Why a new checklist?

Checklists of birds of the world are not particularly strong on introduc-
tions. Of 12 that we have examined, the mean number of pages devoted
to introducing the work is 4.9 (range 2–10). Each of these studies—all of
them, with the exception of Peters (1931), dating from 1974 or later (and
of course “Peters” was only finished in 1986)—has its value and place, and
several of them (Peters 1931–1986, Morony et al., 1975, Sibley & Monroe
1990, Dickinson 2003) represent major successive building-blocks of mod-
ern ornithology. Even so, the modesty with which they have announced
themselves to the world is notable. There are usually some extremely
simple statements of intent, usually some explanation of the taxonomy fol-
lowed and associated issues, and various items of house-keeping relating
to such matters as ranges and sources; and then the list begins.

If the introduction to this new checklist runs on out of all proportion to
precedent, we hope it will not be—and not be thought to be—from lack
of modesty. On the contrary, we want the vision we have in this book to
be immediately apparent to its users, which is to involve them, stimulate
them, and make them part of the process by which it can be constantly im-
proved. This cannot perhaps be as interactive as HBW Alive or the BirdLife
discussion forums (birdlife.org/globally-threatened-bird-forums), but it
nonetheless offers the opportunity for ornithologists around the world to
contribute fact and opinion by way of feedback to the evidence the book
provides, whether directly to Lynx or to BirdLife, or indirectly through
separate publications (see The future of the Checklist below).

This work has several features—other than the length of its introduc-
tion—that set it somewhat apart from other checklists. It illustrates each
species in colour; it updates as accurately as space allows the written ranges
of both species and subspecies, and provides a newly revised map; it gives
French, German and Spanish as well as common alternative English
names; and where appropriate it offers some information about the taxo-
nomic relationships of particular species. The combination of image, map
and text in a double-page spread is, we hope, a powerful and convenient
way of encapsulating key data on a species, and by this means we hope to
bring each bird more to life than would be the case were it just a dry string
of names occupying a single line of text across a page, and thereby increase
the level of engagement with it that each user of the book may have.

Nevertheless, for us the most distinctive feature of the book—and this
is simply an observation, not a claim for its importance—is the approach
it adopts to species-level taxonomy. Checklists are typically conservative,
in that they make secondary use of existing lists, taking rapid decisions over
particular taxonomic problems but certainly not exploring and resolving
issues as in a primary text. Here, however, we have been motivated to dare
to attempt something more. From over 20 years of work to produce the
Handbook of the Birds of the World (HBW), and from over 30 years engaged
in evaluating the conservation status of all bird species, our two organiza-
tions, Lynx Edicions and BirdLife International, albeit from rather differ-
ent perspectives, have become acutely sensitized to the issues and prob-
lems surrounding modern species-level taxonomy. Given that conservation
very largely takes the species as its unit of concern, and that the future of

Figure 1 – Ever since the introduction of a trinomial system in Ridgway’s list of North American birds (1880), and particularly since Mayr’s for-
maton of the Biological Species Concept (1942), reproductive isolation has been the decisive criterion in the human classification of birds into differ-
ent species. This has the advantage of accounting for not just how we humans see birds but also how they see each other. Even so, processes in
nature are always under varying evolutionary pressures, and avian recognition systems can sometimes malfunction, as when Western Capercaillies
Tetrao urogallus, pictured here at a lek, cross-breed with Black Grouse Lyrurus tetrix.
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many taxa might in part depend on their recognition or not as species (but see the subsection Subspecies, populations and conservation below), it has become increasingly frustrating to have to wait—frequently in vain—for authoritative decisions from other sources over whether form A or form B is a species or subspecies. Taxonomy proceeds through the endeavours of individual biologists working on whatever interests them, for whatever reason, rather than to any all-embracing plan; and the resulting piecemeal patchwork has been, and remains, what the compilers of world lists have had to cope with as best they can.

Lynx on its own or BirdLife on its own could not conceivably have attempted a project that seeks to be proactive in addressing a significant number of the more salient issues in species-level taxonomy at the global scale. However, by pooling our various resources we felt we might generate a synergy which could serve our common interests and needs. We began discussions in 2009, and it has taken five years to reach this seeming halfway stage, although in fact we plan to issue the passerine volume as soon as possible, in 2016 (since the size of the book would require two volumes, and since the non-passerines and passerines form two roughly equal groups in terms of species numbers, we long ago decided that a two-step approach to publication was appropriate). In briefest outline this is the story behind the HBW–BirdLife Checklist; however, we feel it incumbent to go into considerably more detail in order to justify our venture more fully, although to do so we have to go back to the very beginning.

The speciation process and the species problem

Evolutionary theory holds that all life on earth can be traced back to an ill-defined moment in time when certain compounds (methane, ammonia, phosphate), under certain influences (heat, electricity, radiation), began to form self-replicating acids. From a biogenesis so far back in the history of the planet that dozens of ideas have been put forward concerning its nature, the “tree of life” eventually arose, branched and budded into all the dazzlingly intricate forms we know today—and into many others, we can be sure, that we have yet to come to know.

Blind adaptation to environmental conditions in this self-replication process is the driver of the variation in this unimaginably giant tree. Adaptation itself, like the first life on earth, results from entirely random circumstances. Biotic and abiotic conditions in one part of an organism’s range encourage a particular slight variation in that organism where conditions in another part of the range do not; both variants thus adapt to— increase their resource-use efficiency in—their individual circumstances, and in the process begin their slow trajectory towards independent existence. But because conditions are always changing at a great range of scales from global to local, these organisms remain under constant (and constantly changing) pressure to adapt further in order to survive and self-reproduce, and the process—which, because it involves advantages and therefore disadvantages, is necessarily conceived as a competition, a struggle for existence—thus never ends. It can be seen in life-forms separated by the splitting of continents under tectonic effects; but it can be seen, too, in life-forms separated by a few metres and by a few hours every day in rock-pools along a sea-shore.

At a certain point in the divergence of the organisms that make up animal life (the life of plants is considerably more complicated) their differences—their degrees of adaptation to their environment—reach the point at which recombination with their closest relatives represents a disadvantage to their ability to survive and self-perpetuate. These disadvantages mean that recombining populations are outperformed by those that stay separate. This “natural selection” of the separate populations (abetted by “sexual selection”, in which males compete with males and females choose among them on the basis of traits that are not necessarily adaptive) also drives the evolution of mechanisms such as colour patterns, sounds and shapes that help block any further wasteful co-mingling between them. This is the point—complete reproductive isolation—at which biologists...
can judge with certainty that a species has been born (Figure 1): a new and distinctive leaf on the tree of life has unfurled.

Unfortunately, in reality the situation is not always so clear-cut. Populations of apparent species do sometimes merge without apparent disadvantage. Other populations may behave like species in one part of their range but merge without disadvantage in another. Hybridizations occur, sometimes with fertile offspring, sometimes not. Owing to such inconvenient truths some evolutionary biologists make the points that life on earth is a continuum, that life-forms are continuously evolving, and that their division into “classes”, “orders”, “families”, “genera”, “species” and “subspecies” is simply a human artefact, made for our convenience (see, e.g., Mallet 2006). Such pronouncements are certainly a timely reminder that these distinctions are subject to constant revision; moreover, if speciation is a continuous process, then determining species limits must to some extent be arbitrary (although of course arbitrariness is not the same as random: it is, rather, the result of the best subjective attempt to evaluate a case by reference to similar cases, within the framework of contemporary opinion—informed inference rather than pure guesswork). Nevertheless, as working hypotheses our hierarchical classifications of animals and plants commonly work well: nobody need doubt that Greater and Lesser Flamingos Phoenicopterus roseus and Phoeniconaias minor are two species or that they clearly group together with several other flamingos into one highly recognizable family.

But what about the populations of flamingo that live on opposite sides of the Atlantic Ocean—American Phoenicopterus ruber in the New World and Greater P. roseus in the Old? They differ in certain respects, but they are far more like each other than either is like Lesser Flamingo. So are they one species or two? Are the differences that have evolved between them large enough to prevent them from interbreeding, or at least interbreeding successfully? Unfortunately we cannot tell by reference to nature alone, since their populations live in allopatry, never naturally coming into contact. The obvious basic test of species status involves populations that live alongside each other through their use of the same localities (sympathy) and habitats (syntopy), as in the case of the Greater and Lesser Flamingos in the lakes of the Great Rift Valley; because they do not interbreed, de facto they are species (Figures 2 and 3). This is the basis of the Biological Species Concept (BSC): any population that retains its phenotypic and genetic integrity when in direct contact with another population must, necessarily, represent a species (if it did not, it would not exist).

However, populations of similar-looking taxa that do not come into contact present a problem for the BSC. Separated by geographical barriers such as mountains, seas, rivers and other kinds of unsuitable habitat, such populations are not and cannot be subject to the test of reproductive incompatibility. Experiments in captivity may be indicative but never conclusive, because animals are unavoidably but unquantifiably modified by ex situ conditions (Frankham 2008); and, in any case, the great majority of species cannot easily be maintained in captivity for the sake of such studies. Faced with many thousands of cases of allopatric taxa, taxonomists have been thrown back on their informed inference to judge what taxonomic status two populations should have, based on the degree of difference they perceive between them and subjectively assess as evidence. In an attempt at greater rigour (although it rarely if ever appears to have been practised), they were enjoined to apply a criterion that involves measuring the differences between two allopatric populations and comparing their magnitude with the differences between two closely related sympatric species that are also the closest relatives of the taxa under review (Mayr 1969, Mayr & Ashlock 1991). If the magnitude of the difference between the allopatric taxa is more than that between the sympatric taxa, then the allopatric taxa are species; if not, not.

This criterion may have some general appeal and applicability (it was adopted in this century, for example, by Heibig et al. 2002), but it has several significant although not always obvious drawbacks. The first is that there may be close relatives with which to make the comparison. The second is that, even if there are such relatives, the result may not be helpful. Are the very similar Lattice-tailed and Choco Trogons Trogon clathratus and T. comptus (Figure 4) two species or one? Pairs of sympatric trogons exist to compare the levels of differentiation—Green-backed and Violaceous T. viridis and T. violaceus, Mountain and Elegant T. mexicanus and T. mexicanus, Slate-tailed and Black-tailed T. massena and T. melanurus— but in each of these cases the two trogons constituting the pair are more obviously distinct from each other than clathratus is from comptus. The two transatlantic Greater Flamingo populations are another case in point: all other flamingo species are more distinct from them than they are from each other, but P. [ruber] ruber and P. [ruber] roseus are still strongly distinct, to the point where some taxonomists treat them as two species while others continue to consider them one.
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rarity could be dismissed as accidents, considerable dissatisfaction
remained over the seemingly counter-intuitive relegation to conspecific-
ity of, for example, Bullock's Oriole Icterus bullockii with Baltimore Oriole
I. galbula and of Golden-winged Warbler Vermivora chrysoptera with Blue-
inged Warbler V. cyanoptera, the members of these pairs being far too
distinct from each other to be easily credited as subspecies (Figure 5).

In the 150-year period between the epoch-making tenth edition of Lin-
naeus's Systema Naturae (1758–1759) and Sharpe's monumental Handbook
of the Genera and Species of Birds (1899–1900), when the great majority of
avian taxa were described, these problems did not exist. Linnaeus is most
celebrated for introducing the binomial system into biology, whereby every
species must possess both a generic (Otis) and a specific (tarda) name
(the generic name can sometimes be changed according to new perceptions
of the species' relationships with other species; the specific name can
be changed only in exceptional circumstances). Sharpe was in a sense the
last in Linnaeus's ornithological line, taking a narrow, typological view that
treated each described taxon as binomial irrespective of its similarity to
another taxon; so by his own reckoning the number of bird species known
on earth in 1909 ran to 18,939.

However, towards the end of the nineteenth century, with the steady ac-
cumulation of material allowing ever-greater sampling power, certain orni-
thologists, notably the Americans Elliott Coues and Robert Ridgway (Birk-
head et al. 2014) and the German Ernst Hartert, based at Tring alongside
his fellow countryman and like-minded taxonomist Karl Jordan in the em-
ploy of Lord Walter Rothschild (Johnson 2012), began to develop the use of
triminials as a means of indicating the very close relationship of certain
taxa, when these appeared to differ in only trivial characters. In the thirty
or so years after Sharpe's death in 1910 the trinomial system—transfer-
ing many described taxa from the status of species to that of subspecies
(Otis dybowskii becoming Otis tarda dybowskii) in a process now universally
referred to as "lumping"—was imported into ornithology with astonishing
speed, cutting his number of species by over 10,000 (i.e. more than half).
Whenever today one of these subspecies is restored to the level at which
Sharpe left it (a process now universally referred to as "splitting"), it has
become commonplace to deprecate the ornithologists who pursued this
taxonomic synthesis—Peters pre-eminent among them as a consequence
of his pioneering and monumental Checklist (1931–1986), which ran to
15 volumes and over 6,000 pages—for their failure to provide evidence or
explanation for their decisions, rendering the process seemingly arbitrary
and unaccountable. This failure can of course be particularly distressing
in cases where the newly split taxon, whose conservation status when a
subspecies was given no attention, proves to be threatened with extinc-
tion or even conceivably extinct (e.g. Blue-bearded Helmetcrest Oxypteryn
cyanolimnus Collar & Salaman 2013). Nevertheless, in reality this work of
synthesis was a vitally important stage in establishing both the geographical
and biological relationships between taxa, while at the same time clarify-
ing the pattern of avian diversity across the planet. The great majority of
these decisions would certainly appear to have been accepted by the global
community of ornithologists: as Haffer (1997) noted, the number of bird
species reckoned in 1946 was 8,616, in 1980 it was 9,021 and in 1990 it was
9,672, so that, although very roughly a thousand subspecies were reinstated
as species during the second half of the twentieth century, another nine
thousand—using Sharpe's 18,939 as a baseline—remained unchanged
and unchallenged. What instead we witnessed in this period was a slow but
steady unpicking of species limits throughout the global avifauna as new in-
formation came to light (and since 1990 several hundred more splits have
been proposed, bringing the total close to, if not over, the 10,000 mark).

Even so, "what is a species, and what is not?", as Mayr (1996) porten-
tously phrased it (and which these days can equally be re-cast as "what is
a subspecies, and what is not?"), has become an increasingly live issue in
ornithology over the past two or three decades. This is attributable to three
interacting developments. First, dissatisfaction with the performance of
the BSC in relation to allopatric taxa led to a proliferation of alternatives,
of which by far the most important, influential and intelligible has been
the Phylogenetic Species Concept (PSC), introduced into ornithology by
Cracraft (1983). The key criterion in the PSC is diagnosability: if a popula-
tion can be consistently discriminated by one or more unique characters,
Figure 5a – Although two taxa can possess characters that strongly differentiate them from each other, as in the case of many pairs of toucans in the Amazon and elsewhere, where they come into secondary contact they may commonly hybridize. This happens, for example, in the upper reaches of the Rio Tapajós, Brazil, where intermediates between the Western and Eastern Red-necked araçaris Pteroglossus sturmii and P. bitorquatus are found. Until recently, strict adherence to the BSC required that these forms be treated as conspecific, as the existence of intermediate birds was considered proof that reproductive isolation had not yet been achieved. Now the reverse is considered more appropriate: the failure of the genomes of the parent taxa to merge is strong evidence that full reproductive compatibility between the taxa has not occurred.

Figure 5b – Yellow-ridged and Ariel Toucans Ramphastos culminatus and R. ariel differ strongly in bill and underparts pattern, rump, bare skin and iris colours, as well as in morphometrics, yet the hybrid zone they form is a broad one, indicating an even lesser degree of reproductive isolation than in the case of the araçaris in Figure 5a (above). Consequently, in most recent handbooks, monographs and checklists, these taxa have been treated as subspecies of the same species. For many, the subsuming of such distinct forms into one species is a source of frustration with the BSC (although hybridization causes similar problems for other species concepts too). However, while hybridization could be taken to indicate that the two taxa are on course eventually to become one, it is equally valid to argue that the failure of the parent taxa to have lost their identities (yet) indicates that hybridization carries a significant biological disadvantage. Indeed, the breeding success of pairs involving hybrid birds was recently shown to be significantly lower than between pure ones (Harr & Price 2012), suggesting that incomplete reproductive isolation still has important selective consequences.

Figure 5c – Other examples of distinctive forms that for similar reasons have commonly appeared merged in the plates and texts of field guides until recently include Baltimore and Bullock’s Orioles Icterus galbula and I. bullockii, as Northern Oriole, in North America (left-hand pair); Browncapped and White-faced Barbets Pogonornis minor and P. macclouni, as Black-backed Barbet, in Africa (central pair); and Rufous-throated and Black-throated Thrushes Turdus ruficollis and T. atrogularis, as Dark-throated Thrush, in Asia (right-hand pair).
it is assumed to represent a monophyletic “terminal taxon” (a monotypic entity with a single ancestral lineage). Under this concept all subspecies that are disjunct populations (as on islands or mountaintops) are terminal taxa and therefore species; and all subspecies that are arbitrary segments of clines (in which a character such as size or shade changes fractionally but continuously across a geographical range) cannot be diagnosed and thus acquire the status of populations within a monotypic species (Figures 6 and 14). By this means, subspecies (which are integral to the BSC as natural and necessary phases in the evolution of species) are rendered obsolete, and the world reverts to a list of species very much as Sharpe knew it.

