

**Distribution of Pink-footed and Greylag
Geese in South-east Scotland,
especially in relation to disturbance**

**Report to
the Nature Conservancy Council for Scotland**

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Summary

The Lothians and Borders Regions have long been important for geese, supporting around 20% of Pink-footed Geese *Anser brachyrhynchus* and 5% of Icelandic Greylag Geese *A. anser* wintering in Great Britain.

Gladhouse Reservoir was a nationally important site for Pinkfeet in the 1960s and 1970s but numbers there declined dramatically in the mid 1980s, reportedly as a result of overshooting. The Wildfowl & Wetlands Trust was commissioned by the Nature Conservancy Council for Scotland to investigate possible causes of this decline, the distribution of geese in the region and the nature and effects of disturbance. The study concentrated on Gladhouse and the roosts of Fala Flow and Aberlady Bay, known to be linked to Gladhouse in their function as roosts, and West Water Reservoir, one of the most important Pinkfoot roosts nationally. Fieldwork was conducted in September to December 1991, and included roost counts and daytime counts of feeding birds. Data from 1978 onwards were also analyzed.

The numbers of geese using the Lothians and Borders Regions in the last decade was found to peak in early October when large numbers of newly arrived Pinkfeet passed south through the area. A smaller population remained in the area until mid winter.

Numbers of Pinkfeet at Gladhouse reached autumn maxima of around 13,000 in the early 1980s and often remained at around 4,000 to 5,000 into December. However, numbers declined rapidly in 1984 and 1985 and generally less than 2,000 were recorded in the late 1980s and early 1990s. In the early 1980s, numbers at Fala Flow showed a large but short-lived peak of around 5,000 in early October, whereafter birds moved to Gladhouse. After 1984, the size of the peak increased to over 10,000 and large numbers often remained at the site into November. Numbers at West Water exhibited a very large October peak, increasing from 10,000 in the late 1970s to over 30,000 in the late 1990s, amongst the highest of any roost in Britain. Around one third of the peak remained at the site until mid winter. Peak numbers at Aberlady Bay were around 7,000 in the late 1970s and rose to around 12,000 in the early 1990s. There was a less pronounced peak at this site and around half this number remained here until mid winter.

Peak numbers of Pinkfeet at other roosts in the region were generally less than 2,000 in most years. The numbers of geese at Hule Moss rose from 4,000 in the late 1970s to 15,000 in the early 1990s. There was also an increase at Watch Water, with in excess of 2,500 in the late 1980s, although none were recorded in the late 1970s. Numbers at Hoselaw Loch rose to over 5,000 in the mid 1980s but fell to less than 2,000 in the late 1980s, similar to records in the late 1970s. Numbers at Whitton Loch exhibited a similar pattern, with a peak of over 3,000 in the mid 1980s, but around 500 in the late 1970s and late 1980s.

Only a few sites in the region regularly held more than 1,000 Greylag Geese. Threipmuir and Harperrig Reservoirs together supported just under 2,000 birds, although numbers at Harperrig fell slightly in the late 1980s while those at Threipmuir increased. Around 1,000 Greylag were recorded at Dowlaw Dam in the mid and late 1980s. Numbers at Watch Water Reservoir declined from around 1,000 to 200 during the 1980s in contrast with the increase in Pinkfeet. Over 1,000 were recorded at Hirsell Lake in the late 1980s compared with only 400 in the mid 1980s. Numbers at Hoselaw rose from 3,000 to 4,000 in the early to mid 1980s but had declined to only 1,300 in the late 1980s. Numbers at Whitton Loch declined from 1,600 in the late 1970s to only 200 in the late 1980s.

Numbers of Pinkfeet in the Lothians and Borders as a whole have risen in line with the national population, which has increased by 9% per annum over the last decade. The decline at Gladhouse has been compensated partly by the increase at Fala Flow. However, numbers at Aberlady Bay were also lower than predicted from previous levels and the rate of increase at West Water does not exceed that nationally. There has thus been a net loss of birds from this area. Increases recorded at Hule Moss, Watch Water and a number of "satellite" roosts will have resulted in the stability of total numbers of Pinkfeet in the Lothians and Borders Regions. There were local shifts in the Hoselaw and Whitton area in the mid 1980s.

The numbers of Greylag in the region have decreased compared with the national population, mainly at Borders roosts, although birds here are at the limit of the wintering range. Several sites, notably Hoselaw and Whitton, decreased in importance in the mid 1980s, although there was a corresponding increase in numbers at adjacent, previously little used, roosts.

Large numbers of geese fed in the area to the north and north-west of Fala Flow in autumn 1980. The majority used stubbles which remained into mid winter. Smaller numbers were found in the same area in autumn 1986 and a higher proportion of birds were recorded on pasture. The main concentration of geese in autumn 1991 was in the West Linton area with some around Fala and the River Clyde. Some 75% and 55% of geese were recorded on stubbles in September and October, respectively, but less than 15% in November and only 1% in December. The proportion of birds on improved pasture increased from 25% in September to 90% in December. Overall, 51% of birds were found on improved pasture, 40% on stubbles, 4% on rough pasture and 3% loafing at roost sites, mainly in October. Less than 2% were found on potatoes or winter cereal.

The used of flightlines at roosts and during the day was largely consistent with the known feeding distributions. However, much larger numbers of birds left West Water in the direction of the Clyde than were found there during the day, while daytime observations also indicated the presence of further feeding areas and/or roosts nearby. Geese also left West Water over the Pentlands, where no corresponding feeding area is known. The number of birds using northerly flightlines at Fala Flow indicated the presence of additional feeding areas not found in 1991.

Goose shoots occur at both Gladhouse and West Water, although they are not well documented. The number of shoots at Gladhouse varied between none and 10 per year between 1978 and 1990. A large number of shoots in 1984 and 1985 appear to have been responsible for the decline of the roost, especially in the absence of change in other site characteristics. Shooting has since been regulated so that shoots do not occur before 15 October and at a frequency of only once every two weeks thereafter. Shoots take place at dusk and guns are position on the banks of the reservoir under the north-east flightline.

The restricted shooting regime now used at Gladhouse is also used at West Water. Shoots occur at dawn and guns are positioned c.1 km from the reservoir. Around five shoots were organised each year. There may be a period of a few days directly after the shoot when the roost is reduced or the behaviour of birds using the roost is altered. However, shooting at West Water appears to have little long term effect on the use of the site. The continued decline in numbers at Gladhouse thus might be attributable to a number of other factors. In addition to reduced feeding in the area, higher water levels preclude banks being exposed onto which roosting geese can haul out, and the growth of surrounding vegetation may not be tolerated. Restrictions on fishing prevent this activity having any impact on the geese. A

large number of Pheasant shoots and walk-up shoots occur on the adjacent estate which may limit the feeding area available for geese, although levels of such shooting do not appear to have increased greatly over the last decade.

Intensive shooting in the late 1980s was also responsible for the decline in numbers at Hoselaw and the simultaneous establishment of roosts at other waterbodies in the area. Shooting at Aberlady Bay is restricted to a small area of the reserve and ducks are the only permitted quarry. Geese are not shot at Fala Flow, although ducks are shot, normally about once a year. Goose shooting was not notable at other sites in the region.

There were no records of goose shooting in fields in 1991, and although some was reported from estates around Fala, this was not confirmed. Many farmers in the area said they employed shooting as a scaring technique several times a year. Low flying military aircraft were noted to disturb feeding geese on many occasions in 1991. Geese invariably took to the air but quickly returning to the same or a nearby field. Disturbance by vehicles had a similar effect, although birds were less easily scared by vehicles and normally fed well away from roads. These disturbances were not considered to affect more than local distributions of birds.

Many farmers in the area considered geese were a pest, especially in spring when they were thought to compete with livestock for new grass. There were some incidences of damage to crops. However, most farmers adopted only low key measures to scare geese e.g. scarecrows.

It is recommended that current shooting regimes be kept in place to prevent undue disturbance to the roosts. The possibility of conducting shoots at dawn and away from the reservoir itself should be investigated at Gladhouse. Also, when possible, water levels should be drawn down by several feet in autumn and adjacent shoreline should not be planted. Current fishing restrictions should remain, with the season ending before the main arrival of geese to allow the use of small roosts as daytime rest stations. A warden would greatly benefit the conservation of the roosts and facilitate close liaison between all interested parties that is necessary for the continued voluntary support of current management practices. Access to sites needs to be restricted where visitors cannot be concealed from the geese.

To further elucidate many of the aspects of goose distribution and the effects of disturbance and other site factors, further study is required. More intensive roost counts are needed to investigate roost usage and interchange, and the passage and resident populations of geese that use the region. A wider area should be searched for feeding areas. Spring time distribution should also be investigated as this is when much of the conflict with farmers occurs and would reveal the distribution of birds in the absence of hunting pressure. Radio-tracking of individuals would assist many of these areas of research.

1 Introduction

1.1 Background

The populations of Icelandic and Greenlandic Pink-footed Geese *Anser brachyrhynchus* and Icelandic Greylag Geese *A. anser* overwinter almost entirely in Britain (Owen 1980). Both species disperse over wide areas to feed during the day, primarily in agricultural landscapes, and concentrate in large numbers at wetland roosts at night.

1.1.1 Numbers and distribution

The numbers of geese wintering in Britain have been censused annually since 1950 by The Wildfowl & Wetlands Trust (WWT) with the co-operation of many regional goose groups. The census of Pink-footed and Greylag Geese takes place in early November, although an additional, mid October census was introduced in 1990. The population of Pink-footed Geese has increased from some 48,000 birds in 1960 (Boyd 1960) to 233,000 in autumn 1991 (Cranswick & Kirby 1992). In recent years, the proportion of birds counted in early November in south-east Scotland, mainly at roosts in the Borders and Lothians, has averaged around 20% of the population (WWT unpublished).

Pink-footed Geese arrive in Britain from the middle of September and the majority of the population is present by mid October. The birds arrive at key areas and use traditional roosts, generally on or near the coast, mainly in north-east Grampian, Tayside, Central and the Borders and Lothians (Newton *et al.* 1990). The concentration of birds at roosts at this time is such that over half the population can be located at just a few roosts *e.g.* 66% of birds were counted at just 7 roosts in October 1991 (Cranswick & Kirby 1992). The geese move south and inland as the winter progresses, dictated largely by food availability and prevailing weather conditions so that, by mid winter, large numbers also occur around the Solway, and in Lancashire and Norfolk. Birds again concentrate in central and eastern Scotland before leaving for the breeding grounds in mid April (Owen 1980).

Pink-footed Geese were traditionally associated with estuaries (Owen 1976). However, increased military activity on estuaries in the 1940s and increased cereal cultivation inland, especially of Barley, coincided with a change in the distribution of feeding birds (Kear 1965). Consequently, inland roosts were increasingly used, with the birds favouring large, open waters, including reservoirs. Birds may fly large distances from roosts to suitable feeding grounds that usually comprise discrete areas within the surrounding countryside (Newton *et al.* 1973).

The number of Greylag Geese recorded by WWT annual censuses has increased from 30,000 in 1960 (Boyd 1960) to over 88,000 in 1991 (Cranswick & Kirby 1992). Numbers fluctuated markedly towards the end of this period, with a maximum count of nearly 115,000 in November 1990 (Kirby & Cranswick 1991). By far the greatest proportion of birds is located in north and north-east Scotland, whilst south-east Scotland has held around 5% of the population in recent years (WWT unpublished).

Migratory Greylag Geese arrive in Britain from early October, most being present by early November, and return to the breeding grounds from around mid March. The shorter period spent in Britain by Greylags is a consequence of their lowland breeding areas in Iceland being

tenable for a longer period than the central, highland areas used by Pinkfeet (Newton *et al.* 1973). Wintering Greylag exhibit a more northerly distribution than Pinkfeet and are concentrated in north-east Highland, around the Moray Firth, north-east Grampian, Tayside and Central. Greylags are far less nomadic, only dispersing from favoured arrival points to other sites in the neighbourhood, and the Lothians, the Borders and Northumberland represent the southerly limit of migratory birds. A small, native population is resident in the Outer Hebrides (Paterson 1987) and a feral population is present in Dumfries and Galloway (Shimmings *et al.* 1989). Birds south of a line from Teesside to the Isle of Man are considered to be feral (Owen *et al.* 1986).

The Greylag Goose is traditionally a bird of freshwater marshes and is less wary and less mobile than the Pink-footed Goose (Owen 1976). Consequently, Greylags occur in smaller flocks and generally feed close to the roost sites. As their original habitat diminished, birds moved to take advantage of agricultural feeding areas and used man-made waterbodies for roost sites.

1.1.2 Feeding and agriculture

Pink-footed Geese possess a small bill primarily for grazing, although they generally feed on spilt grain in stubble fields when they first arrive in Britain. The amount of available grain often dictates the timing of the birds' move south. Once the grain has been consumed or the stubbles ploughed, birds move to potatoes or other root crops where available, and eventually to graze in improved pasture, which predominates in the diet in spring. Cereals, along with leguminous plants such as clover, also feature in the birds' diet. The wary nature of the Pink-footed Geese results in them using large, open fields with good all-round visibility situated away from sources of disturbance such as buildings or roads (Keller 1991).

Greylags possess a relatively large bill designed for uprooting marshland plants as well as grazing. They feed predominately on arable land and, like Pinkfeet, will make use of spilt grain in stubble fields. Greylags tend to be more tolerant of man and livestock, and use a wider range of feeding and roosting sites.

The movement of geese from their original habitats to agricultural areas has brought them into conflict with farmers in many areas (Owen 1990). Prior to the introduction of winter cereals, stubbles were often available into January or beyond and geese using these fields generally caused few problems to farmers. Incidences of damage to crops are rare, although birds can damage undersown stubble fields. The persistent use of an area over a period of days can cause the loss of that part of the crop, both of winter sown cereals, and more rarely, of root crops such as carrots. However, one of the main conflicts between geese and agriculture occurs when geese compete with livestock for the "first bite" of spring grass. Damage can also occur through the trampling, the resultant "puddling" varying in seriousness depending on prevailing weather conditions. To prevent damage to crops and fields, farmers erect a variety of scaring devices, often incorporating brightly coloured moving objects or loud noises. However, since the precise area used by feeding geese varies at different times of the season, shooting is often used as an immediate means of moving birds from fields, undertaken usually by the farmer or gamekeeper, and on occasion by hired shooters.

1.1.3 Shooting and conservation

Pink-footed Geese and Greylag Geese are legal quarry species and may be shot for sport between 1 September and 31 January inclusive, extending to 21 February in Scotland below the high-water mark. Legislation in 1967 banned the sale of Pink-footed and Greylag Geese as food. This legislation, combined with the creation of refuges in the 1960s, were partly responsible for reducing the mortality rates in many goose populations, including Pinkfeet and Greylag, and the subsequent increase in their numbers (Owen 1990, Ebbinge 1991).

The concentration of large numbers of geese at roosts provides a popular wildfowling opportunity and birds are shot both flying to or from the site at dusk or dawn. Birds are also shot in fields where they may be lured by the use of decoys. These forms of wildfowling are widespread, often involving local syndicates or parties travelling from abroad under the guidance of a tour operator to participate in organized shoots.

The concentration of large numbers of Pink-footed and Greylag Geese at roosts means that they are of high conservation value and many are afforded protection under international agreements. Several sites have been designated as "Ramsar" sites under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971), to which Britain is a signatory. Ramsar sites are identified as wetland areas that support important assemblages of wetland flora and fauna and criteria for the selection of sites include that they regularly support more than 1% of a biogeographical population, or more than 20,000 waterfowl. Several roost sites are also classified as Special Protection Areas (SPAs), being of important ornithological interest, under the EC Directive 79/409 on the Conservation of Wild Birds (1979). A larger suite of sites has been notified as Sites of Special Scientific Interest (SSSIs), under the Wildlife and Countryside Act (1981), identified because of their important flora, fauna, geographical or physiographic features. In addition to those sites which already have Ramsar and/or SPA status at least partly because of their importance as grey goose roosts, further roosts are currently proposed for designation (Stroud *et al.* 1990).

1.1.4 Gladhouse Reservoir

Gladhouse Reservoir, in the Lothians Region, is a key grey goose roost and has supported internationally important numbers of Pinkfeet since modern records began (Owen *et al.* 1986, Newton *et al.* 1973, WWT unpublished). The site is both a Ramsar site and an SPA and is also a Local Nature Reserve (LNR), primarily because of its importance to geese. However, the number of Pink-footed Geese roosting at this site has shown a dramatic decline in the last eight years. The apparent loss of what was previously a prime roost site has been the cause of much concern, especially in view of increases in numbers of Pinkfeet both nationally and locally, notably the nearby roost at West Water Reservoir (Newton *et al.* 1990). The reasons for the decline are unclear, although shooting at the roost is purportedly a major factor. Several other factors may also contribute to the decline, including the availability of suitable feeding areas, disturbance and shooting on the feeding grounds. Possible changes in feeding behaviour (birds remaining on the feeding grounds during the night), and interchange with other sites may also affect the numbers of birds using the site.

1.2 Objectives

The WWT was commissioned by the Nature Conservancy Council for Scotland (NCCS) to investigate the decline in numbers of Pinkfeet using Gladhouse Reservoir. A three month project was undertaken in autumn 1991 with the following aims:

- To examine the use of goose roosts in the Lothians and Borders Regions over the last ten years. This would allow Gladhouse to be viewed in a regional context, investigate possible interactions with adjacent sites and seasonal fluctuations in the use of roosts. Historical data would be augmented by fieldwork in 1991.
- To examine the effect of disturbance at roosts, especially shooting, on the numbers and distribution of geese. Fieldwork in 1991 would augment the little data already available.
- To identify feeding areas in the region and linkage with individual roost sites. Fieldwork would identify current feeding locations and habitat choice and would be compared with previous studies.
- To assess local opinion, particularly of farmers and other interested parties, on the presence of geese, particularly in the Gladhouse area.

2 Study area

2.1 The Lothians and Borders Regions

The area addressed by this project covered all major grey goose roosts in the Borders and Lothian Regions of Scotland (Table 1) and the associated feeding grounds. These are located in four main areas (see Figure 1): the Pentland Hills, running due south-west from Edinburgh for c.20 km; the northern edge of the Moorfoot Hills, running north-east from a position some 20 km south of Edinburgh; the Lammermuir Hills, which continue as an extension to the north-east of the Moorfoots to the coast; the northern part of the Cheviot Hills and adjacent areas of the valley of the River Tweed. With the exception of those roosts associated with the River Tweed and the Cheviots, nearly all sites are located at an altitude of 250 m or more and can be considered as upland sites. Two further roosts are coastal and located on the Firth of Forth near North Berwick. Many of the reservoirs in Lothian Region are owned by the Lothians Regional Council (LRC) for water supply purposes. The majority of the Borders roosts are privately owned. Several sites are designated under international and national legislation for their wildlife interests. Several sites are also managed as reserves by the Scottish Wildlife Trust (SWT).

The project concentrated in particular on Gladhouse Reservoir, in view of the recent decline in Pinkfeet numbers at this site, and adjacent sites that have known or suspected links with Gladhouse. Fala Flow was known to be linked to Gladhouse, with the same local population of geese using either of these sites depending on prevailing conditions (Newton *et al.* 1973, Brotherston unpublished). The other Moorfoot roosts, especially Portmore Loch and Rosebery Reservoir, also inherit moderate numbers of geese under certain conditions. West Water Reservoir, a nearby roost that has grown considerably in importance and where shooting also occurs, was also included in the intensive study area. Limited data also suggested that Aberlady Bay is linked to the roosts of the Moorfoots and south-east Pentlands (Brotherston unpublished). Regular counts at this site meant that much data were readily available and it was also included in the intensive part of this study.

The potential feeding ground for birds using roosts in the Lothians and Borders covers around 150 km². However, much of this area is unsuitable and feeding areas are distributed patchily throughout this area. The areas searched for feeding birds from the four intensively studied roost sites (Gladhouse, Fala Flow, West Water and Aberlady), comprised that south of North Berwick; the foothills of the Moorfoots, extending some 5-8km to the north of the escarpment between Pathhead and Penicuik; the lowland area between the Moorfoots and the Pentlands, roughly bounded by the A702 and A701 south of Penicuik to the A721; and the Clyde valley from Lanark in Strathclyde to Biggar, extending also along the tributaries of the South Medwin to Dolphinton and Biggar Water to Broughton.

Figure 1. The Lothians and Borders, showing the main roosts within the study area and other sites mentioned in the text. Ab Aberlady Bay, B Baddingsgill Resr., Be Bemersyde, Ca Caudshiels L., Cl River Clyde, C Cobbinshaw Resr., Co Cowgill Resr., Cu Culter Resr., Cr Crosswood Resr., E Edgelaw Resr., FF Fala Flow, GH Gladhouse Resr., H Harperrig Resr., Ha Harlaw Resr., Hi Hirsal Lake, Ho Hoselaw L, Hp Hopes Resr., Hu Hule Moss, L Lochlyoch, P Portmore L., Q Quarryford Pool, R Rosebery Resr., S Springfield Resr., St Stobshiels Resr., T Threipmuir Resr., Ty Tynninghame, Wa Watch Water Resr., WW West Water Resr., W Whiteadder Resr., Y Yetholm L.. Graduations are 10km squares.

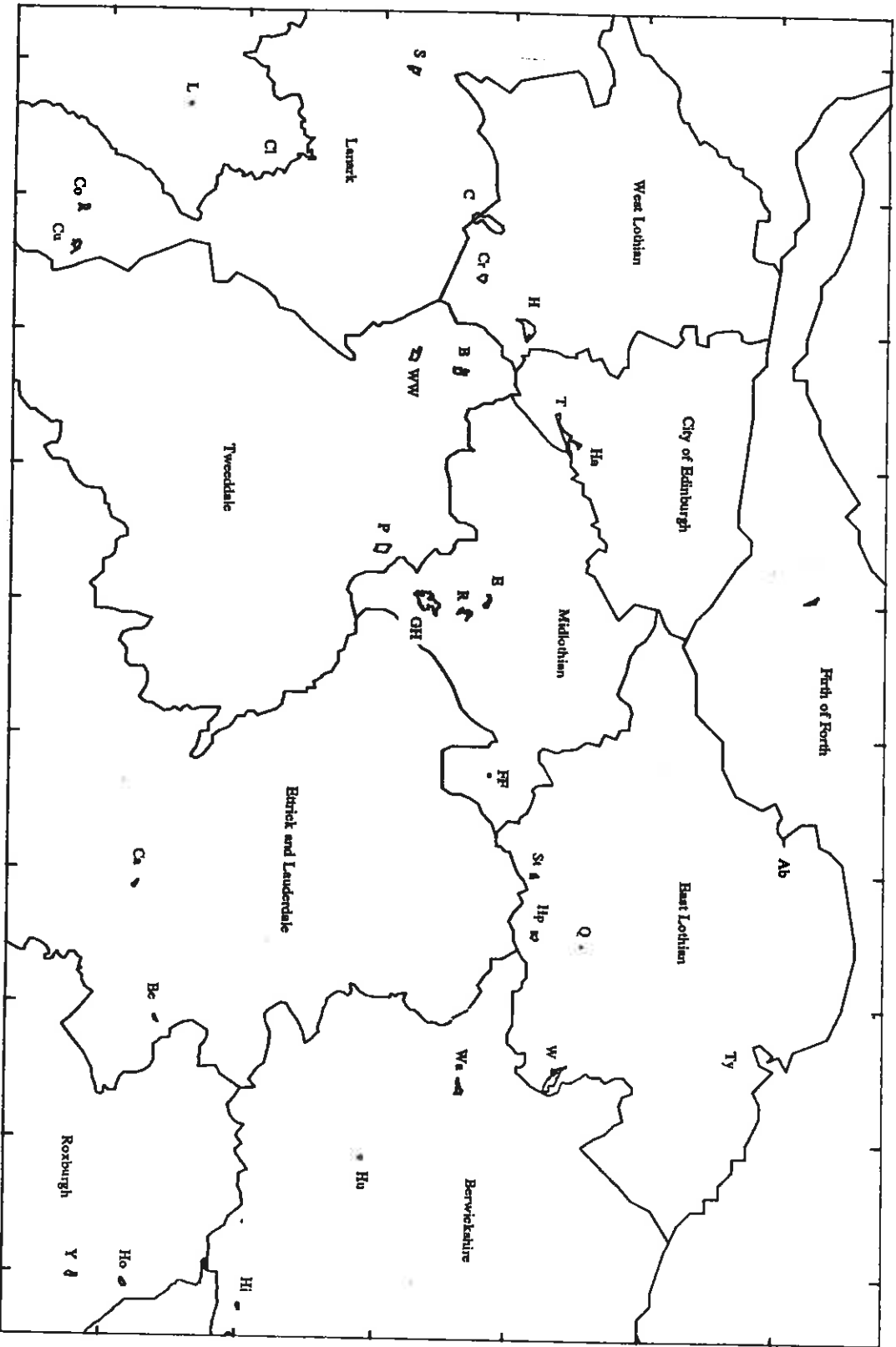


Table 1. Principal Pink-footed and Greylag Goose roosts in the Lothian and Borders Regions.

Name	Region	District	Grid ref	Conservation status
Pentlands				
Baddingsgill Rsr*	Borders	Tweeddale	NT128558	
Cobbinshaw Rsr	Lothian	West Lothian	NT018580	SSSI
Crosswood Rsr*	Lothian	West Lothian	NT059575	
Harlaw Rsr	Lothian	City of Edinburgh	NT181648	
Harperrig Rsr	Lothian	West Lothian	NT096611	
Threipmuir Rsr	Lothian	City of Edinburgh	NT173638	Part is SSSI
West Water Rsr	Border	Tweeddale	NT117524	SSSI, p. Ram/SPA
Moorfoots				
Edgelaw Rsr*	Lothian	Midlothian	NT300582	
Fala Flow	Lothian	Midlothian	NT428586	SSSI, Ramsar, SPA
Gladhouse Rsr	Lothian	Midlothian	NT299535	SSSI, LNR, Ramsar, SPA
Portmore Loch	Borders	Tweeddale	NT260502	
Rosebery Rsr	Lothian	Midlothian	NT307567	
Coastal				
Aberlady Bay	Lothian	East Lothian	NT464806	SSSI, LNR, p. Ram/SPA
Tynninghame	Lothian	East Lothian	NT635793	SSSI, p. Ram/SPA
Lammermuirs				
Dowlaw Dam	Lothian	East Lothian	NT852698	
Hopes Rsr*	Lothian	East Lothian	NT547621	
Hule Moss	Borders	Berwickshire	NT713491	SSSI, p. Ram/SPA
Quarryford Pool*	Lothian	East Lothian	NT554657	
Stobshiel Rsr*	Lothian	East Lothian	NT501620	
Watch Water Rsr	Borders	Berwickshire	NT660564	
Whiteadder Rsr	Lothian	East Lothian	NT653636	
Tweed and Cheviots				
Bemersyde Moss	Borders	Ettrick & Lauderdale	NT612338	SSSI
Cauldshiels Loch*	Borders	Ettrick & Lauderdale	NT512322	
Hirsel Lake	Borders	Berwickshire	NT824402	SSSI
Hoselaw Loch	Borders	Roxburgh	NT808318	SSSI, Ramsar, SPA
Whitton Loch	Borders	Roxburgh	NT745198	
Yetholm Loch	Borders	Roxburgh	NT803279	SSSI

* not counted in autumn/winter 1991

p. Ram/SPA indicates a site proposed for designation as a Ramsar site and an SPA. Aberlady Bay and Tynninghame form only part of large proposed Ramsar sites and SPAs.

2.2 Gladhouse Reservoir

Gladhouse Reservoir is located in the Midlothian District approximately 20 km to the south of Edinburgh. The reservoir lies just over 1 km to the north of the escarpment of the Moorfoot Hills. The reservoir is a complex shape and has three islands. When full, the surface area of the water is 162 ha and is just over 270 m above sea level (LRC 1990, 1991). The reservoir is fed by several small streams to the south and east and empties into the River South Esk which flows roughly due north.

The reservoir and the immediate surrounding land, is owned by LRC, land having been purchased from the adjoining Arniston and Rosebery Estates. Gladhouse Reservoir, along with Portmore Loch, Rosebery Reservoir and Edgelaw Reservoir, forms part of the Moorfoot water supply scheme which started in 1879. The scheme fulfils statutory obligations to provide water to Edinburgh and Midlothian and supplies compensation water during periods of drought to the River South Esk via Rosebery Reservoir. Since the early 1980s, Megget Reservoir has also supplied water to Edinburgh, lessening the role of Gladhouse Reservoir with the effect that water levels, on average, can be kept higher.

Gladhouse was designated a Local Nature Reserve (LNR) under the National Parks and Access to the Countryside Act (1947) on 1 November 1979. The site was re-notified as an SSSI in 1985. The reservoir was also designated a Ramsar Site and classified as an SPA on 14 July 1988.

In view of the wildlife importance of the reservoir and the need to safeguard this, an Advisory Committee, comprising councillors from LRC, representatives of the estates, Countryside Commission for Scotland, Midlothian Angling Advisory Committee, Scottish Ornithologists' Club, SWT and NCCS, was set up by the regional council to produce a Management Plan. The Management Plan for the period up to 1997 (LRC 1991) has recently been adopted by the council. The objectives of this plan are to: (a) maintain and enhance the value of the reservoir as a roost site for geese; (b) maintain and enhance the value of the reservoir for breeding and overwintering waterfowl; (c) maintain, and where appropriate, enhance the habitat diversity of the reserve; (d) promote and encourage public access, educational and recreational use, insofar as they are compatible with the first three objectives. However, all associated interests in the reservoir are secondary to its water supply function. A refuge area has been defined covering the southern half of Mauldslie Bay in the south-eastern corner of the reservoir.

A regime of water level control has been in operation since 1983 for the benefit of conservation interests. The water level is maintained at maximum height from the end of February until the end of June, is then drawn down to 5 ft below maximum by 30 September to accommodate winter runoff from the catchment, and then allowed to refill to maximum some time before the end of February (LRC 1991). This regime is subject to the requirements of water supply and reservoir safety.

Shooting rights over the reserve are owned by the Arniston and Rosebery Estates. Geese are shot for sport at Gladhouse Reservoir as birds arrive at or leave the roost. There has been a voluntary agreement since 1986 that wildfowling at the reservoir will not commence before 14 October and thereafter is restricted to a frequency of one shoot every 14 days. Proposed shoot dates are supplied to the LNR Management Committee at the start of the season. The Arniston and Rosebery Estates also provide a summary of the number of shoots and geese

shot for the Gladhouse LNR report. The estates also operate commercial shoots for game, particularly Pheasants *Phasianus colchicus*, and manage areas specifically for this purpose. A number of drives are present on the estates at varying distances from the reservoir. Duck ponds and areas of grouse moor are also present on the estates. Arniston Estate also hosts walk-up days, covering areas of open ground, and Rosebery hosts a few shoots over open ground early in the season.

Angling on the reservoir is permitted from boats, with the reservoir being developed and managed as a natural Brown Trout *Salmo trutta* fishery. There are currently eight boats (two owned by each of the estates and four by LRC) although it has been proposed that this be increased to 11. Fishing is prohibited before 10 a.m. on Thursdays and 11 a.m. on Sundays for bird recording purposes. Fishing is also prohibited after 5 p.m. from 15 September until the end of the season (30 September), preventing disturbance to roosting geese. No fishing is allowed within the refuge area. Gladhouse Reservoir has been recognized by LRC as having a potential for quiet water activities (windsurfing, yatching *etc.*) although is are currently permitted. Any such recreation would be restricted to a period from 1 April until 30 September.

2.3 Fala Flow

Fala Flow is located in the Midlothian District approximately 20 km to the south-east of Edinburgh. The Flow is a small loch, some 100 m in diameter, with a small pool approximately 20 m in diameter, situated less than 100 m to the south. The loch is located in an extensive area of blanket bog and Heather *Calluna vulgaris* moor, at 325 m above sea level. The moor occupies a plateau area on the edge of the north-eastern end of the Moorfoot escarpment, adjacent to the Lammermuirs.

Fala Moor, including Fala Flow, is owned by the Fala Estate. The Moor has been notified as an SSSI, covering some 323 ha, with the Flow positioned just west of the centre. The Moor is also a Ramsar Site and an SPA, due to its importance as a Pink-footed Goose roost, and in recognition of the size and quality of the blanket bog.

Shooting rights over the moor and the flow are owned by the Fala Estate. No shooting of roosting geese occurs at the Flow, although some flightline shooting at the edge of the escarpment has been recorded on adjacent estates. Duck shooting occurs very rarely and the surrounding land is managed as a Red Grouse *Lagopus lagopus* moor.

2.4 West Water Reservoir

West Water Reservoir is located in the Tweeddale District of the Borders Region, approximately 25 km south south-west of Edinburgh. The reservoir is situated at the south-eastern corner of the Pentland Hills. The reservoir is roughly rectangular with an arm extending to the north-west and a number of small islands close to the northern shore, depending on water levels. The surface area of the reservoir is approximately 40 ha in size when full and is approximately 325 m above sea level. The reservoir is fed by small streams originating in the Pentlands and empties into West Water, a tributary of Lyne Water, which flows into the River Tweed.

The reservoir, including its boundary, is owned by the LRC, and is located within the North Slipperfield Estate. West Water was built during the mid 1960s and started filling in 1965. The reservoir is used to supply water to West Lothian and the River Tweed. Water levels vary according to demand and weather. The water level is generally lower during the summer and autumn period, at around 4-5 m below top level, and fills to maximum from December to April. There is only limited capacity for topping up water levels from small reservoirs close by.

West Water was notified as an SSSI for its importance as a Pink-footed Goose roost and also for supporting locally important numbers of breeding wildfowl, waders and gulls. The SSSI includes moorland to the west, occupying some 51 ha in total. The site is also a proposed Ramsar site and SPA. A management plan for the reservoir is currently in preparation by LRC, in conjunction with relevant bodies, to determine conservation, recreational and educational objectives for West Water. Two of the islands have been identified as a refuge.

Shooting rights over the reservoir are owned by the North Slipperfield Estate. A voluntary agreement exists between the Estate, LRC and NCCS that goose shoots are not permitted before 14 October and thereafter to only one shoot every 14 days. NCCS and LRC are informed in advance of the proposed shooting dates at the reservoir. The adjacent moor is managed for Red Grouse. The reservoir is managed as a Brown Trout fishery. Only fly fishing is permitted at the site and must be conducted from boats, which are permitted to land only at designated points on the shore. Marked exclusion zones delimit the refuge and associated areas. There are currently two boats at the reservoir, one owned by LRC and the other by the West Linton Angling Club. Fishing is allowed between 8 a.m. and 11 p.m. only, or one hour after sunset, whichever is earlier, and is prohibited before 10 a.m. on Thursdays and 11 a.m. Sundays for bird recording purposes. The fishing season extends from 1 May to 31 August, April and September being excluded to prevent disturbance to the geese. West Water is recognized as having a potential for water sports, but its location and access difficulties mean that this is unlikely to be realised (LRC 1990).

2.5 Aberlady Bay

Aberlady Bay is situated in the East Lothian District on the southern shore of the Firth of Forth, just over 20 km north-east of Edinburgh. The bay includes approximately 460 ha of exposed foreshore at low tide. Easy access to the bay is provided by public road and footpath and one of the major problems for wildlife in the area is the pressure of tourism.

The bay and adjacent land was designated an LNR on 14 July 1952, the first in the UK. The reserve boundary encompasses a margin of some 120 ha of land above the high water mark, consisting largely of grasslands, dunes and rocky shoreline, in addition to the foreshore. The reserve area is owned by private landowners, divided between two local companies and the Gullane Golf Club. The reserve and an additional area to the east is designated as an SSSI, covering over 860 ha, in recognition of the site's botanical, geological and ornithological interest. The reserve is part of a proposed Ramsar site and SPA for the Outer Firth of Forth.

Wildfowling is permitted under the bye-laws governing the reserve. Shooting under permit is allowed within the boundary of the reserve between one hour before sunrise and 10 a.m. and between 3 p.m. and one hour after sunset. Only duck species may be legitimately shot. Goose shooting is not permitted within the reserve.

3 Methods and data sources

3.1 Contemporary count data

A programme of fieldwork was undertaken from the end of September to late December 1991 to obtain the following information:

a) Roost counts: all known major sites in the region (Table 1) were counted by local volunteers for the two national censuses of Pink-footed and Greylag Geese (12/13 October and 9/10 November 1991). In addition, several coordinated counts were conducted in the Lothians and the Borders. Additional counts at some of these sites were also received from counters. The roosts at Gladhouse, West Water, Fala Flow and Aberlady Bay were counted weekly from the end of September until late December. Further counts were also obtained for these sites, usually near the time of scheduled shoots.

A count form was distributed for use at roosts (Appendix 1). This asked observers to record the size, time and direction of arriving, departing and overflying groups of geese, weather conditions and the nature of any disturbance at the roost. The direction of major flightlines were drawn on site maps.

b) Daytime counts: the location and behaviour of birds by day were recorded in the intensive study area. Most observations were made from roads, although some areas were visited on foot if geese were suspected of using ground not visible from roads. Daytime counts were largely undertaken by the author, visiting the study area for several days periodically throughout the study period. Although complete coverage of the area was made regularly, observations were concentrated on known feeding areas once these were recognized. Co-ordinated coverage by several observers was also achieved either side of a scheduled roost shoot on two occasions. Casual records were also received from volunteers.

