
Joel Cracraft

Departments of Anatomy and Cell Biology and of Biological Sciences, University of Illinois, P.O. Box 6998, Chicago, Illinois 60680, U.S.A.

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Abstract: The phylogenetic species concept is applied for the first time to a major radiation of birds, the birds-of-paradise (Paradisaeidae) of Australasia. Using the biological species concept, previous workers have postulated approximately 40–42 species in the family. Of these, approximately 13 are monotypic and 27 are polytypic with about 100 subspecies. Phylogenetic species are irreducible (basal) clusters of organisms (terminal taxa) that are diagnosably distinct from other such clusters. Within the context of this concept, approximately 90 species of paradisaeids are postulated to have diversified within Australasia. The phylogenetic species concept more accurately describes evolutionary diversity within the family and provides a better theoretical and empirical framework for analysing speciation, historical biogeography and patterns of morphological, behavioral and ecological diversification within this group than does the biological species concept.

Introduction

Species concepts play a central role in systematic and evolutionary biology. A species concept establishes an ontological discourse. It provides a basis for individuating the primary elements of our description and categorization of biological diversity. Those entities which are individuated as species establish the currency for a host of disciplines, ranging from systematics to ecology, behavior, biogeography, biomedical science and conservation biology. Likewise, species concepts play a fundamental role in evolutionary theory, for species are, generally, seen as the "units" of evolution, either as the things that speciate or, more accurately, as the things that are speciated (for more discussion of this distinction, see Cracraft, 1989a).

Recent years have witnessed a resurgence in the debates over species concepts. Many different concepts are being defended and criticized in this burgeoning literature, and although some may grow weary of the debate, there is much at stake. The entire theoretical and empirical structure of comparative biology depends on how species, and taxa in general, are conceived (Nelson, 1989). Different concepts often have substantially different consequences for the description and explanation of patterns of diversity through space and time. Nowhere are these consequences more critical than in the analysis of speciation and diversification.

Within ornithology, the biological species concept (BSC) has been the species concept of choice for many historical reasons. The polytypic species concept (see especially Mayr, 1942) was developed primarily using examples from birds, and many classic studies of speciation analysis within ornithology have been cast within the conceptual framework of the BSC–polytypic species concept in which the taxonomic rank of allopatric populations has been judged on their degree of differentiation or, if sympatric, by the amount of intergradation (e.g. see the conceptual framework described by Mayr, 1942, 1963; Short, 1969; Selander, 1971; Vuilleumier, 1980). Although the BSC has
garnered support among evolutionary biologists whose work focuses at the level of local populations and not taxa (Wheeler and Nixon, 1990), it has come under strong criticism by numerous systematists and has been largely abandoned in botany, invertebrate zoology, as well as by many vertebrate zoologists primarily because it is difficult, if not often impossible, to apply in practice (see, especially, Cronquist, 1978; Rosen, 1978, 1979; Levin, 1979; Raven, 1960; Cracraft, 1983, 1987, 1989a,b; Donoghue, 1985; McKitrick and Zink, 1988). "Biological species", especially those that are polytypic, greatly underestimate the number of diagnosably distinct populations that have resulted from processes of differentiation, but most importantly, the use of "biological species" will often confound the description of historical patterns of differentiation because many such "species" are composites of those diagnosably distinct populations or are paraphyletic (Rosen, 1978, 1979; Cracraft, 1983, 1987, 1989b).

This paper applies an alternative species concept, the phylogenetic species concept (Rosen, 1978, 1979; Nelson and Platnick, 1981; Cracraft, 1983, 1987, 1989a; Nixon and Wheeler, 1990), to a complex avian radiation, the birds-of-paradise (Paradisaeidae) of New Guinea and nearby Australasia. Our understanding of patterns of diversification among terminal taxa of paradisaeids has been based on the use of the biological species concept (Mayr, 1962; Gilliard, 1969; Diamond, 1972). This has resulted in the recognition of many "species" that are composites of two or more differentiated evolutionary taxa as well as in an inconsistent, and sometimes arbitrary, application of "subspecies" designations to describe patterns of variation. As a consequence, patterns of evolutionary differentiation and historical biogeography (endemism) have been misconstrued. This paper marks the first application of the phylogenetic species concept across an entire family of birds and provides a systematic framework for further analyses of species interrelationships and their diversification through space.

Application of the Phylogenetic Species Concept

The choice of a particular species concept is dictated by empirical and theoretical perceptions about how the biological world is structured. Those underlying the use of the phylogenetic species concept are straightforward. Empirically, characteristics of organisms and populations can be ordered into patterns called characters (homologies) that constitute evidence for the existence of taxa (Nelson, 1989). These taxa can be grouped together into hierarchies of more inclusive taxa on the basis of the most parsimonious hierarchical arrangement of these characters (cladistics). Some of these taxa are terminal (basal) in that they cannot, on the basis of available character evidence, be subdivided into other taxa. These are phylogenetic species. Theoretically, phylogenetic species correspond to our expectations that taxa arise through a process of isolation and genetic/phenotypic differentiation: novelties arise in individual organisms within populations, become fixed in those populations, and thus a new "evolutionary unit" (taxon; species) is produced whose history is marked by the systematist's observation of those novelties. Phylogenetic species can therefore be viewed as irreducible (basal) clusters of organisms comprising one or more populations that are diagnosably distinct (having unique combinations of characters) from other such clusters (see Cracraft, 1983, 1989b; McKitrick and Zink, 1988; Wheeler and Nixon, 1990; Nixon and Wheeler, 1990; as these authors have noted, information about reproductive history may also be important in drawing species' limits).

The application of any species concept is an hypothesis, that is, the "true" number of
species may be over- or underestimated. We expect that as groups are studied more thoroughly our understanding of the limits of terminal taxa will be refined. As will be evident from this analysis, different species concepts can influence our estimates of evolutionary diversity. Within the birds-of-paradise, virtually all decisions about species' boundaries have been based on an evaluation of external morphological variation. This study is no different in that regard, but the interpretation of those data within the context of the phylogenetic species concept leads to results different from previous workers.

When applying the biological species concept, degrees of morphological difference among allopatric populations lead the investigator to speculate about the degree of reproductive isolation that might obtain if and when those populations were ever to come into contact. Under the biological species concept, moreover, degrees of morphological difference serve as the basis for conclusions about the relative age of divergence, or the relative amount of genetic differentiation. Such considerations have been the hallmark of virtually all applications of the biological species concept when delineating taxonomic rank (e.g. between subspecies and species), yet not only have those speculations generally been unsupported by critical evidence, they also necessitate adoption of the assumption that rates of change are not only uniform among groups but also that rates of divergence in external morphological characters are strongly correlated with rates of genetic divergence. In some birds, at least, these expectations are not met (e.g. Capparella, 1988; Hackett and Rosenberg, 1990). The biological species concept, moreover, sometimes compels us to speculate on what may or may not happen to the integrity of populations far into the future when making ranking decisions.

In applying the phylogenetic species concept, no assumption is made that the degree of difference in morphological characters observed among populations is related to the degree of genetic divergence or age of divergence. Although morphological differentiation will almost certainly reflect some genetic differentiation, the absence of morphological differences cannot be taken as evidence that allopatric populations are not in fact differentiated genetically, and perhaps substantially so (Capparella, 1988; for an instructive example in plants, see Davis and Manos, 1991). Both lines of evidence will eventually be needed. Thus, the number of phylogenetic species recognized in this paper is likely to be conservative, and others will probably be recognized as more evidence for differentiation (e.g. molecular) is obtained. In principle, phylogenetic species are those basal populations that are 100% diagnosable; that is, depending upon the characters being examined, 100% of the males, females or both have a unique combination of characters (except for the obvious abnormalities). This study attempts to apply the criterion of 100% diagnosability when examining the specific status of each population. In a few instances, however, if a widespread population is not entirely diagnosable from closely related species, it may still be postulated to be a distinct entity particularly if there is no evidence for cinal variation and if the population is isolated. Because of the problems associated with using museum material (e.g. too few specimens of the right plumages from critical localities, or aging and damage to specimens), it is not always possible to apply this criterion unambiguously, especially when differentiation in external characters is not extensive. All systematists will appreciate, however, that ambiguities are a part of applying any species concept to patterns of variation within and between populations and that ambiguities usually arise as a consequence of insufficient evidence (see also McKirrick and Zink, 1988). Arguments over whether a population is 100% diagnosable will not generally be fruitful and may tend to obscure more
important issues, such as the consequences—phylogenetic, biogeographic, ecological—of applying a somewhat less stringent version of the criterion in a particular instance. As long as one views species’ limits as hypotheses formulated within the context of available evidence, the existence of populations whose status as a terminal taxon is presently unclear should not be particularly disturbing.

Adoption of the phylogenetic species concept solves a long-standing source of contention within systematics, namely the taxonomic status of subspecies. Because phylogenetic species are basal (smallest recognizable) differentiated taxonomic units, subspecies could only be applied as arbitrary descriptors of within-species variation. Within that context, therefore, they serve little useful purpose.

The Species of the Paradisaeidae

This section enumerates the postulated phylogenetic species for the birds-of-paradise. Limits of genera follow those of Mayr (1962) and Gillard (1969) until their relationships can be clarified. Etymology of scientific names follows Bechler and Finch (1985), the synonyms listed below follow Mayr (1962), include only those names (generally subspecies) currently applied to populations, and do necessarily include all names previously applied to the taxon. Diagnoses are based on examination of museum material and discussions in the literature, but unless noted all diagnoses were confirmed on museum material. Most of the diagnostic characters involve variation in structural modifications of the plumage, coloration or plumage color patterns. It should be emphasized that colors are not precise descriptions of characters, which in reality involve varying amounts of pigment deposition and/or structural modification of the feathers themselves. Names for colors and plumage patterns generally follow those in Cooper and Forshaw (1977) and Coates (1990) to facilitate the studies of future workers. Within the context of the biological species concept, differences in the means of quantitative variables (especially bill, wing and tail length) often play an important role in distinguishing subspecies. Such measurements do not assume that importance under the phylogenetic species concept unless populations show discrete size differences that can be interpreted as diagnosable “characters”. Consequently, discussion of measurements will largely be de-emphasized except in those cases in which size differences characterize discrete taxa.

The species list employs the use of “species groups” to call attention to groups of species that are presumably closely related. In many instances, the term is applied to taxa that have generally been ranked as subspecies within a widespread polyporphic/biological species. “Species groups” are hypotheses of monophyly, and a more detailed discussion of the evidence supporting these relationships will be given elsewhere.

Distributions are also hypotheses, and boundaries of distributions will always be fuzzy depending on the scale of the observer. The distributions given here begin with the literature, but are supplemented by data from museum specimens when appropriate. A definitive description of species’ distributions in New Guinea is especially problematic because so many areas have been explored inadequately. Altitudinal distributions and habitat are summarized from the literature (Coates, 1990) and from data on museum specimen labels.

Virtually all of the paradisaeid specimens housed in the following museums were examined in this study (see Table 1): AM, Australian Museum, Sydney; AMNH, American Museum of Natural History, New York; ANSP, Academy of Natural
Table 1
Approximate number of specimens examined in this study. In some cases specimens lacking locality data (e.g., trade skins) were also examined.


Sciences, Philadelphia; GSIRO, Commonwealth Scientific and Industrial Research Organization, Division of Wildlife and Rangelands Research, Canberra; FMNH, Field Museum of Natural History, Chicago; SA, South Australian Museum, Adelaide; QM, Queensland Museum, Brisbane.

Family Paradisaeidae, Subfamily Cnemophilinae

Genus Loria Salvadori

A single species, with three subspecies, is recognized by virtually all workers. Three allopatric species are recognized here on the basis of differences in male plumage coloration.

Loria loriae Salvadori


Diagnosis. Males having blue-purple sheen of secondaries not bright bluish or purplish.


Alitudinal distribution and habitat. Montane forest and secondary growth between 1200 and 2800 meters.

Comments. All three forms previously united into a single species appear to be diagnosably distinct based on comparison of a long series of each in the AMNH. Loria loriae is "intermediate" in the coloration of the secondaries, not being bright metallic blue as L. inexpectata or as deep purple as L. amethystina. Although there is variation within specimens of each of these forms, most is probably due to wear and/or age. There is no evidence of introgression, and the distribution of the purplish form amethystina between the other two species indicates that variation across these three taxa is not clinal.

Mayr's (1962: 182) mention of the Weyland Mountains as being included in the range of this form is no doubt a typographical error.
Loria inexpectata Junge


Diagnosis. Males having sheen of secondaries decidedly bright bluish or metallic greenish blue in coloration.

Distribution. Mountains of western New Guinea, from the Weyland Mountains through the Nassau, Orange, Hindenburg and Victor Emanuel Ranges.

Altitudinal distribution and habitat. See *L. loriae*.

