



Population trends of breeding birds in the United Kingdom since 1800

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ABSTRACT Building on the extensive reviews by Alexander & Lack (1944) and Parslow (1973), a scoring system is used to assess the general population trend of each species that bred in the United Kingdom during the entire 196-year period 1800-1995. This semi-quantification of qualitative assessments allows comparison of trends between species. It is recommended that revisions of the Red Data List should consider those species which have declined dramatically over historical, as well as recent, time periods. The number of species that bred in the UK apparently increased by 19%, from 194 to 230, during 1800-1995, though nearly one-third of this increase was as a consequence of introductions (intentional or otherwise).

The composition of the breeding avifauna of the United Kingdom, and the status of individual species, has changed markedly during the last two centuries. Here we review changes in status of all breeding species in the UK since 1800, building on the earlier work of Alexander & Lack (1944), Parslow (1973) and Sharrock (1974), with a view to determining the general population trend of each species over this period of nearly two centuries.

Such a review has interest in its own right, but it could also help to determine today's conservation priorities. Species which have declined most are potentially those which are good candidates for future recovery programmes (see, for example, Anon. 1994). Candidates for such programmes are currently chosen, in part, from among those species whose populations have declined most over relatively short time periods of one (e.g. Mace & Stuart 1994) or a few (e.g. Batten *et al.* 1990, Tucker & Heath 1994) decades; thus, species which have declined over longer time periods may be overlooked. Whilst we acknowledge that for most taxa and most countries there are insufficient monitoring data to extend backwards the period over which the population decline is measured, we show here that this may not be the case for birds in the UK.

Methods

Sources of information

Though there is little quantitative information on population trends of breeding birds available before the 1960s, there have been several qualitative reviews of the status of British and Irish birds published this century. The three most important are those of Alexander & Lack (1944), Parslow (1973) and Sharrock (1974). A brief synopsis of each of these follows:

1. Alexander & Lack (1944): Changes in status among British breeding birds.

This review covered the period from 1800 to 1940 and considered mainly British birds, though Irish populations received an occasional mention. The information was collated from county avifaunas and species monographs. Since most avifaunas were written in the second half of the nineteenth century, Alexander & Lack's review concentrated on the period 1840-1940, though they commented on marked changes before that period. Although the presentation of the review is rather poor, as it is simply an annotated list with few references to the original sources, the authors attempted to give some idea of the magnitude of changes in breeding status of each species by using such phrases as 'Huge and widespread decrease' through 'No evidence for change' to 'Huge increase and spread'.

2. Parslow (1973): Breeding birds of Britain and Ireland.

This was originally published as a series of papers in *British Birds*, but was updated and published as a book in 1973. This review covered the period 1940-70, and in some instances improved on the information presented by Alexander & Lack for the period 1800-1940. For each species there is a simple summary, the first part of which repeats (almost verbatim) Alexander & Lack. This is useful because Parslow then adopted very similar terminology to represent population change, thus allowing comparison with Alexander & Lack.

3. Sharrock (1974): The changing status of breeding birds in Britain and Ireland. Using the two earlier reviews and other sources, Sharrock (1974) summarised

status changes in six time periods from 1800 to 1972 for 129 species that had shown marked changes, quantifying these changes with a ++, +, 0 or - scoring system. Sharrock was able to show that proportionately more of these 129 species had expanded in range or increased in numbers than had contracted in range or declined in numbers since 1800, and that, whereas the number of species breeding regularly in Britain and Ireland was fairly static from 1800 to 1949, there had subsequently been a net gain of about five species per decade, so that the total in the early 1970s was higher than at any time since recording began.

Table 1. Scoring system used to quantify population changes of UK breeding birds. The system is based on the terminology developed by Alexander & Lack (1944) and subsequently adopted by Parslow (1973). The terms 'decrease' and 'decline' were used interchangeably in both reviews, as well as here. Species which did not breed during a particular time period were noted as such. The minimum requirement to qualify as a breeding species within each time period was arbitrarily taken as a record of a single pair with eggs.

Score value	Positive score	Negative score
5	Huge increase. Spectacular increase.	Huge decrease. Spectacular decrease. Widespread decline . . . [to extinction or near-extinction].
4	Very marked increase. Very rapid increase.	Very marked decrease. Very rapid decrease. [Very] widespread decline . . . [though not to extinction]. Widespread decline . . . [to extinction in some areas].
3	Marked increase. General widespread increase. Great increase. Sharp increase.	Marked decrease. General widespread decrease. Great decrease. Sharp decrease.
2	Increasing. Steady increase. General increase. Continuing increase. Spreading.	Decreasing. Steady decrease. General decrease. Continuing decrease.
1	Probably increasing. Somewhat increasing. Small increase. Small (but steady) increase. Slowly increasing. Some evidence of an increase. Gradual increase. Increase with setbacks. Despite local declines continues to increase.	Probably decreasing. Somewhat decreasing. Small decrease. Small (but steady) decrease. Slowly decreasing. Some evidence of a decline. Gradual decline.
0	No marked change. No obvious trend. Little change. Fluctuates but no overall trend.	

Quantification of population changes

In this paper, we build on the ideas underlying Sharrock's (1974) review, though we have adopted a slightly different approach. We have attempted to quantify population changes in several time periods by using a simple scoring system built on the terminology used by Alexander & Lack and subsequently adopted (fortunately so for our purposes) by Parslow. Thus 'Huge and widespread decline' was ranked as -5, 'No evidence for change' was 0, and 'Spectacular increase' was +5. The scores we have used, and the way in which they relate to the terminology of Alexander & Lack and Parslow, are given in table 1 (see page 293).

The method adopted here differs from that used by Sharrock (1974) in a number of ways. First, all species that have bred since 1800 have been included. Secondly, we have attempted to score each species' trend in each time period into more categories (11 here, compared with Sharrock's four). Thirdly, these analyses update Sharrock by including a post-1970 period.