A count form was distributed to observers for recording the number of geese, the habitat in which they were located (crop type *etc.*), the proportions of the flock feeding and loafing, the direction and time of any arriving or departing groups and the nature of any disturbance (Appendix 2).

3.2 Historical count data

Counts for the period 1978 to 1990 inclusive were obtained as follows:

a) Roost counts: goose counts for the major roosts were obtained from WWT databases and Lothian and Borders Bird Reports. Data were also obtained directly from counters and from the William Brotherston's diaries, provided by the William Brotherston Trust. Further counts for Gladhouse were obtained from the Gladhouse LNR Annual Reports. These data consist largely of count totals for each species at each site, although the direction of arriving and departing geese are noted on some occasions.

b) Daytime counts: data were obtained for autumn and winter 1986 from the Lothians Goose Survey (Brown 1987), and for autumn and winter 1980 from the diaries of William Brotherston. These counts were largely obtained in a similar way to that for 1991, with observations being made mainly from public roads. The areas covered, however, were not

as extensive as in 1991: observations in 1986 covered the area between West Water Reservoir and Fala Flow, whilst 1980 data relate only to the area adjacent to Gladhouse and Fala Flow.

3.3 Disturbance data

The author was notified of dates of shoots at roosts scheduled for 1991 at the start of the study period and confirmation that these had taken place was later sought from the relevant estates. Information regarding frequency and the nature of shooting on surrounding estates and farmland was obtained through contact with farmers and gamekeepers. Three shoots, one at Gladhouse and two at West Water, were attended by the author. Any disturbance incidences, and the cause of disturbance, were recorded during fieldwork, both at roosts and during the day. Data on low flying by Royal Air Force jets in the area was sought from the Ministry of Defence.

3.4 Local opinion

Local opinion on the presence of geese, and anecdotal information, was obtained through liaison with a number of interested parties, including estate owners, shooting tenants, gamekeepers, tenant farmers, birdwatchers, waterkeepers, LRC Planning Department and NCCS.

4 Results

4.1 Roost counts

4.1.1 The Lothians and Borders Regions

The Lothians and Borders consistently held 28-31% of the total population of Pink-footed Geese in mid November from 1978 to 1986 inclusive, with the exception of 1982 and 1984 when the national census totals for both species were probably under-estimated. This fell to around 20% of the population after 1986, although the number of Pinkfeet counted in south-east Scotland continued to rise (Table 2). However, additional regional censuses since the mid 1980s show that a higher proportion of birds was present in the region in October than in November. The size of the October count varied considerably in the late 1980s and early 1990s, with between 15% and 43% of the population being recorded in the region. Despite this variation, peak numbers generally occurred in October and fell away by mid November.

The Lothians and Borders are the wintering haunts of a smaller proportion of the Greylag population, with the northern Cheviots and eastern Pentlands supporting the majority of birds. Numbers in the region have shown a similar pattern of increase to that nationally (Table 2), and, as with Pinkfeet, represent a fairly stable proportion of the total population. This varied between 7% and 10% from 1978 to 1988 inclusive, with the exception of 1982, 1984 and 1987. In 1989 and 1990, this proportion fell slightly to 6% and 4%, respectively. With the exception of 1985, the series of regional censuses conducted in following years showed an increase in the number of birds in the region from September to November. In the late 1970s and early 1980s, the majority of the region's birds were located in the Borders and, although a number of high counts were recorded in the mid 1980s, the total has fallen slightly in recent years. The number in the Lothians has increased gradually since the late 1970s but numbers are quite erratic.

4.1.2 Site accounts

A summary of roost counts in the Borders and Lothians between 1978 and 1991 is given here. Greater detail is given in Appendix 3, where all counts are listed. For each roost, the average peak count is given for one four-year and two five-year periods, firstly for Pink-footed and secondly for Greylag Geese. The number of counts for each period is given in brackets. Where insufficient counts are available, averages are given for the whole 14 year period, denoted by the use of "All". "n.c." indicates no count data are available for the period.

Data have been extracted from a number of sources including the district bird reports where counts are often presented as monthly maxima. In these instances, counts of the less abundant goose species may not be presented if considered too small *e.g.* counts of Greylag at West Water. The number of counts shown in the accounts gives the total number of visits and does not allow for such missing data. The average count of the less abundant species will thus be falsely low. However, the loss of such information will not invalidate any site assessment, in view of the importance of the site for the other species. Furthermore, counts at large roosts often assume large flocks of distant birds to be of one species. Small numbers of the less numerous species are undoubtedly missed, and thus even published figures represent minima, although this is unlikely to affect the following assessments.

Table 2. The numbers of Pink-footed and Greylag Geese counted in national and local censuses since 1978.

Year	Date	National Total		Lothian Total		Borders Total	
		Pinkfeet	Greylag	Pinkfeet	Greylag	Pinkfeet	Greylag
1978	5.11	78,000	76,000	14,800	760	7,400	4,130
1979	11.11	80,000	81,000	11,700	660	13,660	5,080
1980	10.11	95,000	90,000	17,280	760	10,900	8,290
1981	8.11	90,000	96,000	13,240	3,210	13,780	4,780
1982	14.11	89,000	80,000	8,350	1,160	10,750	1,710
1983	13.11	101,000	82,000	19,020	3,630	8,540	4,460
1984	18.11	86,000	64,000	5,140	1,050	6,700	2,190
1985	13.10	n.c.	n.c.	14,418	478	23,979	6,962
	17.11	128,000	107,000	15,010	1,600	23,720	3,190
1986	12.10	n.c.	n.c.	10,762	206	37,074	4,348
	9.11	n.c.	n.c.	6,280	1,275	22,914	23,474
	16.11	135,720	101,940	12,110	2,780	25,870	6,170
1987	18.10	n.c.	n.c.	12,442	608	23,311	868
	15.11	171,980	104,790	15,490	1,470	19,430	3,660
	13.12	n.c.	n.c.	n.c.	n.c.	26,650	1,815
1988	16.10	n.c.	n.c.	14,810	647	11,866	2,925
	13.11	176,210	108,700	7,530	980	14,573	6,917
	mid.12	n.c.	n.c.	n.c.	n.c.	10,816	1,189
1989	30.9	n.c.	n.c.	n.c.	n.c.	49,050	0
	8.10	n.c.	n.c.	18,050	n.c.	61,985	2
	22.10	n.c.	n.c.	11,699	1,487	24,925	984
	19.11	182,969	83,577	12,430	3,170	5,305	1,178
1990	30.9	n.c.	n.c.	15,182	36	40,588	143
	7.10	n.c.	n.c.	15,950	110	36,458	1328
	14.10	n.c.	n.c.	n.c.	n.c.	10,266*	703
	21.10	175,724	76,286	28,780	1,212	31,366	3,090
	11.11	191,452	114,678	20,690	2,120	19,530	3,090
1991	28.9	n.c.	n.c.	12,784	0	40,616	15
	5.10	n.c.	n.c.	26,003	64	n.c.	n.c.
	12.10	232,962 ⁺	38,919 ⁺	24,094	19	45,500	275
	19.10			26,295	30	28,479	1,500
	9.11	178,736	88,272	8,906	1,459	23,451**	2,357

* the Borders total on 14 October 1990 does not include birds at West Water.

** the Borders total on 9 November 1991 includes the count for West Water from 16 November

+ the national census in October 1991 was conducted over two weekends

Some of the following site accounts are for roosts outwith the Borders and Lothians Regions. Geese using these roosts are thought to contribute to the feeding flocks in the Clyde Valley, thus mixing with those from West Water. Counts for these sites were included in Borders and Lothians summary reports at the end of the 1970s. Figures from this period and contemporary data are assessed here. Brief location details accompany the site accounts.

4.1.2.1 Pentland roosts

Baddinsgill Reservoir

All	1,720	7	(11)
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Prior to the construction of West Water in the mid 1960s, this site was the major roost for Pink-footed Geese in the southern Pentlands. However, the site rapidly declined in importance and has subsequently been little visited. The last count of any note was of 9,820 on 10 October 1979 coinciding with heavy shooting at West Water on that date. A total of only 43 birds have been recorded on seven occasions since that date.

Cobbinshaw Reservoir

1978-81	62	47	(5)
1982-86	547	433	(7)
1987-91	1,282	0	(16)

This site is used somewhat erratically, primarily by Pink-footed Geese, and represents the only site of significance for this species on the west side of the Pentlands. No Pinkfeet were recorded in 1985 or 1986, but subsequent records often involved large numbers (*e.g.* 2,000 on 12 November 1983; 3,000 on 21 November 1990) suggesting a rise in the importance of the site. However, these peaks were very short lived, indicating that birds may have been disturbed from adjacent sites or were migrating through the area quickly. The site was used by Greylag Geese in the early 1980s, with a count of 1,430 on 12 November 1983 being exceptional, but only two birds have been recorded since 1984. Although the major Greylag concentration in the Lothians is located close by (see accounts for Threipmuir and Harperrig) it remains fairly sedentary.

Crosswood Reservoir

All	202	44	(11)
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Data are only available for seven years between 1978 and 1991 and show little use of the site by geese, with seven of 11 counts returning no birds. Counts of 1,000 Pinkfeet and 130 and 160 Greylag probably relate to birds disturbed from other sites or passing through the area.

Harlaw Reservoir

This site is directly adjacent to Threipmuir. Birds in this area favour Threipmuir as a roost site but have occasionally been noted to use Harlaw. Goose roosts are normally attributed to Threipmuir and Harlaw as one site. All counts have been considered under Threipmuir for the purposes of this report.

Harperrig Reservoir

1978-81	0	923	(5)
1982-86	8	1,332	(23)
1987-91	213	850	(18)

This, and the adjacent site of Threipmuir, support the major concentration of Greylags in the West Lothians, with Harperrig being used by the majority of these birds. Peak numbers in the early 1980s reached 2,000 in 1981 and 1982, and 1,500 in 1983, and normally occurred in November. Since 1984, numbers have generally remained below 1,000, although a count of 1,635 on 15 November 1989 is noteworthy. The site is not used by Pink-footed Geese, with the exception of 1,000 noted roosting in October 1990 and 65 in December 1991.

Threipmuir Reservoir

1978-81	0	4	(3)
1982-86	0	385	(15)
1987-91	0	580	(27)

Threipmuir and Harperrig are the only sites in the Pentlands and Moorfoots at which Greylag predominate, with Harperrig supporting the most birds. The few counts from the early 1980s indicate little usage of the site. However, from 1983 onwards, the site has been used regularly by an increasing number of birds, from 300 in 1983 to a maximum of 700 in 1988. More recently, the peak count, normally in November or late October, has averaged just over 500 birds. Although there is probably limited interchange with Harperrig, the relatively constant flock size suggests that the sites are not linked to any great extent. Only one Pink-footed Goose has been recorded at the site since 1978. The local Greylag population has occasionally been noted to use Harlaw.

West Water Reservoir

1978-81	11,867	20	(59)
1982-86	16,233	40	(56)
1987-91	31,197	26	(50)

For over a decade, West Water has been one of the foremost sites for Pink-footed Geese. The reservoir attracted large numbers of birds very shortly after construction and numbers using the roost have increased steadily, reflecting the increase in the population as a whole. In recent years peak counts have averaged over 30,000 birds, a figure that can be matched by only three other sites in the UK (WWT unpublished).

Peak numbers have generally occurred shortly after the first arrival of birds from the breeding grounds, with numbers then falling away by late November or December (Figures 2a-2c). More recently, a large number of birds, often in excess of 5,000, have remained into the middle of the winter period. Although there is less information for the late 1970s, the peak has generally occurred earlier in recent years, often in the first week of October. In the early 1980s the peak occurred between mid October and mid November. Only in 1984 was there a lack of an obvious peak, although the national total for this year was much lower than expected from counts in previous and following years.

In several years, a very large peak has been recorded at the site, often around twice the number of other counts for that year. However, this number often fell rapidly, sometimes

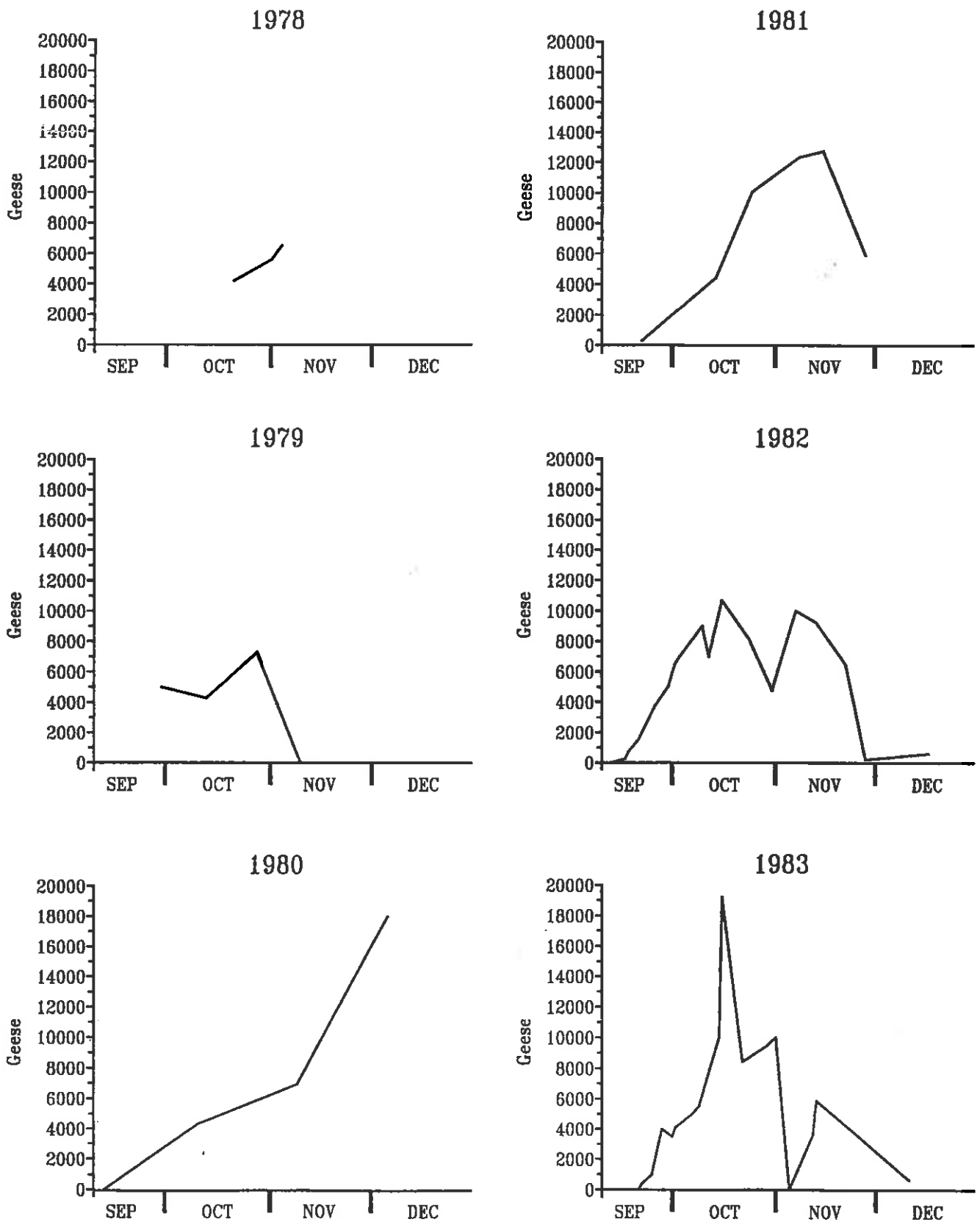


Figure 2(a). The numbers of Pink-footed Geese roosting at West Water Reservoir in October to December, 1978 to 1983. Greylag Goose counts are not shown (see text).

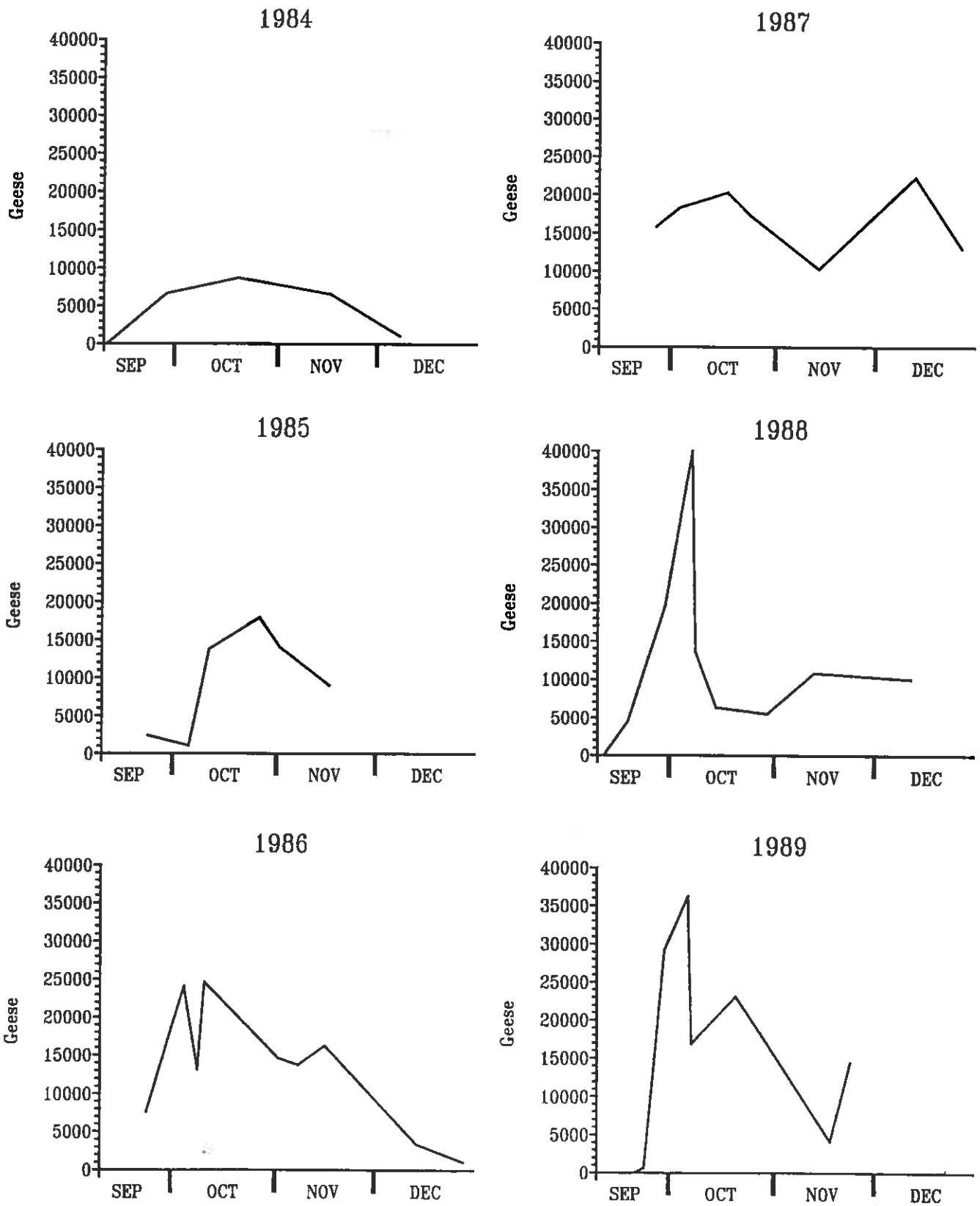


Figure 2(b). The numbers of Pink-footed Geese roosting at West Water Reservoir in October to December, 1984 to 1989. Greylag Goose counts are not shown (see text).

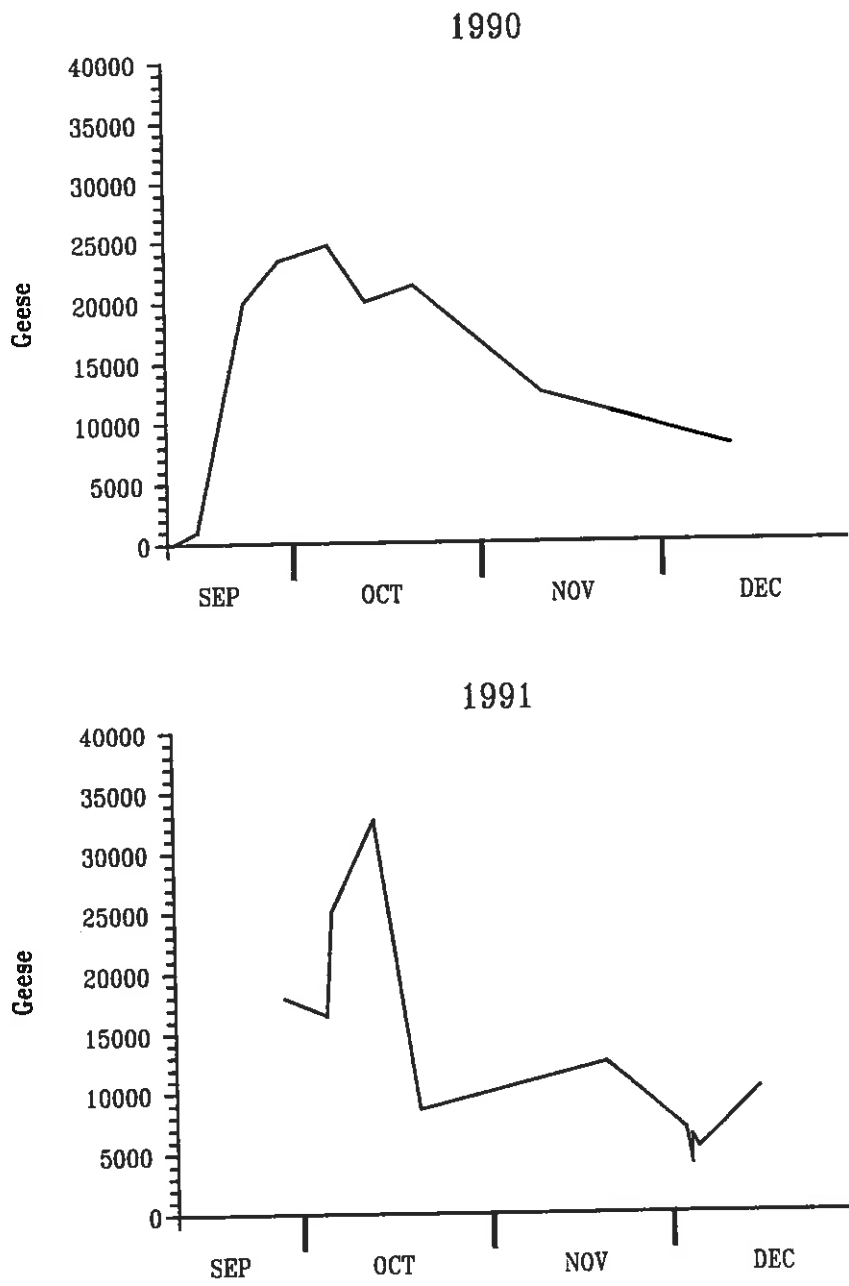


Figure 2(c). The numbers of Pink-footed Geese roosting at West Water Reservoir in October to December, 1990 and 1991. Greylag Goose counts are not shown (see text).

literally overnight (*e.g.* 40,000 on 8 October 1988, yet only 13,650 on 9 October) suggesting large numbers of birds moving rapidly through the area. Numbers have also fallen considerably over a short time outside this arrival period, although they often return to the original level (*e.g.* October 1982, November 1983, October 1986, November 1989). Such counts suggest that birds simply did not use the site on the night of the count, rather than had left the general area. Large numbers have occurred in December on several occasions, notably 18,000 in 1980 and 22,400 in 1987, when the counts constituted the peak count for these years.

Greylag numbers at this site are comparatively very low, with peak counts of 100 in 1980 and 1985, and 94 in 1987. However, figures are only published for a small proportion of the counts made at this site and it is probable that some birds are missed in the many thousands of Pink-footed Geese, especially those in flightlines distant from the counter. It is very unlikely that the lack of these data or any undercounting significantly affects regional totals.

4.1.2.2 Moorfoot roosts

Edgelaw Reservoir

No data were available for this site. Local farmers and gamekeepers have noted that small numbers of geese have occasionally used the site, including a few pairs of feral Greylags, but no noteworthy numbers have used the site on a regular basis.

Fala Flow

1978-81	3,130	0	(46)
1982-86	6,428	4	(19)
1987-91	12,166	8	(35)

This site has shown a steady and marked increase in importance for Pink-footed Geese over the last decade. Although small, the site is relatively remote and undisturbed, and is one of the first sites to be used in the autumn.

Numbers at Fala Flow often show a particularly pronounced peak in the last few days of September or the first week of October (Figures 3a-3b). Numbers in some years drop dramatically after this peak, but in others fall more slowly, so that around half the peak has still been present in late October. Numbers in November have been somewhat erratic, probably as a result of local weather conditions or factors, such as disturbance, operating at other sites, especially Gladhouse. Up until 1983, when there was a noticeable decline in the numbers of birds using Gladhouse, the peak count averaged 6,000 to 7,000 birds. However, only one count of this magnitude was recorded each year, despite a large number of roost counts in the years up until 1981. Since 1983 numbers have shown a steady increase, especially from 1987 onwards, when a peak of at least 10,000 birds has been recorded every year, with over 16,000 in 1991. High numbers have persisted for longer at Fala Flow in recent years, with around 4,000 birds being recorded in November in 1987, 1989 and 1990.

The site is little used by Greylag Geese, birds only being recorded in three years since 1978, with a maximum of 30 in 1991.

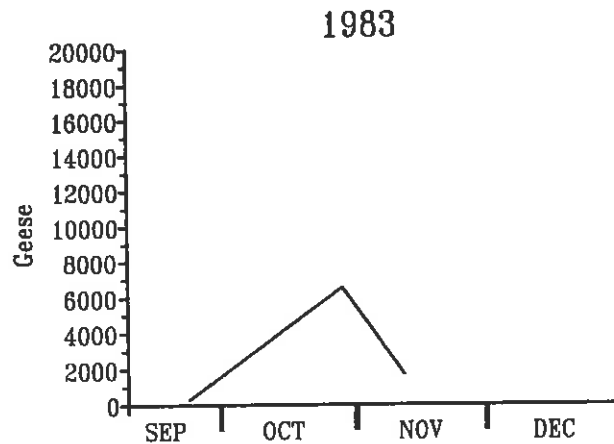
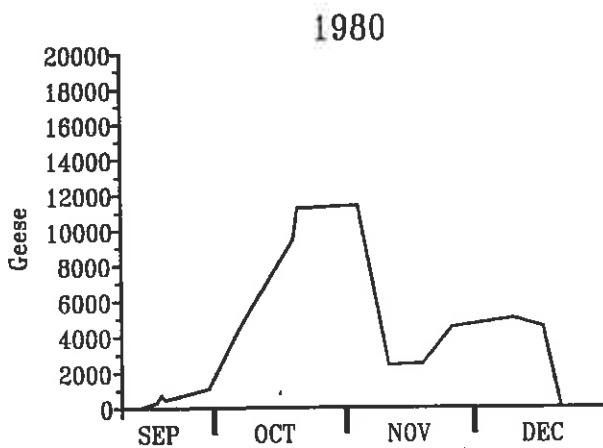
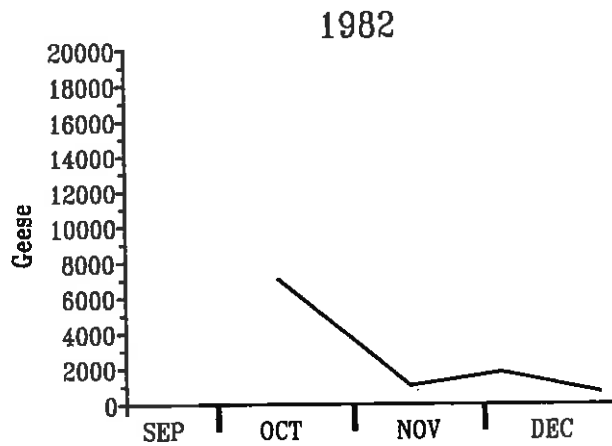
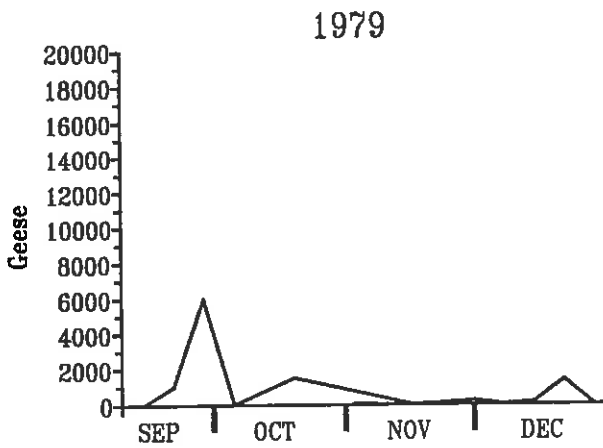
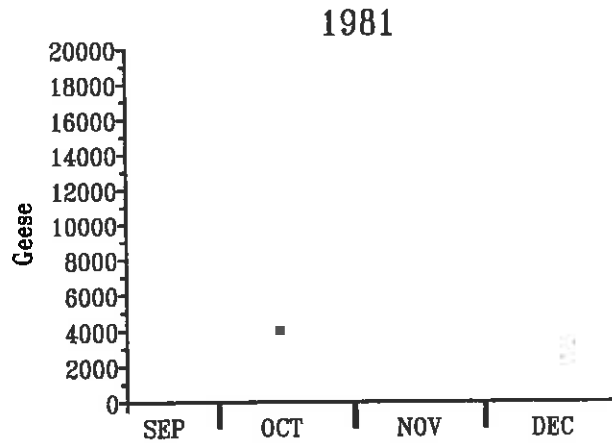
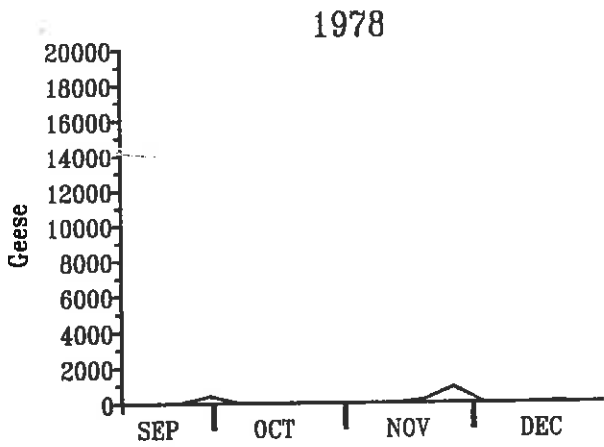


Figure 3(a). The numbers of Pink-footed Geese roosting at Fala Flow in October to December, 1978 to 1983. Greylag Goose counts are not shown (see text).

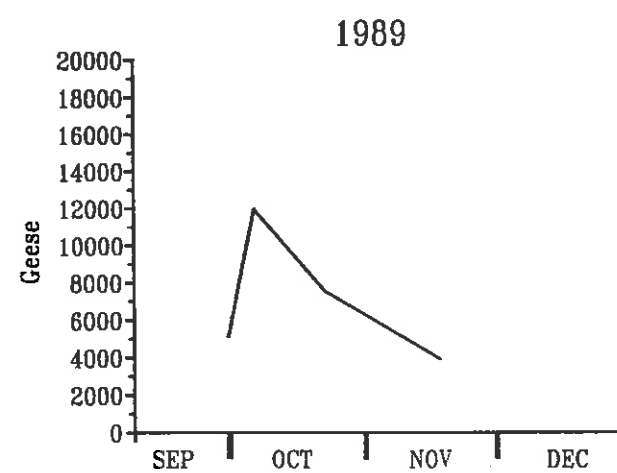
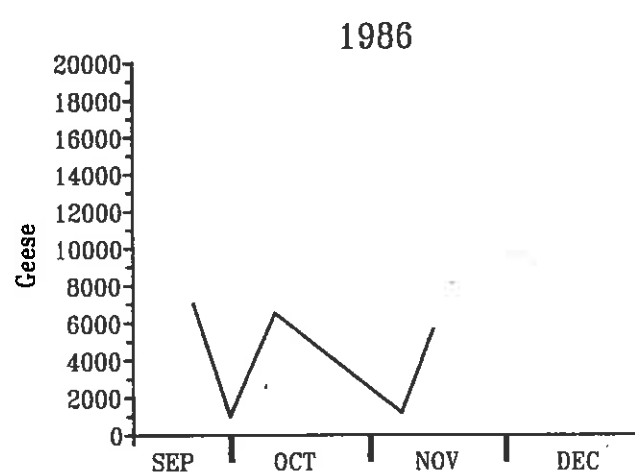
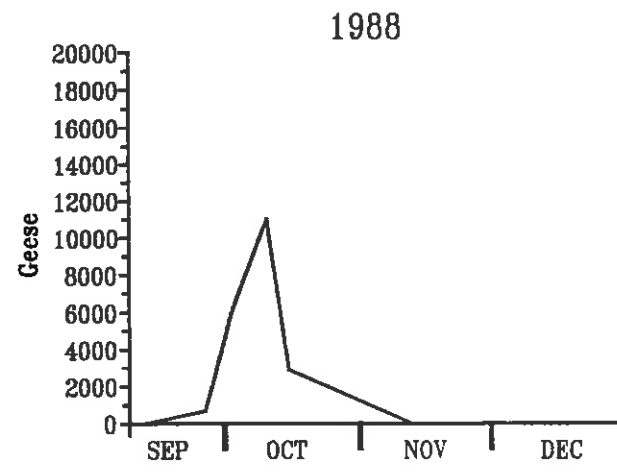
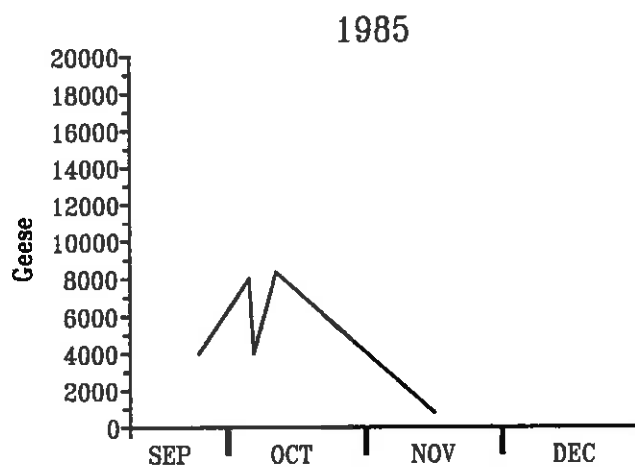
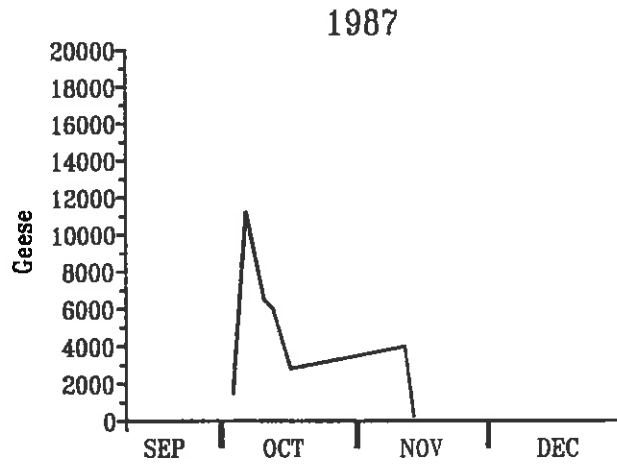
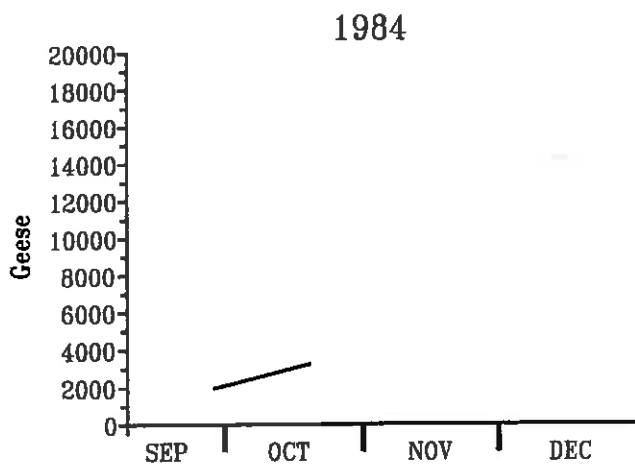


Figure 3(b). The numbers of Pink-footed Geese roosting at Fala Flow in October to December, 1984 to 1989. Greylag Goose counts are not shown (see text).

