Wildfowl and Wader Counts 1990-91

The Results of the
National Waterfowl Counts
and the
Birds of Estuaries Enquiry
in the United Kingdom

By

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Cover painting by Mark Hulme

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This booklet represents the twelfth combined report of the National Waterfowl Counts and the Birds of Estuaries Enquiry and is based on count information supplied by many thousands of volunteer ornithologists. The national overview presented here, so critical to the conservation of bird populations in the United Kingdom and elsewhere, is only possible with the help of these people. We owe them an immense debt of gratitude.

We are grateful to the following for providing technical assistance and supplementary information during the production of this report: Mario Bertuca (WWT), David Bryant, Peter Cranswick (WWT), Tim Davis (WWT), Simon Delany (WWT), Richard Evans (RSPB), Tony Fox (WWT), Joseph Harris (WWT), Tim Jones (IWRB), Kim Kirby, John Lane, Carl Mitchell (WWT), Marie Montesdeoca (WWT), Myrfyn Owen (WWT), Joyce Portlock (WWT), Carol Powley (BTO), John Quinn (WWT), Steve Ridgill (WWT), Peter Simpson (BTO), Dorothy Smallwood-Keating (BTO) and David Stroud (JNCC).

The new A4 format of this report, designed by Tim Davis, Publications Officer of The Wildfowl & Wetlands Trust, enables more material to be presented in a more pleasing, easier to read style. We hope you will like it. Thank you Tim for an excellent job.

Mark Hulme provided the cover painting of Tufted Ducks and Scaup. Other illustrations are by Sir Peter Scott (pages 8, 17, 22, 25, 31, 36), Thelma Sykes (14, 33, 38, 39), Joe Blossom (21), Paul Johnsgard (41), Su Gough (54, 60), Richard Richardson (58), David Thelwell (59).

WILDFOWL AND WADER COUNTS 1990-91

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WINTER WEATHER IN 1990-91

The following details were derived from the monthly weather reports, produced by The Meteorological Office, Bracknell, and refer to the September to March period only.

The beginning of September 1990 was rather hot, after which cooler weather spread to the north-west, bringing some rain to most places, especially in the west and north. A somewhat settled spell between the 7th and 15th was followed by generally cooler and more changeable weather after mid-month. Heavy showers on the 22nd/23rd in the south and west became widespread later over England and Wales with hail and thunder in places. It remained unsettled in most places for the rest of the month, apart from a brief spell of fine weather on the 27th. In October, the weather was changeable overall, being generally unsettled with one or two brighter interludes. November was a generally dry month, sunny in southern and western areas although rather dull in the east. After a quiet beginning to the month the weather was unsettled with some rain, hail, thunder and even snow in places. Hail was reported over north Wales on the 18th and other parts of the country later in the month. On the 7th and 8th of December there was a very heavy snowfall over northern England, Wales, the Midlands and south-west England, with heavy drifting in gale-force winds. The snow did not freeze, however, but melted very rapidly during the next few days, as temperatures climbed a little. Towards the end of the month, bands of rain, prolonged and heavy at times and accompanied by very strong winds, crossed many parts. Sleet and snow were reported as far south as south Wales on the 27th.

The weather was frequently stormy during the first week of January, with strong winds, rain and snow, and long sunny periods in between. There was widespread flooding in southern Scotland and gales, particularly in western areas. After the 10th, the month was generally dry, although there was rain in places between the 17th and 20th, and snow in some western areas on the 30th and 31st. February was unsettled throughout, with cold weather and frequent falls of snow during the first half. Between the 6th and 14th, snowfall was heavy in many places and it became very cold for a few days. After mid-month it became somewhat milder, although remaining generally wet and at times windy. The first three weeks of March were wet, although the amount of rainfall was greater in western areas but less than usual in some parts of the east and south-east. North-eastern coastal areas had cold and foggy weather between the 6th and 9th. There were thunderstorms in some southern areas towards the end of the month.

INTERPRETATION OF WATERFOWL COUNTS

A word of caution is necessary regarding the uses to which waterfowl counts can correctly be applied and the limitations of these data, especially in the summary form, which of necessity, is used in this booklet. The primary aim here is the rapid feedback of key results to the many participants in both the NWC and BoEE count schemes. Persons requiring to make use of NWC or BoEE data for research or site assessment purposes may obtain more detailed information from the appropriate headquarters.

Explanation of the basis for the qualifying levels used for defining both the international and national importance of sites is provided in Appendix 1. Note that, at present, the sites in Northern Ireland are considered in terms of what are strictly British qualifying levels, hence use of the term "national importance" for these results is an anomaly which will require clarification when Irish qualifying levels become available. In the "Species Accounts" and "Principal Sites" sections, it is necessary to bear in mind the distinction between sites **regularly** (i.e. based on five-year averages) holding wintering populations of national/international importance and those which may merely happen to exceed the appropriate qualifying levels in occasional winters. Also, the ranking of sites according to the total numbers of birds they support (Tables 6 & 54 and Appendix 3) should not be taken as a rank order of the conservation importance of these sites. This is because certain sites, perhaps low down in terms of their total numbers, may nevertheless be of critical importance to certain species or populations at certain times, for example during the main migratory periods.

Peak counts based on monthly visits to a particular site in a given season will reflect more accurately the relative importance of the site for the species than do single visits. It is important to bear this in mind since despite considerable improvements in coverage, some site data presented here derive from single counts during 1990-91. Similarly, in assessing the importance of a site, peak counts from several winters should be used in preference to information from a smaller number of years, as the peak counts made in certain years may be unreliable due to gaps in coverage and disturbance- or weather-induced problems. The movement of birds between closely adjacent sites may lead to altered assessments of a site's apparent importance for a particular species. More counts than those made during a single monthly visit are necessary to assess more accurately the true relative importance of each site. This is especially true when waterfowl populations are 'turning over' rapidly at times of migration or cold weather movements.

IMPORTANT NOTICES

NWC/BoEE schemes:

Please return your counts to the appropriate local organizer as soon as you can. This should be by the end of **March** at the latest for the National Waterfowl Counts and by end of **June** in the case of BoEE. For coastal sites, for which many are counted in every month of the year, counters are strongly advised to forward each count to their local organiser soon after the count has been done. This will give the local organisers time to collate the results and summarise them as necessary. The rapid return of information to the relevant headquarters helps to make sure that annual analyses are completed on time and the results presented promptly in this booklet. Many thanks for your help.

It is vital that you consult with both the NWC and BoEE organisers before making any changes to the overall site or sector boundaries of your count area. This is so that we can ensure that we are fully aware of the precise details of such changes and can amend our computer files and maps accordingly. This is especially important since we are now beginning to computerise data at the smallest scale, for example individual count sectors on estuaries or individual gravel pits. Please tell us of any changes you may be planning so that we can manage our databases accordingly. We can also advise on the positioning of existing SSSI (and other) statutory site boundaries so that the count boundaries can be matched with these, hence increasing the applicability of the count data collected.

NWC scheme:

Readers of the July NWC newsletter will have heard something about the new 'NWC programme'. Within the new scheme we wish to benefit from the fact that many people either already do, or would like to do, extra counts additional to those on the specified count weekend. These might be extra autumn or winter counts, made in between the count dates, or summer visits to wetlands. Clearly we could benefit greatly from collating such information, and we would like to do so. However, we ask you to remember two important points. Firstly, we would prefer that any extra counts are complete ones in the sense that all waterfowl species are counted, rather than just particular ones, and that the entire area within the boundary used for your winter count is covered - i.e. that the boundaries used for both the usual and extra counts at your site are identical. Obviously also, we afford the highest priority to counts on the set dates so that coverage across the whole country can be as synchronous as possible.

The counting of divers, grebes and seaducks in coastal waters is fraught with difficulties and we are aware that trying to count these on set dates is rarely successful. For these species, we would very much welcome more opportunistic records, i.e. counts made when the weather and sea conditions are suitable to observe them. Such records will allow important feeding and roosting areas to be identified, and will allow their frequency of use to be examined. So send in **all** records of these please!

The following changes to the WWT's Regional Organizers have occurred since the production of the July 1991 newsletter:

Oxfordshire (Banbury): Nick Page, Deneside, Banbury Street, Kineton, Warks, CV35 OJS;
North Yorkshire: Bill Haines, 2 Stoke Lake Road, Harrogate, N. Yorks., HG1 5NH;
Clwyd: Dr. G. Morris, Research Division, NE Wales Institute, Deeside, Clwyd, CH5 4BR.

Finally, we were deeply saddened to hear of the death of Alan Walker whose stalwart efforts as our NWC Regional Organiser for North Yorkshire will be remembered for many years to come. Our thoughts go to his family and especially his wife Alison who assisted him in much of the excellent work he did.

WILDFOWL

By J.S.Kirby and J.R. Ferns

The National Waterfowl Counts (NWC) Programme receives financial support from the Joint Nature Conservation Committee (JNCC - the successor body to the Nature Conservancy Council and with statutory responsibility for nature conservation in the United Kingdom), the Royal Society for the Protection of Birds (RSPB) and the Department of the Environment for Northern Ireland (DoENI), and is organized by staff from the Wildfowl & Wetlands Trust's (WWT) headquarters in Slimbridge, Gloucestershire. Many thousands of volunteer ornithologists throughout the U.K. take part, and the success of the programme to date accurately reflects their enthusiasm and dedication. Instigated in 1947, the core activity in the counts programme comprises once-monthly counts of swans, geese, ducks and co-incident wetland species (currently divers, grebes, Cormorant and Coot), on a wide variety of wetland habitats including estuaries and coastal bays, reservoirs, lochs/loughs, gravel pits, freshwater marshes, rivers, canals and ponds. Most counts take place during the autumn and winter period, between September and March, although valuable information from other times of the year is currently also received. To complement the monthly counts, additional surveys of certain swans and geese are organized in most years, as some species prove difficult to census completely by the monthly counts alone. Also 'Special Surveys' of breeding and moulting waterfowl are carried out. The WWT works closely with the British Trust for Ornithology (BTO), as both organizations collect information on the waterfowl occupying coastal sites. Results from the Birds of Estuaries Enquiry (BoEE) for 1990-91 are presented in the second part of this booklet.

PROGRESS AND DEVELOPMENTS

The demand for detailed, high-quality information on the distribution and abundance of waterfowl within the U.K. continues to grow. Consequently, Counts and Surveys Unit staff have been doing much in 1990-91 to improve still further on the quality of the information collected and the way it is stored, disseminated and applied. The Unit grew from four to five full-time members during 1990-91. Thanks to new funding from the RSPB we welcomed Joanne Ferns as our 'Waterfowl Counts Officer' in June 1991 but, on the negative side, we lost the services of our temporary helpers, Dave Remmer and Bill Haines during the period. Dave succumbed to greater temptations and left the Trust to pursue an alternative career in 1990, whilst Bill obtained a long-term contract with the Ministry of Agriculture, Fisheries and Food in September 1991, and is researching the distribution and movements of Canada Geese in Yorkshire. We are particularly grateful to Bill who gave many long (and painful!) hours of dedicated service and we wish him well in his new employment. The rest of us (JK, JF, Peter Cranswick, Simon Delany and John Quinn) have yet to escape!

The basic monitoring of waterfowl and related species through the monthly counts remained, as ever, our highest priority during 1990-91. Summarized results from this, the 44th consecutive season of counts, form the bulk of this report. In July 1991, we changed the name of the NWC programme to reflect our wider interest in wetland birds - to the National **Waterfowl**, rather than National **Wildfowl**, counts - and, at the same time, introduced a much improved recording form. The new form allows for the recording of waders, and other wetland birds, at inland sites, and asks for specific details pertaining to count and site conditions during each visit. This is part of a series of planned changes for the scheme and will be followed by full guidelines for participants and standard recording forms more relevant to the recording of swans and geese and breeding waterfowl. Thus, emerges the beginnings of a new NWC programme, one which allows systematic and comprehensive monitoring of waterfowl populations in the U.K.

The first phase of the 'Establishing relationships between waterfowl census and statutory site units' project, which started in July 1990, was completed in July 1991 and will be reported by Cranswick & Kirby (in prep.). Many of you will have contributed valuable information for this project which aimed to improve our understanding of the way in which the 500 or so included sites are counted, and how the counting units used relate to statutory site designations (e.g. Sites of Special Scientific Interest (SSSI), Ramsar sites etc.). A comprehensive database and computerized maps have been established to facilitate automatic retrieval of the relationship information and these will allow the numbers of waterfowl using statutory designated sites to be obtained literally at the touch of a button. We hope that this work will help to better protect existing SSSIs and sites protected under international agreements, and facilitate the designation of new ones. Further, we hope to continue this project so that similar information can be gathered for further NWC sites in the near future.

Monthly visits to wetlands do not alone provide complete census data for certain goose and swan species which tend to feed away from wetlands during the day (and are thus missed by day-time counts) and/or to occupy remote areas which are visited only irregularly. Therefore the WWT has for many years organized supplementary surveys for appropriate species on an annual basis. Goose surveys conducted in 1990-91, in all cases involving assessments of total numbers, distribution and breeding success, included the following: surveys of both Pink-footed and Icelandic Greylag Geese throughout Britain in both October and November (Kirby & Cranswick 1991); a complete census

of Greenland White-fronted Geese organized by the National Parks and Wildlife Service in Ireland and the Greenland White-fronted Goose Study (GWGS 1991); a census of native Greylag Geese on the Uists (Western Isles) in August 1990 and January 1991 (Mitchell 1991a); censuses of the Greenland Barnacle Geese wintering on Islay in December and March and, almost daily counts of Svalbard breeding Barnacle Geese wintering at Caerlaverock; autumn age-counts of Dark-bellied Brent Geese at a sample of British sites (Kirby & Haines 1990, Kirby 1991a) and complete censuses of the British population in January and February 1991 (Kirby 1991b). Further details of these surveys appear in the "Species Accounts" that follow.

For wintering swans, many hundreds of volunteers contributed to an international (Britain, Ireland and Iceland) census of Whooper Swans in January, a repeat of the 1986 survey (Salmon & Black 1986). Furthermore, they gathered detailed information on habitat usage by Bewick's, Whoopers and Mute Swans throughout the autumn and winter period. The very large quantities of data collected for this project are currently being computerized and will be reported in detail in 1992. Very many thanks to all who took part.

Of course the Trust's interest in wetlands and their waterfowl is not only confined to the non-breeding season. For this reason, Simon Delany is charged with organizing a rolling programme of 'Special Surveys', each aimed at examining the distribution and status of a particular waterfowl species during the breeding/moulting season. Preliminary results from the 1990 survey of breeding Mute Swans in Britain, a collaborative project with the BTO and the Scottish Ornithologists' Club, were reported at the end of 1990 (Delany 1990). Since then a great deal of time has been spent in validating breeding swan data from the 1990, 1983 and 1978 surveys, so that a comprehensive final analysis can be undertaken. This analysis is now underway and will be published as a final report late in 1991 and in the scientific literature subsequently.

In summer 1991, many hundreds of volunteers again homed in on wetlands, this time helping to examine the distribution and abundance of Britain's introduced geese, such as the Canada and feral Greylag, whose populations are known to have increased in many areas. This survey will provide a baseline against which to measure future trends, and upon which any proposals for population management, which are being actively pursued in some quarters, can be assessed. During the same period, pilot surveys of breeding Shelducks at 18 U.K. sites were undertaken (Delany 1991a), using methodology developed on the Severn Estuary (e.g. Delany 1991b), in preparation for a national survey in 1992. The Trust will also collaborate with the Irish Wildbird Conservancy in 1992 to survey the breeding Mute Swan population in Ireland.

Detailed surveys of individual sites or regions are conducted by the Counts and Surveys Unit under the banner of 'Special Projects', the responsibility for which falls to John Quinn. John is currently preparing a report for work commissioned by North West Water Plc, via the Trust's Wetlands Advisory Service. The overall aim of this 18-month project was to evaluate the ornithological importance of the Company's reservoirs, for wintering and breeding waterfowl, by placing them in a local, regional and national context. This involved both new survey work and analyses of the resulting and existing data, enabling management recommendations to be drafted. Thanks to the considerable enthusiasm of both existing and newly recruited volunteers, the project is proving to be a great success with nearly three times the usual number of sites counted in midwinter and much information on breeding waterfowl being amassed. The results of this important piece of work will be disseminated during the latter part of 1992.

Other site based studies undertaken in 1990-91 included regular mid-week and weekend counts at the 100 or so gravel pits comprising the Cotswold Water Park, for the third winter in succession carried out by local counters and staff of the Trust. The real value of the counts undertaken at this site is being reflected in the consideration by English Nature to propose designation of each individual pit within the park as a Site of Special Scientific Interest and the complex of pits as a Special Protection Area/Ramsar site, based on its importance to overwintering wildfowl.

The forthcoming 1991-92 winter season sees the start of a new wildfowl monitoring system for the Somerset Levels and Moors. RSPB, English Nature and NWC volunteers will work together, building on the existing counts to improve and increase coverage. Specifically, intermediary fortnightly counts will be introduced, as will mapping of areas of standing water and significant concentrations of birds. These measures have been introduced in part as a result of plans by the NRA to alter water levels in the area. It will undoubtedly be of immense value in establishing the true conservation value of the sites.

Over 90 requests for National Waterfowl Count data were received and met by The Wildfowl & Wetlands Trust during the 1990-91 season. The majority of these requests came from the NCC and its U.K. successor body JNCC, the RSPB and other conservation organisations. Increasingly however, requests are being received from private researchers and environmental consultancies, probably in part due to increased public awareness of the scheme. Also, as in all recent years, January NWC counts from the U.K. were passed onto IWRB for incorporation into their international counts database for use in the more 'global' research and conservation projects.

The Wetlands Advisory Service (WAS), the consultancy wing of the Trust, continues to attract considerable attention from the commercial world. Inevitably therefore, Counts and Surveys Unit staff are being more frequently employed to undertake both small, and large scale, contracts on behalf of WAS. Five such contracts, involving Counts & Surveys Unit staff, have been completed, or commenced, during the 1990-91 season:

(a) In anticipation that the area might be suitable for the establishment of an important wetland refuge, Haines & Kirby (1991) used NWC and other bird data to assess the national and regional importance to birds of Broomhill Flash and Wath Ings, South Yorkshire.

(b) Delany (1991c), working on behalf of the BTO, investigated numbers, distribution and breeding success of Shelduck on the Severn Estuary in summer 1991 in relation to an oil spill there in February.

(c) The Trust commenced studies of the evolution of a new reservoir at Carsington, Derbyshire, on behalf of Severn Trent Water. The site will be slowly inundated during the 1991-92 winter and its developing aquatic macrophytes, invertebrate communities and waterfowl interest will be closely monitored by the Trust for several years to come. NWC volunteer Ian Stanley has begun undertaking counts at the site. Despite the very low water levels at present, interesting birds are already beginning to turn up including a party of Bewick's Swans on their way to Martin Mere.

(d) On behalf of British Nuclear Fuels, the Trust will undertake detailed studies of birds throughout the Solway Firth and in the Annan catchment with regard to proposals for a new nuclear power station at Chapelcross, Annan. These studies will last for a two year period, commencing in September 1991, and will involve censuses of breeding and non-breeding bird populations in both intertidal and terrestrial habitats, and will include observations of birds on the Solway Firth by night! The survey work will be undertaken by Peter Cranswick and John Quinn, assisted by Mike Carrier, Johnathon Drew and Jeff Stenning.

(e) A WAS project has just begun for Stirling Central Regional Council, Forth Valley Enterprise and the Nature Conservancy Council for Scotland which will aim to establish the feasibility of creating a nature reserve at Bothkennar and Skinflats on the banks of the Forth Estuary. Joanne Ferns will provide technical input from the Counts & Surveys Unit.

RESEARCH, CONSERVATION AND MANAGEMENT

Information from the NWC programme continued to feature prominently in many Trust publications in 1990-91, and is widely used in wetland management and conservation by the Trust and other organisations. The most relevant publications are mentioned in the Species Accounts but extensive contributions to a number of major conferences, workshops and reviews are worthy of special mention here.

Though taking place some time ago now, the Proceedings of the Third International Swan Symposium, held at Oxford in December 1989, are now available as a supplement to the Trust's journal *Wildfowl*. There were four papers contributed by staff from the Trust: 'The breeding success of Whooper Swans *Cygnus cygnus* nesting in upland and lowland regions of Iceland - a preliminary analysis (Rees *et al.* 1991a); 'Distribution within the USSR of Bewick's Swans *Cygnus columbianus bewickii* marked in Britain' (Rees 1991); 'Feeding activities of Bewick's Swans *Cygnus columbianus bewickii* at a migratory site in the Estonian SSR' (Rees & Bowler 1991); and, 'Distribution of Whooper Swans *Cygnus cygnus* in Britain and Ireland in relation to habitat type and flock social structure' (Black *et al.* 1991).

Goose damage, or the concentration of large numbers of geese into relatively small areas of farmland, was the focus of a workshop arranged by the Trust at its Martin Mere Centre in April 1990. The workshop involved farmers, conservationists, the licensing authorities and a number of scientists involved in goose damage assessments, and all participated in a healthy debate. The proceedings and conclusions of this meeting have been published by the JNCC (Owen & Pienkowski 1991) and provide considerable insight into the complexities of the problems and possible solutions. Such problems are not only restricted to the U.K., but are rather more widespread. In The Netherlands, during October 1991 an international workshop was convened by the Ministry of Agriculture, Nature Management and Fisheries to discuss Farmers and Waterfowl : Conflict or Co-existence. This explored the international dimensions of the same problems.

Staying with geese, the Trust was represented and made contributions to a major international symposium on the Canada Goose, taking place in Milwaukee in April 1991. Canada Geese worldwide have shown tremendous increases in numbers since the early 1950s and this meeting brought together managers, administrators and researchers to discuss the future management of Canada Goose populations. Britain is, of course, not without an expanding Canada Goose population of its own and there is increasing conflict between the geese and those managing agricultural and amenity lands. Owen *et al.* (in press)

reviewed the history, prospects and problems caused by the Canada Goose population in Great Britain, which may now number more than 60,000 birds. They considered population growth in different habitats and different regions of Britain, and demonstrate spectacular increases on reservoirs and gravel pits, and in southern England. Agricultural and amenity damage is discussed, as is potential competition with native waterfowl, such as the Mute Swan. In conclusion, they demonstrate that there are no signs of any slowing down of population growth in this species, indicating that there will be increasing conflict in the years to come.

A major conference held in New Brunswick in August 1991, entitled 'Aquatic Birds in the Trophic Web of Lakes', brought together ornithologists and limnologists to consider the role of avifauna in wetland ecosystems. Presentations were made by researchers from all corners of the world and the Trust made several contributions: Fox *et al.* (in press, a) related the use made of the Cotswold Water Park by Pochards to recreational disturbance; Fox & Bell (in press) examined and classified Scottish lochs according to their importance for breeding waterfowl; and, Kirby *et al.* (in press) used NWC data to examine the current status and long-term trends of the Mute Swan population in Britain in relation to poisoning by lead fishing weights.

Lead, originating in a somewhat different way, was the focus of a particularly important international symposium organised by IWRB in June 1991 at the invitation of the Belgian Ministry of Agriculture and held in Brussels. The 'Lead poisoning in Waterfowl' workshop was attended by representatives from governments, the arms and ammunition industries, hunting organisations and experts on lead poisoning (including our own Myrfyn Owen). The aim was to gather objective information on the problems of lead poisoning, on possible solutions, and on steps that had to be taken around the world to address the problem. In conclusion, there developed a remarkable harmony between the groups represented - and a strong spirit that 'wise use' should prevail - with several countries vowing to tackle the problem by replacing lead shot with non-toxic alternatives.

On the coast, extensive threats to estuaries and coastal habitats in recent years have caused many conservation groups to express great concern about the planning, management and administration of activities in these areas. This in turn has led to specific actions from, among others, the Marine Conservation Society (MCS), NCC, RSPB and WWF. Each have produced comprehensive reports including the MCS/WWF report *A future for the coast? - proposals for a U.K. Coastal Management Plan* (Guhbay 1989), and the RSPB's *Turning the Tide - a future for Estuaries* (Rothwell & Housden 1990). The NCC also produced a major report entitled *Estuaries, Wildlife and Man* (Davidson *et al.* 1991), providing a comprehensive summary of the nature conservation interest of Britain's estuaries and, not surprisingly, relying heavily on information supplied by the NWC and BoEE schemes. Together these organisations, like WWT, see the limitations of the present statutory framework with regard to estuarine conservation and call upon the Government to play a key role in supporting the appropriate and sustainable use of estuaries without prejudicing their wildlife.

This year, progress with Ramsar and Special Protection Area (SPA) designation for Britain's internationally important wetlands has been notably slow. Whilst potential sites have been identified by JNCC as meeting qualification criteria, the actual responsiblity for designation rests with the government. To date, 19 candidate Ramsar sites and 31 candidate SPAs in the UK have been submitted to the government and are awaiting designation. Rutland Water has now achieved Ramsar and SPA status, by regularly supporting in winter over 20,000 waterfowl and internationally important numbers of Gadwall and Shoveler.

Unfortunately, as much as we try to facilitate the protection of our important wetland heritage, threats to them are never far away. This message was driven home with some considerable force when, towards the end of the summer of 1991, we saw commencement of the destruction of one of the finest artificial wetlands for waterfowl in northern England, Woolston Eyes. Situated in Lancashire, the "Eyes" as it became known, is a nature reserve and SSSI occupying some 214 hectares alongside the Manchester Ship Canal, visible to many when driving over the Thelwall Viaduct on the M6. The Manchester Ship Canal Company own the land and use the area to deposit dredgings removed from the canal into large lagoons. With active management over many years by the Woolston Eyes Conservation Group, the site became an excellent feeding ground for overwintering wildfowl and regularly features on the pages of the *Wildfowl and Wader Counts* reports for its internationally important numbers of Teal and nationally important concentrations of Shoveler. In addition, the Eyes supported excelleut breeding bird communities, including several wildfowl species that are not regularly found elsewhere in the region such as the Black-necked Grebe, Gadwall and Pochard. The Canal Company identified a need to draw water from one of the beds, to maintain stability of the embankments and the importance of this bed to wildfowl has now been lost. Talks are currently in progress with the Company and the Woolston Eyes Group, to see how the remaining conservation interest of the site can be safeguarded. It is likely that some compensation measures may be offered in the form of a new reserve area. However, one must question how a situation arises where the interest of an internationally important Site of Special Scientific Interest is destroyed. There must be lessons to be learnt all round.

Finally, 1991 saw the appearance of the first in a new series of publications - *Britain's Birds in 1989-90: the conservation and monitoring review* - produced jointly by JNCC and BTO (Stroud & Glue 1991). This series aims to bring together up-to-date information about the monitoring of bird populations and their habitats into one convenient volume on a regular basis. It provides not only a synopsis of results from the wealth of monitoring programmes, but also information on topical issues, such as pesticide abuse, and on the nation's conservation battles. Naturally, the Trust has much to contribute and, in addition to a significant contribution to the species accounts in the review (using NWC data), there are a further ten articles either partly or wholly by WWT staff. The review is packed with extremely useful information and makes it much more easily accessible than was previously the case, to the amateur and professional alike.

COVERAGE IN 1990-91

The dates used for monthly counts in 1990-91 were September 16th, October 14th, November 18th, December 16th, January 13th, February 17th and March 17th. Counts made at coastal sites were sometimes undertaken on different dates to correspond with appropriate tidal conditions and to correspond with counts made for the BoEE. As in earlier years, there was a special effort in January aimed at covering as many extra sites as possible to correspond with the International Census organized by the IWRB.

A grand total of 2,504 wetland sites in Britain and Northern Ireland were covered at least once during the 1990-91 season, including 2,442 in January and 1,460 in all seven of the priority months, September to March. This represents an all-time record for the NWC programme and is considerably higher than the total of 1,910 sites achieved in 1989-90. Furthermore, the coverage in Britain improved in every month compared with the previous season. The improved coverage can be attributed to two main factors: most significant were the considerable efforts expended by counters in north-west England (under the direction of John Quinn) to cover additional sites for the North West Water project (see "Progress and Developments"); also, we have chosen to computerise much of the count data from estuaries at a finer level, computerising several parts of sites where previously it was entered as one. However, this has led to the creation of approximately 60 sites only.

The distribution of the sites counted in 1990-91 is shown in Figure 1. The comprehensive coverage of north-west England is evident, but so too are gaps in eastern and north-east Wales, in central and east Kent and East Anglia, northern England and throughout many regions of Scotland. It is important to remember though that counts from many of these areas have been received in past seasons, and so some data are available from these areas. The regions contributing most sites in 1990-91 were Cumbria (242), Lancashire (206), Greater Manchester (118), Strathclyde (113), County Down (110), Gwynedd (71), Cheshire (71), Derbyshire (71), Hampshire (69), Borders (57) and Dumfries & Galloway (56). On the coast, incomplete counts were received from the estuaries of Humber, Rough Firth and Dulas Bay.

Numerous supplementary surveys of geese were accomplished in 1990-91 (see "Progress and Developments") and extra information for seaducks in the Moray Firth was again supplied by the RSPB, courtesy of British Petroleum.

DATA PRESENTATION

The format of data presentation follows closely that of the last report. Data derived from sources outwith the routine monthly counts are clearly identified throughout, either by means of specific references or by use of an asterisk (*) to identify counts derived from the Trust's goose censuses. The flagging of goose counts in this way is important as such surveys rely on different methodology (e.g. dawn/evening flight counts, field searching) to that adopted in the mid-monthly visits to wetlands. Furthermore, the dates of goose surveys have frequently, but not always, differed from those used for basic wetland monitoring.

In Tables 1 & 2, total counts for all species have been presented except for exotic, hybrid and domestic wildfowl. This enables an assessment of the true scale of NWC monitoring with regard to particular species. In order to save space, the following abbreviations for wetland types have been used in all tables that include site names:

Br. = Broad(s)	Hbr. = Harbour
Est. = Estuary	Lo. = Loch(s) or Lough(s)
Fth. = Firth(s)	R. = River
Gp. = Gravel pit(s)	Rsr. = Reservoir(s)

In order to facilitate the matching of count information at coastal sites with that collected for waders through the BoEE, both the names of coastal sites, and the areas included in them, correspond with those used in the second section of this report (see Figure 1, p.10, and Kirby 1991c). As in previous reports, counts made outwith the September to March period have been used in cases where they represent the maxima for the count season (June to July).

TOTAL NUMBERS

Tables 1 & 2 show the total numbers of each species of wildfowl, grebes, Cormorant and Coot recorded in September to March of 1990-91 for Britain and Northern Ireland separately.

The numbers of grebes counted in each month of 1990-91 were mostly similar to the numbers in 1989-90, despite the improvements in coverage. The peak count of Cormorants in Britain was relatively high, with a maximum of around 15,000 in 1990-91 compared with 13,500 in 1989-90, whilst that for Northern Ireland was on the low side. Amongst the swans, Mute Swans in Britain surpassed the peak number counted last season (12,616) by some 2,600 birds, whilst both Bewick's and Whooper Swans were recorded in similar numbers in both Britain and Northern Ireland to those of 1989-90. The numbers of Pink-footed, Greenland White-fronted, Icelandic Greylag, Barnacle and Dark-bellied Brent were, not surprisingly, highest during the months of specific surveys for them, and in all cases exceeded that recorded in the previous year. The numbers of both feral Greylags and Canada Geese appeared to be relatively high in Britain.

For the freshwater ducks, the peak British count of Mallard in January (214,458) exceeded the previous season's maximum by a staggering 33,396 birds - due to cold weather immigration or the expansion of coverage perhaps? In Northern Ireland, Wigeon reached over 18,600 in October compared with just 12,500 in 1989-90 and, whilst Pochard exceeded the previous year's figure by over 4,400 birds, Tufted Ducks were relatively less abundant by some 7,200 birds. Goldeneye were also noticeably more abundant in Britain (over 17,000 compared with 12,700 in 1989-90) and Northern Ireland (15,200 vs 12,170), and Ruddy Ducks continued to increase reaching almost 3,100 birds in total. There was clearly an influx of Smew to Britain in February related to the cold weather early in that month.

Numbers of seaducks, particularly Eider, Scoter spp. and Long-tailed Duck, were characteristically very variable due to difficulties in observing them adequately on a regular basis. The recorded maximium for Coot in Britain was almost 13,000 fewer than in 1989-90.

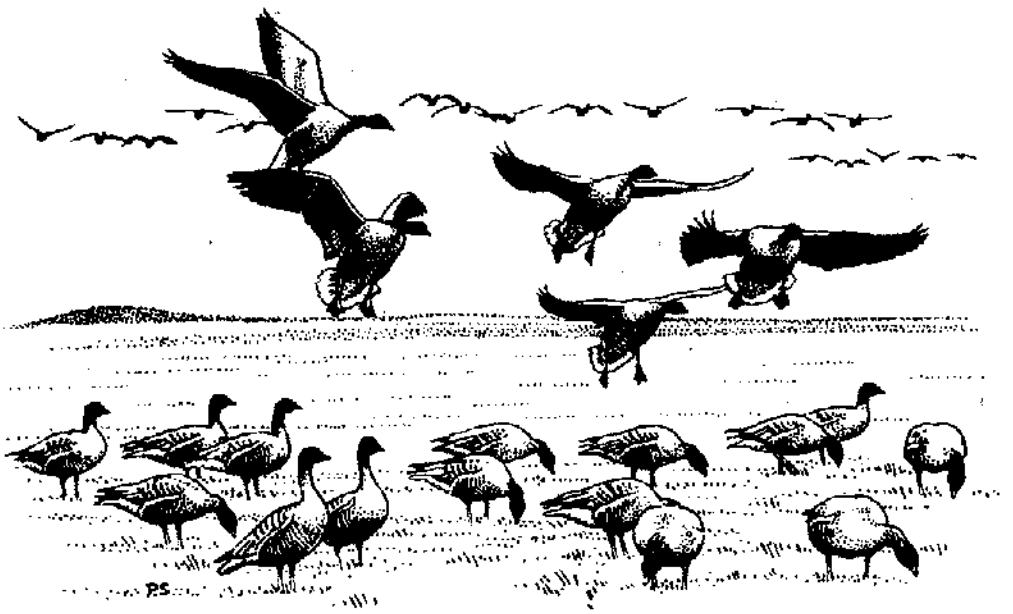


Figure 1. COVERAGE BY 10-KM GRID SQUARES FOR THE NATIONAL WATERFOWL COUNTS IN 1990-91.