Comments. Cooper and Forshaw (1977: 34) call this form doubtfully distinct, but the specimens examined support the hypothesis that it is differentiated from its congeners (see comments above for *L. loriae*).

*Loria amethystina* Stresemann


Diagnosis. Males having sheen of secondaries dark, with decidedly purplish coloration (not bright greenish blue), and with relatively little metallic blue.

Distribution. Mountains of north central New Guinea, including the Schrader, Hagen, Kubor and Bismarck Ranges, eastward to the vicinity of Mt Karimui, Chimbu Province (Coates, 1990: 429).

Altitudinal distribution and habitat. See *L. loriae*.

Comments. See *L. loriae*.

Genus Loboparadisa Rothschild

One species with two subspecies is usually assigned to this genus. Two strongly differentiated species are recognized here.

*Loboparadisa sericea* Rothschild


Diagnosis. Male with crown dark golden-brown, golden-brown of back with light yellow–green tinge, rufous golden-brown of wings and tail darker compared to *L. aurora*.

Distribution. Mountains of western and central New Guinea, including Weyland, Nassau, Orange and Victor Emanuel Ranges.

Altitudinal distribution and habitat. Poorly understood. Apparently wide ranging elevationally in lower and mid-montane montane forest but patchily distributed, from perhaps 600 to 2000 meters.

Comments. See *L. aurora*.

*Loboparadisa aurora* Mayr


Diagnosis. Male with crown olive-green brown, back dark yellow–green golden and not deeply brown as in *L. sericea*, and wings and tail rufous golden-brown but less dark than in *L. sericea*.


Altitudinal distribution and habitat. See *L. sericea*.

Comments. The yellow of the underparts and rump are somewhat less deep than in *L. sericea*, but this difference may not be consistent.

Genus Cynemophilus De Vis

One species, having three subspecies, is commonly recognized in this genus. Two diagnosably distinct species are postulated here.
Paradisaeid Species

Chenophillus macgregorii De Vis


Diagnosis. Male having crown and nape orange–yellow, mantle strongly yellowish, rump and upper tail coverts dull yellowish buff, tail cinnamon-brown, underparts blackish brown; female having upperparts dull brownish yellow, breast pale brownish yellow and abdomen yellowish buff.

Distribution. Mountains of southeastern New Guinea from Mt Knutsford west to the Wharton Range.

Altitudinal distribution and habitat. High montane forest habitats from 2000 to 3650 meters.

Comments. See C. sanguineus.

Chenophillus sanguineus Iredale


Diagnosis. Male having crown and nape orange–red, mantle and back orange, rump and upper tail coverts tinged with orange, wings and tail deep rufous, underparts dark chocolate brown; female having upperparts less brown and more olive than C. macgregorii, breast more olive-green, abdomen pale yellow.

Distribution. Mountains of central New Guinea, including Hagen, Bismarck and Kabor Ranges.

Altitudinal distribution and habitat. See C. macgregorii.

Comments. Given present evidence, the form kuboriensis (Mayr and Gilliard, 1954) is not diagnosably distinct from sanguineus (see also Diamond, 1972: 320–321).

Genus Magggoria De Vis

One species with two subspecies is currently recognized in this genus. A single species is also accepted here.

Magggoria pulchra De Vis

Synonymy. Magggoria pulchra De Vis, 1897, Ibis, p. 251.
Magggoria pulchra carolinæ Junge, 1939, Nova Guinea, (N.S.), vol. 3, p. 82.

Diagnosis. Male and female having velvet black plumage with orange–yellow wing patch and orange–yellow lappet wattle over cheeks and ear-coverts.


Altitudinal distribution and habitat. High montane forest from 2800 to 4000 meters.

Comments. Nominat pulchra is, on average, larger than carolinæ but because the number of specimens is insufficient to establish whether size is diagnostic, one species is recognized here. No differences in external characters were noted.

Subfamily Paradisaeinae.
Genus Litycorax Bonaparte

A single species with three subspecies is generally recognized in this genus. At least three phylogenetic species are postulated here. Two are large-billed forms, obiensis and morotensis, each having distinctive characters of the body plumage and primaries. In general appearance, the small-billed species, L. tyrhopterus, appears closer to obiensis in having a dark body plumage and a whitish inner web of the primaries.
**Lycocorax pyrrhopterus** (Bonaparte)


*Diagnosis.* Bill decidedly short; plumage dull blue–black with poorly developed gloss; primaries brown with very little, if any, whitish edging to inner web of basal portion of feathers.

*Distribution.* Batjan and Halmahera, Northern Moluccas.

*Altitudinal distribution and habitat.* Broadly distributed from sea-level to the highest elevations; primarily confined to forest, apparently mostly above 1200 meters.

*Comments.* The two populations of *L. pyrrhopterus* may also be distinct phylogenetic species. Both are small-billed forms, but the population on Halmahera has the whitish of the inner webs of the primaries much less developed, essentially absent in some specimens. The Batjan population has a whitish inner web much more consistently present but there is variation in its intensity (greyish-brown to whitish). These populations are united here until further information is available as to the extent of their behavioral or genetic differentiation.

**Lycocorax obiensis** Bernstein


*Diagnosis.* Plumage deep blue–black with a well-marked glossy appearance; primaries brown, with only a small portion of inner webs of basal portions of primaries whitish.

*Distribution.* Obi Island, Northern Moluccas.

*Altitudinal distribution and habitat.* See *L. pyrrhopterus*.

*Comments.* See above.

**Lycocorax morotensis** Schlegel

*Synonomy.* Lycocorax morotensis Schlegel [= *L. p. morotensis* of recent authors], 1863, Ibis, p. 119.

*Diagnosis.* Plumage dull brownish black, with glossy appearance poorly developed; primaries brown, with well-developed white patch on inner web of the basal portion of the feathers.

*Distribution.* Morotai, Rau, Northern Moluccas.

*Altitudinal distribution and habitat.* See *L. pyrrhopterus*.

*Comments.* See above.

**Genus Manucodia** Boucard

*Manucodia atrata* (Lesson)


*Diagnosis.* Feathers of breast tipped with three distinct, narrow bands that are V-shaped because feathers are strongly attenuated distally.

*Distribution.* Misol, Salawati, Batanta, Gemien, Waigeu and western New Guinea, from the Vogelkop eastward in the north to the Huon Gulf, and in the south to about the Fly River delta (*atra*); Aru Islands and eastern New Guinea, westward on the south coast
to about the Fly River delta, along the north coast to the Kumusi River (subalter); Tagula Island, Louisiade Archipelago (alter).

*Altitudinal distribution and habitat.* Lowland forest and savannah habitats, sea-level to about 1000 meters.

*Comments.* Three subspecies have been recognized. Gilliard (1956) undertook an extensive analysis of their geographic variation and concluded that variation in size and coloration was clinal across populations. Examination of specimens failed to identify any diagnostic characters.

*Manucodia jobiensis* Salvadori


*Diagnosis.* Feathers of breast having three fan-shaped (nearly parallel) bands; feathers of breast, throat and neck not frayed and filamentous due to loss of barbs basally.

*Distribution.* Japen Island (*jobiensis*), from the head of Geelvink Bay south to the Setekwa River, eastward to Astrolabe Bay and the upper Ramu River (*rubiensis*).

*Altitudinal distribution and habitat.* Lowland forest, generally below 500 meters.

*Comments.* The two subspecies recognized in this species are apparently not diagnosably distinct. It may be that mainland populations are, on average, suffused with a more intense purplish gloss, but the small number of specimens examined from Japen Island is insufficient to establish this with confidence. Gilliard (1969:101) notes that *rubiensis* is generally smaller than *jobiensis*, but it is not clear from present evidence whether these differences are diagnostic.

*Manucodia chalybata* (Pennant)


*Diagnosis.* Feathers of breast, throat and neck frayed and filamentous due to loss of barbs basally but lacking extensive curling, and with crown lacking extensive mat of curled feathers.

*Distribution.* Misol and throughout the lowlands of New Guinea.

*Altitudinal distribution and habitat.* Lowland forest, usually above 500 meters and below about 1700 meters.

*Comments.* No subspecific variation has been described for this species.

*Manucodia comrii* Sclater


*Diagnosis.* Crown feathers with large mat of curled feathers, feathers of breast, throat and neck highly modified being extensively curled distally.

*Distribution.* D'Entrecasteaux Archipelago, including Fergusson, Goodenough and Normanby Islands (*comrii*), and Trobriand Islands including Kiriwina and Kaillema Islands (*trobiandi*).

*Altitudinal distribution and habitat.* Broadly distributed across island habitats, from sea-level to 2200 meters.

*Comments.* Mayr (1936) notes that *trobiandi* is smaller than *comrii* and indeed most specimens fall into two distinct size groups (see also Gilliard, 1969). There are, however, some specimens from each form that arc essentially the same size. Accordingly, only one
species is recognized here, but future genetic analysis may reveal that the populations are in fact distinct phylogenetic species. No consistent differences were noted in plumage.

**Genus Phonygammus Lesson and Garnot**

One polytypic species is currently recognized in this genus. Seven of the currently described forms are diagnosably distinct and recognized here as species (Table 2). Furthermore, all are apparently allopatric. Variation within this assemblage has always been viewed as being complex, and indeed there seems to be several undescribed, diagnosably distinct populations.

*Phonygammus keraudrenii* (Lesson and Garnot)


*Diagnosis. Throat, upper breast and posterior crown and nape feathers metallic greenish purple-blue; occipital tufts relatively short; breast and belly dull metallic greenish blue.*

*Distribution. Western New Guinea: Vogelkop, Onin Peninsula and Weyland Mountains.*

*Altitudinal distribution and habitat. Lowland forest but widely distributed into mountains.*

*Phonygammus jamesii* Sharpe


*Diagnosis. Throat, breast and belly feathers dark metallic blue, with greenish suffusion; mantle, lower back and rump purplish blue, with little greenish tone; occipital tufts moderately long.*

*Distribution. Southern New Guinea from the Mimika River in the west, eastward to the vicinity of Hall Sound.*

*Altitudinal distribution and habitat. Lowland forest, mostly below 1000 to 1500 meters.*

*Comments. See also *P. aruensis*. Compared to *P. purpureoviolaceus*, *P. jamesii* does not exhibit a strong demarcation between the coloration of the throat and upper breast and that of the lower breast and belly. In this respect, *P. jamesii* and *P. aruensis* are similar.*

*Phonygammus aruensis*, new species

*Type. AMNH 677414, adult male, Sq. Wanoem Bay, Kobror Island, Aru Islands, West Irian, 2 September 1900, H. Kuhn collection (Rothschild collection).*

*Diagnosis. Back, upper tail coverts, tail, wing coverts, secondaries and underparts dark dull metallic purplish blue, strongly suffused with purple; occipital tufts relatively short; feathers of tufts, hind crown, hind neck and throat purplish blue with little greenish.*

