1988), with up to 9,371 roosting on the estuary (November 1969) and 4,100 at Meikle Loch (March 1967). During the early 1980s, however, the main arrival of Greylag Geese into the Slains lochs of Meikle, Sand and Cotehill occurred after the November census (Bell *et al.* 1988) and therefore the dataset for this site is likely to underestimate its importance at that time. Detailed counts between 1980/81 and 1985/86 reveal a population ranging from 500–1,600 birds (Bell *et al.* 1988). The importance of the lower Ythan Valley for roosting Greylag Geese further decreased during the 1990s, with flocks now peaking in the low hundreds, although 2,880 were counted there in December 1999 (Fig. 33).

iii) Corby Loch

Corby Loch (NJ9214) is a small (12 ha) waterbody situated 4 km from the coast just north of Aberdeen. Only a handful of birds roosted there in the late 1960s, but this increased to a few hundred during the early 1970s, peaking at 673 in December 1974. No counts were then available until the early 1980s, by

Figure 27. Greylag Geese at Dinnet Lochs, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

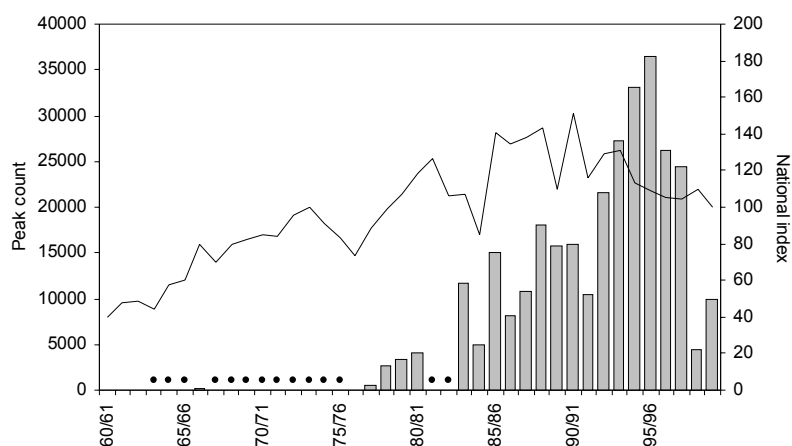


Figure 28. Greylag Geese at Dinnet Lochs, 1995/96–1999/2000: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

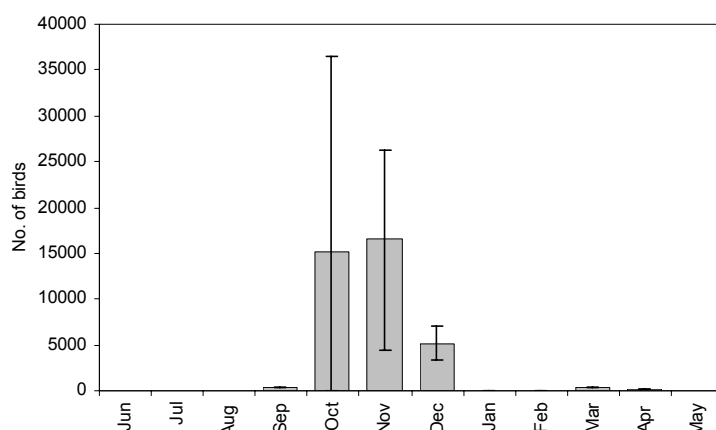


Figure 29. Greylag Geese at Loch of Skene, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

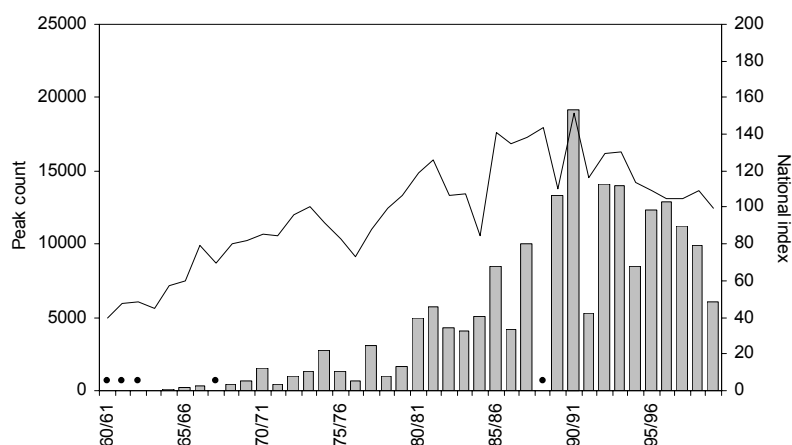
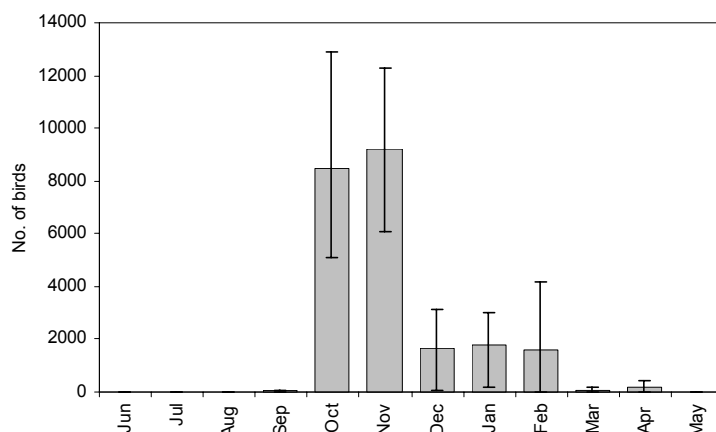


Figure 30. Greylag Geese at Loch of Skene, 1995/96–1999/2000: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)



which time an increase in line with that in the overall population had occurred. The peak winter average for the period 1982/83–1993/94 was 1,463, with a maximum count of 2,600 in March 1990. No counts were made from 1994/95–1997/98, but it seems that numbers there were much lower than they had been previously. Counts in 1998/99 and 1999/2000 recorded no birds at all, and it appears that the site has now largely been abandoned by roosting geese (Fig. 34).

iv) Fedderate Reservoir

Fedderate Reservoir (NJ8652) is a small, exposed site (c. 10 ha) that is easily disturbed (Bell *et al.* 1988). It was a well used roost site during the late 1970s and 1980s, supporting an average autumn maximum of 1,297 (maximum count 3,300, November 1988). It was also a regular spring roost, averaging 1,711 during March between 1982 and 1989. Some 2,950 Greylag Geese roosted there in November 1990, but since then numbers are thought to have decreased considerably, although few counts were made during the 1990s to confirm this.

v) Minor roosts

Greylag Geese have also been recorded from a number of other sites in Aberdeenshire. Occasional counts from the Loch of Auchlossan (NJ5603) from the 1960s through to the 1990s recorded a maximum of 1,300 in November 1984. This site has now been drained and is unsuitable for waterfowl. Also in Deeside, Greylag Geese have been counted on the Dee at Kincardine O'Neil (NO5797). A maximum of 10,000 was recorded there in November 1982, and between 1974/75 and 1982/83 there was an average November peak of 3,433. No counts have been made at this site since 1984/85.

At the Loch of Loirston (NJ9401), 741 Greylag Geese were counted in April 1997. Similar numbers were observed at Inverquhomery Pools (NK0246) in the mid-1980s and mid-1990s, with 756 in February 1987. Nearby, at South Ugie Water (Inverquhomery to Longside, NK0247), there are eight counts from the 1980s, with a maximum of 1,200 birds in March 1983. Three thousand birds roosted at Loch of Fyvie (NJ7638) in November 1979 (Owen *et al.* 1986a).

The River Don around Inverurie has held small flocks of Greylag Geese in the past. From Kemnay to Inverurie (NJ7216) the maximum was 698 in November 1963, with peak counts in the low hundreds during the 1970s, although there have been no subsequent counts. From Inverurie to Hatton of Fintray (NJ7916), two counts in the 1960s revealed a maximum of 670 birds in January 1969.

2.1.4.5 Key references

Bell (1988), Bell *et al.* (1988), Patterson *et al.* (1989)

2.1.5 Angus/Dundee (incl. Tay Estuary)

2.1.5.1 Background

Angus extends from the Tay Estuary in the south to the North Esk Estuary, a few miles north of the Montrose Basin, the almost totally enclosed estuary of the River South Esk. Geese use three main groups of freshwater lochs in the region in addition to the Montrose Basin: the Forfar lochs, the Lundie lochs and the Lintrathen and Kinnordy group.

2.1.5.2 Historical status

Towards the end of the 19th century, Greylag Geese were considered to be occasional winter visitors to Angus (Drummond-Hay 1886, cited in Boase 1955, 1961). Between 1900 and 1920, the number increased rapidly around the upper Firth of Tay (Berry 1939), which included parts of southwest Angus, as a consequence the area became famous with wildfowling, and Greylag Geese were heavily shot and disturbed. By the early 1930s, the species had almost completely disappeared from the area, and many birds established new wintering areas farther up the Tay above Stanley, including in the Isla valley (Berry 1939), in west Angus, where, since 1941 at least, it had become an annual visitor to Loch of Lintrathen (Boase 1955). By the end of the 1930s, Berry (1939) noted that a slight increase had again become apparent on the upper Firth of Tay. Boase (1961) states that Greylag Geese were first recorded at Kingoodie in 1925, and since that time large numbers have been noted there during the late winter and spring, including up to 1,000 in 1956.

Boase (1955) quotes a reference to similar increases during the 1920s that were noted around southeast Angus. Later in the century, some tens of birds were known to be using Rescobie Loch, having been first noted there in 1948. Likewise, small parties were also observed on occasions around the Lundie lochs and at the Loch of Kinnordy groups of several hundred were observed in the early 1950s, including 755 in October 1951. At the Montrose Basin, a large increase occurred after 1981 when a Local Nature Reserve that includes the entire basin and some surrounding farmland was established (Owen *et al.* 1986a). In contrast to Pink-footed Geese, however, Greylag Geese have remained an irregular visitor to Angus.

Figure 31. Greylag Geese at Haddo House lakes, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

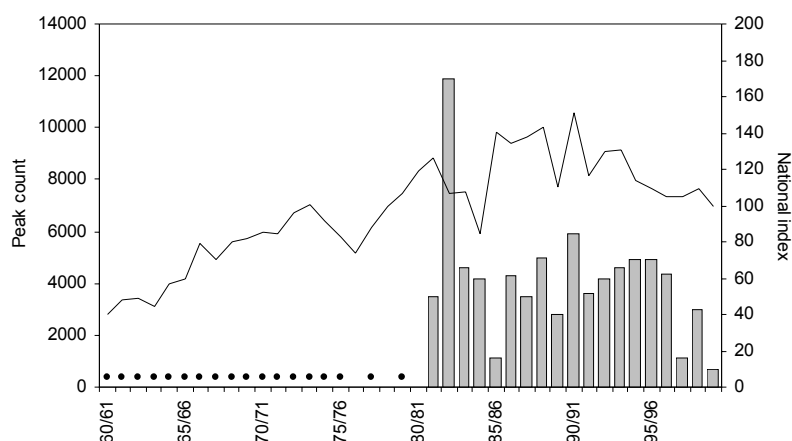


Figure 32. Greylag Geese at Loch of Strathbeg, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

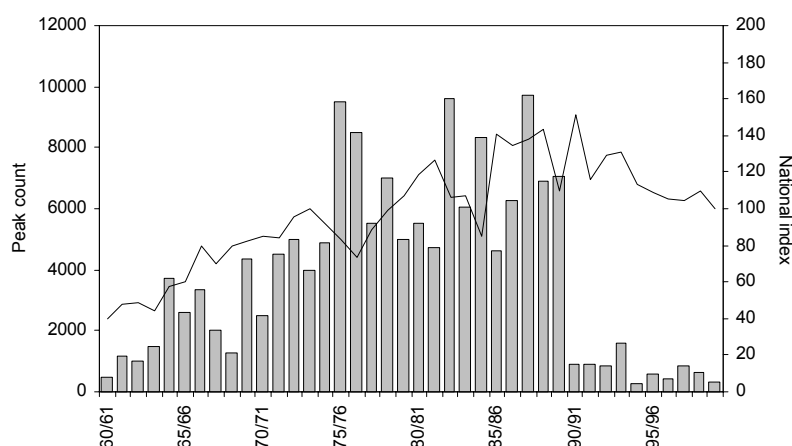


Figure 33. Greylag Geese at Slains Lochs and the Ythan Estuary, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

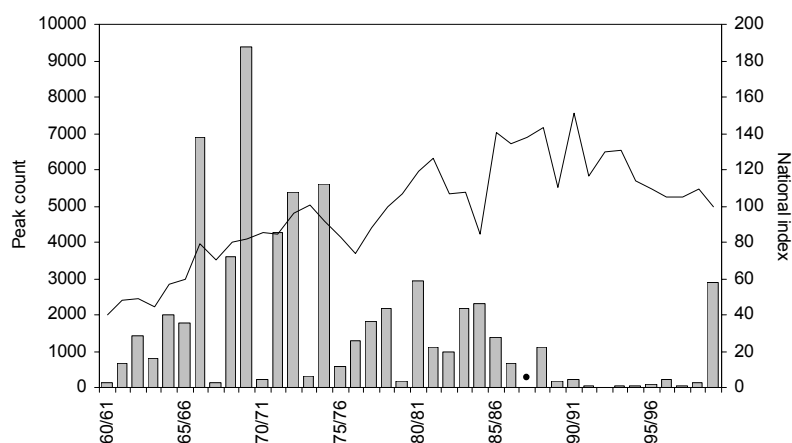
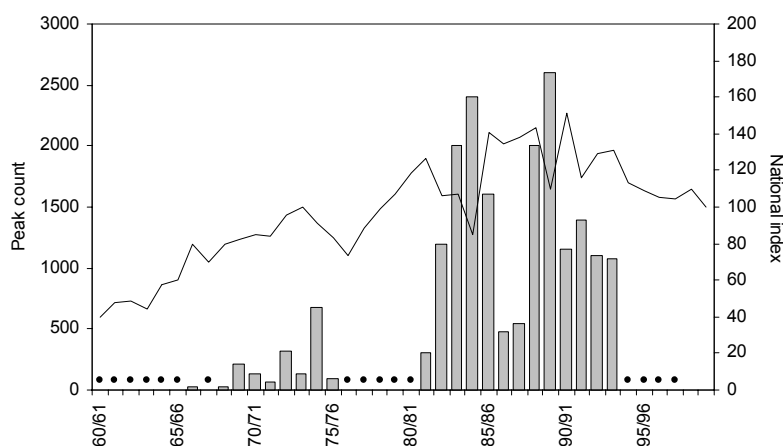


Figure 34. Greylag Geese at Corby Loch, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



2.1.5.3 Internationally important sites

i) Loch of Lintrathen

Five-year mean 95/96–99/2000: 2,930

Site conservation status

SPA (Loch of Lintrathen: selection stage 1.2)
Ramsar (Loch of Lintrathen: qualifying criterion 6)
SSSI (Loch of Lintrathen)
IBA (Loch of Lintrathen: criteria A4i, B1i, C3)

Site description and habitat

A large 120 ha reservoir (NO2754) with predominantly natural banks; it is well screened by plantations.

Numbers and trends

Greylag Geese were first noted at the site in 1941, when eight birds were present (Boase 1955). Since the mid-1940s, more regular counts have been made and it was found that numbers varied considerably, with high counts of 350 in November 1946 and 1,500 in November 1952 (Boase 1955). Since 1960, there has been an unbroken run of November counts. In the early to mid-1960s, the average peak count was around 2,000 birds; this rose through to the end of the 1960s to a maximum count of 12,000 in November 1970. Since then, numbers have been more variable, ranging from several hundred to 6,000 or more. The count of 7,200 in November 1997 was the highest since 1971/72 (Fig. 35).

Site use

The highest numbers of Greylag Geese are present during October and November, tailing off throughout the rest of the winter and spring, although a count of 2,300 was recorded in January 1996. Little information on feeding areas is available, but most birds are thought to disperse short distances onto surrounding farmland, particularly around Incheoch, Torrax and Easter Peel (M. Robinson pers. comm.).

ii) Firth of Tay

Five-year mean 95/96–99/2000: 1,932

Site conservation status

SPA (Firth of Tay and Eden Estuary: selection stage 1.2)
Ramsar (Firth of Tay and Eden Estuary: qualifying criterion 6)
SSSI (various)

Site description and habitat

A large estuary running some 30-km inland from the Tay bridges at Dundee. It is a difficult area to count

because roosting geese may be found almost anywhere along its length.

Numbers and trends

Counts of roosting Greylag Geese on the Tay Estuary were irregular during the period 1960/61–1989/90, thus it is difficult to be certain about the numbers using the site during that period, although from the counts that are available it would appear that in most years the winter peak was fewer than 1,000. Since 1990/91, counts have been available from each winter. During the first half of the decade, the number varied from a few hundred to 1,355 in 1990. The second half of the 1990s saw an increase, with a maximum of 4,350 in January 1999 (Fig. 36).

Site use

Counts of Greylag Geese are highest during the autumn, with a second peak during January (Fig. 37). The main roost on the Tay occurs on the extensive sand/mudflats off Newburgh (NO2318), and other roosting flocks have occasionally been recorded from Powgavie to Earmouth. Geese roosting on the Tay typically feed to the north of the site in southern Angus, often flying over the Sidlaw Hills into Strathmore.

2.1.5.4 Other sites

i) Loch of Kinnordy

The Loch of Kinnordy (NO3654), a small, shallow waterbody 2-km west of Kirriemuir, has been managed by the RSPB since 1977. It was an important roost from the 1960s through to the end of the 1980s, typically supporting up to 5,000 Greylag Geese each autumn, with a maximum of 5,500 in November 1967. There was always much interchange with the Loch of Lintrathen and it now appears that Kinnordy has been largely abandoned in favour of the bigger site, with much lower numbers using the loch in the 1990s; the highest count thus far being 617 in October 1992. The 1990s also saw a large increase in the numbers of Pink-footed Geese roosting at Kinnordy (Mitchell & Hearn 2004), although these also now appear to have abandoned the site.

ii) The Lundie lochs

The group of lochs around Lundie in the Sidlaw Hills, the best of which for wildfowl are Lundie, Long and Thriepley, produced some high combined counts during the 1980s, up to a maximum of 2,500 in November 1984. The most important of these has been Long Loch (NO2938), which has held occasional roosting flocks, particularly during the 1990s, with two peak counts of 1,000 in October

1992 and November 1993. Counts are infrequent, however, particularly during mid-winter when the greatest numbers of birds are likely to be present, and it is probable that the importance of this site is currently underestimated. The average peak winter count (1995/96–1999/2000) was 817. Nearby, Redmyre Loch (NO2833) has also held roosting Greylag Geese on occasions (K. Brockie pers. comm.).

iii) The Forfar lochs

Forfar Loch (NO4450) was used occasionally as a roost during the 1960s to 1980s, although today its proximity to Forfar and the consequent disturbance from recreation and encroachment of housing and industry make it an unfavourable site. During the 1970s, there were two counts over 1,000 birds (maximum of 1,270 in November 1975), but since 1992 there have been no counts over 50. To the east of Forfar lie Rescobie Loch (NO5151) and Balgavies Loch (NO5350); both have supported variable numbers of roosting Greylag Geese over the years. Rescobie was generally the more important of the two, with a maximum of 2,400 in January 1967, but in 1975 Balgavies became a Scottish Wildlife Trust reserve and began to attract roosting geese from Rescobie, with a peak of 1,360 in November 1988. Nowadays, counts for both lochs are typically in the low hundreds, although recent data are incomplete.

iv) Monikie and Crombie Reservoirs

Monikie Reservoirs (NO5038), northeast of Dundee, supported occasional roosting flocks in the low hundreds during the 1960s and 1970s, up to a maximum of 1,212 in November 1979. Few counts have been undertaken since the late 1980s, however, and only single-figure flocks have been recorded since then. Crombie Reservoir (NO5240), 2 km to the north of Monikie, has supported 500 or more Greylag Geese on six occasions since the early 1970s, with a maximum of 1,300 in November 1976. During the 1990s, the site was rapidly abandoned, with an autumn roost of 1,000 in November 1990 falling to just 130 the following year, followed by maxima of 60 and 80 in 1992 and 1993, respectively. No counts have been carried out since December 1993 and it is thought that few, if any, birds now roost there.

v) Montrose Basin and Dun's Dish

Since the early 1960s, the Montrose Basin (NO6958) has supported variable numbers of Greylag Geese throughout the winter. A notable increase occurred after 1981, when the site became a Local Nature Reserve, although numbers did not continue to

increase like those of its congener, the Pink-footed Goose. Before this period, there had been three counts of up to a maximum of 1,000. During the 1980s, the mean peak count was 1,055 and, although the maximum count at the site (2,100 in February 1991) occurred during the 1990s, numbers since then have typically been fewer than 500, with a mean peak winter count (1995/96–1999/2000) of 387. The Montrose Basin is designated as a Ramsar site and SPA for its importance to Iceland Greylag Geese. Dun's Dish (NO6460), to the north of Montrose Basin, has held occasional roosting flocks of up to 580 (November 1988), but use of this site has always been irregular, with birds only likely to move here during periods of disturbance at Montrose Basin.

