

The New Guinea Region

Our region of coverage follows Mayr (1941: vi), who defined the natural region that encompasses the avifauna of New Guinea, naming it the “New Guinea Region.” It comprises the great tropical island of New Guinea as well as an array of islands lying on its continental shelf or immediately offshore. This region extends from the equator to latitude 12° south and from longitude 129° east to 155° east; it is 2,800 km long by 750 km wide and supports the largest remaining contiguous tract of old-growth humid tropical forest in the Asia-Pacific (Beehler 1993a). The Region includes the Northwestern Islands (Raja Ampat group) of the far west—Waigeo, Batanta, Salawati, Misool, Kofiau, Gam, Gebe, and Gag; the Aru Islands of the southwest—Wokam, Kobroor, Trangan, and others; the Bay Islands of Geelvink/Cenderawasih Bay—Biak-Supiori, Numfor, Mios Num, and Yapen; Dolak Island of south-central New Guinea (also known as Dolok, Kimaam, Kolepom, Yos Sudarso, or Frederik Hendrik); Daru and Kiwai Islands of eastern south-central New Guinea; islands of the north coast of Papua New Guinea (PNG)—Kairiru, Muschu, Manam, Bagabag, and Karkar; and the Southeastern (Milne Bay) Islands of the far southeast—Goodenough, Fergusson, Normanby, Kiriwina, Kaileuna, Woodlark, Misima, Tagula/Sudest, and Rossel, plus many groups of smaller islands (see the endpapers for a graphic delimitation of the Region).

Politically, the island of New Guinea is bisected at longitude 141° east. To the west is Indonesian New Guinea (comprising Papua and Papua Barat Provinces). To the east of the line is the mainland portion of Papua New Guinea. Although this abrupt north-south boundary line is an artificial product of colonial-era claims, today this line, in effect, separates Asia (to the west) from the Pacific (to the east).

Indonesian New Guinea includes the western half of mainland New Guinea plus the islands of Geelvink (Cenderawasih) Bay, the Aru Islands, and the Raja Ampat Islands—all territory covered in this book. Papua New Guinea encompasses territory in the New Guinea region—the eastern half of the island of New Guinea and the islands of Milne Bay Province, as well as ter-

ritory outside the Region and not covered in this book—the Bismarck and Admiralty Islands and the northernmost of the Solomon Islands. Thus, much of insular Papua New Guinea is *not* included in this treatment.

The New Guinea region *does not* include Seram, the Southeast Islands of Indonesia, the Kai Islands, the Torres Strait Islands, Long and Umboi Islands, New Britain, New Ireland, Manus, or the Solomon Islands. The northern Melanesian avifauna inhabiting these last six entities is admirably treated in Mayr & Diamond (2001) and Dutson (2011).

The postmodern political side of geographic names is problematic—is it Maluku or Moluccas? Nusa Tenggara or Lesser Sundas? Tagula or Sudest? Rossel or Yela? We have tended toward conservatism here (particularly because the main users of this type of work are people interested in the history of ornithology), as the older names have received more use in the literature and are, quite simply, better known and more widely used in the science. Our geographic gazetteer in the back of the book (Appendix) makes an initial attempt to present *all* the geographic names, so one can locate and identify both the new and old name here, even if only the “old” name appears in the text accounts. Some of the more prominent choices appear in our usage chart at the end of this introductory section.

With regard to seabirds, our treatment includes records within *ca.* 50 km of the Mainland coastline and *ca.* 25 km of any fringing New Guinea island. Also included are waters encompassed by embayments (the limit is a straight line between major projecting points on the Mainland). That said, we do not include any territorial waters of Australia (which in the Torres Strait approaches northward to the shores of the New Guinea mainland) or the Solomon Islands. We strongly encourage much additional seabird-watching in New Guinea’s waters. These efforts should be timed to coincide with the annual spring and fall movements of these long-distance migrants and mainly should focus on the western and eastern extremities of the Region, where north-south water passages encourage concentrations of the birds where they can bypass the substantial east-west land barrier posed by mountainous mainland New Guinea.

New Guinea in Context

Aside from continental Australia, the only island larger than New Guinea is ice-capped Greenland. Among tropical islands, New Guinea is the largest and highest (it is larger and substantially higher than either Madagascar or Borneo) and still supports tropical glaciers in the far west of its high Central Ranges.

New Guinea is the geographic hub of the southwest Pacific—situated at the heart of an array of tropical island arcs that are home to a wonderful assemblage of bird species featured in this book. Australia lies just to the south. New Guinea and Australia share the Australian plate and thus the same tectonic history—New Guinea is the high, wet, and equatorial sector, whereas continental Australia is the low, dry, and temperate sector. To the west lie the Moluccas (Maluku) and Lesser Sundas (Nusa Tenggara) of Indonesia. To the north and northwest lie the Philippines, Palau, and the Mariana Islands. The Bismarck, Admiralty, Caroline, Marshall, and Gilbert Islands lie to the northeast and east, and the Solomons, Vanuatu, New Caledonia, and Fiji to the southeast.

New Guinea supports the Pacific's richest humid-forest avifauna. By contrast, Australia hosts the Pacific's richest savanna and dry-zone avifauna. Both rest atop the Australian continental craton, isolated by deepwater barriers from Sundaland to the west and from the Melanesian islands to the northeast and southeast. Whereas the differences between the avifaunas of New Guinea and Australia are mainly products of their distinct environments, the differences distinguishing New Guinea's avifauna from that of southeast Asia are biogeographic in origin. Wallace's Line, an ancient deepwater barrier, marks the eastern limit of many continental Asian bird lineages, separating the continental avifaunas of southeast Asia from those of Australia–New Guinea. In a similar manner, moving from New Guinea eastward into island Melanesia, one suddenly encounters oceanic avifaunas poor in many of the lineages that are widespread in the Australia–New Guinea region (*e.g.*, Australasian robins, Australasian warblers, bowerbirds, and birds of paradise) yet distinctively rich in a subset of Australasian lineages that have exploded across this insular geography (*e.g.*, monarchs and whistlers). Many bird groups that evolved on the Australian continent have not been very successful in colonizing oceanic island archipelagoes.