*Distribution. Aru Islands, West Irian.*

*Altitudinal distribution and habitat. Broadly distributed across islands.*

*Comments. The Aru population has traditionally been united with mainland *jamesii*, but on the basis of available material the former is clearly diagnosably distinct. One reason why this form was not described earlier is that individuals assigned to mainland *jamesii* show considerable variation, much of which is non-geographic. A very small number of individuals, moreover, are variants that tend to resemble Aru birds in some non-diagnostic characters.*
<table>
<thead>
<tr>
<th>Species</th>
<th>Throat</th>
<th>Breast and belly</th>
<th>Occipital tufts and nape</th>
<th>Head</th>
<th>Mantle to rump</th>
<th>Wings</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. kerendrenii</em></td>
<td>Greenish purple-blue</td>
<td>Greenish blue</td>
<td>Relatively short</td>
<td>Greenish purple-blue</td>
<td>Bluish purple</td>
<td>Bluish purple</td>
<td></td>
</tr>
<tr>
<td><em>P. jennii</em></td>
<td>Greenish purple-blue</td>
<td>Shiny dark metallic blue with greenish suffusion</td>
<td>Moderately long</td>
<td>Greenish purple-blue</td>
<td>Bluish purple</td>
<td>Bluish purple</td>
<td></td>
</tr>
<tr>
<td><em>P. arenensis</em></td>
<td>Purplish blue</td>
<td>Dark, dull metallic purplish blue</td>
<td>Relatively short</td>
<td>Purplish blue, little greenish</td>
<td>Bluish purple</td>
<td>Bluish purple</td>
<td>Dull purple</td>
</tr>
<tr>
<td><em>P. purpureocibicus</em></td>
<td>Intense greenish blue; feathers elongated and strongly lanceolate</td>
<td>Intense purple-blue</td>
<td>Relatively long</td>
<td>Intense purple-violet</td>
<td>Intense coppery purple</td>
<td>Dull purple-violet</td>
<td></td>
</tr>
<tr>
<td><em>P. diomedii</em></td>
<td>Intense bluish green</td>
<td>Intense greenish blue or greenish purplish blue (only slight purple wash)</td>
<td>Exceedingly elongate</td>
<td>Intense purplish blue</td>
<td>Intense purplish blue to purple-violet</td>
<td>Dull purple-violet</td>
<td></td>
</tr>
<tr>
<td><em>P. adelberti</em></td>
<td>Dark metallic blue</td>
<td>Dark metallic blue to greenish blue</td>
<td>Very short</td>
<td>Dark metallic blue</td>
<td>Dark greenish blue to bluish green</td>
<td>Dark bluish green to greenish blue</td>
<td></td>
</tr>
<tr>
<td><em>P. neumanni</em></td>
<td>Intense dark purplish blue</td>
<td>Very dark metallic blue</td>
<td>Very short</td>
<td>Dark metallic blue</td>
<td>Very dark purplish blue</td>
<td>Very dark purplish blue</td>
<td></td>
</tr>
<tr>
<td><em>P. kumsteini</em></td>
<td>Dark metallic greenish blue</td>
<td>Dark purplish blue</td>
<td>Moderately long</td>
<td>Dark metallic greenish</td>
<td>Very dark purplish</td>
<td>Very dark purplish</td>
<td></td>
</tr>
<tr>
<td><em>P. gouldi</em></td>
<td>Dark bluish green</td>
<td>Dark bluish green</td>
<td>Very long</td>
<td>Dark bluish green</td>
<td>Very dark purplish</td>
<td>Dark bluish green</td>
<td></td>
</tr>
</tbody>
</table>
The Aru sample (five males, including the type: AMNH 677411-677415) differs from virtually all specimens of mainland janesii in having: (1) the entire plumage much darker and more bluish, less greenish, in tone; and (2) the underparts, but especially the back, suffused with purple. Because the plumage is darker in arnesis, the lanceolate feathers of the head are a deeper, more purplish, cobalt blue as compared to the lighter cobalt blue of janesii. A single specimen (AMNH 677422), a male from the Eilanden River region of southern West Irian, has far more purple suffused through the plumage than any other janesii specimen. It is very similar to arnesis birds but still has the bluish green tone to the lanceolate feathers of the head which is characteristic of janesii. No other adult specimens are available from Eilanden River, but a small series from the Snow Mountains, to the west, are “typical” janesii.

Phonygammus purpureoviaceus Meyer


Diagnosis. Back, uppertail coverts, wing coverts and secondaries intensive metallic purple-violet; feathers of posterior crown, nape and sides of neck very elongate and glossed greenish purple-blue; breast and belly intensively suffused with purple-blue; wings intense coppery purple.

Distribution. Mountains of southeastern (Astrolabe, Owen Stanley Ranges) and northeastern (lowlands of Huon Gulf region) New Guinea.

Altitudinal distribution and habitat. Forest habitats from about 950 to 2000 meters (purpureoviaceus) as well as lowlands (mayri).

Comments. The original description of P. k. mayri (Greenway, 1942) is inadequate to separate this form from P. purpureoviaceus. The former is said to have a purple-violet back as in P. purpureoviaceus, although the usefulness of this characterization is problematic because it fails to take into account other populations having purple-violet on the back and because Greenway states (1942:51-52) that “three individuals are perfectly intermediate in coloration between purpureoviaceus and janesis, two are purpureoviaceus in coloration”. P. k. mayri is said to be differentiated from P. purpureoviaceus on the basis of a higher “wing-tail index” although the measurements provided by Greenway for the two forms broadly overlap. Given that mayri is allopatric and given patterns of differentiation within the genus, it is very possible it will prove to be distinct. Until this can be confirmed with additional evidence, however, there is no basis to recognize it as a well-defined population, let alone a distinct species, and it is synonymized here with purpureoviaceus on the basis of the presumed coloration of the upperparts.

Phonygammus diamodi, new species

Type. AMNH 809310, adult male, Awanoe, near Okapa, Eastern Highlands District, Papua New Guinea, 15 June 1965, 6300 feet, collected by Jared Diamond.

Diagnosis. Breast and belly dark metallic greenish blue or greenish purple-blue, with little or no purple-violet wash; lanceolate head feathers and occipital tufts very elongate and metallic bluish green in color; mantle, lower back and rump intense purplish blue; wings purplish blue to purplish violet.

Distribution. Eastern Highlands, near Okapa, possibly including the northern portions of the Kratke Ranges, Papua New Guinea.

Comments. Diamond (1972: 326–327) discussed variation in a small series of specimens from the Eastern Highlands region including Aowade, Okapa, and the vicinity of Karimui. He proposed that these birds were intermediate between *jamesii* and *purpureoviolaceus*, and suggested that the more western (Karimui) specimens were more similar to Fly River and Aru birds ("jamesii") than to *purpureoviolaceus* to the east. Five of these specimens in the AMNH (809308-809312) are all labeled *jamesii*. Keeping in mind the distinction between the Aru and mainland populations of *jamesii*, and after comparison with all other populations, the Eastern Highland birds, along with one from the Kratke Range (AMNH 784702) can all be assigned to a diagnosably distinct taxon, which appears to have its closest relationships to *purpureoviolaceus* and not to *jamesii*.

*Phonygammus adelberti* is similar to *P. purpureoviolaceus* in having the back, wings and tail strongly suffused with violet-purple and in having the occipital tufts and lacrimal feathers of the head very well developed. The two forms are distinct in that *adielberti* has the breast and belly dark metallic blue with or without relatively little violet-purple suffusion whereas the breast and belly of *purpureoviolaceus* is strongly suffused with violet–purple. In addition, the lacrimal head feathers of *adielberti* are bluish green in coloration whereas those of *purpureoviolaceus* are greenish blue often with a violet–purple tinge.

Having made this distinction between these taxa, two caveats are required. First, there is considerable variation within the taxonomic entity *purpureoviolaceus* and some individuals tend toward *adielberti*. One specimen of *adielberti* (AMNH 784702) from Kassam at the northeastern extreme of the Eastern Highlands (also included as part of the Kratke Range) is presumably at the eastern end of the range of *adielberti*. This bird has more violet–purple feathers on the breast and belly and hence more nearly matches some *purpureoviolaceus*. These latter specimens, however, are not those closest to the Kratke Range but are instead from the vicinity of Port Moresby. Several series of specimens farther up the coast, from the upper Arua River and from the hills above Yule Island and Hall Sound, are “typical” *purpureoviolaceus* and quite different from *adielberti*. Only one specimen, a female from the upper Arua River (AMNH 677427), resembles *adielberti*, particularly in the coloration of the head. There is variation within *adielberti*, moreover, in that the head feathers of one female specimen (AMNH 809308) are much bluer in tone than are those of the other specimens. The second caveat is one of ignorance as a consequence of lacking relevant specimens. The region between Hall Sound and the Kratke Range has not been collected extensively and we lack sufficient material to say whether *adielberti* and *purpureoviolaceus* are really disjunct or whether variation between these areas is clinal. As it stands now, specimens can be assigned to one or the other taxon and patterns of variation as we presently know them do not suggest clinal variation.

It is a pleasure to name this new form in honor of Dr. Jared Diamond who, in addition to having collected the type series of *adielberti*, has made innumerable contributions to the ornithology of New Guinea and to our knowledge of the birds-of-paradise.

*Phonygammus adelberti* Gilliard and LeCroy


**Diagnosis.** Back, uppertail coverts, wing coverts, secondaries and tail dark greenish blue; occipital tufts very short, poorly developed; feathers of posterior crown, nape, sides of neck and throat relatively short and dark metallic blue.
Distribution. Adelbert Mountains, Papua New Guinea.

Altitudinal distribution and habitat. Hill forest, including up to about 1200 meters (Gilliard and LeCroy, 1967: 73).

*Phongammus neumanni* Reichenow

*Synonymy.* *Phongammus neumanni* Reichenow [= *P. k. neumanni* of recent authors], 1918, Journ. f. Orn., vol. 66, p. 438.

*Diagnosis.* Lower back, uppertail coverts and wing coverts metallic blue-black with purplish tone, sharply demarcated from metallic dark blue of crown, nape and upper back; breast and belly dark metallic blue; occipital tufts and feathers of nape very short, poorly developed.

*Distribution.* Lordberg and Sepik Mountains, and Jimi and Baiyer River valleys, and possibly Bismarck Mountains.

Altitudinal distribution and habitat. Presumably hill forest, up to 1500 meters on Lordberg Mountain.

*Phongammus hunsteini* Sharpe


*Diagnosis.* Feathers of breast, belly, back, wings and tail dark purplish blue; occipital tufts moderately well developed and dark metallic greenish in tone; throat dark metallic greenish.

*Distribution.* D’Entrecasteaux Archipelago: Fergusson, Goodenough and Normanby Islands.

Altitudinal distribution and habitat. Forest habitats on islands.

*Phongammus gouldii* (Gray)


*Diagnosis.* Entire plumage dark metallic bluish green, brighter in tone than that found in other species of *Phongammus*.

*Distribution.* Northern Queensland, Australia.

Altitudinal distribution and habitat. Lowland forest.

**Genus Ptiloris** Swainson

The genus *Ptiloris* has traditionally contained three species. Two are monotypic, and the third, *P. magnificus*, has three subspecies, which are here postulated to be diagnosably distinct.

*Ptiloris paradisicus* Swainson


*Diagnosis.* Male with feathers of crown and throat metallic oil green; velvety feathers of breast and abdomen strongly edged with metallic green.

*Distribution.* Coastal forests of northeastern New South Wales (Hunter River in the south) to central Queensland (Rockhampton), Australia.

Altitudinal distribution and habitat. Lowland rainforest, between 500 to 1000 meters.

*Ptiloris victoriae* Gould

Diagnosis. Male with feathers of crown and throat metallic blue–green; velvety feathers of breast and abdomen strongly edged with dull metallic green.

Distribution. Coastal forests of northeastern Queensland (Atherton Plateau), Australia.

Altitudinal distribution and habitat. Lowland rainforest, up to about 1200 meters.

Ptiloris magnicus species group

Ptiloris magnicus (Vieillot)


Diagnosis. Male with throat metallic bluish green; abdomen velvety black lightly suffused with dark pink–purple; male and female without base of upper mandible (culmen) extensively feathered.

Distribution. Lowlands of western New Guinea from the Vogelkop Peninsula eastward in the north to the Sepik River and in the south to the Fly River.

Altitudinal distribution and habitat. Lowland rainforest, generally up to about 1200 meters (but occasionally as high as 1700 meters; Coates, 1990).

Ptiloris intercedens Sharpe


Diagnosis. Male with throat metallic greenish blue; feathers of lower breast and abdomen strongly suffused with bright pinkish gloss; male and female with base of upper mandible (culmen) extensively feathered, not bare; bill significantly shorter than that of magnicus (see also Diamond, 1972: 334).

Distribution. Lowlands of eastern New Guinea from Hall Sound in the south, then west and north to Astrolabe Bay.

Altitudinal distribution and habitat. See P. magnicus.

Ptiloris alberti Elliot


Diagnosis. Male with throat metallic bluish green; feathers of lower breast and abdomen with little or no pinkish suffusion; male and female without base of upper mandible (culmen) extensively feathered; bill significantly shorter than that of magnicus.

Distribution. Cape York and Claudie River district of northern Queensland, Australia.

Altitudinal distribution and habitat. Lowland rainforest.

Genus Semioptera Gray

A single species with two subspecies is usually recognized in this genus. Both subspecies, however, are diagnosably distinct and therefore recognized here as phylogenetic species.

Semioptera wallacei Gould

Synonymy. Semioptera wallacei Gould, 1859, Birds Australia, Suppl., pl. II.

Diagnosis. Male with crown and nape feathers iridescent greyish lilac in color; female with crown and nape buff-brown, and remainder of upperparts light brown.

Distribution. Batjan.

Altitudinal distribution and habitat. Forest habitats of island interior.

Comments. See S. kalmaherae.
Semioptera halmaherae Salvadori


Diagnosis. Male with crown and nape feathers suffused with light iridescent pink–purple; female crown and nape darkish brown with purple sheen, remainder of upperparts dark brown.

Distribution. Halmahera.

Altitudinal distribution and habitat. Forest habitats of island interior.

Comments. Males of halmaherae also generally have darker brown backs than do those of wallacei but there is overlap in coloration.

Genus Seleucidis Lesson

This genus is usually said to contain a single species having two subspecies. These subspecies are diagnosably distinct, thus two phylogenetic species are recognized here.

Seleucidis melanoleuca (Daudin)


Diagnosis. Male with flank plumes yellow; female with underparts buff-brown in color and with narrow dark chestnut barring.

Distribution. Entire southern coast of New Guinea.

Altitudinal distribution and habitat. Lowland swamp forest, below 100 meters.

Comments. See S. auripennis.

Seleucidis auripennis Schlüter


Diagnosis. Male with flank plumes golden yellow; female with underparts darker than in melanoleuca, more brownish, and with heavy dark barring, the upper breast appearing darker.

