

# Overwinter population estimates of British waterbirds

Andrew J. Musgrove, Graham E. Austin,  
Richard D. Hearn, Chas A. Holt, David A. Stroud  
and Simon R. Wotton

**Abstract** In total, over 12.5 million waterbirds occur in Britain during the winter. Estimates of the numbers of non-breeding waterbirds visiting Britain are important for the birds' conservation, both for status assessments and for the identification and designation of nationally and internationally important sites. This paper collates data from a wide range of sources, principally for the period 2004/05 to 2008/09, and produces estimates for 92 different species or populations, some using novel analytical methods developed by the authors. For 15 species or populations, formal estimates of wintering numbers are presented for the first time. The estimates demonstrate that species such as Avocet *Recurvirostra avosetta*, Gadwall *Anas strepera* and, especially, Little Egret *Egretta garzetta* have increased substantially in the last decade, while others, such as Greenland White-fronted Goose *Anser albifrons flavirostris*, Dunlin *Calidris alpina* and Common Pochard *Aythya ferina*, have declined markedly.

## Introduction

Overwintering waterbirds constitute one of the most distinctive and significant elements of the British avifauna. A very high proportion of many populations moves to Britain for at least part of the non-breeding season, the numbers involved being especially notable in comparison with the relatively small proportion (about 2.5%) of the land area of Europe that Britain occupies (Moser 1987). Such concentrations of birds are due to a number of factors. First, because of the influence of the Atlantic Ocean and the Gulf Stream, Britain's overwinter temperatures remain markedly higher than those of other regions at a similar latitude. Species that breed at more northerly latitudes (west to Canada and Greenland and east to Scandinavia and Arctic Russia), or to the east in northern Europe and Russia, vacate their

breeding grounds as food availability dwindles with the onset of winter, and a post-breeding migration to Britain can involve a shorter journey than might otherwise be required. Second, despite the fact that (outside protected areas) much of the British countryside is seriously degraded and inhospitable to wildlife, Britain does retain substantial areas of wetland habitats, in particular its estuaries, which are highly productive in terms of invertebrate food, and newly created inland wetlands, such as flooded gravel-pits. Third, Britain's geographic position places it along an important migratory route (the East Atlantic Flyway) between northern breeding grounds and important wintering areas farther south such as Iberia, Morocco and the Banc d'Arguin in Mauritania. Finally, there has been a general reduction in hunting pressure for many of



David Tipling

**205.** One of the most memorable of British winter birding experiences is surely the dawn flight of Pink-footed Geese *Anser brachyrhynchus* leaving their roost, in this case at Snettisham, Norfolk, December 2008. Pinkfeet numbers have increased steadily in recent years, the most recent estimate being 360,000 in autumn 2009.

these populations, an increase in provision of nature reserves and the implementation of other positive conservation policies, all of which help to create favourable wintering conditions (Tubbs 1977, 1991; Owen *et al.* 1986).

Despite these positive aspects, however, there are increasing causes for concern. Monitoring schemes such as the Wetland Bird Survey (WeBS) suggest that, following decades of generally increasing numbers of waterbirds, many species are now declining, in some cases rapidly (Calbrade *et al.* 2010). Conversely, numbers of other species continue to increase. In addition to the scientific desire to understand such changes, and a moral argument to reverse declines if they are due to human factors, there is also a legal requirement to investigate these changes in population size and the factors underlying them. The UK is a signatory to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (better known as the Ramsar Convention), the Convention on the Conservation of Migratory Species of Wild Animals, the African-Eurasian Migratory Waterbird Agreement,

and the Convention on Biological Diversity, among others. In addition, as a member of the European Union, the UK is bound by Directives 2009/147/EC and 92/43/EEC (generally referred to as the Birds Directive and Habitats Directive, respectively). Among other requirements, these international Conventions and European Directives oblige the UK to monitor its waterbirds and provide for their conservation (for further details, see [www.jncc.gov.uk/page-1359](http://www.jncc.gov.uk/page-1359)).

The monitoring of waterbirds in Britain is typically undertaken by collating sample counts to derive interannual population trends, i.e. the relative numbers of a species present in one year compared with the numbers in another. However, there are cases where it is necessary to know not just relative numbers, but population sizes as well. These include the application of criteria supporting the Ramsar Convention; Criterion 6 says that a wetland is considered internationally important if it regularly holds at least 1% of the individuals in a biogeographic population of one species or subspecies of waterbird. Knowledge of population size is also important when assessing threat and extinction risk,

in understanding resource use and interspecific competition, and in assessing the potential effects of avian diseases. It should be noted that population estimates are required at both national and international levels; waterbird monitoring data from Britain are thus passed on to the International Waterbird Census and so contribute to the regular *Waterbird Population Estimates* publications (e.g. Wetlands International 2006).

Given the need to work with reasonably up-to-date estimates, and given that many species are showing clear changes in recent status in Britain, it is timely to reassess the

numbers of waterbirds overwintering in Britain. Such assessments have previously been undertaken approximately once every ten years, the most recent being those described by Kershaw & Cranswick (2003) for wildfowl and by Rehfisch *et al.* (2003) for coastal waders. Both of those papers relied largely on data from the period 1994/95 to 1998/99. The aim of this paper is to update these estimates (and the corresponding 1% thresholds for determining site importance), principally by making use of new data but also by considering new analytical approaches for particular species.



Richard Chandler

**206.** Black-tailed Godwits *Limosa limosa*, Snettisham, Norfolk, April 2010. In the early part of the winter at least, over 95% of Black-tailed Godwits and almost all Bar-tailed Godwits in Britain occur on estuaries, so WeBS counts of these two species produce a clear and accurate picture of totals and trends. These show a substantial decline in wintering Bar-tails in recent years (the current estimate is 38,000); moreover, the Bar-tailed to Black-tailed ratio has now fallen from 4:1 to less than 1:1 in a single decade.

## Scope

### Geographic area

This assessment covers Great Britain, including the offshore islands of England, Scotland and Wales (such as Shetland, Orkney, the Outer Hebrides, Anglesey, the Isles of Scilly and the Isle of Wight). However, the Isle of Man and the Channel Islands are omitted. Estimates of non-breeding waterbirds in Northern Ireland are traditionally considered alongside those in the Republic of Ireland; the latest all-Ireland estimates were published by Crowe *et al.* (2008). For birds making use of the sea, the estimates presented here attempt to stick broadly to birds visible from the shore, although for a number of species, notably Red-throated Diver *Gavia stellata* and Common Scoter *Melanitta nigra*, concentrations of birds located by aerial survey farther offshore have also been included as discussed in individual species accounts.

### Timescale and season

Most data used in the analyses relate to counts made in the five winters between 2004/05 and 2008/09 (although more recent counts were available for several species). The overwinter period, for the purposes of the estimates presented in this paper, is defined as September to March for the majority of species. It should be noted that this differs from the period used for some previous estimates, for example Rehfish *et al.* (2003), in which wader estimates were all based on data collected during November to March. Wader counts for September and October were omitted from previous estimates owing to concerns about passage birds inflating the winter numbers. However, among the more numerous species, only Ringed Plover *Charadrius hiaticula* and Sanderling *Calidris alba* show very pronounced peaks in numbers on passage compared with those during the winter, and these typically occur in August and May (which are omitted from the analyses here). A number of less abundant waders, however, show peak numbers at times of passage, with far higher numbers in autumn than remain for the winter. Although it is not always straightforward to define a

clear demarcation between seasons, examination of WeBS data suggests that, for a useful estimate of the size of the wintering population, data for November to March only should be considered for Little Stint *C. minuta*, Whimbrel *Numenius phaeopus*, Common Sandpiper *Actitis hypoleucos*, Spotted Redshank *Tringa erythropus* and Greenshank *T. nebularia*. Therefore, estimates for these five waders have been calculated based on the period November to March.

### Species and populations covered

Previous papers presenting British population estimates of waterbirds have tended to focus on either wildfowl or waders, owing to the manner in which monitoring has historically been organised in Britain. This paper represents the first occasion that new estimates have been presented for both of these main groups together, in addition to estimates for divers (Gaviidae), grebes (Podicipedidae), cormorants (Phalacrocoracidae), herons and allies (Ardeidae), rails (Rallidae) and gulls (Laridae).

All species on Category A or C of the BOU's British List were considered for inclusion. Rarer species – those on the BBRC list



Mike Lane

**207.** Male Mallards *Anas platyrhynchos*, UK, October 2005. The Mallard is one of the more difficult wildfowl species to survey accurately, by virtue of the fact that it occurs widely throughout the British countryside as a whole, rather than being found predominantly on the larger waterbodies that are well covered by WeBS counters.





Mike Lane

**208.** Slavonian Grebe *Podiceps auritus*, Worcestershire, March 2010. The small numbers of Slavonian Grebes that occur at inland sites in England are paid the most attention by birders but the majority of those wintering in Britain are found in sheltered coastal waters in the north and west, from the Solway northwards, and particularly in the Northern Isles and Outer Hebrides; the population in Orkney alone may be in excess of 300.



Mike Lane

**209.** Northern Lapwings *Vanellus vanellus*, Lancashire, December 2009. In contrast to those waders whose distribution is predominantly coastal, Lapwings occur in many terrestrial as well as wetland habitats, which makes estimation of the total population that much more difficult. Some 620,000 are estimated to occur in Britain in winter, which is a major decline from the previous estimate of 1,500,000 (Cayford & Waters 1996), although the uncertainty around the figures demands that caution about the extent of the decline is needed. Nonetheless, the UK breeding population declined by about 50% between 1982 and 2007, which matches the situation farther afield in Europe, and supports the likelihood of a significant decline.

(see Hudson *et al.* 2010) or in the reports of scarce migrant birds (e.g. Fraser & Rogers 2006) – have been omitted. Given that the focus is on non-breeding birds, terns have been excluded, since they are predominantly summer visitors to Britain. The following species were also omitted, being almost exclusively summer or passage migrants to Britain: Garganey *Anas querquedula*, Corn Crane *Crex crex*, Stone-curlew *Burhinus oedicephalus*, Little Ringed Plover *Charadrius dubius*, Dotterel *C. morinellus*, Curlew Sandpiper *Calidris ferruginea* and Wood Sandpiper *T. glareola*. However, some other species which occur more commonly in the summer or passage periods, such as Whimbrel and Common Sandpiper, are included as they form a small but regular component of the British wintering waterbird assemblage, and because wintering numbers of these species may increase in future according to current climate-change predictions. Kittiwake *Rissa tridactyla* was omitted, since outside the breeding season it occurs mostly far offshore. Similarly, Little Gull *Hydrocoloeus minutus* has been excluded, given that it occurs in Britain principally as a passage species, and also that, especially in winter, the majority of birds are to be found offshore. Finally, although Water Rail *Rallus aquaticus* population estimation was considered carefully, and is discussed in detail below, it was concluded that no estimate was currently possible for this species.

Although waterbirds are most frequently considered at the species level, it is now a well-established practice (both in terms of monitoring and in terms of species conservation) to cover clearly differentiated populations separately, as discrete units of conservation management (Scott & Rose 1996; Wetlands International 2006; Delany *et al.* 2009). In a British context, this applies most clearly to several species of geese, where there are well-defined, discrete populations, and here we present separate estimates for recognised subspecies or populations of Bean *Anser fabalis*, White-fronted *A. albifrons*, Greylag *A. anser*, Barnacle *Branta leucopsis* and Brent Goose *B. bernicla*. In addition, we follow the recommendations of Scott & Rose (1996) and Furness *et al.* (2010) and treat Common Eiders *Somateria mollissima* on

Shetland as a separate population from those elsewhere in Britain (although we have not followed the taxonomic recommendation of Furness *et al.* (2010), since BOU has yet to recognise this population as belonging to the subspecies *faeroeensis*). Population delimitation is discussed in table 2 for other species that have more than one recognised population wintering in Britain.

It should be noted that, although population estimates are presented for the more numerous non-native species (BOU Category C), selection of protected areas for these species in Britain would be inappropriate (and has no legal basis) and so 1% population thresholds are not presented.

### Methods

#### Count data

Given the wide range of species considered, there is no single survey or approach that can produce satisfactory population estimates for all British waterbirds. Despite an impressive effort by dedicated volunteer counters, there will always be birds that go unrecorded, even in such a well-surveyed country as Britain. Estimating the uncounted proportion of any population remains a continuing challenge. For this paper, a range of data sources has been used to determine both the counted and the uncounted proportions of each population, with the most appropriate methods of estimation being selected for each species.

The most comprehensive monitoring of Britain's waterbirds is carried out by the Wetland Bird Survey (WeBS). Pre-defined wetland sites are visited monthly by volunteers, the majority of counts being carried out on a pre-selected date to minimise the risk of birds that move between sites being double-counted. WeBS counts take place throughout the year, but coverage is substantially higher between September and March. Over 2,000 sites are counted each year, with many of the larger sites subdivided into smaller count units and covered by co-ordinated teams (Calbrade *et al.* 2010).

Coverage by WeBS is excellent for estuaries, and very good for the larger inland still waterbodies in lowland Britain. Coverage of smaller lowland still waters, upland still waters, rivers and the open coast (between estuaries) is much less complete, however,

while offshore habitats are particularly challenging in terms of obtaining satisfactory coverage. Although the largest concentrations of most species of waterbirds are covered by WeBS, these other habitats collectively add up to a large resource that is utilised by different species to a greater or lesser extent. Moreover, some species of ‘waterbird’ use more terrestrial habitats, either for part of the day (such as many geese and gulls, feeding on land but returning to waterbodies to roost) or more generally (such as European Golden Plover *Pluvialis apricaria*, Northern Lapwing *Vanellus vanellus* and, the most extreme case, Woodcock *Scolopax rusticola*).

Although WeBS regularly covers some important stretches of the non-estuarine coasts of Britain, most of the rocky and sandy shores are surveyed on a roughly decadal basis only, by a one-off midwinter count of a large proportion of the coast. Since the coast of Britain is too long to cover in its entirety, count stretches are selected randomly to allow reliable estimation of the total numbers of birds using the open coasts (Austin 2008). The latest such Non-estuarine Coastal Waterbird

Survey (NEWS) was undertaken in January 2007, making it ideal for incorporation into the current population estimates.

Some populations of geese and swans using wetlands as safe overnight roosts are missed during daytime WeBS counts. These species are well monitored by the Goose & Swan Monitoring Programme (GSMP), an umbrella scheme which includes several detailed surveys of these populations. Counts are generally undertaken either at daytime feeding locations or as birds fly to or from nocturnal roosts, as appropriate.

While this paper generates new estimates for the majority of species, for some others (e.g. Red-throated Diver, Golden Plover, Lapwing) recent population estimates have been published based on detailed consideration of those species; in such cases, we simply present the estimate from these recent sources. Similarly, wintering gulls are typically highly dispersed during the day and have thus been counted at nocturnal roosts on a decadal basis, the latest such undertaking being the Winter Gull Roost Survey (WinGS) carried out from 2003/04 to



Richard Chandler

**210.** Little Egret *Egretta garzetta*, Norfolk, July 2010. The spread of the Little Egret is one of the most striking of the population changes described in this paper – from a BBRC rarity to a wintering population of at least 4,500 individuals in little over 20 years. The species now occurs widely inland in southern Britain, and along most parts of the coastline of England and Wales.

