Population estimates of birds in Great Britain and the United Kingdom

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Northern Lapwing *Vanellus vanellus*

Abstract

Population estimates of birds have many applications in conservation and ecological research, as well as being of significant public interest. This is the fourth report by the Avian Population Estimates Panel, following those in 1997, 2006 and 2013, presenting population estimates of birds in Great Britain and the United Kingdom. Overall, there are thought to be about 84 million breeding pairs of birds in the UK, similar to the total in *APEP 3*. The Wren *Troglodytes troglodytes* continues to be the most common species, with a current estimate of

11 million pairs, which has increased since *APEP 3*. There are more than one million pairs of 20 species (23 in *APEP 3*) and these 20 species contribute 77% of the total (58% of the total is accounted for by the ten commonest species alone). Population estimates originate from a wide variety of sources, many involving extrapolation of previous estimates by recognised trend measures. Despite the often exceptionally detailed information available on bird numbers, there remain many gaps in our knowledge. Recommendations are made to improve our understanding of bird numbers nationally.

Introduction

Knowing the absolute number of birds in a population is important to those who make decisions about conservation policy and engage in site conservation management, but is also of public interest. However, it can be difficult to produce robust estimates of bird population size. First, numbers fluctuate from year to year and even from month to month as individuals breed, die and migrate (Newton 1998). Second, for all but the scarcest species, it is usually impossible to carry out a full census (i.e. count every individual), and hence population estimates are based on surveys that provide information for a sample of sites and use statistical techniques and

assumptions about behaviour, detectability and representativeness in order to turn counts into population estimates. This raises inevitable uncertainties about the accuracy of population estimates (Hewson *et al.* 2018).

Although trends over time are particularly valuable for assessing the status of species and biodiversity for many conservation purposes, knowledge of the absolute size of an animal population is also needed to fully understand threats to that species, to evaluate the risk of extinction and to make decisions about how to protect it. One of the most important uses of national and international population estimates in conservation is to enable sites to be designated and hence protected on the basis that they support an important part of a species' population, usually 1% of the international or national population (Ramsar Convention 2012; Drewitt *et al.* 2015; IUCN 2016). Absolute population estimates are also important in assessing extinction risk: species with a small population are more likely to be at risk of extinction, particularly if a large proportion of that population is found at a small number of sites.

David Tipling

26. The UKвЂ™s breeding population of

> Turtle Doves *Streptopelia turtur* is declining rapidly. The first APEP report (in 1997) put the population at 75,000 pairs, which compares with the current estimate of just 3,600 pairs in 2016 (and even that may now be too high);
> UK, April 2009.

Population size estimates are therefore a key conservation tool alongside population trends and other information. The European Union (EU) Directive on the conservation of wild birds (2009/147/EC) requires Member States to report on the status of native bird species every six years. This report under Article 12 includes an assessment of species population status (population sizes and distributions, and changes in these parameters over time). EU reporting under Article 12 was added to information collated in parallel from non-EU countries in order to update the European Birds of Conservation Concern (Staneva & Burfield 2017), which followed on from previous Birds in Europe publications (e.g. BirdLife International 2004).

The Avian Population Estimates Panel (APEP) is a collaboration between the UK statutory conservation agencies and relevant non-governmental organisations. The role of APEP is to collate the best estimates of breeding and non-breeding bird population size and present a consensus view on the most appropriate estimates for relevant conservation applications, such as defining thresholds for statutory site designations. The APEP process was endorsed in 2002 by the Joint Nature Conservation Committee (JNCC), which acknowledged the value to the conservation agencies of a single, quality-assured source of population estimates for statutory conservation purposes

(Stroud *et al.* 2002). Three previous APEP assessments have been published in *British Birds*: *APEP 1* (Stone *et al.* 1997), *APEP 2* (Baker *et al.* 2006) and *APEP 3*(Musgrove *et al.* 2013).

This report (*APEP 4*) presents the most recent estimates for both Great Britain (GB) and the United Kingdom (UK). Most of these estimates were submitted, together with other data and information, as part of the UK's Article 12 report to the EU in September 2019 (JNCC 2019).

Mark Lewis

27. Arctic Skua *Stercorarius parasiticus*, Sanday, Orkney, May 2017. The population estimate for Arctic Skua, and seven other seabirds, has been extrapolated from trends since the last complete national survey, *Seabird 2000*, which ran from 1998 to 2002. The current national census, *Seabirds Count*, is expected to be complete in 2020 and new counts for all species should be available soon.

Methods

Taxonomic scope: species, subspecies and biogeographic populations

All species in Categories A and C of the British List (BOU 2017) were considered for inclusion in the main species table (table 1); other non-native species were not listed in previous APEP reports but, for completeness, all non-natives for which breeding has been confirmed since 2011 are listed here in table 3. Population estimates were sought mainly at species level, but for 18 species it was possible to give estimates for some subspecies or geographical populations (table 2). This is of particular significance where the subspecies has a distinct legal status or is endemic. It was not possible to give estimates for three currently recognised endemic subspecies owing to a lack of knowledge about their distribution: Meadow Pipit *Anthus pratensis whistleri*, Linnet *Linaria cannabina autochthona* and Yellowhammer *Emberiza citrinella caliginosa* (Parkin & Knox 2010).

In addition, for some waterbirds it is well-established practice to base conservation policy on separately delineated biogeographic populations; we follow the treatment used by Frost *et al.* (2019b) in this regard.

Population estimates are presented for 249 species during the breeding season, 113 species during winter and for one species during passage. The estimates for 18 species are broken down into subspecies for either the breeding season or winter (or both), and are presented for a total of 29 breeding and 12 wintering subspecies.

28. Breeding Eurasian Spoonbills *Platalea leucorodia* (with juvenile Grey Herons *Ardea cinerea* to the left), Holkham, Norfolk, May 2011. The Spoonbill is one of several wetland bird species presently colonising the UK.

Seasonal scope: breeding, wintering and passage populations

Most estimates are for the breeding season. Breeding estimates are presented for all species included in *APEP 3* and for additional species (including non-natives) with at least one case of proven breeding from 2011 onwards.

The precise definition of the non-breeding season varies according to species and estimation technique (as set out in this paper and in sources referenced). In general, non-breeding estimates have been omitted for largely resident species, except for waterbirds where statutory site protection and reporting is based around non-breeding estimates; this repeats the approach used

for *APEP 3*. Apart from waterbirds, winter estimates have been produced only for the small number of wintering species included in *APEP 3*. For some other species (such as Common Chaffinch *Fringilla coelebs* and Blackbird *Turdus merula*), estimates of non-breeding numbers have again not been attempted owing to lack of suitable data sources, even though it is known that resident populations are supplemented in winter by large-scale arrivals.

Estimates of passage numbers have been excluded, with the exception of the globally threatened Aquatic Warbler *Acrocephalus paludicola*.

Geographic scope

As far as possible, separate estimates have been produced for the geographical entities of Great Britain and the UK (although the two estimates are sometimes identical following rounding; see below). All estimates exclude the Channel Islands. The Isle of Man (IoM) is not part of GB nor the UK but given the available data sources and methods, its exclusion from most estimates is generally not straightforward, and thus most estimates are actually those for GB+IoM and UK+IoM. For most species this makes little difference but in cases where the IoM contributes a significant and calculable proportion of the GB or UK total, separate IoM estimates are presented (and in those cases, strict GB and UK estimates are also given): IoM estimates are given in table 4 for Ringed Plover *Charadrius hiaticula*, Herring Gull *Larus argentatus*, Little Tern *Sternula albifrons*, Hen Harrier *Circus cyaneus*, Peregrine Falcon *Falco peregrinus* and Red-billed Chough *Pyrrhocorax pyrrhocorax*.

For many conservation purposes, an estimate for the UK – i.e. GB plus Northern Ireland (NI) – is required. However, for Special Protection Area

(SPA) and Sites of Special Scientific Interest (SSSI) selection, the geographical framework is either GB or All-Ireland (in the case of site Areas of Special Scientific Interest selection in Northern Ireland). If separate estimates for GB and the UK were available from the original source, these are presented. However, many original estimates, in particular those in *Breeding Atlas 1988–91* (Gibbons *et al.* 1993), were for GB or for All-Ireland. In some cases, such as many wintering waterbirds, estimates from NI were also available, and were added to the GB estimate to produce a UK estimate. Where the original source estimate was a UK figure, such as in the Rare Breeding Birds Panel report (RBBP; Holling *et al*. 2019), a NI estimate has been subtracted to produce the GB estimate. If NI-specific estimates were not available, then the UK estimates have been derived from extrapolated GB estimates using Atlas data, as described below.

Offshore wintering populations

Frost *et al.* (2019b) incorporated aerial and boat-based survey data from British waters into the wintering estimates for some marine species. British marine waters extend up to 200 nautical miles (370.4 km) or to an international boundary, if closer. In practice, there have been relatively few such surveys and many are commercial surveys from which data are not in the public domain. Consequently, most estimates exclude offshore areas out of sight of land. For 17 species that were suspected or known to have significant offshore distributions, the figures presented are marked as known underestimates in table 1 and include mostly birds in the near-shore environment only. Limited offshore data were included in previous estimates for Common Scoter *Melanitta nigra* and Red-throated Diver *Gavia stellata*, but more aerial survey data have become available subsequently for these

species (Frost *et al.* 2019b). Although some of these data were used, the totals are still considered an underestimate for British waters.

Richard Chandler

29. The Wren *Troglodytes troglodytes* remains the species with the highest population estimate in the UK, with a new estimate of 11 million pairs; Norfolk, May 2015.

Timescale and extrapolation

For each combination of species, geographical area and season, the Panel sought the most recent published estimate, along with its confidence limits (if any), units, date (or date range), method of derivation and reference. The aim has been to collate the most recently published estimates. Typically, these relate approximately to the period 2013–17 (for breeding estimates) or 2012/13–2016/17 (for winter). However, as in previous APEP reports, many of the breeding estimates are based on extrapolation of previously published estimates using breeding trend data. In these cases, breeding-season

estimates have generally been extrapolated from given baselines to 2016 (as described below). In addition, for older estimates (from 2012 or earlier) the possibility of extrapolating estimates forward in time was investigated. In some cases, more than one estimate was available for a given species/region/season combination; as in previous APEP reports, the Panel discussed the reasons behind such discrepancies and came to a collective view on the most appropriate estimate.

The methodology for extrapolating from estimates from 2012 or earlier was described in detail in *APEP 3* and is not repeated fully here. For most species for which this method of extrapolation was used, the UK estimate was derived from a GB estimate using data from *Bird Atlas 2007–11* (Balmer *et al*. 2013) in the same way as in *APEP 3*. The extrapolation used was a combination of two factors. First, the ratio of numbers of 10-km squares with possible, probable or confirmed breeding evidence in GB and UK was calculated. Second, a measure of average density in both GB and Ireland was derived by comparing results of *Bird Atlas 2007–11* timed tetrad visits (first hour only, and adjusted to account for differing levels of coverage in different areas).

