HELM IDENTIFICATION GUIDES

STARLINGS AND MYNAS

Chris Feare and Adrian Craig

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DEDICATION

To our children
Adam, Simon, Roland and Andrew

We hope that these birds will be there for them and their children to see

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ACKNOWLEDGEMENTS

The seeds of this book were sown during the writing of the first chapter of the 1984 monograph *The Starling* (Feare 1984), but two subsequent events provided the impetus to commence what became a long gestation period; first, a chance meeting of the authors in the Natural History Museum in Tring, when both of us were working on starlings in the collection, and second, a stimulus from Christopher Helm ('If you don't do it, I'll find someone else!') to write a book for his series of identification guides.

During the gestation period, we have been fortunate to have been able to investigate some aspects of the biology and behaviour of several starling species, thereby giving us the opportunity to gain insight into some of the relationships between them. These studies involved both observations of birds in the wild and also in collections of captives. CF enjoyed valuable field trips with Kang Nee and Kamol Komolphalin in South-East Asia, and with Salvador Peris in Spain, and was able to study captive starlings with the help of Jim Irwin-Davies (Harewood Bird Garden, Yorkshire), Alan Martin (Merley Bird Gardens, Hampshire), Peter Olney (Zoological Society of London, Regents Park), and Roger Wilkinson (North of England Zoological Society, Chester). AC was assisted in field studies in Africa by Ludwig Coetzer, N Collins, Pat Hulley, Hanna Hofshi, Penn Lloyd, Gimme Walter and Francis White, and his research was funded by BirdLife South Africa (formerly the Southern African Ornithological Society), Rhodes University, and the Foundation for Research Development.

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ABOUT THIS BOOK

Starlings range from familiar species such as Common Starling and Common Myna, which are closely associated with people and have been introduced to many parts of the world, to little-known forest birds with a very restricted distribution. The family is centred on tropical Asia and tropical Africa, where two separate evolutionary radiations have occurred.

The iridescent plumage of many glossy starlings makes them some of the most colourful birds, and presents a special challenge to artists. Blues and greens in this family are structural colours, produced by light reflected from the internal structure of the feather, and not by pigments. Thus colours change with light conditions and with the position of the observer, which often complicates identification.

This is the first monograph on the starling family, and summarises our current knowledge of all species, with a comprehensive bibliography. Information from the avicultural literature is included since for some species nesting and other behaviour have never been observed in the field. Many starlings are highly social, some even nest in colonies, and co-operative breeding ('helpers at the nest') occurs in a number of African species. This book highlights areas where information is lacking, particularly for those starlings whose existence is threatened by habitat destruction.

How to use this guide

While we hope that this book will enable readers to identify every starling species in the field, we do not expect that many people will carry a hamper of bird family handbooks with them on their travels! Since there has never been a single comprehensive account of the starling family, we have tried to assemble all of the literature on the group and provide a synthesis of information on their biology. For many species, little is known, and some of them are threatened with extinction, a fate that has befallen at least five in recent history. We hope that this book will stimulate an increased interest in and awareness of the many poorly studied starling species, and in places we have been deliberately controversial in the hope of stimulating research and discussion.

In its basic format, this book follows the style of earlier volumes in this series, and readers should consult them for details of avian morphology and terminology.

Plates

All living species are illustrated, and where sexes are separable in the field, or distinctive juvenile plumages are known, these are also depicted, as are some well-differentiated subspecies. Flight illustrations are included for those species which show distinctive markings on the wings, rump and tail. On each plate the birds are drawn to the same scale, but dependent on the number of species illustrated on each plate, the scales differ between plates. Body size is indicated in the text.

The caption to each plate and map includes a brief description of the geographical range and habitat, and key identification features.

Maps

The distribution maps follow the style of other books in this series. Where birds are resident, their distribution is shown in green. For migrants, the breeding ranges are shown in yellow and the non-breeding ranges are shown in blue.

Species sequence

The sequence of genera and the numbering of species should not be considered an indication of how closely they are related. Our ideas on the evolutionary relationships of the starlings are set out in the introductory chapters.

Measurements

In all cases these have been taken from museum specimens. For all African species, and for the genus *Saroglossa*, AC personally measured a sample of adult specimens. Wing and tarsus measurements were taken in the standard manner, but all bill lengths were measured to the skull, not to the feathers at the base of the bill (see Baker, *Warblers of Europe, Asia and North Africa*, Helm Identification Series, A&C Black, for illustrations). For remaining Asian species, measurements have, where possible, been taken from the literature and the source of the information is given. Where this was not possible, museum specimens in the Natural History Museum, Tring, were measured as described above. Body mass data have been taken from museum labels, or from published and unpublished sources. Body length measurements, at the beginning of the 'Field Identification' section, are taken from museum skins, and should be used only as a guide to comparative size (see Plates above), as skin preparation techniques vary.

References to published literature

In most cases, a reference is cited after the information to which it refers, but in species accounts where one or a few references are the main sources of information for that species, these are listed at the end of the species account to avoid repetition within the account.

THE STARLING FAMILY

Sibley and Ahlquist (1990) have recently reviewed the proposed relationships of the starling family. This family was traditionally associated with the corvids (Corvidae), although there was little evidence for such a link. Von Boetticher (1931a) suggested a link with the weaver family (Ploceidae) but his comparison of bill structure, vocalisations and nesting behaviour is unconvincing since it relies on shared primitive characters. Using egg-white protein data and some biological (nesting) characters, Sibley and Ahlquist (1974) suggested that the southern African sugarbirds *Promerops* might be derived from starlings, but this relationship has not been supported by subsequent work (Sibley and Ahlquist 1990). On the basis of DNA-hybridisation data, Sibley and Ahlquist (1990) concluded that starlings are not closely related to corvids or weavers, but that starlings, thrushes (Turdidae) and flycatchers (Muscicapidae) should be included in one superfamily. More controversial is their proposal that starlings are the closest relatives of the New World mockingbirds and thrashers (Mimidae) (Sibley and Ahlquist 1984, 1990). This is an intriguing possibility but, as with many of the conclusions based on DNA-hybridisation data, we may reserve judgement until further critical studies have been carried out.

The starlings are an entirely Old World family (apart from introductions to the New World by man), with the main concentrations of species in the Indo-Malayan and Afrotropical regions. The dichotomy between the Asian and African starlings appears to have occurred early in the family's history, for primitive features appear in both groups and there is wide divergence between them in certain aspects of their behaviour. There does, however, seem to have been repeated contact between the two regions as the Asian genus, *Saroglossa*, has a representative in Madagascar, and the Wattled Starling *Creatophora cinerea* of Africa and the extinct Bourbon Crested Starling *Fregilupus varius* of Reunion Island appear to show close relationships with more advanced Asian genera like *Sturnus.*

The intra-family classification accepted in most recent check-lists (e.g. Gruson 1976, Howard and Moore 1984, Sibley and Monroe 1990) is based on Mayr and Greenway (1962), which used the classification devised by Amadon (1943, 1956). This classification was based largely on the study of preserved skin collections and more recent studies of the ecology and behaviour of some species are revealing new and more complex relationships. For example, Marien (1950) stated that 'the one constant character by which *Acridotheres* differs from *Sturnus*, a tendency for the possession of a frontal crest, is too trivial in comparison with the many features which they share to warrant excluding *Acridotheres* from the enlarged genus *Sturnus*'. We now know that there are many behavioural features, including displays and voice, which distinguish these two genera. In this book we take the opportunity to revise the classification of starlings but, as studies of the various species' biology add to our knowledge, and as studies using recently developed genetic techniques are applied to relationships within the family, we expect further revisions to be necessary. We are currently experiencing a renewed bout of debate in taxonomy over the definition of 'species', and this has implications for many who may use this book. Our elevation of some formerly subordinate taxa to the species level may alarm some avian taxonomists, may excite some birders, and will almost certainly concern conservationists who will find a few more island endemics whose status is fragile. Above all, we hope that our decisions will stimulate further research and debate about the starling family.