In sum, New Guinea is the Pacific's version of Andean South America—wet, tropical, cordilleran, and species-rich. And New Guinea's vast rain forests and montane cloud forests, like those of the Andean region, remain a treasure trove for research ornithologists. Here, future students of biogeography will come to address the distributional and systematic mysteries that are embedded in the species accounts that constitute the bulk of this book.

One thing that makes New Guinea different from cordilleran South America is its incredible cultural and linguistic diversity. Its many indigenous peoples live customary lifestyles and speak more than a thousand distinct languages (not dialects). These rural-dwelling people have had a long and close relationship with the birdlife, and village naturalists are often incredibly knowledgeable about the habits of these birds (Diamond 1966). In many instances, the astute guidance and cheerful assistance of local New Guinean naturalists have ensured the success of Western field ornithologists, especially in the period after World War II. Both authors can attest that their doctoral and postdoctoral field researches were immeasurably aided by the contribution of New Guinean field collaborators.

New Guinea's Bird Regions

New Guinea is geographically complex, and poses a challenge to the novice seeking to study its avifauna. It is hard enough learning the scientific and English names of nearly 800 bird species. Add to that the difficulty of learning where these species live in a mountainous world twice the size of California but with far fewer cities, roads, and other identifying features. Here, we employ a set of 15 standardized names for New Guinea's bird regions. These New Guinean bird regions articulate ornithogeographic zones, defined by areas of species or subspecies endemism and bounded by physiographic barriers that separate abutting ranges of sister forms. These are adapted from the bird areas highlighted in the first edition of the *Birds of New Guinea* field guide (Beehler *et al.* 1986) and influenced by Birdlife International's endemic bird areas as well

as the World Wildlife Fund's Pacific ecoregions. They appear in the accompanying map (fig. 1), and are briefly described below, from northwest to southeast. Note that these updated bird regions are also used in the revised *Birds of New Guinea* field guide (Pratt & Beehler 2014).

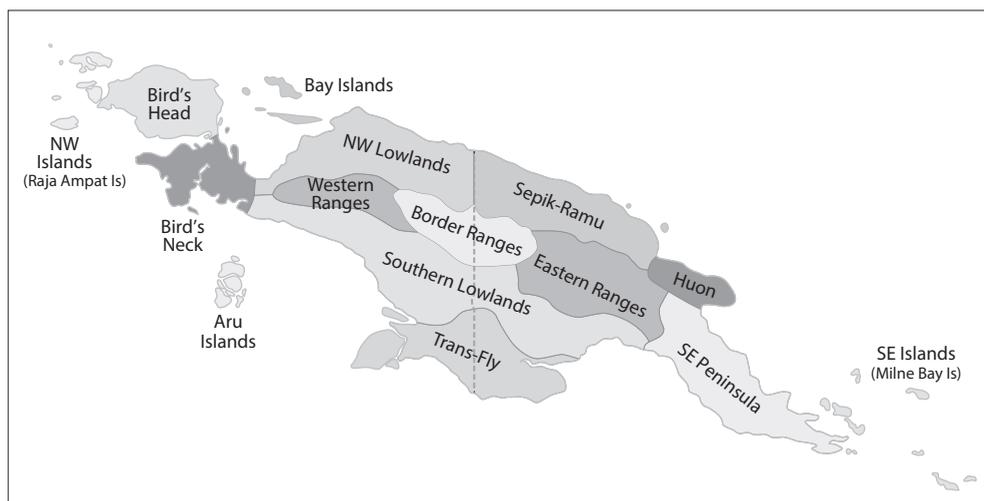


Figure 1. New Guinea Bird Regions

Northwestern Islands/NW Islands (Raja Ampat or Western Papuan Islands). The islands of this region include Waigeo, Batanta, Salawati, Misool, Kofiau, Gam, Gag, and Gebe (plus other smaller islands). They are home to an array of Moluccan species found nowhere else in the New Guinea region, plus six endemics: *Aepyodius bruijnii*, *Tanysiptera elliotii*, *Pitohui cerviniventris*, *Symposiachrus julianae*, *Cicinnurus respublica*, and *Paradisaea rubra*.

Bird's Head (Vogelkop, Berau or Doberai Peninsula). This area features the Arfak and Tamrau Mountains, which host a number of montane specialties (some shared with the Bird's Neck): *Charmosyna papou*, *Amblyornis inornata*, *Melipotes gymnops*, *Melidectes leucostephes*, *Sericornis rufescens*, *Parotia sefilata*, *Paradigalla carunculata*, *Astrapia nigra*, and *Lonchura vana*. The region also includes substantial lowlands in its southern sector.

Bird's Neck. An expanse of rugged and isolated low mountains featuring fjords on the southern coast, this is a little-studied and physiographically spectacular region. Specialties shared with the Bird's Head include *Amblyornis inornata* (or an undescribed relative), *Melipotes gymnops*, *Melidectes leucostephes*, *Parotia sefilata*, and a *Paradigalla* not yet identified to species. Note that the Bird's Neck includes the Onin Peninsula (home of the Fakfak Mountains); the Bomberai Peninsula (home of the Kumawa Mountains); and the Wandammen Peninsula (home of the Wandammen or Wondiwoi Mountains), all of which are important areas of montane endemism, mainly at the subspecies level.

Bay Islands/Bay Is (islands of Geelvink Bay/Teluk Cenderawasih). This region features Biak and Supiori Islands (a matched pair) and Numfor, Mios Num, and Yapen Islands. Biak-Supiori and Numfor are oceanic islands and support endemic species of birds: *Centropus chalybeus*, *Otus beccarii*, *Tanysiptera riedelii*, *Seicercus misoriensis*, *Symposiachrus brehmii*, and

others on Biak; *Tanyiptera carolinae* and *Seicercus maforensis* on Numfor; *Micrositta geelvinkiana* and *Myiagra atra* on Biak and Numfor. Some of these endemic species also range out to small islands in the bay: *Megapodius geelvinkianus*, *Ducula geelvinkiana*, and *Eos cyanogenia*. Substantial and mountainous Yapen Island is a land-bridge island with some endemism at the subspecies level.