2.1.5.5 Key references

Boase (1955), Boase (1961)

2.1.6 Fife (excl. Tay Estuary)

2.1.6.1 Background

The 170-km rocky coastline of Fife lies between the Firths of Forth and Tay. Fife covers an area of 1,305 km² and is composed of rolling hills up to 522 m in the West Lomonds. There are three principal rivers: the Eden, the Leven and the Ore, and over 400 standing waterbodies; 45 of these are larger than 2 ha (Corbet 1998) and the majority are man-made reservoirs. Fife is intensively farmed, with 75% of the area under agriculture. Arable farming predominates in the east of the county, with more extensive pastures in the west.

2.1.6.2 Historical status

In the early part of the 20th century, Greylag Geese were considered scarce in east Fife, although abundant for many years in the Newburgh area (Berry 1939). Little information is available concerning their status during the middle part of that century, although in certain areas they became scarce during World War II, re-establishing themselves during the 1950s. By the mid-1980s, they were considered a common winter visitor (Smout 1986). During the early to mid-1990s, they continued to increase and became more dispersed throughout the region, although numbers fluctuated greatly between months (A. Brown, unpublished Fife Goose Reports).

2.1.6.3 Internationally important sites

i) Eden Estuary

Five-year mean 95/96–99/2000: 1,340

Site conservation status

SPA (Firth of Tay & Eden Estuary: selection stage 1.2)

Ramsar (Firth of Tay & Eden Estuary: qualifying criterion 6)

SSSI (Eden Estuary)

IBA (Eden Estuary, Tentsmuir Point and Abertay Sands: non-qualifying species)

Site description and habitat

The Eden Estuary lies 3-km northwest of St Andrews (NO4719). It covers some 1,160 ha of intertidal mud and sand flats, together with associated saltmarsh and sand dunes.

Numbers and trends

Around 300 Greylag Geese frequented this site during the mid-1960s, but during the 1970s and 1980s peak counts were fewer than 100 birds, with three exceptions including a remarkable 3,200 in March 1986. A more regular roost developed during the 1990s, typically supporting 1,000–2,000 birds, with a peak of 2,050 in January 1993 (Fig. 38).

Site use

In recent years, numbers have increased steadily throughout the winter to a peak between February and April, usually March (Fig. 39). This may be a reflection of increased wildfowling activity during the early winter (A. Brown pers. comm.).

ii) Kilconquhar Loch

Five-year mean 95/96–99/2000: 1,247

Site conservation status

SSSI (Kilconquhar Loch)

Site description and habitat

Located in southern Fife just 2 km from the Firth of Forth at Earlsferry and Elie (NO4801), Kilconquhar Loch covers 48.2 ha and is thought to have originated from flooded peat diggings (Smout 1986). It is important for its aquatic flora and alder-willow carr, but has recently experienced nutrient enrichment with a resultant reduction in its macrophytic plant composition (Corbet 1998).

Numbers and trends

Greylag Geese apparently used the loch prior to World War II, but abandoned the site during this period because of increased disturbance. The roost

became re-established in 1951 (Atkinson-Willes 1963) and has been in regular use since then. From 1964/65, there was an increase in the number there, with a mean peak of 517 during the late 1960s. These birds were typically present during the early spring. A second increase occurred in 1969/70, but lasted for only three winters, during which time a peak of 1,896 was recorded in November 1971. A further, unsubstantiated, count of 1,900 in March 1972 is reported by Smout (1986). In contrast, these peak counts occurred during the early winter, typically December. Subsequent counts during the 1970s and 1980s showed fluctuating numbers, typically 400–700, with occasional counts upwards of 1,000. In the early 1990s, numbers began to increase again, firstly during the autumn and more recently, peak numbers have occurred during late winter (Fig. 40). The site is now used regularly throughout the winter, with more than 600 birds roosting in most months (Fig. 41). A slight decrease during the mid-1990s was due to the birds' using an alternative roost at Carlhurlie Reservoir.

Site use

Regular monthly roost counts give a detailed picture of phenology at Kilconquhar Loch (Fig. 41). They show that after the birds' arrival in October, numbers build steadily to a peak in February. Thereafter numbers decrease, although typically several hundred remain as late as April.

The main feeding areas are situated within 2–3 km of the roost, at Muircambus and Grangehill to the west and Balbuthie to the east. Feeding further afield may occur occasionally in the Knights Ward area, 5–6 km to the northeast. During the mid-1990s, use was made of feeding areas associated with the roost at Carlhurlie Reservoir, 8 km to the northwest.

2.1.6.4 Other sites

The large number of stillwaters in Fife provides geese with numerous alternative roost sites, and many are used on an infrequent basis. Their true status is often difficult to determine, however, because of the lack of counts made outside the national census period.

i) Carlhurlie Reservoir

This reservoir, no longer used to supply water, lies inland of Largo Bay, some 3-km northwest of Lower Largo (NO3904). It is relatively open and steep-sided, with a fringe of emergent and bank-side vegetation. No counts exist for the site prior to 1983, it was used as a roost in the early to mid-1990s and counts there were typically associated with a

Figure 35. Greylag Geese at Loch of Lintrathen, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

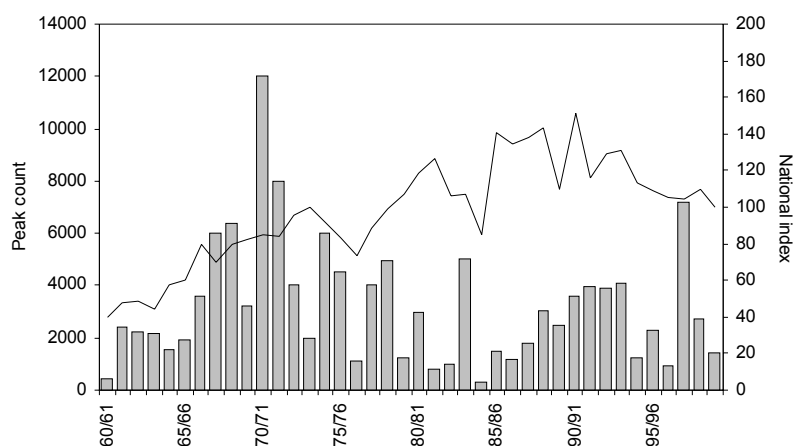


Figure 36. Greylag Geese at the Firth of Tay, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

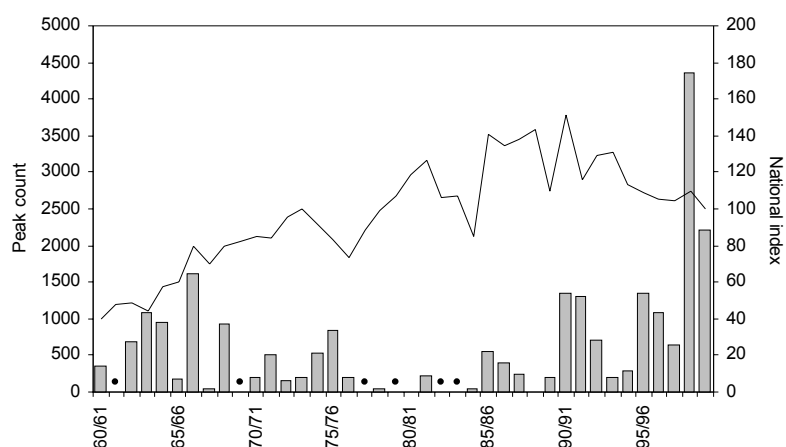


Figure 37. Greylag Geese at the Firth of Tay, 1995/96–1999/2000: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

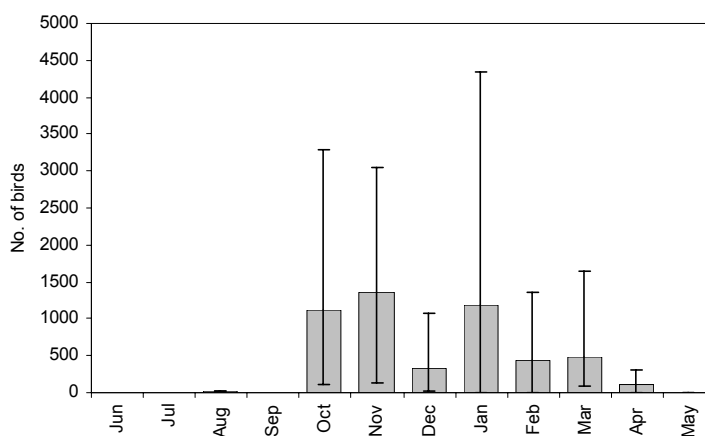
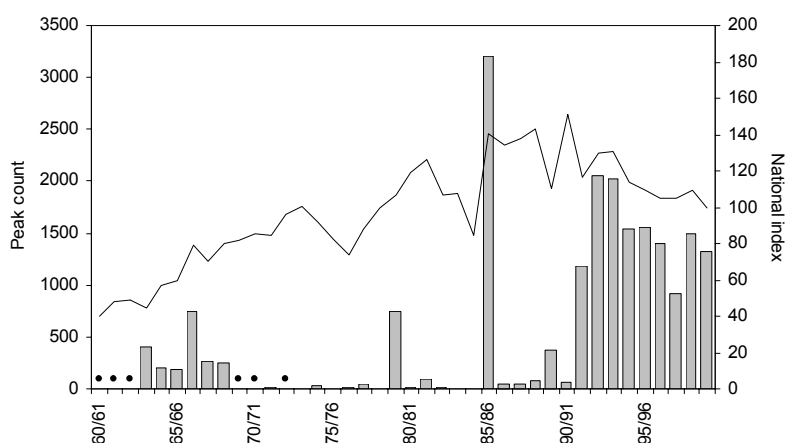


Figure 38. Greylag Geese at the Eden Estuary, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



in numbers at Kilconquhar Loch. Between 1991/92 and 1995/96, peak counts of over 1,200 were recorded between January and March, with a maximum of 2,470 in February 1994. Since then, however, the site has largely been abandoned, with Greylag Geese recorded there in only one winter between 1996/97 and 1999/2000.

ii) Southwest Fife

The lochs and reservoirs south of Loch Leven hold modest roosting flocks of Greylag Geese. Loch Fitty (NT1291) has occasionally supported several hundred, with a maximum of 800 in January 1980. More recently, counts of 700 in January 1995 and 413 in February 1996 have been recorded, and feeding birds counted in the vicinity may have roosted (e.g. 1,000 in December 1994, 1,100 in December 1995 and 700 in February 1996). These counts are isolated, however, and the site is not counted regularly as part of the IGC, although it appears that Greylag Geese do not use this loch on a regular basis. A major fishery exists there and may make the site unsuitable for roosting geese. Loch Glow (NT0895) has recently supported some tens of geese during early winter, but was not counted at all during the 1980s. The maximum number recorded there was 250 in November 1978. Loch Gelly (NT2092) consistently held between 150–250 Greylag Geese during the early to mid-1990s, with a maximum of 250 in November 1992. In recent years, no Greylag Geese have been recorded during IGC counts. Despite their small size, Craighluscar Reservoirs (NT0690) have held up to 350 Greylag Geese (in March 1996), although they normally support fewer than 100, with none during IGC counts in 1998/99 and 1999/2000. Numbers of feeding Greylag Geese in the vicinity of this site have increased since the mid-1990s, but it is not clear whether these birds are roosting at the reservoirs. Torry Bay (NT0185), a Local Nature Reserve on the Firth of Forth, supported occasional flocks of roosting Greylag Geese during the 1990s, with a peak of 390 in November 1998.

iii) The Lomond Hills reservoirs

To the east of Loch Leven, the conglomeration of reservoirs in the Lomond Hills, dominated by Ballo, Harperleas and Holl, have held relatively large roosting flocks of Greylag Geese in the past. During the 1970s and 1980s, numbers, and counts, were irregular, but a maximum of 2,318 was recorded in December 1987. Combined records for these three reservoirs are not available after 1991/92, but counts for Ballo Reservoir alone during the 1990s indicate that Greylag Geese continued to use the site regularly, although in some years there appear to be

few present. Two peak counts over 1,000 were recorded at the beginning of the 1990s, including 2,000 in December 1992, and more recently, 1,000 were present in November 1998.

iv) Lindores Loch area

Lindores Loch (NO2616) has occasionally held roosting Greylag Geese, although counts for the site are available from only seven winters between 1964/65 and 1990/91. The maximum count of 3,476 in December 1978 is the only count over 1,000, and others range widely from 1–700. The site now appears to be little used and is heavily disturbed by angling. The nearby Birnie and Gaddon Lochs (NO2812), flooded gravel workings created in the early 1990s, have held roosting birds on occasion, mainly in the mid-1990s. Although limited, counts are available for every year since 1991/92. They suggest that use of the site is sporadic, although this is believed to be an underestimation. The maximum count recorded there is 490 in March 1998, although counts of zero were made in 1998/99 and 1999/2000. Nearby, at Rossie Bog (NO2711), counts of 804 in April 1997 and 900 in December 1997 may have been of roosting birds.

v) Carriston Reservoirs

Smout (1986) refers to Carriston Reservoirs (NO3203), 4 km to the northeast of Glenrothes, as the largest roost in central Fife. It regularly held several hundred or more Greylag Geese during the mid-1960s to mid-1980s, with a maximum of 2,000 in November 1972. After a reduction in numbers in the early 1990s, more birds started to roost at the site again from 1993/94, with an exceptional count of 3,500 recorded in February 1995. More recently, few birds seem to be using the site and it is thought that excessive shooting disturbance may be limiting the use of this roost (A. Brown pers. comm.). From the late 1960s to the mid-1980s, Greylag Geese were also present in reasonable numbers at nearby Tank Dyke and Star Moss (NO2904). A maximum of 1,220 was recorded in March 1981 and, although no counts for this site have been available since 1984/85, it is still regularly used as a feeding area.

vi) South Fife

Further east in southern Fife, Clatto Reservoir (NO3607) and Carnbee Reservoir (NO5206) are irregular roost sites, with a maximum of 700 in March 1996 and 350 in March 1994, respectively.

vii) Cameron Reservoir

Cameron Reservoir (NO4711) is the largest reservoir in Fife and is located 6-km southwest of St. Andrews. It is an internationally important site for roosting Pink-footed Geese and has held high numbers of roosting Greylag Geese from time to time, with peak winter counts greater than 1,000 typical during the 1980s and frequent during the 1960s. The maximum count at the site was 2,500 in March 1964. During the 1990s, however, the site's importance decreased, with only two counts over 100 birds. Occasional larger counts suggest that by the mid to late 1990s Greylag Geese were roosting there again in larger numbers, with counts of 750 in December 1996 and 407 in November 1998 (when up to 940 were feeding in the area).

2.1.6.5 Key references

Smout (1986), Brown (1996), Brown (1997), Brown (1998), Brown (1999), Brown (2000)

2.1.7 Perth & Kinross

2.1.7.1 Background

A large region that encompasses a number of key Scottish goose areas, centred on Perth, because of its range of suitable roost sites and feeding areas. To the north, running west from Blairgowrie, lies the Carse of Gowrie, where a number of important roost sites for Greylag Geese are located, notably Loch Clunie, Marlee Loch and Loch of the Lowes. These sites are closely associated, and geese frequently move between them and the River Tay at Kercock/Meikleour to the south. To the west lies Strathearn, where a number of important roost sites are located, most notably Drummond Loch, formerly the most important site in the UK for Iceland Greylag Geese. This is also a key area for Pink-footed Geese, particularly around the key roost at Dupplin Loch. To the southwest of Strathearn lies Strathallan, where the valley of the Allan Water runs southwest to join the Forth at Bridge of Allan. This strath was also much more important for Greylag Geese in the 1960s and 1970s. To the south of Perth, in the Ochil Hills, is Glenfarg Reservoir, with Loch Leven in the Kinross basin still further south. Scattered flocks of Greylag are also found along the upper Tay and Tummel valleys, north of Dunkeld, and in Glenalmond, north of Strathearn.

2.1.7.2 Historical status

Prior to the 20th century, the once abundant Greylag Goose was already noted to be visiting the Carse of Gowrie in diminished numbers (Drummond-Hay 1886, cited in Boase 1955, 1961). In the upper Firth of Tay, the species was sufficiently rare in the 1880s for a specimen shot near Errol to be carefully preserved (Berry 1939). Numbers in this area subsequently increased rapidly between 1900 and 1920 (Berry 1939), so much so that the area became famous with wildfowling and Greylag Geese were heavily shot and disturbed, causing them to disappear almost completely from the area by the early 1930s and establish new wintering areas farther up the Tay above Stanley and in the valleys of the Earn and Isla. In particular, the Carse of Gowrie was reoccupied, where, in contrast to Drummond-Hay (1886), Berry (1939) considered it to have been plentiful since the start of the 20th century. By the end of the 1930s, a slight increase had again occurred in the upper Firth of Tay (Berry 1939) and, by the 1950s, Greylag Geese were again roosting there in some number, particularly between Powgavie and Monorgan on the north shore (Boase 1961), which includes part of southwest Angus. Furthermore, use of the Blairgowrie lochs was well established by at least the late 1940s (Boase 1961).

In Strathearn, Greylag Geese were known to be present in some number around Crieff by the late 1950s and were no doubt roosting at Drummond Loch (Boase 1961). Use of the area west of Perth, around Dupplin and Tibbermore, for feeding was also noted by Boase (1961).

Greylag Geese were first recorded at Carsebreck around the turn of the 20th century, when the lochs were first dammed. By the 1920s, they were numerous and up to 2,000 were often present (Berry 1939). At Loch Leven, Greylag Geese numbered 200–300 in the 1930s (Berry 1939).

In the area as a whole there has been a steady decrease in the number of wintering Iceland Greylag Geese. This has been particularly pronounced since the start of the 1990s, with many former key roost sites now abandoned. This is consistent with the increasing tendency of Greylag Geese to winter further north in Orkney and the Moray Basin. In several cases, these sites are now becoming important roost sites for Pink-footed Geese. At the same time, an increasing number of small flocks of up to 200 Greylag Geese, have appeared along the upland margins of the region, away from the more intensively managed arable farmland, which is heavily disturbed by farmers and shooting parties.

