

Order CUCULIFORMES

A diverse and heterogeneous group, thought on the basis of DNA–DNA hybridization studies (Sibley & Ahlquist 1990) to comprise six families: (1) CUCULIDAE: True cuckoos and koels of Old World; all parasitic; roughly 46–54 species in 13–17 genera; *Cuculus* and *Chrysococcyx* largest genera (both in HANZAB region); (2) CENTROPODIDAE: Coucals, ground-cuckoos and couas of Palaeotropics; non-parasitic; about 39–42 species in three genera; (3) COCCYZIDAE: New World cuckoos, with about 18 species; (4) OPISTHOCOMIDAE: Monotypic Hoatzin *Opisthocomus hoatzin* of Amazonia; systematic position disputed and sometimes thought to be closer to Galliformes (e.g. Brush 1979; Campbell & Lack 1985); Sibley & Ahlquist (1973) suggested most closely related to Guira Cuckoo *Guira guira* (Crotophagidae); (5) CROTOPHAGIDAE: Anis of Neotropics; four species in two genera; gregarious, non-parasitic, communally breeding species; (6) NEOMORPHIDAE: New World ground-cuckoos and road-runners; 13 species, three of which parasitic, in six genera. About 143 species in total; on all continents except Antarctica, with species diversity greatest in the Tropics; generally absent from higher latitudes of North America and Eurasia, and s. South America (s. Chile and Argentina). Cuculiformes appear to be an ancient lineage with no close living relatives (Sibley & Ahlquist 1990). Turacos, or louries (Musophagidae), endemic to Africa, have traditionally been placed in this order (e.g. Sibley & Ahlquist 1972), but studies of DNA–DNA hybridization (Sibley & Ahlquist 1990), osteology, myology and pterylography (Lowe 1943), structure and pigmentation of feathers (Brom 1991; Dyck 1992), and development of young, diet and feather lice (Rowan 1983) suggest there are no close affinities between the turacos and Cuculiformes; they are best kept separate ordinarily (Rowan 1983; Fry *et al.* 1988; *contra* Campbell & Lack 1985).

Range from small (c. 15 cm) to large (c. 70 cm). Most have rather short, slender bills; straight or decurved; in some, bills large to massive (e.g. *Scythrops*). Holorhinal; nares more or less impervious. No basipterygoid processes; no cere; and rostrum immovable. Palate desmognathous, with small vomer. Fourteen cervical vertebrae (13 in *Clamator*), 17–18 presacral vertebrae, four dorsal vertebrae; atlas perforated; furcula present, no bony canal formed by coracoid, four ribs each sternum. Foot zygodactyl, with fourth toe permanently reversed; flexor tendons type 1; podotheca scutellate. Oil-gland, bilobed; naked in most families; has small tuft in some Opisthocomidae. Afterfeathers absent or small, eyelashes present. Ten primaries; 9–13 secondaries, eutaxic; usually ten rectrices (eight in Crotophagidae).

One species at least, the Common Cuckoo *Cuculus canorus*, has been known since antiquity because the calls of males during the breeding season attract attention and because its parasitic habits are mysterious and intriguing. For centuries, its two-note call has been incorporated in madrigals and in the works of such composers as Beethoven, Delius and Saint-Saens. The vernacular name of the bird in many languages is based onomatopoeically on its call. Parasitic habits were first recorded in ancient Vedic literature about 2000 BC for Common Koel *Eudynamis scolopacea* (Friedmann 1964) and Aristotle (384–322 BC) was aware of the matter. Yet the breeding habits of many species are still unknown or incompletely known. Many species were first described scientifically in the last half of the 18th century by such workers as Linnaeus and Latham; nearly all had been described by the middle of the 19th century, though there has been much re-arrangement since then into genera and subspecies. All species that occur in Aust. and NZ had been described by 1867, by Latham, Gould, Horsfield, Gmelin and others.