English names

Several species of starlings have been given a wide variety of English names in the past, and we list many of them in the species text headings; for some species, the list is so great that we do not claim to be exhaustive. The names that we have selected for each species are those that we consider to be most appropriate, often based on common usage, but we have also tended to employ names that are descriptive, either of appearance, or of geographical origin where this is applicable. With many Asian members of the family, common usage dictates that they are called mynas or mynahs. This derives from the Hindi word 'maina', which is a term of endearment, often used towards children and favoured females, and more or less equivalent to the English word 'pet' (Bertram 1970). The centre of Hinduism is India, but the word 'myna' is commonly used to refer to starlings in other regions of South-East Asia that bear a resemblance to the Indian mynas of the genus *Acridotheres* and *Gracula.* We follow this usage, but accept that it is arbitrary and people will have their own preferences for different species.

The genera of Asian starlings

Aplonis

The genus *Aplonis* contains 21 currently recognised extant species and a further three species are known to have become extinct during the last two centuries. The members of the genus are entirely island species, reaching continental land masses only on the Malay Peninsula and in southern

Vietnam, and in northeast Queensland. They are widely distributed over the islands of Indonesia, Oceania and northern Australasia. In terms of the number of species, the centre of their present distribution is undoubtedly New Guinea and its associated islands.

Aplonis comprises species of different kinds of distribution, ranging from those with a wide distribution embracing many island groups, to single island endemics, suggesting a complex evolutionary history. There are six widespread species, Shining Starling *A. metallica* and Singing Starling *A. cantoroides* of Melanesia, Asian Glossy Starling *A. panayensis* of Indonesia and the Philippines, Short-tailed Starling *A. minor*, Micronesian Starling *A. opaca* and Polynesian Starling *A. tabuensis* (Fig 1). It is tempting to think that these are recent species and there are suggestions that Asian Glossy Starling is indeed so, and is still expanding its range (Deignan 1954). Polynesian Starling has, however, lost many of the characteristics regarded as typical of these starlings (in common with many island forms) and lacks the glossy iridescent plumage of most of its congeners, resembling more closely the immature plumages of these species. A further eight species have ranges that embrace groups of islands, these ranges overlapping those of some of the more widely distributed species above, especially in the New Guinea, Bismarck and Solomons areas (Fig 2).

At the other end of the scale, species endemic to single islands or island pairs (Fig 3) might be considered to be relicts of former more widespread distributions, having been outcompeted from some areas by more recent colonists, or having lost former breeding islands through rises in ocean levels, or through a variety of other causes including, of course, habitat modification and other factors associated with colonisation by man. The extinctions of Kusai Island Starling *A. corvina* and the Norfolk and Lord Howe Island Starling *A. fusca hulliana* in recent times are probably both attributable to the introduction of rats to these islands (Fuller 1987). Some of the island endemics display a number of features that deviate from more 'typical' congeners and might be taken to indicate a long history of isolation. Kusai Island Starling was large, as is Samoan Starling *A. atrifusca* and Brown-winged Starling *A. grandis*. White-eyed Starling *A. brunneicapilla* and Long-tailed Starling *A. magna* have some of the tail feathers exceptionally elongated. Tanimbar Starling *A. crassa*, Norfolk and Lord Howe Island Starling *A. fusca* and Striated Starling *A. striata* have developed a marked sexual dimorphism. Several species have entirely (Pohnpei Mountain Starling *A. pelzelni* and Rufous-winged Starling *A. zelandica*) or largely (Mountain Starling *A. santovestris*, Norfolk and Lord Howe Island Starling, Polynesian Starling, Samoan Starling, Mysterious Starling *A. mavornata* and Rarotonga Starling *A. cinerascens*) lost gloss in the plumage. Most *Aplonis* are lowland birds but, as the names of some imply, some occupy higher altitudes. Mountain Starling and Pohnpei Mountain Starling are birds of montane forest, as was Kusai Island Starling. The lowlands of the islands on which these species occurred were occupied by more widespread and, in the cases of the last two, more generalised forms. Deignan (1954) suggested that this process of competitive exclusion was currently occurring between Asian Glossy Starling and Short-tailed Starling *A. minor*. The former species is widespread in Indonesia and the Philippines, while the latter is much more localised on Mindanao (Philippines), central and southern Sulawesi and the Lesser Sundas. In most places, Short-tailed Starling is a lowland bird but on Mindanao, where both species occur, this species occurs in montane forest above 900 m. In Sulawesi, the ranges of the two species are mutually exclusive. Deignan (1955) considered that the range of Short-tailed Starling was formerly more extensive, but was contracting under the influence of the spread of the larger and more competitive Asian Glossy Starling. White and Bruce (1986) consider that these two species form a superspecies. It is possible that other *Aplonis* starlings are experiencing interspecific competition with congeners. For example on Rennell Island, there is habitat partition between Rennell Starling *A. insularis* and Singing Starling (Bradley and Wolff 1956). Perhaps more remarkable is the co-existence in parts of New Guinea of Shining and Yellow-eyed Starlings *A. mystacea*, between which there appear to be no ecological differences (Safford 1996).

The biology of many species of *Aplonis* is poorly known and the taxonomy of the genus is likely to change as more knowledge is gained. For the time being we follow the specific identities of Amadon (in Mayr and Greenway 1962) although we have changed the order of species. Our order reflects the present biogeography of species, for we feel that to look for relationships between widely separated species that have evolved on isolated island groups is unlikely to have much biological meaning.

Shining Starling is the widespread form of Melanesia, where its range embraces that of both Singing Starling and Yellow-eyed Starling. Shining Starling has differentiated into a number of races. The monotypic Yellow-eyed Starling shows many resemblances to Shining Starling and the little information available (Coates 1990, Safford 1996) suggests that the two species may also share ecological attributes. Singing Starling is also monotypic, but appears to form a superspecies with Tanimbar Starling, which has sometimes been regarded as a race of Singing Starling (Amadon in Mayr and Greenway 1962). Atoll Starling *A. feadensis* and Rennell Starling also appear closely related to Singing Starling, and the distributions of these species are largely complementary; however, both Singing and Atoll Starlings have been found together on an island in the Ninigo group, and Singing and Rennell Starlings occur together on Rennell Island (Coates 1990). Long-tailed and White-eyed Starlings have greatly elongated central tail feathers but differ in eye colour