2.1.7.3 Internationally important sites

i) Drummond Loch

Five-year mean 95/96–99/2000: 1,757

Site conservation status

SPA (South Tayside Goose Roosts: selection stage 1.2)

Ramsar (South Tayside Goose Roosts: qualifying criterion 6)

SSSI (Drummond Loch)

IBA (South Tayside Goose Roosts: criteria A4i, B1i, C3)

Site description and habitat

A lowland (40 m asl) eutrophic lake of 34.5 ha, located near Crieff in upper Strathearn (NN8518).

Numbers and trends

During the 1960s this was the largest Greylag roost in Scotland (Boyd & Ogilvie 1972), and throughout the 1960s and early 1970s there was a steady increase in the roosting flock, which reached a peak of 15,000 in November 1979. Subsequently, there was a gradual decline in the roosting flock, with peak winter counts of 1,000–2,500 in the most recent years (Fig. 42).

Site use

Numbers usually peak in November, with fewer birds during December and January and few in late winter and spring. Occasional large flocks have been found later in the winter, particularly after harsh weather conditions further north. In Strathearn as a whole, there is usually a small increase during February and March as birds pass through on their way north.

The situation in Strathearn, however, is now greatly complicated by the fragmentation of the roosting flock onto many smaller waters. At times in late winter and spring, the majority of Greylag Geese in the valley now roost away from the loch (Bell *et al.* 1997). This situation is therefore best understood by considering the whole valley as a single site with a main roost (Drummond Loch) and a series of minor satellite roosts that, at times, may hold most of the geese. Birds move between these sites on a daily basis, depending on levels of disturbance and weather conditions.

Most geese feed along the Earn valley in the patchwork of farmland to the east of the loch as far as Dalreoch. Some use is also made of the parkland to the south and farmland to the north between Crieff and Comrie (Newton *et al.* 1973, Bell & Newton 1995).

ii) Marlee Loch

Five-year mean 95/96–99/2000: 1,319

Site conservation status

SSSI (Lochs Clunie and Marlee)

IBA (Tay-Isla valley: criteria A4i, B1i, C3)

Site description and habitat

Marlee Loch lies at 40 m asl in the Carse of Gowrie (NO1444) and is one of the Blairgowrie Lochs complex, which includes Stormont Loch, Loch Clunie and Loch of the Lowes.

Numbers and trends

Prior to the 1990s this was probably the least important of the Blairgowrie Lochs for Greylag Geese, with numbers during November usually being much larger at Loch Clunie, Stormont Loch and Monk Myre. The latter two much smaller lochs were, however, progressively deserted, probably due to excessive shooting on the surrounding arable farmland where the geese fed (M.V. Bell pers. comm.). Nevertheless, this site has held significant numbers since the early 1960s, and these increased as the number at Stormont Loch and Monk Myre declined. Typical winter maxima up to the late 1980s varied from the low to high hundreds, occasionally reaching over 1,000 birds. During the 1990s, the peak winter count was over 1,000 in six years, with a maximum of 2,000 in November 1998 (Fig. 43). Up to 200 re-established Greylag Geese are often found here and mix with the Icelandic migrants.

Site use

Peak numbers typically occur from October to December (Fig. 44). The loch is used for roosting purposes only and the birds disperse into farmland within a few kilometres of the loch to feed.

2.1.7.4 Other sites

Greylag Geese have used a large number of other waters as roosts in this area since at least the mid-1980s, when detailed counts were started by the Central Scotland Goose Group. Many of these sites lie close to more established roosts and are therefore best regarded as satellite roosts; others have been on temporary floodwaters and are therefore extremely difficult to monitor, although they are used regularly in late winter and spring when they hold water. The seasonal use of roosts by geese in this area was described by Bell *et al.* (1997).

Figure 39. Greylag Geese at the Eden Estuary, 1995/96–1999/2000: mean peak counts by month (error bars donate minimum and maximum peak counts during the period)

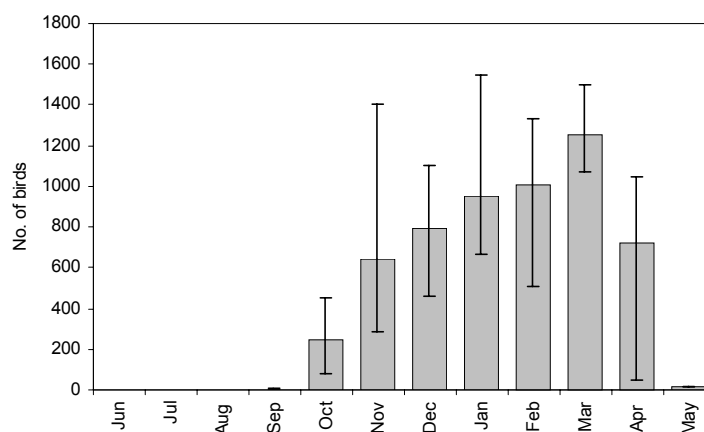


Figure 40. Greylag Geese at Kilconquhar Loch, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

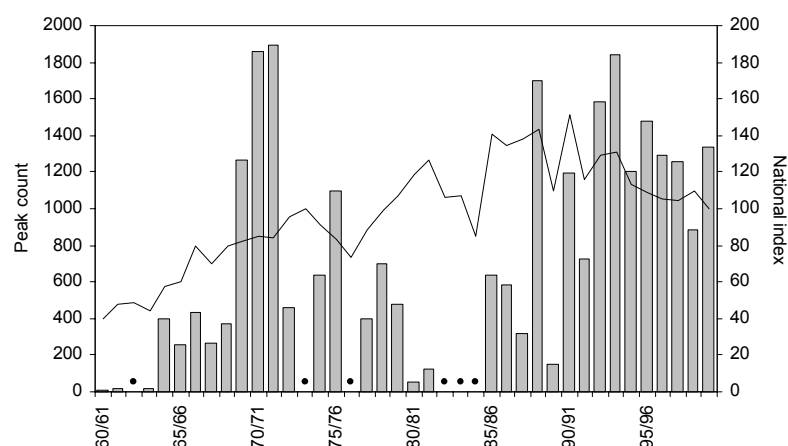


Figure 41. Greylag Geese at Kilconquhar Loch, 1995/96–1999/2000: mean peak counts by month (error bars donate minimum and maximum peak counts during the period)

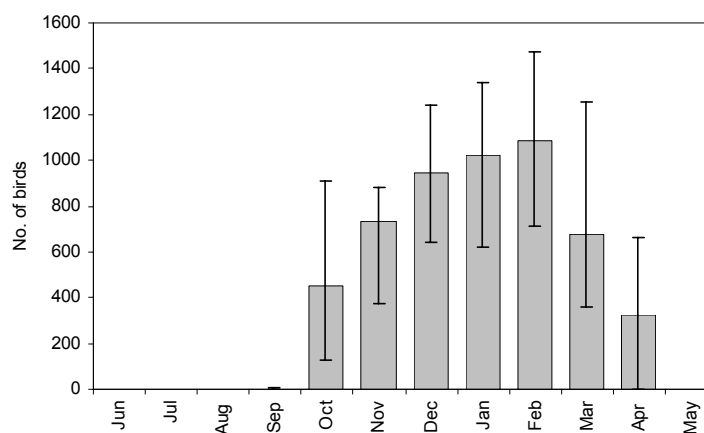
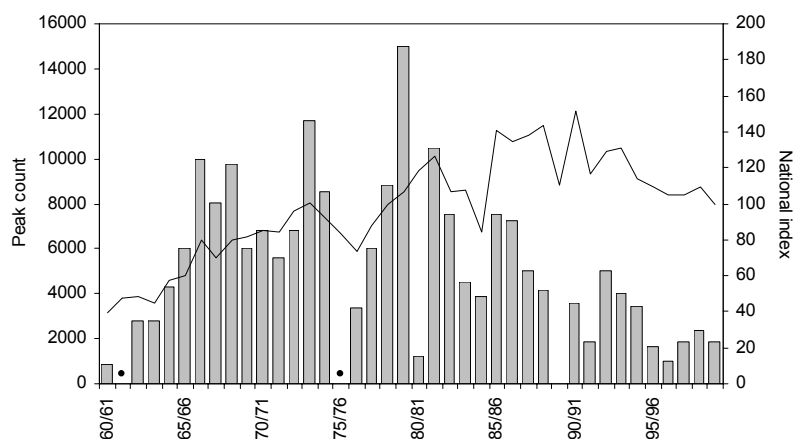


Figure 42. Greylag Geese at Drummond Loch, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)



i) River Tay at Kercock

The stretch of the River Tay that is of most importance to Greylag Geese is that extending west from the Meikleour area (NO1339 and NO1439). This area is variously known as Bloody Inches, Meikleour or Kercock and lies on the river 2–4 km upstream of the Isla confluence. Here the river is broader, with exposed shingle banks and some low lying, often wet, ground on either side. The lower reaches of the River Isla are also used (Owen *et al.* 1986a). Greylag Geese have been recorded roosting here since counts began in the early 1960s, with a peak count below 1,000 in only 11 years since 1960/61. Five of these were in the late 1990s, however, and consequently the site no longer qualifies as internationally important (Fig. 45). The mean peak winter count (1995/96–1999/2000) was 718.

Numbers were at their highest during the late 1960s and 1970s, when a site maximum of 9,170 was recorded in November 1966. Since then, roosting flocks have been smaller, with a peak of 3,685 during the 1980s and 3,196 during the 1990s. This site is particularly important during hard weather when the Blairgowrie lochs are frozen.

ii) Upper Tay/Tummel valleys

This site is a linear complex of feeding and roosting areas found along the upper Tay and Tummel rivers, extending from their confluence at Ballinluig to Loch Tay, Loch Rannoch and Loch Moraig (by Blair Atholl); it covers some 100 km of the valley and supports a number of small flocks, most of which roost on remote hill lochs. The area is counted as a single unit, due to the inaccessibility of the roosts and the peak winter mean for 1995/96–1999/2000 (930) is just less than the threshold for international importance. Since 1991/92, peak counts have ranged from 350–2,000, with a maximum of 2,030 in November 1994. In most years, however, the peak count is fewer than 1,000. Later in the winter, up to 700 birds have been recorded in January, with fewer, typically around 300–400, in March and April.

Counts for individual locations within this site are also available. Loch Tay (NN6838) regularly held flocks of several hundred and occasionally 1,000 or more during the 1960s and 1970s. Few counts were made during the 1980s and 1990s, but a peak of 1,700 in November 1991 was recorded from the Lawers area of the loch (NN6839). Dunalastair Hydroelectric Reservoir (NN6958) held roosting flocks peaking in the low hundreds for much of the 1980s and, to a lesser extent, the 1990s, with a maximum of 553 in March 1989. Loch Tummel

(NN8259) and Loch Faskally (NN9159) supported small numbers in most recent winters, with up to 340 in February 1982 at Tummel and 660 in November 1992 at Faskally. However, some doubt exists over whether these are Icelandic migrants, from re-established populations, or a mixture of the two. Similarly, Loch Moraig (NN9066), 3-km northeast of Blair Atholl, and Fincastle Loch (NN8762), 3 km to the south, held occasional flocks in the 1990s, with a maximum of 224 at Moraig in November 1995 and 1,997 in November 1992 at Fincastle, although the status of these birds is also uncertain.

iii) The Blairgowrie lochs

Apart from Marlee Loch, the most important of the Blairgowrie lochs for Iceland Greylag Geese is Loch Clunie (NO1144). For most of the 1960s, peak counts were over 1,000, reaching a peak of 7,750 in November 1967, although fewer than 100 birds were recorded in two winters. Throughout the 1970s and 1980s, peak counts were more variable, typically under 1,000 and never higher than just over 3,000, except for a very large count of 12,000, the maximum recorded at the loch, in November 1985. In the 1990s, numbers decreased, with peak roosting flocks of fewer than 1,000 now typical (Fig. 46). The mean peak winter count (1995/96–1999/2000) was 877 birds.

A few kilometres to the south of Blairgowrie and Rattray are a number of small waterbodies, three of which, Monk Myre (NO2042), Stormont Loch (NO1942) and Fingask Loch (NO1642), have been used as occasional roosts by Greylag Geese wintering in the Carse of Gowrie that more often roost at Marlee Loch or Loch Clunie. Monk Myre has held up to 2,500 (November 1973) in the past and, during the early 1970s, regularly supported over 1,000, including all months November to March in 1972/73. During the 1980s, however, numbers declined to under 500 and in the 1990s the site was not used as a roost at all. Stormont Loch shows a similar, if more variable, trend, with peak use of the site during the late 1960s and 1970s, when up to 8,730 birds were recorded. During the 1990s, counts reached a maximum of 850 in November 1991, but have been no greater than 55 since 1995/96. Similarly, Fingask Loch has held Greylag Geese inconsistently, peaking at 1,500 in February 1983.

Loch of the Lowes (NO0443), 2-km northeast of Dunkeld, is another loch holding fewer Greylag Geese than ever before, although numbers have always been unpredictable. The peak count is 5,000 in November 1980, and numbers fluctuated between 800 and 3,000 during the early 1990s. Since 1995/96,

Figure 43. Greylag Geese at Marlee Loch, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

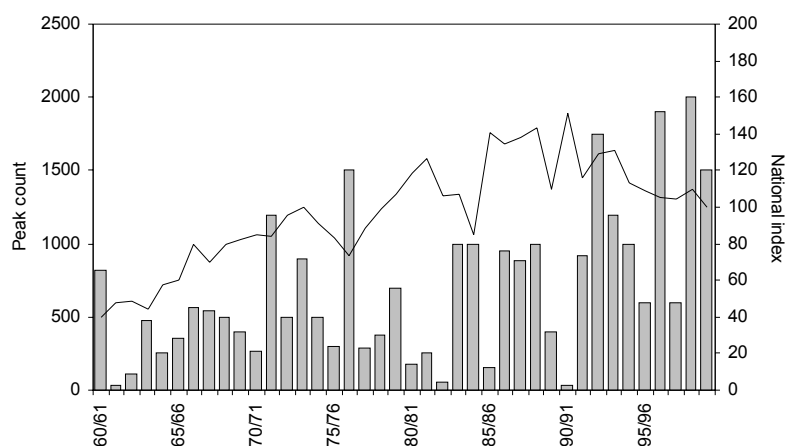


Figure 44. Greylag Geese at Marlee Loch, 1995/96–1999/2000: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

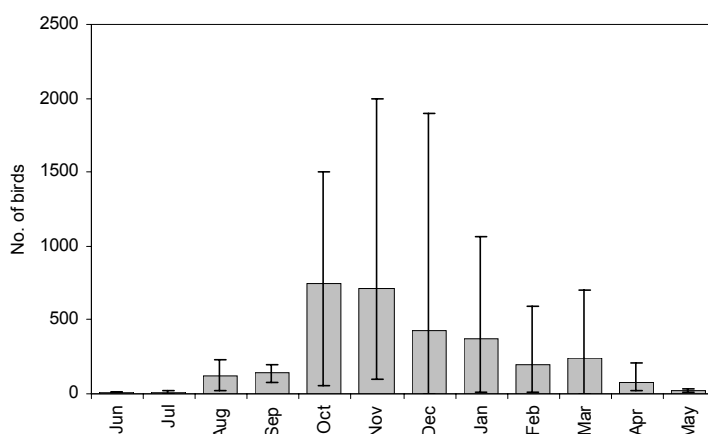


Figure 45. Greylag Geese at River Tay at Kercok, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

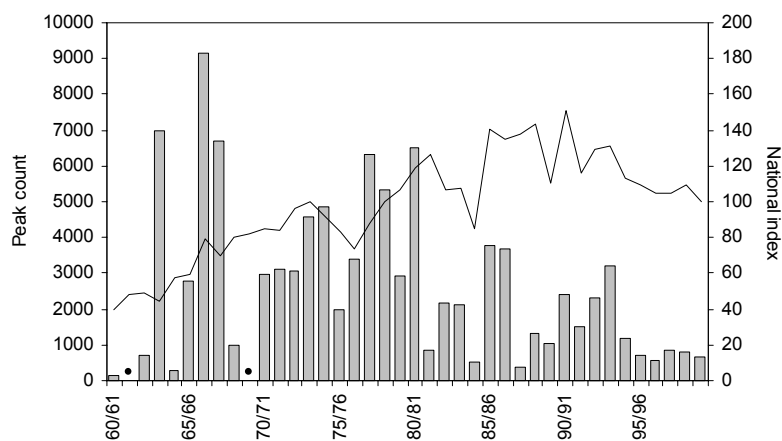
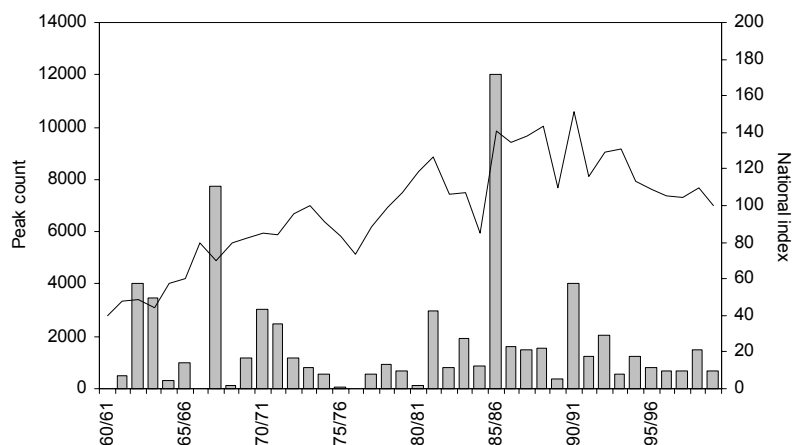


Figure 46. Greylag Geese at Loch Clunie, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



however, the peak count was just 300, in November 1998 (Fig. 47).

The adjacent Loch of Butterstone (NO0544) also holds roosting Greylag Geese on occasion, peaking at 800 in November 1972. Some 4 km from Loch of the Lowes, at the River Tay at Dunkeld (NO0042), two counts in 1993/94 of geese roosting on the river peaked at 1,400 in January, followed by 890 in March. Kingsmyre (NO1136), 10-km north of Perth, has been an occasional roost for Greylag Geese, with a maximum of 1,000 in November 1984.

iv) Forest of Clunie lochs

In the hills above the Carse of Gowrie are a number of lochs and reservoirs. Loch Benachally (NO0750) is a very occasional roost, with 620 in October 1964. The adjacent Loch Ordie (NO0350) has a single count of 370 in October 1989. Several hundred Greylag Geese roost at times on Loch Charles (NO0854) and a newly created waterbody on Cochrage Muir (NO1349), although count data are scarce (Bell & Newton 1995).

v) Lower Isla and Tay valleys

Two sites on the lower Isla were used by large numbers of Greylag Geese during the 1970s and 1980s. West Banchory (NO1940) held 2,000 in October 1980 and Couper Angus (NO2140) also held 2,000 in November 1979.