The time periods

We have split the historical data into four time periods: 1800-49, 1850-99, 1900-39 and 1940-69. Though these time periods are not of equal length, they reflect the time periods covered by the relevant reviews. A population-trend score was then allocated to each time period for each species. Where Alexander & Lack did not provide separate information for each of the first three time periods, the same value has been allocated to each. Where populations fluctuated *within* time periods, an approximate average value was allocated (e.g. an increase of +2 followed by a marked decline of -3 was rated as -1). We also took into account the proportion of the population which had changed, and downgraded the ranks by 1 where the change affected only part of the population. This was especially important for seabirds and widespread species. Thus, for some auks (Alcidae), a marked decline (-3) in southern English colonies but not elsewhere would have been ranked as -2, because most auk colonies occur outside these areas.

Wherever Parslow had improved upon or updated the information presented by Alexander & Lack for the period 1900-39, Parslow's data have been used.

A fifth time period has been added, 1970-95, and population-trend scores have been allocated by us to each species following the spirit of the two earlier reviews. The trend scores were based on both published and unpublished data from the existing monitoring schemes. The most widely used sources of information were from the Common Birds Census (e.g. Marchant *et al.* 1990, and more recent updates), the Rare Breeding Birds Panel (e.g. Ogilvie & RBBP 1995), the Seabird Colony Register (Lloyd *et al.* 1991) and the New Breeding Atlas (Gibbons *et al.* 1993). Though we originally tried to allocate scores in a rigorous quantified manner (e.g. >90% decline = -5, >1000% increase = +5), it proved surprisingly difficult to do so for some species. For example, the White-tailed Eagle* has increased from zero to about ten pairs since 1970, and its increase is thus infinitely large and would score +5; this does not seem realistic as, by comparison with its historical population levels, it is only a modest increase (thus ranked +2). Scorings for 1970 to the present are, thus, subjective; but so were those for the earlier periods.

*Scientific names of all species are given in table 2.

Extinctions, colonisations and recolonisations

Species which began breeding during the 195-year period were allocated a score of 0 for the time periods in which they did not breed. Some species became extinct in the UK during the two centuries; amongst these, some remained extinct, whilst others subsequently recolonised or were reintroduced. For example, the Great Bittern declined to extinction extremely rapidly in the early 1800s, only to reappear as a breeder in the early twentieth century. During the period 1850-99, the Great Bittern thus did not breed as a consequence of its earlier extinction. Rather than score the period 1850-99 for this species as 0, we carried over the value from the previous time period (-5). We believe this makes sense, since otherwise the Great Bittern, which had declined rapidly to extinction just a few decades earlier, would score the same during 1850-99 as, for example, Temminck's Stint, which did not even begin breeding until a century later. A few other species which bred, declined to extinction and subsequently recolonised (Whooper Swan, Avocet, Ruff, Black-tailed Godwit, Black Tern, Savi's Warbler and Brambling), were reintroduced (White-tailed Eagle) or remained extinct (Great Bustard and Great Auk) have been treated in the same manner.

Population trend during the period since 1800

A general population trend for the period 1800-1995 has been calculated for each species, taking the sum of the scores from all individual time periods. Though more sophisticated measures, taking into account differences in the length of each time period, could be developed, the data probably do not warrant such analyses. In addition, the same method has been used for each species and, despite its flaws, this makes the results comparable between species. The range of possible values across the entire period of 1800-1995 is -25 to +25.

Results

Table 2 documents trends for each period, species by species, and the general population trend for each across all periods. These vary from -19 for the Wryneck to +19 for the Tufted Duck. Table 3 documents the 20 species whose sum is -10 or less; these are the species that have shown the greatest declines over the period 1800-1995, though the -10 threshold is purely arbitrary. A comparison with the classification of Batten *et al.* (1990) shows that their threshold value of a 50% decline over 25 years for qualification as a declining breeding species on the British birds Red Data list pulled out only three of the species that have declined most since 1800 (Corn Crane, Red-backed Shrike and Great Bittern). In most cases, the reason for this was simply that the remaining species had not declined sufficiently (or in some cases had even increased, for example the Dartford Warbler) in recent years. Interestingly, three of the eight species that Batten *et al.* allocated to a 'Special Concern' category (i.e. which they had expected to qualify on the basis of population decline, but which did not do so for lack of data), Hen Harrier, Merlin and Black Grouse, are included in this listing, while a fourth, Barn Owl, comes close to inclusion.

Table 2. Historical population trends of UK breeding birds.

The manner of calculation of the population-trend scores is given in the text.

All scores are positive, except 0 and those preceded by a minus sign.

nb = did not breed in that time period and had not bred previously (effective score = 0).

nb* = did not breed in that time period, but had bred previously so allocated value from previous time period (see text for explanation).

Asterisked species are introduced, of domestic or non-native origin, with self-sustaining populations in the wild, as outlined in Gibbons *et al.* (1993).