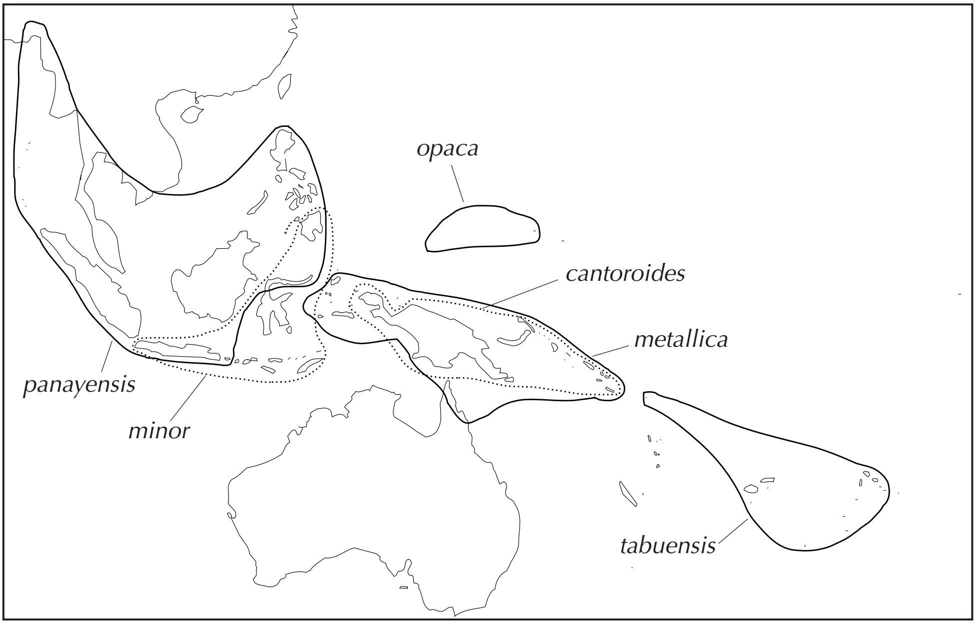


Figure 1. The distribution of the six wide-ranging species of Aplonis

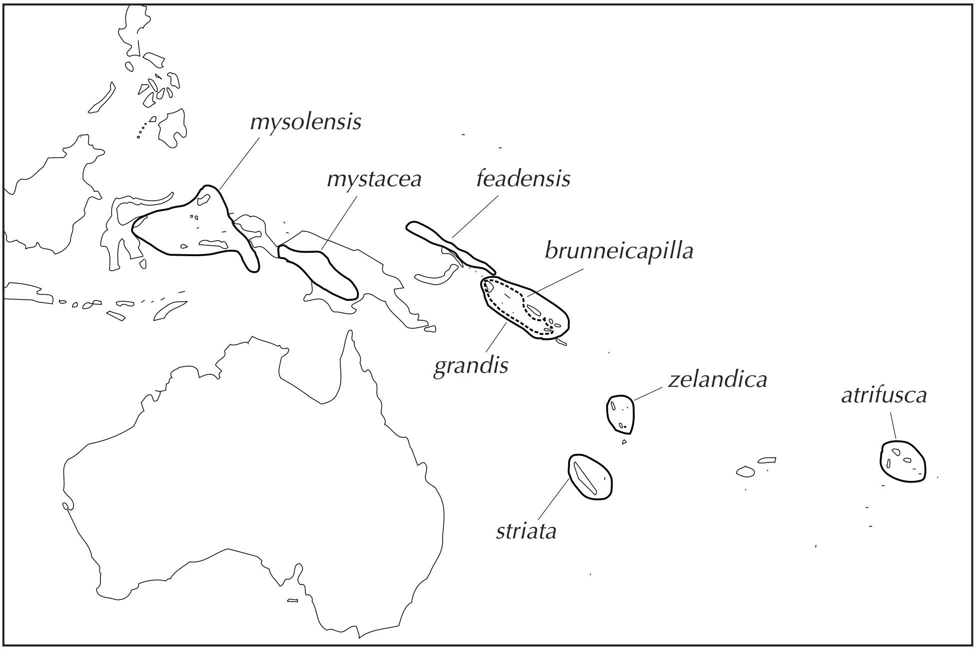


Figure 2. Eight species of Aplonis *whose ranges embrace several islands within groups*

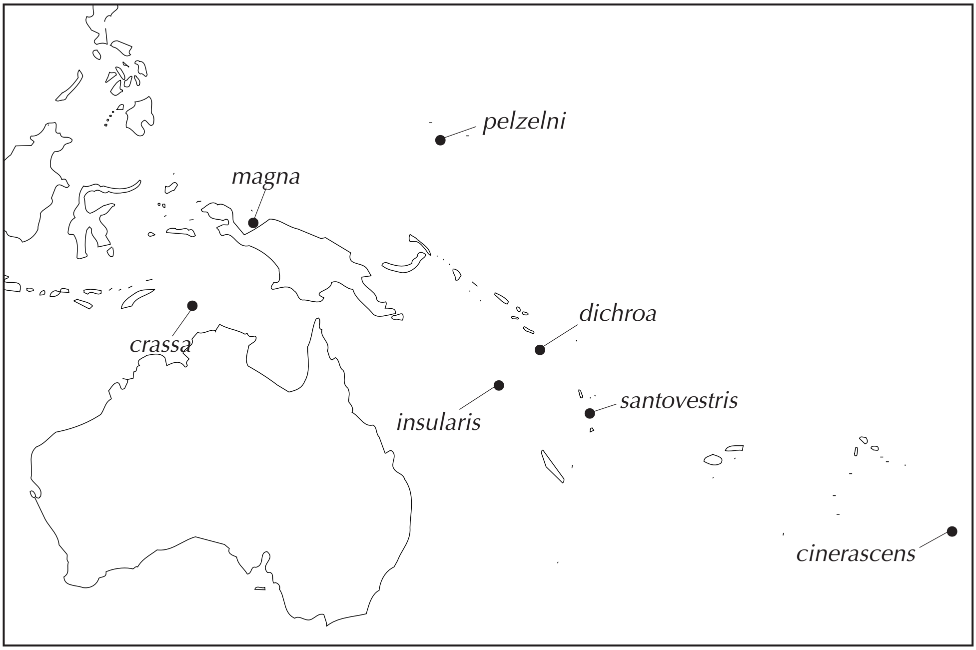


Figure 3. Island endemic species of Aplonis *(*magna *occupies two nearby islands in Geelvink Bay, Irian Jaya)*

and the latter has a slight crest; perhaps this feature and the long tail led Amadon (1956) to consider White-eyed Starling to be closely related to Yellow-eyed Starling, which to an extent shares these characteristics, while Finch (1986) considered White-eyed Starling to be most closely related to Shining Starling. Amadon (1943) linked Long-tailed Starling in a superspecies with Moluccan Starling, which also has a brown iris and long graduated tail. These possible relationships need further investigation. Brown-winged and Makira *A. dichroa* Starlings have been considered to form a superspecies, but Finch (1986) casts doubt on a close relationship; he did, however, consider that *A. grandis malaita* should be given full specific status on the basis of its eye colour, longer hackles on the head and more glossy, greener plumage than the nominate form. The remaining three species of the Melanesian region, Rufous-winged, Striated and Mountain Starlings are unrelated to each other or to other species in the region.

The close relationship between Asian Glossy and Short-tailed Starlings of the Indonesian/Philippines region, and the possible competition between them, has been mentioned above. They share general features of the glossy plumage and brightly coloured eye of the mainland New Guinea species but differ from Shining and Yellow-eyed Starlings in lacking the long graduated tail. Hoogerwerf (1965) regarded a race of Moluccan Starling *A. mysolensis sulaensis* as a race of Asian Glossy Starling, but White and Bruce (1986) doubted the validity of this subspecies of Moluccan Starling, thereby casting doubt on the relationship between the two species. With its graduated tail, Moluccan Starling more closely resembles other New Guinea species.