Second, from the mid-1980s the growth in scope and ease of international travel, and the concomitant growth of the nature-tour industry, and the world reverts to a list of species very much as Sharpe knew it. Field guides and handbooks have made use of this knowledge, and in some cases have proceeded to make splits less on PSC grounds than on evidence compatible with BSC criteria, with perhaps the prime example being Rasmussen & Anderton (2005), which made extensive use of vocal evidence to inform often radical taxonomic decisions on the birds of the Indian subcontinent; Ridgely & Greenfield (2001) for Ecuador and Sinclair & Ryan (2003) for sub-Saharan Africa are other authors who also made significant innovations based on their judgements and preferences. There is even, to some degree and in some quarters, a certain pressure from birdwatchers, especially the more widely travelling and preferences. There is even, to some degree and in some quarters, a certain pressure from birdwatchers, especially the more widely travelling and the world reverts to a list of species very much as Sharpe knew it. Laboratories for molecular analyses have proliferated in many avian taxa. Field guides and handbooks have made use of this knowledge, and in some cases have proceeded to make splits less on PSC grounds than on evidence compatible with BSC criteria, with perhaps the prime example being Rasmussen & Anderton (2005), which made extensive use of vocal evidence to inform often radical taxonomic decisions on the birds of the Indian subcontinent; Ridgely & Greenfield (2001) for Ecuador and Sinclair & Ryan (2003) for sub-Saharan Africa are other authors who also made significant innovations based on their judgements and preferences. There is even, to some degree and in some quarters, a certain pressure from birdwatchers, especially the more widely travelling and the world reverts to a list of species very much as Sharpe knew it.

Third, genetic studies came of age in the 1980s and have, as with individual human growth, developed in maturity and authority with each passing decade. Laboratories for molecular analyses have proliferated in many museums and universities, resulting in a breathtaking number of papers in recent years that offer, on a monthly basis, new phylogenetic insights and unexpected connections and disconnections between taxa (the verb “reveal” commonly features in their titles). Many of these papers address, either directly or indirectly, the issue of species limits and make recommendations based on the genetic distances that the analyses disclose. Almost all such proposals have substance, but here, too, in rare instances, there may be an unacknowledged and indeed unconscious pressure to split species, if only because to do so represents a somewhat more momentous scientific conclusion, a correspondingly more publishable result, and a more demonstrable return on the often very considerable investment of both time and money that such work represents (a view wisely espoused, for example, by Pyle 2012).

These three factors have loosely combined to create a new democracy in taxonomy in which several different kinds of expert have felt able to participate, largely supplanting the traditional museum taxonomist, into whose quotidian remit this kind of work fell for the previous two and a half centuries. Moreover, the constituency is now much greater than it was in past eras: an array of “stakeholders”, from birdwatchers through professional ornithologists, biologists, systematists and collection managers to legislators, conservation planners and funding agencies, have legitimate interests in wishing for greater clarity and confidence over the taxonomic entities they are dealing with. However, what taxonomy thereby indubitably gains in terms of rejuvenation and openness it risks losing in terms of stability and coherence, since different authors give different weight to such elements as morphology, voice, genetic distinctiveness and even conservation status. At any rate, the clear trend in modern avian taxonomy is to split species on increasingly narrow margins of differentiation, involving sometimes PSC principles (turning the Golden-green Woodpecker Piculus chrysochilus into six species: Del-Rio et al. 2013); sometimes variations in vocal and other behavioural characters in morphologically similar taxa (turning two Sirystes into four: Donegan 2013); sometimes degree of molecular distance (establishing New Caledonian Parakeet Cyanoramphus cervinicauda...
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phus [novaezelandiae] saisseti and Norfolk Parakeet C. [n.] cookii Boon et al. 2001; Figure 7); and sometimes through different combinations of these factors (breaking the Clapper/King Rail Rallus longirostris complex down into five: Maley & Brumfield 2013).

A further trend is for these splits to pass largely unchallenged into the literature, by virtue of a domino effect involving one uncritical acceptance after another, each exerting an ever-increasing peer pressure to conform (if two or three lists accept the split, it looks increasingly perverse or out of touch for a new list to stand against it). This trend towards taxonomy by default may indeed promote a greater homogenization in world lists, but this is not the same as creating stability, since new insights, particularly emerging from the welter of modern genetic studies, frequently promote further changes and combinations, so that the lifespan of a split can sometimes be rather short, as in the case of, for example, Cape Verde Kite Milvus fasciinucha (1995–2005), Southern Grey Shrike Lanius meridionalis (in the polytypic sense in which it was always treated; 1993–2010) and Fuerteventura Blue Tit Cyanistes degener (1996–2008) (Collar 2013). That this phenomenon has considerable ramifications for ornithology in general and conservation in particular—in its various managerial and legislative guises—goes without saying.

But the taxonomic genie is out of its little museum bottle, and it shows no sign of intending ever to go back. This is not something simply to be accepted with good grace but to be welcomed with unpatronizing if cautious enthusiasm. On the one hand, increasing numbers of bird taxa are being documented through photographs and video- and sound-recording, producing a major new body of behavioural and morphological evidence (AVoCet, the Internet Bird Collection, the Macaulay Library and Xeno-canto are manifestations of this); and on the other, increasing numbers of bird taxa are being DNA-sampled, both dead and alive, with ever-greater sophistication and confidence. These two factors in particular, abetted by the world wide web and perhaps even, through its illustration of every distinctive subspecies, by HBW, have created a new era in global ornithology. If the species problem is still part of that new era, we perhaps need new ways of addressing it.

Convergence and criteria in species-level avian taxonomy

Recent steep rises in the numbers of species being recognized, particularly among vertebrates, has led to concerns that “taxonomic inflation” may be devaluing the currency of the species and increasing the costs, complexities and choices that must be faced by conservationists (Isaac
Lesser Snow Petrel
Pagodroma nivea nivea

As a result, the consensus about the true status of distinctive subspecies—the list of species—cannot be attributed to one or the other. This means that the great majority of observations of these two species (treated as separate) moves the BSC to a more accommodating position. Similarly, the criteria formulated by the British Ornithologists’ Union (BOU) stipulate the need for species limits to be determined on “multiple characters” (Helbig et al. 2002), shifting at least a little from the PSC, which readily defines species on the basis of a single character. Moreover, analysis by Sangster (2014) suggests that “avian species-level taxonomy has become increasingly plural-istic and eclectic”, meaning that “taxonomists consider different criteria as complementary rather than as rival approaches to species delimitation”. This observation is supported by the notable trend in recent (post-2000) papers splitting species or establishing new ones to assess the taxa under review against both PSC and BSC.

All the same, the fact that a thousand species were “created”, mostly through splitting (of course a percentage were new discoveries) in the second half of the twentieth century, in reaction to the trinomial consolidations of the post-Sharpe decades, is a clear sign that species limits in birds are by no means settled, and that world lists continue to abide by taxonomic decisions from 70–80 years ago, many of which are incommensurate with modern treatments and indeed modern evidence. These world lists are to varying degrees dependent on regional or national lists, on family and other taxonomic monographs, or on both, and inevitably this patchwork dependence results in inequalities and imbalances of treatment owing to differing judgements and possibly different levels of competence in the authorities used. A notable dimension to this problem is the geographical bias in the scope and intensity of taxonomic investigations, which is generally high in regions and continents where western institutions have long been active (the Americas, Europe, the Middle East, Africa and Australia), but rather lower where they have not (Asia, Papuasia and parts of the Pacific). For example, ten years ago the birds of Asia were very crudely judged to be undersplit by 8% compared with the Neotropics, resulting in an even cruder estimate that a level of scrutiny on a par with that given to the New World avifauna might increase the Asian species complement by over 500 (Collar 2005).

One of the strongest ambitions of HBW (1992–2013) was to illustrate all well-marked subspecies; accounting properly for geographical variation is, after all, a central raison d’être of any zoological handbook. Consequently, in the first ten years of the project visits were made to the world’s most important museums as well as over 80 zoos and aviaries in order to build up a photographic reference collection of all distinctive avian taxa, resulting in a body of some 30,000 slides. Naturally, therefore, the two decades of editorial scrutiny, part of them spent in carefully checking plates against text against photographs, prompted many reflections about the status of the taxa in question; indeed, although this was never the primary intention, the entire venture constituted a unique opportunity to review the distinction of subspecies of the world through fresh eyes. Moreover, as HBW approached its conclusion, it was very obvious that—irrespective of any perceptions about the true status of distinctive subspecies—the list of species it treats (total 9,903) was significantly out of date.

In parallel with this, the small science team at BirdLife International was coming under increasing pressure from the sheer volume of taxonomic changes being put forward not just in the technical peer-reviewed literature but also in popular magazines, field guides and handbooks.
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Given the need to document and, more importantly, conserve any “new” species that might be emerging from these sources, the work of assessing the validity of these changes against some sort of standard relating to the BSC (the only species concept used in world lists and indeed in virtually all avifaunal and taxonomic lists) was and remains imperative. Moreover, fieldworkers with both experience of taxa in the wild and some feeling for their conservation status would increasingly often suggest that certain of them be scrutinized for an urgent taxonomic upgrade. Independently, the science team’s own work in museums, connected with the search for distributional and ecological data on specimen labels, commonly brought them face to face with species-level issues that needed to be addressed by someone sometime soon. At the back of the BirdLife team’s mind was always the question: how many taxa that most modern taxonomists would regard as species are going extinct unnoticed because they are currently treated as subspecies?

Clearly, then, Lynx and BirdLife had convergent interests in a thoroughgoing review of avian taxa across the world, and to a degree they had complementary resources with which to tackle such a venture. Lynx’s list derived from the treatments of the many HBW authors, most of them acknowledged world experts in the families whose accounts they wrote; BirdLife’s list derived from a conflation of regional checklists, with Sibley & Monroe (1990) as the default authority (BirdLife International 2014) but with a succession of annual revisions produced by a small committee that reviewed (and continues to review) new taxonomic proposals. The new vision was for a list that carefully takes into account everything that other authors have produced in recent years, but which also evaluates in a consistent way all the prospective cases that present themselves within the pages of HBW, the drawers of museums and the messages of concerned correspondents. HBW’s extensive collection of plates and BirdLife’s ambitions to update and improve its dataset of maps for all bird species were further persuasive considerations for a collaboration. But was there also common ground on the small matter of the criteria to use in making this new global assessment? From all points of view the dominant need was for consistency, for equality of treatment; so what were the options?

Figure 9 – Criticism of the BSC is mainly directed at its most restrictive version (disallowing species status for taxa that hybridize), but in reality for a number of years now almost nobody has applied it in this way. Taxonomists who prefer to relate species rank to reproductive isolation tend to accept a looser, more liberal interpretation of the BSC, several of which have been formulated over recent years (see, e.g., Haffer 1997). Perhaps the most salient of them is the Comprehensive Biological Species Concept (Johnson et al. 1999), under which taxa are species if they “demonstrate essential but not necessarily complete reproductive isolation” (see previous page). Thus these modern formulations of the BSC no longer place hybrids, which indicate that breeding incompatibility has not been fully reached, as an impediment to species status of clearly distinct forms previously ranked as subspecies. This is the case with all the taxa shown in this figure, which are today more or less unanimously accepted as species.
A PSC-based approach to the issue was never likely to be practical to adopt. Whatever the attractions of a world list that might stretch to 25,000 species—and number of species has never been a reason, on its own, to reject the PSC, despite claims to the contrary—the PSC rejection of subspecies runs counter both to evidence and to intuition. Both HBW and BirdLife have long acknowledged the legitimacy of subspecies, and the case for retaining this taxonomic rank is, we judge, compelling (see, e.g., Remsen 2010). No less compelling is the fundamental difficulty that exists with the PSC dependence on diagnosability; with increasing scrutiny, populations can frequently be divided into new “terminal taxa” based on very minor but consistent (and therefore diagnosable) differences, with the consequence that PSC species lists are, of their very nature, impractically volatile (Figure 7). The difficulty remains even in the case of multiple (i.e. at least two) characters, as proposed by Helbig et al. (2002), if those characters are weak enough: a case in point might be the recently described race wirthi of the Blue-winged Siva Siva cyanouroptera, the only known material of which is undiscriminated in museum drawers for 80 years, but which differs from S. c. orientalis in two unobtrusive characters—a warmer rump colour and slightly smaller size (Collar 2011)—on which basis it could qualify as a species under the BOU criteria. A further consideration is the circumstance in which the central section of a cline becomes extinct; under the BSC the two end-points normally remain subspecies, but under the PSC they become diagnosable and therefore species, creating the paradox whereby a decrease in actual biological diversity produces an increase in measured biological diversity (Collar 1997). For these and other reasons, some conservation biologists are elected not to work with the PSC (e.g. Frankham et al. 2012).

What, then, of genetics? Taxonomists have, of course, always used phenotypic evidence as a surrogate for genetic evidence, and the general assumption is naturally that large and small phenotypic differences correspond to large and small genetic differences. That this is not always the case has been one of the most striking features of the discoveries made by molecular workers in recent years. Nevertheless, an exclusively genetic solution to the challenge of a world list of bird species is, at least currently, no more practicable than one involving the PSC because, although molecular research is making extraordinary strides in the exploration of avian relationships, the number of taxa to be sampled and assessed remains defiantly large, and the coverage of taxa to date is patchy and uneven. One day—and it is difficult to predict how soon it might come (as early as 2022 Jud Harr & Price 2012)—genetic work may entirely underpin all avian species-level taxonomy, as it is rapidly managing to do at higher phylogenetic levels. In sympathy, two near-identical forms that demonstrate clear molecular work may entirely underpin all avian species-level taxonomy, as it is rapidly managing to do at higher phylogenetic levels.

Figure 10 – The arrival of genetic studies in systematic ornithology produced a major upheaval. The pioneering work of C. Sibley and colleagues in the early 1990s, mainly seeking to clarify the relationships between the higher groups of birds, had a marked influence. While some of their findings are still considered valid, others were later contradicted by more advanced research techniques, with much more comprehensive samples, and in recent years results have reached a level of reliability that is regarded as very high. Perhaps the most notable example is the work of S. Hackett and collaborators, published in Science in 2008, after which there has been a high degree of consensus about the orders and families into which the class Aves can be divided (Winkler et al. in prep.).
This comes on top of evidence that the study of mtDNA is in any case not the most dependable means of investigating relationships—being rather, in one stark assessment, “perhaps intrinsically the worst population genetic and phylogenetic molecular marker we can think of” (Galéria et al. 2009). It is certainly fair to say that molecular workers have sometimes found their results in conflict with those of their colleagues or of their earlier selves, leaving non-molecular taxonomists in a state of mystified irresolution. A recent case in point concerns Black-backed Oriole Icterus abeillei, which until 1999 was considered most closely related to Bullock’s Oriole I. bullockii, but then in three successive mtDNA studies was claimed instead to be closest to Baltimore Oriole I. galbula (Omland et al. 1999, Kondo et al. 2004, Kondo et al. 2008) before once again emerging, after nuclear DNA analysis, as sister to Bullock’s (Jacobsen et al. 2010, Jacobsen & Om-lander 2011, 2012). Other salutary studies have found that nuclear DNA and mtDNA revealed divergent patterns of relationships in Pterodroma petrels in the north-east Atlantic (Ganghoff et al. 2013) and in the Yellow-fronted White-eye Zosterops flavifrons (Phillimore et al. 2008). In the latter case morphology was incongruent with both nuclear DNA and mtDNA evidence, which indicates how natural selection might produce morphological change without leaving a detectable signature in the sampled genes—but what does this tell the taxonomically curious bystander about choosing between lines of evidence? What are we to make of a morphological study which concludes that Archer’s Buzzard Buto archiesis merely a colour morph of Augur Buzzard B. augur and therefore has no taxonomic status at all (Clark 2003) and a genetic analysis which suggests that it is basal to all Afrotopical buzzards and not even closely related to B. augur (Riesing et al. 2005)? The taxonomic notes in this checklist under Antipodean, Amsterdam and White-capped Albatrosses Diomedea antarctica, D. amsterdamensis and Thalassarche steadi carry further evidence of the contradictory findings that molecular work can bring to the taxonomic table. For the moment, therefore, insights from such work are, we strugglingly conclude, best used to prompt and consolidate splitting and lumping decisions based on other evidence, but not to be their sole arbiter.