Distribution. Northern coast of New Guinea from the head of Geelvink Bay in the west to Astrolabe Bay and the Ramu River in the east.

Altitudinal distribution and habitat. Lowland rainforest.

Comments. These two species of Seleucidis are distinct but not strongly so. Because the yellow of the underparts fades to white in museum material, it is not possible to judge this difference in study skins, although specimens of auripennis generally have a stronger yellowish tinge. Females are variable but the characterization of the underparts given above generally holds. The depth of the chestnut coloration of the upperparts is too variable to provide a consistent difference, although auripennis tends to be darker. These two taxa may also be diagnosed by differences in size. Measurements provided by Gilliard (1969: 130–131) show no overlap, and examination of recently collected males in the collections of the CSIRO confirms that individuals of auripennis are consistently smaller, although sample sizes are not large (wing length for three auripennis: 161–167 mm; for two melanoleuca: 172, 175 mm).

There are two females from Nakimi, near the mouth of the Siriwo River, in the collection of the AMNH (302940, 302941), which are similar to auripennis specimens to the east. These specimens extend the range of auripennis west to Geelvink Bay.

Genus Paradigalla Lesson

Two species are traditionally recognized. One of these, P. corneolata, has two allopatric subspecies which are diagnostically distinct and therefore treated here as phylogenetic species.
Paradigalla carunculata Lesson


Diagnosis. Male and female with long tail; male with large wattle at the base of the bill and forehead yellowish green; small lateral wattle at base of mandible violet–blue above and orange–yellow and red below.

Distribution. Arfak Mountains, Vogelkop Peninsula, Irian Jaya.

Altitudinal distribution and habitat. Poorly known, apparently mid-elevational montane forest.

Comments. See P. intermedia.

Paradigalla intermedia Ogilvie-Grant


Diagnosis. Male and female with moderately long tail; male with large wattle at the base of the upper mandible and forehead and at the base of the lower mandible lemon-yellow.


Altitudinal distribution and habitat. See P. carunculata.

Comments. This form has generally been placed in P. carunculata, although Mayr (1941) united it with P. brevicauda. Paradigalla intermedia is nevertheless diagnostically distinct based on differences in wattle color (e.g. Ogilvie-Grant, 1915: 26; Ripley, 1964: 48). Genetic data will be required to decipher relationships within this genus.

Paradigalla brevicauda Rothschild and Hartert


Diagnosis. Male and female with large wattle at the base of the bill and forehead lime-yellow; lateral wattle at the base of mandible ultramarine blue above and yellow below, without red; tail very short.

Distribution. Mountains of central New Guinea, from the Weyland Mountains, through the Nassau, Oranje, Victor Emanuel, Sepik and Hagen Ranges, to the Bismarck and Schrader Mountains in the north and Mt Karimui in the south.

Altitudinal distribution and habitat. Montane forest habitats from about 1600 to 2600 meters (down to 1400 meters at Lake Wangbin; Coates, 1990).

Genus Drepanornis Selater

Two species are commonly recognized in this genus, a highland form and one in the lowlands of northwestern New Guinea. The highland form, D. albertisi consists of four named subspecies distributed allopatrically. At least two diagnostically distinct taxa can be recognized within this "biological species". The lowland form is monotypic. Hence, based on characters from external morphology alone, three phylogenetic species are postulated here.

Drepanornis albertisi (Selater)


Diagnosis. Upper parts of male and female, including crown, nape and back, dark brown with chestnut tinge; uppertail coverts deep chestnut, tail bright chestnut; background color of underparts of female dark buff, strongly vermiculated with dark brown.

Distribution. Arfak, Wandammen and Kumawa Mountains, Irian Jaya (albertisi) and mountains of Huon Peninsula (geisteri), the Weyland Ranges in the west to the Sepik Mountains in the east (inversus).

Altitudinal distribution and habitat. Montane forests, between 600 and 2200 meters.

Comments. The population named D. a. geisteri is isolated on the mountains of the Huon Peninsula, far removed from D. albertisi on the Vogelkop. Unfortunately, only one adult male of the former (AMNH 677845) was available for comparison, and based on this specimen geisteri is not diagnosably distinct from albertisi. D. a. geisteri is said to have uppertails that are paler, more buff-brown, but the specimen available is actually darker than most albertisi. The specific status and historical relationships of these widely allopatric forms deserves further investigation using molecular techniques.

The type of inversus (AMNH 302362), an adult male from the Weyland Mountains, is not diagnosably distinct from albertisi, but like albertisi, is diagnosably distinct from cervinicauda in having a darker crown and back as well as more chestnut uppertail coverts and tail. Unfortunately, only the type was available for study. Diamond (1972:329) and Cooper and Forshaw (1977) synonymized inversus with cervinicauda, but the type of inversus is more similar to albertisi. Inexplicably, the diagnoses of inversus and geisteri are identical in Gilliard (1969:135)—both are said to be paler above than is albertisi.

The species albertisi was announced in a note by the editor of Nature not by Sclater himself (Sclater, 1873a:151), with the description only stating that the bird was a member of the “Epimachine division, with a peculiarly long and curved beak, which he [Sclater] proposed to name Drepanornis albertisi, after its discoverer.” Shortly thereafter Sclater (1873b:558) proposed the name Drepanornis albertisi and provided an adequate description.

Drepanornis cervinicauda Sclater


Diagnosis. Color of upper parts of male and female, including crown, nape and back, brown with little chestnut tinge; upper tail coverts and tail light chestnut; female, background color of underparts pale buff, strongly vermiculated with very light brown.

Distribution. Mountains of southeastern New Guinea from the Owen Stanley Range in the east, through the Herzog Mountains to the Bismarks.

Altitudinal distribution and habitat. See D. albertisi.

Comments. See D. albertisi.

Drepanornis bruijni Oustalet


Diagnosis. Pale bill; male with dark grey underparts, large naked ocular area purplish brown. For many other differences from the D. albertisi complex, see Cooper and Forshaw (1977:96).

Distribution. Lowlands of northeastern New Guinea from the east coast of Geelvink Bay (Waropen) and the Mamberamo basin eastward to the Tami River, east of Humboldt Bay (see Diamond, 1981 for details).

Genus Epimachus Guvèr

Two species are usually recognized in this genus, each having four named subspecies. Six phylogenetic species are postulated here.

Epimachus fastuosus species group

Epimachus fastuosus (Hermann)


 Diagnosis. Male with underparts rich blackish brown; female with dorsal surface of tail somewhat rufous brown.

 Distribution. Mountains of the Vogelkop Peninsula (Arfak, Tamrau), Irian Jaya. Altitudinal distribution and habitat. Mid-montane forest, from about 1300 to 2500 meters (2800 meters on Mt Giluwe; Coates, 1990: 444).

 Comments. See E. atratus.

Epimachus atratus (Rothschild and Hartert)


 Diagnosis. Male with underparts very dark blackish brown; female with dorsal surface of tail olive-brown, generally not rufous.

 Distribution. Western mountains of the Central Ranges of New Guinea, from the Wandammen Ranges in the west, through the Weyland, Nassau and Oranje Ranges (atratu), and in the mountains of eastern and central New Guinea, including the Sepik Mountains (Schraderberg), Mt Hagen, and Hindenburg Mountains (stresemanni).

 Altitudinal distribution and habitat. In Hindenburg Mountains, below 2100 meters in mid-mountain forests (Gilliard and LeCroy, 1961). It has been postulated that the species is excluded from beech forest above 2100 meters by E. meyeri, although on Mount Hagen specimens have been collected at 2500 meters, still below the elevational distribution of E. meyeri (Mayr and Gilliard, 1954).

 Comments. Based on specimens examined at the AMNH, and especially a series in the collection of the CSIRO, the form stresemanni does not appear to be diagnostically distinct from E. atratus, there being overlap in plumage coloration between individuals of the two populations. Gilliard and LeCroy (1961: 65) found that some of the putative differences between stratus and stresemanni are due to ageing of museum specimens. They also suggest that size differences among populations of the Central Ranges are clinal, and Diamond (1969) presents evidence supporting this hypothesis.

 The differences between fastuosus and atratus are not great. The two forms are seemingly consistently separable on the basis of the color of male underparts, which are darker in atratus. Females of atratus tend to be buffier below and have the tail more olive, but these differences are not consistently diagnosable.

Epimachus ultimus Diamond


 Diagnosis. Female with background coloration of underparts deep buffy, not light
buff; horizontal barring of underparts relatively broad, thus making underparts dark in tone; very dark rufous crown.

Altitudinal distribution and habitat. Montane forest, apparently 1500 meters and above.

Comments. Diamond (1969) described plumage variation in detail and noted variation in size among the species of this species group. While ultimus females generally have longer tails than do other populations, there is some overlap and the differences are not diagnostic. Only the type (AMNH 78976) was available for comparison. It is more distinct from the females of fastuosus and aitrus than the latter are from each other.

Epimachus meyeri species group

Epimachus meyeri Finsch


Diagnosis. Males with flank plumes light brown in color.

Distribution. Mountains of southeastern New Guinea, including Owen Stanley Range westward to Herzog Mountains.
Altitudinal distribution and habitat. High montane forests, between 2200 and 3100 meters.

Comments. See E. bloodi.

Epimachus bloodi Mayr and Gilliard


Diagnosis. Males with flank plumes grey in color.

Distribution. Central highlands, including Hagen, Kabor and Bismarck Mountains, Papua New Guinea.
Altitudinal distribution and habitat. High montane forest, 2700 to 3150 meters (on Mt Hagen: Mayr and Gilliard, 1954).

Comments. In the collections of the CSIRO, six males of E. meyeri and three of E. bloodi, all in good condition, were compared, and the differences in flank plume coloration were consistent. Some of the E. meyeri specimens in the Queensland Museum showed slight variation in the color of flank plumes, from brown to light brown. Males of E. bloodi in the CSIRO collection were substantially smaller in body weight (225–230 g, x = 228.3 g; three individuals) than those of E. meyeri (266–310 g, x = 289.6 g; five individuals).

Epimachus albicans (van Oort)


Diagnosis. Males with flank plumes white with dark bases.

Distribution. Mountains of central New Guinea, from the Orange Mountains in the west, through the Hindenburg, to the Victor Emanuel Mountains in the east (albicans), and in the Weyland Mountains, Irian Jaya (megarhynchus).

Altitudinal distribution and habitat. Highest portion of mid-montane and beech forest, 2600 to 2700 meters in Hindenburg and Victor Emanuel Mountains (Gillard and LeCroy, 1961). The type of megarhynchus was collected between 3000 and 3300 meters.

Comments. The specific status of megarhynchus is problematic. Only one male has been studied (the type, AMNH 677998), and the characters of the population—male with a
bill much longer than other members of this species group—are based on this bird. There are two females from the Weylands in the AMNH collections (302367, 302946) and their bill sizes are well within the range of those of *E. albicans* (measurements of these two Weyland birds were not given by Mayr and Gilliard, 1951: 11, Table 8). So either there is substantial sexual dimorphism in this population, which would be unusual for species of *Ephippus*, or the type represents an extreme variant.

Mayr and Gilliard (1951: 10) propose other characters based on female plumages. The two Weyland females are not quite as dark on the breast as *albicans* females, yet some of the latter look indistinguishable from the former. Furthermore, there are no consistent differences in the coloration of the upperparts. Because of these observations, *megarhynchus* is synonymized with *albicans* until genetic studies or additional specimens can provide evidence of its distinctness.

**Genus Astrapia Vieillot**

Five species are conventionally recognized in this genus. Three of these, *A. nigra*, *A. mayet* and *A. Rothschildi*, are monotypic. The other two “biological species” have three named subspecies each. Six phylogenetic species are postulated here.

*Astrapia nigra* (Gmelin)


*Diagnosis.* Male with large fan-shaped tuft of black feathers on side of neck and upper neck; narrow iridescent coppery green breast band that extends up neck to below eye; female with underparts brown narrowly barred with buff; see Cooper and Forshaw (1977: 109) for many additional characters.

*Distribution.* Arfak Mountains, Irian Jaya.

*Altitudinal distribution and habitat.* Montane forests from 1700 to 2400 meters.

*Astrapia splendidissima* Rothschild


*Diagnosis.* Male with broad iridescent copper-red breast band that extends up side of neck to just below eye; tail of moderate length having basal two-thirds white; female with tail of moderate length having base white; see Cooper and Forshaw (1977: 112) for many additional characters.

*Distribution.* Western and central ranges of New Guinea, including the Weyland Mountains eastward to the Wissel Lake district (*splendidissima*), the Oranje and Nassau Ranges as well as the nearby mountains on the upper Mamberamo River (*helios*), and to the east in the Hindenburg and Victor Emanuel Mountains (*eliottsmithi*).