In Micronesia, the widely distributed Micronesian Starling is a generalised *Aplonis* species, with reduced gloss compared with Asian and New Guinea species, and has differentiated into several subspecies. The other Micronesian species, Pohnpei Mountain Starling and the extinct Kusai Island Starling are island endemics, the former being a small, dull brown bird, while the extinct species was large and glossy black with a red iris, and with a distinctively long, curved bill.

The widespread starling of Polynesia, Polynesian Starling, has, as stated above, largely lost the glossy plumage of its more typical congeners, perhaps indicating a long period of isolation from them. The other Polynesian species also have much reduced gloss although the large Samoan Starling retains slight gloss on the body plumage. The two island endemics, Rarotonga Starling and the extinct Mysterious Starling, are both smallish, largely brown birds which may be related to Polynesian Starling.

Amadon (1943) linked Raratonga and Polynesian Starlings of Polynesia in a superspecies with Micronesian Starling and with Norfolk and Lord Howe Island Starling, from the southern Melanesian area. While similarities between birds of such wide distribution might reflect a common origin from an early radiation throughout the Pacific, such similarities could equally arise through convergence. Until there is evidence, e.g. from genetic studies, to support such a relationship, we treat these species along with their geographic congeners.

Mino

Species of the genus *Mino* inhabit New Guinea and its associated Bismarck and Solomon Islands. They are lowland arboreal frugivores. Some of their features, e.g. glossy black plumage and bare facial skin, are shared with many Asian starlings, while the presence of greatly elongated and degraded feather tips, vivid orange or gold in all forms, is characteristic of this genus and only occurs elsewhere in the genus *Enodes*. The primaries have white patches about halfway along their length, with the white restricted to the inner web of the outer primary, on both webs of most of the other primaries but only on the outer web of the inner primaries; this forms a prominent white patch on the wing, conspicuous in flight. This feature is shared with Golden-crested Myna *Ampeliceps* (in which the primary markings are yellow on the outer webs), and in *Gracula*. Amadon (1943) placed *Ampeliceps coronatus* in the genus *Mino*, but later revised this opinion (Amadon 1956), retaining *Ampeliceps* as a monotypic genus. Two species of *Mino, dumontii* and *anais*, were recognised by Amadon (1943) and Sibley and Monroe (1990). Schodde (1977), however, reported that the form of *M. dumontii* of the Bismarcks and Solomons, *kreffti*, differs both morphologically and in several behavioural traits from that on New Guinea, and we follow Schodde in recognising *kreffti* as a full species.

Basilornis

The genus *Basilornis*, of Sulawesi, the Moluccas and the Philippines, shares glossy black plumage and bare peri-orbital skin with the genus *Mino*, together with white patches on the breast of three species, tinged with orange in two of them. Three of the species also have white filoplumes around the head, as in *M. dumontii*. We thus agree with Amadon (1943, 1956) that the two genera are closely related. The genus *Basilornis* differs from the genus *Mino* in lacking white wing patches and in possessing a well-developed crest. The four species of *Basilornis* show a gradation of characteristics: Sulawesi Crested Myna *B. celebensis* has the least well-developed crest, which assumes a more pronounced form in Helmeted Myna *B. galeatus* and a remarkable erect structure of partially degraded feathers in Long Crested Myna *B. corythaix*. In Apo Myna *B. miranda*, the crest feathers are degenerate and the crest appears wispy. The first three species have white patches on the cheeks and sides of the breast, tinged orange in the first two. *B. miranda* differs from the other three species in lacking white on the sides of the neck and breast, but posesses a white rump, much more extensive, bare peri-orbital skin and a long tail. *B. miranda* is also restricted to montane forest, while *celebensis*, *galeatus* and *corythaix* inhabit lowland woodlands, extending into hills in some places. Eck (1976) considered that the latter three species comprised a single species, and that Apo Myna should be allocated to a separate genus *Goodfellowia*. We follow Amadon (1943) and White and Bruce (1986) in regarding them as congeneric, the first three forming a superspecies.

Sarcops

In some ways, the Coleto *Sarcops calvus*, a polytypic species of the Philippines, takes further some of the traits seen in the genus *Basilornis*, and also shows relationships with the genus *Streptocitta*. The area of bare skin on the head is considerably enlarged, some white feathers on the side of the lower neck are retained, but it possesses no crest and lacks gloss on the body plumage. While it does not have the white rump of the genus *Mino* or *B. miranda,* feathers of the upperparts are variously tipped silvery-grey in the three subspecies. The bill is black and the tail is wedge-shaped, but nevertheless very short in comparison with the genus *Streptocitta*.

Streptocitta

The two species of *Streptocitta,* of Sulawesi and Sula, the Moluccas, are magpie-like birds, with black and white plumage and very long tails. Both have bare facial skin, restricted to the peri-orbital region in the White-necked Myna *S. albicollis*, but more extensive in the Bare-eyed Myna *S. albertinae,* in which the throat is also bare. The black parts of the plumage of both species are glossed, but white plumage is more extensive than in the genera *Basilornis* and *Sarcops*, including the belly and breast, and extending round the back of the neck in *albicollis* and on to the crown in *albertinae*. None of the white feathers have any orange tinges, but the bill and legs of *albertinae* are orange-yellow, as in *Basilornis* species, while the bill of *albicollis* is largely black and the legs are black, as in *Sarcops*.

The four genera *Mino*, *Basilornis*, *Sarcops* and *Streptocitta* thus form a group with clear relationships between them, ranging over the area of New Guinea, Sulawesi and the Philippines.

Enodes and *Scissirostrum*

These two monotypic genera of Sulawesi were regarded by Amadon (1956) as specialised offshoots of the Sturnidae. The general similarity of plumage colour, absence of gloss, small legs and feet, and pointed tail suggested to Amadon that they were related, although there are substantial differences between them. Their life styles differ, and the Grosbeak Myna *Scissirostrum dubium* is clearly highly specialised as a colonial wood-boring starling, and the waxy red feathers of the rump and flanks are a peculiarity. The bristly orange feathers that form the superciliary stripe of the Flame-browed Myna *Enodes erythrophris* bear a resemblance to similar bristly feathers on the heads of some other starlings, especially *Sarcops*, and the elongated, degraded and golden-orange tips of the rump feathers bear a strong resemblance of those of *Mino* species. Although more remote, there are thus nevertheless links between these two genera and the complex of New Guinea, Sulawesi and Philippines starlings discussed above.

Saroglossa

Saroglossa was formerly a monotypic Asian genus, but Amadon (1943) expanded it to include the endemic Madagascar Starling, previously in its own monotypic genus *Hartlaubius*. He noted resemblances in the form of the bill and nostrils, the immature plumages, the white patch in the primaries, and the spotted eggs laid by both species. There are several other bird genera that link the Malagasy avifauna to that of Asia rather than Africa (Moreau 1966), including the extinct starling *Fregilupus varius*, from Reunion (Julian Hume, pers. comm.). Benson *et al.* (1977) accepted the generic placing, but disagreed with Moreau's (1966) comment that the genus is close to the Afrotropical genus *Cinnyricinclus*. On the basis of feather melanin granule structure, Durrer and Villiger (1970) placed Madagascar Starling in a group which included *Sturnus vulgaris* and *Creatophora cinerea.* However, they did not examine feathers from Spot-winged Starling *Saroglossa spiloptera*. Beecher (1978) investigated the jaw musculature of the Madagascar Starling and on this basis grouped it with Asian starlings, noting its close resemblance to Spot-winged Starling. He also commented on its frayed tongue, apparently adapted to drinking nectar. Sibley and Monroe (1990) retained both species in the genus *Saroglossa*, but there have been no studies of the DNA of this genus. We also retain this classification, thereby accepting the Asian affinities of Madagascar Starling, but the affinities of the genus *Saroglossa* with other Asian genera are less clear.

