

SUMMARY

The Wetland Bird Survey and Wildfowl and Wader Counts

The Wetland Bird Survey (WeBS) is a joint scheme of the British Trust for Ornithology (BTO), The Wildfowl & Wetlands Trust (WWT), Royal Society for the Protection of Birds (RSPB) and Joint Nature Conservation Committee (JNCC) to monitor non-breeding waterbirds in the UK. The principal aims of the scheme are to identify population sizes, determine trends in numbers and distribution, and to identify important sites for waterbirds. WeBS Core Counts are made annually at around 2,000 wetland sites of all habitats; estuaries and large still waters predominate. Monthly co-ordinated counts are made mostly by volunteers, principally from September to March, with fewer observations during summer months. Data from other sources, e.g. roost counts of grey geese, are included in this report where relevant.

This report presents total numbers counted for all species in the most recent year in Great Britain and Northern Ireland. Annual indices, calculated using the 'Underhill' method, are provided for the more numerous species. For certain wildfowl species, monthly indices, showing relative abundance during the winter, are also provided.

Species accounts provide yearly maxima for all sites supporting internationally and nationally important numbers. Sites with changed status are highlighted and significant counts at a national or site level are discussed. Counts are placed in an international context where possible, and relevant research is summarised. Waterbird totals are provided for all sites meeting criteria for international importance and species occurring in internationally important numbers on each are identified. Brief overviews of research initiated by WeBS or using WeBS data, and of conservation issues pertaining to UK waterbirds, are provided.

WeBS Low Tide Counts are made on selected estuaries to determine the distribution of birds during low tide and to identify important feeding areas that may not be recognised during Core Counts which are made mostly at high tide. A summary of results for these estuaries, and distribution maps for selected species, are provided.

Waterbird totals recorded by the Irish Wetland Bird Survey, a similar scheme operating in the Republic of Ireland, are also included.

Appendices list all UK sites designated under the Ramsar Convention and Special Protection Areas classified under the EC Directive on the Conservation of Wild Birds. Also, waterbird count totals for the most recent year are provided separately for England, Scotland, Wales, the Isle of Man and the Channel Islands.

The 1999-2000 year

This report summaries counts during 1999-2000 and previous years (since 1960 for wildfowl, 1969 for waders and the early 1980s or 1990s for other species groups). Coverage remained at the same relatively high levels, with over 1,600 sites counted each month during the winter. Weather was generally mild, as has often been the case in recent years, with no prolonged periods of cold weather in continental Europe.

Many species in Great Britain fared well in 1999-2000. Both common grebe species recorded increases from the previous winter, whilst Cormorant numbers reached record levels, surpassing 16,000 for the first time. Both Grey Heron and Little Egret counts were the highest recorded by WeBS to date, the latter peaking in September at over 1,000 birds in WeBS Core Counts whilst roost counts suggest a total as high as 1,700 birds in September. The long-term increase in the numbers of Mute Swans was sustained, with three counts in excess of 19,000 birds, a figure previously unsurpassed. European White-fronted Geese numbers have been steadily dwindling during the 1990s and low counts once again continued this trend. Naturalised Canada Geese in contrast fared much better, with a peak total of almost 50,000 birds a considerable jump up from recent years. Dark-bellied Brent Geese, whose numbers have been affected by a continued run of poor breeding success, peaked around 90,000 birds following a successful breeding season (23.5% young). This is the first time that productivity has exceeded mortality (estimated at 15%) since 1993.

Peak Shelduck counts in Great Britain fell for the third consecutive winter, with only 57,000 recorded in January and February, the lowest since the 1970s. Wigeon numbers were lower than in recent winters, though this was one of the few wildfowl species that increased in Northern Ireland. Gadwall numbers in Britain once again exceeded all previous counts, whilst Pintail numbers worryingly plummeted, with only 17,000 birds present during the midwinter months

(compared to a typical figure of around 25,000). Mallard numbers fell once again, the tenth fall in twelve winters. Numbers of all diving duck species were unexceptional. Seaduck numbers counted by WeBS were similarly unremarkable, although bespoke surveys of Carmarthen Bay recorded over 21,000 Common Scoters, numbers clearly having recovered from the *Sea Empress* oil spill of February 1996.

Lapwing and Golden Plover numbers in Britain were both high, peaking in November following a brief period of cold weather mid month. Avocets rose to record levels, with more than 4,000 present in January. Curlew Sandpiper autumn passage coincided well with the September counts, numbers almost matching the record counts of the previous year. Dunlin counts on both sides of the Irish Sea were in the lower range of usual fluctuations, whilst peak counts of Knot and Bar-tailed Godwit in Northern Ireland were also well down on the previous year, the latter being less than one third of the previous

winter's peak. Numbers of Black-tailed Godwits remained high, the UK annual index reaching its highest level to date, whilst Curlew numbers in Great Britain also reached an all-time high. Turnstone fared less favourably, the peak British count being the lowest since the mid 1980s. Counts of Oystercatchers and Redshank, numbers of which have remained relatively stable for many years, were unremarkable.

Black-headed and Common Gull counts in Great Britain were the highest recorded by WeBS to date, though totals represent only a small proportion of the British population. Numbers of other gull and tern species were near normal.

Perhaps most notable overall was a geographical split along the Irish Sea, with numbers of many waterbird species in Great Britain faring much better than those in Northern Ireland. Several wildfowl species registered record counts in Britain, whilst few totals in Northern Ireland were exceptional. Waders, in particular, fared poorly in Northern Ireland.

INTRODUCTION

The UK is of outstanding international importance for waterbirds. Lying on some of the major flyways for arctic-nesting species, large numbers of waterbirds are attracted, especially during winter, by the relatively mild climate and extensive areas of wetland, notably estuaries. The UK thus has both moral and legal obligations to conserve both these waterbirds and the wetlands upon which they depend.