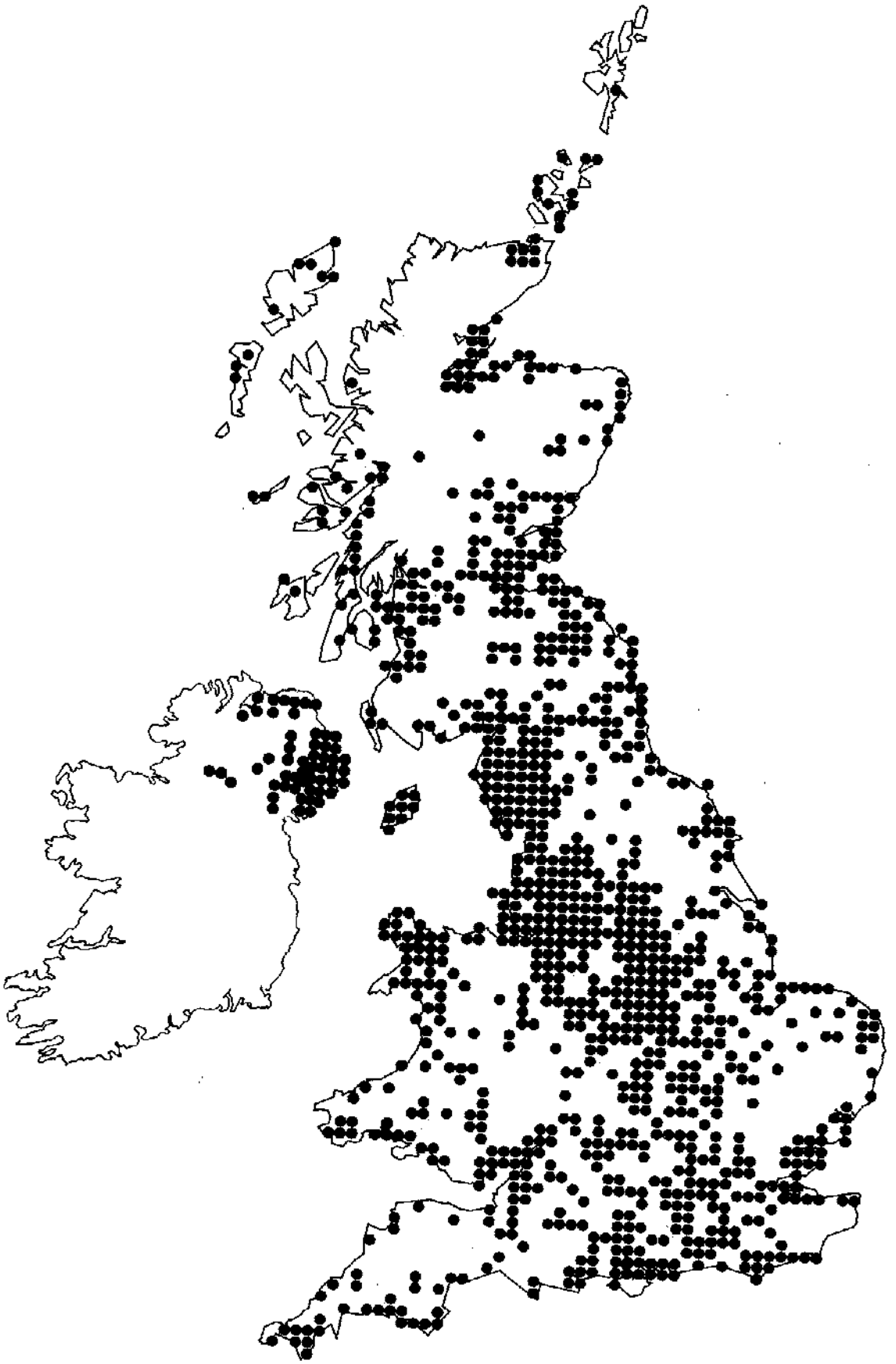


Table 1. TOTAL NUMBER OF WILDFOWL, GREBES, CORMORANT AND COOT COUNTED IN GREAT BRITAIN IN EACH MONTH OF 1990-91.

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Number of sites counted	1,595	1,694	1,756	1,779	2,295	1,790	1,737
Little Grebe	2,878	2,570	2,385	2,434	2,411	1,931	1,552
Great Crested Grebe	8,803	8,126	7,770	7,823	8,365	7,156	7,179
Cormorant	12,861	12,785	13,866	12,661	12,620	12,485	9,305
Mute Swan	12,751	13,801	13,585	13,328	15,220	12,119	9,983
Bewick's Swan	11	321	4,761	5,966	7,905	7,809	973
Whooper Swan	29	1,344	3,972	4,285	4,556	3,252	2,463
Bean Goose	0	3	116	446	509	308	0
Pink-footed Goose	3,495	*175,724	*194,752	82,767	100,541	93,781	74,508
European White-fronted Goose	27	207	898	3,005	498	4,025	2,352
Greenland White-fronted Goose	19	637	*14,762	13,111	9,056	1,625	*15,180
Greylag Goose (Icelandic)	1,057	*76,286	*114,678	29,548	50,105	30,915	19,528
Greylag Goose (feral)+	12,176	9,210	10,118	12,017	15,334	9,623	7,391
Canada Goose	34,741	37,994	35,540	32,807	35,457	34,388	20,432
Barnacle Goose++	246	10,340	2,603	*33,523	3,430	7,771	*24,768
Dark-bellied Brent Goose	4,466	101,513	91,140	116,276	105,474	124,067	50,445
Light-bellied Brent Goose	142	1,419	2,706	2,705	1,723	732	65
Shelduck	21,965	42,589	61,149	64,594	78,097	79,949	56,905
Mandarin	78	209	167	69	134	49	61
Wigeon	55,145	151,479	158,200	213,665	238,369	221,411	107,909
Gadwall	5,700	6,683	6,973	7,497	6,843	5,288	3,402
Teal	67,747	91,119	93,517	121,403	135,423	100,854	37,246
Mallard	153,779	156,374	159,812	176,708	214,458	140,863	57,282
Pintail	9,026	23,041	18,463	22,509	16,019	23,091	3,913
Garganey	17	2	0	0	0	0	11
Shoveler	8,975	8,862	6,445	6,748	6,806	5,074	4,482
Pochard	11,640	23,920	35,335	33,863	37,419	36,138	12,121
Tufted Duck	34,525	37,827	46,825	46,333	48,425	46,422	34,581
Scaup	454	603	1,206	2,353	6,028	6,492	2,826
Eider	25,574	24,130	18,735	19,272	16,184	44,232	17,957
Common/Velvet Scoter+++	1,412	2,800	4,650	5,899	2,993	9,072	4,612
Long-tailed Duck	6	542	1,472	1,865	1,796	1,625	644
Goldeneye	391	2,669	8,442	13,076	16,756	17,102	12,663
Smew	1	1	19	60	67	270	32
Red-breasted Merganser	2,008	2,809	2,824	3,891	3,777	3,884	3,103
Goosander	809	1,050	1,918	3,249	2,918	3,064	1,516
Ruddy Duck	1,850	1,917	2,088	3,076	3,087	2,387	1,859
Coot	85,806	80,174	85,453	83,388	79,026	69,845	34,853

+ In all months except September, the feral component of this species is approximated by totalling counts from English (exc. Northumberland) and Welsh sites only and 1500 (after Shimmings *et al.* 1989) for the feral birds in Dumfries & Galloway. ++ Includes mainly birds from the Greenlandic and Svalbard breeding populations, with a few feral birds also. +++ In some instances, these species are inseparable.

Table 2. TOTAL NUMBER OF WILDFOWL, GREBES, CORMORANT AND COOT COUNTED IN NORTHERN IRELAND IN EACH MONTH OF 1990-91.

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Number of sites counted	114	124	125	116	147	135	134
Little Grebe	687	560	722	656	500	542	289
Great Crested Grebe	750	759	1,518	1,034	942	1,040	1,088
Cormorant	1,310	1,079	1,278	1,529	869	1,283	766
Mute Swan	1,956	2,060	1,996	2,184	2,032	1,666	1,493
Bewick's Swan	0	84	343	480	347	584	113
Whooper Swan	5	828	1,875	1,658	1,593	1,476	1,284
Greenland White-fronted Goose+	0	17	13	3	3	53	55
Greylag Goose++	169	377	407	523	1,107	1,094	1,113
Light-bellied Brent Goose	14,468	15,903	10,206	4,198	3,843	3,274	3,549
Canada Goose	147	245	252	89	61	150	82
Barnacle Goose	71	68	65	64	62	56	58
Shelduck	54	514	1,474	2,416	3,128	3,738	2,675
Wigeon	8,246	18,660	10,864	5,892	9,052	4,453	1,929
Gadwall	241	169	240	148	153	170	122
Teal	1,866	3,802	4,241	5,548	6,133	4,254	1,688
Mallard	10,864	9,556	7,551	7,313	7,430	5,703	2,526
Pintail	70	88	127	251	253	134	134
Shoveler	127	274	202	161	88	59	28
Pochard	1,420	5,870	26,128	41,364	9,606	10,049	881
Tufted Duck	4,684	7,981	23,138	20,442	19,174	12,682	8,981
Scaup	4	95	583	753	615	1,821	1,579
Eider	164	816	1,207	1,382	489	630	647
Common/Velvet Scoter+++	299	0	2,480	945	483	0	191
Long-tailed Duck	2	0	32	37	44	69	18
Goldeneye	982	475	12,630	12,088	10,298	15,201	5,204
Red-breasted Merganser	584	520	442	450	426	550	544
Goosander	0	0	1	1	0	0	0
Ruddy Duck	6	34	30	2	0	14	31
Coot	8,304	8,426	7,385	5,504	4,844	4,234	2,442

+ See the appropriate Species Account for census details for the whole of Ireland. ++ It is not possible to separate the feral from the wild component of this population in Northern Ireland. +++ In some instances, these species are inseparable.

MONTHLY FLUCTUATIONS

Since the number of sites counted is not the same in all months, monthly count totals may not necessarily reflect true changes in relative abundance during the season. However, this can be examined by using only counts from sites counted in all seven months (September until March). Once these totals are calculated, the number present in each month can be expressed as a percentage of the maximum numbers present, thus revealing patterns of seasonality for the considered species. This is shown in Tables 3 & 4, for Britain and Northern Ireland separately. Non-migratory, scarce and irregularly counted species are omitted.

In both Britain and Northern Ireland, mid-winter (December to February) was the period during which most species reached maximum abundance, the rise to this peak being steady in most cases but especially dramatic for the included swan and goose species. Other species, however, were relatively more abundant earlier in the season, during the September to November period. These include the grebes, Shoveler and Coot in both countries, Cormorant in Britain only, and Wigeon, Gadwall and Mallard in Northern Ireland only. Such patterns are perhaps indicative of either emigration from the U.K. or movements away from the sites counted and, for these, detailed count information from other countries, particularly Eire, would be invaluable.

Table 3. PROPORTIONS IN EACH MONTH OF THE PEAK POPULATION PRESENT ON BRITISH SITES THAT WERE COUNTED IN ALL SEVEN MONTHS OF 1990-91.

(The number of sites included was 1,364 and bracketed figures give averages for the 1985-86 to 1990-91 period.)

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Little Grebe	100 (100)	90 (96)	76 (86)	78 (76)	70 (77)	61 (64)	51 (62)
Great C. Grebe	100 (100)	93 (93)	82 (87)	85 (75)	92 (70)	77 (74)	80 (81)
Cormorant	100 (95)	99 (100)	97 (97)	86 (89)	85 (90)	86 (88)	74 (82)
Bewick's Swan	0 (0)	3 (1)	58 (36)	76 (71)	100 (99)	96 (77)	9 (17)
Whooper Swan	1 (1)	28 (36)	74 (86)	100 (75)	99 (90)	87 (81)	69 (63)
E. White-front. G.	1 (0)	4 (1)	19 (9)	63 (50)	100 (91)	82 (93)	18 (33)
Dark-b. Brent G.	4 (1)	91 (57)	71 (73)	95 (90)	83 (93)	100 (96)	43 (48)
Shelduck	26 (18)	59 (50)	78 (67)	82 (76)	95 (93)	100 (97)	76 (81)
Wigeon	27 (19)	61 (56)	82 (75)	98 (88)	100 (100)	99 (73)	51 (44)
Gadwall	84 (76)	99 (90)	92 (92)	100 (96)	91 (83)	74 (69)	50 (47)
Teal	54 (51)	73 (69)	74 (81)	92 (98)	100 (82)	74 (66)	28 (37)
Mallard	86 (87)	84 (89)	85 (91)	90 (97)	100 (94)	71 (66)	31 (36)
Pintail	42 (38)	98 (84)	79 (83)	98 (93)	65 (75)	100 (62)	18 (17)
Shoveler	100 (89)	96 (96)	71 (75)	76 (69)	72 (57)	54 (61)	50 (51)
Pochard	31 (31)	67 (63)	94 (88)	93 (98)	100 (95)	95 (92)	33 (42)
Tufted Duck	76 (79)	82 (80)	99 (96)	99 (98)	100 (97)	98 (87)	77 (75)
Goldeneye	3 (1)	13 (11)	59 (55)	80 (77)	94 (91)	100 (99)	89 (92)
Goosander	29 (24)	27 (23)	61 (45)	90 (80)	68 (87)	100 (78)	49 (63)
Coot	100 (88)	95 (96)	96 (95)	92 (92)	82 (84)	76 (66)	39 (44)

Table 4. PROPORTIONS IN EACH MONTH OF THE PEAK POPULATION PRESENT ON NORTHERN IRELAND SITES COUNTED IN ALL SEVEN MONTHS OF 1990-91.

(The number of sites included was 96 and bracketed figures give equivalent figures for 1989-90.)

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Little Grebe	100 (77)	70 (89)	94 (100)	89 (77)	66 (54)	76 (37)	34 (26)
Great C. Grebe	100 (70)	63 (72)	41 (35)	37 (100)	64 (18)	51 (27)	97 (68)
Cormorant	81 (100)	59 (93)	66 (83)	100 (90)	51 (55)	77 (35)	50 (54)
Bewick's Swan	0 (0)	14 (0)	59 (76)	82 (100)	60 (78)	100 (48)	19 (9)
Whooper Swan	0 (0)	45 (27)	100 (60)	86 (69)	79 (91)	75 (99)	63 (100)
Shelduck	2 (7)	14 (9)	39 (77)	63 (100)	73 (98)	100 (90)	70 (87)
Wigeon	44 (25)	100 (95)	55 (100)	25 (56)	43 (76)	20 (33)	10 (30)
Gadwall	100 (54)	70 (88)	99 (79)	61 (95)	62 (100)	71 (45)	51 (58)
Teal	34 (50)	65 (57)	69 (66)	86 (100)	100 (90)	67 (42)	26 (45)
Mallard	100 (100)	82 (90)	65 (68)	62 (50)	61 (55)	49 (29)	22 (21)
Pintail	28 (16)	35 (31)	50 (100)	98 (93)	100 (95)	53 (82)	53 (19)
Shoveler	47 (39)	100 (100)	73 (53)	59 (37)	31 (72)	21 (29)	9 (36)
Pochard	3 (4)	14 (29)	63 (77)	100 (100)	23 (44)	24 (11)	2 (3)
Tufted Duck	20 (18)	34 (63)	100 (25)	89 (100)	83 (66)	55 (37)	38 (30)
Scaup	0 (0)	6 (5)	37 (0)	47 (100)	20 (30)	91 (34)	100 (60)
Goldeneye	7 (0)	3 (9)	87 (28)	82 (100)	68 (34)	100 (43)	34 (84)
Coot	100 (82)	95 (100)	81 (77)	63 (70)	54 (54)	47 (32)	27 (28)

INDICES

Because not all sites are counted in every year, population changes cannot be derived from simply comparing total numbers counted in each year. Consequently, a simple method of indexing population change has been derived and has been applied to wildfowl and wader counts for many years.

Table 5 gives index values for individual species in Britain for each of the 1988-89 to 1990-91 seasons, and for earlier five-year periods for comparison. Indices are not, as yet, calculated for Northern Ireland. The values are obtained by comparing only counts for sites covered in the relevant month in consecutive years, and by relating the ratio of the two monthly totals to an arbitrary standard, nominally 1970-71, when the index was set at 100. The months chosen for each species are those in which the greatest numbers are usually present. For species which may peak in either of two months, the average indices for these months are given, and for those with significant populations at different times of the year (usually autumn and mid-winter), separate sets of indices are given. Species for which complete censuses are attempted each year (e.g. Pink-footed Goose) and species counted irregularly (e.g. scaducks) are omitted.

Indices for 1990-91 suggest relatively large population increases in Britain for Mute Swans, Gadwall, Shoveler and Goldeneye. Amongst these, the increase in Gadwall in both October and December was particularly marked. For Goosander, the trends went in opposite directions according to the month chosen, with a large decrease in January and an increase in February. Indices for the remaining species suggested relative stability or population declines, though most declines were relatively small. Declines of 21% for Whooper swan in November and of 39% for Pintail in December were the only two that exceeded 20%.

Testing of the new method of indexing population changes (see Underhill 1989 and Kirby *et al.* 1990) continues. It is hoped that future editions of this report will contain improved wildfowl indices following the adoption of the new method in due course.

Table 5. INDICES FOR WILDFOWL POPULATIONS IN BRITAIN, 1960-61 TO 1990-91.

		Mean 1960/61 -64/65	Mean 65/66 -69/70	Mean 70/71 -74/75	Mean 75/76 -79/80	Mean 80/81 -84/85	Mean 85/86 -89/90	88/89	89/90	90/91
Mute Swan	Sep	105	96	103	93	119	145	158	169	174
	Jan	88	106	90	85	89	99	102	113	124
Bewick's Swan	Jan	15	50	72	153	215	272	233	244	218
Whooper Swan	Nov	69	77	104	148	164	188	235	225	178
	Jan	202	146	118	114	116	160	180	174	159
E. White-front. G.	Jan	62	85	56	39	40	59	68	43	37
Canada Goose	Sep/Jan	47	72	127	175	275	407	444	451	438
Dark-b. Brent G.	Jan	61	87	134	305	455	475	523	406	445
Shelduck	Jan	92	106	102	132	133	128	125	125	123
Wigeon	Oct	111	112	138	149	183	194	235	219	219
	Jan	83	91	84	85	97	113	113	96	107
Gadwall	Oct	42	50	146	149	259	461	553	515	599
	Dec	86	81	164	336	781	1275	1464	1488	1562
Teal	Dec/Jan	94	76	115	150	193	188	199	259	251
Mallard	Sep	73	83	92	82	92	93	94	101	97
	Dec	78	89	86	80	90	95	91	91	90
Pintail	Dec	27	54	151	177	147	129	134	123	75
Shoveler	Oct/Nov	91	97	144	193	201	204	180	208	211
	Jan	50	63	113	139	127	99	107	123	141
Pochard	Jan	64	105	124	122	101	93	102	114	93
Tufted Duck	Sep	44	64	110	122	134	122	135	122	111
	Dec	73	91	119	123	123	142	170	130	131
Scaup	Jan	64	110	114	33	11	16	24	6	11
Goldeneye	Jan	115	92	126	109	98	107	114	104	127
Red-b. Merganser	Jan	49	101	115	245	222	210	195	129	107
Goosander	Jan	92	80	121	285	213	311	311	363	174
	Feb	171	115	153	123	171	186	191	148	184

PRINCIPAL SITES

In addition to the criteria for individual species (see Appendix 1), any site regularly holding a total of 20,000 or more waterfowl (i.e. divers, grebes, wildfowl, waders, etc.) qualifies as internationally important, as agreed by the Contracting Parties to the Ramsar Convention (Ramsar Convention Bureau 1988). Table 6 lists all U.K. sites holding an average of 10,000 or more wildfowl, Great Crested and Little Grebes, Cormorants and Coots, ranked according to their average maxima over the five-year period 1986-87 to 1990-91. As the table deals with wildfowl only, the importance of these sites is underestimated; more sites would qualify as internationally important in view of their total waterfowl populations if the waders present were included , as the 20,000 level applies to waterfowl (see Appendix 3). For this, and other reasons, Table 6 must not be used to rank the conservation importance of the included sites as some, which are perhaps low down the list in terms of their total numbers, may nevertheless be of critical importance to certain species or populations, for example during the migratory periods or in severe weather.

For each winter in turn, the peak counts for each site are calculated by listing the highest count for each species, irrespective of the month in which it was made, and then totalling these counts. The peak total for 1990-91 is given in the first column, and average figures for the most recent five year period are provided for comparison. The locations of these sites, together with those included in subsequent tables are given in Appendix 2.

Peak counts in 1990-91 at 14 sites exceeded the appropriate five year average by over 30%, thus revealing considerable increases in the importance of these sites. These were Medway Est. (+152%), Loch Eye (+143%), Loch of Skene (+85%), Tay Estuary (+65%), Wash (+57%), Ribble Estuary (+50%), Crouch/Roach (+48%), Swale (+47%), Loch of Harray (+44%), Poole Harbour (+42%), Forth Estuary (+40%), Loch Leven (+37%), North Norfolk Marshes (+33%) and The Fleet/Wey (+32%). Conversely, 4 sites supported much smaller numbers than expected: Martin Mere (-59%), Hamford Water (-49%), Burry Inlet (-47%), Cromarty Firth (-42%). In addition, a 91% reduction at the Slains Lochs was due to the lack of spring counts of roosting geese.

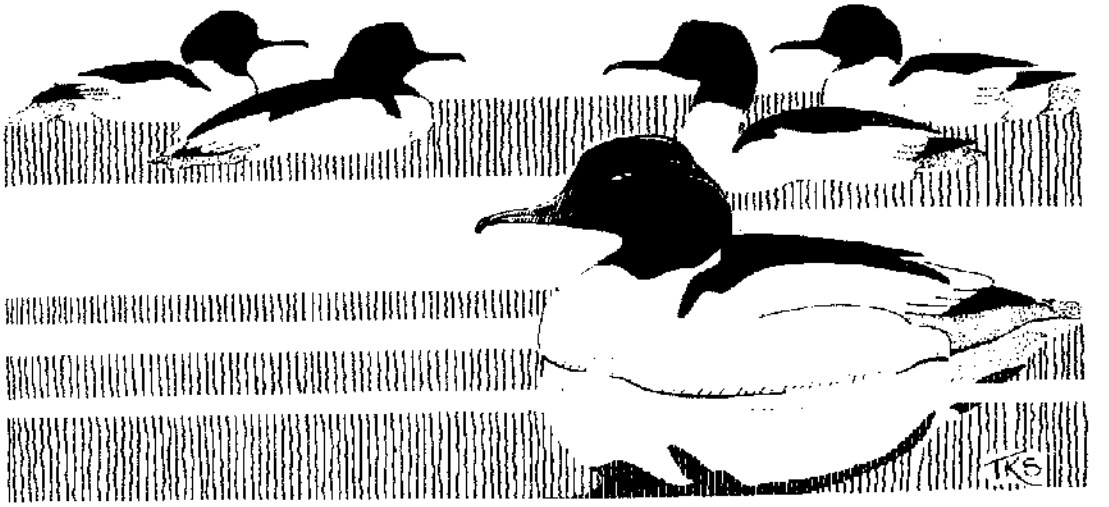


Table 6. SITES WITH AVERAGE MAXIMA OF MORE THAN 10,000 WILDFOWL, GREBES, CORMORANT AND COOT OVER THE 1986-87 TO 1990-91 PERIOD.

	Peak Count 1990-91	Average Count 1986-87 to 1990-91
Lo. Neagh/Beg	104,539	87,049
Ribble Est.	104,292	69,455
Ouse Washes	43,957	60,954
Wash	81,192	51,627
Solway Est.	41,522	43,091
Lo. of Strathbeg	34,320	39,801
Abberton Rsr.	35,764	39,261
Thames Est.	45,225	34,573
North Norfolk Marshes	45,730	34,372
Montrose Basin	27,704	31,323
Forth Est.	43,121	30,705
Lindisfarne	22,189	29,665
Mersey Est.	27,893	28,444
Inner Moray Fth	26,002	27,983
Morecambe Bay	32,420	27,080
Dee Est. (Eng/Wales)	21,705	25,715
Swale Est.	36,872	24,988
Loch Leven	33,202	24,234
Poole Hbr.	10,335	24,785
Martin Mere	9,892	23,827
Westwater Rsr.	24,700	23,436
Lo. Foyle	27,857	23,267
Strangford Lo.	23,169	23,223
Dornoch Fth	17,127	22,814
Severn Est.	20,200	22,411
Rutland Water	22,133	20,975
Humber Est.	22,128	19,331
Blackwater Est.	19,121	17,680
Chichester Hbr.	15,270	16,914
Cromarty Fth	9,346	16,086
Tay Est.	25,685	15,570
Carsebreck/Rhynd Lo.	10,118	14,764
Medway Est.	37,190	14,709
Lo. of Skene	25,056	13,545
Slains Lochs	13,190	13,042
Lo. Eye	30,106	12,375
The Fleet/Wey	16,422	12,371
Lo. of Harray	17,700	12,298
Langstone Hbr.	9,938	12,280
Hamford Water	9,845	19,055
Burry Inlet	6,044	11,327
Wigtown Bay	9,082	11,289
Colne Est.	9,585	10,813
Alde Complex	10,761	10,793
Crouch/Roach Est.	14,975	10,127

SPECIES ACCOUNTS

The following tables rank the principal sites for each species according to average maxima calculated from counts received in any month (June to May) during the last five seasons, 1986-87 to 1990-91. Crosses indicate missing counts and incomplete counts are bracketed. In the first instance, averages were calculated using only complete counts, but if any incomplete counts exceeded this initial average they were then also incorporated and the averages recalculated. The sites included in the tables are in most cases those that exceed the appropriate G.B. qualifying level for national importance (see Appendix 1). However, where this would involve a very long list of sites, a convenient higher level has been selected and used. The month column shows when the maximum count of 1990-91 was made, an asterisk (*) denotes counts made during WWT goose surveys and other sources of information are cited accordingly. As in Table 6, the locations of the included sites are given in Appendix 2.

Little Grebe *Tachybaptus ruficollis*

The NWC scheme only covers a rather small proportion of the population of this species in the U.K.. The peak number counted in the U.K. was 3,565 in September (Tables 1 & 2), slightly more than the 3,345 recorded in 1989-90. This is probably due to the increase in the number of smaller freshwater sites visited. Numbers in both Britain (Table 3) and Northern Ireland (Table 4) peaked in September and declined steadily thereafter.

Sites supporting average maxima of 50 or more are shown in the Table, with Loughs Neagh/Beg and Strangford Lough supporting the highest numbers. There were fewer recorded at Loughs Neagh/Beg in 1990-91 than might to expected from the counts made in recent winters, but increases were recorded at many of the remaining sites. Other sites supporting more than 50 individuals in 1990-91, but failing to qualify for entry into the table on averages, include the Wash (112, February), Clandeboye Lake (73, November) and the Hampshire Avon between Blashford and Hucklesbrook (60, August).

Table 7. LITTLE GREBE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	292	x	412	480	324	(Sep)	302
Strangford Lo.	x	98	x	103	122	(Dec)	108
Swale Est.	x	x	x	71	108	(Nov)	90
Thames Est.	27	19	146	104	88	(Dec)	77
Chew Valley Lake	70	80	42	83	100	(Sep)	75
R. Soar: Leicester	x	x	62	67	68	(Dec)	66
Medway Est.	x	x	39	60	100	(Jan)	66
Deben Est.	45	39	45	84	87	(Dec)	60
Rutland Water	x	46	73	69	40	(Oct)	57
Southampton Water	x	x	87	50	27	(Mar)	55
Upper Lo. Erne	30	x	62	57	67	(Nov)	54

Great Crested Grebe *Podiceps cristatus*

The total number of this species counted in Britain (8,803 in September) was higher than in 1989-90, almost certainly because of the increased site coverage and the expansion of the species on gravel pit complexes and reservoirs in lowland England. In contrast, fewer were recorded in Northern Ireland (maximum of 1,518 in November) than was the case in 1989-90 (1,955); there were fewer at Loughs Neagh/Beg (see below). As for the Little Grebe, numbers were highest throughout the U.K. in September (Tables 3 & 4) and declined thereafter.

A total of 18 sites currently support over 150 Great Crested Grebes on average (Table 8), with Loughs Neagh/Beg, Belfast Lough, the Forth Estuary and Rutland Water holding by far the largest concentrations. Loughs Neagh/Beg held far fewer than in 1990-91, whilst the count of 1,038 birds at Rutland Water is the highest number ever recorded at an inland site in Britain. There seems to be an increasing trend at this site, which is extremely important for a number of waterfowl. In addition to the sites listed in the Table, up to 400 birds are seen regularly off Greatsone-on-Sea, Dungeness, during the winter, and a further 4 sites held more than 150 in 1990-91: Blithfield Reservoir (233, December), Loch Leven (212, November), Hanningfield Reservoir (186, December) and Stewartby Lake (171, February).

Table 8. GREAT CRESTED GREBE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	1,104	1,356	1,605	1,188	612	(Sep)	1,173
Belfast Lo.	279	703	776	886	1,162	(Nov)	761
Forth Est.	759	795	311	849	524	(Sep)	648
Rutland Water	462	382	605	544	1,038	(Jan)	606
Chew Valley Lake	445	430	560	490	440	(Aug)	473
Grafham Water	524	288	179	264	744	(Nov)	400
Queen Mary Rsr.	410	413	251	360	526	(Oct)	392
Upper Lo. Erne	374	446	404	306	137	(Nov)	333
Swale Est.	418	(68)	346	160	(28)	(Sep)	308
Medway Est.	194	143	357	254	206	(Feb)	231
Morecambe Bay	202	128	277	236	229	(Sep)	214
Pitsford Rsr.	169	189	202	142	243	(Dec)	189
Carlingford Lo.	186	164	106	216	259	(Feb)	186
Borth/Ynyslas	177	(103)	190	x	186	(Dec)	184
Conwy Bay	x	189	164	x	x		177
Colne Est.	x	255	100	322	214	(Jan)	178
Stour Est.	100	119	127	322	200	(Oct)	174
Abberton Rsr.	229	93	44	303	161	(Nov)	166

Cormorant *Phalacrocorax carbo*

The total count of Cormorants in 1990-91 reached 13,866 in Britain (Table 1) and 1,529 in Northern Ireland, representing an increase and a decrease, respectively, on the totals of 1989-90. In Britain, the Cormorant population appears to be expanding, especially in inland areas and this is naturally alarming to fisheries managers (the species is shot under licence in many parts of the country). The species reached its highest level of abundance in September on British NWC sites (Table 3), declined slowly subsequently, but did not peak until December in Northern Ireland (Table 4).

Summers & Laing (1990) analysed recoveries of Cormorants ringed as chicks on the Lamb in the Firth of Forth. Dispersal was rather limited. Of 196 recoveries of birds ringed as chicks, only 6 were recovered overseas, one of which was in Ireland. A quarter of the birds were recovered locally and a further 54% elsewhere in Scotland and in northern England. Warke *et al.* (*in press*) examined long-term trends and regional abundance of both breeding and wintering Cormorants in Northern Ireland. They found that the numbers of breeding birds have decreased in recent years, perhaps due to a decline in the Roach (*Rutilus rutilus*) population which is itself affected by the tapeworm *Ligula intestinalis*. This may have affected the fitness of adult Cormorants, influencing the numbers of birds attempting to breed.

Table 9 lists all sites that support at least 200 birds according to average five year maxima. At several sites, such as the Medway, Forth and Tees estuaries, and the Queen Mary Reservoir, Loch Leven and Grafham Water, there is evidence of a long-term increase in Cormorant numbers. A further 9 sites supported over 200 Cormorants in 1990-91 but their five year averages do not qualify them for inclusion in the table. These were Lindisfarne (720, November), Queen Mother Reservoir (419, December), Hanningfield Reservoir (374, December), Queen Elizabeth II Reservoir (320, November), Carmarthen Bay (303, September), Blithfield Reservoir (278, December), William Girling Reservoir (232, October), Rostherne Mere (222, January) and Alton Water (208, December).

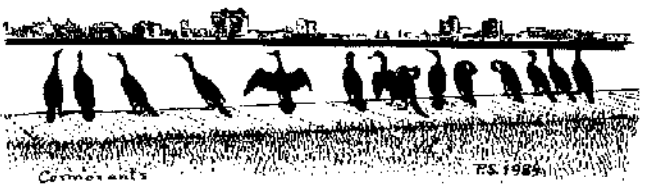


Table 9. CORMORANT: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	x	x	591	951	904	(Dec)	815
Morecambe Bay	303	544	733	1497	991	(Sep)	814
Medway Est.	x	219	415	920	1,280	(Feb)	709
Forth Est.	(145)	414	479	766	962	(Nov)	655
Inner Clyde	x	x	x	663	408	(Jan)	536
Inner Moray Fth.	685	940	641	229	112	(Oct)	521
Solway Est.	527	374	483	550	492	(Sep)	485
Poole Hbr.	436	426	615	232	417	(Oct)	425
Queen Mary Rsr.	x	278	438	315	467	(Feb)	375
Ranworth/Cockshoot Br.	267	354	368	325	329	(Jan)	329
Loch Leven	91	117	270	330	800	(Feb)	322
Abberton Rsr.	233	117	x	570	320	(Sep)	310
Rutland Water	x	x	280	250	350	(Feb)	293
Dee Est.	x	210	290	291	286	(Sep)	269
Tees Est.	x	144	113	337	480	(Sep)	269
Ouse Washes	286	169	182	533	163	(Mar)	267
Swale Est.	136	301	394	228	263	(Oct)	264
Blackwater Est.	x	252	345	219	208	(Nov)	256
Grafham Water	158	200	325	74	450	(Feb)	241
Belfast Lo.	68	x	235	369	284	(Nov)	239
Outer Ards	61	374	379	197	153	(Feb)	233
Wash	188	198	294	224	263	(Oct)	233
Upper Lo. Erne	182	181	131	316	192	(Feb)	200

Mute Swan *Cygnus olor*

The total counts of Mute Swans in Britain (Table 1) clearly reflect a continuation of the population increase in this species following the ban on the sale of lead weights for angling and the later prohibition of its use by water companies and others. This is also confirmed by both the September and January population indices (Table 5). Preliminary results from the 1990 breeding survey of Mute Swans in Britain have been produced (Delany 1990), and these clearly show that there have been major increases in some regions compared with the levels reported in the 1983 survey. The largest increases have occurred in places where lead poisoning had been a problem, for example there has been a doubling of numbers in Surrey and in parts of the English Midlands. However, there have been increases elsewhere also, such as over much of Scotland where lead poisoning was never a problem, and so other factors must also be important. The reasons may well emerge from more detailed comparative analyses of breeding Mute Swan data which are currently under way. Despite the increase in our coverage, the total count obtained from the NWC scheme still accounts for less than 60% of the number known to be in Britain from the summer surveys, but it does provide a good year-on-year estimate of the trend in numbers.

Kirby *et al.* (in press) used NWC data to examine the current status of Mute Swans during the non-breeding season and examine long-term regional trends. They showed that the British population had increased dramatically since the 1986-87 winter when it reached its highest level for 27 seasons. Recent increases occurred in most regions of Britain and there has been an expansion in numbers on all habitat types, but especially on reservoirs, gravel pits, rivers and marshes. Clearly the future looks somewhat brighter for the British Mute Swan population. Unfortunately however, the lead poisoning problem has not gone away altogether. There has been a decline in swan deaths on the Thames, but there were a number of cases of poisoning on the Severn at Worcester in October 1990. Many of the birds were rounded up and treated by local vets, advised by WWT's Animal Health Officer, Martin Brown. Martin, himself a keen fisherman, examined split shot and ledger weights collected from the river bank by local conservationists. More than 80% of both types of weights comprised lead rather than alternative materials! Some of the lead would have undoubtedly been deposited some time ago, but much of it was certainly of recent origin. Some anglers thus appear to be flouting the River Authority byelaws and continue to use lead, either from stocks remaining from pre-ban days or brought in from

abroad (*e.g.* lead is legally sold in Ireland, a favoured haunt of large numbers of British fishermen). Clearly, it will be some time before the problem is fully eradicated.