Ampeliceps

The form of the pale yellow patches on the primaries of the Golden-crested Myna is very similar to that of *Mino species,* and the golden crown of this myna is also present in *M. anais*. In Golden-crested Myna, however, the golden crown feathers are elongated into a crest, more reminiscent of some representatives of the genera *Acridotheres* and *Sturnus*. The black glossy plumage and the pale wing markings are more reminiscent of the genus *Gracula*, however, and Golden-crested Myna shares spotting on the eggs with this genus. This myna thus appears to form a link between the genera *Mino* and *Gracula* and its distribution in Indochina, Burma and Assam is remote from New Guinea, but within the geographical area occupied by *Gracula* species.

Gracula

Hill mynas *Gracula* are glossy black birds, renowned for their ability to mimic human speech in captivity. They are characterised by highly glossy plumage, the presence of white patches in the primaries, similar to those of the genera *Mino* and *Ampeliceps*, a heavy bill with a strongly curved culmen, and fleshy yellow wattles on the head, found in no other genus (apart from the temporary black wattles of the African *Creatophora*). Their distribution includes India, Sri Lanka, Malaysia, Indochina, the Greater Sundas, Borneo, Palawan and the Lesser Sundas east to Alor. Within this area two species are generally recognised (Mayr and Greenway 1962, Sibley and Monroe 1990), Common Hill Myna *G. religiosa* and Sri Lanka Hill Myna *G. ptilogenys*, the latter endemic to Sri Lanka. We follow Bertram (1976) and Wolters (1980) in recognising the southwest Indian and Sri Lankan form *indica* as a distinct species, Southern Hill Myna *G. indica*, on the basis of its different calls and shape of the wattles, and its failure to interbreed with *G. religiosa* in captivity. We also give full specific status to Nias Hill Myna *G. robusta* and Enggano Hill Myna *G. enganensis*, both of which Ripley (1944) synonymised with *G. religiosa.* However, both taxa outlie considerably the range of variation seen in remaining races of Common Hill Myna, and as both occur on islands off the southern coast of Sumatra, there is unlikely to be genetic exchange with the mainland form. *G. robusta* is particularly distinctive, being a large, crow-like bird with a massive red bill and a considerably more extensive white wing patch, which extends on to the secondaries, than in other members of the genus, and specific status was advocated by Finsch (1899) and Riley (1929). *G. enganensis* is similar in size to *religiosa*, again with more extensive white in the primaries (although less marked than in the preceding species) which extends to the first (inner) primary. This species shows a more turquoise gloss and a stubby bill. Hoogerwerf (1963) accepted that differences in the pattern of the wattles were sufficient to confer sub-specific separation, but we consider the characters outlined above to be of more fundamental importance. Nevertheless, more information is needed on these island forms and data on behaviour and social structure should be sought in confirmation of our classification.

Hill mynas are generally resident birds that may sometimes undertake local movements, and the classification proposed here recognises several races of Common Hill Myna *G. religiosa*, with four outlying taxa that have differentiated substantially from this stock. In one of these, *G. indica*, behavioural (voice) differences have also been described and studies of the behaviour of the other species may reveal other differences between them and the Common Hill Myna. *G. r. batuensis*, of Batu Island which also lies of the southwestern coast of Sumatra, is much larger than other races of *religiosa* (but not as large as *robusta*) and was regarded as a distinct species by Finsch (1899). It has the wattle arrangement similar to that of *robusta*, but has the white wing patch extending only to the 3rd primary, as in other forms of *religiosa*; its physical distinctiveness appears not to warrant full specific status but study of its behaviour may change this viewpoint.

Gracula hill mynas are largely arboreal frugivores and this habit, and their spotted eggs, link them to mynas from further east in Sulawesi and New Guinea.

Acridotheres

Acridotheres mynas have sometimes been included in *Sturnus* (Marien 1950, Medway and Wells 1976), but they differ from that genus in being larger and more stockily built, and display different behaviour. *Acridotheres* mynas demonstrate some relationship to *Gracula* mynas in that most species have largely dark plumage, all species have white patches in the primaries and give resonant fluty calls, and some have limited bare skin around the eye. There are, however, many departures from the *Gracula* form. *Acridotheres* mynas have lost most of the gloss on the plumage, retaining it only on the head, and there is a tendency towards the development of paler areas of plumage, especially on the underparts. *Acridotheres* mynas are much more terrestrial and, associated with feeding on the ground, they show some development of the 'prying' or 'open bill probing' feeding technique, which involves pushing the closed bill into the ground and then opening it in order to make a hole to expose concealed prey; this ability involves modifications of the skull structure and musculature (Beecher 1978). Also associated with their more terrestrial life, *Acridotheres* mynas walk, whereas *Gracula* mynas hop. *Acridotheres* mynas nevertheless also eat fruit and frequently visit trees in flower to take nectar; several species have well-developed frontal crests and, after feeding on nectar, the crests of these birds can often be seen to be covered in pollen. The crest may thus have a role in pollination, suggesting a co-evolution between these birds and those tree genera to which they are primarily attracted. *Acridotheres* mynas further differ from the preceding genera in laying unmarked blue eggs, and *Acridotheres* mynas frequently indulge in bowing displays, used in courtship and at other times, whereas *Gracula* mynas appear to have no visual displays other than copulation solicitation (Bertram 1970).

The taxonomy of the 'crested' mynas is confused. Amadon (1943) recognised this and commented that they must have had a complicated evolutionary history in Indochina. These complications are still evident today, with distributional changes promoted by habitat change, especially deforestation and urbanization, and introductions. The confusion within the 'crested mynas' is exacerbated by the non-uniform use of English names. For example, *A. javanicus* has been referred to as White-vented Myna in Singapore (Hails 1987), while in central and northern parts of Thailand this species has been referred to as Crested Myna by Lekagul and Cronin (1974) but White-vented Myna by Boonsong and Round (1991). The latter authors referred 'crested' mynas of the Thai peninsula to Jungle Myna *A. fuscus*, while Medway and Wells (1976) attributed these birds to 'Jungle or Buffalo' Myna, with the specific name *mahrattensis*. Deignan (1945) used the English name Crested Myna for northern Thai birds, but allocated to them the scientific name *A. critatellus grandis*. The 'crested' mynas of central and northern Thailand are clearly different from those in Singapore (CJF, pers. obs.), and we refer the Thai birds to *A. grandis*, the Great Myna. In northeastern India, Choudhury (1991a) and Ripley *et al.* (1991) reported the occurrence of Orange-billed Jungle Mynas, to which they ascribed the specific name *javanicus*, following Ali and Ripley (1972); this is unlikely to be the Javan White-vented Myna, which is endemic to Java and Bali but which has been introduced to Sumatra and Singapore, and doubtless refers to *A. grandis*. Kang Nee (*in litt.*) considers that *javanicus*, *grandis* and *fuscus* all now occur in the Malaysian peninsula, with interbreeding and hybridisation between them.