2005/06. The estimates of the more numerous gull species generated from this survey are described in Banks *et al.* (2007) and are simply repeated here.

Finally, for many of the scarcer species, we have compiled supplementary information from various sources, including BirdTrack, some preliminary information from the currently ongoing Bird Atlas 2007–11 project, the BirdGuides database, reports of dedicated aerial and boat-based surveys and, significantly, recent county bird reports. In other cases, the approach to producing an estimate has involved demographic data, such as breeding population size and measures of productivity and survival. For a small number of species, information from ring-recovery rates and shooting-bag returns has also been incorporated. Such species-specific approaches are described in more detail in the results.

### Extrapolation to uncounted sites

There have been a number of approaches in the past to try to estimate the number of inland birds missed by the main counting schemes. Jackson *et al.* (2006) described a Dispersed Waterbirds Survey (DWS), which asked volunteers to count waterbirds in randomly selected 1-km squares in the winter of 2002/03. This survey generated population estimates for a number of the more widespread species, and these estimates have been considered as part of the current work and are referred to alongside the results below.

Kershaw & Cranswick (2003), following Kirby (1995), used extrapolation factors for the more widespread wildfowl species; these factors were used to multiply up the numbers of birds found during WeBS. The factors were based on three intensive studies in several parts of England, and effectively compared the number of each species counted during an attempt at 'complete' coverage, with the number counted at the standard WeBS sites. While this is a sensible approach, there are a number of potential issues. First, using extrapolation factors in this way makes the assumption that the same proportion of a species will remain on counted sites into the future, even if the actual number increases or declines. Second, while each of these three intensive studies certainly provided greatly

enhanced coverage, they were not able to cover the entire habitat spectrum utilised by all species of waterbirds. For example, Moorhens *Gallinula chloropus* can be found in small drainage ditches, garden ponds, pools in damp woodland, etc. The extrapolation factors calculated from these studies are likely to be more valid for those species restricted to medium/large still waters (e.g. Common Pochard *Aythya ferina*, Shoveler *Anas clypeata*), and less valid for those species which are distributed more widely across the landscape (e.g. Moorhen, Mallard *A. platyrhynchos*). Third, using extrapolation factors derived solely from these three studies makes the assumption that they are representative of the whole of the British landscape. Although not unreasonable, especially given that one of them covered a large area of northwest England, there may have been an under-representation of some landscape types, notably lowland farmland and mountain/moorland (although the latter supports relatively few waterbirds in winter, and so under-recording in this habitat type may be a less important issue). Finally, the study in northwest England was carried out during a period of cold weather, which may have caused birds to congregate more than normal on larger sites, leading to a lower extrapolation factor than in a more typical winter.

Despite such reservations, this method is still a reasonable way of estimating the number of non-counted birds, and remains the best possible approach given current data availability. A similar approach is adopted in this paper, with two further datasets being used to enhance the extrapolation factors. First, the Teesmouth Bird Club kindly made available the results of the Cleveland Water Body Survey (Sharp 2008; James 2009) from the winters of 2006/07 and 2008/09 (although only the former was used for the current analysis, as coverage was higher in that winter), the aim of which was to investigate how many waterbirds occurred on sites away from standard WeBS sites. Very good coverage was obtained of the lakes and larger ponds in Cleveland, as well as the River Tees; smaller rivers and very small ponds were not included. Second, during the winters 1999/2000 to 2006/07, a Norfolk Bird Atlas project was carried out (Taylor & Marchant



**Table 1.** Extrapolation factors derived from five UK studies designed to identify the proportion of common waterbirds missed by standard survey techniques.

Species	NW Eng Jan 1991	NE Eng Jan 1993	SW London Jan 1993	Cleveland 2006–07	Norfolk 1999/00– 2006/07	MEAN
Mute Swan <i>Cygnus olor</i>	1.79	1.52	1.64	2.60	5.48	2.61
Greylag Goose <i>Anser anser</i> *	————	1.72	————	1.06	3.10	1.96
Canada Goose <i>Branta canadensis</i>	1.32	1.71	1.62	1.78	4.84	2.25
Common Shelduck <i>Tadorna tadorna</i>	1.01	1.08	n/a	1.01	1.00	1.02
Eurasian Wigeon <i>Anas penelope</i>	1.02	1.15	1.00	1.06	1.00	1.05
Gadwall <i>Anas strepera</i>	1.30	1.11	1.09	1.06	1.37	1.18
Eurasian Teal <i>Anas crecca</i>	1.20	1.40	1.03	1.24	1.16	1.21
Mallard <i>Anas platyrhynchos</i> **	(1.57)	(2.13)	(1.43)	(3.82)	4.00	4.00
Pintail <i>Anas acuta</i>	1.00	n/a	n/a	1.01	1.00	1.00
Shoveler <i>Anas clypeata</i>	1.27	n/a	1.18	1.19	1.01	1.16
Common Pochard <i>Aythya ferina</i>	1.18	1.25	1.10	1.18	1.38	1.22
Tufted Duck <i>Aythya fuligula</i>	1.34	1.43	1.17	1.44	2.02	1.48
Goldeneye <i>Bucephala clangula</i>	1.36	1.24	1.02	1.09	1.60	1.26
Goosander <i>Mergus merganser</i>	1.92	4.47	1.48	1.25	5.65	2.95
Little Grebe <i>Tachybaptus ruficollis</i>	1.43	n/a	n/a	1.21	3.72	2.12
Great Crested Grebe <i>Podiceps cristatus</i>	1.63	n/a	1.16	1.04	2.36	1.55
Great Cormorant <i>Phalacrocorax carbo</i>	1.19	1.50	1.04	1.12	3.14	1.60
Moorhen <i>Gallinula chloropus</i> **	n/a	n/a	n/a	(3.10)	16.78	16.78
Common Coot <i>Fulica atra</i>	1.54	1.27	1.10	1.14	1.77	1.36

## Notes

n/a: no estimates presented in those studies

\* These are British-breeding Greylags. No extrapolation factors for re-established Greylag Goose were presented by Kirby (1995). Kershaw & Cranswick (2003) included a value of 1.72 based on additional data from a Naturalised Goose Survey in summer 1991.

\*\* Extrapolation factors for Mallard and Moorhen are based only on the Norfolk study, given that these species occur in many habitats in the wider countryside that were not covered in the other studies.

2011). Counts were made of all species within each tetrad in Norfolk across the winter period, and the results were available to us.

The extrapolation factors from these five studies for a number of common and widespread species are presented in table 1. A range of values is apparent, with those from Norfolk often noticeably higher than the others. This may be due, in part, to waterbird densities being relatively high in this lowland county, which has extensive areas of wetland habitat, notably in the Fens and the Norfolk Broads. However, the most important factor is likely to be that data were collected across all habitats, not only larger still waters, and so the assessment of the numbers of some species present in the wider countryside is likely to be more complete. Given the range of extrapolation factors estimated for the different regions, it was considered that a mean

of the factors generated from the five individual studies would be most appropriate to produce the updated population estimates for most species. The exceptions were Moorhen and Mallard, which were considered to be such widespread species that they would be under-represented by all but the Norfolk study.

## Analytical methods

### WeBS & NEWS

For the majority of waterbird populations, data from all British WeBS sites were extracted from the WeBS database. While coverage of the key sites is generally excellent, there are inevitably occasions when the regular sites go uncounted. To deal with the issue of missing counts, estimates are produced by standard WeBS processing methods (Thaxter *et al.* 2010). Estimated counts were examined by eye to guard against any risk of



**211.** Ringed Plovers *Charadrius hiaticula* in flight, Anglesey, April 2009. Wintering Ringed Plovers in Britain are of the nominate form, but birds of two other subspecies, *C. h. tundrae* and *C. h. psammodyma*, pass through Britain on migration. The majority of these Ringed Plovers are thought to be *psammodyma* still moulting into breeding plumage (note the largely dark bills of most of the birds – unlike *tundrae* and *psammodyma*, nominate *hiaticula* has no non-breeding plumage as such).

Richard Chandler

unsuitable estimates being generated, with just a few such counts being removed as a result.

The sites in the WeBS dataset are classified as ‘inland’, ‘estuarine’, or ‘non-estuarine coastal’. It is thus possible to sum counts across sites to obtain a total (per species/month/year) for each of these three broad habitat classes. As stated earlier, WeBS is known to cover only a relatively small proportion of Britain’s non-estuarine coasts, whereas NEWS gives good estimates of the total numbers of birds present in this habitat. Since NEWS was a single count, in January 2007, an estimated NEWS-equivalent total for each month of the five winters under consideration was generated, by using the ratio of the non-estuarine WeBS total (in any given month) to the non-estuarine WeBS total in January 2007. Then, for each month, the non-estuarine component of the WeBS total was replaced with the estimated NEWS-equivalent.

Following this, totals were summed across these three broad habitat classes. For each species, for each of the five winters 2004/05 to 2008/09, the peak monthly British total was then selected, and then the means of these winter peaks over the five winters were calculated for each species. These ‘five-year peak-means’ represent the entire coast (estuarine and non-estuarine), plus counted

inland WeBS sites. Thereafter, for the species in table 1, estimates were scaled upwards by the extrapolation factors listed, to allow for the unsurveyed population component.

### Censuses

For eight swan and goose populations, estimates are best based on the extensive national censuses that are carried out at regular intervals. For Taiga Bean Goose *Anser f. fabalis*, Pink-footed Goose *Anser brachyrhynchus*, Greenland White-fronted Goose *Anser albifrons flavirostris*, Icelandic Greylag Goose and Svalbard Barnacle Goose, such census values are available annually. In the cases of Taiga Bean Goose, Greenland White-fronted Goose and Icelandic Greylag Goose, the mean value of the five most recently available census totals (2005/06 to 2009/10) was used as the population estimate. However, both Pink-footed Goose and Svalbard Barnacle Goose have shown sustained increases over recent years and a five-year mean substantially underestimates their population sizes; in these two cases, the census value from the most recent winter was used as the estimate. Bewick’s Swan *Cygnus columbianus*, Whooper Swan *C. cygnus* and Greenland Barnacle Goose are censused on a periodic basis and so for these populations, the most recently available national census was used for the estimate.

### Compilations

For 19 populations, estimates were derived by subdividing Britain into regions, generally standard bird recording areas (Ballance & Smith 2008) but sometimes broader sea areas, such as the Moray Firth, depending on the nature of the species involved. Estimates for each region were produced through expert opinion following examination of multiple datasets. This is broadly the same approach as that taken by Kirby *et al.* (1993) and Kershaw & Cranswick (2003). In summing regional estimates to produce a British estimate, account was taken (so far as possible) of major movements. For example, peak numbers of Common Scoters on the Solway Firth occur during passage, and thus peak numbers there were not added to peaks from wintering sites farther south (Hartley 2007).

### Existing sources

For 12 populations, other detailed studies have recently produced published British estimates. In these cases, the estimates from these studies are simply collated here.

### Miscellaneous

For the remaining five populations (Shag *Phalacrocorax aristotelis*, Grey Heron *Ardea*

*cinerea*, Jack Snipe *Lymnocyptes minimus*, Common Snipe *Gallinago gallinago* and Woodcock), none of the approaches above were suitable and the methods used to produce the estimate are described in table 2.

### Results

Population estimates for wintering waterbirds in Britain are presented in table 2, along with notes on their derivation to aid the task of updating the estimates in future years. For each species, or defined population, the new recommended British non-breeding estimate is presented. For most populations, a 1% threshold value is also given for purposes of site assessment. Threshold values are not presented for non-native species as there is no legal basis for site assessment for these species. Estimates and thresholds have been rounded as follows:

Unrounded estimate	Estimate rounded to	1% threshold rounded to
1–100	nearest 1	nearest 1
101–1,000	nearest 10	nearest 1
1,001–10,000	nearest 100	nearest 1
10,001–100,000	nearest 1,000	nearest 10
100,001–1,000,000	nearest 10,000	nearest 100
>1,000,000	nearest 100,000	nearest 1,000



Richard Chandler

**212.** Sanderlings *Calidris alba*, Norfolk, February 2008. Sanderlings are more or less entirely coastal in the non-breeding season, with over a third found on non-estuarine stretches of the British coastline. Numbers have declined since the last estimate, although that trend appears to be solely due to the situation on open coastlines, as the counts from estuarine areas have remained steady or increased overall.

It should be noted that where 1% of the national population is less than 50 birds (i.e. the national population is less than 5,000), 50 is normally used as the minimum qualifying threshold for the designation of sites of importance (Stroud *et al.* 2001).

As discussed above, different methods have been used in determining estimates for different species and populations, and these methods are indicated in table 2. Inevitably, given the range of species involved, and the variety of data sources and analytical approaches required, a variable level of confidence can be attached to each estimate. Following the approach taken by the Avian Population Estimates Panel (Baker *et al.* 2006), a reliability score has been assigned to each estimate. This score is simply a broad judgement by the authors. A score of 1 is given to an estimate based on good-quality counts of a large proportion of the individuals involved; a score of 2 is given to an estimate which is heavily based on count data but for which these data have had to be extrapolated to a large degree; and a score of 3 is given to an estimate which is not strongly based on actual count data and/or for which large assumptions have had to be made.

### Discussion

The combined estimates for the 92 populations presented in this paper suggest that Britain is host to at least 12.5 million overwintering waterbirds each year. For 15 of the species or populations, the winter estimates presented in this paper are the first to be formally published. All of the estimates presented are felt to provide the best possible representation of current numbers of non-breeding waterbirds in Britain, and it is recommended that these figures are used for all relevant purposes from now until such time as they are updated. The estimates continue to underline the immense importance of Britain for many of the species involved, and will underpin the ongoing implementation of conservation policy for wetlands and waterbirds. Future *Waterbirds in the UK* reports<sup>1</sup> will use the new thresholds to list sites supporting nationally important numbers of

each species or population; there will clearly be some marked changes in the numbers of such sites for many species as a result of these new estimates.

For the majority of non-breeding waterbirds in Britain, estimates were last produced based on data from 1994/95 to 1998/99. The new estimates presented here, based largely on the period 2004/05 to 2008/09, show many changes. Some of these clearly reflect large-scale population changes. For example, numbers of species such as Avocet *Recurvirostra avosetta*, Gadwall *Anas strepera* and, especially, Little Egret *Egretta garzetta* increased substantially over the intervening decade, while those of other taxa, such as Greenland White-fronted Goose, Dunlin *Calidris alpina* and Pochard, have declined seriously. However, for other species, the change in population estimate may not be an accurate reflection of real changes in abundance but more to do with variation in the methods used to produce the estimates, typically an improvement in data collection. For example, the population estimate of Mallard published here is more than twice that in Kershaw & Cranswick (2003). This is at odds with the trend in winter numbers of Mallard, which is known to be one of steady decline (21% over the ten-year period to 2006/07; Thaxter *et al.* 2010). The discrepancy arises from a change in the extrapolation factor used to scale the numbers counted by WeBS, from 1.71 previously to 4.00 now. For most species, population change is best reflected by reference to annual indices as published each year in *Waterbirds in the UK* (e.g. Calbrade *et al.* 2010).