Species	TIME PERIOD					Sum of periods
	1800-49	1850-99	1900-39	1940-69	1970-95	
Red-throated Diver <i>Gavia stellata</i>	-2	-2	1	1	1	-1
Black-throated Diver <i>Gavia arctica</i>	-1	-1	-1	1	-1	-3
Great Northern Diver <i>Gavia immer</i>	nb	nb	nb	0	nb	0
Little Grebe <i>Tachybaptus ruficollis</i>	0	0	1	0	0	1
Great Crested Grebe <i>Podiceps cristatus</i>	-3	3	3	2	1	6
Red-necked Grebe <i>Podiceps grisegena</i>	nb	nb	nb	nb	1	1
Slavonian Grebe <i>Podiceps auritus</i>	nb	nb	1	1	1	3
Black-necked Grebe <i>Podiceps nigricollis</i>	nb	nb	1	-3	1	-1
Fulmar <i>Fulmarus glacialis</i>	0	5	5	3	2	15
Manx Shearwater <i>Puffinus puffinus</i>	-2	-2	0	0	-1	-5
European Storm-petrel <i>Hydrobates pelagicus</i>	0	0	0	0	0	0
Leach's Storm-petrel <i>Oceanodroma leucorhoa</i>	0	0	0	1	0	1
Northern Gannet <i>Morus bassanus</i>	1	1	1	2	2	7
Great Cormorant <i>Phalacrocorax carbo</i>	-1	-1	0	0	1	-1
Shag <i>Phalacrocorax aristotelis</i>	0	0	0	3	1	4
Great Bittern <i>Botaurus stellaris</i>	-5	nb*	2	1	-4	-11
Little Bittern <i>Ixobrychus minutus</i>	nb	nb	nb	nb	0	0
Grey Heron <i>Ardea cinerea</i>	0	0	0	0	2	2
Mute Swan <i>Cygnus olor</i>	2	2	2	1	1	8
Whooper Swan <i>Cygnus cygnus</i>	nb	1	nb*	nb*	1	4
Greylag Goose <i>Anser anser</i>	-2	-2	-1	0	2	-3
Canada Goose* <i>Branta canadensis</i>	3	3	3	2	3	14
Egyptian Goose* <i>Alopochen aegyptiacus</i>	0	0	0	0	3	3
Common Shelduck <i>Tadorna tadorna</i>	2	2	2	1	1	8
Wood Duck* <i>Aix sponsa</i>	nb	1	1	1	2	5
Mandarin Duck* <i>Aix galericulata</i>	nb	nb	2	0	3	5
Eurasian Wigeon <i>Anas penelope</i>	4	4	4	-1	0	11
Gadwall <i>Anas strepera</i>	nb	2	2	2	3	9
Common Teal <i>Anas crecca</i>	0	0	0	-1	-1	-2
Mallard <i>Anas platyrhynchos</i>	0	0	0	0	1	1
Northern Pintail <i>Anas acuta</i>	nb	3	3	1	-1	6
Garganey <i>Anas querquedula</i>	1	1	1	0	-1	2
Northern Shoveler <i>Anas clypeata</i>	-1	5	5	1	-1	9
Red-crested Pochard* <i>Netta rufina</i>	nb	nb	nb	nb	1	1
Common Pochard <i>Aythya ferina</i>	3	3	3	1	1	11
Tufted Duck <i>Aythya fuligula</i>	5	5	5	3	1	19
Greater Scaup <i>Aythya marila</i>	0	0	0	0	0	0
Common Eider <i>Somateria mollissima</i>	4	4	4	2	2	16
Long-tailed Duck <i>Clangula hyemalis</i>	0	0	0	0	nb*	0
Common Scoter <i>Melanitta nigra</i>	nb	2	2	1	-3	2
Common Goldeneye <i>Bucephala clangula</i>	nb	nb	nb	nb	3	3
Red-breasted Merganser <i>Mergus serrator</i>	4	4	4	1	0	13
Goosander <i>Mergus merganser</i>	nb	2	2	1	3	8
Ruddy Duck* <i>Oxyura jamaicensis</i>	nb	nb	nb	1	5	6
Honey-buzzard <i>Pernis apivorus</i>	-2	-2	-2	0	1	-5
Red Kite <i>Milvus milvus</i>	-5	-5	-5	1	2	-12

Table 2 (continued).