In the taxonomy we adopt here, we depart from Mayr and Greenway (1962) and follow Sibley and Monroe (1990) in giving full specific status to *javanicus*, on the basis of its more uniform colour than *fuscus*, and its uniformly orange bill. *Acridotheres* mynas are surprisingly absent from Borneo but a geographically disjunct population occurs in southern Sulawesi; this form, *cinereus*, is distinctively pale. Amadon (1956) regarded this form, together with *javanicus,* as conspecific with *fuscus*. However, *javanicus* and *cinereus* are more similar morphologically to *grandis*, and Inskipp *et al.* (1996) treated these three as conspecific. We follow Sibley and Monroe (1990) in allocating full specific status to *grandis* and *javanicus*. Furthermore, we consider that the geographical and morphological distinctiveness of *cinereus* warrant its treatment as a full species, as advocated by Meyer and Wigglesworth (1898). This separation of *cinereus* from *javanicus* renders redundant the problem of nomenclatorial precedence raised by Sibley and Monroe (1993).

Our acceptance of Jungle Myna *A. fuscus*, White-vented Myna *A. javanicus*, Great Myna *A. grandis,* Pale-bellied Myna *A. cinereus*, Crested Myna *A. cristatellus* and Collared Myna *A. albocinctus* as full species represents our attempt to simplify terminology to what appears sensible at present, but we accept that studies of their behaviour, genetics, distribution and interbreeding, are needed and that these studies might modify our perception of their taxonomy in the future. Such studies may indicate that *A. f. mahrattensis* may warrant specific status as an endemic of southwest India, in the way that we feel *Gracula indica* does.

On the basis of voice, wing shape and pattern, leg colour and courtship behaviour, we follow Feare and Kang (1992) and include Black-winged Myna *melanopterus* in the genus *Acridotheres*; in all of these features *melanopterus* differs substantially from *Sturnus* species. Feare and Kang (1992) suggested that Vinous-breasted Myna *burmannicus*, considered by Sibley and Monroe (1990) to form a superspecies with *melanopterus*, might also be allocated to the genus *Acridotheres*. As yet there have been no studies of the social behaviour of *burmannicus*, but K. Komolphalin (*in litt.*) has informed us that it performs bowing movements, is round-winged with a wing pattern resembling that of other *Acridotheres* mynas, and its calls have the fluty quality of Common Myna *A. tristis*. We therefore place *burmannicus* alongside *melanopterus* in the genus *Acridotheres*. This represents a departure from Mayr and Greenway's (1962) and Sibley and Monroe's (1990) classification, where these two species were placed in the genus *Sturnus.* The colour differences between these species and more typical *Acridotheres* species in fact simply take further traits that already exist in this genus, for Jungle Myna has pale lower underparts and Common Myna has pale underparts and browner plumage.

Leucopsar

Bali Myna *Leucopsar rothschildi*, with all-white plumage except for black-tipped primaries and a black tip to the tail, takes to an extreme form the lightening of the plumage seen in several *Acridotheres* species: *tristis, burmannicus, melanopterus*. Bali Myna shares with *Acridotheres* species a stocky body with rounded wings and short tail, unspotted eggs, bare skin around the eye, and courtship and contact behaviour involving raising and lowering the head, and is clearly closely related to that genus. Wolters (1980) included both Black-winged and Vinous-breasted Mynas in the genus *Leucopsar*; all three species have erectile crests but this is much larger in Bali Myna. Stresemann (1912) considered it to be structurally close to Black-collared Myna *Gracupica nigricollis*. We retain Bali Myna in the monotypic genus *Leucopsar*, rather than linking it with *Acridotheres*, since the species is extreme in several ways: the crest is greatly elongated and erectile, much more so than in any *Acridotheres* species; the plumage is largely white and has lost the distinctive wing pattern of the *Acridotheres* genus, formed by white bases to the primaries contrasting with an otherwise dark wing; the bill and legs are not yellow as in *Acridotheres*, and are proportiontely more massive; display movements are more pronounced, and rather than bowing involve movements of the head which can be exaggerated to include bobbing of the entire body; and song differs markedly from that of *Acridotheres*, lacking the fluty resonant quality of that genus.

Gracupica

Amadon (1943), Greenway and Mayr (1962) and Sibley and Monroe (1990) included Black-collared Myna *nigricollis* and Asian Pied Myna *contra* in the genus *Sturnus*, although Amadon (1943) recognised that his definition of *Sturnus* contained a numbers of diverse forms. Wolters (1980) retained several genera which these other authors had synonymised with *Sturnus*, and allocated *nigricollis* to the genus *Gracupica* and *contra* to the genus *Sturnopastor*. Both species show affinities to each other and show closer affinities to the genus *Acridotheres* than to *Sturnus*. They both have similarly pied plumage, although there are differences in detail, and both are unusual among the starling family in building large domed nests with a side entrance. Affinities to the genus *Acridotheres* are shown by: calls which resemble those of that genus; they consort mainly in pairs throughout the year although larger groups sometimes form; display during courtship and at other times includes bowing; in flight the wings are rounded, rather than pointed; both genera have bare skin around the eye and yellowish legs. Furthermore, Beecher (1978) claimed that *nigricollis* is clearly related to the genus *Acridotheres* in its skull structure and musculature, although its bill is long and more typical of the genus *Sturnus*. On these morphological and behavioural grounds we accept that these two species are close to *Acridotheres* and more remote from the genus *Sturnus*, and on the basis of their similarities to each other place them together in the genus *Gracupica*.

Temenuchus

Brahminy Starling *Temenuchus pagodarum* was included in the genus *Sturnus* by Amadon (1943), Greenway and Mayr (1962) and Sibley and Monroe (1990). It differs from typical *Sturnus* species in having a crest, bare skin behind the eye and more rounded wings. It is also less gregarious, usually living in pairs or family groups, like birds of the preceeding two genera, but it does congregate in larger numbers where food is plentiful and at communal night roosts (Ali and Ripley 1972). Although it spends much time feeding on the ground, it also forages arboreally, eating fruits and visiting flowers, and has a brush-tipped tongue adapted for taking nectar (Beecher 1978). There appear to be no good descriptions of courtship, but Henry (1971) and Tyagi and Lamba (1984) mentioned head movements, perhaps allying this species closer to the genera *Acridotheres* and *Gracupica*, rather than to *Sturnus* in which wing movements are more evident. Structurally, the skull of *pagodarum* differs from *Sturnus* species, in particular showing little adaptation for prying (Beecher 1978). Sontag (1992) noted similarities between the behaviour of Brahminy Starlings and Chestnut-tailed Starlings and considered them to be closely related. On the basis of this evidence, we feel that *pagodarum* should be retained in the monotypic genus *Temenuchus*, but accept that its affinities are unclear.

Sturnia

Amadon (1943), Greenway and Mayr (1962) and Sibley and Monroe (1990) included in the genus *Sturnus* a group of small, pointed-winged starlings which are largely arboreal, unlike more typical *Sturnus* which spend much time on the ground. These are Purple-backed Starling *Sturnia sturnina*, Red-cheeked Starling *S. philippensis,* White-shouldered Starling *S. sinensis,* Chestnut-tailed Starling *S. malabarica*, White-headed Starling *S. erythropygia* and White-faced Starling *S. albofrontata* (this species has been referred to as *S. senex* in most texts, but Mees (1997) demonstrated that the species was originally described by Layard under the specific name *albofrontata*). White-headed, White-faced and Chestnut-tailed Starlings form a superspecies, and further information on the behaviour of the southwest Indian form of Chestnut-tailed Starling *S. malabarica blythii* may suggest that it should be elevated to an endemic species of that area. Beecher (1978) found that these species (and others) differed from *Sturnus* species in having broader, shorter skulls which are less well adaptated for prying. These features render these species sufficiently different from *Sturnus* species to be placed in a separate genus and, while Wolters (1980) allocated them to several genera, we prefer to treat them all as *Sturnia*.