The UK is bound by international law by being a signatory to a number of international conservation conventions, as well as being a member of the EU. In particular, the 'Ramsar' Convention on Wetlands of International Importance especially as Waterfowl Habitat, the EC Birds Directive and the EU Habitats and Species Directive, between them, require the UK to identify important examples of wetland and other habitats and sites important for birds and designate them for protection. Implicit in these obligations is the need for regular monitoring to identify and monitor such sites. These instruments also lay particular significance on the need to conserve migratory populations, and consequently most of the waterbird populations in the UK.

The UK has ratified the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) of the 'Bonn' Convention on the Conservation of Migratory Species of Wild Animals. AEWA entered into force in 1999. It is a specific Agreement requiring nations to take co-ordinated measures to conserve migratory waterbirds given their particular vulnerability due to their migration over long distances and their dependence on networks that are decreasing in extent and becoming degraded through non-sustainable human activities. Article three of the Agreement requires, among other things, that sites and habitats for migratory waterbirds are identified, protected and managed appropriately, that parties initiate or support research into the ecology of these species, and exchange information and results. Explicit in this Agreement is that adequate monitoring programmes are set in place to fulfil these objectives and the Action Plan to the Agreement specifically requires that nations endeavour to monitor waterbird populations.

Aims and objectives of WeBS

The Wetland Bird Survey (WeBS) aims to monitor all non-breeding waterbirds in the UK to provide the principal data on which the

conservation of their populations and wetland habitats is based. To this end, WeBS has three main objectives:

- to assess the size of non-breeding waterbird populations in the UK;
- to assess trends in their numbers and distribution; and
- to assess the importance of individual sites for waterbirds.

A programme of research, to understand the ecology of waterbirds and investigate the effects of habitat change and anthropogenic impact, underpins and enhances these objectives.

These results also form the basis for informed decision-making by conservation bodies, planners and developers and contribute to the sustainable and wise use and management of wetlands and their dependent waterbirds. The data and the WeBS report also fulfil some of the objectives of the Conventions and Directives listed above. WeBS also provides UK data to Wetlands International to assist their function to co-ordinate and report upon waterbird monitoring at an international scale.

Structure and organization of WeBS

WeBS is partnership scheme of the British Trust for Ornithology (BTO), The Wildfowl & Wetlands Trust (WWT), Royal Society for the Protection of Birds (RSPB) and the Joint Nature Conservation Committee (JNCC), the last on behalf of English Nature (EN), Scottish Natural Heritage (SNH) and the Countryside Council for Wales (CCW), and the Environment and Heritage Service in Northern Ireland (EHS).

WeBS continues the traditions of two, long-running count schemes which formed the mainstay of UK waterbird monitoring since 1947 (Cranswick *et al.* 1997). WeBS Core Counts are made at a wide variety of wetlands throughout the UK. Synchronised counts are conducted once per month, primarily from September to March, to fulfil all three main objectives. In addition, WeBS Low Tide Counts are undertaken on selected estuaries with the aim of identifying key areas used during the low tide period, principally by feeding birds; areas not otherwise noted for their importance by Core Counts which are normally conducted at high tide.

The day-to-day running of the Core and Low Tide Count schemes is the responsibility of the National Organisers, with assistance from a number of other staff.

The success and growth of these count

schemes reflects accurately the enthusiasm and dedication of the several thousands of volunteer ornithologists who participate. It is largely due to their efforts that waterbird monitoring in the UK is held in such international high regard.

Aim of this report

This report presents syntheses of data collected in 1999-2000 and previous years in line with the WeBS objectives. Data from other national and local waterbird monitoring schemes are included

WEATHER IN 1999-2000

This summary of UK weather is drawn from the journals *Weather* and *British Wildlife*. Figures in brackets denote the WeBS priority count date in that month. European weather is summarised from *Weather* and arctic breeding conditions for birds that winter in the UK, are summarised from Soloviev & Tomkovich (2001).

United Kingdom

Continuing the recent trend, winter 1999-2000 was mild and wet. There were no prolonged spells of cold weather and almost all months were warmer than average; in England and Wales, June was the only month to show a negative temperature anomaly.

April (18) began warm giving way to northerly airflows and a cool, wintry spell mid-month. This brought several inches of snow in south Wales and the Severn Vale and in the Pennines with harsh frosts across many areas. Mild and unsettled conditions prevailed thereafter until high pressure brought very warm conditions to all areas at the month end. Rainfall was above average in most areas. **May** (16) was warm and changeable, typically more unsettled in the northwest and drier in the southeast. **June** (13) was slightly cooler than average in all parts of the country, with only Northern Ireland being drier than normal. **July** (18) was very warm and sunny, particularly in the south, though less so in northern and western areas. In England and Wales, it was the driest July since 1911. **August** (15) began very warm, Heathrow Airport recording 32.7°C on the 1st. Cooler and more unsettled conditions prevailed from the second week, although Scotland was unusually drier than most of England and Wales.

A warm start to **September** (12) brought with it thundery outbreaks leading to localised flooding. Giant hail fell at Purley (Surrey), an event which has been associated with

where WeBS data alone are insufficient to fulfil this aim, so that the report provides a single, comprehensive source of information on waterbird status and distribution in the UK. All nationally and internationally important sites for which data exist are listed, as are all sites designated under international law or Conventions (see Appendices 1 & 2).

We recommend that the National Organisers (see *Contacts*) are contacted in the first instance by anyone with queries regarding this report or requiring further information.

considerable bird mortalities locally. Gravesend on the Swale Estuary recorded 30.4°C, the highest September temperature since 1973. The hot weather gave way to more unsettled conditions mid month, though warm periods and heavy rainfall saw further localised flooding in England and Wales. A tornado at Pagham in Surrey on the 23rd caused extensive damage to dwellings and vessels. Overall temperatures were 1.5-2.5°C above average.