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods
White-tailed Eagle <i>Haliaeetus albicilla</i>	-5	-5	-5	nb*	2	-18
Marsh Harrier <i>Circus aeruginosus</i>	-5	-5	-5	0	3	-12
Hen Harrier <i>Circus cyaneus</i>	-5	-5	-4	3	1	-10
Montagu's Harrier <i>Circus pygargus</i>	0	0	0	-1	-1	-2
Northern Goshawk <i>Accipiter gentilis</i>	0	0	0	1	4	5
Eurasian Sparrowhawk <i>Accipiter nisus</i>	-2	-2	-2	-1	3	-4
Common Buzzard <i>Buteo buteo</i>	-5	-5	3	1	1	-5
Golden Eagle <i>Aquila chrysaetos</i>	-4	-4	1	1	0	-6
Osprey <i>Pandion haliaetus</i>	-5	-5	-5	1	2	-12
Common Kestrel <i>Falco tinnunculus</i>	0	0	0	-2	-2	-4
Merlin <i>Falco columbarius</i>	-4	-4	-1	-3	2	-10
Hobby <i>Falco subbuteo</i>	-2	-2	0	0	3	-1
Peregrine Falcon <i>Falco peregrinus</i>	-3	-3	-2	-1	3	-6
Red Grouse <i>Lagopus lagopus</i>	0	0	0	-3	-1	-4
Ptarmigan <i>Lagopus mutus</i>	-4	-4	0	0	-1	-9
Black Grouse <i>Tetrao tetrix</i>	-4	-4	-4	1	-2	-13
Capercaillie <i>Tetrao urogallus</i>	1	3	-1	1	-3	1
Red-legged Partridge* <i>Alectoris rufa</i>	3	3	0	1	1	8
Grey Partridge <i>Perdix perdix</i>	0	0	-2	-3	-4	-9
Common Quail <i>Coturnix coturnix</i>	-4	-4	-4	1	1	-10
Common Pheasant* <i>Phasianus colchicus</i>	3	3	3	3	2	14
Golden Pheasant* <i>Chrysolophus pictus</i>	nb	nb	1	1	1	3
Lady Amherst's Pheasant* <i>Chrysolophus amherstiae</i>	nb	nb	1	1	-2	0
Water Rail <i>Rallus aquaticus</i>	0	0	0	0	-1	-1
Spotted Crake <i>Porzana porzana</i>	-3	-2	-2	1	-1	-7
Baillon's Crake <i>Porzana pusilla</i>	0	0	nb*	nb*	nb*	0
Corn Crake <i>Crex crex</i>	-4	-4	-4	-2	-4	-18
Moorhen <i>Gallinula chloropus</i>	2	2	2	0	-1	5
Common Coot <i>Fulica atra</i>	2	2	2	0	0	6
Common Crane <i>Grus grus</i>	nb	nb	nb	nb	1	1
Great Bustard <i>Otis tarda</i>	-3	nb*	nb*	nb*	nb*	-15
Oystercatcher <i>Haematopus ostralegus</i>	-2	-2	1	4	2	3
Black-winged Stilt <i>Himantopus himantopus</i>	nb	nb	nb	0	0	0
Avocet <i>Recurvirostra avosetta</i>	-2	nb*	nb*	2	3	-1
Stone-curlew <i>Burhinus oedipnemus</i>	0	-2	1	-2	-3	-6
Little Ringed Plover <i>Charadrius dubius</i>	nb	nb	nb	4	2	6
Great Ringed Plover <i>Charadrius hiaticula</i>	0	0	0	-3	1	-2
Kentish Plover <i>Charadrius alexandrinus</i>	-2	-2	-2	-2	0	-8
Dotterel <i>Charadrius morinellus</i>	-3	-3	-3	-1	2	-8
European Golden Plover <i>Pluvialis apricaria</i>	-2	-2	-2	-2	-1	-9
Northern Lapwing <i>Vanellus vanellus</i>	-3	-3	2	-1	-1	-6
Temminck's Stint <i>Calidris temminckii</i>	nb	nb	nb	nb	1	1
Purple Sandpiper <i>Calidris maritima</i>	nb	nb	nb	nb	0	0
Dunlin <i>Calidris alpina</i>	-1	-1	-1	0	0	-3
Ruff <i>Philomachus pugnax</i>	-3	nb*	nb*	1	1	-7
Common Snipe <i>Gallinago gallinago</i>	-2	2	2	-2	-1	-1
Woodcock <i>Scolopax rusticola</i>	3	3	0	1	0	7
Black-tailed Godwit <i>Limosa limosa</i>	-5	nb*	nb*	1	-1	-15
Whimbrel <i>Numenius phaeopus</i>	-3	-3	-3	2	2	-5
Eurasian Curlew <i>Numenius arquata</i>	0	0	3	2	-1	4
Common Redshank <i>Tringa totanus</i>	-3	2	2	-1	-1	-1
Common Greenshank <i>Tringa nebularia</i>	0	2	0	-1	0	1
Green Sandpiper <i>Tringa ochropus</i>	nb	nb	0	0	nb*	0
Wood Sandpiper <i>Tringa glareola</i>	nb	nb	nb	1	0	1
Common Sandpiper <i>Actitis hypoleucos</i>	0	0	0	-1	0	-1
Spotted Sandpiper <i>Actitis macularia</i>	nb	nb	nb	nb	0	0

Table 2 (continued).

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods
Red-necked Phalarope <i>Phalaropus lobatus</i>	-3	-3	-2	1	-3	-10
Arctic Skua <i>Stercorarius parasiticus</i>	-1	-1	1	2	3	4
Great Skua <i>Stercorarius skua</i>	-3	-3	3	3	2	2
Mediterranean Gull <i>Larus melanocephalus</i>	nb	nb	nb	nb	1	1
Little Gull <i>Larus minutus</i>	nb	nb	nb	nb	0	0
Black-headed Gull <i>Larus ridibundus</i>	-3	-3	3	2	-1	-2
Common Gull <i>Larus canus</i>	4	4	4	1	1	14
Lesser Black-backed Gull <i>Larus fuscus</i>	2	2	1	1	1	7
Herring Gull <i>Larus argentatus</i>	2	2	2	3	-2	7
Great Black-backed Gull <i>Larus marinus</i>	-2	2	4	3	0	7
Kittiwake <i>Rissa tridactyla</i>	-2	-2	2	2	1	1
Gull-billed Tern <i>Gelochelidon nilotica</i>	nb	nb	nb	0	nb*	0
Sandwich Tern <i>Sterna sandvicensis</i>	-2	-2	1	1	2	0
Roseate Tern <i>Sterna dougallii</i>	-3	0	3	1	-4	-3
Common Tern <i>Sterna hirundo</i>	-1	-1	1	-1	0	-2
Arctic Tern <i>Sterna paradisaea</i>	0	0	0	0	-1	-1
Little Tern <i>Sterna albifrons</i>	-2	-2	1	-2	1	-4
Black Tern <i>Chlidonias niger</i>	-3	nb*	nb*	0	0	-9
Great Auk <i>Pinguinus impennis</i>	-3	nb*	nb*	nb*	nb*	-15
Common Guillemot <i>Uria aalge</i>	0	0	-1	-1	2	0
Razorbill <i>Alca torda</i>	0	0	-1	-1	1	-1
Black Guillemot <i>Cephus grylle</i>	-2	-2	-2	1	2	-3
Puffin <i>Fratercula arctica</i>	-2	-2	-2	-1	1	-6
Pallas's Sandpiper <i>Symphictes paradoxus</i>	nb	0	nb*	nb*	nb*	0
Rock Dove <i>Columba livia</i>	-3	-3	-3	0	-1	-10
Domesticated Rock Dove* <i>Columba livia</i>	?	?	?	?	3	3
Stock Dove <i>Columba oenas</i>	3	3	2	-1	2	9
Wood Pigeon <i>Columba palumbus</i>	4	4	2	1	3	14
Collared Dove <i>Streptopelia decaocto</i>	nb	nb	nb	5	4	9
Turtle Dove <i>Streptopelia turtur</i>	2	1	1	1	-2	3
Rose-ringed Parakeet* <i>Psittacula krameri</i>	nb	nb	nb	nb	5	5
Common Cuckoo <i>Cuculus canorus</i>	0	0	0	-1	0	-1
Barn Owl <i>Tyto alba</i>	-3	-3	0	-2	-1	-9
Snowy Owl <i>Nyctea scandiaca</i>	nb	nb	nb	0	0	0
Little Owl* <i>Athene noctua</i>	nb	3	3	-2	-1	3
Tawny Owl <i>Strix aluco</i>	-2	-2	2	0	-1	-3
Long-eared Owl <i>Asio otus</i>	0	0	0	-3	-1	-4
Short-eared Owl <i>Asio flammeus</i>	0	0	0	1	-1	0
European Nightjar <i>Caprimulgus europaeus</i>	0	0	-1	-3	-3	-7
Common Swift <i>Apus apus</i>	1	1	1	0	0	3
European Bee-eater <i>Merops apiaster</i>	nb	nb	0	0	nb*	0
Common Kingfisher <i>Alcedo atthis</i>	-2	-2	1	-1	-1	-5
Hoopoe <i>Upupa epops</i>	0	0	0	0	0	0
Wryneck <i>Jynx torquilla</i>	-4	-4	-4	-3	-4	-19
Green Woodpecker <i>Picus viridis</i>	0	0	1	3	1	5
Great Spotted Woodpecker <i>Dendrocopos major</i>	-2	2	2	2	3	7
Lesser Spotted Woodpecker <i>Dendrocopos minor</i>	0	0	0	0	-1	-1
Wood Lark <i>Lullula arborea</i>	-3	-3	1	-2	-1	-8
Sky Lark <i>Alauda arvensis</i>	0	0	0	0	-3	-3
Horned Lark <i>Eremophila alpestris</i>	nb	nb	nb	nb	0	0
Sand Martin <i>Riparia riparia</i>	-1	-1	-1	0	-1	-4
Barn Swallow <i>Hirundo rustica</i>	-1	-1	-1	-1	-2	-6
House Martin <i>Delichon urbica</i>	-1	-1	-1	-1	0	-4
Tree Pipit <i>Anthus trivialis</i>	0	0	0	0	-1	-1
Meadow Pipit <i>Anthus pratensis</i>	0	0	0	-1	0	-1
Rock Pipit <i>Anthus petrosus</i>	0	0	0	0	0	0