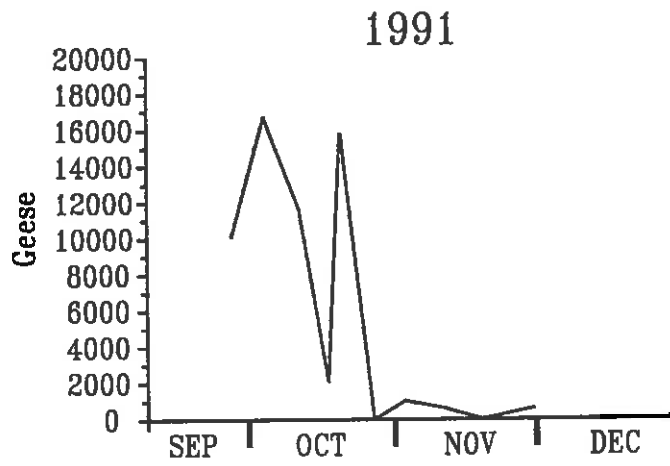
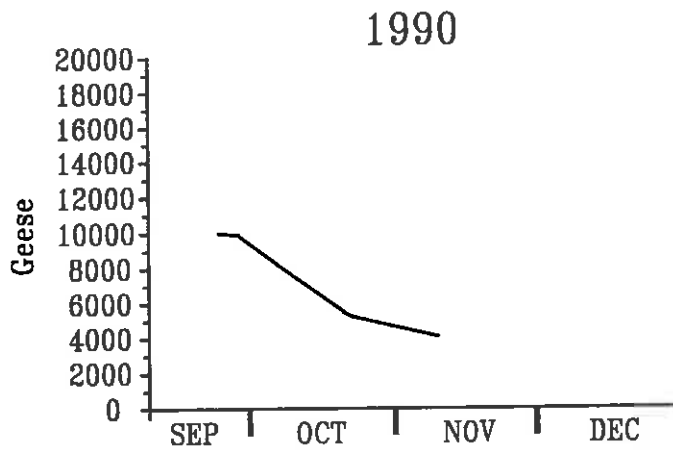


Figure 3(c). The numbers of Pink-footed Geese roosting at Fala Flow in October to December, 1990 and 1991. Greylag Goose counts are not shown (see text).

Gladhouse Reservoir

1978-81	11,606	275	(56)
1982-86	8,720	489	(54)
1987-91	3,650	371	(52)

This site was one of the prime roost sites for Pink-footed Geese in the late 1970s and early 1980s, a situation that had existed since the early 1960s, when peak counts averaged over 4,000 birds (Owen *et al.* 1986).

During the period of high counts in the late 1970s and early 1980s, peak numbers (usually in excess of 12,000 birds) often occurred in late October and declined quite quickly thereafter (Figures 4a-4c). However, numbers often showed considerable fluctuation after this time with a series of sharp peaks and troughs throughout November and often into December. From 1979 to 1980, between 3,000 and 5,000 birds were present in mid or late December, whereas numbers had fallen to zero at this time in 1981 and 1983 (data not available for the late autumn period in 1982).

There was a marked change in site usage after 1983. Although birds were occasionally present in large numbers, usually in October, there were on average about 10,000 less than in the period 1978 to 1983. There has been a gradual decrease in the numbers of roosting birds since 1983, with peak numbers still reaching around 5,000 birds in 1989. In 1990 and 1991, numbers failed to reach 3,000 birds. Over the last eight years, there have been counts of over 2,000 birds in October, November and December, but many counts of less than 100 birds were also recorded. There were very few periods of sustained use by more than 2,000 birds. For the period 1978 to 1983 inclusive, the average peak count of Pink-footed Geese was 12,004 birds. For 1984 to 1991 inclusive, this number was 4,531.

Gladhouse also represents a locally important Greylag roost site, being consistently used by several hundred birds. Counts of over 500 have been recorded on several occasions *e.g.* 625 in 1983, 800 in 1985 and 750 in 1990. Fewer data have been published for Greylags at Gladhouse. However, Greylag numbers have not mirrored the decline shown by the Pink-footed Geese, and in contrast, more birds have been recorded since 1983, although they may have been more visible among the smaller numbers of Pinkfeet. However, the smaller amount of data available for this species prevent a more detailed assessment of variation at this locally important site.

Portmore Loch

1978-81	327	0	(6)
1982-86	498	7	(5)
1987-91	63	4	(12)

This site was regularly used by Pink-footed Geese in the early 1980s, although there are comparatively few data for the period. However, there was no regular pattern of use and numbers varied between no birds and 1,250 (16 November 1985). Very few birds were noted in the late 1980s despite increased coverage. Only 42 Greylag have been recorded since 1978.

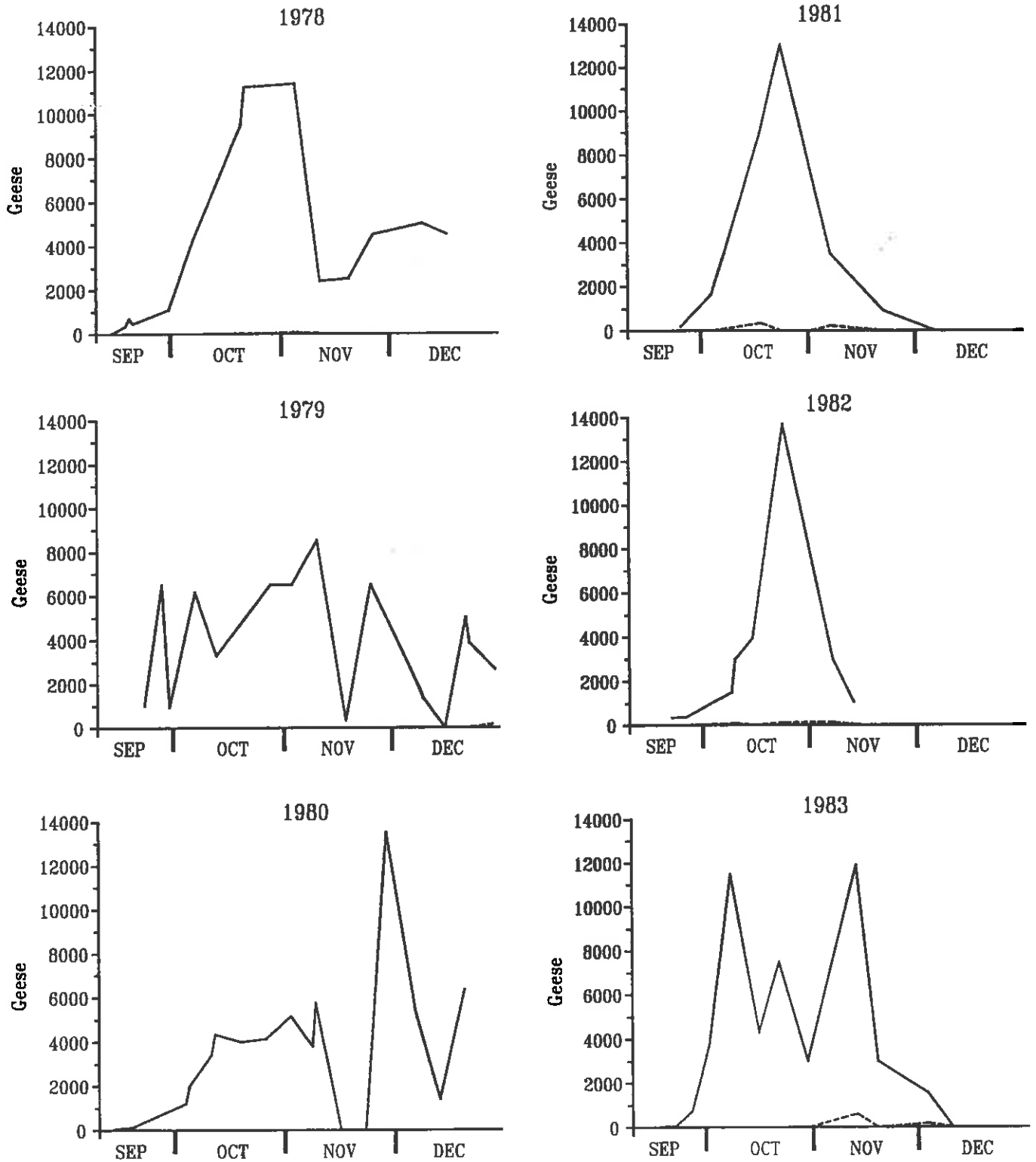


Figure 4(a). The numbers of grey geese roosting at Gladhouse Reservoir in October to December, 1978 to 1983. Pink-footed Goose counts are denoted by the use of a solid line. Greylag Goose counts are represented using a dashed line.

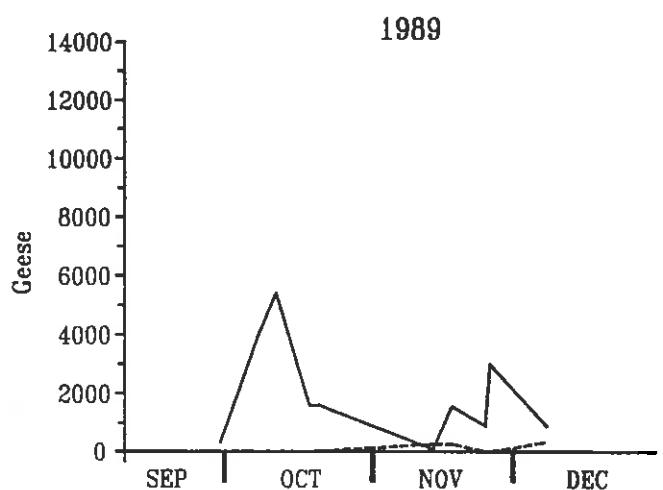
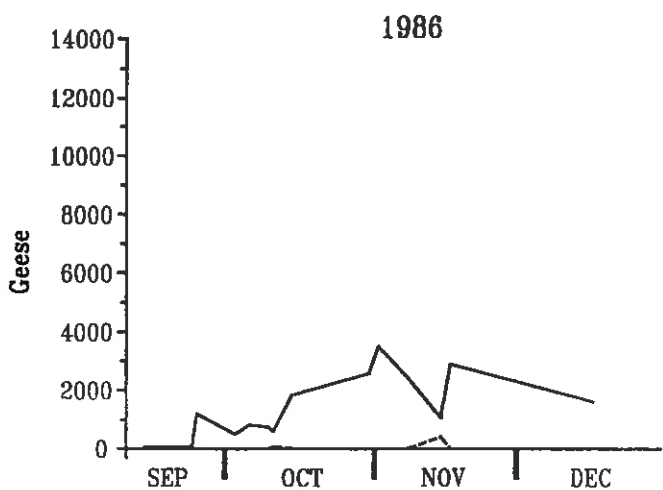
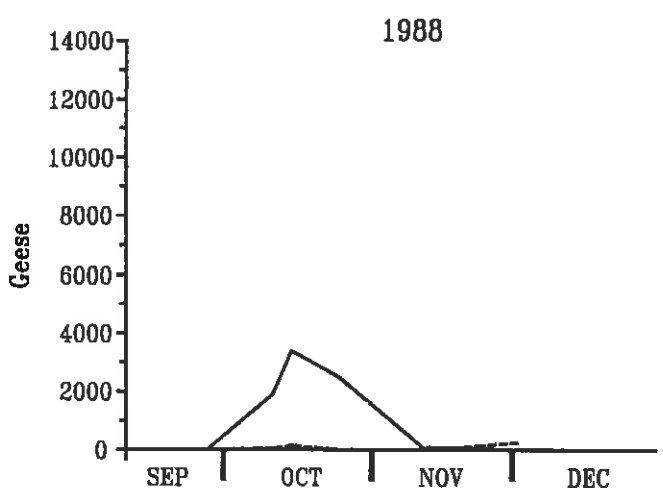
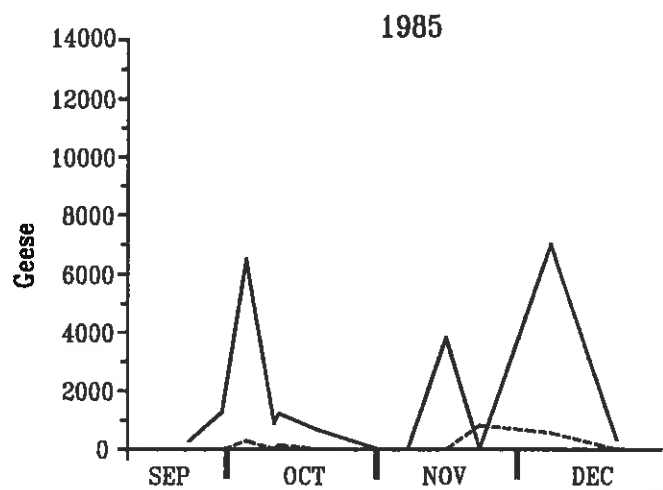
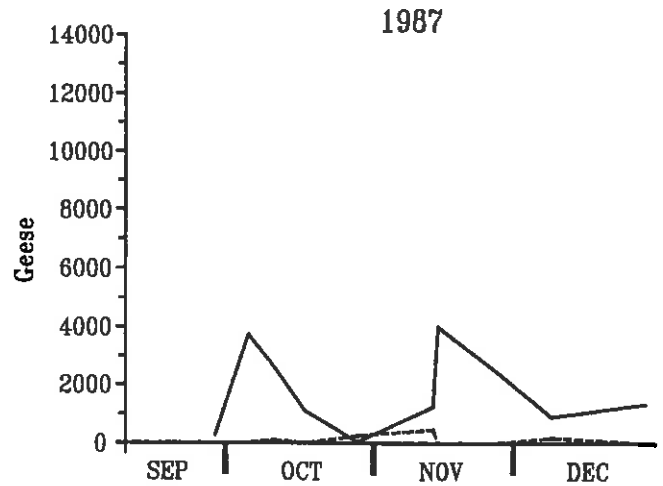
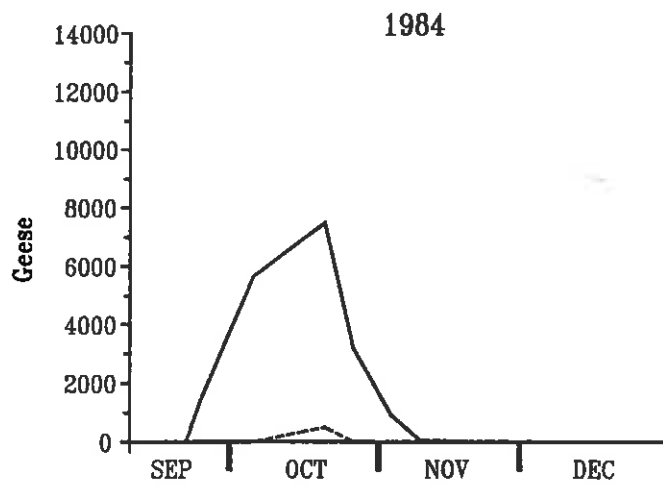


Figure 4(b). The numbers of grey geese roosting at Gladhouse Reservoir in October to December, 1984 to 1989. Pink-footed Goose counts are denoted by the use of a solid line. Greylag Goose counts are represented using a dashed line.

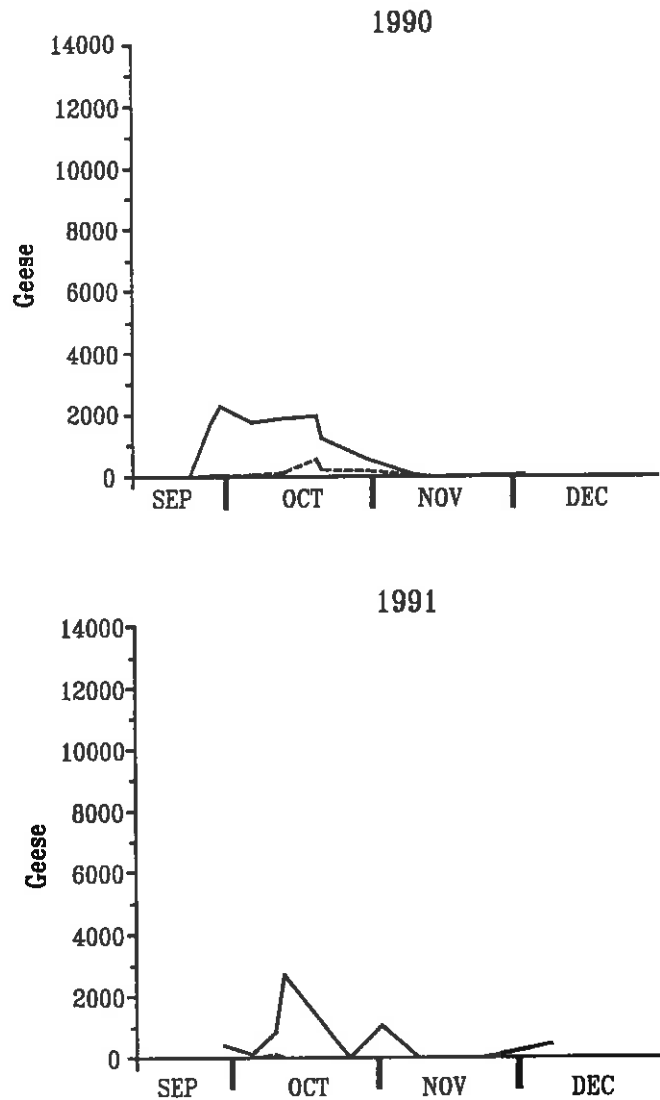


Figure 4(c). The numbers of grey geese roosting at Gladhouse Reservoir in October to December, 1990 and 1991. Pink-footed Goose counts are denoted by the use of a solid line. Greylag Goose counts are represented using a dashed line.

Rosebery Reservoir

1978-81	n.c.	n.c.	(0)
1982-86	1,813	16	(5)
1987-91	380	131	(11)

Data for this site were only available after 1984 but records show regular, though fluctuating, use by Pink-footed Geese, with at least several hundred birds being recorded in most years, and 3,000 in 1985. There were only a few records of Greylag Geese although 650 were present on 20 October 1990.

4.1.2.3 Coastal roosts

Aberlady Bay

1978-81	7,498	0	(20)
1982-86	7,995	4	(40)
1987-91	11,839	29	(37)

This site has been a traditional roost site for Pink-footed Geese since the 1960s, when the peak count averaged over 700 birds (Owen *et al.* 1986). The numbers using Aberlady Bay have increased steadily and, although data for the late 1970s are limited, this increase has continued over the last 13 years.

As with all major Pinkfoot roost sites in the region, numbers at Aberlady Bay peak in October or November followed by a decrease into December (Figures 5a-5c). The peak at Aberlady was usually somewhat later than other sites, often late October or, as in 1985 and 1989, even late November. Numbers at this site also showed less fluctuation during the season in comparison with other sites and there was generally a far more steady decline following the peak, although the spacing of counts may miss some of the variation. A large proportion, usually around 50% of the peak count, often remained at the site in early December, with over 8,000 in December 1987.

Over 10,000 birds have been recorded annually at Aberlady Bay since 1984, with the exception of 1989, when October counts were very low, and 1991, when numbers peaked at 9,995. The highest count of 17,500 birds was recorded in October 1990.

Very few Greylag Geese have been recorded at Aberlady, and few data were available in the literature consulted. Only four records of Greylag were found and thus are not shown in the Figures 5a-5c. The maximum count of 132 birds was in December 1988. Numbers, however, are generally very low (P.R. Gordon, pers. comm.).

Tynninghame

1978-81	791	0	(4)
1982-86	142	20	(7)
1987-91	87	26	(22)

There were only a few records of geese each year at this site, usually of Pinkfeet, although 2,000 were recorded in 1981 and 400 in 1985 and 1990. No birds were found on about half the visits from 1978 to 1990.

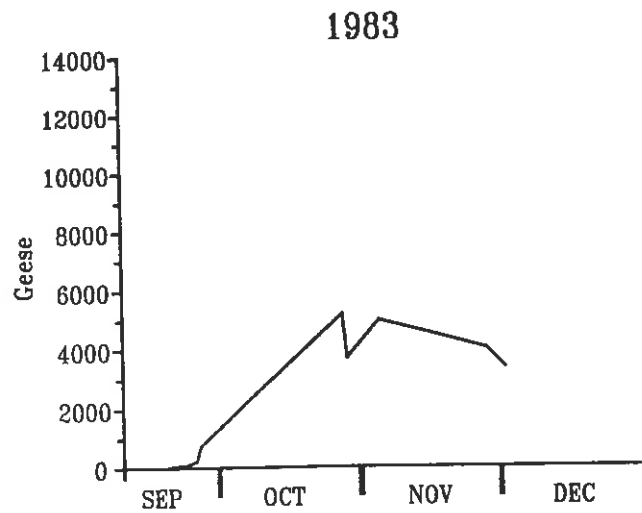
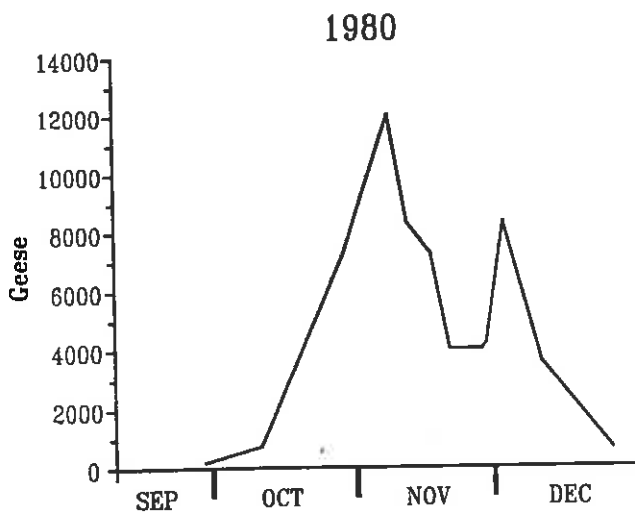
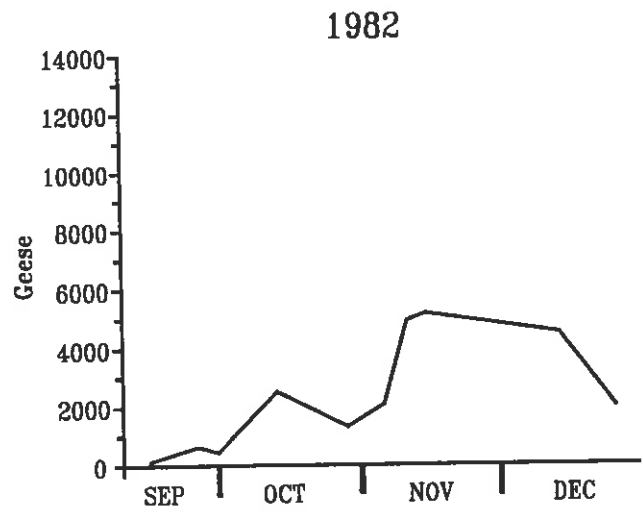
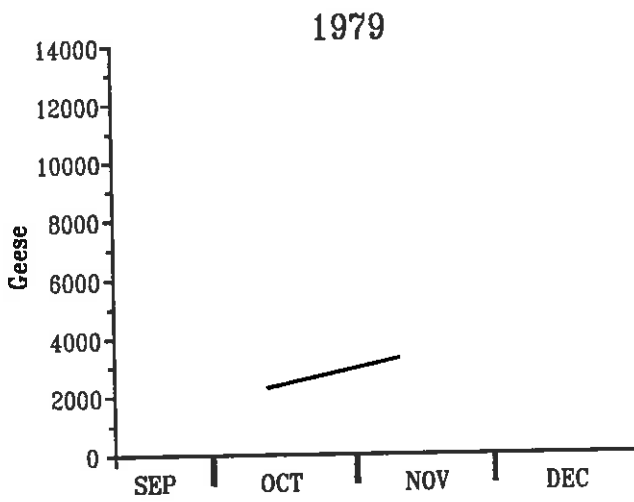
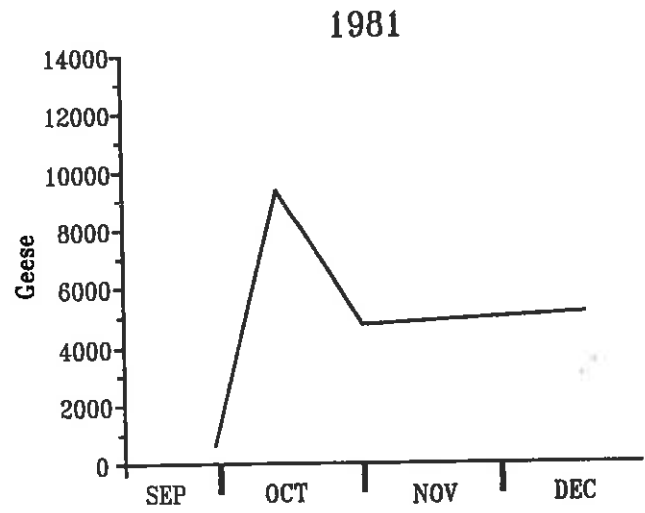
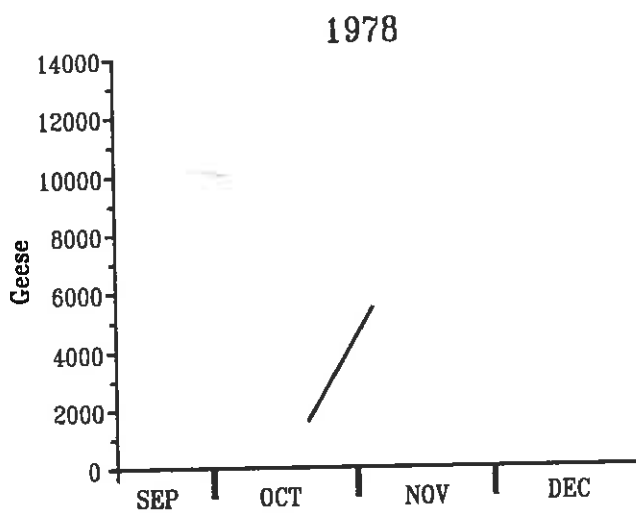


Figure 5(a). The numbers of Pink-footed Geese roosting at Aberlady Bay in October to December, 1978 to 1983. Greylag Goose counts are not shown (see text).

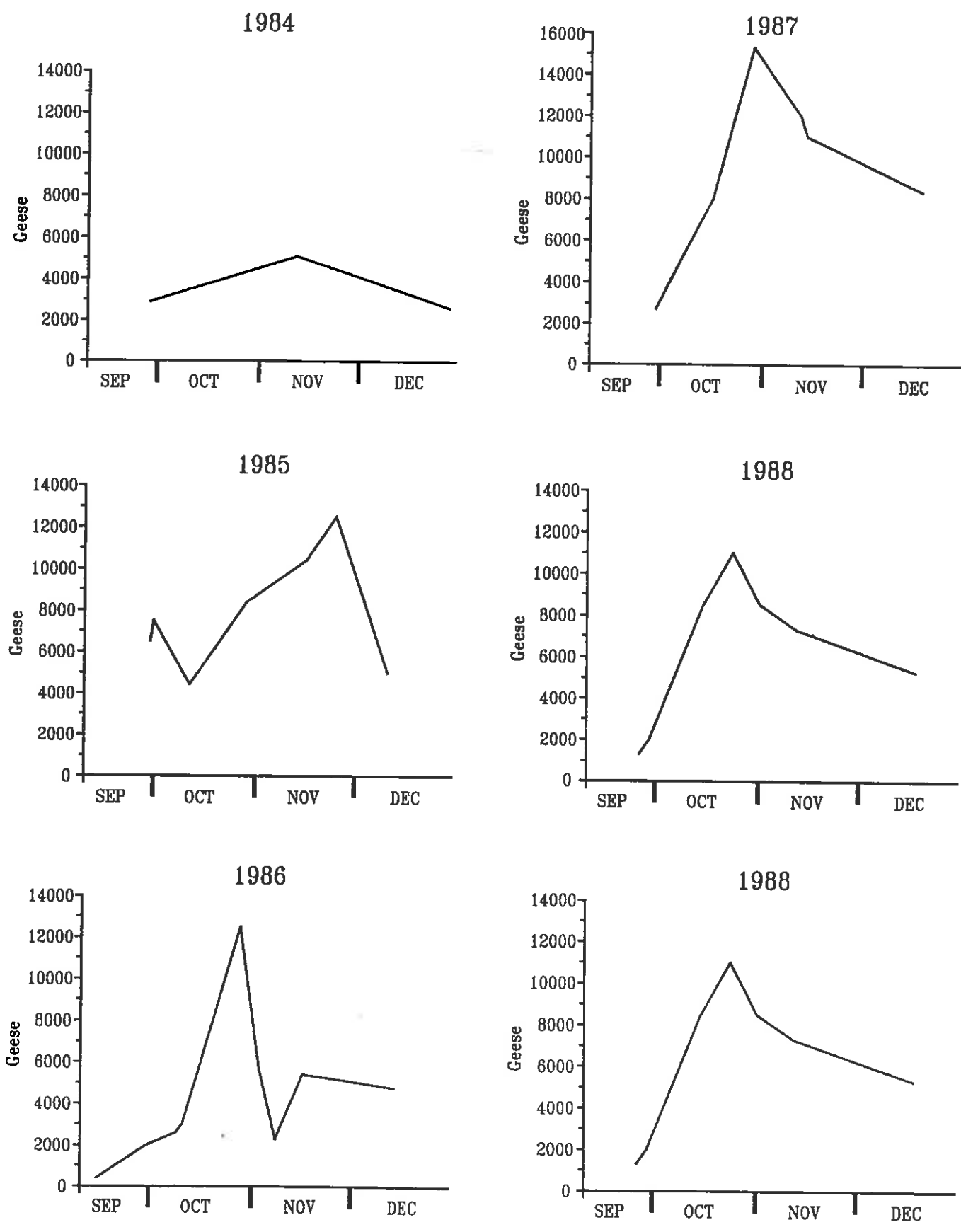


Figure 5(b). The numbers of Pink-footed Geese roosting at Aberlady Bay in October to December, 1984 to 1989. Greylag Goose counts are not shown (see text).

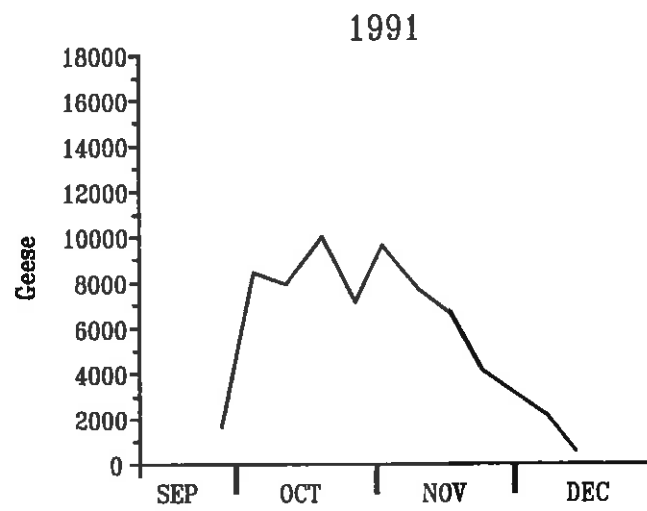
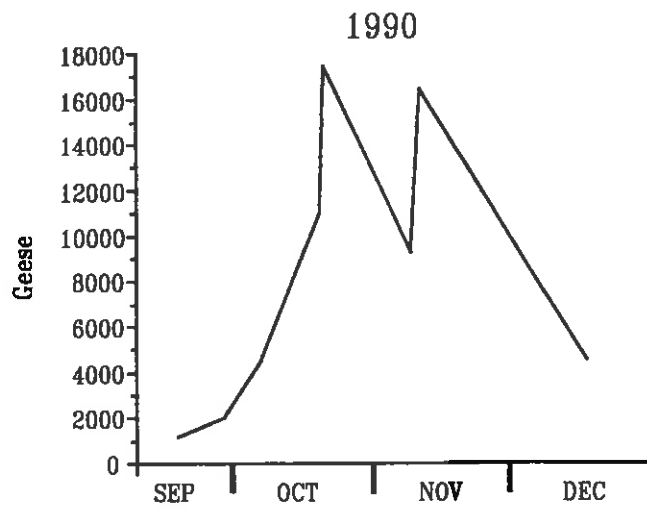


Figure 5(c). The numbers of Pink-footed Geese roosting at Aberlady Bay in October to December, 1990 and 1991. Greylag Goose counts are not shown (see text).

4.1.2.4 Lammermuir roosts

Dowlaw Dam

1978-81	0	366	(4)
1982-86	41	974	(14)
1987-91	8	917	(14)

This site is an important Greylag roost site, with a gradual increase from several hundred birds in the early 1980s to just under 2,000 birds in the mid 1980s, the peak count being 2,382 in 1985. More recently, annual maxima have only reached around 400 birds. The site was used sporadically by Pink-footed Geese, with only four records in the 1980s.

Hopes Reservoir

All	0	29	(4)
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This site has only been counted on four occasions since 1978, with 85 Greylag in November 1978 being the only count of note. This site is quite distant from the nearest known major feeding grounds and probably does not hold significant numbers of geese on a regular basis.

Hule Moss

1978-81	4,496	0	(10)
1982-86	4,760	0	(18)
1987-91	14,398	76	(28)

Hule Moss is by far the most important easterly site for Pink-footed Geese in the Borders and Lothians Regions and, in recent years, numbers at this site have only been exceeded by those at West Water. There has been a steady increase in the numbers of birds using the site in the last decade, although the frequency of counts was perhaps not sufficient in the early and mid 1980s to accurately gauge the annual pattern of usage at that time.

Hule Moss normally receives peak numbers in the first part of October, although in more recent years some of the very large counts have been made in the last few days of September. Thus, like Fala Flow, Hule Moss is one of the principal arrival sites for Pinkfeet. As early as 1979, numbers reached 8,000 birds, and annual maxima between 4,000 and 6,000 were recorded in all years from 1980 to 1987 inclusive (with the exception of 1982, when there was no count before late October). Since 1988, there has been a large increase in the peak count, with over 25,000 in 1989, almost 17,000 in 1990 and 18,500 in 1991. In each of these years, between 15,000 and 20,000 Pink-footed Geese were present in September. Although numbers fell sharply after the large count in 1989, around 10,000 birds were recorded on several dates until late October in these years.

Small numbers of Greylag Geese made regular use of the site, comprising just tens of birds in most years. A maximum of 266 in 1987 was exceptional.

Quarryford Pool

All	30	8	(5)
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This site has only been counted on five occasions since 1978 with 30 Pink-footed Geese in 1980 and 120 in 1988 being the only records. There are no major feeding grounds within the immediate vicinity of the sites, and it is unlikely to receive many birds on a regular basis.

Stobshiel Reservoir

All	0	18	(2)
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This site was only counted in 1988 when it held 35 Greylag in October.

Watch Water Reservoir

1978-81	0	893	(4)
1982-86	863	419	(9)
1987-91	2,512	193	(19)

This site was an important Greylag roost in the late 1970s and early 1980s, with counts of 1,200 and 1,245 at this time. Numbers declined steadily to an average peak of several hundred birds at the end of the 1980s. The site continued to be used regularly, with 300 birds in December 1988 and 290 in November 1991.

Conversely, the number of Pink-footed Geese using Watch Water has increased steadily. No birds were recorded in visit from 1978 to 1981. However, 875 birds were recorded in 1983 and there were peaks of 4,000 and 6,760 in 1987 and 1991 respectively. The use of Watch Water by Pinkfeet is, however, somewhat erratic (*e.g.* fewer than 100 birds in 1989) and some of the high counts probably refer to passage flocks rather than birds using the roost over a period of time *e.g.* the October 1991 count of 6,760 was followed by a count of 430 in November.

Whiteadder Reservoir

1978-81	0	375	(3)
1982-86	6	785	(11)
1987-91	0	876	(13)

This is a regular roost site for Greylag Geese, representing the only major concentration of this species in the Lothians away from the Pentlands. The flock size increased steadily through the 1980s, with the exception of 1987, to an average peak of over 1,000 at the end of the 1980s, 1,600 being recorded in 1988. Very few birds were recorded in 1991 in comparison with recent years. There are only two records of Pink-footed Geese from this period, involving 18 and seven birds.

4.1.2.5 River Tweed and Cheviot roosts

Bemersyde

1978-81	n.c.	n.c.	(0)
1982-86	0	69	(2)
1987-91	0	307	(13)

This site has only been counted since 1986 and held up to 485 Greylag in November 1990, with between 69 and 300 in other years.

Cauldshiels Loch

All	17	155	(11)
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Up to 400 Greylag and 50 Pink-footed Geese were present at this site in 1987 when it was first counted but birds have only been recorded on one of eight occasions since. This site is comparatively distant from the other roosts in this area.

Hirsel Lake

1978-81	n.c.	n.c.	(0)
1982-86	0	401	(4)
1987-91	319	1,052	(14)

Records are only available for this site from 1985 onwards but show a regular and steady increase in use by Greylag and 1,000 or more birds were recorded in most years. There was a peak of 2,000 in 1987. The site was also occasionally used by Pinkfeet, with a peak of 845 in 1988.

Hoselaw Loch

1978-81	1,750	3,133	(6)
1982-86	5,450	4,202	(17)
1987-91	1,020	1,324	(16)

This site is unusual in holding large numbers of both Pink-footed and Greylag Geese. Hoselaw accounted for a large proportion of the south-east Scotland total of Greylag in the early 1980s (*e.g.* 5,000 in 1980 and 4,100 in 1982) and numbers remained high into the mid 1980s, with a maximum of 6,350 on 12 October 1985. However, the roost virtually disappeared in 1987. Although the site continued to be used by geese, numbers fluctuated greatly, and only three counts have since recorded over 1,000 birds. The importance of Hoselaw for Pink-footed Geese rose dramatically in the early to mid 1980s, from around a few thousand birds to a peak of 12,000 in 1985. Numbers then fell, with a maximum of 6,500 in 1987, less than 1,000 in 1987, and only five in 1989. There has since been a small recovery, with 1,200 in 1990 and 2,700 in 1991, suggesting that it may regain its importance for Pinkfeet.