For a small number of species for which the UK estimate was derived from the GB estimate in *APEP 3*, a more recent NI estimate was available for *APEP 4*, either from a species survey in NI or from the Irish Rare Breeding Birds Panel (IRBBP) reports covering 2012–16 (Perry 2013; Perry & Newton 2014; Newton 2015, 2016). For these species, the GB estimate is based on extrapolation from *Breeding Atlas 1988–91* (as before), and the NI estimate has been added to produce a UK figure. In the case of Northern Lapwing *Vanellus vanellus*, Eurasian Curlew *Numenius arquata* and Common Snipe *Gallinago gallinago*, the UK estimates in table 1 include figures from the

breeding wader survey in 2013 (Colhoun *et al.* 2015). For other breeding species for which a NI estimate was available, the NI population was negligible. The source for each NI estimate (usually IRBBP) is listed in the table wherever it has been used to produce raw (unrounded) UK estimates, even if the rounded GB and UK estimates remain the same.

As in *APEP 3*, extrapolations use unrounded estimates whenever they are available in order to avoid the risk of unnecessary multiple rounding (i.e. taking a rounded estimate, extrapolating by a rounded trend, and then rounding the final answer again). In addition, all estimates presented here have been recalculated from original source estimates, rather than extrapolating from 2009 estimates presented in *APEP 3*. This is to avoid introducing potential errors from subsequent changes to the 2009 smoothed trend, caused by inclusion of additional BBS data that were not available when the *APEP 3* estimates were calculated.

Richard Chandler

30. Oystercatchers *Haematopus ostralegus* piping at their territorial boundary (left two birds are one pair, the right two birds are the other pair; far left and far right are males, centre birds both females); Snettisham, Norfolk, March 2012. The

Oystercatcher and Northern Lapwing *Vanellus vanellus* are two declining species of breeding wader for which population estimates have dropped below 100,000 pairs for the first time in this report.

Data sources and derivation methods

For most species, the data sources and derivation methods are the same as those used in *APEP 3*; see Musgrove *et al.*(2013). In a small number of cases they have changed, usually because data from a new single-species survey or new analyses of existing data have become available.

Summary details of each data source and derivation method are provided below to enable interpretation of the estimates presented in the tables and to highlight minor differences from the previous methods where appropriate. The numbers for each section are the same as those used to reference the derivation method in the tables.

1. Common breeding species: extrapolation from *Breeding Atlas 1988–91*

For many common species, the original GB estimates from 1988–91 have been extrapolated forward using exactly the same methodology as described above, and using the same trend measures. The extrapolation uses the most appropriate trend information available, usually a joint Common Birds Census (CBC)/Breeding Bird Survey (BBS) trend (Woodward *et al.* 2018) for estimates made prior to 1995, or a smoothed BBS-only trend (Harris *et al.* 2019) for

estimates made since 1995 (BBS started in 1994). For a few species favouring waterways, the extrapolation uses a smoothed UK joint trend calculated from the Waterways Bird Survey (WBS, running from 1974 to 2007; Woodward *et al*. 2018) combined with the Waterways Breeding Bird Survey (WBBS, from 1998 onwards; Harris *et al*. 2019). Although *Bird Atlas 2007–11* has been published since *APEP 3*, new population estimates were not produced for that work and the 1988–91 estimates remain the most recent GB original source reference for many species. As UK estimates are derived from the extrapolated 2016 GB figure, the adjustments make use of the more concurrent *Bird Atlas 2007–11* timed count data, which present a robust measure of relative abundance between GB and NI.

As previously, there are a small number of species for which a robust CBC/BBS (or equivalent WBS/WBBS) trend could not be calculated. Extrapolated estimates for these species use the BBS trend from 1995 and hence make the assumption that there was no population change between 1988–91 and 1995. An exception is Red Grouse *Lagopus lagopus*, for which the estimate from *Breeding Atlas 1988–91* was extrapolated to 1995 by means of the Game & Wildlife Conservation Trust's National Gamebag Census trend (Aebischer 2019), recalibrated to density as per *APEP 2*, and then from 1995 to 2016 by the BBS trend. For one species, Rock Pipit *Anthus petrosus*, the estimate given in *Breeding Atlas 1988–91* has again been repeated as no suitable trend was identified to extrapolate it to 2016.

2. Distance-sampled BBS density-based estimates

For 24 common species, the population estimates in *APEP 3* were extrapolated from those produced by Newson *et al*.(2008), which used 2006

data from distance bands in BBS to infer the proportion of birds undetected by observers, and hence estimate how many birds were present in total. The method is computationally intensive so has not been repeated subsequently; and the estimates for 2006 have been extrapolated to 2016 using the BBS smoothed trend. As discussed fully in *APEP 3*, BBS density-based estimates work better for some species than others, depending on (for example) the relative detectability of males and females and the number of non-breeding birds present. The Panel carefully considered estimates from Newson *et al.* (2008) for *APEP 3* on a case-by-case basis, and used only those where there was clear evidence that the distance-based estimate was likely to be more accurate. This report uses this method for the same 24 species as *APEP 3*.

3. Rare breeding birds

The annual RBBP report publishes a population estimate for many scarce breeders to help monitor breeding trends, based on the mean maximum reported population size over the most recent period for which data are available. For most species, the population estimates given here are the five-year means from the 2017 RBBP report (Holling *et al*. 2019), covering the period 2013−17; these are adjusted to exclude breeding records from the Channel Islands and IoM and also exclude mixed pairs. A five-year mean is preferred to data for a single year as it accounts for variation in reporting and detection. The population estimates presented here are thus equivalent to the maximum (higher) figure where a range was reported for rare breeding birds in *APEP 3* (minimum and maximum five-year mean estimates). Five-year means for non-native breeders have been calculated for the most recent five-year period for which data were available (2010−14). Where the mean

maximum figure would round down to zero pairs, a range of 0–1 pairs is given.

For five species (Eurasian Spoonbill *Platalea leucorodia,* Eurasian Bittern *Botaurus stellaris,* Cattle Egret *Bubulcus ibis*, Great White Egret *Ardea alba* and White-tailed Eagle *Haliaeetus albicilla*), it was considered that recent increases seem likely to be sustained, and consequently that data from the most recent year is a more realistic assessment of the population than a five-year mean. Similarly, for the non-native Lady Amherst's Pheasant *Chrysolophus amherstiae,* the most recent information (Holling *et al.* 2018) suggests that this species is now extinct as a UK breeding species.

In isolated cases, older data are considered more reliable than the most recent figures. The *APEP 3* estimate for Common Goldeneye *Bucephala clangula*, covering the period 2006–10, is repeated here as there has been a reduction in monitoring intensity since 2011.

The estimates for Gadwall *Mareca strepera* and Red Kite *Milvus milvus* were based on RBBP data in *APEP 3* but both have since been dropped as RBBP species as they have become more abundant. The GB estimates in *APEP 3* for these species have been updated by extrapolation using BBS trends as described above. Both species are still covered by the IRBBP, and the NI mean total for the most recent five-year period was added to GB estimates to produce UK totals. Cetti's Warbler *Cettia cetti* was dropped from the RBBP list after 2016 and hence the 2016 RBBP estimate is used.

4. Breeding seabirds

The estimates of numbers of breeding seabirds were based on *Seabird 2000*, carried out between 1998 and 2002 (Mitchell *et al.* 2004). The next national

census (*Seabirds Count 2015–2020*) is not yet complete and hence the estimates for some species are the same as in *APEP 3*. These include Herring and Lesser Black-backed Gulls *Larus fuscus*, which increasingly nest in urban areas and for which traditional census techniques have become difficult.

Annual monitoring of some seabird colonies takes place under the Seabird Monitoring Programme (SMP) (https://jncc.gov.uk/our-work/seabird-monitoring-programme/) and thus some *Seabird 2000* population estimates have been extrapolated to 2015 using SMP trends. These were calculated using the long-term Thomas trend index (Thomas 1993; JNCC 2016) from 1986–2015 (using counts from a sample of colonies monitored by SMP), anchored to the *Seabird 2000* census count. Owing to concerns about how representative the colonies monitored by SMP are, updated estimates are presented here for only those eight species for which trends are considered a robust measure for the whole population. To test the robustness of the Thomas trend, an estimation of the *Seabird 2000* population was produced using the trend index between 1986 and 2000 and anchored to the 1986 Seabird Colony Register (SCR) census population for the species. If this estimate had a variance of 30% (or more) from the actual *Seabird 2000* population, the method was not used and the *Seabird 2000* census figure is repeated instead. All seabird estimates in table 1 are strict GB or UK estimates and exclude the IoM.

For four species, alternative estimates are used: Northern Gannet *Morus bassanus*, for which a full survey was carried out in 2013–14 (JNCC 2016); and Mediterranean Gull *Ichthyaetus melanocephalus*, Little Tern and Roseate Tern *Sterna dougallii*, for which annual data of sufficient quality are available via the RBBP.

5. Breeding estimates based on single-species surveys and bespoke analyses

As in previous APEP reports, breeding estimates have been sourced from the literature and include single-species surveys carried out under the SCARABBS programme (Statutory Conservation Agency and RSPB Annual Breeding Bird Scheme), as well as other dedicated surveys. Where possible, older published estimates have been extrapolated to 2016 as described above. For species where no suitable trend was available for extrapolation, the estimate relates to an earlier date, which is stated in the tables. For Grey Heron *Ardea cinerea*, estimates of the breeding population are derived annually from the BTO's long-running Heronries Census.

Edmund Fellowes/BTO

31. The Black Grouse *Lyrurus tetrix* is an example of a species for which a bespoke estimate was produced specifically for *APEP 4*; UK, April 2014.

For five resident wildfowl species – Greylag Goose *Anser anser*, Canada Goose *Branta canadensis*, naturalised Barnacle Goose *B. leucopsis*, Egyptian Goose *Alopochen aegyptiaca* and Mandarin Duck *Aix galericulata* – breeding population estimates were derived in the same way as for *APEP 3*, by dividing the most recent winter estimate by a standard value of three (Meininger *et al.* 1995).

For a small number of other species, novel analyses or compilations were undertaken for *APEP 4;* these are described in the footnotes in table 1. Since more recent data were not available for Tawny *Strix aluco*, Long-eared *Asio otus* and Short-eared Owls *A. flammeus*, the *APEP 3* estimates have been repeated for these species. The GB breeding estimate for Common Eider *Somateria mollissima* has been updated using the same method used for *APEP 3*; and new bespoke estimates for two further species, Black Grouse *Lyrurus tetrix* and Barn Owl *Tyto alba*, are described in table footnotes*.*

6. Wintering populations of waterbirds

Estimates of wintering waterbirds in GB were taken from Frost *et al.* (2019b). These were based on a variety of data sources, including the Wetland Bird Survey (WeBS), Goose & Swan Monitoring Programme (GSMP), Non-estuarine Coastal Waterbird Survey (NEWS), Winter Gull Roost Survey (WinGS), county bird reports, and for Mandarin Duck a novel analysis based on *Bird Atlas 2007–11* data. For full details see Frost *et al.* (2019b). Note that estimation methods have changed for many species and thus not all estimates are directly comparable with *APEP 3*. Most of these estimates relate to the period 2012/13 to 2016/17 (for estimates derived from WeBS or NEWS) or to 2011/12 to 2014/15 (for estimates derived from county

reports).

32. Wintering populations of wildfowl, such as these Tufted Ducks *Aythya fuligula* in Northamptonshire in December 2011, are relatively well monitored by the Wetland Bird Survey (WeBS). More broadly, the populations of many other wintering species remain poorly understood.