Could the peer-review process, however, be the sole arbiter? This is a stance that has sometimes been taken in the past by compilers of species lists. Indeed, a recent comparison of two world checklists praised one over the other for being “more progressive in terms of adopting splits published in the literature” (Rostroon 2011). The advantage here is that a seemingly neutral system of assessment, by which papers proposing species-level changes are independently refereed for their scientific rigour, takes sole responsibility for what does or does not get incorporated into a checklist. However, a moment’s reflection reveals that such a strategy clearly will not serve the interests of consistency. First, some papers that pass the peer-review process are still poor enough in quality for their findings to be challenged. Second, some papers are perfectly good but openly use criteria relating to the PSC rather than the BSC. Third, ignoring a proposed or potential split because it has not been sanctioned in a peer-reviewed journal only perpetuates the patchiness of treatment that the HBW–BirdLife list in particular seeks to overcome (Figure 13).

Throughout the 2000s, in order to make rapid, consistent judgements in cases where the literature was claiming a split, BirdLife experimented with some simple criteria that sought to approximate to the levels of distinctiveness shown by species as defined under the BSC. Eventually, with the participation of evolutionary biologists from the University of Oxford, these grew into a system of assessing the level of difference between allopatric taxa on the basis of a number of characters for their strength (Tobias et al. 2010). This system takes into account morphology, vocalizations, other behaviours and ecology as well as degree of hybridization, which, as determined by Johnson, et al. (1999), is not fatal to species status under the BSC. Molecular data are used so far as possible to establish evolutionary history, to inform and support decisions made on other characters, and to cue research into taxa for other evidence, as in the case of the Rattan Fruit-dove Ptilinopus chryogaster which, concordant with molecular findings, proved to show characters aligning it with Raratonga Fruit-dove P. rantonettensis. However, molecular differences between taxa are not assigned a score, because, as noted above, degree of genetic distance does not perfectly reflect degree of reproductive incompatibility, given that bigger distances can be found within some populations of what everyone regards as one species—as noted above for Common Raven and Common Redstart—than exist between many forms that are universally regarded as two, leaving us with no way of determining an appropriate score threshold for a given distance.

On the other hand, and crucial to its validation irrespective of its capacity to incorporate genetic information, the system was calibrated experimentally when it was trialled on 58 pairs of closely related sympatric or parapatric bird species, in 95% of cases species status was reflected in a total score of 7. It was then applied, with 7 as the threshold, to 23 pairs of European subspecies, resulting in 21 (91%) remaining as subspecies and only two (both of them already considered by some to merit the higher rank) rising to species (Tobias et al. 2010). This sample suggests that the system coincides well with species limits as broadly agreed within the taxonomically well-worked and relatively stable avifauna of Europe, and that consequently it can be applied to other avifaunas with a reasonable degree of confidence.
Phenotypic criteria

Phenotypic differentiation between taxa (involving plumage colour, pattern and structure, morphometric evidence and vocal characters) is scored according to four categories of magnitude, each as far as possible defined by quantitative thresholds; some smaller allowance is also made for differences in ecology and behaviour. Morphometric differences are quantified by using effect sizes (a measure of the magnitude of a relationship based on the spread of individual data points) for the largest degree of difference computed from means and standard deviations (which show the degree of variation from the mean) and presented as the Cohen’s $d$ statistic; characters in a taxon that evidently co-vary (e.g. longer wing and longer tail) can be scored only once against another taxon, but characters that evidently do not co-vary (e.g. longer wing and shorter tail) can both be scored, involving the strongest increase and strongest decrease in effect size. Vocal characters are scored through spectrographic analysis based on the strongest temporal and strongest spectral effect size in analogous vocalizations in two taxa.

The four categories of magnitude in the phenotypic criteria are minor, which scores 1, medium 2, major 3 and exceptional 4 (Figure 15).

- A minor difference involves weak divergence in a plumage or morphometric character, in the form of a slightly different wash or suffusion on an area of feathering or on a bare part (although minor differences in bare part coloration are either not common or infrequently detected).
- A minor morphometric or vocal character is one in which the effect size is 0.2–1.99.

Figure 12 – In contrast to those at the macro-systematic and generic levels, molecular results at the species level are often much more difficult to interpret and use for taxonomic purposes. For instance, two populations of the Common Redstart Phoenicurus phoenicurus from different parts of Germany possess a difference in their mitochondrial DNA of as much as 5% without showing any obvious phenotypic distinction or any evidence of reproductive incompatibility where they meet (Lohlsen et al. 2010; Högner et al. 2012). On the other hand, several forms of monarch, normally recognized as independent species and highly distinctive in morphology, differ by less than 2% (Filardi & Smith 2005). To date, perhaps because of such seemingly contradictory evidence, nobody has proposed a species concept based on the amount of genetic difference between taxa, but more and more studies are splitting almost indistinguishable forms based on a similar percentage of genetic differentiation found between another pair of congenic species. It is predictable that in the not too distant future, with the use of larger and more representative samples of DNA, much more conclusive results will be obtained and criteria developed for using them to help determine species limits; but for the present, given the lack of consensus about what genetic distances really mean in species-level taxonomy, the results of these studies need to be treated with respectful caution.
Introduction

• A medium difference involves a distinctly different tone (shade: light yellow vs. dusky yellow, etc.) on an area of feathering or bare part. A medium morphometric or vocal character is one in which the effect size is 2–4.99.

• A major difference involves a contrastingly different hue (colour: e.g. white vs yellow) on an area of feathering or bare part, and/or the presence of an entirely different patterning (such as strong spotting vs strong stripes). A strong morphometric or vocal character is one in which the effect size is 5–9.99.

• An exceptional difference involves a radically different coloration or pattern (a striking contrast in colours or shapes) applying to the majority of the plumage area, or any trait directly involved in courtship and mate choice. An exceptional morphometric or vocal character is one in which the effect size is 10 or more.

Obviously it is the highest-scoring characters that must be used in the assessment of species rank. However, to constrain the effects of interdependence in phenotypic characters, several conditions apply. The number of characters relating to differences in plumage and bare-part colours and patterns is capped at three. The number of morphometric and vocal characters is capped at two. Differences in ecology and behaviour can be scored only once, and except for non-overlapping differences in courtship display (allowed a score of 2) all such differences are limited to a score of 1.

Distributional criteria

These involve five conditions of geographical relationship: allopatry, broad hybrid zone, narrow hybrid zone, parapatry and sympathy. Of
Possible delimitation of taxa in the *Trichoglossus haematodus* complex, following a strict application of the PSC: 21 monotypic species.

**Rainbow Lorikeet**
*Trichoglossus haematodus*

- ssp *intermedius*
- ssp *brooki*
- ssp *micropteryx*
- ssp *nesophilus*
- ssp *flavicans*
- ssp *massena*
- ssp *deplanchii*

**Scarlet-breasted Lorikeet**
*Trichoglossus forsteni*

- ssp *mitchellii*
- ssp *forsteni*
- ssp *djampeanus*
- ssp *stresemanni*

**Flores Lorikeet**
*Trichoglossus weberi*

- ssp *fortis*
- ssp *capistratus*
- ssp *flavotectus*

**Marigold Lorikeet**
*Trichoglossus capistratus*

- ssp *flavotectus*

**Coconut Lorikeet**
*Trichoglossus haematodus*

- ssp *haematodus*
- ssp *nigrogularis*

**Biak Lorikeet**
*Trichoglossus rosenbergii*

- ssp *septentrionalis*
- ssp *moluccanus*

**Rainbow Lorikeet**
*Trichoglossus moluccanus*

- ssp *rubritorquis*

**Red-collared Lorikeet**
*Trichoglossus rubritorquis*
these, allopatry scores 0, because it cannot be quantified and supplies no evidence of evolutionary separation, while sympatry automatically scores 7 since the taxa in question are behaving demonstrably as species. The three intermediate conditions, however, can be allowed scores which reflect the approximate degree of the resistance of the taxa to phenotypic merging.

- A broad hybrid zone is one in which hybridization between two taxa occurs over a range more than 200 km wide at its maximum point. The breadth of the zone suggests a relatively low resistance, thus allowing a “minor” score of 1.
- A narrow hybrid zone is one in which hybridization between two taxa occurs over a range less than 200 km wide at its maximum point. The narrowness of the zone suggests relatively high resistance, reflected in a “medium” score of 2.
- Parapatry involves an extremely narrow line along which the boundaries of two taxa abut with no or minimal hybridization. The taxa are not dissimilar enough ecologically to coexist in sympathy, but appear to exclude each other (i.e. there is no assistance from a geographical barrier such as a broad river), suggesting strong resistance worthy of a “major” score of 3.

Obviously, these three conditions exclude each other: a taxon can be scored only once on distributional criteria.

In our scheme, 7 can be reached purely on phenotypic characters, but combinations of phenotypic characters and a particular distributional condition can also make up the necessary total. However, scores of 7 that are achieved on minor characters only (which here include a broad hybrid zone) are disallowed as triggering species status.

The fact that hybridization is treated in these criteria as a positive rather than a negative characteristic in determining species rank must appear counterintuitive to many people who, perhaps for many decades, have assumed that almost any serious degree of hybridization between two taxa is evidence of their reproductive compatibility and hence of their conspecificity. The fact that at least 9% of all bird species have interbred in the wild (Grant & Grant 1992) tends, however, to suggest that hybridization is on the one hand a widespread and common phenomenon and on the other very rarely capable of producing significant changes in parent taxa (mostly on oceanic islands and only as a result of anthropogenic interference). So if taxa—lineages—meet and hybridize on a regular basis but whose genomes have not merged (as judged by molecular or phenotypic evidence), there is every reason to consider them species (Johnson et al. 1999, Helbig et al. 2002, Carling & Brunfield 2009, Harr & Price 2012). If Icterine Warblers Hippolais icterina and Melodious Warblers H. polyglotta were allopatric, the relatively low levels of differentiation between them would form an arguable case for their conspecificity; but, precisely because they slightly overlap and hybridize without merging into one another, this possibility is quashed outright. Thus, in this checklist, we accept because they slightly overlap and hybridize without merging into one another (and indeed distance between islands forms part of a system for determining taxonomic rank proposed in Pratt 2010). Paradoxically it is also sometimes remarked that two taxa separated by only a short distance could also be judged two species because, in spite of their proximity, they have managed to maintain the integrity of their characters. In both cases, however, it needs to be recognized that the distance between the ranges of taxa, whether very small or very large in size, has no taxonomic value per se. Disjunction is simply the circumstance that triggers the need for criteria to judge the differences in character between the taxa involved. It cannot then also be invoked as one of the factors on which the degree of difference is assessed. It is perhaps also worth noting that broad rivers render the ranges of understory birds distinct, since such species cannot cross them; but this means that these rivers do not represent a line of parapatry. On the other hand, the same rivers should not pose a barrier to larger canopy species such as parrots and toucans, so for these kinds of bird rivers may indeed be considered, potentially, as forming lines of parapatry.

### The Tobias criteria: in practice

Although received with two thoughtful, positive commentaries (Winker 2010, Brooks & Helgen 2010), the Tobias criteria have not been rapidly adopted in published species-level taxonomic revisions. Five papers with one common author (Collar 2011, Collar & Bird 2011, Rasmussen et al. 2012, Collar & Salaman 2013, Collar et al. 2013) have resulted in the elevation of some 40 taxa to species level, and a number of other papers (Rheindt et al. 2011, Shirihai et al. 2011, Donegan 2012, Donegan & Salaman 2012, Leader & Carey 2012, Praveen & Nameer 2012, van Balen et al. 2013, Leader et al. 2013, Mahood et al. 2013) have used the criteria to explore and in some cases decide the status of taxa. (It should be noted that taxonomic revisions using what may now be seen as prototypes of the Tobias criteria will need to be reworked in the light of various changes that were introduced when the criteria were finally, formally published.) However, wide use has been made of them internationally in its evaluations has been steadily generating decisions in response to the many proposed splits in the recent literature, and providing a partial basis for a more proactive evaluation of the global avifauna such as envisioned by this checklist.

### Identifying candidate taxa

Our ambition therefore has been to apply the Tobias criteria as fully as possible to the global avifauna, not only for splitting but also—to be even-handed and consistent—for lumping. However, within the constraints of a relatively tight time-frame it was clearly not practicable to evaluate every taxon—this would be more the work of half a lifetime. The assumption had to be made that the great majority of subgroups are distinguished by one or two characters with low to medium strength. With this acknowledged limitation, we prepared candidate lists for taxonomic inquiry based on evidence trawled from the peer-reviewed literature (not always easy, of course, that very broad hybrid zones reflect relatively high levels of hybrid fitness, and we acknowledge that these pose challenges that deserve thought and reflection, for example in the cases of Masked and Black-shouldered Lapwings Vanellus miles and V. novaehollandiae and of Campo and Pampas Flickers Colaptes campestris and C. campestris rufidorsa, both pairs of which we split, with some uncertainty; indeed in one case, involving the Oriental Dwarf-kingshisher Ceyx erithaca, the hybrid zone between northern nominate erithaca and southern rufidorsa is so wide—far wider than the range of pure rufidorsa—that logic and practicality militate altogether against establishing the taxa as species.)

A further important point made but not discussed in any detail by Tobias et al. (2010) is that, although it may play a part in the speciation process, disjunction is not a taxonomic character. In recent years several splits have been proposed on the basis of the existence of a great distance between one taxonomically distinct population and another (and indeed distance between islands forms part of a system for determining taxonomic rank proposed in Pratt 2010). Paradoxically it is also sometimes remarked that two taxa separated by only a short distance could also be judged two species because, in spite of their proximity, they have managed to maintain the integrity of their characters. In both cases, however, it needs to be recognized that the distance between the ranges of taxa, whether very small or very large in size, has no taxonomic value per se. Disjunction is simply the circumstance that triggers the need for criteria to judge the differences in character between the taxa involved. It cannot then also be invoked as one of the factors on which the degree of difference is assessed.
<table>
<thead>
<tr>
<th>Type of taxonomic character</th>
<th>Frequency of scoring</th>
<th>Magnitude (score)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minor (1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Medium (2)</strong></td>
<td>Effect size: 2–5</td>
<td></td>
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<tr>
<td><strong>Major (3)</strong></td>
<td>Effect size: 5–10</td>
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</tr>
<tr>
<td><strong>Exceptional (4)</strong></td>
<td>Effect size: &gt;10</td>
<td></td>
</tr>
</tbody>
</table>

### (1) Biometrics

- **Frequency of scoring**: 2
- **(strongest increase and strongest decrease only)**
- **Magnitude (score)**: Effect size: 0.2–2

### (2) Acoustics

- **Frequency of scoring**: 2
- **(strongest increase and strongest decrease only)**
- **Magnitude (score)**: Effect size: 0.2–2

### (3) Plumage and bare parts

- **Frequency of scoring**: 3
- **(three strongest characters)**

- **Magnitude (score)**: A slightly different wash or suffusion to all or part of any area
- **Distinctly different tone/shade to all or part of a significant area**
- **Contrastingly different hue/colour to all or part of a significant area**
- **Radically different coloration or pattern to most of plumage (striking contrast in colour, shade, shape)**

### (4) Ecology and behaviour

- **Frequency of scoring**: 1

- **(once)**

- **Non-overlapping differences in (a) foraging/breeding habitat, (b) adaptations related to foraging/breeding, or (c) an innate habit**
- **Non-overlapping differences in an innate courtship display**
- **not applicable**
- **not applicable**

### (5) Geographical relationship

- **Frequency of scoring**: 1

- **(once)**

- **Broad hybrid zone**
- **Narrow hybrid zone**
- **Parapatry**
- **not applicable**

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Red-cheeked Cordon-bleu

Red-winged Blackbird

Eurasian Treecreeper

Long-tailed Minivet

Blue Waxbill

Tricolored Blackbird

Short-toed Treecreeper

Short-billed Minivet

Introduction
owing to the increasing number of—sometimes rather arcane—journals catering for molecular biology), field guides, monographs and handbooks; information supplied by correspondents; insights of our own from work in museums and the field; and a review of the distinctive subspecies used in illustrations in HBW (which, as mentioned above, were particularly targeted for inclusion in the series). By scrutiny of the HBW plates and other sources we also listed out species whose distinctiveness appeared sufficiently low to call in question their taxonomic rank.

That this process is far from exhaustive may be gauged by the case of the Australian Painted-snipe Rostratula australis, which was treated in HBW as a subspecies of Great Painted-snipe R. benghalensis with the words “averages considerably longer-winged; no significant plumage differences”, and hence was not even illustrated. In this case other sources suggested a split, prompting our own assessment; but even the key “splitting” paper (Baker et al. 2007) failed to account for the full morphological distinctiveness of the form, which is only now in these pages indicated for what we believe may be the first time. This case could easily have been missed, and serves as a warning that other equally distinctive taxa may have escaped scrutiny in this exercise.

The same may be true of the exercise to evaluate the possible conspecificity of forms long treated as separate species (Figure 23). This targeted a wide sweep of taxa, including for example (although scores in these cases are not always provided) the Spheniscus penguins, Aptodytes herons, Threskiornis ibises, Leucos birds, Ardeola bustards, the two smallest Numenius and a significant number of pigeons, nightbirds, hummingbirds and woodpeckers, although we should again stress that we were unable, from lack of time, specimen material and other evidence, to undertake a full review of taxa, thus leaving certain intriguing complexes (for example the Macrowyra cuckooves, Dendroica tilder imperial-pigeon complex, Tyniptera paradise-kingfishers, various gulls and skuas) unexplored. Only a very small proportion of cases of these we considered resulted in the lumping of taxa, but we again acknowledge that some of these may be challenged in due course. Nonetheless we consider it a cardinal obligation in this major exercise to use the Tobias criteria dispassionately both for splitting and for lumping.