Whitton Loch

1978-81	560	1,600	(4)
1982-86	3,388	263	(10)
1987-91	543	240	(10)

As with Watch Water, high numbers of Greylag Geese were recorded at Whitton (2,000 or more) in the early 1980s. This was followed by a sharp decrease, with only 118 birds in 1984 and 45 in 1985. Whitton was still used regularly by Greylags and the peak has varied between 128 and 670 birds since 1986. The number of Pink-footed Geese increased to a peak of 6,500 in 1986 but they have since used the site only sporadically, with only one count in excess of 1,000 birds in the period 1987-91.

Yetholm Loch

All	608	204	(9)
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Although only sporadic data are available, all counts recorded birds. Species maxima are 3,000 Pinkfeet, in November 1982, and 145 Greylag, in November 1981.

4.1.2.6 Clydesdale roosts

Cowgill Reservoir

Grid ref: NT010280

All	727	0	(5)
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Located in the Lanark District of Strathclyde Region, adjacent to the River Clyde. This site was regularly used by a large number of Pink-footed Geese, although numbers are only available for the end of the 1970s. Recent counts, in October and November 1990, varied between 2,200 and 3,700.

Culter Waterhead Reservoir

Grid ref: NT038273

All	760	0	(4)
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Located in the Lanark District of Strathclyde Region. Counts are only available for the late 1970s but show a significant number of birds using this site, despite being several miles from the Clyde. The only October count for the site recorded 1,400 Pink-footed Geese.

Lochlyoch Reservoir

Grid ref: NS932357

All	796	0	(4)
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Located in the Lanark District of the Strathclyde Region. Only a few counts are available for this site from the end of the 1970s. Numbers fluctuated with a maximum count of 1,120.

Springfield Reservoir

Grid ref: NS905522

All	63	0	(3)
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Located in the Lanark District of Strathclyde. Although only a few counts are available (made in the late 1970s and early 1980s), this appears the least important of four sites in the Lanarkshire and Tweeddale Districts adjacent to the River Clyde.

4.1.3 Rates of increase

The increase in the numbers of Pink-footed and Greylag Geese at national, regional and site levels was calculated for the period 1981 to 1991 (Table 3). The 1981 figure was calculated as the average peak from the three autumns 1980, 1981 and 1982, to prevent undue importance being given to one-off high or low counts. The 1991 figure was calculated as the average peak from the autumn of 1990 and 1991. Only two seasons were used as it was felt the more frequent counting at roosts in these years was sufficient to accurately record the importance of the sites. National populations for 1991 were calculated using estimated population figures from mortality rates and the proportion of young where census totals were known to be incomplete (see Kirby & Cranswick 1991, Cranswick & Kirby 1992).

Table 3. The increase between 1981 and 1991 in the numbers of Pink-footed and Greylag Geese both nationally and regionally and in the numbers of Pink-footed Geese at key sites in the region. The mean annual rate of increase is given under inc. (see text for details).

Region/Site	Pinkfeet			Greylag		
	1981	1991	inc.	1981	1991	inc.
National pop ⁿ	91,333	220,000	9.2%	88,667	100,000	1.2%
Lothians pop ⁿ	12,957	27,538	7.8%	1,710	1,790	0.5%
Borders pop ⁿ	11,810	43,044	13.8%	4,927	2,724	-6.1%
Lothians & Borders pop ⁿ	24,767	64,870	10.1%	6,637	4,513	-3.9%
Gladhouse	13,400	2,950	-16.3%	-	-	-
Fala Flow	3,823	13,205	13.2%	-	-	-
West Water	13,807	28,688	7.6%	-	-	-
Aberlady	8,822	13,748	4.5%	-	-	-
Hule Moss	3,828	17,628	16.5%	-	-	-

The rates of increase given in Table 3 must be viewed with some caution as the censuses conducted in the early 1980s were made on just one date and the number of counts at sites were generally fewer, especially for Fala Flow and Hule Moss. Also, counts in earlier years were generally made from mid October to mid November whereas counts in recent years have recorded peak counts in late September or early October at some sites. However, despite these limitations, the figures allow broad comparisons to be made.

The combined population of Pinkfeet in the Lothians and Borders has grown at a similar rate to that of the national population, although this comprises a bigger than average increase in the Borders and smaller than average growth in the Lothians. The number at Gladhouse has fallen dramatically while that at Aberlady has shown only a small increase, around half the national average. There has been a corresponding increase in excess of the national average at Fala Flow and at Hule Moss, although the large increase at the latter will be partly an artefact of increased coverage at this site in recent years. Numbers at West Water have grown at a rate slightly below the national average over the last decade, although the number of geese at this site have not increased in absolute terms in the last few years; the average peak count for 1987 to 1991 was 31,200.

4.2 Daytime counts

Daytime observations of geese from the three autumns of 1980, 1986 and 1991 are summarised below. All data are listed in Appendix 4. The areas covered in each autumn differed in extent and the frequency of visits to the respective study areas also varied (see Methods 3.1 and 3.2).

4.2.1 Local agriculture

Interpretation of the distribution of geese by day and the choice of field type must consider the local agricultural landscape and the distribution and availability of the different crop types. No quantitative data to this effect were collected during the project, but a qualitative information was obtained from the Scottish Office's Midlothian Agricultural Advisor and the West Fife Area Office of The Scottish Office Agriculture and Fisheries Department and is summarised below.

The higher land at the base of the Moorfoots, including the area directly around Gladhouse, is comparatively poor and used extensively for livestock farming. There are few arable crops and the area of land devoted to cereals is small. The lower ground, as in the north of the Arniston Estate, is of better quality and can be profitably farmed for crop production.

Over the last two decades, Oilseed Rape has come to the fore, especially the higher yielding winter varieties, and the crop is reasonably well forward by mid winter. There has also been a general trend away from spring sown to winter sown Barley and Wheat. This trend has accompanied a small increase in the amount of arable land, as opposed to grassland, on the lower, better quality ground, such as around Gorebridge. This change accompanied the rationalization of sheep numbers, although the greatest change occurred in the mid 1970s, with the situation being more stable in the last decade. Higher ground, such as that immediately around Gladhouse, will have changed little in use from the traditional upland cattle and sheep farming during this period.

4.2.2 Autumn 1980

Observations of geese by day in autumn and winter 1980 are shown in Figures 6a-6c. Most were made by William Brotherston, although additional records from other observers are also included. The diary records often only record flock size and, in most cases, would have been entirely of Pinkfeet, but it is likely small numbers of Greylag were included in the totals in some instances. Counts of both species have therefore been summed for the purpose of analysis. Observations were made most weekends throughout the winter period from mid September until April, although only records until the end of December are considered in this report. Coverage in the early to mid October period was less intense. Observations were made from roads and, although the exact route taken varied, the nearly always included the main feeding area adjacent to Fala Flow. The southern limit of the area surveyed extended to Middleton and Esperston, approximately 5 km north-east of Gladhouse. Supplementary records of birds around Gladhouse were provided by occasional extended trips and additional observers. Although coverage of the area immediately adjacent to Gladhouse was thus less intense, it is at a level that permits some comparisons of the distribution of feeding birds to be made, both with the area around Fala and with subsequent surveys.

Data from 1980 must be interpreted with caution. Field type was not always noted and in these cases an assumed field type was used, based on the name or location of the field and previous references to the field type. However, names were sometimes ambiguous, and used for a group of fields rather than individual fields. While this is not thought to have affected the results significantly, it should be noted that they are not strictly accurate. Also, very rarely was the description of pasture qualified. For convenience, all pasture records have been recorded as improved pasture. With one exception, the records do not record the proportion of a flock that was feeding. Birds were simply noted as feeding or resting. Values given in Table 4 for the proportion of birds feeding thus serve only as a rough guide.

Some 79% of all birds were observed in stubble, with nearly all remaining birds observed in pasture, generally thought to be improved (Table 4). Very few birds were recorded on moorland, although this may reflect a low number of visits to roost sites by day rather than the absence of birds. Generally, a high percentage of birds was observed feeding, although the lack of detailed data for this activity, and small sample size for all but birds in stubble, prevent further qualification of this figure.

Table 4. The number of flocks, the total number of birds (all observations) and the percentage of birds feeding in each field type in 1980.

Field Type	Flocks	No. Geese	% of total	% feeding	(sample size)
Stubble	25	42,100	78.7%	82%	(22,300)
Improved Pasture	4	11,000	20.6%	100%	(500)
Moorland*	1	400	0.7%	0%	(400)
Total	30	53,500		81%	(23,200)

* for the purposes of this report, birds recorded at roost sites by day are classified as being in moorland as most birds were observed loafing in the moorland surrounds e.g. at Fala Flow and West Water. However, birds recorded on the water are also included in this category, although this only accounts for a small proportion of the birds loafing at roosts.

Only one observation of feeding birds (200 geese on stubble at Cakemuir) was made in September, although many flocks of several hundred birds were noted in flight in the area. There were comparatively few records in October and the majority of observed birds were feeding on stubbles, especially in the farms adjacent to Fala Moor, around Cakemuir and Blackcastle. Numbers in the area during this period were lower than would be expected for this time of year, with the roost sites of Fala Flow and Gladhouse not exhibiting the large peak of birds after arrival from Iceland. Mid November produced only a few records of comparatively small feeding flocks, coinciding with several nil counts at Gladhouse at this time, although the absence of roosting birds was thought to be due to poor weather conditions, driving rain perhaps being responsible for birds staying in fields overnight. In late November, and early December, snow was recorded in the area, lying for several days. At this time, large numbers of birds were observed feeding in the Halflaw Kiln and Tynehead area, with approximately 13,000 birds being located in only a few square kilometres on the same day. These numbers corresponded with the number roosting at Gladhouse. The birds were largely on a few stubble fields and adjacent pasture. Numbers remained high throughout the following week but, in the beginning of December, the stubbles had been ploughed and the numbers fell accordingly. The main concentrations of birds in December were observed in the Esperston and Outerston areas, again on stubbles.

4.2.3 Autumn 1986

Observations of geese by day in autumn 1986 are taken from Brown (1987). More detail is given in that report but observations of feeding birds are outlined here in view of the change of importance of Gladhouse as a roost site two years before this survey.

Observations were made from roads. Distances travelled each day were generally less than in the 1980 or 1991 studies and were confined to the feeding area of just one roost. Excursions were made on a regular basis, once in every five to seven days in the Gladhouse/Fala and West Linton areas. Greater emphasis was placed on the area surrounding and north of Gladhouse than in either of the other years. The distribution of geese in autumn 1986 is given in Figures 7a-7c.

As for 1980, the small numbers of Greylags recorded have been added to the counts of Pink-footed Geese. The percentage of feeding birds in a flock was not noted. Flocks were recorded as either feeding or resting, and on two occasions as feeding and resting, when 50% of the flock has been assumed to be engaged in each activity for the purposes of this report.

In 1986, the same high proportion (79%) of birds was observed on stubbles as in 1980. Some 9.5% were on improved pasture, 8.4% on moorland or at the roost site and 3.1% on rough pasture (Table 5). Over 90% of birds in stubble and improved pasture were observed feeding. The majority (60.2%) of birds in rough pasture were resting although the sample size for this field type was small. As would be expected, nearly all birds (96.8%) on moorland or on the roost site were resting.

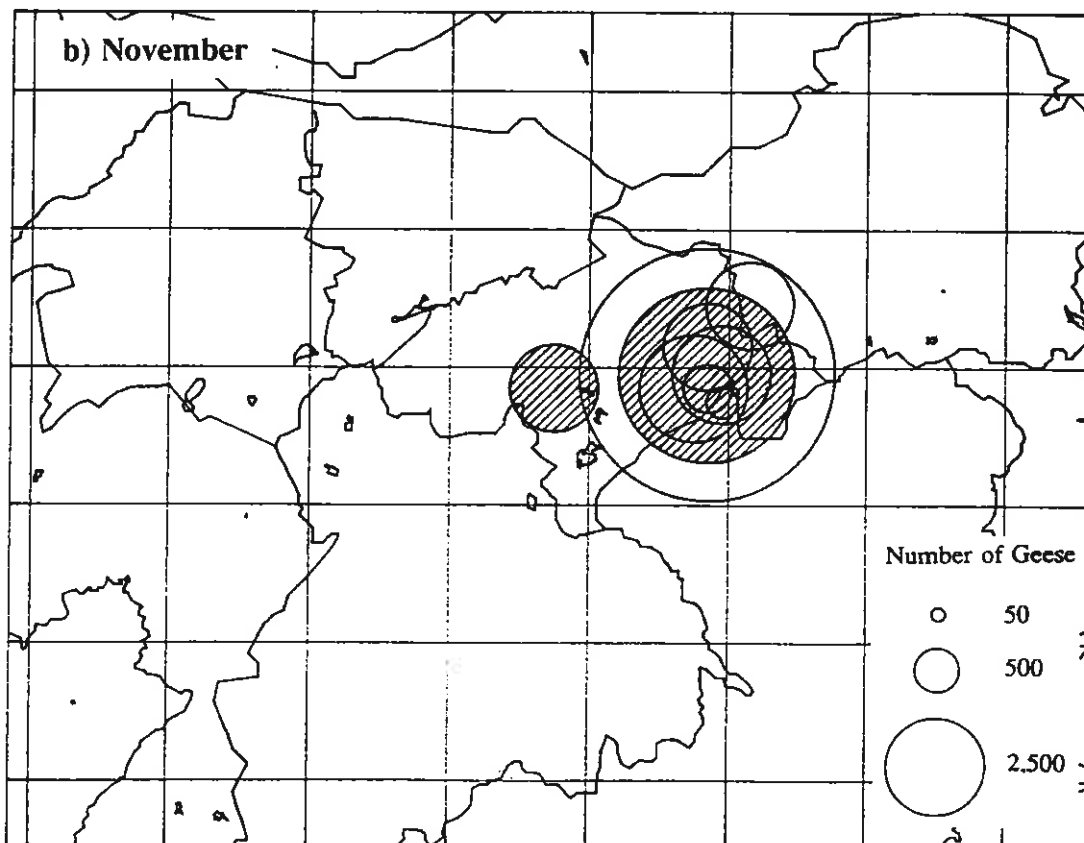
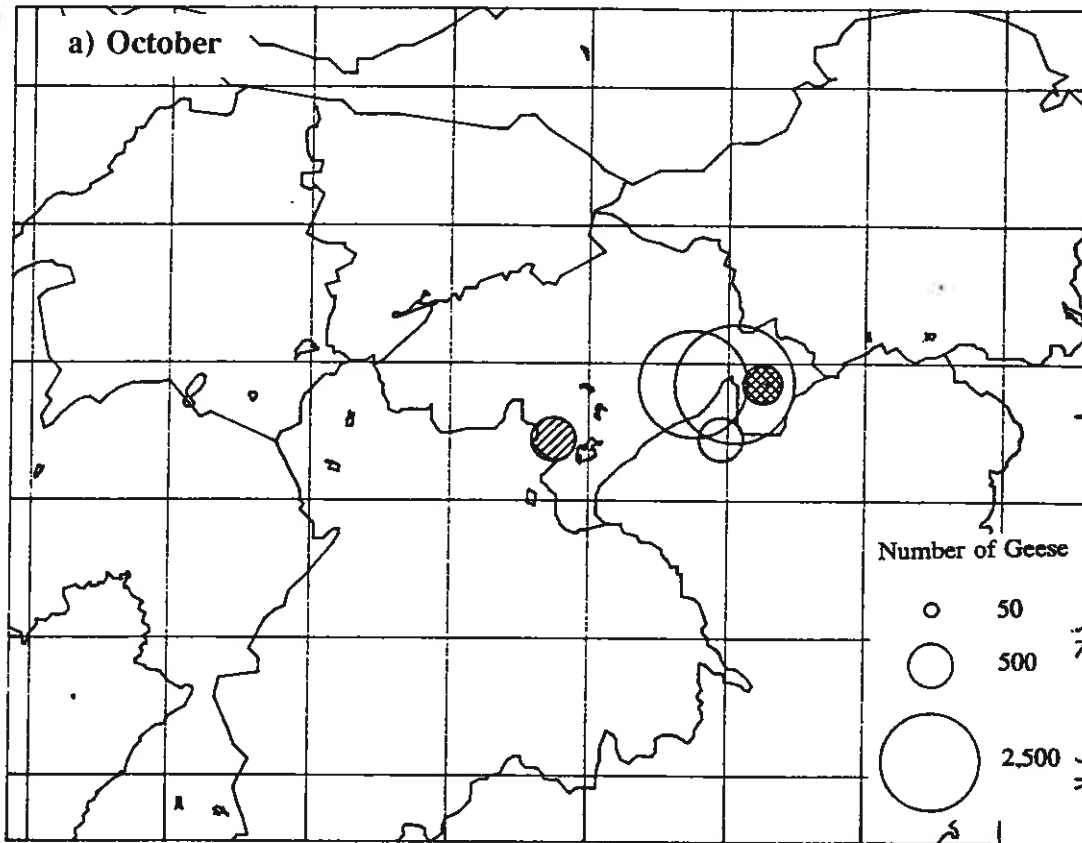
Table 5. The number of flocks, the total number of birds (all observations) and the percentage of birds feeding in each field type in 1986.

Field Type	Flocks	no. Geese	% of total	% feeding	(sample size)
Stubble	28	29,189	79.0%	90.6%	(29,189)
Improved Pasture	7	3,520	9.5%	93.2%	(5,520)
Rough Pasture	5	1,130	3.1%	39.8%	(1,130)
Moorland*	1	3,111	8.4%	3.2%	(3,111)
Total	45	36,950		88.6%	(36,950)

* see footnote to Table 4.

In October there were notable concentrations of birds feeding in close to West Water and Fala Flow, with birds at West Linton and in the Tynehead/Blackcastle area. A large number of birds was also at Fala Flow itself during the day. Of note is the presence of many birds on stubble in the Mount Lothian area, to the north-west of Gladhouse. Some geese still remained in this area, near Howgate, in November. Large numbers were also observed close to Gladhouse and Rosebery, largely on stubbles, while no birds were recorded in the Fala area. Smaller numbers were present at West Linton, corresponding with the decrease in the numbers roosting at West Water, with only improved pasture being used. Geese continued to use improved pasture in December, lesser numbers again reflecting the use of West Water. Birds had generally left the area around Gladhouse. The main concentration of birds was in

Figure 6. Observations of feeding geese in 1980. Circles represent goose days for each 1 km square. Circle area is proportional to the number of geese. Field types are: stubbles (open), improved pasture (hatched), rough pasture (solid), moorland (cross-hatched), potatoes (vertical hatch) and winter cereal (horizontal hatch).



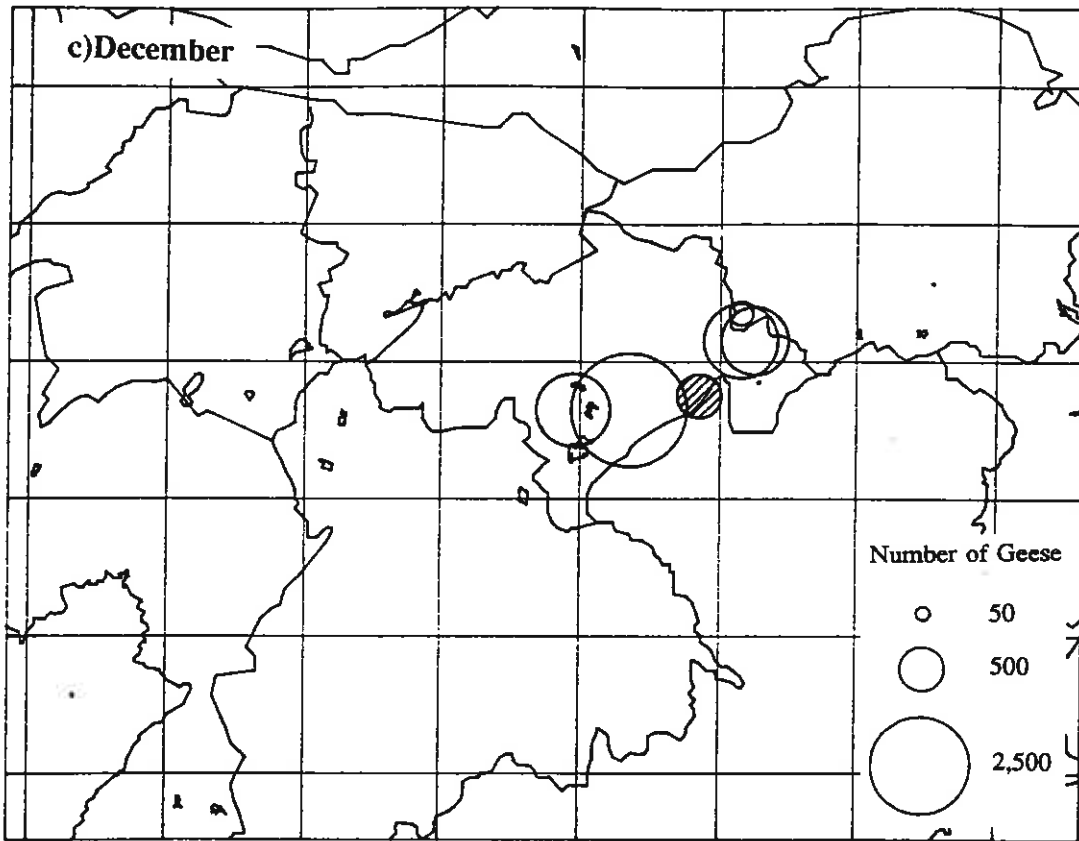
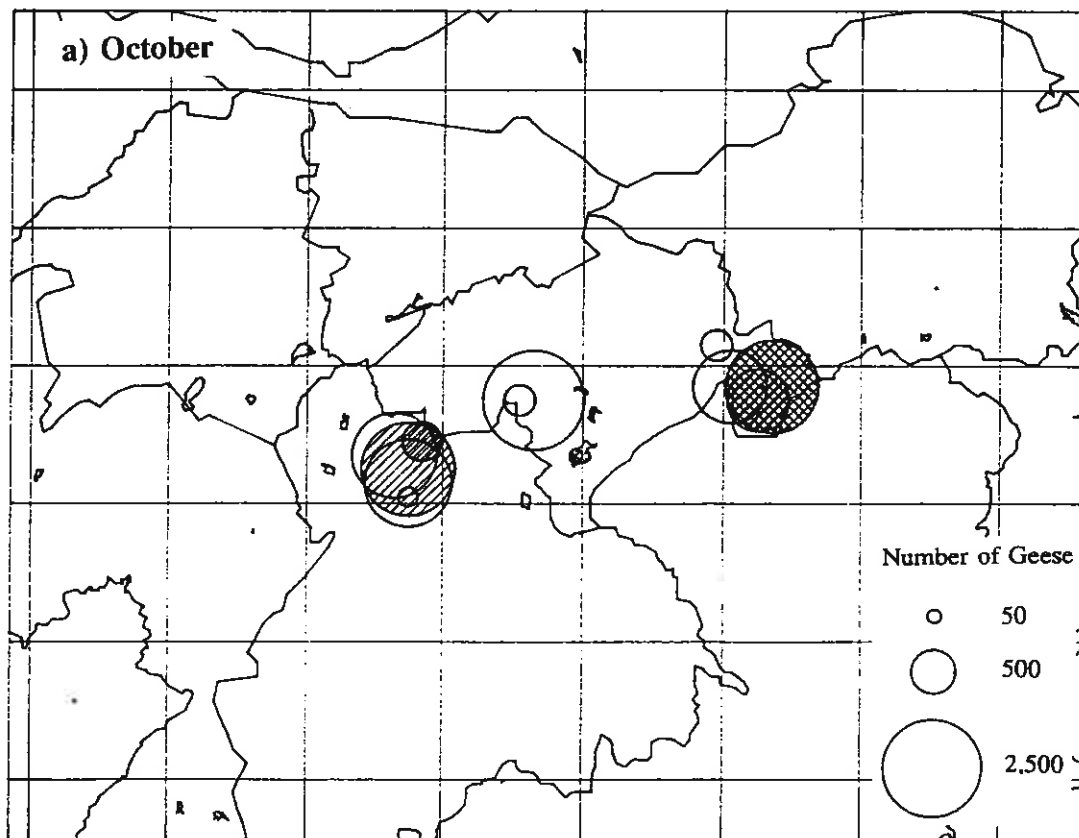
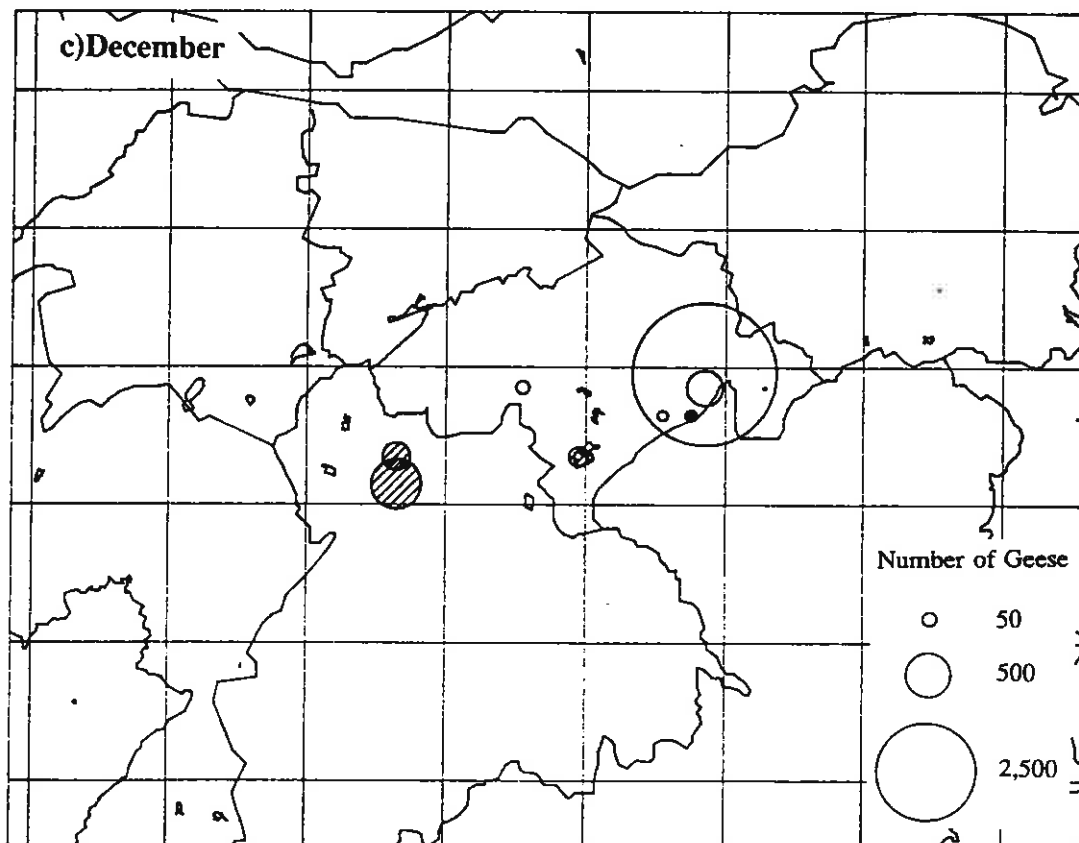
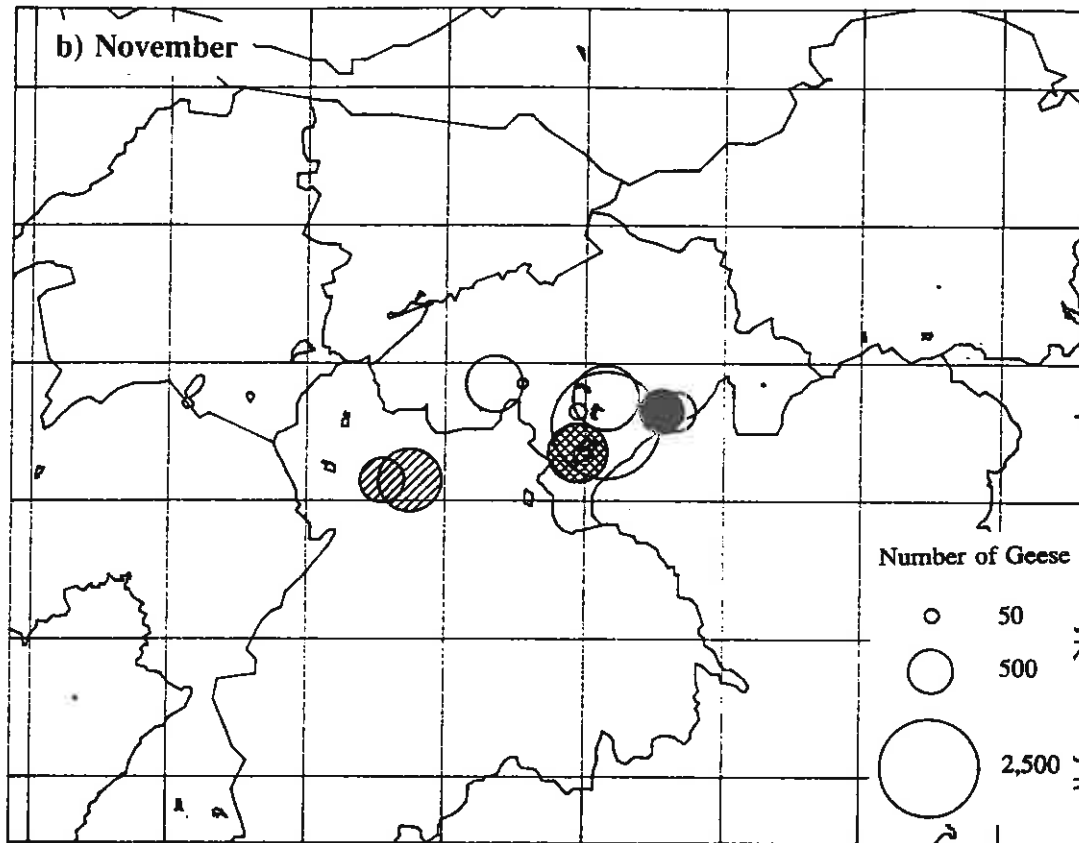


Figure 7. Observations of feeding geese in 1986. Circles represent goose days for each 1 km square. Circle area is proportional to the number of geese. Field types are: stubbles (open), improved pasture (hatched), rough pasture (solid), moorland (cross-hatched), potatoes (vertical hatch) and winter cereal (horizontal hatch).





the Halflaw Kiln and Middleton area, due west of Fala Flow, with nearly all birds on stubbles.

Almost 37,000 observations of geese were made in autumn 1986. This compares with 53,500 in autumn 1980, despite less coverage, both in terms of time in the field and area surveyed, in that year. Only 25,889 birds were observed in the Fala and Gladhouse area; less than half the number in 1980, reflecting the difference in numbers roosting at Gladhouse in the two years (4,000 to 5,000 in October and November with over 13,000 in late November 1980; generally 2,000 to 3,000 in all months in 1986).

4.2.4 Autumn 1991

Daytime observations of geese were undertaken between the end of September and late December in 1991. The majority of records are derived from a series of excursions to the study area, each lasting for a period of three to seven days. The times of these visits and the main areas covered, given as feeding areas associated with relevant roosts, were:

late Sep/early Oct:	Gladhouse, Fala Flow, West Linton
late Oct:	Fala Flow, Gladhouse
late Oct/early Nov:	West Linton, River Clyde, Gladhouse
mid/late Nov:	West Linton, River Clyde
early Dec:	Fala Flow, West Linton, Gladhouse, River Clyde

Fieldwork in the early part of the season was restricted to comparatively small areas on each excursion, with each being examined carefully to locate feeding birds. As the favoured feeding areas became known, the fieldwork concentrated on monitoring numbers at these sites. Although the whole study area was still covered periodically, searching for birds away from known feeding sites was less intense towards the end of the season. This allowed a greater number of observations to be made. No nil counts are recorded in the results. Mention is made, where relevant, of the effect of differential coverage on the results.

These data were supplemented by occasional counts from other observers. Counts concentrated on known feeding areas, often with the observer returning to the area on several occasions over a short period of time. Observations obtained in this way were mainly from the West Linton area, the Middleton area and between Aberlady Bay and Tynninghame in northern East Lothian.

Field surveys were also conducted around two shoots. In each case, intensive searches of the whole study area, between the River Clyde and the area north-west of Fala Flow, were made by a team of observers, each covering a comparatively small area in detail simultaneously. The second of these searches also attempted, with the use of radios, to follow birds flying from the roost over large distances to the feeding grounds. However, both attempts were hampered by poor weather: the first coinciding with a cold spell, when many birds left the area, and the second with thick fog that prevented observations of flying birds.

Daytime observations of geese in 1991 are summarized in Table 6 and the distribution of records is given in Figure 8a. No distinction is made between Pink-footed and Greylag Geese in the results as Greylags only formed a small proportion of the total count. Records of Greylag were concentrated around Thriepmuir and Harlaw Reservoirs and in the Lanark and

Thankerton area adjacent to the River Clyde, where small numbers of birds were found in large flocks of Pink-footed Geese. Away from these two areas, only seven observations were made of Greylags, always involving small numbers of birds, between West Linton and Tynninghame (Figure 8b).

A total of almost 140,000 geese was recorded by daytime counts in 1991, over two and a half times that recorded in 1980 and almost four times that in 1986. However, the average number of geese in each observation was very similar to that in 1986 (864 in 1991; 821 in 1986) and less than half the flock size recorded in 1980 (1,783).

The predominant field type used by geese was improved pasture, accounting for over 50% of observations. Approximately 40% of geese were recorded in stubbles, only half the proportion recorded in both 1980 and 1986. Observations in rough pasture (4.0%) were similar to those in 1986, although the proportion in moorland habitat (3.4%) was just under the 1986 figure. Unlike previous years, potato and winter cereals featured in the records although all such observations were made in the North Berwick area and accounted for 1% or less of observations.

A high proportion of birds (>90%) was recorded feeding in both stubble fields and improved pasture, as in previous years, while a comparatively high proportion (>60%) was also recorded feeding in rough pasture. No birds were recorded feeding in moorland habitat. As would be expected, all birds in potato or winter cereal fields were feeding, although sample sizes for these habitats were small.

Observations in September showed a high proportion of birds using stubbles (74%), with virtually all birds feeding. Birds were located mainly at Esperston/Middleton and at Hamilton Hall and Halmyre near Romannobridge (Figure 8c), generally in very large flocks (>1,400 birds on average). Nearly all other observations (25%) were in improved pasture, again with a high proportion (>95%) recorded feeding.

In October, the largest number of birds was again observed on stubbles, although the proportion had fallen to just over half of all observations and flock size was just under 900. Feeding remained high in this habitat (92%). Almost one third of birds were on improved pasture. The average flock size was 600 birds while only 80% of birds were now recorded feeding in this field type. A significant proportion (10%) was observed loafing at roost sites during the day. A large number of birds remained in the area of stubbles around Romannobridge, with birds also using the improved pasture directly east of West Linton (Figure 8d). Geese were also found directly around Fala Flow, at Blackcastle and Crichton, largely on stubbles, and in the North Berwick area, again on stubbles. In Lanarkshire, flocks concentrated around the River Clyde, especially at Westraw, near Carstairs, using both stubbles and pasture. A few hundred birds on stubbles near Edgelaw were the only geese recorded in the area around Gladhouse.

There was a marked decline in the numbers of birds using stubbles in November, accounting for only 14% of observations, although this largely reflects availability, as many fields had been ploughed by this time. The proportion of birds feeding had fallen to 80%. Over two thirds of birds were using improved pasture, with an average flock size of over 700 birds, and a comparatively high proportion were feeding (88%). Over 10% of birds were in rough pasture, although less than half were feeding. One large flock (1,100) was recorded on

potatoes near Aberlady. No birds were recorded at roost sites, although West Water Reservoir was not visited during the day.

The feeding grounds adjacent to Fala Flow were little used in November (Figure 8e), mirroring the use of Fala as a roost, and the loss of stubbles in this area will have no doubt been partly responsible for this. The major concentration was of birds in improved pasture, and to a lesser extent stubbles, at West Linton, around Westraw and near Quothquan by the Clyde. Smaller numbers were also present in the area of Biggar Floods, in the Medwin Valley and near Gladhouse.

In December over 90% of birds were on improved pasture, with a very high proportion (97%) feeding and comparatively large flock size (1,100). Small numbers were in rough pasture (5%) and winter cereals (4%), again with a very high proportion of birds feeding. Less than 1% of birds were recorded on the few stubbles that remained.

The focus of feeding in December was the West Linton area (Figure 8f), although significant numbers of geese were also found in the Esperston and Middleton areas at the base of Moorfoots. Birds were also at Howburn, whereas no birds were recorded in the Clyde area.

During the first part of the winter, there was thus a steady decline in the use of stubbles with a corresponding increase in the use of improved pasture. These two field types together held a minimum of 84% of birds in all months. The percentage of birds feeding (all field types combined) was initially very high (97%) but fell to 77% in October, before steadily rising to its original level in December. With the exception of September, when the birds (and observers) were only present for a few days, the number of flocks located per month fell during the study period, from 59 in October to 39 in November and 35 in December. Despite the comparatively small number of observations in September (25), large flock size (almost 1,500) resulted in a large number of birds being recorded. Flock size fell to about half this value in October, despite almost 45,000 birds being seen. The number of birds seen (25,000) and flock size (650) were lowest in November, coinciding with a cold spell in the middle of the month which included snow. More birds were seen in December, despite a smaller number of flocks being recorded, when average flock size was 950 birds.