Richard Chandler

UK estimates were produced by summing GB and NI estimates, the latter mostly from Burke *et al.* (2018) and generally relating to the period 2011/12 to 2015/16. However, estimates for several (mostly naturalised and scarcer) species were not published in Burke *et al.*, and for these species, NI estimates have been taken from other sources. Where no suitable source was found, the NI estimate is based on BirdTrack/BirdGuides/BTO survey data (see method 7). Details of the derivation are shown in the sources.

7. Wintering population estimates for scarce winter visitors based on BirdTrack/BirdGuides

Winter estimates are presented for a small number of scarce non-breeding species that now winter annually in small numbers. The Panel developed a standardised approach to generate the *APEP 3* estimates for these species, to enable changes in status to be tracked in the future. The same method was used to produce *APEP 4* estimates. Records are extracted from the BirdTrack database, which also includes all records from the bird information service BirdGuides, and the highest count in each 10-km square is used to estimate GB and UK totals per month/year to calculate peak monthly totals each winter. For more details see Musgrove *et al.* (2013).

8. Estimates from *Winter Atlas 1981–84*

APEP 3 presented winter estimates for five species dating back to *Winter Atlas 1981–84* (Lack 1986); the same estimates for these species are included in this report given the absence of more recent assessments. These are: Fieldfare *Turdus pilaris*, Redwing *T. iliacus,* Black Redstart *Phoenicurus ochruros*, Brambling *Fringilla montifringilla* and Snow Bunting *Plectrophenax nivalis*.

9. Miscellaneous passage estimates

An estimate of passage numbers is presented only for Aquatic Warbler, which is included in view of its globally threatened status and its Birds Directive Annex I status requiring the classification of Special Protection Areas (of which there are four). The estimate is taken from Holt *et al.* (2018).

Assessing reliability of estimates

As with the two previous APEP reports, the Panel gave a broad reliability

score to each estimate, ranging from 1 (for good) to 3 (for poor) for the date (or date range) indicated. In producing these scores, both the means of derivation of the original estimates and any methods used to extrapolate those original estimates were considered. As a general rule, estimates with a reliability score of 1 are based on direct counts with a minimum of extrapolation; those with a reliability score of 2 have been arrived at through extrapolation from reliable figures, or have a small amount of uncertainty around the estimate; and those with a reliability score of 3 were based on assumptions and opinion in place of actual fieldwork. Importantly, estimates scored as having poor reliability are still considered the best estimates available at present and are, in most cases, priorities for future work.
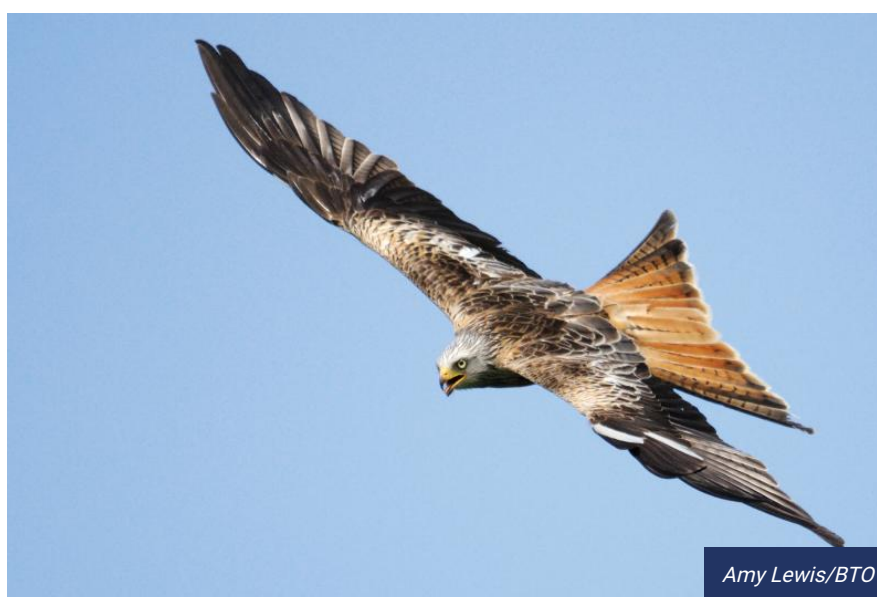
33. The Red Kite *Milvus milvus* is an example of a former RBBP (Rare Breeding Birds Panel) species that is now too numerous to be covered by RBBP but which can now be monitored by BBS (Breeding Bird Survey), which has enabled the last RBBP population

The reliability scores depend heavily on the means of derivation. For example, estimates of many common breeding passerines are based on trend-based extrapolation of estimates presented in *Breeding Atlas 1988–91*, which were themselves largely based on density measures derived from 1982 CBC data. Such estimates (indicated as '1 – CBC/BBS' in the tables) are based on a foundation of sound data but have involved a large degree of extrapolation; consequently, most estimates derived by this method are given a reliability score of 2.

It is important to note that the reliability scores state how reliable the estimate was considered to be *for the date/period that it relates to*. In a number of cases, the estimates presented are now known to be either too high or too low *for the current population*, but suitable data sources were not available for satisfactory population updates. For example, the breeding estimate for Puffin *Fratercula arctica* has a reliability score of 1, since it is a good estimate of the population size for the period 1998–2002, when it was produced, but it is now believed to overestimate the size of the current population (Harris & Wanless 2011). In cases where an estimate is known to be too low (but where there is no basis of a more precise, larger estimate) it is marked '+', whereas an estimate known to be too high is marked '-'.

Results and Discussion

Population estimates for species of GB and UK birds are presented in table 1. Population estimates for selected subspecies or biogeographical populations are presented in table 2. Within the breeding season, the units are mostly

'pairs' or 'territories', depending on the survey methodology used (and for most purposes the two terms can be used interchangeably), while outside the breeding season all estimates relate to individuals. For some species, population size is more meaningfully estimated in other units, as set out in table 1. Estimates are rounded to two-and-a-half significant figures (i.e. rounded to three significant figures, with the third figure rounded to either five or a zero); thus a raw estimate of 52,651 is rounded to 52,500 and one of 52,751 is rounded to 53,000. Estimates in previous APEP papers were rounded to two significant figures. The difference between UK and GB populations is the population size in Northern Ireland; readers should note that rounding may exaggerate this in some instances and reduce it in others.

In order to document the derivation of each estimate, the section number of the Methods (1, 2, etc.) is given against each estimate. For those estimates that involved forward extrapolation, the trend-measure used is also given; for example, '1−BBS' means extrapolation from a *Breeding Atlas 1988−91* estimate using the BBS trend (see table 1 key for other trend measures).

Footnotes are provided for estimates that require further explanation beyond that provided above, in particular where estimates were judged of lower reliability. References are given to document original sources. To avoid confusion, users of population estimates are strongly encouraged to cite the original published source of an estimate, other than for those calculated specifically for this paper.

34. Golden Eagles *Aquila chrysaetos*, Scotland, May 2013. The Golden Eagle is one species for which a new population estimate has been produced using a single-species survey (Hayhow *et al*. 2017), and for the first time the UK population has gone above 500 pairs. ***Chris Knights/BTO***

The population estimates presented here indicate that there are now thought to be about 84 million breeding pairs of birds in the UK, similar to the number estimated by *APEP 3*. The Wren *Troglodytes troglodytes* continues to be the most common species and has increased slightly since *APEP 3*, with the current estimate of 11 million pairs making up about one in eight of our breeding birds. Out of a total of 249 breeding species, 20 species have estimates exceeding one million pairs (compared with 23 species in *APEP 3*) and these 20 contribute 77% of the total, with 58% provided by the ten commonest species alone. Although the total number of breeding pairs has fallen, the changes for individual species were mixed and showed slightly more increases than decreases.

The vast majority of these increases and decreases relate to genuine population changes measured by long-term monitoring schemes such as BBS for many of the commoner species, or by single-species surveys or RBBP data for scarcer species. However, some changes to estimates are the result of new species surveys or a change in the estimation method, particularly for wintering estimates (see Frost *et al*. 2019b), while some increases or decreases since *APEP 3* may represent better understanding of a species' abundance rather than genuine population change. For example, our breeding estimate for the non-native Canada Goose population is based on the winter population estimate, which has decreased in GB from 190,000 to 160,000 individuals as a result of methodological change (Musgrove *et al.* 2011; Frost *et al*. 2019b), yet the ten-year winter population trend for Canada Goose (2006/07 to 2016/17) is +10% (Frost *et al*. 2019a).

There have been relatively few such changes since *APEP 3* for the breeding season, with around 10% of breeding estimates being based on a change of method. In one case (Snow Bunting), the estimate of 60 pairs given here, following a national survey (Hayhow *et al.* 2018a), is coincidentally exactly the same as in *APEP 3*, but our confidence in the accuracy of the new estimate is markedly higher, since the previous figure was based on a tentative estimate published in *Birds of Scotland* (Forrester *et al.* 2007). Of the 10% of species for which a method change has occurred, around half update the previous estimates using trend data from BBS or SMP, and in most other cases the direction of change since *APEP 3* matches independent knowledge about the species trend. Canada Goose (see above) is the only species for which we can be fairly certain that the direction of change since *APEP 3* does not represent a genuine population change, although there is uncertainty in a handful of other cases.

There have been a larger number of method changes for the new GB wintering waterbird population estimates, but a comparison of species for which methodological changes did not occur suggests that numbers of many (but not all) geese have increased and the numbers of many (but not all) waders have decreased since *APEP 3* (Frost *et al.* 2019b). Of the other scarcer wintering species included in APEP for which new estimates have been produced, the population estimates have increased for ten species and decreased for six. Passage estimates are produced only for the Aquatic Warbler: estimates for this species have decreased in each of the four APEP reports, from a high of 40 individuals in *APEP 1* (relating to 1987–92) to three here.

Analysing the *APEP 4* breeding population estimates by taxonomic group (fig. 1) shows that the vast majority of species with populations greater than 100,000 breeding pairs are passerines, and all but one of the 20 species with more than a million pairs are passerines (the exception being Wood Pigeon *Columba palumbus*). This partly reflects the fact that most species found in the UK are passerines, and that this group includes many ecological 'generalists', able to make use of widespread habitats across the UK, including woodland and gardens. Also, most passerines are small-bodied and exhibit particular ecological traits such as smaller territories and higher densities (Peters 1983).

The UK's coastline is important for breeding seabirds, with populations of international importance for some species (Mitchell *et al.* 2004). The seabirds include a notable proportion of species with a breeding population estimate of greater than 100,000 pairs, with the population estimate for Common Guillemot *Uria aalge* falling just under a million pairs (950,000).