Sources of information

Every reasonable effort has been made to ensure that all publications relevant to this work have been traced, procured and considered. The number of taxonomic and distributional papers consulted runs to over 9,000. Nevertheless, we will obviously have missed some material (as noted above, the appearance of many ornithological studies in the proliferating zone of hybridization 2 and a broad zone of hybridization 1 (see text for details and reasoning). Taxa scoring a total of 7 or more are considered of a pale iris and strong red pre- and post-ocular patches in Seram Mountain-pigeon Gymnophaps stalkeri but not in Buru Mountain-pigeon G. madja, something no specimen or specimen label conveyed. A similar discovery of a red face in living male Hainan Peacock-pheasants Polyplecton katsumatae, something completely missed from previous diagnoses using museum material (Davison et al. 2012), significantly increased the confidence with which this form could be split.

In the absence of either specimens or photographs, in a very small number of cases use was made of written descriptions and, if judged to be clear enough, these were accepted as a basis for taxonomic decisions. A case of some interest involves the detailed and meticulous split by Stiles (1996)—not accepted by HBW but supported by the Tobias criteria—of Blue-tailed Emerald Chlorostilbon melinnaeus into as many as eight species, when even Stiles himself was unable to access specimens of every taxon under review; inevitably, then, information on character differences has had to be taken on trust. Occasionally, published morphometric differences between taxa lacked the standard deviations needed to apply a Cohen’s d test; in these cases—see, e.g., under American Comb Duck Sarkidiornis sylvestris and American Comb Anas—many of the available data are presented and an estimate was made of the likely score, prefixed by the word “allow.”

In outlining these sources of information we must pay tribute to the various global and regional checklists on whose giant shoulders this work dares to stand (although we do not presume to see any further than they, but merely to have an alternative perspective). The American Ornithologists’ Union, British Ornithologists’ Union and South American Checklist Committee all publish updates to their respective lists and include varying levels of explanation for their taxonomic decisions, and this transparency is a particular virtue which we seek to emulate. Annotated checklists such as Dickinson (2003), Dickinson & Renslen (2013) and Dowsett & Forbes-Watson (1993) (as interpreted by Dowsett & Dowsett-Lemaire 1995) represent an indispensable resource in the pursuit of taxonomic understanding; so too do major scholarly compilations typified by the eight-volume Birds of Africa series (1982–2013), Wells (1999, 2007) and Ridgely & Greenfield (2001), not to mention the multitude of bird family monographs that have been appeared in the past two or three decades. Last but not least we should mention HBW itself, whose many authors contributed taxonomic information which this checklist often extensively reproduces and on which it directly builds.

Characters not specified in the Tobias criteria

A series of characters emerged during this review that are not mentioned in the Tobias criteria. Number of tarsal scutes (Puna Rhea Rhea torquata, Northern Brown Kiwi Apteryx monticola), feather softness and facial cuticle (Northern Brown Kiwi, Kiwi feathers, Japanese Kiwi), featherous emollients (Northern Brown and Okarito Kiwi A. nov), casque shape (Sira Curassow Pauxi hoepkeae), comb shape (American Comb Duck Sarkidiornis sylvestris), femur structure (Laysan Duck Anas laysanensis), shape of bill (Siberian Scoter Melanitta stejnegeri, Australian Gull-billed Terntorchidula macrorhyncha), “osteological morphology” (Grey-faced Petrel Pterodroma gouldi, presence of polymorphism (Papuan Harrier Circus sphyrocephalus), number and structure of coronal plumes (Ouaveke Parakeet Eunymphicus wauensis) and egg colour (Green Nightjar Caprimulgus jotaka) required some thought as to the appropriate level of scoring in the absence of guidelines (the scores given indicate our conclusions in these cases, but a review of these

Figure 15——Under a recently proposed system of quantitative criteria for species delimitation (Tobias et al. 2010) phenotypic differences (i.e. differences in plumage, morphology, measurements and vocalizations) are scored as minor (1), medium (2), major (3) and exceptional (4), depending on their perceived degree of strength. Co-varying differences (e.g. longer wing length and proportionately longer bill size) can be scored only once, and (to avoid maximizing the value of minor differences) only three morphological and two vocal differences may be scored. Molecular differences between taxa are not given quantitative scores because genetic and phenotypic differences have no consistent correlation (see Figure 12); although this omission has drawn criticism, genetic information is repeatedly used to illuminate or infer evolutionary history, and in some cases molecular evidence has been central to the way species have been defined and their limits drawn. Ecological and behavioural differences are also taken into account and, if present, they receive an extra score of 1 (with 2 allowed for “non-overlapping differences in courtship display”). Finally, distributional data are also incorporated, and, while allopatric (no matter how disjunct) ranges do not score, parapatry scores 3, a narrow zone of hybridization 2 and a broad zone of hybridization 1 (see text for details and reasoning). Taxa scoring a total of 7 or more are considered distinct enough to be accorded species status (based on scores achieved by similar species in sympatry and compared with lower scores for taxa widely considered to be subspecies). The “Tobias criteria” were not introduced as a new species concept or a truly objective method, but rather as a practical tool to help assess the degree of difference between non-sympatric taxa, in as consistent and transparent a way as possible.
issues may form an addendum in any future revision of the criteria). There is also the problem of breeding season, which notably affects two seabirds in the north-east Atlantic: Desertas Petrel *Pterodroma deserta* and Monteiro’s Storm-petrel *Hydrobates monteirii*, a score of 1 for a behavioural/ecological difference is arguably inappropriate in these cases.

And how taxonomically informative are differences in juvenile plumage? Although these are clearly unrelated to signalling in the reproductive process, they must nevertheless be assumed to represent distinct adaptations with particular survival value, and therefore be not entirely irrelevant to taxonomic processes. Pattern of downy young proved decisive in the split of Grey Teal *Anas gracilis*, and colour of soft parts and plumage of juveniles in the split of Common Gallinule *Gallinula chloropus*, while relatively distinct juvenile plumages help to maintain the specific identity of, for example, the Spanish Imperial Eagle *Aquila adalberti*, Philippine Drongo-cuckoo *Surniculus violaceus* and São Tome Kingfisher *Corythornis thomensis* and may, in future, bear on the taxonomic status of “Cabot’s Tern” *Sterna sandvicensis acuflavid*a.

**Acoustic evidence**

The Tobias criteria stipulate precise thresholds for quantifying vocal differences through the analysis of recorded elements. However, for this non-passerine volume, with relatively few groups for which vocalizations were critical, such specialized research was for the most part felt to be unnecessary. To begin with, partly from considerations of time, we felt it unnecessary to represent distinct adaptations with particular survival value, and therefore be not entirely irrelevant to taxonomic processes. Pattern of downy young proved decisive in the split of Grey Teal *Anas gracilis*, and colour of soft parts and plumage of juveniles in the split of Common Gallinule *Gallinula chloropus*, while relatively distinct juvenile plumages help to maintain the specific identity of, for example, the Spanish Imperial Eagle *Aquila adalberti*, Philippine Drongo-cuckoo *Surniculus violaceus* and São Tome Kingfisher *Corythornis thomensis* and may, in future, bear on the taxonomic status of “Cabot’s Tern” *Sterna sandvicensis acuflavid*a.

**Figure 16** – In many cases, the results of applying the Tobias criteria are clear-cut. For example, the differences between Von der Decken’s *Tockus deckeni* (left) and Jackson’s *Tockus jacksoni* (right), hitherto predominantly considered conspecific and still so in very recent works (Dickinson & Remsen 2013), reach a total scoring of 9–12, well above the threshold of 7 for species status. Of course, some level of subjectivity inevitably enters the scoring process depending on the individual judgement of the scorer (whose uncertainty is expressed here by three “1–2” scores), but at least in easy cases like this one the result is unaffected. In more borderline cases another advantage of this method, according to its proponents, is its transparency, as the scores are explained, meaning that other, perhaps more sceptical, workers have the opportunity to repeat the scoring process and judge the conclusions for themselves.

In a good number of cases, however, acoustic differences were decisive in making a split (ten examples: Comoro Green-pigeon *Triops givouini*, Ecuadorean Hermit *Phaethornis baroni*, Whistling Yellowbill *Cathartornis australis*, Eastern Water Rail *Rallus indicus*, Plumbeous Water Redstart *Octotoma malachitis*, Snowy Plover *Charadrius nivosus*, Guadalcanal Boobook *Ninox granti*, Palau Kingfisher *Tockus rufilatus*, Annam Barbet *Psilopogon anamensis*, Bronze-winged Woodpecker *Campephilus splendens*).

Some of these differences are well documented via recordings on the internet, or via detailed written descriptions and sonagrams, and for these we often provide a transcription of our own or a copy of a pre-existing description, adding a score based on our sense of degree of difference. Some, however, are blunt unsupported assertions in publications with little or no descriptive information, so that in the absence of accessible material to confirm them they had to be taken on trust; such cases are particularly difficult to score, and our tendency was to treat such evidence as a minor character only.

There are, of course, notable instances where voice is the dominant character in determining species status. In the case of Least Terrestrial *Turdus astillarius*, various hawk-cuckoos *Hierococcyx*, Australian Little Bittern *Ixobrychus rubricollis* and Madagascar Hoopoe *Upupa marginata* this is sufficiently well documented to allow a confident evaluation against the Tobias criteria, the general rule being that a large vocal difference is supported by two or three relatively minor morphological characters. However, this is not always so, and one or two cases present interesting and important challenges to the premises that sit behind the Tobias criteria. The most
notable is Mees’s Nightjar *Caprimulgus meesi*, which is in plumage “exceedingly similar to and not diagnosably different from *C. maerzii schlegeli*”, the form of Large-tailed Nightjar with which it was previously lumped, but highly distinct in its song, to which playback experiments repeatedly demonstrated species-specific responses (Sangster & Rosendal 2004). This circumstance is extremely rare and conceivably unique among non-passerines, although something very similar appears to happen in Costa Rica, where Northern Potoo *Nyctibius jamaicensis* and Common Potoo *N. grisens* are supposedly inseparable except on voice (although here the taxa appear to be sympatric). However, the Tobias criteria are not necessarily invalidated in this case: they allow for a song to be scored on the strongest of both temporal and spectral characters, so that structure of delivery and pitch of note can be assessed. In the absence of the data required to make a formal evaluation, the evidence on Xeno-anto strongly suggests high scores for both, and it is entirely plausible that other elements in the vocal repertoire of *C. meesi* will also, in due course, prove distinct from those of its closest relatives.

A similar expectation underpins our tentative recognition of species status in certain other nocturnal birds, namely the burrow-nesting procellariiforms (Figure 2). The recent discovery of Monteiro’s Storm-petrel *Hydrobates monteiri*, which differs in barely significant proportions from Band-rumped Storm-petrel *H. castro* but has a somewhat different song in its burrow (and does not respond to the song of *H. castro*), provides evidence that highly philopatric oceanic seabirds have evolved precise acoustic signals by which to discriminate their own kind over relatively short distances, in the seclusion of their night-time nest-sites. This possibility makes it easier to accept multiple species in the intractably difficult Little/Audubon’s Shearwater complex (dealt with in this checklist under *Puffinus elegans*, all of which are borderline cases with the Tobias criteria.

A note of caution is perhaps worth sounding here. It was proposed that the Comoro Thrush *Turdus bruennichi* be split from *T. comorensis* (with race *moheliensis* on the basis mainly of vocal differences (Herremans 1988), but “further study of voice has shown the differences to be less marked than first thought” (Safford & Hawkins 2013). While the issue of sample size is particularly relevant to birds that at least in part learn vocalizations from their environment (true in non-passerines only of hummingbirds and parrots), it is probably worth stressing that multiple vocal sampling of any taxon across the spatial and temporal spectrum provides a far stronger basis for taxonomic evaluation. In the same way, playback experiments will be all the more informative when they are conducted and presented with the kind of rigour invested in the case of *Caprimulgus meesi*.

**Difficult groups and special problems**

Taxonomic decision-making tends to be much easier when it involves only two taxa. There have been many such situations in the course of this exercise, resulting in some straightforward outcomes such as the splits of Taiwan Bamboo-partridge *Bambusicola sonorosus*, Puerto Rican Mango *Anthracothorax auridentus*, and Black-faced Go-away-bird *Corythosoides leopoldi*, with among the more striking cases two parrots, Mustard-capped Lorikeet *Trichoglossus meyeri* and Cordilleran Parakeet *Psittacara frontatus* (see also Figure 16). However, the process need not be less straightforward in three- or four-way comparisons if the taxa involved are all easily discriminated, as appears to be the case with the Gutter *G. guineafowl*, Otidi­phaps pheasant-pigeons and *Oxypogon* helmetcrests. The bright plumages of these birds signal their identity; distinctions between them are generally easily detected in museum specimens or photographs, rendering the taxonomic evaluation process relatively undemanding.

Unfortunately, these clean, cut-and-dry conditions tend to be less frequently encountered than their opposite. To start with, particular groups represent significant challenges to the Tobias criteria: birds, that is, whose environments and life histories constrain their coloration and structure, for example seabirds, swifts, nightbirds, tanagers. These cases are in which for fairly obvious reasons bright colours and patterns have not evolved, but this does not mean that their capacity to signal their identities is any less developed. Rather, the context in which these signals are made is much more constrained, and human ability to perceive them is correspondingly limited. The danger of assuming that human proficiency in perception is equal to that of the birds themselves has been highlighted in recent years by studies of the degree to which birds make use of ultraviolet reflectance (Eaton & Lanway 2003, Stoddard & Prum 2011), although to date there has been no evidence of its value in species recognition.

One notable characteristic of procellariiform seabirds is their ability to detect “chum”, the bait commonly made of fish offal used by birdwatchers to attract petrels and shearwaters close to ships, even seemingly from beyond the horizon. It is tempting to imagine that this hypertrophied olfactory sense might also find a role in determining the identity of potential mates although it is perhaps more likely that—as noted in the previous section—the key means of communicating identity is through vocalizations at the breeding colony, to which these burrow-nesting birds possess an extraordinary degree of fidelity. At any rate, this large group of species poses age-old taxonomic problems to which there have been many proposed solutions, none of them definitive, and we recognize that conservatively plumaged seabirds (along with swifts!), for which other ecological and behavioural characters may play a far more significant role in mate choice and speciation, represent an interesting challenge to the Tobias criteria. Advances towards a coherent classification of taxa will require the dedication of substantial resources and, even so, a degree of stability is unlikely for many years. We have sought to make an independent assessment of as many taxa as possible, but in the case of the *Puffinus assimilis/P. herminieri* complex we elect simply to follow the taxonomy of a recent authority (Onley & Scofield 2007) without attempting to apply the Tobias criteria to the taxa involved; and with albatrosses we do the same, “provisionally and precautionarily” accepting the largely phylogenetic taxonomy of the Agreement on the Conservation of Albatrosses and Petrels (ACAP), which benefits from the force of international law and the advice of an expert taxonomic panel.

![Figure 17](image-url)
Introduction

uncritically. In contrast, we proceed with the split of Yellow-headed Amazon
for all members of the Apodidae is accepted
status quo
for the most part the Fernando Po Swift
Apus sladeniae
Indeed,
A. balstoni
Gallinago delicata
Evidence informs our recognition of Wilson’s Snipe,
tory (and probably not a very stable) arrangement. Similarly incomplete
distances involved in most of the “herring gull complex”, not a very satisfac-
L. argentatus
, and with the caveat that this is, owing to the very small genetic
surprisingly, paraphyletic with the near-identical European Herring Gull
Larus smithsonianus
, and are not taken from conservation interests. The gull is recognized as a
reaching the Tobias threshold, but these decisions are explained in the text
—where species status is accepted for a seabird without its
smithsonianus
Larus, Grey Noddy
deserta
and Arctic Herring Gull
R. xantholaema
consequence entirely of several molecular studies rendering it, somewhat
extraneous and inexplicable disjunction) being a miniature
Papuan Hornbill
R. plicatus
; rather than overhastily lumping these two
taxa, we judge that further research, including into behavioural and eco-
ological factors, is needed. We also make a leap of faith—arguably a leap of
logic—with three nightbirds: Allied Owlet-nightjar
Aegotheles affinis
, which
has been indicated such that we confidently anticipate further evidence
support their original HBW 4 treatment as a single species and (b) the
subspecies xantholaema, from the isolated easternmost end of the range of
xantholaema, resembles one of the onatrix subspecies: we do so in part
because subsequent molecular work (Ribas et al. 2007) indicates that the
genetic evidence is far from settled, and in part because application of the
Tobias criteria supports the split so long as the anomalous xantholaema is set
aside, an uncomfortable decision which further research (including into
the behaviour and ecology of xantholaema) will, we hope, help to justify.
Elsewhere, we do not disturb the taxonomic status quo of Dwarf Ibis
Bostrechia bosagrai and Narcondam Hornbill
Rhytienos narcondami
, although
on present knowledge the latter in particular cannot be justified as a spec-
cies by use of the Tobias criteria, seemingly (discounting, for reasons given
above, its extraordinary and inexplicable disjunction) being a miniature
Papuan Hornbill
R. plicatus
rather than overhastily lumping these two
taxa, we judge that further research, including into behavioural and eco-
ological factors, is needed. We also make a leap of faith—arguably a leap of
logic—with three nightbirds: Allied Owlet-nightjar
Aegotheles affinis
, which
genetic analysis, combined with a significant size difference and the geo-
 graphical position of the taxa involved, strongly implies is a full species; and
Northern and Chocolate Boobooks
Ninox japonica
and
N. varius
, in both of which significant vocal and some morphometric distinctiveness
have been indicated such that we confidently anticipate further evidence
to be assembled in due course. In addition, we have chosen to accept the
findings of a very recent molecular study of the King Rail
Rallus elegans
complex (Maley & Brumfield 2013) which, combined with a degree of
morphological evaluation (which we have had no time to confirm and extend), has drawn species limits in a way that appear at least as plausible and satisfactory as any previous arrangement.