Anticyclonic conditions dominated throughout the first part of **October** (10), with warm sunny days and occasional night-time frosts. A cold spell from the 18th to the 21st was the only notable event. Rainfall was near normal in most areas though it was notably dry in Northern Ireland, and temperatures were only fractionally above the long term mean.

The mild weather continued for the first two weeks of **November** (28), though a vigorous depression tracked across northern areas on the 5th causing localised flooding in Wales and Cumbria. A cold front crossed the country between the 16th and the 21st bringing colder weather and wintry showers. Milder more unsettled conditions returned for the remainder of the month, though in England and Wales it remained the driest November of the decade.

December (26) was dominated by a series of fronts bringing strong winds, heavy rain and sunny spells. Scotland and Northern Ireland were particularly wet, and both had mean temperatures below the long term average. A cold spell during the third week gave a brief period of snow across south Wales and England and temperatures in Northumberland failed to rise above -5°C on the 20th. Gales were common on the west coast during the latter part of the month.

Atlantic fronts and westerly wind dominated the early part of **January** (16) bringing mild and

unsettled conditions. A high pressure centred to the west of the UK brought settled and cooler conditions towards mid month, with night-time frosts widespread. Mild, wet and windy conditions returned to all areas at the end of the month. January was mild, with all bar southwest England and Wales recording mean temperatures 1-2°C above the long term average. Some meteorological stations in the northern and western isles recorded a totally frost free month. Southern and central England were particularly dry with less than half the typical precipitation.

Early **February** (13) saw the continuation of the unsettled conditions prevail for the first two weeks. Cooler conditions during the third week brought snow to some parts of England and up to 12 cm in parts of lowland Scotland. The resumption of mild, wet and windy weather brought the month to a close, with temperatures above average in all parts of the country and some northern and western areas experiencing more than twice the normal rainfall.

The WeBS year concluded in **March** (12) with another mild month. After a changeable first week with widespread frosts in the south and east, temperatures rose during the second week with Torquay, Devon, recording an exceptional 19.7°C on the 13th. High pressure in the third week brought more mild weather and some night-time frosts, with more unsettled anticyclonic conditions bringing the month to a close. A very dry month, March saw many parts of England receive less than half the typical rainfall, with only northwest Scotland being wetter than normal.

Northwest Europe

As in the UK, the weather throughout most of continental Europe was milder than average in almost all months, with no prolonged periods of cold weather. September was mild throughout all of Europe, with Scandinavian and Baltic countries typically averaging 2-4°C above normal. October was unexceptional, temperatures being near normal though slightly milder in the eastern Baltic and western Russia. As in the UK, most countries in western Europe experienced their coldest spell around 18th and 19th, and some central parts remained relatively dry. Iceland and Scandinavian countries experienced another mild month in November, temperatures around 2°C above the long term mean. Elsewhere most places were drier than average with temperatures near normal or below, particularly cooler in eastern Europe with Russia and the Ukraine 3-4°C below average. The coldest spell

Table i. The proportion of stillwater count units (lakes, reservoirs and gravel pits) in the UK with any ice and with three-quarters or more of their surface covered by ice during WeBS counts in 1999-2000 (England divided by a line drawn roughly between the Humber and the Mersey Estuaries).

Region	Ice	S	O	N	D	J	F	M
Northern Ireland	>0%	0	0	7	0	5	0	0
	>74%	0	0	0	0	0	0	0
Scotland	>0%	0	0	4	20	16	8	<1
	>74%	0	0	1	18	13	3	0
N England	>0%	0	0	<1	6	17	<1	0
	>74%	0	0	<1	2	8	0	0
S England	>0%	0	0	<1	4	5	<1	0
	>74%	0	0	0	2	<1	<1	0
Wales	>0%	2	0	2	5	2	2	0
	>74%	0	0	0	0	0	0	0

occurred between 20-24th just before the November priority count date. December was notably wet in most countries, particularly so in Scandinavia and western Europe, with temperatures typically 1-2°C above normal. As in November, the coolest period occurred just prior to the priority date on 26th. The remainder of the winter was consistently warmer than average in all areas. January was unusually dry, whilst March saw wet conditions in almost all parts. The coldest spells occurred in late January and late February, in both months after the priority count dates.

Arctic breeding conditions

Productivity in arctic-breeding birds was generally noted as good in 1999 (Soloviev & Tomkovich 2001), perhaps rather surprisingly in view of prevailing weather conditions and rodent abundance. Spring weather was generally warmer than normal in northern Scandinavia and the Taimyr, though cold and late in the Pechora region, Greenland and eastern Canada. Summer was around 1°C colder than average in most areas, again except for the Kola and Taimyr peninsulas where it remained slightly warmer than normal. Rodent abundance was generally low across Canada, Greenland, and much of Russia, although it was high in the western Taimyr.

WeBS Core Counts

SURVEY METHODS

The main source of data for this report is the WeBS scheme, providing regular monthly counts for most waterbird species at the majority of the UK's important wetlands. In order to fulfil the WeBS objectives, however, data from a number of additional schemes are included in this report. In particular, a number of species groups necessitate different counting methodologies in order to monitor numbers adequately, notably other national and local schemes for these species are routinely included. Additional, *ad hoc*, data are also sought for important sites not otherwise covered by regular monitoring, particularly open coast sections in Scotland, whilst the results of periodic, co-ordinated surveys, such as the non-estuarine coastal waterfowl survey, are included where the data collected are compatible with the presentation formats used in this report. The methods for these survey types are outlined below and more detail can be found in Gilbert *et al.* (1998). Although the precise methods for some of the additional count data presented within this report are unknown, it is safe to assume that they will follow closely the general methods presented here.

WeBS Core Counts

WeBS Core Counts are made using so-called "look-see" methodology (Bibby *et al.* 2000), whereby the observer, familiar with the species involved, surveys the whole of a predefined area.