Table 6. The number of flocks and geese and the percentage of birds feeding in each field type, September to December, 1991.

Field Type	Flocks	No. Geese	% of total	% feeding	(sample size)
September					
Stubble	19	26,951	73.9%	99.9%	(19,433)
Improved Pasture	5	9,142	25.1%	95.5%	(7,170)
Rough Pasture	1	350	1.0%	0.0%	(350)
Total	25	36,433		97.4%	(26,953)
October					
Stubble	28	24,981	55.8%	91.9%	(24,611)
Improved Pasture	24	14,409	32.2%	80.3%	(10,009)
Rough Pasture	2	550	1.2%	0.0%	(250)
Moorland	4	4,767	10.6%	0.0%	(4,767)
Winter Cereal	1	100	0.2%	100.0%	(100)
Total	59	44,807		77.4%	(39,737)
November					
Stubble	5	3,529	13.9%	79.7%	(3,529)
Improved Pasture	25	17,719	69.9%	88.3%	(17,694)
Rough Pasture	7	2,984	11.8%	43.0%	(2,984)
Potatoes	1	1,100	4.4%	100.0%	(1,100)
Winter Cereal	1	6	<0.1%	100.0%	(6)
Total	39	25,338		82.3%	(25,313)
December					
Stubble	3	155	0.5%	89.0%	(155)
Improved Pasture	27	30,264	90.6%	97.0%	(25,985)
Rough Pasture	5	1,687	5.1%	94.0%	(1,687)
Winter Cereal	4	1,303	3.9%	100.0%	(1,303)
Total	35	33,409		96.9%	(29,130)
All months					
Stubble	55	55,616	39.7%	94.2%	(47,728)
Improved Pasture	81	71,534	51.1%	91.5%	(60,858)
Rough Pasture	15	5,571	4.0%	61.1%	(5,271)
Moorland	4	4,767	3.4%	0.0%	(4,767)
Potatoes	1	1,100	0.8%	100.0%	(1,100)
Winter Cereal	6	1,409	1.0%	100.0%	(1,409)
Total	162	139,997		87.8%	(121,133)

Figure 8a. Observations of feeding geese in 1991. Circles indicate the location of all 1 km squares in which geese were recorded.

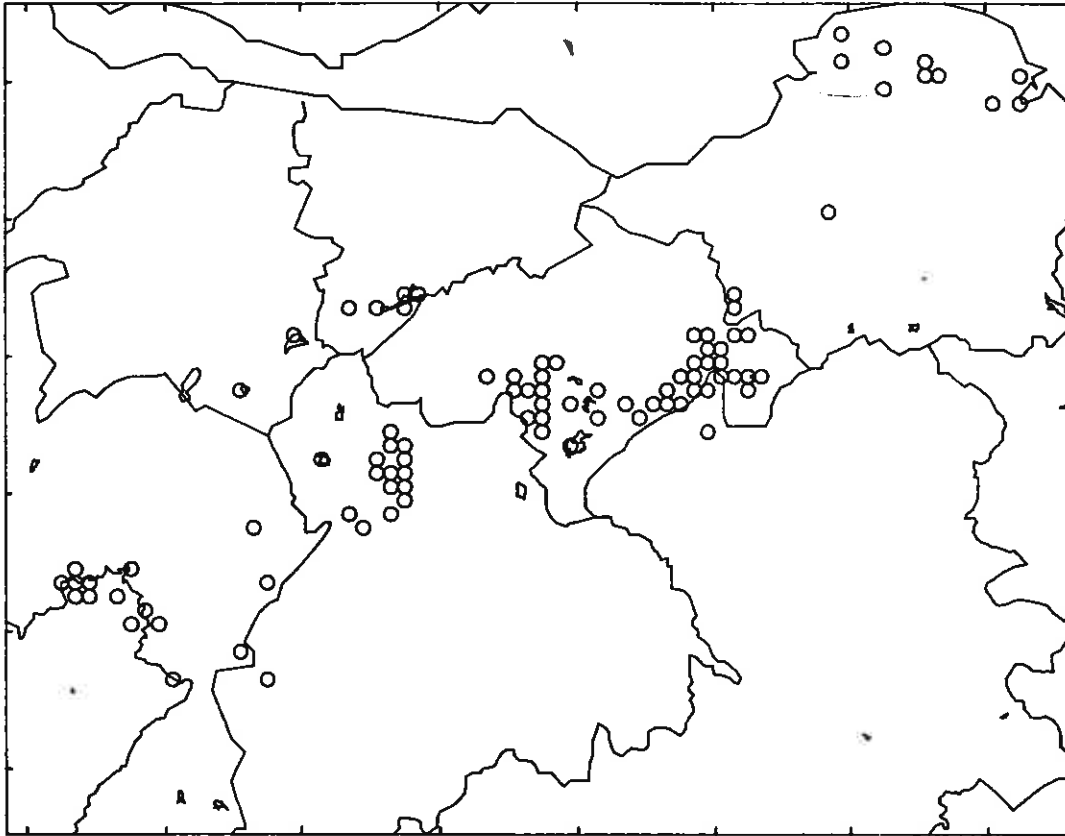


Figure 8b. Observations of feeding geese in 1991. The location of all Greylag Geese. Circles represent goose days for each 1 km square. Circle area is proportional to the number of geese.

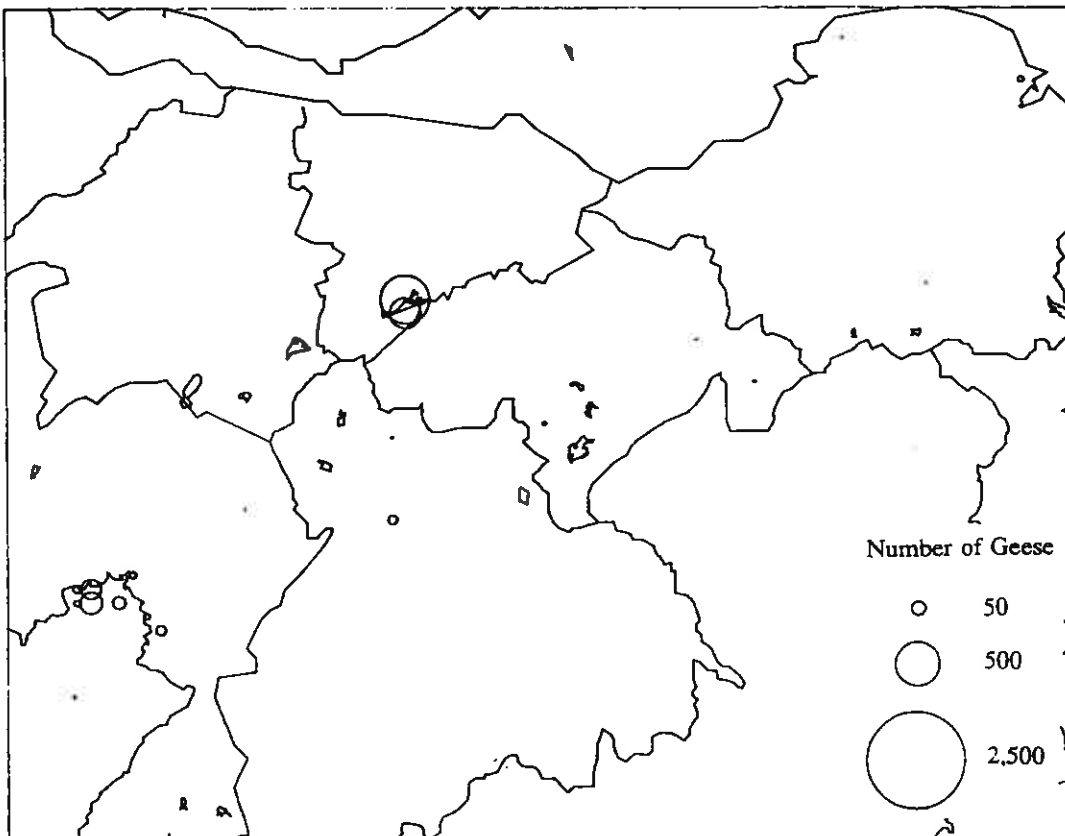
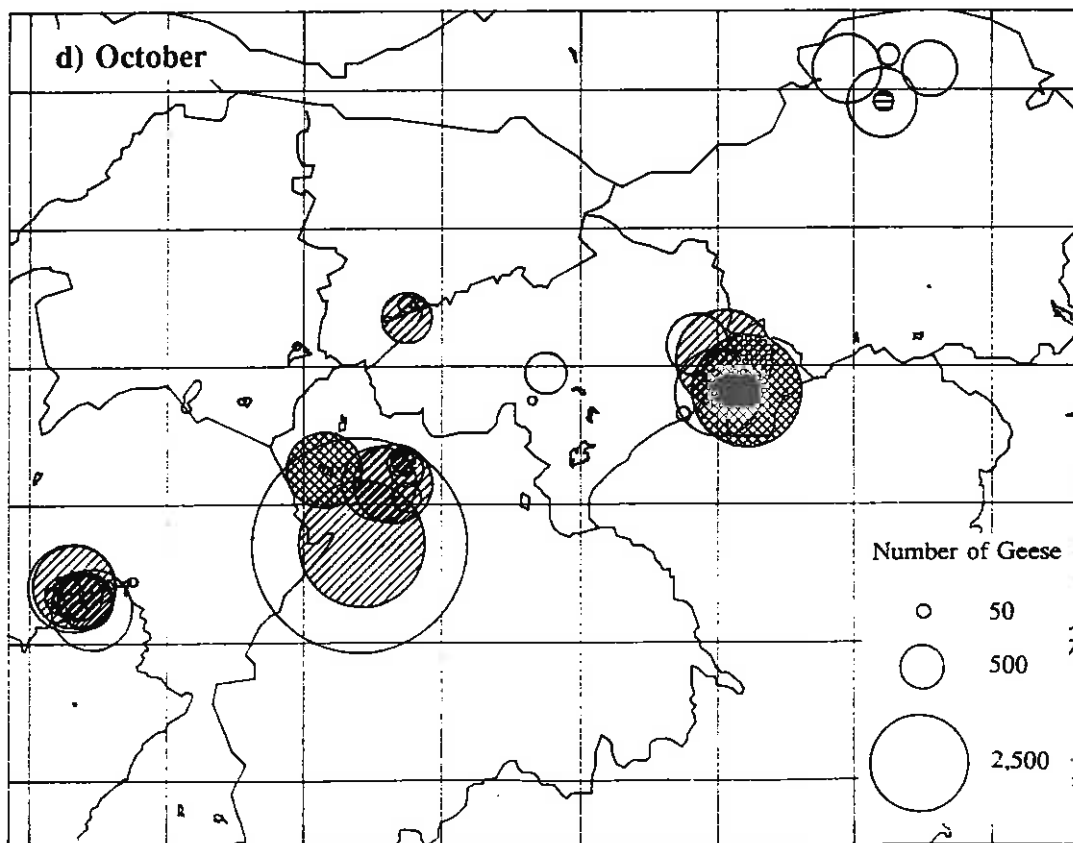
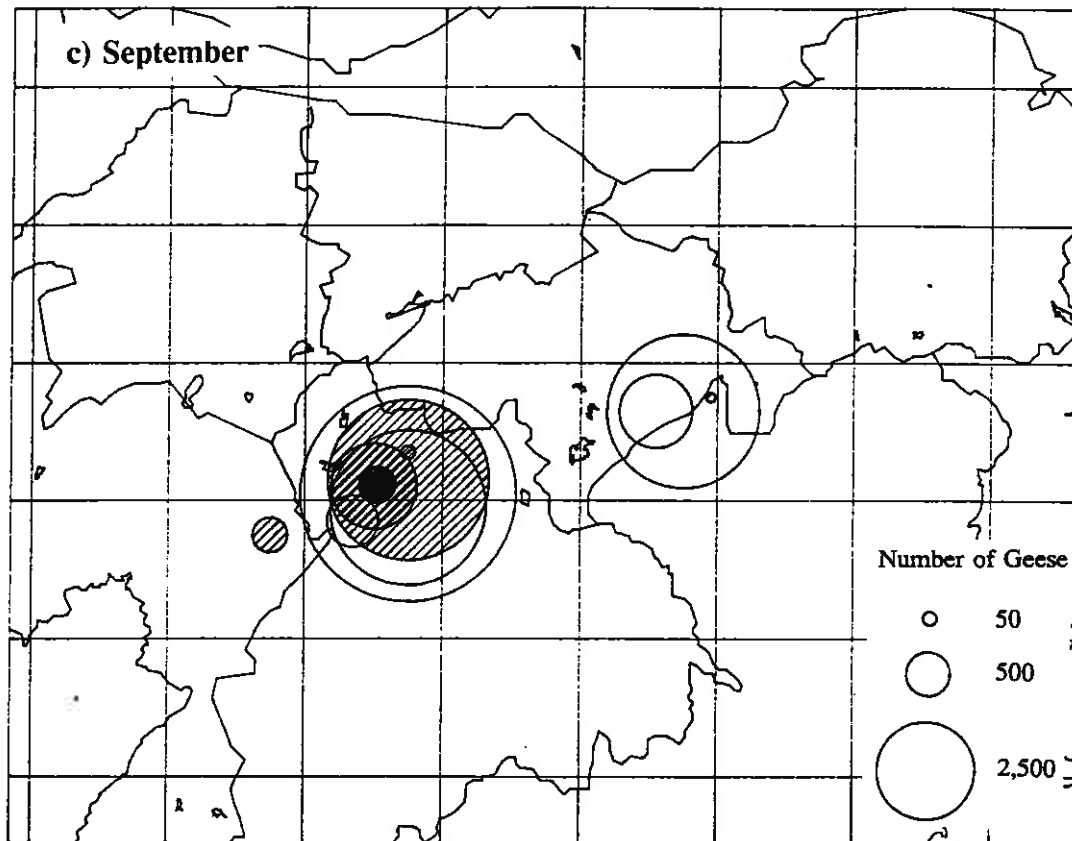
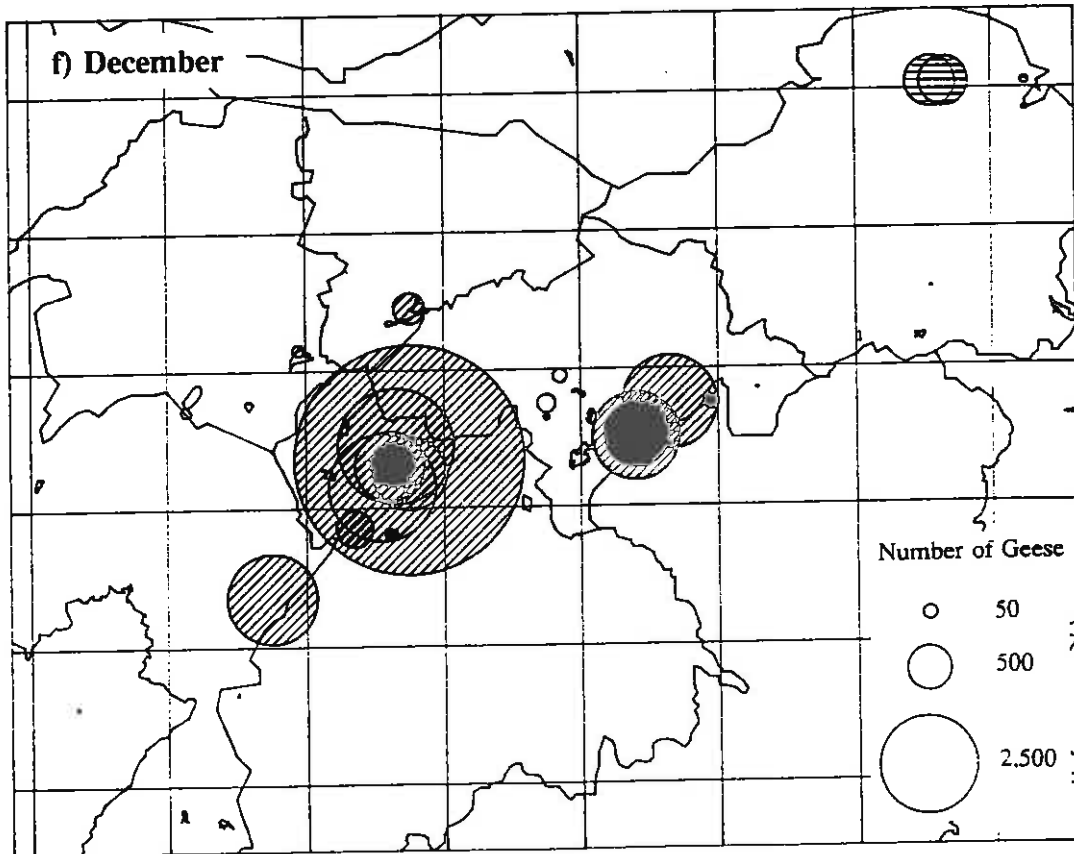
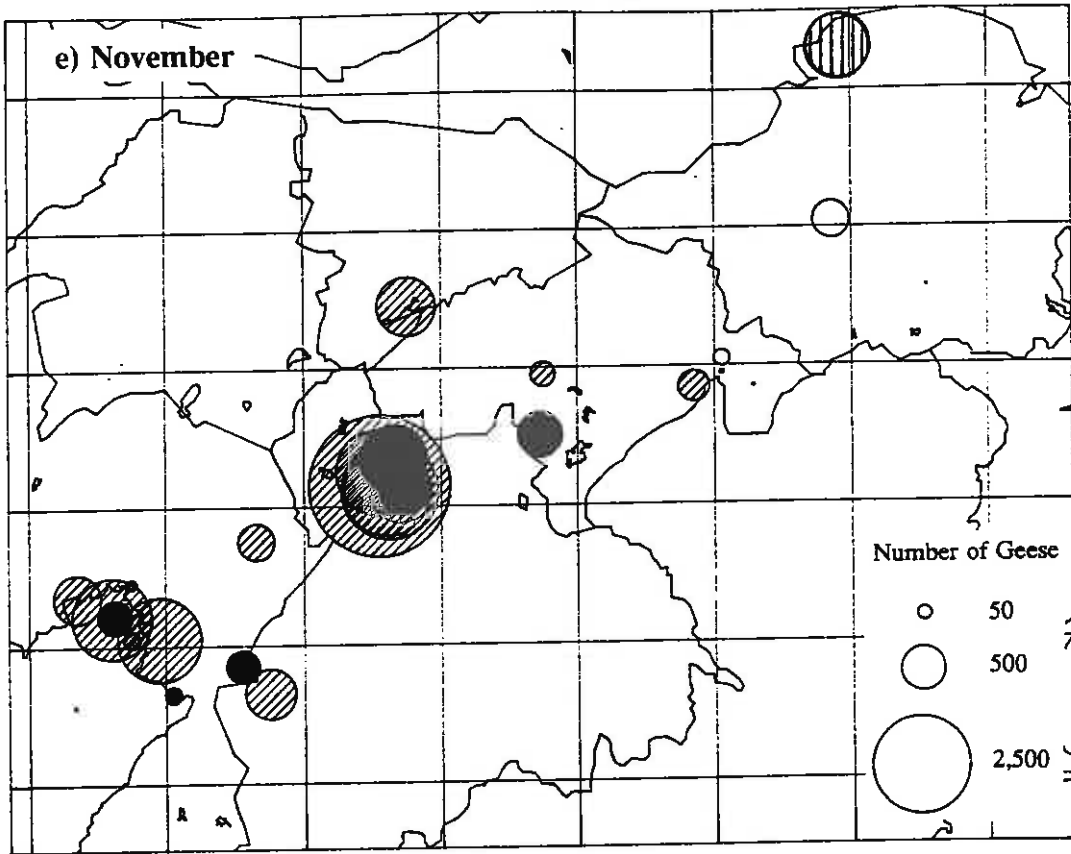


Figure 8c - 8f. Observations of feeding geese in 1991. Circles represent goose days for each 1 km square. Circle area is proportional to the number of geese. Field types are: stubbles (open), improved pasture (hatched), rough pasture (solid), moorland (cross-hatched), potatoes (vertical hatch) and winter cereal (horizontal hatch).





4.3 Flightlines

4.3.1 Flightlines at roosts

Observations at roosts recorded the time and direction of incoming or departing flocks of geese. The numbers of birds using the flightlines at each of the four principal roosts in the intensive study are summarised below. Data for all roosts is given in Appendix 5.

4.3.1.1 Gladhouse Reservoir

During most of the 10 roost counts in 1991, the majority of birds arrived from a direction varying between north-north-east and east. It is probable that all of these birds arrived from feeding areas north-east of Gladhouse, around Esperston, Middleton Moor, Tynehead and Blackcastle. Birds were seen flying along the escarpment of the Moorfoots (during the day, as well as fighting in to roost) and the variation in the actual direction of arrival between north-north-east and east was probably due to the direction of the prevailing wind and at what point birds turn for Gladhouse from the flightline along the Moorfoots.

A small number of birds were also occasionally recorded departing in this direction on evening counts. These were generally the earlier arrivals which may have been wary of the roost and returned later in the company of larger flocks. A few small groups were noted to have departed in this direction and not returned before the observer left. These birds may simply have returned at a later time (birds in December arrived in the dark). Alternatively, birds may have roosted on open ground near the Moorfoots, as has been observed in the past (R.W.J. Smith, pers. comm.), or have flown to roost at Fala.

On a couple of occasions, birds arriving from the north-east overflowed Gladhouse and headed south-west. These birds would probably have roosted at Portmore, or, especially in September, when several large flocks flew over at some height, may have continued south-west beyond the Lothians and Borders Regions, perhaps to the Solway Firth area.

The arrival of 1,040 birds from the north-west in early November is noteworthy, and may indicate the use of the Mount Lothian area for feeding; however, no birds were recorded there during daytime observations.

Records for 1980, and one from 1985, show a similar picture to the present, with large numbers arriving from (or, at morning counts, departing to) an easterly or north-easterly direction, with smaller numbers leaving to the west. The latter birds may have been using the area around Cockmuir. However, Gladhouse is only a few kilometres further from the main feeding area at West Linton than the feeding grounds adjacent to Fala, and it is possible that these birds may have been using the West Linton feeding grounds.

A number of geese also used the flightline to the north-west, corresponding to feeding areas around Mount Lothian, as used in 1986.

4.3.1.2 Fala Flow

There was no regular pattern in the arrival of geese at Fala Flow in autumn/winter 1991, with birds arriving from all points of the compass except the south-east, where the higher ground of the Moorfoots and Lammermuirs would preclude suitable feeding areas.

In early October 1991, large numbers arrived from the south and south-west, corresponding with birds feeding at Middleton and Tynehead, and possibly the Brothershiels area, though few birds were thought to be in the latter area (R. Walker, pers. comm.). The number of birds arriving from the north-west showed a big increase in mid October, suggesting feeding areas around Blackcastle. In mid and late October, a huge arrival of more than 10,000 geese was recorded from the north-east, suggesting feeding around Soutra Hill, or possibly Fala. No feeding observations were made in this area to substantiate this, although there were casual reports of large flocks, comprising several thousand birds, near Whitburgh and Fala village at this time.

In November and December, the number of geese using the roost fell to less than a thousand, with birds arriving from the west and/or the east-north-east.

Comparatively few birds were noted departing from the roost site during evening counts, although over 600 were noted to do so on 17 October, with many leaving once it was quite dark, having arrived at the roost approximately one hour after the main arrival of geese. All departures were to the south or south-west, birds presumably heading for Gladhouse or the Moorfoots.

Records for 1980 show birds arriving predominantly from the west, with smaller numbers from the west-south-west and north-west, and from the east or north-east.

Geese were noted to depart the evening roost in a number of directions in 1980. Birds leaving to the west were thought to have remained on fields at Middleton Moor during the night (2,000 were recorded as roosting here in January 1981), while birds leaving high to the north or north-east were thought to be making for Aberlady (W. Brotherston diaries).

4.3.1.3 West Water Reservoir

The topography of West Water is such that roosting geese arrive or depart along obvious and consistent flightlines, corresponding with breaks in the hills directly around the reservoir and the location of feeding areas. It is also easier to follow geese for greater distances from suitable vantage points to confirm the true direction of flight than is the case with some other roosts. Results in Appendix 5 are thus condensed into the four predominant flightlines, although birds were observed arriving or departing from a greater number of points of the compass. However, birds leaving directly due east may turn to fly either east-north-east or east-south-east when some distance from the reservoir and some of these birds may have been incorrectly assigned to a flightline. This is not thought to have had a significant affect on the results.

Large numbers of birds were observed on all flightlines on most counts. At the beginning of October, when numbers of geese using the site were highest, in excess of 10,000 used the south-south-west flightline. On the lowest of these counts (24,000), 8,600 birds remained at the reservoir when the observer left, and thus more birds may have in fact used this flightline. When the highest count occurred (over 32,000 on 13 October), virtually all additional birds (15,000) arrived from the east-south-east.

Away from the large counts in October, varying numbers of birds used all flightlines, generally between 1,500 and 3,000 on each, with the total roost numbering around 10,000. Of note are 5,614 from the west on 17 November, 5,810 from the east-north-east on 3

December and none from this direction on 15 December, when over 10,000 birds were still using West Water. Thus, despite variation, there was no obvious overall change in the use of flightlines during the season.

No birds were seen to leave a gathering roost, although over 500 were noted to return during a morning count in early October and, on three occasions, over 1,000 birds remained at the roost when the observer left.

During two counts in 1980, birds arrived predominantly from the east and south-east, with additional birds from the south-west and south during a low roost count (4,400), and, later, nearly all birds arriving from the south-west during a high roost count (15,600). No geese were recorded arrived from a northerly direction, although birds from the east-north-east may simply have been recorded as from the east.

Two records from 1985 show, firstly, arrival from only three of the four main flightlines (3,000 to 5,000 from all directions except the west), and nearly all birds from the south-east in a count of over 9,000 geese.

One count of over 10,000 in 1987 shows over half the birds arriving from the south-south-west, with none from the west. A count of over 23,000 in 1989 recorded 20,000 birds from the south-south-west, with remaining birds from the east-north-east.

4.3.1.4 Aberlady Bay

The main direction of arriving or departing geese at this site was between south and east, accounting for the vast majority of geese using the Bay. The only birds to use a different flightline were 1,240 departing to the north-east on 20 October. However, several flocks were noted to arrive from the east at the southern end of the Bay and swing round to fly north into the roost, with the prevailing wind probably determining this behaviour to some extent.

Very few birds were observed to depart the roost in the evening. Those that did left in a southerly or easterly direction. A record of 250 birds leaving to the south-east on 14 December was notable, when a total of only 540 was counted in the Aberlady roost.

4.3.2 Flightlines away from roosts

All observations of flying birds in 1991, excluding arrivals or departures at roosts, are listed in Appendix 6, and are also shown in Figures 9a-9d for the months September to December separately. Several points should be borne in mind when viewing these figures:

Circles indicate the locations of the flying birds when first observed. The size of the circle is proportional to the total number of birds recorded in each one kilometre square over the period flying in the same direction. Birds flying in different directions are displayed using another circle. Only 16 points of the compass were used to record direction of flight. The length of line is constant, irrespective of the distance flown. Generally birds were followed by eye for around 2-3 km until lost from sight, although birds may have been lost within this distance or landed nearby. Birds flying to land in a field under observation are also included if the direction from which they arrived can be ascertained over a reasonable distance. The length of the line, in many cases, extends beyond the point at which birds were either lost

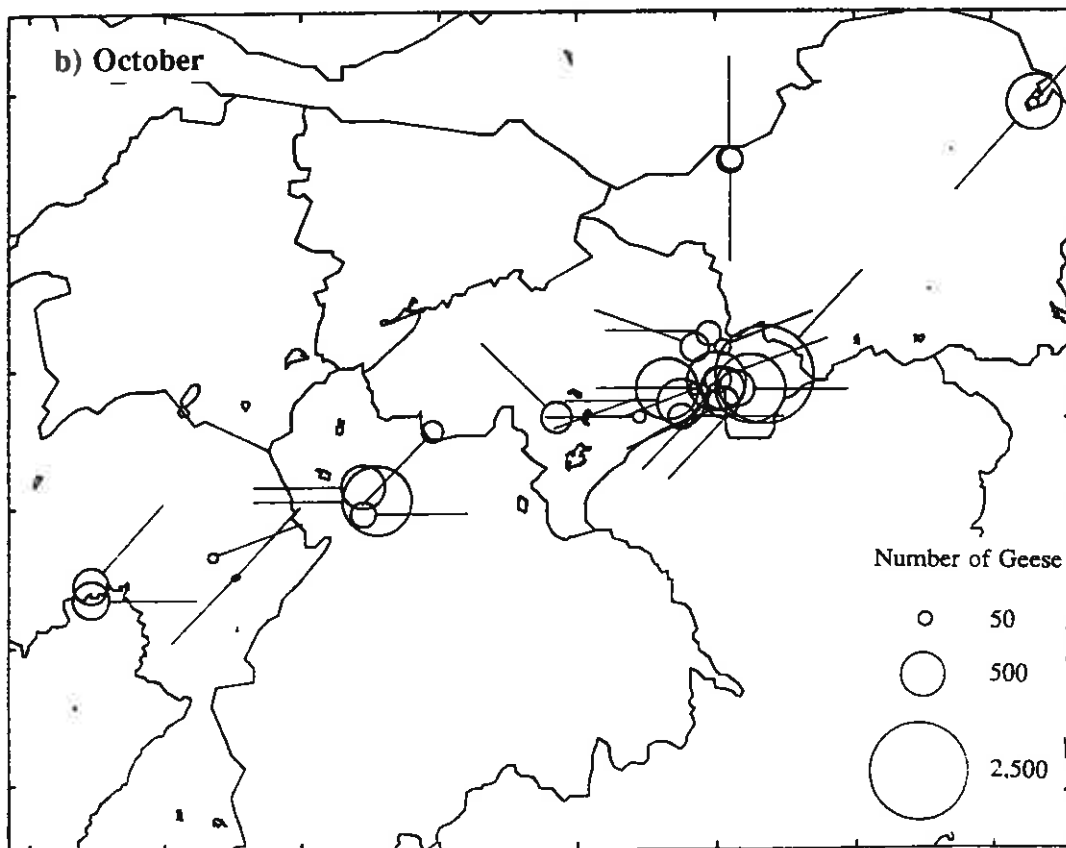
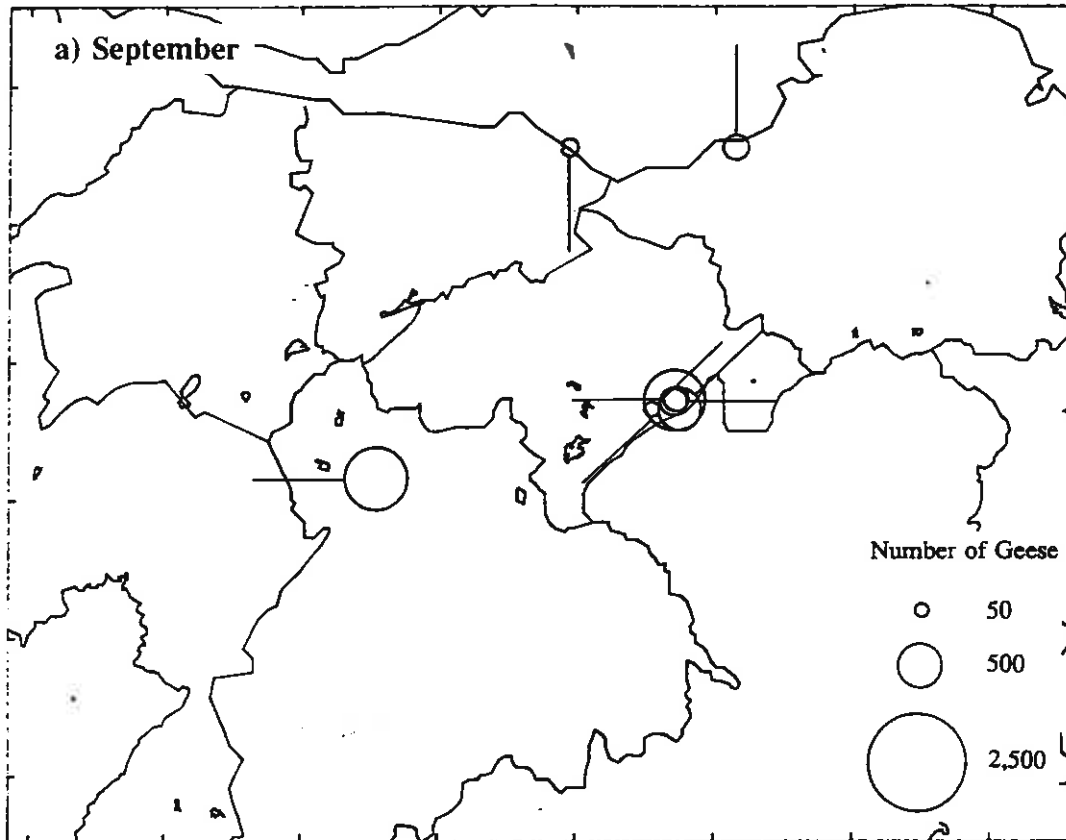
from view or landed, and may therefore incorrectly appear to imply that birds flew to unused areas. If birds changed course significantly during the observation, the final direction of flight was recorded. On very few occasions was this observed.

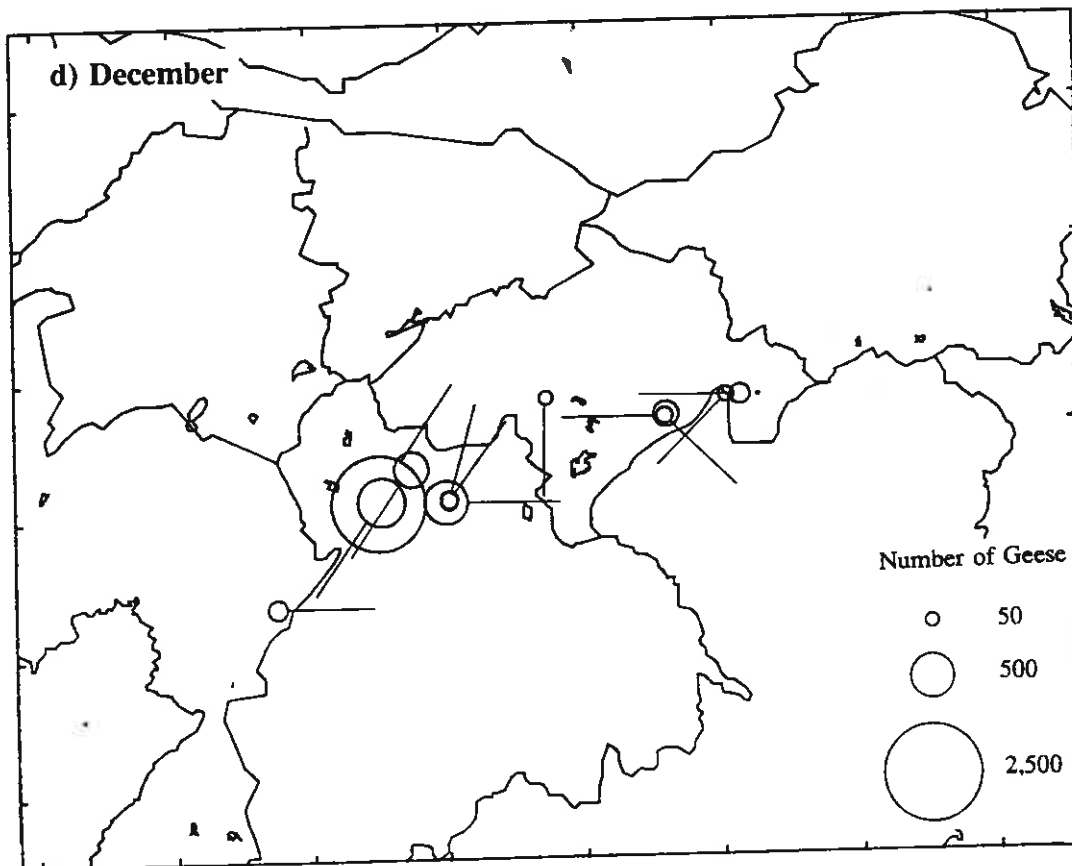
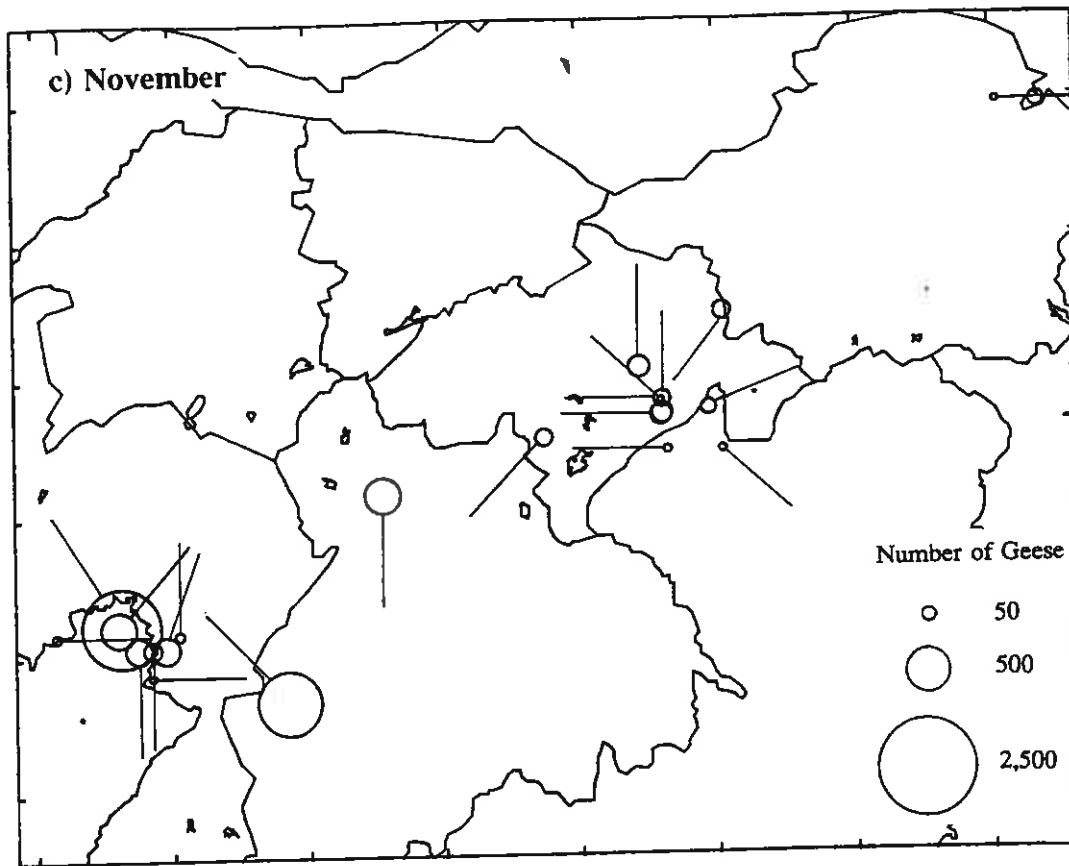
In September and October, the majority of observations were made in the Fala area, with a large number of birds recorded flying along the escarpment of the Moorfoots and Lammermuirs. Many birds flew towards Middleton, where only moderate numbers were found feeding, and, on several occasions, birds were seen to fly further towards Gladhouse. That searching revealed few birds in the Middleton or Esperston area, perhaps suggests feeding grounds around Gladhouse. There was also much local movement between Fala, used as a daytime loafing area, and adjacent feeding areas. Many birds at West Linton were seen flying to and from West Water, which is also used during the day by loafing birds. Of note were several groups of birds observed 4-5 km north-west of Fala flying either parallel to the Lammermuirs or further west, suggesting feeding areas on lower ground. A large number of birds also flew north-east, to an area not extensively searched for feeding geese. These birds may have been flying to the Soutra Hill area, east of Fala village, which has been used in the past (R. Walker, pers. comm.). It is interesting to note birds flying north over the Firth of Forth in both September and October, although it is possible that these birds then headed towards the Aberlady area.