The extrapolation factors (table 1) used to account for waterbirds on uncounted sites have to be acknowledged as one of the least precise elements in producing estimates of more widespread species. The range of values in table 1, arising from the different studies, emphasises the difficulty in understanding how best to account for unsurveyed sites. While it is felt that the factors presented here are the best possible at the present time, there

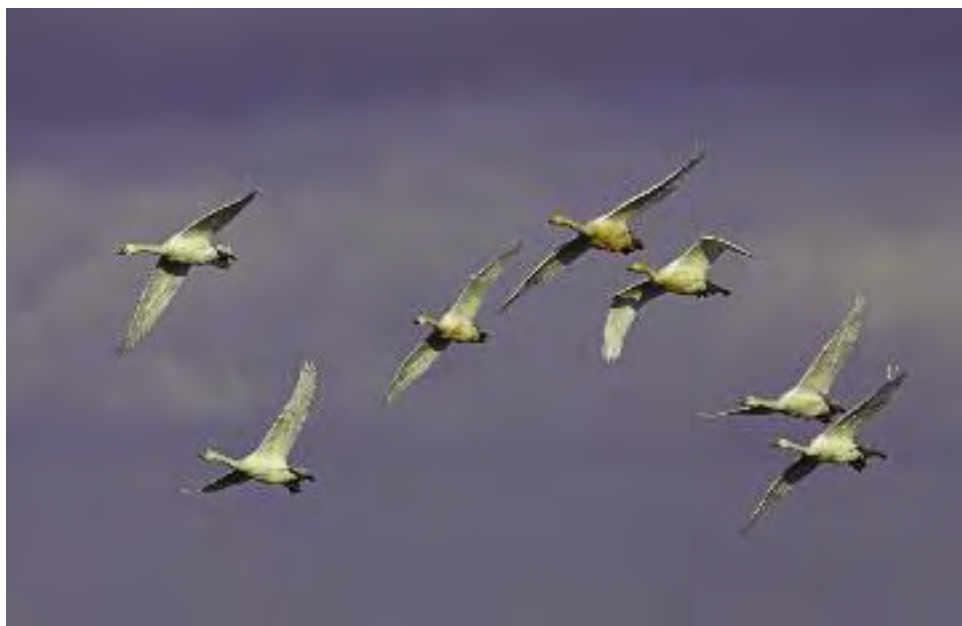
*continued on page 393*

<sup>1</sup> *Waterbirds in the UK* reports are available at [www.bto.org/volunteer-surveys/webs/publications/annual-reports](http://www.bto.org/volunteer-surveys/webs/publications/annual-reports)



**Table 2.** Population estimates for wintering waterbirds in Britain.

Species/population	Estimate	1% threshold	Method	Reliability
<b>Mute Swan</b> <i>Cygnus olor</i>	74,000	740	1	2
Mute Swans are widespread in the British lowlands. The estimate was derived from WeBS Core Counts extrapolated by a factor of 2.61. The resulting estimate is within the range suggested by the DWS (94,000, range 62,000–130,000) but is somewhat higher than implied by the breeding census from spring 2002 (Ward <i>et al.</i> 2007), which found 31,700 birds at the start of the breeding season, even allowing for the addition of another breeding season's cohort of young birds onto that estimate.				
<b>Bewick's Swan</b> <i>Cygnus columbianus</i>	7,000	70	2	1
A complete census of Bewick's Swans is carried out every five years across northwest Europe, the most recent available being that for January 2005, when 6,992 birds were found in Britain (Worden <i>et al.</i> 2006). The results of the January 2010 census were not available in time for inclusion in these estimates.				
<b>Whooper Swan</b> <i>Cygnus cygnus</i>	11,000	110	2	1
The census regime is similar to that for Bewick's Swan (above); the January 2005 census found 10,716 birds (Worden <i>et al.</i> 2009), while that from January 2010 was not available for these estimates. In Kershaw & Cranswick (2003), WeBS data were extrapolated by a factor of 1.49 but, given that there is a five-year census of this species, it seems unnecessary to employ this technique. The majority of birds wintering in Britain are from the Icelandic breeding population, although it appears that small numbers of birds breeding in Scandinavia and north European Russia occur here also (about 200 according to Laubek <i>et al.</i> 1998).				
<b>Taiga Bean Goose</b> <i>Anser fabalis fabalis</i>	410	4	2	1
The two main wintering flocks, on the Slamannan Plateau (Clyde/Upper Forth) and in the Yare Valley (Norfolk), are counted frequently each winter. The peak winter counts of each of these two flocks were summed (with the small numbers of other birds detected by WeBS added also) and then averaged over winters 2005/06 to 2009/10. It was assumed that, away from the two key areas, any 'Bean Geese' not identified to subspecies referred to Tundra Bean Geese.				



Simon Stirrup

**213.** Bewick's *Cygnus columbianus* and Whooper Swans *Cygnus cygnus* coming in to land at wintering grounds in Cambridgeshire, November 2007. A complete census of both species is carried out every five years and the most recent data suggest that around 7,000 Bewick's Swans and 11,000 Whooper Swans winter in Britain.

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Tundra Bean Goose</b> <i>Anser fabalis rossicus</i>	320	3	1	1
<p>Tundra Bean Geese occur in very variable numbers each year, but peak numbers generally occur in January and February and in southeast England. Analysis of WeBS data alone from 2004/05 to 2008/09 suggested a mean of 65 (range 8–239). However, given that Tundra Beans are rather unpredictable in their occurrence, and are often detected away from counted wetlands, a more detailed assessment was undertaken using BirdTrack and BirdGuides data. Where possible, duplicate counts of birds from adjacent sites were omitted, producing a mean total of 322 (range 166–811). It was assumed that, away from the two key wintering areas for Taiga Bean Geese, any unidentified 'Bean Geese' were Tundras.</p>				
<b>Pink-footed Goose</b> <i>Anser brachyrhynchus</i>	360,000	3,600	2	1
<p>Pink-footed Geese are monitored by the Icelandic-breeding Goose Census (part of the GSMP). The vast majority of birds are counted as they arrive at, or leave, nocturnal roost sites. Numbers have increased steadily over recent years, and the estimate used is the rounded peak British count from autumn 2009, the latest available (Mitchell 2010).</p>				
<b>European White-fronted Goose</b> <i>A. albifrons albifrons</i>	2,400	24	1	1
<p>The European White-fronted Goose population is relatively well covered by WeBS. However, cold-weather influxes from the continent are not infrequent, so some supplementary data were used to improve the estimate, for the winters 2004/05 to 2008/09. In addition, counts were incorporated for the important site of Heigham Holmes, which is not currently surveyed for WeBS (data from the <i>Norfolk Bird Report</i>). The numbers missed are likely to have been negligible.</p>				
<b>Greenland White-fronted Goose</b> <i>A. a. flavirostris</i>	13,000	130	2	1
<p>The Greenland White-fronted Goose population is one of the best monitored populations of birds in Britain, if not the world. The vast majority of the population is censused twice each winter. The estimate here is the mean of the peak count of birds in Britain from the five winters 2005/06 to 2009/10. Although there has been a steady decline since 2000, over this five-year period the trend began to level out somewhat.</p>				
<b>Icelandic Greylag Goose</b> <i>Anser anser</i>	85,000	850	2	2
<p>Icelandic Greylag Geese are surveyed in a similar manner (and frequently at the same time) as Pink-footed Geese (see above). The estimate here is the mean of the peak counts from the five autumns 2005–09. The estimate is given a reliability rating of 2, however, because of the difficulty in parts of northern Scotland in determining how many Greylags are Icelandic breeders and how many are British breeders.</p>				
<b>British Greylag Goose</b> <i>Anser anser</i>	140,000	1,400	1/3	2
<p>The Greylag Goose was once a widespread breeding species across much of Britain, but numbers declined greatly in the nineteenth century, probably due largely to habitat change and over-hunting, until native breeders remained only in parts of northwest Scotland, especially the Outer Hebrides. In the twentieth century, however, breeding populations became re-established successfully across several parts of the former range. For many years, the northwest Scotland breeders and the re-established birds have been treated as separate populations. However, as both the remnant and the re-established populations have spread towards each other in Scotland, it is no longer possible to distinguish the two, and they are combined from now on as this single population. A dedicated survey of breeding Greylag Geese in Scotland (Mitchell <i>et al.</i> 2010) estimated a post-breeding total of 47,405 birds. In England and Wales, WeBS data can be scaled up by an extrapolation factor of 1.96 to yield 89,315 birds in September, and the British estimate presented here is the rounded sum of these two estimates.</p>				
<b>Snow Goose</b> <i>Anser caerulescens</i>	180	n/a	4	2
<p>This is an approximate assessment of the combined numbers of wild, naturalised and other birds present in Britain, derived largely from a combination of data from WeBS and county bird reports. The naturalised flock of Snow Geese on Coll has numbered between 25 and 45 birds in recent years (J. Bowler pers. comm.). Elsewhere, double-figure counts are known from Oxfordshire, Yorkshire, Sussex and Lancashire, although there has been a major decline in numbers on the Berkshire/Hampshire border (Clark 2009). In addition, wild birds occur each winter with flocks of other goose species; numbers are difficult to determine, given that the same individuals clearly move around the country with their 'carrier' flocks, but in recent years have probably involved fewer than ten individuals per winter.</p>				

Species/population	Estimate	1% threshold	Method	Reliability
<b>Canada Goose</b> <i>Branta canadensis</i>	190,000	n/a	1	2
The estimate here is based on WeBS counts, scaled upwards by a factor of 2.25. In comparison, the DWS produced an estimate of 174,000 (range 97,000–383,000), which is relatively consistent with that presented here, especially given the continuing increase since the time of that survey.				
<b>Greenland Barnacle Goose</b> <i>Branta leucopsis</i>	58,000	580	2	1
Greenland Barnacle Geese winter widely across many (sometimes remote) islands and coastal areas in north and west Scotland (and northwest Ireland). Although many of the most important sites are surveyed annually, the entire population is censused every five years. During the March 2008 census, 58,269 geese were found in Britain (Mitchell <i>et al.</i> 2008).				
<b>Svalbard Barnacle Goose</b> <i>Branta leucopsis</i>	33,000	330	2	1
A population estimate is calculated each winter by WWT for Barnacle Geese on the Solway Firth, by taking an average of all counts that fall within 10% of the peak count for the winter, and then rounding down to the nearest 100 as a guard against possible double-counting (Griffin 2010). Such estimates have increased consistently in recent years, and so the population estimate presented here is that for the latest available winter, 2009/10, when there were thought to be 32,800 birds on the Solway. In addition, much smaller numbers of birds from this population occur at several other sites but by midwinter, when peak numbers are present on the Solway, WeBS data suggest that only about 100 birds remain at other sites in northeast England and eastern Scotland.				
<b>Naturalised Barnacle Goose</b> <i>Branta leucopsis</i>	2,700	n/a	4	2
Away from the main wintering areas of the two previous populations, Barnacle Geese are now resident in many areas of Britain. Consideration of WeBS data alone suggests more than 1,300 birds. However, it is known that some flocks are either missed or covered only sporadically by WeBS. Barnacle Geese will make use of small (often ornamental) lakes in the wider countryside, often away from major wetlands. A compilation of data from recent county bird reports yielded the higher estimate of about 2,700 birds. Key concentrations occur on the inner Humber, the Ouse valley in Bedfordshire and the Suffolk coast, among others. There remains some uncertainty about the provenance of the flock that winters on the Dyfi Estuary in west Wales, but it seems most likely that these are birds from the Greenland population. In addition, it seems clear that at least some birds from the large Dutch wintering population occur in south-east England in some winters, although the scale of this is difficult to ascertain.				
<b>Dark-bellied Brent Goose</b> <i>Branta bernicla bernicla</i>	91,000	910	1	1
Dark-bellied Brent Geese occur almost exclusively in, or close to, estuarine habitats. This estimate, based solely on WeBS Core Counts, with no extrapolation for missed sites, is still considered to be highly accurate.				
<b>Canadian Light-bellied Brent Goose</b> <i>B. b. hrota</i>	710	7	1	1
This population of Brent Geese, now numbering about 38,000 birds, winters predominantly in Ireland. Numbers in Britain are relatively low, but appear to be increasing in line with the overall population. Most birds occur along western coasts, especially around Anglesey. Small numbers of Light-bellied Brent Geese are also noted each winter on the south coast of England; although they may well involve birds from both this and the next population, they are now all nominally assigned to this one, based on sightings of marked birds.				
<b>East Atlantic Light-bellied Brent Goose</b> <i>B. b. hrota</i>	3,400	34	1	1
Brent Geese from this population, breeding mostly on Svalbard, winter largely on the mudflats adjacent to Lindisfarne, Northumberland, which is well covered by WeBS. Small numbers of Light-bellied Brents elsewhere along the east coast are also usually assigned to this population, although the handful of birds on the south coast of England are now nominally assigned to the Canadian population, based on sightings of marked birds.				