Northwestern Lowlands/NW Lowlands. Essentially the vast drainage of the Mamberamo basin, which includes the Mamberamo, Tariku, Taritatu/Idenburg, and Van Daalen Rivers, it combines lowland forest, swamps, and small but important north coastal ranges (Foja, Van Rees, and Cyclops). Specialties include *Rallicula mayri*, *Psittaculirostris salvadorii*, *Amblyornis flavifrons*, *Ptiloprora mayri*, *Philemon brassi*, *Drepanornis bruijnii*, and *Parotia berlepschi*.

Aru Islands/Aru Is. Composed of islands of uplifted coral with extensive mangrove channels, this region shares avian specialties with the Southern Lowlands. *Eulabeornis castaneoventris* and *Dicaeum hirundinaceum* are recorded in the New Guinea region only from the Aru Islands. *Ptilinopus wallacii*, a Moluccan specialty, is also found in these islands.

Western Ranges/Western Ra. This is the great high sector of New Guinea's main cordillera, with a number of summits exceeding 4,500 m, and several small glaciers on Carstensz Massif/Puncak Jaya (4,884 m). It includes (historically) the Charles Louis, Weyland, Nassau, and Oranje Mountains, now called the Sudirman (western) and Jayawijaya (eastern) ranges. Specialties include *Anurophasis monorhonyx*, *Melionyx nouhuysi*, *Oreornis chrysogenys*, *Astrapia splendidissima*, *Lonchura teerinki*, and *Lonchura montana*.

Border Ranges/Border Ra. Only marginally less impressive than the Western Ranges, the Border Ranges include great summits such as Mount Mandala and Mount Capella and share some montane specialties with the Western Ranges such as *Melionyx nouhuysi*, *Astrapia splendidissima*, and *Lonchura montana*.

Southern Lowlands/S Lowlands. This is a vast expanse of lowland rain forest that transitions to swamp forest and mangrove in the west and east, and seasonally flooded savanna in the central sector. Specialty species include *Sericulus ardens*, *Chenorhamphus campbelli*, *Pseudorectes incertus*, and *Paradisaea apoda*. In the far northwest, where the Southern Lowlands meet the Bird's Neck and the Northwestern Lowlands, one finds an ornithogeographic mixing zone where the ranges of many sister species and subspecies meet. That area would bear additional field study. Numerous species that seem to have originated in the Southern Lowlands have spilled eastward into the southern watershed of the Southeastern Peninsula, for instance, *Casuarius casuarius*, *Talegalla fuscirostris*, and *Psittaculirostris desmarestii*.

Trans-Fly. The southern bulge of New Guinea, this area's large expanses of monsoon woodland and savanna share many species with Australia. Endemics include *Megalurus albolimbatus*, *Lonchura nevermanni*, and *Lonchura stygia*. It is an important area for migratory waders as well as resident waterbirds and migratory waterbirds from Australia.

Sepik-Ramu. The eastern counterpart to the Northwestern Lowlands, this is the interior basin of two rivers—the Sepik and the Ramu—isolated from the Northwestern Lowlands by a series of low ranges near the Papua New Guinea–Papua border. It includes much lowland rain forest plus some fire-generated grassland patches and grassy marshlands of the Sepik. It also

encompasses Papua New Guinea's North Coastal Ranges and the Adelbert Mountains. Its sole endemic is *Sericulus bakeri*.

Eastern Ranges/Eastern Ra. This bird region includes the central highlands of Papua New Guinea (Kaijende Highlands, Mount Giluwe, Mount Hagen, Kubor Mountains, Schrader Range, Bismarck Range, and Kratke Mountains). It extends westward to the Strickland River gorge and eastward to the Kratke Mountains, beyond which lies the Watut-Tauri Gap, which marks the northwestern terminus of the mountains of the Southeastern Peninsula. The Eastern Ranges are home to two endemics: *Melionyx princeps* and *Astrapia mayeri*.

Huon Peninsula/Huon Penin. This bird region contains a compact collection of high ranges (Finisterre, Saruwaged/Sarawaget, Cromwell, and Rawlinson) isolated from the Eastern Ranges by the broad lowland Markham and Ramu valleys. It is home to six endemic or near-endemic species: *Amblyornis germana*, *Melipotés ater*, *Melidectes foersteri*, *Parotia wahnesi*, *Astrapia rothschildi*, and *Paradisaea guilielmi*.

Southeastern Peninsula/SE Peninsula. The region comprises the Herzog and Kuper Mountains as well as the Owen Stanley and Wharton Ranges, the latter two substantial mountain chains with peaks to 4,400 m. The peninsula also includes coastal lowlands and some river basins. It is home to the endemics *Tanyssiptera danae*, *Amblyornis subalaris*, *Parotia helenae*, *Lonchura caniceps*, and *Lonchura monticola*.

Southeastern Islands/SE Islands. This is the southeastern counterpart to the Northwestern Islands at the opposite end of New Guinea. Major islands include Goodenough, Fergusson, and Normanby (constituting the D'Entrecasteaux Archipelago); the Trobriand Islands; Misima, Rossel, and Tagula Islands (the Louisiade Archipelago); and Woodlark Island. Endemics include *Myzomela albigula*, *Meliphaga vicina*, *Manucodia comrii*, and *Paradisaea decora*, among others.

References and Data Sources

Regional taxonomic checklists are historical in nature and reflect the cumulative efforts of many dedicated individuals over long periods. This checklist is built largely on previously published checklists, field guides, handbooks, journals, and newsletters, which will continue to serve as the core of knowledge about the nomenclature, taxonomy, systematics, distribution, and natural history of the birds of New Guinea for decades to come. They should be studied by anyone working on ornithology of the Region. We list the most important of these here, by date of publication.