The mobility of members of the Order is as diverse as its other characters. All species are capable of flight, which varies from the swift and direct flight of long-distance migrants with their comparatively long, narrow and pointed wings (e.g. Oriental Cuckoo *Cuculus saturatus*), to the gliding flight of short-winged tropical forest-dwelling malkohas, and the awkward slow flight of short-winged tropical coucals (Centropodidae). Within Cuculidae, the flight of larger species is generally swift, noticeably direct, undulating and rather hurried, with deep rapid wing-beats not rising above the horizontal and often surprisingly like the flight of small species of *Accipiter*; indeed the general appearance, flight-silhouette and actions of these cuckoos bears some resemblance to these small birds of prey so that several species bear the name hawk-cuckoo. Species of *Cacomantis*, however, fly from perch to perch directly with undulating flight or bursts of rapid wing-beats interspersed with short glides. *Scythrops* often flies in pairs and quite high, with strong powerful wing-beats. Most adult cuckoos have a long tail which is used both as a rudder in slow flight and, in the case of cursorial ground-living cuckoos, as a steering device. Typical cuckoos awkward on ground, with shuffling walk (body and tail swivelling) and hopping. When on ground, coucals are generally slow and clumsy in their movements, but move rapidly in pursuit of prey. When capturing ground-prey, move forward with slow stalking walk, changing to hop and run when close to prey, and either ambush or chase down prey using 'flush and rush' method.

Only Cuculidae and Centropodidae occur in HANZAB region, and other families not considered further here. Occur in most habitats, from open shrublands in arid and semi-arid zones to tropical rainforest. Some species largely arboreal; others at least partly arboreal; and others largely terrestrial (especially Centropodidae). Migratory and resident (Payne 1997). Most detailed migration studies of Black-billed *Coccyzus erythrophthalmus* and Yellow-

billed Cuckoos *C. americanus* (Coccyzidae); these species migrate at night, orientate by stars and make direct flights of up to 4000 km (Payne 1997). Worldwide, species of Cuculidae resident, migratory and partly migratory. Tropical species tend to be resident, and temperate species tend to be migratory. Where species have widespread latitudinal distributions, same pattern of tropical residents and temperate migrants often apparent at populational level (Payne 1997). Worldwide, all Centropodidae considered resident except for populations of two species inhabiting dry areas, which are apparently migratory (Payne 1997). Nearly always solitary or, in monogamous species, in pairs. Most coucals and some cuckoos monogamous; others promiscuous. Monogamous species generally territorial. Vocal, advertising territories and for mates. Displays, both agonistic and sexual, well developed. Courtship feeding probably universal. For full details of social organization, social behaviour and breeding, see Family discussions.

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Family CUCULIDAE true cuckoos and koels

About 46–54 species of obligate brood-parasites in about 13–17 genera; 13 species in five genera in HANZAB region. The limits of Cuculidae not firmly established, and whether or not allied, non-parasitic forms (i.e. the 15 or so species of Old World malkohas [Phaenicophainae]) should be regarded as Cuculidae is not clear; status of extralimital *Clamator* is complex (unusual in possessing large crests, and in details of sequence of moult, structure of sternum and pelvis, and pelvic musculature) and warrants investigation (Schodde & Mason 1997). Following Schodde & Mason (1997) we only discuss true cuckoos and koels (including *Clamator*) in the following summary.