Pastor

Rose-coloured Starling *Pastor roseus* was lumped, along with *Sturnia* and others, in the genus *Sturnus* by Amadon (1943) and by Sibley and Monroe (1990), but has been retained in the monotypic genus *Pastor* by Beecher (1978) and Wolters (1980). We follow the latter authors in retaining the genus *Pastor*. Its reduced specialisation for prying may in fact represent a specialisation to its breeding season diet, which consists predominantly of surface-dwelling grasshoppers and locusts, and it is notable that another species with a similar diet, the Wattled Starling *Creatophora cinerea*, shows a similar reduced development of the skull for prying. The Rose-coloured Starling's courtship display, involving parading on the ground, has presumably evolved in association with its habit of breeding in holes in the ground, rather than higher in trees, as in *Sturnus* species. It shares many features with the genera *Sturnia* and *Sturnus*, for example its formation of large flocks and colonial breeding, its strongly migratory habit, and the juvenile plumage is very similar to that of Common Starling *Sturnus vulgaris*. A similar juvenile plumage is also seen in some *Acridotheres* species, however, and other resemblances to that genus include a well-developed glossy crest on the crown and nape and an arched culmen.

Sturnus

In the genus *Sturnus*, the evolution of the skull structure and musculature as an adaptation for prying is taken to its extreme in the starlings and mynas. This is associated with the terrestrial habit of the *Sturnus* genus, and doubtless facilitated the expansion of the geographical distribution of these species out of the humid tropics of South-East Asia to the more arid lands to the north and northwest. We include in the genus *Sturnus* Red-billed Starling *S. sericeus*, White-cheeked Starling *S. cineraceus*, Common Starling *S. vulgaris* and Spotless Starling *S. unicolor*. Common and White-cheeked Starlings share many attributes of structure and behaviour and are ecological counterparts in the East and West Palearctic. Their similarities, especially in the structure of the skull and its musculature, and its advanced adaptation for prying led Beecher (1978) to regard them as a superspecies, although Wolters (1980) allied White-cheeked Starling with Asian Pied Myna in the genus *Sturnopastor*. Red-billed Starling is relatively poorly known and shows some affinities with *Acridotheres* species in its white bases to the primaries and yellow-orange legs. Wolters (1980) included it in the genus *Sturnopastor* with *cineraceus* and *contra*. However, in flight it has pointed wings, it associates in large flocks and its calls are reminiscent of those of Common Starlings and unlike those of *Acridotheres* species (G. Carey, *in litt.*). Common and Spotless Starlings are clearly closely related and the latter may represent a relict of a population that survived in a refugium during a retraction of the range of *vulgaris.* Now that their ranges overlap in southwest France and northeast Spain, limited interbreeding demonstrates their close relationship.

The genera of African starlings

Some species of African starlings have spectacularly iridescent plumage. This iridescence is produced by the structure of the melanin granules within the feathers, and the resulting blues and greens are structural colours, not based on pigments (Durrer and Villiger 1967, 1970). Since the morphological basis of the colour should be a more reliable indicator of relationship than the superficial appearance of the plumage, all the African starling species have been investigated using transmission electron microscopy to reveal the structural patterns within the feathers (Craig and Hartley 1985). These data, together with unpublished studies of the surface structure of feathers by scanning electron microscopy (M. Smith, pers. comm.) and current investigations of skeletal characters, have been used to reassess the traditional generic arrangements. An analysis of 48 morphological and behavioural characters using both PAUP and HENNIG86 suggests the relationships among the genera shown in Figure 4 (Craig, in press b).

Creatophora

This is the only African starling which shows close links with Asian starlings, in particular the *Sturnus–Acridotheres* group. This is most striking in its jaw musculature and feeding behaviour, as it is the only African species which can perform open-bill probing or prying (Zirkeln of German authors) in the grass mat . The bare facial skin of the male is also a characteristic shared with several Asian starlings, but otherwise not found in the African representatives. The melanin granules show the primitive type of structure and patterning, so this is not suggestive of possible relationships (Craig and Hartley 1985).

Speculipastor

Speculipastor bicolor is a little-known nomadic East African starling. In general appearance and sexual dimorphism it is most like *Grafisia torquata*, though this link is not supported by melanin granule characteristics (Craig and Hartley 1985). Amadon (1943) placed this species in the genus *Spreo*, but subsequently recognised the genus *Speculipastor* (Amadon 1956), originally described by Reichenow (1879).