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Egyptian Goose</b> <i>Aloochen aegyptiaca</i>	3,400	n/a	4	2
<p>WeBS data alone produced an estimate of 791, which is clearly far too low for this species. Taylor &amp; Marchant (2011) suggested that about 1,500–2,000 occur in Norfolk alone in midwinter (data from 1999 to 2007), where the species is widespread in the wider countryside away from core wetland sites. Egyptian Geese are also now becoming increasingly common away from East Anglia, especially to the west of London, although given the more recent colonisation of this area it seems likely that birds there will still be more localised, around gravel-pits and larger lakes. A compilation of data from WeBS and recent county bird reports results in a total British estimate of about 3,400 birds, the vast majority of which occur in England.</p>				
<b>Common Shelduck</b> <i>Tadorna tadorna</i>	61,000	610	1	1
<p>Numbers of Shelducks were estimated from WeBS, extrapolated upwards by 1.02. Outside the breeding season, Shelducks are confined mostly to estuaries and to some larger inland waterbodies, and it is unlikely that more than a handful are missed by the WeBS Core Counts.</p>				
<b>Mandarin Duck</b> <i>Aix galericulata</i>	7,000	n/a	3	3
<p>The retiring nature of this non-native species makes it one of the hardest British birds to estimate numbers for. WeBS data alone account for only about 650 birds, while a collation of counts from recent county bird reports adds up to about 3,200. However, it is clear that many birds are likely to be missed via these reports. The previous estimate of 7,000 (Davies 1988) was derived from a compilation of count data coupled with mark-recapture work at Windsor Forest, Berkshire. Given that WeBS-based national indices for the Mandarin have roughly doubled from 1993/94 to the present, there is a case for increasing the national estimate to about 14,000 birds. However, the evidence base for that is at best fairly thin, and it was felt that the safe option was to repeat the previous estimate of 7,000 birds.</p>				
<b>Eurasian Wigeon</b> <i>Anas penelope</i>	440,000	4,400	1	1
<p>Wigeons are found mostly on larger wetland sites, which tend to be counted for WeBS. Kershaw &amp; Cranswick (2003) suggested that no extrapolation was required for this species, but this has now been revised upwards slightly to an extrapolation factor of 1.05.</p>				
<b>Gadwall</b> <i>Anas strepera</i>	25,000	250	1	1
<p>Gadwalls are now widespread in lowland Britain, with particular concentrations in the Midlands and East Anglia, and the population continues to increase. The previous estimate was based on an extrapolation factor of 1.16; this has now been increased to 1.18.</p>				
<b>Eurasian Teal</b> <i>Anas crecca</i>	210,000	2,100	1	2
<p>Teals are widespread across Britain in a variety of wetland habitats, but the majority occur on larger wetlands. The extrapolation factor of 1.21 used by Kershaw &amp; Cranswick (2003) has been increased to 1.23.</p>				
<b>Mallard</b> <i>Anas platyrhynchos</i>	680,000	6,800	1	3
<p>Given the very wide range of wetland habitats used by Mallards, coverage of this species by WeBS has always been considered relatively poor. The estimate thus depends greatly on the extrapolation factor used. Kershaw &amp; Cranswick (2003) used a factor of 1.71, while an average factor of 2.65 can be derived from the five studies used for the current project. However, given that the Mallard is very much a 'wider-countryside' species, frequently occurring away from typical counted wetlands, this is probably still an underestimate and so a factor of 4.00 is used here, based solely on the Norfolk Bird Atlas fieldwork (which included counts of birds in all habitats). By comparison, the DWS estimated about 631,000 birds (range 475,000–801,000) in winter, while the latest breeding estimates have varied between 47,700 and 114,400 pairs (Baker <i>et al.</i> 2006) and 1,618,000 individuals (Newson <i>et al.</i> 2008). Despite the increase in the estimate of the population size, winter numbers (at least on sites monitored by WeBS) have been declining steadily for about 20 years.</p>				
<b>Pintail</b> <i>Anas acuta</i>	29,000	290	1	1
<p>Virtually all Pintails occur on well-monitored WeBS sites and it was decided that no extrapolation factor was required to scale the WeBS counts of this species.</p>				



Species/population	Estimate	1% threshold	Method	Reliability
<b>Shoveler</b> <i>Anas clypeata</i>	18,000	180	1	1
Most wintering Shovelers occur on well-counted WeBS sites, but an extrapolation factor of 1.16 has been used to account for birds missing on smaller wetlands.				
<b>Red-crested Pochard</b> <i>Netta rufina</i>	320	n/a	1	1
Although some may have been missed on smaller sites, it is thought that most birds occur on a few well-monitored sites, notably the Cotswold Water Park (Gloucestershire/Wiltshire), and that the estimate should be reasonably sound. The status of some individuals, or even flocks, is perhaps questionable, being 'halfway' between captive and naturalised in some areas. Moreover, at least in recent years, at least 120 (maybe more) have been released at Flixton Pits in the Waveney valley, Suffolk, for shooting purposes (A. Green pers. comm.); these birds, many of which have a distinctive washed-out appearance, have not been included in the estimate. Although it is likely that some continental immigrants are involved, the vast majority of birds making up the present estimate occur at sites known to support naturalised birds year-round. Kershaw & Cranswick (2003) gave no estimate as there were assumed to be fewer than 100 birds at the time. No threshold is given here, as the population is treated as mostly naturalised.				
<b>Common Pochard</b> <i>Aythya ferina</i>	38,000	380	1	1
While most Pochards occur in flocks on monitored WeBS sites, sufficient numbers occur on non-counted waterbodies to justify an extrapolation factor of 1.22, a small increase compared with the 1.18 used by Kershaw & Cranswick (2003).				
<b>Tufted Duck</b> <i>Aythya fuligula</i>	110,000	1,100	1	1
The Tufted Duck is a common species and distributed more widely than most other wildfowl, and the population estimate here makes use of an extrapolation factor of 1.48, compared with 1.32 used by Kershaw & Cranswick (2003).				
<b>Greater Scaup</b> <i>Aythya marila</i>	5,200	52	1	2
Preliminary data from Bird Atlas 2007–11 suggest that WeBS covers the main concentrations of this species well, but may miss small numbers dispersed along the coast. NEWS data show that Scaups were noted on only a handful of non-estuarine count stretches. Recent aerial surveys (e.g. Lewis <i>et al.</i> 2008) have located few Scaups away from counted WeBS sites and again suggest that there is relatively little to add to the WeBS data for this species. WeBS data alone gave an estimate of 4,960, and adding the additional birds found by NEWS increases this to 5,200. The previous total was a compilation of regional estimates, but this seems less necessary now given the good coverage of the key sites. Since the estimate of Kershaw & Cranswick (2003), it appears that declines have occurred on the Solway and Forth, in contrast to an increase on the Moray Firth.				
<b>Common Eider</b> <i>Somateria mollissima</i>	55,000	550	4	2
Recent work (Scott & Rose 1996; Furness <i>et al.</i> 2010) suggests that British Eiders are best considered as comprising two populations, with those in Shetland best treated as <i>S. m. faeroensis</i> . This recommended subdivision is followed here although, since <i>faeroensis</i> is not currently included on the BOU's British List, the two are treated as populations rather than subspecies. Although the status of birds in Orkney is unclear, Furness <i>et al.</i> (2010) suggested that there is no evidence to suggest that they should not be included in the southern population, and that approach is followed here (note that this contradicts Wetlands International 2006). The previous estimate of 73,000 Eiders included 6,000 Shetland birds. The new estimate, compiled from WeBS, county bird reports and a selection of aerial and boat-based surveys, reveals a large reduction. Although numbers are difficult to estimate in many areas, the overall picture is thought to be realistic, agreeing with detailed studies on the Clyde (C. Waltho pers. comm.) and apparent declines in Orkney, the Outer Hebrides and Northumberland; the only area seeing a significant increase is the Wash. The large flock at the mouth of the Tay can be difficult to count, but numbers appear to be relatively stable there since the last national estimate.				
<b>Shetland Common Eider</b> <i>Somateria mollissima</i>	5,500	55	4	1
Eiders in Shetland (see above for notes on population definition) are well-monitored by the Shetland Oil Terminal Environmental Advisory Group (e.g. Heubeck & Mellor 2010), which undertakes a regular moult count of Eiders in August, when the birds are at their most concentrated. The estimate presented here is the mean of the moult counts from 2005, 2006 and 2009. Eiders have declined greatly in Shetland over recent decades; numbers were estimated at 17,000 in 1977 (Pennington <i>et al.</i> 2004).				

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Long-tailed Duck</b> <i>Clangula hyemalis</i>	11,000	110	4	2
<p>This has always been a difficult bird to monitor adequately, since many birds use areas distant from the shore, while other concentrations are in the Northern Isles and the Outer Hebrides. The new British estimate has been derived from a compilation of best estimates from around Britain, largely from WeBS, county bird reports, supplementary shore-based counts, boat-based counts in Shetland and aerial surveys of selected areas. The total is extremely dependent on the figure used for the Moray Firth, however. During the period under consideration, peak counts there varied from over 11,500 in 2005/06 to fewer than 700 in 2008/09. It is uncertain to what extent this variation reflects true differences in numbers, as opposed to differences in counting conditions. Nonetheless, the numbers present in 2007/08 and 2008/09 do appear to have been much lower, and a mean count of 6,500 birds has been used here. Comparison with the numbers used by Kershaw &amp; Cranswick (2003) suggests additional declines in Northumberland, Angus &amp; Dundee, North-east Scotland, Orkney and Shetland. Wetlands International (2006) recognised two populations (breeding in Iceland/Greenland and west Siberia/northern Europe respectively); it is considered that birds from both populations winter in British waters but there is currently insufficient information available to separate the two.</p>				

<b>Common Scoter</b> <i>Melanitta nigra</i>	100,000	1,000	4	2
<p>Although small flocks occur widely around the coast, the majority of Common Scoters wintering in British waters do so in just a few large congregations. Aerial survey work in recent years has revolutionised our knowledge of the true numbers of birds present, although estimates for particular areas do tend to be relatively imprecise. The present estimate is highly dependent on the numbers assigned to Liverpool Bay (55,000), Carmarthen Bay (20,000) and Cardigan Bay (12,000), with further counts of over 1,000 off Norfolk, the Forth, Tay, North-east Scotland and the Moray Firth. Large numbers also occur on the Solway but mostly in spring and autumn, presumably en route to/from areas farther south.</p>				

<b>Velvet Scoter</b> <i>Melanitta fusca</i>	2,500	25	4	2
<p>The vast majority of Velvet Scoters wintering in Britain are found between the Firth of Forth and the Moray Firth, and deriving an overall estimate depends heavily on the figures for a small number of large coastal sites in this area. Data have been compiled from WeBS, recent county bird reports and aerial surveys carried out by JNCC. The combined figure includes an estimate of 800 for the Moray Firth, but this is an average of counts from the 2004/05 to 2008/09 seasons, and hides a major decline, with few birds present in the last two winters of this period. Numbers on the Forth and the Tay/St Andrew's Bay also appear to have declined, although perhaps not so dramatically.</p>				



**214.** Common Scoters *Melanitta nigra*, Norfolk, May 2008. The majority of Common Scoters wintering in British waters are found in a few major congregations, and aerial survey work has transformed our knowledge of the numbers involved; the cumulative total is thought to be in the region of 100,000.

Richard Chandler

Species/population	Estimate	1% threshold	Method	Reliability
<b>Common Goldeneye</b> <i>Bucephala clangula</i>	20,000	200	1	2
Many Goldeneyes occur on larger waterbodies and at coastal sites. However, in some areas, including remoter parts of northwest Scotland, they can also be found dispersed on quite small lakes. The extrapolation factor of 1.26 is an increase on that of 1.21 used by Kershaw & Cranswick (2003) but may well still be too low for the UK as a whole; this is a species that would greatly benefit from extrapolation-type studies in Scotland.				
<b>Smew</b> <i>Mergellus albellus</i>	180	2	1	1
The great majority of wintering Smeews occur on well-counted WeBS sites, with probably only a handful of birds elsewhere. Numbers can be variable between winters, but a general downward trend has been apparent in recent years.				
<b>Red-breasted Merganser</b> <i>Mergus serrator</i>	8,400	84	4	2
Although relatively large numbers of Red-breasted Mergansers occur along the coastlines of southern Britain, where they are well-counted by WeBS, they are also widely distributed in the north and west, where coverage is less comprehensive. Moreover, in some northern areas, birds can occur inland in small numbers, at least well into the autumn. The current estimate has been derived via a regional compilation of data from WeBS, county bird reports, and a number of dedicated seaduck surveys. Inevitably, however, estimates for some areas in north and west Scotland are less well defined. The previous estimate of 9,840 was derived initially by Kirby <i>et al.</i> (1993). Comparison by regions suggests that numbers have declined most strongly on the Moray Firth as well as at the Firth of Tay/St Andrew's Bay. There may also have been a decline in the Outer Hebrides and on the Scottish west coast, although establishing true numbers present in a dispersed fashion in these regions is difficult. However, it appears that the previous estimate did not take account of many of the birds in southern England, and thus the decline has been greater than a simple comparison of the two overall estimates would suggest.				
<b>Goosander</b> <i>Mergus merganser</i>	12,000	120	1	2
In southern Britain, most Goosanders winter on larger inland still waters. Farther north, however, birds are more widely distributed and in many areas birds spend the day on rivers and then return to lakes and reservoirs in the evening to roost. Kershaw & Cranswick (2003) used an extrapolation factor of 2.62, which has now been increased to 2.95 for the present estimates; it is acknowledged, however, that considerable uncertainty remains about this factor, particularly in Scotland.				
<b>Ruddy Duck</b> <i>Oxyura jamaicensis</i>	90	n/a	3	1
The naturalised population of Ruddy Ducks in the UK has been the target of an eradication programme, with the aim of enhancing the conservation prospects of the White-headed Duck <i>O. leucocephala</i> in continental Europe. The recent trend in numbers is, unsurprisingly, sharply downwards, and we have used the most recent estimate rather than a five-year mean. In April 2011, the Food and Environment Research Agency estimated that about 90 birds remained (I. Henderson pers. comm.). It remains to be seen whether the target of zero birds can be achieved; control measures in other countries in northwest Europe are now taking on an increased significance.				
<b>Red-throated Diver</b> <i>Gavia stellata</i>	17,000	170	3	2
Red-throated Divers occur around the entire British coastline in winter, but densities are highest off south-east England, between the Humber and Sussex, with other concentrations in Liverpool Bay and Cardigan Bay. In recent years, dedicated aerial surveys have been undertaken with the aims of determining potential marine Special Protection Areas, and investigating potential environmental impacts of the offshore wind industry. These surveys have revolutionised our understanding of the true numbers of this species in British waters, as large numbers may be present out of sight of the coast, often thinly dispersed over a large area. O'Brien <i>et al.</i> (2008) collated the various datasets concerning this species and produced a winter estimate of 17,000 birds, several times higher than the previous figure; moreover, the authors still considered this a 'minimum plausible estimate'. Most of the data underlying this estimate were collected during the period 2001–06 and this figure is simply repeated here.				

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Black-throated Diver</b> <i>Gavia arctica</i>	560	6	4	3

Black-throated Diver is clearly the scarcest of the three commoner diver species wintering in Britain (although it is probably the most numerous species in Europe as a whole). Numbers are difficult to estimate, given that it can be hard to detect and count birds effectively in coastal waters in anything but the calmest of conditions. Additionally, many of the strongholds are in more remote parts of the northwest. It appears that the north and west coasts of Highland region hold the largest numbers, although the Outer Hebrides and the south coast of Cornwall are clearly also important. Recent aerial surveys of coastal waters have struggled to identify Black-throated Divers from the air; in most areas, unidentified diver species are generally assumed to be either Red-throated or Great Northern, depending on which is the commoner species in that area, and it seems likely that at least small numbers of Black-throated Divers are overlooked.

<b>Great Northern Diver</b> <i>Gavia immer</i>	2,500	25	4	3
--	-------	----	---	---

Although relatively scarce in southeast Britain, Great Northern Divers become increasingly plentiful farther north and west. Estimating numbers with any precision is extremely difficult, however, with the majority occurring in a generally dispersed manner in Shetland, Orkney, west Highland, Argyll and the Outer Hebrides. Outside Scotland, the most favoured areas are the coasts of southwest England and northwest Wales. Counts from WeBS have been combined with information from county bird reports and some aerial and boat-based surveys to derive the present estimate, which falls neatly in the middle of the range of 2,000–3,000 suggested in Lack (1986).