Small to large, rather slender birds. Following diagnosis based on Witherby et al. (1938) and Schodde & Mason (1997). Bills slightly decurved, and usually small, though bill stout in some, and massive in *Scythrops*; nostrils swollen and rounded, often with distinctive ‘crater-shaped’ raised rim; and rictal bristles vestigial. Nasal septum imperforate. Palate desmognathous, with vestigial and incomplete vomer; maxillary processes swollen and straight; lachrymals moderately enlarged to vestigial, sometimes almost reaching jugal bar, free from thin, varying enlarged ectethmoids; basipterygoid processes vestigial. Atlas notched or perforated; 14 cervical vertebrae (13 in *Clamator*). Sternum double-notched to almost entire on either side, both spina interna and externa present (fused in *Clamator*) or only spina externa (*Eudynamys*, *Scythrops*). Muscle formula ABXY or AXY (ABEXY in *Clamator*). Feet rather weak, adapted for perching; zygodactyl, with outer toe permanently reversed; tarsi, scutellate; toes have short claws; hypotarsus has two closed canals. Carotids paired. Syrinx tracheo-bronchial. Tongue small, cartilaginous. No crop; caeca present, rather long. Uropygial gland well-developed, naked. Plumage of body, soft and sleek; no down or afterfeathers; contour feathers close in varied tracts but without apterium between dorsal-cervical and interscapular tracts. Wings usually pointed, rounded in some; ten primaries; 9–12 secondaries, eutaxic; four feathers in alula. Tail ranges from short to long and graduated; ten rectrices.

Adults often intricately patterned; not usually brightly coloured, but some species brilliantly glossed green (e.g. *Chrysococcyx*) or blue-black (e.g. koels). Most have barred tails; some have brightly coloured bare parts. Sexual dimorphism in plumage striking in many species, slight to negligible in many others; *Cuculus* often polymorphic, with barred (so-called hepatic) morph only occurring in some or all females. Males often slightly larger than females. Young altricial and nidicolous; hatch naked or with sparse, stiff, hair-like down; in first week of life, species that evict eggs from host-nest (e.g. *Cuculus*, *Chrysococcyx*; see species accounts) have hollow in back in which balance host’s egg while it is pushed from nest. Colouring of nestlings mimics that of host-nestlings in some species (see below for more details). Juveniles usually differ markedly from adults; adult plumage usually attained in complete first or second pre-basic moult when no more than 1 year old. Primaries replaced in complex ‘transilient’ sequence that varies markedly between species; see Stresemann & Stresemann (1961, 1966) for reviews.

Occur throughout Eurasia, Africa and Madagascar, to islands of sw. Pacific Ocean and A’asia; distribution centred in Palaeotropics (Schodde & Mason 1997). In Aust., one species or another spread throughout continent; Pallid Cuckoo *Cuculus pallidus* and Horsfield’s Bronze-Cuckoo *Chrysococcyx basalis* are the most widespread, occurring in all States; most others are confined to, or more common, in e., n. and sw. Aust. (Aust. Atlas; see species accounts). In NZ, Shining Bronze-Cuckoo *C. lucidus* widespread in most regions, and the Long-tailed Cuckoo *Eudynamys*

taitensis, though more restricted in range, is also quite widespread (NZ Atlas; see species accounts). Worldwide, inhabit a wide variety of habitats, ranging from open shrublands in arid and semi-arid zones (e.g. Black-eared Cuckoo *Chrysococcyx osculans*) to tropical rainforest (e.g. Chestnut-breasted Cuckoo *Cuculus castaneiventris*). For parasitic species, breeding habitat is as that of host-species (and no details are given in the texts).