Counts are made at all wetland habitats, including lakes, lochs/loughs, ponds, reservoirs, gravel pits, rivers, freshwater marshes, canals, sections of open coast and estuaries.

Numbers of all waterbird species, as defined by Wetlands International (Rose & Scott 1997), are recorded. In the UK, this includes divers, grebes, Cormorant, herons, Spoonbill, swans, geese, ducks, rail, cranes, waders and Kingfisher. Counts of gulls and terns are optional. Vagrants, introductions and escapes are included.

Most waterbirds are readily visible. Secretive species, such as snipes, are generally under-recorded. No allowance is made for these habits by the observer and only birds seen or heard are recorded. The species affected by such biases are well known and the problems of

interpretation are highlighted individually in the *Species Accounts*.

Most species and many sub-species are readily identifiable during the counts. Categories may be used, e.g. unidentified scoter species, where it is not possible to be confident of identification, e.g. under poor light conditions.

Species present in relatively small numbers or dispersed widely may be counted singly. The number of birds in large flocks is generally estimated by mentally dividing the birds into groups, which may vary from five to 1,000 depending on the size of the flock, and counting the number of groups. Notebooks and tally counters may be used to aid counts.

Counts are made once per month, ideally on predetermined 'priority dates'. This enables counts across the whole country to be synchronised, thus reducing the likelihood of birds being double-counted or missed. Such synchronisation is imperative at large sites which are divided into sectors, each of which can be practicably counted by a single person in a reasonable amount of time. Local Organisers ensure co-ordination in these cases due to the high possibility of local movements affecting count totals.

The priority dates are pre-selected with a view to optimising tidal conditions for counters covering coastal sites at high tide on a Sunday (see *Coverage*). The dates used for individual sites may vary due to differences in the tidal regime around the country. Co-ordination within a site takes priority over national synchronisation.

The accuracy of each count is recorded. Counts suspected to be gross underestimates of the true number of non-secretive species present are specifically noted, e.g. a large flock of roosting waders only partially counted before being flushed by a predator, or a distant flock of sea-duck in heavy swell. These counts may then be treated differently when calculating site totals (see *Analysis*).

Data are input by a professional data input company. Data are keyed twice by different people and discrepancies identified by computer for correction. Any particularly unusual counts are checked by the National Organisers and are confirmed with the counters if necessary.

Goose roost censuses

Since many 'grey geese' spend daylight hours in agricultural landscapes, most are missed during counts at wetlands by WeBS. These species are usually best counted as they fly to or from their roost sites at dawn or dusk since these are generally discrete wetlands and birds often follow traditional flight lines approaching or leaving the site. Even in half-light, birds can generally be counted with relative ease against the sky, although they may not be specifically identifiable at mixed species roosts.

In order to produce population estimates, counts are synchronised nationally for particular species (see Appendix 3), though normally only one or two such counts are made each year. The priority count dates are determined according to the state of the moon, since large numbers of geese may remain on fields during moonlit nights. Additional counts are made by some observers, particularly during times of high turnover when large numbers may occur for just a few days.

In some areas, where roost sites are poorly known or difficult to access, counts are made during daytime of birds in fields.

As with WeBS Core Counts, the accuracy of the count is noted.

Sea-ducks

The accuracy of counts of waterbirds on the sea is particularly dependent on prevailing weather conditions at the time of or directly preceding the count. Birds are often distant from land, and wind or rain can cause considerable difficulty with identifying and counting birds. Wind not only causes telescope shake, but even moderate swell at all sites except those with high vantage points can hamper counts considerably. Many sites may be best covered using aerial surveys, though these are usually expensive and require experienced, professional counters. In many cases, birds can only be identified to genus, e.g. grebe species or scoter species.

Consequently, the best counts of most divers, grebes and sea-duck at open coast and many

estuarine sites are made simply when conditions allow; only rarely will such conditions occur by chance during WeBS counts. Synchronisation between different sites may be difficult or impossible to achieve, and thus co-ordination of most counts to date has occurred at a regional or site level, e.g. within the Moray Firth, within North Cardigan Bay.

Irish Wetland Bird Survey

The Irish Wetland Bird Survey (I-WeBS) monitors non-breeding waterbirds in the Republic of Ireland (Colhoun 2001). I-WeBS was launched in 1994 as a joint partnership between BirdWatch Ireland, National Parks and Wildlife Service of Dúchas The Heritage Service of the Department of Arts, Heritage, Gaeltacht and the Islands (Ireland), and WWT, supported by the Heritage Council and WWF UK (World Wide Fund for Nature). I-WeBS is complementary to and compatible with the UK scheme. The main methodological difference from UK-WeBS is that counts are made only between September and March, inclusive.



Productivity monitoring

Changes in numbers of waterbirds counted in the UK between years are likely to result from a number of factors, including coverage and weather, particularly for European and Russian-breeding species which may winter further east or west within Europe according to the severity of the winter. However, genuine changes in population size will result from differences in recruitment and mortality between years.

For several species of swans and geese, young of the year can be readily identified in the field and a measure of productivity can be obtained by recording the number of young birds in sampled flocks, expressed as a percentage of the total number of birds aged. Experienced fieldworkers, by observing the behaviour of and relationship between individuals in a flock, can record brood sizes as the number of young birds associating with two adults.

ANALYSIS

In fulfilment of the WeBS objectives, results are presented in a number of different sections. An outline of the analyses undertaken for each is given here; further detail is provided in Appendix 3. A number of limitations of the data or these analytical techniques necessitate caution when interpreting the results presented in this report (see *Interpretation of Waterbird Counts*).

National totals

Population estimates are revised once every three years, in keeping with internationally agreed timetables (Rose & Stroud 1994). UK waterbird populations will next be revised in 2001, although a number have been revised recently (Appendix 2) for inclusion in the third edition of international *Waterfowl Population Estimates* endorsed by the Seventh Conference of the Contracting Parties to the Ramsar Convention, in Costa Rica in May 1999.

