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Commentary

BirdLife, conservation and taxonomy

IAN J. BURFIELD, STUART H. M. BUTCHART and NIGEL J. COLLAR

The origins of another global taxonomic checklist

The appearance of the second and concluding volume of the *HBW-BirdLife International Illustrated Checklist of the Birds of the World* (del Hoyo & Collar 2016) provides an occasion to reflect, briefly, on the relationship between bird conservation and taxonomy. As threats to bird species multiply, it has never been more important to have a world list that is grounded in evidence, structured according to clear taxonomic guidelines, and broadly consistent in the treatment of taxa across different regions and between different families. How far, then, have we managed to get?

The first thing to acknowledge is that molecular biology has, since around 1990, utterly transformed the landscape of avian systematics. Finally, science has found the means by which to determine the true relationships of birds. Families have vanished, others appeared; orders have been shuffled, relationships revised, genera reassigned. The rollercoaster is still running, but it *looks* as if the majority of higher-level taxonomic issues have been resolved. Lower-level taxonomy is also firmly in the molecular frame, with swathes of proposals for changes to species limits in birds; by far the greater proportion of these changes have involved increases ('splits') rather than decreases ('lumps').

A further factor compounding this increase in the number of bird species has been the technological and infrastructural advances that have given field observers new opportunities to reach remote areas and record (visually and especially acoustically) the birds they find, yielding new evidence that demonstrates the degree of their taxonomic distinctiveness. Moreover, an extended debate about species concepts, developing in parallel with molecular advances, has led many taxonomists into new ways of defining species. Already 20 years ago in this journal, BirdLife stood accused of allowing extinctions to occur as an unintended consequence of its dependence on a global bird list adhering to the biological species concept (Hazevoet 1996; but see Collar 1996).

These factors in combination have been transformative, not only because of the content of the new taxonomic studies, but also by their sheer volume. By 2000, the speed and number of proposed revisions of avian species limits were such that no published world list could keep up, leaving BirdLife – which maintains the Red List for birds on behalf of IUCN (International Union for Conservation of Nature) and which therefore has a remit to categorise every bird species against the Red List criteria – with the task of keeping up for itself. Consequently, it established its own small working group to track and evaluate all newly published revisions affecting bird species limits, not only in papers but also in field guides and handbooks.

But to evaluate how, by what criteria? Alternatives to the biological species concept (BSC) were unworkable, at least at a global scale (Collar 1997), yet the absence of clear guidelines in assessing cases on the BSC principle of reproductive incompatibility (impossible to test if taxa are not in geographical contact with each other) remained a serious drawback. However, one notable attempt

to establish such guidelines (Helbig *et al.* 2002) – given particular authority by being declared 'an official document of the British Ornithologists' Union' – spurred the development of BirdLife's own criteria, which had several preliminary outings before their eventual configuration (Tobias *et al.* 2010).

In the year these criteria were published, Josep del Hoyo, founder and senior editor of the *Handbook of the Birds of the World* (HBW) and a former member of BirdLife's Global Council, formally approached BirdLife with a proposal for a joint project to produce a new world checklist of birds, using the species recognised in HBW as a baseline but incorporating the revisions BirdLife had already made and was poised to make in response to the many dozens of new taxonomic revisions appearing annually. The opportunity to deploy the 'Tobias criteria' in a proactive rather than merely reactive way held obvious appeal, and the project was quickly approved.

Splits and their consequences for conservation

Proactive taxonomic study is typically slow and painstaking, and revising the entire global avifauna was never the intention behind this initiative; but, because the Tobias criteria render decision-making *relatively* simple and speedy, revising a significant part of it, where evidence clearly points at a need, was feasible. Nevertheless, generating the data by which to make those decisions required assembling and reviewing thousands of papers, as well as months of work spread across twelve museums – in particular the Natural History Museum in Tring, UK, which integrates the world's most extensive bird specimen collection with the world's most comprehensive ornithological library.

Over 11,500 museum specimens representing almost 1,300 taxa (70% of them passerines) yielded over 30,000 measurements for potential use in statistical analyses; naturally the number of specimens examined for their plumage patterns was many times greater. For volume 2 (passerines/songbirds), 877 cases were referred to a world-class bird recordist, Peter Boesman, to quantify the degree of difference in their vocalisations under the Tobias criteria following standardised protocols, with the results summarised in 393 supplementary online documents supporting the *Checklist*. These figures are a rough indication of the extent to which the *Checklist* makes an original contribution to avian taxonomy. Moreover, all species and distinctive subspecies (including all subspecies groups) have been illustrated; all ranges have been revised in detail and visually supported by an updated distribution map; and all changes from the taxonomic treatment in HBW are explained and attributed to source.