Salvadori, Tommaso. 1880–1882. *Ornitologia della Papuasias e delle Molucche*. 3 volumes. Stamperia reale G.B. Paravia e co. di I. Vigliardi, Torino, Italy.

Peters, James L. (and subsequent editors). 1931–1987. *Check-list of Birds of the World*. Harvard University Press and Museum of Comparative Zoology, Cambridge, Massachusetts.

Mayr, Ernst. 1941. *List of New Guinea Birds*. American Museum of Natural History, New York, New York. [Now online at: <http://dx.doi.org/10.5962/bhl.title.68262>.]

Rand, Austin L., & E. Thomas Gilliard. 1967. *Handbook of New Guinea Birds*. Wiedenfeld and Nicolson, London/The Natural History Press, Garden City, New York.

Coates, Brian J. 1985, 1990. *The Birds of Papua New Guinea*. 2 volumes. Dove Publications, Alderley, Queensland, Australia.

Beehler, Bruce M., T. K. Pratt, & D. A. Zimmerman. 1986. *Birds of New Guinea*. Princeton University Press, Princeton, New Jersey.

Marchant, S., P. J. Higgins, *et al.* (eds.). 1990–2006. *Handbook of Australian, New Zealand and Antarctic Birds*. 7 volumes. Oxford University Press, Melbourne, Australia.

del Hoyo, Josep, and collaborators (eds.). 1992–2012. *Handbook of Birds of the World*. 16 volumes. Lynx Edicions, Barcelona, Spain.

Schodde, Richard, & Ian J. Mason. 1999. *The Directory of Australian Birds*. Passerines. CSIRO Publishing, Collingwood, Victoria, Australia.

Mayr, Ernst, & Jared M. Diamond. 2001. *The Birds of Northern Melanesia: Speciation, Ecology, and Biogeography*. Oxford University Press, Oxford, UK.

Coates, Brian J., and William S. Peckover. 2001. *Birds of New Guinea and the Bismark Archipelago*. Dove Publications, Alderley, Queensland, Australia.

Christidis, Les, & Walter E. Boles. 2008. *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Collingwood, Victoria, Australia.

Dutson, Guy. 2011. *Birds of Melanesia: Bismarcks, Solomons, Vanuatu, and New Caledonia*. Princeton University Press, Princeton, New Jersey.

Dickinson, Edward C., & J. V. Remsen (eds.). 2013. *The Howard and Moore Complete Checklist of the Birds of the World*. 4th edition. Volume 1: Non-Passerines. Aves Press, Eastbourne, UK.

Dickinson, Edward C., & L. Christidis (eds.). 2014. *The Howard and Moore Complete Checklist of the Birds of the World*. 4th edition. Volume 2: Passerines. Aves Press, Eastbourne, UK.

Pratt, Thane K., & Bruce M. Beehler. 2014. *Birds of New Guinea*. 2nd edition. Princeton University Press, Princeton, New Jersey.

del Hoyo, J., & N. J. Collar. 2014. *Illustrated Checklist of the Birds of the World*. Volume 1: Non-passerines. Lynx Edicions, Barcelona, Spain.

Gill, Frank, & David Donsker (eds.). 2015. *IOC World Bird Names* (version 5.1). Available at <http://www.worldbirdnames.org> [dx.doi.org/10.14344/IOC.ML.5.1].

In addition to the above references, this checklist synthesizes a wide assortment of primary sources, which we cite within the text and list in the bibliography. We note in particular the following serial publications that over the decades have featured important publications on the birds of New Guinea: the *Emu*, the *Muruk*, and the *Papua New Guinea Bird Society Newsletter*. For every substantive decision or new field record (post Mayr 1941), we have attempted to

cite an authoritative source. In the instances where we ourselves have been the source of novel treatments or distributional records, we provide the distributional details and a reasoned argument in support of a taxonomic or systematic decision.

Systematics

Systematics is the science of delineating the pattern and history of evolutionary diversification of life on earth. The last decade has seen explosive growth in the publication of systematic revisions of avian groups based on the computational analysis of base-pair sequences of mitochondrial and nuclear DNA and, most recently, sampling of genomes. This has been a boon to the understanding of the composition and placement of orders, families, and genera. It has also led to major reorganization of the list as we have come to know it (*e.g.*, Cracraft 2013, 2014, del Hoyo & Collar 2014, Gill & Donsker 2015).

We entirely accept the practice of phylogenetic systematics and branching trees. The field of systematics has left the realm of phenetics and similarity and is firmly camped in the notion of monophyly and phylogeny. We note that DNA sequence analysis has been revolutionary but may not yet offer the magic bullet. Many issues confound the resolution of phylogenies using molecular data, and in not a few instances, morphological characters and molecules do not agree (Sorenson *et al.* 2003, Joseph 2008, Losos *et al.* 2012). Apparently the science of molecular systematics has some way to go before we fully access the secrets of DNA and properly understand all aspects of the relationship between genotype and phenotype.

For this checklist, our task has been to sort through the array of technical systematic publications and generate a synthesis of the results that best captures current understanding of the history of diversification of the birds of the New Guinea region. The task is not always straightforward, for two reasons. First, new studies produce novel results that often do not align with previously supported hypotheses. Second, it is not uncommon for different research teams employing varying techniques to produce disparate results for the same avian lineage—often using essentially the same molecular data set. Furthermore, the quality and rigor of analysis varies. At this time, the analysis of avian evolution using DNA sequence data remains in its early stages. We tend to side with the studies that employ the larger and more diverse (especially nuclear) molecular data sets and which are also informed by additional biological knowledge of the lineage being studied.

