



NATIONAL WATERFOWL COUNTS

SURVEY OF INTRODUCED GEESE IN BRITAIN, SUMMER 1991: PROVISIONAL RESULTS

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The Joint Nature Conservation Committee
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SUMMARY

During June and July 1991, volunteer counters recorded nearly 61,000 introduced Canada Geese and 19,000 re-introduced Greylags in Britain. The total for Canada Geese was much as expected, but that for Greylags was lower than predicted. Totals of 907 Egyptian Geese and 819 Barnacle Geese, along with smaller numbers of 11 other introduced or escaped species, were recorded. No fewer than 18 types of hybrid between these species were found, mostly in very small numbers, but there were 261 Canada x Greylag Geese. These totals are provisional because they do not include data from all regions. The count of Canada Geese is more than three times higher than that obtained by the last survey in 1976 and the population appears to be increasing most rapidly in London and the lower Thames catchment.

INTRODUCTION

The Canada Goose *Branta canadensis* and the Greylag Goose *Anser anser* have large introduced populations in Britain which are increasing rapidly. The number and variety of other introduced species of geese, and of hybrids between them, are also increasing. There is growing pressure to control numbers, particularly of Canada Geese, from farmers whose crops are damaged and from amenity groups whose land is fouled by droppings, and there are indications that birds may cause damage to sites of conservation interest (Owen *et al.* in press).

Although the word "feral" is often used to describe the British populations of the species and hybrids which were the subject of this survey, the word "introduced" is preferred in this report because, strictly speaking, a feral population is one which has arisen from escapes (usually of domesticated species) from captivity, not from deliberate introductions.

The Greylag is Britain's only native nesting goose, formerly widespread as far south as the East Anglian Fens, its population has been reduced by persecution and habitat destruction to a remnant of fewer than 3,000 birds in the Outer Hebrides and adjacent coastal areas of Scotland. In the 1930s, in an early effort to re-establish the species, Greylags from the Hebrides were introduced to south-west Scotland and East Anglia. In 1959, transportation of Greylags was resumed with the stated aim of trying "to re-establish the Grey Lag as a wild nesting bird in England" (Harrison 1959). This organised scheme of re-introduction continued until the early 1970s.

Canada Geese were first introduced to Britain in the 17th century and their numbers remained low until the 1950s, when wildfowling, assisted by the then Wildfowl Trust, transported birds far and wide, unwittingly setting up the nuclei for a population explosion. There have been three previous national surveys of Canada Geese: in 1953 (Blurton-Jones 1956), between 1967-69 (Ogilvie 1969), and in 1976 (Ogilvie 1977). There has also been detailed study of local populations, for example in Nottinghamshire (Parkin & McMeeking 1985). In Yorkshire, Thomas (1977) undertook a study of population dynamics and Garnett (1980) documented the spread of the species into remote moorland areas. In the early 1960s, ringing of the moulting flock on the Beaulieu Firth (Inverness-shire) began (Dennis 1964), and a subsequent ringing study (Walker 1970) documented the origins of these birds in Yorkshire. In a brief review of the status of the Canada Goose Owen *et al* (1986) wrote that "only coordinated action can prevent this introduced species from assuming pest proportions". A recent paper (Owen *et al* in press) reviews the problems associated with management of the species in Britain and concludes that "there is no sign that the growth in the Canada Goose population in Britain is slowing down".

Introduced Greylags are less well established in Britain. The best known population is that in southwest Scotland where a study by Young (1972) was followed up by Shimmings *et al* (1989). Owen & Salmon (1988) reviewed the history, status and distribution of feral Greylags in Britain, and Brown & Dick (1992) have provided a comprehensive summary of the situation in Scotland. These two reviews relied on subjective assessments by local experts as well as on winter count data, whereas the 1991 survey was the first national survey of re-introduced Greylags using co-ordinated counts over a short time period.

The National Waterfowl Counts (NWC) indices (e.g. Kirby *et al*. 1991) give a reliable indication of population trends for Canada and Greylag Geese but, being based on counts at a sample of sites, under-estimate both their population totals and their distribution. For this reason, periodic national surveys are desirable. Counts of Greylags for the national scheme are complicated by the fact that there are three populations which must be separated in any analysis: the native birds whose headquarters are the Outer Hebrides, the re-introduced population that was covered by this survey, and the much larger migrant population which winters in Scotland and northern England.

The aims of the 1991 survey were to produce accurate population estimates for all species of introduced goose in Britain, and of hybrids between them, with the estimates being broken down as far as possible into the adult and juvenile components of the population. The survey also aimed to quantify the relative importance of sites for moulting geese, and to collect basic information about habitats at these sites. This report is a summary of count data so far received and describes the status and distribution of each species of introduced goose counted by the survey, and of hybrids between them. Results are briefly compared with earlier surveys, but at the time of writing data are still awaited from four regions and the extent of under-estimation in the others (usually small) has not been assessed. More detailed analyses including work on habitat information are continuing, and the final results of the survey will differ in some regions from the results presented here.

METHODS

Previous surveys of Canada Geese relied on counts made during the moult period (late June to mid-July) sometimes supplemented by National Waterfowl Counts data from the winter months. The principal study of the status and distribution of feral Greylags (Owen & Salmon 1988) relied on National Waterfowl Counts data, with supplementary information from volunteers with detailed knowledge of certain regions. The recent Scottish review (Brown & Dick 1992) was based on assessments by the network of bird recorders maintained by the Scottish Ornithologists' Club.

The methodology for the 1991 survey was decided upon after consultation with a number of Canada Goose enthusiasts in November 1990. Earlier plans for a breeding survey were scrapped at this stage, and it was decided to organise a survey during the moulting period which (a) would provide a comparison with past surveys; (b) would usually allow separate counts of adults and juveniles; (c) would provide an estimate of numbers prior to the shooting season; and (d) is when birds concentrate into relatively few predictable sites and, mostly being flightless, do not move about between sites. This concentration of birds does, however, mean that distribution maps produced by the survey under-estimate breeding and wintering distribution.

A questionnaire was circulated to more than 100 National Waterfowl Count Regional Organisers in December 1990, with notes explaining the survey aims and methods and a request for their participation. The majority agreed to help, and organisers for most regions where this was not possible were soon recruited. To ensure his involvement at every level of the survey, the National Organiser acted as Regional Organiser for Gloucestershire, and covered 50 sites in Gloucestershire, Tayside (Perthshire), and in north-west England.

For the sake of simplicity, the survey was based on sites rather than 100km squares. Regional Organisers were asked to list all the sites in their region where geese were likely to moult, and allocate sites to their counters. Data forms and instructions sheets (4,500 of each) were distributed in May 1991; the survey was carried out between 22 June and 14 July in Wales southern England and the Midlands, and 29 June - 21 July in northern England and Scotland, to allow for the tendency of geese to moult later further north. One data form was completed for each site, on which details of localities, dates and numbers of birds of each age category for each species or hybrid were entered. Counters were also asked to estimate the accuracy of their counts by using one of four codes for each species at each site: "E" for excellent (90% or more of birds counted); "G" for good (75 - 90%); "M" for moderate (50% to 75%); and "P" for poor (<50%). Information was also collected on crèche and brood sizes, and on any ringed, diseased or injured birds present. Basic habitat data, including information on islands and surrounding habitats, were entered on the reverse of the form, along with a sketch map of the site. Examples of the data forms and instructions sent to Regional Organisers are provided in Appendix 1.

There is an increasing tendency for pairs of Canada and Greylag Geese to colonise small, isolated ponds and ditches. If such pairs breed successfully, they moult at the breeding site because of the necessity to guard their flightless young. The survey will have missed some such birds so that the final totals are slight under-estimates. Under-estimation is also caused by the fact that geese are often more wary during their moult than at other times, and may evade detection by hiding on islands or in surrounding vegetation. An element of under-estimation also resulted from problems of access to privately owned sites, or from a few volunteer counters and organisers being overstretched and unable to undertake agreed work. The level of commitment to this survey shown by Regional Organisers and counters was extremely high, especially considering the unpopularity with many birdwatchers of the species involved. Surveys were conducted in July 1992 in two of the regions where coverage was not possible in 1991, leaving six from which data are still lacking, of which five are areas where few geese would be expected.

A preliminary analysis of the Canada Goose population of Britain at a regional level was undertaken by amalgamating the regions shown by Ogilvie (1977) into 13 larger regions each of which falls entirely within the boundaries of a group of counties. There was only one area, south of London, where this convenient comparison was not possible, and sites from north-east Hampshire and northern Surrey were added to the London and home counties region. The total for each group of counties could then be compared with the total for the equivalent amalgamated set of regions identified by Ogilvie (1977).

RESULTS

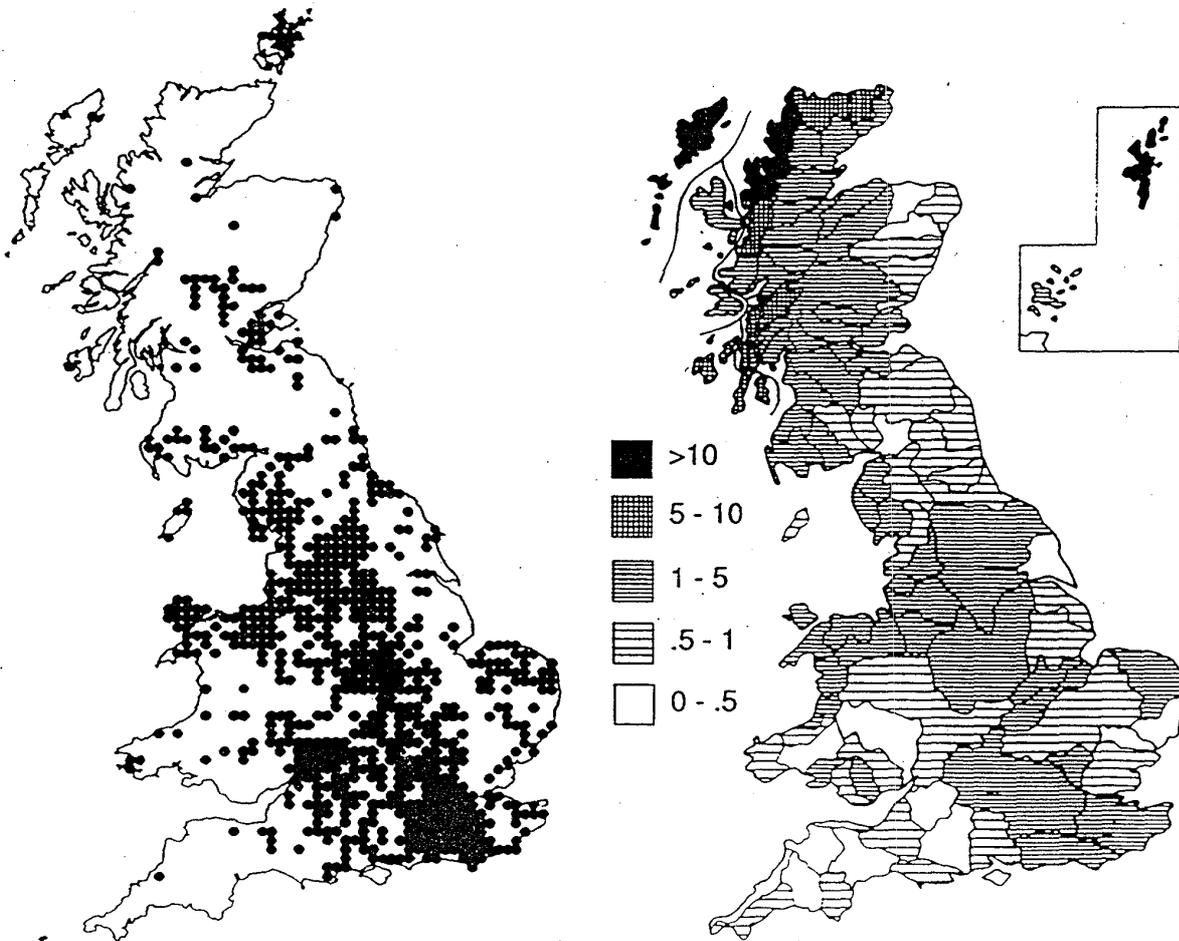
Coverage

A total of 2,100 sites within 761 100km squares was visited during the survey period (Figure 1a). Introduced geese have never been recorded over much of highland Scotland, or elevated areas in central and south Wales and south-west England, and nil returns were received from the following regions: Caithness, Benbecula & the Uists, Skye & Lochalsh, Highland (Moray & Nairn), Tayside (Angus), and Gwent. It was not possible to organise coverage of Central Region, the northern part of Highland Region or of Shetland, mainly because of commitment of the very small number of observers in those regions to other projects. Devon and North Humberside, which were not covered in 1991, were covered a year later (but too late for inclusion in this report). Mid and South Glamorgan were not covered, but are known to hold few, if any introduced geese. Data may yet be forthcoming from the only area not covered that is known to hold large numbers of introduced geese (the Peterborough district of Cambridgeshire) and from the Isle of Wight.

Figure 1a. 10-km squares visited during the survey of introduced geese, June-July 1991.

1. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon.
2. Coverage was not organised in Shetland, Central Region or parts of Highland Region.
3. Nil returns were received from Caithness, Benbecula & the Uists, Skye & Lochalsh, Highland (Moray & Nairn), Tayside (Angus) and Gwent

Figure 1b. The number elf standing waters per 100km² by hydrometric area (reproduced from Smith & Lyle, 1979).



The fact that gaps on the coverage map mostly reflect areas of unsuitable habitat can be seen by comparing the two maps on Figure 1: it is clear that in England and Wales areas with a high density of standing waters received high levels of coverage. The number of nil returns received is another indicator of the quality of coverage. A total of 812 of the sites visited (38%) produced no birds, and 48% of 100km squares shown in Figure 1a represent nil returns.

Abundance and distribution of introduced geese

The number and diversity of species of introduced geese, and of hybrids between them, were remarkable, and are summarised in Table 1. The analysis that follows deals with each species in turn, and with hybrids and domestics in separate sections.