There were comparatively few records of flying birds in November and December, especially around the Fala area. Several groups, especially in November, were noted flying west or north, and so to lower ground. Flights in the Carstairs area of the Clyde appear to head in a number of directions, although this is partly due to poor long-range visibility in this area, and many of these observations relate to local movements of birds up and down the Clyde. Of interest, however, were large numbers of birds which departed from the Westraw area in a north-westerly direction. Springfield was the nearest roost in that direction, although it is possible that birds changed direction when out of sight and headed up the Medwin Valley to West Water, as the birds leaving the Clyde in the early evening in a north-easterly direction were believed to do.

Small numbers of birds were also recorded near Fala Flow flying south east, roughly along the route of the A7. It is possible that these birds were using areas to the south of Fala Flow (e.g. Brothershiels), as has been noted in the past, although it is believed that birds made little use of this area in 1991.

Figure 9. Observations of geese in flight 1991. Circles represent goose days for each 1 km square. Circle area is proportional to the number of geese. The attached line indicates direction of flight.





4.4 Disturbance

4.4.1 Disturbance at roosts

4.4.1.1 Gladhouse Reservoir

The numbers of shoots and geese shot at Gladhouse Reservoir since 1978 are given in Table 7. There were up to 10 shoots per year from 1981-82 to 1990-91, five or six being about average, with most held by the Arniston Estate. No shoots occurred in 1982/83 and 1983/84 followed by 10 in 1984/85. The number of shoots has been maintained by the Arniston Estate at about five a year until the present, with 30 to 50 geese being taken each year. Rosebery discontinued shooting the reservoir in 1987-88, at a time when Arniston agreed to regulate the activity. Although the dates of the shoots are not recorded, it is probable that most took place in October and November. Prior to the regulation of shoots, it is likely that they occurred more frequently than the current practice of not more than every 14 days.

Table 7. The number of shoots at Gladhouse Reservoir and the Arniston Estate, 1978-79 to 1990-91. The number of visits to the reservoir and the number of geese shot is given under **Visits** and **Geese**, respectively (from Gladhouse LNR annual reports). The number of all game shoots by the Arniston Estate is given under **All shoots** (from Arniston Game Book). Where known, the number of walk-up days is also given to the right of a slash. The number of occasions when geese were shot is given under **Shoots** and the total number of birds shot under **Shot**, with the figures to the right indicating the respective numbers for walk-up days. The absence of information for walk-ups may not mean that walk-ups did not occur (see text).

Season	Rosebery		Arniston				
	Visits	Geese	All shoots	Shoots	Shot	Visits	Geese
1978-79	-	-	19/-	3/-	9/-	-	-
1979-80	-	-	23/-	7/-	24/-	-	-
1980-81	-	-	27/-	1/-	1/-	-	-
1981-82	1	5	32/-	2/-	2/-	6	37
1982-83	0	0	29/-	2/-	23/-	0	0
1983-84	0	0	35/-	2/-	17/-	0	0
1984-85	2	25	27/10	2/-	19/39	8	31
1985-86	1	14	29/25	0/-	0/37	5	37
1986-87	-	20	16/9	0/-	0/12	6	34
1987-88	0	0	13/-	0/-	34/-	6	34
1988-89	0	0	18/-	2/-	4/-	2	37
1989-90	0	0	19/13	2/1	46/22	5	47
1990-91	0	0	26/-	0/-	0/-	5	43

"-" information not available

Goose shooting at Gladhouse by the Arniston Estate is nearly always conducted at dusk. The number of guns varies depending on the nature of the shoot, but around 5-10 is normal in recent years. Guns are normally positioned on the east side of the reservoir, on the shoreline around Mauldslie Bay and adjacent areas, along the major flightline of birds arriving from the feeding grounds. Shooters are spaced about 75 m apart.

Data from the Arniston Game Book, which lists the date and number of all game shot, are also given in Table 7. Although the game book does not specify which Pheasant drives were used or whether the reservoir was visited, shoots can be broadly differentiated by the number of each game species shot. The physical requirements of the cartridge size necessary to shoot geese means that they are not generally shot opportunistically (*e.g.* on walk-ups). In the absence of other sites on the estate at which there is a predictable goose shoot, the number of dates on which geese were shot can thus be taken to indicate the number of roost shoots. There are, however, several occasions on which only one or two geese are recorded and, in view of the small number of birds killed, it is possible these were taken away from a dusk shoot at the reservoir. Goose shoots are largely held as the end to a day of shooting, rather than organized separately (P. de Vink, pers. comm.).

About 40 areas are identified by the Arniston Shoot, mostly areas of woodland used as Pheasant drives. The majority of these are located on the low ground to the north-east of the reservoir, although a few drives are within 2 km of the roost. Walk-ups often cover ground to the east of the reservoir at the base of the Moorfoots.

Walk-up days were often organized by an external operator and shoot details in these cases may not be recorded in the gamebook. However, in several seasons, a total of the number of days and game shot are listed for walk-ups (see Table 7), although visits to the reservoir are again not recorded. In years when the number of geese recorded in the game book are lower than the number supplied to the LNR management committee, it seems probable that most goose shoots occurred on walk-up days.

The number of game shoots (excluding walk-ups) averaged just under 30 per year in the early 1980s, dropping to just under 20 in the late 1980s. The majority of shoots were held during October to January although the timing of shoots varies from year to year. The number of walk-ups is only given for four years. Twenty-five walk-up days were conducted in 1985-86, giving a combined total of 54 shoots on the Estate. The number of geese shot in this and the preceding season indicate that the reservoir was also visited on walk-up days. No data are given for the timing of these shoots although the number of geese shot suggest that several occurred in October or November.

Thirteen Pheasant shoots were scheduled for the 1991-92 season on the Arniston Estate. However, at the time of writing, no data had been received regarding how many geese had been shot at the reservoir during the season or how many walk-up days had occurred. The author attended one goose shoot at the end a walk-up when one Pink-footed Goose was shot.

Goose shoots by the Rosebery Estate were conducted from the south-west corner of the reservoir. Water levels in the mid 1980s were sufficiently low to allow about 100 m of exposed substrate and guns were placed on the water's edge. The geese were shot as the birds swung round from the flightline along the Moorfoots from south of the reservoir and headed towards to north end of the reservoir (D. Kirk, pers. comm.).

Rosebery have also shot geese using fields areas as roost sites. An area near Fountainside, adjacent to Rosebery Reservoir, is occasionally flooded and used opportunistically by the geese as a roost or as a pre-roost assembly. Because of the temporary nature of the site and goose usage, only a few shoots are possible, if at all, each year.

The Rosebery Estate also hosts a number of Pheasant drives, largely in the woodland around the Toxside area to the north-west of the reservoir. These number between three and five days a year, generally held in October or November. Around four or five days of Pheasant drives are also held in woodland near Rosebery Reservoir, normally later in the season.

The only record received of goose shoots on the Rosebery Estate involved 12 Pink-footed Geese shot at dusk in a roost gathering in fields close to Rosebery Reservoir in November 1991 (D. Kirk, pers. comm.).

4.4.1.2 West Water Reservoir

Geese are shot for sport at West Water Reservoir on flightlines leaving or arriving at the roost. The Pheasant drives at West Water are in an area not used by the geese by day and the reservoir is effectively shielded from this activity by Slipperfield Mount. The duck pond is located close to the Pheasant Drives, and while geese may loaf at the reservoir during the day, the shielding effect of South Slipperfield Mount probably means that disturbance is minimal. The majority of the moor to the north-west of the reservoir is managed as a grouse moor. This area is not used by the geese.

The shoot at West Water is nearly always at dawn and guns are positioned in a line of purpose-built butts 1 km to the south of the reservoir on the ridge of Slipperfield Mount. Butts are spaced at around 75 m. The geese are often encouraged to leave the roost by a man at the reservoir edge flashing a torch or a firing a shot into the air. This is done with the aim of forcing the birds to leave using the south-west flightline over the butts. A gun may be placed on the north side of the dam to dissuade birds from leaving using that flightline.

The reservoir is revisited after the shoot during the day to remove injured birds, when shots may be fired. This would cause disturbance to any birds using the site for loafing during the day but comparatively few birds are present directly after the shoot. Foxes *Vulpes vulpes* are controlled on the moor and surrounding area by shooting at night with the aid of a spotlight. When doing this, the reservoir is generally avoided and the use of a spotlight appears to have little effect upon roosting birds in the middle of the night (G. Mackay, pers. comm.).

Five goose shoots were scheduled for the 1991-92 season by the South Slipperfield Estate at West Water. The author attended two such shoots, when approximately 12 and 15 birds were shot by parties of around eight people. However, at the time of writing, no data had been received from the Estate on the number of geese shot during the 1991-92 or previous seasons.

Two adjacent estates also shoot geese flying to or from the reservoir. The Fernihaugh Estate uses a series of butts about 1.5 km south-west of the reservoir. Around three goose shoots are conducted per season and guns are restricted to two geese each. About five guns attend a shoot (R. Stevens, pers. comm.). The South Slipperfield Estate allows "low-key" shoots of geese flighting off the reservoir. Normally two guns, located on a hill 1 km to the south-east of the reservoir, shoot an average of twice a year. Over the last eight years, an average of two geese a season have been taken on the South Slipperfield Estate (H. Murray, in litt.)

4.4.1.3 Aberlady Bay

Shooting is permitted at Aberlady Bay but geese are not legitimate quarry under local byelaws. Shooting rights are owned by the East Lothian District Council and wildfowling is available under permit. Shooting is restricted to duck species and to an area due east of a north-south line approximately level with the eastern edge of Aberlady village. Shooting is only permitted between one hour before sunrise and 10 a.m. and between 3 p.m. and one hour after sunset. The number of permits for the reserve is limited to 25 and a record of all visits made and the species shot must be completed each season.

Approximately 150 visits by wildfowlers are recorded annually (P.R. Gordon, pers. comm.) and wildfowlers generally concentrate their activity in an area just north of the Peffer Burn to the north and west of Aberlady village. Pinkfeet generally roost in the centre of the bay and arrive at a location approximately 1 km from the main wildfowling area. While the actual area of the reserve used may change slightly depending on the presence or absence of wildfowlers, geese are generally little disturbed by wildfowling and have not been observed to avoid the site due to this activity.

The 11 roost counts in autumn 1991 recorded three visits by wildfowlers. On one occasion, no shots were fired. One wildfowler firing five shots during the evening evoked no reaction from the nearest roosting geese, less than 500 m away. On the third occasion, two wildfowlers, firing three shots, caused a flock of 100 geese within 200 m of the men to move to join the main group of geese.

4.4.1.4 Fala Flow

Fala Estate is favourably disposed towards geese and does not permit goose shooting at the Flow. The moor is managed for Red Grouse and approximately three drives are conducted each season, generally before the end of October. The Flow itself is occasionally shot for duck, usually about once a season. One dawn duck shoot was conducted in autumn 1991 (R. Grigor, pers. comm.).

Flightline shooting of geese using Fala Flow has occurred in the past on farms adjacent to the Fala Estate (R. Walker, pers. comm.). No records are available to quantify this activity, although it is suggested that it was not uncommon. Contemporary sources suggest that there is little, if any, such shooting now.

4.4.1.5 Other sites

No regular or significant sources of disturbance were recorded at other roost sites in autumn/winter 1991.

Historical data for other roosts is generally limited to annotated counts in reports of the local goose censuses or that obtained through conversation with relevant bodies. Such information is thus patchy in nature and not readily quantifiable. Regular or notable disturbance is known to have occurred at four major roosts in the region in the last 15 years.

Both Rosebery Reservoir and Portmore Loch have occasionally been shot for geese in the past 15 years. Shoots at these sites were generally evening shoots, with only two or three shoots being recorded per year (D. Kirk and G. Mackay pers. comm.), although one roost count for

Portmore records several cars arriving at the site, suggesting a large number of guns (W. Brotherston diaries). At least one incidence has been recorded when shooting at Portmore has responsible for birds not roosting at the site, despite several large flocks flying into the loch or attempting to land.

Wildfowling occurs at Tynninghame under similar restrictions to Aberlady, including a limited number of permits and designated areas from which shooting is permitted. Geese are viable quarry, although a sanctuary area exists in which shooting is prohibited. The sanctuary is used largely by Pinkfeet, with Greylags often using fields at the western end of the estuary. Wildfowling does not prevent geese from using the bay as a roost, although birds may arrive and leave in the dark and have been observed to leave the roost when dawn shooting started. The decline in numbers since the 1970s is thought to be largely due to changes in local farming practice (R. Anderson, pers. comm.) while Aberlady has increased in prominence.

The roost at Hoselaw suffered heavy shooting in 1986 and 1987 with a change of owner. Flightline shooting occurred up to the boundary of the SSSI, on the edge of the Loch itself. Shooting was noted as severe. The numbers of geese using the roost rapidly declined with a corresponding increase at some other sites in the region and the formation of roosts at new or previously little-used sites *e.g.* Hirsell Lake. Many birds were also believed to remain in fields overnight. There is presently an agreement with the landowner to regulate shooting. The numbers of Greylag Geese have begun to increase in recent years but the trend has not been mirrored by Pinkfeet.

4.4.2 Disturbance in fields

Several sources of disturbance to geese in fields were noted during fieldwork in 1991. These events are summarised in Table 8. Very few records of disturbance of geese away from roosts are available for past years.

Table 8. Disturbance to geese in fields in 1991.

Source	Incidences
Aircraft	21
People/dogs in fields	6
Vehicles on roads	4
Other	4

4.4.2.1 Shooting and scaring

Deliberate disturbance of geese in fields appears to be an uncommon event in the study area. Most disturbance is passive, with farmers using a variety of stationary scaring devices, ranging from scarecrows to dilapidated vehicles placed in fields to discourage geese. These were not, however, a common sight in the study area. Several farmers also simply left hay bales in fields for longer as it was noted that geese did not visit these fields.

Active scaring is employed on a rapid response basis to the presence of birds. Most farmers consulted in the area said that they undertook this practice but that this would only occur a few times a season, although the number varied with the location of the farm. Normally, the farmer or gamekeeper would simply approach the geese, usually in a vehicle. This was usually sufficient to scare the birds, although a gunshot was also sometimes used. Very few geese were actually shot in scaring birds from fields.

Only two occasions of deliberate scaring of birds in fields were noted during fieldwork. The first involved a vehicle driven directly at a feeding flock which caused birds to leave the field. The second involved people walking into a field to scare a flock of geese. The birds left the immediate area but returned gradually after 15 minutes. The people returned and once more scared the flock from the area, placing oil drums in the field. After an hour, many of the geese had returned and used the part of the field furthest from the drums.

One incidence of shooting was reported by a farmer near the Clyde who had hired several guns to scare about 1,000 birds that had been regularly using his farm for about a week. In the West Linton area, a large flock of geese were also seen in flight heading away from the general direction from which a gunshot had been heard about one minute previously. The birds, however, were not visible at the time of the gunshot and it is not possible to state whether the disturbance was deliberate or not.

There are very few instances of shooting geese for sport in fields in the study area. No incidences were observed during fieldwork and consultation with gamekeepers of the Amiston and Rosebery Estates indicated that none took place directly around Gladhouse. Shooting specifically for geese in fields did take place on the Outerston/Esperston farmland but this occurred over just one weekend a year. This was also done with the joint objective of dissuading geese from using the area, being one of the intermittently used traditional feeding areas (Mr. Osbourne, pers. comm.).

During the course of the project, the author was notified of regular shooting on farms in the Middleton Moor area. However, no information had been received from farms in this area concerning this activity by the time of writing.

Accidental disturbance by tractors, dogs or people in adjacent fields caused geese to move within the field to a position further from the source of disturbance. The birds did not generally move until the disturbance was within c.200 m of the feeding flock.

Incidences of shooting in the area in the 1980s are virtually unrecorded. Farmers and gamekeepers suggested that there had been little change in recent years. The only written records (the diaries of William Brotherston) noted encounters with shooters, normally leaving fields, or notes of conversations with gamekeepers after the event. No more than half a dozen incidences are recorded although comparatively large kills (around 20 or more) are noted. Several of these took place in stubbles, confirming that these were sporting shoots. This suggests that shooting may have been more prevalent in the late 1970s when large flocks consistently used the land adjacent to Fala Flow, allowing a more predictable shoot.

There are no records of disturbance by people or vehicles in fields from 1980 or 1986 other than for shooting.

4.4.2.2 Aircraft

The Royal Air Force operates practice flights for combat aircraft in south Scotland, including the study area. During fieldwork in 1991, low flying jets were observed over the Pentlands, Moorfoots and Lammermuir and were the most frequently noted source of disturbance to geese during the day.

During the study period, low flying activity was recorded on seven out of a total of 61 days of fieldwork, with 19 separate incidences of disturbance due to low flying military aircraft and two incidences from other aircraft. William Brotherston only recorded the presence of low flying aircraft on two days from 28 days fieldwork in his diaries for autumn and winter 1980-81. No disturbance due to aircraft was recorded during fieldwork in 1986-87 (Brown 1987). Although it is probable that significant disturbance events would have been noted, neither work in 1986-87 nor W. Brotherston's diaries necessarily recorded all disturbance events.

Precise figures of low flying activity are not available in detail. Between 1,000 and 2,000 flights were scheduled for each month during the study period for southern Scotland. However, disruption, due, for example, to poor weather, may have caused the extent of actual activity to differ from that proposed. No details of actual flights flown are available.

The presence of a low flying aircraft within approximately 1 km of geese on the ground caused the birds to take flight. The flock would generally circle within the area and, within one to two minutes, either return to the same field or fly to a favoured field nearby. Large flocks would often fragment when disturbed, redistributing between several fields. At West Linton, where the majority of disturbance due to military jets was observed, birds redistributed between Robinsland, Broomlee Mains, Whitfield and Sunnyside, all within an area of approximately 1.5 km radius. Only two incidences of disturbance by jets were observed near Fala. Birds disturbed from Fala Moor were seen to fly further, generally to Blackcastle or Cakemuir, representing the nearest favoured feeding grounds, and birds disturbed while feeding near Crichton either returned to the same field or flew to Fala Flow.

Geese did not appear to become accustomed to the presence of aircraft as the season progressed, and always took to the air if a plane was close enough. However, intense disturbance did not appear to change the birds' standard behaviour *e.g.* despite four groups of aircraft noted within one hour over West Linton, the main feeding flock still stayed within the general area, each time simply taking to the air for a couple of minutes before resettling. The practice of planes flying "in tandem", with two or three following the same flightline in quick succession, simply caused the birds to be in the air longer as a new stimulus appeared, and an occasion of a third plane flying very close to an airborne flock caused considerable panic for a short while. However, the birds largely returned to the general feeding area within a matter of minutes. There was no evidence that disturbance by aircraft caused birds to leave an area permanently.

Two other incidences of disturbance by aircraft were noted. A passenger jet passing high overhead caused geese to redistribute between adjacent fields, although this was a large flock of c.5,000 birds that had just been disturbed by a passing vehicle. The second incident involved a stunt plane that repeatedly performed stalls and dives directly over a flock of c.500 geese. Only after the fourth or fifth dive did the birds take to the air and many resettled in the same field as the plane moved away once the flock was airborne.

4.4.2.3 Vehicles

The majority of Pink-footed Goose flocks were located in fields away from main roads or in sections of the field furthest from an adjacent road. The few occasions of disturbance occurred when a vehicle either slowed or stopped alongside a flock close to a road, generally within 100 m. One very large flock of geese, being joined by further birds, was disturbed by a very noisy vehicle on a nearby road. Geese disturbed in this way generally flew to an area of the field further from the road or to an adjoining field.

There are no records of disturbance of this nature in 1980 or 1986.

4.4.2.4 Miscellaneous

A variety of other disturbance sources included an Grey Heron *Ardea cinerea* flying over the flock and grazing livestock, both causing only temporary disturbance and only birds nearest to the disturbance altering position within the field. A loud noise from a nearby farm caused one flock of geese to move to an adjacent field.

The only record of geese being disturbed by a predator involved a pair of Gyrfalcons *Falco rusticolus* hunting over Fala Moor on several occasions in 1980, and observed on one occasion to kill a Pink-footed Goose (W. Brotherston's diaries).

4.5 Local opinion

A number of brief, informal interviews were conducted with farmers in the area especially on the Arniston and Rosebery Estates adjacent to Gladhouse, Rosebery and Edgelaw Reservoirs, and immediately north of West Linton. One farm in the Lanark to Thankerton area, adjacent to the River Clyde, was also contacted. Twelve farms were contacted during the project. Letters were sent to a few further farms but no replies were received. No formal questionnaire was prepared, although farmers given a brief outline of the project and were asked a number of questions: the size of the farm; agricultural practices and any changes in the last 10 years; the occurrence of geese and changes in numbers in the last 10 years; which areas of the farm and which crop types, if any, were favoured; whether the geese were considered a pest; whether the geese were actively dissuaded from using the farm.

Farms ranged in size from 160 to 1600 acres, with around 600 being average. Most farms, being at the base of the Moorfoot escarpment, were on comparatively poor agricultural soils and were predominantly used for livestock farms. Only a few farms nearer Temple, in the northern part of the Arniston Estate, farmed a larger area for cereals than for livestock.

Nearly all farms were visited by geese during the winter period, with two to six visits being average for those who quantified these occasions. Several farmers noted that birds would persistently return to a particular area over a number of days, even if scaring took place. Four farmers were of the opinion that numbers of geese had increased recently while two considered that there had been a decline, with one farmer suggesting that changes in farming practices and RAF activity were responsible for the decline. Two farmers noted that the birds were present for longer, arriving earlier in the winter and leaving later than previously.

Geese generally favoured higher ground or ground nearer Gladhouse and larger, more open fields. Birds were particularly evident in March and April, especially on young grass when fields had been cleared of livestock prior to lambing. This was the most persistent problem posed by the geese. Several farmers also noted that livestock would not graze fields with large numbers of goose droppings. Puddling was also noted as damaging young grass.

Goose damage to crops did not appear to be a problem in such a way as damage to spring grass, but several farmers noted that considerable damage had occurred to individual fields of cereals in recent years, when night-time feeding on two or three consecutive nights had prevented farmers from being able to adequately protect the crop.

Most farmers scared geese from their land. Exact methods varied, although about half were passive, using scarecrows or placing "foreign" objects, such as old vehicles in fields, or simply leaving hay bales out for longer. About half scared geese by either cycling or driving at birds, while about a third used gunfire. Only one farmer brought in shooters, but this occurred on just one weekend every year and involved only two or three guns.

Most farmers regarded geese as pest, although two said they were not a problem. The owner of two farms that form the principal feeding area for birds at West Linton did not permit goose shooting on her land. Only two farmers appeared particularly angered by their presence while most appeared to accept them as part of the local agricultural scene and were somewhat apathetic to taking more than low key measures to prevent geese using their land, other than in particular fields at particular times of the year. Two farmers considered rabbits *Oryctolagus cuniculus* were either of equal or more concern as a pest species.

5 Discussion

5.1 Numbers and distribution

5.1.1 Roosts sites: 1981 to 1991

The average increase of 9% per annum in the Icelandic and Greenlandic numbers of Pink-footed Geese between 1981 and 1991 indicates a healthy situation for this population. The change between years has fluctuated markedly, from an increase of 49% to a decrease of 15%, although the differing success of the census in achieving a full count of the population will have been responsible for much of this variation. The increase greatly exceeds the rate of 4% per annum predicted by Fox *et al.* (1989) which was based on observed breeding success and calculated mortality from the period 1960 to 1987. The combined population of the Lothians and Borders has shown a similar increase to that nationally, although, again there has been much between year variation. The distribution of birds has also shifted slightly from Lothians to Borders roost sites.

The decline at Gladhouse is in stark contrast to the general picture. Numbers have fallen to 22% of those recorded in 1981, and are equivalent to only 8% of that which could have been expected if numbers had increased in line with the national trend. The fell markedly over a very short space of time, mainly in the latter half of the early to mid winter period of 1984. However, numbers have since continued to decline, albeit slowly. This represents the loss of a very important local site as Gladhouse was the principal roost for the population of geese that remained in the Midlothian area until mid winter.

An increase of similar magnitude to the decline at Gladhouse has occurred at the nearby roost of Fala Flow. This increase exceeds the average for the region, indicating that numbers have been swollen by birds from other sites, presumably comprising many of the Gladhouse birds. However, the increase is insufficient to account for the loss of birds that should have been using Gladhouse, showing there to have been a real reduction in the numbers using the Gladhouse/Fala Flow area compared with the projected increase.

The seasonal use of Fala has also changed since the late 1970s. Generally, Fala was favoured as an early arrival site, with birds switching to Gladhouse in October, perhaps due to the higher altitude and exposed nature of Fala causing temperature to be a limiting factor later in the season. Fala Flow and Gladhouse were known to be linked, as birds would use either roost depending on local conditions. This pattern of usage no longer occurs and it appears that the local population of geese almost exclusively uses Fala Flow, with large numbers of birds often remaining well into November. The timing of this change is unclear due to a paucity of available data, but appears to have occurred in the early to mid 1980s. However, despite showing a more protracted stay at Fala than a decade ago, birds leave the Gladhouse/Fala area up to a month earlier than in the early 1980s.

The numbers of geese that use Aberlady are fairly consistent between years and also within a season. The peak count is not as pronounced as at some other sites, but numbers often remain high well into December. This consistency means that Aberlady plays a key role in the fortunes of Pink-footed Geese in the region. However, the increase in numbers at this site is much lower than average, although this will be partly the effect of large counts in 1980 and 1981. The effective loss of geese from this site, compared with the predicted increase, will have contributed to the decline in the Lothians.

Perhaps the most notable of the increases in the region has been at West Water, with an average peak of over 30,000 in recent years. However, the roost has grown at the below average rate of 7.6% annually. This figure may be low due to a large count in 1980 and, by its own standards, a modest year in 1990. However, these calculations suggest that the larger than average growth in the Borders population is not a result of the increase at West Water.

West Water is somewhat anomalous in that it receives extremely large numbers, affording the roost much prominence nationally. However, peaks are usually very short-lived as birds pass through the region in early October. Thereafter, numbers at West Water are considerably lower, although the roost remains important at a regional level into mid winter. West Water does not appear to have inherited local birds from other roosts in the region in the last decade.

The above average increase in the Pinkfoot population in the Borders Region as a whole must therefore lie with other roost sites. In the five year period from 1987 to 1991, only four sites in the Borders and Lothians Regions had average maxima in excess of 10,000 birds. At over 14,000, Hule Moss is second only to West Water, and numbers at this site have shown the largest increase (16.6% per annum) of the major roosts. Although Hule Moss has been counted regularly since at the late 1970s, coverage on a weekly basis from the end of September has only occurred in recent years. The increase may thus be partly an artefact of the increased coverage, more likely to record the large peak in early winter. Hule also maintains large numbers of birds in mid winter. A count of 8,000 birds in 1979 indicates that the site has been long used by large numbers of birds and that, since coverage in previous years is not comparable to sites such as West Water, its true value has not necessarily been recorded. Nevertheless, the increase at this site is far in excess of both the average and that of any other site and as contributed heavily to the increase in the Borders Region. However, while it appears that the site has inherited birds from other roosts, the increase in coverage makes it difficult to ascertain to what extent this has occurred.

The emergence of Watch Water as a roost, not used by Pink-footed Geese in the early 1980s but where an average peak of 2,500 has been recorded in recent years, will also have made a significant contribution to the increase in the Borders. Numbers at Hoselaw and Whitton showed increases in excess of the national average in the mid 1980s but have since returned 1970s' levels, suggesting two large shifts in the local populations in the last decade. Smaller roosts, such as Cobbinshaw, Rosebery and also Harperrig, have been increasingly used as "satellite" roosts. Although only holding a few thousand birds in total, these may represent some of the "missing" birds from the major roosts in the Lothians.

The national population of Greylags has shown an overall increase of around 1% per annum during the last decade, despite an increase in the mid 1980s. Lothian totals for this period have shown a similar trend while those for the Borders have decreased at a rate of 6% per annum, although both have fluctuated enormously. Although Greylags are more sedentary in their winter distribution than Pinkfeet Geese, these fluctuations might be expected in view of the Lothians and Borders Greylags being at the edge of the population's range.

In the Lothian, numbers at Harperrig and Gladhouse have mirrored the national trend, while Whiteadder and Threipmuir have shown increases, although all hold less than 1,000 birds. The Borders roosts of Hoselaw, Whitton and Watch Water have all shown decreases over the period, with a combined loss of around 4,000 birds. The emergence of new roosts in the Tweed area (*e.g.* Bemersyde and especially Hirsell Lake) have partially compensated for this. That these events were concurrent point to site specific problems, especially at Hoselaw.

5.1.2 Links between roost sites

Demonstrating linkage between roost sites within a season is hampered by large fluctuations at individual roosts, which may be caused by a variety of factors:

- a) birds may remain on fields on moonlit nights if it is sufficiently bright to continue feeding;
- b) poor weather may prevent flying to the roost or cause birds to leave the area altogether;
- c) temporary pools or flashes in fields may be used for roosting in preference to usual sites;
- d) disturbance at a roost may cause birds to fly to roost only once it is dark when they may be missed by counters.

The situation in the Lothians and Borders is further complicated by the passage of birds through the region in early October. The large numbers of geese that are present for only one or two nights probably do not remain in the region as a whole for longer than this period. Any interchange between roosts, if it occurs, will probably be on an *ad hoc* basis in such a short period. The population of birds that is apparently resident from early October until late November will be present for sufficient time to display roost and feeding ground preferences. Studies in Grampian showed that Pinkfeet changed roosts every 10 days, and used 3-4 roosts during December to April (Giroux 1991). However, further study is necessary to determine the degree of turnover in the region as a whole during the winter.

The use of flightline direction at roosts to identify birds arriving from areas outwith the normal feeding area for that roost *i.e.* from other roosts, is clouded by several factors:

- a) the topography of the land may concentrate birds into a limited number of flightlines;
- b) new arrivals may coincidentally use recognized flightlines;
- c) the frequency of counts (normally one per week) is unlikely to be sufficient to detect either large or gradual changes in roost use;
- d) birds arriving from directions in which there are no recognized feeding areas may simply have been missed during the day as only between a quarter and a half of birds roosting in the region were located by day;
- e) birds arriving from other roosts may arrive at the roost late due to the longer distance flown and may thus arrive once dark and be missed by the counts.

Although roost counts fluctuated, often markedly, at many sites in 1991, it was felt that the frequency of counts was insufficient to analyze interchange between roosts within the season.

5.1.3 Feeding areas

Four principal feeding areas for Pink-footed Geese can be identified in the East and Midlothian, Tweeddale and Clydesdale Districts and can be linked to major roosts in the area by the direction of flightlines used at roosts and observations of flying birds by day:

- a) the land between Aberlady and Tynninghame, south of North Berwick (Aberlady Bay);
- b) land immediately around, but especially to the west and north-west of Fala Flow (Fala Flow and Gladhouse);
- c) West Linton and adjacent areas between the A701 and A702 (West Water);
- d) around the River Clyde between Lanark and Thankerton (though to be mostly West Water). Adjacent areas, such as land around Haddington (Fala and Aberlady), land immediately around and to the north-west of Gladhouse (Gladhouse, Fala and Rosebery), the South Medwin valley (West Water), Biggar Floods (probably West Water) and the upper reaches

of Biggar Burn (West Water), were also used but by smaller numbers of birds and more infrequently, although this may be partly due to less coverage of these peripheral areas.

In the last decade, there has been a notable shift in the feeding around the Fala Flow. Many of the stubbles are no longer available, especially during mid winter, and there were far fewer birds feeding in this area in 1986 and 1991 (although a cold spell in November 1991 had caused many birds to leave the region at this time). The absence of alternative feeding in November will have been an important factor in the length of time spent by geese in the Fala and Gladhouse area. It is also possible that Fala becomes less attractive due to colder temperatures later in the season, although no data have been sought to confirm this.

The percentage of birds recorded feeding in September was very high, indicating that birds were replenishing lost energy stores after migration. In October, this proportion had fallen, and a large number of birds were recorded loafing at roost sites during the day. Feeding activity increased during the remainder of the study, presumably due to greater energy requirements in colder weather and also daylight becoming limiting. Such limits would perhaps necessitate birds remaining in fields after dark (recorded in 1991 at West Linton and in 1980 at Halflaw Kiln) and, with the reduction in the amount of stubbles, presumably the most profitable food, may influence the length of stay by birds in the region.

The number of birds recorded by daytime observations was only between one quarter and half that recorded at roosts. Although some birds were undoubtedly missed, this suggests that birds also fed outwith the known feeding areas. Records of birds flying south-east or north-east from Fala indicate the use of areas alongside the A7 and A68, known to have been used in the past. Also, two large flocks 5 km due north of Fala and birds flying away from or parallel to the Lammermuirs some distance from Fala suggest the use of feeding areas outwith the intensive study area. A cursory examination of land between Fala and Haddington recorded only one flock of birds, although these could have been from Fala or Aberlady.

Birds roosting at West Water also feed extensively on stubbles in the early part of the season, with some of the biggest flocks (>10,000) found in the Hamilton Hall and Halmyre areas. However, these are only available to the geese for about one month before being ploughed. Birds remaining in the area then move to pasture. The most intensively used feeding site in the study area was the few farms directly west of West Linton. This area proved ideal in view of its close proximity to the roost, the quality of the grass, and, being dairy farms, the absence of disturbance from livestock which had been taken in by November.

The area around the River Clyde is known to be used by large numbers of birds from the direction of birds arriving to roost at West Water. However, only a small proportion of these birds was located, and it seems likely that additional feeding areas have yet to be identified. Birds fed primarily on pasture, although no observations were made in this area in early winter when the largest numbers of birds left the roost in this direction. Also, birds were absent from land around the Clyde in December, despite birds departing the roost in this direction. A local farmer attributed the presence of geese in November to a period of cold weather, and considered that birds had returned to higher ground in December. This again points to undiscovered feeding grounds in this area.

That all of the birds using the Clyde area derive from the West Water roost is also questionable. Observations of birds arriving from the north and north-west at Westraw indicate feeding areas to the north of Carstairs, although birds arrived low, suggesting that

these may have been close by. Also, a significant number of Greylag were always present in the Clyde flocks whereas comparatively few are recorded at West Water, despite this site having long been covered by experienced observers. However, Clyde birds arrive at the roost using the flightline furthest from the observer, making identification difficult. Nevertheless, this lends weight to the theory that some of the Clyde birds derive from other roosts in the area. The only roost adjacent to the Clyde to have been counted in recent years is Cowgill Reservoir and, while it has recorded several thousand geese, these have all been Pinkfeet. No data are available on where these birds feed, although if they do use the Clyde area, then numbers recorded feeding there are an even smaller fraction of those known to be in the area. This again suggests that there may be additional roosts in the Clydesdale area. Cobbinshaw birds are reported to use the Clyde area, and this may explain the departure of birds due north from the Clyde, although, with the exception of 2,000 birds recorded on one date in 1991, the numbers roosting at Cobbinshaw have been small in recent years.