*Altitudinal distribution and habitat.* Beech forest above 2100 meters in Hindenburg and Victor Emanuel Mountains (Gilliard and LeCroy, 1961).

*Comments.* The three, presumably allopatric populations of *A. splendidissima* are not strongly differentiated and, on the basis of the material examined, do not appear to be diagnosably distinct from each other and thus are treated here as a single species. Further genetic analysis may reveal that these taxa are distinct.

The form *helios* shows some differences from *splendidissima* (Mayr, 1936) but none appear to be clearly diagnostic. In the specimens examined, there was no noticeable difference in throat coloration. There is a tendency for *helios* to have a more bluish purplish cast to the crown, neck and dorsal collar, but it is questionable whether this is
100% diagnosable. *A. s. helios* does have the spatula on the central tail feathers wider than in *splendidissima*, but some individuals of the two populations clearly overlap. Finally, females and young males of *helios* do not appear to be consistently “more brownish” than those of *splendidissima* but they are, in general, slightly darker above. Nevertheless, dark birds are also found in *splendidissima*.

The easternmost population, *elliotsmithi*, may prove to be consistently separable from *helios* on the basis of external characters and from *splendidissima* on size (see Gilliard, 1961), but there are too few critical specimens of both populations to confirm this. The feathers of the shoulder and upper back may be deeper violet-purple in some specimens of *elliotsmithi* but there is considerable overlap in coloration with *helios*. There is consistently more green in specimens of *splendidissima* as compared to the deeper purple of *elliotsmithi*, thus suggesting this variation might be clinal. In *elliotsmithi* the green of the abdomen is darker and more suffused with purplish blue, which seems to be a consistent difference in the small series of specimens available of this form. No consistent differences were noted either in general size or in the width of the spatula of the tail, which is relatively large in both *helios* and *elliotsmithi*.

*Astrapia mayeri* Stonor


**Diagnosis.** Male with very long, narrow, nearly all white tail; with well-developed iridescent green nasal tuft; female with well-marked green crown and nape; see Cooper and Forshaw (1977: 115) for additional characters.

**Distribution.** Narrowly endemic to the central highlands of Papua New Guinea, including Mt Hagen, Mt Giluwe, and extending westward to the mountains of the Wabag and Strickland regions.

**Altitudinal distribution and habitat.** High montane beech forest, from 1800 to nearly 3400 meters.

*Astrapia stephaniae* species group

Three subspecies have traditionally been placed in *A. stephaniae*. At least two of these appear to be diagnosably distinct and are here treated as phylogenetic species. The males of both are nearly identical and are separable from other species of *Astrapia* in having the central tail feathers very long and relatively narrow, black glossed with pink-purple and with the basal part of the shaft being white (see Cooper and Forshaw, 1977: 120, for additional characters).

*Astrapia stephaniae* (Finsch)


**Diagnosis.** Females having the crown and nape blackish brown contrasting with a dark brown back; crown and nape without much bluish black sheen.

**Distribution.** Owen Stanley Range, Papua New Guinea.

**Altitudinal distribution and habitat.** Montane forest, between 1400 and 3200 meters.

**Comments.** See *A. feminina*.

*Astrapia feminina* Neumann


**Diagnosis.** Females having the crown, nape and back all brownish black with little strong delineation among them; crown and nape with bluish black sheen.
**Distribution.** Central and eastern highlands of Papua New Guinea, including the Schrader Mountains (type locality) and possibly the Wahgi Divide (Gyldenstolpe, 1955) (feminina), and from the Herzog Mountains in the east to the Kubor, Bismarck and Hagen Ranges and the region of the Tari Gap in the west (ducalis).

**Altitudinal distribution and habitat.** See A. stephaniae.

**Comments.** The taxic status of feminina is uncertain due to the lack of critical specimens. Only a single female specimen in the AMNH collections (792816, from the Schrader Mountains) is available for comparison. It has the coloration of the upper parts as in ducalis and the breast and belly is generally more rufous as given in the published diagnosis (see, for example, Mayr and Gilliard, 1952: 11). The distinctness of this specimen was pointed out by Mayr and Gilliard (1954: 336), but whether the color of the underparts is consistently diagnostic, however, is uncertain since females of ducalis, as well as those of stephaniae, are sometimes quite rufous. A further problem is whether the ranges of feminina and ducalis are not actually continuous, especially given the supposed distribution of feminina in the Wahgi–Sepik Divide (Gyldenstolpe, 1955), which has been thought to be included within the range of ducalis (Mayr and Gilliard, 1952). The upperparts of the Schrader Mountain female are identical to those of ducalis. Thus, given the variation in the coloration of the breast and belly, the fact that the upperparts are identical, and given that their ranges are possibly continuous, ducalis and feminina cannot be maintained as diagnosably distinct entities at this time. On the other hand, given present data, stephaniae and feminina are distinct species based on female characters.

*Astrapia rothschildi* Foerster

**Synonymy.** Astrapia rothschildi Foerster, 1906, Two New Birds of Paradise, p. 2.

**Diagnosis.** Male with feathers of hindneck and upper mantle iridescent pinkish purple; throat and upper breast black glossed with blue; female with underparts brownish black very finely barred with buff-white (see Cooper and Forshaw, 1977: 124, for additional characters).

**Distribution.** Huon Peninsula, northeastern Papua New Guinea.

**Altitudinal distribution and habitat.** Montane forests, between 1500 and 3500 meters.

**Genus Lophornis Vieilliot**

A single species, *Lophornis superba*, with nine subspecies is currently recognized in this genus. Most of the subspecies populations are allopatric, and even though patterns of variation are complex it is clear that some of these populations are diagnosably distinct. There are two well-marked clusters of taxa, the westernmost forms *superba* and *niedda*, on the one hand, and the central and easternmost forms on the other. A judgment as to whether these represent monophyletic groups will have to wait until relevant outgroup species can be more precisely specified, although preliminary comparisons suggest that many of the characters of the westernmost cluster are primitive whereas those of the easternmost group are derived. Relationships within *Lophornis* will be discussed elsewhere, and two species groups will be accepted here.

*Lophornis superba* species group

Some of the characters distinguishing the two species in this group include males having a short posterior projection at the lateral edge of the breast shield and without longitudinal black streaks on the feathers of the breast shield; females lacking a superciliary stripe and having the posterior portion of the flight feathers blackish brown without a rufous patch.
Lophorina superba (Pennant)


Diagnosis. Females with background color of the upper breast, abdomen and flanks greyish, tinged with buff.

Distribution. The Vogelkop (Arfak and Tamrai Mountains), Irian Jaya.

Altitudinal distribution and habitat. Forest habitats, from about 1000 to 2300 meters.

Comments. See L. niedda.

Lophorina niedda Mayr


Diagnosis. Females with background color of the upper breast, abdomen and flanks distinctly rufous.

Distribution. Wandammen Mountains, Irian Jaya.

Altitudinal distribution and habitat. See L. superba.

Comments. No differences between superba and niedda are apparent in male plumages, but the populations show strong differentiation in female plumages.

Lophorina minor species group

Some of the characters distinguishing the species in this species group include males with the breast shield having long lateral projections and feathers with a longitudinal black streak; females having a superciliary stripe and flight feathers with a rufous patch on the posterior margin.

Lophorina minor Ramsay


Diagnosis. Females with throat, crown and sides of head decidedly blackish brown; upperparts rich deep chestnut in tone, not flat brown; superciliary lacking above and in front of eye and reduced posteriorly; speckling on back of neck lacking or markedly reduced.


Altitudinal distribution and habitat. See L. superba.

Comments. A series of females in good condition in the collection of CSIRO show that minor is a strongly differentiated taxon. The species is characterized by a distinctly more melanized plumage than the other species, which accounts for the reduced or lost speckling on the crown and back of neck and for the condition of the superciliary stripe, which is essentially lost in some specimens (e.g. CSIRO 7937 from Mt Wadimana, QM 19641 from Mt Maneao). The underparts of these specimens exhibit considerable variation in color, from light buff to deep buff. This variation does not seem related to age but additional material is needed to verify this assumption. Immatures of minor approach latipennis.

The description of Lophorina superba sphinx is based on a single female from an unknown location (Neumann, 1932). Its description suggests similarities to minor, and sphinx is here synonymized with that species until further evidence suggests otherwise.

Lophorina latipennis Rothschild


Diagnosis. Females with crown, sides of head (postocular stripe) and nape dark brown; strong white superciliary; marked white streaking on forehead, crown and back of neck; sides of head (postocular stripe) very lightly streaked or not at all; upperparts brownish in tone.

Distribution. Mountains of the Huon Peninsula (latipennis) and the Herzog Mountains (connectens) in the east, and further west, from the Bismarcks through Hagen Mountains to the Hindenburg and Victor Emmanuel Ranges and perhaps as far west as the Snow Mountains (addenda).

Altitudinal distribution and habitat. Riverine forest and mid-mountains forest, 1600 to 2500 meters (Mayr and Gilliard, 1954).

Comments. There is substantial variation in female plumage within and among these three named populations, and even though they are somewhat differentiated, they seem not to be diagnosably distinct.

Relatively recently obtained specimens of all three forms were examined in the collections of the CSIRO. Females of the Herzog Mountain population, connectens, are described as having browner upperparts than latipennis (Mayr, 1930). Three latipennis females (CSIRO 25843, 26036, 26263) exhibit no consistent differences from three connectens females (CSIRO 25186, 25999, 25601) in the depth of brown coloration.

Females of both populations have a strong white superciliary and variable amounts of white speckling on the back of the neck. Differences between these two forms cannot therefore be confirmed (see also Diamond, 1972: 330–331).

The CSIRO collections also house specimens of addenda (labeled feminina; see below) from the Kubor and the Mt Hagen Ranges, including five females. All addenda females are much more buffy below than are Herzog connectens females, the latter showing relatively little buff below. Two addenda specimens (CSIRO 1047, 2271) show darker buff below than do three Rawlinson Mountain (latipennis) females, but two others (CSIRO 2064, 2467) are not entirely separable from two Rawlinson females (CSIRO 25843, 26036).

Three addenda females from the Baiyer and Wahgi River valleys near Mt Hagen housed in the collections of the Australian Museum also show considerable variation in the amount of buff on the underparts. The addenda females exhibit considerable variation in the brown coloration of the upperparts. Two (CSIRO 2271, 2467) fall within the range of latipennis and connectens females, one (CSIRO 1047) is darker than either, and one (CSIRO 2064) is much lighter. Female addenda have strong white superciliaries with white streaking on the back of the neck, and all three forms have marked white streaking on the forehead. In summary, no consistent differences were found among these three populations. This conclusion is reinforced by material in the AMNH. Five females from the Eastern Highlands (809324–809328) are not consistently separable from six females from the Huon Peninsula (268246–268250, 268232), as Diamond (1972: 330) has noted. All show a reduction in the streaking of the crown, which is very dark brown. Most have intense whitish streaking on the forehead but very little on the crown itself (in many, the white superciliaries meet in the midline of the nape). One bird from the Wahgi Divide (AMNH 705615) and one from the Victor Emanuel Mountains (AMNH 765927) are similar to those just described but have the crown more heavily streaked. Whether these differences are consistent enough to warrant recognition of distinct taxa will require more information. Also worthy of investigation is whether the more western populations ("addenda") will be shown to be eastern parts of a cline running through feminina. The
Victor Emanuel bird is moderately buffy below, whereas the Wahgi bird is much lighter. At the present time, evidence supports *feminina* and *latipennis* as distinct species.

*Lophornis pseudoparotia* Stresemann


*Diagnosis.* Female with forehead and back uniform brown, with the back not having much grey; crown without any light streaking (Stresemann, 1934: 145).

*Distribution.* Hunstein Mountains, Papua New Guinea.

*Altitudinal distribution and habitat.* Unknown, presumably similar to other species in the genus.

*Comments.* Because this species is apparently known only from the type (not examined), its systematic status is uncertain. If streaking is absent from the head, then that would suggest the population is distinct, and it is provisionally accepted here.

*Lophornis feminina* Ogilvie-Grant

*Synonomy.* Lophornis superba feminina Ogilvie-Grant, 1915, Ibis, Jubilee Suppl., no. 2, p. 27.

*Diagnosis.* Females with crown, nape and sides of head (postocular stripe) intensely marked with broad buff streaks; breast and belly strong rufous buff and more or less sharply demarcated from whitish throat.

*Distribution.* Weyland, Nassau and Oranje Ranges, and the mountains above the upper Mambramo River, Irian Jaya.

*Altitudinal distribution and habitat.* See *L. superba*.

*Comments.* Few recently collected females of *feminina* are available for study. Three specimens from the Weyland Mountains (AMNH 302391, 302392, 302393) and one from the Snow Mountains (AMNH 678270) are distinct from all females to the east in the characters listed above.