Canada Goose

Altogether 60,834 Canada Geese were counted at 1,104 sites (just over half those visited) in 547 100km squares (72% of those visited). This indicates a mean population density during the moult of 55 birds per site, or 111 per occupied 100km square. Figure 2 illustrates their distribution and indicates relative abundance at each site. The species was most common in Hampshire, Sussex and Kent and north through England to Cumbria, with the highest densities occurring in the lower catchment of the Thames. Very high densities were also found in the Midlands, North-west England (including West Yorkshire) and East Anglia.

Table 2 lists the 50 most important sites for Canada Geese. These were widely distributed through the areas of high density, with one notable outlier, at Chew Valley Lake in Avon, and another in Scotland on the Beaulieu Firth. More than two thirds of these sites are reservoirs, gravel pits, city parks and other man-made sites. These 50 sites, representing just 4.5% of sites holding the species, held 34% of the national population of Canada Geese. Low counts occurred far more frequently, however: 633 sites (57% of those holding the species) held fewer than 25 birds, and 357 (32%) held ten or less. Figure 3 summarises the frequency distribution of flock size among Canada Geese at all sites not appearing in Table 2. It is clear that the majority of sites hold small numbers of birds.

Table 3 shows the 1991 counts of Canada Geese broken down by age and region. A total of 55,107 birds (91% of those recorded) was aged and, of these, 23% were juveniles. The variation in the proportion of juveniles counted in each area was highly significant ($\chi^2=11742.7$, d.f.=12, $P\ll 0.001$). Much of this was attributable to the high proportion of juveniles in East Anglia (37%), which itself was strongly influenced by just three sites in Suffolk with extremely high numbers of juveniles: Lackford Wildfowl Reserve, nearby Livermere, and Micklemere (see Table 2) ..

Of the remaining 12 areas, nine had between 18% and 26% of the aged population comprising juveniles, and the remaining three, with 10-15%, were in the northern and south-western extremities of the species' range and held low numbers of birds overall.

The majority of broods had amalgamated to form crèches by the time of the survey, and only 31 % of juveniles were recorded in discernable broods. Figure 4 shows the frequency distribution of brood size among Canada Geese (and also among Greylags) in summer 1991. A total of 3,913 birds was separated into 968 broods, and mean brood size was 4.04 (s.e. 0.65). The distribution was very similar to that of the Greylag Goose (mean 3.99, s.e. 0.68). There was no significant difference between brood sizes of Canada Geese in different regions (ANOVA, $F=0.193$, 12 d.f.).

Table 1. The number of each age category of each species or hybrid counted during the survey of introduced geese, June-July 1991

Species or hybrid	Adult	Juvenile	Unaged	Total
Canada	42,547	12,560	5,727	60,834
Greylag	11,610	5,098	2,206	18,914
<i>Egyptian</i>	661	196	50	907
Barnacle	685	88	46	819
Snow (both races)	119	8	14	140
Pink-footed	82	7	12	101
Bar-headed	66	9	8	83
White-fronted (both races)	13	3	31	47
Bean	2	0	30	32
lesser White-fronted	14	0	15	29
Emperor	14	0	7	21
Brent	6	0	1	7
Swan	4	0	1	.5
Red-breasted	2	0	0	2
Ross's	2	0	0	2
Total	55,827	17,969	8,148	81,944
Canada x Greylag	207	46	8	261
Canada x Barnacle	10	2	0	12
Canada x Greylag x Chinese	0	5	0	5
Canada x Snow	4	0	0	4
Canada x White-fronted	2	0	0	2
Canada x Swan	1	0	0	1
Greylag x unknown	9	1	0	10
Greylag x White-fronted	4	4	0	8
Greylag x Bar-headed	2	0	2	4
Greylag x Snow	5	0,	0	5
Greylag x Barnacle	0	2	0	2
Greylag x Swan	0	0	2	2
Greylag x Chinese	1	0	0	1
Unidentified hybrid	3	0	0	3
lesser White-fronted x White-	2	0	0	2
Barnacle x unknown	1	0	0	1
Blue Snow x Barnacle	1	0	0	1
Snow x Barnacle	1	0	0	1
Snow x unknown	1	0	0	1
Total hybrids	254	60	12	326
Domestic	107	10	14	131
White domestic	99	20	6	125
Greylag x domestic	31	16	28	75
Greylag x Embden	33	11	0	44
Embden	32	4	0	36
Chinese	17	0	0	17
Canada x domestic	8	8	0	16
Total domestics	327	69	48	444
Overall Total	56,408	18,09	8,208	82,714

Figure 2. The distribution and abundance of the Canada Goose in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

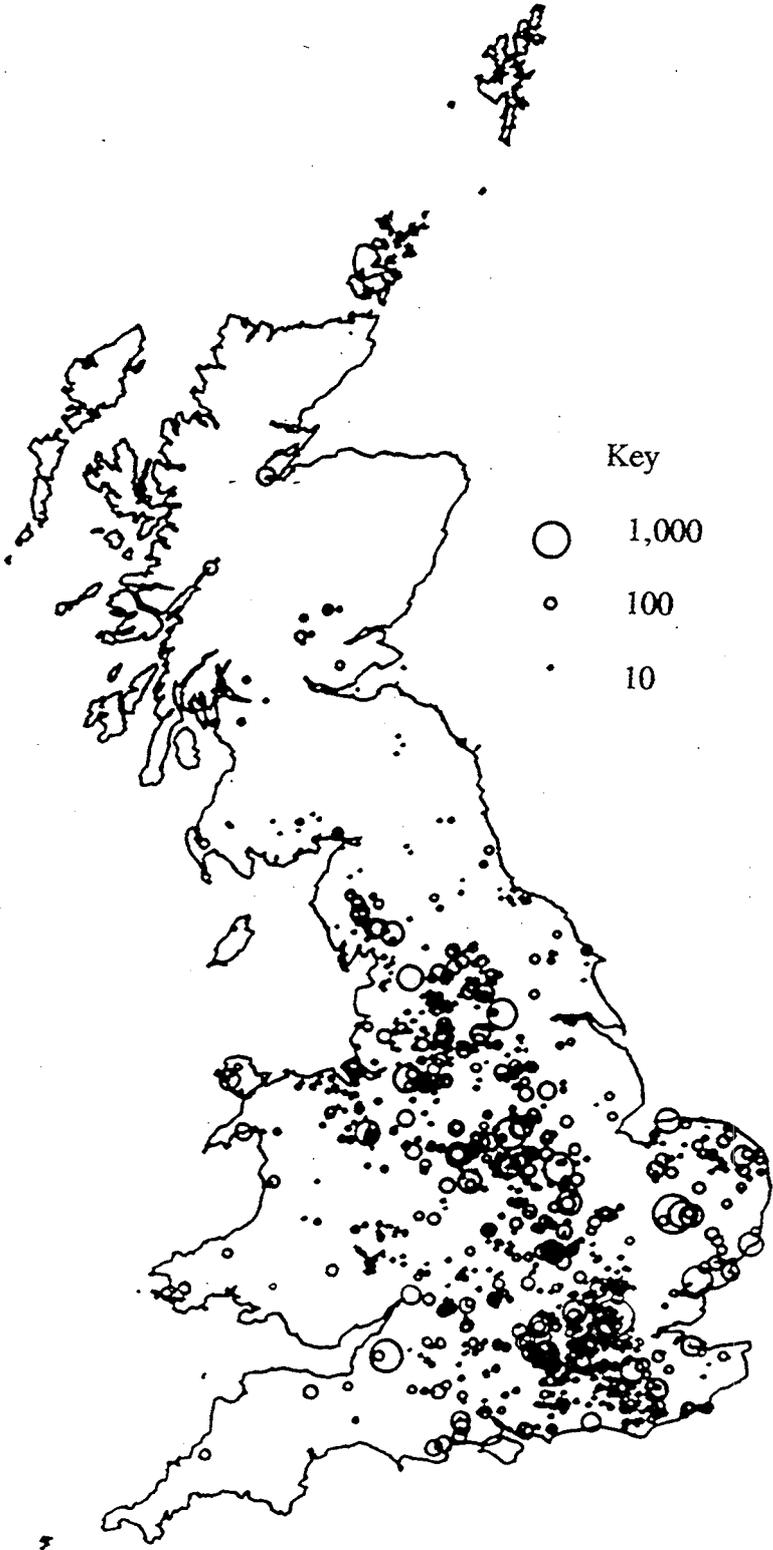


Table 2. Counts of Canada Geese at the 50 most important sites for the species, 22 June _ 21 July 1991 .

County	Site name	Adults	Juveniles	Not aged	Total
Suffolk	Lackford Wildfowl Reserve	480	705	0	1185
London '(Essex)	Wafthamstow Reservoir	1080	77	0	1157
Avon	Chew Valley Lake	699	89	0	788
Nottinghamshire	Attenborough Reservoir & Gravel Pits	614	138	0	752
Leicestershire	Rutland Wat!3r	710	30	0	740
West/North Yorkshire	Fairburn Ings	633	65	0	698
Essex	Abberton Reservoir	641	24	0	665
Cheshire	Talley Mere	470	119	0	589
Suffolk	Livermere	120	455	0	575
Northamptonshire	Thrapston Gravel Pits	377	114	0	491
Lancashire	Stocks Reservoir	431	54	0	485
Shropshire	Ellesmere	441	23	0	464
Hertfordshire	Stockers Lake	370	90	0	460
Suffolk	Boyton Marsh & Havergate Island	271	186	0	457
Norfolk	Titchwell	441	12	0	453
Hampshire/Berkshire	Yateley Gravel Pits	268	180	0	448
Staffordshire	Kings Bromley	340	97	0	437
Warwickshire	Kingsbury Water Park	400	10	0	410
Kent	Bough Beech Reservoir	396	10	0	406
Cumbria	Killington Reservoir	379	25	0	404
Hampshire/Berkshire	Eversley Gravel Pits	304	99	0	403
Berkshire/Bucks	River Thames Hurfey to Marfow	317	84	0	401
Berkshire/Bucks	River Thames Henley to Hurfey	270	127	0	397
Sussex	Bewl Water	384	5	0	389
Suffolk	Micklemere	53	325	0	378
Buckinghamshire	Willen Lake	335	27	0	362
Leicester	Groby Pool	353	0	0	353
Berkshire	Dinton Pastures Gravel Pits	349	1	0	350
Norfolk	River Sure system (Broads)	280	69	0	349
Nottinghamshire	Colwick Country Park	295	51	0	346
Nottinghamshire	Holme Pierrepont area	271	75	0	346
London	Battersea Park Lake	260	80	0	340
London	Hyde Park, Kensington Gardens	336	0	0	336
Gwynedd (Anglesey)	Llyn Traffwll	314	14	0	328
Gloucestershire	Frampton Pools	250	48	0	298
London	Regents Park	285	0	0	285
Buckinghamshire	Great Linford Gravel Pits	0	0	280	280
North Kent	Elm ley Marshes	170	109	0	279
West Yorkshire	Bretton Lakes	242	30	0	272
Cumbria	Grasmere	100	0	170	270
Lancashire	Castleshaw Reservoir West	135	0	135	270
Merseyside	Knowsley Park	217	47	0	264
Berkshire	Searfs Farm Gravel Pit, Burghfield	243	20	0	263
Hampshire	Stratfield Saye Park	254	9	0	263
West Sussex	Wildfowl & Wetlands Centre, Arundel	186	74	0	260
Derbyshire	Willington Gravel Pit	96	145	18	259
Berkshire	Twyford Gravel Pit	f17	37	0	254
Hampshire	Blashford Lakes	194	59	0	253
Berkshire	Theale area east	153	97	0	250
Inverness/Ross-shire	Beaully Firth	250	0	0	250
Totals		16,674	4,135	603	21,412

Table 3. Canada Goose totals showing the percentage of juveniles in each region.

Region	Adult	Juvenile	Unaged	Total	% juvenile
Cornwall, Devon, Somerset, Avon*	910	120	145	1,175	12%
Dorset, Hampshire*	1,675	443	220	2,338	21%
Sussex, Kent, Surrey	3,874	1,305	209	5,388	25%
Herts, Bucks, Beds, Berks, London, NE Hants, N Surrey	9,868	2,457	1,605	13,930	20%
Oxfordshire, Wilts, Gloucs	2,538	661	113	3,312	21%
Wales	1,043	367	669	2,079	26%
Essex, Suffolk, Norfolk	4,196	2,469	424	7,089	37%
Cambs, Lines, Northants*	2,090	630	239	2,959	23%
Leics, Notts, Derbys	4,478	-1,508	380	6,366	25%
Cheshire, Salop, Hereford, Staffs, Warwicks, W.Midlands, Montgomery	4,508	1,018	238	5,764	18%
Lanes, Yorks, Humberside: Merseyside, Gt Manchester,	5,349	1,290	1,094	7,733	19%
Cumbria, Northumb, Cleveland, Durham, Tyne & Wear,	1,034	188	391	1,613	15%
Scotland	984	104	0	1,088	10%
Totals	42,547	12,560	5,727	60,834	23%

- Regions marked with an asterisk were affected by lack of information from Devon, Isle of Wight, Peterborough District and North Humberside.

Figure 3. Frequency distribution of flock size among Canada Geese in Britain, June-July 1991. Only sites with fewer than 250 birds are shown; for sites with 250 or more, see Table 2.