Every phylogeny, whether based on morphology or molecules, is no more than an evolutionary hypothesis, subject to future testing, revision, and refinement. However, there is a widespread perception that gives unwarranted “power” to molecules over morphology in systematic analysis. The unspoken belief that molecules don’t mislead, whereas morphology does (because of homoplasy) is in no way resolved (see Losos *et al.* 2012, among others). It is essential to resist the temptation to see a molecular phylogeny as a magical revelation of evolutionary truth. Yet not only is it difficult to envision how DNA can mislead, the computer algorithms deployed to generate phylogenetic trees operate behind a veil, and do indeed appear magical.

In fact, the inability of molecular systematists to generate consensus or replicability, espe-

cially where sequence evolution has been sparse and/or random, points clearly to the need for general practitioners to proceed with caution. The generation of multiple systematic hypotheses, even when employing the same sequence data uploaded from GenBank, is the enemy of taxonomic and checklist stability. Systematists generate abundant publications with novel results, but to what effect? Practicing ecologists and conservationists wanting nomenclatural stability find frustration in this continual change in the details of systematic relationships and the need for repeated checklist revision. The end users of the new systematics await improved algorithms, better understanding of the inner workings of the DNA molecule, a capability to combine molecular and nonmolecular character data in tree generation, and the humility needed to generate good science, which is all about the replicability of results.

The accounts treating orders, families, genera, and species form the bulk of this work. In each, we provide minimal discussion of historical systematic treatment, and instead focus on the most recent informative work. Because of the comprehensive coverage provided in Schodde & Mason (1999), Christidis & Boles (2008), B. J. Gill *et al.* (2010), Dickinson & Remsen (2013), and Dickinson & Christidis (2014) among others, we feel it is not necessary to tread that ground in detail once again. Moreover, the discussion of all past systematic treatments, with their attendant conflicting systematic hypotheses, provides historical background but little in the way of ontological synthesis that leads to a higher degree of resulting systematic insight.

Our most challenging decisions have been at the ordinal and familial level, where there has been wholesale resetting of the sequence of nonpasserine orders and passerine families, as well as the breaking apart of lineages long treated as close relatives (Barker *et al.* 2004, Hackett *et mult.* 2008, Cracraft 2013, 2014, Jarvis *et al.* 2014). For purposes of this checklist, we have chosen to build our list from a combination of original research (*e.g.*, Hackett *et mult.* 2008, Jøns-son *et al.* 2011b, Jarvis *et al.* 2014, Aggerbeck *et al.* 2014) as well as synthetic analyses (Dickinson & Remsen 2013, Dickinson & Christidis 2014, del Hoyo & Collar 2014, Gill & Donsker 2015). Our objective has been to provide a well-researched and well-referenced platform from which field and museum biologists may continue the study of the birds of New Guinea productively. The most recent whole-genome analysis of avian orders (*e.g.*, Jarvis *et al.* 2014) has, we think, provided a major step forward in strengthening the understanding of the avian tree at that higher level. Moreover, we hope the existence of our Checklist will, itself, provide some stability of usage over the years to come.

With few exceptions (noted in the text), we follow the latest evidence on systematics and relationships, so long as supporting data and analysis are deemed substantive and consonant with what we know of the biology of the lineage in question. On occasion, analyses may suggest the entire reordering of an existing species or generic sequence, yet are at odds with the known biology and morphology of the taxon in question. In these instances, we have proceeded with caution, accepting only components of the overall analysis supported with additional evidence. Thus, we overrule traditional names and analyses cautiously, and only when novel data provides compelling reason to do so. That said, we see our list as the “2015 model” not the “1985 model” (*e.g.*, Beehler & Finch 1985). We have been advised by some that the 2015 model is unproven and for the benefit of users, our new checklist should stick with the familiar 1985 sequence of

orders and families. We are unable to do that in good conscience. Although this new sequence will prove difficult initially for fresh users, it reflects today's truth, which in years to come may indeed come to be tried and true. We certainly hope so.

The systematists' job would be easier if it were not for two issues: a shortage of reliable tissue samples from the birds of New Guinea and the limitations of the cutting-edge algorithms and statistics being applied to complex systematic problems. The issue of inadequate molecular data on the species of New Guinea's birds can only be remedied by the work of future fieldworkers in tandem with the effort of collaborating laboratory scientists. There are many instances where we have been forced to make checklist decisions based on field observations or laboratory results of uncertain provenience. Moreover, we have had to decide which molecular systematic analyses may or may not be couched in good scientific technique or statistical method. There is also the issue of generating properly identified and clean tissue samples (Moyle *et al.* 2013). Moreover, dealing with species groups that may exhibit introgressive hybridization creates problems for generating stable trees (Lavretsky *et al.* 2014).

Whereas 20th-century scholarship in avian systematics was largely based in building a case for a systematic decision through the marshaling of data related to plumage, behavior, and morphology, today's molecular systematic treatments are opaque to most nonspecialist readers. To demonstrate the instability of current molecular analyses, we review the phylogenetic placement of six important New Guinean honeyeater genera in publications from 2004 to 2014. The phylogenetic results for *Myzomela*, *Philemon*, *Melidectes*, *Meliphaga*, and *Ptiloprora* are as follows:

$(Philemon (Myzomela+Ptiloprora) (Melidectes+Meliphaga))$	(Driskell & Christidis 2004)
$((Myzomela+Philemon) Meliphaga)$	(Gardner <i>et al.</i> 2010; not included: <i>Ptiloprora</i> and <i>Melidectes</i>)
$(Myzomela+Ptiloprora)(Philemon (Melidectes+Meliphaga))$	(Nyári & Joseph 2011)
$(Myzomela+Philemon)(Ptiloprora (Melidectes+Meliphaga))$	(Joseph <i>et al.</i> 2014b)
$(Philemon (Myzomela+Ptiloprora))(Melidectes+Meliphaga)$	(Andersen <i>et al.</i> 2014a)

Of the possible generic pairings above, only the *Melidectes+Meliphaga* pairing is stable, appearing in four phylogenies (and not evaluated in the fifth). The overall instability makes it difficult for researchers generating regional lists to know how to proceed. Is it simply a matter of selecting the most recent publication? Or is it a matter of selecting the publication with the most base pairs or the most genes? Or the one with the best taxonomic sampling?