Among the other groups, it is unsurprising that the breeding population estimates for raptors and owls are all below 100,000 pairs, since these species are apex predators and occur naturally in much lower numbers than their prey species. The UK is important for many wintering waders and wildfowl, the majority of which breed farther north, meaning that UK breeding populations for this group are less significant. However, for some species the UK breeding populations are important and are also in decline: although the current breeding population estimates for all wader species are below 100,000, those for Lapwing and Oystercatcher *Haematopus ostralegus* were both above this threshold in *APEP 3*, as was that for Curlew in *APEP 2*.
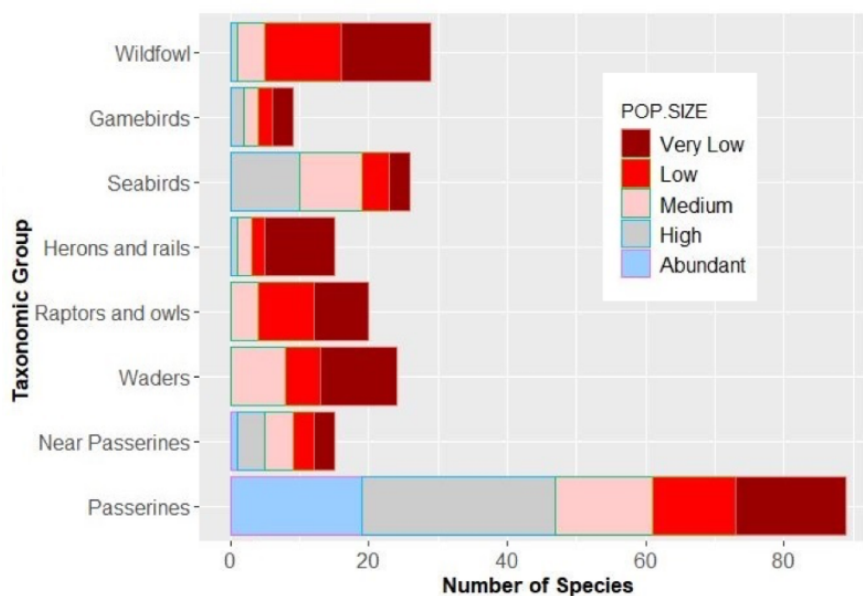

Fig. 1. Number of species in different taxonomic groups for which the breeding population estimates presented in this paper are: Very Low (<1,000 pairs), Low (1,000вЂ"9,999), Medium (10,000вЂ"99,999), High (100,000вЂ"999,999) and Abundant

(1,000,000+).

The breeding population sizes can also be compared across species habitat preferences (fig. 2). For this, we used the habitat-preference categories in Gibbons *et al*. (1993), excluding species not classified there but adding recent colonists to the most appropriate category if they show an obvious habitat preference. Note that each species is assigned to the preferred habitat rather than to all habitats in which it may occur; hence mildly woodland-preferring species such as Dunnock *Prunella modularis* may occur in overall larger numbers in farmland, which covers more than 70% of the UK's land surface.

Fig. 2 confirms that a mix of species with low and high population estimates can be found across all habitat types as predicted by ecological theory (e.g. Gaston & Blackburn 2000). Most species with breeding estimates of more than a million pairs are associated with woodland or lowland farmland. This reflects the ubiquity of these habitats, particularly farmland, in the UK. Moreover, some of the species categorised as woodland may be ecological generalists or occupy wooded features in other habitats such as hedgerows in farmland and gardens in urban areas.

Urban habitats are an exception to the pattern. Of the nine species found predominantly in urban habitats, only the Black Redstart has a UK population estimate of less than 10,000 breeding pairs. Most other species using urban habitats are generalists, abundant in other habitats.

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35. The Black Redstart *Phoenicurus ochruros* remains the UKвЂ™s only scarce breeding species that is found predominantly in urban areas (see fig. 2); Bedfordshire, February 2018.

Both upland and lowland wetland habitats support a larger proportion of species with fewer than 10,000 breeding pairs than other habitats. In the case of lowland wetlands, this may reflect the relative scarcity of certain wetland habitat such as reedbeds, and also that many recent colonists are found in lowland wetlands. In the uplands, the explanation for species with small population sizes includes generally low bird densities, combined with the relative scarcity of some upland habitats such as high mountains.
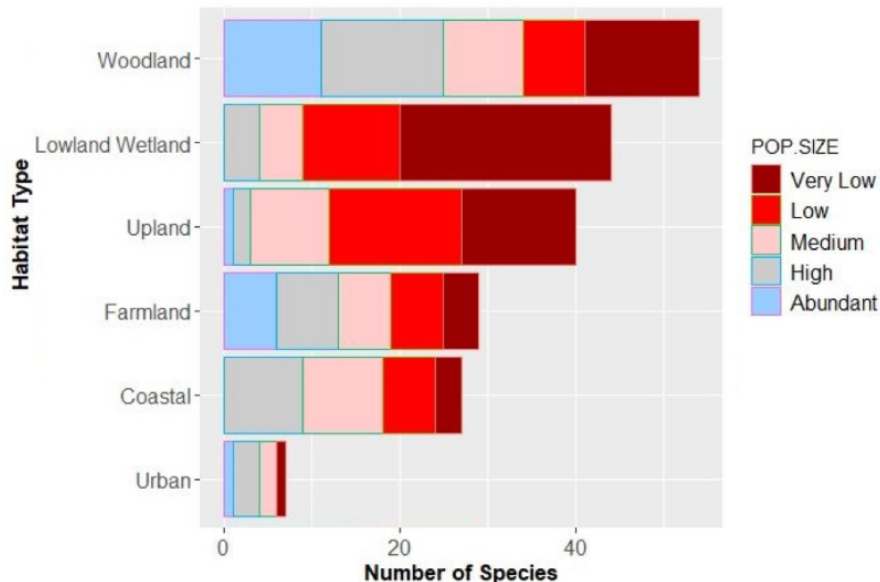
Fig. 2. Number of species using different preferred habitats for which the breeding population estimates presented in this paper are: Very Low (<1,000 pairs), Low (1,000–9,999), Medium (10,000–99,999), High (100,000–999,999) and Abundant (1,000,000+). Habitat types from Gibbons *et al.* 1993, with recent colonists (e.g. Little Egret *Egretta garzetta*) added to the most appropriate category.

Recommendations

Progress since *APEP 3*

APEP 3 included 12 recommendations for improving avian population estimates, with the stated aim of encouraging efforts to improve reliability and have 'fewer 3s and more 1s in the next APEP report'. This aim has not

been achieved. There are slightly fewer '1s' in this assessment, in part because some seabird population estimates are now based on extrapolation rather than census data. The reliability score for these species should improve in the near future with the completion of the 2015–20 seabird census. Although the levels of reliability have not changed substantially for non-seabirds, some progress has been made on some of the recommendations made in *APEP 3*. These should lead to further improvements in the quality of estimates in future, although this will need continued investment:

- The option to record the method of detection (song/call/visual) was introduced in BBS in 2014 and is now recorded by 79% of BBS surveyors (Harris *et al.* 2019). This may enable distance-based population estimates (Method 2) to be refined in future, to account for differences in detectability of males and females for some species and thus allow improved estimates for additional species.

- BBS has also encouraged the surveying of additional upland squares by introducing the option to carry out one-off BBS surveys in remote squares ('Upland Rovers'). This should improve knowledge of population trends for upland species, enable trends for additional species to be reported and, in time and if sufficient squares are covered, may also enable population estimates to be calculated or improved for some species using distance sampling.

- Several papers about local population studies have been published, including on Firecrest *Regulus ignicapilla*(Clements *et al*. 2017) and Hobby *Falco subbuteo* (Clements *et al.* 2016), which have proposed national population estimates based on the local population densities. Although these estimates are not used in *APEP 4*, further work on these and other species is encouraged. Hewson *et al.* (2018) discussed some of the difficulties in using surveys of localised species to produce

national population estimates. The Panel is considering providing guidance for local, single-species surveys, accounting for representativeness and how they can most usefully contribute towards national estimates. Additional local studies will also help to refine local density estimates that may help calibrate Atlas data.

- Work has been undertaken to improve the wintering population estimates for widely dispersed waterbirds such as Eurasian Teal *Anas crecca*, Mallard *A. platyrhynchos* and Moorhen *Gallinula chloropus*, for which a large proportion of the population is not counted by WeBS (Mйndez *et al.* 2015). Frost *et al.* (2019b) took this into account when producing estimates for seven species.

- National winter bird surveys following a BBS-type methodology were carried out for the first time in 2018/19. The aim of this project was to assess usage of farmland habitats in England but there are currently no plans for ongoing monitoring. If resources become available, future monitoring of this sort on a wide scale could help achieve one of the *APEP 3* recommendations and improve our knowledge of the population of widely dispersed non-waterbird species during winter, which is currently poor.

Additional recommendations

Although progress has been made for some of the recommendations made in *APEP 3*, more work is required. The following list, which is not exhaustive, includes some recommendations repeated from *APEP 3* on which little or no progress has been made but which we still consider important.

- In recent years, repeat surveys for a number of scarcer species have not been conducted owing to lack of funding, including European Nightjar *Caprimulgus europaeus*, Dartford Warbler *Sylvia undata*, and Red-throated and Black-throated Divers *Gavia arctica*. Without repeat

surveys we are reliant on ageing estimates for APEP and, more importantly, we do not have robust information to inform conservation prioritisation and (if required) conservation action for these species.

- Data on the breeding populations of a number of ducks remains poor and bespoke surveys are required for species including Common Shelduck *Tadorna tadorna*, Mandarin Duck, Gadwall, Teal, Eider, Red-breasted Merganser *Mergus serrator* and Goosander *M. merganser*.

- Targeted, species-specific surveys would also provide more robust estimates for other species for which current knowledge remains poor, including non-breeding Jack Snipe *Lymnocryptes minimus*, Hen Harrier and Merlin *Falco columbarius*; breeding and non-breeding Water Rail *Rallus aquaticus* and Common Snipe; and breeding Ptarmigan *Lagopus muta*, Common Swift *Apus apus*, Common Kingfisher *Alcedo atthis*, Sand Martin *Riparia riparia* and Rock Pipit.

- Information on the numbers of seabirds and other marine waterbirds using British waters outside the breeding season are still poorly known. As highlighted by Frost *et al.* (2019b), commercial data do exist for some locations but were not available to incorporate into population estimates; a clear mechanism is required to ensure that such data can be used.

- The UK holds internationally important wintering numbers of several gull species, and robust annual monitoring of wintering gulls at key sites, augmented by more comprehensive roost-site counts every few years, would improve understanding of population changes.

- Estimating the breeding populations of some seabirds is complicated by the increased use of other habitats such as urban areas. Work under way on urban gulls may help but this is also important for Great Cormorant *Phalacrocorax carbo* and some terns.

At the time of writing, the UK is scheduled to leave the EU, which means that the existing Article 12 reporting process to the EU will no longer apply. It is

anticipated that directive obligations will be translated into domestic policy where there is an obligation to produce country environmental reports via JNCC; however, it will be important to ensure that any future changes to the reporting protocols are considered carefully and continue to be coordinated at a UK level. This should ensure that the UK can continue to meet other international obligations that require population estimates, and can continue to feed into BirdLife International's six-year assessment of the state of Europe's birds (which necessarily incorporates data from non-EU as well as EU countries). It will also be important that we continue to understand the status of bird populations in the UK in order to inform national conservation policy, and prioritise and undertake any necessary conservation actions. We thus anticipate that APEP updates on population size assessments will continue on a six-year cycle.

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Table 1. Population estimates of full species in categories A−C of the British List.

Key:

Season

: B = Breeding; P = Passage; W = Wintering.

Unit

: AOS = Apparently Occupied Sites; F = females; I = individuals; M = males; N = nests; P = pairs; T = territories.

Estimates:

a single figure or a range is given, but in some cases a mean with 95%

confidence intervals in parentheses.

+/-

: population known to be larger (+) or smaller (-) than the estimate listed, but no better estimate available.