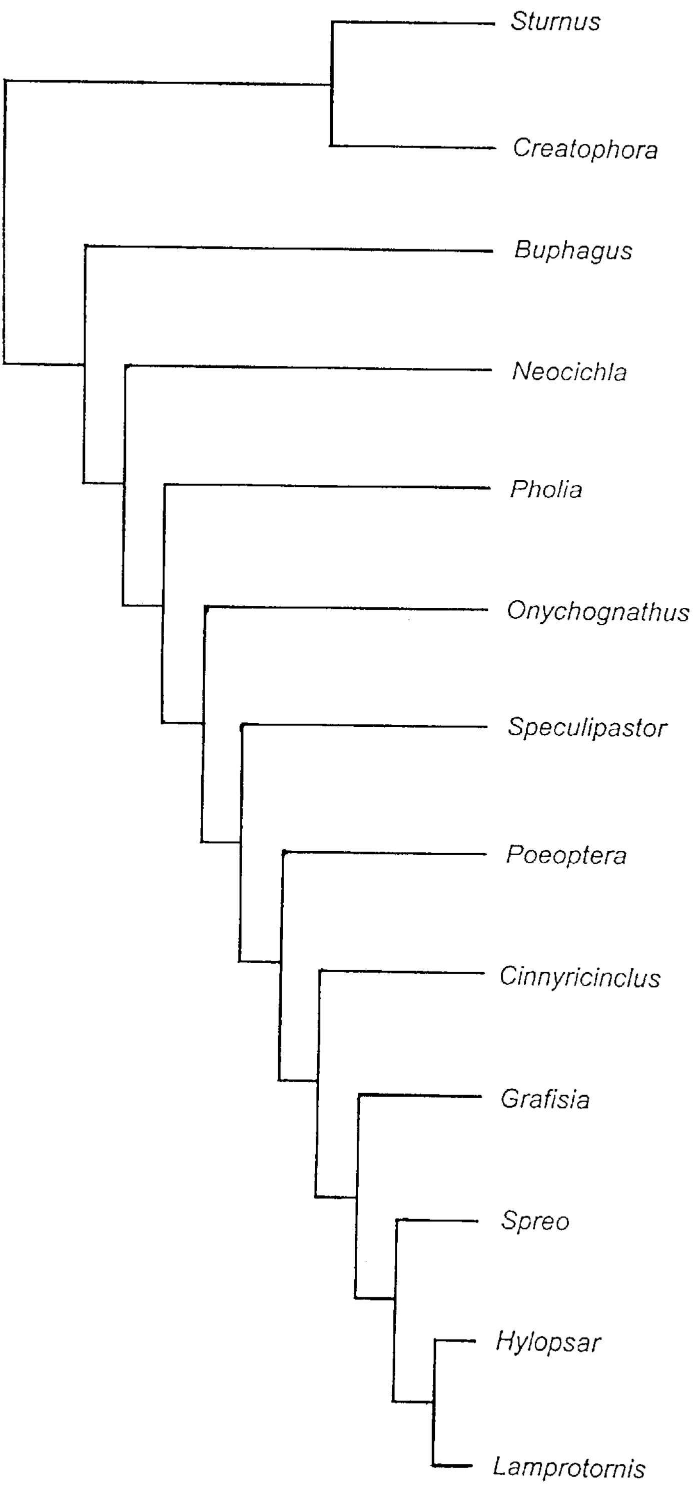
Grafisia

First described from Cameroon by Reichenow (1909) as *Spreo torquatus*, *Grafisia torquata* is a starling of central African woodland. Later a specimen from Zaïre was described as a new species, *Stilbopsar leucothorax* by Chapin (1916), who placed it in the same genus as *S. (Poeoptera) kenricki and stuhlmanni*. Bates (1926) noted that the latter two species belong in *Poeoptera*, and argued that *torquatus* is not in the genus *Spreo*, particularly in view of its sexual dimorphism, and he erected the genus *Grafisia*. Amadon (1943) initially returned White-collared Starling to the genus *Spreo*, but later reinstated *Grafisia* (Amadon 1956). However, its relationships remain obscure. The feather melanin granules are of the primitive, solid type according to Durrer and Villiger (1970), but Craig and Hartley (1985) found them to be of the same type as those of the typical members of the genus *Spreo*.

Neocichla

The sole member of the genus *Neocichla* is endemic to the belt of central African woodland known as *Brachystegia*. This species was originally described as a babbler in the genus *Crateropus* (Bocage 1871), and Sharpe (Layard and Sharpe 1884) retained it in the family Timaliidae, but erected a new genus for it on the basis of the very short first primary and the length of the tail coverts. Amadon (1943) excluded it from the Sturnidae, although Friedmann (1930) had suggested that it might be a starling. Chapin (1948) argued that *Neocichla* was a starling on the basis of morphology, juvenile plumage and the reports of its behaviour, and predicted that it would be found to nest in tree holes. Subsequently Amadon (1956) included the genus *Neocichla* in the Sturnidae, and this has been generally accepted. The feather melanin granule structure provides no new information on its relationships (Craig and Hartley 1985), and it certainly warrants further study. As noted by Chapin (1948), characters such as the white tail spots and pale-coloured legs are more typical of Asian than African starlings.

Figure 4. Diagram showing the possible relationships among the genera of African starlings



Cinnyricinclus

One of the most beautiful of all starlings is the male Amethyst Starling *Cinnyricinclus leucogaster*. This species has a unique feather melanin granule structure for the starling family, though similar to the arrangement found in peacocks *Pavo* sp. (Durrer and Villiger 1970, Craig and Hartley 1985). The female is dull-plumaged, but has a rufous patch in the wing feathers. Two other species have been included in the same genus, but we would prefer to place them in the genus *Pholia*.

Pholia

The genus *Pholia* was described by Reichenow (1900) for the species *Pholia hirundinea* (= *Pholidauges sharpii* Jackson 1898), and placed in the family Muscicapidae on the basis of the broad, flattened bill. The collector (Fuelleborn) reportedly wrote that the birds were seen flying in and out of holes in a steep rock-face, in the manner of swallows, and were apparently nesting there (Reichenow 1900). This observation must however refer to a different species. Later Reichenow (1903) placed the genus *Pholia* in the Sturnidae, with the single species *Pholia sharpii*.

Earlier Shelley (1889) had identified as *Pholidauges (Spreo) fischeri* a male specimen from Kilimanjaro. This is clearly the same species which Richmond (1897) described as *Pholidauges femoralis*. He commented that it was very similar in size to *Spreo fischeri* and *Cinnyricinclus leucogaster*, but it was unlikely to be the male of *S. fischeri* as Shelley (1889) had suggested. However, Reichenow (1903) placed *femoralis* in the genus *Spreo*, while Shelley (1906) used the genus *Cinnyricinclus* for *leucogaster, fischeri, sharpii* and *femoralis*.

Oberholser (1905) created a new genus *Arizelopsar* for the species *Pholidauges femoralis*, but the distinguishing features used are trivial, and no other authors have accepted this genus. Amadon (1943) placed the three species *femoralis, leucogaster* and *sharpii* in the genus *Cinnyricinclus*, although he admitted that *femoralis* and *sharpii* were much closer to each other than to *leucogaster* (Amadon 1956). Hall and Moreau (1970) retained these three species in the genus *Cinnyricinclus*, stressing the spotted juvenile plumage as a common characteristic. Sibley and Monroe (1990) and Dowsett and Forbes-Watson (1993) have also followed this arrangement. However, the feather melanin granule structure is very different (Craig and Hartley 1985), and together with the sexual dimorphism of Amethyst Starling, there are good grounds for placing them in separate genera, as was done by Sclater (1930).

Cosmopsarus

This genus formerly included two long-tailed species endemic to East Africa. Reichenow (1879) defined the genus by the bill shape, wing proportions and tail structure. He noted that species from this genus were similar to those of the genus *Lamprotornis* but were more slender with narrower rectrices, a smaller first primary, and were markedly different in colour (Reichenow 1903). Amadon (1943) included these two species in his enlarged genus *Spreo*, but later restored them to the genus *Cosmopsarus* (Amadon 1956). However, White (1962) placed both species in the genus *Spreo*. The close relationship between the brilliantly-coloured *C. regius* and the drab *C. unicolor* has never been questioned, and they have been grouped as members of a superspecies (Hall and Moreau 1970). However, the feather melanin granules of *C. regius* have the same structure and arrangement as those of *Lamprotornis* species, whereas those of *C. unicolor* are clearly different, like those of the typical members of the genus *Spreo* (Craig and Hartley 1985). Thus we propose transferring both species to these genera; such a radical re-arrangement is bound to stimulate debate and further study! Short *et al.* (1990) noted that *C. regius* and *unicolor* should not be placed in the same superspecies, but made no changes to the generic names, and Dowsett and Forbes-Watson (1993) retained both species in the same genus.

Lamprotornis

Lamprotornis is the largest genus of African starlings. Tail length is highly variable; formerly the group was split into the short-tailed *Lamprocolius* and long-tailed *Lamprotornis* (Hartlaub 1859, 1874, Sclater 1930). No recent authors have regarded this as good grounds for splitting the genus as long tails seem to have developed independently several times (Craig, in press a), and even Wolters (1975–82) includes 16 species in this genus, in eight subgenera. Stresemann (1925) argued that increasing tail length always produced a graduated tail, and even included *L. acuticaudus* in *L. chloropterus* on the basis of other similarities. Sibley and Ahlquist (1990) differ only in treating *L. (chloropterus) elisabeth* as a full species, and include some species usually placed in *Spreo* (see below). In a study of wing pterylography, Naik (1970) compared two species of *Lamprotornis* as defined here with members of the Asian genera *Aplonis, Acridotheres, Gracula* and *Sturnus*, but found no significant differences.

All *Lamprotornis* species are predominantly glossy blue or greenish dorsally, with a common pattern of hollow, oval, melanin granules arranged in a single layer close to the surface of the feather