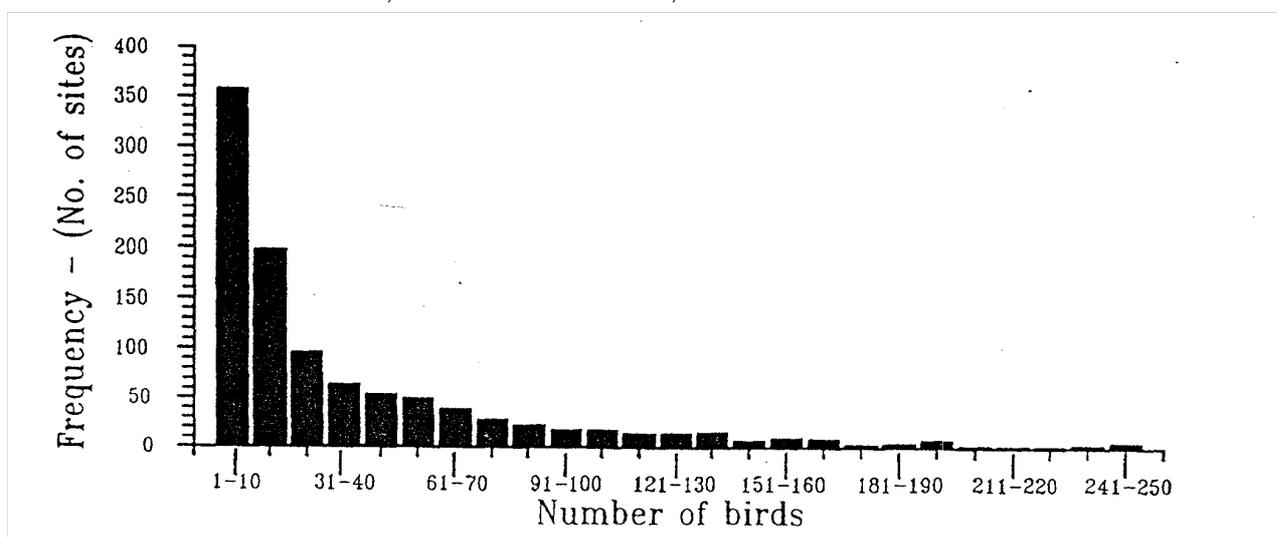
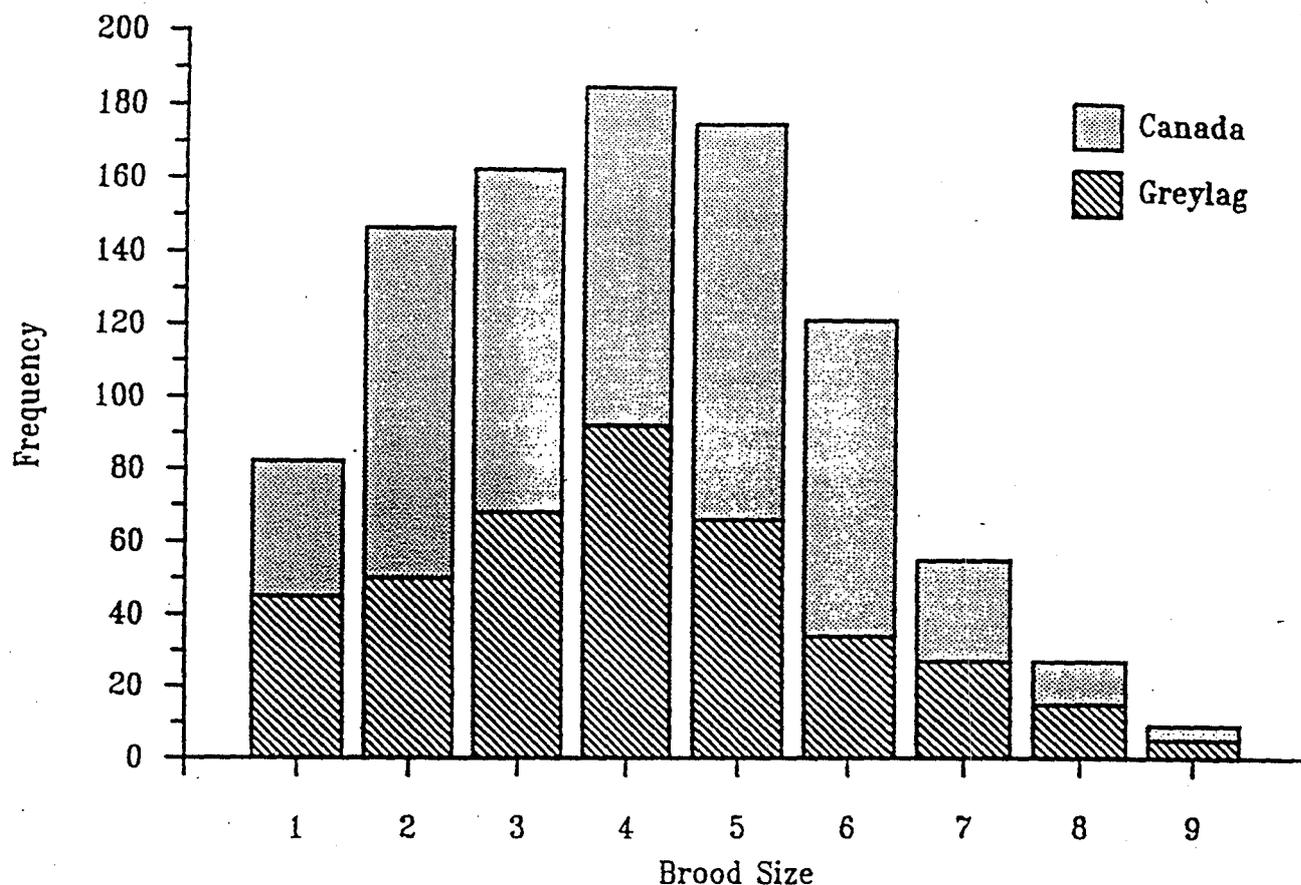


Figure 4. Frequency distribution of brood size among Canada and Greylag Geese, June-July 1991.



Greylag Goose

A total of 18,914 Greylag Geese was found at 435 sites in 309 100km squares. This indicates a population density during moult of 43 birds per site or 61 per occupied 10-km square. Figure 5 illustrates distribution and also relative abundance at each site. Re-introduced Greylags have two distinct centres of population in eastern England, only separated from each other by a narrow, intensively cultivated area of claimed fen land. This is exaggerated on the map by the lack of information from the Peterborough District of Cambridgeshire. In Norfolk there were 5,065 birds (27% of the national total) and in the area within the county boundaries of Buckinghamshire, Northamptonshire, Bedfordshire and Cambridgeshire 3,361 were counted (18% of the national total). Elsewhere there were large numbers in Dumfries and Galloway, Cumbria, Anglesey, parts of Yorkshire, the east Midlands, and in south-east England, especially northern and western Kent. Introduced Greylags have a very scattered distribution over much of Scotland and most of Wales and are virtually absent from south-west England.

Table 4 lists the 50 most important sites for re-introduced Greylag Geese in 1991. These represent 11% of those holding the species, and supported 61% of the national population. They are widely distributed through the areas of high population density described above, and about half consist of reservoirs, gravel pits and other man-made sites. As with Canada Geese, low counts occurred frequently, and 292 sites (67% of those holding the species) held 25 birds or fewer, and 215 (49%) 10 or fewer. Figure 6 summarises the frequency distribution of flock size among Greylag Geese at all sites not appearing in Table 4. The majority of sites clearly only held small numbers of birds.

A total of 88% of Greylags was aged and, of these, 31% (5,098 birds) were juveniles. Altogether, 1,593 juveniles were counted in 399 discernable broods (this was 31% of the juvenile total, the same proportion as for Canada Geese) giving a similar mean brood size and frequency distribution to Canada Geese (Figure 4.).

Figure 5. The distribution and abundance of re-introduced Greylag Geese in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

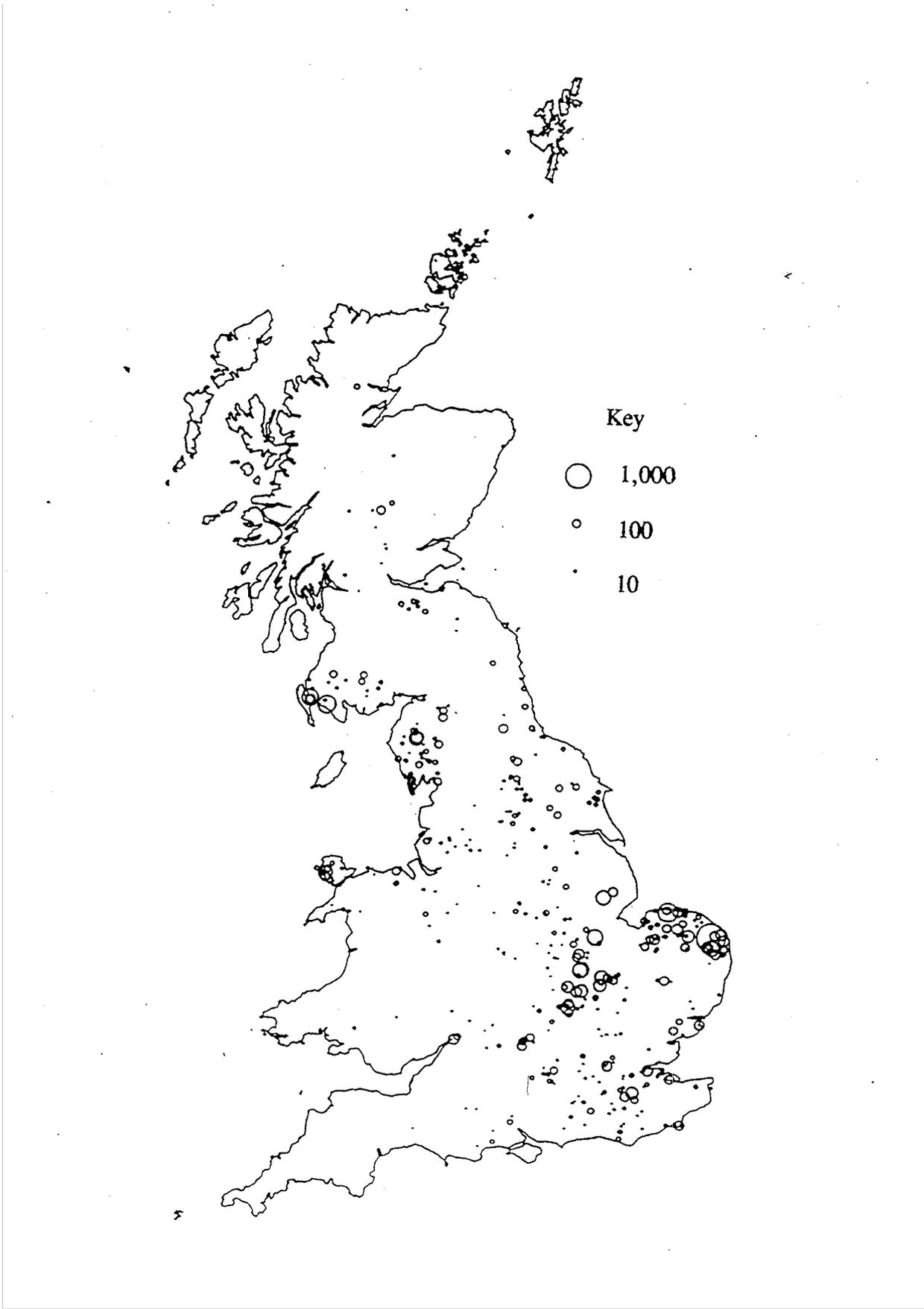
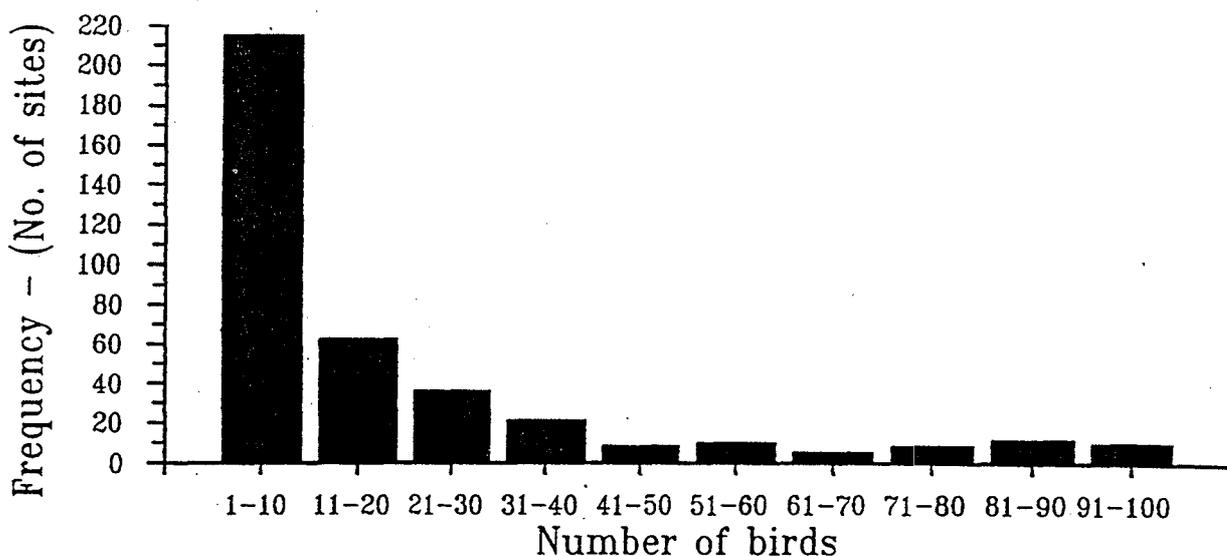


Table 4. Counts of re-introduced Greylag Geese at the most important 50 sites for the population, 22 June - 21 July 1991

County	Site name	Adults	Juveniles	Not aged	Total
Norfolk	River Bure system (Broad)	1,072	325	0	1,397
Norfolk	Holkham Park	382	164	0	546
Dumfries & Galloway	Castle Loch, Kirkcowan	488	22	0	510
Dumfries & Galloway	White Loch	0	5	438	443
Lincolnshire	Baston Common Pits	73	317	0	390
Northamptonshire	Thrapston Gravel Pits	224	159	0	383
Norfolk	mid River Yare, Rockland Broad	227	153	0	380
Lincolnshire	Tattershall Gravel Pits	331	17	0	348
Gwynedd (Anglesey)	Lynn Traffwll	284	23	0	307
Cumbria	Derwent Water	164	137	0	301
Buckinghamshire	Willen Lake	226	74	0	300
Cambridgeshire	Hinchingbrooke Park	0	0	300	300
Bedfordshire	Radwell Gravel Pit	175	82	0	257
Kent	Sevenoaks Wildfowl Reserve	185	56	0	241
Cambridgeshire	Little Paxton Gravel Pits	209	31	0	240
Norfolk	Sparham Lyng Eastburgh	173	66	0	239
Norfolk	Postwick Marsh, River Yare	110	97	0	207
Northamptonshire	Earls Barton Gravel Pits	57	150	0	207
Norfolk	Thune Broad	119	73	0	192
Norfolk	Trinity Broad	154	25	0	179
Bedfordshire	Harold Country Park + Harold Lake	173	0	0	173
Gloucestershire	Slimbridge Wildfowl & Wetlands Centre	100	68	0	168
Norfolk	Sennewe Park	135	32	0	167
Northamptonshire	Blatherwycke Lake	137	29	0	166
North Kent	Cuffe Quarries	165	0	0	165
Norfolk	Narford Lake	140	22	0	162
Norfolk	Stiffkey Marshes	83	76	0	159
London	St James's Park	141	17	0	158
Norfolk	Hardley Flood	119	37	0	156
Essex	Hamford Water	116	38	0	154
Norfolk	River Ant System (Broad)	143	3	0	146
Kent	Bough Beech Reservoir	134	8	0	142
Lincolnshire	Revesby Reservoir	0	0	141	141
Buckinghamshire	Newport Pagnell Gravel Pits	90	47	0	137
Kent	Dengemarsh, Dungeness	45	38	52	135
Dumfries & Galloway	Saileat Loch	0	0	126	126
North Kent	Elmley Marshes	87	34	0	121
Clwyd	West of Pont Canal	0	0	120	120
Durham	McNeil Bottoms	70	50	0	120
Suffolk	Livermere	70	50	0	120
Gwynedd (Anglesey)	Llyn Maelog	57	61	0	118
Hampshire	Beaulieu Estuary	85	28	0	113
Tayside Perthshire	Loch Tummel	109	1	0	110
Cumbria	Abbot Moss	86	20	0	106
Northamptonshire	Deene Lake	48	58	0	106
North Yorkshire	Bolton-on-Swale	62	39	0	101
Norfolk	Coston Trent Lakes	85	15	0	100
Norfolk	Raynham Hall	62	37	0	99
Oxfordshire	Port Meadow	85	15	0	99
Totals		7,424	3,021	1,177	11,622

Figure 6. Frequency distribution of flock size among Greylag Geese in Britain, June-July 1991. Only sites with fewer than 100 birds are shown; for sites with 99 or more, see Table 4.