On the lower Tay, variable numbers of Greylag Geese regularly roost close to Perth itself, between the Perth Bridge and Almond Mouth, typically close to Scone. Flocks of 1,000 or more are frequently present, particularly during periods of hard weather, and were recorded in five winters during the 1990s, with a peak of 1,730 in January 1990 (Fig. 48). The mean peak winter count (1995/96–1999/2000) was 944, just under than the threshold for international importance.

vi) Loch Leven

South of Perth is Loch Leven, the largest natural eutrophic lake in Britain, covering some 14 km². It is one of the most important Pink-footed Goose roosts in Britain and in the past has held substantial numbers of Greylag Geese. From the mid-1960s to the end of the 1980s, a comprehensive set of count data show that several thousand Greylag Geese roosted there throughout the winter, typically peaking in November and December and up to a maximum of 5,615 in November 1980. Since 1991/92, however, there has been a dramatic decline, with a mean peak winter count (1995/96–

1999/2000) of just 584 (Fig. 49). Furthermore, it is likely that the majority, if not all, of these birds are from an increasing population of re-established Greylag Geese, since counts higher than those in the winter period have been made in recent years during August and September. These birds cloud the understanding of the status of Icelandic migrants at Loch Leven, although recent ringing of the summer population is helping to elucidate this.

vii) Carsebreck and Rhynd Lochs

Carsebreck and Rhynd Lochs (NN8609) are another major Pink-footed Goose roost where the number of Greylag Geese has undergone a recent decline. Numbers there were highest from the 1960s to the late 1980s, when counts typically ranged from 1,000 to 5,000. A site maximum of 8,280 was counted in November 1968. The decline during the 1990s was as dramatic as at other sites in the region, falling from 2,150 in 1989/90 to 915 in 1990/91 and from 400 to 500 during 1994/95–1998/99. In 1999/2000, however, a count of 1,060 was made during November (Fig. 50). The mean peak winter count (1995/96–1999/2000) was 602. Over the period 1987/88 to 1993/94, this flock used a further nine sites in Strathallan, and the main roost at Carsebreck was frequently deserted (Bell *et al.* 1997).

viii) Glenfarg Reservoir

In the Ochil Hills, at 180 m asl, lies Glenfarg Reservoir (NO1011). This site supported a maximum of 1,950 Greylag Geese in November 1970 and held 500–1,200 in most years from the mid-1960s to the mid-1970s. Subsequently, numbers decreased and since 1990/91 use of the site has been sporadic, with no birds recorded in some winters. The peak count since then was 405 in November 1998. Nearby, Clevage Loch (NO0513) has also supported the occasional roosting flock, with 158 in November 1984.

ix) Dupplin Lochs

In Strathearn, Dupplin Lochs (NO0320), just north of the River Earn and to the west of Perth, are one of the most important roost sites for Pink-footed Geese in the country. Roosting Greylag Geese used the site mostly from the 1960s to the mid-1980s, when peak counts over 1,000 or more were commonplace and a maximum for the site of 3,990 was recorded in November 1972. In the 1990s, although 1,060 were recorded in November 1991, the size of the roosting flock dropped significantly in line with other roosts in the area and has failed to peak higher than 100 in most years since 1992/93.

x) Upper Strathearn

Occasional roosting flocks have been encountered at a number of temporary sites in upper Strathearn (between Dalreoch Bridge and Comrie) and in the Pow Burn Valley to the north. Since 1987/88, Greylag Geese are known to have roosted on at least 13 different sites in this area. A number of small waterbodies near Kinkell Bridge (NN9316) are particularly important, including the pools at Lowbank (NN9416), Raith (also known as Mossend Pond, NN9318) and East Fordun (NN9515). High counts at these sites include: 1,780 at Lowbank Pools in February 1989 and 1,075 in December 1997; 904 at Raith Pool in January 1998; 1,760 at East Fordun in November 1989. Floodwaters along the River Earn at Dalreoch (also known as Millands Marsh, NN9917) are also used with regularity. Some 1,210 birds were counted there in February 1989 and 1,240 in January 1999. A flock of 1,246 roosted at Pow flood in February 1993.

One kilometre to the northwest of Drummond Loch, Loch of Balloch (NN8318) is often used by small flocks of Greylag Geese that undoubtedly roost at the loch at times. These flocks are typically in the low hundreds, up to a maximum of 820 in December 1988. Similarly, a count of 600 in October 1988 at Bennybeg Pond (NN8618), less than 1 km to the east of Drummond Loch, no doubt consisted of birds that usually used the main roost. Other small lochs in this vicinity that have held Greylag Geese are: Loch Cowden (NN7820) – maximum of 165 in October 1996; Strowan Loch (NN8220) – two counts in the 1970s up to a maximum of 900 in November 1973; St Serfs Water (NN8423) – counted since 1995/96 with a maximum of 209 in December 1996; Ochertyre Loch (NN8317) – six counts peaking at 600 in November 1974.

xi) Glenalmond

To the northwest of Perth are two small waterbodies in the hills between Glenalmond and Strathbraan: Loch Tullybelton (NO0034) and Loch Mullion (NN9833). The former has held Greylag Geese on at least three occasions, with a maximum of 265 in March 1988. Loch Mullion supported up to 351 (April 1995) during the 1990s, and further west in Glenalmond small numbers roosted at another three sites with varying degrees of regularity during the 1990s. Loch Buchanty (NN9328) held small roosting flocks peaking in the low hundreds for much of the 1990s, up to a maximum of 900 in November 1991. Counts at the Glenalmond Estate (NN9429) during the 1990s show a maximum of 420 in January 1996. Loch Meallbrodden (NN9125), in the hills towards Crieff, was counted infrequently during the 1990s

and typically supported fewer than 50 birds, with one exceptional count of 230 in October 1997. Over the hills to the north, Loch Freuchie (NN8538), in Glen Quaich, held increasing numbers of Greylag Geese during the 1990s, peaking at 342 in November 1995. This flock is believed to interchange frequently with birds from Glenalmond, depending on levels of disturbance.

2.1.7.5 Key references

Newton *et al.* (1973), Newton & Campbell (1973), Bell & Newton (1995), Bell *et al.* (1997)

2.1.8 Lothian and Borders

2.1.8.1 Background

The natural inland waters of Lothian and Borders are few and mainly small, but the increasing demand for water by the inhabitants and industries of Edinburgh and its environs has led to the creation of about 30 reservoirs, mainly in the Moorfoot, Lammermuir and Pentland Hills. Several of these have become major roost sites for Pink-footed Geese, but Greylag Geese have not expanded in this region in the same way.

2.1.8.2 Historical status

In the early part of the century, Greylag Geese were scarce everywhere in Lothian, with the exception of 200–300 wintering at Aberlady Bay (Berry 1939, Brotherston 1964). During World War II an increase and withdrawal inland is said to have occurred, and a wintering flock became established at Gladhouse Reservoir around this time. These birds were considered to have been the flock previously found at Aberlady Bay and by the late 1940s numbered around 600 (Brotherston 1964). Large numbers also began to occur at Threipmuir and Harperrig Reservoirs at this time (Brotherston 1964). During the 1950s, numbers remained rather steady, but by the early 1960s the rate of growth of the Greylag population in Lothian and Borders was faster than that of the whole population, with roosting primarily at Watch Water Reservoir (Boyd & Ogilvie 1972) and Gladhouse Reservoir (Brotherston 1964). During the 1970s and early 1980s, the region was a stronghold for the species, with a number of important roosts. Subsequently, numbers have declined over much of the region in line with the general redistribution northwards. The majority of birds still present are now found at sites in the east Borders, close to Northumberland. The problem of separation from re-established Greylag Geese increasingly hampers monitoring in this region.

2.1.8.3 Internationally important sites

i) Threipmuir and Harlaw Reservoirs

Five-year mean 95/96–99/2000: 1,426

Site conservation status

None

Site description and habitat

Threipmuir and Harlaw Reservoirs (NT 1763) are located to the southwest of Edinburgh, 2-km south of Balerno on the edge of the Pentland Hills Regional Park.

Numbers and trends

Between 1960/61 and 1998/99, counts were typically around 500 birds, surpassing 1,000 in five years only and peaking at 1,575 in November 1992. In March 2000, however, an exceptional count, and the site maximum, of 5,192 was made, taking the site above the threshold for international importance (Fig. 51). Re-established Greylag Geese also occur here and make the number of Icelandic migrants difficult to determine, although the high count in March 2000 almost certainly comprised mostly Icelandic birds.

Site use

To the west of the main waterbody are Bavelaw Marshes, a favoured feeding area for Greylag Geese roosting at this site.

2.1.8.4 Other sites

i) Bemersyde Moss

A series of five small pools west of Kelso (NT6133). Greylag Geese did not occur here in significant numbers until 1988/89, when a peak of 300 birds was present. Numbers then rose quickly to a peak of 1,819 in November 1995, but subsequently declined just as quickly, although a count of 850 was made in 1999/2000 (Fig. 52). The mean peak winter count for 1995/96–1999/2000 was 820.

ii) River Teviot (Nisbet to Kalemouth)

This site covers a section of the River Teviot, approximately 5 km in length, between Nisbet (NT6725) and Kalemouth (NT7027), 7 km to the southwest of Kelso and the confluence with the River Tweed. The valley here is wide and flat, surrounded by gently rolling hills. Roosting birds in this area have tended to concentrate around Nisbet, and during the period 1978/79 to 1991/92 numbers using the site ranged from 86–1,450 (mean 801). In

the period 1991/92 to 1997/98, counts included the whole section from Nisbet to Kalemouth, peaking at 1,200 in January and December 1996. The number of Greylag Geese tends to increase through the winter and most recently has typically peaked in March. However, no counts have been made there since 1997/98 (Fig. 53). The mean peak winter count for 1995/96–1999/2000 was 983, and for the last five years for which counts were available (1993/94–1997/98) it was 908, only slightly below the requirement for international importance.

iii) Hirsell Lake

Hirsell Lake (NT8240), on the outskirts of Coldstream, supported Greylag Geese from the mid-1980s to late 1990s. More than 1,000 birds were counted there in four years during the late 1980s and early 1990s, and in two years in the mid-1990s, up to a maximum of 1,250 in November 1990. Since then, numbers have rapidly fallen, with fewer than 110 since 1997/98 (Fig. 54). The mean peak winter count for 1995/96–1999/2000 was 458.

iv) Hule Moss

Hule Moss (NT7149), an important roost for Pink-footed Geese, generally supports very few Greylag Geese. Occasional flocks were observed in the 1960s and 1970s and they became more regular from the 1980s onwards, although numbers remained low (fewer than 100). Larger flocks are occasionally recorded, with a maximum count of 1,130 in November 1997.

v) Watch Water Reservoir

Watch Water Reservoir (NT6656) was once a very important roost site for Greylag Geese, particularly from the mid-1970s to early 1980s, when a maximum of 1,838 was recorded in October 1978. Numbers have declined since the 1980s and counts have been greater than 100 during only three subsequent winters, with a peak of 321 in 1997/98. No birds were recorded there in 1998/99 and 1999/2000.

vi) Kelso area

Two lochs to the south and southeast of Kelso, Whitton Loch (NT7519) and Hoselaw Loch (NT8031), are typical of this region in that high numbers of roosting Greylag Geese during the 1970s and 1980s were followed by a decline in numbers during the 1990s. The maximum recorded at Whitton was 2,750 in October 1982, and the site was used most in the early 1980s. The peak count in the 1990s was 1,500 in November 1993, although this

Figure 47. Greylag Geese at Loch of the Lowes, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

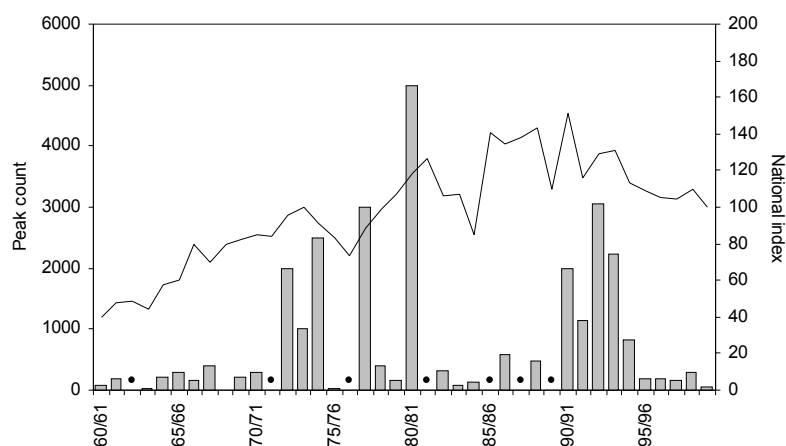


Figure 48. Greylag Geese on the River Tay at Scone, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

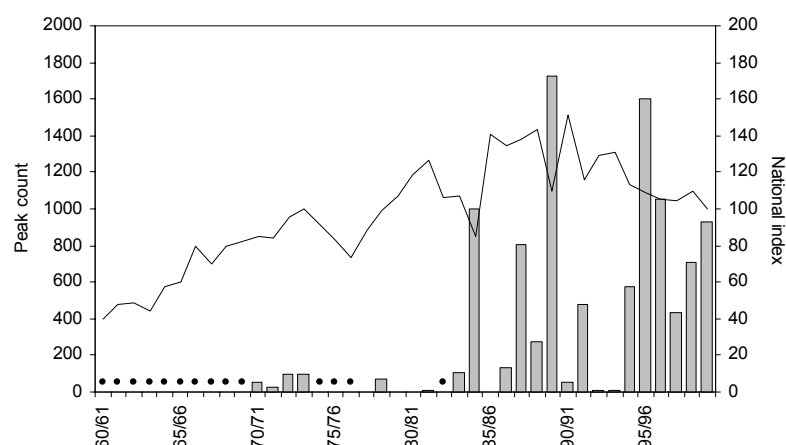


Figure 49. Greylag Geese at Loch Leven, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

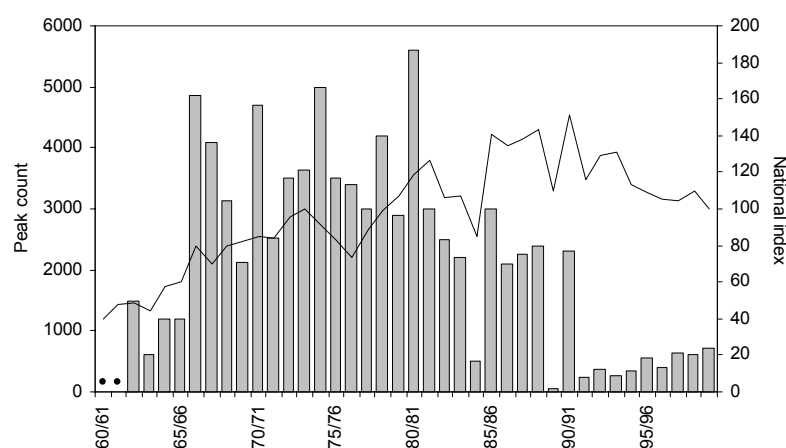
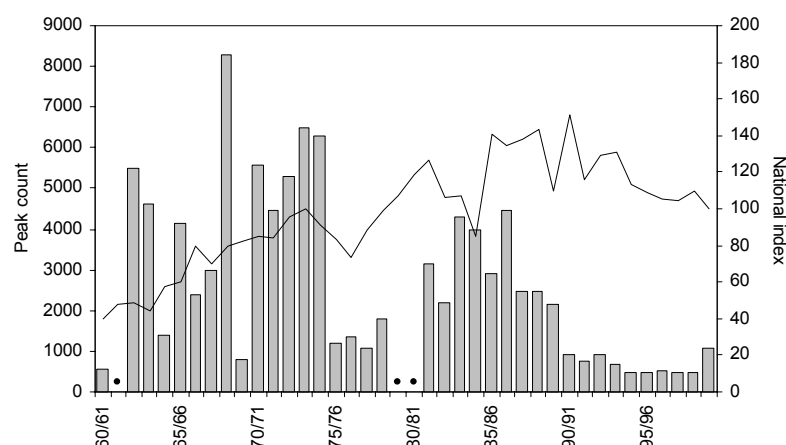


Figure 50. Greylag Geese at Carsebreck and Rhynd Lochs, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



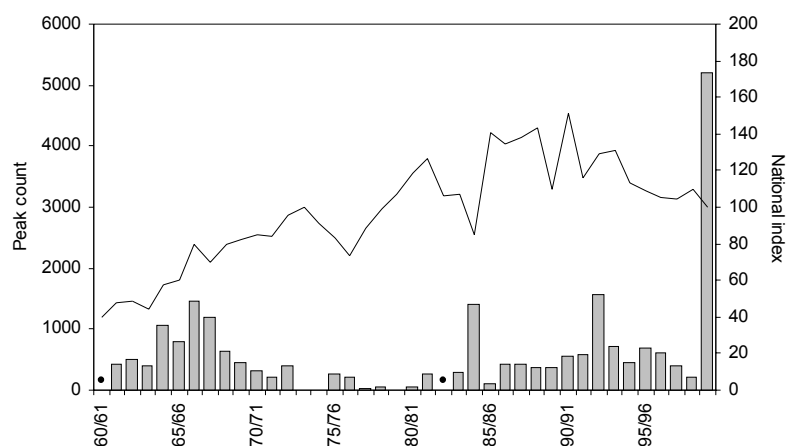


Figure 51. Greylag Geese at Threipmuir and Harlaw Reservoirs, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

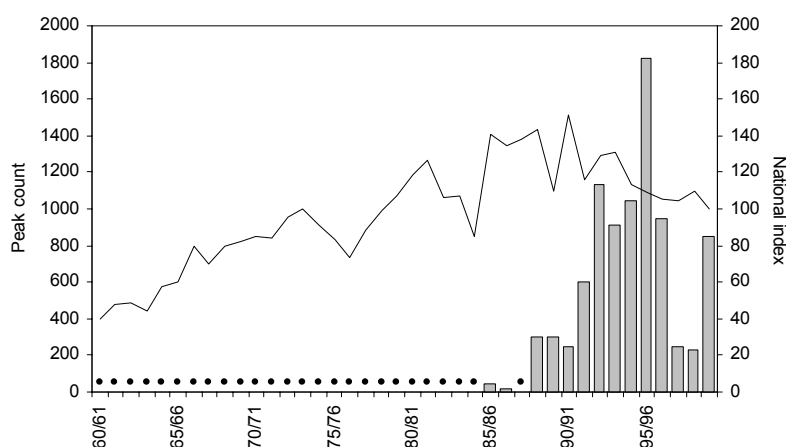


Figure 52. Greylag Geese at Bemersyde Moss, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

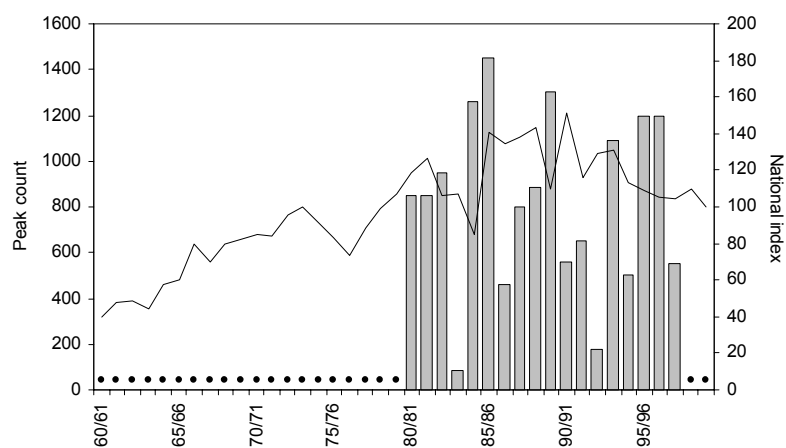


Figure 53. Greylag Geese on the River Teviot (Nisbet to Kalemouth), 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