Table 2 (continued).

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods
Yellow Wagtail <i>Motacilla flava</i>	-1	-1	-1	-1	-1	-5
Grey Wagtail <i>Motacilla cinerea</i>	2	2	2	1	1	8
Pied Wagtail <i>Motacilla alba</i>	0	0	-1	0	0	-1
Dipper <i>Cinclus cinclus</i>	0	0	0	0	-1	-1
Wren <i>Troglodytes troglodytes</i>	0	0	0	0	2	2
Hedge Accentor <i>Prunella modularis</i>	0	0	0	1	-2	-1
Robin <i>Erithacus rubecula</i>	0	0	0	0	1	1
Rufous Nightingale <i>Luscinia megarhynchos</i>	-1	-1	-1	-2	-2	-7
Bluethroat <i>Luscinia svecica</i>	nb	nb	nb	nb	0	0
Black Redstart <i>Phoenicurus ochruros</i>	nb	nb	nb	1	1	2
Common Redstart <i>Phoenicurus phoenicurus</i>	-3	-3	-3	1	-1	-9
Whinchat <i>Saxicola rubetra</i>	0	0	-1	-1	-1	-3
Common Stonechat <i>Saxicola torquata</i>	-1	-1	-1	-2	-1	-6
Northern Wheatear <i>Oenanthe oenanthe</i>	-1	-1	-1	-3	-1	-7
Ring Ouzel <i>Turdus torquatus</i>	0	0	-2	-1	-2	-5
Blackbird <i>Turdus merula</i>	2	2	2	2	-1	7
Fieldfare <i>Turdus pilaris</i>	nb	nb	0	1	1	2
Song Thrush <i>Turdus philomelos</i>	0	0	0	-2	-2	-4
Redwing <i>Turdus iliacus</i>	nb	nb	0	1	1	2
Mistle Thrush <i>Turdus viscivorus</i>	4	2	2	1	-1	8
Cetti's Warbler <i>Cettia cetti</i>	nb	nb	nb	nb	5	5
Grasshopper Warbler <i>Locustella naevia</i>	0	0	0	1	-2	-1
Savi's Warbler <i>Locustella luscinioides</i>	-3	nb*	nb*	1	0	-8
Moustached Warbler <i>Acrocephalus melanopogon</i>	nb	nb	nb	0	nb*	0
Sedge Warbler <i>Acrocephalus schoenobaenus</i>	0	1	1	0	-1	1
Marsh Warbler <i>Acrocephalus palustris</i>	0	0	0	-3	-4	-7
Reed Warbler <i>Acrocephalus scirpaceus</i>	0	0	0	0	1	1
Icterine Warbler <i>Hippolais icterina</i>	nb	nb	nb	nb	0	0
Dartford Warbler <i>Sylvia undata</i>	-4	-4	-4	-2	4	-10
Lesser Whitethroat <i>Sylvia curruca</i>	1	1	1	0	2	5
Common Whitethroat <i>Sylvia communis</i>	0	1	1	-3	1	0
Garden Warbler <i>Sylvia borin</i>	0	0	0	1	0	1
Blackcap <i>Sylvia atricapilla</i>	0	0	0	0	3	3
Wood Warbler <i>Phylloscopus sibilatrix</i>	0	1	1	0	0	2
Chiffchaff <i>Phylloscopus collybita</i>	0	0	0	1	0	1
Willow Warbler <i>Phylloscopus trochilus</i>	0	0	1	-1	-1	-1
Goldcrest <i>Regulus regulus</i>	2	2	2	2	-1	7
Firecrest <i>Regulus ignicapillus</i>	nb	nb	nb	1	3	4
Spotted Flycatcher <i>Muscicapa striata</i>	1	1	1	0	-3	0
Pied Flycatcher <i>Ficedula hypoleuca</i>	2	2	2	2	2	10
Bearded Tit <i>Panurus biarmicus</i>	-3	-3	1	2	2	-1
Long-tailed Tit <i>Aegithalos caudatus</i>	0	0	0	0	0	0
Marsh Tit <i>Parus palustris</i>	0	0	0	0	-1	-1
Willow Tit <i>Parus montanus</i>	0	0	0	-1	-1	-2
Crested Tit <i>Parus cristatus</i>	-1	-1	1	1	1	1
Coal Tit <i>Parus ater</i>	1	1	1	1	2	6
Blue Tit <i>Parus caeruleus</i>	1	1	1	0	1	4
Great Tit <i>Parus major</i>	1	1	1	0	1	4
European Nuthatch <i>Sitta europaea</i>	2	2	2	1	2	9
Eurasian Treecreeper <i>Certhia familiaris</i>	0	0	0	0	0	0
Golden Oriole <i>Oriolus oriolus</i>	0	0	0	1	2	3
Red-backed Shrike <i>Lanius collurio</i>	-3	-3	-3	-4	-5	-18
Eurasian Jay <i>Garrulus glandarius</i>	-2	-2	1	2	1	0
Magpie <i>Pica pica</i>	-2	-2	2	1	3	2
Red-billed Chough <i>Pyrrhocorax pyrrhocorax</i>	-2	-2	-2	0	1	-5
Eurasian Jackdaw <i>Corvus monedula</i>	2	2	2	2	3	11