The presence of yet undiscovered feeding grounds to the west of the Pentlands, perhaps in the Cobbinshaw vicinity, is suggested by the use of a west or north-west flightline from West Water, although it is possible that birds change direction once out of sight, or perhaps use adjacent moorland areas. However, there were no records of birds feeding here in 1991 and no regular feeding sites are known in this area (R.W.J. Smith and R.D. Murray pers. comm.).

5.2 The effects of disturbance

5.2.1 Shooting

Goose shoots occur regularly at both Gladhouse and West Water Reservoirs. Shooting practices follow guidelines given by the British Association for Shooting and Conservation (BASC 1988) and have been adopted voluntarily by the Arniston Estate at Gladhouse and the North Slipperfield Estate at West Water.

Data for shoots from the last decade are patchy and details of the exact dates, the number of visits to the reservoir and the number of guns involved are imprecise or missing for some shoots. The numbers of geese shot also differ according to the source of information. However, the large number of geese shot in 1984/85 would indicate that a greater intensity of shooting occurred at the reservoir in this year. It is also the opinion of local ornithologists that shooting intensity was greater in this year. A high level of shooting was again apparent in 1985. The numbers of birds using Gladhouse declined markedly in these two years and have not recovered since. It thus seems highly probable that the sudden decline of birds at the site was due to disturbance from shooting in 1984 and again in 1985.

Shooting at Gladhouse has occurred in previous or subsequent years with similar or even larger bags than in 1984-85, although, because bag size may vary according to weather, shooting prowess *etc.*, the number of geese shot may not accurately reflect the intensity of shooting. Shooting in the mid 1970s was also reported to occur on a regular basis, perhaps involving several guns up to three times a week (C. Lindsay, pers. comm.). However, in 1984, four shoots occurred in the space of approximately one week (R.W.J. Smith, pers. comm.) and it is believed this high level of disturbance caused the loss of the roost. There are no records of other site characteristics or factors operating at the roost having changed sufficiently to be responsible for this decline.

The practice of dusk shoots at Gladhouse may increase the effective level of disturbance. Incoming geese may leave the site to return later while a shoot is taking place and may thus be subjected to repeated disturbance. Disturbance may thus cause a protracted arrival of birds, which may thus also prolong the period of shooting. Also, geese already present or which do remain at the site will be subjected to continued disturbance. Geese were often recorded arriving at Gladhouse in the dark. Since these geese will have fed close by, this indicates a reluctance to use the roost at dusk.

Shooting on the edge of a waterbody may increase the disturbance effect. The intensive shooting at Hoselaw in the late 1980s occurred close to edge of the loch itself. There was then a rapid decline in the number of Pinkfeet using Hoselaw and numbers remained low for several years even after the cessation of shooting, although Greylag numbers recovered more quickly. Counts of Pinkfeet at Hoselaw in 1990 and 1991 suggest that the roost may recover, although it may be some years before it regains its former status.

There is considerable evidence that shooting and other disturbance causes shifts in the distribution of wildfowl and the abandonment of some sites (Bell & Owen 1990). The number of waterfowl using three similar lakes in Germany was inversely related to the proportion of the area that was shot over. Numbers of Mallard *Anas platyrhynchos* and Tufted Duck *Aythya fuligula* increased on a Ramsar site in West Germany once shooting ceased, although there was a lag period of several weeks before the increase occurred. Hunting regimes that leave an area undisturbed for several days lessens the impact of disturbance from shooting and also increases the shooting success (Bell & Owen 1990). Geese learn to avoid heavily hunted areas (Ebbinge 1991), and circumstantial evidence suggests that Pinkfeet will not return to a site once it is considered untenable through hunting pressure e.g. the low numbers of Pinkfeet at Hoselaw, in comparison with the apparent recovery of the numbers of Greylag Geese. Roosts appear to show a lag period of several days when numbers of geese at the roost, especially Pinkfeet, are lower directly after a shoot for several days (Newton *et al.* 1973, A.W. Brown and A. Moffat, pers. comm.). However, there also appears to be a lag period spanning several years, once the roost has been completely abandoned due to excessive disturbance, as at Hoselaw and Gladhouse.

Pink-footed Geese are site faithful, shown by the consistent number of birds returning to large roosts over a period of years, and show a degree of fidelity to wintering regions (Boyd 1954). It could thus be expected that once a roost is lost, it may therefore also take some time to recover, even though birds may remain within the region e.g. birds displaced from Hoselaw moved to other sites in the Cheviots and Tweed area. The recovery of numbers of birds using Gladhouse might thus be expected to take many years, regardless of other site factors.

Numbers at Gladhouse after 1984, although much reduced, still averaged around 2,000. This may result from the large size of the reservoir which allows some birds to use the site while avoiding disturbance. Gladhouse may also attract young birds or birds unfamiliar with the site on passage each year simply due to its large size.

The decline at Gladhouse was probably responsible for the increase in numbers at Fala Flow. That birds at Fala remained for longer in the season supports this theory. Geese are not shot at Fala and the low level of other forms of shooting (R. Grigor, pers. comm., Major Dalrymple *in litt.*) are likely to have only a small effect on the geese.

Whilst the reduction in suitable feeding areas in the immediate Fala area may have been partly responsible for the reduction in the numbers of birds in the Gladhouse/Fala pairing generally, shooting on the feeding grounds may have also reduced the attractiveness of the area. Pinkfeet in particular are noted as being very susceptible to disturbance and Madsen (1985) found that during the hunting season, flocks would take to flight when a stimulus was much further away than when shooting had ceased. The numbers of game shoots within the Arniston Estate has varied in the past decade but has not shown an overall increase, and many such shoots will be on lower ground not used by the geese. However, there has been an increase in the number of foreign shooting parties in Britain, organized through tour operators. Such shoots are accommodated on the Arniston Estate where they may undertake walk-ups. Such shoots generally cover the higher, rougher ground (P. de Vink, A. Waites pers. comm.) and would thus cover ground occasionally used by feeding geese. Although this is likely to cover only a small part of the feeding area, the disturbance effect from noise will extend much further. However, data regarding walk-ups is rarely documented, and records of the date, number of guns and area covered by such shoots are not available. Shooting in the Middleton area, another goose feeding area, is also reported to have increased recently (R. Walker pers. comm.), and may include or be specifically for geese. However, again, there are no data to substantiate or quantify this.

The continued rise in importance of West Water suggests that there are no serious detrimental factors operating at the site, although the value of West Water is based largely on the peak count rather than the number of geese which remain after. Shooting data were not made available at the time of writing. However, around five shoots per year have been conducted for the last three years, with bag sizes in the region of 50 birds (G. MacKay pers. comm.). Counts of geese at the site suggest that this is a sustainable regime acceptable to the geese.

That shoots occur at dawn and 1 km from West Water itself, may also be of importance. Birds are thus leaving the source of disturbance and may all depart quickly when shooting begins. Disturbance is thus probably less than at dusk shoots. During one shoot that occurred once it was fairly light, birds left very quickly and high over the guns. Birds returned that evening using the same flightlines and at the same time as the previous night, suggesting little apprehension about returning to the site. However, birds have been noted to return late and very high following a shoot (A.W. Brown, pers. comm.), and numbers have fallen after some shoots (A. Moffat, pers. comm.). While it would be difficult to quantify the effect of shooting on the numbers of birds, it is likely that shooting contributes to the factors causing daily fluctuations at the roost. The low level shooting, both in terms of frequency and number of guns, on adjacent estates of West Water flightlines, combined with the large distance from the roost, is not thought to have any effect on the numbers at the roost.

Shooting in the vicinity of West Water does not appear to be prevalent. The key feeding grounds of West Water birds are not, in the main, on estates which conduct extensive shooting for sport. Indeed, the farms encompassing some of the key areas at West Linton do not allow goose shooting on their land. Goose shooting does occur in the Clyde area, largely to move large flocks of birds from fields. Shooting seemed to occur only a few times a year and suggesting it was successful at least in moving birds from the particular farm. However, there are little data from this area and the lack of knowledge on alternative feeding areas prevents a detailed assessment of the effect of shooting around the Clyde.

The population of Pink-footed Geese at Aberlady Bay suggests that duck shooting at this site does not have a deleterious effect upon numbers. Goose shooting is not permitted and the

large size of the site allows birds to land some distance from the main duck shooting areas. Geese appear to be little concerned by this shooting (P.R. Gordon pers. comm.) and will simply move within the site if too near to the source of disturbance.

5.2.2 Fishing

Fishing does not appear to affect the numbers of geese using major roosts in the area at present as a result of management policies which largely preclude the occurrence of geese and fishing at the same time. Fishing is not permitted at Gladhouse and West Water in the early morning and late evening when birds may be roosting. Also, the fishing season ends early so that daytime fishing does not interfere with loafing birds. This allows the roost to be used as a rest station. Such areas are used as safe resting areas by geese from where birds can commute to feeding areas close by (Newton *et al.* 1973). The use of West Water as a rest station, close to the West Linton feeding area, may be of particular importance in the early part of the season when birds are likely to be wary of other, more open, rest areas.

5.2.3 Military Aircraft

The presence of military aircraft had a marked and immediate effect on feeding geese. However, as with several other temporary disturbance events on feeding grounds, geese often returned to the same area or moved to nearby sites. Despite intense activity in the West Linton area, there appeared to be no effect on numbers of birds at West Water or West Linton, with this area remaining as an important feeding site late into the year. However, in the absence of detailed data for previous years, it is difficult to investigate any long term effects of an increase in this activity in the area. Such effects, however, are thought to be small and are probably of less significance than other factors.

5.2.4 Vehicles

Disturbance due to vehicles appears to affect numbers of birds at a very local scale, and results birds using fields or parts of fields away from roads (Keller 1991, Madsen 1985). However, there is little traffic on many of the small roads in the area and it is not thought that this form of disturbance is at a sufficiently high level to affect the number of birds in the area as a whole or at certain sites.

5.3 Other site factors

5.3.1 Water levels

Geese roosting at West Water and Fala Flow were observed to land on the waterbody itself, but usually moved quickly to the side to haul out on the banks of the site and nearby moorland. Observations of birds before departing the roost at dawn counts also revealed the majority of birds to be either on the reservoir banks or on the water close to the banks.

Birds arriving at Gladhouse in 1991 generally landed near the middle or far side of the reservoir from the usual observation point, but the large size of the site and the fact that birds

often arrived late at night meant that it was difficult to determine their subsequent movements. However, there were no large areas of exposed bank onto which geese haul out.

Water levels at Gladhouse have been much lower in the past, leaving large banks of exposed mud (R.W.J. Smith, D. Kirk, pers. comm.), and these were used by guns when shooting geese. In October and November 1982, water levels were 3-15 feet below top level, and would have exposed large areas of mud. In 1983, the level remained 3-4 feet down from October to December. In 1984, levels in November were only two feet below top level, having risen sharply from eight feet below top level, and may have aggravated the effect of disturbance to geese from shooting. Water was drawn down by four feet in October and November of 1986 and 1990 but levels in 1985, 1987 and 1988 were maintained at around top level in autumn and winter. It is likely that the loss of exposed areas for geese to haul out upon, especially when combined with other factors, may cause the site to be less attractive to birds. Water levels may also be partly responsible for preventing the recovery of the roost.

5.3.2 Vegetation around roosts

Pink-footed Geese favour large open sites, both for feeding (Madsen 1985), and for roosting (Newton *et al* 1973). Tall vegetation provides cover for terrestrial predators and the geese are consequently wary of such features. The presence of cover or tall vegetation close to the edge of a roost may be a limiting factor upon the use of the site, especially if there is only a narrow margin upon which birds can haul out. Although Pinkfeet will use wooded sites *e.g.* Dupplin Loch, this is normally only if the site lacks any disturbance (Newton *et al.* 1973). The combination of the belt of trees around Gladhouse, planted in 1964, may be a contributory factor preventing the re-establishment of a roost at Gladhouse, particularly when combined with only a small area on which to haul out. Although these features are not new to the site, site fidelity exhibited by the large numbers of birds using the site prior to 1984 may have been sufficient to overcome these marginal factors. However, since the loss of the site as a roost, these factors will have worsened slightly and may no longer be tolerated by "new" birds.

6 Recommendations

6.1 Site management

6.1.1 Shooting practices

The present shooting regimes at West Water and Gladhouse do not appear to have a detrimental effect upon their value as goose roosts. However, it is important that the guidelines in use are adhered to. Most important are the current practice of shooting only once every two weeks, that prevents a high frequency of disturbance, and the absence of shoots prior to 15 October, that is likely to be important for the site to become established each year by the first arrivals. The early peak count at West Water is of international significance, and it is important that this is feature is not unnecessarily disturbed.

The possibility of conducting shoots at dawn, as opposed to dusk, should be investigated for Gladhouse. The possibility of locating guns further from the edge of Gladhouse Reservoir itself should also be investigated, although the topography at this site may only allow limited opportunity for shooting positions. The timing of shoots and the position of the guns is instrumental in limiting the effect of disturbance during a shoot.

The details of all roost shoots should be fully documented and supplied, on request, to Scottish Natural Heritage, LRC and relevant management committees. The practice of providing provisional shoot dates should be continued. The current reporting practice at the end of the season is only casual (none was made available in time for inclusion in this report). Data should be supplied as a brief written report, detailing the date, time, and if possible, duration of shoot. The number of guns and number of geese shot should also be recorded, and if possible, aged. Any rings or markings should be notified to the WWT. Such data should be made available for all shoots, whether conducted as part of a shoot organized by the estate or as walk-ups by a tour operator. The dates of walk-up shoots on estates should also be available, and ideally, some mention should be made of the area covered to allow investigation of the impact upon feeding areas. The national and international designations highlight the importance of these sites and is imperative that operations having possible impact upon the sites' wildlife are fully documented. The conditions pertaining to shooting and bag sizes should be monitored and changed if necessary in response to changes in the number of birds using the sites and other factors (Owen 1991).

The possibility of coordinating shooting activity on adjacent estates should also be investigated so that not all areas were shot over at the same time. This would allow safe areas within the area that could be used by the geese and reduce the chance of abandonment of the area due to excessive disturbance.

6.1.2 Fishing

Fishing practices should avoid conflict with geese at important roost sites. Generally, cessation of fishing between one hour before sunset until one hour after sunrise should afford geese a sufficient period for roosting without disturbance. However, several sites are also used by significant numbers of birds for loafing during the day, and, especially at comparatively small sites, fishing will prevent this activity. At such sites, it is recommended that the fishing season should be restricted. The exact date at which to end fishing will

depend upon the particular time of arrival of significant numbers of birds. At West Water it is recommended that fishing should cease on 15 September. In view of the low numbers of birds using Gladhouse, especially as a daytime site, and its large size, it is not recommended that the current practice of fishing until the end of September need be changed. However, changes in site use and also the trend for Pink-footed Geese to arrive in Britain earlier in recent years demand that this situation should be open to review on a regular basis.

The same practice should apply to the start of the fishing season, but more data on goose numbers for this period are needed before precise recommendations can be made.

6.1.3 Habitat management

The water supply function of reservoirs will dictate to a large extent the water levels at the site. However, when possible, water levels should be drawn down to expose areas onto which roosting geese can haul out. This is important at less remote sites where surrounding vegetation or the proximity of roads or other sources of disturbance prevent the use of the banks of the waterbody as a roosting area.

The open nature and all round visibility of a site is an important factor in determining its value as a roost for Pink-footed Geese. Tall vegetation, allowing cover for predators, should be avoided close to areas used by geese for roosting. The possibility of having an area at Gladhouse in which bankside vegetation could be kept short, ideally close to an area of bank that is frequently exposed, should be investigated. Trees or tall vegetation should not be planted close to the roosts at Fala and West Water, although, in view of their being situated in or close to grouse moors, this is unlikely to occur.

6.1.4 Water sports and other disturbance

Recreation such as windsurfing, boating *etc.* will have a similar effect to that of angling. It is thus recommended that, should any such activities occur at goose roosts, they be restricted according to the same guidelines used for fishing.

Sources of disturbance should be kept to a minimum near roost sites at night *e.g.* lights should not be situated near waterbodies. Keeping of estates, moors and waterbodies for predators such as Mink *Mustela vison* will also reduce the level of disturbance to the roost.

The promotion of roost sites more widely than at present may not be in the best interests of the geese. The presence of birdwatchers *etc.* could be as damaging to the sites as the presence of any other site users if there is not careful consideration for the use of the site by geese, although this will vary with the size of the site, access *etc.* Careful planning is necessary before the promotion of, especially of small sites, is made wider than at present. Access to such sites would need to be carefully managed, and an increase in the number of visitors at roost times may only be tolerated by the use of a hide or screens.

6.1.5 Site warden

A site warden could greatly benefit many of the sites, as employed at several of the Pentland reservoirs. A warden could promote education and perhaps conduct guided parties to sensitive sites. Also, simply by being present in the area, a warden could provide some degree of policing to deter abuse of the sites. A warden could also facilitate liaison between interested parties and would be able to monitor closely the situation at sites and identify problems as they arose.

6.1.6 Management plans and site designation

In an area with an important complex of roosts such as the Lothians and Borders Regions, it is important that a number of sites are undisturbed at any one time to allow escape from disturbed sites. As many sites qualify for designation under national and international agreements, they should be designated as soon as possible. Management plans for all important sites should be set up and monitored to ensure the control of disturbing activities at the sites.

6.2 Liaison

Although many of the key roost sites in the area are afforded protection under a variety of conventions, legislation and management by conservation bodies, many of the measures in force are through voluntary agreement with the estate owners and site users. Such goodwill may only be relied upon if contact and understanding are maintained by all parties which contribute to management plans and policies for the sites.

However, the present situation may thus be only temporarily fortuitous for geese. In addition to the voluntary agreements at West Water and Gladhouse, the owners of key feeding sites at West Linton and Fala Flow are favourably disposed towards geese. The fortunes of geese in the area thus rely to a large extent upon the goodwill of individuals. There is no guarantee that future land owners would continue the current practices. The continued survival of a healthy regional goose population will thus rely heavily upon the work of bodies such as Scottish Natural Heritage. The loss of key areas may result in the spread of birds to areas where they are not tolerated which may induce bad feeling or conflict within the community.

There is also a need for wider liaison and education. There has been a degree of friction in the past between local ornithologists, waterkeepers, the estates and shooting tenants at a number of sites in the region. Contact between these parties should be encouraged, as well as a degree of open-mindedness on all sides. Estates will be reluctant to publish shooting statistics if they feel this will be used against them by local experts, let alone a less knowledgeable general public or media who tend to draw only the simplest conclusions. However, the lack of such data and apparent secrecy on the part of the estates only promotes a feeling of mistrust among the conservation minded in the community. This is obviously not just a local problem, but the existence of several local conservation and management groups could provide the necessary forum in which to address this problem.

6.3 Further Study

The brief and limited nature of this study permitted an analysis of only certain aspects of goose numbers and distribution in the area and several questions remain only partly answered. Recommendations for further study are made below.

Synchronized roost counts should be conducted on consecutive days for a period of time to determine interchange between roosts, requiring a large team of counters. Counts should also be conducted at both dusk and dawn to allow comparison of counts. Ideally, counters with radios should also be positioned along flightlines to accurately determine feeding and roost site linkage and to identify further possible feeding grounds. The timing of such work should also take into account the differential use of the area by a large number of passage birds in September and early October and the more resident population which remains into November. Fieldwork should begin in the last ten days of September.

Several observations pointed to the existence of feeding grounds in areas not covered by this project. Feeding areas north of Fala Flow, in the Clydesdale District and on the west of the Pentlands need to be explored to determine the feeding range of the Fala/Gladhouse and West Water birds. This would require a team of counters, each familiar with a particular area, and would allow large scale synchronized counts. Again, consideration should be made for the timing of the study in relation to the passage and resident populations of geese.

Radio-tracking of individuals would be of enormous help in identifying feeding sites, the interchange of birds between roost sites and turnover and, indeed, may be the only way of answering many of the related questions with a high degree of confidence.

The presence of large numbers of geese in spring is of much concern to the local farming community although there are little data on roost and feeding site use at this time. A study during spring would also allow an examination of the distribution of birds and the variation in numbers at individual roosts in the absence of hunting pressure.

7 Acknowledgements

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Instructions use this form to record counts of geese at roost sites.

Please use one form per roost count. Record the name and grid reference of the site, your name and the start and end times of the count. Record the weather and any factors affecting the accuracy of the count due to visibility e.g. mist. Please also record light conditions i.e. whether there is a full moon or not and the extent of cloud cover. Continue on this side of the form if necessary.

For each count of birds, tick one of the columns A, D, F or C depending on the activity of geese at the roost:

A: birds Arriving at the roost

D: birds Departing the roost

F: birds Flying over the roost

C: birds appearing to intend to land e.g. Circling, but not doing so.

On the accompanying map, please draw the route of the main flightlines used by geese and number these. Use these numbers in the column 'Flightline' to record the direction of arriving/departing geese.

If the count is done at dusk, please record the number of birds already present at the site on your arrival alongside 'birds present'. If the count is done at dawn, please record the number of birds remaining at the site when you leave at the bottom of the form.

Recording the numbers of geese can be done in a several ways, varying in detail:

1. Record the total numbers of birds that arrived/departed/flew over etc. for each flightline.
2. Record goose movements as totals at regular time intervals e.g. give totals for every half hour for each activity on each flightline. Record the time periods e.g. 6.00 - 6.30 in the 'Time' column.
3. Record the arrival/departure etc. of every group of birds throughout the count, giving time, numbers, and flightline for each group. Where birds arrive/leave en masse preventing all details being recorded accurately, record the total, write 'en masse' in the 'Notes' column and give as many details as possible. Give the time period over which the activity occurred in the 'Time' column.

An example sheet is enclosed illustrating the various methods of recording numbers.

Use the notes column to record any additional information e.g. the direction of departure of birds flying over the site if not using a flightline. Record any disturbance activity and its affect on the geese e.g. a shot causing birds to leave the roost. If possible, note whether the disturbance is directed at the birds or not e.g. is shooting pheasant or goose shooting. Note an event even if it does not affect the geese. Please also record any ongoing activities e.g. presence of fishermen. Continue on this side of the form or on a separate piece of paper if necessary.

*** MANY THANKS FOR YOUR HELP ***

Should you have any queries, please contact

Peter Cranswick, WWT, East Park Farm, Caerlaverock, Dumfrieshire DG1 4RS. Tel. (038 777) 200

Instructions use this form to record observations of geese away from dawn or dusk roost counts

Please record the following details in the relevant columns overleaf: the date and time of your observation; the name of the area (or nearest town) in which the geese are located; the 1 km square grid reference (e.g. NT 12 34) that the geese are using; the total number of geese in the area; the field type that the geese are using. Please record field type using one of the following codes: RP - Rough Pasture; IP - Improved Pasture; ST - Stubble; PL - Ploughed; PO - Potatoes; or state the nature of the habitat if different. If the flock is spread between more than one field type, record the number of birds in each habitat in the column 'number of birds'. In 'Activity' record whether the birds are feeding or loafing, giving the percentage involved in each e.g. F - 75%, L - 25%.

If birds depart the area please note the number in 'number of birds' and record a 'D' in 'Movements'. Note the direction that they leave in and if possible, give a presumed destination for these birds in 'Notes'. Record any birds arriving at the area during your observation with an 'A' in 'movements' column, giving the direction that they arrived from in 'Notes'. Record any birds that simply fly over the area during the observation by recording 'FO' in the 'Movements' column. Please note the time of these individual events in the 'Time' column.

Please record in the 'Notes' column if the birds move within the area i.e. to different fields, noting if there is a significant change in the number of birds in different habitats or not. If movements or arrivals mean that a large number of geese are located in a different 1 km square to the original position, please record the new square in that column.

If the movement is a result of disturbance, please note any details in the notes column and, if possible, whether the action was directed at the geese or not e.g. shooting may be to move the geese from fields or pheasant shooting. Please also record potential disturbance even if it does not affect the geese e.g. distant shots, presence of farmers etc. Please continue any notes on this side of the form or additional sheets if necessary.

Please give brief weather details and any additional information you feel relevant on this side of the form. Please separate observations in different areas by drawing a horizontal line across the form.

An example sheet illustrating observations of feeding geese is enclosed.

*** THANK YOU FOR YOUR HELP ***

Should you have any queries, please contact
Peter Cranswick, WWT, East Park Farm, Caerlaverock, Dumfriesshire DG1 4RS. Tel. (038 777) 200

Appendix 3. Roost counts of Pink-footed PG and Greylag GJ Geese at principal sites in the Lothians and the Borders Regions, and additional sites adjacent to the River Clyde in Lanarkshire, Strathclyde, for the period autumn 1978 to autumn 1991 inclusive. Spring counts are not included. Some data have been extracted from local bird reports and in some instances may only give the count for one species at a roost, in which case n.c. denotes no count for the other species. Some counts are simply given as monthly maxima, in which case a date has been assigned to the count by the author, and the count marked with an asterisk (*). An asterisk followed by a species code indicates that only for that species has an assumed date been used.

Date	Total	PG	GJ	Date	Total	PG	GJ
Baddinsgill							
21.10.78	2	2	0	11.10.86	0	0	0
4.11.78	500	500	0	8.11.86	44	0	44
13.10.79	250	250	0	17.10.87	0	0	0
10.11.79	9820	9820	0	14.11.87	0	0	0
11.10.80	3	3	0	18.11.89	0	0	0
8.11.80	0	0	0				
Cobbinshaw							
21.10.78	0	0	0	14.11.87	136	135	1
4.11.78	22	0	22	15.10.88	100	100	0
11.10.80	34	0	34	13.11.88	0	0	0
8.11.80	185	185	0	21.10.89	0	0	0
24.10.81	85	n.c.	85	19.11.89	1000	1000	0
16.10.82	245	245	n.c.	30.09.90	0	0	0
29.10.83	200	0	200	7.10.90	0	0	0
12.11.83	3430	2000	1430	14.10.90	1300	1300	0
20.10.84	400	340	60	21.10.90	3000	3000	0
17.11.84	790	490	300	11.11.90	50	50	0
12.10.85	1	0	1	29.09.91	65	65	0
16.11.85	0	0	0	6.10.91	37	37	0
11.10.86	0	0	0	13.10.91	2000	2000	0
8.11.86	0	0	0	20.10.91	650	650	0
17.10.87	310	310	0	10.11.91	650	650	0
Crosswood							
4.11.78	0	0	0	12.10.85	130	0	130
13.10.79	0	0	0	11.10.86	0	0	0
10.11.79	10	10	0	1.11.86	1000	1000	0
11.10.80	0	0	0	8.11.86	0	0	0
8.11.80	0	0	0	17.10.87	0	0	0
7.11.81	160	n.c.	160				

Date	Total	PG	GJ
Harperrig			
4.11.78	500	0	500
11.10.80	120	0	120
8.11.80	270	0	270
29.10.81	2000	n.c.	2000
7.11.81	1950	0	1950
16.10.82	180	0	180
6.11.82	1000	0	1000
13.11.82	675	0	675
12.12.82	450	0	450
13.12.82	2000	0	2000
18.12.82	1500	0	1500
21.10.83	1000	n.c.	1000
29.10.83	360	n.c.	360
4.11.83	1500	n.c.	1500
14.11.83	1350	n.c.	1350
20.11.83	600	n.c.	600
20.10.84	800	0	800
17.11.84	580	0	580
12.10.85	84	0	84
19.10.85	300	0	300 *
14.11.85	960	0	960
16.11.85	612	12	600
21.11.85	1200	0	1200 *

Threipmuir

4.11.78	0	0	0
11.10.80	0	0	0
8.11.80	11	0	11
20.10.83	60	n.c.	60
13.11.83	300	n.c.	300
26.11.83	175	n.c.	175
20.10.84	188	0	188
17.11.84	150	0	150
12.10.85	8	0	8
19.10.85	50	n.c.	50 *
16.11.85	73	0	73
23.11.85	170	n.c.	170 *
7.12.85	550	n.c.	550 *
11.10.86	21	0	21
8.11.86	75	0	75
17.11.86	280	0	280
24.11.86	500	n.c.	500 *
7.12.85	80	n.c.	80 *
28.09.87	55	0	55
5.10.87	31	0	31
12.10.87	259	0	259
17.10.87	180	0	180
19.10.87	409	0	409

Date	Total	PG	GJ
12.85	1220	0	1220 *
11.10.86	80	0	80
8.11.86	300	0	300
15.11.86	880	20	860
16.11.86	1160	20	1140
17.10.87	95	0	95
14.11.87	700	0	700
16.10.88	42	0	42
22.10.88	220	0	220 *
12.11.88	0	0	0
19.11.88	350	0	350 *
21.10.89	170	0	170
15.11.89	1635	0	1635
18.11.89	800	0	800
29.09.90	0	0	0
7.10.90	500	500	0
21.10.90	1250	1000	250
11.11.90	500	0	500
30.10.91	293	0	293
3.11.91	296	0	296
9.11.91	1066	0	1066
17.11.91	652	2	650
14.12.91	65	65	0

26.10.87	645	0	645
9.11.87	448	0	448
14.11.87	271	1	270
16.11.87	220	0	220
15.10.88	200	0	200
22.10.88	680	0	680 *
30.10.88	700	0	700
13.11.88	170	0	170
19.11.88	361	0	361 *
12.12.88	550	0	550 *
21.10.89	210	0	210
15.11.89	280	0	280
18.11.89	393	0	393
26.11.89	544	0	544
29.09.90	0	0	0
7.10.90	60	0	60
21.10.90	0	0	0
11.11.90	450	0	450
5.10.91	54	0	54
30.10.91	256	0	256
13.11.91	350	0	350
17.11.91	560	0	560

Date	Total	PG	GJ
West Water			
21.10.78	4200	4200	0
1.11.78	5600	5600	0
4.11.78	6500	6500	0
30.09.79	5000	5000	0
13.10.79	4300	4300	0
28.10.79	7250	7250	0
10.11.79	0	0	0
13.09.80	48	48	0
5.10.80	100	n.c.	100
11.10.80	4395	4395	0
9.11.80	7000	7000	0
30.11.80	15600	15600	100
6.12.80	18000	18000	0
22.09.81	300	300	0
14.10.81	4420	4420	0
25.10.81	10070	10070	0
8.11.81	12340	12340	0
15.11.81	12740	12740	0
29.11.81	5960	5960	0
13.09.82	26	26	0
17.09.82	250	250	0
18.09.82	724	724	0
21.09.82	1500	1500	0
26.09.82	3750	3750	0
30.09.82	5015	5015	0
2.10.82	6500	6500	0
3.10.82	6870	6870	0
10.10.82	8970	8970	0
12.10.82	7000	7000	0
16.10.82	10680	10680	0
24.10.82	8135	8135	0
31.10.82	4775	4775	0
7.11.82	10000	10000	0
13.11.82	9240	9240	0
21.11.82	6450	6450	0
28.11.82	210	210	0
17.12.82	600	600	0
21.09.83	80	80	0
22.09.83	400	400	0
25.09.83	1000	1000	0
28.09.83	4000	4000	0
1.10.83	3500	3500	0
2.10.83	4124	4110	0
7.10.83	5000	5000	0
9.10.83	5500	5500	0
15.10.83	10000	10000	0
16.10.83	19200	19200	0
22.10.83	8400	8400	0
29.10.83	9400	9400	0

Date	Total	PG	GJ
1.11.83	10000	10000	0
5.11.83	0	0	0
12.11.83	3600	3600	0
13.11.83	5895	5870	25
11.12.83	650	650	0
11.09.84	22	22	0
29.09.84	6640	6640	0
20.10.84	8700	8700	0
17.11.84	6500	6500	0
8.12.84	1030	1030	0
24.09.85	2400	2400	0
6.10.85	10550	10550	0
12.10.85	13880	13780	100
27.10.85	17900	17900	0
2.11.85	14000	14000	0
16.11.85	9342	9340	2
17.11.85	9010	9000	10
24.09.86	7600	7600	0
5.10.86	24110	24110	0
9.10.86	13185	13185	0
11.10.86	24685	24610	75
2.11.86	14675	14675	0
8.11.86	13810	13800	10
16.11.86	16342	16300	42
14.12.86	3410	3410	0
28.12.86	1065	1065	0
27.09.87	15900	15900	0
4.10.87	18320	18320	0
18.10.87	20301	20300	1
25.10.87	17260	17260	0
14.11.87	10524	10430	94
13.12.87	22488	22400	88
27.12.87	13230	13230	0
12.09.88	100	100	0
19.09.88	4530	4530	0
30.09.88	19660	19660	0
8.10.88	40000	40000	0
9.10.88	13650	13650	0
15.10.88	6310	6310	0
30.10.88	5545	5530	15
13.11.88	10892	10880	0
12.12.88	10064	10040	24
21.09.89	30	30	0
24.09.89	640	640	0
30.09.89	29250	29250	0
7.10.89	36250	36250	0
8.10.89	16910	16910	0
21.10.89	23171	23170	1
18.11.89	4150	4150	0

Date	Total	PG	GJ
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West Water *continued*

24.11.89	14520	14520	0
11.09.90	20	20	0
15.09.90	1000	1000	0
23.09.90	20000	20000	0
29.09.90	23500	23500	0
7.10.90	24700	24700	0
13.10.90	20000	20000	0
21.10.90	21311	21300	10
11.11.90	12430	12430	0
15.12.90	8000	8000	0
28.9.91	17906	17906	0
5.10.91	16468	16468	0
6.10.91	24971	24971	0
13.10.91	32636	32636	0

Date	Total	PG	GJ
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20.10.91	8566	8566	0
29.10.91	1920	1920	0
30.10.91	4150	4150	0
3.11.91	2916	2916	0
17.11.91	12446	12446	0
20.11.91	4410	4410	0
21.11.91	1255	1255	0
3.12.91	3750	3750	0
3.12.91	6860	6860	0
4.12.91	4000	4000	0
4.12.91	6250	6248	2
5.12.91	5310	5310	0
15.12.91	10195	10195	0

Fala Flow

17.09.78	10	10	0
23.09.78	15	15	0
30.09.78	413	413	0
7.10.78	10	10	0
14.10.78	10	2	8
21.10.78	0	0	0
28.10.78	0	0	0
4.11.78	0	0	0
11.11.78	0	0	0
18.11.78	184	184	0
25.11.78	900	900	0
2.12.78	0	0	0
9.12.78	0	0	0
16.12.78	60	60	0
23.12.78	34	34	0
15.09.79	0	0	0
22.09.79	1000	1000	0
29.09.79	6000	6000	0
6.10.79	25	25	0
20.10.79	1500	1500	0
28.10.79	0	0	0
3.11.79	56	56	0
10.11.79	0	0	0
17.11.79	2	2	0
1.12.79	230	230	0
8.12.79	34	34	0
15.12.79	150	150	0
22.12.79	1375	1375	0
29.12.79	0	0	0
13.09.80	110	110	0
19.09.80	0	0	0
27.09.80	382	382	0

4.10.80	1250	1250	0
11.10.80	380	380	0
18.10.80	1620	1620	0
25.10.80	1555	1555	0
1.11.80	7	7	0
8.11.80	470	470	0
15.11.80	0	0	0
22.11.80	35	35	0
29.11.80	300	300	0
6.12.80	0	0	0
13.12.80	75	75	0
21.12.80	0	0	0
27.12.80	0	0	0
15.10.81	4000	4000	0
15.10.82	7000	7000	0
14.11.82	1000	1000	0
5.12.82	1774	1774	0
28.12.82	650	650	0
24.09.83	320	320	0
29.10.83	6548	6548	0 *
12.11.83	1700	1700	0
29.09.84	2000	2000	0 *
20.10.84	3240	3240	0 *
25.09.85	4000	4000	0 *
6.10.85	8000	8000	0
7.10.85	4000	4000	0
12.10.85	8350	8350	0
16.11.85	800	800	0
23.09.86	7000	7000	0
1.10.86	1000	1000	0
11.10.86	6505	6500	0
8.11.86	1160	1160	0

Date	Total	PG	GJ
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Fala Flow *continued*

15.11.86	5619	5600	19
4.10.87	11500	11500	0
7.10.87	11200	11200	0
11.10.87	6500	6500	0
13.10.87	6000	6000	0
17.10.87	2812	2812	0
12.11.87	4000	4000	0 *
14.11.87	250	250	0
14.09.88	17	17	0
27.09.88	689	689	0
3.10.88	6000	6000	0
11.10.88	11000	11000	0
16.10.88	2917	2900	0
12.11.88	75	75	0
1.10.89	5100	5100	0
7.10.89	11932	11920	12
23.10.89	7500	7500	0
18.11.89	3900	3900	0