Total numbers of waterbirds recorded by WeBS and other schemes are presented separately for Great Britain (including the Isle of Man but excluding the Channel Islands) and Northern Ireland in recognition of the different legislation that applies to each. Separate totals for England, Scotland, Wales, and the Channel Islands are provided in Appendices 4-7. Numbers of waterbirds found on coastal (including estuarine) and inland habitats are provided separately in Appendix 8, particularly for comparison of numbers of waders with those in reports prior to 1994 when waders were not counted at inland sites.

Numbers presented in this report are not rounded. National and site totals calculated as the sum of counts from several sectors or sites may imply a false sense of accuracy if different methods for recording numbers have been used, e.g. 1,000 birds estimated on one sector and a count of seven individuals on another is presented as 1,007. It is safe to assume that any large count includes a proportion of estimated birds. However, reproducing the submitted counts in this way is deemed the most appropriate means of presentation and avoids the summation of 'rounding error'.

The count nearest the monthly priority date or, alternatively, the count co-ordinated with nearby sites if there is considered to be significant interchange, is chosen for use in this report if several accurate counts are available for the same month. A count from any date is used

if it is the only one available.

Data from other national surveys are used instead of WeBS Core Counts where the census total provides a better estimate of the total numbers, e.g. the national census of Pink-footed and Greylag Geese in October and November. Totals from different censuses are not combined to produce national totals due to lack of synchronisation (birds counted at roost by one method may be effectively double-counted during the WeBS count at a different site in that month), with the exception of a few goose populations where the risk of double-counting is minimal (see Appendix 2). Consequently, counts from site or regional-based surveys of sea-ducks, for example, are not included in national totals. Data from NEWS are not included in national totals.

For some scarcer species, including many escaped or introduced species, an estimate of the total number recorded by WeBS throughout the country has been provided using summed site maxima, calculated by summing the highest count at each site, irrespective of the month in which it occurred. For some species, this is likely to result in double-counting where birds move between sites.

Annual indices

Because the same WeBS sites are not necessarily covered each year, changes in waterbird population sizes cannot be determined simply by comparing the total number of birds counted in each year. Consequently, indexing techniques have been developed which allow between-year comparisons of numbers, even if the true population size is unknown.

The 'Underhill index' (Underhill 1989) was specifically developed for waterbird populations and is used in this report for most species. A full explanation of this indexing process is given in Prŷs-Jones *et al.* (1994), Underhill & Prŷs-Jones (1994) and Kirby *et al.* (1995), with additional information on its use in this report in Appendix 3.

In summary, where sites have not been visited, a count for each species is calculated based on counts in other months and years and at other sites. This effectively means that data are available for the same set of sites in each year and counts are thus directly comparable from one year to the next. Changes in the population can be calculated and the relative difference expressed as an index.

Not all species are included in the indexing process. Notably, many of the goose populations are excluded, partly because their reliance on non-wetland sites requires different count methodologies, but also because regular censusing of substantially the whole of the British populations negates the need for an index to be calculated using the Underhill technique. Thus, change indices for Pink-footed, Icelandic Greylag, Greenland White-fronted and Svalbard Barnacle Geese have been derived from the highest total count obtained during censuses of the population in each year (see Appendix 3). Many sea-duck are also excluded from the indexing process because of the extreme counting difficulties involved. Waders excluded from the index include those for which large numbers occur away from wetlands, e.g. Lapwing and Golden Plover, and those that are difficult to count accurately using WeBS methods, e.g. Snipe and Jack Snipe. Waterbird species which only occur in small numbers in Britain and Ireland have also been excluded.

Index values for wildfowl species have been provided separately for Britain and Northern Ireland. However, values calculated for waders in Northern Ireland were found to be statistically unreliable due to the small number of estuaries contributing to each index value, and consequently indices have been calculated for the UK as a whole for these species.

For all species, the index value has been constrained to equal 100 in the most recent year. In particular, this enables direct comparison of values for wildfowl in Great Britain with Northern Ireland despite the different availability of data as a consequence of the later start of the scheme in the province (see Appendix 3 for availability of data for different species groups and countries).

Monthly indices

The abundance of different wildfowl species varies during the winter due to a number factors, most notably the timing of their movements along the flyway, whilst severe weather, particularly on the continent, may also affect numbers in the UK. However, due to differences in site coverage between months, such patterns cannot be reliably detected using count totals. Consequently, an index is calculated for each month to reflect changes in relative abundance during the season.

The index uses only counts from sites covered in all seven months (September to March). Totals calculated for each month from

these sites only can then be compared directly (expressed as a percentage of the maximum numbers), thus revealing patterns of seasonality for the species considered. These are presented as graphs in the species accounts, giving both the value for the 1999-2000 winter, and the average value from the five preceding winters, 1994-95 to 1998-99. Non-migratory, scarce and irregularly counted species are omitted and only WeBS Core Counts have been used in the index.

Broad differences in the monthly values between species reflect their status in the UK. Resident species, or those with large UK breeding populations, e.g. some grebes and Mallard, are present in large numbers early in the winter. Declines through the winter result in part from mortality of first year birds, but also birds returning to remote or small breeding sites that are not covered by WeBS. The majority of UK wildfowl either occur solely as winter visitors, or have small breeding populations that are swelled by winter immigrants, with peak abundance generally occurring in mid winter.

The vast majority of the wintering populations of many wader species are found on estuaries, and, since coverage of this habitat is relatively complete and more or less constant throughout winter, meaningful comparisons of total monthly counts can be made for many species. Consequently, monthly indices are not calculated for waders. As counting of gulls and terns is optional, indices are not calculated for these species either.

Site importance

Tables in the *Species Accounts* rank the principal sites for each species according to average seasonal maxima for the last five seasons in line with recommendations of the Ramsar Convention (see Appendix 2 and *Presentation and notation*).