In the great majority of species-level cases, however, this checklist makes use of species-level genetic evidence as additional corroboration rather than as an integral part of the decision-making process. Naturally it is encouraging when genetic evidence and phenotypic evidence coincide, as when “Crimson”, “Yellow” and “Adelaide” Rosellas Platycercus elegans, P. flavescens and P. australis (as given in HBW 4), which application of the Tobias criteria cannot maintain apart, prove by genetic analysis to be better understood as forms (subspecies, hybrid populations) of a single species (Joseph et al. 2008); or when a molecular paper (den Tex & Leonard 2013) suggested that Pseudepon griseus griseus, known from a single mountain in peninsular Thailand, is a full species, and the (very scarce) specimen material shows that on plumage alone this much-neglected taxon meets the threshold for species status under the Tobias criteria. It is far less satisfactory, however, when a molecular paper makes such a claim and the specimen material provides relatively weak support for it, as with the splits of “American Three-toed Woodpecker” Picoides tridactylus dorsalis (Zink et al. 2002), “New Caledonian Parakeet” Cyanoramphus (novaezelandiae) saisseti and “Norfolk Parakeet” C. (n.) cooki (Boon et al. 2001) and “Western Ground Parrot” Psittacornis (wallucis) flaviventris (Murphy et al. 2011)—this last being particularly distressing to discount when only a few hundred individuals may survive (but see comments above).

Our preference to set such claims aside is, we emphasize, absolutely not out of indifference or hostility to genetic evidence; it is, we repeat, simply because genetic distance between taxa, however great, is as yet impossible to assign to categories whose thresholds invariably reflect a speciation event. There are, incidentally, at least five instances in this checklist—apart from the Amazona ochrocephala example above—where morphological distinctiveness has led us to override molecular results that call for a lump rather than a split: White-faced Plover Charadrius dolbatus, Little White Tern Gygis alba, Sanford’s Sea-eagle Haliaetus sanfordi, Moorea Kingfisher Todiramphus popeii and Yellow-billed Toucanet Aulacorhynchus calorhynchus. In such cases, as Rheindt et al. (2011) observed, “diagnostic phenotypic characters may be encoded by few genes that are difficult to detect”.

Tobias et al. (2010) recommended that in cases of highly polytypic species the comparisons should be made between phenotypically rather than geographically closest taxa, but they admitted a degree of flexibility in such situations (Figure 17). We found this freedom helpful in two cases where we were dependent on a published source which had reviewed the specimen evidence (and where our own review of this evidence was impracticable), namely the Blue-tailed Emerald Chlorostilbon melisugus complex (Stiles 1996) and the White-eared/Painted Parakeet Pyrrhura leucotis/picta complex (Ardnt 2008). Particularly in this second case comparisons between all taxa represent a dizzying challenge, and the only feasible way forward (if only for space reasons!) was to restrict considerations to adjacent taxa. In other cases, we were fortunate enough to find high levels of representation in museums of taxa in difficult complexes, so that comparisons could be multiple, for example Variable Dwarf-kingfisher Ceyx lepidus, Emerald Toucanet Aulacorhynchus prasinus and Rainbow Lorikeet Trichoglossus haematodus. In the case of the first two of these complexes our findings, worked out in parallel, proved largely but not exactly concordant with published molecular phylogenies (respectively Andersen et al. 2013, Puebla-Olivares et al. 2008).

However, many complexes that appear in need of revision proved too difficult—largely in terms of time required to assemble and consider the evidence—to evaluate in this review, and are priorities for future work (Figure 20). In a minority of cases, for example the species closest to Pied Imperial-pigeon Ducula bicolor and to Long-tailed Sylph Aglaeactis kingi, the question is whether lumping would not be more appropriate. In the majority, of course, it is the opposite—how and by how much to split. The list is long, but we would mention here, as cases in particular need of further work, Kali/White-Peasant Lophura leucolyra/meropetala, Common Pheasant Phasianus colchicus, Tyrant Metaltail Metalurhinus tyrannina, Green-backed Heron Butorides striata, Black-winged Stilt Himantopus himantopus, Eurasian Buzzard Buteo buteo, Red-billed Hornbill Tockus erythropthalmus and Ectlectus Parrot Ectlectus roratus. Some such complexes have “budded off” very similar-looking forms that now live in sympathy with them—for example, Great Nicobar Serpent-eagle Spilornis chinensis from Crested Serpent-eagle S. cheela, Little Paradise-kingfisher T. varius/adscensionis from Common Paradise-kingfisher T. tutus, and Talaud Kingfisher Todiramphus eurystomus from Collared Kingfisher T. chloris—and from this we can infer that well-marked taxa in other complexes may in fact merit a higher taxonomic rank than subspecies.

Even so, circumstances can be obstinately uncooperative. It has been argued that the Purple Swamphen Porphyrio porphyrio is actually six species, with “Western” P. porphyrio in Europe, “African” P. modestissimus in Africa, “Grey-headed” P. melanotus from Lombok east to through Indochina and Sundaland to Sulawesi, “Philippine” P. pulverulentus in the Philippines, and “Australian” P. melanotus from Lombok east to Australia and the western Pacific islands (Sanger 1998). Ostensibly the various combinations of colours and shades on the back and face in these taxa, plus various proportional changes and differences in frontal shield, support this view. However, when the necessary diagnostic characters for each taxon are critically examined (including internet photographs reliably assigned to locality), confidence in this arrangement begins to evaporate. Birds in Turkey appear intermediate between P. porphyrio and P. poliocephalus, but since the populations are so discontinuous this suggests an ancient clinal pattern rather than the product of a hybrid zone. Meanwhile birds in eastern mainland Asia (P. vivids) possess grey faces and strongly resemble Indian birds (P. poliocephalus) in this character, while their upperparts are generally midway between those of P. poliocephalus to the west and those of the supposedly conspecific dark-faced (and confusingly named) P. v. indicus of Sundaland. Thus, while there seems little doubt that Purple

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**Figure 19**—In contrast to the cases seen in Figs 17 and 18, well-marked forms at the far geographical limits of a range would be recognized not only under the PSC but also by the Tobias criteria, as in the cases of the Junin Rail Laterallus turrosi and Amami Woodpecker Dendrocopos ovstani (illustrated).
Swamphen is indeed a complex of species, as Sangster’s title runs, it is by no means clear what these species are or where and how to draw the lines and distinctions between them. The best course of action seems therefore to leave the whole group lumped until a more rigorous and comprehensive analysis of characters and ranges can be undertaken. This conclusion derives from our general inclination not to attempt or accept solutions that deal only partially with the evidence, or at least which do not explore existing evidence as fully as possible. The separation of “São Tomé Lemon-dove” Columba [here Aldopelea] simplex from “African Lemon-dove” C. larvata in HBW 4 was based on the important and notable finding that the voices of the two taxa are very different, and this arrangement may indeed eventually be confirmed. However, the plu- mages of the various continental groups formed under larvata are remarkably divergent (far more so than simplex from the unsplit form principalis on adjacent Príncipe), while knowledge of their voices appears to be scant; in this instance, therefore, we think that a comprehensive review of taxa and their many characters might be a more helpful way forward than comparisons based on very few data points, which can appear piecemeal or opportunistic and risk missing some crucial patterns. As a perspective on this particular case, the “Amami Thrush” Zoothera majora was originally accorded species status because its song was different from that of White’s Thrush Z. (dauma) aura, but subsequently this song was found to be very similar to that of the Scaly Thrush Z. (a) dauma, and the status of majora as a species accordingly revised (Fig. 21). The consideration of all taxa in a complex is, of course, a fairly obvious taxonomic requirement, and one which for example prevents this check- list from splitting the form subbardi from Coqui Francolin Poltopinus coqui because, although it reaches a score of 7 against the nominate, P. coqui possesses other subspecies which, owing to specimen diaspora, we have as yet been unable to evaluate. A salutary case in this regard is that of “Siamese Partridge” Anthropoides diversus, which Robson (2000) split from Chestnut- headed Partridge A. caitodon, only for Eames et al. (2002) to discover and describe a precisely intermediate form, chandamoni, resulting in the relumping of diversus within two years of its split (although of course the splitter could not have been expected to foresee this). This is the inverse of the situation referred to earlier in which the ends of a cline are so distinct that they might easily be considered two species if the linking populations disappeared; good examples of that circumstance in non-passerine birds are Elegant Crested Tinamou Tinamus edulis (Figure 18) and Red Spurfowl Galliregina spadicea. There are, however, a couple of instances of clines, both involving the same family and a range from western Europe to eastern Asia, where the eastern (insular) extremes are so sharply differentiated from the western that taxa emerge as separate (if obviously derived) species: Amami Woodpecker Dendrocopos australis (from White-backed D. leucotis, Figure 19) and Sumatran Woodpecker Picus dedemi (from Grey-faced P. canus—although in this case an intervening group of taxa is also split off). Just as consideration of all relevant taxa matters in taxonomy, so also does achieving a reasonable sample size in the consideration of specimen evidence. The Tobias criteria set 10 as a working minimum, and in our measurements and assessments we have always weighed to have met this require- ment. Inevitably, however, there are taxa for which such numbers are practically (in terms of access to holding institutions) or absolutely impos- sible. When sample sizes fall short of 10 in revisions given in the taxonomic notes, this is indicated; but in most cases, if the evidence is consistent, we make use of it as appropriately as possible. For taxa described and still known only from single specimens, the issue of sample size spreads beyond statistics (again, owing to diaspora) we have been able to examine and measure only a small proportion of such material to include doubts over their validity (as hybrids, morphs or aberrations). Many nineteenth-century hummingbird taxa fall into this category, apparently the result of artefacts or hybridization (perhaps anthropogenic in some cases), and while many have now been determined as such, some still remain to be clarified. That such taxa should not be lightly discounted is demonstrated by the rediscover- ing in 2004 of the (in reality very distinctive) Glittering Starfrontlet Coli- gena ornata, which was relegated to a subspecies of Golden-bellied Starfrontlet C. bonapartei in HBW 5 and there described as “doubtful and perhaps even…some melanistic plumage” and hence not illustrated). Twelve such taxa are still known from a single specimen (see Figure 25) and no other evidence but recognition as species in this checklist are Negro Fruit-dove Ptilinopus avraeus, New Caledonian Nightjar Eurotopo-odus excal, Cayenne Nightjar Setopogon maculato, Vaurie’s Nightjar Caprimul- gus centralis, Nechisar Nightjar C. solola, Prigione’s Nightjar C. prigioni- ne, New Caledonian Owlet-nightjar Aegotheles savoi, Bogota Sunangel Helianthus zastii, New Caledonian Buttonquail Turnix novacaledonica, Sian Scops-owl Otus siamen, Guadalcanal Moustached Kingfisher Arctocephalus excelsus and White-chested Tinkerbird Pogoniulus mahawii. Seven (almost 60%) are nighbirds, which strongly implies that their continuing absence from the record is a function of human diurnal adaptations, but none can be common and the chances of being able to confirm their taxonomic identity must accordingly be limited. Most other taxonomists recognize these taxa as species, but E. excal, T. novacaledonia and A. excelsus are not usually given species status and, consequently, were scored here against the Tobias criteria, in all cases during an examination of the specimens themselves. The score for size was decisive in the cases of the nightjar and the buttonquail, and since it was impossible to calculate an effect size this was an estimate based on (a) the assumption that the specimen is fully adult and not immaturation and (b) the experience of comparing effect sizes in other parts of this project. (In one other case, Belem Curassow Crax pixima, where the number of specimens is extremely low and only one was available for review, this single specimen was used and again the morpho- metric score was decisive.) But how dependable, how objective, how can such scoring ever be? Because Tobias scores for degree of difference have clear thresholds for morphometric data and reasonably clear guidelines for plu- mages, in theory the scoring of character differences ought to be very consistent between one practitioner of the system and another. As yet, however, there is very little evidence to demonstrate the truth or falsehood of this assumption. We know of one case, the White-faced Plovers Charadrius dealbatus, where we applied Tobias scores to a taxon independently of another set of practi- tioners. The table here compares the characters selected and the scores given (“–” means character not selected for consideration).

<table>
<thead>
<tr>
<th>Character</th>
<th>Checklist</th>
<th>Rheindt</th>
</tr>
</thead>
<tbody>
<tr>
<td>bill depth at (nas)</td>
<td>3.8 ± 0.24 vs 3.6 ± 0.57 effect size 0.46</td>
<td>1 –</td>
</tr>
<tr>
<td>longer wing, effect size 0.448</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>longer tarsus, effect size 0.922</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>longer bill, effect size 0.34</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>white, not black, lores</td>
<td>2 3</td>
<td></td>
</tr>
<tr>
<td>more extensively white forehead, with black of crown usually reduced</td>
<td>2 1</td>
<td></td>
</tr>
<tr>
<td>brighter and paler upperparts</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td>more dark on lower earcoverts</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>much reduced black lateral breast-patches</td>
<td>(ns[1]) 0</td>
<td></td>
</tr>
<tr>
<td>more vivid orange crown</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>rufous-brown of crown does not reach over nape sometimes to divide hindcollar</td>
<td>(ns[1]) –</td>
<td></td>
</tr>
<tr>
<td>more white in wingbar</td>
<td>(ns[1]) –</td>
<td></td>
</tr>
<tr>
<td>generally sandier, less muddy substrates</td>
<td>1 1</td>
<td></td>
</tr>
<tr>
<td>more active foraging behaviour</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>more upright stance</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

Intriguingly, the final scores of these two assessments are the same, but they agreed on only two out of the four scores that they both applied to the same character; however, the differently scored characters are adjacent on the bird’s face and could be said to form one character, for which both practitioners scored 4. We do not know how many people contributed to the scoring of dealbatus in the Rheindt analysis; for this checklist most scor- ing was done by one individual examining the specimen evidence itself (N. J. Collar), but all scores are critically scrutinized by at least one other individual (J. del Hoyo) and commonly by a second (L. D. C. Fishpool) before any taxonomic decision was finalized.

As a final note here, it needs to be mentioned that, in addition to the taxa that are split and lumped in this checklist, scores for distinctiveness are often (but not always) given also in cases where taxa have been tested for possible splitting or because they have been split by others but main- tained lumped here.

**Subspecies, populations and conservation**

The bird listings on major legal instruments such as CITES (Convention on International Trade in Endangered Species), CMS (Convention on the
Conservation of Migratory Species) and Ramsar (Convention on Wetlands of International Importance) very largely or exclusively comprise species rather than subspecies. Moreover, while the first and second editions of the international bird Red Data Book (Vincent 1966–1971, King 1978–1979) treated subspecies as well as species, the third edition did not. A full explanation for this change of policy was given in the first volume of that edition (Collar & Stuart 1985: xvi–xviii), emphasizing that national conservation organizations should certainly not disengage from subspecies conservation, and that “the environmental crisis of our planet is now so great that to focus merely on species is to fail to recognise the considerable loss of genetic diversity we are about to sustain (and doubtless are sustaining) at the subspecific level”.

A substantial part of the reason for this focus on species lies simply with the level of uncertainty that attaches to the taxonomic status of many subspecies—a circumstance that takes us back to the fundamental difficulty with the PSC. This fact, combined with the sheer number of subspecies and the failure of global conservation in any case to achieve any significant level of success at the species level, has contributed to the absence of subspecies from conservation agendas in many parts of the world. Still less attention is given to populations that are (so far as we know) undifferentiated taxonomically but of interest as geographical outliers (for example, the remnant breeding colonies of Dalmatian Pelican *Pelecanus crispus* in East Asia, Demoiselle Crane *Anthropoides virgo* in Turkey and formerly Morocco, Glossy Ibis *Plegadis falcinellus* on Agalega in the Indian Ocean). On top of this, conservation also has to contend with the steady loss of species from the edges of their ranges and the inexorable thinning of populations throughout their ranges.