A number of interesting papers on Mute Swans (and lead poisoning) can be found in the Proceedings of the Third International Swan Symposium. Of particular interest to readers of *Wildfowl and Wader Counts* might be: 'Factors affecting the number of pairs and breeding success of Mute Swans *Cygnus olor* in an area of South Staffordshire, England, between 1961 and 1985' (Coleman *et al.* 1991); and, 'Survival rates of young Mute Swans *Cygnus olor* (Perrins 1991). In addition to these, Perrins & Sears (1991) have used ringing recoveries to gather information on deaths from collisions with overhead wires. They found that up to a fifth of Mute Swans in Britain die in this way. Clearly, this will become a relatively more important cause of death as lead poisoning becomes less of a problem, and as swans become more abundant. The WWT is currently identifying problem areas and discussing with electricity companies the possibility of marking overhead wires in 'hotspot' localities for collisions.

Those sites averaging more than 180 Mute Swans during the 1986-87 to 1990-91 period are shown in Table 10. There was a spectacular flock on the Loch of Harray, Orkney, and relatively large numbers on The Fleet/Wey complex and at Abberton Reservoir. Otherwise, the numbers at most other haunts in Table 10 were similar to that found in recent years. This suggests that the species may be spreading to smaller waters and increasing on rivers, possibly because its major haunts are already at capacity. Other sites holding over 180 Mute Swans in 1990-91 were Loch of Skene (275, November), Derwent Water (266, January) and Fairburn Ings (197, September).

Table 10. MUTE SWAN: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	1,069	1,269	1,120	1,465	1,205	(Sep)	1,226
The Fleet/Wey	869	836	(571)	891	1,029	(Oct)	906
Abberton Rsr.	547	481	440	599	635	(Aug)	540
Ouse Washes	500	586	399	544	414	(Jan)	489
Colne Est.	435	618	306	316	255	(Jan)	386
Christchurch Hbr.	392	341	402	538	150	(Aug)	365
Upper Lo. Erne	197	229	336	430	470	(Jan)	332
Lo. of Harray	293	456	655	683	1205	(Oct)	329
Tweed Est.	309	268	240	360	368	(Dec)	309
Stour Est.	349	290	357	233	207	(Sep)	287
Somerset Levels	(55)	286	271	332	256	(Jan)	286
Lo. Bee	x	x	x	254	307	(Jan)	281
Rutland Water	462	229	258	205	246	(Sep)	280
Lo. Eye	198	x	x	x	324	(Dec)	261
Thames Est.	210	248	260	298	159	(Jan)	235
Strangford Lo.	193	176	212	174	195	(Sep)	190
R. Welland: Spalding	254	164	241	176	111	(Feb)	189
R. Avon: Fordingbridge	159	153	215	208	211	(Oct)	189

Bewick's Swan *Cygnus columbianus bewickii*

Bewick's Swans reached Britain exceptionally early in autumn 1990 with over 100 individuals recorded at Slimbridge, 740 at Welney and 975 in the Martin Mere area by the end of October (Rees *et al.* 1991b). Such early movements were thought to be a result of shortages of *Potamogeton*, and relative drought in the Lauwersmeer area of The Netherlands. Peak numbers were not particularly high in the 1990-91 winter; the maximum in the U.K. as a whole was almost 8,400 (Tables 1 & 2) compared to almost 9,000 in 1989-90. Peak numbers on NWC sites counted in all seven months occurred in January in Britain (Table 3) and February in Northern Ireland (Table 4). Bewick's Swans bred well in 1990, with nearly 20% juveniles in the wintering flocks at WWT Centres.

The principal sites for Bewick's Swans are shown in the Table. The Ouse Washes are outstanding in their importance for this species, and the numbers there (mainly at the Trust's reserve at Welney) and at Martin Mere and Slimbridge together exceeded more than 6,400 birds, the vast majority of the British total. Furthermore, the numbers from the Martin Mere/Ribble Estuary flock continue to increase, placing this site firmly in third position in the U.K. for this species. The peak count in 1990-91 from Breydon Water was noticeably low. Elsewhere, the following sites supported over 150 Bewick's Swans in 1990-91: Block Fen (250, February), Lough Foyle (195, December) and Ludham How Hill (155, February).

Eileen Rees and Dafila Scott joined a team of scientists from the USSR on an expedition to the mouth of the Pechora river in western Siberia in the summer of 1991. They found a total of 3,000 swans (500 of which were on the ground), the majority of them Bewick's. This is one of the densest breeding areas; some nests were only 200m apart. After the Trust's scientists had left the Pechora, Soviet workers caught 20 Bewick's and marked them with neck collars. The collars are blue and, of necessity, rather conspicuous. The first collared bird was sighted at Martin Mere on 30 October. We hope that this is the start of a long-term collaborative study between USSR and WWT researchers.

Table 11. BEWICK'S SWAN: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Ouse Washes	6,164	3,787	3,834	5,984	5,100	(Jan)	4,974
Nene Washes	x	1,400	1,137	270	653	(Feb)	865
Martin Mere/Ribble Est.	415	552	639	660	+1046	(Nov)	662
Breydon Water	18	691	698	528	167	(Jan)	420
Severn Est.	414	+240	250	+339	340	(Feb)	317
Lo. Neagh/Beg	234	264	246	303	523	(Feb)	314
Walland Marsh	220	225	269	231	x		236
R. Avon: Ringwood	311	136	167	158	169	(Feb)	188
Walmore Common	211	200	112	137	164	(Feb)	165
St Benets Levels	x	23	x	266	182	(Feb)	157

+ from WWT annual swan reports (*e.g.* Rees *et al.* 1991b).

Whooper Swan *Cygnus cygnus*

In contrast to the situation for the Bewick's Swan, Whooper Swans were slow to arrive in the autumn of 1990, with the main influx at Trust Centres not occurring until November. They had enjoyed a moderately successful breeding season with 16.4% young in flocks at Welney, 17.6% at Martin Mere and 16.9% at Caerlaverock (Rees *et al.* 1991b). The total numbers counted at NWC sites were not as high as in 1989-90, but there were more than 6,000 counted in the U.K. in January. The counts for Northern Ireland (Table 2) and the peak numbers at the three major sites which head Table 12, indicate that the swans move between their major haunts in the course of the winter, presumably in relation to decline in food resources.

The main resorts for Whooper Swans are given in Table 12. As usual, Lochs Neagh/Beg had a large flock, but were exceeded this year by a group of 1,115 counted in the Loch Eye/Cromarty Firth area in November. This is thought to be because of exceptional growth of submerged aquatic plants in 1990, providing a rich food source for the swans. Thanks to the attractiveness of the WWT sites for swans, the Ouse Washes and Martin Mere are climbing up the league table; both had over 500 birds this winter. A further two sites held over 170 Whoopers in 1990-91: Montrose Basin (501, February) and Loch of Skene (314, December), though a survey of numerous wetlands in the Western Isles collectively produced over 330 birds in January.

Early results from a comparative study of breeding success in Whoopers nesting in upland and lowland regions of Iceland have been published recently (Rees *et al.* 1991c). Adult birds were heavier in the lowlands and tended to lay more eggs. They also produced larger and heavier cygnets suggesting that habitat quality was superior at the lowland site. The results indicate that birds from different breeding areas may contribute disproportionately to the percentage of juveniles reared annually in the population.

A census of Whooper Swans in Britain, Ireland and Iceland was conducted in January 1991, in collaboration with the Irish National Parks and Wildlife Service and the University of Iceland. Coverage is believed to have been good and the results are currently being analysed. We expect an increase over the 16,700 swans found during the previous survey in 1986 (Salmon & Black 1986).

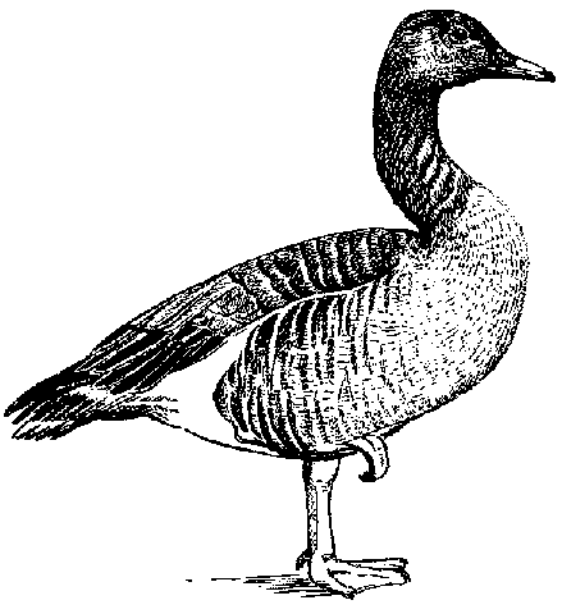
Table 12. WHOOPER SWAN: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Foyle	1,030	1,288	1,960	519	988	(Nov)	1,157
Lo. Neagh/Beg	1,266	1,105	1,192	1,088	1,110	(Dec)	1,152
Upper Lo. Erne	821	669	582	726	896	(Jan)	739
Lo. of Harray	108	485	1,010	817	927	(Nov)	669
Ouse Washes	520	582	603	686	578	(Mar)	594
Lo. Eye/Cromarty Fth.	461	500	275	(183)	1,115	(Nov)	588
Martin Mere/Ribble Est.	243	429	406	572	538	(Nov)	438
Solway Est.	278	132	446	277	96	(Mar)	246
Lo. of Strathbeg	406	202	225	264	129	(Jan)	245
Lo. Leven	199	222	222	220	180	(Dec)	209

Bean Goose *Anser fabalis*

A record total number of Bean Geese was present in the Yare Valley, peaking at 485 in January, noticeably higher than in recent years. Elsewhere, the only record of more than 10 birds came from Loch Ken (20, January). Smaller numbers appeared at numerous other localities.

Parslow-Otsu (1991) provides an account of the history, recent status and population ecology of Bean Geese in east Norfolk. This is the only permanent British wintering locality for Bean Geese of the race *fabalis*. It has long been suspected that this group is an isolated population breeding in Scandinavia, and there is now some evidence for this. In 1987, 36 geese were caught and fitted with neck collars at Vaesterbotten in northern Sweden. No fewer than 22 wintered in the Yare Valley in 1987-88 and all but one of these returned the following winter. Most of the remaining collared geese were found in Jutland, Denmark, and none in the main wintering area for *fabalis* in The Netherlands. This is good evidence that the birds are rather isolated from the bulk of geese of this race and there is a link between the wintering areas in Denmark and England. The mortality rate of the geese appears to be very low, which presumably accounts for the increase in numbers in the Yare Valley in recent years. Although the species is protected from shooting in Britain, its main feeding sites and roost in the Yare Valley have, as yet, little formal protection or management.



Pink-footed Goose *Anser brachyrhynchus*

The 1990 breeding season was relatively good for Pink-feet with averages of 21.5% young and 2.2 young per pair present in autumn flocks (Kirby & Cranswick 1991). The number counted in the October and November censuses were almost 176,000 and 195,000 respectively, the latter representing the highest total yet. Following on from the findings of Newton *et al.* (1990), the October census was expected to be higher than that achieved in November as Pink-feet were highly concentrated in eastern Scotland and perhaps easier to census at this time. However, this was not found to be the case as the total for October did not reach that of November, the traditional month of the census. Why this should be is not known, but it is unlikely that birds remained in Iceland, since Icelandic scientists checked a number of autumn haunts without finding geese during the survey period. Both October and November censuses were again attempted in autumn 1991. Unlike in other recent years, there was no widescale census in spring 1991, but more than 74,000 were counted in Britain in March (Table 1), mainly in Scotland, with more than 17,000 as far south as the Solway (Table 13).

Table 13 lists the sites that currently hold 2,000 or more Pink-footed Geese, according to average maxima calculated over the last five seasons. The Loch of Strathbeg, Dupplin Loch, Aberlady Bay and Castle Loch supported very large numbers in 1990-91 compared with earlier years, whilst the numbers on the Wash, reaching over 25,000 in the January cold spell were unprecedented, these birds presumably having moved south from Lancashire. Relatively low counts were recorded at Westwater and Cameron Reservoirs compared with recent years. Additional flocks of over 2,000 birds were recorded at Glenfarg Reservoir (3,990, October), Drummond Loch (3,550, October), Redmyre Loch (3,200, November), Cobbinshaw Reservoir (3,000, October), on the River Eden between Crosby and Carlisle (3,000, January), Whitton Loch (2,500, October), Duns Dish (2,200, October) and Loch Macanric (2,100, October).

Another WWT expedition travelled to southern Iceland in April 1991 to look at goose staging in the important agricultural lowlands of the area. The team has already shown that Pink-feet respond very sensitively even to small differences in grass quality brought about by snow melt (Fox *et al.* 1991a). Last year, it was found that Greylags also responded in a similar way to grass growth and snow-melt (Fox *et al.*, in press, b) and current analyses are focusing on the reasons behind geese feeding in the restricted numbers of farms on which they are observed. Initial analyses have shown that differences in habitat use and timing of migration ensure that competitive interactions between Greylags and Pink-feet are minimised during the important run-up to the breeding period (Fox *et al.*, in press, b). However, the main objective of the programme continues to be to study the reasons for the fluctuations in breeding success in Pinkfeet and Greylags nesting in Iceland. The spring of 1991 was the first mild one in three seasons, with arriving geese encountering snow-free fields and good feeding conditions. The interior breeding areas of the Pink-feet were free of snow and so geese spent less time than in the past two seasons feeding in the lowlands before travelling to their nest sites. Breeding success was much higher than in the previous two seasons showing that the ability of the geese to get to breeding sites early may play some role in determining ultimate breeding success. This partly explains the correlation between spring weather conditions and subsequent numbers of young in the autumn age ratios (Fox *et al.* 1989, a).

Back home, Giroux (1991) examined roost site fidelity amongst Pink-footed Geese in north-east Scotland, basing his conclusions on the movements of 10 birds fitted with radio transmitters. These birds changed their roost sites approximately every 10 days, each bird visiting about 3 different roosts and returning to the same sites on many occasions. Some shifts followed disturbances from shooting, trapping and other human activities, whilst others occurred during harsh weather or whilst the geese were feeding at night.

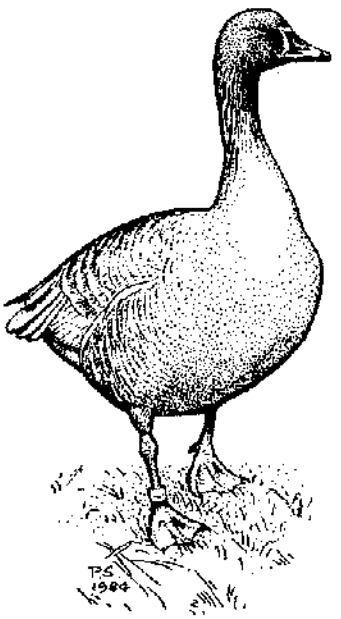


Table 13. PINK-FOOTED GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. of Strathbeg	29,800	*20,900	30,200	*32,150	*37,100	(Nov)	30,030
Westwater Rsr.	24,610	22,400	40,000	36,250	*24,700	(Oct)	29,592
SW Lancashire	16,220	26,695	30,545	*37,550	+31,805	(Nov)	28,563
Dupplin Lo.	*8,448	*11,300	40,000	31,000	42,000	(Oct)	26,550
Montrose Basin	*12,600	*35,000	*22,000	12,000	15,000	(Dec)	19,320
Slains Lo./Ythan Est.	*9,590	*21,700	*21,000	*30,300	13,190	(Apr)	19,156
Solway Est.	14,125	*11,467	*9,006	16,408	17,421	(Mar)	13,685
Lo. Leven	*10,500	*9,700	12,200	*18,000	16,000	(Oct)	13,280
Hule Moss	*5,500	5,000	5,100	25,735	16,755	(Sep)	11,618
Carsebreck/Rhynd Lo.	5,840	*11,100	15,090	11,200	*9,900	(Oct)	10,626
Wash	2,712	6,621	9,382	*8,505	25,330	(Jan)	10,510
Fylde/Morecambe Bay	12,795	8,700	7,900	9,150	+8,240	(Dec)	9,357
Scolt Head	12,000	4,000	10,180	11,500	8,200	(Nov)	9,176
Aberlady Bay	3,000	*11,000	*7,300	*5,600	17,500	(Oct)	8,880
Fala Flow	6,500	*6,800	3,000	11,920	9,908	(Sep)	7,626
Wigtown Bay	3,910	*7,000	*14,000	6,007	6,776	(Mar)	7,539
Cameron Rsr.	*7,500	*6,000	*7,000	*9,500	3,820	(Jan)	6,764
Castle Lo.	5,000	950	2,000	x	16,380	(Feb)	6,083
Findhorn Bay	x	*2,211	9,800	*5,276	x		5,762
Lo. of Kinnordy	x	*4,550	*2,000	8,240	6,980	(Oct)	5,443
Lo. Eye/Cromarty Fth.	(2,700)	*6,306	*7,000	*1,194	(43)	(Nov)	4,833
Lo. Mahaick	1,000	x	*6,531	5,250	4,515	(Oct)	4,324
Lour	*3,850	*7,660	*3,410	*1,800	x		4,180
Crombie Lo.	*5,000	*6,000	6,244	1,391	1,000	(Nov)	3,927
Kinmount Ponds	x	x	1,690	2,570	7,300	(Oct)	3,853
Gladhouse Rsr.	*3,500	*2,500	3,400	5,400	3,200	(Sep)	3,600
Beauly Fth./Munlochy	x	*5,050	*2,560	*2,585	(490)	(Nov)	3,398
Lo. Tullybelton	x	*1,650	*3,050	*3,000	*5,500	(Oct)	3,300
Lake of Menteith	1,040	*2,056	6,000	1,885	*3,600	(Oct)	2,916
Cowgill Rsr.	2,000	2,000	3,000	x	*3,700	(Oct)	2,675

+ from Forshaw (1991).

European White-fronted Goose
Anser albifrons albifrons

Despite the spectacular increase of the Siberian breeding population in recent decades, the number wintering in Britain continues to decline. The flyway population is around half a million birds, but improvements in feeding conditions and protection in The Netherlands, and recently in the Nord-Rhein Westfalia region of Germany, means that few need to migrate to traditional wintering areas further from the breeding grounds. This is a phenomenon known as 'short-stopping', well known among geese in North America. Total numbers recorded in Britain in 1990-91 reached only 4,025 (Table 1), almost 1,800 fewer than in 1989-90, and the population index (Table 5) fell to its lowest level for a number of years.

Counts from the main resorts are shown in Table 14. The numbers at Slimbridge on the Severn Estuary were particularly disappointing, and few were recorded on the Thames and the North Norfolk Marshes. The most westerly wintering flock of this race, on the wet pastures of the Tywi at Dryslwyn, which reached 3,000 birds in the late 1960s, has all but disappeared. Even within Britain, the range appears to be contracting and shifting eastwards. No other sites held over 100 birds in 1990-91.

Table 14. EUROPEAN WHITE-FRONTED GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Severn Est.	3,500	4,600	3,770	3,200	2,600	(Feb)	3,534
Swale Est.	2,070	1,400	2,050	1,660	2,280	(Mar)	1,892
Thames Est.	224	640	300	157	85	(Jan)	281
R Avon: Sopley	520	205	245	(80)	105	(Jan)	269
North Norfolk Marshes	232	290	281	264	215	(Feb)	256
Middle Yare Marshes	37	210	138	x	295	(Jan)	136
Minsmere	119	142	180	45	x		122
R Tywi: Dryslwyn	175	175	x	49	30	(Feb)	107
Alde Complex	140	11	139	0	15	(Feb)	61

Greenland White-fronted Goose
Anser albifrons flavirostris

The Greenland White-fronted Goose Study/National Parks and Wildlife Service censuses produced a total of 29,388 birds in 1990-91. This compares with total counts of 26,845 and 27,341 in the autumns of 1989 and 1988, respectively. The British totals were 14,762 in autumn and 15,180 in spring, with *ca.* 56% and *ca.* 58% counted on Islay, their principal resort. There was 19.0% young amongst flocks aged on Islay (n = 3,770), and 18.8% amongst those aged in Scotland as a whole (n=5,410). This compares with 19.3% in the previous winter (GWGS 1991). It is heartening that numbers have doubled since the subspecies was protected, first in Scotland in 1981 and subsequently in Ireland and, in spring 1991, in Greenland.

The maxima at the main resorts in Britain are shown in Table 15 and all qualify for national recognition for this subspecies. A further 4 sites supported 100 or more birds during the 1990-91 season. These were Loch of Mey (210, February), Craiglin Lochan (134, November), Mains of Greenlaw (104, January) and Loch Quien (100, January).

Increasing numbers have not, however, been greeted by all with joy; farmers on the island of Islay have complained of agricultural damage and have applied for licences to shoot the geese. Licenses to shoot unlimited numbers have been granted, despite protests by conservationists, who argue that shooting is not the most effective way to tackle these problems. The Nature Conservancy Council for Scotland intends to draw up a strategic plan to manage the geese on Islay, which will link with the international management plan (see below), and the WWT has been given a contract to carry out an individual marking programme and to work on the ecology of the geese from November 1991.

During 1990, Stephanie Warren was engaged by WWT under contract to the Irish government to undertake a review of their Greenland White-fronted Goose individual marking project (Warren 1990). Some of the results of this work have already been published (e.g. Wilson *et al.* 1991), but Stephanie carried out detailed analysis of migration patterns and site interchange of marked geese (Warren *et al.*, in press) as well as habitat and field use on the Wexford Slobs, where intensive resighting and census work takes place throughout the winter. She was also able to analyse family relationships and assess whether the use of neck-collars was affecting pairing and breeding success (Warren *et al.* 1991). Three contributions (on the effects of protection on patterns of mortality, age of first breeding and persistence of family groups in Greenland White-fronts) will be presented to the North American Conference on Arctic Geese to be held in California in January 1992.

An expedition was mounted to the important and extensive Ramsar site of Nateraq in central west Greenland during the summer of 1991 funded by the Greenlandic Home Rule Government. It has been proposed that the site be used for the introduction of Musk Oxen to this part of west Greenland, but very little was known of the area at all. One aim was to carry out ground-truth work to confirm the extraordinarily high densities of Greenland White-fronted Geese counted during the aerial surveys of previous years (Fox & Stroud 1988). The area is a low, flat plain of recovered maritime sediments, recently emerged from the sea bed as a result of isostatic up-lift as the land recovers from the loss of the weight of the ice. It is a vast flat, low-lying area, dotted with hundreds of small lakes and marshes with streams meandering across its surface. This remarkable wetland complex is quite unique in Greenland. The team found just under 1000 geese in an area of less than 40 km^2 and saw a goose caught at Wexford during the previous summer (Fox *et al.* 1991,b). Breeding success was apparently high after a fine spring and warm dry summer, but the densities of geese summering and breeding in this area highlight its importance.

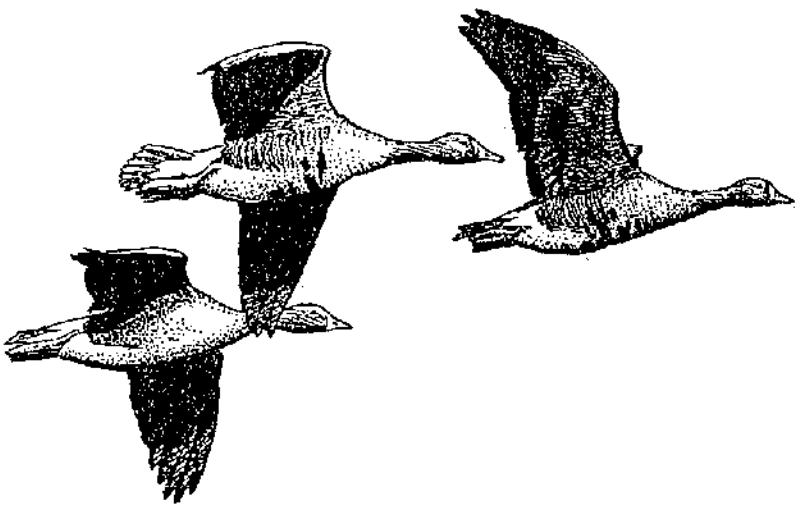
This flurry of analysis is timely as the Greenland White-front will be the subject of the first International Management Plan in Europe which is being drawn up by

the JNCC in Britain, with sponsorship from the Irish National Parks and Wildlife Service and collaboration from IWRB. It will be discussed at a workshop arranged by the Irish Government for early March 1992. The objective is to involve all range states (Greenland, Iceland, Ireland and the U.K.) in the creation of an action plan for the Greenland White-front population. Such an international agreement approach to the conservation of migratory birds is a relatively new idea in western Europe, but will form a key basis of the forthcoming Western Palearctic Waterfowl Agreement under the Bonn Convention. One of the problems identified for the species is that, despite the increasing numbers, there appears to be continued contraction in range, especially in Ireland. Most of the increase in numbers is accommodated at the Wexford Slobs, whereas sites holding smaller numbers in the remainder of Ireland are barely holding their own. The same trend is evident in Britain; the increasing numbers are concentrated at the major sites (compare the trends in numbers in the top and bottom halves of Table 15). It is difficult to know how one might go about reversing this rather worrying trend.

Table 15. GREENLAND WHITE-FRONTED GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Islay	6,490	7,888	7,588	8,826	8,857	(Mar)	7,930
Machrihanish	716	944	907	1,005	1,240	(Mar)	962
Rhunahaorine	733	817	1,116	914	797	(Dec)	875
Tiree	760	759	728	987	941	(Dec)	835
Stranraer Lo.	740	550	393	770	600	(Feb)	611
Coll	405	400	647	671	792	(Nov)	583
Loch Ken	300	370	342	550	306	(Dec)	374
Endrick Mouth	230	240	300	300	350	(Dec)	284
Danna/Keils	136	197	200	224	245	(Dec)	200
Loch Heilen	144	157	162	305	160	(Nov)	186
Westfield	165	163	200	209	180	(Mar)	183
Appin/Eriska/Benderloch	x	215	76	120	314	(Mar)	181
Colonsay/Oronsay	128	137	165	120	250	(Mar)	160
Lismore	170	215	76	120	181	(Mar)	152
Scarmclate	x	x	95	130	192	(Apr)	139
Loch Calder	155	146	0	176	172	(Jan)	130
Ynyshir	95	127	124	111	152	(Feb)	122
Jura (2 flocks)	x	138	90	90	157	(Nov)	119

N.B. including data extracted from the GWGS report (GWGS 1991).



Greylag Goose *Anser anser*

Like the Pink-footed Goose, the population of Icelandic-nesting Greylag Geese has expanded greatly from a mere 30,000 birds in 1960 to 105,000 in 1987 (Fox *et al.* 1989, a). Autumn age counts of Icelandic Greylags in 1990 revealed 20.7% young overall and 2.5 young per pair on average, suggesting that they had bred very well (Kirby & Cranswick 1991). Complete censuses in October and November resulted in just over 76,000 and almost 115,000 birds, respectively, but this is still considered to represent an under-estimate of the true size of this population. Sites supporting over 2,000 Greylag Geese, mainly from the Icelandic stock, are shown in Table 16. A relatively large count was made at the Loch of Skene in 1990-91, whilst several sites supported fewer than might be expected from previous winters, especially the Loch of Strathbeg, Carsebreck and Holborn Moss. In addition to these, some 4,200 birds were recorded on the Isle of Bute and 3,963 at various sites in Orkney, both in November, whilst the Loch of Clunie (4,000, October), Findhorn Bay (2,700, November) and Montrose Basin (2,100, February) also exceeded 2,000 birds.

The feral Greylag population, which resides mainly in England and Wales but also in parts of Scotland, may now number in excess of 22,000 birds (Owen & Salmon 1988), and was the focus of a Special Survey to assess population size and distribution in summer 1991. The number counted on NWC sites in 1990-91 peaked in January at around 15,300 birds (Table 1). Numbers recorded in Northern Ireland (1,107), which will largely be feral birds, are well up on 1989-90 where a maximum of just 456 was recorded.

The non-migratory native Greylag population that occupies the far north and west of Scotland has not escaped the attentions of the Trust. A post-breeding census in August 1990 produced almost 2000 birds, and similar numbers were counted in January 1991. Breeding success, averaging 3.72 young/pair on North Uist and 4.16 young/pair on South Uist, was similar to previous years (Mitchell 1991a). Moulting birds were ringed in July 1990 and July 1991. The Uist Greylags appear to be highly sedentary on the three main islands. Marked birds disperse from the moulting grounds to the west side of North Uist, Benebecula and occasionally to South Uist.

Table 16. GREYLAG GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Dinnet Lo./R. Dee	*8,200	10,800	*18,000	1,5800	*16,000	(Nov)	13,760
Inner Moray Fth.	*12,556	*17,450	*12,311	9,271	*8,525	(Nov)	12,023
Lo. Eye/Cromarty Fth.	*4,774	*4,042	*19,259	*11,193	*18,593	(Oct)	11,572
Lo. of Skene	*4,200	10,000	*8,700	13,305	19,150	(Jan)	11,071
Lo. Spynie	*7,750	9,000	12,000	3,350	*6,100	(Oct)	7,640
Lo. of Strathbeg	6,250	9,700	6,900	*7,050	925	(Feb)	6,165
Haddo House Lo.	4,320	3,500	5,000	*4,700	*5,900	(Oct)	4,684
Tay/Isla Valley	*3,685	*3,663	*6,331	*2,959	*+6,262	(Oct)	4,580
Drummond Pond	*7,225	5,000	*4,160	*1,800	*3,600	(Nov)	4,357
Caithness Lo.	*5,879	*4,995	*2,787	*2,958	*3,064	(Oct)	3,937
Lindisfarne	*4,500	3,800	*5,000	*1,700	2,000	(Jan)	3,400
Dornoch Fth.	*4,389	*3,406	*4,261	2,407	*1,407	(Oct)	3,174
Fedderate Rsr.	*2,500	*2,750	*3,300	*2,700	*2,950	(Nov)	2,840
Stranraer Lo.	*3,500	*2,800	*(1,000)	*2,400	*2,140	(Nov)	2,710
Carsebreck/Rhynd Lo.	*4,450	*3,150	*2,470	*2,150	*915	(Nov)	2,627
Holborn Moss	3,000	*3,000	*2,500	3,200	*740	(Oct)	2,488
Lo. of Lintrathen	1,200	*1,800	3,050	2,490	*3,600	(Oct)	2,428
Hoselaw Lo.	3,000	220	3,600	3,200	*1,270	(Oct)	2,258
Lo. Leven	2,100	2,250	2,400	*1,200	2,300	(Jan)	2,050

Canada Goose *Branta canadensis*

This species continues to flourish, with peak numbers in Britain in October 1990 (almost 38,000 birds) exceeding the equivalent figure of last season by almost 4,000 birds. Canada Geese remain a considerable nuisance, both to farmers and managers of amenity grasslands. In urban areas, Canada Geese are responsible for damage to lawns, destruction of lakeside vegetation and the fouling of footpaths. The species is legal quarry and in the country there seems to be a move to regard the bird as sport; indeed, some local populations are being held in check by shooting. In the towns, however, populations are more difficult to control. Licences can be obtained for pricking eggs, and this practice is becoming more frequent, especially in urban areas. However, since the geese are long-lived, this needs to be carried out with great efficiency and for a number of years to effect a decline in numbers. At Great Linford, the numbers of nesting pairs of Canada and Greylag Geese have steadily increased and experiments have been carried out to try and reduce breeding success because of local agricultural damage (Wright & Phillips 1991). It was concluded that a successful strategy for control through egg removal is to place substitute eggs (in this case wooden or hard-bolied eggs) in the nests of early laying pairs. Few geese nesting later will re-lay and incubate their second clutch.

The sites supporting 600 birds, according to average five year maxima, are shown in Table 17. Examination of these seems to indicate that numbers remain constant at least in some areas, and further evidence of this comes from the population index (Table 5) which in fact fell below that of the previous two winters. However, because the species may feed far from water, birds may be missed during the NWC counts on some occasions. The Introduced Goose Survey undertaken in 1991 will reveal the true size of the Canada Goose population and provide key information needed to plan management of their numbers and thus alleviate the problems. In addition to the sites in Table 17, numerous others held more than 600 birds during the 1990-91 season. These were: Fleet Pond (804, October), Bar Mere (800, November), Kings Bromley gravel pit (714, February), Dinton Pastures (682, September), Tundry Pond (674, September), Capesthorne Hall (653, September), Eversley Cross and Yateley gravel pits (636, December), Eccup Reservoir (622, September), Ellesmere gravel pits (608, October) and Kirby Bellars gravel pit (602, February).

Stephanie Warren of the Trust has commenced a Ph.D study of Canada Geese jointly supervised by WWT and Dr. Bill Sutherland at the University of East Anglia. The work is based on two populations of colour-ringed birds in Gloucestershire and Avon and aims to assess the relative importance of different factors relating to breeding success amongst individuals. The good (or bad!) thing about studying Canada Geese is that they do not fly to remote parts of the world for the summer breeding season! It has so far been possible to follow birds throughout the year, and Stephanie has been able to show that geese which are high in the dominance hierarchy (or "peck-order") of the flock tend to nest earliest in the best nest sites. Her work continues over the coming years, but any resightings of colour-marked Canada Geese from these areas should be sent, as usual, to Carl Mitchell at Slimbridge, who will forward them to Stephanie.

Table 17. CANADA GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Kedleston Park Lake	1,600	2,000	1,000	1,080	1,060	(Nov)	1,348
Stratfield Saye	1,850	1,400	400	1,350	1,701	(Nov)	1,340
Bewl Water	1,500	1,150	1,100	1,000	546	(Feb)	1,059
Abberton Rsr.	539	1,122	1,156	1,240	618	(Aug)	935
Rutland Water	856	1,181	1,102	483	740	(Feb)	872
Dorchester Gp.	895	484	758	447	767	(Oct)	670
Twyford Gp.	282	1,202	792	847	182	(Sep)	661
Blithfield Rsr.	624	830	365	560	896	(Sep)	655
Drakelow Gp.	450	785	650	505	650	(Dec)	608
Harewood Lake	607	651	625	595	550	(Dec)	606

Barnacle Goose *Branta leucopsis*

The Scottish component of the Greenland population of the Barnacle Goose winters mainly on Islay (Table 18) and here they numbered 30,208 in early December 1990 (the highest number ever counted there) and 22,172 in March 1991. The numbers of juveniles present in Islay flocks indicated an excellent breeding season with more than 20% young. Thus, a large proportion of the increased population (*ca.* 6,000) would be birds of the year. This means that the Greenland population as a whole is considerably larger now than the 34,500 counted in 1988. The next international census of this population is planned for 1993. The only other sizeable flocks likely to comprise birds from this population included 375 birds at Craiglin Lochan in March.

Unlimited numbers of birds continue to be shot under Scottish Office licence on Islay; in 1990-91, a total of 1,300 birds was killed. A long-term solution to the conflict there remains elusive. There have been a number of scaring schemes which have attempted to move birds around the island and concentrate them on the SSSIs created on two of the main areas. However such scaring has not been systematic. The birds tend to be loyal to their wintering areas, a fact reinforced by recently published information (Percival 1991), and such moves have met with limited success. Clearly some other solution is required, as suggested at the Martin Mere workshop (Owen & Pienkowski 1991), which will allow farmers to tolerate geese without suffering individual financial loss. This population remains, in world terms, very small.

Almost daily counts of the Svalbard population at Caerlaverock resulted in a maximum count of 12,100 in October, indicating that the population appears to have stabilised at around 12,000 birds. The proportion of juvenile birds in flocks averaged 12.0%. Breeding success has declined relatively in recent years; this is now on average only matching the mortality rate, which has remained constant. Sites supporting smaller flocks during 1990-91, that are likely to belong to this population, included the following: the Loch of Strathbeg (356), Gladhouse Reservoir (275) and Portmore Loch (115), all in October.