Volume 1 (del Hoyo & Collar 2014) was published in July 2014; volume 2 (del Hoyo & Collar 2016) in December 2016, bringing the first and most labour-intensive phase of the project to completion. Apart from the myriad higher-level taxonomic shufflings (for families, the list almost exactly follows Winkler *et al.* 2015), notable changes in the number of species have resulted. Where HBW (volumes 1–7, years 1992–2002, plus the Special Volume [SV] of 2013) treated 3,964 extant species of non-passerine, the *Checklist* volume 1 treated 4,372, adopting or making 462 splits (plus newly described taxa) and 54 lumps, a net increase of 408; and where HBW (volumes 8–16 plus SV, years 2003–2013) treated 6,008 extant species of passerine, the *Checklist* volume 2 recognises 6,592, adopting or making 638 splits (incorporating 11 newly described species) and 54 lumps, a net increase of 584. In both cases, the growth has been around 10%, and the global total of extant bird species has consequently risen by 993 (incorporating another recently adopted non-passerine split: MacGillivray's Prion *Pachyptila macgillivrayi*) from 9,972 to 10,965 (excluding 156 taxa that have gone extinct since 1500). Within a few years, this latter number will surely surpass 11,000; but whether the great surge of taxonomic change is now subsiding only time can tell (see, for example, Barrowclough *et al.* 2016).

Overall, 134 (33%) of the 408 non-passerine splits and 235 (40%) of the 584 passerine splits were generated by the independent application of the Tobias criteria. Thus, the HBW-BirdLife initiative has resulted in 369 'home-grown' taxonomic revisions in favour of species rank (37% of all the accepted new splits and 3.7% of the global avifauna as treated by HBW).

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Of these 369 splits, at least 95 (26%) required a vocal score and 65 (18%) a mensural score to achieve species rank under the Tobias criteria. Perhaps unsurprisingly, 39% of passerine (55% suboscine, 33% oscine) but only 14% of non-passerine splits required vocal evidence; by contrast, 23% of non-passerine and only 10% of passerine splits were achieved on plumage characters alone, while splits that required mensural data were around 33% in both groups. The great majority of the other 623 splits, proposed by external authorities, were accepted by reference to the Tobias criteria, often using project-generated evidence for corroboration; a small proportion of these involved the re-validation of old but subsequently ignored or rejected claims for species status, and could therefore also be part-credited to the HBW-BirdLife initiative.

The geographical distribution of these 'home-grown' splits reinforces what we know already about the distribution of terrestrial biological diversity, but the impact on tropical islands in the Caribbean, South-East Asia and the Pacific is notable. No fewer than 13 new splits occur on Java, which now harbours (together with Bali and Kangean) 50 endemic species. Sangihe, north of Sulawesi, adds to its total of six endemic species with two kingfishers and two passerines. The Tres Marías Islands off western Mexico and Djaul Island off north-west New Ireland each gain two endemic species, with consequences for the number of Endemic Bird Areas (Stattersfield *et al.* 1998).

Overall, 14% of the newly recognised species have been listed as globally threatened (Critically Endangered, Endangered or Vulnerable) on the 2016 IUCN Red List, and another 12% as Near Threatened. Unsurprisingly, both these figures are higher than the equivalent values for all bird species (13% and 9%, respectively), reflecting the smaller distributions and populations of many newly split taxa, both of which are associated with higher extinction risk and Red List category. Taxa have been split in all regions of the world, but the largest proportional increases per biogeographical realm have been in Indomalaya (13%) and Oceania (12%), followed by the Palearctic (10%), Neotropics (10%), Afrotropics (8%), Nearctic (6%) and Antarctic (4%).