Migratory, partly migratory or resident. Species breeding in temperate regions usually but not always strongly migratory; for example, reasonably well-known European breeding population of Common Cuckoo *Cuculus canorus* breeds Apr.–July, and moves to sub-Saharan Africa in n. hemisphere autumn and winter, thus crossing the Equator; most cuckoos or populations of cuckoos breeding in s. Africa are migratory (Payne 1997; BWP). In HANZAB region, only Chestnut-breasted Cuckoo thought to be non-migratory, though some species poorly known (e.g. Black-eared Cuckoo); Oriental Cuckoo *Cuculus saturatus* spends non-breeding period in n. Aust., moving from breeding grounds in Asia (BWP). Most species breeding in HANZAB region move to non-breeding areas in lower latitudes, in n. Aust., Asia or Pacific islands (e.g. Long-tailed Cuckoo). In many cases relationship between breeding and non-breeding areas poorly known (e.g. Brush *Cacomantis variolosus* and Pallid Cuckoos) and complicated by overlap of populations during migration (e.g. in e. Aust. for the Shining Bronze-Cuckoo) or on non-breeding grounds (e.g. in Moluccas for Channel-billed Cuckoo *Scythrops novaehollandiae*). In some species, populations in n. Aust. appear to be resident (e.g. Shining Bronze-Cuckoo, Goulds Bronze-Cuckoo *Chrysococcyx russatus*) and in a number of species extralimital forms are non-migratory (e.g. populations of Little Bronze-Cuckoo *Chrysococcyx minutillus*). Some species make long trans-oceanic flights (e.g. Long-tailed Cuckoo). Commonly strike windows and lighthouses during migration. Young of many species thought to remain for first year in breeding range, or in non-breeding range; thus often thought to account for out-of-season records. Some evidence that young leave breeding areas after adults; in at least some extralimital members of family that are migratory (e.g. Common Cuckoo), adults leave breeding grounds before young (BWP). Similar pattern is apparent in at least some species breeding in HANZAB area, e.g. Fan-tailed Cuckoo *Cacomantis flabelliformis* and Pallid Cuckoo (see accounts). Some migratory species appear to lay down pre-migratory fat (Payne 1997); a little evidence suggests this may occur in at least some species in HANZAB region (e.g. Oriental Cuckoo, Bigg & Bigg 1988); further research needed. At least some migrate at night (e.g. Pallid Cuckoo and Long-tailed Cuckoo). Appears to be little strong evidence for any strictly diurnal migrants in HANZAB area (see accounts); claim that Channel-billed Cuckoo migrates during daytime (Payne 1997) neither differentiates migratory from local movements nor accounts for evidence of nocturnal movements (see account).

Understanding of movements hampered by lack of knowledge of relations between detectability and calling. For example, arrival dates based on first calling assume birds call as soon as they arrive; additionally, earliest arrivals might not be indicative of main arrival. Consequently, first arrivals based on calls warrant cautious interpretation. Further, problems relate to difficulty with assigning birds as breeders or non-breeders; e.g. breeding populations of Channel-billed Cuckoo on Bismarck Arch. only recently discovered (Mason & Forrester 1996). Further studies of geographical variation (e.g. Gill 1983) needed.

Mainly insectivorous; many specialize on hairy, sometimes toxic, caterpillars usually avoided by other birds. Stomachs often found to be lined profusely with hairs from caterpillars. Not all insectivorous: in HANZAB region, Common Koel *Eudynamis scolopacea* and Channel-billed Cuckoo eat fruits as well as insects, and Long-tailed Cuckoo rather carnivorous, eating small vertebrates. Mostly diurnal feeders, though, in HANZAB region, Long-tailed Cuckoo at least partly nocturnal. Forage solitarily, less often in pairs; may occasionally form small feeding groups. Feed mostly on or near ground, though able to obtain food at any level, from tops of trees to ground. Usually hunt through foliage and glean prey as they hop or creep about, or sit on lower perches, watching for prey on ground or in low vegetation, which captured by sally-pounce. Prey normally bashed against branches till gut and toxic contents removed before it is swallowed. Bills of most species show no special adaptations, though frugivorous species show some, e.g. large laterally compressed bill of *Scythrops* and unusually decurved and hooked bill of *Eudynamis*. Proventriculus large and well developed, and walls are twice as thick as those of stomach. Excrete indigestible matter by regurgitation; can periodically shed the weak lining of stomach (Wyllie 1981).