Der (Derivation)

: Numbers correspond to the appropriate section under Derivation in the text, additional text indicates that the original source estimate has been extrapolated as described in the text, using one or more of the following trends (see text for further details): BBS = Breeding Bird Survey; CBC = Common Birds Census; NGC/BBS = National Gamebag Census; SMP = Seabird Monitoring Programme; WBS/WBBS = Waterways Bird Survey/Waterways Breeding Bird Survey. * indicates that a change since *APEP 3* may relate partly or wholly to the use of a different estimation method or improved knowledge rather than being a genuine change.

Rel (Reliability)

: 1 (good) to 3 (poor); see text for further details

. Note

: Numbers refer to the footnotes of the table.

Reference

: Numbers correspond to those given in the References section.

	Season	Unit	GB estimate	UK estimate
Capercaillie *Tetrao urogallus*	W	I	1,100	1,100
Black Grouse *Lyrurus tetrix*	B	M	4,850	4,850
Ptarmigan *Lagopus muta*	B	P	2,000–15,000	2,000–15,000
Red Grouse *Lagopus lagopus*	B	P	265,000	265,000
Red-legged Partridge *Alectoris rufa*	B	T	72,500	72,500
Grey Partridge *Perdix perdix*	B	T	37,000	37,000
Common Quail *Coturnix coturnix*	B	M	350	355
Common Pheasant *Phasianus colchicus*	B	F	2,300,000	2,350,000

Species				
Golden Pheasant *Chrysolophus pictus*	B	M	15	15
Lady Amherst's Pheasant *Chrysolophus amherstiae*	B	M	0	0
Brent Goose *Branta bernicla*	W	I	105,000	135,000
Canada Goose *Branta canadensis*	B	P	54,000	54,500
	W	I	160,000	165,000
Barnacle Goose *Branta leucopsis*	B	P	1,450	1,550
	W	I	105,000	105,000
Snow Goose *Anser caerulescens*	B	P	2	2

	W	I	75	75
Greylag Goose *Anser anser*	B	P	47,000	47,000
	W	I	230,000	230,000
Taiga Bean Goose *Anser fabalis*	W	I	230	230
Pink-footed Goose *Anser brachyrhynchus*	W	I	510,000	510,000
Tundra Bean Goose *Anser serrirostris*	W	I	300	300
White-fronted Goose *Anser albifrons*	B	P	0–1	0–1
	W	I	13,500	14,000
Mute Swan *Cygnus olor*	B	P	6,500 (5,850–7,100)	7,000 (6,300–7,600)

	W	I	50,500	52,500
Bewick's Swan *Cygnus columbianus*	W	I	4,350	4,350
Whooper Swan *Cygnus cygnus*	B	P	24	28
	W	I	16,000	19,500
Egyptian Goose *Alopochen aegyptiaca*	B	P	1,850	1,850
	W	I	5,600	5,600
Common Shelduck *Tadorna tadorna*	B	P	7,600	7,850
	W	I	47,000	51,000
Mandarin Duck *Aix galericulata*	B	P	4,400	4,400

	W	I	13,500	13,500
Garganey *Spatula querquedula*	B	P	105	105
Shoveler *Spatula clypeata*	B	P	1,100	1,100
	W	I	19,000	19,500
Gadwall *Mareca strepera*	B	P	1,250−3,150	1,250−3,200
	W	I	31,000	31,000
Eurasian Wigeon *Mareca penelope*	B	P	200	200
	W	I	445,000	450,000
American Wigeon *Mareca americana*	W	I	17	18

Species				
Mallard *Anas platyrhynchos*	B	P	59,000–140,000	61,000–145,000
	W	I	665,000	675,000
Pintail *Anas acuta*	B	P	27	27
	W	I	19,500	20,000
Eurasian Teal *Anas crecca*	B	P	2,700–4,750	2,700–4,750
	W	I	430,000	435,000
Green-winged Teal *Anas carolinensis*	W	I	32	34
Red-crested Pochard *Netta rufina*	B	P	39 (20–47)	39 (20–47)
	W	I	570	570

Species				
Common Pochard *Aythya ferina*	B	P	695	720
	W	I	23,000	29,000
Ferruginous Duck *Aythya nyroca*	W	I	8	9
Ring-necked Duck *Aythya collaris*	W	I	16	18
Tufted Duck *Aythya fuligula*	B	P	16,000–18,000	16,500–19,000
	W	I	130,000	140,000
Greater Scaup *Aythya marila*	B	P	(0–1)	(0–1)
	W	I	3,900	6,400
Common Eider *Somateria*				

mollissima	B	P	36,000	37,000
	W	I	81,500	86,000
Surf Scoter *Melanitta perspicillata*	W	I	23	24
Velvet Scoter *Melanitta fusca*	W	I	3,350	3,350
Common Scoter *Melanitta nigra*	B	P	52	52
	W	I	135,000	135,000
Long-tailed Duck *Clangula hyemalis*	W	I	13,500	13,500
Common Goldeneye *Bucephala clangula*	B	F	200	200

	W	I	18,500	21,000
Smew *Mergellus albellus*	W	I	125	125
Goosander *Mergus merganser*	B	P	4,800 (4,250–5,250)	4,800 (4,250–5,250)
	W	I	14,500	14,500
Red-breasted Merganser *Mergus serrator*	B	P	1,550 (1,350–1,750)	1,650
	W	I	10,500	11,000
Ruddy Duck *Oxyura jamaicensis*	B	P	2–3	2–3
	W	I	23	23
European Nightjar *Caprimulgus*			4,600 (3,700–	4,600 (3,700–

Species				
europaeus	B	M	5,500)	5,500)
Common Swift *Apus apus*	B	P	59,000 (43,000–75,000)	59,000 (43,000–75,000)
Great Bustard *Otis tarda*	B	P	4	4
Common Cuckoo *Cuculus canorus*	B	P	17,000 (8,950–24,500)	18,000 (9,800–26,000)
Rock Dove *Columba livia*	B	P	460,000 (375,000–545,000)	465,000 (380,000–550,000)
Stock Dove *Columba oenas*	B	T	320,000	320,000
Wood Pigeon *Columba palumbus*	B	P	5,050,000 (4.75–5.35 m)	5,150,000 (4.85–5.45 m)
Turtle Dove *Streptopelia turtur*	B	T	3,600	3,600

Collared Dove *Streptopelia decaocto*	B	P	795,000 (715,000–875,000)	810,000 (730,000–890,000)
Water Rail *Rallus aquaticus*	B	T	3,900	3,900
Corn Crake *Crex crex*	B	M	1,100	1,100
Baillon's Crake *Porzana pusilla*	B	M	0–6	0–6
Spotted Crake *Porzana porzana*	B	M	27	27
Moorhen *Gallinula chloropus*	B	T	200,000	210,000
	W	I	300,000	305,000
Common Coot *Fulica atra*	B	P	25,500	26,000
	W	I	200,000	205,000

Common Crane *Grus grus*	B	P	31	31
	W	I	175	175
Little Grebe *Tachybaptus ruficollis*	B	P	3,300−6,650	3,650−7,300
	W	I	15,000	15,500
Red-necked Grebe *Podiceps grisegena*	B	P	(0−1)	(0−1)
	W	I	59	60
Great Crested Grebe *Podiceps cristatus*	B	P	4,300	4,900
	W	I	16,500	18,000
Slavonian Grebe *Podiceps auritus*	B	P	28	28

	W	I	920	995
Black-necked Grebe *Podiceps nigricollis*	B	P	55	55
	W	I	115	115
Stone-curlew *Burhinus oedicnemus*	B	P	365	365
Oystercatcher *Haematopus ostralegus*	B	P	92,500	95,500
	W	I	285,000	305,000
Black-winged Stilt *Himantopus himantopus*	B	P	3 (0–6)	3 (0–6)
Avocet *Recurvirostra avosetta*	B	P	1,950	1,950

	W	I	8,700	8,700
Northern Lapwing *Vanellus vanellus*	B	P	96,500	97,500
	W	I	620,000	635,000
European Golden Plover *Pluvialis apricaria*	B	P	32,500–50,500	32,500–50,500
	W	I	400,000	410,000
Grey Plover *Pluvialis squatarola*	W	I	33,500	33,500
Ringed Plover *Charadrius hiaticula*	B	P	5,300 (5,100–5,500)	5,450 (5,250–5,600)
	W	I	41,500	42,500
Little Ringed Plover *Charadrius dubius*	B	P	1,250 (1,200–1,300)	1,250 (1,200–1,300)

Dotterel *Charadrius morinellus*	B	M	425 (280–645)	425 (280–645)
Whimbrel *Numenius phaeopus*	B	P	310	310
	W	I	38	41
Eurasian Curlew *Numenius arquata*	B	P	58,000	58,500
	W	I	120,000	125,000
Bar-tailed Godwit *Limosa lapponica*	W	I	50,500	53,500
Black-tailed Godwit *Limosa limosa*	B	P	53	53
	W	I	39,000	41,000
Turnstone *Arenaria*				

Species				
interpres	W	I	40,000	43,000
Red Knot Calidris canutus	W	I	265,000	265,000
Ruff Calidris pugnax	B	F	13	13
	W	I	895	920
Temminck's Stint Calidris temminckii	B	P	0	0
Sanderling Calidris alba	W	I	20,000	20,500
Dunlin Calidris alpina	B	P	8,600–10,500	8,600–10,500
	W	I	345,000	350,000
Purple Sandpiper Calidris maritima	B	P	1	1

	W	I	9,700	9,900
Little Stint *Calidris minuta*	W	I	8	8
Woodcock *Scolopax rusticola*	B	M	55,000 (42,000– 69,000)	57,000 (43,000– 71,000)
	W	I	1,400,000	1,400,000
Jack Snipe *Lymnocryptes minimus*	W	I	100,000	110,000
Common Snipe *Gallinago gallinago*	B	P	64,500	66,500
	W	I	1,000,000	1,100,000
Red-necked Phalarope *Phalaropus lobatus*	B	M	64	64
Common Sandpiper *Actitis*				

hypoleucos	B	P	13,000	13,000
	W	I	52	52
Green Sandpiper *Tringa ochropus*	B	P	2	2
	W	I	290	290
Common Redshank *Tringa totanus*	B	P	22,000	22,000
	W	I	94,500	100,000
Wood Sandpiper *Tringa glareola*	B	P	30	30
Spotted Redshank *Tringa erythropus*	W	I	67	68
Greenshank *Tringa nebularia*	B	P	1,100	1,100

			810	920
	W	I	810	920
Kittiwake *Rissa tridactyla*	B	P	195,000 (170,000– 250,000)	205,000 (175,000– 255,000)
Black-headed Gull *Chroicocephalus ridibundus*	B	P	130,000	140,000
	W	I	2,200,000 (2.1–2.2 m)	2,200,000 (2.1–2.3 m)
Mediterranean Gull *Ichthyaetus melanocephalus*	B	P	1,200	1,200
	W	I	4,000	4,000
Common Gull *Larus canus*	B	P	48,000	48,500
			700,000	710,000

	W	I	(670,000–720,000)	(680,000–730,000)
Ring-billed Gull *Larus delawarensis*	W	I	17	21
Great Black-backed Gull *Larus marinus*	B	P	15,000 (7,200–19,000)	15,000 (7,200–19,000)
	W	I	76,000 (71,000–81,000)	77,000 (72,000–82,000)
Glaucous Gull *Larus hyperboreus*	W	I	155	165
Iceland Gull *Larus glaucoides*	W	I	330	355
Herring Gull *Larus argentatus*	B	P	130,000	130,000
	W	I	730,000 (700,000–760,000)	740,000 (710,000–780,000)