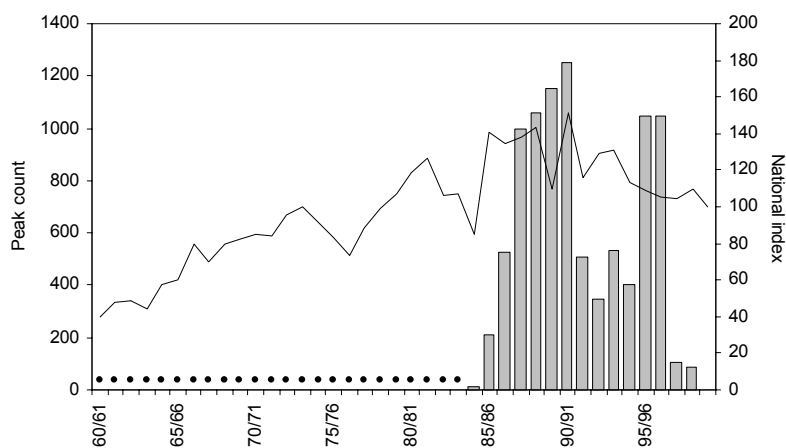


Figure 54. Greylag Geese at Hirsell Lake, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

was exceptional and since then the peak winter count has been fewer than ten birds. At Hoselaw, numbers were much higher during its period of peak usage from the early 1970s to late 1980s, with a maximum of 5,700 in October 1985. Consequently, this site has been designated as a Ramsar site and SPA for its importance to Iceland Greylag Geese. This importance has since declined considerably, however, although the occasional large flock still occurs there (e.g. 2,370 in October 1994). The mean peak winter count (1995/96–1999/2000) was just 136. Nearby, Yetholm Loch (NT8129) shows a trend similar to these sites, with peak occupancy during the 1980s. Numbers were lower, typically 100–400, with a peak of 700 in March 1978. During the 1990s, peak counts did not surpass 100 birds.

vii) River Tweed

A number of sites along the River Tweed have held roosts of geese. Between Kelso and Coldstream several locations have been counted, although this section is generally monitored as a single site. Use tends to be irregular, with high counts including 1,937 roosting at Birgham (NT7938) in January 1997, 2,000 at Redden (NT7737) in November 1980 and 2,044 there in December 1986. Upstream of Kelso, the area around Rutherford (NT6431) held flocks of a few tens on a few occasions in the late 1980s and early 1990s, and more recently flocks of 300–350 were present in January and February 1995 and 650 in December 1995.

viii) River Teviot satellite roosts

Close to the major roost along the River Teviot at Nisbet are three small waterbodies that occasionally support roosting Greylag Geese: Baron's Folly (NT6426), Upper Nisbet Pond (NT6826) and Wooden Loch (NT7025). Records from these sites during the 1980s and 1990s include 750 at Wooden Loch in February 1989, 628 at Upper Nisbet Pond in February 1987 and 500 at Baron's Folly in January and April 1997.

ix) Whitrig Moss

Whitrig Moss (NT6235) occasionally holds birds that usually roost at Bemersyde Moss, just 1 km to the southwest; a maximum of 700 was present in February 1996.

x) Dowlaw Dam

On the Borders coast around Coldingham, Dowlaw Dam (a farm impoundment, NT8569) has been frequently used as a roost since the early 1980s, particularly during the late 1980s when a maximum

of 2,382 Greylag Geese were recorded in November 1988. Throughout the 1990s, numbers were smaller, apart from a flock of 1,600 in November 1997, and the mean peak winter count (1995/96–1999/2000) was 626. These birds feed mainly within a few kilometres of the dam and occasionally roost at nearby Coldingham Loch (NT8968), where around 500 have been counted on two occasions, or Lumsdaine Pond (NT8769), where 800 were recorded in November 1996. However, there are typically fewer than 100 birds. Another occasional roost is Lochhouse Pond (NT6181), where up to 250 roosted at times during the 1990s.

xi) Tynninghame Estuary and Aberlady Bay

Further west around the coast, the Tynninghame Estuary (NT6379) has been used by roosting Greylag Geese with increasing frequency since the mid-1980s. Although the peak count at the site was just 550 in February 1979, the average at that time was fewer than 100 birds. During the 1990s, the site consistently attracted around 200–400, with peak counts occurring during the spring and very few birds present before January. To the west of North Berwick, Aberlady Bay (NT4581) is another important Pink-footed Goose roost. Greylag Geese there are scarce, with fewer than 50 present in most winters and a recent site maximum of 101 in January 1982. Re-established birds from nearby Gosford Ponds (NT4578) are beginning to cause uncertainty over the status of Iceland Greylag Geese there.

xii) Whiteadder and Hopes Reservoirs

Whiteadder Reservoir (NT6563) and Hopes Reservoir (NT5462) are both occasional roost sites for Greylag Geese. Whiteadder regularly supports a few hundred, with a maximum of 1,480 in November 1992, although in some years the peak count is fewer than 100. Hopes Reservoir is far less frequently used, with just a few scattered records during the 1970s and 1980s, peaking at 300 in November 1976.

xiii) Cauldshiels Loch

Cauldshiels Loch (NT5233), south of Galashiels, occasionally held small roosting flocks in the 1980s and 1990s, with a maximum of 200 in October 1997. At nearby Faughill Moor (NT5230), 142 were present in March 1982.

xiv) Quarryford Pool and East Fortune Ponds/Brownrigg

Quarryford Pool (NT5565) regularly held Greylag Geese during the mid-1970s, with flocks usually in

the low hundreds. During the 1980s, numbers were lower, although 600 were present in November 1982. In the 1990s, numbers declined further, with just a few tens using the site occasionally. East Fortune Ponds and Brownrigg (NT5580) is a regular roost for a few hundred Greylag Geese. They began to roost there in 1992/93 and have since numbered around 100–500, with a maximum of 552 in February 1996.

xv) Western Borders

In western Borders, the number of Greylag Geese has always been lower than in adjacent areas, even during the 1970s and 1980s. Portmore Loch (NT2550) held a maximum of 1,400 in December 1968, with peak numbers from the mid-1960s to the early 1970s. Since then, occasional small flocks have been counted at the site, but nothing greater than seven since the start of the 1990s. Gladhouse Reservoir (NT2953) shows a similar trend, with a maximum of 2,350 in November 1970 but, since the 1970s, 150–600 have been more usual. Large numbers of re-established Greylag Geese are found at this site, making the small numbers of Icelandic Greylag Geese almost impossible to detect. Recent sightings of marked birds, however, indicate that some migrants do still frequent this site.

Edgelaw Reservoir (NT2958) has held up to 350 Greylag Geese, although they occur there infrequently and typically number fewer than 50. West Water Reservoir (NT1252), a major roost for Pink-footed Geese, has seen only sporadic use by Greylag Geese. A maximum of 600 was recorded in November 1972, although counts are rarely above 100. Apart from occasional flocks of fewer than 10, Rosslynlee Reservoir (NT2759) held 120 in November 1976.

xvi) Southern Lothian

Southwest of Edinburgh, in southern Lothian, is another group of large reservoirs: Threipmuir and Harlaw (NT1764), Harperrig (NT0961), Crosswood (NT0557) and Cobbinshaw (NT0158). All have held roosting Greylag Geese since the 1960s, although the numbers have varied considerably between sites and over time. The most important of these reservoirs is Harperrig. Numbers there peaked at 1,950 in November 1981 and have recently averaged 277 (mean peak winter count, 1995/96–1999/2000), although no counts were made in 1999/2000. Crosswood and Cobbinshaw are less important, although the latter site was noted to be the most important goose roost in Lothian during the 1930s (Boyd & Ogilvie 1972). Geese started to return to the site in the late 1960s, but numbers remained low

(fewer than 100 in most years). Crosswood Reservoir has held slightly more birds in recent years, with numbers in the low hundreds during the 1990s. Both have maximum counts well above the average (820 at Crosswood in November 1993 and 1,430 at Cobbinshaw in November 1983).

2.1.8.5 Key references

Brotherston (1964), Newton *et al.* (1973), Cranswick (1992)

2.1.9 Clyde Basin

2.1.9.1 Background

The Clyde region contains a wide diversity of landscapes and habitats. In the south, extensive farmland occurs over much of Ayrshire and Lanarkshire. The north is mountainous, with fjord-like sea lochs extending far inland. Central Clyde is covered by Glasgow and its suburbs.

The presence of large numbers of re-established Greylag Geese at numerous sites in this region presents considerable difficulties for monitoring the status of Icelandic migrants.

2.1.9.2 Historical status

Small flocks of migrant Greylag Geese were noted as far back as the middle of the 19th century, passing through parts of Ayrshire at the beginning of winter and again in March and April (Gray & Anderson 1869, cited in Richmond-Paton & Pike 1929). By the early 20th century, they were considered to be winter visitors to the lochs of Ayrshire (Richmond-Paton & Pike 1929), although many of the records were of flying flocks and were simply identified as grey geese. Bean Goose *Anser fabalis* was considered to be the common grey goose of Ayrshire at that time (Richmond-Paton & Pike 1929) and, therefore, the status of the Greylag in the region at that time is difficult to determine. Berry (1939) described the Greylag Goose as 'Comparatively rare except locally in Ayrshire and Kintyre. In the former county, where it is "seen frequently", a colony was formed near Tarbolton about the beginning of this century and by 1927 the flock numbered 150-200 birds'; these birds may have accounted for most records of this species in the county, suggesting that Icelandic migrants were as scarce as in other parts of the Clyde Basin. Berry (1939) also considered the species to have become scarcer in recent years.

2.1.9.3 Internationally important sites

None

2.1.9.4 Other sites

i) Gadloch (Lenzie Loch)

Gadloch is located at Lenzie, northeast of Glasgow (NS6471), and the surrounding area is becoming increasingly urbanised. Areas of farmland are found to the south and east, and to the north around Strathkelvin. From the early 1960s to the mid-1970s, the number of Greylag Geese at the loch averaged 300–600. In the mid-1970s, this fell in response to the opening up of the loch for recreation, with much of the flock transferring to the Balmore Haughs, 4–5 km to the northwest (Owen *et al.* 1986a). Numbers remained low until the early 1980s, then increased again to around 800–900, and a maximum of 1,300 in November 1989. In the 1990s, peak winter counts were between 450 and 1,300, averaging 904 (Fig. 55). The mean peak winter count (1995/96–1999/2000) was 859. Greylag Goose numbers at Gadloch peak during autumn, decline during mid winter and increase again slightly in late winter and spring.

ii) Endrick Mouth/Endrick Water

North of the Clyde Estuary, Endrick Mouth, on the eastern side of Loch Lomond (NS4388), and to a lesser extent the river corridor that runs due east from there to Drymen (Endrick Water), have supported up to 3,000 Greylag Geese (1978/79 and 1980/81), with peak numbers during the late 1970s and early 1980s (Fig. 56). The site still regularly holds internationally important numbers, but low counts in 1995/96 and 1999/2000 mean that the current mean peak winter count (1995/96–1999/2000, 715) is below the threshold for international recognition.

Some of these birds occasionally roost at Caldarvan Loch (NS4283), just a few kilometres to the south. Numbers are typically between a few tens and a few hundred birds, peaking at 400 in February 1991, and tend to occur between January and March.

iii) North Glasgow

Hogganfield Loch (NS6467) has held small numbers of Greylag Geese, most regularly in the 1990s, with, on average, 60 each winter, up to a maximum of 113 in December 1997. It is likely, however, that these are part of the re-established population, as approximately 200 moult there each summer. The number of re-established Greylag Geese has increased annually since they were introduced there

in the 1970s, although they do not breed at the site. Recently, Greylag Geese have occasionally roosted on nearby floodwaters. Counts at Gartloch Flood (NS6767), just 3 km to the east, reached a maximum of 274 in February 1998, and at Summerston (NS5771), large numbers have been counted since 1996/97, up to a maximum of 1,150 in October 1997. Bardowie Loch (NS5873) supported a few hundred birds during the mid-1980s, with a maximum of 544 in January 1987. Subsequently, counts have been of fewer than ten individuals.

iv) South Glasgow

Despite there being a large number of reservoirs in this area, there have been few counts of Greylag Geese. In the 1980s, there were single records from Bellisle Reservoir (NS4834, 100 in January 1982) and Rouken Glen Pool (NS5557, 100 birds in January 1983). More recently, 120 were at Long Loch (NS4752) in October 1996 and 133 were at Merryton Ponds (NS7654), along the River Clyde, in November 1997. This site has also held flocks of fewer than ten birds on a number of other occasions.

v) Lanark area

There are few records of roosting Greylag Geese for this area, but the floodplains around Biggar often hold small flocks of feeding birds, up to a few hundred, which may remain to roost in the area. Knowledge of such site use is limited, however, and counts have been infrequent.

Roosting birds have also been recorded at Cowgill Reservoirs (NT0327, maximum of 150 in October 1987), Fannyside Loch (West) (NS8073, single count of 103 in December 1995), Crane Loch (NT0452, three counts with a maximum of 200 in October 1969) and Lochlyoch Reservoir (NS9335), which regularly held a few hundred during the early and mid-1980s, peaking at 580 in November 1987. There have been no subsequent counts.

vi) Lochwinnoch-Dalry area

The main site in this area is Barr Loch (NS3557), which, for most of the 1990s, regularly supported a roosting flock of several hundred Greylag Geese, peaking in January and February. The maximum recorded is 460 in February 1994. Prior to the 1990s, combined counts at Barr Loch and the adjacent Castle Semple Loch were around 200–400, with numbers peaking in the spring. A maximum count of 560 was present in February 1987. Nearby, at Barcraigs Reservoir (NS3857), 120 birds roosted in November 1996 and at Whittliemuir Midton Loch (NS4158) 288 were present in January 1993.

Further southwest, Greylag Geese roosting at Kilbirnie Loch (NS3354) peaked at 160 in March 1998, but other counts have been scarce and always of fewer than 50 birds. Munnoch Reservoir (NS2547) was a regular roost for a few hundred for much of the 1960s, 1970s and early 1980s, with a peak of 880 in March 1982. Recently, this site has been abandoned, with no birds recorded since 1984/85. Small numbers were also recorded infrequently during the 1960s at Caaf (NS2550) and Glenburn Reservoirs (NS2151).

vii) Southern Ayrshire

A number of small lochs and flashes around Maybole, in southern Ayrshire, are occasionally used by roosting Greylag Geese. Recently, the most important of these has been Meadownay Farm Pools (NS2912), where significant flocks were present for much of the winter from 1993/94 to 1996/97, peaking at 1,233 in February 1996. At Blairbowie Farm Flash (NS3211), numbers tend to increase as winter progresses, peaking during spring migration. Greylag Geese roosted there in greatest numbers during the 1970s, peaking at 1,150 in March 1974. Recently, 50–350 have used the site, with a peak of 350 in November 1990. Recent counts at Mochrum Loch (NS2709) have typically been from a few tens to around 200, with a peak of 560 in March 1983. Drumore Loch (NS3309) regularly held 300–700 during the 1970s and early 1980s, peaking at 1,400 in February 1979, but use of this site ceased in the mid-1980s. Craigdow Loch (NS2606) is used as a roost very infrequently, with a maximum of 120 in December 1986, with no counts since 1991/92. Likewise, Chapelton Loch (NS3209) occasionally holds a few hundred birds, with flocks recorded there twice during the 1990s. A small flock peaking at 106 in February was recorded at Cairnhill Pond (NS2400) during 1983/84. A single count of 2,700 was made at Dipple (NS2002) in January 1978.

Further east, the lochs of Croot (NS3712) and Shankston (NS3911) are infrequently used as roosts. Loch Croot supported 270 birds in March 1964, but has not held more than 100 since, with none there since 1987/88. Shankston has been used more recently, with two flocks of over 200 during the 1980s, but no more than five birds were counted there during the 1990s. No records of Greylag Goose exist for the third loch in this group, Barnshean (NS3711). Just to the south, Loch Spallander (NS3808) typically holds a few tens on occasion, with a peak of 340 in January 1986.

Just to the north, Martnaham Loch (NS3917) regularly holds small flocks of Greylag Geese. Numbers were greatest during the late 1970s and

early 1980s, when several hundred roosted, with a maximum of 500 in March 1979. Recently, numbers have been below 100, although 500 were counted in February 1996. Just 1 km to the north, Fergus Loch (NS3918) is used occasionally, with flocks larger than 200 recorded twice since 1989/90. Other occasional roosts include Kerse Loch (NS4214), with 165 in December 1978 and flocks of 20–30 more recently, and Belston Loch (NS4716), where similar numbers have occurred, peaking at 115 in February 1987, although none have been recorded since 1989/90.

To the east is Knockshinnoch Lagoons (NS6013), just west of New Cumnock. Occasional flocks have been recorded there, including 135 in February 1996.

viii) The Clyde firths

Greylag Geese have been recorded roosting in a number of locations on the firths around the Clyde Basin. Whilst some of these counts are of large numbers, such records are very infrequent.

Along the Firth of Clyde, 1,178 Greylag Geese were recorded in January 1983 in the Dunoon area (NS1776) and a peak count of 1,334 occurred in the Inner Firth of Clyde (NS3576) in January 1983. Some large counts have also been made to the north in Loch Long, from Ardentinnay to Strone Point (NS1983), particularly in the 1960s to the mid-1970s, reaching a maximum of 2,000 in November 1974.

Further south, occasional counts have been recorded at Hunterston to Fairlie (NS1953, maximum of 210 in January 1981), Hunterston Peninsula and Ardnail Bay (NS1848, maximum of 320 in January 1970) and Ardrossan to West Kilbride (NS2045, maximum of 1,581 in January 1979). Around Ayr, four counts at the Doon Estuary (NS3219) reached a maximum of 135 in February 1979, and occasional counts between Ayr and Prestwick (NS3324) have recorded up to 120 birds.

ix) Isle of Arran

On the Isle of Arran, a few hundred Greylag Geese winter regularly around the Shiskine Valley. These birds roost at the mouth of Machrie Water (NR8933), where an exceptional count of 2,672 was recorded in March 1963. More typically, 100–500 have roosted there, and numbers have usually been fewer than 100 since the mid-1980s. During the 1990s, however, the number feeding in the Shiskine Valley, 3 km to the southeast, remained at 150–400 and it appears that birds are now also roosting there. Some also feed in the Bennecarrigan area (NR9424), the highest count being 350 in January 1995.

2.1.10 Argyll & Bute

2.1.10.1 Background

This area encompasses west coast islands from Tiree and Coll to Islay and also includes Bute, in the outer Firth of Clyde, and the associated mainland areas, including the Kintyre Peninsula.

2.1.10.2 Historical status

In the first half of the 19th century, Greylag Geese were a widespread breeding species in this region, nesting on Islay, Colonsay, Tiree and Coll. By 1892, however, this population had disappeared (Berry 1939). Northwest Scotland Greylag Geese have since re-colonised some of these old breeding haunts, particularly Tiree and Coll, but appear never to have occurred further south and east than the Kintyre Peninsula. Consequently, Greylag Geese were unknown on the Island of Bute until recently. They were not mentioned by McWilliam (1927) and the first records appear to be those of Stuart (1953), who stated that 'by 1938, several hundred were wintering on the west side of the island'. These birds were assumed to be of Icelandic origin and ringing has recently confirmed this (B. Swann pers. comm.). Away from Bute, Iceland Greylag Geese also occur regularly on the Kintyre Peninsula and other sites nearby, although their status at these localities is clouded by the presence of small numbers of northwest Scotland Greylag Geese.

2.1.10.3 Internationally important sites

i) Island of Bute

Five-year mean 95/96–99/2000: 2,022

Site conservation status
SSSI (various)

Site description and habitat

The Island of Bute (NS0761) contains a rich variety of wildfowl habitat with several quite shallow and fertile lochs set in good quality farmland. There are five principal lochs: Greenan Loch, Loch Quien, Loch Fad, Loch Dhu and Loch Ascog.