Egyptian Goose

Altogether, 907 Egyptian Geese were found at 47 sites in 37 100km squares. Figure 7 shows that the majority of birds were in Norfolk, where 826 birds represented 91 % of the national population. A further 20 birds were present in the Waveney Valley (on the border with Suffolk), and 26 birds at five other sites within Suffolk, although none appear to have bred in the county. Elsewhere, 12 birds were found at two sites in Berkshire, nine at Rutland Water (Leicestershire), four at Slimbridge (Gloucestershire), three at Stockley Park (Greater London), two at Fen Drayton Gravel Pits (Cambridgeshire), one in Cleveland, one in Hampshire and one in Somerset. Away from Norfolk, successful breeding only occurred at Rutland Water, where a pair reared seven juveniles, and on the Thames at Lower Basildon in Berkshire, where three juveniles were present with seven adults.

A total of 95% of the population was aged and of these 23% were juveniles, 80% of which were in discernable broods. The mean brood size was 3.9, 157 young being counted in 40 broods.

Barnacle Goose

Altogether, 819 Barnacle Geese were found at 85 sites in 79 100km squares scattered throughout Britain. Figure 8 illustrates their numerical distribution. The county with the highest number (217) was Gloucestershire, where the species was found at six sites, most notably at Slimbridge, where the flock numbered 174 birds. The county with the second highest total was Cumbria, where 124 Barnacle Geese were counted at seven sites, the most important of which were Park Farm (59), and Burlington Fish Farm (58). Hampshire held the third largest county total with 97 birds at seven sites, the principal one being Stratfield Saye (78). Tyne and Wear and West Sussex held the fourth and fifth highest county totals, consisting entirely of birds at the WWT Centres at Washington and Arundel. Elsewhere, the species was found at nine sites in Norfolk, four sites in each of Lancashire and Dumfries and Galloway, three sites in each of West Yorkshire, Lincolnshire and Greater London, two sites in a further 10 counties, and at single sites in 19 counties from Orkney to Avon.

Most Barnacle Geese (94%) were aged and, of these, 11 % were juveniles. If the adult flocks at Slimbridge, Washington and Arundel, which are normally prevented from breeding, are excluded from the totals, the proportion of juveniles rises to 21 %.

Snow Goose

A total of 140 Snow Geese was found at 25 sites in 24 100km squares (Figure 9). The largest flock, of 32 birds, was at Linch Hill Leisure Park (Oxfordshire). The Slimbridge flock of Greater Snow Geese numbered 22 adult birds, and there was a flock of 23 Lesser Snow Geese, including four juveniles, on the Babingley River (Norfolk). Flocks of 11 Snow Geese were seen at Stratfield Saye (Hampshire) on 30 June, nearby at Eversley Gravel Pits (Berkshire) on 6 July and at Baffins Pond (Hampshire) on 9 July. It seems likely that these sightings referred to the same individuals, and that the overall total for Snow Geese should be reduced to 118. In Argyll, the flock of 40-50 birds which winters on CoIl and Mull (Newton 1989) was not located, but three adults (including one blue morph Lesser Snow Goose) and a single juvenile were present on Mull A further two sites held three, five sites held two, and eleven held single birds. Individuals of the blue morph of the Lesser Snow Goose were seen at a further five sites, with two at Chew Valley Lake (Avon), and singles at sites in Greater London, Berkshire, Kent and Norfolk. Only eight juveniles, representing 6% of the aged population, were seen.

Pink-footed Goose

A total of 101 Pink-footed Geese was found at 30 sites, each in a different 10-km square (Figure 10). The pattern of distribution was similar to the distribution observed in winter, when more than 200,000 Icelandic birds are found in Britain, principally in eastern and southern Scotland, in Lancashire and in Norfolk. There were 25 Pink-footed Geese in Lancashire (where the only pair bred, at Scarisbrick Hall Pond, producing seven young), 17 in Norfolk, 11 in Dumfries and Galloway and 11 in Tayside, and it seems likely that some of these were birds which had failed to undertake a return migration due to injury or disease. Others will have been associated with, or escaped from, waterfowl collections.

Bar-headed Goose

Figure 11 illustrates the distribution and relative abundance at each site of Bar-headed Geese, 83 of which were recorded during the survey. A flock of 19 at Stratfield Saye (Hampshire) included nine juveniles in three broods, and 11 were noted at Highfield Lake (South Yorkshire). Flocks of six were present at Abberton Reservoir (Essex), The Otter Trust, Bungay, (Suffolk) and Castle Loch (Dumfries and Galloway). Smaller numbers were present in 19 counties, most notably Norfolk which held nine birds at five sites.

White-fronted Goose

Of 70 White-fronted Geese found during the survey, 40 were in Norfolk at: six sites (Figure 12). Principal among these were Blakeney Fresh Marsh (26 birds), and Hardley Flood, where the presence of three juveniles indicated that the species had bred nearby. Elsewhere there were 20 adults and three juveniles of the Greenland race at the Rhinns of Islay (Argyll), three at Regent's Park (London), three (two European, one Greenland race) at Slim bridge (Gloucestershire), and singles in. Cambridgeshire, Cheshire, Gwynedd and Orkney.

Bean Goose

A full-winged flock of 30 Bean Geese of the Western race is kept at the Otter Trust, near Bungay, Suffolk. Single birds were also recorded at Hamford Water (Essex) and Stradsett Lake (Norfolk).

Lesser White-fronted Goose

Of 29 Lesser White-fronted Geese found during the survey, 24 were in East Anglia. The principal site is at The Otter Trust near Bungay (Suffolk) where a flock of 15 full-winged birds is kept. There were also four at Lackiord Wildfowl Reserve, two on the River Bure broads system, and singles at three other Norfolk sites. Elsewhere there were two in Gloucestershire, one in Kent, one in Clwyd and one in Cumbria.

Figure 7. The distribution and abundance of the Egyptian Goose in Britain" June-July 1991.

Information is missing from North Humberside, Peterborough District. Isle of Wight ctnd Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

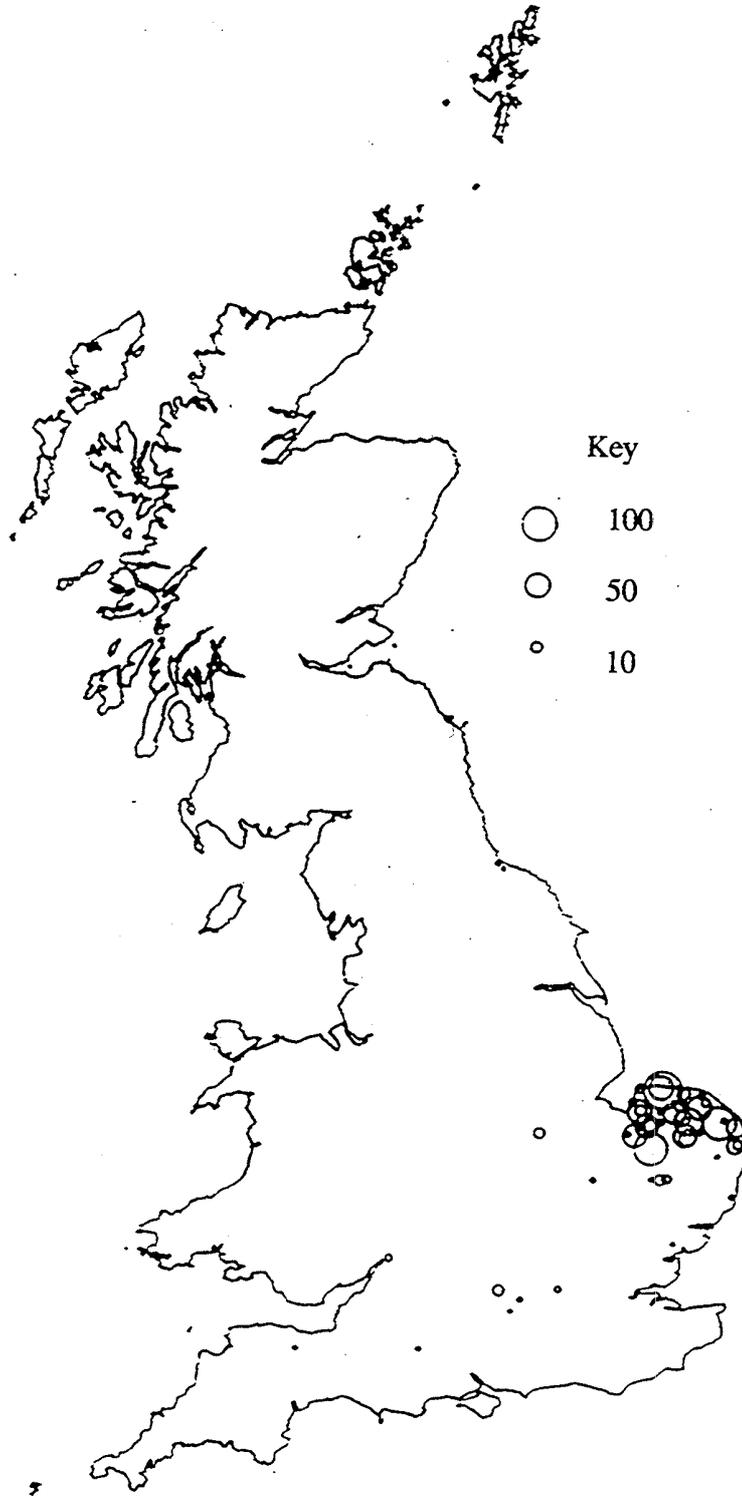


Figure 8. The distribution and abundance of the Barnacle Goos. in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

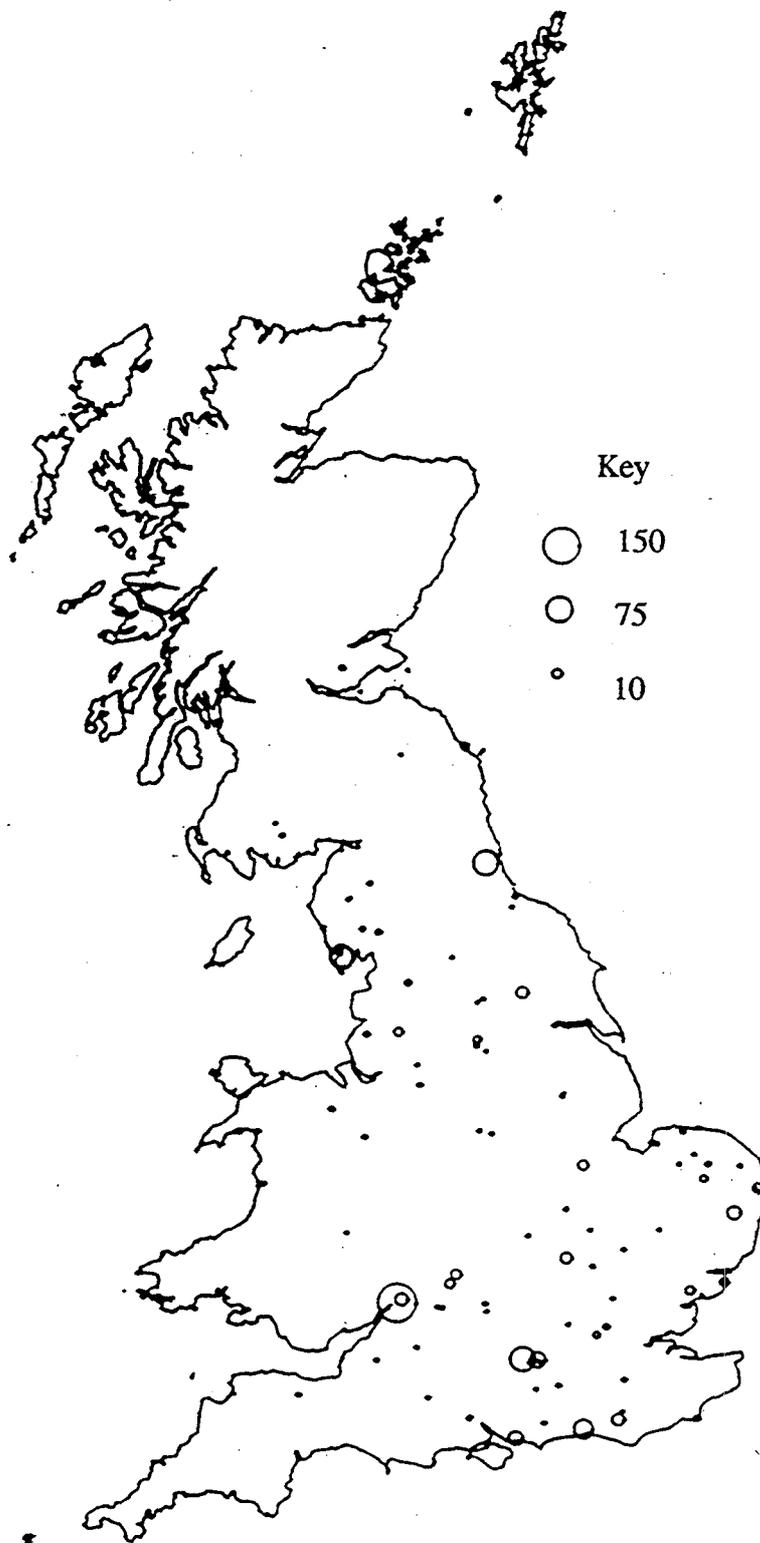


Figure 9. The distribution and abundance of the Snow Goose in Britain, June-July 1991.