<b>Great Cormorant</b> <i>Phalacrocorax carbo</i>	35,000	350	1	2
---	--------	-----	---	---

Cormorants winter both on the coast and, increasingly widely, inland. The estimate here is based on an extrapolation factor of 1.60, rather higher than the 1.24 used by Kershaw & Cranswick (2003). In comparison, the DWS suggested about 31,000 birds (range 21,000–46,000). Two separate populations are involved: coastal-breeding *carbo* and the more recent colonist, continental *sinensis*, which is more prevalent in eastern England. Mitchell *et al.* (2004) suggested that about 16% of British-breeding Cormorants were *sinensis*. The same proportion applied to the current estimate would suggest about 5,600 *sinensis*, although it seems likely that *sinensis* has increased its share of the population since Seabird 2000 (S. Newson pers. comm.) Moreover, there is certainly movement of some birds into and out of the country outside the breeding season, again likely to involve mostly *sinensis*, but again the numbers involved are difficult to judge precisely.



Mike Lane

**215.** Red-throated Diver *Gavia stellata*, Northumberland, December 2006. As is the case for the Common Scoter *Melanitta nigra*, estimates of the size of the wintering Red-throated Diver population around British coasts have improved radically with the help of aerial survey work. This is a species that often occurs just beyond the reach of land-based observers, and is thinly spread across vast areas of sea. Some 17,000 or so are thought to occur in British waters.



Species/population	Estimate	1% threshold	Method	Reliability
<b>Shag</b> <i>Phalacrocorax aristotelis</i>	110,000	1,100	5	2
Shags breed widely around the British coastline, especially in the north and west. Outside the breeding season, birds are widely dispersed, many in areas not well surveyed by regular monitoring schemes. Although ringing shows that some British-bred birds are found in other countries in the winter, the scale of such movements appears to be small and the Shag can be treated as essentially resident in Britain. To derive the present estimate, the most recent breeding estimate of about 26,300 pairs (Mitchell <i>et al.</i> 2004) has been combined with estimates for productivity (average 1.21 young per pair; Seabird Monitoring Programme data), annual survival (0.49 for first-year birds, 0.76 for older birds) and age of first breeding (assumed average three years old; Wanless & Harris 1997), all of which suggests that at the end of the breeding season, about 110,000 Shags would be present in Britain.				
<b>Eurasian Bittern</b> <i>Botaurus stellaris</i>	600	6	3	2
The breeding population of Bitterns has shown a strong recovery in recent years, with 87 booming males in 2010. Most breeding birds and their offspring probably remain in Britain in the winter, and are joined by immigrants from Scandinavia and the Baltic States. Bitterns can breed in their first summer, although not all do so. An assessment of data from BirdTrack, BirdGuides, county recorders and RSPB datasets suggests that there was a minimum of 600 Bitterns present in winter 2009/10 (Wotton in prep.). This was a particularly cold winter, and many birds will have been more visible than normal in the frozen conditions. Nevertheless, this figure is adopted here as the best estimate for the non-breeding population.				
<b>Little Egret</b> <i>Egretta garzetta</i>	4,500	45	1	2
Little Egret was removed from the BBRC list at the end of 1990 and numbers have increased enormously in the years since then. An estimate in autumn 1999 suggested about 1,650 birds (Musgrove 2002). The current estimate is based solely on WeBS data, with no extrapolation for birds at large in the wider countryside away from WeBS sites. Preliminary results from Bird Atlas 2007–11 show that the species is found very widely inland in southern Britain. However, there are no suitable data available yet with which to assess the numbers of birds being missed in this way. The estimate should therefore be considered a minimum.				
<b>Grey Heron</b> <i>Ardea cinerea</i>	61,000	610	5	2
Grey Herons occur widely across Britain outside the breeding season, utilising every kind of wetland habitat: the coast, rivers, large lakes, small ponds and ditches. Consequently, schemes such as WeBS record only a fraction of the total number of birds present, with a peak of about 4,000 counted each winter. Immigrants do arrive from the continent each winter and the scale of this arrival is unclear but WeBS monthly indices suggest that immigrants do not form a large proportion of the winter total. A broad estimate of numbers in the non-breeding season can thus be derived by combining an estimate of the number of breeding pairs (average estimate 13,162 pairs in Britain between 2004 and 2008; BTO data) with estimates of the average age of first breeding (two years old), productivity (two young per pair) and first-year survival (0.31; <i>BWP</i> ). This yields an estimate of about 61,000 birds at the start of the winter, which compares with an estimate from the DWS of 42,000 birds (range 36,000–51,000).				
<b>Eurasian Spoonbill</b> <i>Platalea leucorodia</i>	20	1	1	1
The Spoonbill is an uncommon but regular wintering species in southern Britain. Virtually all occur on sites that are monitored by WeBS, and thus coverage is good. During 2004/05 to 2008/09, peak winter numbers averaged 20 (range 12–30). The majority are found in Poole Harbour (Dorset), the Taw/Torridge estuary (Devon), and the Tamar/Lynher estuary (Devon/Cornwall); East Anglian sites tend to be more favoured in the summer months.				
<b>Little Grebe</b> <i>Tachybaptus ruficollis</i>	16,000	160	1	2
Little Grebes occur widely in lowland Britain in winter, in a few places forming small flocks but more frequently occurring in ones and twos, and the species is easy to overlook. The estimate here is based on an extrapolation factor of 2.12, substantially higher than the 1.43 used by Kershaw & Cranswick (2003). In comparison, the DWS suggested about 19,000 (range 11,000–26,000).				

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Great Crested Grebe</b> <i>Podiceps cristatus</i>	19,000	190	1	1
Great Crested Grebes winter inland (especially on larger waterbodies, but also widely on smaller lakes and rivers) and on the coast; in places, large flocks can occur offshore, when they are difficult to count unless conditions are good. The estimate here is based on an extrapolation factor of 1.55, compared with 1.40 used by Kershaw & Cranswick (2003). The DWS suggested slightly fewer birds (12,100, range 9,300–15,300), but may well have underestimated some of the larger coastal flocks.				
<b>Red-necked Grebe</b> <i>Podiceps grisegena</i>	55	1	4	2
Red-necked Grebes occur widely in Britain but numbers are generally low and appear to be declining. The only site regularly supporting double figures is the Firth of Forth, but even here there has been a major reduction. The south coast of England, especially Cornwall, also appears to be relatively important, but birds are highly dispersed and thus difficult to survey systematically. The estimate of 55 is thought to be a fair representation of average numbers during 2004/05 to 2008/09; numbers may increase somewhat during periods of cold weather.				
<b>Slavonian Grebe</b> <i>Podiceps auritus</i>	1,100	11	4	2
Slavonian Grebes can be found around much of the British coastline (and less commonly inland), but larger congregations of birds tend to be relatively localised. A compilation of WeBS counts and recent county bird reports suggests a figure of nearly 1,100 wintering birds. Given that it is easy to overlook birds on the sea, and that many occur in the north and west, it is possible that this estimate is still on the low side. In comparison with the detailed breakdown by Evans (2000), it appears that there has been a fairly consistent pattern of change, with declines throughout most of England and Wales and also along much of the Scottish east coast north to the Moray Firth. In contrast, it appears that increased numbers now occur in the north-west, from the Solway northwards and including the Outer Hebrides, Shetland and, especially, Orkney (where there may be over 300 wintering birds; <i>Orkney Bird Report 2008</i> ). To some extent, this apparent increase may be due to improved monitoring in some areas, but there may also have been a genuine increase in the north and west, perhaps involving birds from Iceland where the breeding population is increasing. In recent years, the small breeding population in Scotland has declined and cannot account for more than a small fraction of the British winter total. Breeding numbers are also declining in Sweden and Finland, which may relate to the trends on the south and east coasts of Britain. Wetlands International (2006) recognised these two separate populations ('large-billed, NW Europe' and 'small-billed, NE Europe') and some (but not all) authorities assign the former to subspecies <i>arcticus</i> .				
<b>Black-necked Grebe</b> <i>Podiceps nigricollis</i>	130	1	1	1
Although Black-necked Grebes occur widely throughout Britain (although less so towards the north and west), the majority of birds in winter are found on just a few sites, namely William Girling Reservoir in Greater London, and along the south coast at Langstone Harbour (Hampshire), Studland Bay (Dorset), Tor Bay (Devon) and the Fal Estuary (Cornwall).				
<b>Water Rail</b> <i>Rallus aquaticus</i>	n/a	n/a	n/a	n/a
Numbers of non-breeding Water Rails are extremely difficult to estimate. The 1988–91 Breeding Atlas (Gibbons <i>et al.</i> 1993) suggested a possible estimate of 450–900 breeding pairs and it seems likely that many of these, and their offspring, would remain throughout the winter. In addition, it is clear that many birds arrive from northern Europe to winter here. WeBS counters tend to locate up to about 600 birds per winter, but it is clear that many Water Rails will be overlooked at WeBS sites and that many more will be present elsewhere in the wider countryside, in small wetlands and along rivers. Preliminary results from Bird Atlas 2007–11 show that Water Rails have been detected in winter in over 1,000 10-km squares in Britain and, during timed tetrad visits, one Water Rail is counted for about every 50 Moorhens. Taken at face value, that would suggest that about 6,400 Water Rails overwinter in Britain. However, Water Rails are far less detectable than Moorhens; if we assumed that Water Rails were 20% as detectable as Moorhens, this would imply about 32,000 birds. Unfortunately, there is currently no way of defining what the ratio of detectability is, and at present it is simply not possible to derive a defensible estimate of wintering Water Rails in Britain. There are an estimated 140,000–360,000 breeding pairs in Europe (BirdLife International 2004) and given that most northern breeders are likely to move southwest to winter, a figure in the range of 10,000–100,000 seems not unreasonable.				

Species/population	Estimate	1% threshold	Method	Reliability
<b>Moorhen</b> <i>Gallinula chloropus</i>	320,000	3,200	1	3
Moorhen is one of the most difficult waterbirds to survey, being common (but often unobtrusive) in all lowland habitats that include even the smallest amount of running or standing water. The previous estimate of 750,000 was based largely on the 1981–84 Winter Atlas (Lack 1986) and was fairly approximate. For the period 2004/05 to 2008/09, WeBS data alone suggest about 19,000 birds. Only two of the studies used to derive extrapolation factors (Cleveland and Norfolk) included Moorhen, and the factors varied greatly, from 16.78 in Norfolk to 3.10 in Cleveland. Given that the Cleveland study did not include small ponds, ditches and the 'wider countryside', it seems more appropriate to use the Norfolk factor alone in deriving the estimate. Compared with the resulting figure of 320,000, the DWS produced an estimate of 218,000 (range 170,000–276,000). For the breeding season, Newson <i>et al.</i> (2008) estimated 355,000 birds (range 312,000–399,000) in the UK, based on Breeding Bird Survey data, which reflects the number of adults present in the breeding season and excludes both young birds produced and immigrants (most Moorhens that breed in Britain are highly sedentary but some winter immigration does occur, apparently mostly from Denmark and the Netherlands; Wernham <i>et al.</i> 2002). Derivation of population estimates from the BBS is still at an early stage of development (Newson <i>et al.</i> 2008); for a species like the Moorhen, the estimate may be biased by the tendency of survey transects to follow linear features, such as ditches or streams, which are favoured by Moorhens. Consequently, a discrepancy between estimates derived by different methods is not surprising.				
<b>Common Coot</b> <i>Fulica atra</i>	180,000	1,800	1	1
Coots occur widely in lowland Britain in the winter but are far more concentrated on larger waterbodies than Moorhens. The estimate is based on WeBS data, scaled upwards by a factor of 1.36 (cf. the 1.30 used by Kershaw & Cranswick 2003).				
<b>Oystercatcher</b> <i>Haematopus ostralegus</i>	320,000	3,200	1	1
The majority of British Oystercatchers winter on estuaries, although NEWS estimated that about 66,000 were present on non-estuarine coasts. In the early part of the winter, only c. 2% of birds are found inland, although this rises in February and March as the species returns to breeding areas. It is thought that the number of Oystercatchers that will have been missed at inland sites in the peak winter period is insignificant compared with the overall estimate.				
<b>Avocet</b> <i>Recurvirostra avosetta</i>	7,500	75	1	1
During the winter, virtually all British Avocets occur on estuaries, with just a handful of birds inland. Non-estuarine coast is avoided entirely. The estimate is therefore based solely on WeBS counts and is assumed to be extremely accurate.				
<b>Ringed Plover</b> <i>Charadrius hiaticula</i>	34,000	340	1	1
Wintering Ringed Plovers in Britain are nominate <i>hiaticula</i> , although <i>C. h. tundrae</i> and <i>C. h. psammodyroma</i> do pass through Britain on migration. A comparison of WeBS and NEWS data suggests that about 70% of Ringed Plovers wintering in Britain are found on open coasts, with most of the remainder on estuaries. It is thought that any birds missed (inland) by WeBS in midwinter would contribute little to the overall estimate. Despite the similarity with the previous estimate (32,450), Ringed Plovers have declined substantially over the last decade; this is masked by the inclusion here of September/October WeBS data for the new estimates, which will include some passage birds (although the peak of the autumn passage is in August).				
<b>European Golden Plover</b> <i>Pluvialis apricaria</i>	400,000	4,000	3	2
Although large numbers of Golden Plovers are counted by WeBS, and over 20,000 were estimated on the open coast for NEWS, it is clear that many remain uncounted in terrestrial habitats such as farmland. Gillings & Fuller (2009) reported a more focused survey from the 2006/07 winter, which suggested a total population estimate of 400,000 birds (including WeBS counts). Golden Plovers wintering in Britain comprise birds from three biogeographical populations: two populations of <i>P. a. altifrons</i> (one from Iceland and the Faeroe Islands, the other from northern Europe) and nominate <i>apricaria</i> (Delany <i>et al.</i> 2009). The latter includes British-breeding birds (an estimated 38,400–59,400 pairs; Thorup 2006). Quantifying these three separate elements is currently impractical, although it is thought that a majority of British-wintering birds originate from Iceland. The previous estimate of 250,000 originates largely from the Winter Atlas of 1981–84 (Lack 1986) and was considered highly approximate.				