Numbers and trends

The island has been a regular wintering haunt for Greylag Geese for approximately 70 years (Owen *et al.* 1986a). They were first recorded during the 1930s (Stuart 1953), when several hundred were present, increasing to about 1,000 by the late 1940s and 6,000 by the mid-1960s (Owen *et al.* 1986a). At around this

time, intolerance towards the geese was widespread among farmers on the island and intensive scaring and commercial shooting were initiated around 1964 (I. Hopkins pers. comm.). This was almost certainly the cause of the rapid decline that followed and by the end of the 1970s numbers had fallen considerably (Owen *et al.* 1986a). During the 1980s and 1990s, however, Greylag Geese returned to some extent and co-ordinated counts in the 1990s show that apart from a couple of higher counts (4,200 in November 1990 and 4,280 in January 1996) the number roosting on the island was around 1,500–2,000 (Fig. 57).

Most counts are island-wide censuses of feeding birds and few roost counts exist. On Loch Ascog, Greylag Geese numbers are typically in the high hundreds, with the occasional count of over a thousand, up to a maximum of 2,500 in January 1968. Lochs Quien, Fad and Dhu, which were counted together from the 1960s to early 1980s, held large numbers of Greylag Geese during this period, with over 1,000 regularly present, up to a maximum of 6,300 in November 1965. Counts at Loch Quien since the mid-1980s peaked at a maximum of 1,400 in January 1990. The main roost sites during the 1990s were Lochs Ascog and Quien, averaging 400–500 birds. Ettrick Bay is also used when winds are not too strong, and Loch Dhu, the main roost of Greenland White-fronted Geese on the island, and Loch Greenan are also used occasionally.

Site use

The number of Greylag Geese on Bute builds during the autumn to a peak in January (Fig. 58). Counts suggest that a second peak occurs in March, which may indicate Greylag Geese from other wintering areas stopping over as they move north. Only one count was available for this month, however, and this was in 1995/96, when higher than average numbers were present.

Those Greylag Geese roosting at Lochs Ascog and Quien typically remain to feed on improved grasslands in the immediate vicinity. The birds at Ettrick Bay usually forage in the fields to the northeast. Once disturbed, however, flocks can be found feeding almost anywhere on the west side of the island, between Ettrick Bay in the north and Stravanan Bay to the south. Favourite sites in recent years have been fields at Ballycaul Farm (NS0463) and those between Big Kilmory and Mecknoch (NS0459). Flocks have also been observed flying east from Bute towards the Ayrshire coast and west towards Ardlamont Point, where it is thought they may spend the day feeding.

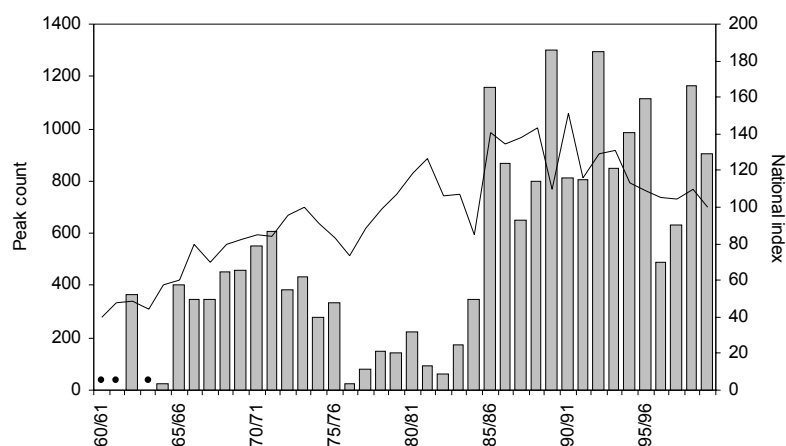


Figure 55. Greylag Geese at Gadloch, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

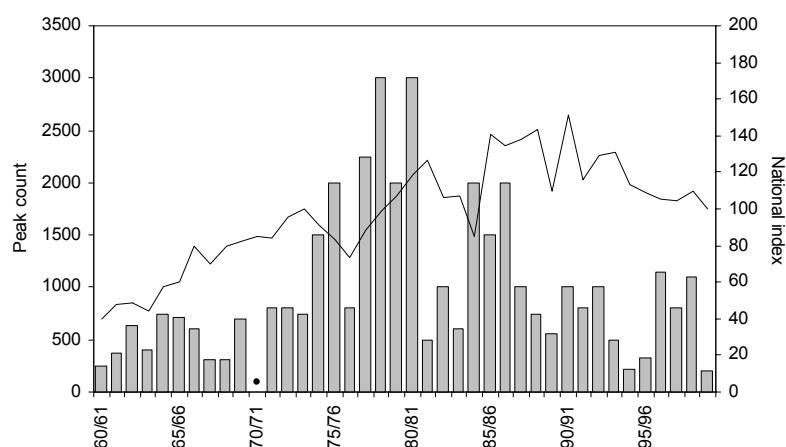


Figure 56. Greylag Geese at Endrick Mouth/Endrick Water, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

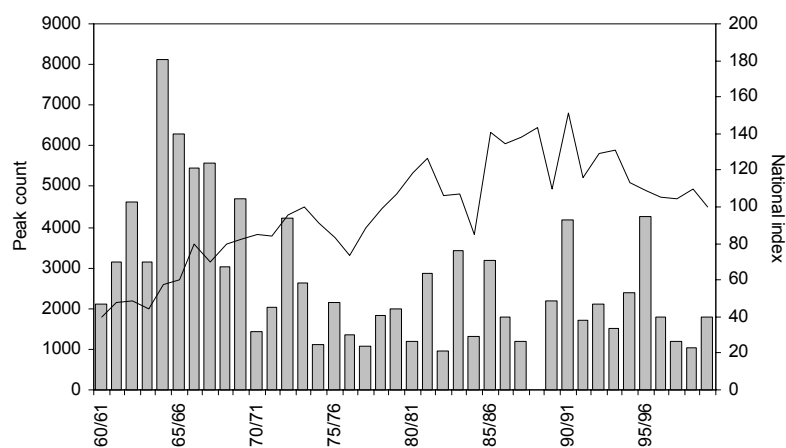


Figure 57. Greylag Geese on the Island of Bute, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles donate years with no known data)

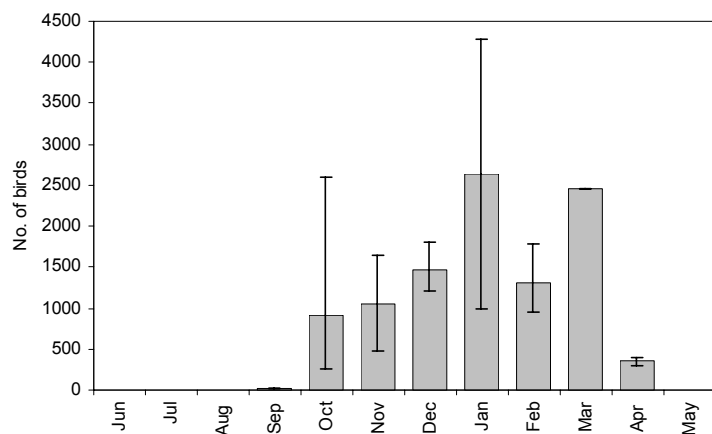


Figure 58. Greylag Geese on the Island of Bute, 1995/96–1999/2000: mean peak counts by month (error bars donate minimum and maximum peak counts during the period)

2.1.10.4 Other sites

There are very few sites in this region away from Bute that support Iceland Greylag Geese.

i) Kintyre Peninsula

At Rhunahaorine (NR7049), flocks in the low hundreds roosted during the 1960s through to the early 1990s, with a maximum of 622 in December 1991. Since the 1960s, feeding birds have been counted regularly at Machrihanish (NR6522), where a maximum of 726 was present in March 1996, although flocks in the mid to low hundreds are more typical. These birds feed mainly on the low-lying arable land and pastureland to the south of the airfield and roost at Tangy Loch (NR6927), 7 km to the north. Flocks at the loch were recorded for only a few years in the 1960s and early 1970s, however, and numbered no more than 220.

Roosting Greylag Geese were also recorded in the Sound of Gigha (NR6950) during 1993/94, reaching a peak of 472 in January. Corachan Burn, Southend (NR7109), held occasional flocks in the 1960s–1980s, up to 400 in March 1963. Small flocks were also found on West Loch, Tarbert (NR8162), during the 1960s and 1970s, with a maximum of 243 in January 1978, and at Ardpatrik Bay (NR7559), with a single count of 120 in October 1990.

At the northern end of the peninsula, the main site for Iceland Greylag Geese is Crinan Moss (NR8393), near Lochgilphead, where a maximum of 850 was counted in January 1987. Numbers at the site have remained fairly stable (around 500) since the 1960s. The birds remain at the site all winter, moving between the feeding grounds on the moss to the adjacent Add Estuary to roost. Carse (NR7361) supported a peak of 700 birds in November 1965, with records continuing until the late 1980s. Occasional records at nearby Kilberry (NR7063), up to 245 in November 1969, were probably of Carse birds.

ii) Ardlamont Point

Five counts at Ardlamont Point (NR9765) in the 1970s recorded a maximum of 128 Greylag Geese in November 1971. Just to the north, roosting Greylag Geese have been recorded at Loch Melldalloch (NR9374), with counts in the low hundreds during the late 1960s and 1970s, peaking at 280 in February 1978. There have been no recent records from this site.

2.1.11 Dumfries & Galloway

2.1.11.1 Background

Dumfries-shire is dominated by the Solway Basin, which lies to the south and influences much of the goose distribution of the area. Further west, in Galloway, are a number of lochs between the Nith and Cree valleys. There are also several extensive bays on the southern shore of this region, such as Wigtown and Luce. The primary agriculture is rearing of cattle and sheep, with much less corn and fodder root crops grown today compared with 20 years ago; this has occurred at the same time as an increase in silage grasslands, which are heavily fertilised.

2.1.11.2 Historical status

Greylag Geese were uncommon in the region during the mid-19th century and may have been absent altogether (Berry 1939). By 1890, they had begun to rapidly colonise the Solway area, keeping chiefly to the merse. They soon abandoned this, however, and moved inland during the 1910s and 1920s, so that by the mid-1930s they were again largely absent from around the Solway Firth. This change is thought to be due to excessive disturbance from shooting along the shore and an aerial bombing range at Sands of Luce in the early part of the 20th century (Berry 1939).

In recent decades the status of Iceland Greylag Geese in much of this region has been confused by the presence of a considerable population of re-established Greylag Geese. Birds of Outer Hebridean stock were released initially at Lochinch, Stranraer, in the early 1930s, with further releases nearby a few years later (Young 1972). They have since spread widely across Galloway, nesting on many of the inland lochs as far east as Dumfries (Shimmings *et al.* 1989). Results from the summer 1991 survey of introduced geese in Britain revealed 1,526 re-established Greylag Geese in Dumfries and Galloway (Delany 1993). Colour-marking of Icelandic birds elsewhere, however, confirms that birds from this population still occur in the region, including at the principal site, Stranraer Lochs (B. Swann pers. comm.).

2.1.11.3 Internationally important sites

i) Stranraer Lochs (Black Loch and White Loch)

Five-year mean 95/96–99/2000: 1,075

Site conservation status

SPA (Loch of Inch and Torrs Warren: non-qualifying species)

SSSI (White Loch – Lochinch)

IBA (Lochinch and Torrs Warren: criteria B1i, C3)

Site description and habitat

Stranraer Lochs, or Lochinch, consists of two waterbodies, Black Loch and White Loch, located 4-km east of Stranraer (NX1061). Situated at approximately 15 m asl, these two lochs are largely surrounded by estate and woodland.

Numbers and trends

This is the original release site for the re-established population of Greylag Geese in southwest Scotland, and where up to 910 birds from this population were counted in September 1988 (Shimmings *et al.* 1989). Co-ordinated November counts peaked at 5,000 in November 1961, with numbers subsequently remaining around 2,000–3,000. Since the mid-1990s, however, numbers appear to have declined, although counts have been less frequent and 2,717 birds were present in November 1998 (Fig. 59).

Due to the irregularity of counting at this site over the last five years and the large population of re-established birds, an assessment of the status of Iceland Greylag Geese at this site is currently extremely difficult. Nevertheless, a decrease in the number of Icelandic birds has almost certainly occurred, although resightings of marked birds show that they continue to use this site to some degree, typically arriving after the autumn census, when few counts have been made.

Site use

The principal feeding area is the airfield at West Freugh and the surrounding fields, 6 km to the south, where up to 1,200 Greylag Geese have been counted as recently as April 1995.

2.1.11.4 Other sites

i) Loch Ken/Threave Mains

Loch Ken (NX6870), northwest of Castle Douglas, has a continuous set of counts since 1961/62 and has regularly supported internationally important numbers of Greylag Geese. Consequently, it was designated as a Ramsar site and SPA for this species.

At the southern end of Loch Ken, Threave Mains (NX7362) is an important feeding area for Greylag Geese and also holds roosting flocks at times, with counts from the 1960s, 1980s and 1990s. The Greylag Geese in this area undoubtedly move between these two areas on a frequent basis and the areas are therefore considered as a single site. Although the peak count at this site (1,742) was made in December 1999, the main period of consistently high numbers was from the mid-1970s to mid-1980s, with roosting flocks of over 1,000 present from November to March in almost every year. The peak count during this period was 1,720 in January 1982. During the late 1980s and early 1990s, numbers decreased in line with other sites in the region to around 400 by the mid-1990s. Since then, an increase has again taken place, with peak counts of more than 800 in every year since 1997/98, including the site peak of 1,742 (Fig. 60). Despite this, the site currently supports just less than the number required for international importance (the mean peak winter count for 1995/96–1999/2000 was 913). There are also a small number of re-established birds at the site, with 10–15 breeding pairs and up to 120 post-breeding birds recorded during the late 1980s (Shimmings *et al.* 1989).

ii) Solway Estuary

Iceland Greylag Geese are uncommon in Dumfriesshire, and co-ordinated roost counts of the Solway Estuary during the 1990s revealed a maximum of 545 in November 1997. On the north Solway, the main sites include Caerlaverock NNR (NY0464), with a maximum of 1,850 in January 1985, and Carse Bay (NX9861), with up to 1,500 in March 1994. Greylag Geese are also counted occasionally at Powfoot (NY1464, three counts up to 150 in December 1982), Borron Point (NX9959, four counts up to 350 in December 1985), Merse Head (NX9454, maximum of 400 in March 1963) and Carsethorn-Southernness (NX9861, maximum of 500 in March 1985).

iii) Lochmaben

One of the more important roosts in the region has been at Castle Loch, Lochmaben (NY0881), where a maximum of 3,100 Greylag Geese was recorded in March 1985. Around 1,000–3,000 birds roosted there for much of the 1970s and 1980s, with peak numbers occurring from January through to March. Since 1988/89, however, much smaller numbers have occurred, typically 200–800, apart from one exceptional count of 1,800 in January 1995. Since 1996/97, numbers have declined still further, with fewer than 100 birds recorded in most years, and none in 1999/2000, although, as counts have

become smaller, counting effort has also been reduced. Other waterbodies in the Lochmaben complex hold far fewer geese. Hightae Mill Loch (NY0880), just to the south, supported up to 370 in January 1983, but usually holds fewer than 100. Occasional flocks recorded at the other Lochmaben lochs are likely to be birds disturbed from the Castle Loch roost. Maximum counts at these sites are 750 at Kirk Loch (NY0783) in January 1974, 162 at Upper Loch (NY0783) in January 1984 and 100 at Blind Lochs (NY0683) in April 1986. Feeding Greylag Geese from the Lochmaben complex are regularly recorded on farmland to the northwest around the Water of Ae/Blind Lochs Marsh (NY0584) and occasionally further afield at Waterside Mains, along the River Nith (NX8692), where up to 1,000 were present in March 1984 and 296 in January 1996.

Throughout the rest of the region, roosts of Iceland Greylag Geese are more infrequent. Sites where they have been recorded are as follows:

iv) Wigtown

Soulseat Loch (NX1058) and Loch Magillie (NX0959), just 2-km south of Stranraer Lochs, are occasional roosts for birds from White Loch. Up to 3,000 have been recorded there (November 1970) and the site regularly supported several hundred during the 1980s. None have been recorded since 1987/88, however, with the exception of re-established birds, of which ten pairs bred during 1988 (Shimmings *et al.* 1989). Small numbers of birds from Stranraer also use Cults Loch (NX1260) on occasions, with a peak of 165 in November 1995. Greylag Geese in this area also roost very occasionally on Loch Ryan (NX0565), the sea loch at Stranraer, with a maximum of 500 in March 1984.

Loch Connell (NX0168), to the north of Stranraer, has supported large flocks of Greylag Geese at times, with 2,000 in February 1987. With one exception of 14 birds, none have been recorded since 1987/88, however, and recent visits suggest that Greylag Geese no longer roost there with any regularity.

Loch Ochiltree (NX3174) has consistently held Greylag Geese since the 1960s, although some are of re-established origins, with 23 there in June 1988 (Shimmings *et al.* 1989). The site maximum was 162 in March 1982, but in most other years fewer than 100 are recorded, suggesting that just a few tens of Iceland Greylag Geese use this site during the autumn. Other occasional roosts have been found at Castle Loch (NX2853, peak of 214 in February 1972), Loch Maberry (NX2874, peak of 132 in

November 1988 and April 1989) and Torhousekie Marsh (NX3756, peak of 550 in December 1961).

The west side of Wigtown Bay (NX4456) is a regular roost for 200–600 birds in most years, although the site maximum was an exceptional 5,000 in January 1986. The number at this site has not changed significantly since the 1960s. Fleet Bay and Wigtown Bay East (NX5652) also support Greylag Geese from time to time, with flocks most frequent during the 1960s, but only very occasionally since.

The Piltanton and Luce Estuaries (NX1855) show a similar level of use by Greylag Geese, with occasional counts throughout the 1960s and 1970s, peaking at 1,200 in March 1970. Midwinter flocks of fewer than 100 were seen fairly regularly in the 1990s.

v) Nithsdale and Stewartry

Occasional roosts of fewer than 100 Greylag Geese have occurred at Loch Kindar (NX9664), although an exceptional peak of 1,200 was recorded in March 1974. Shimmings *et al.* (1989) found just four re-established birds in June 1988. At Loch Arthur (NX9068), several hundred were sporadically recorded during the 1960s–1980s, with a maximum of 800 in January 1985. None have been counted since 1990/91, however. Glenkiln Reservoir (NX8478) held a peak of 310 in March 1988, but flocks no larger than 25 were recorded in the early 1990s. These birds are likely to be of re-established origin as Shimmings *et al.* (1989) recorded 46 there in June 1988, including three broods, and it seems that the site is no longer used by Icelandic migrants.

At Lochrutton Loch (NX8972), roosting flocks of 200–800 were fairly regular during the 1960s–1980s, with a maximum of 1,630 in November 1967. In the 1990s, numbers peaked no higher than 105. Milton Loch (NX8371) supported 1,800 in February 1967, with peak numbers usually present during the spring. The site was most important from the early 1970s to the mid-1980s, regularly holding 500–900 birds. Since then, peak counts have typically been of fewer than 200. A new roost developed at Auchenreoch Loch (NX8171) during the 1990s, regularly supporting 100–200 birds, with a peak of 460 in March 1996. These birds now seem to have returned to Milton Loch, however, and tend to use Auchenreoch only if disturbed from there. Shimmings *et al.* (1989) found a small number of re-established birds at Auchenreoch, with one breeding pair present during June and 27 in September.