Gladhouse

14.09.78	0	0	0
18.09.78	340	340	0
19.09.78	700	700	0
20.09.78	465	465	0
30.09.78	1100	1100	0
7.10.78	4350	4350	0
20.10.78	9500	9470	30
21.10.78	11250	11250	0
4.11.78	11458	11393	65
12.11.78	2425	2400	25
19.11.78	2500	2500	0
26.11.78	4500	4500	0
10.12.78	5010	5010	0
17.12.78	4500	4500	0
23.09.79	1027	1027	0
28.09.79	6500	6500	0
30.09.79	936	936	0
7.10.79	6148	6148	0
13.10.79	3271	3271	0
28.10.79	6500	6500	0
3.11.79	6500	6500	0
10.11.79	8530	8530	0
18.11.79	324	324	0
25.11.79	6500	6500	0
9.12.79	1746	1746	0
10.12.79	1350	1350	0
16.12.79	0	0	0
22.12.79	5000	5000	0

Date	Total	PG	GJ
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25.09.90	10000	10000	0
29.09.90	9908	9908	0
7.10.90	8490	8490	0
21.10.90	5500	5500	0
23.10.90	5254	5254	0
10.11.90	4124	4124	0
28.9.91	10500	10500	0
1.10.91	3465	3460	0
5.10.91	16410	16410	0
12.10.91	11362	11362	0
17.10.91	1898	1897	0
19.10.91	15680	15650	30
26.10.91	0	0	0
2.11.91	830	830	0
9.11.91	566	566	0
16.11.91	0	0	0
23.11.91	250	250	0
30.11.91	340	340	0

23.12.79	3848	3848	0
30.12.79	2855	2670	185
14.09.80	50	50	0
19.09.80	120	120	0
2.10.80	500	n.c.	500
4.10.80	1200	1200	0
5.10.80	2000	2000	0
11.10.80	3419	3419	0
12.10.80	4347	4340	0
19.10.80	4000	4000	0
26.10.80	4120	4120	0
2.11.80	5150	5150	0
8.11.80	3800	3800	0
9.11.80	5773	5761	12
16.11.80	0	0	0
23.11.80	300	0	300
29.11.80	13500	13500	0
7.12.80	5465	5385	80
14.12.80	1400	1400	0
21.12.80	6395	6345	50
25.09.81	170	170	0
4.10.81	1650	1650	0
18.10.81	9350	9000	350
24.10.81	13000	13000	0
1.11.81	7500	7500	0
7.11.81	3735	3500	235
22.11.81	900	900	0
6.12.81	30	30	0

Date	Total	PG	GJ
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Date	Total	PG	GJ
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Gladhouse *continued*

22.09.82	350	350	0	
26.09.82	370	370	0	
9.10.82	1580	1500	80	
10.10.82	3090	3000	90	
15.10.82	7940	7940	0	
24.10.82	13830	13700	130	
7.11.82	3130	3000	130	
13.11.82	1090	1050	40	
18.09.83	46	46	0	
22.09.83	60	60	0	
27.09.83	750	750	0	
2.10.83	3800	3800	0	
8.10.83	11507	11500	7	
16.10.83	4300	4300	0	
22.10.83	7500	7500	0	
30.10.83	3000	3000	0	
13.11.83	12525	11900	625	
19.11.83	3000	3000	0	
3.12.83	1750	1550	200	
10.12.83	0	0	0	
22.09.84	40	40	0	
25.09.84	1400	1400	0	
6.10.84	5650	5650	0	
21.10.84	7990	7500	490	
27.10.84	3200	3200	0	
4.11.84	900	900	0	
10.11.84	55	55	0	
18.11.84	21	21	0	
23.09.85	280	280	0	
30.09.85	1270	1270	0	
5.10.85	6800	6500	300	*GJ
11.10.85	880	880	0	
12.10.85	1342	1200	142	
20.10.85	650	650	0	
2.11.85	0	0	0	
8.11.85	0	0	0	
16.11.85	3844	3800	44	
23.11.85	813	13	800	*GJ
8.12.85	7550	7000	550	
22.12.85	330	330	0	
14.09.86	40	40	0	
24.09.86	80	80	0	
25.09.86	1200	1200	0	*
3.10.86	500	500	0	
6.10.86	825	825	0	
10.10.86	777	755	0	
11.10.86	698	610	88	
15.10.86	1850	1850	0	
31.10.86	2600	2600	0	

2.11.86	3500	3500	0	
8.11.86	2500	2500	0	
15.11.86	1480	1080	400	
17.11.86	2900	2900	0	
17.12.86	1610	1610	0	
29.09.87	250	250	0	
6.10.87	3700	3700	0	
11.10.87	2805	2700	105	
18.10.87	1100	1100	0	
29.10.87	305	55	250	
14.11.87	1695	1230	465	
15.11.87	4000	4000	0	
27.11.87	2500	2500	0	
9.12.87	1105	900	205	
29.12.87	1350	1350	0	
27.09.88	0	0	0	
11.10.88	1960	1900	60	
15.10.88	3560	3400	160	
25.10.88	2500	2500	0	
12.11.88	36	35	1	
13.11.88	110	100	10	
2.12.88	280	0	280	
30.09.89	320	320	0	
8.10.89	3930	3930	0	
12.10.89	5400	5400	0	
19.10.89	1600	1600	0	
21.10.89	1620	1600	20	
14.11.89	340	75	265	
18.11.89	1810	1550	260	
25.11.89	900	900	0	
26.11.89	3000	3000	0	
8.12.89	1250	900	350	
23.09.90	150	150	0	
27.09.90	2472	2450	22	
29.09.90	3204	3200	4	
6.10.90	2550	2500	50	
13.10.90	2805	2650	155	
20.10.90	3506	2750	750	
21.10.90	2105	1750	310	
31.10.90	1010	760	250	
11.11.90	12	0	12	
13.11.90	0	0	0	
3.12.90	50	50	0	
29.09.91	427	427	0	
5.10.91	95	95	0	
10.10.91	934	839	95	
12.10.91	2700	2700	0	
26.10.91	0	0	0	
2.11.91	1040	1040	0	

Date	Total	PG	GJ
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Gladhouse *continued*

10.11.91	0	0	0
16.11.91	10	0	10
21.11.91	0	0	0
22.11.91	0	0	0

Portmore

21.10.78	0	0	0
4.11.78	0	0	0
13.10.79	750	750	0
10.11.79	420	420	0
11.10.80	0	0	0
8.11.80	230	230	0
29.10.83	125	125	0
12.10.85	30	30	0
16.11.85	1261	1250	11
11.10.86	120	120	0
8.11.86	11	0	11
17.10.87	83	83	0

Rosebery

11.10.85	3000	3000	0
12.10.85	450	450	0
16.11.85	15	0	15
11.10.86	642	625	17
8.11.86	400	400	0
17.10.87	223	220	3
14.11.87	3	3	0
15.10.88	10	10	0

Aberlady

21.10.78	1600	1600	0
4.11.78	5460	5460	0
13.10.79	2300	2300	0
10.11.79	3233	3233	0
29.09.80	213	213	0
11.10.80	750	750	0
29.10.80	7200	7200	0
8.11.80	12000	12000	0
12.11.80	8315	8315	0
17.11.80	7250	7250	0
21.11.80	4000	4000	0
28.11.80	4000	4000	0
29.11.80	4200	4200	0
3.12.80	8320	8320	0
11.12.80	3550	3550	0
26.12.80	650	650	0

Date	Total	PG	GJ
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23.11.91	0	0	0
5.12.91	360	360	0
7.12.91	400	400	0
8.12.91	450	450	0

14.11.87	20	0	20
15.10.88	20	20	0
12.11.88	0	0	0
21.10.89	0	0	0
19.11.89	0	0	0
29.09.90	1	1	0
21.10.90	0	0	0
11.11.90	0	0	0
28.09.91	210	210	0
12.10.91	0	0	0
9.11.91	0	0	0

21.10.89	670	670	0
18.11.89	380	380	0
29.09.90	0	0	0
20.10.90	650	0	650
11.11.90	0	0	0
28.09.91	130	130	0
5.10.91	1000	1000	0
12.10.91	50	50	0

30.09.81	650	650	0
14.10.81	9300	9300	0
1.11.81	4750	4750	0
19.12.81	5150	5150	0
16.09.82	140	140	0
26.09.82	620	620	0
27.09.82	620	620	0
1.10.82	440	440	0
14.10.82	2500	2500	0
29.10.82	1300	1300	0
6.11.82	2080	2080	0
11.11.82	4940	4940	0
15.11.82	5165	5165	0
14.12.82	4500	4500	0
26.12.82	2000	2000	0
20.09.83	40	40	0

Date	Total	PG	GJ
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Date	Total	PG	GJ
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Aberlady Bay continued

24.09.83	120	120	0	19.12.87	8400	8400	0
26.09.83	250	250	0	25.09.88	1300	1300	0
27.09.83	760	760	0	29.09.88	2000	2000	0
28.10.83	5200	5200	0	15.10.88	8400	8400	0
29.10.83	3710	3710	0	24.10.88	11000	11000	0
5.11.83	5000	5000	0	6.11.88	8500	8500	0
28.11.83	4015	4015	0	12.11.88	7300	7300	0
2.12.83	3380	3380	0	18.12.88	5432	5300	132 *GJ
29.09.84	2900	2900	0	30.09.89	1905	1905	0
1.10.84	3000	3000	0	7.10.89	2200	2200	0
11.11.84	4610	4610	0	21.10.89	1920	1920	0
29.12.84	2600	2600	0	19.11.89	5600	5600	0
30.09.85	6500	6500	0	11.12.89	4500	4500	0
1.10.85	7500	7500	0	19.09.90	1200	1200	0
12.10.85	4418	4400	18	29.09.90	2000	2000	0
29.10.85	8350	8350	0	7.10.90	4460	4460	0
16.11.85	10400	10400	0	20.10.90	11000	11000	0
25.11.85	12500	12500	0	21.10.90	17500	17500	0
11.12.85	5000	5000	0	9.11.90	9300	9300	0
15.09.86	400	400	0	11.11.90	16500	16500	0
30.09.86	2000	2000	0	17.12.90	4570	4570	0
9.10.86	2600	2600	0	28.09.91	1662	1662	0
11.10.86	3000	3000	0	5.10.91	8423	8423	10
28.10.86	12500	12500	0	12.10.91	7959	7947	12
3.11.86	5650	5650	0	20.10.91	9995	9995	0
8.11.86	2280	2280	0	27.10.91	7135	7135	0
16.11.86	5400	5400	0	2.11.91	9640	9640	0
14.12.86	4750	4750	0	10.11.91	7690	7690	0
30.09.87	2700	2700	0	17.11.91	6630	6630	0
17.10.87	8000	8000	0	24.11.91	4105	4105	0
30.10.87	15100	15100	0	8.12.91	2130	2130	0
12.11.87	12000	12000	0	14.12.91	540	540	0
14.11.87	11000	11000	0				

Tynninghame

4.11.78	0	0	0	16.10.88	0	0	0
11.10.80	374	374	0	13.11.88	0	0	0
8.11.80	0	0	0	21.10.89	0	0	0
31.12.81	2000	n.c.	2000	18.11.89	17	0	17
20.10.84	60	0	60	30.09.90	76	74	2
17.11.84	21	0	21	7.10.90	0	0	0
12.10.85	0	0	0	21.10.90	30	30	0
9.11.85	400	400	0 *	27.10.90	400	400	0
16.11.85	0	0	0	11.11.90	0	0	0
11.10.86	27	27	0	19.09.91	1	1	0
8.11.86	0	0	0	26.09.91	5	0	5
17.10.87	5	0	5	28.09.91	0	0	0
15.11.87	13	13	0	5.10.91	11	11	0

Date	Total	PG	GJ
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Tynninghame continued

7.10.91	1	1	0
13.10.91	7	0	7
16.10.91	3	0	3
29.10.91	28	0	28

Dowlaw

8.11.80	32	0	32
28.10.81	350	n.c.	350
7.11.81	570	n.c.	570
12.11.81	700	n.c.	700
21.10.82	66	0	66
13.11.82	69	0	69
22.11.82	137	0	137
29.10.83	240	203	37
12.11.83	280	0	280
20.10.84	135	0	135
17.11.84	825	0	825
16.10.85	240	0	240
23.10.85	426	0	426
1.11.85	190	0	190
17.11.85	2382	0	2382
15.12.85	1837	0	1837

Hopes

21.10.78	0	0	0
4.11.78	85	0	85

Hule Moss

9.10.78	3000	3000	0
15.10.78	3500	3500	0
4.11.78	400	400	0
13.10.79	8000	8000	0
10.11.79	3500	3500	0
25.09.80	700	700	0
11.10.80	3735	3735	0
21.10.80	2100	2100	0
8.11.80	3672	3672	0
5.12.81	2750	2750	0
25.09.82	4500	4500	0
3.10.82	5020	5000	20
13.12.82	1100	1100	0
29.10.83	2816	2800	16
12.11.83	2727	2650	77
15.12.83	2000	1984	16
20.10.84	5580	5500	80
17.11.84	3000	3000	0

Date	Total	PG	GJ
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9.11.91	30	30	0
30.12.91	60	0	60
31.12.91	105	0	105

12.10.86	628	0	628
8.11.86	1247	0	1247
17.10.87	0	0	0
14.11.87	1900	n.c.	1900
13.12.87	0	0	0
2.10.88	162	0	162
9.10.88	250	0	250
22.10.88	1700	0	1700
12.11.88	1390	0	1390
12.12.88	465	0	465
21.10.89	460	0	460
18.11.89	158	0	158
23.09.90	40	40	0
21.10.90	410	0	410
10.11.90	475	0	475
13.10.91	50	0	50

16.11.85	0	0	0
21.10.90	2	0	2

11.09.85	250	250	0
29.09.85	4000	4000	0
12.10.85	4242	4200	42
17.11.85	4450	4400	50
16.09.86	2500	2500	0
27.09.86	6130	6100	30
11.10.86	2740	2730	10
8.11.86	5550	5500	50
26.11.86	3000	3000	0
13.12.86	120	120	0
10.10.87	3246	2980	266
14.11.87	5007	5000	7
12.12.87	2518	2500	18
26.12.87	1475	1475	0
19.09.88	1000	1000	0
14.10.88	6000	6000	0
15.10.88	5120	5100	20
12.11.88	2272	2272	0

Date	Total	PG	GJ
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Hule Moss *continued*

12.12.88	776	776	0
30.09.89	19800	19800	0
7.10.89	25737	25735	2
21.10.89	1755	1755	0
18.11.89	1264	1252	12
23.09.90	9512	9500	12
30.09.90	16787	16755	32
7.10.90	9128	9075	53
14.10.90	8305	8300	5
21.10.90	10045	10030	15
10.11.90	6105	6100	5

Quarryford

8.11.80	30	0	30
16.11.85	0	0	0
15.10.88	0	0	0

Stobshiel Reservoir

15.10.88	35	0	35
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Watch Water

4.11.78	1200	0	1200
11.10.80	803	0	803
8.11.80	1245	0	1245
7.11.81	235	n.c.	235
29.10.83	1745	875	870
12.11.83	905	685	220
20.10.84	579	475	104
17.11.84	108	4	104
12.10.85	545	500	45
17.11.85	450	25	425
11.10.86	1090	814	276
20.10.86	1600	1600	n.c.
8.11.86	136	34	102
17.10.87	62	31	31
29.10.87	150	150	0
13.11.87	4170	4000	170
20.11.87	2000	2000	0

Whiteadder

4.11.78	0	0	0
8.11.80	310	0	310
7.11.81	815	0	815
30.10.83	513	n.c.	513
12.11.83	112	n.c.	112

Date	Total	PG	GJ
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15.09.91	23	23	0
22.09.91	1095	1095	0
29.09.91	18515	18500	15
13.10.91	12000	12000	0
20.10.91	17207	17207	0
26.10.91	11215	11187	28
10.11.91	8840	8840	0
8.12.91	5000	5000	0
22.12.91	2587	2587	0
29.12.91	3865	3865	0

13.11.88	120	120	0
21.10.90	0	0	0

13.11.88	0	0	0
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13.12.87	62	0	62	*
29.09.88	1000	1000	0	
15.10.88	60	60	0	
12.11.88	99	0	99	
12.12.88	300	0	300	
21.10.89	66	0	66	
18.11.89	1	0	1	
30.09.90	301	300	1	
7.10.90	60	60	0	
14.10.90	26	6	20	
21.10.90	0	0	0	
10.11.90	940	800	140	
28.09.91	250	250	0	
29.09.91	4000	4000	0	
14.10.91	480	480	0	
27.10.91	6847	6760	87	
10.11.91	720	430	290	

13.11.83	700	n.c.	700	
20.11.83	500	n.c.	500	
20.10.84	708	0	708	*
17.11.84	202	0	202	*
12.10.85	113	18	95	

Date	Total	PG	GJ
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Whiteadder *continued*

16.11.85	510	0	510
11.10.86	0	0	0
8.11.86	830	0	830
15.11.86	1227	7	1220
17.10.87	325	0	325
14.11.87	30	0	30
15.10.88	210	0	210
12.11.88	810	0	810
19.11.88	1500	0	1500 *

Bemersyde

11.10.86	69	0	69
8.11.86	30	0	30
15.10.88	0	0	0
12.11.88	300	0	300
12.12.88	0	0	0
21.10.89	58	0	58
18.11.89	141	0	141
30.09.90	0	0	0

Cauldshiels

14.11.87	175	0	175
28.11.87	450	50	400
13.12.87	127	0	127 *
21.10.89	0	0	0
18.11.89	0	0	0
23.09.90	0	0	0

Wooden Loch

18.10.87	65	0	65
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Hirsel

17.11.85	2	0	2
8.11.86	200	0	200
11.11.86	424	n.c.	424
7.12.86	800	0	800
17.10.87	155	0	155
11.11.87	2000	0	2000
14.11.87	1000	0	1000
13.12.87	1300	0	1300
15.10.88	0	0	0

Date	Total	PG	GJ
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27.11.88	1600	0	1600
22.10.89	1087	0	1087
18.11.89	1000	0	1000
30.09.90	0	0	0
10.11.90	1150	0	1150
13.10.91	0	0	0
8.11.91	43	0	43
15.12.91	220	0	220

7.10.90	0	0	0
14.10.90	0	0	0
21.10.90	148	0	148
10.11.90	485	0	485
11.10.91	75	0	75
20.10.91	300	0	300
17.11.91	60	0	60

30.09.90	0	0	0
7.10.90	0	0	0
14.10.90	0	0	0
21.10.90	65	0	65
10.11.90	0	0	0

19.11.88	1895	845	1050
12.12.88	400	0	400
21.10.89	75	0	75
18.11.89	600	0	600
21.10.90	350	0	350
10.11.90	1300	200	1100
10.10.91	0	0	0
10.11.91	790	280	510
1.12.91	840	550	290

Date	Total	PG	GJ
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Hoselaw

4.11.78	2700	0	2700
17.11.79	5000	5000	n.c.
24.10.80	5000	0	5000
8.11.80	2690	0	2690
2.12.80	250	250	n.c.
7.11.81	1700	n.c.	1700
5.10.82	1375	1350	25
10.10.82	1250	n.c.	1250
17.10.82	4100	n.c.	4100
23.10.82	5300	3700	1600
7.11.82	1950	1700	250
29.10.83	1400	150	1250
12.11.83	4150	550	3600
20.10.84	7400	4500	2900
17.11.84	1250	0	1250
12.10.85	11350	5000	6350
3.11.85	11500	11500	n.c.
10.11.85	3400	n.c.	3400
17.11.85	4800	2700	2100
3.12.85	14000	12000	2000

Whitton

4.11.78	200	0	200
18.11.79	1030	1030	n.c.
8.11.80	2000	0	2000
7.11.81	2100	n.c.	2100
21.11.81	1210	1210	n.c.
30.11.80	2500	n.c.	2500
26.10.82	3000	3000	n.c.
4.12.82	400	0	400
29.10.83	1240	490	750
12.11.83	1370	1250	120
20.10.84	310	192	118
17.11.84	11	1	10
12.10.85	506	461	45

Yetholm

7.11.81	145	n.c.	145
13.11.82	3000	3000	n.c.
12.11.83	27	0	27
20.10.84	0	0	0
17.11.84	0	0	0
12.10.85	140	0	140

Date	Total	PG	GJ
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25.09.86	2000	2000	0
4.10.86	7500	6500	1000
11.10.86	5300	2300	3000
9.11.86	7390	3330	4060
17.10.87	35	0	35
14.11.87	26	0	26
13.12.87	970	750	220
16.10.88	1770	270	1500
12.11.88	3960	360	3600
21.10.89	325	0	325
18.11.89	181	5	176
30.09.90	112	2	110
7.10.90	1420	150	1270
14.10.90	1293	1280	13
21.10.90	506	36	470
10.11.90	350	0	350
12.10.91	500	350	150
20.10.91	3906	2706	1200
27.10.91	560	320	240
10.11.91	2640	1435	1205

16.11.85	6000	6000	0
11.10.86	6500	6500	0
11.11.86	1200	810	390
17.10.87	380	0	380
14.11.87	260	0	260
15.10.88	31	26	5
12.11.88	344	216	128
21.10.89	0	0	0
7.10.90	2505	2500	5
14.10.90	1450	780	670
10.11.90	530	0	530
13.10.91	0	0	0
10.11.91	22	0	22

17.11.85	8	8	0
18.10.87	380	0	380
13.10.91	34	34	0
14.11.91	330	0	330
15.12.91	188	0	188

Date	Total	PG	GJ
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Cowgill Reservoir

4.11.78	900	900	0
13.10.79	950	950	0
10.11.79	600	600	0

Culter

21.10.78	1400	1400	0
4.11.78	400	400	0

Loch Lyoch

21.10.78	0	0	0
4.11.78	1120	1120	0

Springfield Reservoir

21.10.78	20	20	0
11.10.80	32	32	0

Date	Total	PG	GJ
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12.10.80	330	330	0
8.11.80	300	300	0

10.11.79	800	800	0
8.11.80	80	80	0

11.10.80	472	472	0
10.11.80	31	31	0

8.11.80	106	106	0
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Date	Time	Grid	Location	ST	fd	IP	fd	RP	fd	ML	fd	PO	fd	WC	fd	Total	GJ
7.12.80		NT4163	Whitburgh	150												150	
13.12.80		NT4161	Saughland	1200												1200	
21.12.80		NT3356	Esperston	1000	1000											1000	
26.12.80		NT3356	Esperston	400												400	
27.12.80		NT3356	Esperston	2000												2000	
27.9.86		NT3960	Tynehead	3600	2000											3600	
27.9.86		NT4060	Blackcastle				0	200								200	
4.10.86		NT2953	Gladhouse Restr.							46	0					46	46
4.10.86		NT3961	Harle Rigging	250	250											250	
4.10.86		NT4058	Cakemuir	1400	1400											1400	
4.10.86		NT4257	Fala Moor			1020	1020									1020	20
4.10.86		NT4358	Fala Moor							265	100					265	
9.10.86		NT1751	Sunnyside	2000	2000											2000	
11.10.86		NT1854	Auchencorth					400	200							400	
12.10.86		NT4358	Fala Moor							2000	0					2000	
17.10.86		NT2657	Mount Lothian	600	600											600	
19.10.86		NT2657	Mount Lothian	2000	2000											2000	
20.10.86		NT1653	Whitfield	1900	1900											1900	
23.10.86		NT1752	Whitfield	2300	0											2300	
24.10.86		NT1750	Noble House	100	0											100	
24.10.86		NT2557	Howgate	250	250											250	
1.11.86		NT2953	Gladhouse Restr.							720	0					720	120
1.11.86		NT3556	Sowburnrig	1100	1100											1100	
1.11.86		NT3656	Whitelaw	412	200											412	12
2.11.86		NT3157	Yorkston	1100	1100											1100	
2.11.86		NT1751	Sunnyside			1000	1000									1000	
6.11.86		NT2953	Gladhouse Restr.	300	300											300	300
6.11.86		NT3155	Howburn	3000	3000											3000	
7.11.86		NT2358	Howgate	400	400											400	400
7.11.86		NT2558	Howgate	26	10											26	26
8.11.86		NT2358	Howgate	60	60											60	60
9.11.86		NT2358	Howgate	220	220											220	220

Date	Time	Grid	Location	ST	fd	IP	fd	RP	fd	ML	fd	PO	fd	WC	fd	Total	GJ
15.11.86		NT2358	Howgate	90	90											90	90
15.11.86		NT2953	Gladhouse Restr.							180	0					180	180
15.11.86		NT3556	Sowburnrig					500	250							500	500
16.11.86		NT1751	Sunnyside			30	30									30	30
16.11.86		NT2358	Howgate	56	56											56	56
22.11.86		NT2956	Fountaininside	70	70											70	70
30.11.86		NT1551	West Linton			520	250									520	520
6.12.86		NT2558	Howgate	45	45											45	45
6.12.86		NT3556	Sowburnrig	25	25											25	25
6.12.86		NT3756	Middleton Moor	3250	3250			30	0							3280	30
6.12.86		NT3859	Halfway Kiln	5250	5250											5250	5250
9.12.86		NT2953	Gladhouse Restr.			100	100									100	100
14.12.86		NT1651	West Linton			650	650									650	650
14.12.86		NT1653	Whitfield			200	200									200	200
18.12.86		NT3858	Middleton Mains	330	200											330	330
18.12.86		NT3859	Halfway Kiln	55	55											55	55
17.9.91	1930	NT3556	Sowburnrig	18	18											18	18
18.9.91		NT3756	Middleton Moor	120												120	120
19.9.91	1030	NT3756	Middleton Moor	120												120	120
19.9.91	1200	NT1551	West Linton			1950										1950	1950
19.9.91	1730	NT3556	Sowburnrig	66												66	66
20.9.91	820	NT3756	Middleton Moor	140												140	140
22.9.91		NT3957	Cowbraehill			22										22	22
23.9.91		NT3756	Middleton Moor	230												230	230
25.9.91	1030	NT3756	Middleton Moor	450												450	450
25.9.91	1430	NT3756	Middleton Moor	541												541	541
25.9.91	1815	NT3756	Middleton Moor	741												741	741
27.9.91	845	NT3756	Middleton Moor	950												950	950
28.9.91	1500	NT3756	Middleton Moor	240												240	240
28.9.91	1700	NT0747	Dunsyre			320	0									320	320
28.9.91	1730	NT1750	Noble House	5200	5200											5200	5200
29.9.91	830	NT3756	Middleton Moor	920												920	920

Date	Time	Grid	Location	ST	fd	IP	fd	RP	fd	ML	fd	PO	fd	WC	fd	Total	GJ
6.12.91	800	NT0743	Howburn			1030	1030									1030	
6.12.91	855	NT1348	Hyndfordwell			350	350									350	
6.12.91	905	NT1653	Whitfield			550	550									550	
6.12.91	910	NT1753	Upper Whitfield			1650	1650									1650	
10.12.91		NT6280	Tynninghame Links	16	16											16	16
11.12.91	1430	NT3455	Sowburnrig					1100	1000							1100	
12.12.91		NT3657	Middleton			420										420	
13.12.91	1115	NT3657	Middleton			1100										1100	
14.12.91	1030	NT3657	Middleton			800										800	
21.12.91		NT6278	Tynefield										3			3	3
31.12.91	1500	NT0961	Harperrig Resr.			35	0									35	
6.01.92		NT6078	Preston											49		49	49
7.01.92		NT5580	Brownrigg											540		540	
7.01.92		NT6078	Preston											114		114	114
18.01.92	1500	NT1764	Threipmuir Resr.			292										292	287
28.01.92	1530	NT1764	Threipmuir Resr.			472	472									472	450
13.02.92	1300	NT1363	Buteland			1600	1600									1600	1200
16.02.92	1400	NT1363	Buteland			1600	1600									1600	1200
17.02.92	1600	NT1563	East Rigg			1600	1600									1600	1200

Appendix 5. Flightlines at roosts. The number of birds arriving at (A) or leaving (D) the roost is given for each flightline, indicated by its compass bearing. The total number of birds arriving or leaving is given in bold type-face at the end of the row. The number of birds already present at a dusk count or remaining at a dawn count is given in normal type face and the total number of birds using the roost, calculated from the total arrivals and departures and the number of birds already present or remaining is given in bold type-face in a shaded cell.

Gladhouse Reservoir

Date		N	NNE	NE	ENE	E	SW	W	NW	Totals	
29 Sep	A			1445						1455	0
	D			280			748			1028	427
5 Oct	A			100			17			117	0
	D			17			5			22	95
10 Oct	A	14			432	393			70	909	25
	D									0	934
12 Oct	A		250		2550					2800	0
	D				60					60	2740
26 Oct	A			50						50	0
	D						50			50	0
2 Nov	A								1040	1040	0
	D									0	1040
16 Nov	A	10						60		70	0
	D					60				60	10
5 Dec	A			400						400	0
	D			40						40	360
7 Dec	A			400						400	0
	D									0	400
8 Dec	A	450								450	0
	D									0	450

West Water Reservoir

Date		ENE	ESE	SSW	W	Totals	
6 Oct	A		269	140	99	508	8600
	D	460	3899	10375	2145	16879	24971
13 Oct	A	2454	15767	10315	900	29436	0
	D					0	32636
20 Oct	A					0	1850
	D	1645	1926	925	2220	6716	8566
29 Oct	A	520		1200	200	1920	0
	D					0	1920
30 Oct	A	650		3500		4150	0
	D					0	4150
3 Nov	A					0	1550
	D	1036			330	1366	2916
17 Nov	A					0	0
	D	1845	3077	1910	5614	12446	12446
20 Nov	A					0	0
	D	3250		1160		4410	4410
21 Nov	A	80		700	475	1255	0
	D					0	1255
3 Dec	A					0	0
	D	2860		890		3750	3750
3 Dec	A	5810		1050		6860	0
	D					0	6860
4 Dec	A					0	0
	D	2000	2000			4000	4000
4 Dec	A	3500	1400	1350		6250	0
	D					0	6250
5 Dec	A					0	0
	D	2025	3110	175		5310	5310
15 Dec	A					0	0
	D		3470	3925	2800	10195	10195

Aberlady Bay

Date		N	NE	ENE	E	ESE	SE	S	WSW	NW	Totals	
28 Sep	A				1362						1362	0
	D										0	1362
5 Oct	A	25			7		4008	2869	8		6917	1620
	D				62			25			87	8450
12 Oct	A	29			1960		2465				4454	3600
	D				72						72	7982
20 Oct	A									70	70	1600
	D		1240		900		6325				8465	9995
27 Oct	A										0	1040
	D						690	5405			6095	7135
2 Nov	A				3690		2220	730			6640	3000
	D										0	9640
10 Nov	A										0	0
	D					7690					7690	7690
17 Nov	A										0	500
	D		70			6023	37				6130	6630
24 Nov	A										0	0
	D			10		3330		705			4105	4105
8 Dec	A										0	0
	D						840	1290			2130	2130
14 Dec	A						330	460			790	0
	D						250				250	540

Appendix 6. Observations of flying birds. For each group of lying birds, the date and time (given as B.S.T. before 28 October 1991) are given. The grid reference and site name are that of the flock's position when first observed. The direction of flight from this position is given under Dir. All counts are for Pink-footed Geese. The number of Greylags, where this species comprised some or all of the count, is given under GJ.

Date	Time	Grid	Location	Count	GJ	Dir
20.09.80		NT3456	Sowburnrig	35		SW
22.09.80		NT3860	Halfflaw Kiln	100		NE
24.09.80		NT3860	Halfflaw Kiln	220		NE
25.09.80		NT3456	Sowburnrig	900		NE
27.09.80		NT3758	Middleton	600		NE
27.09.80		NT4158	Cakemuir	500		NW
7.10.80		NT3958	Tynehead	300		SW
11.10.80		NT3856	Falahill	300		WSW
25.11.80	730	NT3659	Borthwick	500		NE
26.11.80		NT4060	Blackcastle	2500		SW
7.12.80		NT4058	Cakemuir	200		NE
12.12.80		NT2860	Shewington	3000		SW
21.12.80		NT3861	Crichton Castle	2000		SW
26.12.80		NT3860	Halfflaw Kiln	370		W
26.12.80		NT3959	Tynehead	400		WSW
4.10.86		NT4056	Nettlingflat	110		SW
19.09.91	1215	NT1551	West Linton	125		W
19.09.91	1230	NT1551	West Linton	500		W
22.09.91	1150	NT2975	North-east Edinburgh	50		S
25.09.91	1330	NT3757	Middleton Moor	24		W
25.09.91	1530	NT3757	Middleton Moor	70		W
25.09.91	1600	NT3757	Middleton Moor	170		SW
25.09.91	1700	NT3757	Middleton Moor	80		SW
25.09.91	1715	NT3757	Middleton Moor	120		SW
25.09.91	1730	NT3757	Middleton Moor	140		SW
25.09.91	1800	NT3757	Middleton Moor	36		SW
25.09.91	1830	NT3757	Middleton Moor	30		SW
27.09.91	910	NT4175	Seton	100		N
28.09.91	1500	NT3757	Middleton Moor	24		E
28.09.91	1730	NT3757	Middleton Moor	90		E
29.09.91	1400	NT3756	Middleton Moor	280		NE
29.09.91	1415	NT3556	Sowburnrig	33		NE
1.10.91	930	NT1448	Hamilton Hall	2000		S
2.10.91	945	NT1955	Auchencorth	70		SW
2.10.91	955	NT1449	White Moss	100		E
2.10.91	955	NT1550	Bog's Bank	750		W
2.10.91	1030	NT3756	Middleton Moor	100		E
2.10.91	1445	NT4258	Fala Flow	750		SW
2.10.91	1545	NT3456	Sowburnrig	25		W
2.10.91	1615	NT3658	Middleton	400		WSW
2.10.91	1625	NT3757	Middleton Moor	350		W
3.10.91	1710	NT4359	Fala Moor	1500		NE
5.10.91	910	NT4175	Seton	100		N
6.10.91	825	NT4064	Whitburgh	50		Y
20.10.91		NT6379	Tynninghame	484	79	SW
22.10.91	1345	NT3861	Crichton Castle	65		WNW
22.10.91	1355	NT4061	Harle Rigging	40		ENE
22.10.91	1358	NT3861	Crichton Castle	60		WNW
22.10.91	1625	NT4059	Blackcastle	400		ENE

Date	Time	Grid	Location	Count	GJ	Dir
22.10.91	1630	NT4057	Cowbraehill	150		WSW
22.10.91	1630	NT4059	Blackcastle	145		ENE
23.10.91	1100	NT3962	Crichton	90		W
23.10.91	1100	NT4058	Cakemuir	290		SW
23.10.91	1135	NT3858	Middleton Mains	23		W
23.10.91	1145	NT4059	Blackcastle	110		WSW
23.10.91	1300	NT4158	Cakemuir	200		E
23.10.91	1500	NT2856	Toxside	150		NW
23.10.91	1745	NT0346	South Medwin	15		ENE
23.10.91	1810	NT0545	Walston	4		NE
23.10.91	1810	NT0545	Walston	4		SSW
29.10.91	1000	NT4175	Seton	80		S
29.10.91	1620	NS9443	Westraw Mains	11		E
30.10.91		NT6379	Tynninghame	20	20	NE
30.10.91	1240	NT3658	Middleton	190		WSW
30.10.91	1335	NT1451	West Linton	300		W
30.10.91	1545	NS9443	Westraw Mains	205	25	E
30.10.91	1555	NS9444	Carstairs Mains	200		NE
2.11.91	1300	NT3657	Middleton	65		W
5.11.91		NT6079	Lawhead	7		E
14.11.91	830	NT3658	Middleton	7		NW
14.11.91	900	NT3657	Middleton	70		N
15.11.91	1130	NT3460	Bells Mains	70		N
15.11.91	1545	NT3654	Whitelaw Cleugh	10		W
16.11.91	840	NT2353	Easter Deans	20		E
16.11.91	1015	NT0142	Whitecastle	55		S
16.11.91	1325	NS9141	Hyndford Bridge	12		E
16.11.91	1505	NS9740	Hillhead	110		S
17.11.91	1230	NS9840	Hillhead	52		S
17.11.91	1235	NS9940	Quothquan Mill	120		NNE
17.11.91	1345	NT0836	Biggar Water	665		NW
17.11.91	1500	NT3957	Cowbraehill	34		ENE
17.11.91	1540	NS9642	Swaites	200		NE
17.11.91	1540	NS9642	Swaites	1000		NNW
19.11.91	1000	NT2755	Mount Lothian	45		SW
19.11.91	1525	NT3658	Middleton	45		W
20.11.91		NT6379	Tynninghame	37		E
20.11.91	1000	NT1551	West Linton	200		S
20.11.91	1320	NS9838	Thankerton	7		E
21.11.91	1050	NT0041	Arthurshields	14	14	N
22.11.91	1410	NT4064	Whitburgh	50		SW
27.11.91	820	NT4054	Hangingshaw Hill	9		SE
2.12.91		NT3657	Middleton	40		SE
3.12.91		NT2758	Cauldhall Moor	30		S
3.12.91	800	NT2051	Ruddenleys	50		NNE
3.12.91	820	NT2051	Ruddenleys	50		NE
3.12.91	835	NT2051	Ruddenleys	300		E
3.12.91	1115	NT4158	Cakemuir	60		W
3.12.91	1125	NT4058	Cakemuir	35		SW
4.12.91	845	NT1753	Upper Whitfield	200		SW
5.12.91	1005	NT1551	West Linton	1450		NE
5.12.91	1130	NT1551	West Linton	250		SW
5.12.91	1140	NT1551	West Linton	120		SW
5.12.91	1140	NT1752	Whitfield	100		
6.12.91	800	NT0743	Howburn	60		E
15.12.91	1030	NT3657	Middleton	100		W