**Genus Parotia Vieillot**

In most accounts of this genus five “biological species” are recognized, three monotypic and two polytypic. One of these latter species, *P. carolae*, is composed of a variable number of well-differentiated forms, whereas the second, *P. bocortii*, seems to be a single taxon.

*Parotia sefilata* (Pennant)


*Diagnosis.* Males with a prominent, midline nasal crest tipped silver-white, throat and breast shield iridescent copper-green; female with pale grey or buff underparts having extensive narrow black barring.

*Distribution.* The Vogelkop Peninsula (Arfak and Tamrau ranges) and the Wandammen Mountains, Irian Jaya.

*Altitudinal distribution and habitat.* Mid-montane forests, between 1000 and 1800 meters (Gyldenstolpe, 1955: 303).

*Parotia carolae* species group

Six named subspecies have been recognized within *Parotia carolae* (see Gilliard, 1961). Some of these populations are diagnosably distinct, but the status of others is uncertain due to a scarcity of relevant specimens and a lack of information about their precise
distributional limits. All are united by having males with white flank plumes; a complex modification of the forehead feathers including a narrow frontal crest tipped orange-gold; supra-narial tufts that are golden-brown and tipped white, and which cover the bottom part of the frontal crest; and by having elongated blackish feathers that are tipped white and which enclose the frontal crest and tufts (see Schodde and McKean, 1973, and Forshaw and Cooper, 1977:159, for additional characters). All species differences are based on male plumage characters; the available specimens of females exhibit overlapping patterns of variation. There are no consistent size differences among the forms.

*Parotia carolae* Meyer


**Diagnosis.** Male with poor to moderately developed whiskers, throat buff brown anteriorly and whitish posteriorly with moderate barring, upperparts rich iridescent black-brown, and eye-ring bright golden.

**Distribution.** Weyland Mountains and Wissel Lake region, Irian Jaya.

**Altitudinal distribution and habitat.** Mid-montane forests, between 1000 and 2000 meters.

*Parotia clelandiae* Gilliard


**Diagnosis.** Male throat dark brown anteriorly with strongly developed golden-brown whiskers; upperparts iridescent black; eye-ring bright golden; crown feathers tipped rich golden; lower breast and belly rich brownish black.

**Distribution.** Telefomin district of Victor Emanuel Mountains, and possibly the Mt Hagen region, Papua New Guinea.

**Altitudinal distribution and habitat.** Mid-mountain forest, 1600 to 1700 meters in Victor Emanuel Mountains (Gilliard and LeCroy, 1961).

**Comments.** There is an adult male in the collections of the Australian Museum (AM 39346) from Manjim, on the Ganz River near Mt Hagen, collected 16 July 1954. This specimen has the whiskers moderately developed; the throat dark brown anteriorly and whitish posteriorly with moderately heavy barring; underparts rich, very dark brown (not black); upperparts black with very little iridescence dorsally; a dark golden eye-ring; and the breast shield greenish with iridescent purple. These collections contain a second Mt Hagen male, a flat skin (AM 37694) from Kuta. It agrees with AM 39346 in having the back velvety black (but with no iridescence) and a greenish breast shield with purplish iridescence. It is probable that the Mt Hagen population shows some slight variation in the amount of dorsal iridescence. These specimens fit clelandiae fairly well and thus may indicate that the range of this species extends eastward to the Mt Hagen region (but see remarks for *P. chrysoena* below).

*Parotia meeki* Rothschild


**Diagnosis.** Males with anterior part of throat and chin dark brown, with virtually no long golden-brown whiskers, and heavily barred posteriorly; crown feathers tipped yellow-golden.

**Distribution.** Mountains of the Nassau and Oranje Ranges, Irian Jaya.

**Altitudinal distribution and habitat.** See *P. carolae*.

**Comments.** There are no adult males in the collections of the AMNH or in other collections examined. The type (AMNH 678161) is a subadult. Two males (AMNH
678163, 678164) also from the Snow Mountains, as well as the type, although all subsadults, allow this population to be diagnosed from other species in the *P. caroleae* species group.

**Parotia chalexoranth** Stresemann


*Diagnosis.* Males with the back and wings brownish and the neck iridescent coppery (Stresemann 1934; Gilliard 1961:5).

*Distribution.* Doormanpaad, on the headwaters of the Mamberamo River, Irian Jaya. Known only from the type locality.

*Altitudinal distribution and habitat.* Unknown.

*Comments.* There are no adult males of this form in the collections of the AMNH or other collections studied, hence its status could not be confirmed.

**Parotia berlepschi** Kleinschmidt


*Diagnosis.* Males with throat dark brown anteriorly and heavily barred posteriorly, eye-ring dark brownish golden, feathers of neck and back strongly tipped with a golden-brown, coppery iridescence.

*Distribution.* Exact distribution unknown, perhaps from the Foja Mountains of northern Irian Jaya (see discussion in Diamond, 1985:79).

*Altitudinal distribution and habitat.* Unknown.

*Comments.* There is one adult male Rothschild specimen from “Dutch New Guinea” in the AMNH collections (AMNH 678171). If this specimen is typical of the population, then *berlepschi* is very distinct from the other taxa in this species group.

**Parotia chrysea** Stresemann


*Diagnosis.* Males with upperparts and underparts black, eye-ring dark golden; long feathers emanating from loreis iridescent or coppery gold.

*Distribution.* Humatein Range, northern Papua New Guinea, and possibly the Jimi River region of the Schrader and Bismarck Ranges, Papua New Guinea.

*Altitudinal distribution and habitat.* See *P. caroleae*.

*Comments.* There is one adult male in the AMNH collections (AMNH 815834) marked “(chrysea?) RAS” [R. A. Schodde], said to be from the Mt Hagen area, but donated by the Dallas, Texas zoo. If this specimen fairly represents the characters of *chrysea*, then this population differs from other taxa in the species group by having the males decidedly blacker. The eye-ring is also darker than all other forms except *berlepschi*. Stresemann (1934; see also Gilliard, 1961) notes that the feathers of the loreis are iridescent or coppery gold. This specimen has the upperparts velvety (only slightly iridescent) black and the underparts flat black; the eye-ring is dark golden and the feathers of the loreis are black but with a golden iridescence. In light of the comments for *P. cieandiae* and *P. chrysea*, the identification of the population in the Western Highlands needs additional study.

**Parotia laevisi** Ramsay


**Parotia laevisi exhibita** Iredale, 1948, Australian Zoologist, vol. 11, p. 162.

Diagnosis. Male with short supra-narial tufts that curve dorsally and medially to meet in midline, tufts tipped white, breast shield iridescent golden-green.

Distribution. Mountains of the Wharton and Owen Stanley Ranges (luevi), the Herzog Mountains (fuscior) and the Mount Hagen area (exhibita), Papua New Guinea (see Schodde and McKeen 1973, for details).

Altitudinal distribution and habitat. Mid-montane forests, from 500 to 2300 meters.

Comments. In most earlier systematic treatments of luevi, the form helenae was treated as a subspecies, but Schodde and McKeen (1972, 1973) recognized the latter as a separate species. It is diagnostically distinct (see below).

Schodde and McKeen (1973) reviewed in detail the distribution and geographic variation of the forms luevi, fuscior and exhibita and concluded that there are no consistent differences among these populations. Additional CSIRO specimens of fuscior collected in the fall of 1973, after Schodde and McKeen (1973) was published, confirm their judgement. Differences among the three forms are said to be evident in female plumages, but there is considerable variation in the so-called diagnostic characters across the range of the species (see Schodde and McKeen, 1973; Cooper and Forshaw, 1977:146).

Parotia helenae De Vis


Diagnosis. Male with frontal crest consisting of blackish brown hair-like feathers; supra-narial tuft golden-brown.

Distribution. Principally northern slopes of Owen Stanley and Wharton Ranges, Papua New Guinea (see Schodde and McKeen, 1972, for details).

Altitudinal distribution and habitat. Mid-montane forests, from 500 to 1500 meters.

Comments. See Schodde and McKeen (1972).

Parotia wahnse Rothschild


Diagnosis. Male with prominent iridescent orange-gold narial tuft, narrow nuchal patch iridescent violet-blue; female with crown and sides of head black, with white stripe extending behind eye.

Distribution. Mountains of the Huon Peninsula and in the Adelbert Mountains, Papua New Guinea.

Altitudinal distribution and habitat. Montane forest, between 1100 and 1700 meters.

Genus Pteridophora Meyer

Pteridophora alberti Meyer


Diagnosis. Male with orange-yellow lower breast, belly and undertail coverts; base of primaries light orange rust; long feather shaft emerging behind eye and possessing numerous enamel-like blue lobes; see Cooper and Forshaw (1977:153) for additional characters.

Distribution. Mountains of western New Guinea, from the Weyland Mountains in the west, eastward to the Hindenburg and Victor Emanuel Ranges (alberti), mountains of
the central and Eastern Highlands, including the Sepik and Schrader Ranges to the Kratke Mountains (*burgersi*), as well as the southern watersheds of the Kuebior, Hagen and Bismark Ranges (*hallstromi*).

**Altitudinal distribution and habitat.** Montane forest, from 1400 to 2850 meters.

**Comments.** There are three named subspecies, which on the basis of available data are not diagnosably distinct taxa. The western subspecies *alberti* has females that differ from those of populations to the east in that the throats tend to be darker and the breast bands broader and slightly thicker. Some females of the two eastern races, *burgersi* and *hallstromi*, also share these characters. Given the considerable variation in female plumages within populations, the latter two forms cannot be maintained as distinct taxa (see also Gilliard and LeGroy, 1968: 26; Diamond, 1972: 339).

**Genus Cinnyrus Vieillot**

Virtually all workers who have studied this genus recognize a single species having six subspecies. Variation is extremely complex yet clear patterns of differentiation are recognizable. Although the six subspecies are generally distinct from one another, there is sufficient overlap in external morphological characters among some of them to preclude their being 100% diagnosable. The evidence is suggestive that these six forms have differentiated in isolation but given their widespread distribution throughout the lowland forests and given that they are generally present in substantial numbers, it is likely that introgression does occur among some of the forms. Until genetic data are available to compare with those of external morphology, the species limits recognize here will have to remain tentative.

*Cinnyrus regius* (Linnaeus)


**Diagnosis.** Green–black patch above the eye rounded or broad and of irregular shape, and the throat deep iridescent crimson, with only a little violet suffusion. Characters of the "subspecies" are as follows: males with anterior part of crown, forehead and forehead tuft orange–red (*regius*); males with anterior part of crown, forehead and forehead tuft deep orange–red, almost scarlet (*rex*); males with crown as well as forehead and forehead tuft light orange–red (*gymnorhynchus*).

**Distribution.** Aru Islands, Irian Jaya (*regius*); Misol, Salawati and most of New Guinea, except the north between the head of Geelvink Bay and the Huon Gulf (*rex*; see also Mees, 1982: 172); northeastern coast of Huon Gulf, Papua New Guinea (*gymnorhynchus*).

**Altitudinal distribution and habitat.** Lowland forest, between sea-level and about 1100 meters.

**Comments.** The forms *regius* and *rex* are only slight differentiated. There is considerable variability in forehead coloration, with moderate overlap among specimens. The differences in violet suffusion and the coloration of the crown seem to be the most consistent characters, but again, there is occasional overlap of specimens. Viewing the populations as a whole, there is little question that some well-defined patterns of geographic differentiation are apparent, and it is very likely this will be confirmed by genetic analysis.
The form *gymnorrhynchus*, which is apparently isolated by the Markham River and possibly by coastal extensions of the Rawlinson Range, is nearly 100% diagnosably distinct. Nine males in the AMNH collection have much more extensive light orange–red onto the crown than do males of *rex*, but again, there are a few individuals that show overlapping variation. Virtually all have a throat that is deep violet–crimson, thus compared to *rex* it is darker and has more purple suffusion. The throat differs from males of the *coccineifrons* species group in that the latter species have the violet brighter, without an underlying deep crimson tone.

*Cicinnurus coccineifrons* species group

The species in this species group have the green–black patch above the eye slit-like and the throat and upper breast iridescent crimson–violet. The three species included here are differentiated and nearly 100% diagnosable, hence they are tentatively recognized as phylogenetic species.

*Cicinnurus coccineifrons* Rothschild


*Diagnosis.* Males with black patch above eye long and narrow, slit-like, oriented vertically; entire forehead tuft deep red and extends anteriorly very far, to within 5–6 mm of tip of bill; iridescent dark green breast band relatively narrow (6–8 mm).

*Distribution.* Japen Island, Irian Jaya.

*Altitudinal distribution and habitat.* See *C. regius*.

*Comments.* Eight males in the AMNH collections, including the type (AMNH 678666), are all uniform with respect to the diagnostic characters listed above.

*Cicinnurus cryptorrhynchus* Stresemann

*Synonymy. Cicinnurus regius cryptorrhynchus* Stresemann, 1922, Journ. f. Orn., vol. 70, p. 405.