Carlingwark Loch at Castle Douglas (NX7661) held 300 Greylag Geese in December 1984, but typically

holds fewer than 10 and is seldom used these days. A single count at Bargaton Loch (NX6961) recorded 270 in January 1972 and two counts at Woodhall Loch (NX6767) recorded a maximum of 160 in February 1968. On the south coast, Auchencairn Bay (NX8252) and Orchardton Bay (NX8151) occasionally hold roosting Greylag Geese, with a maximum count of both bays of 900 in February 1989. Further west, Kirkcudbright Bay (NX6849) has held up to 360 (March 1964), but very few since the 1970s.

Other sites where Greylag Geese have been recorded include Ironhurst Loch (NY0471, three counts, peaking at 900 in December 1974) and Upper Lochar Moss (Tinwald to Torthorwald, NY0178, maximum of 700 in November 1964, but no records after the early 1970s). There are also occasional records of flocks on the River Nith at Dumfries (NX9775, single count of 500 in November 1990), from Kirkconnel to Sanquhar (NS7610, single count of 180 in December 1995) from Keltonbank to Nutholm (NX9774, peak count of 120 in October 1997), the River Annan at Roberthill (NY1079, peak of 544 in November 1960 with 460 in March 1993 and a few smaller counts since then) and at Broomhill to Shillahill (NY1082, single count of 385 in February 1985). It is not known whether these records relate to roosting or feeding birds.

2.1.12 Northumberland

2.1.12.1 Background

There is a strong contrast between the west and east of Northumberland. The west is dominated by the uplands of the north Pennines, while the east consists primarily of mixed farmland, with several notable estuaries along the coast. In the south it is more industrialised and many wetlands have been lost, although they have been replaced, to some degree, by disused quarries and other similar habitats.

2.1.12.2 Historical status

Little information is available on the status of Greylag Geese in this region prior to the first counts in the 1960s. During that decade, Northumberland held very few Greylag Geese, averaging just 170 each winter (Boyd & Ogilvie 1972). There was a clear increase during this period, however, and by the first two years of the 1970s the average had increased to 650 birds.

2.1.12.3 Internationally important sites

None

2.1.12.4 Other sites

i) Lindisfarne

This area is one of the largest intertidal areas in northeast England and encompasses Fenham Flats and the sands around Holy Island (NU1041). It has been designated as a Ramsar site and SPA, and is an IBA, partly because of its importance for Iceland Greylag Geese, yet it no longer supports internationally important numbers of this population.

After the designation of Lindisfarne as a National Nature Reserve in 1964 and the restriction of wildfowling within the site, the number of Greylag Geese roosting there increased significantly. This first began in the early 1970s, with a dramatic rise in numbers during the 1976/77 winter. From then until the late 1980s, numbers closely mirrored the overall increasing trend in the Iceland population, averaging around 3,000 for most of the winter, with peaks of 4,500 in January 1982 and March 1987. During the 1990s, however, numbers declined, also in line with the overall population trend and contraction northwards. After the decadal peak of 2,600 in November 1994, the largest count was of 1,000 in 1996/97 (Fig. 61). The mean peak winter count for 1995/96–1999/2000 was 750.

ii) Holburn Moss

Holburn Moss is a small pond located 5.5-km inland of Fenham Flats (NU0536) and surrounded by mire and swamp. It has been designated as a Ramsar site and an SPA, and is an IBA as a result of its importance for Iceland Greylag Geese. Yet, like Lindisfarne, it no longer supports internationally important numbers of this population.

The trend in numbers of roosting Greylag Geese also shows many similarities with Lindisfarne, with which this site is likely to share birds. During the 1960s, counts in the low hundreds were typical. In the 1970s, a significant increase in numbers occurred, peaking at 4,500 in December 1978, followed by a decline during the 1980s and 1990s. The mean peak winter count for 1995/96–1999/2000 was 708, with counts since 1997/98 being 200 or fewer (Fig. 62).

Figure 59. Greylag Geese at Stranraer Lochs, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

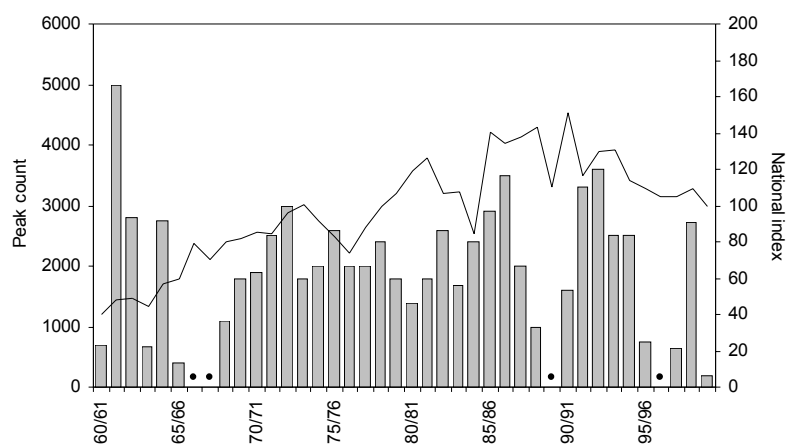


Figure 60. Greylag Geese at Loch Ken/Threave Mains, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

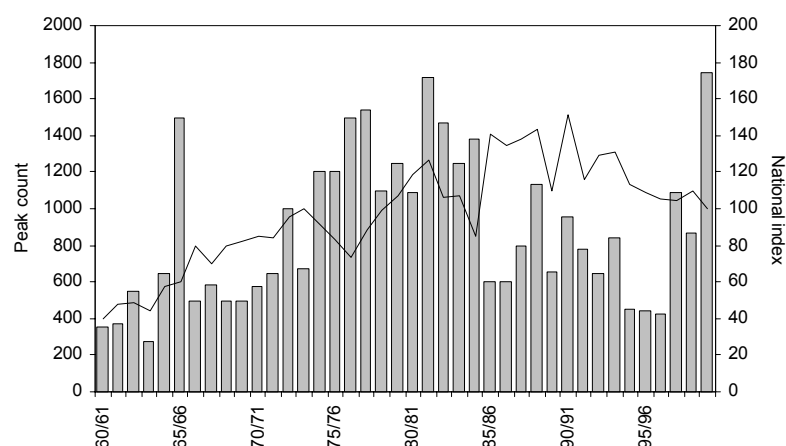


Figure 61. Greylag Geese at Lindisfarne, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

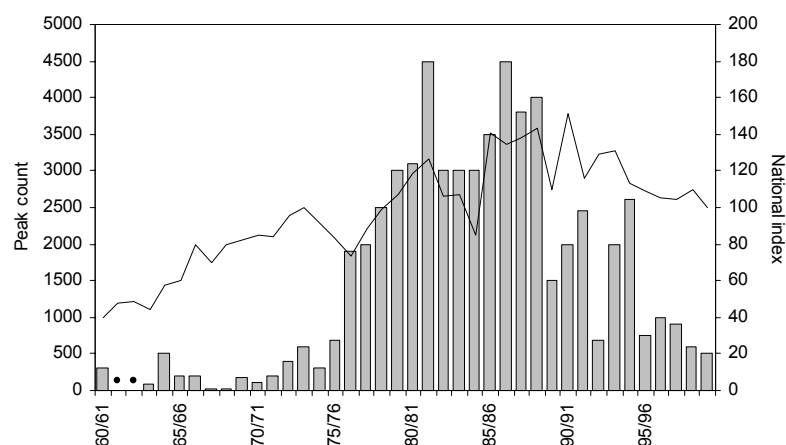
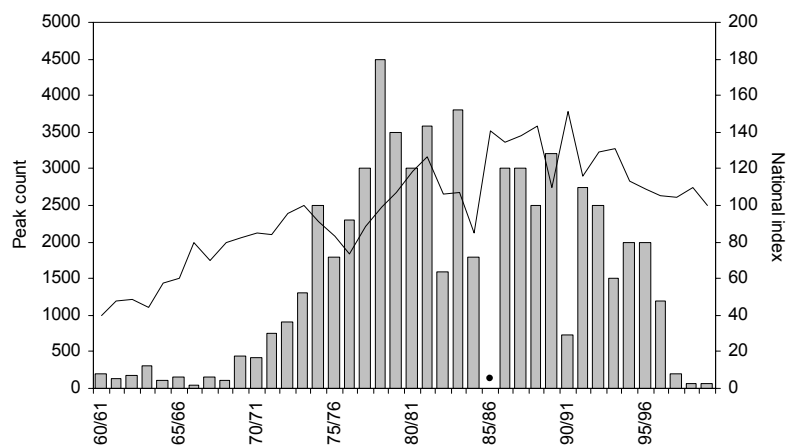


Figure 62. Greylag Geese at Holburn Moss, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



iii) Caistron Quarry

A man-made site located 5 km west of Rothbury, in the floodplain of the River Coquet (NU0001). Greylag Geese were first recorded here in 1983/84, when numbers peaked at 200. They quickly increased to more than 1,000 by the late 1980s, and have since fluctuated between the high hundreds and the peak count of 1,530, in March 1996 (Fig. 63). Numbers peak during the autumn and again at a slightly higher level in the late winter and spring. The mean peak winter count for 1995/96–1999/2000 was 732.

2.1.12.5 Other sites

A number of other sites in Northumberland held small, but increasing, numbers of roosting Greylag Geese during the 1990s. It is currently unknown whether these increases are a reflection of local redistribution by Icelandic birds formerly roosting at Lindisfarne and Holburn Moss or an increase in the local re-established population.

Numbers at Grindon Lough (NY8067) increased in the mid-1980s, peaking at 340 in November 1985, with more typical counts being 200–300. Holywell Pond (NZ3175) shows a similar increase, although this did not begin until the early 1990s, reaching a maximum of 678 in January 1994 and averaging 400–500 during that period. Whittledene Reservoirs (NZ0667) has consistently held around 200–400 Greylag Geese since the late 1970s, with a maximum of 535 in December 1991. Hallington Reservoir (NY9776) shows a similar trend, with around 200 birds roosting in most years during the 1990s, typically peaking in autumn or mid-winter. An exceptional count of 1,050 was recorded there in January 1995 and in the late 1990s numbers have been above average at around 500. Colt Crag Reservoir (NY9478) held peak numbers throughout the 1980s, with a maximum of 558 in October 1989. Numbers declined again during the 1990s, with counts since 1992/93 failing to reach 50, and no birds recorded in 1999/2000.

Other, less frequently used sites include Broomlee Lough (NY7869, peak of 180 in December 1987), Shield-on-the-Wall (NY8370, single count of 242 in February 1981), Sir Edward's Lake (NZ0379, peak of 180 in October 1992 but all other counts fewer than 30), Angerton Lake (also known as Hartburn Reservoir) (NZ0686, peak of 300 in December 1970 but none since 1990/91), Rayburn Lake (NZ1193, used in mid-winter between 1990/91 and 1992/93 with a maximum of 200 in January 1992), Cresswell Pond (NZ2894, peak of 140 in April 1994), Warkworth Lane Ponds (NZ2793, peak of 150 in February 1995), Kimmer Lough (NU1217, geese

mostly present during 1995/96 with peak of 240 in January), Fontburn Reservoir (NZ0493, peak of 400 in November 1970 but no birds since 1972/73), River Till at Doddington (NT9832, nine counts during 1978/79 and 1979/80 with a maximum of 3,500 in November 1979). It is not known whether these records relate to roosting or feeding birds.

2.1.13 Other Regions

2.1.13.1 Shetland

Available count data underestimate the status of Greylag Geese in Shetland. Anecdotal records suggest that while the species did not breed in the archipelago, considerable numbers visited the region in the early 19th century. Later reports confirmed that it was common on migration during the late 19th century, but was thought to be scarce during the mid-20th century (see references cited by Pennington 2000).

Records at this time include sporadic counts of roosting geese at Loch of Spiggie (HU3716), in southern Mainland. They have been recorded there since the mid-1960s, although numbers and the frequency of their occurrence increased during the 1990s. The peak count during the period of this review was 230 in November 1981, although Pennington (2000) states that up to 350 have been counted recently. Feeding geese, presumably birds roosting at Loch of Spiggie, have been seen occasionally at Quendale Bay (HU3712). Smaller numbers, usually fewer than 30, winter elsewhere, especially around Sullom Voe and in the northern islands, and about 80–100 pairs are currently estimated to breed in the islands (Pennington 2000).

2.1.13.2 Central

The main roosting site for Greylag Geese in the upper reaches of the Forth Valley, west of Stirling, has in the past been at the Lake of Mentieth (NN5700), with a maximum count of 3,020 in March 1983. In the 1990s, however, only two flocks over 100 were recorded. There are numerous other potential roost sites for geese feeding in the upper Forth Valley, including Flanders Moss (NS6398), Loch Rusky (NN6103), Loch Watston (NN7100), the River Forth itself, and the reservoirs on the hills to the south, North Third (NS7588) and Loch Coulter (NS7687). Greylag Geese in this area may also use sites along the nearby Teith Valley, such as Loch Venachar (NN5705) and Loch Mahaick (NN7006).

A shortage of counters, however, has meant that most counts in recent years have been of birds feeding during the day, although it is unlikely that any roost has held internationally important numbers during this period. Recently, roosting flocks in the low hundreds have been counted at Loch Coulter and 1,200 birds were reported at Loch Watson in November 1975. In addition, in the 1990s small flocks occasionally roosted at Loch Rusky, Loch Venachar, Loch Mahaick, and North Third Reservoir. Greylag Geese roosting at Loch Coulter may also flight to the east to feed on arable farmland near the estuary, which is equidistant with the Carse of Stirling. Thus, some of the birds seen between Grangemouth and South Alloa might have come from Loch Coulter. To the north of Clackmannan lies Gartmorn Dam (NS9194), which held reasonably sized roosting flocks throughout the 1990s (maximum of 1,600 in November 1990), although peak winter counts have been variable.

The small flocks recently found in the Teith Valley, near Callander, use Loch Venachar and the disused gravel pit at Gart as roost sites. Loch Mahaick also holds small numbers of Greylag Geese on occasion. Another small flock has recently used Glen Dochart in late winter and spring, though this group is probably part of the Loch Tay flock. Increasing numbers occur on the Slamannan Plateau, around Loch Ellrig (NS8874), sharing feeding sites with Scotland's only flock of Bean Goose.

In the last few years, WeBS counters have recorded Greylag Geese, presumably feeding birds, on stretches of the Rivers Forth and Teith, west of Stirling, in flocks of up to several hundred. The highest counts have been on the River Forth at Gargunnoch (NS7195) (maximum of 815 in March 1994) and on the River Forth from West Carse Farm to the River Teith confluence (maximum of 1,250 in March 1998). A count of 1,740 in February 1983 was also recorded on the River Forth from Meiklewood Bridge to the Teith confluence (NS7494). To the east of Stirling, on the inner Firth of Forth, Greylag Geese are found feeding from Grangemouth up the river to Devon Mouth. From Grangemouth to Kincardine Bridge (Skinflats) (NS9284), a couple of flocks over 100 were counted in the 1990s. From Kincardine Bridge to Alloa (Kennetpans), feeding flocks of up to 617 (in January 1996) have been recorded in recent years. There has been only one recent record from Alloa to Devon Mouth (Tullibody) (NS8692): 200 in January 1996.

2.1.13.3 Cumbria

Cumbria is another region where the status of Iceland Greylag Geese is difficult to determine

because of the presence of a large population of re-established Greylag Geese that was introduced into the north of the county during the 1960s and 1970s. As with other regions at the southern edge of the range, proof that Iceland Greylag Geese still occur here has been provided by resightings of colour-marked birds, but this tends to be in late winter, when counts are made less frequently.

Most counts from Cumbria have been of feeding flocks, including those of likely Icelandic origin. The key area is around the confluence of the Rivers Eden & Eamont (NY5830), where some 1,000–2,000 Greylag Geese were found during the 1970s. Since then numbers have declined, although the maximum count (2,160) was made as recently as January 1986 and 1,023 were counted less than 1-km away in March 1998. Geese at this site usually roost on the River Eden or at Whins Pond (NY5530). Nearby, on the River Eamont between Watersmeet and Pooley Bridge (NY5329), internationally important numbers have also recently been present, including an exceptional flock of 2,150 in February 1993. It is likely that these counts refer to the same flock more regularly encountered around the confluence of the Rivers Eden & Eamont.

During the mid-1980s, Iceland Greylag Geese were confined mostly to a 10-km stretch of the Eden Valley to the east of Penrith, and to another less important area between Crosby and Aglionby on the eastern outskirts of Carlisle (Owen *et al.* 1986a). In the past 15 years, however, the latter birds have largely disappeared and it is now thought that few Iceland Greylag Geese winter in this area.

Other feeding flocks have been found at a large number of sites within the Eden Valley, including above Dalemmain (NY4725, peak of 445 in November 1996), Salkeld (NY5633, single count of 546 in January 1991), Lazonby to Armthwaite (NY5441, peak of 315 in November 1995), Crosby to Carlisle (NY4658, peak of 585 in January 1989), Irthing to M6 (NY4758, single count of 750 in January 1990), Stainton to Rockcliffe (NY3558, peak of 400 in January 1990), High Hesket (NY4842, peak of 174 in January 1995), Low Hole (NY5049, peak of 377 in October 1993), Scotby Holmes (NY4357, peak of 250 in November 1995), near Culgaith (NY6130, peak of 600 in January 1996), Low House (NY5049, peak of 174 in October 1992), Lower Eden Valley (NY4559, peak of 566 in November 1992), Helton (NY5122, peak of 800 in November 1992) and the Upper Eden Valley (NY5833, peak of 260 in November 1996).

A summary of the records of roosting Greylag Geese elsewhere in Cumbria is as follows: the larger inland

lakes of Ullswater (NY4420), Derwent Water (NY2520), Bassenthwaite Lake (NY2128), Loweswater (NY1221), Abbots Moss (NY5142) and Castle Carrock Reservoir (NY5454) all hold re-established birds, but roosting Icelandic migrants can swell numbers on occasion, especially at Bassenthwaite Lake and Abbots Moss, as well as at Whins Pond. The wild birds also tend to roost on shingle banks in the River Eden. Other records come from Longtown Gravel Pits (NY3768, peak of 270 in March 1996).

Greylag Geese also roost on the Solway Estuary, with roosts on the south Solway at Rockcliffe (NY3163, maximum of 600 in February 1967 but fewer than 100 in the 1990s), the occasional flock at Herdhill Scar (NY1656, peak of 220 in January 1992) and Moricambe (Newton Arlosh) (NY1656, peak of 772 in March 1969, with none since 1976/77).

2.1.13.4 Lancashire

No recent counts of Greylag Geese from this county are thought to relate to Icelandic birds, and a lack of resightings of known Icelandic migrants confirms this. Atkinson-Willes (1963), however, states that during the 1920s small flocks of Greylag Geese (as well as White-fronted and Pink-footed Geese) began to winter regularly in the county. Boyd & Ogilvie (1972) refer to up to 200 Greylag Geese that were thought to be Icelandic as wintering in the region during the 1960s, although a steady decline had already been noted at that time and few remained by the start of the 1970s.

2.1.13.5 Yorkshire

Historically, Iceland Greylag Geese were not thought to occur in Yorkshire and, given the presence of large numbers of re-established birds at many sites throughout the county, this remained so until recently. During the late 1990s, however, the presence of colour-marked birds highlighted the fact that Icelandic birds occurred there on a regular basis during late winter, although precise numbers cannot currently be determined. The two key sites are Nosterfield Gravel Pits (SE2880) and the Lower Derwent Valley (SE6944), and it is possible that hundreds may occur there in some years.

2.2 Ireland

2.2.1 Background

In this account, the island of Ireland is treated as a single biogeographic area, even though it is politically divided. Ireland has a relatively small human population and consequently still contains many areas of unspoiled countryside, including a large number of wetlands. Iceland Greylag Geese are believed to be uncommon in Ireland, although their status is poorly known because of the few count data available and the confusion with re-established Greylag Geese.