Table 18. BARNACLE GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Islay	*23,900	*21,900	*20,800	*25,297	*30,208	(Dec)	24,421
Solway Est.	*10,500	*11,400	*12,100	*11,700	*12,100	(Oct)	11,560

Dark-bellied Brent Goose *Branta bernicla bernicla*

In 1990, breeding performance by the Dark-bellied Brent Goose was moderately good, with 21.4% juveniles and 3 young per pair overall in autumn flocks in Great Britain (Kirby & Haines 1990, Kirby 1991a). Midwinter censuses in January and February 1991 resulted in a maximum count of around 115,000 birds (Kirby 1991b), though examination of Table 1 reveals that further counts have been received subsequently to bring this figure up to 124,000 birds. This is by far the highest total yet recorded in Britain and provides welcome evidence of a continuing population increase in this subspecies (see also Table 5).

The sites listed in Table 19 are those which exceed the level required for international recognition for Dark-bellied Brent Geese. Counts made in 1990-91 were relatively high, compared with those made in recent years, at numerous sites; on the Blackwater Estuary, Hamford Water, Pagham Harbour, Swale, North West Solent and Portsmouth Harbour, and especially so on the Thames (with a staggering 33,109 birds) and Crouch estuaries. In addition to these main resorts, counts of over 1,700 were recorded from The Fleet/Wey (2,800, December) and Deben (2,051, January).

The feeding ecology of Dark-bellied Brent Geese feeding in Norfolk has been the focus of much recent research, some of which has now been published. Summers & Critchley (1990) studied field selection by the geese and found that, on average, 74% of the day was spent on grass or arable fields during midwinter, with between 44-66% of the total number of observations being made on grass fields. Individual geese visited four fields per day on average and their home ranges were approximately 6km^2. Fields with a high percentage of live grass were selected by geese, perhaps on the basis of their colour. Once selected, those fields with the shortest grass and the fewest thistles were more intensively used.

On winter cereals, grazing by geese resulted in the loss of *ca.* 75% of the biomass of leaves and shoots (Summers 1990a). Grazed wheat ripened late and average grain yield losses were between 6-10%. Defoliation of the wheat was

responsible for the loss. Cost-effective scaring of geese from winter wheat fields was achieved by suspending long lines of red tape across the field under experimental conditions where there were untaped fields of wheat available (Summers & Hillman 1990). However, when all the fields were taped the geese eventually grazed in the taped fields but at lower grazing intensity than in years when this scaring method was not employed.

Feeding on beds of green algae (mainly *Enteromorpha* spp.) was also studied at low tide during autumn and early winter (Summers 1990b). However, the number of geese present started to decline when the biomass of algae was reduced to less than a critical level, and the birds rarely occurred on the beds after mid-November. The biomass of ungrazed algae declined less rapidly, to a level higher than that of grazed algae during the winter, showing that grazing by geese was partly responsible for the earlier decline in this food source.

On saltmarshes, Brent Geese selected *Aster tripolium* leaves in the mid-ranges of those available (Summers & Atkins 1991). Smaller leaves had proportionately more crude protein and water soluble carbohydrates than large leaves. Thus, the geese were not selecting the most nutritious leaves though they may have been selecting the mid-range ones to maximise the rate of intake of nutrients.

Table 19. DARK-BELLIED BRENT GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Wash	17,679	23,166	27,612	19,309	21,273	(Dec)	21,808
Thames Est.	19,847	18,551	17,263	12,555	33,109	(Oct)	20,265
North Norfolk Marshes	9,800	9,450	12,711	6,711	11,888	(Nov)	10,112
Chichester Hbr.	9,998	9,721	10,473	9,484	9,406	(Jan)	9,816
Blackwater Est.	12,387	7,709	8,363	6,370	9,918	(Dec)	8,949
Langstone Hbr.	8,567	6,800	8,050	7,821	6,133	(Dec)	7,474
Hamford Water	8,000	3,750	3,942	(150)	6,889	(Feb)	5,645
Colne Est.	7,748	5,487	5,494	3,966	4,924	(Feb)	5,524
Crouch Est.	5,600	2,853	5,333	3,109	8,388	(Feb)	5,057
Medway Est.	2,888	2,910	6,868	1,200	6,809	(Feb)	4,135
Swale Est.	1,966	2,789	3,032	1,769	4,823	(Dec)	2,876
Portsmouth Hbr.	2,347	2,129	2,062	2,567	5,318	(Jan)	2,885
Pagham Hbr.	2,251	2,551	2,965	2,755	3,181	(Nov)	2,741
Exe Est.	2,500	1,724	2,795	2,510	2,665	(Nov)	2,439
NW Solent	2,170	1,750	2,400	1,600	3,335	(Feb)	2,251
Dengie	980	2,598	2,445	1,900	1,950	(Oct)	1,975
Humber Est.	2,229	1,263	(2,000)	1,631	2,733	(Dec)	1,971

Light-bellied Brent Goose
Branta bernicla hrota

The U.K. key sites for Light-bellied Brent Geese are listed in Table 20. The geese present at both Strangford Lough and Lough Foyle in Northern Ireland originate from the population breeding in arctic Canada and Greenland, whilst those at Lindisfarne are from the Svalbard population. The numbers at Strangford Lough and Lindisfarne appear relatively stable, whilst the maximum number at Lough Foyle was very much higher than in recent years. Indeed, there is some evidence of a population increase at that site.

As a result of the IWRB workshop held in June 1990, it was considered important to study in more detail the effects of all types of recreational disturbance on waterfowl distribution in Strangford Lough. The problem is being addressed through a series of intensive counts throughout the Lough to complement those carried out under the NWC scheme. These special counts will assess bird distribution and to measure the frequency and impact of human activities. Ray Mathers will be collating disturbance data as part of his Ph.D study funded by the Department of the Environment for Northern Ireland and jointly supervised by WWT from Slimbridge with Dr Ian Montgomery of Queen's University Belfast. Ray's study commenced in October and is concentrating on examining the distribution and abundance of Brent Geese and Wigeon in relation to food supply and human activity.

Table 20. LIGHT-BELLIED BRENT GOOSE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(mth)	Average
Strangford Lo.	14,516	15,031	8,478	12,423	13,237	(Sep)	12,737
Lo. Foyle	1,693	2,495	3,700	4,105	6,007	(Oct)	3,600
Lindisfarne	3,000	2,000	3,000	3,000	2,700	(Dec)	2,740

Shelduck *Tadorna tadorna*

The total number of Shelduck recorded on NWC sites in Britain increased markedly in 1990-91 reaching a February peak of 79,949 (Table 1), almost 6,000 more than in 1989-90. Numbers were also up on last season in Northern Ireland (Table 2), by *ca.*900 birds, with the peak also occurring in February. The long-term index showed relatively little change on recent seasons, however (Table 5).

The main resorts are shown in Table 21. The Wash remains by far the most important site for Shelduck in the U.K., with the Medway and estuaries of north-west England supporting large populations also. The number of breeding/moulting birds on the Forth Estuary appears to be increasing. In addition to the sites in the table, the Swale Estuary held 2,545 birds in January and a total of 3,354 was counted in July 1991 on the Solway (P.J. Shimmings in Delany 1991a), certainly one of the largest pre-moult concentrations in Britain.

Survey work co-ordinated by Simon Delany (Delany 1991b) in the Severn Estuary has added considerably to our knowledge of the spatial and annual variations in the use of the Severn by Shelduck. Efforts to identify the number of occupied territories during the early incubation period appear to have been successful. In 1990, the population on the estuary on the 10th May was 1,559 of which 368 pairs apparently attempted to breed, though with relatively little success compared with other years. There was a low number recorded on the traditional moulting sites in Bridgwater Bay, numbers peaking at just 2,000 in mid-July.

Investigations on Shelduck with broods on the Ythan Estuary, Aberdeenshire (Ingold 1991) showed that, among neighbouring pairs, one pair was dominant over the other. Dominant pairs occupied larger exclusive areas (non-overlapping zones) than subordinate pairs at high density, irrespective of the order of their arrival on the mudflats. The behaviour of dominant pairs may limit the number of broods and the breeding output of the Ythan shelduck.

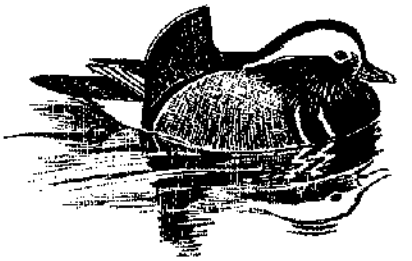
Table 21. SHELDUCK: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Wash	23,755	16,332	15,613	19,460	16,275	(Feb)	18,287
Medway Est.	5,303	3,300	5,805	5,092	10,149	(Feb)	5,930
Dee Est.	6,130	4,600	4,896	6,924	1,149	(Nov)	4,740
Humber Est.	5,427	2,943	4,681	4,245	5,856	(Oct)	4,630
Morecambe Bay	3,888	4,433	3,345	5,208	6,143	(Oct)	4,603
Ribble Est.	5,055	6,037	3,534	3,162	3,113	(Jan)	4,180
Mersey Est.	2,355	2,225	2,602	4,040	5,757	(Dec)	3,396
Severn Est.	2,459	2,707	2,819	+3,332	3,598	(Dec)	2,983
Forth Est.	2,404	++2,470	++2,400	2,670	++4,025	(Aug)	2,794
Chichester Hbr.	3,772	2,451	2,514	2,717	2,321	(Feb)	2,755
Thames Est.	3,688	1,749	2,351	3,137	2,535	(Jan)	2,692
Poole Hbr.	3,588	1,439	2,230	2,179	3,451	(Jan)	2,577
Blackwater Est.	2,263	1,168	2,000	2,599	3,398	(Jan)	2,286
Strangford Lo.	1,335	1,579	3,973	1,867	2,311	(Feb)	2,213

\+ Counts of breeders and non-breeders from Jones (1989).
++ Counts in August of moulting birds (D.M. Bryant, in litt.).

Mandarin *Aix galericulata*

October, November and January produced the highest counts of Mandarin in Britain (Table 1), with the peak of 209 in October being similar to that of 1989-90 (226). The number counted on NWC sites then decreased in December to just 69 but had increased to 134 by January. The largest counts of Mandarin came from Virginia Water (72, October), Hammer Pond (47, November) and Witley Park (39, October).



Wigeon *Anas penelope*

Maximum total numbers of Wigeon in Britain were recorded in January (238,369), following a November/December influx (Table 1). However, the peak was lower than in 1989-90, when the maximum count was over 260,000. In Northern Ireland, numbers reached 18,660 in October and fell subsequently (Table 2), with the majority of these birds occurring on Lough Foyle.

Sites supporting over 7,500 Wigeon, the level required for international recognition of a site for this species, are shown in Table 22. Numbers on the Ribble Estuary continue to increase dramatically, this site now holding the largest concentration of birds in the U.K. Peak counts from Lindisfarne and Lough Foyle during 1990-91 were also higher than in 1989-90, but are somewhat down on earlier seasons. Other sites supporting large concentrations of Wigeon in 1990-91, but not qualifying for inclusion in the table, were the North Norfolk Marshes (12,779, November), Loch Eye (9,815, October) and Loch of Harray (9,200, October).

Table 22. WIGEON: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Ribble Est.	24,462	35,000	41,809	43,541	59,187	(Dec)	40,800
Ouse Washes	42,175	38,672	30,968	53,615	24,715	(Jan)	38,029
Lindisfarne	18,000	22,000	28,000	7,500	9,040	(Oct)	16,908
Lo. Foyle	12,220	11,997	22,000	7,797	15,584	(Oct)	13,920
Dornoch Fth.	15,029	14,194	10,299	13,861	10,251	(Oct)	12,727
Swale Est.	10,714	9,750	6,801	8,625	11,671	(Feb)	9,512
Cromarty Fth.	8,871	8,392	8,158	9,888	6,512	(Dec)	8,324

Gadwall *Anas strepera*

In 1990-91, the total numbers of Gadwall in Britain (Table 1) and Northern Ireland (Table 2) were similar to those of 1989-90, but the population index for Britain increased in both October and December to reach the highest ever levels (Table 5). This increase was predicted in last year's annual report (Kirby *et al.* 1990) and may be related to expansion onto artificial waters in the inland southern lowlands. For sites counted in all seven months, maximum numbers were achieved in December in Britain (Table 3) and in September in Northern Ireland (Table 4).

Those sites regularly holding more than 150 Gadwall are listed in Table 23. Rutland Water continues to hold the vast majority, perhaps some 20% of the British population. Other sites not qualifying for inclusion in the table in view of their average Gadwall numbers, but holding more than 150 birds in 1990-91 were: Eversley Cross/Yateley gravel pits (338, December), Hickling Broad (312, October), Buckden/Stirtloe gravel pits (232, November), Amwell gravel pit (209, January), Burry Inlet (177, October), The Fleet/Wey (171, January), Langtoft gravel pits (168, January) and Hanningfield Reservoir (165, September).

Table 23. GADWALL: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Rutland Water	1,031	1,387	1,805	1,606	1,323	(Sep)	1,430
Abberton Rsr.	140	160	784	846	402	(Sep)	466
Gunton Park Lakes	266	389	461	496	325	(Sep)	387
Severn Est.	262	322	290	384	345	(Feb)	321
Ouse Washes	356	277	229	379	352	(Mar)	319
R. Avon: Blashford	45	90	333	366	364	(Nov)	240
Cheshunt Gp.	105	185	200	335	290	(Dec)	223
Lo. Leven	250	140	154	163	258	(Oct)	193
Chew Valley Lake	58	152	160	351	190	(Jan)	182
Stanford Meres	316	67	110	133	141	(Oct)	153

Teal *Anas crecca*

The total numbers of Teal counted in the U.K. approached 142,000 birds (Tables 1 & 2), an almost identical figure to 1989-90, and maximum numbers were recorded in January (Tables 3 & 4). The December/January population index for Teal (Table 5) remained at its currently high level.

The traditional sites in north-west England continued to support large numbers of Teal in 1990-91 (Table 24), with the Mersey, Ribble and Dee Estuaries ranking as the best U.K. sites for this species. A very large peak count was made at Abberton Reservoir in September and at Hamford Water in December. The peak counts at Martin Mere and on the Severn Estuary were relatively low. At sites not included in the table, concentrations exceeding the qualifying level for national importance were present on the Irvine shore (7,500, February), Blithfield Reservoir (3,410, January), Alaw Reservoir (2,938, December), Pulborough Levels (2,210, January), Rutland Water (2,187, September) and Alde Complex (2,160, January). At Chew Valley Lake, a drop in water levels over the autumn/early winter period was followed by flooding of encroaching weedy areas in January and this produced excellent feeding conditions for Teal. Not surprisingly, the January count produced 5,500 at Chew and 2,500 at nearby Blagdon Lake.

Fox *et al.* (in press, c) examined biometric data from almost 7,000 Teal captured at Abberton Reservoir. They showed that body condition increased from September to reach maximum values late in the year, before falling to their lowest levels in February. Females showed a more marked reduction in body condition in response to hard weather than did males, and indeed the proportion of females caught at Abberton declined with increasing severity of weather conditions.

Table 24. TEAL: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Mersey Est.	8,350	12,730	9,670	12,300	10,375	(Dec)	10,685
Ribble Est.	6,177	3,435	6,417	1,709	9,078	(Nov)	5,363
Dee Est.	2,940	3,640	4,670	9,825	4,824	(Oct)	5,180
Abberton Rsr.	2,731	1,042	1,850	4,225	11,483	(Sep)	4,266
Ouse Washes	3,551	2,753	3,870	4,920	5,225	(Jan)	4,064
Woolston Eyes	3,000	3,500	3,500	4,000	4,500	(Oct)	3,700
Hamford Water	(366)	1,700	1,975	(677)	7,211	(Dec)	3,629
Martin Mere	2,600	4,700	4,300	2,600	1,900	(Sep)	3,220
Cleddau Est.	2,224	2,688	3,243	2,586	3,148	(Dec)	2,778
Thames Est.	2,130	2,393	1,996	3,342	3,407	(Jan)	2,654
Severn Est.	2,515	2,451	1,253	3,402	1,820	(Jan)	2,288
North Norfolk Marshes	1,389	770	2,337	5,538	3,223	(Dec)	2,651
Loch Leven	1,542	1,400	1,400	3,270	3,614	(Oct)	2,245
Lo. Neagh/Beg	2,173	2,619	2,155	1,576	2,915	(Dec)	2,288
Swale Est.	1,286	3,030	2,353	2,040	1,846	(Jan)	2,111
Dornoch Fth.	2,697	1,666	2,307	1,761	1,831	(Dec)	2,052
Humber Est.	1,975	1,241	2,875	1,425	1,795	(Nov)	1,862

Mallard *Anas platyrhnchos*

The total number of Mallard counted at NWC sites in Britain increased very considerably to reach *ca.*214,500 birds (Table 1), exceeding the 1989-90 peak by some 33,400. As the population index for Mallard did not change very much (Table 5), the increased total count is presumably related to the fact that more sites were counted in 1990-91 than in 1989-90, especially in north-west England. Future analyses of the data collected on behalf of North West Water Plc. (see "Progress and Developments") will reveal whether this is in fact the case. The total maximum count in Northern Ireland (Table 2) was similar to that of previous seasons.

The principal U.K. sites for Mallard are listed in Table 25 ranked according to their five year average counts. There was a massive count on the Swale Estuary in January 1991. Conversely, relatively low maxima were recorded on the Dee Estuary, the Loch of Strathbeg, and the Solway and Thames estuaries. In addition to these sites, only one, Rutland Water (2,438, September), held over 2,000 Mallard in 1990-91.

Table 25. MALLARD: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Humber Est.	6,422	10,040	4,940	4,184	4,373	(Feb)	5,992
Lo. Neagh/Beg	5,282	4,054	5,560	6,438	5,318	(Sep)	5,330
Wash	5,852	5,448	2,910	4,254	5,200	(Jan)	4,733
Ouse Washes	4,216	5,553	4,905	4,856	3,530	(Jan)	4,612
Morecambe Bay	3,625	4,527	4,670	4,496	3,400	(Oct)	4,144
Swale Est.	2,045	2,682	2,408	1,617	10,469	(Jan)	3,844
Dee Est.	5,325	3,880	4,105	3,505	1,947	(Dec)	3,752
Martin Mere	3,600	3,200	3,900	3,600	4,170	(Dec)	3,694
Severn Est.	3,549	4,263	3,916	3,074	3,186	(Nov)	3,670
Lo. of Strathbeg	2,650	3,450	3,300	1,460	1,828	(Jan)	2,497
Solway Est.	2,629	3,188	2,666	2,185	1,511	(Dec)	2,436
Lo. Foyle	3,300	2,274	2,000	1,889	2,309	(Sep)	2,354
Forth Est.	2,082	2,609	2,434	2,182	2,425	(Jan)	2,346
Abberton Rsr.	2,700	1,471	1,458	2,796	2,599	(Sep)	2,205
Thames Est.	2,546	1,726	2,637	2,732	1,169	(Dec)	2,162
Lo. Leven	2,300	1,060	2,710	2,800	1,928	(Oct)	2,160

Pintail *Anas acuta*

The peak total count of Pintail in Britain (23,091, Table 1) was some 3,300 birds less than that of 1989-90, whilst the peak in Northern Ireland was slightly higher, by 86 birds (Table 2). In Britain, the total numbers recorded on sites counted in all seven months (Table 3) varied erratically, with Pintail being approximately equally abundant in October, December and February. The pattern of seasonal change was rather different in Northern Ireland (Table 4), with numbers increasing steadily to reach a December/January peak and then declining rapidly in February. The British population index for Pintail fell markedly in 1990-91 (Table 5). It is important to keep an eye on this trend in future years.

Sites holding internationally important numbers of Pintail, based on the fact that their five season's averages exceeded 700 birds, are listed in Table 26. A number of sites recorded relatively low counts in 1990-91 (e.g. Mersey Estuary, Wash, Martin Mere and the Duddon Estuary), whilst Morecambe Bay, the Solway Estuary and North Norfolk Marshes held relatively large numbers. Pagham Harbour (839, November) was the only other site that supported more than 700 birds in 1990-91.

Table 26. PINTAIL: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Dee Est.	4,620	9,550	8,435	11,945	8,706	(Dec)	8,651
Mersey Est.	6,000	8,050	4,288	8,000	3,200	(Oct)	5,908
Wash	4,562	7,715	6,541	2,757	1,910	(Feb)	4,697
Morecambe Bay	2,072	2,140	1,662	1,962	3,190	(Oct)	2,205
Burry Inlet	2,085	2,017	1,800	2,306	1,784	(Feb)	1,988
Martin Mere	1,200	1,370	2,600	1,500	640	(Sep)	1,462
Ouse Washes	1,803	1,080	1,228	1,818	1,332	(Jan)	1,452
Duddon Est.	1,102	1,289	2,200	873	,830	(Sep)	1,259
Solway Est.	1,022	1,003	1,165	550	2,208	(Oct)	1,190
Medway Est.	1,042	1,011	927	700	1,243	(Dec)	985
North Norfolk Marshes	557	490	569	616	1,714	(Nov)	789

Garganey *Anas querquedula*

A total of 30 of these rare summer wildfowl were counted on NWC sites, mainly in September and March, and six were recorded at Chew Valley Lake in August. The records were widespread, with birds occupying gravel pits and freshwater marshes. The size of the March-April influx varies from year to year, and whether or not the birds stay to breed depends on favourable weather and the availability of suitable breeding habitat.

Shoveler *Anas clypeata*

A total of 8,975 birds was recorded in Britain in September (Table 1) exceeding last season's peak count by 10%, whilst the 1990-91 total from Northern Ireland (274, October, Table 2) was slightly down. Maximum numbers at sites counted throughout the season were recorded in September and October (Tables 3 & 4). The October/November and January values for the British population index showed slight increases in 1990-91.

Sites holding over 250 Shoveler, based on the five year average maxima, are listed in Table 27. Most held numbers that were similar to previous seasons, though Abberton Reservoir probably had a record count in September. A further seven sites held more than 250 Shoveler in 1990-91 but did not qualify for entry into the table: Severn Estuary (454, August), Queen Mary Reservoir (427, October), King George V Reservoir (360, October), Staines Reservoir (339, October), Stain Hill Reservoir (271, February), Attenborough gravel pits (268, October) and Grafham Water (263, February).

Table 27. SHOVELER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Ouse Washes	445	1,443	523	696	625	(Mar)	746
Abberton Rsr.	522	240	418	829	1,085	(Sep)	619
Rutland Water	525	285	729	372	680	(Sep)	518
Lo. Leven	780	391	540	285	540	(Oct)	507
Chew Valley Lake	390	440	475	490	465	(Sep)	452
Swale Est.	257	603	348	224	276	(Mar)	342
Woolston Eyes	475	230	167	300	260	(Sep)	286

Pochard *Aythya ferina*

The total number of Pochard counted in Britain reached almost 37,500 (Table 1), some *ca.*4,000 fewer than in 1989-90, and there was a noticeable drop in the January index (Table 5). Conversely, more were counted in Northern Ireland in 1990-91 than in 1989-90, with the maximum totals being 41,364 (Table 2) and 36,946 respectively. Pochard numbers were highest between November and January in Britain (Table 3), but reached a sharp single peak in December in Northern Ireland (Table 4).

The main U.K. resorts for Pochard are listed in Table 28. Loughs Neagh/Beg are overwhelmingly important for this species, whilst in Britain, Abberton Reservoir is the key site. A relatively large maximum count of Pochard, in relation to earlier seasons, was made at the Loch of Harray, whilst the peak count from Chew Valley Lake was remarkably low. In addition to the sites in the table, Stanton Harcourt gravel pits (1,243, November), Rutland Water (1,218, October) and Wintersett Reservoir (1,035, November) were the only ones with more than 1,000 Pochard in 1990-91.

The Pochard remains one of the relatively few waterfowl species declining in the western Palearctic, where increasing numbers are resorting to artificial wetlands such as gravel pits and reservoirs (Pirot & Fox 1990, Fox & Salmon 1988). However, such waters are under enormous pressure for recreational use, especially those which lie close to centres of population. With sensitive management, recreation may not be completely disruptive, but we need to be able to assess the impact of water-borne and bank-side disturbance on wintering waterfowl. Pochard are especially sensitive, taking to the air from waters almost as soon as a boat is launched. Intensive counting in the Cotswold Water Park has shown that pits suffering water-based recreation support fewer birds than predicted and that even bank-side activities lessened the numbers using a lake regularly compared with nature reserves where bank-side access was restricted (Fox *et al.*, in press, a). This gives a real measure of the potential impact of a development on a lake (given adequate information about the numbers using a site and various environmental parameters of each water body) on wintering Pochard.

Pochard are also recognised as a rare breeding species in Britain by the Rare Breeding Birds Panel. A recent review showed that the estimated population now stood at 370-395 pairs and that there was continued but modest expansion in numbers over the last ten years, mainly in response to the increase in suitable artificial nesting habitat (Fox 1991). Analysis was made of March NWC data for Pochard which suggested that the breeding and near breeding population in Britain has remained stable over the last 27 years, with some sign of an increase during the 1980s. The species has its breeding concentration in the south and east reflecting its stronghold in the 'fleet'-type habitats of coastal areas and the distribution of more recently utilised nesting habitat on gravel-pits and reservoirs of lowland Britain. The numbers of nesting pairs in Scotland though are poorly monitored.

The feeding distribution of Pochard on two flooded gravel pits was studied at the ARC Wildfowl Centre Great Linford in January/February 1989, when peak wintering numbers were present (Giles 1990). It would appear that Pochard prefer to feed in shallow water and can select prey-rich areas, thus maximising their food intake whilst minimizing their energy expenditure. Prey-density is the key to the choice of feeding site rather than depth. The differences in abundance of chironomid larvae, in different parts of the lakes are relatively subtle but Pochard appear to have the ability to detect richer areas Phillips (1991).

Table 28. POCHARD: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	16,348	24,072	39,811	36,380	40,928	(Dec)	31,508
Abberton Rsr.	3,000	2,102	2,739	2,271	4,064	(Aug)	2,835
Ouse Washes	1,511	3,750	1,129	2,964	1,135	(Feb)	2,098
Lo. of Boardhouse	2,402	3,755	723	1,327	1,594	(Nov)	1,960
Rostherne Mere	2,850	2,395	1,151	120	2,703	(Feb)	1,844
Severn Est.	2,070	1,701	2,026	1,742	1,616	(Feb)	1,831
Cotswold Water Pk. East	1,578	3,291	1,352	1,147	1,113	(Feb)	1,697
Kingsbury/Coton Pools	2,000	1,775	1,408	1,387	1,099	(Feb)	1,534
Lo. of Harray	1,569	1,043	1,372	1,011	2,245	(Oct)	1,448
Cotswold Water Pk. West	1,176	1,119	1,538	1,329	1,046	(Nov)	1,242
Poole Harbour	+1,200	+1,177	+685	+1,020	1,311	(Feb)	1,079
Loch Leven	780	1,270	770	1,510	895	(Sep)	1,045
Chew Valley Lake	1,080	650	2,450	625	260	(Dec)	1,013

+ collated from county records by S. Aspinall.

Tufted Duck *Aythya fuligula*

The maximum total number of Tufted Duck was recorded in January in Britain (48,425, Tables 1 & 3) and was similar to the peak total count of last season. In Northern Ireland however, there was a November peak (Table 4) of 23,138 birds (Table 2) which was substantially lower than in 1989-90 (30,402). The trends from the British population indices for September and December went in opposite directions (Table 5).

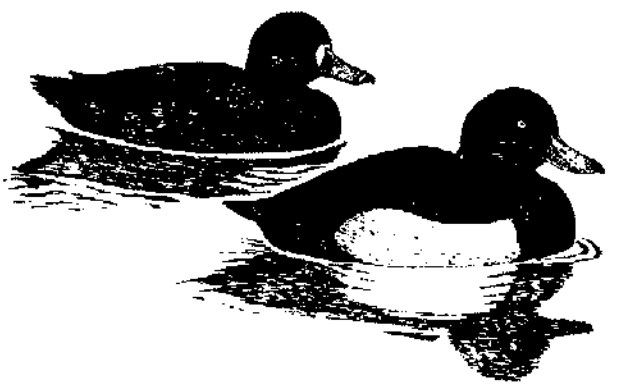
Generally the numbers of Tufted Duck at the most important sites dropped (Table 29), but there was a large increase at Walthamstow and King George V Reservoirs. Sites not qualifying for inclusion in the table but supporting over 600 Tufted Duck in 1990-91 were as follows: Rostherne Mere (1,075, February), Humber Estuary (956, February), Inner Moray Firth (777, January), Pitsford Reservoir (764, October) and Stanton Harcourt gravel pits (603, November).

Nick Giles of The Game Conservancy's ARC Wildfowl Centre related the underwater feeding success of downy Tufted ducklings (14-25 days old) to differing levels of food (chironomid larvae) availability. Feeding success (chironomids caught per dive) improved with increased prey density and, within the range of food densities in the experiments, ducklings showed no signs of becoming limited by time in their ability to catch more prey per dive at high prey densities (Giles 1990a).

On Lough Neagh, increases in the roach *Rutilus rutilus* population through the 1970s was accompanied by a decline in the numbers of Tufted Ducks, and an increase in overwintering Great Crested Grebes (Winfield *et al.* in press). The authors suggest that these contrasting trends are causally related and that competition for benthos and increased prey availability are the mechanisms responsible for the changes in the Tufted Duck and grebe populations, respectively. In agreement, a reduction in the roach population during the mid-1980s was accompanied by a recovery of Tufted Ducks and a decline of grebes.

Table 29. TUFTED DUCK: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	8,943	19,603	16,642	29,393	22,278	(Nov)	19,372
Abberton Rsr.	3,375	3,463	3,987	4,387	3,550	(Aug)	3,752
Rutland Water	3,301	3,237	5,582	3,709	2,097	(Sep)	3,585
Lo. Leven	1,800	2,580	3,180	2,700	3,120	(Sep)	2,676
Kingsbury/Coton Pools	1,300	2,271	1,405	1,794	1,433	(Nov)	1,641
Lo. of Harray	987	1,142	1,920	1,992	1,643	(Oct)	1,537
Severn Est.	1,490	1,101	990	997	817	(Feb)	1,079
Walthamstow Rsr.	1,347	760	721	721	1,589	(Feb)	1,028
Wraysbury Gp.	1,101	(426)	1,447	683	470	(Jan)	925
Besthorpe/Girton Gp.	600	560	1,100	557	1,801	(Feb)	924
Staines Rsr.	3,313	303	387	547	440	(Nov)	919
Kilconquhar Lo.	288	477	1,570	1,250	725	(Sep)	862
Ouse Washes	1,078	1,847	470	528	365	(Mar)	858
King George V Rsr.	181	302	430	530	2,500	(Oct)	790
Hanningfield Rsr.	790	870	655	530	537	(Jan)	676
Cotswold Water Pk West	413	524	1,322	464	593	(Mar)	663



Scaup *Aythya marila*

Just over 8,300 Scaup were counted in February in the U.K. (Tables 1 & 2) and their principal resorts (all of which are nationally important) are shown in Table 30. The Solway Estuary currently ranks as the best U.K. site for Scaup, whilst Loughs Neagh/Beg are very important also. A tenth consecutive winter of seaduck monitoring in the Moray Firth, undertaken by the RSPB on behalf of BP, produced a maximum of 614 Scaup in March, the largest total count there since at least 1981. In the Moray Firth, the main sites were the Dornoch and Cromarty Firths, and the Inner Moray Firth (223, March). Elsewhere, relatively low maximum counts were made on the Forth Estuary, whilst the counts from Belfast Lough and the Dee Estuary were only a fraction of what they used to be. This is presumably due to not being able to see the birds adequately on the count dates to estimate their numbers, rather than desertion of these sites by this species. Counts of over 130 Scaup were made at five other sites in 1990-91: Dungeness (245, March), Hamford Water (219, February), Loch of Stenness (194, March), Ribble Estuary (178, March) and the Towyn-Abergele coast (151, February).

Table 30. SCAUP: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Solway Est.	1,438	4,000	3,092	1,562	3,803	(Jan)	2,779
Lo. Neagh/Beg	1,586	1,432	2,150	1,215	1,539	(Mar)	1,584
Lo. Indaal	817	1198	1230	442	660	(Dec)	869
Forth Est.	958	861	762	135	381	(Jan)	619
Loch Ryan	340	120	200	409	200	(Jan)	254
Carlingford Lo.	435	178	140	150	352	(Feb)	251
Dornoch Fth.	194	107	266	149	+368	(Mar)	216
Lo. of Harray	218	137	219	164	240	(Sep)	196
Cromarty Fth.	193	155	151	+126	+247	(Dec)	174
Inner Clyde	x	80	174	267	144	(Dec)	173
Belfast Lo.	422	44	19	29	43	(Feb)	147
Dee Est.	240	171	174	x	3	(Nov)	147

+ RSPB/BP studies.

Eider *Somateria mollissima*

The maximum number of Eider counted in Britain was in February (44,232, Table 1), this total representing 7% fewer than in 1989-90 (when 50,403 were counted in November). In Northern Ireland, the peak of 1,382 in December (Table 2) was almost double that of last season (738, January). The sites holding more than 1,500 Eider, on average, are shown in Table 31. Most of the British total count of Eiders comes from the Outer Firth of Tay where over 20,000 were present in February 1991. Elsewhere, there was a relatively large number in Morecambe Bay in 1990-91 compared with earlier seasons, and the RSPB/BP surveys found 2,109 Eider in the Moray Firth in November, the main sites being the outer Dornoch Firth (1,091, October), the East Ross coast (355, February) and Burghead to Lossiemouth (461, January).

Table 31. EIDER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Tay Est.	6,000	20,000	x	30,000	20,300	(Feb)	19,075
Forth Est.	4,878	4,941	3,977	10,798	7,836	(Oct)	6,486
Morecambe Bay	4,144	6,247	5,773	7,604	8,183	(Nov)	6,390
Inner Clyde	x	4,325	4,384	4,674	2,939	(Oct)	4,081
Lindisfarne	5,300	2,505	2,300	2,000	2,600	(Nov)	2,941
Montrose Basin	2,772	2,230	2,000	2,960	2,100	(Feb)	2,412
Ythan Est.	1,661	1,831	1,315	1,013	2,322	(Mar)	1,628
Murcar	2,500	1,000	1,000	2,000	x		1,625
Troon	(461)	3,000	(402)	153	x		1,577

Long-tailed Duck *Clangula hyemalis*

The Long-tailed Duck winters in Britain and Ireland in localized concentrations, with flocks occurring in open coastal waters, mainly along the east coast of Scotland and the northern and western isles. The peak total count recorded in Britain was 1,865 birds in December (Table 1) but the species is counted only very irregularly and is notoriously difficult to census. The prime Long-tailed Duck site is the Moray Firth and land-based counts peaked at 8,037 in January (Table 32), though roost counts at this time indicated an actual population of around 12,000. The main sites were the Riff Bank (4,200) and from Nairn to Burghead (5,000). Lindisfarne produced relatively large numbers, as did Water Sound in Orkney. The Eden Estuary held 360 Long-tailed Ducks in December.

Table 32. LONG-TAILED DUCK: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Moray Fth.	10,000	(3,900)	10,500	+6,270	+8,037	(Jan)	7,741
Forth Est.	694	898	1,037	465	451	(Nov)	709
Lindisfarne	305	386	800	294	420	(Jan)	441
Water Sound	240	240	++219	206	365	(Feb)	254
Broad Bay	200	210	x	100	x	x	170

\+ RSPB/BP studies.
++ from Christer (1989).