Here we simply wish to stress again that, while we firmly believe in the species as the simplest and soundest unit of biological diversity in terms of conservation attention, we acknowledge and applaud endeavours that target subspecies and populations, with the only proviso that these complement and supplement, rather than detract or distract from, endeavours that target species. If we do not judge *Cyanoramphus novaeseelandiae cookii* or *Chersomanes albifasciata beesleyi* to hold species rank, we nevertheless urge those concerned for their survival to use whatever means they can to maintain these taxa into the future (for the former, see next paragraph). We certainly hope that at some stage BirdLife International will attempt the task of evaluating the global conservation status of subspecies, which may go some way to reducing the pressure we sense in some quarters to elevate subspecies to species level as a means of increasing their profiles with potential funding sources. We repeat here, however, our earlier assertion that, fully committed to conservation though we are, conservation considerations have no place in taxonomic evaluations.

**Results in broad brief outline**

Comparing the list of species recognized in this checklist with those published in the volumes of HBW, a total of 30 has been lumped into 22 species, all of which are now treated as Least Concern on The IUCN Red List.
Introduction

**P. p. porphyrio** (Spain)

**P. p. madagascariensis** (South Africa)

**P. p. caspius** (Turkey)

**P. p. bellus** (SW Australia)

**P. p. poliocephalus** (India)

**P. p. caspius** (Turkey)

**P. p. poliocephalus** (India)

**P. p. melanotus** (New Zealand)

**P. p. viridis** (Malaysia)

**P. p. indicus** (Borneo)
As noted above, however, the three taxa formerly considered threatened species, but now no longer recognized at the species level (Manus Owl Tyto novae-hollandiae manusi, Usambara Eagle-owl Bubo poensis vosseleri and Socorro Parakeet Psittacara holochlora brevipes) remain important conservation priorities. Moreover, Cyanornis amplissimus newarzucandae owls (treated as a subspecies in HBW) remains equally protected as a subspecies under Australian law (Garnett & Christidis 2007) and has its own action plan (www.birdsindanger.net).

The number of lumped taxa is outweighed 15-fold by the 462 newly split taxa (although it is important to note that very roughly half of these result from post-HBW splits proposed by others). Over 22% of these are considered threatened, falling into the categories of Critically Endangered, Endangered or Vulnerable, and a further 15% are listed as Near Threatened. These proportions are significantly higher than those for taxa that were treated as full species and remain so in this checklist (16% threatened and 11% Near Threatened), reflecting the smaller distributions and populations of the split taxa, both of which are associated with higher extinction risk and Red List category. Across all 4,471 non-passerines recognized in this checklist, 17% are considered threatened with extinction, and a further 11% are Near Threatened. Incorporating the taxonomic revisions presented in the Checklist, 13% of the world’s birds are now considered threatened with extinction.

The new splits are not evenly distributed across families, with over 20 new splits documented in this volume for each of the pigeons, woodpeckers, hummingbirds, kingfishers, owls and parrots. Excluding families with fewer than ten species, those undergoing the largest proportional increase include the albatrosses, motmots, kingfishers, toucans and all three barbet families (Asian, African and New World), each growing by over one quarter. Similarly, there are geographical biases: while taxa have been split in over 20 families (Asian, African and New World) Across all 4,471 non-passerines recognized in this checklist, 17% are considered threatened with extinction, and a further 11% are Near Threatened. Incorporating the taxonomic revisions presented in the Checklist, 13% of the world’s birds are now considered threatened with extinction.

The subsections that follow outline the technical processes, presentational conventions, sources followed and similar details relating to all aspects of this checklist. Although the volume is large in size, its structure is rather simple: following this introduction, the main body of the book—the checklist itself—comes directly; then three appendices, two of them covering the extend species, the third comprising a set of maps to help users to interpret the distributional information; then a bibliography and index. More information on all these components follows in this section.

Macro systematics
All species of bird belong within a higher classification, of course. The world of ornithological taxonomy has long been confronted with an intimidating array of higher order divisions—subclass, infraclass, parvclass, superorder, suborder, infraorder, parvorder, superfamly, and so on—established to provide the best approximation of the degree of relatedness of taxa on a notional evolutionary tree. However, for the purposes of this volume, these various divisions can be set aside, and in this checklist only the categories of orders and families (and subfamilies and tribes when applicable, and very occasionally suborders) are used.

These are generally good times for avian macro systematics, as the plethora of molecular works at this level is yielding consistent results and thus seems to be laying the foundations on which we expect will be a solid and durable higher classification of birds (Cracraft 2013, Fieldhå 2013). Recent years have been based on both the geographical and systematic level, which has considerably increased the robustness of the results. Amongst these works it is essential to mention the revolutionary “A phylogenomic study of birds reveals their evolutionary history” (Hackett et al. 2008), which examined nuclear DNA sequences from 19 independent loci for 169 species, representing all major extant groups (see Figure 10). No subsequent study has presented any major contradiction of its findings. The practical result of all this is that, for the division and sequence of higher groups of birds, mainly orders and families, there is a welcome homogeneity in most if not all, recently published checklists, online lists and major new ornithological works. For this checklist, however, rather than following a recently published classification, we adopt—so far as possible, although minor discrepancies may occur according to the taxonomic revisions involved—one that will appear in due course in Bird Families of the World: a Guide to the Spectacular Diversity of Birds (Winkler et al. in prep.). By contrast, the family level downwards the options for subdivisions and their sequences multiply, so that many more classifications are possible than exist for the higher groups of birds. Consequently we follow generic arrangements and sequences largely as adopted in HBW, but naturally with a considerable number of adjustments based on more recent information, citations of individual sources under the genus headings. In similar fashion we largely adopt the subspecies and their sequences as provided in HBW, with all updated references to the systematic notes.

Inevitably, of course, there are some groups of species whose genetic signature continues to defy a confident ascription of relationship—turacous, for example. The usual method of treatment of such groups is to place them in a separate category labelled “inertae sedis” (of uncertain position), but this option is avoided in this checklist (see further commentary under the subsection Genera below).

Genera
Despite its enormous importance as a taxonomic unit and its equal place in the binomial nomenclature, the genus is a notably vague and plastic entity whose defining criteria have never been clearly codified. Every genus should have diagnosable characters, but it is increasingly apparent that these may be very subtle: when the genus Psittacomas was reinstated for all New World pigeons previously treated in Columba, the sole basis for the case was its strong monophyletic identity as revealed by molecular study (Johnson et al. 2001); no mention was made of any morphologically, behaviourally or ecological traits unique to the clade, and it is not very certain that any such traits could be found. Genetic studies are becoming increasingly important in determining generic limits, of course, resulting in the break-up of even highly uniform groups that used to be treated under one name—Carpocolum was a good example—but then leaving certain other groups not yet subjected to molecular scrutiny appearing exaggeratedly heterogeneous, as in the case of Vulturina.

This checklist started with the generic allocations made by the authors of HBW, checked against and conflated with the existing BirdLife list. Then of course it sought to modernize all these by reference to the many new insights provided by two decades of mostly molecular work. Nevertheless, two guiding principles in choosing genera have been first, monophyny (where generic names define groups of species whose members are all more closely related to each other than they are to members of any other group) and, second, practicality (where opportunities have been taken, for the sake of stability and continuity, to reduce the number of changes to the status quo). Thus in recent years, molecular evidence has suggested a close genetic relationship between the curassow genera Abarus and Pudua (Grau et al. 2005), and between oco and Oocu (Frank-Hoeflich et al. 2007), resulting in their merging respectively into Abarus and Croc alone; but each of these four genera clearly defines a monophy-
letic grouping that is diagnostically distinct in various characters including morphology, voice and/or habitat, so we have no compunction in retaining them in spite of the story their genes may be telling us. As noted in Figure 11, results of molecular studies at the generic level can sometimes be contradictory, as in the case of the *Larus* gulls, and therefore at least for the time being we prefer to balance information on genera that comes from laboratory work with evidence deriving from morphological, behavioural and other studies. In certain cases an arrangement used by an HBW author has found little acceptance (e.g. the splintering of *Amazilia* into six genera in HBW 5) and we have reverted to the original.

All genera in this checklist are given a heading with the describer and year of description. In some cases there is also a note beneath it that provides new or notable information concerning the relationships of the genus. The category *inertiae velis* is not used; we prefer to retain a traditional position, with a note as necessary. The sequence of species within genera seek to follow the most recent published evidence (it is a frustrating aspect of many molecular projects that they fail to sequence certain taxa that are crucial to a clear definition of relationships); our default has been to follow the excellent third and fourth editions of the Howard & Moore checklists (Dickinson 2003, Dickinson & Remsen 2013), but always with exceptions when more recent evidence is available (e.g. with the hornbills and the pigeon genus *Ptilinopus*).

**Species accounts**

The rationale for the recognition of species in this checklist is covered in the earlier sections of this introduction.

A blue box contains first the number indicating the species’ place in sequence within the family, followed by the scientific name of the species in italic, its English name in bold, a small coloured square with IUCN Red List category abbreviation, and a pointer to the volume and page on which the species is treated in HBW.

**Scientific names**—The great majority of scientific binomials have remained stable over many decades and from one checklist to another, but with many recent changes of genus and new assessments of the gender of these, novelties in this checklist are inevitable even if only in the agreements of specific names. For this volume on non-passerines we pay tribute to the meticulous and exhaustive work on these aspects conducted by Dickinson (2003), David & Gosselin (various papers, see below) and Dickinson & Remsen (2013), whom we generally follow on issues of nomenclature.

Several years ago, while working on HBW, we were kindly invited by Edward Dickinson and Normand David to join in their discussions concerning emendations, looking at individual cases and judging whether or not each emendation was justified, depending on individual interpretations of the Code (see Box 2). It was readily agreed that in matters purely affecting nomenclature it would be to the benefit of us all if we could reach a good level of agreement, and thus cut down discrepancies in nomenclature between our respective works. The result was almost total agreement: there was an already very high level of initial consensus, and this was followed up, after lengthy debate, by all partiesceding in a number of cases. It must be stressed that all the hard work and the merit is theirs; our contribution was limited to offering opinions. The process and the main results (non-passerines) were summarized in David & Dickinson, Appendix 8 in Dickinson & Remsen (2013). Since the publication of that work, further discussions have led us all to revise our joint opinions on two species names included in the present volume. The two names now emended herein on the basis of being correct (classical) Latin are *Microcarbo pygmaeus* and *Caldyodon azureus*. We stress that these changes have been agreed by all the parties involved, and applaud our colleagues in being prepared to reverse these decisions which they published only last year.

**English names**—We recognize that the English names of birds have been a matter of protracted debate, with many attempts at producing a stable, definitive set of names for worldwide usage according to particular principles. It happens, however, that HBW and BirdLife have long shared very similar views on the formulation of English names, and in this work of synthesizing their two lists we prefer to maintain continuity with them rather than seek to adopt another system. Irrespective of relationships we hyphenate compound generic names with the second element of the name in lower case, thus preferring to resist the situation, as advocated by Gill & Wright (2006) (whose comprehensive and thoughtful overall review of name formation we respectfully acknowledge), in which it is possible to have three variant combinations (e.g. “Fruit Dove”, “Eagle-Owl” and “Flycatcher-shrike”). We follow the long-standing BirdLife policy of avoiding eponyms when alternatives present themselves, preferring to associate a bird species with a place (potentially positive for its conservation) or a physical characteristic (neutral) rather than a person (sometimes with potentially negative connotations). Similarly, we seek to use modern national names where appropriate; in the case of birds recently called “Malayan” or “Malaysian” we have opted for “Malay” (“Malay” has imperial overtones while “Malaysian” covers a political entity not necessarily coinciding with the range of the species, whereas “Malay” is, we hope, neutral and suitably imprecise in geographical terms).
the point where it is not obtrusive, we retain spellings that are the norm for the respective English speakers in the New and Old Worlds (colored/coloured, racket/racquet, checker/chequer). For newly split species we have sought first to find an existing name that might have been used in regional guides or as a subspecies name, or otherwise to invent a name that best characterizes the bird by its geographical range or its diagnostic features. Occasionally, we chose to create a new name to replace an established one—for example, Glittering Starfrontlet for Dusky Starfrontlet, since “dusky” is a wholly inappropriate epithet for the species.

**IUCN Red List categories**—These were outlined for readers of HBW by Collar (1999) and the latest version was described by IUCN (2001), with various updates online. There are altogether seven categories, as follows: Extinct = CR; Extinct in the Wild = EW; Critically Endangered = CR; all with the tags CRCP for Critically Endangered (Possibly Extinct) and CRCE for Critically Endangered (Possibly Extinct in the Wild); Endangered = EN; Vulnerable = VU; Near Threatened = NT; Least Concern = LC, and Data Deficient = DD. Definitions of these categories can be found in the sources cited above. See also additional explanatory notes given below, in the subsection *Extinct species*. In this checklist all species, including those newly split or lumped, have been evaluated by BirdLife International against the IUCN Red List criteria, and are published for the first time alongside BirdLife International’s 2014 IUCN Red List for birds.

**Pointers to HBW**—Readers wanting to check facts about a given species can of course use many sources, including the internet, but we offer as a first point of reference HBW, as the only published source in which every bird species is treated in some detail, providing well over 20,000 owners and probably many more users with a fast and easy way to cross-refer, whether to check name and taxonomic changes or simply to find further information on the species. If this pointer mentions only HBW volume number and page, it means that the species appears in this checklist with exactly the same scientific name as in HBW. Any change of scientific name results in the pointer indicating the former name as it appears in HBW, thereby making these pointers a simple way of detecting nomenclatural or taxonomic changes from the HBW treatment. Taxonomic changes are explained lower in the entry, as are changes in nomenclature apart, normally, from those limited to gender agreement; these are in accordance with David & Gosselin (2002a, 2002b, 2011, 2013). The final (special) volume of HBW is referred to as HBW SV.

**French, German and Spanish names**—For the most part these follow those given in HBW, but the same committees used by HBW (see Acknowledgements) have been consulted for updated corrections to spellings, new group-names necessitated by new phylogenetic positions, and name changes required by the splitting or lumping of species.

**Other common names**—This entry is discretionary, depending on whether or not alternative names exist. HBW sought to indicate as many other English names as possible when these were current or fairly recent, resulting in the need to compress them through a series of slashes and sometimes brackets, e.g. “Equatorial/Cadet Hummingbird”, “Cuvier’s (Scaly-breasted) Hummingbird”. For this checklist these names have been significantly reduced in number, retaining or adding only those found in peer checklists, monographs and field guides dating from approximately the last twenty years; consequently they are given in full. Names after semi-colons apply only to a subset of the species (typically a single subspecies) indicated by the taxonomic name in brackets; names of subspecies-groups are given in the section “Subspecies and Distribution”, discussed separately below.

**Taxonomic notes**—The first line of the note gives the original scientific name in italic, followed by the name of the describer (see Box 1), the year of description and the type locality. Where the original type locality was modified significantly, this is signalled, for example: “New Guinea; error = Cuba” would mean that the type locality given in the original description was New Guinea, but that this was subsequently corrected for Cuba; “no locality = Sumatra” means that no type locality was specified in the original description and that Sumatra was later decided upon as an appropriate locality; “Africa = Kaduna, Nigeria” means that the original, rather vague type locality of Africa was subsequently narrowed down as specified. The rest of the section may be as short as the single word “Monotypic”, but in the great majority of cases it introduces condensed, basic information on the issues that affect the taxonomic status of the species (and all taxa included in it), dealing with its relationships, former and current alternative treatments (in different genera, as subspecies, etc.), problems of nomenclature, errors and options; in many cases the choices between options are fully explained. See Box 2 for a concise explanation of some of the terms used. These notes draw heavily on and in many cases simply copy the notes that appeared in the equivalent part of the section entitled Taxonomy under each species in HBW, and we gratefully acknowledge the HBW authors who contributed this material. However, all cases have been revised, and the majority of entries have been significantly modified and extended in various ways. Reference to superspecies, although given some prominence in HBW, has almost entirely been dropped, as over the years the term has been applied in various ways, not always consistent with the original concept; moreover, the concept itself has fallen out of fashion in recent decades as the use of clades to demarcate monophyletic groups has risen. Not replacing “superspecies”, but to some extent comparable,
is the phylogenetic use of the word “sister”. Although, of course, different speciation events can be in progress affecting the same “parent” species simultaneously in different parts of its range, the act of speciation unavoidably constitutes the splitting off of a single species from another. Only two entities can be involved in any one speciation event, and these two entities are considered to be each other’s sister: they are sister-species. The same principle applies right the way up the taxonomic tree so, for example, two genera may be sisters. In all such cases, it is naturally a prerequisite that each sister group must be monophyletic, as must any two sisters when considered together. Special attention is given to account for changes between HBW and this checklist (except concerning gender agreements, for which see the subsection Pointers to HBW above).