The separation of Icelandic and re-established birds is a problem in Ireland (Colhoun 2001). Browne *et al.* (1998) reported totals of 810 adult and 167 gosling Greylag Geese at 30 sites in 15 counties during summer 1994, representing an increase of 5.5% per annum since the estimate given by Merne (1986). Fifty-five percent of these birds were in Northern Ireland, where just 18% of the midwinter peak count was found in 1998/99 (Colhoun 2001). This suggests that few Iceland Greylag Geese frequent Northern Ireland, with greater numbers occurring in the Republic. This assertion is borne out by resightings of colour-marked birds.

Roost counts co-ordinated with the IGC in Scotland and England began in 1998/99. Prior to that, all Greylag Geese were counted collectively as part of the Irish Wetland Bird Survey (I-WeBS) (see Colhoun 2001). Consequently, it is not possible to examine long-term trends in the status of Iceland Greylag Geese in Ireland. Since 1998/99, sites where re-established Greylag Geese are known to mix with Icelandic migrants have been counted prior to the arrival of Icelandic birds, in order to estimate the number of re-established birds there at the time of the IGC count. This has helped to increase the accuracy of the estimate of Iceland Greylag Geese at this time. Most peak counts tend to occur later in the winter, however, and resightings of colour-marked birds also suggest that most Iceland Greylag Geese are found in Ireland from mid-winter onwards.

Because of these problems, the assessment of site importance presented below is based mostly on IGC data collected since 1998/99. These have been supplemented by data given in Colhoun (2001), and counts are adjusted where possible using late summer counts of re-established Greylag Geese, provided as part of the IGC. Whilst this considerably reduces the amount of data available to carry out the assessment, it is believed that the ability to adjust site counts for the number of re-established Greylag

Geese provides a more meaningful assessment of the status of Iceland Greylag Geese.

In order to be able to monitor the status of Iceland Greylag Geese in Ireland in the future, considerable improvements to monitoring methods need to be designed and implemented (see section 3).

2.2.2 Historical status

In Ireland, the number of Greylag Geese has fluctuated considerably over the past 100 years. The population increased from about 1,000 in the 19th century to perhaps 6,000 by the mid-1940s, mainly at the Wexford Slob (Merne 1986). Numbers declined rapidly during the late 1940s and 1950s, however, both at Wexford and in other parts of Ireland (Ruttledge & Hall Watt 1958). By 1967, as few as 700 occurred there (Cabot 1967), although they have subsequently increased again, with the latest census (1998/99) recording maxima of 4,302 in the Republic and 967 in Northern Ireland (Colhoun 2001). During this time the distribution of Greylag Geese has changed significantly, with most birds found in Wexford during the 1940s but now concentrated at more northerly sites, such as Lough Swilly in Donegal and Stabannan/Braganstown in Louth.

2.2.3 Internationally important sites

i) Lough Swilly

Five-year mean 95/96–99/2000: 1,218

Site conservation status

SPA (Lough Swilly)

Ramsar (Lough Swilly)

IBA (Lough Swilly including Blanket Nook and Inch Lake: criteria B1i, C3)

Site description and habitat

Lough Swilly is a long narrow sea inlet, with extensive banks of mud and shingle, located on the north Donegal coast. It runs for 50 km north to south and is only 4-km wide at its maximum. It covers approximately 9,000 ha and is bounded by agricultural grasslands and other farmland.

Numbers and trends

The mean peak winter count (1995/96–1999/2000) of 1,218 is derived as follows. Annual peak counts for 1995/96–1998/99 are taken from Colhoun (2001) and for 1999/2000 from the IGC database. In each case, an estimate of 600 re-established birds is deducted from the peak count in order to improve

the estimate of Iceland Greylag Geese, since that is the approximate number of re-established birds estimated at the site in early autumn 1998 (K. Colhoun pers. comm.) (Fig. 64).

Site use

Peak numbers typically occur in January and February. Most birds feed on the Inch levels and at Blanket Nook, on the eastern side of the lough. Smaller numbers can be found around the Big Isle, in the south of the lough.

ii) Stabannan/Braganstown and Dundalk Bay

Five-year mean 95/96–99/2000: 1,214

Site conservation status

SPA (Dundalk Bay)

Ramsar (Dundalk Bay)

Wildfowl Sanctuary (Dundalk Bay)

IBA (Stabannan-Braganstown: criteria B1i, C3)

IBA (Dundalk Bay: criteria B1i, C3)

Site description and habitat

Located in northeast Louth, this site consists of 491 ha of drained wetlands in the Glyde floodplain, which are now predominantly improved grasslands, and a large open shallow sea bay that covers some 4,920 ha and encompasses extensive sand and mudflats up to 3 km wide.

Numbers and trends

All Greylag Geese present at this site are considered to be Icelandic in origin as no re-established birds were found during the 1994 census (Browne *et al.* 1998). Since 1994/95, peak winter counts have been consistently around 1,000–1,400 (Fig. 65).

Site use

Peak counts typically occur in late winter, principally January and February. Greylag Geese roost on the bay and forage in the grasslands of the Stabannan/Braganstown floodplain.

2.2.4 Other sites

i) Poulaphouca Reservoir

Poulaphouca Reservoir (O0010) is the largest inland waterbody in southeast Ireland, covering some 1,949 ha. Created in 1944, it is surrounded by wet grassland and sandy shores, as well as conifer plantations. It has been designated as an SPA, principally for its population of Greylag Geese. The number there is typically around 650–700, but an exceptional count of 1,452 was made in December 1998 (Colhoun 2001). These birds are believed to be

largely, if not entirely, Icelandic, as few re-established birds were found in County Wicklow by Browne *et al.* (1998) (11 adults at three sites).

ii) Minor roosts

A number of other sites in Ireland support Iceland Greylag Geese. Based upon data provided by Colhoun (2001), the most important are as follows: Mounteskin/Gortlum (mean peak count 1994/95–1998/99 750), Lower River Suir (726), Lambay Island (309), North Wicklow coastal marshes (234), Skerries, Baldongan (231), River Foyle (181), Rogerstown Estuary (158), Ballyrea, Skerries (150), Shannon & Fergus Estuary (86), Inishcarra Reservoirs (63), Tacumshin Lake (51). The status of re-established Greylag Geese at these sites is unknown, and the above counts may include birds from this population.

2.2.5 Key references

Cabot (1967), Merne (1986), Browne *et al.* (1998)

2.3 Iceland

Few Greylag Geese remain in Iceland during the winter. Christmas counts reveal that only c. 500 have been present in most winters over the past 10–15 years; these are mainly found in and around Reykjavík, with the majority at Lake Tjörnin, in central Reykjavík. Smaller numbers occur on the Reykjanes Peninsula, just south of the capital city and, more recently, up to 116 were counted at Hafnarfjörður - Álfanes, just outside Reykjavík. In 1998, Greylag Geese were recorded from a total of 12 locations during the Christmas Count. Away from Reykjavík, 'a few tens' were reported from Þykkvibær, near Hella in coastal Rangárvallasýsla.

2.4 Other countries

Small numbers of Greylag Geese are also found during the winter in Norway (perhaps several thousands) and the Faeroe Islands (on occasion up to 1,000). The birds' status in these countries is, however, unclear due to the presence of local breeding populations. Long-term data have not been collected from these areas but available data are summarised in section 1.

Figure 63. Greylag Geese at Caistron Quarry, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

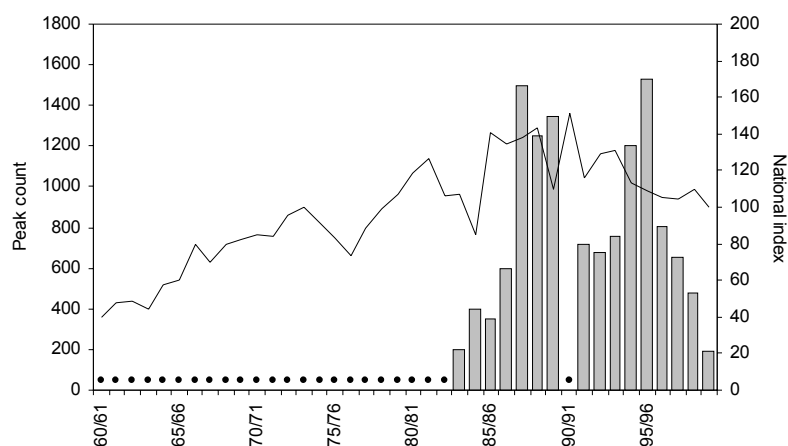


Figure 64. Greylag Geese at Lough Swilly, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)

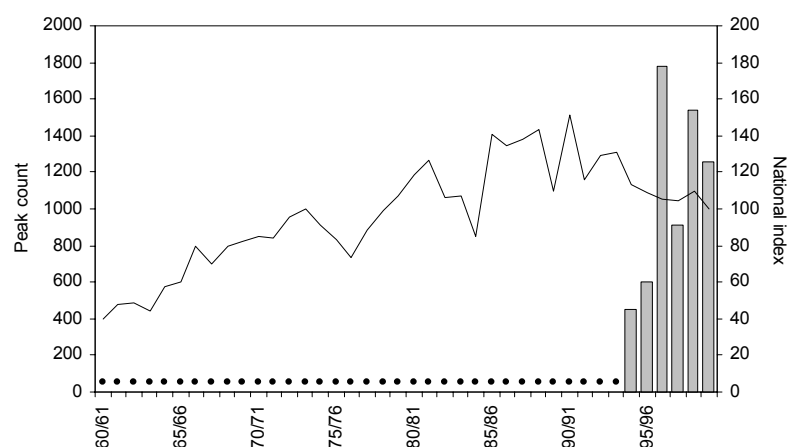
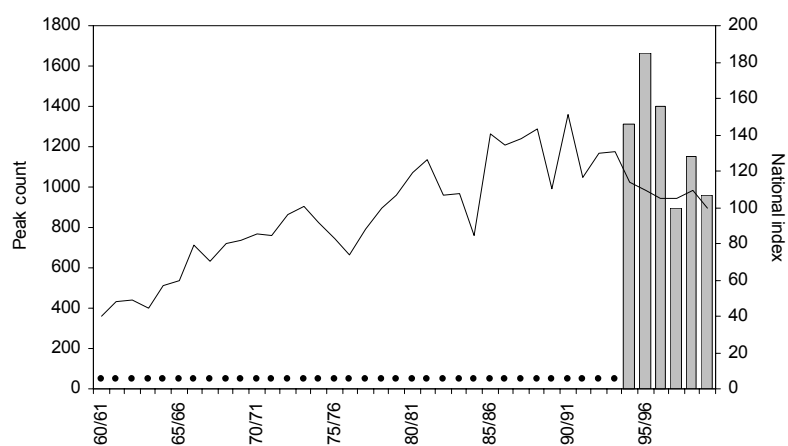


Figure 65. Greylag Geese at Stabannan/Braganstown and Dundalk Bay, 1960/61–1999/2000: peak counts (bars) and British index (line) (circles denote years with no known data)



3 FUTURE MONITORING AND DATA NEEDS

Recent population models have suggested that some current monitoring methodologies for Iceland Greylag Geese may require adjustments in order to continue to provide accurate estimates of the parameters they monitor (see section 1.3.5.5. and Frederiksen *et al.* 2004), although currently it is not clear where these adjustments may be needed. Given the possibility that this population declined by around 20% in the 1990s and remains finely balanced between increase and further decline (Rowcliffe *et al.* 2000), measures that identify the most appropriate ways to effectively monitor this population are urgently needed.

Furthermore, funding for continued ringing activity is no longer available. As population parameters change over time, there is an important need for a long-term commitment to the collection of relevant data.

Without such testing and improvement of monitoring methodologies and greater long-term commitment to ringing, the effective conservation and management of Iceland Greylag Geese will remain problematic.

With these fundamental issues in mind, a workshop on grey geese was held in Iceland in 2001, attended by specialists from Iceland, Britain and other countries. Current knowledge of the status and monitoring of Iceland Greylag Geese, as well as the Greenland/Iceland population of Pink-footed Goose, was reviewed and the effectiveness of current research and monitoring activity to provide essential data and information for the conservation management of these geese was assessed.

A series of recommendations were made and those relevant to Greylag Geese are summarised below (see Frederiksen 2001 for further details), along with some other issues not considered at that time.

3.1 Population delimitation

1. In order to continue to monitor the status of Iceland Greylag Geese effectively during the non-breeding season, there is an urgent need to understand more about the delimitation, distribution and timing of movements of this and other Greylag Goose populations on their shared wintering grounds.
2. For this reason, a comprehensive and wide-ranging capture and marking programme is needed, with long-term commitment to ensure

its continuation, in order to better understand the degree of interaction between Icelandic and re-established Greylag Geese during the winter.

3. Further, a feasibility study to determine whether analysis of stable isotope signatures in the flight feathers of Greylag Geese would permit identification of the origins of wintering Greylag Geese in Britain is also needed.

3.2 Counts and surveys

1. The seasonal timing of population estimation is critical; it should be undertaken at a time when the most accurate estimate (i.e. the smallest confidence intervals and minimal bias) can be made. If both considerations cannot be met at the same time, minimising bias is the most important factor to consider.
2. Current monitoring activities in Britain should be maintained, and international co-ordination of the UK autumn census with annual inputs from Norway, Iceland, Faeroes and Ireland should be developed.
3. A survey of stratified sample squares in the UK should be planned and implemented with the aim of generating a comprehensive autumn total that includes numbers on small wetlands not regularly included in the current census.
4. Given that this population has changed its autumn distribution considerably in recent years, a further, and thereafter regular, series of midwinter and spring counts is urgently needed in order to maintain an understanding of site use during these periods.
5. A stratified sample survey of Greylag Geese in Iceland during August should be designed and implemented, initially to assess the resource requirements of such a survey. A survey undertaken close to the onset of the hunting season would be useful; this could be supplemented with additional surveys of moulting non-breeders earlier in the summer.
6. A comprehensive pre-breeding census of Greylag Geese in Iceland would be valuable, but there is a wide range of, possibly intractable, methodological problems.
7. It is essential that comprehensive surveys in Iceland and UK are co-ordinated (with any follow-up activity), i.e. that they occur in the same year.

3.3 Age ratios

1. There is a need to review the statistical basis of age ratio estimation with respect to within-flock sampling, geographical sampling and seasonal timing, and to implement the recommendations. In particular, there is a need to better understand the relationship between age ratios in the field, in the hunting bag, and in samples caught for ringing.
2. There may be a need for greater formal geographical stratification of age ratio estimates throughout the present winter range. In particular, there is a need for data from Orkney.
3. A stratified sampling procedure for assessing age ratios in Iceland in August should be developed and implemented in conjunction with the sample count suggested under 3.1.5 above.
4. More detailed and regular information on breeding success (numbers of pairs attempting to breed and brood size at or around fledging) would aid refinement of population models.
5. Collection of wing sample data from hunting bags in the UK would be desirable, and collection of such data should be continued in Iceland.

3.4 Ringing

1. Ringing plays a vital role in population monitoring and should be continued annually on this basis (see Kershaw *et al.* 2001).
2. A greater geographic spread of ringing activity within the UK and possibly Iceland is desirable.
3. In using ringing for monitoring purposes, there is a need to review optimal numbers (and distribution) of different age classes of geese ringed and then seek to implement these targets in a regular programme that complements other methods of monitoring population dynamics.
4. Important insights into population dynamic processes can be gained from the collection of higher quality information from future resightings of marked geese (e.g. family relationships). There is a need for continued dialogue with observers to encourage such better-quality data collection.
5. There is a specific need to collect data that will help assess the numbers of individuals recruited into the breeding population and hence enable assessment of the effective population size of Greylag Geese. Collection of such data on the

breeding grounds in Iceland should be encouraged

6. In order to aid the analysis of survival from resighting data, observers in the UK should be encouraged to focus effort during specific periods: these are November and March for Greylag Goose. It is also important, however, to maintain collection of observations outside of these periods for other purposes.

3.5 Bag statistics

1. The continuation of all aspects of the Icelandic hunting bag monitoring system is essential, including wing surveys. Further, independent clarification of the accuracy of the methods employed is needed.
2. The value of the hunting bag data collected in Iceland is high. Given obligations under the African-Eurasian Waterbird Agreement to report harvest statistics for hunted waterbirds, the UK government is urged to investigate the best statistical means to collect similar data. The commitment to this made by the Scottish Executive (Scottish Executive 2000) and the recent development of monitoring trials are a positive step towards a comprehensive harvest monitoring system in the UK.

3.6 Management issues

1. The population of Iceland Greylag Goose is already subject to high shooting pressure throughout its migratory range. The best available data and information suggests a recent population decline. In response, existing programmes enhanced through the recommendations outlined above will provide better data on this trend and its causes.
2. In Scotland, the Executive has recommended that there be no further increase in shooting mortality (Scottish Executive 2000) and, on a similar basis, any increase in shooting pressure in Iceland should also be avoided. The situation should be reviewed again once research and monitoring clarify the role of hunting mortality in determining current population trends.
3. There is an urgent need in Britain to quantify the distribution and scale of alleged agricultural damage.
4. The recent shift in winter distribution has resulted in a reduction in the proportion of the population protected by the existing SPA suite in

Britain. To ensure that designation suites for Iceland Greylag Geese continue to safeguard this population, they may need to be adapted in response to changes in the distribution of the birds.

3.7 Future collaboration

1. The world range of this population of Greylag Goose is largely restricted to three countries: Iceland, Britain and Ireland (with small numbers in Norway and the Faeroes also). This considerably aids the development of a flyway conservation plan for the population to guide national and international conservation and management actions, since such a plan would involve relatively few governments and organisations.
2. Co-ordination and co-operation between Iceland and the UK on the conservation management of shared migratory goose populations should, therefore, continue to be furthered at both governmental and technical levels.

4 ACKNOWLEDGEMENTS

A great many people have contributed to this review in almost as many ways. Firstly, many hundreds of counters, too numerous to mention by name, have contributed their data to national monitoring schemes, in this case primarily WWT's Goose Monitoring Programme, but also the National Wildfowl Counts or Wetland Bird Survey and the Irish Wetland Bird Survey. In many cases, goose counts are carried out in remote areas at unsociable hours and so without the dedication of volunteer counters it would have been impossible to collate this review. Our understanding of Iceland Greylag Geese is much richer for their efforts.

Secondly, many regional experts have contributed their knowledge to make this review as comprehensive as possible, either now or in the past. They are thanked wholeheartedly, and a list of their names can be found on the front page of this report.

Other people who have made valuable contributions to this report are: Ævar Petersen (for the provision of Christmas count data from Iceland and other information), Jesper Madsen (for permission to

reproduce much of the text in section 1 from Madsen *et al.* 1999), Óli K. Nielsen (for information about the Greylag Geese ringed in Reykjavik) and Halldór W. Stefansson (for numerous contributions).

Finally, in addition to many of those mentioned on the front cover, it has also been a great pleasure to have shared time in the field, chatting about geese, with the following: Bob Adam, John Bowler, Hugh Boyd, George Brown, Colin Corse, Andy Douse, Raymond Duncan, Óli Einarsson, Tony Fox, Nige Jarrett, Jens Nyeland Kristiansen, Alan Lauder, Alan Leitch, Iain Munro, Malcolm Ogilvie, Ian Patterson, Rab 'Skitts' Rae and Paul Shimmings. Apologies to anyone who has been momentarily forgotten.

Thanks also to Helen Baker, Peter Cranswick and Morten Frederiksen for comments that allowed improvements to be made to earlier drafts. Paul Marshall, Sally Mackenzie, Nancy Robb, Helen Rowell and Peter Cranswick prepared graphics and layout.

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