Information is missing from North Humberside, Peterborough District, Isle of Wight and *Devon*. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

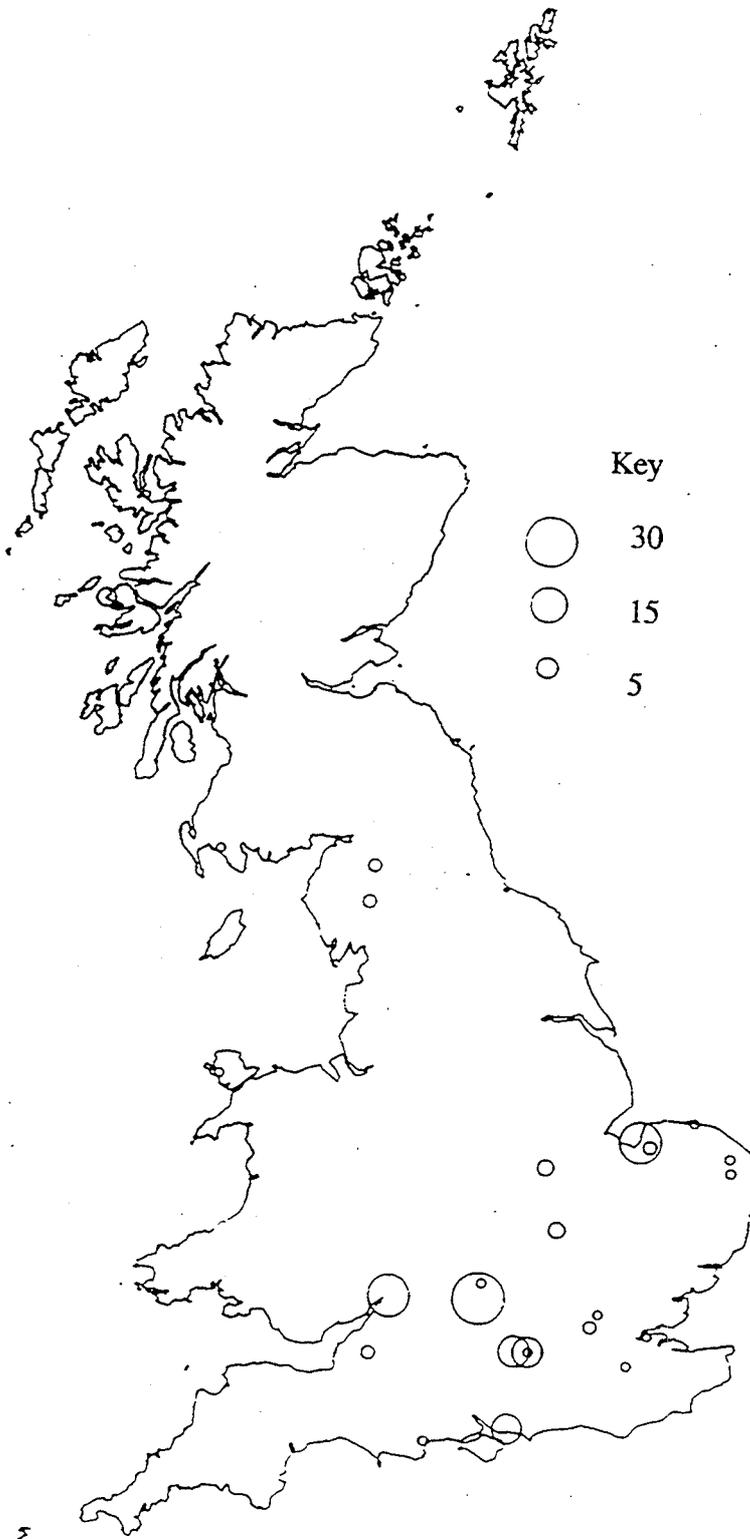


Figure 10. The distribution and abundance of the Pink-footed Goose in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage Was not organised in Shetland, Central Region or parts of Highland Region.

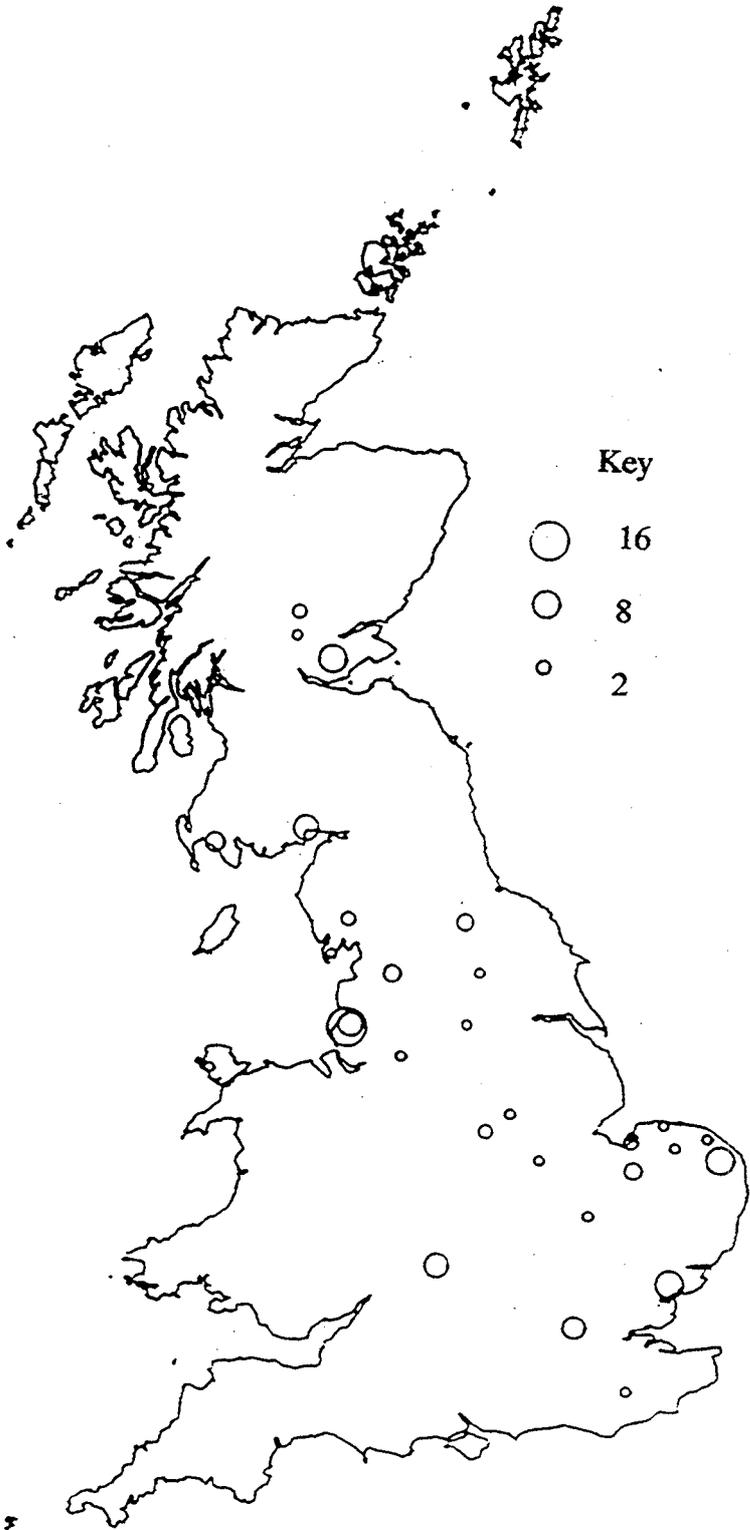


Figure 11. The distribution and abundance of the Bar-headed Goose in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.

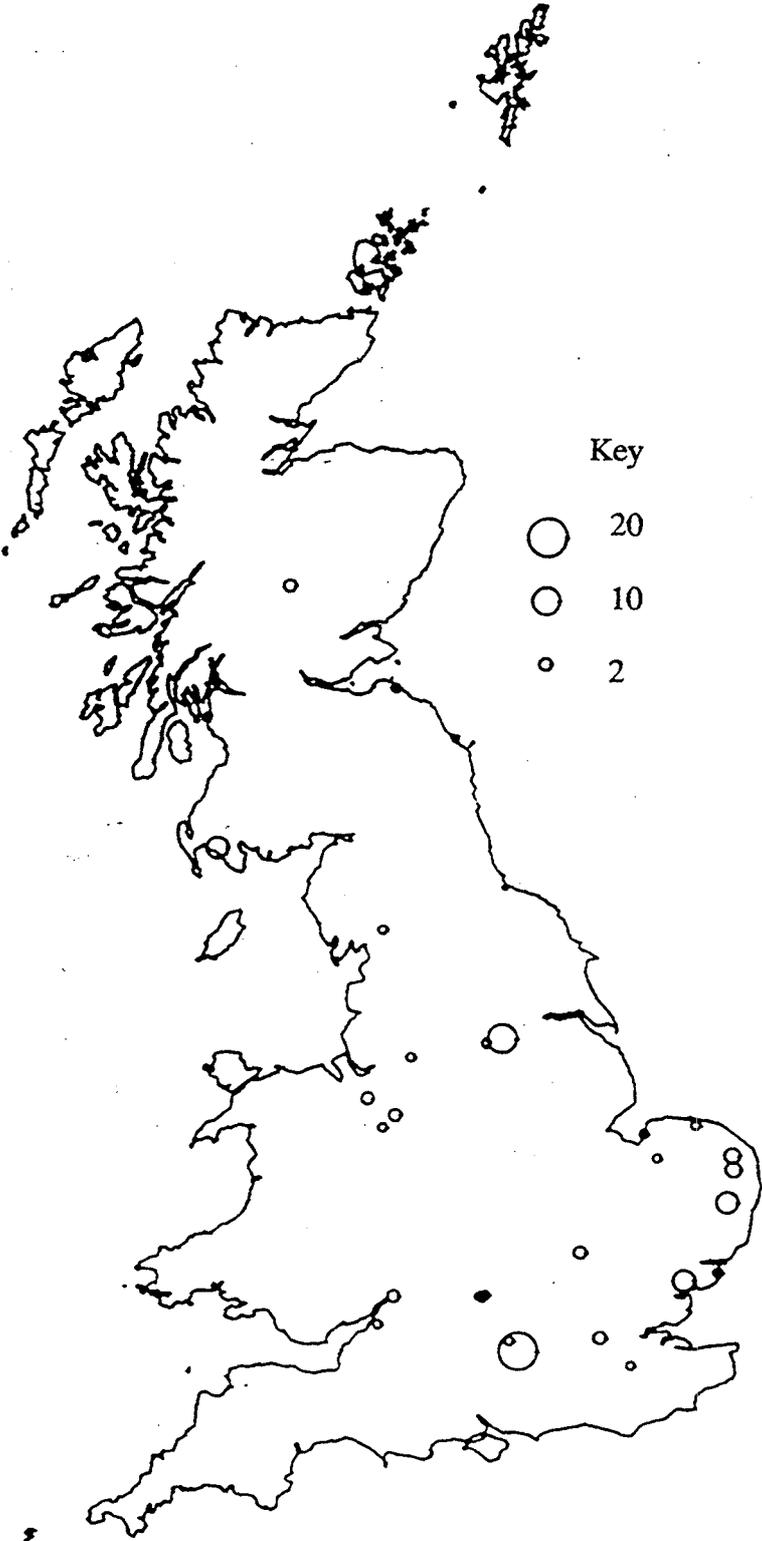


Figure 12. The distribution and abundance of the White-fronted Goose in Britain, June-July 1991. Information is missing from North Humberside, Peterborough District, Isle of Wight and Devon. Coverage was not organised in Shetland, Central Region or parts of Highland Region.



Emperor Goose

Altogether 21 Emperor Geese were found during the survey, 16 of which were in north-west England and the adjacent part of Wales. There were seven at Esthwaite (Cumbria), five at Stocks Reservoir (Lancashire), three at Llyn Gweryd (Clwyd), and one at Ellesmere (Shropshire). Elsewhere there were single birds at three sites in Oxfordshire, and two at Castle Lake (Kent).

Brent Goose

There were three at Hamford Water (Essex), and single birds at Sandbach Flashes (Cheshire), Donnington Brewery (Gloucestershire), Hardwick Gravel Pits (Oxfordshire), and Medley Brook (Oxfordshire).

Swan Goose

There were single birds at five sites in Norfolk.

Red-breasted Goose

One was seen at Snettisham (Norfolk), and a second on the Beaulieu Estuary (Hampshire) is known to have escaped from a collection nearby at Buckler's Hard.

Ross's Goose

There were two records of single birds, at Willen Lake (Buckinghamshire) and at Kings Bromley in Staffordshire.