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Grey Plover</b> <i>Pluvialis squatarola</i>	43,000	430	1	1
Virtually all Grey Plovers wintering in Britain occur on estuaries, with NEWS estimating just 800 birds along the entire non-estuarine coast. The species is virtually absent inland. The estimate presented here can thus be taken as highly accurate.				
<b>Northern Lapwing</b> <i>Vanellus vanellus</i>	620,000	6,200	3	2
Large numbers of Lapwings are counted for WeBS, but many also occur in terrestrial habitats. The survey reported by Gillings & Fuller (2009) estimated a British total of 620,000 birds in winter 2006/07. The previous estimate of 1,500,000 (Cayford & Waters 1996) was based on a combination of inland data from Lack (1986) and coastal data from WeBS. It was acknowledged that there was considerable uncertainty about the estimate, and it is hard to know how much credence to give to the apparent major decline since. WeBS indices suggest a major increase in Lapwing numbers from the mid 1980s to the mid 1990s, with a subsequent smaller decline. However, those indices are based on wetland habitat not farmland, and if there has been a change in habitat preference over that period, that would affect the trends as much as any real change in wintering numbers. The breeding population in the UK declined by about 50% over the 25 years between 1982 and 2007 (Baillie <i>et al.</i> 2010) and this appears to reflect the wider situation in Europe (PECBMS 2009). It seems most likely that a decline in the British-wintering Lapwing population has indeed occurred.				
<b>Red Knot</b> <i>Calidris canutus</i>	320,000	3,200	1	1
Almost all Knots winter on estuaries, with only about 2,000 birds estimated for the non-estuarine coast by NEWS. This species is virtually absent inland, and the estimate presented here is thus assumed to be extremely accurate. Virtually all British Knots are of the <i>C. c. islandica</i> population (breeding in northeast Canada and Greenland); although hundreds of thousands of nominate <i>canutus</i> pass through the Wadden Sea, just a short hop across the North Sea, they continue to wintering grounds farther south without making any significant use of Britain at all.				
<b>Sanderling</b> <i>Calidris alba</i>	16,000	160	1	1
Sanderlings are strictly coastal in the winter in Britain. NEWS estimated 6,300 birds on the non-estuarine coast in January 2007, and the remainder of birds making up the present estimate are found on estuaries. The decline since the population estimate of 20,540 by Rehfish <i>et al.</i> (2003) is intriguing, given that the annual indices based on WeBS Core Counts, which reflect estuaries and selected parts of the open coast, have shown an increasing trend. The decline appears to represent the situation on the open coasts (which broadly supports the findings of Austin <i>et al.</i> 2008).				
<b>Little Stint</b> <i>Calidris minuta</i>	14	1	1	1
Numbers of Little Stints in Britain peak strongly (albeit highly variably) in the autumn, with few birds remaining over winter; the estimate here is based on the months November to March. The species occurs widely inland in the autumn but the majority of wintering birds are on south-coast estuaries. While some Little Stints may be overlooked, perhaps within flocks of Dunlins at larger estuaries, this is unlikely to affect the estimate greatly.				
<b>Purple Sandpiper</b> <i>Calidris maritima</i>	13,000	130	1	2
The Purple Sandpiper is the wader most strongly tied to non-estuarine coasts in Britain, with the vast majority found in this broad habitat type. Indeed, even the remainder that are nominally counted as being estuarine are invariably found on the rockier stretches of those sites. The estimate is thus highly dependent on NEWS, which estimated 11,200 birds in January 2007. Most of Britain's wintering birds, especially in the northwest, appear to originate from northeast Canada and northeast Greenland but some, especially in the northeast, appear to be short-billed birds from western Norway. Delany <i>et al.</i> (2009) suggested that these two groupings involve two separate biogeographical populations. Interestingly, birds breeding in western Greenland and Iceland appear to be sedentary. Nicholl <i>et al.</i> (1988) estimated that short-billed birds comprised about 25% of the British wintering population; it would be extremely valuable to reassess the ratio of the two populations wintering in Britain.				



Species/population	Estimate	1% threshold	Method	Reliability
<b>Dunlin</b> <i>Calidris alpina</i>	350,000	3,500	1	1
<p>Most Dunlins in Britain winter on estuaries, with just over 7,000 estimated for the non-estuarine coast by NEWS. Less than 1% occur on inland sites, and any inland birds missed by WeBS would have little effect on the estimate. A number of different biogeographic populations are represented among non-breeding Dunlins in Britain (Delany <i>et al.</i> 2009). Most are nominate <i>alpina</i>, breeding largely in Scandinavia and northern Russia, but there are three populations of <i>C. a. schinzii</i>: Icelandic breeders pass through and winter mostly in North and West Africa; British and Irish breeders are thought to winter mostly in north-west Africa and southwest Europe; while Baltic breeders winter in western Europe (although the overall numbers involved are small compared with <i>alpina</i>). In addition, a relatively small population of <i>C. a. arctica</i> migrates from breeding areas in east Greenland through Britain to wintering areas thought to be in West Africa. For most purposes, it can be assumed that British-wintering birds should be assigned to <i>alpina</i>, although there may be small numbers of <i>schinzii</i> present also.</p>				
<b>Ruff</b> <i>Philomachus pugnax</i>	800	8	1	1
<p>Most wintering Ruffs in Britain occur on freshwater marshes and wet grassland, either inland or in suitable habitats adjacent to estuaries. Given the inland element, it is possible that some go uncounted by WeBS. However, BirdTrack data revealed that no key concentrations were being entirely missed by WeBS, so it seems likely that the vast majority of wintering Ruffs are recorded by that survey.</p>				
<b>Jack Snipe</b> <i>Lymnocyrtus minimus</i>	100,000	1,000	5	3
<p>Jack Snipe is one of the most difficult waterbirds to survey. WeBS data alone suggest about 230 birds, but this is clearly a major underestimate. An earlier estimate of 'as many as 100,000' (Lack 1986) was based on figures from the British Association for Shooting and Conservation, which recorded about 10,000 as being shot annually in the early 1980s, and this estimate was accepted as reasonable by Olivier (2007). Jack Snipe was removed from the British quarry list in 1981. Kalchreuter (2003) suggested that the population size of Jack Snipe in western Europe is at least a tenth that of Common Snipe. This study was based largely on French and Dutch data; in the absence of any comparable British data this yields an estimate of at least 104,217 Jack Snipes. Clearly, this estimate is highly approximate and, given the frequency with which most observers in Britain encounter this species, the figure will seem very high. Given that the total European population has been estimated at over one million birds (Delany <i>et al.</i> 2009), or even three million birds (Kalchreuter 2003), it may not be unreasonable.</p>				



David Tipling

**216.** Jack Snipe *Lymnocyrtus minimus*, Norfolk, December 2010. After Water Rail *Rallus aquaticus*, for which no formal estimate was attempted, the next most difficult species treated here, in terms of putting a figure on the numbers occurring in Britain, is probably Jack Snipe. This is a cryptic species, which often sits tight when other species are flushed, and which occurs in damp areas throughout the wider countryside. The population estimate given here is based on findings from other western European countries that there are approximately ten Common Snipes *Gallinago gallinago* for every Jack Snipe – hence the tentative estimate of a wintering population of 100,000 individuals.

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Common Snipe</b> <i>Gallinago gallinago</i>	1,000,000	10,000	5	3
<p>This species' secretive nature and its occurrence throughout the wider countryside makes population estimates for Common Snipe particularly challenging. WeBS data alone suggest about 10,000 birds, clearly a major underestimate. The DWS came up with an estimate of about 84,000 birds (confidence limits 51,000–140,000), but this is clearly still too low. The number of Common Snipes wintering in Britain can be estimated approximately (N. Aebischer pers. comm.), based on the numbers shot (61,595 in 2004; PACEC 2006), the ring-recovery rate (3.6%; Wernham <i>et al.</i> 2002) and the proportion of ring-recoveries attributable to shooting (92%; Wernham <i>et al.</i> 2002). The likelihood that a bird ringed and then shot is subsequently reported to the BTO is difficult to quantify, but if we assume a rate of 56% (see Woodcock below) this generates an estimate for Common Snipe of 1,042,169. Birds from two populations of Common Snipe winter in Britain (Delany <i>et al.</i> 2009): nominate <i>gallinago</i> (over 2.5 million birds, breeding throughout most of Europe) and <i>G. g. faeroensis</i>, (c. 570,000 birds, breeding in Iceland, the Faeroe Islands, Orkney and Shetland). Wernham <i>et al.</i> (2002) suggested that most birds wintering in southern and eastern Britain are likely to be <i>gallinago</i>, that most <i>faeroensis</i> winter in Ireland but some (many?) of those wintering in northwest Britain are <i>faeroensis</i>. At present, it is not possible to quantify the proportions of the two populations involved.</p>				
<b>Woodcock</b> <i>Scolopax rusticola</i>	1,400,000	14,000	5	3
<p>A few hundred are typically recorded during WeBS counts each winter, which is a small proportion of the true numbers occurring. Hoodless &amp; Powell (2010) estimated that about 17% of Woodcocks shot in Britain &amp; Ireland originated from the British breeding population, which is largely sedentary, and was estimated at 78,350 roding males (Hoodless <i>et al.</i> 2009). Converting roding males into pairs is not straightforward, given that Woodcocks are polygynous. The average productivity of young per 'pair' is also difficult to determine, but, multiplying by three (e.g. Meininger <i>et al.</i> 1995) to convert roding males into winter birds, and then again by 5.88 (i.e. 100/17, to account for immigrants), a winter estimate of 1,382,647 birds is derived. This estimate of wintering Woodcocks is highly approximate, but is thought to be of the right order of magnitude. It can be used in combination with knowledge of the number of birds shot (about 181,000 in 2004; PACEC 2006) and the number of ringed birds reported to BTO to derive a reporting rate for ringed individuals of 56% (see Common Snipe above).</p>				
<b>Black-tailed Godwit</b> <i>Limosa limosa</i>	43,000	430	1	1
<p>All Black-tailed Godwits wintering in Britain are of the subspecies <i>L. l. islandica</i> (breeding in Iceland, the Faeroe Islands and northern Britain). In the early part of the winter, over 95% of Black-tailed Godwits are found on estuaries, but in the late winter and early spring, some move to selected feeding areas inland. Virtually all Black-tailed Godwits are counted by WeBS and the population estimate is considered extremely accurate. There has been a major increase in numbers of Black-tailed Godwits wintering in Britain but part of the increase in the population estimate presented here (the previous estimate was 15,390) is simply due to the inclusion of September and October counts this time; some birds continue southwards as the winter progresses.</p>				
<b>Bar-tailed Godwit</b> <i>Limosa lapponica</i>	38,000	380	1	1
<p>Almost all Bar-tailed Godwits winter on estuaries, and this species is thus well monitored by WeBS. NEWS estimated about 1,500 birds on non-estuarine coasts, and the species does not winter inland. In contrast to the previous species, there has been a major decline of Bar-tailed Godwits in recent years; the Bar-tailed to Black-tailed ratio has fallen from 4:1 to less than 1:1 over the last decade. Wintering birds are nominate <i>lapponica</i> (breeding in northern Europe and northern Siberia). In addition, some <i>L. l. taymyrensis</i> appear to stop briefly in Britain in late summer before continuing to wintering grounds in West Africa; in the spring, these birds use the Wadden Sea for refuelling en route to their breeding grounds.</p>				
<b>Whimbrel</b> <i>Numenius phaeopus</i>	30	1	1	1
<p>Passage of Whimbrels through Britain peaks in late April/early May and then again between July and September. Numbers are fairly constant between November and March (the period on which the current estimate is based). Migrants passing through Britain are derived from two biogeographical populations: <i>N. p. islandicus</i> (breeding mostly in Iceland but also including the small numbers of British breeders) and nominate <i>phaeopus</i> (breeding in northeast Europe; Delany <i>et al.</i> 2009). It is not known to which population the small number of wintering birds belongs; most occur on south-coast estuaries.</p>				

Species/population	Estimate	1% threshold	Method	Reliability
<b>Eurasian Curlew</b> <i>Numenius arquata</i>	140,000	1,400	1	1
<p>Although the majority of British Curlews winter on estuaries, over 44,000 were recorded on non-estuarine coasts in January 2007 by NEWS. In some areas, small flocks of Curlews winter inland, away from counted WeBS sites, but these are thought likely to form only a small proportion of the total.</p>				
<b>Common Sandpiper</b> <i>Actitis hypoleucos</i>	73	1	1	1
<p>The autumn passage of this species is early, with peak numbers on WeBS sites in July and August. Numbers then decline and the winter estimate presented here is based on the months November to March, when numbers are reasonably stable. The majority of wintering birds occur on southern estuaries, with a few others inland and on non-estuarine coasts.</p>				
<b>Green Sandpiper</b> <i>Tringa ochropus</i>	910	9	4	3
<p>This is a difficult species to estimate, as it occurs thinly but widely across much of the country and does not necessarily require large wetland sites. WeBS counts suggest that, following a strong peak in passage in August, the overwintering population is relatively stable from October onwards. WeBS data alone give a wintering estimate of fewer than 200 birds, but a compilation of estimated midwinter totals from recent county bird reports suggests about 910 birds; this is likely to be more accurate, although considerable uncertainty remains.</p>				
<b>Spotted Redshank</b> <i>Tringa erythropus</i>	98	1	1	1
<p>Spotted Redshank numbers tend to peak in autumn, but are reasonably stable from November to March and the estimate given here is based on that period. Although birds can occur widely on passage, in winter most are found in estuarine habitats (none was recorded on non-estuarine coasts during NEWS).</p>				
<b>Greenshank</b> <i>Tringa nebularia</i>	610	6	1	1
<p>Although Greenshanks occur widely on passage, wintering birds are typically found at coastal sites, mostly estuarine (although NEWS did find about 150 along non-estuarine coasts). The estimate here is based on data from November to March, after the main autumn passage, although there is a continuing gradual decline through the rest of the winter: colour-ringing studies at Farlington Marsh, Hampshire, show that some autumn birds move through fairly rapidly while others remain for several months to moult before moving on (P. Potts pers. comm.).</p>				




Richard Chandler

**217.** Turnstones *Arenaria interpres*, Anglesey, April 2010. Some three-quarters of the British wintering population of c. 48,000 Turnstones, most of which breed in northeast Canada and northern Greenland, occur along non-estuarine coasts.