Criticisms and counterarguments

Perhaps the most frequent criticism of the *Checklist*, certainly on website forums, relates to the fact that the Tobias criteria 'ignore' genetic differences. Reasons for the (current) inability to score such differences, which consequently cannot be used directly in defining species limits, are set out in the extensive introduction to volume 1, while the introduction to volume 2 draws renewed attention to the extensive use of genetic evidence in the *Checklist*. In a very few cases, particularly when paraphyly is involved (e.g. the *Rallus longirostris* complex) and where other factors seem strongly to favour an alternative arrangement, such evidence has been allowed, with explicit caveats, to 'overrule' the Tobias criteria; volumes 1 and 2 contain respectively 10 and 11 splits that do not qualify under the criteria, and of these 5 and 9 cede primacy to molecular evidence. Nevertheless, it is worth recalling that genetic work can be unhelpfully self-contradictory: for example, the *Checklist* entry for *Diomedea amsterdamensis* notes that 'recent molecular analysis indicates a very close relationship (0.5% difference) with *D. exulans*' but that 'another genetic analysis… claims a far higher level of divergence'. Likewise, one study of *D. dabbenena* found levels of genetic differentiation 'low', but another 'high'. Moreover, the interpretation of these degrees of difference can itself be confusingly subjective (Collar 2013).

A particular criticism levelled at the Tobias criteria and by extension the *Checklist* concerns their treatment of hybrid zones. Under the BSC, hybridisation on a regular basis normally implies that reproductive incompatibility has not yet occurred, whereas under the Tobias criteria the failure of taxa to merge completely is taken as a scorable measure of their reproductive incompatibility. The entire system has been held to be at fault largely for this one consideration (Remsen 2015, 2016). Without recapitulating or expanding further the arguments for the Tobias approach (including recent publications showing that hybrids are less fit, e.g. between Swainson's Thrush *Catharus swainsoni* and Russet-backed Thrush *C. ustulatus*, Delmore & Irwin 2014; and between

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Collared Flycatcher *Ficedula albicollis* and European Pied Flycatcher *F. hypoleuca*, Svedin *et al.* 2008), it is worth noting that in volume 1 only 27 cases exist where a score relating to hybrid zones was included in the total for a successfully split species; and of these, 11 needed the hybrid zone score to reach species rank, while 16 did not. In volume 2, the equivalent three numbers are 22, 5 and 17. Thus, altogether only 16 (1.6%) of 992 splits required hybrid zone scores, which hardly seems a solid basis for rejecting the criteria and their implications *in toto*. Furthermore, the treatment of hybrid zones in the *Checklist* does not imply that 'hundreds of parapatric non-passerine subspecies that intergrade at their boundaries (and thousands of passerine cases…)' warrant recognition as species (Remsen 2016), because of course in the great majority of these cases the morphological and vocal differences between the taxa are considered too trivial under the Tobias criteria.

Further research is planned to explore one proposed potential improvement to the Tobias criteria in this respect: examining the utility of scoring hybrid zone width in relation to the total range size of the relevant taxa. Funding permitting, other planned research will focus on: expanding the taxonomic breadth and sample size of well-known taxa to examine and validate the threshold score of 7 for species status; exploring methods for integrating genetic divergence; and investigating potential biases generated by applying the criteria to different bird families. As with the taxa whose relationships they attempt to categorise in a standardised way, the Tobias criteria will no doubt evolve over time.

Future directions

Consistency and transparency of treatment, along with comprehensiveness, practicality, speed, rigour and robustness, have repeatedly been indicated as the guiding principles behind the new *Checklist*; but as the introduction to volume 2 makes clear, the *Checklist* is more of a beginning than an end. The Tobias criteria themselves are to be scrutinised for improvements, as indicated above. BirdLife and HBW are accumulating new publications to evaluate and add to the list of cases that were investigated for the *Checklist* but could not be resolved in time for publication. The vocal analyses that the *Checklist* has pioneered represent an avenue of inquiry that stretches far into the future.

Uniquely, the HBW-BirdLife initiative allows and indeed invites the global ornithological community to contribute to the updating and refinement of its species-level taxonomy. Anyone with relevant information (e.g. on vocal or plumage differences) can post comments on HBW Alive (or contact BirdLife directly) to challenge revisions made or to propose further splits and lumps. BirdLife and HBW will review such feedback alongside the other material they evaluate, and submit any consequent taxonomic revisions to the processes for updating HBW Alive, the BirdLife Data Zone and the IUCN Red List. By this means, the initiative is poised to enter a new phase of crowd-sourced, evidence-based avian taxonomy.

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IAN J. BURFIELD*, STUART H. M. BUTCHART, NIGEL J. COLLAR
BirdLife International, David Attenborough Building, Pembroke Street, Cambridge CB2 3QZ, UK

**Author for correspondence; e-mail: ian.burfield@birdlife.org*