Common Scoter *Melanitta nigra* and Velvet Scoter *M. fusca*

Scoter peaked at 2,836 in the Moray Firth in December when at least 1,818 Common and a minimum 328 Velvet Scoter were present. This compares with a maximum count in 1989-90 of 1,607 birds. The main sites were the outer Dornoch Firth (763 scoter, including 688+ Common Scoter, December and 85+ Velvet Scoter, March), , Culbin Bars (450 scoter including 305+ Common Scoter, January and 115 Velvet Scoter, February), Burghead Bay when many were unidentifiable (1,093, December) and Spey Bay (609 scoter, including 127 Velvet Scoter, January and 561 Common Scoter, December) At other sites, 2,150 Common Scoters frequented the Eden Estuary in February, 1,735 were in the Forth Estuary in March, 1,100 were at Lindisfarne in December and St Andrews Bay held 700 in January. Velvet Scoter numbers peaked at 84 in the Forth Estuary in October and 400 in St Andrews Bay in December.

On the Welsh coast the JNCC's Seabirds at Sea Team overflew Carmarthen Bay on the 12th January and carried out transecting surveys from the coast. A single flock of Common Scoter comprising 2,500 birds was seen off Pendine outside the 200m band transect used. In Cardigan Bay, the surveys reported by Elliot & Green (1991) produced 1,226 birds in December. Other counts off the Welsh coast included 2,900 Common Scoter between Towyn-Abergele and 992 in Red Wharf Bay, both in December.

Further analysis of the 1988 freshwater loch survey of the extreme north of Scotland (Fox *et al.* 1989b) has identified water bodies with low acidity and high conductivity (an index of dissolved salts in the water) as being those of highest conservation interest, with Common Scoter in particular being identified with such lakes. Classification techniques enabled the identification of peatland lochs of greatest conservation importance based on the presence/absence of the rarer nesting waterfowl species (Fox & Bell, in press). This provides a simple framework for site-safeguard in the area, but again underlines the need for protection of whole catchments from afforestation and other damaging activities in order to adequately safeguard the interests of particular waters.

Goldeneye *Bucephala clangula*

The maximum total number of Goldeneye counted in Britain was 17,102 in February (Table 1), considerably up on last season's peak count of 12,702 in January. Not surprisingly, the January index for Britain increased in 1990-91 also (Table 5). In Northern Ireland, the 15,200 birds counted in February (Table 2) also represented a substantial increase on 1989-90 (12,170). Goldeneye numbers peak on NWC sites in February in both Britain (Table 3) and Northern Ireland (Table 4).

Sites holding average maximum counts of more than 250 Goldeneye are listed in Table 33. Loughs Neagh/Beg represent the only internationally important U.K. site for this species, the number there greatly exceeding the appropriate qualifying level (3,000). Other sites holding more than 250 in 1990-91, but not gaining a place in the table, were the Solway Estuary (507, February), the Dipple shore (462, January), Loch of Skene (358, November), Doon shore (324, February), Humber Estuary (310, February), Irvine shore (300, December) and Loch of Stenness (259, February).

The heavy stocking of lochs with rainbow trout may deplete invertebrates on which the Goldeneye feeds and the poisoning of lochs to remove unwanted fish species before restocking with sport fish may also present problems. Also, whilst the effects of acidification on invertebrates of Scottish lochs are not yet understood, the monitoring of invertebrate feeders like the Goldeneye must remain a priority for the future (Batten *et al.* 1990).

Table 33. GOLDENEYE: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Lo. Neagh/Beg	9,906	10,463	12,239	11,408	13,591	(Feb)	11,521
Forth Est.	1,855	1,425	1,608	991	1,831	(Jan)	1,542
Inner Moray Fth.	510	559	682	+680	+993	(Feb)	685
Abberton Rsr.	677	389	1002	362	707	(Mar)	627
Belfast Lo.	692	580	320	578	634	(Feb)	561
Maidens Hbr./Turnberry	x	x	x	625	462	(Jan)	544
Eden Est.	366	447	250	33	360	(Dec)	291
Inner Clyde	x	580	607	413	609	(Jan)	442
Morecambe Bay	413	313	430	480	425	(Mar)	412
Blackwater Est.	490	228	172	518	424	(Feb)	366
Strangford Lo.	280	725	289	240	290	(Mar)	365
Tweed Est.	340	290	408	360	351	(Jan)	350
Rutland Water	243	272	385	345	505	(Feb)	350
Loch Leven	297	279	330	310	265	(Jan)	296
Windermere	345	246	256	292	329	(Jan)	294

+ RSPB/BP studies.

Smew *Mergus albellus*

There was clearly a cold weather influx of Smew from the continent between the January and February count dates. Relatively large counts were recorded in February at Rye Harbour (22), Stain Hill Reservoirs (21), Goldhanger (18) and King George VI Reservoir (18), and smaller numbers occurred at many other sites in that month. In December, there were 15 on the Wraysbury gravel pits and 12 at Dungeness. Marlow gravel pits supported 10 birds in February.

Red-breasted Merganser *Mergus serrator*

The principal resorts for Red-breasted Merganser are shown in Table 34. The Inner Moray Firth holds by far the highest numbers in the U.K., though the peak count there in 1990-91 was relatively low. Across the Moray Firth as a whole, RSPB/BP surveys revealed a maximum count of 1,923 in December, when 1,130 birds were present over the Riff Bank. Other sites in the Moray Firth holding more than 100 birds were the outer Dornoch Firth (431, October) and Burghead Bay (104, October). Relatively few were recorded at Tentsmuir and Lindisfarne and the only other localities holding relatively large concentrations in 1990-91 were The Fleet/Wey (280, February) and Chichester Harbour (151, December).

Table 34. RED-BREASTED MERGANSER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Inner Moray Fth.	3,063	1,374	1,076	+1,080	+658	(Oct)	1,450
Tentsmuir	600	1,102	420	200	220	(Sep)	508
Forth Est.	546	316	437	472	478	(Oct)	450
Cromarty Fth.	615	584	332	+194	+340	(Dec)	413
Poole Hbr.	302	309	387	168	338	(Nov)	301
Strangford Lo.	183	213	371	303	274	(Oct)	269
Morecambe Bay	177	222	250	371	256	(Dec)	255
Duddon Est.	178	267	262	281	271	(Aug)	252
The Fleet/Wey	285	144	x	259	280	(Feb)	242
Lo. Ryan	210	460	50	104	130	(Oct)	191
Langstone Hbr.	131	214	234	185	186	(Dec)	190
Lindisfarne	217	310	198	132	81	(Aug)	188
Belfast Lo.	92	209	181	234	204	(Feb)	184
Larne Lo.	92	165	181	218	125	(Sep)	156
Dundrum Bay	104	93	255	119	196	(Sep)	153
Inner Clyde	x	253	118	112	113	(Feb)	149

+ RSPB/BP studies.

Goosander *Mergus merganser*

The total number of Goosander in Britain reached a maximum of 3,249 birds in December (Table 1), well up on last season's peak of 2,733 in January. Population indices for Goosanders in Britain fell in January but increased in February (Table 5). For sites counted in all seven months of the counting season, Goosanders were most abundant in February in both Britain and Northern Ireland (Tables 3 & 4).

Table 35 includes all sites exceeding the level of 50 for national importance over the last five seasons. The Inner Moray Firth supports by far the largest counted concentrations, though numbers there were less than in earlier years. Indeed, numbers there were well below average for the second winter in succession, as were numbers of other fish-eating species, and their numbers and feeding locations varied on an almost daily basis, possibly indicating that the birds were having difficulty foraging (R. Evans, in litt.). Elsewhere, there appears to be a sustained increase at Hirsel Lake and perhaps also at a number of other sites *e.g.* Hay-a-Park gravel pits, Blithfield Reservoir, Rutland Water, Loch Leven etc. The large number recorded at Chew Valley Lake in February can probably be attributed to the low autumn/early winter water levels which would have concentrated fish stocks there. Other localities supporting over 50 Goosanders in 1990-91 that are not included in the table were: Castle Semple/Barr Lochs (106, February), River Tweed (103, January), Balgray (103, December), Cults Reservoir (102, October), Montrose Basin (89, September), Tweed Estuary (72, January), Yetholm (71, December), Whittledene (69, November), Caban Coch Reservoir (68, September), Willington gravel pits (58, March), River Teviot (55, February), Wraysbury gravel pits (54, February), Cauldshiels Loch (52, November), Lindley Reservoir (52, February) and William Girling Reservoir (50, January).

Mitchell (1991b) has noted the gradual build up during the last decade of non-breeding Goosanders in the shallow waters around Endrick Mouth in the south-east corner of Loch Lomond. Although evidence is only circumstantial, there is reason to believe that the attraction for this gathering of sub-adult birds is the presence of large numbers of spawning Ruffe, the species' breeding period peaking in late April/early May.

Table 35. GOOSANDER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Inner Moray Fth.	1,241	1,900	1,490	273	610+	(Nov)	1,103
Hirsel Lake	35	79	124	202	290	(Oct)	146
R.Tweed:Kelso/Coldstream	145	102	91	88	147	(Feb)	115
Thrapston Gp.	174	66	101	44	149	(Feb)	107
Tentsmuir	70	225	8	x	x		101
Chew Valley Lake	105	55	107	110	163	(Feb)	98
Tay Est.	1	225	8	26	206	(Sep)	93
Hay-a-Park Gp.	15	25	53	195	166	(Dec)	91
Eccup Rsr.	108	82	105	55	101	(Feb)	86
Castle Lo.	120	81	82	69	52	(Feb)	81
R.Eden:Rockcliffe/Armtw.	95	29	60	111	110	(Jan)	81
Leighton/Roundhill Rsr.	90	65	82	x	x		79
Castle Howard Lake	120	57	95	25	84	(Dec)	76
Lo. of Skene	61	92	x	99	40	(Feb)	73
Hamilton Low Parks	94	97	65	68	42	(Dec)	73
Blithfield Rsr.	80	48	73	61	88	(Jan)	70
Besthorpe/Girton Gps.	67	97	55	44	x		66
Rutland Water	55	44	56	45	89	(Feb)	58
Pitsford Reservoir	71	46	27	69	67	(Jan)	56
Loch Leven	12	16	73	79	94	(Oct)	55
Hoselaw Lo.	164	6	23	38	25	(Sep)	51

Ruddy Duck *Oxyura jamaicensis*

The maximum number of Ruddy Duck counted in Britain increased by 9.2% between 1989-90 and 1990-91, with a peak count in January of 3,087 (Table 1). The status of the Ruddy Duck was reviewed in a recent paper by Barry Hughes (Hughes 1991). Since its escape from captivity in 1952, and during the first twenty years of colonisation, numbers increased at an exponential rate, slowing to an annual increase of approximately 10% per annum during the 1980s, and there has now been a 100-fold increase in the British population. Although there appears to be no serious competitive interaction between Ruddy Duck and other species in Britain, at the present population size, there is potential for competition in the future as the expected population increase continues. Ruddy Duck appear to be exploiting a previously unfilled niche in the British wetland ecosystem, but there may be some cause for concern because of their aggression during their extensive courtship and breeding period (March-August). Further, there has been an increase in the number of continental records of Ruddy Ducks as the British population has expanded. The first record on the continental mainland was in Sweden in 1965 but now there are now reports from at least 12 European countries. There is currently considerable concern that the Ruddy Duck may interbreed with the White-headed Duck, a species which itself is rare and threatened.

Sites holding an average five year maxima of 80 or more Ruddy Duck are listed in Table 36. Numbers were relatively high at Blithfield, Eyebrook and Swithland Reservoirs, whilst freezing conditions brought large numbers to Rutland Water in February. Furthermore, there were 528 at Chew Valley Lake on the second day of February. A further seven sites held over 80 Ruddy Duck during 1990-91: Rostherne Mere (195, February), Swithland Reservoir (184, March), Cheddar Reservoir (162, February), Hanningfield Reservoir (123, February), Hilfield Park Lake (114, December), Staines Reservoir (103, February) and Attenborough gravel pits (81, March).

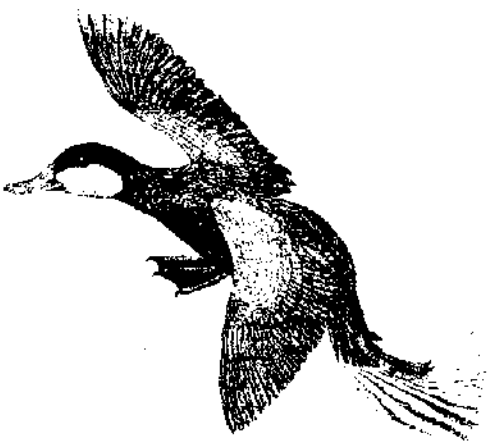


Table 36. RUDDY DUCK: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Blithfield Rsr.	570	909	640	508	899	(Dec)	705
Chew Valley Lake	1,064	610	785	470	435	(Dec)	673
Rutland Water	287	305	468	398	750	(Feb)	442
Belvide Rsr.	212	156	340	348	248	(Oct)	261
Eyebrook Rsr.	125	230	218	302	304	(Jan)	236
Blagdon Lake	603	121	173	61	108	(Jan)	213
Woolston Eyes	162	116	137	152	56	(Oct)	125
Farmwood Pool	72	104	79	166	106	(Dec)	105
Stanford Rsr.	83	142	57	195	37	(Mar)	103
Swithland Rsr.	66	48	55	81	184	(Mar)	87
Llyn Penrhyn	54	74	71	118	101	(Feb)	84
Llyn Traffwll	52	107	81	97	84	(Sep)	84

Coot *Fulica atra*

The peak numbers of Coot recorded in Britain (85,806, Table 1) and Northern Ireland (8,304, Table 2) were almost 13,000 and 1,500 birds fewer, respectively, than in 1989-90, and the highest counts were made in September (Tables 3 & 4). The principal concentrations are listed in Table 37, all of which exceed the 1,000 required for national importance. Peak numbers recorded at most sites are very variable, but were relatively high in 1990-91 (compared with the averages) at Loughs Neagh/Beg and in the Cotswold Water Park. Five sites, although not qualifying for a position in the table, held over 1,000 Coot in 1990-91. These were Chew Valley Lake (1,070, August), King George V Reservoir (1,800, October), Staines Reservoir (1,131, October), Dorchester gravel pits (1,095, February) and Aqualate Mere (1,000, December).

Table 37. COOT: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Abberton Rsr.	8,703	10,274	12,510	16,790	9,252	(Sep)	11,506
Lo. Neagh/Beg	5,687	5,008	4,821	7,696	6,685	(Sep)	5,979
Rutland Water	4,623	3,062	4,160	5,502	3,743	(Nov)	4,218
Hanningfield Rsr.	4,930	1,450	1,983	4,350	3,668	(Sep)	3,276
Cotswold Water Pk. West	2,606	2,731	3,033	3,775	3,608	(Dec)	3,151
Ouse Washes	2,388	3,005	1,537	2,345	x		2,319
The Fleet/Wey	2,684	2,169	(1,750)	1,561	2,647	(Nov)	2,265
Cotswold Water Pk. East	1,888	2,112	1,680	1,760	2,396	(Dec)	1,967
Lo. Leven	1,150	1,150	2,270	1,630	1,515	(Oct)	1,543
Kingsbury/Coton Pools	839	1,747	1,936	1,459	1,310	(Nov)	1,459
Cheddar Rsr.	2,050	1,300	1,000	1,491	1,416	(Oct)	1,451
Stanford Rsr.	1,660	400	1,750	2,115	1,118	(Sep)	1,409
Fen Drayton Gp.	1,150	1,021	1,112	2,090	950	(Dec)	1,265
Chichester Gp.	1,227	1,210	1,011	1,118	1,099	(Oct)	1,133
Fairburn Ings	1,284	1,053	1,511	1,275	1,151	(Sep)	1,025
Shepperton Gp.	1,263	1,098	707	975	x		1,011
Brogborough Gp.	1,300	720	979	1,240	807	(Dec)	1,009

WADERS

by R.J.Waters and R.P.Prys-Jones

The Birds of Estuaries Enquiry (BoEE) is co-sponsored by the British Trust for Ornithology (BTO), Joint Nature Conservation Committee (on behalf of English Nature, the Countryside Council for Wales, and the Nature Conservancy Council for Scotland), the Royal Society for the Protection of Birds and the Department of the Environment for Northern Ireland, and is organised by staff of the BTO Estuaries Unit based at Thetford, Norfolk. Including the 1969-70 Pilot Study, the twenty-second consecutive season of co-ordinated counts for the BoEE took place between July 1990 and June 1991. Counts are made on selected dates near the middle of each month, timed to coincide with the best tidal conditions for censusing estuarine birds. Records of wildfowl from both the BoEE and the National Wildfowl Counts are analysed by the Wildfowl and Wetlands Trust and are presented in the first section of this booklet.

DEVELOPMENTS IN THE ESTUARIES UNIT

The move by the BTO from Tring to its new headquarters at Thetford in April 1991 meant the Estuaries Unit had to say a sad goodbye to its long-serving, part-time secretary, Dorothy Smallwood-Keating, as well as to Nicola Bliss, who had provided additional secretarial support made necessary by the recent upsurge in BTO involvement in estuarine research and data collection. We were, however, fortunate to be able to welcome Carol Powley as their full-time replacement, and she will no doubt soon become a familiar contact for BoEE site organisers.

Despite the disruption consequent on the move, the range of studies undertaken by the Estuaries Unit has continued to grow. At the time of writing (late October 1991), the Unit comprises ten personnel, of whom four are permanent staff members and six are contract research officers. The BoEE continues to occupy the pivotal role at the heart of all this activity, with its results in ever-increasing demand for use in assessing the conservation importance of coastal sites faced with development proposals. Illustrating this, over 80 requests for BoEE data were handled during 1990-91, more than in any previous year. As usual, the NCC and its successor body, the JNCC, as well as the RSPB were the main users of this information, and both organisations were provided with comprehensive sets of BoEE data for use for conservation purposes.

During the course of the year, the results of the BoEE Estuarine Sites Review appeared (Kirby 1991), based on analysis and collation of a questionnaire previously distributed to site organisers. An immediate benefit of this review was the standardisation of the count units into which each estuary is divided. Computerised mapping of how count units on estuarine and inland sites relate to statutorily protected areas has subsequently been undertaken by WWT under contract to the NCC. During winter 1991-92, Ray Waters will, in liaison with WWT, be extending our original review to cover BoEE non-estuarine sites. To date, BoEE coverage of the open coast environment has been relatively limited. In some areas, notably Northumberland, there has been a long tradition of open coast counting, but elsewhere coverage has been largely restricted to a few sites of key importance which were identified as a result of the Winter Shorebird Count of 1984-85. The aims now are to review carefully the coverage we currently achieve, especially with respect to site boundaries, and to formulate plans for increased site coverage, aimed in particular at species such as Purple Sandpiper and Turnstone whose non-breeding populations are predominantly non-estuarine.

The first of a planned series of papers outlining the results of spring passage studies undertaken in recent years will be published shortly (Prys-Jones *et al.* in press), with further ones submitted for publication or in preparation. Similarly, two papers currently being prepared will respectively cover the methodological background to the new population indexing technique of Underhill (1989) and provide a species-by-species review of the population fluctuations revealed to date by more than 20 years of BoEE results. A further important development in late 1990 was the establishment of a new database on Wader Productivity. It had become increasingly clear that interpretation of the observed variations and trends in U.K. wintering wader numbers revealed by the BoEE could be much improved if we had better understanding of annual variations in the breeding success of the species and populations present. This cannot be gathered on their far-flung breeding grounds, but can potentially be deduced from knowledge of the proportions of first-year birds in wintering populations. BTO ringers already collected this information for most of the many waders they catch, and the problem therefore lay merely in making results from existing studies available in a form suitable for easy extraction and analysis. This co-ordination of the efforts of ringers and BoEE counters represents an exciting development which will hopefully yield much new information.

Many of the wintering and passage waders recorded by BoEE counters in the U.K. breed in the Siberian high arctic, but information on their biology there is extremely limited. Taking advantage of the new Soviet political openness, Robert Prys-Jones, together with Ron Summers of the RSPB, participated during summer 1991 in a joint British/South African/Dutch/Soviet research expedition to study breeding waders in the far north-east of the Taimyr peninsula, northern Siberia, an uninhabited area previously almost unexplored ornithologically. The main aims were: firstly, to investigate exactly which wader populations were

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The Birds of Estuaries Enquiry (BoEE) is co-sponsored by the British Trust for Ornithology (BTO), Joint Nature Conservation Committee (on behalf of English Nature, the Countryside Council for Wales, and the Nature Conservancy Council for Scotland), the Royal Society for the Protection of Birds and the Department of the Environment for Northern Ireland, and is organised by staff of the BTO Estuaries Unit based at Thetford, Norfolk. Including the 1969-70 Pilot Study, the twenty-second consecutive season of co-ordinated counts for the BoEE took place between July 1990 and June 1991. Counts are made on selected dates near the middle of each month, timed to coincide with the best tidal conditions for censusing estuarine birds. Records of wildfowl from both the BoEE and the National Wildfowl Counts are analysed by the Wildfowl and Wetlands Trust and are presented in the first section of this booklet.

DEVELOPMENTS IN THE ESTUARIES UNIT

The move by the BTO from Tring to its new headquarters at Thetford in April 1991 meant the Estuaries Unit had to say a sad goodbye to its long-serving, part-time secretary, Dorothy Smallwood-Keating, as well as to Nicola Bliss, who had provided additional secretarial support made necessary by the recent upsurge in BTO involvement in estuarine research and data collection. We were, however, fortunate to be able to welcome Carol Powley as their full-time replacement, and she will no doubt soon become a familiar contact for BoEE site organisers.

Despite the disruption consequent on the move, the range of studies undertaken by the Estuaries Unit has continued to grow. At the time of writing (late October 1991), the Unit comprises ten personnel, of whom four are permanent staff members and six are contract research officers. The BoEE continues to occupy the pivotal role at the heart of all this activity, with its results in ever-increasing demand for use in assessing the conservation importance of coastal sites faced with development proposals. Illustrating this, over 80 requests for BoEE data were handled during 1990-91, more than in any previous year. As usual, the NCC and its successor body, the JNCC, as well as the RSPB were the main users of this information, and both organisations were provided with comprehensive sets of BoEE data for use for conservation purposes.

During the course of the year, the results of the BoEE Estuarine Sites Review appeared (Kirby 1991), based on analysis and collation of a questionnaire previously distributed to site organisers. An immediate benefit of this review was the standardisation of the count units into which each estuary is divided. Computerised mapping of how count units on estuarine and inland sites relate to statutorily protected areas has subsequently been undertaken by WWT under contract to the NCC. During winter 1991-92, Ray Waters will, in liaison with WWT, be extending our original review to cover BoEE non-estuarine sites. To date, BoEE coverage of the open coast environment has been relatively limited. In some areas, notably Northumberland, there has been a long tradition of open coast counting, but elsewhere coverage has been largely restricted to a few sites of key importance which were identified as a result of the Winter Shorebird Count of 1984-85. The aims now are to review carefully the coverage we currently achieve, especially with respect to site boundaries, and to formulate plans for increased site coverage, aimed in particular at species such as Purple Sandpiper and Turnstone whose non-breeding populations are predominantly non-estuarine.

The first of a planned series of papers outlining the results of spring passage studies undertaken in recent years will be published shortly (Prys-Jones *et al.* in press), with further ones submitted for publication or in preparation. Similarly, two papers currently being prepared will respectively cover the methodological background to the new population indexing technique of Underhill (1989) and provide a species-by-species review of the population fluctuations revealed to date by more than 20 years of BoEE results. A further important development in late 1990 was the establishment of a new database on Wader Productivity. It had become increasingly clear that interpretation of the observed variations and trends in U.K. wintering wader numbers revealed by the BoEE could be much improved if we had better understanding of annual variations in the breeding success of the species and populations present. This cannot be gathered on their far-flung breeding grounds, but can potentially be deduced from knowledge of the proportions of first-year birds in wintering populations. BTO ringers already collected this information for most of the many waders they catch, and the problem therefore lay merely in making results from existing studies available in a form suitable for easy extraction and analysis. This co-ordination of the efforts of ringers and BoEE counters represents an exciting development which will hopefully yield much new information.

Many of the wintering and passage waders recorded by BoEE counters in the U.K. breed in the Siberian high arctic, but information on their biology there is extremely limited. Taking advantage of the new Soviet political openness, Robert Prys-Jones, together with Ron Summers of the RSPB, participated during summer 1991 in a joint British/South African/Dutch/Soviet research expedition to study breeding waders in the far north-east of the Taimyr peninsula, northern Siberia, an uninhabited area previously almost unexplored ornithologically. The main aims were: firstly, to investigate exactly which wader populations were

present by ringing and colour-marking nesting birds, recording detailed information on their biometrics, taking small blood samples for genetic analysis, and collecting ectoparasites; secondly, to begin a study into the role of predation in affecting wader breeding success. The work went extremely well, and a preliminary account of the results achieved has been provided for BTO members in the "Shorebirds" section of *BTO News* (Prys-Jones 1991a). Furthermore, these studies formed only one part of a wider and unprecedented international collaborative effort, which has been developing since 1989 and is focused on improving scientific understanding and providing more effective conservation of migratory Siberian waterfowl (Prys-Jones 1991b). Long may it continue!

The methodology of BoEE counts is aimed at producing accurate estimates of the total waterfowl populations of all U.K. estuaries, while requiring minimum labour on the part of the counters (even if it often doesn't feel like it!). As a result, most counting is carried out around high tide, when birds tend to be concentrated in roosting flocks. However, assessment of the potential conservation impacts of proposed estuarine developments is increasingly requiring detailed information as to how intertidal birds distribute themselves within estuaries while feeding. Commercially-funded work carried out by the Estuaries Unit over a number of years on the Severn and Mersey, in relation to proposed tidal barrages there, has revealed that even on such large and complex estuaries it is possible for teams of volunteer counters to obtain comprehensive, low-tide distributional information. With strong backing from the RSPB and JNCC, we are therefore hoping to initiate a programme of low-tide counting which would result in coverage of all the main U.K. estuaries at intervals of five years or so and the maintenance of a computerised database of results. Plans for a pilot survey of about 10 estuaries during winter 1992-93 are currently being formulated, and in the meantime we would welcome receiving information as to sites at which locally-based projects are planned or already underway.

A whole suite of *BTO Research Reports* containing the results of estuarine studies carried out under commercial contract has appeared since mid 1990. Perhaps particularly notable have been reports relating to the Mersey, which have arisen as a result of two key issues. Firstly, proposals to build a tidal barrage there resulted in funding, from the Energy Technology Support Group (ETSU) of the Department of Energy, for Clark *et al.* (1990c) to review the migration patterns of waterfowl visiting the Mersey and adjacent areas, as well as comprehensively documenting patterns of feeding usage of the Mersey intertidal flats by waterfowl between November 1988 and October 1989. Clark *et al.* (1990a) extended these studies to include data on feeding distribution from a second winter, 1989-90, during which fieldwork was carried out by night as well as during the day. A continuation of research into waterfowl distribution and diet on the Mersey, including radio-tracking studies of Teal and Pintail, was funded by the Mersey Barrage Company in winter 1990-91 (Rehmfisch *et al.* 1991a), and further developments of these studies will be undertaken during winter 1991-92.

Secondly, following the August 1989 oil spill, the Mersey Oil Spill Project Advisory Group was set up with funding from Shell U.K. and Cheshire County Council to investigate its environmental consequences. The BTO was contracted to undertake three studies: firstly, into bird mortality occurring as a result of the spill (Evans 1990); secondly, into the impact that the spill had on the population sizes and distributions of waterfowl present (Clark *et al.* 1990b); and thirdly, into possible sub-lethal effects the spill might have had on the condition and age structure of bird populations (Clark & Evans 1990). The overall conclusions of this work have been outlined for BTO members in a "Shorelines" article in *BTO News* (Donald 1991); its title "Alright this time" succinctly summarises the fortuitously limited overall impact of the spill. A further oil spill which occurred on the Severn estuary in February 1991 resulted in British Steel funding some similar research there regarding its effects on bird populations (Rehmfisch *et al.* 1991b). On both the Mersey and Severn, the Estuaries Unit was particularly well-placed to conduct assessments of oil impact because of the comprehensive pre-spill information it held on bird distribution, largely gathered through the efforts of volunteer counters.

The proposed building of a huge tidal energy barrage on the Severn has resulted in investigations of the distribution of intertidal bird populations there since 1987. Results from some of the earlier studies, funded by ETSU, are now beginning to appear as published papers (Clark 1991, Clark & Prys-Jones in press), whereas the most recently completed phase of work, funded by the Severn Tidal Power Group (STPG), has been written up in report form by Warbrick *et al.* (1991). Further studies due to be carried out in winter 1991-92 will mean that five successive years of information on low tide bird distribution will have been accumulated for the Severn, in addition to four successive years of similar data for the Mersey. These unique data sets are both now scheduled for comprehensive analysis of year-to-year variability in estuarine bird distribution patterns, funded by ETSU.

On the outer north shore of the Severn estuary, the Taff and Ely rivers jointly discharge into Cardiff Bay, which itself is subject to a proposed barrage as part of a major programme of urban renewal for the Welsh capital. Unlike the permeable tidal energy barrages proposed for the Severn and Mersey, this would be a non-permeable barrage which would submerge the area it encloses under a freshwater lake. Funded by the Cardiff Bay Development Corporation, the Estuaries Unit has been conducting

fieldwork there since November 1989 into the likely impacts that the construction would have on bird populations, and the first two reports from this work have now appeared (Evans *et al.* 1990, Donald & Clark 1991). Also in relation to a proposed barrage, Woolfall (1991) carried out a literature review of the importance for bird populations of the Wyre estuary in Morecambe Bay, under contract from Binnie & Partners.

Further ETSU-funded studies reported on during the year were a comprehensive review of the impact of organic inputs (e.g. sewage) on estuarine bird populations (Green *et al.* 1990) and, in conjunction with the Applied Statistics Research Unit of Kent University, a statistical investigation of monitoring requirements for detecting changes in estuarine bird populations (Davenport *et al.* 1990). Langston (1990) finalized an analysis of the wintering wader and wildfowl populations of Strangford Longh, as part of a major review of the management of this key waterfowl area co-ordinated by IWRB under contract to the National Trust. Ward (1990) published a paper on the migration patterns and origins of Poole Harbour's wader populations, based on earlier contract studies. Finally, with funding from STPG, a countrywide analysis of the distribution and abundance of feeding Dunlin in relation to sediment structure is approaching completion, which should add considerably to our knowledge of habitat selection by waders.

In addition to our continuing studies on the Mersey and Severn, the Estuaries Unit will be carrying out special research during winter 1991-92 in the Solway area, the Duddon, Morecambe Bay, Swansea Bay and the Swale for a variety of clients. On top of this, work is already underway on a major contract arising out of the massive cold weather kill of waders on the Wash in February 1991, from which the Wash Wader Ringing Group collected over 2,800 corpses. In collaboration with the Institute of Terrestrial Ecology, we will be assessing which birds were hardest hit by the severe weather and how birds recolonise the Wash in future winters, funded by ETSU and the Department of the Environment.

The Estuaries Unit is now building up a reputation for undertaking high quality research in an impartial manner, thereby providing the "science behind conservation" in the estuarine environment. It cannot be overstated that the direct volunteer input to many of these projects, as well as the existence of over 20 years of national BoEE counts, has led to much greater understanding of the bird populations under study than would have been possible if professional staff alone had been involved. This linkage between the enjoyment of bird-watching and the collection of scientific data will hopefully continue to flourish in the future.

DATA PRESENTATION

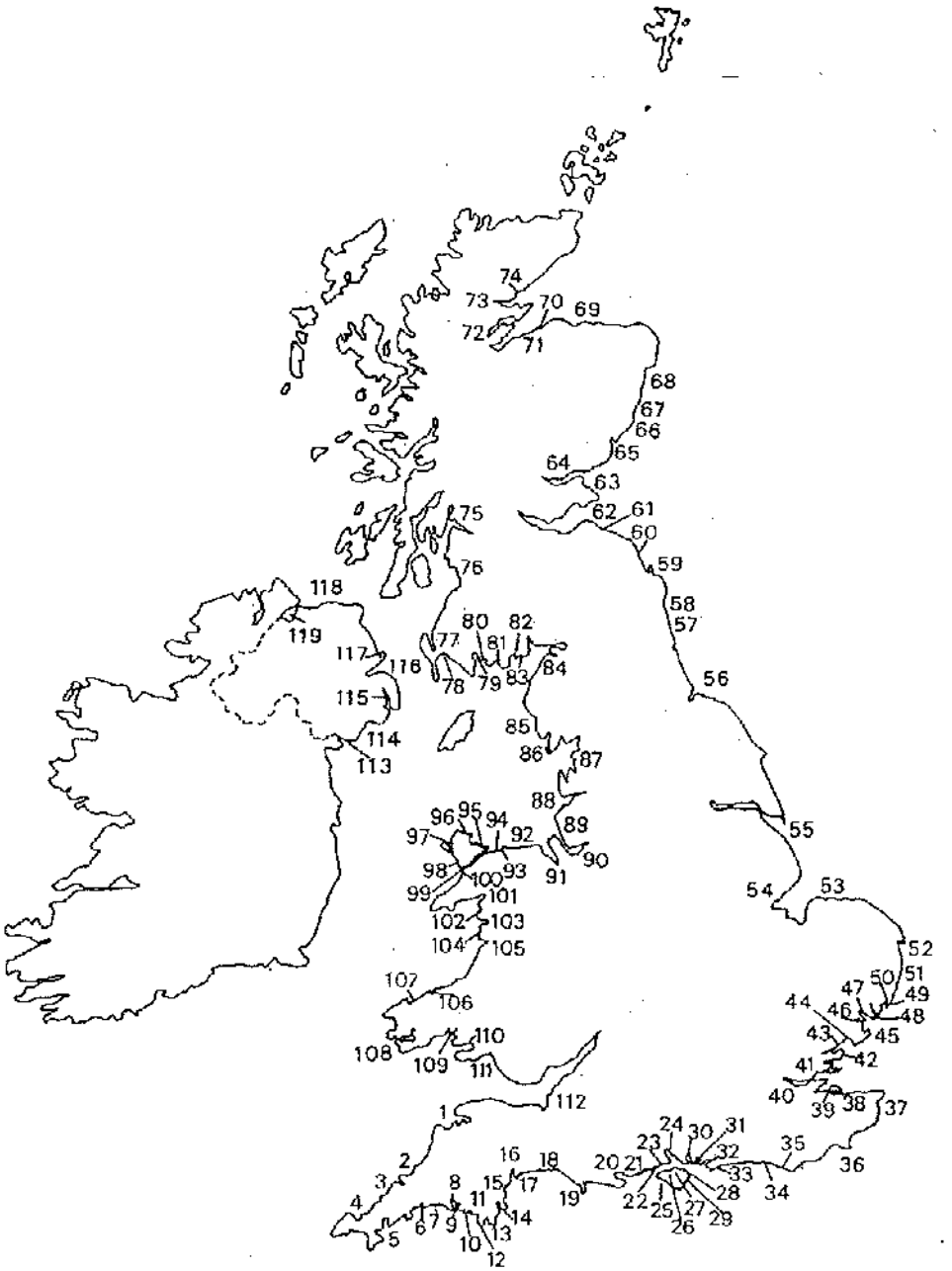
The period of year covered comprehensively in this report comprises the entire winter (November-March), although additional information relating to the spring (April-June) and autumn (July-October) is provided for species with notable passage populations. With one exception, the areas counted at each site have not altered since 1989-90. The exception concerns renewed coverage of the Roach after a prolonged gap; as a result, the site of which it forms part has been reinstated as the Crouch/Roach. Where information is available on non-estuarine sites this is also incorporated, but such sites are clearly indicated by an asterisk (*).