*Diagnosis.* Male with black patch above eye slit-like or rounded; forehead tuft red posteriorly, deep orangish–red (not intense red) anteriorly, and extends only to about 7–9 mm from tip of bill; iridescent dark green breast band broad (9–11 mm).

*Distribution.* Eastern coast of Geelvink Bay, east beyond the mouth of the Mamberano River to the region of the Cyclops Mountains or somewhat beyond.

*Altitudinal distribution and habitat.* See *C. regius*.

*Comments.* Four male specimens in the AMNH (302410, 302413–15) are available from the area of the Wanggar River. One (302410) lacks feathers on the front of the forehead, so the characters of the tuft noted above are based on the other three males. One of these specimens (302413) has a deep red tuft that approaches those of *coccineifrons*, hence it remains to be seen how consistently diagnostic this character is. All four have a broad breast band. Each has a very different supraocular patch, two (302414–15) have a short, relatively narrow, slit-like patch but not as narrow as most *coccineifrons*; the third (302413) has a very long, very narrow patch like *coccineifrons*, and the fourth (302410) has a large rounded patch. On the basis of the four specimens, and Stresemann's (1922:405) description, *cryptorrhynchus* appears to be diagnosably distinct from Japen Island *coccineifrons*.

Five AMNH specimens (578656–60) from Takar and one from Sarmi (678661), both near Wadki, are also assignable to *C. cryptorrhynchus*. They have a relatively broad breast band (8–10 mm), and the forehead tuft does not extend as far anteriorly as in *coccineifrons*. Their forehead and forehead tuft are uniform orange–red, generally somewhat less deep red than in *coccineifrons*, but a few specimens of each overlap in coloration. Four
specimens from the Cyclops Range (AMNH 678617-18) and Cyclops Island (294525-26) are also referable to C. cryptorhynchus. The forehead and forehead tuft are orange-red but slightly lighter (more orangish) than those from Takar. The breast bands are broader (9-11 mm) still. A fifth specimen (AMNH 678614) from Ilar, Sentani Lake, just south of the Cyclops Range is not separable from these other four birds. Current evidence suggests that the eastern edge of the range of cryptorhynchus may lie in the region of the Cyclops/Denande Ranges or perhaps farther to the east where the Torricelli and Prince Alexander Mountains create a barrier for the lowland biota.

Cinnurus similis Stresemann


_Diagnosis._ Male with forehead and forehead tuft reddish orange; tuft extending to 8-9 mm from tip of bill, iridescent green breast band variable in width but broad, from 0-13 mm.

_Distribution._ From Astrolabe Bay and the upper Ramu westward probably to the region of the Torricelli Mountains, south to the upper Mamberamo basin (Idenburg River).

_Altitudinal distribution and habitats._ See _C. regius._

_Comments._ There are over 20 adult or subadult specimens in the AMNH, and they exhibit considerable variation. The only character that is close to being 100% diagnosable is the reddish orange forehead and tuft. The vast majority of the specimens are orangish (some even yellowish) in tone, not orange-red or deep red as in cryptorhynchus (or cocciiformis). There are, however, a few specimens that approach these latter two species. The breast band of similis is broad, although variable as in cryptorhynchus.

The series of specimens geographically closest to cryptorhynchus is inland along the Idenburg River (Bernhard Camp of the Archbold Expedition). Of 10 adult or subadult males, all but two have much more orangish on the forehead and forehead tuft than the Takar and Wanggar River birds. Overall, the series is closer to the Cyclops specimens than to Takar. Most, however, are very comparable to similis from other areas.

Summarizing, although specimens of similis exhibit considerable variation, well over 90% are separable from cryptorhynchus. The specimens with the most yellow in their plumage are distributed at the eastern end of the range, around the Adelbert Mountains and Astrolabe Bay. If the ranges of cryptorhynchus and similis are in contact, then variation may appear to be clinal. Present evidence suggests a pattern of geographic separation—with cryptorhynchus north of the coastal uplands (Foja, Karamoor Ranges) and similis inland and to the east—and differentiation, and thus two species-level taxa are postulated here.

**Genus Diphylloides Lesson**

Two species are generally recognized in this genus, one of which (_D. respublica_), is monotypic, the second (_D. magnificus_) of which contains four name subspecies. Three of these subspecies appear to be diagnosably distinct taxa and are here postulated to be phylogenetic species.

_Diphylloides magnificus_ species group

_Diphylloides magnificus_ (Pennant)

Diagnosis. Males with secondary coverts and margins of flight feathers light orangish yellow; crown light orangish brown (frontal tuft somewhat darker).

Distribution. Salawati Island, Vogelkop Peninsula, region of Wandammen Mountains, and Onin Peninsula, Irian Jaya.

Altitudinal distribution and habitat. Primarily lower montane forest, below 1800 meters but also extends down to near sea-level.

Comments. This form is apparently consistently diagnosable on the basis of the light yellowish orange coloration of the secondary coverts.

Diphyllodes chrysopterus Elliot


Diagnosis. Males with crown brownish, anterior portion of crown and forehead dark brownish; secondary coverts and margins of flight-feathers bright orange.

Distribution. Japen Island, from the region of Geelvink Bay to the Sepik River valley, south to the central ranges including the Victor Emanuel Mountains and north to the Wahgi Divide (chrysopterus; see Gyledenstolpe, 1955:134); Weyland Mountains east to the southern slopes of the Nassau and Oranje Mountains (intermedius).

Altitudinal distribution and habitat. See D. magnificus.

Comments. Despite apparently being allopatric, D. chrysopterus and the form intermedius are less strongly differentiated from each other than they are from the other two species of this species group. Five specimens (AMNH 302993, 302987, 302991, 302399, 678418) from the Weyland Mountains and one (678408) from the Snow Mountains potentially represent intermedius. When compared to a large series of chrysopterus, they are not consistently diagnosable. The Weyland birds are very similar to a small series from the Idenburg River (Bernhard Camp of the Archbold Expedition) and to birds from the Victor Emanuel Mountains and Wahgi Valley. Two of the intermedius (one from the Wanggar River area of the Weylands and one from the Snow Mountains) have secondary coverts that are much lighter than those of specimens from Mount Derimapa in the Weylands. Given no consistent diagnostic characters, chrysopterus and intermedius must be synonymized at this time, but given that they are apparently allopatric, genetic analysis may show that two distinct entities do exist.

Diphyllodes hunsteinii Meyer


Diagnosis. Males with crown burnt orangish, anterior half of crown and forehead extensively dark red-brown; lower back bright red-scarlet; secondary coverts and margins of flight feathers bright deep orange.

Distribution. Eastern New Guinea, from Huon Peninsula in the north, to Milne Bay area, then westward to the Eastern and Western Highlands and Fly River drainage.

Altitudinal distribution and habitat. Riverine forest up to 1600 meters (Mayr and Gilliard, 1954).

Comments. Of the specific characters of D. hunsteinii, those of the crown and forehead and of the lower back are the most consistently diagnostic (see also Gyledenstolpe, 1955:136). Although the secondary coverts of D. hunsteinii are generally much more deeply orange than in D. chrysopterus, some specimens of each overlap.
Diphylloides respublica (Bonaparte)


Diagnosis. Male with crown and hindcrown naked and cobalt blue, mantle, upper wing coverts, secondaries and margins of primaries crimson-red (see Cooper and Forshaw, 1977:171, for many additional characters).


Altitudinal distribution and habitat. Forest habitats, up to 780 meters.

Genus Paradisaea Linnaeus

Patterns of differentiation within Paradisaea are more complex than within any other genus of Paradisaeidae. Mayr (1962) recognized six biological species and Gillard (1969) seven. A number of populations are diagnostically distinct, however, and 14 phylogenetic species are recognized here.

Paradisaea apoda Linnaeus


Diagnosis. Male with dark velvety ring of feathers around bill, dark maroon breast, long filamentous yellow to orange-yellow flank plumes.

Distribution. Aru Islands (apoda), lowlands of southern New Guinea from the Mimika River, Irian Jaya, east to region of the Fly River drainage, Papua New Guinea (novaeguineae).

Altitudinal distribution and habitat. Lowland forest, from sea-level up to about 1000 meters.

Comments. The mainland form novaeguineae is said to differ from the nominate form in having the upper breast paler and more maroon. Examination of specimens in the AMNH and Australian Museum indicate that these forms are not diagnostically distinct, at least using external morphological characters. In both forms, there is considerable variation in the intensity of melanization of the upper breast, and at least some mainland specimens (e.g. AM 53336) have overall darker breasts than Aru birds.

Paradisaea raggiana species group

The taxa of this species group all have been considered to be subspecies of Paradisaea apoda (Mayr, 1962), yet most are apparently diagnostically distinct and together form a monophyletic group (Gillard, 1969; unpub. observ.). Treating them as subspecies of a more distantly related species confounds this historical pattern. All of these species are found in southern and eastern Papua New Guinea. Present evidence suggests that some of their patterns of variation are not clinal but have arisen in allopatry. Because distributional limits are not known with certainty, patterns of variation cannot be said to be fully understood. Patterns of speciation will be discussed elsewhere.

Paradisaea raggiana Selater


Diagnosis. Male with upperback (mantle) maroon–brown and sharply demarcated from yellow of crown and nape, varying to mantle suffused with yellow, not sharply demarcated from yellow of crown and nape, flank plumes scarlet.

Distribution. Southern New Guinea from near the Irian Jaya–Papua New Guinea border (Tarara), the Fly River, and the upper Purari River (including Waigi Valley) in the west, eastward to the Port Moresby region and Cloudy Bay (salvadorii), then through Orangerie Bay to Milne Bay (raggiana).

Altitudinal distribution and habitat. Mixed, second-growth primary forest, up to 1850 meters (Mayr and Gilliard, 1954).

Comments. Typical salvadorii males in the east have a maroon–brown mantle and the yellow of the crown and nape is sharply demarcated from the mantle, whereas typical raggiana to the west have the yellow of the crown and nape suffused over the mantle. The form raggiana is thought to be distributed westwards to Orangerie Bay (Mayr and Rand, 1935; Cooper and Forshaw, 1977), but specimens in the CSIRO show this not to be the case and that raggiana phenotypes range much farther to the west. Specimens collected from Nunumai north of Amazon Bay (CSIRO 8406, 8424), Agna (CSIRO 8071), Nowata (CSIRO 8619, 8649) and Opanabu (CSIRO 7846) all have yellow suffused across the upperback and lack a demarcation between the crown and neck and the back. In addition, two males in the collections of the Queensland Museum (QM 19443, 19444) from Cloudy Bay have upper mantles with some suffusion of yellow, although the mantle is still moderately demarcated from the neck and crown. Specimens from the Astrolabe scarp near Barakau (CSIRO 8922, 9037) are salvadorii, as expected, but there are two males (CSIRO 1925, 1959) from Segeri, just east of Port Moresby, that have some slight suffusion of yellow down the upper back. These observations suggest that raggiana and salvadorii are not diagnosably distinct and that differences vary, probably climinally, over a large geographic area.

Paradisea intermedia De Vis


Diagnosis. Male with yellow/yellow–green back, with yellow streaking down to upper tail coverts; flank plumes scarlet or deep orange–red, not suffused basally with yellow.

Distribution. Southeastern Papua New Guinea from Collingwood Bay in the south, northwest along the coast to the Mambare River.

Altitudinal distribution and habitat. See P. raggiana.

Comments. Neither raggiana nor salvadorii populations have yellow streaking down to the upper tail coverts.

Paradisea granti North

Synonomy. Paradisea granti North [= P. a. granti of recent authors], 1906, Victorian Nat., 22, p. 156.

Diagnosis. Male with extensive orangish yellow across back with streaking to upper tail coverts; flank plumes deep yellowish orange to orange, with little yellow basally.

Distribution. Southeastern Papua New Guinea from the Mambare River in the south, northwestward along the coast, perhaps as far as Salamaua, Huon Gulf.

Altitudinal distribution and habitat. See P. raggiana.

Comments. This form differs from intermedia in the coloration of the back and flank plumes.
Paradisaea australis: victoriae Cabanis


Diagnosis. Male with extensive light orangish yellow across back and streaking to upper tail covers; flank plumes light yellowish orange (apricot), with considerable yellow basally.

Distribution. Along the south coast of the Huon Peninsula, and up the Markham River valley to the region of the upper Ramu River, northeastern Papua New Guinea.

Altitudinal distribution and habitat. See P. regiana.

Comments. Based on 11 males in the AMNH collection, this species has the yellow of the upper parts lighter, less orangish, than does granti (nine males; locality data state only “Low Country behind Huon Gull”; all except one have light reddish orange flank plumes).

Paradisaea minor species group

The four species included in this species group have all been treated as subspecies within Paradisaea minor. All of these populations are diagnosably distinct, and thus are recognized here as phylogenetic species.