Table 2 (continued).

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods
Rook <i>Corvus frugilegus</i>	1	1	1	2	1	6
'Black' Carrion Crow <i>Corvus corone corone</i>	0	0	0	4	3	7
'Hooded' Carrion Crow <i>Corvus corone cornix</i>	-2	-2	-2	0	0	-6
Common Raven <i>Corvus corax</i>	-3	-2	2	1	-1	-3
Common Starling <i>Sturnus vulgaris</i>	-3	2	2	1	-2	0
House Sparrow <i>Passer domesticus</i>	3	3	-2	1	-1	4
Tree Sparrow <i>Passer montanus</i>	0	0	0	3	-4	-1
Chaffinch <i>Fringilla coelebs</i>	1	1	1	-1	2	4
Brambling <i>Fringilla montifringilla</i>	nb	nb	0	nb*	1	1
European Serin <i>Serinus serinus</i>	nb	nb	nb	0	0	0
Greenfinch <i>Carduelis chloris</i>	1	1	1	1	-1	3
Goldfinch <i>Carduelis carduelis</i>	-5	-5	3	1	-1	-7
Siskin <i>Carduelis spinus</i>	0	0	0	1	3	4
Linnet <i>Carduelis cannabina</i>	-2	-2	1	-1	-3	-7
Twite <i>Carduelis flavirostris</i>	-3	-3	-3	-1	0	-10
Common Redpoll <i>Carduelis flammea</i>	2	2	2	3	-1	8
Common Crossbill <i>Loxia curvirostra</i>	3	3	3	1	3	13
Scottish Crossbill <i>Loxia scotica</i>	?	?	?	?	0	0
Parrot Crossbill <i>Loxia pytyopsittacus</i>	nb	nb	nb	nb	0	0
Common Rosefinch <i>Carpodacus erythrinus</i>	nb	nb	nb	nb	1	1
Bullfinch <i>Pyrrhula pyrrhula</i>	1	1	1	3	-2	4
Hawfinch <i>Coccothraustes coccothraustes</i>	1	2	2	0	-2	3
Lapland Longspur <i>Calcarius lapponicus</i>	nb	nb	nb	nb	0	0
Snow Bunting <i>Plectrophenax nivalis</i>	0	0	-1	-1	2	0
Yellowhammer <i>Emberiza citrinella</i>	0	0	0	-1	-1	-2
Cirl Bunting <i>Emberiza cirlus</i>	1	2	1	-1	-3	0
Reed Bunting <i>Emberiza schoeniclus</i>	0	0	0	1	-2	-1
Com Bunting <i>Miliaria calandra</i>	-3	-3	-3	-4	-4	-17

Table 4 documents the 18 species whose populations have increased most since 1800 (those whose sum was arbitrarily taken as +9 or more); a surprising number of these species (seven) are ducks. Several other species (Ruddy Duck, Collared Dove, Rose-ringed Parakeet and Cetti's Warbler) that have shown great population expansions recently are not included in the top 18 simply because they began breeding here only during this century.

Table 5 shows changes in the number of breeding bird species recorded in the UK since 1800, and the changing status of three separate groupings of birds: all species, birds of prey, and farmland birds. A total of 240 species of birds has bred in Britain since 1800, although 13 of these are naturalised species now with self-sustaining populations. The total number of species breeding in the UK has increased markedly since 1800, with 36 more species breeding in 1970-95 than in 1800-49, a 19% increase. This is despite the smaller number of years in the most recent time period. Most of this increase has occurred since 1940, as shown by Sharrock (1974). A quarter of this increase (nine species) is as a consequence of introductions (unintentional or otherwise), while the rest (27) is apparently due to the balance between natural colonisation and extinction being markedly in favour of colonisation. Table 5 also shows that, during the nineteenth century, the mean population-trend score for birds of prey was large and negative, while during the latter part of the twentieth century this had switched to a small positive value. For farmland birds, however, a mean score of just above zero at the beginning of the twentieth century has turned to a fairly large negative value in recent years.

Table 3. UK breeding species that have undergone the greatest population declines since 1800.