## Overwinter population estimates of British waterbirds

Species/population	Estimate	1% threshold	Method	Reliability
<b>Common Redshank</b> <i>Tringa totanus</i>	120,000	1,200	1	1
<p>Most Redshanks are found on estuaries, and are thus well covered by WeBS, but NEWS estimated almost 22,000 birds on non-estuarine coasts (about one-fifth of the British-wintering total). About 3% of wintering birds are found inland, and small numbers of these probably go uncounted, although it seems unlikely that this affects the overall estimate significantly. Redshanks wintering in Britain are a combination of three populations (Delany <i>et al.</i> 2009): nominate <i>totanus</i> (breeding in northern Europe); <i>T. t. robusta</i> (breeding in Iceland and the Faeroe Islands); and <i>T. t. britannica</i> (breeding in Britain &amp; Ireland). There is currently no means of quantifying the relative proportions of these three populations.</p>				
<b>Turnstone</b> <i>Arenaria interpres</i>	48,000	480	1	1
<p>About 75% of British-wintering Turnstones occur on non-estuarine coasts, with the remainder on estuaries, generally in rockier parts. Given the lack of birds inland, the population estimate is thought to be extremely reliable. The majority of Turnstones wintering in Britain breed in northeast Canada and northern Greenland. Another population, breeding in Fennoscandia and northwest Russia, winters mostly between the Gulf of Guinea and the western Mediterranean; some of these birds stage in Britain but it appears that few, if any, remain into the winter.</p>				
<b>Mediterranean Gull</b> <i>Larus melanocephalus</i>	1,800	18	4	2
<p>The Mediterranean Gull has increased greatly in recent years, both as a breeding species and in the non-breeding season. WeBS does not cover all the key sites for this species, and a compilation of estimates from recent county bird reports was made. This suggests that peak numbers of non-breeders occur in September, declining through the autumn to about 900 by the end of the year, before increasing again into March. This species occurs widely in small numbers but key localities attract the majority of birds. The Solent is currently the most significant area; the Kent coast around Copt Point remains important, although numbers may be declining there (from a peak of 900 in autumn 2005); and other flocks of over 50 are currently restricted to the area south of a line between Great Yarmouth and Aberystwyth.</p>				
<b>Common Gull</b> <i>Larus canus</i>	700,000	7,000	3	2
<p>WeBS data alone gave an estimate of only 101,000 birds and the most reliable estimate of the overall wintering population comes from WinGS, which estimated 695,833 over the winters 2003/04 to 2005/06 (Banks <i>et al.</i> 2007).</p>				
<b>Caspian Gull</b> <i>Larus cachinnans</i>	90	1	4	2
<p>Caspian Gulls occur widely but sparsely across England in the winter but remain rare in Scotland and Wales. Recent county bird reports suggest that numbers may reach about 90 in midwinter, with the highest numbers in East Anglia and the Midlands. There are still considerable identification problems with this species and some may still be overlooked.</p>				
<b>Lesser Black-backed Gull</b> <i>Larus fuscus</i>	120,000	1,200	3	2
<p>WeBS data alone gave an estimate of 62,400 birds, while WinGS estimated 124,654 over the winters 2003/04 to 2005/06 (Banks <i>et al.</i> 2007). Lesser Black-backed Gulls wintering in Britain are a mixture of two subspecies, <i>graellsii</i> and <i>intermedius</i>; there are currently insufficient data to determine the relative proportions of the two populations.</p>				
<b>Glaucous Gull</b> <i>Larus hyperboreus</i>	150	2	4	2
<p>Glaucous Gulls occur widely throughout Britain in winter, but are more numerous farther north. Given that there are fewer observers in northern Britain, it is likely that some are overlooked, yet even in remote areas, fishing ports and rubbish tips, to which this and the following species are attracted, are still relatively well covered. The estimate given here, based on recent county bird reports, suggests a decline from the early 1980s, when Lack (1986) suggested 200–500 birds, although numbers can vary quite substantially between years.</p>				
<b>Iceland Gull</b> <i>Larus glaucoides</i>	210	2	4	2
<p>In terms of coverage, similar comments apply to this species as those for Glaucous Gull, but the estimate presented here, also from recent county bird reports, compares more favourably with that of 70–80 (but sometimes in influxes of up to 300) given by Lack (1986).</p>				

Species/population	Estimate	1% threshold	Method	Reliability
<b>Yellow-legged Gull</b> <i>Larus michahellis</i>	1,100	11	4	2
<p>Yellow-legged Gulls occur widely across England but remain scarce in Wales and, especially, Scotland. The largest concentrations are around some southern estuaries, notably in the Poole Harbour, Solent and Thames areas, although inland sites in East Anglia and the Midlands can also support larger numbers. Counts peak in late summer and early autumn, although considerable numbers remain through the winter. Recent county bird reports suggest that numbers may reach about 1,100 in September, declining to about 400 by midwinter and 200 by March. Observers are now mostly familiar with this species but it seems likely that some remain overlooked, especially first-years.</p>				
<b>Herring Gull</b> <i>Larus argentatus</i>	730,000	7,300	3	2
<p>WeBS data alone gave an estimate of 94,200 birds, while WinGS estimated 729,801 over the winters 2003/04 to 2005/06 (Banks et al. 2007). Wintering birds are a mixture of (mostly) British-breeding <i>L. a. argentatus</i> and the nominate <i>argentatus</i> from northern Europe, but there are insufficient data to estimate the proportions involved. The balance of the two races probably varies during the winter, and certainly geographically, with <i>argentatus</i> relatively scarce in the southwest.</p>				
<b>Great Black-backed Gull</b> <i>Larus marinus</i>	76,000	760	3	2
<p>WeBS data alone gave an estimate of 14,400 birds, while WinGS estimated 75,860 over the winters 2003/04 to 2005/06 (Banks et al. 2007).</p>				
<b>Black-headed Gull</b> <i>Chroicocephalus ridibundus</i>	2,200,000	22,000	3	2
<p>WeBS data alone gave an estimate of 311,000 birds, while WinGS estimated 2,155,147 over the winters 2003/04 to 2005/06 (Banks et al. 2007). Note that although the 1% threshold for this species is 22,000, in reality a site that regularly supports in excess of 20,000 waterbirds is considered as internationally important by virtue of absolute numbers alone.</p>				
<b>Notes</b>				
<p>Method: 1 – standard WeBS+NEWS+extrapolation approach; 2 – census data; 3 – other published sources; 4 – compilation of county/regional data; 5 – miscellaneous (discussed in table).</p>				
<p>Reliability: 1 – good-quality counts of most of the individual birds; 2 – based mostly on count data but large degree of extrapolation; 3 – not strongly based on actual count data and/or where large assumptions have been made.</p>				
<p>Abbreviations: WeBS (Wetland Bird Survey); DWS (Dispersed Waterbirds Survey); GSMP (Goose &amp; Swan Monitoring Programme); NEWS (Non-estuarine Coastal Waterbird Survey); WinGS (Winter Gull Roost Survey).</p>				
				
<p><b>218.</b> Gulls, predominantly Black-headed Gulls <i>Chroicocephalus ridibundus</i>, Norfolk, February 2010. Over 2 million Black-headed Gulls winter in Britain, according to the latest Winter Gull Roost Survey.</p>				

David Tipling



are ways in which estimates of uncounted birds could be improved in future. First, there would be clear value in expanding both the number and the geographical range of such studies. A comparison of WeBS numbers with complete numbers in parts of Scotland or Wales would be particularly valuable. Second, work is currently underway to compare waterbird numbers with wetland characteristics such as area, perimeter, latitude, longitude, altitude. It may then be possible to use data on the wider wetland resource of Britain to estimate the numbers present on uncounted sites. The precision with which this will be possible, however, is uncertain at the present time. Third, the data collected for Bird Atlas 2007–11 will certainly be of huge potential value and, if analysed appropriately, could give great insights into the numbers of certain waterbird species occurring widely across Britain.

Estimates of wild bird populations inevitably vary in their reliability. Although some are far more approximate than others, it seems unsatisfactory not even to attempt to assess numbers of these species, when at least some data exist. Importantly, we hope that publishing some of the more approximate estimates in this paper will spur others on to improve on them. The current estimates are flagged with a reliability rating (following Baker *et al.* 2006). Such ratings are only relative yet, in many ways, the precision with which we can enumerate waterbird populations in Britain is far more reliable than could be attempted for many other species, or for most other countries. Even for the least certain estimates presented here, such as that for Jack Snipe, the fact that we can even determine the likely order of magnitude of the numbers present is reassuring.

Of the 92 populations for which estimates have been listed, only nine were considered to have the poorest reliability rating of 3. The majority of this latter group are widespread, inland species that are readily overlooked because of their behaviour and/or favoured habitats: Mandarin Duck *Aix galericulata*, Mallard, Moorhen, Jack Snipe, Common Snipe, Woodcock and Green Sandpiper *Tringa ochropus*. While surveys involving concentrated search effort could pay dividends for some of these (Mandarin in particular),

for others it is likely that extra survey effort would have to be combined with alternative approaches (such as a better understanding of bag records for the snipes). In coastal waters, Black-throated *G. arctica* and Great Northern Divers *G. immer* would benefit not only from an increase in dedicated land-based survey effort, but also from an improved understanding of how they use the sea out of sight of land; it is noteworthy how aerial survey has revolutionised our understanding of wintering Red-throated Divers in recent years, and further development of techniques, such as high-definition video (Thaxter & Burton 2009), might help to address remaining uncertainties. Finally, Water Rail was the one species for which it was felt no suitable estimate could be presented. Exploration of techniques for estimating winter numbers of this species should be a priority; for example, to what extent might playback techniques (e.g. Gilbert *et al.* 1998) be applicable outside the breeding season? Might such an approach also be used for a better assessment of Moorhen numbers?

The consideration of distinct biogeographical populations, as opposed to whole species, has long been a feature of waterbird conservation, most notably for geese. As our understanding of waterbird populations has improved, this concept is increasingly being applied to other species. However, this paper has revealed that there is much still to be learnt about the relative numbers and distributions of different populations of a number of species, and more work would certainly be valuable in this area. For example, despite the upsurge in interest in gulls in recent years, the relative numbers of *argenteus* and *argentatus* Herring Gulls and of *graellsii* and *intermedius* Lesser Black-backed Gulls wintering in the UK are not known. Similarly, the apparent regional variation in trends in numbers of wintering Slavonian Grebes *Podiceps auritus* discussed in table 2 suggest a potential difference in the conservation status of two different biogeographical populations wintering in Britain.

The paper deliberately concentrates on numbers of birds overwintering, and does not attempt to estimate the numbers passing through in spring and autumn. An understanding of passage numbers is clearly

important, but is beyond the scope of what can be achieved simply through count-based schemes like WeBS, owing to the issue of turnover. To determine the total numbers of birds moving through a single site requires not only counts (and frequent ones, especially in the more concentrated spring-passage period), but also a measure of the average duration that a bird stays at a site. Some progress is being made in investigating this issue by using resightings of individually marked birds (e.g. Gillings *et al.* 2009), but this is currently a very labour-intensive task, even at a single site. However, it seems likely that it will soon be possible to collect an increasing amount of relevant data using newer technologies such as satellite tags. To understand the scale of passage through the whole of Britain, we would also require knowledge of the extent to which some individuals use more than one British site during the passage period. It should be noted that turnover is not only an important issue for species like Whimbrel, which clearly peak strongly in spring and autumn. Many other species, for example Eurasian Teal *Anas crecca*, are known from ringing studies to show a large amount of turnover in passage periods, but this is masked by the fact that large numbers remain throughout the winter.

It is suggested that these estimates should be updated every six years, and so the next update should be based primarily on data from the 2010/11 to 2014/15 winters. Further changes in the numbers of wintering water-

birds in Britain will certainly have occurred by then; for example, the inclusion of Great White Egret *Ardea alba* and Black Swan *Cygnus atratus* seems entirely plausible. The continued production of population estimates is entirely dependent on the participation of thousands of volunteers in a wide range of waterbird recording schemes, as illustrated by this paper. This can be as simple as submitting casual observations to a county bird recorder, ideally via BirdTrack, or even better by volunteering to participate in one of the more structured monitoring schemes such as WeBS. It is hoped that this paper will help inspire a new generation of counters to get involved.

### Key recommendations

1. For the conservation of the important overwintering waterbirds in Britain, the highest priority is to maintain and, where possible, enhance the core monitoring schemes such as WeBS, GSMP, NEWS and WinGS.
2. It is important to continue to develop methods of estimating the numbers of waterbirds in the wider countryside (i.e. on smaller still waters, rivers and other suitable habitat) away from the larger wetlands that are counted regularly for WeBS.
3. New methods and surveys, or new data from less traditional sources such as bird ringers or hunters, are also needed for species not easily estimated through direct counts, such as the snipes and Water Rail.
4. Understanding the numbers of birds



David Tipling

**219.** Common Eiders *Somateria mollissima*, Northumberland, February 2005. Eiders are declining in Britain, for reasons that are not well understood. Several well-monitored subpopulations, including those in Shetland, Orkney, the Outer Hebrides, the Clyde and Northumberland have all decreased in recent years, and the only area to see a significant increase is the Wash.

passing through Britain in spring and autumn is also important and studies to determine the degree of turnover should be further developed, especially using emerging technologies.

5. There is much still to be learnt about the relative numbers and distributions of different biogeographical populations of a number of species, and more work would certainly be valuable in this area.

## Acknowledgments

This paper is the product of information provided by many thousands of people. The fact that it is possible to produce estimates at all is testament to the extraordinary amount of data available, collected largely by volunteers, whether through participation in more structured surveys such as WeBS, or simply by submitting casual observations to county bird recorders. We would therefore like to extend our sincere thanks to each of the many contributors to waterbird recording across Britain.

A major source of information was the collection of county bird reports held at the BTO's library and thanks are therefore due to the many county recorders and report editors for their work in producing this important resource and in making it available. A huge amount of useful background information was also sourced from the BTO's databases, from the BirdTrack and Bird Atlas 2007–11 projects. Thanks are also given to BirdGuides for access to their dataset.

Particular thanks go to Nicholas Aebischer, who suggested the approach used for Common Snipe; to Eric James for discussions concerning the Cleveland Water Body Survey; to John Marchant and Moss Taylor for allowing the use of unpublished Norfolk Bird Atlas data; to Steve White for data and advice on Little Gulls; and to Mark Eaton, Rowena Langston and Carl Mitchell for providing detailed comments on this paper. Additional information was also provided by Dawn Balmer, Phil Barnett, Adrian Blackburn, Jez Blackburn, John Bowler, Niall Burton, Neil Calbrade, Nigel Clark, Jackie Clark, Preben Clausen, Peter Cranswick, Bill Curtis, Simon Gillings, Mark Grantham, Andrew Green, Larry Griffin, Colette Hall, John Harradine, Andrew Hoodless, Baz Hughes, Melanie Kershaw, Yann Kolbeinsson, Dave Leech, Ilya Maclean, John Marchant, Nick Moran, Stuart Newson, Sue O'Brien, Steve Piotrowski, Eileen Rees, Mark Rehfish, Rob Robinson, Viola Ross-Smith, Russell Slack, Mike Swan and Lucy Wright.

WeBS is a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds, and the Joint Nature Conservation Committee (the latter on behalf of the Council for Nature Conservation and the Countryside, the Countryside Council for Wales, Natural England and Scottish Natural Heritage) in association with the Wildfowl & Wetlands Trust. The Goose & Swan Monitoring Programme is organised by WWT on behalf of WWT, JNCC and SNH. BirdTrack is a partnership between the BTO, RSPB, BirdWatch Ireland and the Scottish Ornithologists' Club. Bird Atlas 2007–11 is a partnership between BTO, BWI and SOC.