Taxonomic changes involving the use of the Tobias criteria (see above) are introduced with a variety of formulaic phrases (e.g. “Usually considered…”, “Formerly treated…” and “Until recently…”) leading to a listing of characters with their scores in brackets afterwards. In these cases such
enumerations of characters, although our own, have been prompted by other taxonomic evaluations, but use of the term “Hitherto” indicates that the taxonomic change that follows is unique to the checklist and is formally being introduced here (this discounts cases where the original description is a hundred or more years ago treated the form as a typological species; but otherwise we have always sought to give credit to earlier workers who have indicated, even if only in vague terms, the possibility of a split). Candidates for a change in rank between species and subspecies have always been scored against the Tobias criteria, although for various reasons (mostly relating to the weakness of the candidature) the scoring has not always been given in the text. Weaker candidates may have been judged by reference to illustrations or photographs and ranked as far as possible candidates that achieve the score for a change in rank have been evaluated or at least checked through the examination of museum material. As noted earlier, every reasonable attempt was made, when measuring specimens, to achieve a sample size of 10 and to ensure (where material was a constraint) an equal balance of the sexes (and preferably the use of one sex only); cases where the sample size is smaller than 10 are indicated (sometimes, e.g., when unique specimens are involved, this is very obvious). All measurements are given in millimetres. Note that what was previously the British Museum (Natural History) (BMNH) has now been renamed as the Natural History Museum (NHMUK). All references in the text use the latter form. AMNH refers to the American Museum of Natural History.

In addition to comments relating to species-level issues this section will also deal with possible nomenclatural conflicts, particularly when a name is changed. Comments may be made about the validity of both accepted and synonymized subspecies, giving, where possible, some idea of the ranges of the latter, and often providing explanations for decisions (rather than simply referring the reader to another source). Names given to hybrids, aberrants and other infraspecific forms, as well as those in invalid descriptions, are normally noted, and thus are listed in the index to make them searchable. Extinct subspecies, if any, are marked with a cross (†) but are also sometimes mentioned in the notes. The last sentence of this section always indicates either monotypy or else the number of extant subspecies accepted herein. In cases of uncertainty, or where others take a different view, the statements may be prefaced with a qualifier such as “ provisionally” or “treated as.” We acknowledge that the validity of many avian subspecies is open to question, but the task of assessing them is so dauntingly large that for the great majority the only option is to accept them on the basis of their general currency and usage, after consulting an array of relevant sources.

**Distribution/Subspecies and Distribution**—Each subspecies is marked by a bullet point, except in the case of extinct races, which are marked instead by a cross (†). The generic and specific names are abbreviated and often the subspecific name is given in full, followed by the name of the describer and the year of description. In those cases where the describer and year when the currently used genus is different from that in the original description of each subspecies, the text outlines the range of each of the subspecies following a standard geographical sequence (north–south, west–east), but flexibly depending on logic and best fit, seeking a level of detail beyond simply country and cardinal points, with extensive use of provincial and regional divisions in certain countries (such as additional details in France and the United States in Appendix 3). For migratory species the breeding and non-breeding ranges are separated; in cases where non-breeding ranges are poorly known for individual subspecies, the range may be generalized to account for all subspecies. Ranges known, or believed, no longer to be occupied are indicated, along with those where the species is known to occur but the subspecies has not been determined. The ranges of introduced populations are indicated separately. Certain country and region names (and limits) have been updated since HBW (e.g., Ethiopia, South Sudan).

**Subspecies groups**—These are informal taxonomic units used in several recent world checklists to highlight seemingly monophyletic groups of taxa (sometimes single subspecies) that at present appear to sit between the species and subspecies levels (although in some cases it seems likely that fuller scrutiny and better evidence will result in their being awarded species rank). Such groups are identified by their possession of one or a number of reasonably distinct characters and which therefore seem worthy of notice (but in most cases no attempt has been made to score these with the Tobias criteria, and no threshold number has been set for the recognition of such groups). They may already have been recognized as species in other lists or accorded a taxonomic status such as “megasubspecies” or “allspecies,” and may already possess English names (which we typically make use of). They may sometimes, however, result from our own work in applying the Tobias criteria, and for these groups we commonly supply our own English names. As a general rule, groups identified through the Tobias criteria were reasonably well marked; the weaker their distinctiveness became, the less likely they were to be separated as groups so that, if a name already existed for them, this was simply given in the Other Common Names section. Also, when an alternative name for a subspecies-group exists it is given under Other Common Names. In some cases a potential group could not be defined because one or more of the

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**Box 1 Identifying authors of scientific descriptions**

Each author of scientific bird names is, theoretically, identified individually, so when the same surname crops up, one of several systems may be used for separation. In a few cases, the surname itself given in full can supply a solution (Du Monte de Sainte-Croix, Dumont d’Urville). Much the commonest method, however, is by the insertion of initials (J. F. Gmelin, S. G. Gmelin; P. L. Sclater, W. L. Sclater; G. R. Gray, J. E. Gray; A. H. Miller, J. F. Miller, L. Miller, W. deW. Miller; C. M. White, C. M. N. White, H. L. White, J. White, S. A. White). Full initials are often given, and sometimes serve to avoid potential or real ambiguities, such as the previously listed name “H. Blasius”, which might apply to any of A. W. H. Blasius, J. H. Blasius or R. H. P. Blasius. But full initials are not always given, normally based on common usage, thus, Emilie Snethlage appears simply as E. Snethlage rather than H. M. M. E. E. Snethlage. Occasionally, the solution can be a combination of both of the first two styles (J. G. Fischer von Waldheim or E. A. Fischer, J. G. Fischer, J. C. H. Fischer). There are a few exceptional cases, notably that of H. Milne Edwards and his son, A. Milne-Edwards; the hyphen would distinguish their names, but as the son used it normally but not invariably, it is clearer to provide the initials. If the initials are the same, a different generic name may be written in full, as with Nagarnicki Kuroda and his son, Nagahisa Kuroda. When initials and names are identical, another system must be used. If those involved are father and son (as is, not surprisingly, often the case with an identical combination of names), we omit the initials and attach Sr and Jr; this occurs with the names M. Bartels, J. H. Gurney and W. H. Phelps, which become Gurney, Sr and Gurney, Jr, etc. But if the authors involved are not father/son, we do not use the Sr/Jr system. One particularly complicated case involves the German/Chilean R. A. Philippi and his son F. H. E. Philippi because further down the same line comes a second R. A. Philippi. To solve this one, we decided to use the Spanish custom of the second surname to separate these two, who become respectively R. A. Philippi [Krumwiede] and R. A. Philippi [Barahona]. A single scientific description by a like-named person can result in a prolific author’s name having to be given initials throughout. Claudia Hartert is cited (C. Hartert) for a single subspecific name in this volume, but her formal participation in this description (and, in fact, in those of a few other bird names) means that her husband has to receive his initials each time—we prefer to give his full initials, E. J. O. Hartert—each of the 272 times his name appears herein. A similar but far less extreme case is that of Anne Meinertzhagen, whose limited participation in descriptions means that her frequently named (and notorious) husband also requires his initials. Interestingly, she also requires initials under her maiden name, A. C. Jackson. One last matter perhaps deserves a brief explanation. Several years ago, and after consultation with a German colleague, it was decided not to add in the “von” that is sometimes listed with some German names such as Spix, Pelzeln and Berlepsch. It was decided that many of these well-known figures from the history of ornithology are better known without the “von.” For much the same reason (that the person in question talks about “the symphonies of van Beethoven”) we readily acknowledge that not everyone will agree with this decision. A few authors (in our subjective opinion) are better known with the “von,” and so are always listed with it, e.g., J. W. von Müller.
Box 2
Notes on some terms used in nomenclature

The complicated business of scientific nomenclature is governed by the International Code of Zoological Nomenclature, commonly abbreviated as the Code. This is maintained by the International Commission on Zoological Nomenclature (ICZN). For any doubts in connection with this subject, readers are referred to the Code, which is available online (http://iczn.org/iczn/index.jsp); for a general overview, readers are warmly invited to consult the excellent and informative foreword on the subject by Richard C. Banks, HBW 9: 13–25. However, for those unfamiliar with these and looking for a very succinct explanation of some of the potentially more obscure terms used in the text, we include some extremely brief notes on a selection here; it must be stressed that these summaries of just a few words cannot hope to encapsulate the complexities of each term, when the Code expends a good deal more space on each—in some cases several pages—so these summaries should be taken merely as general indications of what each term refers to. A taxon (plural “taxa”) is any taxonomic unit, with the implication that all of its members are thought to be interrelated, with no equally close relative excluded; it is broadly comparable with the phylogenetic term clade. It is sometimes used to refer only to species and subspecies (as, for convenience, in HBW family summary boxes), but it can equally be applied to other ranks, such as the family—or, indeed, Class Aves, although only up to family rank are these names regulated by the Code. Taxonomy is the science of attempting to put all relevant taxa into a meaningful order or scheme. Each species-group taxon that has been formally described has its type specimen (or specimens), an individual museum specimen against which the identity of any closely related taxa may be compared. Except in early works, this individual tends to be explicitly indicated by its museum specimen number in the formal scientific description and marked in the museum by a special label (usually red). If the type is a single specimen, that is the holotype. If it is a series of specimens, these are all syntypes. If the type specimen has been lost, a neotype may be designated, under strict rules and preconditions. If a group of syntypes proves to refer to a mixture of more than one taxon, one of the syntypes may be designated as the lectotype, and it thus gains the same status as a holotype. For higher ranks the system is similar: each genus has its type species; each family its type genus, upon which the name is based. For a family-group name to be valid, the genus name upon which it is based must be available, although it need not be recognized. Thus, for example, although due to merging with the older name Psilopogon, the genus Megalaima is not recognized in this checklist, the correct name for the family remains Megalaimidae, as it is the oldest available family-group name for these birds. The type locality is theoretically the place of collection of the type specimen. The idea of having a type locality is to have a geographical which the population that is so far that individuals observed at the same location are likely to belong to the same subspecies (if applicable) or species. However, if migrants or vagrants are involved, birds of several races may co-occur, so that it is by no means the case that all conspecifics seen at the same site need belong to the same race, as has commonly been illustrated, for example, in the case of the Yellow Wagtail Motacilla flava. More to the point, however, is the fact that the type locality need not even form part of a taxon’s normal range—as, for example, in the case of the American Bittern Botaurus lentiginosus, with a type locality in England, where the species is only a very rare vagrant—but such cases are rare, and are usually to be avoided, as their implications are misleading. Turning to the actual names themselves, a name that has been correctly adapted to the scientific literature of the time to be available, it may or may not be in current use, or indeed it might even never be used for a valid taxon, but it complies with the requirements of the Code as a name that can be used, if and when some worker considers it appropriate. The oldest valid available name (dating from no earlier than 1758) is normally the name to be applied to a taxon, through the system of priority. A nomen nudum is a name of doubtful applica-
tion, which normally means that the name cannot reliably be applied to a particular taxon; it may be considered unidentifiable. A nomen dubium is a generalisation so, for example, this term most commonly crops up when an old, unused name is unearthed in old literature and found to refer to a taxon that is now normally known by another, more recent name—in such cases, the older, unused name loses its rights of priority, and the current name persists. If two names were correctly described for what is now judged to be the same taxon, the equivalent of the synonymy in normal circumstances, the older name has priority, and is the name to be used, while the younger name becomes a junior synonym of the older one. Homonyms are identical names denoting different animal taxa. They are spelt identically (or at some taxonomic levels, they can have different suffixes) but were proposed separately, usually but not necessarily by different authors in different publications at different times. Thus, for example, the genus name Lorius Boddaert, 1783 (which refers to the genus now known as Eclectus), is a homonym of the currently valid name Lorius Vigors, 1825; in this particular case the latter name is the valid one because the earlier name was formally suppressed by ICZN, primarily to avoid various possible forms of confusion. No two fully identical complete names for taxa can be simultaneously valid in zoology. Within any one genus no two taxa can have the same species-group name (this includes subspecies). Species-group names can be brought into secondary homonymy by the transfer of a taxon from one genus to another. For example, if the Whistling Dove Chrysocarpa viridis is considered to belong to the genus Phainoecus, as was the case until recently in most checklists, its name becomes preoccupied by the name of the Claret-breasted Fruit-dove Phainoecus viridis, as the latter’s name is older and thus has priority. In such a case, the Whistling Dove adopts its next-oldest available name, P. payardi; if no replacement name is already available, a new name must be formally established. Thus, somewhat confusingly, the same binomen (combination of generic and specific names) can occasionally end up at different times or in different classifications referring to two markedly different taxa, which may even prove not to be particularly closely related. The original spelling of a name, as published in the original scientific description, is largely sacrosanct, and can only be modified in certain ways or in certain circumstances. Much the commonest and least complicated or controversial form of modification for species-group names involves mandatory gender agreement with the respective genus name, when applicable; much recent work in this field has been carried out by David & Gosselin (see main text). Any other intentional change made to the original spelling is considered an emendation. Emendations are either justified or unjustified, depending on what the Code specifies. The Code provides very precise rules on such issues, but in many instances there is considerable latitude for personal interpretation of these rules, and therefore different spellings can sometimes be found in different checklists (but see below). A justified emendation can only be based directly on the rules themselves and the original publication. Thus, if a name is based on the misspelling of a proper name, however well known that name may be, the scientific name cannot be emended unless there is internal evidence within the original publication that clearly shows the misspelling to have been unintentional. For example, the White-capped Fruit-dove Pitinopus dupetitthouarsi is a name undoubtedly based on that of the distinguished French naval family Dupetit Thouars, but the missing “t” cannot be added, as there is no internal evidence to justify this. Even if the same author publishes at a later date a clear statement that the original spelling was erroneous, it cannot be altered unless there is internal evidence to support an emendation. In some instances, an original scientific description included two or even more different spellings of the same name. In such cases a single spelling must be selected as the valid one, and the first person to deal with this problem in the required fashion becomes the First Reviser. Nomenclature serves taxonomy by facilitating a unique system of names available for global communication and exchange of information on all animal taxa. Nomenclature does not, however, influence taxonomic decisions, whereas, as seen above, the taxonomy adopted by any author regularly influences the nomenclature.
taxa involved has or have not been sufficiently studied to determine its or their affiliation.

In this checklist the convention is that subspecies that do not separate into groups retain a black bullet point; those that do separate into groups have bullet points coloured according to group, with the English name blocked out in the same (but more subdued) colour, always with blue for the group with the nominate subspecies, and always with the next group(s) coloured in the same sequence: red, green, etc.; but the nominate group need not be the first in the sequence, so bullet points may also run red, blue, green, or red, green, blue, entirely depending on the appropriate sequence of the subspecies overall. In many cases the subspecies-groups do not disturb the geographical order of the subspecies themselves, but particularly complex patterns of distribution sometimes require alterations to the geographical order as a means of keeping the subspecies together in the appropriate group.

Bibliographical references in the texts—For reasons of space and readability, sources are cited through superscript numbers linked to an alphabetical bibliography, although two or more consecutive citations are usually cited chronologically to allow due precedence, so that a higher number may precede a lower one. Citations occur mainly under Taxonomic notes and Distribution/Subspecies and Distribution. Although as indicated earlier the published sources used in this checklist exceed 9,000, for simplicity and clarity only those that provide significant, substantive new evidence are cited. Other information is derived from HBW or, in the case of applications of the Tobias criteria, from the authors. The main relevance of each citation is normally already summarized very briefly in the text, but there are a few situations in which it was felt that this would merely amount to an unnecessary waste of space, as the gist of the contents is already apparent.

Introduction

Figure 25 – One of the most intriguing aspects of taxonomy involves taxa represented by unique specimens. Are they species or subspecies? Morphs or aberrations? Hybrids or even artefacts? Could they already be extinct? Taxonomists have been generally more accepting when the specimen has a provenance and date attached, and especially if there is some corroborating evidence from the collector. Even so, some forms have had to endure years of scepticism before their validation through rediscovery: the beautiful hummingbird Coeligena orina—here named the Glittering Starfrontlet—was known from a specimen taken in Colombia in 1951 but, despite its distinctiveness, it was judged likely to be an immature and relegated to the status of subspecies until a concerted search in 2004 found it and proved its strikingly different from any congener. On the other side of the South American continent, in eastern Brazil, the woodpecker Celeus spectabilis obrieni was described in 1973 from a single distinctive female taken in 1926, but it took until 2006 before another bird was found, and very soon shown to be sufficiently different to merit full species status. DNA studies may be particularly helpful in some of these cases. Bogota Sunangel Heliangelus zusii was recently shown to be a good species (but could be extinct), whereas “Bulo Burti Bush-shrike” Laniarius lberatus has been judged to be a morph of Somali Boubou L. erlangeri (Ngunnbock et al. 2008). In the absence of the rediscovery of such birds as White-chested Tinkerbird Pogoniulus makawai and Vaurie’s Nightjar Caprimulgus centralasicus, genetic study to ascertain their taxonomic status will be all the more helpful.