The count nearest the priority date or, alternatively, the count co-ordinated with nearby sites if there is considered to be significant interchange, is chosen for use in this report if several accurate counts are available for the same month. A count from any date is used if it is the only one available.

In accounts for most divers, grebes, Cormorant, herons, wildfowl and Kingfisher, annual maxima are derived from any month, with the season running from July to June inclusive. Average maxima for sites listed in the wader accounts are calculated using data from only the winter period, November to March. For species

which occur primarily as summer visitors, e.g. Garganey, Little Ringed Plover, annual statistics are calculated using the calendar year.

Data from other sources, often involving different methods, e.g. goose roost censuses, are used where these provide better, i.e. larger, counts for individual sites. NEWS data have only been presented for selected species (Ringed Plover, Sanderling, Purple Sandpiper, Bar-tailed Godwit and Turnstone) and only for sites previously noted as being of national importance.

In the first instance, average maxima were calculated using only complete counts but, if any incomplete counts exceeded this initial average, they were also incorporated and the averages recalculated. Averages enclosed by brackets are based solely on incomplete counts.

Counts at any site are considered to be incomplete whenever significant under-recording is thought to have occurred, due to part of the site not being counted or adverse counting conditions. This information is provided by the observer on the accuracy of the overall count (either 'OK' or 'Low', the latter indicating that a significant proportion of birds present were thought to have been missed, e.g. due to poor visibility) or for individual species.

For sites comprising just one count unit, completeness is assessed on a species-by-species basis using the accuracy information provided by the observer.

For complex sites (i.e. those comprising more than one count unit), counts from individual count sectors might have been made under very different conditions, particularly at very large sites, and consequently may have quite different qualities assigned to accuracy of the count. Additionally a variable amount of the overall site may have been uncounted.

For wildfowl and their allies, completeness assessments for the major complex sites (most

estuaries, gravel pit complexes etc.) have been made according to the number of sectors covered. If a significant proportion of the total number of sectors were not counted, and the total number of wildfowl was correspondingly lower than normal, all counts of those species at that site in that month are deemed incomplete.

For waders, gulls, terns and herons, more sophisticated species-by-species completeness qualities are assigned. In this case, the importance of the contribution of each count sector to the site total is based on its average contribution to the total at the time of year in question and on recent years (to allow for seasonal and long-term trends). Further, consideration is given to the fact that a count sector which normally holds a significant proportion of a site total for species A may hold only a small proportion of the site total for species B. Consequently, if such a count sector is not completely counted, the site total will now be treated as complete for species B but incomplete for species A.

In addition to the assessment of sites in *Species Accounts*, sites are identified for their importance in terms of overall waterbird numbers in *Principal Sites*. The peak count at each site is calculated by summing the individual species maxima during the season, irrespective of the month in which they occurred. Only WeBS Core Counts and national goose censuses (see Appendix 3) are included in totals. Note that non-native introduced or escaped species (i.e. those not in BOURC category A; see *Introduced and Escaped Waterbirds* under *Total Numbers*) are not included in these totals. Additional counts made using different methodologies, such as those of sea-ducks on the Moray Firth, are not incorporated.

The locations of all sites named in this report are given in Appendix 9.

PRESENTATION AND NOTATION

Detail is provided here on the format of presentation and the notation used in *Species Accounts* in particular. The information provided in *Analysis and Interpretation of Waterbird Counts* should mean that results presented in other sections are self-explanatory.

The main purpose of the *Species Accounts* is to list important sites for each species, subspecies or populations, as relevant. This is done using certain numerical criteria adopted widely for use in conservation legislation and guidelines

for site designation (see Appendix 2), although a number of exceptions have been made in some cases. Where available, the international and national importance thresholds are listed at the start of each account, although, for some numerous species, no population estimates, and therefore no thresholds, are available. Less numerous species, for which thresholds are not likely to be produced, are classified as "scarce" whilst species are classified as a "vagrant" where the UK does not fall within its normal range of

distribution. In line with the recommendations of Vinicombe *et al.* (1993), records of all species recorded by WeBS, including escapes, have been published to contribute to the proper assessment of naturalised populations and escaped birds. Following Holmes & Stroud (1995), non-native species which have become established are termed “naturalised”. These species are categorised according to the process by which they became established: naturalised feral (domesticated species gone wild); naturalised introduction (introduced by man); naturalised re-establishment (species re-established in an area of former occurrence); or naturalised establishment (a species which occurs, but does not breed naturally, e.g. potentially Barnacle Goose in southern England). With the exception of vagrants, all other non-native species have been classed as “escapes”. The native range is given in the species account for naturalised species, escapes and vagrants.

The maximum count in any month of 1999-2000, and the month of occurrence, is given for Great Britain and Northern Ireland in each account except for species occurring in very small numbers. Where productivity data have been collected, the proportion of young and mean brood size, where available, are also listed at the start of the account for ease of reference.

Index values, where calculated, are graphed within each account. Annual indices are presented on a log scale, as is the scientific norm for population growth. Where separate British and Northern Ireland values have been calculated (for certain wildfowl species), these are presented on the same graph to allow direct comparison but with different y-axes (vertical axes) for clarity. British indices are denoted using circles and the left-hand axis, and Northern Ireland values using squares and the right hand axis. Where only one index series is presented, circles and the left-hand axis have been used regardless of country.

Monthly indices, where calculated, are graphed within each account. Mean values for the previous five years (1992-93 to 1996-97) are shown using black columns and values for the most recent year using white columns.

Text in each account highlights significant points, e.g. coverage, changes in numbers or indices and at individual sites, and provides an overview of any recently published relevant research or surveys. The terms “recent average” and “previous average” refer to averages based on the winters 1992-93 to 1996-97, i.e. those presented in the previous WeBS report.