It is necessary to exercise caution when using BoEE information, especially in the summary form as presented here, for making statements regarding the conservation importanee of sites. Please refer to the section "Interpretation of waterfowl counts" (p.1) for guidance, or contact Ray Waters, BoEE National Organiser, BTO, (at the address on p.ii), who will be happy to advise.

COVERAGE IN 1990-91

For the first time ever, winter counting occurred at all 117 estuarine sites shown in Figure 2. This is testament to the high level of commitment and enthusiasm of the thousand or so counters, the "lifeblood" of the BoEE. A complete count was made at least once in the winter period at all sites except the Humber, Rough Firth and Dulas Bay. These three sites have, in recent years, been amongst the most difficult to cover. The future looks optimistic now, however, as enthusiastic new recruits are joining the counting teams.

Figure 2. MAP OF THE BRITISH ISLES SHOWING THE LOCATIONS OF ALL ESTUARIES CONSIDERED IN THIS REPORT.



Site numbers are as follows:

1 Taw/Torridge; 2 Camel; 3 Gannel; 4 Hayle; 5 Fal complex; 6 Fowey; 7 Looe; 8 Tamar complex; 9 Plym; 10 Yealm; 11 Erme; 12 Avon; 13 Kingsbridge; 14 Dart; 15 Teign; 16 Exe; 17 Otter; 18 Axe; 19 The Fleet/Wey; 20 Poole Harbour; 21 Christchurch Harbour; 22 NW Solent; 23 Beaulieu; 24 Southampton Water; 25 Yar; 26 Newtown; 27 Medina; 28 Wootton; 29 Brading Harbour; 30 Portsmouth Harbour; 31 Langstone Harbour; 32 Chichester Harbour; 33 Pagham Harbour; 34 Adur; 35 Newhaven; 36 Rye Harbour/Pett Levels; 37 Pegwell Bay; 38 Swale; 39 Medway; 40 Thames; 41 Crouch/Roach; 42 Dengie; 43 Blackwater; 44 Colne; 45 Hamford Water; 46 Stour; 47 Orwell; 48 Deben; 49/50 Alde complex; 51 Blyth; 52 Breydon Water; 53 N Norfolk Marshes; 54 Wash; 55 Humber; 56 Tees; 57 Blyth; 58 Coquet; 59 Lindisfarne; 60 Tweed; 61 Tyninghame; 62 Forth; 63 Eden; 64 Tay; 65 Montrose Basin; 66 Dee; 67 Don; 68 Ythan; 69 Spey; 70/71 Inner Moray Firth; 72 Cromarty Firth; 73 Dornoch Firth; 74 Loch Fleet; 75 Inner Clyde; 76 Irvine; 77 Loch Ryan; 78 Luce Bay; 79 Wigtown Bay; 80 Fleet Bay; 81 Kirkcudbright Bay; 82 Auchencairn Bay; 83 Rough Firth; 84 Solway; 85 Irt/Mite/Esk; 86 Duddon; 87 Morecambe Bay; 88 Ribble; 89 Alt; 90 Mersey; 91 Dee; 92 Clwyd; 93 Conwy; 94 Lavan Sands; 95 Red Wharf Bay; 96 Dulas Bay; 97 Inland Sea; 98 Cefni; 99 Braint; 100 Foryd Bay; 101 Traeth Bach; 102 Artro; 103 Mawddach; 104 Dysynni; 105 Dyfi; 106 Teifi; 107 Nyfer; 108 Cleddau; 109 Carmarthen Bay; 110 Burry; 111 Swansea Bay; 112 Severn; 113 Carlingford Lough; 114 Dundrum Bay; 115 Strangford Lough; 116 Belfast Lough; 117 Lough Larne; 118 Bann; 119 Lough Foyle.

UNITED KINGDOM POPULATION TOTALS

Table 38 shows the total populations of each wader species counted in each winter month of 1990-91 in both Britain and Northern Ireland. The numbers of BoEE sites covered in each month are also given. Recorded totals of the highly cryptic Jack Snipe and Snipe are likely to be far smaller than the populations of those species actually present on the BoEE sites covered, but for other species the figures should provide reliable population estimates.

1990-91 saw another record-breaking season, with the U.K. January total of all wader species topping the 1.7 million mark for the first time. Numbers were also higher than in previous years in each of the other winter months. At least in part, this was a result of the increasingly complete coverage of estuarine sites being achieved by the BoEE. The January indices, which correct for differences in coverage from year to year, give a better picture of actual population levels for the species included (see pp48-49).

U.K. totals during the 1990-91 winter reached record high levels for several species. Counts of over 9,000 Black-tailed Godwits in November and over 1,500 Avocets in January were substantially the highest U.K. winter totals of these species ever recorded by the BoEE, and the February counts for Oystercatcher, Grey Plover and, most notably, Bar-tailed Godwit also appear to be records for any winter month. These February peaks followed a very cold spell, which clearly caused a major movement of Bar-tailed Godwits into the U.K., presumably from the Wadden Sea area. This cold spell caused an opposite response among Lapwing, Golden Plover and Black-tailed Godwit, which all recorded much lower totals in February than January. Last, but not least, Dunlin numbers in each month of the winter were well up on the equivalent totals recorded in winter 1989-90; not since the mid 1970s have U.K. monthly totals for this species exceeded 500,000.

Table 38. TOTAL NUMBERS OF WADERS RECORDED BY BOEE COUNTS IN THE UNITED KINGDOM DURING WINTER 1990/91

BRITAIN	November	December	January	February	March
Oystercatcher	247,131	257,761	269,944	277,091	161,707
Avocet	1,141	1,418	1,564	1,044	718
L. Ringed Plover	0	0	1	0	0
Ringed Plover	11,880	10,935	10,202	8,310	4,313
Kentish Plover	0	0	1	0	1
Golden Plover	56,309	52,238	42,912	25,885	20,502
Grey Plover	36,259	37,170	40,779	43,186	36,422
Lapwing	138,080	173,511	130,534	44,858	15,032
Knot	292,117	247,973	278,735	247,342	121,508
Sanderling	6,717	5,111	6,405	4,818	7,451
Little Stint	10	5	9	1	0
Curlew Sandpiper	10	1	0	0	0
Purple Sandpiper	1,312	1,246	1,832	2,039	1,185
Dunlin	423,977	526,991	567,173	533,782	231,945
Ruff	111	39	106	134	100
Jack Snipe	56	48	19	37	22
Snipe	2,027	2,382	2,516	1,358	906
Woodcock	2	0	0	16	0
Black-tailed Godwit	9,440	8,056	7,028	4,724	7,922
Bar-tailed Godwit	37,645	39,401	43,458	71,912	19,034
Whimbrel	11	6	5	1	8
Curlew	56,463	58,663	67,774	62,544	65,807
Spotted Redshank	109	84	60	51	51
Redshank	74,429	72,784	69,093	62,870	47,725
Greenshank	198	188	166	157	161
Green Sandpiper	44	45	31	14	10
Terek Sandpiper	1	0	0	0	0
Common Sandpiper	25	34	28	8	5
Turnstone	15,651	15,923	17,199	15,927	15,900
Total	**1,411,155**	**1,512,013**	**1,627,011**	**1,408,109**	**758,435**
No. sites counted	136	146	150	144	135

NORTHERN IRELAND

	November	December	January	February	March
Oystercatcher	13,622	13,115	13,698	12,598	7,901
Ringed Plover	1,310	1,007	1,140	1,053	385
Golden Plover	7,242	6,231	7,485	4,370	5,929
Grey Plover	135	142	184	152	66
Lapwing	12,284	12,903	19,106	18,480	622
Knot	2,020	6,673	1,566	896	565
Sanderling	18	13	57	40	63
Purple Sandpiper	111	122	132	101	130
Dunlin	8,658	11,721	16,268	12,286	3,830
Ruff	1	3	4	4	0
Jack Snipe	3	1	0	0	0
Snipe	126	209	157	84	69
Black-tailed Godwit	99	181	152	164	135
Bar-tailed Godwit	510	937	2,709	4,063	2,623
Curlew	3,499	4,346	6,017	4,909	4,422
Spotted Redshank	0	1	1	2	0
Redshank	5,606	4,989	4,488	5,975	4,712
Greenshank	78	74	94	75	51
Turnstone	2,422	2,356	2,940	2,676	2,486
Total	**57,744**	**65,024**	**76,198**	**67,929**	**33,989**
No. sites counted	9	10	10	9	7
U.K. Totals	**1,468,899**	**1,577,037**	**1,703,209**	**1,476,038**	**792,424**

INDICES OF WINTERING NUMBERS

The geographical coverage achieved by the BoEE varies from year to year; it is not therefore possible to derive satisfactory data on population changes between winters simply by examining national totals of birds counted. To overcome this problem, an index of wintering numbers has been devised, based on the January counts. The indices have been calculated by the same method as for wildfowl (see p.13), except that 1973 is used as the arbitrary "anchor" year. Species which occur only in small total numbers are excluded. Lapwing and Golden Plover are also excluded because a high proportion of the population occurs on inland fields; as a result, the indices are highly sensitive to cold weather movements rather than reflecting true changes in population levels from year to year.

No fewer than seven of the ten species included in the index showed population changes of more than 10% compared to 1990. Sanderling increased by 24%, whereas both Curlew and Redshank declined by over 20%. Dunlin, Bar-tailed Godwit, Grey Plover and Turnstone all changed by between 10% and 20%, with only the last-named showing a decrease on 1990. Possible causes of these changes are discussed in the individual species accounts. However, for all species it should be borne in mind that whereas long-term trends in index values almost certainly indicate real changes in overall wintering populations, short-term fluctuations may merely reflect changes in population distribution caused by factors such as the weather.

Table 39. JANUARY INDICES FOR WADER POPULATIONS IN THEUNITED KINGDOM, 1971-91

	Mean 1971 to 75	Mean 1976 to 80	Mean 1981 to 85	1986	1987	1988	1989	1990	1991
Oystercatcher	116	158	173	203	171	215	238	244	222
Ringed Plover	107	129	141	162	105	129	169	149	149
Grey Plover	115	157	173	221	199	299	386	326	366
Knot	112	84	83	92	82	88	92	119	113
Sanderling	129	120	107	104	85	103	81	87	108
Dunlin	101	93	71	64	55	64	77	78	92
Bar-t.Godwit	101	137	184	166	190	161	142	105	123
Curlew	119	103	93	75	69	108	101	110	84
Redshank	100	97	77	78	69	100	109	108	85
Turnstone	118	143	130	192	144	173	181	179	160

SPECIES ACCOUNTS

The tables presented in this section rank the principal sites, including all internationally important ones, for each species in the United Kingdom on the basis of the average winter maxima recorded over the last five winters. Incomplete counts presented for individual years are bracketed. The five-year averages for each site were in the first instance calculated using only complete counts, but if any incomplete counts exceeded this initial average they were then also incorporated in order to give the best possible estimate of the average winter peak count.

Oystercatcher *Haematopus ostralegus*

The Oystercatcher U.K. index was 9% lower in January 1991 relative to the previous year, but still remained higher than any pre-1989 value. Seven sites continue to rank as internationally important, and these are listed in Table 40 together with all other sites supporting average peak winter counts exceeding 5,000. Two major sites, the Thames and the Solway, showed substantial increases in their peak winter count in 1990-91. The figure for the Thames was due to one exceptionally high February count of over 16,000 at Foulness, a key area that has been regularly covered since the very start of the BoEE.

Cayford & Goss-Custard (1990) found that Oystercatchers on the Exe changed their diet in spring, concentrating on smaller mussels than those eaten in the rest of the year. This change was associated with a deterioration in the quality of the large mussels at this time, due to the onset of spawning. Research into the feeding biology of Oystercatchers was also highlighted at the 1991 Wader Study Group Conference in Texel (Netherlands). Here Arjo Bunskoeke showed that Oystercatchers at a site in the Wadden Sea changed their diet during their breeding season. At this time, *Nereis diversicolor* (a polychaete worm, also widespread in the U.K.) became the major food, instead of the bivalve mollusc *Macoma*, which was less abundant at this time of year.

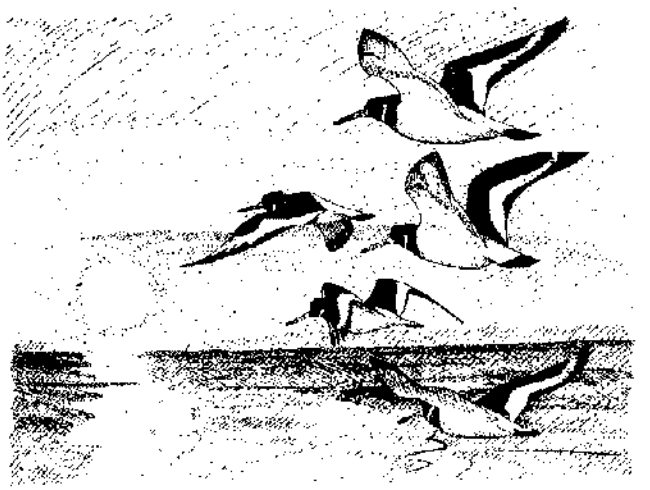


Table 40. OYSTERCATCHER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Morecambe Bay	(45,395)	61,664	50,776	64,967	56,361	(Jan)	58,442
Wash	23,202	35,421	46,912	40,689	33,791	(Feb)	36,003
Solway	(21,897)	(32,916)	28,536	(27,959)	40,095	(Feb)	33,849
Dee (Eng/Wales)	24,600	28,890	27,397	33,293	35,774	(Nov)	29,990
Burry	21,390	19,334	14,980	11,862	15,151	(Jan)	16,934
Ribble	10,963	15,062	19,271	(15,046)	18,263	(Feb)	15,889
Thames	13,703	(9,438)	8,295	9,973	(17,378)	(Feb)	12,337
Forth	(8,807)	(7,574)	(7,600)	5,859	7,374	(Nov)	7,442
Duddon	6,933	6,650	6,401	8,428	5,898	(Feb)	6,862
Humber	(2,790)	(3,522)	(5,102)	(4,750)	(5,806)	(Nov)	(5,806)
Inner Moray Firth	8,376	5,423	4,901	5,022	5,060	(Feb)	5,756
Belfast Lough	5,698	6,689	5,594	4,480	5,601	(Dec)	5,612

Avocet *Recurvirostra avosetta*

Yet again the wintering population of Avocet continued its rise. The U.K. total of over 1,500 in January 1991 was almost 50% higher than the previous January count. The Alde complex remains the main site for the species, supporting about half the U.K. wintering population; for the second successive year the peak winter total there topped 700, although the average peak winter count still falls short of international importance. Six estuaries, listed in Table 41, now qualify as nationally important wintering sites. Of these, Hamford Water and Poole Harbour recorded particularly striking increases in numbers, although the main factor boosting the U.K. totals is the increasing number of sites, now over 20, which support small numbers of Avocet. In addition to the sites shown, North Norfolk Marshes (110 in March), the Swale (75 in March) and the Blyth (Suffolk) (59 in March) all supported over 50 birds during winter 1990-91.

Although the Medway only held 36 Avocets by November 1990, 235 had been present a month earlier in October. A late autumn peak on this site appears typical, with birds apparently passing through to winter elsewhere. By contrast, highest totals on the neighbouring Swale tend to be in spring, with 99 birds present in April 1991.

A coordinated low-tide count of Avocets in East Anglia on 3 February 1991 revealed a population of 1,045 birds in that area. This compares with the corresponding standard BoEE totals of 981 and 564 in January and February respectively. As a result of a thorough, long-term research project, Reay (1991) has discovered some interesting aspects to the feeding biology of the Avocets in SW England. Notably, he has shown that feeding distribution within the Tamar complex is affected by river flow rate, which in turn is influenced by recent rainfall.

Hermann Hötker, at the WSG Conference in Texel, was able to demonstrate clearly using colour-ringed birds that North Frisian (Netherlands) Avocets move to Iberia to winter. He also found that juveniles wintered further away and tended to occupy smaller estuaries than the adults. The breeding origin of U.K. wintering Avocets has still to be firmly established, and it seems likely that those on the east coast originate from a different area from those in the south-west.

Table 41. AVOCET: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Alde complex	(411)	285	514	721	729	(Jan)	562
Exe	121	152	229	379	323	(Dec)	240
Tamar complex	(1)	(102)	90	185	240	(Feb)	171
Hamford Water	26	(64)	85	(0)	188	(Dec)	99
Poole Harbour	59	48	65	122	175	(Jan)	93
Medway	0	(16)	(38)	(136)	36	(Nov)	52

Ringed Plover *Charadrius hiaticula*

The January 1991 index for Ringed Plover was unchanged on last year's value. However, peak numbers in the U.K. occurred in November rather than in January, as was the case in 1989-90, suggesting that the overall 1990-91 winter population may have been slightly up on the previous year. All internationally important sites, plus those of national importance with winter peaks averaging over 400 birds, are given in Table 42. In addition to these, Guernsey* (519 in January) recorded over 500 birds in winter 1990-91. The internationally important site of Tiree* no longer appears as it has not been covered since 1986-87.

For a species that showed little overall change on the previous year, there were a number of sites where the peak counts from the two winters were very different. Lindisfarne, Guernsey* and, in particular, Hamford Water showed major increases on the 1989-90 peaks, although improvements to coverage probably account for part of the change at Hamford Water. In contrast, declines were noted at the Medway, Colne, Blackwater and Orwell. The peak at Hamford Water in November coincided with low numbers on the nearby Colne, suggesting possible shifts in distribution between these Essex estuaries. Overall, however, caution must be observed in interpretation, as the Ringed Plover is known to be one of the most difficult intertidal birds to census accurately (Spearpoint *et al.* 1988).

In addition to the wintering population, there is a substantial passage of Ringed Plovers through the U.K. in autumn and spring. BoEE data provide minimum estimates of site usage during these times, both because population turnover is rapid and because not all sites are covered. Nevertheless, peak passage counts exceeding 500 birds were recorded on Morecambe Bay (2,615 in May), the Wash (2,147 in September), the Severn (1,573 in August), Hamford Water (1,462 in September), Langstone Harbour (1,279 in August), the Dee (Eng/Wales) (1,202 in August), Chichester Harbour (1,149 in September), the Thames (1,110 in October), the Humber (998 in May), the Medway (984 in August), North Norfolk Marshes (818 in September), the Colne (663 in October), the Blackwater (605 in September), the Ribble (583 in August), Lindisfarne (582 in October), the Stour (530 in September), the Orwell (505 in September), and the Solway (502 in September).

Table 42. RINGED PLOVER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/88	89/90	90/91	(Mth)	Average
Chichester Hbr.	624	x	924	(2,093)	519	(Dec)	1,040
Thames	(955)	(505)	540	922	(674)	(Nov)	827
Medway	(571)	(1,003)	(971)	(696)	501	(Nov)	748
Outer Ards*	630	710	(753)	623	709	(Feb)	685
Hamford Water	134	(120)	310	(0)	1,427	(Nov)	623
Lindisfarne	216	480	720	311	800	(Nov)	505
Langstone Hbr.	460	615	542	375	420	(Jan)	482
Morecambe Bay	(348)	554	497	410	380	(Dec)	457
Forth	(268)	427	475	382	422	(Dec)	426
Colne	382	469	403	511	276	(Dec)	408

Golden Plover *Pluvialis apricaria*

Overall BoEE counts of around 60,000 Golden Plover in November and December 1990 were exceptionally high, although numbers dropped off subsequently in both January and February to levels below those of a year previously. Table 43 includes the only internationally important BoEE wintering site for the species, the Humber, together with all sites currently of national importance. In addition to these, Lough Foyle (2,828 in March) and North Norfolk Marshes (2,671 in December) had counts exceeding 2,000 Golden Plover in winter 1990-91. Most important sites showed numbers peaking in November or December, well before the onset of the cold weather which occurred between mid January and mid February. Totals at the major sites around the Irish Sea tended to be down on recent years, whereas along the east coast sites such as the Forth, Wash and Blackwater recorded particularly high totals.

Table 43. GOLDEN PLOVER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Humber	(10,233)	(14,219)	(10,346)	(27,249)	(20,168)	(Nov)	(27,249)
Strangford Lough	6,454	7,333	9,972	7,036	4,136	(Nov)	6,986
Ribble	4,291	3,660	5,111	8,902	2,451	(Nov)	4,883
Forth	(1,824)	(832)	1,742	(2,999)	6,637	(Nov)	4,189
Solway	2,323	2,762	(4,360)	(3,706)	2,693	(Dec)	3,380
Crouch/Roach	(800)	(825)	(2,860)	(2,502)	2,223	(Jan)	2,528
Wash	695	2,124	3,568	2,248	(3,591)	(Dec)	2,445
Thames	623	(2,767)	1,832	(4,412)	(2,572)	(Mar)	2,441
Lindisfarne	1,100	1,300	4,000	3,200	1,600	(Feb)	2,240
Blackwater	620	1,160	1,551	2,213	3,388	(Mar)	2,078
Morecambe Bay	596	485	1,498	4,426	1,831	(Nov)	2,060

Grey Plover *Pluvialis squatarola*

After a decline in the previous year, the Grey Plover January index increased by 12% in 1991, taking it to its second highest level ever. Indeed, February 1991 saw an all-time BoEE record count of 43,186 birds in the U.K. The qualifying level for international importance of a site for Grey Plover is 1,500, and all sites currently supporting average peak wintering populations exceeding 1,000 birds are shown in Table 44. In addition to these listed sites, the Mersey (2,620 in February) held in excess of 1,500 birds in winter 1990-91. The peak counts on both the Mersey and the Blackwater were exceptional in being more than treble the average peak of the previous four winters.

By collecting evidence going back more than 100 years, Tubbs (1991) has been able to document the long-term increase in wintering Grey Plovers on the Solent, the complex of estuaries in central southern England. He concludes that the species was comparatively scarce until the 1940s or 1950s and that the recent increase there is without precedent this century. More speculatively, he suggests that the increase both on the Solent and elsewhere in the U.K. would not have been possible without the cessation of autumn and winter shooting, which followed the protection conferred on the species in Britain by the Protection of Birds Act 1954 and by protection subsequently elsewhere in Europe.

Table 44. GREY PLOVER: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Wash	5,512	8,385	9,054	8,840	7,432	(Feb)	7,844
Thames	(4,411)	4,884	8,486	(4,835)	(6,388)	(Feb)	6,685
Medway	(1,121)	(2,534)	(3,209)	(6,185)	(3,435)	(Mar)	(4,810)
Ribble	2,048	3,872	3,539	(3,111)	2,720	(Mar)	3,058
Humber	(891)	(365)	(1,425)	(1,343)	(2,490)	(Nov)	(2,490)
Chichester Hbr.	1,631	x	2,791	(1,591)	1,718	(Mar)	2,046
Stour	1,430	1,629	1,761	2,473	1,999	(Jan)	1,858
Morecambe Bay	(1,167)	1,146	3,062	(1,074)	1,466	(Feb)	1,687
Blackwater	1,290	1,150	905	1,003	4,085	(Mar)	1,686
Swale	(420)	1,409	(1,362)	1,730	1,559	(Jan)	1,566
Dee (Eng/Wales)	1,607	1,800	1,270	1,120	2,004	(Jan)	1,560
Lindisfarne	2,100	1,200	1,825	1,200	1,020	(Jan)	1,469
Langstone Hbr.	1,281	1,629	1,870	1,196	1,299	(Jan)	1,455
Dengie	840	1,082	1,375	1,110	1,700	(Feb)	1,221
Colne	811	1,234	1,063	1,540	1,083	(Mar)	1,146
Alt	1,023	849	1,276	1,340	990	(Nov)	1,095
Hamford Water	200	(664)	1,257	(3)	1,780	(Dec)	1,079
Severn	(272)	(330)	673	(521)	1,405	(Jan)	1,039

Lapwing *Vanellus vanellus*

The wintering Lapwing population recorded on BoEE counts in the U.K. in 1990-91 showed two striking differences from that in the previous winter. First, the exceptional peak of over 250,000 birds in January 1990 was not repeated. Secondly, numbers present in February 1991 were well down on early winter totals in Britain, although not in Northern Ireland, probably as a result of the onset of very cold weather around the January and February counts.

Table 45 lists all sites with average peak winter counts exceeding 5,000 birds. Following an all-time record BoEE Lapwing count of 32,590 birds on the Ribble, just up on the previous winter, this site has now joined the Humber as an internationally important site for the species. Morecambe Bay and Strangford Lough both rank as nationally important sites. It is striking that, among the sites listed, those in Northern Ireland and south-east Britain recorded peak counts in January or February, whereas elsewhere the peaks were all in November or December.

In April 1987, the BTO carried out a major membership-based survey of the numbers, distribution and habitat preferences of breeding Lapwings in England and Wales. In their analysis of the results of this, Shrubb & Lack (1991) estimate a total population of *ca.* 125,000 pairs, with a major concentration in north-west England and very few in Wales or the south-west. By contrast, a previous BTO survey in 1960 had shown no evidence of this breeding concentration in the north-west, which is apparently the product of steep population declines in central and southern England which themselves have probably been caused by a major switch from spring to autumn tillage.

Table 45. LAPWING: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Humber	(6,306)	13,165	(12,644)	(30,892)	(26,506)	(Nov)	23,521
Ribble	8,917	10,883	21,174	32,145	32,590	(Dec)	21,141
Morecambe Bay	(9,520)	6,672	26,327	24,171	12,247	(Nov)	17,354
Strangford Lough	6,740	18,057	13,592	11,826	10,651	(Jan)	12,173
Thames	(3,751)	(7,530)	7,988	(8,983)	(7,668)	(Jan)	8,903
Swale	(2,968)	11,184	(3,445)	(5,561)	4,915	(Jan)	8,049
Solway	(8,456)	(7,959)	(6,883)	(6,989)	3,504	(Dec)	6,758
Dee (Eng/Wales)	5,175	5,490	5,155	11,136	5,083	(Dec)	6,407
Tees	4,571	3,721	4,352	6,600	9,824	(Dec)	5,813
Forth	(2,450)	(2,792)	4,091	5,124	7,529	(Nov)	5,581
Wash	1,982	5,013	4,943	10,261	(3,007)	(Dec)	5,549
Alde complex	(4,176)	7,815	5,205	4,635	3,393	(Jan)	5,262
Outer Ards*	3,880	(6,060)	6,492	5,688	3,915	(Feb)	5,207

Knot *Calidris canutus*

The January 1991 population index for Knot was just 5% down on that for the previous year, an insignificant change for a species which shows considerable inter-site mobility within the winter period. U.K. monthly population totals were unusually stable between November 1990 and February 1991, suggesting little movement in or out of the area occurred over this period.

All sites of international and national importance are shown in Table 46. In addition to those listed, both the Stour (3,596 in February) and the Blackwater (3,561 in January) held over 3,500 birds during winter 1990-91. The November count of 164,176 birds on the Wash is an all-time winter record for any wader species at any site and was a remarkable 50% higher than the previous highest, also of Knot on the Wash. In the previous month the Wash recorded an even higher count of 169,321, probably the highest BoEE count of a wader species in any month of the year. Exactly a year previously, in October 1989, another huge flock of Knot was present at Holme on the Wash. Ireland (1990) vividly describes this flock and how the Wash Wader Ringing Group managed to ring 1,478 of these birds in one morning.

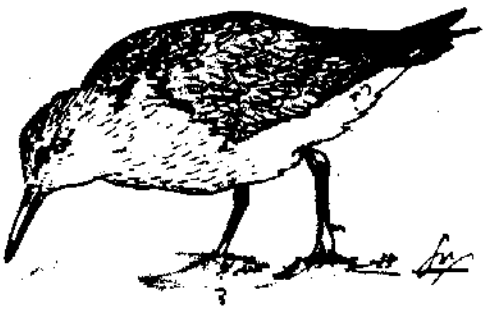
Virtually all Knot which winter in the U.K. are *C.c.islandica*, which breed in north-east Canada and Greenland. A number of recent studies have examined these birds both while on spring passage northwards and on the breeding grounds. Gudmundsson *et al.* (1991) showed that Knot staging in western Iceland increase in mass by an average of 3.1g per day between 14 and 26 May, a similar rate of spring fat deposition to that observed elsewhere in

Europe. Working in the same area, Alerstam *et al.* (1990) found that Knot departed onwards from western Iceland in late May in flocks averaging 100-200 individuals. Their main flight route surprisingly appears to be a rhumbline (constant compass direction) across the Greenland ice cap, rather than the great circle route which is both shorter and, in principle, more simple to navigate. Whitfield & Brade (1991) examined Knot breeding behaviour in high arctic Ellesmere Island, north-east Canada. They concluded that the displays used by breeding Knot tend to be unlike those of most other *Calidris* sandpipers, supporting the notion that the species is something of an "odd man out" within this genus.

Tomkovich (1990) has carried out a review of geographical variability in Knot, on the basis of which he found it necessary to propose a new subspecies, *C.c. roselaari*, for birds breeding on Wrangel Island and in Alaska. He could find no biometric differences and only slight colour variation between *C.c.canutus* of northern Siberia and *C.c islandica*, and concluded that the wintering grounds of the Siberian birds in Africa remain to be determined. Since his paper was submitted for publication, however, Underhill *et al.* (1989) have reported strong circumstantial evidence that most Knot wintering in southern Africa have a Siberian provenance.

Table 46. KNOT: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Wash	83,340	93,666	75,921	108,570	(164,176)	(Nov)	105,134
Ribble	27,007	52,400	60,030	(45,103)	30,567	(Dec)	43,021
Alt	46,000	40,000	45,000	51,000	28,000	(Nov)	42,000
Humber	(29,247)	22,438	(38,465)	(30,894)	(35,292)	(Nov)	31,267
Thames	(25,826)	(20,794)	30,160	(21,668)	(23,100)	(Jan)	30,160
Morecambe Bay	(28,081)	23,968	25,229	(23,770)	30,958	(Mar)	26,401
Dee (Eng/Wales)	12,170	18,860	13,132	44,715	16,916	(Jan)	21,158
Solway	(3,070)	(6,668)	(7,311)	(5,943)	15,305	(Feb)	15,305
Forth	(8,145)	9,803	10,810	7,744	7,163	(Dec)	8,880
N Norfolk Marshes	4,930	(4,200)	6,260	(6,524)	13,298	(Feb)	8,162
Dengie	10,280	5,200	6,390	(7,300)	6,540	(Jan)	7,142
Strangford Lough	8,700	2,918	1,745	7,028	6,376	(Dec)	5,353
Duddon	12,000	5,500	600	2,300	5,570	(Feb)	5,194
Burry	7,100	5,740	1,920	2,410	1,725	(Jan)	4,243
Tees	4,640	5,030	4,484	3,000	1,953	(Feb)	3,821
Medway	(427)	(1,200)	(581)	(940)	3,690	(Feb)	3,690
Severn	(771)	1,419	3,150	(1,637)	4,996	(Feb)	3,188
Swale	(1,750)	1,904	(3,503)	(2,101)	(3,208)	(Dec)	2,679
Montrose Basin	2,000	450	2,000	4,000	4,000	(Jan)	2,490



Sanderling *Calidris alba*

The January 1991 index for Sanderling was a substantial 20% up on that of the previous year, reaching its highest level since 1983. All nationally important sites for the species which had average peak winter counts exceeding 250 birds are shown in Table 47. Among these, the Ribble remained the only site of international importance, having a population four times that of its nearest rival. Along with a number of other major sites, the Ribble recorded its peak Sanderling count of winter 1990-91 in March, contributing towards an unusual March peak for the overall monthly U.K. totals. Sanderling numbers on the Dee (Eng/Wales) were high for the second successive winter; it will be interesting to see if this trend continues in future years.

Counts of Sanderling in passage periods tend to be much higher than those recorded in winter. A U.K. count total of over 12,000 was recorded in May 1991, mainly at estuaries in north-west England, despite the smaller number of BoEE sites covered at this time. Sites recording over 1,000 birds during passage periods in 1990-91 had peak counts as follows: the Ribble (5,043 in July), Morecambe Bay (4,354 in May), the Humber (1,868 in May), the Wash (1,455 in August) and Lindisfarne (1,400 in August).

During studies on Sanderling spring passage in north-east Orkney, Summers (1990c) made the intriguing observation that Sanderling feeding on the large island of Sanday by day appeared to move to the smaller neighbourhood island of North Ronaldsay at night. He suggested the reason for this might be that North Ronaldsay lacks rats, which can at times take a large toll of night-roosting birds. Sanderlings by no means always roost at night, however. In a winter study on a tourist beach in Florida, Burger & Gochfield (1991) found that Sanderling continued to feed into the night, at which time human disturbance was less than during daylight or at dusk.

Gudmundsson *et al.* (1991) examined fat deposition by Sanderling staging in western Iceland in spring. Turnover in their study population was high, with birds departing on onwards migration from 25 May. Individuals achieved a fat deposition rate averaging *ca.* 1.7g per day, and at departure carried a fat load of about 50% for their flight to east Greenland or beyond.

Table 47. SANDERLING: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Ribble	1,193	2,801	3,574	(1,460)	2,200	(Mar)	2,442
Thanet*	659	722	572	604	566	(Mar)	624
Alt	727	625	429	680	488	(Dec)	589
Dee (Eng/Wales)	374	477	186	823	1,011	(Nov)	574
Humber	(408)	461	(472)	(556)	(559)	(Mar)	512
Wash	768	572	435	471	302	(Jan)	509
Duddon	291	447	388	457	383	(Feb)	393
Tay	560	362	336	312	380	(Nov)	390
Chichester Hbr.	206	x	300	(432)	253	(Mar)	297
Tees	800	200	252	100	130	(Nov)	296
Swansea Bay	300	(234)	77	258	415	(Mar)	262
Solway	(266)	277	222	(214)	(255)	(Nov)	255
Clwyd coast*	180	225	237	176	458	(Dec)	255

Little Stint *Calidris minuta*

The only BoEE sites with peak counts exceeding 2 Little Stint in winter 1990-91 were the same as those in the previous year: Chichester Harbour (6 in November) and the Swale (4 in January). During autumn passage, counts of over five were made at ten sites, all in September: Morecambe Bay (15 birds), Dee (Eng/Wales) (15), Chichester Harbour (12), the Severn (11), Rye Harbour/Pett Levels (11), the Humber (11) the Swale (10), the Exe (8), Langstone Harbour (8) and the Forth (7). Only one spring count involved more than 5 birds, with Breydon Water holding 8 individuals in May.

Curlew Sandpiper *Calidris ferruginea*

The only record of more than one Curlew Sandpiper in winter 1990-91 was of a surprising 8 on the Humber in November. Autumn passage as usual provided most of the records during the count year, with totals in autumn 1990 being intermediate between the low levels of autumn 1989 and the high counts of autumn 1988. Five out of six sites recording peak counts of 25 or more had them in September: the Severn (54), Forth (42), Exe (31), Humber (28) and Christchurch Harbour (25). The sixth site, the Thames, recorded 37 birds in July.