A more sinister problem is when lab teams do not know the biology of the birds they study and thus cannot tell when a computer-generated tree is uninformative. A published molecular analysis for bowerbirds using mitochondrial DNA (mtDNA) provided an example of this. The study aimed to trace the evolution of bower design across a molecular phylogeny. In this instance, the resulting tree was as follows:

(((((*Amblyornis inornatus*/Fakfak Mts+*Amblyornis inornatus*/Arfak Mts)
Archboldia papuensis) *Amblyornis macgregoriae*) *Prionodura newtoniana*)
Amblyornis subalaris)

Here, the mtDNA provided an uninformative tree, probably through no fault of the practitioners. The failing in the bowerbird analysis was to ignore a wide array of morphological and behavioral characters that could aid the fine-tuning of the published phylogeny or at least alert the team that their molecular phylogeny was flawed. The unambiguously monophyletic genus *Amblyornis*—supported by an array of morphological and behavioral synapomorphies—is scattered across the tree, and obvious monotypic lineages (*Archboldia*, *Prionodura*) are interdigitated among the *Amblyornis* taxa. There are simply too many nonconforming characters to list in detail here. But for example, *Archboldia*'s mat bower is unique among the bowerbirds and shares essentially no characters with the bower of *Amblyornis*. *Prionodura* exhibits a unique plumage and a unique two-pole bower design. In the same vein, the *Amblyornis* species build bowers that are unique in being based around a single pole, indicating that all members of the genus should be clustered. Moreover *Amblyornis* plumage is as uniform as the plumage of any genus in New Guinea, and clearly distinct from the plumages of *Archboldia* and *Prionodura*. And yet the publication of this phylogeny—with its beguiling molecular backing—presumably influences systematic and taxonomic thinking in spite of what, to us, are irreconcilable flaws.

As part of our research for this book, we have examined various museum collections in order to study and diagnose species and subspecies. Both authors have worked on the collection at the AMNH on multiple visits; BMB has visited the collections at Tring on two occasions and Leiden once; BMB is a research associate at the USNM, and TKP is a research associate at the BPBM. Both of those two institutions hold substantial reference collections of birds from New Guinea. We have, in addition, requested and received color photographs of specimens of interest from the museums at Genoa, Leiden, and Cibinong.

Taxonomy

Taxonomy is the science of naming and classifying the earth's life-forms according to natural evolutionary relationships. Taxonomic decisions are made based on systematic relationships in combination with the history of name creation and use over time. In its bookkeeping and historical dimensions, taxonomic nomenclature is driven by the International Code of Zoological Nomenclature, or ICZN (International Commission on Zoological Nomenclature 1999), which can be both complex and subject to interpretation. In this realm we have chosen to follow the authorities and their published determinations. We cite sources of taxonomic decisions in all instances. Here, the world lists of Dickinson & Remsen (2013), Dickinson & Christidis (2014), their predecessor Dickinson (2003), del Hoyo & coeditors (1992–2012), and Gill & Donsker (2015) have been of great value in drawing together the latest taxonomic judgments in the scientific literature. Dickinson *et al.* (2011) highlighted the degree to which history and precedence play a role in taxonomy. Research into the original sources of bird names is not

for the faint of heart. With respect to authority and original date of publication of type descriptions, we have generally followed the decisions presented by Dickinson & Remsen (2013) and Dickinson & Christidis (2014), as informed by Dickinson *et al.* (2011). In many instances, Mary LeCroy checked the original publication.

Species Concepts

There are many avian species concepts, and the thinking on what constitutes a species changes with the decades. Our view is founded upon the classic Mayrian Biological Species Concept (BSC; see Mayr 1963, 1970), but also incorporates a more contemporary vision of species delimitations (Sangster 2014). Most ornithologists today, ourselves included, hold to a much narrower species delimitation than did Mayr. We still appreciate Mayr's concept of "superspecies," yet in virtually all instances we treat the component taxa as full species rather than well-marked subspecies (see Mayr & Short 1970), while at the same time lowering the bar for full-species recognition of Mayr's "semi-species."

We illustrate our differing viewpoint with the following example. Mayr (1941, 1962) saw New Guinea's golden-plumaged, lowland-dwelling *ardens* population of *Sericulus* bowerbird as a subspecies of the masked form *aureus* from New Guinea's northern foothills. He treated the two as a single species—*Sericulus aureus*. By contrast, we recognize the two forms as full species—well delimited by unique plumage characters and exhibiting clear differences in habitat preference and geography. Moreover, three recent treatments of this group (Frith & Frith 2004, Frith & Frith 2008, and Dickinson & Christidis 2014) support our more narrow species concept, and Zwiars *et al.* (2008) provided a molecular phylogeny indicating the two are not even sister forms. We thus do not hesitate to treat the two as distinct species—*Sericulus aureus* and *Sericulus ardens*. This is but one of many examples in which we treat as two species an assemblage of phenotypically varying populations that Mayr treated as one.

Some authorities argue that the splitting of a single species into two should be accompanied by a freestanding analytical paper published in the scientific literature. It is our opinion that this bar for splitting species is unnecessarily high, especially given the narrowing of the species concept over the last several decades. We assert that the bar for splitting should be as low as the bar for not splitting. In other words, the decision to not split up a species in the face of supporting evidence is as substantive as the decision to split (Gill 2014). Thus, we have split up a number of traditional species herein, and have felt no compunction toward doing so. For example, we recognize here the following novel species pairs: *Charmosyna papou* and *stellae*, *Heteromyias albispecularis* and *armiti*, and *Rhamphocharis crassirostris* and *piperata*. We perhaps err on the side of liberality in our desire to tell the world about full species hidden within New Guinea's avifauna.