Tables provide data for all internationally important sites and all nationally important sites (either in a Great Britain context or, for sites in Northern Ireland, in an all-Ireland context) monitored by WeBS or other appropriate surveys. For each site, the maximum count in each of the five most recent years, the month of occurrence of the 1999-2000 peak and the mean of the maxima is given. Incomplete counts are bracketed and missing counts are denoted using a dash “-”.

Sites are selected for presentation using a strict interpretation of the 1% threshold (for convenience, sites in the Channel Islands and Isle of Man are identified using 1% thresholds for Great Britain and included under the Great Britain section of the tables). For some species with very small national populations, and consequently very low 1% thresholds, an arbitrary, higher level has been chosen for the inclusion of sites and is highlighted in the text. Where no thresholds are given, e.g. for introduced species, and where no or very few sites in the UK reach the relevant national qualifying levels, an arbitrary threshold has been chosen to select a list of sites for this report. These thresholds are highlighted in the text, whilst a blank line has been inserted in the table to separate sites that qualify as nationally important from those selected for the purposes of this report using lower thresholds, including 1% thresholds of less than 50 birds.

Where the importance of a site has changed as a result of the 1999-2000 count, i.e. it has become nationally or internationally important but was not following the previous year, or it has changed from international to national importance or vice versa, this is indicated in the table. Sites with elevated status have a black triangle pointing up (▲) to the right of the average, whilst those with lowered status are indicated using a triangle pointing down (▼). Sites for which the average fell below the threshold for national importance following 1999-2000 are listed under the heading “Sites no longer meeting table qualifying levels”.

A few sites that have not been counted in recent years, in most cases due to their isolated location, but were of national or international importance for one or more species when last counted (and thus retain that status in the absence of data to the contrary), are listed in the accounts under the section “Internationally or nationally important sites not counted in last five years”. This also serves to highlight the need for counting to be resumed.

All sites which, in 1999-2000, held numbers exceeding the relevant national threshold (or adopted qualifying level), but with five year means below this value are listed under "Other sites surpassing table qualifying levels in 1999-2000". This serves to highlight important sites worthy of continued close attention. For waders, this includes counts from any month of the year.

It should be noted that a site may appear to have been flagged erroneously as having elevated status if the most recent count was below the relevant threshold. However, a particularly low count six years previously will have depressed the mean in the previous report. The converse

may be true for sites with lowered status and thus, in exceptional circumstances, a site may be listed in the relevant sections of the table as both no longer being of national importance and with a peak count in the most recent year exceeding the national threshold.

For a number of wader species, different thresholds exist for passage periods. The list of "sites surpassing passage thresholds in 1999-2000" includes all those with counts above the relevant number, even if already listed in the main part of the table by virtue of the winter mean surpassing the national threshold.

See page 32 for symbols and notation used.

INTERPRETATION OF WATERBIRD COUNTS

Caution is always necessary in the interpretation and application of waterbird counts given the limitations of these data. This is especially true of the summary form which, by necessity, is used in this report. A primary aim here remains the rapid feedback of key results to the many participants in the WeBS scheme. More detailed information on how to make use of the data for research or site assessment purposes can be obtained from the appropriate National Organisers.

Information collated by WeBS and other surveys can be held or used in a variety of ways. Data may also be summarised and analysed differently depending on the requirements of the user. Consequently, calculations used to interpret data and their presentation may vary between this and other publications, and indeed between organisations or individual users. The terminology used by different organisations may not always highlight these differences. This particularly applies to summary data. Such variations do not detract from the value of each different method, but offer greater choice to users according to the different questions being addressed. This should always be borne in mind when using data presented here.

For ease of reference, the caveats provided below are broadly categorised according to the presentation of results for each of the key objectives of WeBS. Several points, however, are general in nature and apply to a broad range of uses of the data.

National totals

The majority of count data are collected between September and March, when most species of waterbird are present in the UK in highest

numbers. Data are collected during other months and have been presented where relevant. However, caution is urged regarding their interpretation both due to the relative sparsity of counts from this period and the different count effort for different sites.

A number of systematic biases of WeBS or other count methodology must be borne in mind when considering the data. Coverage of estuarine habitats and large, standing waters by WeBS is good or excellent. Consequently, counted totals of those species which occur wholly or primarily on this habitat during winter will approximate the true number. However, those species dispersed widely over rivers, non-estuarine coast or small inland waters are likely to be considerably under-represented, as will secretive or cryptic species, such as snipes, or those which occur on non-wetlands, e.g. grassland plovers. Species which occur in large numbers during passage are also likely to be under-represented, not only because of poorer coverage at this time, but due to the high turnover of birds in a short period. Further, since counts of gulls and terns are optional, national totals are likely to be considerable underestimates of the number using the WeBS network of sites. Only for a handful of species, primarily geese, do count totals approach the true number in the UK.

One instance of possible over-estimation is the use of summed site maxima to determine the total number of scarcer species. For species with mobile flocks in an area well covered by WeBS, e.g. Snow Goose in south-east England, it is likely that a degree of double-counting will occur, particularly if birds move between sites at different times of the year. These cases are

highlighted in the *Species Accounts*.

The publication of records of vagrants in this report does not imply acceptance by the *British Birds* Rarities Committee (e.g. Rogers and the Rarities Committee 1998).

Annual indices

For all species, the long-term trends in index values can be used with confidence to assess changes in overall wintering populations. Because short-term fluctuations provide a less rigorous indication of population changes, care should be taken in their interpretation.

Caution should be used in interpreting figures for species which only occur in small numbers. Thus, numbers tend to fluctuate more widely for many species in Northern Ireland, largely as a result of the smaller numbers of birds involved but also, being at the westernmost limit of their range, due to variable use being made of Ireland by wintering wildfowl.