	W	I		
Caspian Gull *Larus cachinnans*	W	I	125	125
Yellow-legged Gull *Larus michahellis*	B	P	2	2
	W	I	840	840
Lesser Black-backed Gull *Larus fuscus*	B	P	110,000	110,000
	W	I	120,000 (120,000–130,000)	130,000 (120,000–130,000)
Sandwich Tern *Thalasseus sandvicensis*	B	P	12,500 (11,500–14,000)	14,000 (13,000–15,000)
	W	I	53	65

Species				
Little Tern *Sternula albifrons*	B	P	1,450	1,450
Roseate Tern *Sterna dougallii*	B	P	100	100
Common Tern *Sterna hirundo*	B	P	9,600 (7,550–11,500)	11,000 (8,900–13,500)
Arctic Tern *Sterna paradisaea*	B	P	52,500	53,500
Great Skua *Stercorarius skua*	B	P	9,650	9,650
Arctic Skua *Stercorarius parasiticus*	B	P	785 (535–1,550)	785 (535–1,550)
Common Guillemot *Uria aalge*	B	P	885,000	950,000
Razorbill *Alca torda*	B	P	140,000 (93,000–215,000)	165,000 (100,000–250,000)

Species				
Black Guillemot *Cepphus grylle*	B	P	19,000	19,500
Puffin *Fratercula arctica*	B	P	580,000	580,000
Red-throated Diver *Gavia stellata*	B	P	1,250 (1,000–1,550)	1,250 (1,000–1,550)
	W	I	21,500	21,500
Black-throated Diver *Gavia arctica*	B	P	215 (190–250)	215 (190–250)
	W	I	560	560
Great Northern Diver *Gavia immer*	W	I	4,350	4,400
White-billed Diver *Gavia adamsii*	W	I	80	80
European Storm-			25,500	25,500

Species				
petrel *Hydrobates pelagicus*	B	AOS	(21,000– 33,500)	(21,000– 33,500)
Leach's Storm- petrel *Oceanodroma leucorhoa*	B	P	48,000 (36,500– 65,000)	48,000 (36,500– 65,000)
Fulmar *Fulmarus glacialis*	B	P	350,000 (195,000– 680,000)	350,000 (195,000– 680,000)
Manx Shearwater *Puffinus puffinus*	B	P	295,000 (280,000– 315,000)	300,000 (280,000– 320,000)
Northern Gannet *Morus bassanus*	B	N	295,000	295,000
Shag *Phalacrocorax aristotelis*	B	P	17,500 (13,500– 20,500)	17,500 (13,500– 20,500)
	W	I	110,000	110,000

Great Cormorant *Phalacrocorax carbo*	B	P	8,200	8,900
	W	I	62,000	64,500
Glossy Ibis *Plegadis falcinellus*	W	I	27	27
Eurasian Spoonbill *Platalea leucorodia*	B	P	29	29
	W	I	105	105
Eurasian Bittern *Botaurus stellaris*	B	M	191	191
	W	I	795	795
Little Bittern *Ixobrychus minutus*	B	M	5	5
Night Heron *Nycticorax*				

nycticorax	B	P	0–1	0–1
Cattle Egret *Bubulcus ibis*	B	P	10–15	10–15
	W	I	65	66
Grey Heron *Ardea cinerea*	B	P	9,950	10,500 (10,000–11,000)
	W	I	45,000	45,500
Purple Heron *Ardea purpurea*	B	P	0	0
Great White Egret *Ardea alba*	B	P	8–12	8–12
	W	I	72	72
Little Egret *Egretta garzetta*	B	P	1,100	1,100

	W	I	11,500	11,500
Osprey *Pandion haliaetus*	B	P	240	240
Honey-buzzard *Pernis apivorus*	B	P	33−69	33−69
Golden Eagle *Aquila chrysaetos*	B	P	510	510
Eurasian Sparrowhawk *Accipiter nisus*	B	P	28,500	30,500
Northern Goshawk *Accipiter gentilis*	B	P	620	620
Marsh Harrier *Circus aeruginosus*	B	P	590−695	590−695
Hen Harrier *Circus cyaneus*	B	P	500	545
Montagu's Harrier *Circus pygargus*	B	P	8	8

Red Kite *Milvus milvus*	B	P	4,350	4,400
White-tailed Eagle *Haliaeetus albicilla*	B	P	122	123
Rough-legged Buzzard *Buteo lagopus*	W	I	29	29
Common Buzzard *Buteo buteo*	B	P	61,500–85,000	63,000–87,500
Barn Owl *Tyto alba*	B	P	4,000–14,000	4,000–14,000
Tawny Owl *Strix aluco*	B	P	50,000	50,000
Little Owl *Athene noctua*	B	P	3,600 (2,350–4,900)	3,600 (2,350–4,900)
Long-eared Owl *Asio otus*	B	P	1,600–5,300	1,800–6,000
Short-eared Owl *Asio flammeus*	B	P	610–2,150	620–2,200
Common Kingfisher *Alcedo*				

atthis	B	P	3,650–6,100	3,850–6,400
European Bee-eater *Merops apiaster*	B	P	1 (0–3)	1 (0–3)
Wryneck *Jynx torquilla*	B	P	0	0
Lesser Spotted Woodpecker *Dryobates minor*	B	P	600–1,000	600–1,000
Great Spotted Woodpecker *Dendrocopos major*	B	P	130,000 (120,000–145,000)	130,000 (120,000–145,000)
Green Woodpecker *Picus viridis*	B	P	45,500 (40,500–50,500)	45,500 (40,500–50,500)
Common Kestrel *Falco tinnunculus*	B	P	30,000	31,000
Merlin *Falco columbarius*	B	P	1,150 (850–1,450)	1,150 (890–1,450)

Species				
Hobby *Falco subbuteo*	B	P	2,050	2,050
Peregrine Falcon *Falco peregrinus*	B	P	1,650 (1,500–1,800)	1,750 (1,600–1,900)
Rose-ringed Parakeet *Psittacula krameri*	B	P	12,000	12,000
Red-backed Shrike *Lanius collurio*	B	P	3	3
Great Grey Shrike *Lanius excubitor*	W	I	98	98
Golden Oriole *Oriolus oriolus*	B	M	0 (0–2)	0 (0–2)
Eurasian Jay *Garrulus glandarius*	B	T	165,000	170,000
Magpie *Pica pica*	B	T	550,000	610,000
Red-billed				

Species				
Chough *Pyrrhocorax pyrrhocorax*	B	P	330	335
	W	I	1,250	1,250
Jackdaw *Coloeus monedula*	B	P	1,450,000 (1.3–1.6 m)	1,550,000 (1.35–1.75 m)
Rook *Corvus frugilegus*	B	P	885,000 (775,000– 1,000,000)	980,000 (865,000– 1,100,000)
Carrion Crow *Corvus corone*	B	T	1,050,000	1,050,000
Hooded Crow *Corvus cornix*	B	T	185,000	285,000
Common Raven *Corvus corax*	B	P	9,500	10,000
Waxwing *Bombycilla garrulus*	W	I	9,750	11,500

Coal Tit *Periparus ater*	B	T	590,000	660,000
Crested Tit *Lophophanes cristatus*	B	P	1,000–2,000	1,000–2,000
Marsh Tit *Poecile palustris*	B	T	28,500	28,500
Willow Tit *Poecile montanus*	B	P	2,750	2,750
Blue Tit *Cyanistes caeruleus*	B	T	3,250,000	3,400,000
Great Tit *Parus major*	B	T	2,200,000	2,350,000
Bearded Tit *Panurus biarmicus*	B	P	695	695
Woodlark *Lullula arborea*	B	P	2,300 (1,850–2,750)	2,300 (1,850–2,750)

Species				
Skylark *Alauda arvensis*	B	T	1,500,000	1,550,000
Shore Lark *Eremophila alpestris*	W	I	110	110
Sand Martin *Riparia riparia*	B	N	64,500–210,000	70,500–225,000
Barn Swallow *Hirundo rustica*	B	T	625,000	705,000
House Martin *Delichon urbicum*	B	P	470,000 (330,000–610,000)	480,000 (335,000–620,000)
Cetti's Warbler *Cettia cetti*	B	M	3,450	3,450
Long-tailed Tit *Aegithalos caudatus*	B	T	370,000	380,000
Wood Warbler *Phylloscopus sibilatrix*	B	M	6,500 (6,000–7,050)	6,500 (6,000–7,050)
Yellow-browed				

Species				
Warbler *Phylloscopus inornatus*	W	I	25	25
Willow Warbler *Phylloscopus trochilus*	B	T	2,050,000	2,300,000
Common Chiffchaff *Phylloscopus collybita*	B	T	1,650,000	1,750,000
Iberian Chiffchaff *Phylloscopus ibericus*	B	P	0–1	0–1
Aquatic Warbler *Acrocephalus paludicola*	P	I	3	3
Sedge Warbler *Acrocephalus schoenobaenus*	B	T	220,000	240,000
Reed Warbler *Acrocephalus scirpaceus*	B	P	130,000 (100,000–155,000)	130,000 (100,000–155,000)

Marsh Warbler *Acrocephalus palustris*	B	P	8	8
Icterine Warbler *Hippolais icterina*	B	P	0–2	0–2
Grasshopper Warbler *Locustella naevia*	B	T	9,750	12,000
Savi's Warbler *Locustella luscinioides*	B	P	5	5
Blackcap *Sylvia atricapilla*	B	T	1,600,000	1,650,000
Garden Warbler *Sylvia borin*	B	T	145,000	145,000
Lesser Whitethroat *Sylvia curruca*	B	T	79,000	79,000
Common Whitethroat *Sylvia*				

communis	B	T	1,100,000	1,100,000
Dartford Warbler *Sylvia undata*	B	P	2,200	2,200
Firecrest *Regulus ignicapilla*	B	T	2,000	2,000
Goldcrest *Regulus regulus*	B	T	675,000	790,000
Wren *Troglodytes troglodytes*	B	T	9,750,000	11,000,000
Eurasian Nuthatch *Sitta europaea*	B	T	250,000	250,000
Eurasian Treecreeper *Certhia familiaris*	B	T	210,000	225,000
Common Starling *Sturnus vulgaris*	B	P	1,650,000 (1.45–1.80 m)	1,750,000 (1.55–1.95 m)
Ring Ouzel *Turdus torquatus*	B	P	7,300 (5,550–9,400)	7,300 (5,550–9,400)

			4,850,000	5,050,000
			(4.60–5.05 m)	(4.80–5.25 m)
Blackbird *Turdus merula*	B	P		
Fieldfare *Turdus pilaris*	B	P	0–1	0–1
	W	I	680,000	720,000
Redwing *Turdus iliacus*	B	P	24	24
	W	I	650,000	690,000
Song Thrush *Turdus philomelos*	B	T	1,200,000	1,300,000
Mistle Thrush *Turdus viscivorus*	B	T	150,000	165,000
Spotted Flycatcher *Muscicapa striata*	B	T	38,500	41,500
Robin *Erithacus rubecula*	B	T	6,650,000	7,350,000