Hybrids

By far the commonest type of hybrid recorded during the survey was between Canada and Greylag geese: 261 were found at 87 sites in 79 10-km squares scattered throughout the ranges of both species (Figure 13). Altogether, 98% of these birds were aged, and juveniles accounted for 18%. Sandall Park (South Yorkshire) held the highest concentration, a flock of 43 including four juveniles representing 16% of all those found. There were 16 adults at West Sleddale Reservoir (Cumbria) and 12 on the River Ouse (Bedfordshire). Otherwise the population was mostly very thinly distributed, with single birds recorded at 49 sites, 56% of those holding the species.

Table 5 summarises occurrences of all other hybrids. Numbers of most were low, but it seems that escaped or introduced geese will breed freely with almost any available species, sometimes producing fertile hybrids (e.g. a Canada bred with a Greylag x Chinese in Avon and produced five juveniles).

Domestics

A total of 444 feral domestic geese was found in Britain during the survey period (Figure 14). There was a marked concentration of birds from Hertfordshire and Bedfordshire west to Gloucestershire and Hereford & Worcester, with further records in a majority of English counties, two Scottish Regions and one Welsh county. The commonest recorded variety was the Embden Goose (36 birds) and there were ten Chinese Geese (the domesticated form of the Swan Goose) at Kelsey Park and Grovelands Park (London), two each at Victoria Park (Avon) and at Fountains Abbey (North Yorkshire), and single birds at Bristol Docks (Avon), Somerford Lakes (Gloucestershire) and Hodbarrow (Cumbria). Most records of domesticated geese (58%) did not, however, specify the variety involved. Domestic geese hybridise freely with Greylags (from which most domestic varieties are derived) and occasionally with Canadas.

Figure 13. The distribution and abundance of Canada Goose x Greylag Goose hybrids in Britain, June-July 1991.

Information is missing from North Humberside, Peterborough District, Isle of Wight and *Devon*. Coverage Was not organised in Shetland, Central Region or parts of Highland Region.

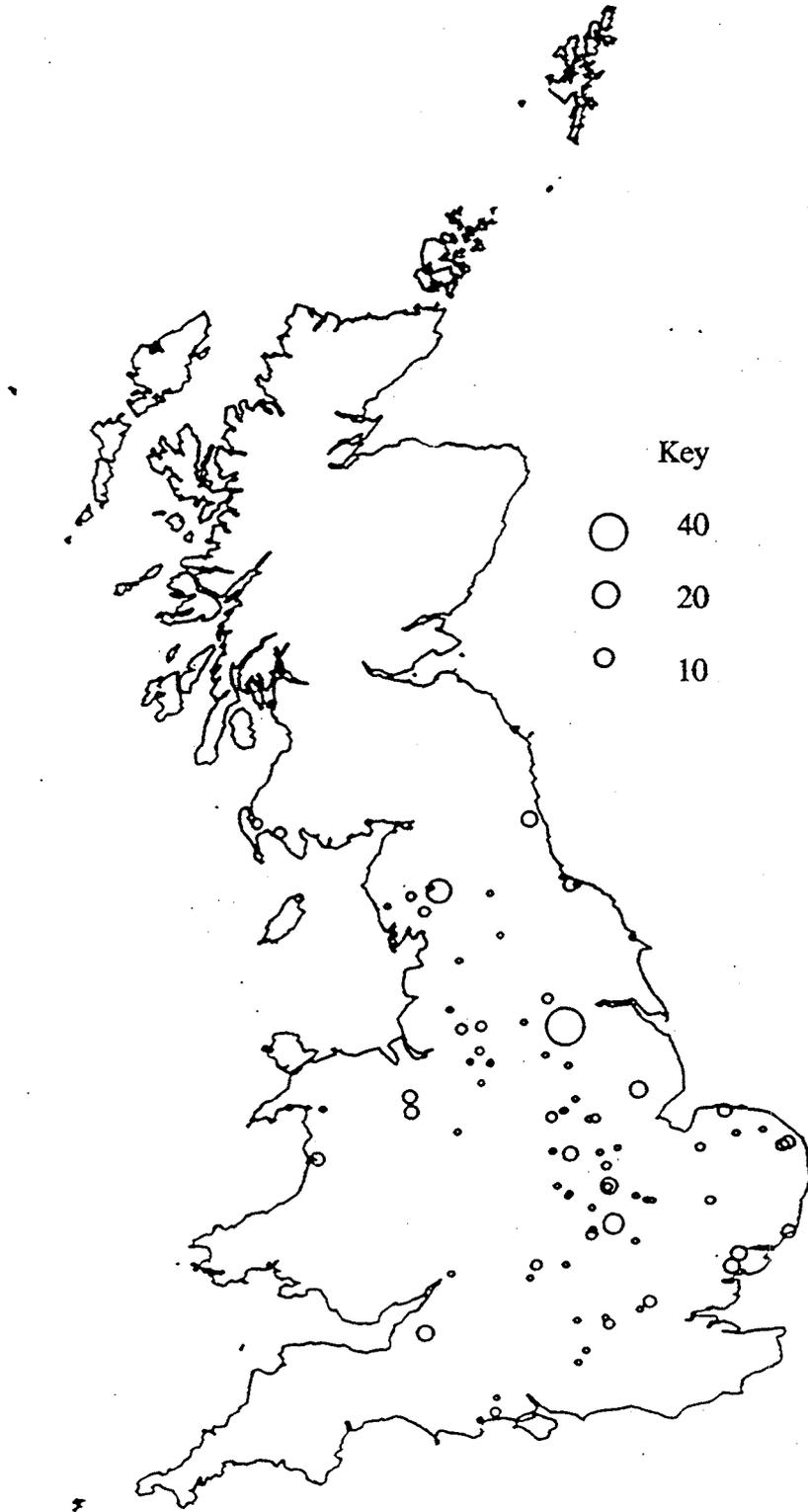
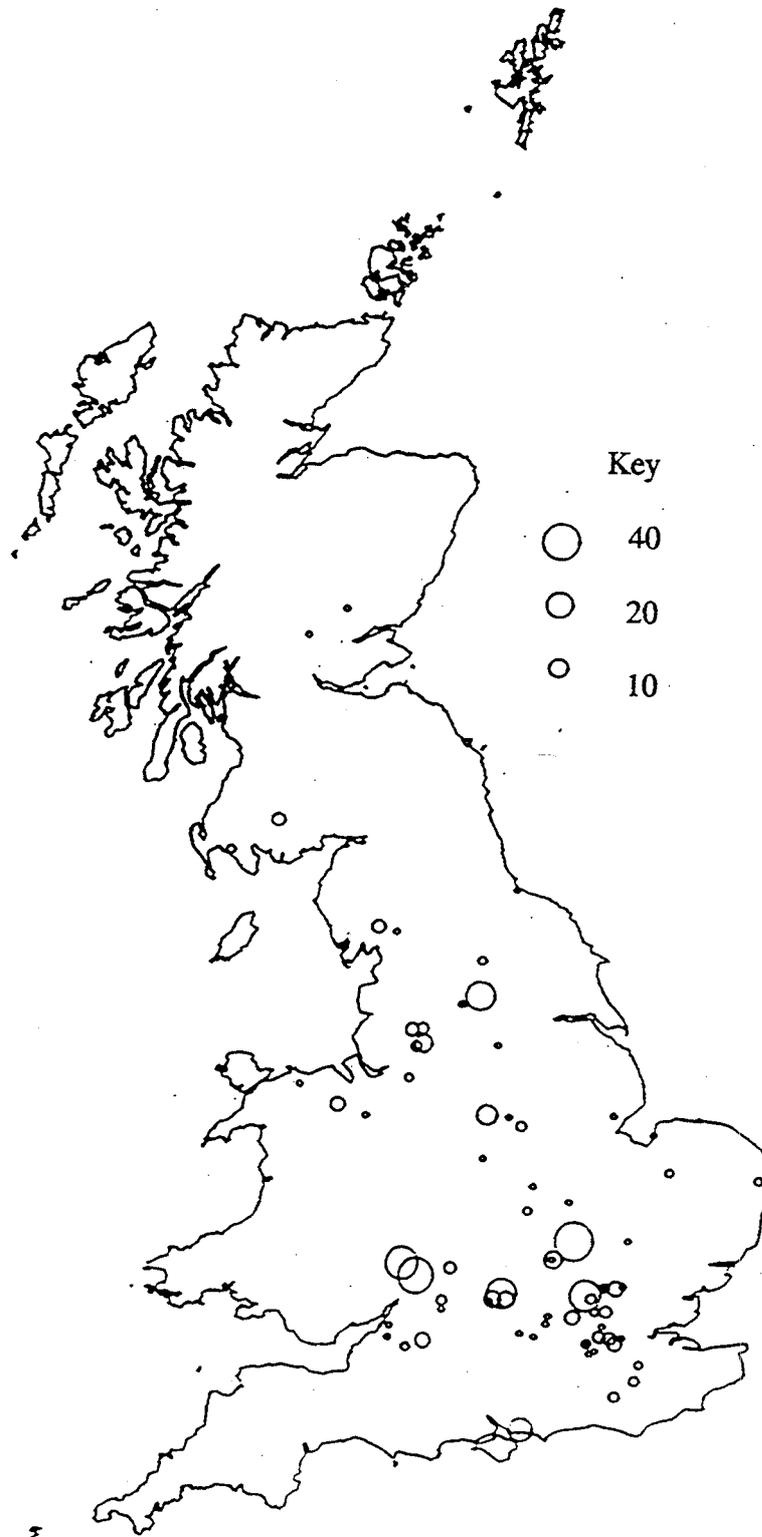


Table 5. Summary of records of hybrids other than Canada x Greylag

County	Site	Hybrid	Adult	Juvenile	Not	Total aged
Lincolnshire	Baston Common Pits	Barnacle x Unknown	1	0	0	1
Kent	Bough Beech Reservoir	Barnacle x Snow	1	0	0	1
Dumfries	Castle Loch Kirkcowan	Barnacle x Blue Snow	1	0	0	1
Staffordshire	Tittesworth Reservoir	Canada x Bar-headed	1	0	0	1
Buckinghamshire	Claydon Lakes & Park	Canada x Barnacle	1	0	0	1
Essex	Hamford Water	Canada x Barnacle	0	2	0	2
Hampshire	Bramshill College Lake	Canada x Barnacle	2	0	0	2
Hampshire	Stratfield Saye Park	Canada x Barnacle	2	0	0	2
Hants/Berks	Eversley Gravel Pits	Canada x Barnacle	1	0	0	1
Northamptonshire	Yarwell Gravel Pits	Canada: x Barnacle	1	0	0	1
Oxfordshire	Linch Hill Leisure Park	Canada x Barnacle	1	0	0	1
Tyne & Wear	WWT Washington	Canada x Barnacle	2	0	0	2
Cheshire	Talley Mere	Canada x Domestic	2	0	0	2
London	Herefield moor	Canada x Domestic	1	0	0	1
Kent	Ashurst Park	Canada x Domestic	2	1	0	3
Tayside	Loch of Drumellie	Canada x Domestic	1	0	0	1
Wiltshire	Corsham Lake	Canada x Domestic	0	7	0	7
Hampshire	River Avon Causeway Systeme	Canada x Snow	3	0	0	3
Hampshire	Stratfield Saye Park	Canada x Snow	1	0	0	1
Lincolnshire	Ancaster Gravel Pits	Canada x Swan	1	0	0	1
Norfolk	S1jffkey Marshes	Canada x White-fronted	2	0	0	2
Cumbria	Irt-Mite-Esk	Greylag x Barnacle	0	2	0	0
Buckinghamshire	Marlow Gravel Pits	Greylag x Bar-headed	1	0	0	0
Buckinghamshire	Newport Pagnell Gravel Pits	Greylag x Bar-headed	1	0	0	1
Huntingdonshire	Hinchingsbrooke Park	Greylag x Bar-headed	0	0	1	1
AVOO	River Avon North Parade Bath	Greylag x Chinese	1	0	0	1
AVOO	River Avon North Parade Bath	Greylag x Chinese x Canada	0	5	0	5
Avon	Aztec West	Greylag x Domestic	1	0	0	1
Buckinghamshire	Bourne End River Thames	Greylag x Domestic	1	0	0	1
Buckinghamshire	Caldecote	Greylag x Domestic	2	0	0	2
Cambridgeshire	Whittlesford Gravel Pit	Greylag x Domestic	1	0	0	1
Derbyshire	Belper River Gardens	Greylag x Domestic	7	5	0	12
London	Ewell Mill Pond	Greylag x Domestic	0	0	2	2
London	Harefield Moor	Greylag x Domestic	6	0	0	6
Hertfordshire	Amwell Gravel Pit	Greylag x Domestic	4	3	0	7
Kent	Sevenoaks Wildfowl Reserve	Greylag x Domestic	2	0	0	2
Leicestershire	Grange farm Pond East Langton	Greylag x Domestic	0	0	1	1
Leicestershire	Grange farm Pond East Langton	Greylag x Domestic	0	1	0	1
Norfolk/Suffolk	River Waveney	Greylag x Domestic	0	6	0	6
Norfolk/Suffolk	River Waveney	Greylag x Domestic	2	0	0	2
Nottinghamshire	Blenheim Ponds Bulwell	Greylag x Domestic	1	0	0	1
Oxfordshire	Sonning Eye and Henley Road	Greylag x Domestic	1	0	0	1
West Sussex	Latchetts upper Lake	Greylag x Domestic	2	1	0	3
Tayside	Loch Monzievairst	Greylag x Domestic	1	0	0	1
West Yorks	Golden Acre Park Leeds	Greylag x Domestic	0	0	25	25
Oxfordshire	Linch Hill Leisure Park	Greylag x Domestic	8	0	0	8
Oxfordshire	Port Meadow	Greylag x Domestic	17	11	0	28
Oxfordshire	River Thames Iffley	Greylag x Domestic	8	0	0	8
Cumbria	Grasmere	Greylag x Unknown	3	0	0	3
Kent	Langton sewage works	Greylag x Unknown	2	1	0	3
Kent	Sevenoaks Wildfowl Reserve	Greylag x Unknown	3	0	0	3
Northamptonshire	Overstone Park lakes	Greylag x Unknown	1	0	0	0
Suckinghamshire	Marlow Gravel Pits	Greylag x Snow	1	0	0	1
Buckinghamshire	River Thames	Greylag x Snow	1	0	0	1
Norfolk	Mid River Yare	Greylag x Snow	2	0	0	2
Leicestershire	Stapleford Park	Greylag x Snow	1	0	0	1
Cheshire	Dunham Park	Greylag x White-fronted	1	0	0	1
Gloucestershire	Slimbridge grounds WWT	Greylag x White-fronted	2	4	0	6
Norfolk	Holkham Park	Greylag x White-fronted	1	0	0	1
Norfolk	River Sure system (broads)	Lssr White-front x White-front	2	0	0	2
Northamptonshire	Ravensthoep Reservoir	Snow x Unknown	1	0	0	1
Norfolk	Trinity BroWs	Swan x Greylag	0	0	2	2
Strathclyde	Endrick Mouth Loch Lomond	Unknown hybrid	3	0	0	3

Figure 14. The distribution and abundance of the Domestic Geese in Britain, June-July 1991. Information is missing from *North Humberside*, *Peterborough District*, *Isle of Wight* and *Devon*. Coverage was not organised in *Shetland*, *Central Region* or parts of *Highland Region*.