Purple Sandpiper *Calidris maritima*

Over 95% of Purple Sandpipers wintering in Britain occur away from estuaries (Moser 1987). Although over 50 non-estuarine or "open shore" sites were counted by the BoEE in 1990-91, the total numbers of Purple Sandpiper recorded represent only around one-tenth of the likely U.K. total. The identification of any trends in numbers of Purple Sandpiper therefore must be made with caution. It is of note, however, that despite the cold spell in January and February 1991, these two months recorded the peak U.K. totals during winter 1990-91, with a very similar pattern to the previous winter which was particularly mild. To qualify for national importance for wintering Purple Sandpiper a site needs an average peak count of 160 birds, calculated over the five most recent winters. In 1990-91 four BoEE sites recorded counts exceeding this level: the Tees (peak of 261 in February), Budle Pt.-Seahouses* (peak of 243 in November), Rosehearty-Fraserburgh* (peak of 235 in January) and the Spey coast* (peak of 228 in February). Apart from these strongholds in NE Britain, only the Isle of Thanet* in the south-east recorded over 100 birds, with 102 recorded in March.

Most of the Purple Sandpipers wintering in NE Britain are presumed to breed in Norway. Two recent ringing recoveries, however, have shown that some birds spend part of spring in NE Britain after wintering further south in Germany and Holland (Summers *et al.* 1990a). The authors suspect that these birds belong to a population that continues to Iceland and finally to breeding grounds, probably in Canada.

As in many wader species, female Purple Sandpipers tend to have longer bills than males. This dimorphism probably accounts for the females taking larger molluscs (Summers *et al.* 1990b). At high tide the diet switches to kelp fly larvae which infest heaps of rotting algae. Purple Sandpiper winter further north than any other wader and, hence, daylight will be very limited over much of their wintering range. It is of interest, therefore, that Strann & Summers (1990) found that if high tide occurred around midday, Purple Sandpipers in N Norway spent only 10% of the day feeding. Under these conditions they needed to do most of their feeding after dark.

Norway is the most important wintering area in Europe (Smit & Piersma 1989). Counts recently carried out around Tromso (70°N) by Summers *et al.* (1990c) revealed a population of about 10,000 birds in the immediate study area. Projecting these figures suggests a Norwegian wintering total of several hundred thousand birds.

Dunlin *Calidris alpina*

Using the January index as a measure, Dunlin increased in 1990-91 by 18% compared to the 1989-90 winter. An increase was also recorded in all other winter months. Previous winters with cold spells have not resulted in increases in the Dunlin wintering population. In 1990-91 the timing of the peak winter counts at major sites was similar to the previous year, further indicating that the cold weather was not the cause of the increase in numbers. All internationally important sites, plus nationally important ones averaging over 10,000 birds, are given in Table 48. Some major sites did, in fact, record a lower than average peak in the 1990-91 winter. Interestingly, five of these seven sites were between Lindisfarne and the Swale in E Britain, together with Strangford Lough in N Ireland and Langstone Harbour on the south coast.

The count of 76,602 Dunlin at Morecambe Bay in January 1991 is the highest-ever winter count at any BoEE site. Probably associated with this, both the Mersey and the Dee (Eng/Wales) also showed major increases in numbers on recent winters.

Two recent surveys by Meltofte (1991) and Onnen (1991) have confirmed that our wintering Dunlin are of the *alpina* race. They migrate to the Wadden Sea during March, fatten up there and leave for their N Europe breeding grounds in mid-May. After breeding the adults migrate through S Scandinavia in July/early August, heading directly to the Wadden Sea and the Wash, where they moult. After moult, most birds move on during October and November to their wintering grounds in the British Isles. Juveniles migrate more slowly across to the Wadden Sea and the British Isles during September to November. In the central Taimyr, Kania (1990) found that all 14 incubating birds he examined were undergoing primary moult. This suggests that the *alpina* Dunlins from this region do not move to the Wash or Wadden Sea to moult. It also supports Meltofte's assertion that birds from the eastern end of the *alpina* range moult earlier than those from the west.

Using data from Dunlin ringed on the Wash in autumn, Branson (1991) calculated that adult birds from this group had a life expectancy of around 3 years. Juveniles had a significantly lower expectancy, averaging between 0.8 and 1.5 years.

Table 48. DUNLIN: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Morecambe Bay	(36,404)	40,409	42,987	54,838	76,602	(Jan)	53,700
Wash	37,257	46,239	65,679	56,510	43,233	(Jan)	49,783
Severn	(25,410)	44,580	44,311	(44,170)	58,705	(Feb)	49,198
Langstone Hbr.	25,800	32,900	31,700	37,660	27,720	(Jan)	31,156
Thames	(34,987)	(23,892)	19,279	25,893	29,925	(Dec)	26,778
Humber	(28,089)	(16,090)	(21,899)	(22,903)	(26,133)	(Dec)	(28,089)
Mersey	12,000	16,040	22,000	17,500	52,100	(Dec)	23,928
Medway	14,777	(19,663)	(28,569)	(21,843)	26,442	(Nov)	22,907
Chichester Hbr.	19,361	x	12,915	(28,268)	24,235	(Jan)	21,194
Dee (Eng/Wales)	12,300	19,490	16,772	14,710	24,670	(Dec)	17,588
Ribble	17,993	12,663	16,684	(14,147)	19,038	(Mar)	16,594
Blackwater	16,400	11,265	19,785	11,400	19,025	(Feb)	15,575
Stour	11,852	16,134	16,154	16,116	16,429	(Jan)	15,337
Swale	(4,520)	13,276	(13,610)	(12,055)	12,410	(Feb)	13,098
Solway	(5,498)	10,160	(12,443)	(10,240)	12,977	(Dec)	11,860
Colne	12,250	9,559	10,933	12,930	12,506	(Nov)	11,635

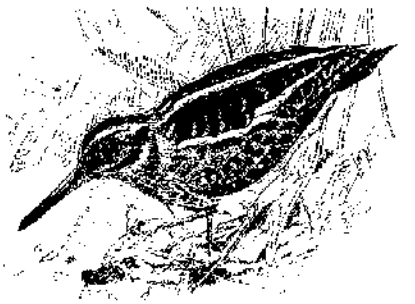
Ruff *Philomachus pugnax*

Around 1,400 Ruff are thought to winter in Britain and Ireland (Sorensen, in Lack 1986). The U.K. totals recorded by the BoEE in recent years of around 100 therefore represent only a very small fraction of the national wintering population, most of which is found at muddy margins of lakes and pools. Compared to the previous winter, Ruff were down in numbers in 1990-91 except in February 1991. It is tempting to explain the peak in February as movement to the coast in a cold spell. However, a very similar pattern occurred in the 1988-89 winter, when there were no significant cold spells. As usual all the major wintering sites in 1990-91 were in SE England. None reached the level of national importance of 50, but six sites recorded counts over 20 in the 1990-91 winter: the Alde complex peaked at 41 in February, Hamford Water reached 41 in January, the North Norfolk Marshes peaked at 34 in March, the Swale maximum was 29 in March, Southampton Water peaked at 24 in February and Chichester Harbour held 22 in November. At Pagham, formerly a site of national importance, not a single Ruff was recorded during the winter months. In 1969, when the BoEE began, Ruff only occurred there in small numbers but between 1975 and 1985 counts frequently exceeded 100, with the highest being 540 in December 1978. In recent years a steady decline has set in, culminating in the complete disappearance of wintering Ruff at Pagham Harbour.

Spring passage is usually light but autumn passage Ruff tend to be more numerous than the wintering population. Typically the major sites during autumn passage had a definite easterly bias, compared to the southerly bias in the wintering sites. Autumn 1991 counts exceeding 50 birds were made at three sites, with the site peaks being 133 at the Humber (in September), 79 on the North Norfolk Marshes (in September) and 51 on Breydon Water (in October).

It is of some concern that the numbers of Ruff recorded during spring in an area around the Po Delta in N Italy have declined drastically from around 10,000 in 1983 to around 600 in 1989 (Serra *et al.* 1990). A large proportion of these birds feed in artificial habitats and the management of these areas has recently altered, to the birds' detriment. OAG Munster (1989, 1990, 1991) have ringed over 6,000 Ruffs on a German site over a period of 16 years. The authors investigated migration strategies and concluded that the population wintering in Senegal largely migrates non-stop to west and central Europe.

Jack Snipe *Lymnocryptes minimus*



Jack Snipe is probably the most underestimated species counted by the BoEE due to its habit of sitting tight and being difficult to locate on the ground. Nevertheless it is of interest that British totals for this species were unusually high in the 1990-91 winter, with similar counts not recorded since 1985-86. Double figures were recorded at three sites in 1990-91, with 13 at Langstone Harbour in October, 12 at Morecambe Bay in October and 10 on the River Orwell in November.

Snipe *Gallinago gallinago*

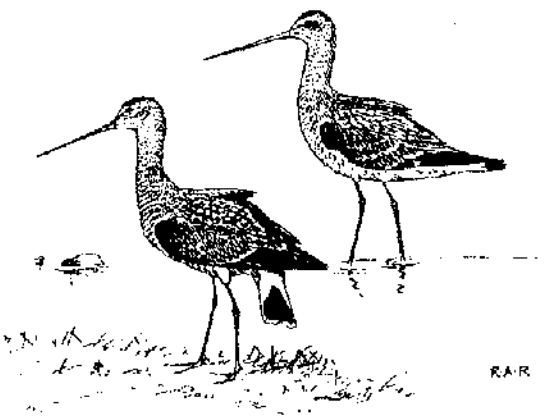
Snipe are not easy to count and BoEE totals should be considered as underestimates. U.K. totals in winter 1990-91 were rather less than the typical values of recent years. Sites recording 200 birds or more in the 1990/91 winter were Morecambe Bay (max. of 240 in November), Breydon Water (max. of 236 in January), the Thames (max. of 200 in December) and the Dee (Eng/Wales) (max. of 200 in December).

By analysing numbers of Snipe shot, Hoodless (1991) summarises the decline of the wintering population in Britain. The decline began around the turn of the century and has been most marked in E Britain, with extensive drainage of wetlands considered to be the major cause. The severe winter of 1962-63 had a drastic effect on numbers but since then the population appears to have been relatively stable.

In an intensive study of migrant Snipe in a Dutch study plot, Nijland & Timmerman Azn (1990) investigated the most accurate methods of censusing these birds. They found that the distribution of the birds, although not clumped, varied enormously across the plot, particularly in relation to the exact type of grassland present. Autumn counts were always much higher than those in the spring and, over the three years studied, the year-to-year variation was very small.

Black-tailed Godwit *Limosa limosa*

U.K. totals for Black-tailed Godwit were higher than in 1989-90 in all winter months except February. The November count was more than 1,000 above the previous record winter count, made in February 1990. The drop in numbers recorded in February 1991 coincided with the severe cold weather at that time. All internationally important sites, together with those of national importance that average over 400 birds, are presented in Table 49. Several estuaries on the west side of the British Isles, notably the Dee (Eng/Wales), Mersey and Belfast Lough actually recorded increases in numbers in February, perhaps indicating some movement from the east of Britain. As in 1989-90 the Dee held more birds than the Ribble during the winter months excepting March. As well as this change in the overall Dee population, the distribution of feeding birds within the Dee has also altered in recent years, possibly due to changes in the sand-flats and mud-flats (Morris 1990).



In 1990-91 seven sites recorded passage counts over 700: the Blackwater (peak of 1,932 in April), Hamford Water (peak of 1,584 in September), the Wash (peak of 1,486 in

September), the Ribble (peak of 1,261 in September), Dee (England/Wales) (peak of 1,221 in October), Langstone Harbour (peak of 1,185 in September), and the Stour (peak of 1,124 in October).

A coordinated low-tide count carried out in East Anglia on 3 February 1991 revealed a total there of around 2,860 birds. The standard BoEE counts for East Anglia were 3,034 and 1,819 for January and February respectively. Low water studies on the Stour, organised by the RSPB and involving local BoEE counters, revealed that the Black-tailed Godwit was the one species whose numbers and distribution changed dramatically between the winters 1988/89 and 1989/90 (Coombes 1991). This change was probably due to reclamation of a section of the Stour, previously a major feeding area.

Studies in the Netherlands were unable to provide methods of separating the two races *islandica* and *limosa* in the field (Roselaar & Gerritsen 1991). However, the two races are likely to occur together in the U.K. only during passage periods. In another Dutch project, Groen (1991) colour-dyed birds wintering in Morocco and was able to show clearly that at least part of this population migrates to the Netherlands to breed. A similar link has just been demonstrated involving British birds. The first foreign recovery of a British-bred Black-tailed Godwit (from the Ouse Washes) occurred recently, when one was shot in Guinea-Bissau (W Africa) in November.

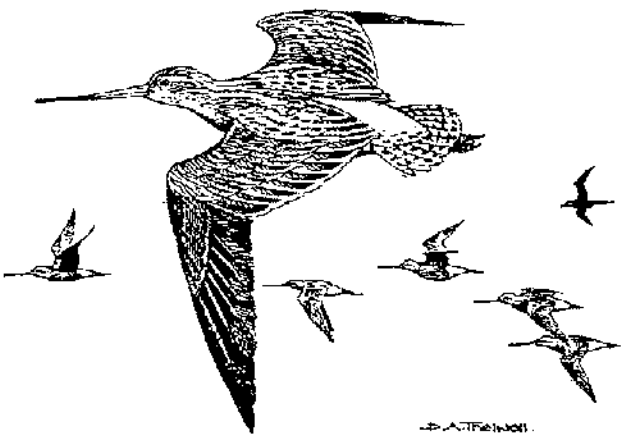
Table 49. BLACK-TAILED GODWIT: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Hamford Water	1,477	(250)	1,010	(70)	2,241	(Nov)	1,576
Stour	906	1,067	1,080	(1,734)	2,372	(Nov)	1,431
Ribble	560	1,497	2,490	491	977	(Mar)	1,203
Poole Hbr.	569	874	1,099	1,451	1,236	(Mar)	1,045
Dee (Eng/Wales)	773	400	552	1,600	1,233	(Nov)	911
Langstone Hbr.	1,019	869	761	599	651	(Nov)	779
Colne	(445)	500	1,400	616	378	(Dec)	723
Chichester Hbr.	521	x	1,125	(750)	367	(Mar)	690
Exe	582	520	542	648	782	(Jan)	614
Blackwater	273	(269)	392	(1,037)	743	(Mar)	611
Southampton Water	306	(750)	427	(997)	311	(Jan)	558

Bar-tailed Godwit *Limosa lapponica*

U.K. totals for Bar-tailed Godwit in 1990-91 were up 17% compared to the previous winter as measured by the January index. The February 1991 total, however, was 70% higher than the corresponding figure from the previous winter. This peak in numbers coincided with a spell of very cold weather, which has been found to trigger an influx of birds, particularly from the Wadden Sea. Surprisingly, however, only seven of the fourteen internationally important sites showed a peak winter count in 1990-91 that exceeded the average of the past five years. All sites of international and national importance are given in Table 50.

There was a clear difference between east coast and west coast Britain in 1990-91. Of those 12 sites showing a higher count than average only the Dee (Eng/Wales), Morecambe Bay and Lough Foyle (N Ireland) were from the west side of the British Isles. The December count of 2,480 on the Dee is the highest there since the 1981-82 winter, but this peak was extremely short-lived with the BoEE counts for November and January being merely 53 and 1 respectively. Movement between the Dee and other north-west estuaries, especially the Alt, is well-known. In the same month that the Dee peaked at 2,480 birds the population at the Ribble declined by over 2,000 on the previous month. The Dee was atypical, however, with the other major estuaries of NW Britain peaking, albeit less spectacularly, at the same time as those on the east coast i.e. in February, during the very cold spell.



The previous spell of severe winter weather in Britain occurred in January 1987. Then the list of the top nine sites comprised the same ones as in 1990-91, although the top four now average more birds than then, whilst the other five now hold fewer. The effect of the cold weather also appears to have been different in 1986-87. Unlike in 1990-91, both west and east Britain appear to have received large influxes of birds from the continent around January 1987.

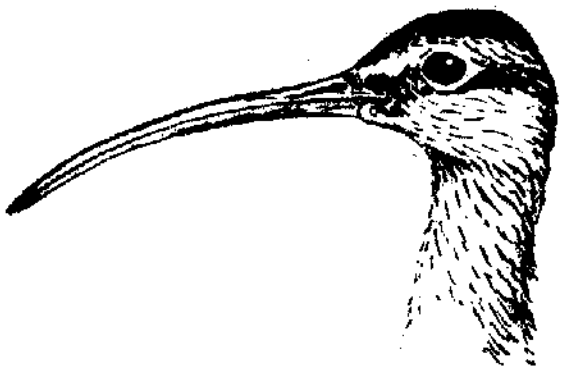
In an Australian estuary migrant Bar-tailed Godwits were found to be distributed in an apparently puzzling manner. Thompson (1990) found that the highest density of feeding birds was close to a sewage outfall. Surprisingly this area was little used by adults, which normally dominate the most favourable feeding areas. Food levels there were apparently high, but the lack of adults was explained by this food being of low quality and being difficult to collect, due to the unfavourable muddy nature of the substrate.

Table 50. BAR-TAILED GODWIT: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Wash	12,809	10,691	8,403	12,622	14,834	(Feb)	11,871
Ribble	10,836	16,756	7,898	13,350	9,940	(Feb)	11,756
Alt	11,310	9,001	7,902	5,391	7,095	(Feb)	8,139
Lindisfarne	8,900	7,000	6,010	6,200	4,900	(Nov)	6,602
Thames	(5,066)	2,076	3,304	(3,804)	(11,517)	(Feb)	5,153
Solway	(5,761)	(2,310)	7,315	(1,874)	3,650	(Feb)	4,759
Forth	(2,663)	(3,621)	3,372	1,510	2,722	(Feb)	2,777
Lough Foyle	3,210	651	2,520	(2,222)	3,427	(Feb)	2,452
Morecambe Bay	2,877	3,570	1,844	858	2,568	(Feb)	2,343
Inner Moray Firth	3,418	2,308	1,465	1,487	1,987	(Feb)	2,133
Tay	1,615	1,200	1,835	(1,000)	1,696	(Feb)	1,586
Humber	(1,681)	659	(1,054)	(1,270)	(2,002)	(Jan)	1,333
Chichester Hbr.	985	x	890	(1,448)	1,056	(Feb)	1,094
N Norfolk Marshes	(782)	463	423	(1,599)	1,653	(Feb)	1,034
Eden	1,800	900	892	700	680	(Jan)	944
Cromarty Firth	319	582	907	801	1,309	(Dec)	783
Dee (Eng/Wales)	146	452	152	396	2,480	(Dec)	725
Dengie	250	756	386	800	1,000	(Jan)	638
Langstone Hbr.	544	834	383	548	844	(Jan)	630
Dornoch Firth	187	257	633	546	1,515	(Feb)	627

Whimbrel *Numenius phaeopus*

As in most years only a very small number of sites recorded even the odd bird during the winter months. Passage populations are much larger, particularly in autumn in recent years. Counts of over 50 birds were made at nine different sites in 1990-91, with only three being in the April-June period. 100 or more birds were recorded at the Wash (max. of 252 in July), the Exe (max. of 138 in April), the Tamar complex (max. of 135 in July), the Burry (max. of 122 in May) and Rosehearty-Fraserburgh* (max. of 101 in August).



Curlew *Numenius arquata*

Of the ten wader species covered by the January index, the Curlew showed the biggest decline on the previous winter, dropping by 24% in January 1991. The last time Curlew declined to such an extent was in January 1984, also a period of severe winter weather. The following three winters also contained major cold spells and the index for Curlew remained at a low level for four years. Total numbers in the U.K. in the 1990-91 winter, however, were not as low as suggested by the index, which was somewhat distorted by the short-lived peak count of over 70,000 birds

in January 1990. There was surprisingly no large decline in the U.K. totals when the cold spell arrived in January/February 1991. Nationally important sites averaging over 1,750 birds, together with all internationally important ones, are shown in Table 51.

In an intertidal area in NW Spain, Dominguez (1990) studied the foraging habits of Curlew and found that more time was spent foraging in winter than on passage. Feeding activity in winter was found to be greatest on rising and falling tides. He also found, perhaps surprisingly, that foraging intensity actually increased as the birds became more crowded.

Table 51. CURLEW: MAXIMA AT MAIN RESORTS

	1986/78	87/88	88/89	89/90	90/91	(Mth)	Average
Morecambe Bay	(9,897)	12,888	9,849	10,219	13,174	(Mar)	11,527
Solway	(4,455)	(8,248)	(3,757)	(4,573)	5,171	(Mar)	6,709
Humber	(2,370)	4,107	(2,704)	(1,483)	(2,320)	(Mar)	4,107
Thames	(4,864)	(3,698)	3,492	(3,345)	(3,301)	(Mar)	4,018
Wash	2,265	4,814	3,796	3,295	3,578	(Feb)	3,549
Severn	(3,416)	4,576	2,706	(2,736)	2,505	(Feb)	3,300
Dee (Eng/Wales)	3,510	3,840	2,474	2,910	2,892	(Mar)	3,125
Lough Foyle	1,670	2,370	3,000	(1,351)	1,925	(Jan)	2,241
Forth	(2,161)	(2,709)	(1,306)	1,676	2,137	(Nov)	2,170
Duddon	2,131	1,761	2,163	2,300	1,992	(Mar)	2,069
Swale	(1,591)	1,970	(688)	(1,132)	(1,013)	(Dec)	1,970
Medway	(710)	(1,545)	(1,796)	(1,981)	1,868	(Jan)	1,924
Cleddau	1,903	1,722	1,839	2,151	1,541	(Jan)	1,831
Strangford Lough	1,657	1,710	2,056	1,483	2,096	(Jan)	1,800
Inner Moray Firth	1,681	1,654	1,355	1,929	2,293	(Feb)	1,782
Wigtown Bay	1,262	1,274	2,160	2,456	1,683	(Mar)	1,767

Spotted Redshank *Tringa erythropus*

U.K. totals for Spotted Redshank in winter 1990-91 were at similar levels to the previous winter. Five sites recorded winter counts in double figures, namely the Wash (peak of 31 in November), the Tamar complex (peak of 19 in December), the Medway (peak of 19 in November), the Dee (Eng/Wales) (peak of 14 in December) and the Fal complex (peak of 10 in November). In the mid 1970s nationwide totals were not very different to those of 1990-91 but the three sites then recorded as regularly holding more than 10 birds were Poole Harbour, the Beaulieu River and the Fal (Prater 1981).

Counts during passage periods exceed those made during the winter. In 1990-91, however, only the Wash recorded over 50 birds. Here 192 were present in August, with 104 in September and 67 in July.

Redshank *Tringa totanus*

The January 1991 index was 21% down on that of the previous year. In fact the U.K. totals were low in all three months during or after the cold spell which began mid-January. Similar declines in the U.K. population have occurred during very cold spells in previous winters. In February 1991 large numbers of dead waders were found at east coast estuaries, including 1,500 Redshank on the Wash. Other species e.g. Grey Plover and Dunlin were also found but the predominant one was Redshank, a species which seems unwilling to move away from adverse weather conditions.

The U.K. now contains 21 sites of international importance to wintering Redshank (Table 52), two less than last winter's figure. Table 52 shows all internationally important sites, plus those of national importance that average in excess of 1,000 birds. Of the internationally important sites, all the top six recorded reduced peak counts in 1990-91 compared to the recent average.

A large proportion of the U.K.'s wintering population of Redshank are of the race *robusta*, which breeds in Iceland. Summers & Underhill (1991) visited Iceland and demonstrated that Bergman's Rule applies to females nesting there. Bergman's Rule predicts that larger individuals can withstand colder conditions than small ones. Salmonsen (1954) had already shown that smaller Redshank winter further south than larger individuals but this current work upholds Bergman's Rule on the breeding grounds, as larger females were found to nest earlier than smaller birds.

Table 52. REDSHANK: MAXIMA AT MAIN RESORTS

	1986/87	87/88	88/89	89/90	90/91	(Mth)	Average
Dee (Eng/Wales)	9,220	9,930	8,035	7,692	7,330	(Jan)	8,441
Morecambe Bay	(5,806)	6,575	7,151	(5,635)	6,379	(Nov)	6,717
Humber	(3,145)	(4,295)	(2,671)	(5,208)	(4,776)	(Nov)	(5,208)
Thames	(3,872)	3,563	3,280	6,040	(4,569)	(Nov)	4,921
Wash	3,346	7,501	4,619	3,497	(3,872)	(Nov)	4,740
Medway	(2,926)	(3,557)	(5,087)	(4,664)	3,450	(Jan)	4,189
Forth	(3,067)	(4,952)	3,464	3,563	4,393	(Nov)	4,093
Mersey	3,300	4,100	2,930	4,458	4,335	(Dec)	3,824
Lindisfarne	3,500	3,800	3,100	3,600	2,600	(Jan)	3,320
Swale	(910)	2,492	(3,714)	(1,552)	(1,472)	(Dec)	3,103
Inner Moray Firth	2,032	2,635	2,962	3,664	2,827	(Jan)	2,824
Strangford Lough	2,645	3,079	2,809	2,771	2,420	(Nov)	2,744
Severn	(1,908)	3,286	2,627	(1,614)	2,166	(Dec)	2,693
Inner Clyde	2,423	2,798	2,243	1,546	2,441	(Feb)	2,290
Montrose Basin	1,900	1,785	1,983	2,530	2,717	(Jan)	2,183
Solway	(964)	2,075	(1,851)	(1,966)	2,049	(Feb)	2,062
Deben	1,779	1,760	1,903	1,657	(1,191)	(Nov)	1,774
Cromarty Firth	1,557	1,817	1,829	1,168	2,304	(Dec)	1,735
Chichester Hbr.	1,522	x	1,770	(1,595)	1,718	(Dec)	1,670
Belfast Lough	1,341	1,999	1,646	2,153	1,043	(Nov)	1,636
Tay	1,055	2,506	1,051	2,339	711	(Jan)	1,532
Duddon	1,463	1,829	1,878	1,219	1,043	(Mar)	1,486
Ribble	1,211	1,863	1,449	1,151	1,717	(Mar)	1,478
Cleddau	1,508	1,148	1,603	1,629	1,326	(Dec)	1,442
Orwell	1,170	1,600	1,373	1,243	1,574	(Nov)	1,392
Colne	1,292	1,280	1,247	1,288	1,152	(Feb)	1,251
Hamford Water	1,120	(1,650)	946	(120)	1,245	(Dec)	1,240
Alde complex	550	1,046	1,128	(1,458)	1,784	(Jan)	1,193
Stour	936	1,158	905	1,185	1,478	(Jan)	1,132
Tees	716	1,347	1,319	888	1,264	(Nov)	1,106
Burry	650	1,299	(1,276)	1,001	1,089	(Feb)	1,063
Poole	730	648	1,997	858	1,012	(Jan)	1,049

Greenshank *Tringa nebularia*

In 1990-91 U.K. winter totals of Greenshank were slightly up on the previous year, but the peak was still below 300 birds. As usual, the sites recording counts of 20 or more birds were all from N Ireland or the west of Britain: Strangford Lough (peak of 36 in January), Loch Foyle (peak of 30 in January), the Tamar complex (peak of 26 in November), Lavan Sands (peak of 23 in March), Kingsbridge (Devon) (peak of 22 in November) and the Dee (Eng/Wales) (peak of 22 in March).

Much larger numbers pass through during autumn passage, with eleven sites recording more than fifty birds in autumn 1990. Typically these autumn sites,unlike the wintering areas, included several away from the west of Britain: the Wash (max. of 252 in July), Chichester Harbour (max. of 150 in September), the Blackwater (max. of 123 in September), the Thames (max. of 97 in September), Strangford Lough (max. of 66 in September), the Medway (max. of 80 in July), Morecambe Bay (max. of 72 in August), the Tamar complex (max. of 67 in September), the Dee(Eng/Wales) (max. of 66 in August), the Stour (max. of 62 in September) and Langstone Harbour (max. of 62 in August).

Much of the U.K. wintering population is believed to breed in Scotland (Hutchinson, in Lack 1986). A long-term study of breeding Greenshank in NW Scotland by Thompson & Thompson (1991) is therefore relevant to the BoEE. Between 1964 and 1989 their study plot of 15km^2 contained between 4 and 13 breeding pairs. A steady decline has occurred over the past 10 years with habitat change quoted as the most likely cause.

Green Sandpiper *Tringa ochropus*

Green Sandpipers are almost completely absent in Northern Ireland in winter, which is surprising since they seem to require a relatively mild climate as occurs in southern England (Smith, in Lack 1986). Five sites, all in S England held five or more Green Sandpipers in the 1990-91 winter. The Tamar complex held up to six (in December), with peak counts of five at each of the following sites: the Severn, Rye Harbour/Pett Levels, the Thames and the Orwell. This essentially inland wader species is also scarce during spring, but in autumn far larger numbers are present. In the autumn of 1990 only the Thames recorded over 20 birds, with a peak there of 28 in August.

Common Sandpiper *Actitis hypoleucos*

U.K. totals of Common Sandpiper dropped to only 8 birds in February 1991, possibly as a result of the severe winter weather at the time. The five sites holding more than two birds in the winter months reflect the strong southerly distribution of this species in winter. The Tamar complex (max. of 8 in December), the Thames (max. of 5 in November), the Cleddau (max. of 5 in December), Taw/Torridge (max. of 3 in December) and Southampton Water (max. of 3 in December and January) are all regular wintering sites for this species. Slightly larger numbers occur in spring but the highest counts are made in autumn. In autumn 1990 Morecambe Bay (91 in July) and the Wash (57 in August) were the only sites recording over 50 birds.

Turnstone *Arenaria interpres*

As measured by the January index, the Turnstone total in the U.K. declined by 11% in 1990/91 compared to the previous winter. Typically the U.K. count totals varied little across the winter months in 1990-91. Most major sites showed little change in numbers compared to recent averages although both Guernsey* and Jersey* recorded peak counts well up on the average for the past five winters. Seventeen sites are now of national, or international, importance; those with winter peaks averaging over 600 are shown in Table 53.

Autumn counts over 700 were recorded at nine sites. Peaks at these major sites were 1,554 at Morecambe Bay in October, 1,508 at Outer Ards* in October, 1,292 at the Wash in October, 906 on the Dee (Eng/Wales) in September, 873 at Guernsey* in October, 815 on the Humber in September, 803 on the Duddon in September, 794 on the Medway in October and 779 at Thanet* in September. As in recent years, there were fewer large counts in spring but, as in 1989/90, the highest BoEE count all year was made in April. 2,580 Turnstone on Morecambe Bay in April is one of the highest BoEE counts ever made for this species, but was the only spring count over 700 in 1991.

Knot, Sanderling and Turnstone migrating through W Iceland in spring were studied by Gudmundsson *et al.* (1991) and they suggested that these waders regularly deposit more fat than is necessary to complete the next stage of their migration. The excess fat may be an insurance against meeting adverse conditions whilst on migration. The authors also believed that the birds so not use all suitable stopping places along the migration routes, passing over possible staging posts.

Table 53. TURNSTONE: MAXIMA AT MAIN RESORTS

	1986/78	87/88	88/89	89/90	90/91	(Mth)	Average
Morecambe Bay	2,269	2,189	1,647	1,651	1,944	(Jan)	1,940
Outer Ards*	1,803	1,990	1,775	2,336	1,612	(Jan)	1,903
Forth	(959)	1,642	1,184	(869)	(1,188)	(Mar)	1,413
Thanet*	1,010	1,674	1,284	1,144	1,253	(Jan)	1,273
Wash	754	1,995	1,282	967	(1,131)	(Nov)	1,249
Dee (Eng/Wales)	721	909	960	1,185	853	(Jan)	925
Thames	(868)	(640)	681	(595)	766	(Dec)	778
Guernsey*	582	752	602	(664)	936	(Mar)	718
Belfast Lough	929	322	575	778	877	(Feb)	696
Medway	(721)	(558)	(524)	(895)	489	(Nov)	637
Rosehearty-Fras.*	593	x	435	698	727	(Mar)	613
Solway	(209)	759	(507)	(335)	449	(Mar)	604

PRINCIPAL SITES

All estuarine sites in the United Kingdom covered by BoEE counts are listed in Table 54, ranked in order of their average peak winter counts over the five-year period 1986-87 to 1990-91. Included with them are non-estuarine sites ranking as of at least national importance in terms of the total numbers of waders they support. Information on peak counts in winter 1990-91 at all these sites is also presented.

For each of the included five winters, the peak count for each site was first calculated by listing the highest count for each species between November and March, irrespective of the month in which it was made, and then totalling these counts. The results for the 1990-91 winter are shown in the first column. The numbers in brackets following these indicate the numbers of complete and incomplete counts (before and after the slash respectively) available for each included site in winter 1990-91. Where no complete counts were performed, the peak count is itself placed in brackets to indicate that it is no more than a minimum estimate.

The average peak winter count for each site was initially calculated using only the totals from winters in which at least one complete count was conducted. However, in the few cases where totals from other winters exceeded this initial average, they were then also incorporated in order to give the best possible estimate of the average peak count. In the brackets following, the numbers of winters with at least one complete count are given before the slash and the number without after it. Sites averaging at least 20,000 and 10,000 waders are definitely internationally and nationally important respectively in terms of total numbers (see also Appendix 3).

In 1990-91 most major sites registered overall wader counts exceeding recent averages, hence the high U.K. totals recorded, but two sites, the Alt and Lindisfarne, recorded relatively low wader totals. On the Alt exceptionally low numbers of Knot, typically a species of erratic occurrence on many sites, were responsible for the low total wader counts there. At Lindisfarne numbers of Dunlin, Bar-tailed Godwit, Redshank and Grey Plover were all sufficiently low to cause a significant decline in the total number of waders recorded. In marked contrast, both the Mersey and Hamford Water registered overall wader counts more than double the average of previous years. On the Mersey peak counts of Dunlin and of Grey Plover exceeded the average of recent winters by factors of three and ten respectively. These two species also showed increases in their U.K. totals, albeit to a much lesser extent. At Hamford Water most species registered much higher counts than in recent winters, almost certainly because of improved coverage at this site of difficult access. Unusually high overall wader counts were also registered at six further sites, all on the east coast of Britain. At the Wash, the Humber, North Norfolk Marshes and Montrose Basin the increase was largely due to high counts of Knot. At the two Essex sites, Dengie and the Blackwater, high counts of Dunlin boosted the overall wader totals.