It should be borne in mind that the missing values used in the Underhill index are calculated anew each year. Because the index formula uses data from all years, each new year's counts will slightly alter the site, month and year factors. In turn, the missing counts may differ slightly and, as a result, the index values produced each year are likely to differ from those published in the previous *Wildfowl and Wader Counts*. The indices published here represent an improvement on previous figures as the additional year's data allow calculation of the site, month and year factors with greater confidence. Index values are given in Appendix 3.

Monthly indices

As for annual indices, the reduced numbers of both sites and birds in Northern Ireland result in a greater degree of fluctuation in numbers used in the analyses of data from the province.

Site importance

Criteria for assessing the international importance of wetlands have been agreed by the Contracting Parties to the Ramsar Convention on Wetlands of International Importance (Ramsar Convention Bureau 1998). Under criterion 6, a wetland is considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird, whilst any site regularly supporting 20,000 or more waterbirds qualifies under

criterion 5. Similar criteria have been adopted for identification of SPAs under the EC Birds Directive in the UK legislation. A wetland in Britain is considered nationally important if it regularly holds 1% or more of the estimated British population of one species or subspecies of waterbird, and in Northern Ireland, important in an all-Ireland context if it holds 1% or more of the estimated all-Ireland population. The relevant 1% thresholds are given in Appendix 2.

Sites are selected for presentation in this report using a strict interpretation of the 1% threshold. However, it should be noted that, where 1% of the national population is less than 50 birds, 50 is normally used as a minimum qualifying threshold for the designation of sites of national importance. It should also be noted that the 'qualifying levels' used for introduced species are used purely as a guide for presentation of sites in this report and do not infer any conservation importance for the species or the sites concerned since protected sites would not be identified for these non-native birds.

It is necessary to bear in mind the distinction between sites that *regularly* hold wintering populations of national or international importance and those which may happen to exceed the appropriate qualifying levels only in occasional winters. This follows the Ramsar Convention, which states that key sites must be identified on the basis of demonstrated regular use (calculated as the mean winter maxima from the last five seasons for most species in this report), otherwise a large number of sites might qualify as a consequence of irregular visitation by one-off large numbers of waterbirds. However, the Convention also indicates that provisional assessments may be made on the basis of a minimum of three years' data. These rules of thumb are applied to SPAs and national assessments also. Sites with just one or two years' data are also included in the tables if the mean exceeds the relevant threshold for completeness but this does not, as such, imply qualification.

Nevertheless, sites which irregularly support nationally or internationally important numbers may be extremely important at certain times, e.g. when the UK population is high, during the main migratory periods, or during cold weather, when they may act as refuges for birds away from traditionally used sites. For this reason also, the ranking of sites according to the total numbers of birds they support (particularly in *Principal Sites*) should not be taken as a rank order of the conservation importance of these sites, since

certain sites, perhaps low down in terms of their total 'average' numbers, may nevertheless be of critical importance to certain species or populations at particular times.

Peak counts derived from a number of 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, data for a few sites presented in this report derive from single counts in some years. Similarly, in assessing the importance of a site, peak counts from several winters should ideally be used, as the peak count made in any one year may be unreliable due to gaps in coverage and disturbance- or weather-induced effects. The short-term movement of birds between closely adjacent sites may lead to altered assessments of a site's apparent importance for a particular species. More frequent counts than the once-monthly WeBS visits are necessary to assess more accurately the rapid turnover of waterbird populations that occurs during migration or cold weather movements.

This list of potential sources of error in counting wetland birds, though not exhaustive, suggests that the net effect tends towards under- rather than over-estimation of numbers and provides justification for the use of maximum counts for the assessment of site importance or the size of a populations. Factors causing under-estimation are normally constant at a given site in a given month, so that while under-estimates may occur, comparisons between sites and years remain valid.

It should be recognised that, in presenting only sites of national importance, this report provides just one means of identifying important sites and does not provide a definitive statement on the conservation value of individual sites for waterbirds, let alone other conservation interests. The national thresholds have been chosen to provide a reasonable amount of information in the context of this report only. Thus, for example, many sites of regional importance or those of importance because of the assemblage of species present are not included here. European Directives and conservation Conventions stress the need for a holistic approach to effect successful conservation, and lay great

importance on maintaining the distribution and range of species, in addition to the conservation of networks of individual key sites.

For the above reasons of poor coverage, geographically or temporally, outlined above, it should be recognised that lists of internationally and nationally important sites are limited by the availability of WeBS and other survey data. Whilst the counter network is likely to cover the vast majority of important sites, others may be missed and therefore will not be listed in the tables due to lack of appropriate data.

Some counts in this report differ from those presented previously. This results from the submission of late data and corrections, and in some cases, the use of different count seasons or changes to site structures. Additionally, some sites may have been omitted from tables previously due to oversight. It is likely that small changes will continue as part of the current site mapping project and as the database, developed initially for waders, is brought on line for wildfowl. Most changes are minor, but comment is made in the text where they are significant. Where a site has apparently changed status as a result of recalculations or omissions, comment is made in the text but it is not flagged in the tables in the *Species Accounts*.

Note that sites listed under "Sites no longer of national/all-Ireland importance" represent those that were listed in the 1998-99 report as of national importance but which, following the 1999-2000 counts, no longer meet the relevant threshold. It is not an exhaustive list of sites which, at any time in the past, have been of national or all-Ireland importance.

Counts made using non-WeBS methodologies, such as those of sea-ducks on the Moray Firth, are not incorporated into the site totals presented in *Principal Sites*, with the exception of goose roost counts. Thus, it should be borne in mind that other sites that are important for certain waterbird species are not included in the table, whilst the sites listed may be of 'greater importance' for the species listed if additional data were included.

Lastly, owing to possible boundary differences, totals given for WeBS sites in this report are not necessarily the same as totals for designated statutory sites (ASSIs/SSSIs, SPAs or Ramsar Sites) having the same or similar names.