DISCUSSION

Canada Goose

The number of Canada Geese counted during the survey was 220% higher than in 1976, indicating that the population has more than tripled in 15 years, an average rate of increase of 8% per year.

Table 6 shows Canada Goose population estimates from the four national surveys to date. The national population appears to have been growing at a slightly increasing rate of 6.8% to 8.0% per year for nearly 30 years. The factors causing under-estimation are likely to have been constant from survey to survey, so that the proportion of the population missed by each survey is likely to have been similar, and the population trend revealed by the surveys is probably a true one. Sample counts undertaken for the National Waterfowl Counts scheme have suggested a very similar national trend in winter numbers between 1964 and 1989 to that revealed by these surveys (8.5% per year), but considerable variation between different regions and habitats (Owen et al in press).

Table 6. Canada Goose population estimates from four national surveys (Blurton-Jones 1956, Ogilvie 1969, Ogilvie, 1977)

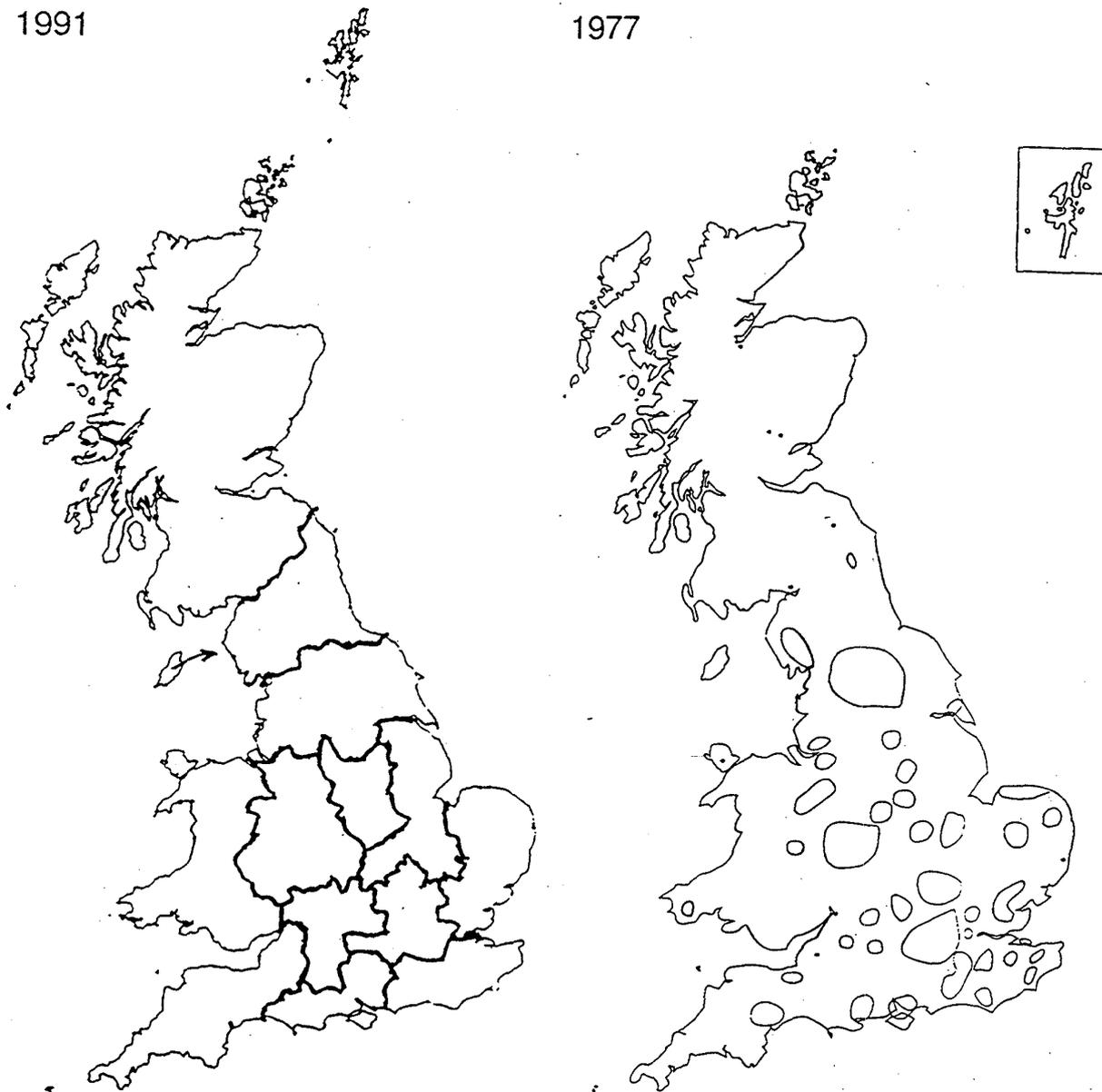
	1953 (maximum counts)	1967-69	1975-76 _	1991
Population	3,906 .	10,510	19,190	60,834
% increase between surveys		169%	83%	217%
Average % Increase per year		6.8%	7.8%	8.0%

The range of the Canada Goose in Britain has expanded slightly since 1976, but the main effect of the population increase has been a rise in population density. The 1976 survey found a mean population density of 44 Canada Geese per occupied 100km square; by 1991 this had grown to III birds per occupied square, an increase of 155%. The population has spread in peripheral areas, and Canada Geese were found in 25% more 100km squares in 1991 than in 1976. The division into discrete subpopulations observed by Blurton-Jones (1956) and Ogilvie (1977) is now impossible as the boundaries between them have disappeared and many "sub-populations" have merged.

Figure 15 illustrates the sub-populations recognised by Ogilvie (1977) for his analysis, and the groups of counties with which amalgamations of those sub-populations were compared. Table 7 shows that a population increase was recorded in every region and that the proportional increase varied between regions. The difference between the proportion of the national population held in eight out of 13 regions between 1976 and 1991 was, however, negligible (between -1.1% and 1.8%), indicating that over most of the range the Canada Goose population has increased, on average, at a uniformly steady rate. There was a .marked increase (8%) in the proportion of the national population held in London and the Home Counties, and two adjacent regions (South-east England and Oxfordshire-Wiltshire-Gloucestershire), also recorded increases of 4.2% and 3.2% respectively. The biggest change in the proportion of the national population held by a region was in the West Midlands, where there was a considerable decrease (-15.9%). There was also a decrease in Scotland. These changes in the proportions of birds counted in each region were very significantly different ($\chi^2=17,489$, d.f.-12, $P=<<0.001$).

The reasons for these differing population trends are complex, but there seems to be little doubt that in London and the lower Thames catchment increasing tolerance of the urban environment is a factor, together with continuing creation of habitat in the form of new gravel pit complexes. The 1991 count for Greater London was actually abnormally low because the production of juveniles was reduced by a campaign of licensed egg pricking that year, co-ordinated between Boroughs by the London Canada Goose Working Party. This resulted in the destruction of 287 clutches containing 2,008 eggs (D . Dawson *in litt.*).

Figure 15. Regions' used in analysis of 1991 Canada Goose survey data with sub-populations recognised by Ogilvie (1977).



The apparent decline in the West Midlands, (this region held 25% of the national count in 1976 and in 1991 held less than 10%) is difficult to explain, but differences in coverage probably account for some of the apparent change. In 1976, an intensive ringing study of Canada Geese was under way in the West Midlands and the totals for the region in that year include a "guesstimate" of 100 adults plus 300 young on small waters that were not visited (C.D.T. Minton *in litt*). There is also evidence that a higher level of control of Canada Geese takes place in this region than in others, for example, Owen *et al.* in press) show that between 1985 and 1989, 80.2% of licensed shooting and 89.3% of licensed egg destruction took place in "mid and western England." The counts from Cheshire and Shropshire appear more affected by the difference in count totals than those from Staffordshire, Warwickshire, West Midlands or Hereford & Worcester, but the occurrence of county boundaries across Ogilvie's (1977) goose sub-population boundaries makes comparison at this level difficult.

The decline in the proportion of the national population of Canada Geese in Scotland is entirely due to a decline in the moulting flock of English birds on the Beaulieu Firth. If these birds are removed from the calculation, the Scottish population has increased from 0.7% to 1.7% of the British total.

Table 7. Canada Goose Regional totals; comparison between 1976 and H991 surveys.

Region	1976 total	% of 1976 total held in region	1991 total	% of 1991 total held in region	% increase in population 1976-1991	Difference between % held in 1976 and 1991
Cornwall, Devon, Somerset, Avon*	300	1.6	1,175	1.9	292	0.3
Dorset, Hampshire*	640	3.3	2,338	3.8	265	0.5
Sussex, Kent, Surrey	890	4.7	5,388	8.9	505	4.2
Herts, Bucks, Beds. Berks. London. NE Hants, N Surrey	2,850	14.9	13,930	22.9	389	8.0
Oxfordshire, Wilts, Gloucs	420	2.2	3,312	5.1	688	3.2
Wales	300	1.6	2,079	3.0	593	1.8
Essex, Suffolk, Norfolk	2,450	12.8	7,089	11.7	189	-1.1
Cambs, Lines, Northants*	660	3.5	2,959	4.9	348	1.4
Leics, Notts, Derbys	2,130	11.1	6,366	10.5	199	-0.6
Cheshire, Salop, Hereford, Staffs, Warwicks, W.Midlands, Montgomery	4,850	25.4	5,764	9.5	19	-15.9
Lancs, Yorks. Humberside, * Merseyside, Gt Manchester,	2,170	11.3	7,733	12.7	256	1.4
Cumbria, Northumb, Cleveland, Durham, Tyne & Wear,	400	2.1	1,613	2.7	303	0.6
Scotland	1,060	5.5	1,088	1.8	3	-3.7
Totals	19,120	100	60,834	100	218	0

* Regions marked with an asterisk were affected by lack of information from Devon, Isle of Wight, Peterborough District and North Humberside.

Greylag Goose

Since this was the first survey of the introduced population of the species, there is no basis on which to analyse national population changes at a regional level, although detailed comparison with the estimates made by Owen & Salmon (1988) will be made in due course.

Wright & Giles (1988) showed that at Great Linford (Buckinghamshire) Canada and Greylag geese coexisted readily and at high density, and experienced both high overall nesting success and considerable population increases between 1974 and 1987, although gosling mortality was higher in Canada Geese than in Greylags. Owen *et al* (in press) have shown that between 1960 and 1988, at a majority of sites where substantial numbers of both were found, increases in Canada Goose numbers were accompanied by increases in Greylags over and above that expected given the overall trend of increase in that species.

During the 1991 survey, many sites supported large numbers of both species, and there was a difference in overall breeding success, with the proportion of juveniles being, on average, considerably

higher in Greylag Geese (30%) than in Canadas (23%). Mean brood size was virtually identical for the two species, and was 70% smaller than the published mean clutch size for the Canada Goose, and 67% smaller than that of the Greylag (Ogilvie 1978). This suggests similar levels of juvenile mortality in the two species, so that the lower proportion of juveniles counted in the 1991 Canada Goose population was probably because the non-breeding component of the population was larger.

Owen & Salmon (1988) estimated that the population of feral Greylags in Britain was 13,700 birds in 1985-86, and that the population was increasing at an average rate of 13% per year. They calculated that this would result in a population of 26,000 by 1990, but indicated that this 'was an unrealistic prediction since farmers were likely to intervene and, by increasing the mortality rate, reduce the rate of increase in the population. This would appear to have been happening, but it is also possible that their overall population estimate, being based on the sum of 35 maximum estimates, erred on the high side and so exaggerated the apparent trend. The 1991 count is an undoubted under-estimate, but the addition of outstanding data and corrections for gaps in coverage are unlikely to raise the total by more than 10%, leaving the 1991 population count 20% below Owen & Salmon's prediction for 1990.

Comparison with recent population estimates for Greylag Geese in Scotland made by Brown & Dick (1992) are of interest because they throw light on the strengths and weaknesses of different approaches (co-ordinated counts versus informed estimates by local experts). Table 8 compares the totals obtained for each Scottish region by the two methods. The major weakness of co-ordinated counts is immediately apparent in the lack of coverage in 1991 of Central Region or Shetland. The six birds estimated for Shetland by Brown & Dick (1992) are, however, of unknown origin, and the 50 for Central Region are based on five pairs found in the Trossachs in 1991. Reference is made to "a small group based on Loch Katrine, but no year is given, and the birds were not seen in 1991, which perhaps makes the inclusion of a further 40 birds in the Regional estimate questionable.

Table 8. 1991 counts of re-introduced Greylag Geese in Scotland compared with estimates published by Brown & Dick (1992).

Region	1991 counts				1992 estimates
	Adults	Juveniles	Not aged	Total	
Borders	8	9	0	17	2
Central	-	-	-	-	50
Dumfries & Galloway	706	115	705	1526	1469
Fife	2	3	0	5	56
Grampian	4	5	0	9	6
Highland	21	14	34	69	331
Lothian	90	65	36	191	300
Orkney	172	148	0	320	12
Shetland	-	-	-	-	6
Strathclyde	17	4	5	26	55
Tayside	153	6	0	159	368
Western Isles	0	0	18	18	18
Totals	1173	369	798	2340	2673

Lack of coverage for the 1991 survey in the northern part of Highland Region was more serious, probably resulting in flocks at Loch Brora, Loch Fleet, Loch Maree and in the Migdale/Spinningdale area being missed. Brown & Dick (1992) estimated the number of birds at these sites at 285, plus three to five pairs at Loch Maree, but the presence nearby of native stock must make the status of at least some of these birds uncertain.