Bluethroat *Luscinia svecica*	B	P	0–1	0–1
Common Nightingale *Luscinia megarhynchos*	B	M	5,550 (5,100–6,000)	5,550 (5,100–6,000)
Pied Flycatcher *Ficedula hypoleuca*	B	P	22,000–25,000	22,000–25,000
Black Redstart *Phoenicurus ochruros*	B	P	58	58
	W	I	400	400
Common Redstart *Phoenicurus phoenicurus*	B	P	135,000 (97,000–170,000)	135,000 (97,000–170,000)
Whinchat *Saxicola rubetra*	B	P	49,500 (19,500–79,000)	49,500 (19,500–79,000)
European Stonechat *Saxicola rubicola*	B	P	61,000 (39,500–83,000)	65,000 (43,000–87,000)

Species				
Northern Wheatear *Oenanthe oenanthe*	B	P	165,000 (115,000– 220,000)	170,000 (120,000– 220,000)
Dipper *Cinclus cinclus*	B	P	6,350–19,000	6,900–20,500
House Sparrow *Passer domesticus*	B	P	5,150,000 (4.65–5.65 m)	5,300,000 (4.80–5.75 m)
Tree Sparrow *Passer montanus*	B	T	225,000	245,000
Dunnock *Prunella modularis*	B	T	2,350,000	2,500,000
Yellow Wagtail *Motacilla flava*	B	T	19,500	19,500
Grey Wagtail *Motacilla cinerea*	B	P	33,500	37,000
			495,000 (435,000–	505,000 (445,000–

Pied Wagtail *Motacilla alba*	B	P	560,000)	570,000)
Meadow Pipit *Anthus pratensis*	B	P	2,250,000 (1.95−2.55 m)	2,450,000 (2.10−2.75 m)
Tree Pipit *Anthus trivialis*	B	P	105,000 (66,000−145,000)	105,000 (66,000−145,000)
Water Pipit *Anthus spinoletta*	W	I	205	205
Rock Pipit *Anthus petrosus*	B	P	34,000	36,000
Common Chaffinch *Fringilla coelebs*	B	T	4,800,000	5,050,000
Brambling *Fringilla montifringilla*	B	P	0−1	0−1
	W	I	45,000−1,800,000	45,000−1,800,000
Hawfinch *Coccothraustes*				

coccothraustes	B	P	500–1,000	500–1,000
Bullfinch *Pyrrhula pyrrhula*	B	T	225,000	265,000
Greenfinch *Chloris chloris*	B	P	760,000 (710,000–810,000)	785,000 (735,000–835,000)
Twite *Linaria flavirostris*	B	P	7,800 (5,800–10,000)	7,850 (5,850–10,000)
Linnet *Linaria cannabina*	B	T	530,000	560,000
Common Redpoll *Acanthis flammea*	B	P	12	12
	W	I	335	335
Lesser Redpoll *Acanthis cabaret*	B	P	220,000	260,000
Arctic Redpoll *Acanthis*				

hornemanni	W	I	9	11
Parrot Crossbill *Loxia pytyopsittacus*	B	P	65	65
Scottish Crossbill *Loxia scotica*	B	P	6,800 (4,050–11,500)	6,800 (4,050–11,500)
Common Crossbill *Loxia curvirostra*	B	P	25,000 (19,000–33,000)	26,000 (19,500–34,000)
Goldfinch *Carduelis carduelis*	B	P	1,600,000 (1.40–1.75 m)	1,650,000 (1.45–1.80 m)
European Serin *Serinus serinus*	B	P	0	0
Siskin *Spinus spinus*	B	P	430,000	445,000
Lapland Bunting *Calcarius lapponicus*	B	P	0–1	0–1
	W	I	310	310

Snow Bunting *Plectrophenax nivalis*	B	T	60 (48−83)	60 (48−83)
	W	I	9,000−13,500	10,000−15,000
Corn Bunting *Emberiza calandra*	B	T	11,000 (9,050−13,000)	11,000 (9,050−13,000)
Yellowhammer *Emberiza citrinella*	B	T	685,000	700,000
Cirl Bunting *Emberiza cirlus*	B	T	1,100	1,100
Reed Bunting *Emberiza schoeniclus*	B	T	255,000	275,000

Notes

1.

Estimate comes from a bespoke calculation by N. J. Aebischer using the most recent survey information available from ongoing annual monitoring in Scotland and Wales, adjusted using the 2005 survey data (Sim *et al.* 2008) to account for areas not covered by ongoing monitoring, and data from the 2014 survey in England (Warren *et al.* 2015), extrapolated to 2016 using the average annual change since the previous survey.

2.

A large reduction in numbers has occurred and this non-native species is believed to be on the way to extinction in the UK.

3.

A mean of four males were present during 2010−14 (Holling *et al.* 2014a, 2017a), but the last male has not been seen since May 2016 (Holling *et al.* 2018) and the species is now believed to be extinct as a breeding species in the UK.

4.

GB estimates based on the wintering estimates for the naturalised population divided by 3.

5.

The NI estimate for Canada Goose is based on BirdTrack records since there is no published estimate for NI, applying the same method used for scarce

winter visitors (method 7).

6.

 The NI estimate uses a count from Strangford Lough, which is believed to be the only feral population of Barnacle Geese in NI (H. Thurgate, S. Wolsey pers. comm.).

7.

 Dates for the different subspecies estimates are shown in table 2.

8.

 Note that the NI estimate (264 individuals, 88 pairs) is based on the latest published figure (Boland & Crowe 2008) and is known to be an underestimate. There are now flocks of at least 300 in Belfast in July and possibly 700–800 or more in the whole of NI (K. Mackie pers. comm.) but there is no definitive recent count or estimate to replace the published figure.

9.

 A feral pair bred in Essex or northeast London in 2017 (Holling *et al.* 2019).

10.

 The BBS extrapolation uses the UK anchor trend, which is thought to better reflect the UK trend than the England joint trend used in *APEP 3*. The large decrease in the population estimate since *APEP 3* results from this change of estimation method rather than a substantial decline in breeding numbers: the

species is believed to have been increasing in England since *APEP 3*.

11.

This species is no longer considered by the RBBP, so the previous GB estimate from RBBP data has been updated by extrapolation using BBS.

12.

The RBBP five-year mean is believed to be an underestimate and the population may fall closer to or within the range of 300–500 given by previous APEP papers. However, the previous estimate dates from 1968–72 and is of uncertain reliability so is replaced here with the more recent RBBP estimate to enable comparison with future RBBP monitoring.

13.

The difference between the wintering and breeding estimates suggests that either (i) breeding is substantially under-recorded or (ii) there is either a large non-breeding population or a substantial influx from Europe during winter. RBBP recorded 67 breeding pairs in 2017 (Holling *et al*. 2019).

14.

A single brood was recorded in 2014. It could have involved a hybrid pair, since males were not seen with the brood, although males were seen at the same site earlier in 2014 (Holling *et al*. 2016).

15.

The GB estimate repeats the method used in *APEP 3*, and takes the wintering estimate minus birds wintering between Lincolnshire and Essex (assumed to be Dutch breeders), adjusted by a scale of 2.21 to calculate the number of breeding pairs. Note that the NI estimate (Leonard 2010) is an estimate of breeding females rather than breeding pairs.

16.

The *APEP 3* estimate is repeated rather than using more recent RBBP data; the latter are believed to be incomplete following more limited monitoring since 2011.

17.

The GB estimate is based on a similar method to that used for *APEP 3*, based on *1988–91 Atlas* data, but uses *2008–11 Atlas* data. Note that Humphreys *et al.*(2016) gave some caveats and state that the estimates should be considered a minimum. The UK estimate makes the assumption that breeding density per occupied 10-km square in NI is the same as in GB.

18.

RBBP figures show that there were seven nesting females in 2016 in the reintroduced population, but the five-year mean figure has been used rather than the most recent year, since it is unclear whether this level will be sustained.

19.

Francis *et al.* (2020) give a range of 2,500–3,900 pairs as the estimate, but

state that 3,900 is the best single estimate for the UK population and believe that the true figure may be higher.

20.

A total of 6–11 singing males were reported during the national Spotted Crake survey in 2012 (Ausden *et al.* 2013), although RBBP subsequently reported 0–6 since some records were not submitted to BBRC and hence remained unverified. It remains unclear whether 2012 was a one-off or whether more regular undetected breeding attempts may occur.

21.

The estimate of 28 singing males from the survey in 2012 (Schmitt *et al.* 2015) gives confidence that the RBBP data are likely to be complete or near-complete.

22.

Burke *et al.* (2018) did not give an estimate for wintering Moorhens, so the UK figure uses the *APEP 3* estimate for NI, based on data from 2004/05–2008/09.

23.

The NI estimate comes from a survey in 2013 (Colhoun *et al.* 2015), which is added to the extrapolated GB estimate in order to produce the UK figure.

24.

The previous estimate has been updated by extrapolation using the BBS trend since 1995. Note that the previous estimate covered the period 1980–2000 so the extrapolation may not account for changes that occurred in the 1980s.

25.

The 2013 survey covered GB only, so the UK estimate presented here makes the assumption that the population change in NI matched the rate of decline observed in GB.

26.

Note that although the *APEP 3*/Seabird 2000 estimate is repeated here, an error in the UK total in *APEP 3* has been corrected (birds from the IoM were included in the UK total in *APEP 3*).

27.

The sample from the SMP was not considered sufficiently robust to use the trend to update the population estimate and therefore the Seabird 2000 estimate is again repeated. Perkins *et al.* (2018) stated that there has been little overall change in the number of territories; they suggested a slight (but not statistically significant) increase in the area they covered (Orkney, Shetland and Handa).

28.

Perkins *et al.* (2018) give an estimate of 554 (422–728) breeding pairs for Orkney, Shetland and Handa in 2015, with the area they covered holding

around 90% of the population during Seabird 2000. The estimate presented here, based on SMP trends, would fall just inside the upper confidence interval given by Perkins *et al.* assuming similar declines across all colonies.

29.

This estimate is repeated from Frost *et al.* (2019b), who suggested that it may be a substantial underestimate.

30.

The previous estimate, from Seabird 2000, is repeated here. SMP trends since then suggest a decline, but these have not been used to produce an updated estimate owing to uncertainty about whether they are fully representative of both coastal and inland colonies, for which the trends are different.

31.

Following rapid recent increases, the most recent available annual figure has been used rather than a five-year mean, since breeding numbers seem likely to be sustained or to increase further in the future.

32.

A pair bred in 2017 in Somerset, the first record of breeding in the UK (Holling *et al.* 2019).

33.

The UK estimate comes from the BTO's Heronries Census published in BirdTrends (Woodward *et al.* 2018) with the calculation accounting for both actual counts and sites not surveyed. Recent census coverage in NI has been near-complete so the actual counts from NI were deducted from the UK estimate to derive the GB estimate.

34.

This species first nested in the UK in 2010 but nesting was not confirmed during 2013–17.

35.

Now that this species is relatively common and widespread, breeding is likely to be under-recorded and this may be a substantial underestimate. A comparison with the wintering estimate suggests a breeding population of around 2,700 pairs or more, if the proportion breeding was similar to that for Grey Heron (but we do not have sufficient information to make this assumption).

36.