Only species whose sum of scores across all time periods was less than or equal to -10 are shown. See legend to table 1 for all other details. The 'RDB category' column lists the breeding categories within which each species qualified in the British birds Red Data list (Batten *et al.* 1990). BD = declining breeder; BR = rare breeder; BL = localised breeder; BI = breeds in internationally important numbers; SC = special category.

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods	RDB category
Wryneck <i>Jynx torquilla</i>	-4	-4	-4	-3	-4	-19	BR
White-tailed Eagle <i>Haliaeetus albicilla</i>	-5	-5	-5	nb*	2	-18	BR
Corn Crake <i>Crex crex</i>	-4	-4	-4	-2	-4	-18	BD
Red-backed Shrike <i>Lanius collurio</i>	-3	-3	-3	-4	-5	-18	BD, BR
Corn Bunting <i>Miliaria calandra</i>	-3	-3	-3	-4	-4	-17	
Great Bustard <i>Otis tarda</i>	-3	nb*	nb*	nb*	nb*	-15	
Black-tailed Godwit <i>Limosa limosa</i>	-5	nb*	nb*	1	-1	-15	BR, BL
Great Auk <i>Pinguinus impennis</i>	-3	nb*	nb*	nb*	nb*	-15	
Black Grouse <i>Tetrao tetrix</i>	-4	-4	-4	1	-2	-13	SC
Red Kite <i>Milvus milvus</i>	-5	-5	-5	1	2	-12	BR
Marsh Harrier <i>Circus aeruginosus</i>	-5	-5	-5	0	3	-12	BR
Osprey <i>Pandion haliaetus</i>	-5	-5	-5	1	2	-12	BR
Great Bittern <i>Botaurus stellaris</i>	-5	nb*	2	1	-4	-11	BD, BR, BL
Hen Harrier <i>Circus cyaneus</i>	-5	-5	-4	3	1	-10	SC
Merlin <i>Falco columbarius</i>	-4	-4	-1	-3	2	-10	SC
Common Quail <i>Coturnix coturnix</i>	-4	-4	-4	1	1	-10	BR
Red-necked Phalarope <i>Phalaropus lobatus</i>	-3	-3	-2	1	-3	-10	BR, BL
Rock Dove <i>Columba livia</i>	-3	-3	-3	0	-1	-10	
Dartford Warbler <i>Sylvia undata</i>	-4	-4	-4	-2	4	-10	BR, BL
Twite <i>Carduelis flavirostris</i>	-3	-3	-3	-1	0	-10	BI

Table 4. UK breeding species that have undergone the greatest population increases since 1800.

Only species whose sum of scores across all time periods was equal to or greater than 9 are shown. See legend to table 1 for all other details.

Species	1800-49	1850-99	1900-39	1940-69	1970-95	Sum of periods
Tufted Duck <i>Aythya fuligula</i>	5	5	5	3	1	19
Common Eider <i>Somateria mollissima</i>	4	4	4	2	2	16
Fulmar <i>Fulmarus glacialis</i>	0	5	5	3	2	15
Canada Goose <i>Branta canadensis</i>	3	3	3	2	3	14
Common Pheasant <i>Phasianus colchicus</i>	3	3	3	3	2	14
Common Gull <i>Larus canus</i>	4	4	4	1	1	14
Wood Pigeon <i>Columba palumbus</i>	4	4	2	1	3	14
Red-breasted Merganser <i>Mergus serrator</i>	4	4	4	1	0	13
Common Crossbill <i>Loxia curvirostra</i>	3	3	3	1	3	13
Eurasian Wigeon <i>Anas penelope</i>	4	4	4	-1	0	11
Common Pochard <i>Aythya ferina</i>	3	3	3	1	1	11
Eurasian Jackdaw <i>Corvus monedula</i>	2	2	2	2	3	11
Pied Flycatcher <i>Ficedula hypoleuca</i>	2	2	2	2	2	10
Gadwall <i>Anas strepera</i>	nb	2	2	2	3	9
Northern Shoveler <i>Anas clypeata</i>	-1	5	5	1	-1	9
Stock Dove <i>Columba oenas</i>	3	3	2	-1	2	9
Collared Dove <i>Streptopelia decacto</i>	nb	nb	nb	5	4	9
European Nuthatch <i>Sitta europaea</i>	2	2	2	1	2	9

Table 5. Summary of number of breeding species and across-species population trends in the UK within each time period.

The mean score for each grouping in each period has been calculated as follows: (Total score for breeding species+Carried-over score from earlier extinctions) ÷ (Total number of breeding species+Number of species with carried-over score). Introduced species are as defined in table 2. Farmland species are as defined in Gibbons *et al.* (1993).

	1800-49	1850-99	1900-39	1940-69	1970-95	1800-1995
Total number of indigenous breeding species (A)	190	188	193	207	217	227
Total number of introduced breeding species (B)	4	6	9	10	13	13
Total number of breeding species ((A) + (B))	194	194	202	217	230	240
Total score for all breeding species	-123	-61	42	46	48	-
Mean score for all breeding species	-0.63	-0.31	0.21	0.21	0.21	-
Total number of breeding species of birds of prey (excl. owls)	15	15	15	14	15	15
Total score for all breeding species of birds of prey (excl. owls)	-47	-47	-27	-5	23	-
Mean score for all breeding species of birds of prey (excl. owls)	-3.13	-3.13	-1.8	-0.33	1.53	-
Total number of breeding farmland species	27	28	28	28	28	28
Total score for all breeding farmland species	-13	-6	9	-12	-29	-
Mean score for all breeding farmland species	-0.46	-0.21	0.32	-0.43	-1.04	-

Discussion

The scoring method

We have attempted to quantify qualitative descriptions of changes in status of UK breeding birds since 1800. As the scoring method we have adopted is not without its faults, we discuss the most important of these before considering the conservation implications of the results.