A total of 69 birds were found at four sites in the rest of Highland Region during the 1991 survey. Brown & Dick (1992) provide estimates of 2-3 pairs at one of these, Loch Laggan (where the 1991 survey found 44 birds), and 10-15 pairs between the Insh Marshes and the Boat of Garten. This allowed them a maximum estimate of 36 birds for this part of southern Highland, an underestimate of 40% compared with the survey.

The work of Shimmings *et al* (1989) in Dumfries and Galloway ensured that accurate counts from 1988 were available for Brown & Dick's (1992) estimate of this, the longest established and most important Scottish population. Counts by the same observers in 1991 found that the population had increased by just 3.8% to 1,526 birds.

The second largest sub-population of introduced Greylags found during the survey in Scotland, 320 birds in Orkney, is newly established and was missed by Brown & Dick (1992), who estimated the presence of 12 birds. There was also a small population (17 birds) at three sites in Borders District in 1991, but they wrote that in Borders District "no feral population has become established" and estimated the presence of one pair. Introduced Greylags are also clearly scarce in Grampian Region, and Brown & Dick (1992) estimated six birds near Ballater, whereas the survey found nine 60 Ian away at Haddo Country Park. .

Fewer birds were counted during the 1991 survey in Fife, Lothian, Strathclyde or Tayside than were estimated by Brown & Dick (1992) despite these Regions receiving good coverage. Their estimates seem occasionally to include records from all seasons; for example, reference is made to Icelandic wintering birds in Lothian and the uncertainty as to whether or not they mix with feral birds. Despite this uncertainty, plus the fact, referred to in their review, that there was considerable dispersal of summering pairs and flocks in the region in the 1980s, the Lothian population is estimated to number 300 birds, a total which seems likely, in the light of the number of birds found during the survey, to include Icelandic migrants.

The flock of 50 birds in Fife referred to by Brown & Dick (1992) was not located during the survey. Similarly, in Strathclyde, Brown & Dick's (1992) estimates involved different sites from those counted during the survey. In Tayside, 159 birds were counted at six sites, fewer than half the number estimated by Brown & Dick (1992), who give details of considerable year-to-year fluctuations in numbers of birds at different sites, but appear sometimes to use maximum figures when calculating their estimates. There were, for example, 62 birds at Loch Leven in 1989, but none in the year of the survey. Also, the 60-100 birds of unknown origin present at the Loch of Clunie in August - September 1987 and 1989 appear to have been included in their estimates.

It seems that introduced Greylags in Scotland fluctuate in number in areas where they are not well established; indeed, Brown & Dick (1992) provided details of many such fluctuations. These changes must be caused by the mortality of birds, or by their movement within and between regions, but when calculating their estimates it seems that Brown & Dick sometimes took the maxima from different sites without making sufficient allowance for these factors, and so probably double-counted birds that were moving around, or included birds which had died. These over-estimates were cancelled out to some extent by under-estimates caused by lack of information from newly colonised areas, so that the final totals were probably fairly similar.

In Scotland, the movement of birds over large areas which are difficult to census means that co-ordinated counts such as the 1991 survey may miss birds in areas where they are not well established, resulting in a population under-estimate. This is exacerbated by the difficulty of obtaining coverage in remote areas where there are few observers. The result of this is that the attempted coordinated count of introduced Greylags in Scotland may have produced a less realistic overall population estimate than the subjective estimates co-ordinated by Brown & Dick (1992).

Egyptian Goose

Sutherland & Allport (1991) reviewed the status and distribution of the Egyptian Goose in Britain. They estimated the population in the spring of 1988 to be about 400 birds, and produced a map showing distribution during the moult restricted to 15 sites in Norfolk and one in Suffolk. The present survey found birds moulting at more than twice as many sites in Norfolk and Suffolk, and the apparent population increase of 127% in three years can probably partly explained by an improvement in coverage.

Other species and hybrids

The introduced species which are still rare in Britain are considered by some to be an attractive addition to the avifauna, but few conservationists would agree that hybrids or domestics are. One species, the Barnacle Goose, appears to be consolidating its numbers and distribution and breeding successfully, as are Domestic geese in some areas. No other species appears yet to have a population which could be self-sustaining, and the number and variety of hybrids found by the survey attest to the difficulty that many escaped or introduced exotics have in finding a mate of the same species or form. Given the problems associated with the explosion in the Canada Goose population over the past 30 years, and the example of the threat posed by feral North American Ruddy Ducks to the endangered population of White-headed Ducks in Spain, it is essential to enforce regulations concerning the keeping of full-winged captive waterfowl strictly before any other species has the opportunity to expand out of control. The large number of exotic geese found in Norfolk probably reflects the large number of privately owned waterfowl collections in the county (N. Hewston, pers. comm.). Another area of the country with an above-average number of waterfowl collections is northwest England and this perhaps explains the relatively high numbers of Emperor and Bar-headed Geese found there.

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Appendix 1



SURVEY OF INTRODUCED GEESE, JUNE - JULY 1991 INFORMATION AND INSTRUCTIONS FOR REGIONAL ORGANISERS

Background

The Canada Goose and Greylag Goose have large introduced populations in Britain which are expanding rapidly. Canada Geese were last surveyed in 1976 and, on the basis of trends revealed by the National Wildfowl Counts, the present population is probably about 60,000. Introduced Greylags are less numerous and have never been systematically surveyed; their present population probably numbers about 26,000. There is growing pressure to control numbers of both species, especially from farmers and amenity groups and there are indications that the birds may be causing some damage to conservation sites. We need sound knowledge of the number and distribution of both species - hence the need for a survey. Other introduced species of goose also occur in some areas, notably Barnacle and Egyptian Geese, and hybrids, particularly between Canadas and Greylags, are appearing in larger numbers. The survey will also obtain information on the numbers of these.

The Survey

This census aims to produce estimates of Canada, Greylag and other introduced goose species in England, Scotland and Wales during the moulting period (late June to mid - July). This is when birds in many areas concentrate into relatively few reasonably predictable sites and, being flightless, remain sedentary. Most juveniles, which stay with their parents, are still noticeably smaller than adults at this time, so that separate estimates of adults and young should not be difficult to obtain. The continuing increases in the populations of these species mean that larger numbers of birds will need to be counted and at a greater number of sites than in previous surveys. Thus tight organisation and good communication will be necessary to ensure that no sites are missed. In some parts of their ranges these geese do not moult communally or conspicuously. If your region contains areas like this, a different approach will be necessary (see 7 below).

What to do

- 1) List all the sites in your region where you expect geese to moult and allocate sites to counters. [If you are unfamiliar with the habits of geese in your region, I can probably help; just let me know.
- 2) Consult (for example) OS maps, the county bird recorder and birdwatchers active in your region to discover potential, hitherto unknown moulting sites. "The Birdwatcher's Yearbook" is an excellent source of contacts in all regions. Ensure that all possible areas are checked during the survey period. The biggest problems here are likely to be river systems, which can take a lot of effort to cover.
- 3) Ensure that you know the boundaries of your region and co-ordinate coverage of "boundary sites" with your neighbouring organisers. A list of Regional Organisers is enclosed. Note that names flagged with an asterisk have not yet confirmed their commitment to the survey.
- 4) Your counters will be required to fill in one data form for each site covered. Counters are being encouraged to make repeat counts of sites if possible, and for each site covered should submit one form with the maximum count of each species.

Appendix 1 continued

5) Please stick one name and address label on each form (in the space at the top) before you send them out, *tb* ensure that observers know to whom to return them. If you need more forms or instruction sheets, please let me know.

6) The timing of the survey will be from 22 June to 14 July in Wales, south and midland England whilst in northern England and Scotland it will be from 29 June to 21 July. These periods comprise four weekends and the intervening three weeks, but you are being encouraged to concentrate efforts on the middle part of the period.

7) In regions with small, dispersed populations of Introduced geese, the best approach will be an attempt to find breeding birds throughout the summer. Contact with county bird recorders, local clubs and societies will often bring to light records of isolated families. Non-breeders (normally a high proportion of the population) usually moult in large, conspicuous flocks, but breeders have to moult close to their nest site, since they moult before the young can fly.

8) After the end of the survey period, check through the data forms as they come in, and summarise them on the regional summary sheet. Two copies are provided, one for your own records. Most observers dislike paperwork and many will have to be "chased". Please note that sites that were visited but produced no birds (nil returns) should be entered on your regional summary sheet below the sites with geese.

9) Please return your completed data forms and summary sheet to me by the end of September (1991), along with an itemised list of postage and telephone expenses if you wish to claim these.

Very many thanks for your help,

Simon Delany
Special Surveys Officer
Counts and Surveys Unit



SURVEY OF INTRODUCED GEESE JUNE - JULY 1991 **INFORMATION AND INSTRUCTIONS FOR COUNTERS**

Background

The Canada Goose and Greylag Goose have large introduced populations in Britain which are expanding rapidly. Canada Geese were last surveyed in 1976 and, on the basis of trends revealed by the National Wildfowl Counts, the present population is probably about 60,000. Introduced Greylags are less numerous and have never been systematically surveyed; their present population probably numbers about 26,000. Other introduced species of goose also occur in some areas, notably Barnacle and Egyptian Geese, and hybrids, particularly between Canadas and Greylags, are appearing in larger numbers. The survey will also obtain information on the numbers and distribution of these.

Methods

The survey aims to produce estimates of the total summer populations of Canada, Greylag and other introduced goose species in Great Britain. It has been timed to coincide with the period when Canada and Greylag geese moult, from late June to mid-July. Adult birds are flightless at this time and congregate at a smaller number of sites than at other times of the year, making them relatively easy to count. Most juveniles will be conspicuously smaller than the adults, and so can be counted separately.

Your regional organiser has allocated you one or more sites to count. Please visit the site(s) as close to the middle of the survey period as possible (22 June - 14 July in Wales, south and midland England, 29 June - 21 July in northern England and Scotland) and make your observations on the form provided. Please use one form for each site. If you make repeat visits to a site, please send one form to your Regional Organiser with details of the maximum count of each species. If you visit a site and find no introduced geese, be sure to send a "nil return" to your Regional Organiser; fill in the site/observer details, write "nil return" in the "Count Totals" box and leave the rest of the form blank. It is recommended that you use a notebook in the field and write up your observations on the form afterwards.

The data form

1) Site/observer details Please fill in the names of the county, the site, and your name, address and telephone number in the spaces provided. Please enter the six figure Ordnance Survey National Grid Reference for the site, remembering to read the grid reference horizontally first, then vertically.

2) Count Totals For each species, enter the date of your count, and the total number of adult, juvenile and unaged geese counted. If more than one count visit is made to the site, enter the highest count of each species and the date of that count. For species of introduced geese other than Canada, Greylag and hybrids between the two, use the "Other" section of the form, making sure that you enter the species (or hybrid) at the top of the box.

Appendix 1 continued

3) Count accuracy Estimate the proportion of birds counted successfully using the following codes:

"E" for "excellent" (90% or more of birds counted)
"G" for "good" (75% to 90%)
"M" for "moderate" (50% to 75%)
"P" for "poor" (<50%)

4) Details of creche/brood sizes. Enter the number of juveniles in creches in the first column. If there is more than one creche at a site, enter the size of each creche and separate the totals by commas (18, 45). Use the other columns to enter the number of broods of each size present. These will be accompanied by one or both parents, but it will not always be possible to separate the families. In these circumstances, simply record the number of young in as many families as possible.

5), 6) and 7) In these sections of the form, complete details of any ringed birds seen (note the colour of any plastic ring and if possible, read the inscription), of any diseased or injured birds, including those with slipped or "angel" wings and any other comments that you wish to make.

Site details

On the back of the form, please fill in as many details about the site as possible. Most sites will require you to tick one box in the "Wetland' habitat" section, and to enter the approximate percentages of different immediately adjacent habitats in the "Surrounding/terrestrial habitat" section. If the site includes islands, indicate the number of islands in each size category, and enter the approximate percentages of island habitats. Also, please provide a quick sketch map of the site. Several of the habitat descriptions require you to delete one of two alternatives flagged by an asterisk, e.g. natural/man-made* lake, tidal river/estuary* etc.

To clarify the form further an example with fictitious details is provided. If, after reading this information and studying the example you are still unclear about any aspect of the fieldwork or paperwork, do not hesitate to get in touch with your Regional Organiser or directly with me at Slimbridge. (Tel: 0453 890333 X263}

Hints for counting moulting geese

Making counts of moulting geese will usually be reasonably straightforward, although geese are often more wary during their moult period than at other times. The biggest difficulties are likely to be birds hiding on islands and in surrounding vegetation at large sites. If you know the site, you will be familiar with the best vantage points and with areas used by geese. If not, it is important to spend time ensuring that all geese are found, and that they are counted from the best vantage points. Many sites are best covered by two people, one of whom ~ flushes birds on to open water, while the other counts the lines of swimming birds.

After you have made your counts, complete and check the data form as soon as possible and send it to your Regional Organiser. Thank you and good luck.

Appendix I continued



SURVEY OF INTRODUCED GEESE JUNE-JULY 1991

Please read the information and instructions sheet carefully before doing any counts or completing this form. Thank you.

1.) SITE/OBSERVER DETAILS

Your Regional Organiser is: _____

County: _____
 Site name: _____
 Grid Reference: _____
 Your name, address & phone number: _____

2.) COUNT TOTALS

3.) COUNT ACCURACY

E, G, M, P

4.) DETAILS OF CRECHE/BROOD SIZES

Creches: No of broods of:

	Date:	Total adults	Total young	Total unaged	E	G	M	P	No of broods of:											
									9	8	7	6	5	4	3	2	1			
CANADA																				
GREYLAG																				
HYBRID Canada/ Greylag																				
OTHER Name species or hybrid here:																				

5.) Were any ringed birds seen? Enter details here. _____

6.) Were any diseased or injured birds seen? Enter details here. _____

7.) Space for comments (continue on another sheet if you wish). _____