Paradisaea minor Shaw


Diagnosis. Male flank plumes with moderately extensive lemon-yellow coloration basally; yellow of the shoulder extensive; greenish yellow back, with yellow relatively deep in tone.

Distribution. Vogelkop and Onin peninsulas, Wandamen region north and eastward to Humboldt Bay, Irian Jaya.

Altitudinal distribution and habitat. Lowland forest, generally below 1600 meters.

Comments. See P. pulchra.

Paradisaea pulchra Mayr and de Schauensee


Diagnosis. Male and female with brown of plumage having a decided reddish tone; male with flank plumes having pale yellowish wash proximally, not deep yellow.


Altitudinal distribution and habitat. Lowland forest.

Comments. There are so few adult male specimens of pulchra available that its systematic status is uncertain. Mees (1965: 196) could find no consistent differences from mainland minor, although he apparently did not examine any adult males. Specimens examined in this study suggest that pulchra may be diagnosably distinct. One male (ANSP 168444), said to be from Misool but with no date, differs from minor specimens (ANSP 132380-82) from the Vogelkop in having the brown of the breast and wings brighter, more reddish, and in having the flank plumes with much less yellow (plumes not deep yellow but with a light yellowish wash basally). One female pulchra (ANSP 132384) differs from one minor female (ANSP 133070) from the Vogelkop in having the brown of the wings and tail decidedly more reddish. Mees' (1965: 196) discussion implies, however, that these differences are not consistent. Ripley's observations (1964: 50), based on a single adult female, support the hypothesis that P. pulchra and P. minor are diagnosably distinct.
Paradisaea finschi Meyer


_Diagnosis._ Male flank plumes with extensive, bright deep yellow coloration basally; yellow of shoulder reduced; back greenish yellow, with yellow not deep in tone.

_Distribution._ Northern coastal region of Papua New Guinea from the Sissano and Aitape region eastward to Astrolabe Bay and the upper Ramu River, south to central ranges (Victor Emanuel, Schrader Mountains).

_Atitudinal distribution and habitat._ Lowland forest, up to 1600 meters in the Victor Emanuel Mountains (Gilliard and LeCroy, 1961).

_Comments._ Although there are a few specimens of _P. finschi_ and _P. minor_ that are intermediate or overlapping in some characters, virtually all specimens can be placed unequivocally in one species or the other. The amount of yellow on the shoulder may prove to be the most diagnostic character, although some variation may be age-related and needs verification. Some Cyclops Island specimens of _minor_ have fairly deep yellow flank plumes comparable in intensity to some specimens of _finschi_ but not to others.

Paradisaea jobiensis Rothschild


_Diagnosis._ Male flank plumes very elongated, with light lemon-yellow coloration basally; yellow of shoulder extensive; greenish yellow back with yellow relatively deep in tone.

_Distribution._ Japan Island, Irian Jaya.

_Atitudinal distribution and habitat._ Lowland forest.

_Comments._ Two males (ANSP 132378–79) from Japan Island differ from three Vogelkop _minor_ in having the flank plumes fuller and larger. The yellow of the plumes, however, is as deep as that of the _minor_ specimens and thus is not consistently diagnostic. Compared to _minor_, the yellow of the back is slightly deeper in tone. The yellow of the shoulder cannot be assessed in these specimens because only the primaries are present!

Paradisaea decora Salvin and Goodman

_Synonomy._ Paradisaea decora Salvin and Godman, 1883 (January), Ibis, p. 131.

_Diagnosis._ Male with breast dark lavender-grey, flank feathers bright crimson-red; female with ochraceous buff underparts having dark barring (see Cooper and Forshaw, 1977: 191, for additional characters).

_Distribution._ Fergusson and Normanby Islands, D'Entrecasteaux Archipelago, Papua New Guinea.

_Atitudinal distribution and habitat._ Forest habitats, between 350 and 600 meters.

Paradisaea rubra Daudin


_Diagnosis._ Male with feathers above eye modified into horn-like protrusion, central rectrices modified into long, ribbon-like plumes of black enamel-like texture; female with upper breast, hinderrown and nape dull yellow (see Cooper and Forshaw, 1977: 194, for other characters).

_Distribution._ Waienu, Batanta and Saonek Islands, Irian Jaya.

_Atitudinal distribution and habitat._ Lowland forest.

Paradisaea guilelmi Cabanis

Diagnosis. Male with crown, throat and breast metallic oil green, long white flank feathers that are tinged yellow basally and are filamentous and lace-like distally; female with crown, sides of head, throat and upper breast chocolate brown (see Cooper and Forshaw, 1977: 198, for other characters).


Altitudinal distribution and habitat. Forest habitats, generally between 450 and about 1800 meters.

Paradisaea rudolphi species group

The two phylogenetic species recognized here are generally treated as subspecies of a very distinctive species in the genus (see Cooper and Forshaw 1977: 202, for characters). A third subspecies population does not appear to be diagnosably distinct on the basis of external characters.

Paradisaea rudolphi (Finsch)


Diagnosis. Female without significant barring on lower breast and belly; lower breast and belly chestnut in tone; throat greyish black.

Distribution. Mountains of southeastern Papua New Guinea, including the Wharton Range and Owen Stanley Ranges, westward to the Kratke Range (rudolphi), and the Herzog and Kratke Ranges (ampla).

Altitudinal distribution and habitat. Montane oak forests between 1100 and 2000 meters.

Comments. The subspecies ampla was described from very little material (Greenway, 1934). Male ampla are said to differ from rudolphi in being browner, less blackish, on the head, with the sheen of the cheeks and throat being more greenish and less bronzey. The CSIRO collections house three male ampla and one rudolphi, all collected in the early 1970s, and none of these show any diagnosable differences. The same is true for a female of each form, although the upper breast of the rudolphi specimen is slightly darker. On the basis of the present data, these populations can be considered to represent a single species.

Paradisaea margaritae Mayr and Gilliard


Diagnosis. Female with lower breast and belly uniformly barred; lower breast and belly greenish brown in tone; throat deep black.

Distribution. Mountains of the Kubor, Bismarck and Hagen Ranges west to the Tari region, Papua New Guinea.

Altitudinal distribution and habitat. Dense mountain forest, 1500 to 2100 meters.

Comments. The two species of this species group are seemingly well differentiated, although there are few specimens of margaritae available for comparison.

The Consequences of Species Concepts: Describing Evolutionary Diversity

A primary goal of systematics is to describe, and thus enumerate units of biological diversity. Systematists generally agree that species should be our basic unit of diversity,
yet seen from an historical perspective there is little agreement as to what constitutes a species. The birds-of-paradise are a case in point. In the 19th and beginning of the present century, avian systematists were in an intensive phase of exploration and naming of biological diversity. These investigators were primarily interested in cataloging life's diversity, and for most of them species represented any discernably distinct population (although to be sure some of these populations have subsequently been shown to be poorly defined). This approach to species resulted in an increasingly large number being described, many of which differed morphologically very little from one another. This conception of species naturally influenced perceptions of the number of species within the birds-of-paradise, and virtually all "subspecies" of later workers were ranked as species (e.g., Rothschild, 1898; Sharpe, 1909).

This rapid increase in the cataloging of diversity created difficulties for some workers, thus the polytypic species concept was created to unite, under a single species name, all geographically isolated populations which differed very little from one another and which presumably represented close relatives. Early in its history, then, a primary rationale for the polytypic/biological species concept, as Mayr (1942: 102-146) has stressed, was to simplify our naming of diversity:

"In 1910 was published the last complete list of all birds [the British Museum (Natural History) Handbook; Sharpe, 1909, cited above], recording 19,000 species of birds. Since that time about 8,000 additional forms have been described, but they are now arranged in 8,500 species, many of which are polytypic, instead of in 27,000 species. The total number of species to be memorized by the taxonomist has thus been cut by two-thirds. The practical advantage of this simplification is so obvious that nothing more needs to be said. The scientific advantage of the method is that the species has become once more a uniform and unequivocal concept, instead of a mixture of two different categories, true reproducitively isolated species and morphologically distinct geographic races" (Mayr, 1942: 127).

This new view of species also influence the way in which species boundaries were drawn within the birds-of-paradise, and many of the species of Rothschild, Sharpe and others were relegated to subspecies of widespread polytypic species. Under this new way of seeing species, workers have enumerated 40 to 43 species of paradisaeids (e.g. Mayr, 1941, 1962; Rand and Gilliard, 1967; Gilliard, 1969; Beethler and Finch, 1985). Adopting a phylogenetic approach to species, this paper postulates 90 species of birds-of-paradise. This number is based on the same kinds of evidence—patterns of morphological variation and geographic distribution—available to workers for much of this century. Direct evidence about the degree of reproductive isolation—presumably so critical for individuating "biological species"—has played little or no role in establishing species limits, no matter what concept has been followed.

If it is generally agreed that diagnosably distinct terminal taxa represent the products of evolutionary differentiation, then we are led to ask to what extent different species concepts accurately enumerate biological diversity and which taxonomic category best serves that purpose. Whereas 8500 species may in some sense be simpler than 27000, we must ask at what price? Supporters of the biological species concept will surely appreciate the fact that if we were to count those diagnosably distinct taxonomic entities within birds that have differentiated geographically, our count would be much closer to 27000 than to 8500. That being the case, then the biological species concept shifts the burden of counting evolutionary diversity to infraspecific taxa, in particular to the subspecies. One problem with this is that the ontological status of subspecies themselves has always been viewed with uncertainty. Mayr's early and influential view (1942: 106), that they are populations differing "genetically and taxonomically" from other such populations,
allows for a very broad interpretation—some might say unnecessarily vague—from using subspecies to name arbitrary subdivisions of clinal variation, on the one hand, to naming diagnosably distinct, allopatric populations, on the other. Within the framework of the biological species concept, the line between species and subspecies has always been drawn on subjective assessments of the degree of morphological difference and whether those differences might, or might not, translate into reproductive isolation. This has probably been the major shortcoming of the biological species concept through the years: applying the concept to allopatric populations is not uniform and unequivocal, Mayr’s statement notwithstanding (McKitrick and Zink, 1988).

The proper taxonomic framework for counting biological diversity resides with taxa of species rank, not with subspecies as required by the biological species concept. Within the birds-of-paradise the application of the biological species concept has resulted in an ambiguous status for subspecies as discrete evolutionary taxa (Table 3). Thus, about two-thirds of the subspecies of paradisaeids are discrete terminal taxa and consequently are recognized as phylogenetic species in this paper. The remaining one-third, however, are not diagnosably distinct on the basis of present evidence. Some, especially those that are allopatric, will prove to be diagnosably distinct, but others will not. On the other hand, of the 90 phylogenetic species recognized in this paper, only a few may prove not to be diagnosably distinct, including several species in the genera Epimachus, Ciaimurus and Paradisaea. When the number of named taxa is compared under the two concepts, proponents of the biological species concept have recognized approximately 110–115

Table 3
Comparison of numbers of taxa of specific and subspecific rank recognized in three systematic treatments of the birds-of-paradise. The last three columns represent taxonomic decisions made in this paper.

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a Subspecies count includes all subspecies of polytypic species.

b Number of species in Phoenicurus includes two species described in this paper.

c Number of species in Epimaclis includes one subspecies (wilcoxii) described subsequent to Mayer (1962) and Gilliard (1969).
(monotypic species plus subspecies of polyporic species), as opposed to 90 taxa under the phylogenetic species concept. Even assuming that a number of subspecies not elevated to species rank in this paper are eventually found to be distinct taxa, the total number of named taxa recognized under the phylogenetic species concept will probably not differ importantly from previous analyses.

Finally, because the biological species concept relies so heavily upon morphological distinctness as a ranking criterion, the danger always exists that polyporic species will be non-monophyletic (as Rosen, 1978, 1979, and others have discussed). Although analyses of interspecific relationships are still in progress, present evidence suggests that most polyporic “species” of birds-of-paradise are monophyletic units, that is, the terminal taxa included in them are each other’s closest relatives. One potential exception—and there may be others—is in the genus Paradisaea in which the taxa included in the P. raggiana species group have sometimes been united into a single species (e.g. Mayr, 1962). Cladistic analysis of morphological characters, however, suggests that P. decora may be closely related to terminal taxa within the P. raggiana complex (Cracraft, in prep.). If this can be corroborated, then it provides another case in which the use of polyporic species confounds speciation analysis.

An essential distinction between the two concepts of species is that the phylogenetic species concept recognizes terminal taxa (species) as the units of biological diversity—that is, those units presumably produced by various processes of differentiation—whereas the biological species concept frequently does not do this. Cataloging biological diversity accurately seems to be one of the more critical tasks of systematists, and the phylogenetic species concept is an important vehicle for doing this. The goal of systematics is not to use a species concept with the purpose of simplifying the naming of diversity. Rather, that goal is to use a concept that will facilitate the naming of all relevant products of evolutionary diversification and our understanding of their history through space and time.

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