We have placed each species' trend in each time period into one of 11 categories, from -5, through 0 to +5. We believe that such a level of resolution is justified, despite the somewhat coarse quality of the data, but only because of the way it has been done (i.e. by allocating scores to the terminology of Alexander & Lack and Parslow). We could have chosen to ignore their terminology and come to our own assessment of the likely trend of each species in each time period. We feel, however, that this would have been even more subjective than the method we have adopted. Our scoring system simply replaces Alexander & Lack's and Parslow's words with numbers. Much of the subjectivity thus lies with those reviewers' assessments, particularly as it was reasonably straightforward to allocate scores to terms in a sensible manner (see table 1).

Despite this, although we tried to be rigorous in allocating scores for individual species, it was impossible to avoid some subjectivity on our own part as well, and it is likely that different analysts would come to subtly different conclusions for particular species in particular time periods. Owing to these two sources of subjectivity (that of the earlier reviewers and that of ourselves), these assessments can be considered only as semi-quantitative. Nevertheless, we feel that the errors introduced will be small when compared with each species' general population trend, thus allowing us to compare population trends between species reasonably

well, at least to the extent that we have been able to determine which species' populations have changed most over the 196-year period.

Our method does not allow a between-species comparison of numerical losses (or gains) in each time period. Thus, for example, during 1800-49 the number of pairs of breeding White-tailed Eagles lost from the UK would have been considerably less than the number of Corn Crakes lost at the same time. Despite this, the latter species has been allocated a smaller negative score than the former (-4 compared with -5). This is because the scores represent only probable proportionate losses (or gains) within time periods. We do not see this as a failing in the method, however, as species naturally live at different population levels and, from a conservation perspective, proportionate changes are more important than numerical ones.

The manner in which we have scored periods during which a species was extinct is perhaps the most contentious aspect of the methods. In principle, this could have been done in a number of ways: by scoring periods of extinction as 0; by carrying over the species' last extant score to its first extinct period only; or by carrying it over to all subsequent extinct periods, as we have done here. We have argued in the section 'Methods' why we believe that it is invalid to score periods of extinction as 0 and can see no logical reason for arbitrarily carrying scores over for only a single period. In practice, whether or not the score is carried over for one or many periods makes little difference to the final rankings of currently extant species. The only change to table 3, for example, would be that Black-tailed Godwit would fall off if scores were carried over for only a single period. We do, however, recognise that this particular problem is difficult to resolve and welcome alternative suggestions.

Finally, we chose to sum each individual time period to give a general trend for each species for the entire 196-year period. Theoretically, this may not yield a reliable estimate of a species' actual population trend over that period. For example, a species could have undergone a widespread decline in each of the four time periods up to 1969 and then recovered completely to its 1800 population level in the most recent time period. Though the species' population size would be the same in 1995 as in 1800, it would still have a large negative score. In practice, we think it unlikely that such an extreme example actually applies for any species. Though one potential candidate might be the Dartford Warbler, as its numbers have increased four-fold in the last decade, its distribution is still much reduced compared with that in the last century (Gibbons & Wotton 1996). Despite these problems, we feel that our method of summing across time periods is valuable for a number of reasons. First, it is simple. Secondly, it is comparable among all species. Thirdly, in the absence of population estimates for all species from 1800, we can think of no other way of estimating each species' trend during 1800-1995.

Implications for conservation priorities

We feel that this review has potential implications for assigning conservation priorities. Only species whose breeding populations declined by more than 50% over a 25-year period were included as declining breeders in the British birds Red Data list (Batten *et al.* 1990). Table 3 shows that only three out of the 20 species

which have declined most since 1800 fulfil the criteria of Batten *et al.* Eleven out of the same 20 species were classified by them as rare breeders (fewer than 300 breeding pairs). Our analysis suggests that these species may be rare as a consequence of widespread population decline during the last two centuries. In a recent review of the 'red listing' procedure, Avery *et al.* (1995) have suggested that, all other things being equal, species that are merely rare are not of such conservation concern as those that are in steep decline. We concur with this view, but are concerned that species which have undergone large historical declines have been overlooked compared with those that have declined recently, simply because they have declined over a longer time period during which there has been no continual monitoring. We recommend that most of the species listed in table 3 should be considered for addition to the list of declining breeders in any future review of the British birds Red Data list. The exceptions are the Rock Dove, because its genuinely wild population is now virtually inseparable from its feral population, which has increased markedly in recent years; the Great Bustard, which has been extinct in the UK for nearly 170 years; and the Great Auk, which is globally extinct.

Changes in species richness

The increase in number of indigenous species breeding in Britain since 1800 has been noted before (Sharrock 1974). The cause of the increase is, however, uncertain. Sharrock suggested that this was largely due to improved species-protection and site-protection, and we agree that for some species this is probably true. Attitudes towards conservation have changed so much over the last two centuries that the likelihood of a colonist being successful has improved markedly. Individuals of colonising species that would once have been shot or had their nests robbed are now afforded a much greater degree of protection. For some of the rarer colonists, the apparent increase is probably also due in part to the increasing numbers of observers. The increase in number of indigenous species (27 over 20 decades) is, however, probably too great to be explained by these factors alone.

Changes in status of taxonomic and ecological groupings

Although we have not attempted to examine status changes of different ecological or taxonomic groupings of birds in any great detail, we have presented two examples which show how the data can be used to highlight particular issues. The data confirm that the massive declines of birds of prey during the last century, largely a consequence of extensive persecution (e.g. Newton 1979; Cadbury 1980), have now been reversed and that most raptor populations are now increasing, even though most remain well below their former levels. The data also add further support to concerns about declining farmland birds (e.g. Marchant *et al.* 1990; Gibbons *et al.* 1993; Tucker & Heath 1994; Fuller *et al.* 1995).

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