Table 54. OVERALL WADER COUNTS AT BOEE SITES IN WINTER

Site No.+	Site	Peak winter count 1990/91	Average peak winter count 1986/87 to 1990/91
54	Wash	279,882 (3/2)	228,703 (5/0)
87	Morecambe Bay	204,906 (5/0)	174,824 (5/0)
88	Ribble	121,864 (5/0)	122,016 (5/0)
55	Humber	(127,082) (0/5)	103,636 (1/4)
40	Thames	108,521 (1/4)	94,890 (5/0)
91	Dee (Eng/Wales)	100,837 (5/0)	92,132 (5/0)
84	Solway	87,447 (4/1)	79,061 (3/2)
112	Severn	74,131 (4/1)	63,051 (3/2)
89	Alt	46,944 (5/0)	59,525 (5/0)
62	Forth	48,095 (4/1)	41,539 (4/1)
115	Strangford Lough	36,830 (5/0)	41,316 (5/0)
31	Langstone Harbour	36,744 (5/0)	40,965 (5/0)
39	Medway	45,378 (5/0)	39,216 (2/3)
90	Mersey	75,576 (5/0)	36,024 (5/0)
32	Chichester Harbour	38,621 (5/0)	35,902 (3/1)
110	Burry	36,798 (5/0)	35,806 (5/0)
38	Swale	29,760 (2/3)	32,615 (2/3)
59	Lindisfarne	21,979 (4/0)	28,081 (5/0)
46	Stour	30,331 (5/0)	27,063 (5/0)
43	Blackwater	37,140 (5/0)	26,851 (5/0)
86	Duddon	27,764 (5/0)	25,963 (5/0)
44	Colne	21,131 (5/0)	22,886 (5/0)
53	N Norfolk Marshes	34,768 (5/0)	21,949 (5/0)
70/71	Inner Moray Firth	25,476 (3/0)	21,359 (5/0)
42	Dengie	28,714 (5/0)	20,746 (5/0)
56	Tees	18,992 (5/0)	16,351 (5/0)
*	Outer Ards	13,751 (5/0)	16,063 (5/0)
16	Exe	18,981 (5/0)	15,702 (5/0)
47	Orwell	16,297 (5/0)	15,054 (5/0)
119	Lough Foyle	16,378 (3/2)	13,550 (5/0)
116	Belfast Lough	12,994 (5/0)	13,311 (5/0)
65	Montrose Basin	17,503 (4/1)	13,128 (5/0)
75	Inner Clyde	11,471 (3/2)	12,714 (5/0)
49/50	Alde complex	12,242 (5/0)	11,893 (5/0)
41	Crouch/Roach	11,721 (5/0)	11,799 (1/4)
45	Hamford Water	19,153 (5/0)	11,472 (2/3)
94	Lavan Sands	12,733 (2/2)	11,435 (3/2)
64	Tay	10,417 (3/2)	11,274 (5/0)
20	Poole Harbour	14,373 (5/0)	11,006 (5/0)
24	Southampton Water	11,835 (5/0)	10,608 (5/0)
30	Portsmouth Harbour	10,834 (5/0)	10,387 (5/0)
108	Cleddau	10,212 (4/0)	10,205 (5/0)
72	Cromarty Firth	12,342 (3/0)	10,150 (5/0)
48	Deben	9,285 (3/2)	9,798 (5/0)
1	Taw/Torridge	8,420 (5/0)	9,646 (5/0)
63	Eden	11,530 (5/0)	9,519 (5/0)
8	Tamar complex	8,971 (5/0)	8,983 (5/0)
52	Breydon Water	18,940 (5/0)	8,505 (5/0)
109	Carmarthen Bay	12,149 (3/2)	8,308 (4/0)
73	Dornoch Firth	10,314 (3/0)	7,726 (5/0)
79	Wigtown Bay	8,128 (5/0)	7,407 (5/0)

Continued/

Site No.+	Site	Peak winter count 1990/91	Average peak winter count 1986/87 to 1990/91
33	Pagham Harbour	4,785 (4/0)	7,266 (5/0)
114	Dundrum Bay	5,366 (4/0)	6,789 (5/0)
111	Swansea Bay	6,413 (5/0)	6,179 (4/1)
36	Rye Hbr/Pett Levels	6,868 (5/0)	6,139 (5/0)
22	NW Solent	6,877 (5/0)	6,082 (4/1)
2	Camel	6,766 (5/0)	5,534 (5/0)
74	Loch Fleet	4,035 (3/0)	4,976 (5/0)
113	Carlingford Lough	4,251 (3/0)	4,582 (5/0)
61	Tyninghame	4,785 (5/0)	4,567 (5/0)
76	Irvine	5,497 (4/1)	4,538 (5/0)
68	Ythan	2,660 (1/0)	4,364 (5/0)
37	Pegwell Bay	4,082 (4/1)	4,252 (5/0)
97	Inland Sea	4,129 (5/0)	4,189 (5/0)
23	Beaulieu	3,618 (5/0)	3,892 (5/0)
51	Blyth (Suffolk)	5,869 (5/0)	3,731 (5/0)
5	Fal complex	3,034 (5/0)	3,570 (4/1)
93	Conwy	2,378 (4/0)	3,387 (4/0)
118	Bann	3,801 (5/0)	3,090 (5/0)
105	Dyfi	2,883 (5/0)	3,063 (5/0)
26	Newtown	3,680 (5/0)	3,053 (5/0)
117	Lough Larne	3,702 (5/0)	2,997 (5/0)
82	Auchencairn Bay	2,028 (2/0)	2,984 (5/0)
4	Hayle	3,014 (5/0)	2,791 (5/0)
92	Clwyd	2,105 (5/0)	2,516 (5/0)
85	Irt/Mite/Esk	2,778 (3/1)	2,391 (5/0)
34	Adur	2,271 (5/0)	2,387 (5/0)
77	Loch Ryan	2,460 (5/0)	2,223 (5/0)
13	Kingsbridge	1,892 (2/3)	1,941 (5/0)
95	Red Wharf Bay	2,289 (5/0)	1,872 (5/0)
98	Cefni	1,982 (5/0)	1,831 (5/0)
101	Traeth Bach	2,851 (5/0)	1,828 (5/0)
100	Foryd Bay	1,844 (5/0)	1,651 (5/0)
21	Christchurch Harbour	3,139 (4/1)	1,628 (5/0)
78	Luce Bay	1,831 (4/0)	1,348 (3/0)
35	Newhaven	1,064 (5/0)	1,325 (5/0)
99	Braint	1,322 (5/0)	1,315 (5/0)
19	The Fleet/Wey	899 (5/0)	1,235 (4/1)
29	Brading Harbour	1,044 (5/0)	1,073 (5/0)
60	Tweed	1,063 (4/0)	890 (5/0)
57	Blyth(Northumberland)	1,284 (4/0)	888 (5/0)
58	Coquet	1,438 (3/2)	845 (5/0)
27	Medina	711 (5/0)	816 (5/0)
9	Plym	884 (5/0)	786 (5/0)
81	Kirkcudbright Bay	722 (5/0)	766 (3/1)
103	Mawddach	768 (5/0)	753 (5/0)
104	Dysynni	599 (5/0)	677 (5/0)
3	Gannel	590 (2/0)	602 (5/0)
18	Axe	214 (4/0)	594 (2/0)
83	Rough Firth	(591) (0/4)	(591) (0/1)
66	Dee (Scotland)	639 (5/0)	588 (5/0)
106	Teifi	77 (2/0)	393 (5/0)
96	Dulas Bay	(239) (0/1)	360 (1/0)
25	Yar	353 (5/0)	349 (5/0)
12	Avon	260 (5/0)	324 (5/0)

Continued/

Site No.+	Site	Peak winter count 1990/91	Average peak winter count 1986/87 to 1990/91
15	Teign	210 (4/0)	323 (5/0)
107	Nyfer	145 (5/0)	298 (5/0)
28	Wootton	460 (5/0)	292 (3/0)
102	Artro	224 (5/0)	275 (5/0)
67	Don	136 (5/0)	213 (5/0)
17	Otter	122 (5/0)	196 (5/0)
7	Looe	90 (2/0)	176 (5/0)
6	Fowey	82 (1/0)	145 (4/0)
10	Yealm	145 (5/0)	137 (5/0)
11	Erme	113 (5/0)	118 (5/0)
14	Dart	47 (3/0)	101 (4/0)
80	Fleet Bay	129 (1/1)	60 (3/0)
69	Spey	26 (1/1)	26 (1/0)

+ see Figure 2
* non-estuarine site

The following non-estuarine sites were also counted at least once in 1990/91:

Aln, Alnmouth-Boulmer, Amble-Chevington, Applecross Bay, Ardrossan-Seamill, Arran (Brodick, Cordon, Kildonan, Kingscross, Machrie-Waterfoot), Arun-Middleton, Ayr-Prestwick, Beadnell-Howick, Blyth-Seaton Sluice, Boulmer-Howick, Budle Pt.-Seahouses, Burghead, Carnoustie-Easthaven, Clwyd coast, Colonsay, Cresswell-Chevington, Cuckmere, Isle of Cumbrae, Deveron, Doon, Eye, Glyne Gap-Galley Hill, Goring/Ferring/Kingston, Loch Gruinart, Guernsey, Helford, Holy Loch, Hunterston, Loch Indaal, Jackson's Bay, Jersey, Killough, Loch Gilp, Lossiemouth, Newbiggin-Blyth, Newbiggin-Cresswell, Norman's Bay, Orkney (Newark, Widewall), Rosehearty-Fraserburgh, Saltwick Bay, Seahouses-Beadnell, Spey coast, St.Mary's Island, Thanet, Troon-Barassie, Turnberry-Dipple, Tyrella/Minerstown.

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Appendix 1. INTERNATIONAL AND NATIONAL IMPORTANCE

Criteria for International Importance have been agreed by the Contracting Parties to the Ramsar Convention on Wetlands of International Importance (Ramsar Convention Bureau 1988). Under one criterion, a wetland is considered Internationally Important if it regularly holds 1% of the individuals in a population of one species or subspecies of waterfowl, while any site regularly holding a total of 20,000 waterfowl also qualifies. Britain and Ireland's wildfowl belong to the north-west European population (Pirot *et al.* 1989), and the waders to the east Atlantic flyway population (Smit & Piersma 1989). A wetland in Britain is considered Nationally Important if it regularly holds 1% of the estimated British population of one species or subspecies of waterfowl. Table 55 gives the current qualifying levels among wildfowl and waders for both these categories of importance. NB: The category of National Importance applies to Great Britain only; equivalent criteria and figures have not yet been produced for Ireland.

A total of 64 countries are now Contracting Parties to the Ramsar Convention. They have listed a total of 542 sites covering 32,312,309 ha. Five new Ramsar sites have been designated in the United Kingdom since the publication of last year's booklet. Three are in England: Redgrave and South Lopham Fens (Norfolk/Suffolk), Rutland Water (Leicestershire), Esthwaite Water (Cumbria); and two are in Wales: Llyn Idwal and Llyn Tegid (Gwynedd). Two Special Protection Areas (SPAs) were designated in 1991, one of which was an extension of the Skomer Island SPA and the other Rutland Water. A total of 50 Ramsar sites and 41 SPA's have now been designated by the UK.

(R) = Ramsar site only; (S) = SPA only; the remainder have dual designation.

Abberton Reservoir (R)
Abernethy Forest (S)
Ailsa Craig (S)
Alt Estuary
Bridgend Flats
Bridgwater Bay (R)
Bure Marshes (R)
Cairngorm Lochs (R)
Chesil Beach/Fleet
Chew Valley Lake (S)
Chichester/Langstone Harbours
Claish Moss (R)
Coquet Island (S)
Cors Fochno/Dyfi (R)
Dee Estuary
Derwent Ings
Eilean na Muice Duibhe (Duich Moss)
Esthwaite Water (R)
Fala Flow
Farne Islands (S)
Feur Lochain
Forth Islands (S)
Glac-na-Criche
Gladhouse Reservoir
Grassholm (S)
Gruinart Flats
Handa Island (S)
Hickling Broad/Horsey Mere (R)
Holburn Lake and Moss
Hoselaw Loch
Irtinghead Mires (R)
Laggan Peninsula (S)
Leighton Moss
Lindisfarne (R)
Llyn Idwal (R)
Llyn Tegid (R)
Loch-an-Duin (R)
Lochs Druidibeg/a'Machair/Stillgary
Loch Eye
Loch Leven (R)
Loch of Lintrathen (R)
Loch Lomond (R)
Loch of Skene
Loughs Neagh/Beg (R)
Martin Mere
Minsmere/Walberswick (R)
Moor House (S)
North Norfolk Coast
Orfordness/Havergate (S)
Ouse Washes (R)
Pagham Harbour
Priest Island (S)
Rannoch Moor (R)
Redgrave and South Lopham Fens (R)
Ribble Estuary (part) (S)
Rhum (S)
Rockcliffe Marshes
Rostherne Mere (R)
Rutland Water
Silver Flowe (R)
Skokholm and Skomer Island (S)
The Swale
The Wash
Upper Severn Estuary

Table 55. QUALIFYING LEVELS FOR NATIONAL AND INTERNATIONAL IMPORTANCE

	National (G.B.)	International
Great Crested Grebe	100	?
Mute Swan	180	1,800
Bewick's Swan	70	170
Whooper Swan	60	170
Bean Goose	*+	800
Pink-footed Goose: Iceland/Greenland	1,100	1,100
European White-fronted Goose	60	3,000
Greenland White-fronted Goose	100	220
Greylag Goose: Iceland	1,000	1,000
Barnacle Goose: Greenland	200	320
Svalbard	100	100
Dark-bellied Brent Goose	900	1,700
Light-bellied Brent: Canada/Greenland	*+	200
Svalbard	*30	40
Shelduck	750	2,500
Wigeon	2,500	7,500
Gadwall	50	120
Teal	1,000	4,000
Mallard	5,000	**50,000
Pintail	250	700
Shoveler	90	400
Pochard	500	3,500
Tufted Duck	600	7,500
Scaup	*40	1,500
Eider	700	**20,000
Long-tailed Duck	200	20,000
Common Scoter	350	8,000
Velvet Scoter	*30	2,500
Goldeneye	150	3,000
Smew	*+	150
Red-breasted Merganser	100	1,000
Goosander	50	1,250
Coot	1,000	15,000
Oystercatcher	2,800	9,000
Avocet	*5	700
Ringed Plover	230 (passage: 300)	500
Golden Plover	2,000	10,000
Grey Plover	210	1,500
Lapwing	10,000	**20,000
Knot	2,200	3,500
Sanderling	140 (passage: 300)	1,000
Purple Sandpiper	160	500
Dunlin	4,300 (passage: 2,000)	14,000
Ruff	*15	10,000
Snipe	?	10,000
Black-tailed Godwit	50	700
Bar-tailed Godwit	610	1,000
Whimbrel	+ (passage: 50)	700
Curlew	910	3,500
Spotted Redshank	*2	?
Redshank	750 (passage: 1,200)	1,500
Greenshank	*4	?
Turnstone	450	700

Notes to Table 55:

\+ British population too small for a meaningful figure to be obtained.

* Where 1% of the British wintering population is less than 50 birds, 50 is normally used as a minimum qualifying level for national importance.

** A site regularly holding more than 10,000 wildfowl or 20,000 waders qualifies as Internationally Important by virtue of absolute numbers.

Sources of qualifying levels for International Importance: for wildfowl see Pirot *et al.* (1989) and for waders see Smit & Piersma (1989); see Scott (1982) for species they do not cover.

Sources of qualifying levels for National Importance: for wildfowl see Owen *et al.* (1986), updated where necessary from NWC data, and for waders see Moser (1987); see Prater (1981) for species they do not cover.

Appendix 2. LOCATIONS OF INCLUDED NATIONAL WATERFOWL COUNT SITES

The location of all count sites or areas mentioned in the wildfowl section of this booklet are given here, they are listed in alphabetical order. Estuaries are not listed but can be located in Figure 2.

Site	10-km square	County
Aberlady Bay, Forth Estuary	NT 4581	Lothian
Abberton Reservoir	NT 4581	Lothian
Alaw Reservoir	SH 3986	Gwynedd
Amwell Gravel Pits	TL 3713	Hertfordshire
Alton Water	CT 1546	Suffolk
Attenborough Gravel Pits	SK 5234	Nottinghamshire
Aqualate Mere	SJ 7720	Staffordshire
Balgray Reservoir	NS 5157	Strathclyde
Bar Mere	SJ 5347	Cheshire
Belvide Reservoir	SJ 8610	Staffordshire
Besthorpe/Girton Gravel Pits	SK 8165	Nottinghamshire
Bewl Water	TQ 6733	East Sussex
Blagdon Lake	ST 5150	Avon
Blithfield Reservoir	SK 0524	Staffordshire
Bluemull Sound	HP 5502	Shetland
Borth/Ynylas	SN 6092	Dyfed
Breydon Water	TG 4907	Norfolk
Broad Bay	NB 4733	Western Isles
Brogborough Gravel Pit	SP 9739	Bedfordshire
Buckden/Stirtloe Gravel Pits	TL 2066	Cambridgeshire
Caban Coch Reservoir	SN 9163	Powys
Caerlaverock,Solway Estuary	NY 0460	Dumfries & Galloway
Cameron Reservoir	NO 4711	Fife
Capesthorne Hall	SJ 8472	Cheshire
Carsebreck/Rhynd Lochs	NN 8609	Tayside
Carsington Reservoir	SK 2452	Derbyshire
Castle Howard Lake	SE 7170	North Yorkshire
Castle Loch	NY 0881	Dumfries & Galloway
Castle Semple and Barr Lochs	NS 3558	Strathclyde
Cauldshiels Loch	NT 5233	Borders
Cheddar Reservoir	ST 4454	Somerset
Cheshunt Gravel Pit	TL 3602	Hertfordshire
Chew Valley Lake	ST 5659	Avon
Chichester Gravel Pit	SU 8703	West Sussex
Chichester/Langstone Harbours	SU 7700	West Sussex/Hants
Cobbinshaw Reservoir	NT 0158	Lothian
Cotswold Water Park	-	Gloucestershire/Wiltshire
Cowgill Reservoirs	NT 0327	Strathclyde
Crombie Loch	NO 5240	Tayside
Cults Reservoir	NJ 9002	Grampian
Derwent Water	NY 2520	Cumbria
Dinnet Lochs	NJ 4800	Grampian
Dinton Pastures	SU 7872	Berkshire
Dipple	NS 2002	Ayrshire
Dorchester Gravel Pits	SU 5795	Oxfordshire
Drakelow Gravel Pit	SK 2320	Derbyshire
Drummond Pond	NN 8518	Tayside
Dudgrove Gravel Pit	SU 1899	Gloucestershire
Dungeness	TR 0619	Kent
Duns Dish	NO 6460	Tayside
Dupplin Loch	NO 0320	Tayside

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Site	10-km square	County
Eccup Reservoir	SE 2941	West Yorkshire
Ellesmere Pits	SJ 4133	Salop
Endrick Mouth, Loch Lomond	NS 4388	Strathclyde
Esthwaite Water	SD 3596	Cumbria
Eversley Cross/Yately Pits	SU 8061	Hampshire
Eyebrook Reservoir	SP 8595	Leicestershire
Fairburn Ings	SE 4627	North Yorkshire
Fala Flow	NT 4258	Lothian
Farmwood Pool	NS 8073	Strathclyde
Fedderate Reservoir	NJ 8652	Grampian
Fen Drayton Gravel Pits	TL 3470	Cambridgeshire
Fleet Pond	SU 82 55	Hampshire
Gladhouse Reservoir	NT 2953	Lothian
Glenfarg Reservoir	NO 1011	Perth & Kinross
Grafham Water	TL 1568	Cambridgeshire
Gunton Park Lakes	TG 2234	Norfolk
Haddo House Lakes	NJ 8734	Grampian
Hamilton Low Parks	NS 7257	Strathclyde
Hammer Pond	TQ 2229	West Sussex
Hamford Water	TM 2225	Essex
Hanningfield Reservoir	TQ 7398	Essex
Harewood Lake	SE 3144	West Yorkshire
Hay-a-Park Gravel Pits	SE 3658	North Yorkshire
Hickling Broad	TG 4121	Norfolk
Hilfield Park Reservoir	TQ 1595	Hertfordshire
Hirsel Lake	NT 8240	Borders
Holborn Lake and Moss	NU 0536	Northumberland
Hoselaw Loch	NT 8031	Borders
Hule Moss	NT 7149	Borders
Kedleston Park	SK 3141	Derbyshire
King George V Reservoir	TQ 3796	Greater London
King George VI Reservoir	TQ 0473	Surrey
King's Bromley Gravel Pits	SK1116	Staffordshire
Kingsbury Water Park/Coton Pools	SP 2096	Warwickshire
Kinmount Ponds	NY 1468	Dumfries & Galloway
Kirby Bellars	SK 7018	Leicestershire
Lake of Menteith	NN 5700	Central
Langtoft Gravel Pits	TF 1111	Lincolnshire
Leighton/Roundhill Reservoirs	SE 1678	North Yorkshire
Leighton Moss	SD 4875	Lancashire
Lindisfarne	NU 1041	Northumberland
Lindley Wood Reservoir	SE 2149	North Yorkshire
Lismore	NM 8441	Strathclyde
Llyn Idwal	SH 6459	Gwynedd
Llyn Tegid	SH9033	Gwynedd
Llyn Penrhyn	SH 3077	Gwynedd
Llyn Traffwll	SH 3276	Gwynedd
Loch-an-Duin	NB 5536	Lewis
Lochs Druidbeg	NF 7937	South Uist
Loch Bee	NF 7743	Western Isles
Loch Calder	ND 0760	Highland
Loch Eye	TH 8379	Highland
Loch Heilen	ND 2568	Highland
Loch Indaal	NR 3060	Strathclyde
Loch Ken	NX 6870	Dumfries & Galloway
Loch Leven	NO1401	Tayside

/continued

Site	10-km square	County
Loch Macanrie	NS 5699	Central
Loch Mahaick	NN 7006	Central
Loch Spynnie	NJ 2366	Grampian
Loch of Clunie	NO1144	Tayside
Loch of Harray	HY 2915	Orkney
Loch of Kinnordy	NO 3655	Tayside
Loch of Lintrathen	NO 2754	Tayside
Loch of Mey	ND 2773	Highland
Loch of Skene	NJ 7807	Grampian
Loch of Stenness	HY 2812	Orkney
Loch of Strathbeg	NK 0758	Grampian
Loch Quien	NS 0659	Bute
Loch Ryan	NX 0565	Dumfries & Galloway
Lough Neagh & Beg, N. Ireland	-	Down/Antrim/Derry/ Tyrone/Armagh
Loch Spynie	HU 3716	Shetland
Loch Tullybelton	NO 0034	Tayside
Lour	NO 4746	Tayside
Ludham How Hill	TG 3719	Norfolk
Machrihanish	NS 6922	Strathclyde
Marlow Gravel Pits	SU 8686	Buckinghamshire
Martin Mere	SD 4105	Lancashire
Middle Yare Marshes	TG 3504	Norfolk
Minsmere	TM 4666	Suffolk
Murcar, Aberdeen	NJ 9510	Grampian
Nene Washes	TF 3300	Cambridgeshire
Ouse Washes	TL 5394	Cambridgeshire
Pitsford Reservoir	SP 7669	Northamptonshire
Portmore Loch	NT 2550	Borders
Pulborough Levels	TQ 0416	West Sussex
Queen Elizabeth II Reservoir	TQ 1167	Surrey
Queen Mary Reservoir	TQ 0769	Surrey
Queen Mother Reservoir	TQ 0076	Berkshire
Radwell Gravel Pits	TL 0157	Bedfordshire
Ranworth/Cockshoot Broads	TG 3515	Norfolk
Redmyre Loch	NO 2833	Tayside
Red Whart Bay	SH 5380	Gwynedd
Rhunahaorine	NR 7049	Strathclyde
R. Avon : Blashford-Hucklesbrook	SU 1408	Hampshire
R. Avon : Fordingbridge	SU 1617	Hampshire
R. Avon : Ringwood	SU 1408	Hampshire
R. Avon : Sopley	SZ 1498	Hampshire
R. Clyde : Lamington-Hyndford	NS 9839	Strathclyde
R. Eden : Rockcliffe/Armathwaite	NY 4758	Cumbria
R. Eden : Crosby-Carlisle	NY 4658	Cumbria
R. Soar : Leicester	SK 5805	Leicestershire
R. Teviot : Nisbet	NT 6725	Borders
R. Tweed : Kelso-Coldstream	NT 7737	Borders
R. Twyi : Dryslwyn	SN 5720	Dyfed
R. Welland : Spalding	TF 2516	Lincolnshire
Rostherne Mere	SJ 7484	Cheshire
Rutland Water	SK 9207	Leicestershire
Rye Harbour	TQ 9318	East Sussex
St. Benets Levels	TG 3815	Norfolk
Scolt Head, N. Norfolk coast	TF 8046	Norfolk
Shepperton Gravel Pits	TQ 0767	Surrey

/continued

Site	10-km square	County
Skokholm and Skomer Island	SM 7209	Dyfed
Slains Lochs/Ythan Estuary	NK 0230	Grampian
Somerset Levels	-	Somerset
Stain Hill Reservoir	TQ 1269	Surrey
Staines Reservoir	TQ 0573	Greater London
Stanford Meres	TL 8695	Norfolk
Stanford Reservoir	SP 6080	Leicestershire
Stanton Harcourt Gravel Pits	SP 4105	Oxfordshire
Stewartby Lake	TL 0042	Bedfordshire
Stranraer Lochs	NX 1161	Dumfries & Galloway
Stratfield Saye	SU 7061	Hampshire
Swithland Reservoir	SK 5513	Leicestershire
Tentsmuir	NO 5024	Fife
Towyn to Abergele	SH 9679	Clwyd
Tundry Pond	SU 7752	Hampshire
Twyford Gravel Pit	SU 7875	Berkshire
Upper Loch Erne, N. Ireland	H3 231	Fermanagh
Virginia Water	SU 9769	Berkshire
Walland Marsh	TQ 9824	Kent
Walmore Common	SO 7425	Gloucestershire
Walthamstow Reservoir	TQ 3589	Greater London
Wanlip Gravel Pits	SK 6011	Leicestershire
Water Sound	ND 4694	Orkney
Westfield Marshes	ND 0664	Highland
Westwater Reservoir	NT1252	Borders
Whittledene Reservoir Reservoir	NZ 0667	Northumberland
Whitton Loch	NT 7519	Borders
William Girling Reservoir	TQ 3694	Greater London
Willington Gravel Pits	SK 2828	Derbyshire
Windermere	SD 3995	Cumbria
Wintersett Reservoir	SE 3714	West Yorkshire
Witley Park	SU 9239	Surrey
Woolston Eyes	SJ 6588	Cheshire
Wraysbury Reservoir	TQ 0274	Surrey
Yare Valley	TG 3504	Norfolk
Yetholm Loch	NT 8129	Borders

Appendix 3. INTERNATIONALLY IMPORTANT WATERFOWL SITES IN THE UNITED KINGDOM OVER THE PERIOD 1986-87 TO 1990-91.

This summary table ranks the principal sites in terms of overall waterfowl conservation importance. All sites regularly holding a total of at least 20,000 waterfowl and/or supporting at least one species with a population level that qualifies as Internationally Important, according to average maxima calculated over the five-year period (1986-87 to 1990-91), are included and they are ranked according to their total waterfowl populations. Also shown are values for total wildfowl, total waders and the numbers of species with Internationally Important populations (IIP) at each site. As with the Principal Sites tables, there may be some sites which are of critical importance to certain waterfowl species or populations which are not included in this list. These may include, for instance, sites that do not regularly support large numbers, but become important only in times of severe weather or during migratory periods.

However, despite needing careful interpretation, this table does serve to identify some of the U.K's best wetlands and emphasises the range of species for which each site is important. The Wash produced the highest waterfowl count and supports some 12 internationally important species. Morecambe Bay comes second in terms of total numbers. It is interesting to note that out of the top 15 sites listed the majority support more than five internationally important species, reflecting the diversity of birds for which some of the top wetland sites are important. Conversely, a few sites with relatively large total populations of waterfowl may support only one or two species in internationally important numbers, e.g. Westwater Reservoir and the Slains Lochs, both with huge populations of Pink-footed Geese.

Site name	Waterfowl	Wildfowl	Waders	IIP	Species codes
Wash	280,330	51,627	228,703	12	PG,Bd,SU,PT,OC,GV,KN,DN,BA,CU,RK,TT
Morecambe Bay	201,904	27,080	174,824	11	PG,SU,PT,OC,GV,KN,DN,BA,CU,RK,TT
Ribble Est.	191,471	69,455	122,016	13	BS,WS,SU,WN,T,OC,GV,L,KN,SS,DN,BW,BA
Thames Est.	129,463	34,573	94,890	11	Bd,SU,OC,RP,GV,KN,DN,BA,CU,RK,TT
Humber Est.	122,967	19,331	103,636	10	Bd,SU,GP,GV,L,KN,DN,BA,CU,RK
Solway Est.	122,152	43,091	79,061	10	WS,PG,BY,PT,SP,OC,KN,BA,CU,RK
Dee Est. (Eng/Wales)	117,874	25,715	92,132	10	SU,T,PT,OC,GV,KN,DN,BW,RK,TT
Lo. Neagh/Beg	87,049	87,049	-	6	BS,WS,PO,TU,SP,GN
Severn Est.	85,462	22,411	63,051	6	BS,We,SU,GA,DN,RK
Forth Est.	72,244	30,705	41,539	6	PG,SU,KN,BA,RK,TT
Strangford Lo.	64,539	23,223	41,316	3	Bl,KN,RK
Mersey Est.	64,468	28,444	36,024	5	SU,T,PT,DN,RK
Alt Est.	61,220	1,695	59,525	2	KN,BA
Ouse Washes	60,954	60,954	-	7	BS,WS,WN,GA,T,PT,SV
Lindisfarne	57,746	29,665	28,081	6	GJ,Bl,WN,RP,BA,RK
Swale Est.	57,603	24,988	32,615	4	Bd,WN,GV,RK
N Norfolk Marshes	56,321	34,372	21,949	4	PG,Bd,PT,KN,BA
Medway Est.	53,925	14,709	39,216	8	Bd,SU,PT,RP,GV,KN,DN,RK
Langstone Hbr.	53,245	12,280	40,965	3	Bd,DN,BW
Chichester Hbr.	52,816	16,914	35,902	7	Bd,SU,RP,GV,DN,BA,RK
Inner Moray Firth	49,342	27,983	21,359	5	PG,GJ,RM,BA,RK
Burry Inlet	47,133	11,327	35,806	3	PT,OC,KN
Blackwater Est.	44,531	17,680	26,851	3	Bd,GV,DN
Montrose Basin	44,451	31,323	13,128	2	PG,RK
Lo. of Strathbeg	39,801	39,801	-	3	WS,PG,GJ,
Abberton Rsr.	39,261	39,261	-	3	GA,T,SV
Lough Foyle	36,817	23,267	13,550	4	WS,Bl,WN,BA
Stour Est.	36,379	9,316	27,063	3	GV,DN,BW
Poole Hbr.	35,791	24,785	11,006	2	SU,BW
Colne Est.	33,069	10,813	22,886	2	Bd,BW
Duddon Est.	30,704	4,741	25,963	2	PT,KN
Dornoch Firth	30,540	22,814	7,726	2	GJ,WN
Hamford Water	30,527	19,055	11,472	3	Bd,RP,BW
Tay Est.	26,844	15,570	11,274	2	BA,RK
Cromarty Firth	26,236	16,086	10,150	5	WS,PG,GJ,WN,RK

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Site name	Waterfowl	Wildfowl	Waders	IIP	Species codes
Dengie	24,238	3,492	20,746	2	Bd,KN
Loch Leven	24,234	24,234	-	5	WS,PG,GJ,GA,SV
Martin Mere	23,827	23,827	-	3	BS,WS,PT
Westwater Rsr.	23,436	23,436	-	1	PG
Alde Complex	22,686	10,793	11,893	0	
Exe Est.	22,518	6,816	15,702	1	Bd
Tees Est.	22,306	5,955	16,351	1	KN
Crouch/Roach Est.	21,926	10,127	11,799	1	Bd
Inner Clyde	21,463	8,749	12,714	1	RK
Rutland Water	20,975	20,975	-	2	GA,SV
Dupplin Lo.	20,954	20,954	-	1	PG
Orwell Est.	20,158	5,104	15,054	0	
Wigtown Bay	18,696	11,289	7,407	1	PG
Belfast Lo.	17,114	3,803	13,311	1	RK
Outer Ards	16,923	860	16,063	2	RP,TT
Deben Est.	15,982	6,184	9,798	1	RK
Portsmouth Hbr.	15,051	4,664	10,387	1	Bd
Carsebreck/Rhynd Lo.	14,764	14,764	-	2	PG,GJ
Dinnet Lo.	14,220	14,220	-	1	GJ
Loch of Skene	13,545	13,545	-	1	GJ
Pagham Hbr.	13,400	6,134	7,266	1	Bd
Slains Lo.	13,042	13,042	-	1	PG
Breydon Water	12,497	3,992	8,505	1	BS
Loch Eye	12,375	12,375	-	3	WS,PG,GJ
Lo. of Harray	12,298	12,298	-	1	WS
NW Solent	10,666	4,584	6,082	1	Bd
Chew Valley Lake	9,274	9,274	-	2	GA,SV
Nene Washes	8,648	8,648	-	1	BS
Lo. Spynie	8,193	8,193	-	1	GJ
Cameron Rsr.	8,021	8,021	-	1	PG
Castle Lo.	6,908	6,908	-	1	PG
Lo. of Kinnordy	6,344	6,344	-	1	PG
Upper Lo.Erne	5,848	5,848	-	1	WS
Thanet	5,788	-	5,788	1	TT
Drummond Pond	5,186	5,186	-	1	GJ
Lour	5,040	5,040	-	1	PG
Fala Flow	4,905	4,905	-	1	PG
Haddo House Lo.	4,795	4,795	-	1	GJ
R. Avon: Blashford	4,632	4,632	-	1	GA
Crombie Lo.	4,601	4,601	-	1	PG
Gladhouse Rsr.	4,254	4,254	-	1	PG
Hule Moss	4,148	4,148	-	1	PG
Lo. of Lintrathen	4,134	4,134	-	1	GJ
Fedderate Rsr.	3,743	3,743	-	1	GJ
Holborn Moss	3,243	2,243	-	1	GJ
Lo. Mahaick	3,140	3,140	-	1	PG
Lake of Menteith	3,109	3,109	-	1	PG
Hoselaw Lo.	3,056	3,056	-	1	GJ
Guernsey	3,051	-	3,051	1	TT
Lo. Ken	2,911	2,911	-	1	Wg
Kinmount Ponds	2,770	2,770	-	1	PG
R. Avon: Ringwood	2,541	2,541	-	1	BS
Lo. Tullybelton	2,506	2,506	-	1	PG
Cowgill Rsr.	2,489	2,489	-	1	PG
Endrick Mouth	2,387	2,387	-	2	PG,Wg

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Site name	Waterfowl	Wildfowl	Waders	IIP	Species codes
Cheshunt Gp.	2,060	2,060	-	1	GA
Gunton Park Lakes	1,359	1,359	-	1	GA
Machrihanish	1,214	1,214	-	1	Wg
Rhunahaorine	1,041	1,041	-	1	Wg
Stanford Meres	931	931	-	1	GA
Walland Marsh	-	-	-	1	BS
Islay	-	-	-	2	Wg,BY
Coll	-	-	-	1	Wg
Tiree	-	-	-	3	Wg,RP,TT
Tay/Isla Valley	-	-	-	1	GJ
Stranraer Lo.	-	-	-	2	Wg,GJ
Caithness Lo.	-	-	-	1	GJ
SW Lancashire	-	-	-	1	PG

Species Codes:

Bewick's Swan	BS	Scaup	SP
Whooper Swan	WS	Goldeneye	GN
Pink-footed Goose	PG	Red-breasted Merganser	RM
Eur. White-fronted Goose	We	Oystercatcher	OC
Green. White-fronted Goose	Wg	Ringed Plover	RP
Greylag Goose	GJ	Golden Plover	GP
Barnacle Goose	BY	Grey Plover	GV
Dark-bellied Brent Goose	Bd	Lapwing	L
Light-bellied Brent Goose	Bl	Knot	KN
Shelduck	SU	Sanderling	SS
Wigeon	WN	Dunlin	DN
Gadwall	GA	Black-tailed Godwit	BW
Teal	T	Bar-tailed Godwit	BA
Pintail	PT	Curlew	CU
Shoveler	SV	Redshank	RK
Pochard	PO	Turnstone	TT
Tufted Duck	TU		

NB. Not every species covered by the NWC scheme has a corresponding qualifying level for international importance - for example, Little Grebe, Great Crested Grebe, Cormorant, Canada Goose and Ruddy Duck. Hence these species do not figure in this table.

- indicates that no total count is available.