We prefer the BSC over the phylogenetic species concept (PSC), in part because the BSC recognizes subspecies, species, and genus, whereas the PSC acknowledges only species and genus. Thus we highlight three levels of relatedness in our treatment, and subspecies form an important component of this checklist that provides additional power of resolution (see below).

However, we do recognize the challenge of distinguishing between species-level taxa and subspecies-level taxa, and turn to guidance provided by Winker & Haig (2010), Tobias *et al.* (2010), and del Hoyo & Collar (2014). Notably, we see the phenomenon of hybridization as informative but not decisive when distinguishing species from subspecies. So long as each lineage maintains a stable phenotype over much of its range, we do not see presence of a hybrid zone as proof that the two focal lineages are conspecific. In New Guinea, we treat the hybridizing *Melidectes rufocrissalis* and *belfordi* as distinct species but, at the same time, we treat the distinct but hybridizing subspecies populations of *Paradisaea raggiana* as conspecific. We do not doubt the correctness of our decision with these two examples. That said, we have less confidence regarding our treatment of “*Sericornis virgatus*” as nothing more than as series of stable hybrid crosses between *S. beccarii* and *S. nouhuysi*.

We cannot entirely embrace the PSC for one substantial reason—the PSC considers as a species any population that can be defined by one or more characters. In our experience in New Guinea, there are so many situations in which two populations differ but only in one or two minor ways. We see these as obvious subspecies, not species.

Treatment of Subspecies

A subspecies is a geographically defined allopatric population that exhibits some measurable and readily detectable morphological traits distinguishing it from an adjacent population—another subspecies of that species. Subspecies are identified and named to help *us*—museum ornithologists and fieldworkers, who attempt to define and analyze the diversity of life. We know from many molecular studies that some subspecies represent populations that exhibit a distinct molecular fingerprint, whereas other subspecies do not (*e.g.*, Ross & Bouzat 2014). That said, practicing ornithologists can see plumage, size, and morphology but cannot see molecules, so we believe describing and delineating morphologically distinct populations as subspecies has some merit even today, especially for fieldworkers.

Despite the utility of delimiting subspecies, we guess that as many as half the currently accepted subspecies on earth listed in contemporary world checklists are poorly or very thinly defined and without true merit. Why are there so many “bad” subspecies in circulation? It often is related to inadequate sample sizes and large gaps in geographic sampling. It also traditionally came from the earnest desire to describe all variation of life on earth—even minor variation. Moreover, in the culture of expeditionary field ornithology, there has been an incentive for the field ornithologist to come home with new forms to describe. After the expedition has spent large sums of donor money in some far away jungle in New Guinea, the subsequent naming of novel taxa confirms its worthiness and provides the fodder for creating new names that honor generous sponsors. Even the best ornithologists (*e.g.*, Mayr, Rand, Gilliard) succumbed to temptation and named populations that they believed were slightly browner, slightly larger, or slightly shorter-billed. But this all gets back to inadequate samples early on. With this unchecked enthusiasm, the true purpose of new taxa—to aid researchers in understanding the process of geographic differentiation and the evolution of biotic complexity—can be lost in a welter of

names. Our job today is to weed out the least informative of these. We have tried to do that here. Mayr (1941) dismissed (rendered into synonymy) 331 subspecies in his monumental list. In our checklist, we dismiss (or synonymize) 400+ more subspecies. We believe at least an additional 50 to 100 probably merit removal from the list and placement in synonymy.

To clarify: Our treatment of subspecies is conservative. We have looked at every named subspecies from the Region with a critical eye, recognizing only well-marked subspecies while relegating many poorly defined forms to synonymy. Our “ideal” subspecies exhibit distinct characters rather than grades: we do not support subspecies based on slight size increments or subspecies that capture endpoints in clinal variation. Thus we do not look with favor on a named subspecies that is defined by being “slightly browner ventrally, on average,” but we do favor a form that is “blue-capped, distinct from the black-capped form.” Similarly, we find subspecies based on mensural characters particularly unsatisfying unless the size disparity is *substantial*. We here rather arbitrarily select 10 percent as the minimum difference worthy of recognition. This we calculate as follows: $L - S / S > 0.10$, where L is the mean measurement for the larger form and S the mean measurement for the smaller form.

Contrary to tradition, we feel no special need to examine holotypes, unless topotypical material is not available. We note that in many instances a holotype has been chosen to best exhibit the putative characters of the new subspecies, and thus is *unlikely* to be “typical” but rather more likely to be an extreme individual. We prefer to look at a range of topotypical material to determine whether there is some recurrent set of characters that unambiguously distinguishes the population in question.

Finally, we do not believe all “distinct” forms merit recognition, and thus we have synonymized some described subspecies that *do* exhibit some objective but rather minor distinction from the other described forms. These subspecies, in our opinion, do not reach a threshold of distinction worthy of recognition. Our threshold is higher than for past treatments. That said, we have allowed a large number of thinly defined subspecies to squeak through our filter, mainly due to the inability to examine museum material or inadequate sample sizes. The next authority to review this avifauna can, we hope, carry the process to the next stage of refinement. With that in mind, we have noted those forms that we believe need additional scrutiny, and we strongly encourage all taxonomic practitioners to get to work on this underappreciated housecleaning task—not just in the New Guinea region, but worldwide.

We offer an adaptation of Mayr’s (1942) definition of subspecies: a geographically defined subdivision of a species that is diagnosable in measurable ways from other subdivisions of that species. We stress diagnosability and nonclinal traits as the building blocks of strong subspecies. Mayr in 1942 linked genetic and phenotypic characters in underpinning subspecies, but today we better realize that in many instances phenotype does not align well with genotype—that is the main reason subspecies are viewed by evolutionary biologists with less favor today than in Mayr’s day.

A final note on subspecies: In some subspecies accounts, the subspecific epithet is preceded by a question mark to indicate our uncertainty as to diagnosis. These, of course, need future research.