The *APEP 3* estimate (200–250) was based on expert opinion rather than the RBBP five-year mean, which is likely to be an underestimate. Hence, although this estimate falls in the middle of the previous range, it is likely to be an underestimate and the population is believed to be still increasing. RBBP recorded 258 pairs in 2017 (Holling *et al.* 2019).

37.

The previous estimate is repeated and is considered the best current estimate. The RBBP five-year mean of 39 for 2013–17 is at the lower end of this range and is believed to be an underestimate. Roberts & Law (2014) estimated 100–150 pairs; while their figures could be correct, it is felt that further survey work is required to confirm that this estimate is robust.

38.

This uses the BBS trend to extrapolate from the last national survey, in 2005, which found 429 pairs (Holling *et al.* 2008).

39.

The *APEP 3* figure of 4,000 pairs is believed to be an underestimate. Extrapolating using the BBS trend gives an updated estimate of 14,200 pairs but there are uncertainties about the reliability of using BBS for this crepuscular/nocturnal species. Expert opinion and information from ringing and nest record schemes suggests that the population falls somewhere between these two figures and hence a tentative estimate of 4,000–14,200 pairs is given here.

40.

Two pairs nested in both 2014 and 2015 and three pairs in 2017 (RBBP).

41.

Wryneck is judged to be extinct in the UK as breeding has not been confirmed since 2002 (Holling *et al.* 2019), although singing males are still recorded occasionally.

42.

 This species is difficult to find and breeding is believed to be under-recorded, so producing a robust population estimate is challenging. Casual recording suggests that the severe decline of this species has continued, so the revised estimate of 600–1,000 pairs (Holling *et al.* 2017b) is adopted.

43.

 The current estimate is based on an extrapolation from the *APEP 3* figure and reflects the decline recorded by BBS during this period. Clements & Everett (2012) and Clements *et al.* (2016) suggested that densities are much higher than previously thought in some areas and that 3,000–3,500 pairs should be a lower limit for the population, which is perhaps as high as 5,000 pairs. Further work will hopefully lead to a robust, revised population estimate.

44.

 Wilson *et al.* (2018) gave two estimates; this is the most conservative and the one considered to be their main estimate.

45.

 The *APEP 3* estimate from 2012 was updated using the BBS trend, reflecting a substantial increase over the four years to 2016.

46.

 This species is probably now extinct as a breeding bird in the UK (Holling *et*

al. 2018).

47.

RBBP data (196–678 pairs in 2016) suggest that the population may be lower than this estimate, but the species is probably under-recorded by RBBP. A survey being carried out in 2019 and 2020 may produce a better estimate.

48.

The estimate from the 2006 survey was extrapolated using the BBS trend. Although the mean sample size (22 squares) is too low for a formal BBS trend, the data reinforces the expected pattern of a strong decline caused by the cold winters in 2008/09 and 2009/10 followed by a slight recovery. The extrapolated estimate is likely to be more reliable than repeating the 2006 survey estimate, carried out prior to the severe winter declines.

49.

The estimate of 0–1 pairs assumes that the 2015 breeding record was most likely to be a one-off and assumes that singing males holding territory in most years (mean estimate of 2 (1–4) over the period 2013–17) are likely to be overshooting migrants. However, the recent records may be an indication that this species is in the process of colonising the UK.

50.

This species remains an occasional breeder only. Two singing males were recorded in both 2015 and 2016 (RBBP).

51.

 The most recent national survey figure was 3,200 pairs in 2006 but numbers crashed during the severe winters in 2008/09 and 2009/10 (Clark & Eyre 2012). The 2017 RBBP total is considered to be a more reliable current figure, although note that it is based in part on county estimates, mostly within the core range in Hampshire.

52.

 Clements *et al.* (2017) suggested that the population is in excess of 4,000 singing males. However, this is based on extrapolation from core areas, not a full survey. Following the removal of Firecrest from the RBBP species list (Holling *et al.* 2019), and in the absence of evidence that breeding distribution is other than sparse away from core areas, the RBBP threshold of 2,000 is given as a minimum estimate. It is considered that the population is likely to be in excess of 2,000 pairs but that the data are not sufficiently robust to give a more precise estimate.

53.

 Note that the 2012 estimate includes a correction to account for detectability and the higher population estimate than *APEP 3* reflects this rather than a genuine population change. The BBS trend suggests little or no change since the 1999 survey, although the sample size during the early years of BBS was too low to report BBS trends.

54.

 The last confirmed breeding was in 2012 (Holling *et al.* 2017b).

55.

One pair bred in 2016 (Ince 2018).

56.

The estimate is the mean of 12 population estimates presented by Hewson *et al.* (2018), and the means of the confidence limits from these 12 estimates.

57.

The estimate is the maximum estimate from the survey; this is considered to be the most accurate assessment of the population (Jeffs *et al.* 2018).

Table 2.

Population estimates of subspecies or geographical populations. For key, see table 1.

	Season	Units	GB estimate	UK estimate
Red Grouse *Lagopus lagopus hibernica*	B	P	0	200
Red Grouse *Lagopus*				

lagopus scotica	B	P	265,000	265,000
'Dark-bellied Brent Goose' *Branta b. bernicla*	W	I	98,500	98,500
'Pale-bellied Brent Goose' *Branta bernicla hrota* (Nearctic)	W	I	1,550	31,000
'Pale-bellied Brent Goose' *Branta bernicla hrota* (Svalbard)	W	I	3,400	3,400
Barnacle Goose *Branta leucopsis* (Greenland)	W	I	56,000	56,000
Barnacle Goose *Branta leucopsis* (Svalbard)	W	I	43,500	43,500
Barnacle Goose *Branta leucopsis* (naturalised)	W	I	4,350	4,700
'Greenland White-fronted Goose' *Anser albifrons flavirostris*	W	I	11,500	11,500

Species				
'European White-fronted Goose' *Anser a. albifrons*	W	I	2,100	2,100
Common Eider *Somateria mollissima* (excl. Shetland)	B	P	34,000	35,000
Common Eider *Somateria mollissima* (excl. Shetland)	W	I	77,000	81,000
Common Eider *Somateria mollissima* (Shetland)	B	P	2,100	2,100
Common Eider *Somateria mollissima* (Shetland)	W	I	4,600	4,600
Rock Dove *Columba l. livia*	B	P	1,000–5,000	1,000–5,000
Feral Pigeon *Columba*			455,000 (375,000–	460,000 (375,000–

livia domestica	B	P	540,000)	545,000)
Black-tailed Godwit *Limosa limosa islandica*	B	P	7	7
Black-tailed Godwit *Limosa l. limosa*	B	P	46	46
Common Guillemot *Uria a. aalge*	B	P	850,000	850,000
Common Guillemot *Uria aalge albionis*	B	P	34,500	100,000
Great Cormorant *Phalacrocorax c. carbo*	B	P	6,450	7,150
Great Cormorant *Phalacrocorax c. carbo*	W	I	55,500	58,500
Great Cormorant *Phalacrocorax c. sinensis*	B	P	1,550	1,550

Great Cormorant *Phalacrocorax c. sinensis*	W	I	6,100	6,100
Eurasian Jay *Garrulus glandarius hibernicus*	B	T	0	4,250
Coal Tit *Periparus ater britannicus*	B	T	590,000	590,000
Coal Tit *Periparus ater hibernicus*	B	T	0	74,000
Wren *Troglodytes troglodytes indigenus*	B	T	9,750,000	11,000,000
'Fair Isle Wren' *Troglodytes troglodytes fridariensis*	B	T	39	39
'Hebridean Wren' *Troglodytes troglodytes hebridensis*	B	T	5,000–10,000	5,000–10,000

'St Kilda Wren' *Troglodytes troglodytes hirtensis*	B	T	230	230
'Shetland Wren' *Troglodytes troglodytes zetlandicus*	B	T	1,500–3,000	1,500–3,000
'Shetland Starling' *Sturnus vulgaris zetlandicus*	B	T	10,000–20,000	10,000–20,000
'Hebridean Song Thrush' *Turdus philomelos hebridensis*	B	P	500–2,200	500–2,200
Dipper *Cinclus cinclus gularis*	B	P	6,350–19,000	6,350–19,000
Dipper *Cinclus cinclus hibernicus*	B	P	?	570–1,700
Dunnock *Prunella modularis hebridium*	B	T	75,000–125,000	245,000–295,000

Yellow Wagtail *Motacilla flava flavissima*	B	T	19,500	19,500
'Blue-headed Wagtail' *Motacilla f. flava*	B	P	0–1	0–1
Pied Wagtail *Motacilla alba yarrellii*	B	P	495,000 (435,000– 560,000)	505,000 (445,000– 570,000)
White Wagtail *Motacilla a. alba*	B	P	2	2

Notes

1.

See table 1 for details of breeding calculation.

2.

Derived from wintering population estimate, adjusted by a factor of 2.21.

3.

Note that *U. aalge albionis* is calculated based on all Guillemots in Northern Ireland being *albionis;* Guillemots in SW Scotland north to, and including, Ailsa Craig are *albionis*; all Guillemots in England excluding Northumberland

are *albionis*. All other Scottish birds and those in Northumberland are *U. a. aalge*.

4.

Subspecies *brittanicus* mostly found in GB but also occurs in extreme northeast of Ireland where it intergrades into *hibernicus*; the precise nature of zone of intergradation is unknown.

5.

This is an overestimate as some Scottish birds are assigned to *hibernicus*.

6.

Estimate is for NI but is an underestimate as *hibernicus* also occurs in Hebrides and parts of west coast of mainland Scotland.

7.

The RBBP five-year mean is stated as three breeding pairs (Holling *et al.* 2019) but includes mixed pairs, which are excluded here.

Table 3.

Population estimates of non-native species for which breeding has been confirmed in the UK since 2011. For key, see table 1. Note that estimates for Category C species are in table 1.

	GB		
	Season	Units	estimate
Helmeted Guineafowl *Numida meleagris*	B	P	1
Indian Peafowl *Pavo cristatus*	B	P	4
Wild Turkey *Meleagris gallopavo*	B	P	1
Bar-headed Goose *Anser indicus*	B	P	1
Emperor Goose *Anser canagicus*	B	P	0–1
Black Swan *Cygnus atratus*	B	P	19
Ruddy Shelduck *Tadorna ferruginea*	B	P	1
Wood Duck *Aix sponsa*	B	P	3
Muscovy Duck *Cairina moschata*	B	P	10
Harris's Hawk *Parabuteo unicinctus*	B	P	2
Eagle Owl *Bubo bubo*	B	P	2

Monk Parakeet *Myiopsitta monachus*	B	P	18

Notes

1.

 Cheke (2019) suggests some local UK populations of this species could be considered self-sustaining.

Table 4.

Population estimates for six species with notable breeding populations in the Isle of Man. For key, see table 1. Estimates are shown here for the five species for which separate IoM estimates were published in *APEP 3*, and also for Little Tern.

	Season	Units	IoM estimate	+/-	Date	Der.
Ringed Plover *Charadrius hiaticula*	B	P	147 (135–160)		2007	5
Herring Gull *Larus argentatus*	B	P	7,100	-	1998–2002	4

Little Tern *Sternula albifrons*	B	P	18	2013–17	3
Hen Harrier *Circus cyaneus*	B	P	30	2016	5
Peregrine Falcon *Falco peregrinus*	B	P	22 (22–23)	2014	5
Red-billed Chough *Pyrrhocorax pyrrhocorax*	B	P	160	2014–15	5

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