## References

- Austin, G. E., Collier, M. P., & Rehfish, M. M. 2008. 2007 *Non-estuarine Coastal Waterbird Survey: population estimates and broad comparisons with previous estimates*. BTO Research Report No. 501, Thetford.
- Baillie, S. R., Marchant, J. H., Leech, D. I., Renwick, A. R., Joys, A. C., Noble, D. G., Barimore, C., Conway, G. J., Downie, I. S., Risely, K., & Robinson, R. A. 2010. *Breeding Birds in the Wider Countryside: their conservation status 2010*. BTO Research Report No. 565, Thetford. ([www.bto.org/birdtrends](http://www.bto.org/birdtrends))
- Baker, H., Stroud, D. A., Aebischer, N. J., Cranswick, P. A., Gregory, R. D., McSorley, C. A., Noble, D. G., & Rehfish, M. M. 2006. Population estimates of birds in Great Britain and the United Kingdom. *Brit. Birds* 99: 25–44.
- Ballance, D. K., & Smith, A. J. 2008. Recording areas of Great Britain. *Brit. Birds* 101: 364–375.
- Banks, A. N., Burton, N. H. K., Calladine, J. R., & Austin, G. E. 2007. *Winter Gulls in the UK: population estimates from the 2003/04–2005/06 Winter Gull Roost Survey*. BTO Research Report No. 456, Thetford.
- BirdLife International. 2004. *Birds in Europe: population estimates, trends and conservation status*. BirdLife International, Cambridge.
- Calbrade, N. A., Holt, C. A., Austin, G. E., Mellan, H. J., Hearn, R. D., Stroud, D. A., Wotton, S. R., & Musgrove, A. J. 2010. *Waterbirds in the UK 2008/09: the Wetland Bird Survey*. BTO/RSPB/JNCC in association with WWT, Thetford.
- Cayford, J. T., & Waters, R. J. 1996. Population estimates for waders Charadrii wintering in Great Britain, 1987/88–1991/92. *Biol. Conserv.* 77: 7–17.
- Clark, J. M. 2009. Feral Barnacle and Snow Geese in the upper Loddon and Blackwater valleys. *The Birds of Berkshire* 2005: 11–14.
- Crowe, O., Austin, G. E., Colhoun, K., Cranswick, P. A., Kershaw, M., & Musgrove, A. J. 2008. Estimates and trends of waterbird numbers wintering in Ireland, 1994/95 to 2003/04. *Bird Study* 55: 66–77.
- Davies, A. K. 1988. The distribution and status of Mandarin Duck *Aix galericulata* in Britain. *Bird Study* 35: 203–208.
- Delany, S., Scott, D., Dodman, T., & Stroud, D. (eds.) 2009. *An Atlas of Wader Populations in Africa and Western Eurasia*. Wetlands International, Wageningen.
- Evans, R. J. 2000. Wintering Slavonian Grebes in coastal waters of Britain and Ireland. *Brit. Birds* 93: 218–226.
- Fraser, P. A., & Rogers, M. J. 2006. Report on scarce migrant birds in Britain in 2003. *Brit. Birds* 99: 74–91; 129–147.
- Furness, R. W., Mable, B., Savory, F., Griffiths, K., Baillie, S. R., & Heubeck, M. 2010. Subspecies status of Common Eiders *Somateria mollissima* in Shetland based on morphology and DNA. *Bird Study* 57: 330–335.
- Gibbons, D. W., Reid, J. B., & Chapman, R. A. 1993. *The New Atlas of Breeding Birds in Britain and Ireland: 1988–1991*. Poyser, London.
- Gilbert, G., Gibbons, D. W., & Evans, J. 1998. *Bird Monitoring Methods – a manual of techniques for key UK species*. RSPB, Sandy.
- Gillings, S., & Fuller, R. J. 2009. How many Eurasian Golden Plovers *Pluvialis apricaria* and Northern Lapwings *Vanellus vanellus* winter in Great Britain?



**220.** Avocets *Recurvirostra avosetta*, Norfolk, March 2011. For waders such as Avocets, which winter predominantly on estuaries, where coverage by WeBS counters is good, the estimates presented in this paper are considered to be very accurate. There are thought to be around 7,500 Avocets wintering around British coasts.

- Results from a large-scale survey in 2006/07. *Wader Study Group Bulletin* 166: 21–28.
- , Atkinson, P.W., Baker, A. J., Bennett, K. A., Clark, N. A., Cole, K. B., González, P. M., Kalasz, K. S., Minton, C. D. T., Niles, L. J., Porter, R. C., Serrano, I., Sitters, H. P., & Woods, J. L. 2009. Staging behaviour in Red Knot (*Calidris canutus*) in Delaware Bay: implications for monitoring mass and population size. *Auk* 126: 54–63.
- Griffin, L. 2010. *Svalbard Barnacle Goose distribution around the Solway Firth 2009–2010: flock counts from the Solway goose management scheme area*. Final Report to SNH. WWT, Slimbridge.
- Hartley, C. 2007. Status and distribution of Common Scoters on the Solway Firth. *Brit. Birds* 100: 280–288.
- Heubeck, M., & Mellor, M. 2010. *SOTEAG Ornithological Monitoring Programme: 2009 Summary Report*. SOTEAG, Aberdeen.
- Hoodless, A. N., & Powell, A. 2010. Origins of wintering Woodcock: initial findings. *Game & Wildlife Conservation Trust Review of 2009*: 18–19. GWCT, Fordingbridge.
- , Lang, D., Aebischer, N. J., Fuller, R. J., & Ewald, J. A. 2009. Densities and population estimates of breeding Eurasian Woodcock *Scolopax rusticola* in Britain in 2003. *Bird Study* 56: 15–25.
- Hudson, N., & the Rarities Committee. 2010. Report on rare birds in Great Britain in 2009. *Brit. Birds* 103: 562–638.
- Jackson, S. F., Austin, G. E., & Armitage, M. J. S. 2006. Surveying waterbirds away from major waterbodies: implications for waterbird population estimates in Great Britain. *Bird Study* 53: 105–111.
- James, E. 2009. Cleveland Water Body Survey 2008–09. *Cleveland Bird Report for 2008*: 8–9.
- Kalchreuter, H. 2003. On the population status of the Jack Snipe (*Lymnocyptes minimus*). *Game & Wildlife Science* 20: 175–193.
- Kershaw, M., & Cranswick, P.A. 2003. Numbers of wintering waterbirds in Great Britain, 1994/95–1998/99: I. Wildfowl and selected waterbirds. *Biol. Conserv.* 111: 91–104.
- Kirby, J. S. 1995. Winter population estimates for selected waterfowl species in Britain. *Biol. Conserv.* 73: 189–198.
- , Evans, R. J., & Fox, A. D. 1993. Wintering seaducks in Britain & Ireland: populations, threats, conservation and research priorities. *Aquatic Conservation: Marine & Freshwater Ecosystems* 3: 105–137.
- Lack, P. 1986. *The Atlas of Wintering Birds in Britain and Ireland*. Poyser, Calton.
- Laubek, B., Knudsen, H. L., & Ohtonen, A. 1998. Migration and winter range of Whooper Swans *Cygnus cygnus* breeding in different regions of Finland. In: Laubek, B. (ed.), *The Northwest European Whooper Swan (Cygnus cygnus) population: ecological and management aspects of an expanding waterfowl population*, pp. 1–33. PhD thesis, University of Aarhus, Denmark.
- Lewis, M., Wilson, L., Söhle, I., Dean, B. J., Webb, A., & Reid, J. B. 2008. *Wintering Sea Ducks, Divers and Grebes in UK Inshore Areas: aerial surveys and shore-based counts 2006/07*. JNCC Report No. 414, Aberdeen.
- Meininger, P. L., Schekkerman, H., & van Roomen, M. W. J. 1995. Population estimates and 1% criteria for waterbird species occurring in the Netherlands: suggestions for standardization. *Limosa* 68: 41–48.
- Mitchell, C. 2010. *Status and Distribution of Icelandic-breeding Geese: results of the 2009 international census*. WWT, Slimbridge.
- , Griffin, L., Trinder, M., & Newth, J. 2010. The population size of breeding Greylag Geese *Anser anser* in Scotland in 2008/09. WWT report to SNH, Slimbridge.
- , Walsh, A., Hall, C., & Crowe, O. 2008. *Greenland Barnacle Geese Branta leucopsis in Britain and Ireland: results of the international census, spring 2008*. WWT, Slimbridge.
- Mitchell, I., Newton, S. F., Ratcliffe, N., & Dunn, T. E. 2004. *Seabird Populations of Britain and Ireland*. Poyser, London.
- Musgrove, A. J. 2002. The non-breeding status of the Little Egret in Britain. *Brit. Birds* 95: 62–80.
- Moser, M. 1987. Importance of UK estuaries for waders and wildfowl. *RSPB Conservation Review* 1: 34–36.
- Newson, S. E., Evans, K. L., Noble, D. G., Greenwood, J. J. D., & Gaston, K. J. 2008. Use of distance sampling to improve estimates of national population sizes for common and widespread breeding birds in the

- UK. *J. Appl. Ecol.* 45: 1330–1338.
- Nicholl, M., Summers, R. W., Underhill, L. G., Brockie, K., & Rae, R. 1988. Regional, seasonal and annual variations in the structure of Purple Sandpiper *Calidris maritima* populations in Britain. *Ibis* 130: 221–233.
- O'Brien, S. H., Wilson, L. J., Webb, A., & Cranswick, P. A. 2008. Revised estimate of wintering Red-throated Divers *Gavia stellata* in Great Britain. *Bird Study* 55: 152–160.
- Olivier, G.-N. 2007. *The Jack Snipe Lymnocyptes minimus*. Editions OMPO/CICB, Paris.
- Owen, M., Atkinson-Willes, G. L., & Salmon, D. 1986. *Wildfowl in Great Britain*. 2nd edn. Cambridge University Press, Cambridge.
- PACEC. 2006. *The Economic and Environmental Impact of Sporting Shooting*. Report prepared on behalf of BASC, CA and CLA and in association with GCT. ([www.shootingfacts.co.uk/pdf/pacemainreport.pdf](http://www.shootingfacts.co.uk/pdf/pacemainreport.pdf))
- PECBMS. 2009. *The State of Europe's Common Birds 2008*. CSO/RSPB, Prague.
- Pennington, M., Osborn, K., Harvey, P., Riddington, R., Okill, D., Ellis, P., & Heubeck, M. 2004. *The Birds of Shetland*. Helm, London.
- Rehfish, M. M., Austin, G. E., Armitage, M. J. S., Atkinson, P. W., Holloway, S. J., Musgrove, A. J., & Pollitt, M. S. 2003. Numbers of wintering waterbirds in Great Britain, 1994/95–1998/99: II. Coastal waders (Charadrii). *Biol. Conserv.* 112: 329–341.
- Sharp, C. 2008. The Cleveland Water Body Survey 2006–07. *Cleveland Bird Report for 2007*: 8–9.
- Scott, D. A., & Rose, P. M. 1996. *Atlas of Anatidae populations in Africa and western Eurasia*. Wetlands International Publication No. 41, Wageningen.
- Stroud, D. A., Chambers, D., Cook, S., Buxton, N., Fraser, B., Clement, P., Lewis, P., McLean, I., Baker, H., & Whitehead, S. (eds.) 2001. *The UK SPA Network: its scope and content*. JNCC, Peterborough.
- Taylor, M., & Marchant, J. H. 2011. *The Norfolk Bird Atlas: summer and winter distributions 1999–2007*. BTO, Thetford.
- Thaxter, C. B., & Burton, N. H. K. 2009. *High Definition Imagery for Surveying Seabirds and Marine Mammals: a review of recent trials and development of protocols*. BTO, Thetford.
- , Sansom, A., Thewlis, R. M., Calbrade, N. A., Ross-Smith, V. H., Bailey, S., Mellan, H., & Austin, G. E. 2010. *Wetland Bird Survey Alerts 2006/2007: changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs) and Sites of Special Scientific Interest (SSSIs)*. BTO Research Report 556, Thetford.
- Thorup, O. 2006. *Breeding Waders in Europe 2000*. International Wader Studies 14. International Wader Study Group, Thetford.
- Tubbs, C. R. 1977. Wildfowl and waders in Langstone Harbour. *Brit. Birds* 70: 177–199.
- 1991. The population history of Grey Plovers *Pluvialis squatarola* in the Solent, Southern England. *Wader Study Group Bull.* 61: 15–21.
- Wanless, S., & Harris, M. P. 1997. *Phalacrocorax aristotelis* Shag. *BWP Update* 1: 3–13.
- Ward, R. M., Cranswick, P. A., Kershaw, M., Austin, G. E., Brown, A. W., Brown, L. M., Coleman, J. T., Chisholm, H., & Spray, C. 2007. *National Mute Swan Census 2002*. WWT, Slimbridge.
- Wernham, C. V., Toms, M. P., Marchant, J. H., Clark, J. A., Siriwardena, G. M., & Baillie, S. R. (eds.) 2002. *The Migration Atlas: movements of the birds of Britain and Ireland*. Poyser, London.
- Wetlands International. 2006. *Waterbird Population Estimates*. 4th edn. Wetlands International, Wageningen.
- Worden, J., Cranswick, P. A., Crowe, O., McElwaine, G., & Rees, E. C. 2006. Numbers and distribution of Bewick's Swan *Cygnus columbianus bewickii* wintering in Britain and Ireland: results of the International Censuses, January 1995, 2000 and 2005. *Wildfowl* 56: 3–22.
- , Crowe, O., Einarsson, O., Gardarsson, A., McElwaine, G., & Rees, E. C. 2009. Population size and breeding success of the Icelandic Whooper Swan *Cygnus cygnus*: results of the January 2005 International Census. *Wildfowl* 59: 17–40.

*Andrew J. Musgrove, Graham E. Austin and Chas A. Holt, BTO, The Nunnery, Thetford,*

*Norfolk IP24 2PU; e-mail [andy.musgrove@bto.org](mailto:andy.musgrove@bto.org)*

*Richard D. Hearn, WWT, Slimbridge, Gloucestershire GL2 7BT*

*David A. Stroud, JNCC, Monkstone House, City Road, Peterborough PE1 1JT*

*Simon R. Wotton, RSPB, The Lodge, Sandy, Bedfordshire SG19 2DL*

**Andy Musgrove** is Head of Monitoring at the BTO and is responsible for the delivery of many of the BTO's large-scale monitoring schemes, having been involved with the Wetland Bird Survey in particular since 1996. **Graham Austin** is Senior Research Ecologist in the Wetland & Marine Research team at the BTO and has been heavily involved in the analysis of WeBS data since the 1990s. **Chas Holt** is WeBS national organiser at the BTO, involving co-ordination of the Core Count scheme and reporting annually on the results. **Richard Hearn** has worked on waterbird monitoring projects at the Wildfowl & Wetlands Trust for the past 15 years, and has a particular interest in developing and supporting more comprehensive monitoring of duck populations. **David Stroud** is Senior Ornithologist with JNCC and a long-term Greenland White-fronted Goose obsessive. **Simon Wotton** is a Senior Conservation Scientist at the RSPB. He has been involved with organising a number of national surveys since the 1994 Dartford Warbler survey, including co-ordinating the national Bittern Monitoring Programme since 2005, and has been the RSPB representative on the WeBS steering group since 2007.