The Avifauna

The avifauna of New Guinea is rich and taxonomically diverse. The complete bird list for the Region as of February 2015 comprises 101 families, 330 genera, 769 species, and 1,331 forms.

We boil it down to a few salient species numbers below:

	Mayr (1941)	Beehler & Finch (1985)	This Checklist
Breeding land bird species	568	578	630
Seabirds	22	40	46
Palaearctic migrants	37	56	60
Australian migrants	22	34	33
The avifauna	649	708	769

The reader will find that the major changes in the list since the publication of Mayr (1941) relate to the whittling down of marginal subspecies and the splitting up of polytypic species—leading to an increase in recognized species and a decrease in recognized subspecies.

Note that this checklist was a work in progress when the field guide *Birds of New Guinea*, second edition, was published in October 2014 (the printed year of publication in that work is 2015 because of a publisher's convention). Thus the reader should be warned that while the two taxonomies have a similar origin and are nearly congruent, they do differ, mainly because of the appearance of new analyses in the scientific literature since the publication of the field guide. A more substantive difference is the delimitation of geographic coverage for seabirds, which in the field guide includes the full extent of surrounding seas but in this checklist is more limited by set distances from the coast.

Historical Biogeography of the New Guinea Region

The avifauna of New Guinea has featured in the formulation of speciation theory and the development of models for historical biogeography (*e.g.*, Mayr 1942, 1963, Diamond 1972). This is, in large part, because the distribution of bird species is so well known and can serve as a model. In the last several decades, weighty multiauthored tomes have sought to provide comprehensive overviews of the various major components of the biota of the New Guinea region (Gressitt 1982, Marshall & Beehler 2007). These include detailed descriptions of plate tectonic scenarios for the Region (Polhemus 2007) as well as summaries of the avifauna and its affinities (Pratt 1982, Mack & Dumbacher 2007). More recently, large-scale work on molecular systematics has been combined with biogeographic analyses (*e.g.*, Deiner *et al.* 2011, Jønsson *et al.* 2010b, 2011b, 2014, Aggerbeck *et al.* 2014).

In brief, the latest research on historical ornithogeography of the Region has produced several take-home points. First, the remarkable corvoid assemblage evolved in Australo-Papua and dispersed outward from this isolated source region (Jønsson *et al.* 2011b). Second, local lineages have evolved in place both on the Australian craton and in island Melanesia (Filardi &

Moyle 2005). At a fine scale, the process of speciation on New Guinea and its fringing islands is complex and not easily summarized (Deiner *et al.* 2011). At best, we find clear repeated patterns of species distribution relating to visible biogeographic barriers, which are highlighted in the New Guinea Bird Regions discussed earlier. The Strickland River gorge appears to be an important species barrier to upper montane forest birds of the Central Ranges. In a similar manner, the meeting place of the eastern terminus of the Eastern Ranges and the mountains of the Huon Peninsula is an effective barrier for lowland-dwelling birds in the northern watershed. In the southern watershed, the Purari River basin serves as an important barrier for many lowland species and subspecies. The eastern sector of the Bird's Neck is also a place where many species' ranges start or end ("Zoogeographer's Gap"). Most of these distributional barriers are formed by the interplay of mountains and basins. Given the estimated youthful ages of most avian species in the Region, we think that the movement of tectonic plates has little to do with current species ranges (*pace* Heads 2001), though it may have influenced the current distribution of higher lineages (subfamilies and families).

The first step towards devising compelling theories of historical biogeography is the delineation of species and their distribution. This is what our Checklist seeks to achieve. We encourage biogeographers to deploy the results found here to take the next step forward toward explaining the evolution of the great New Guinea biota in time and space.

The Checklist and Nature Conservation

Both authors have spent decades actively pursuing nature conservation in the Pacific (Pratt *et al.* 2009, Beehler & Kirkman 2013). What does this checklist have to do with nature conservation? At the most basic level, one must give a name to a thing before society will move to conserve it. The history of ornithology in New Guinea has been: discover, describe, study, and conserve (Beehler & Mandeville 2016). We believe knowing the taxonomy, distribution, and evolutionary history of the birds of New Guinea is the first step toward conserving this rich avifauna. Virtually every recent field ornithologist who has studied New Guinea birds in the rain forest has also invested effort in promoting conservation of these birds and their forests.

This is not the place to provide conservation guidance for New Guinea's birds and their habitats. But we think everyone using this book should think about conservation of the birds they study. Although the forests of New Guinea have been more resistant to wholesale conversion than those of adjacent southeast Asia, future decades will bring new threats. It is better to act sooner rather than later on behalf of this natural treasure. We advocate for (1) locally driven conservation of natural habitats; (2) government-led survey, study, and management of natural resources; and (3) international advocacy for Western investment in the protection and study of the biotas and rain forests of the developing world. Allied to this is the need to conserve cultures and traditional languages in the New Guinea region. Strong local cultures can generate the political will to act to conserve local natural wealth.

The Future

Over the long term, the future of the study and conservation of New Guinea's birdlife is in the hands of local naturalists and scientists. It is the mandate of international scientists to reach out and assist the growth of cohorts of local practitioners whenever possible. In both eastern and western New Guinea, we believe local and national governments should be actively training, equipping, and funding local naturalists to better survey, document, publish, and curate knowledge about collections of birds of the Region. This knowledge base should include photographs, digital sound files, field notes, and yes, museum specimens (study skins, anatomical specimens, skeletal specimens, and DNA samples; see Peterson 2014). We are confident that local museums and research institutions can easily attract the partnership and collaboration of a whole range of international institutions—and with respect to biodiversity survey and study, the more the merrier! International partners can provide training, intellectual input, equipment, supplies, and other resources. Local partners can provide special knowledge, access, linguistic tools, and other intangibles. The mix is usually productive for all concerned. Formal, government-sponsored, and permanent biological surveys for Tanah Papua (western New Guinea) and for Papua New Guinea are institutions whose time has come. These need to be established, staffed, and fully funded.