Species illustrations and range maps

Illustration may not be essential to taxonomy, but the essence of taxa has always best been captured through their accurate depiction. HBW represented the first endeavour to provide high-quality illustrations of every bird species on the planet, as well as of (to the extent possible) their most distinctive subspecies. To judge from reviews, for many users of the series the plates have, in fact, been the primary value of the work, playing as they do an immensely important practical role in keying out the diagnostic characters of taxa. However, despite every effort to ensure the highest levels of accuracy in this regard, inevitably in some cases illustrations were felt to fall short in conveying the distinctiveness of taxa, as for example in the comments on the Oceanic Flycatcher Myiagra oceanica complex—four species or one?—by Pratt (2010).

Most of the artwork in this checklist comes from HBW. However, to take account of taxonomic changes, critical opinion and better information, new illustrations have been provided for a significant number of taxa, and modifications made to a much higher number of existing illustrations in order to improve their accuracy. This new post-HBW evidence derives mainly from our own museum work as well as from photographs of living birds. In cases where the text mentions a diagnostic character, every reasonable effort has been made to ensure that the plate portrays that character accurately, but it is important to recognize that practical and economic constraints relating to production schedules have limited complete matching in all cases as the strands of the project converged on its necessary deadline. Moreover, there are certain conditions that are extremely hard for an artist to convey, notably the iridescent colour in a hummingbird, which is apparent only at particular angles that are not possible to depict without compromising the rest of the illustration.

As in HBW, a single adult bird in breeding plumage is depicted for species with little or no sexual dimorphism. For sexually dimorphic species both male and female are depicted, both in breeding plumage (if a seasonal difference exists); in a few cases where the females of sexually
dimorphic species in a particular group are very similar and time has been
unfavourable, the female has not been shown (but this will be rectified
in future editions). Juvenile plumages, although these are occasionally
used as taxonomic evidence, are not illustrated. Morphs and variants are
also depicted if they are sufficiently frequent not to be considered a rar-
ity. As in HBW, distinctive subspecies are shown, thus always including a
representative of each subspecies-group recognized in this checklist, with
a preference if possible for the most representative taxon in the group to
be shown. All these additional illustrations are appropriately labelled.

Each species on a plate thus has (at least) one illustration, with a legend
giving its number in the family sequence followed by its scientific name
in italic (generic name contracted) and below this its English name in
boldface, and a range map closely adjacent. The genus is given in capital
letters elsewhere on the plate. The plate has a neutral background to
offset the colours of the illustrations, with subtle pale lines separating each
taxon (except subspecies), thinner around species, thicker around gen-
era. A scale is given on each plate in both centimetres and inches. When
birds set to different scales occur on the same plate, they are separated by
a dashed line and scales for each are given. If in one plate two or more
families occur, a thick straight white line is used to divide them.

Owing to shifting taxonomic arrangements and the sometimes increased
number of species shown per plate, some plates contain artwork by more
than one artist. Credit for each illustration is assigned on pages 16–17.

The production of the maps for this checklist has involved a major effort
of research and synthesis. Many of the maps inherited from the HBW se-
ries, particularly the earlier volumes, were considerably outdated and inac-
curate. BirdLife’s maps (from BirdLife International & NatureServe 2013),
while much more recent and with the advantages of being GIS-based with
national boundaries depicted, were also far from perfect and not up to
date. Resolving the discrepancies between the HBW maps and BirdLife
maps, and between these maps and modern evidence, occupied two teams in
the two institutions for well over a year, and of course for a significant
proportion of species entirely new maps had to be generated to account
for the taxonomic revisions in the present work. Range maps and distribu-
tion texts have also been checked against each other for their consistency.

Range maps are based on known records (observations, museum speci-
mens), location of sites (particularly Important Bird and Biodiversity Areas)
known to hold populations, the distribution of suitable habitat between
known records, and expert information, all of which have been drawn from
online data repositories, published papers, unpublished reports, field
guides, family monographs and other sources. They usually exclude areas
reported in the range descriptions to be “possible” parts of a species’ dis-
tribution, along with records of vagrancy and places to which species have
been introduced or (recently) reintroduced; but reintroduced populations
are mapped where the evidence of viability and stability is good (particular-
ly so in New Zealand). The map colour code copies that in HBW: green for
present all year round (although this can cover locally or partially migratory
populations), yellow for breeding range, and blue for non-breeding range.
For seabirds in general, breeding colonies are depicted in yellow and
their distribution at sea in blue. In the case of species Extinct in the Wild,
their former ranges are shown in grey, and, exceptionally, this colour has also been used for a few species which, while not yet officially considered extinct, are known to be absent from most, if not all, of their documented range. In the very few cases where the whole range is completely unknown, a question mark has been added in order to indicate this. Maps zoom in much more on ranges than they did in HBW, in order to give more detail, but there is usually some attempt at leaving a recognizable geographical reference point; however, for possibly unfamiliar islands the emphasis has been on supplying detail at the expense of a general geographical locator. In cases where the distribution patterns are rather complex, larger maps are offered to allow the details to be picked out.

**Extinct species**

For many users a checklist is supposed to live up to its name: a list against which to check off sightings and records. Since this is not likely to happen with extinct species, there is good reason to separate them out together for reference, rather than interpolate them into a list of living forms; and since extinct birds fall roughly into two types—those that can be illustrated with confidence and those that cannot—the notion of treating them all in their rightful place in the sequence of living birds, in an illustrated checklist, is even less appealing. Indeed, the assembling of all extinct taxa in one place provides a better opportunity for those interested in studying extinctions to consider and contrast the evidence, and to present extinctions to demonstrate the dimensions of anthropogenic impacts in the past half-millennium. Nevertheless, there is also real value for certain disciplines in ornithology, not least systematics and taxonomy, in keeping all (recent) species, dead or alive, in a single sequence; and this checklist is clearly intended as much for these as for anything else.

Consequently we do both. In the main checklist, the names of extinct species are included in pale grey rather than pale blue boxes, at the appropriate point in the family sequence; no family number is given, but the reader is directed to the page on which a text entry on the species appears in one of two appendices for extinct species. Appendix 1 is for species known from full specimens and/or travellers’ illustrations and reports, and these are of necessity given far briefer documentation. Only species believed to have survived past AD1500 are included in this checklist. There is, however, a grey area in the categorization of species as extinct owing to the difficulty of proving that the last individuals have died—a particular problem in parts of the world relatively infrequently visited and relatively hard to cover comprehensively (even in a country as well worked as the USA the case of the Ivory-billed Woodpecker *Campephilus principalis* has proved highly problematic). Species that are likely to have gone extinct, but for which comprehensive searches are required to confirm that the last individual has died, are classified as “Critically Endangered (Possibly Extinct)” following a BirdLife initiative by Butchart et al. (2006) and IUCN (2014). Determining whether to classify a taxon as Extinct, Critically Endangered (Possibly Extinct) or Critically Endangered has to consider the time since the last record, the intensity, extensiveness and adequacy of searches, the extent, intensity and timing of threats, and the likely susceptibility of the taxon to these. Experience has shown that prematurely classifying a species as extinct is potentially a threat in itself (Collar 1998). Work is currently under way to develop a more quantitative version of the BirdLife initiative, and when this is applied the list of Possibly Extinct and Extinct species will be revised more rigorously. This is likely to lead to a number of changes, including perhaps the reclassification of taxa such as Crested Shelduck *Tadorna cristata*, Pink-headed Duck *Rhodonessa caryophyllea*, Glaucous Macaw *Anodorhynchus glaucus* and White-winged Teal *Zoota labiata*. Rather than guessing the outcomes of this ongoing analysis, this checklist follows BirdLife’s current classification approach. A similar approach has been applied to avian subspecies by Szabo et al. (2012), whom we follow here (plus a few more recent updates), by marking extinct subspecies with a cross (†).  

**Reference maps**

An important and original development in the interpretation of evidence in checklists of birds of the world was the introduction in Sibley & Monroe (1990) of 25 political maps which marked and labelled the internal divisions of many of the larger countries, and showed some rivers and mountain ranges. These served as a valuable reference point for understanding the distributional information given in the main text of their work, and set a high standard for our own maps, outlining mountain ranges in as much detail as possible without obscuring boundaries and their labels. Although Sibley & Monroe (1990) thoughtfully added a gazetteer, this is not deemed necessary here, in part because we hope the detail of the maps in this checklist is sufficient and in part because these days the internet is a source of immediate information on even very small geographical and political entities.

**Bibliography and index**

All cited sources of information used in this checklist, personal and web-based as well as bibliographical, are listed alphabetically in the bibliography at the end of the book. Published references are presented in the same style as in HBW. These are numbered to match the citation number given in the main text. Names of Korean, Chinese and Indochinese authors typically consist of the surname followed by the given name, but in some publications these are reversed to conform with standard Western style, leading to great potential confusion. In the following bibliography, for clarity, the given names of such authors are retained in full, with the surname always placed in front of them.

The Index is organized to allow searches for both extant and extinct taxa by scientific name of family, genus, species and subspecies and by English name of family and species (with both parts of a compound name). Also included here are all alternative English names and all synonymized and unavailable scientific genus, species and subspecies names mentioned in the text. All extant taxa (and those also possibly extinct) are in black print, all extinct taxa are in blue, and all alternative and unaccepted names are in red (alternative and unaccepted names of extinct taxa are in blue).

**The future of the Checklist**

Our objective in this collaboration is to provide the most accurate evidence-based account of extinct and recently (post-AD1500) extinct avian diversity at all levels of the taxonomic spectrum, but with the strongest emphasis falling on species. However, like all taxonomic studies, this checklist is a work in progress. Although it is the product of many years of work, and may—like all large books!—give the impression of being definitive and conclusive, in reality it is far from finished and is always likely to remain so, precisely because taxonomy is an investigative discipline with ever-changing insights and inferences (see Figure 24). Our inability in this volume to resolve the difficulties presented by, among others, the Purple Swamphen *Porphyrio porphyrio* (see Figure 21) is solid evidence that there is much more to be done in the world of avian species-level taxonomy—and that we cannot possibly achieve it alone. Moreover, a huge pending task which has been far beyond the scope of this work to date is the systematic, rigorous review of the validity of all subspecies, an unknown proportion of which may not be worthy of recognition at all (to abdicate the likely scale of this task, we simply mention the exhaustive analysis that was required to determine that a single subspecies, *Penelis penilis sphagnorum*, is invalid: Bot & Jansen 2013).

First, then, we acknowledge that we expect there to be a number of revised editions of this checklist in the coming decades. To this end—and because of BirdLife’s remit to assess taxa judged as species against the IUCN Red List criteria—together our organizations plan to maintain a comprehensive review of taxonomic revisions as they appear in the literature, following developments at both the macro- and the microsystematic levels and with a particular interest in the results of new molecular studies of families, genera and species complexes. Where appropriate, this will be matched by corroborative work of our own in museums and through other sampling systems available on the internet in order to compare and contrast other forms of evidence.

Second, however, we judge that there is a major opportunity which we want to take to harness the energy, interest and goodwill of owners and users of this checklist in the taxonomic process. We see this as one of the strongest ways of maintaining the momentum of this ongoing project. In the Tobias criteria we have a system of taxonomic evaluation which has, we feel, given good service in this non-passerine volume, and certainly
We propose to continue with its use in the second volume (although we speculate that it, too, may experience adjustments and alterations in due course) and in the expected revisions of both. The application of this system in the present volume has thrown up many intriguing challenges, a good proportion of which could very probably be met by field ornithologists and birdwatchers. Video-recordings of living birds, audio-recordings of their vocalizations (especially when several individuals are sampled), records of their presence in key areas (such as suspected lines of parapatry), descriptions of their key features, behaviour and ecology—all such material, made by fieldworkers of all types, can contribute to our better understanding of the taxonomic status of what we currently rank as species and subspecies. The evidence supplied by such endeavours can help to resolve issues such as whether the form purpureicollis of Australian Brush-turkey Alectura lathami or the form intermedia of Bronze-tailed Plumeleteer Chaohura ochrochrysa would better be treated as a species (other examples among many possibilities are in Figure 26); moreover, it can be used to challenge the scores and notes provided for current splits and lumps, many of which may well not stand the test of time. All such information, made accessible to the checklist team either directly or indirectly, can be fed through the same process of evaluation as a means of maintaining, so far as possible, the consistency of treatments between taxa.

Our current proposition is for the websites of both BirdLife and HBW to host the same world list of species so far as is practical, with an internet forum where anyone can contribute information or informed opinion on the taxonomic status of the forms itemized and the evidence presented. This will be accessible at www.birdlife.org/globally-threatened-bird-forums/category/taxonomy/ as well as from the open-access pages of HBW Alive (www.hbw.com/). We intend to establish a fixed schedule for making regular updates. Depending on various factors, a new edition of the book, volume by volume, may be produced at longer intervals.

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Museums and Institutions

The continuing value and relevance of natural history museums to the advancement of taxonomy cannot be overstated. The taxonomic checking, comparisons and evaluations in this checklist were undertaken at a number of museums, and we record here our enormous gratitude to all of these institutions for their unfailing welcome and encouragement. First among these is the Natural History Museum at Tring, UK (NHMUK), where collectively several months were spent in research with specimen material and library resources; we particularly thank Robert Prys-Jones, Mark Adams, Hein van Grouw, Joanne Cooper and Alison Hardinge for their steadfast support. At the American Museum of Natural History (AMNH) in New York, Paul Sweet, Peter Capainolo, Tom Trombone, Lynda Garetano and Mary LeCroy actively assisted our work. For their good offices (in descending order of time spent in their collections) we also warmly thank Chris Milenkovic and the staff of the Peabody Museum of Natural History (Smithsonian Institution) National Museum of Natural History; Selke Frahnert and Pascal Eckhoff at the Museum für Naturkunde (Zoológisches Museum), Berlin; Steven van der Mije, René Decker and Kees Roselaar at the Naturalis Biodiversity Center ( Nationaal Natuurhistorisch Museum), Leiden; and Martin Päckert at the Staatliches Museum für Naturkunde (Zoológisches Museum), Stuttgart. We should also like to make particular mention of the Biblioteca Instituto Bio- ciências at the Universidade de São Paulo, the Bibliothèque Nationale de France, the British Library in London, the Estación Biológica de Doñana, the Zoological Museum (Copenhagen University), the H. L. White Library in Australia, the Herzig August Bibliothek in Wolfenbüttel, the Library of the Academia Nacional de ciencias de Córdoba in Argentina, the Library of the Max-Planck-Institute for Ornithology in Radolfzell, the National Library of Australia in Sydney, the Niven Library in South Africa, the Royal Danish Academy of Sciences and Letters, the Smithsonian Institution Libraries, the Sociedad Española de Ornitología in Madrid, the State Library of Victoria in Melbourne, the States and University Library in Göttingen, the Western Foundation of Vertebrate Zoology and the Yamashina Institute for Ornithology. We should also like to acknowledge the great assistance provided by the Biodiversity Heritage Library, most notably in making readily available to everyone a wealth of historic texts of the pioneers in ornithology.

Individuals

A key constituency to thank here is all the authors of texts in HBW 1–7 (see pages 16–17), since a large part of this book takes the texts of these authors as the starting point, to which changes and additions have been made as deemed appropriate. A number of ornithologists gave us help of a type that warrants particular highlighting and the strongest expression of gratitude: Thomas Arndt, Axel Bräunlich, John Croxall, Edward Dickinson, Thomas Donegan, Bob Dowsett, François Dowsett-Lemaire, Shannon Hackett, Karen Hsu, Jon Fjeldså, Stephen Garnett, Steve Howell, Tasso Leventis, Dorit Liebers-Heltig, Robert Prys-Jones, Pam Rasmussen, Van Remsen, Roger Safford, Claire Spottiswoode, Frank Steinheimer, Viviane Sternkopf and Joe Tobias. We greatly appreciate the enthusiastic assistance of David Winkler, Irby Lovette and Shawn Billerman at the Cornell Laboratory of Ornithology, and thank them for their important input to our sequence, especially as their own book, Bird Families of the World: A Guide to the Spectacular Diversity of Birds, is still in active preparation. We are most grateful to Normand David and Michel Gosselin, who very kindly checked the spelling and gender agreement of all the scientific names at species level, in addition to providing much other help and advice; they also updated the French names as needed. All changes in French names comply with the principles set out by Devillers et al. (1993), although several names differ for a number of reasons, sometimes due to corrected mispellings, new group-names necessitated by new phylogenetic positions, names changed to allow for the splitting of species. The German names were revised and, when necessary, newly created by the “Standing Committee for German Names of the Birds of the World” of Deutsche Ornitologen-Gesellschaft and IOU: Peter H. Barthel, Frank Steinheimer, Christine Barthel, Einhard Bezzel, Renate van den Elzen and Christoph Hinkelmann. The Spanish names used in the HBW series were selected by the committee of the Spanish Ornithological Society (SEO/BirdLife) comprising Eduardo de Juan, Josep del Hoyo, Manuel Fernández-Cruz, Xavier Ferrer and Jordi Sargatal; most of these names are retained here, although some new ones have necessarily been assigned in cases affected by taxonomic changes and a few others have been changed for a variety of reasons.

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Introduction

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However, it is clear that many bird species are under threat, and conservation efforts are needed to prevent their extinction.

References

Variable Dwarf-kingfisher
(Rhodostethia hypoleuca)
from Java.