Social organization and behaviour complex and vary greatly but generally poorly known; best known from some African and European species (Wyllie 1981; Rowan 1983; Fry *et al.* 1988; BWP). Most species obligate brood-parasites. Common Koel, Channel-billed Cuckoo and *Clamator* monogamous, forming bonds lasting at least for a season; otherwise promiscuous or perhaps polygynous; Long-tailed Cuckoo may form leks (McLean 1988). Apart from migration when small flocks can occur, monogamous species usually seen in pairs and other species mostly solitary; larger gatherings occur occasionally at sources of food. Some species territorial, including monogamous ones; others not territorial (Wyllie 1981). Males highly vocal; call to advertise territory or for mates; females of monogamous species also vocal in contrast to other species. Display behaviour, both sexual and agonistic, well developed and varying; often includes display flights and chases and usually noisy. Communal gatherings of several birds calling, chasing and displaying common in non-monogamous species. Courtship feeding probably universal (Smithers 1977; Rowan 1983); in many species occurs before, during or after copulation; in non-frugivorous species, male usually feeds female caterpillars. Feeding of fledgelings by adults commonly reported (e.g. Moreau & Moreau 1939; see species

accounts, such as Shining Bronze-Cuckoo) but many probably misidentified cases of courtship feeding (Rowan 1983). However, other cases are unequivocal (e.g. Ambrose 1987), though even these may be misdirected courtship feeding by adult cuckoos. Only in monogamous species is it usual for males to assist females with laying by distracting the hosts; these species are also only ones in which females often lay repeatedly in the same nest and the nestlings do not eject eggs or young of hosts (e.g. see species accounts). Nestlings produce foul-smelling liquid faeces when disturbed. Fledgelings beg persistently and attract others besides foster-parents to feed them.

Obligate brood-parasite. Breeding reasonably known for most species in HANZAB region; Brooker & Brooker (1989a) undertook a detailed review of the breeding biology of all Aust. cuckoos, summarizing records of cuckoo eggs and nestlings, feeding of cuckoo chicks, and general statements of parasitism, based on published literature, museum and private egg-collections, records in NRS and ABBBS, and unpublished data. The breeding of parasitic cuckoos has long attracted human attention and, as it is not easily observed, somewhat mysterious, and rouses strong feelings in some people, it has given rise to many myths. Typically lay single egg in nest of passerine smaller than itself and at the same time remove an egg of the host; usually all incubation and care of nestlings and fledgelings by host. Breeding generally seasonal, with timing of laying coinciding with laying by host-species. Female cuckoo finds nest of host by watching nest-building birds inconspicuously from a concealed perch, and by searching through habitat of host-species. Cuckoo often visits nest when owner is away feeding, though in some species, mate distracts hosts while female lays in nest (Linton 1930; Payne 1997). Chance (1922, 1940) found that in fairly open country, female Common Cuckoos spent many hours at a vantage point, sitting quietly and watching the activities of potential hosts, no doubt trying to find nests. However, in woodland and forest in se. Aust., Fan-tailed Cuckoos and Shining Bronze-Cuckoos have been seen searching furtively through low understorey and not feeding; it may be a different strategy used in denser vegetation (S. Marchant). Females may also be able to carry a mature egg in the oviduct for a day or so in emergencies because developing embryos have been reported in newly laid eggs (Liversidge 1961; Perrins 1967; Payne 1973). It has also been suggested that females may be able to store sperm (Marchant 1989).

There has been much argument and controversy about how cuckoos deposit eggs in nests of hosts, particularly enclosed nests or nests that seem inaccessible. Many claims of cuckoos carrying its egg in its bill, or even its foot, from ground to host-nest (see species accounts). However, detailed studies have shown that cuckoos lay directly in nest of host-species and all claims of carrying eggs to nests must be considered doubtful. Chance (1922, 1940) proved conclusively that the Common Cuckoo lays its eggs directly in open cup-shaped nests of hosts (taking only a few seconds) and this has been confirmed since (Wyllie 1981). In HANZAB region, some cuckoos habitually parasitize hosts with domed nests with very small entrances, such as thornbills *Acanthiza* and scrubwrens *Sericornis*; Brooker *et al.* (1988) and Brooker & Brooker (1989b) have shown that Horsfield's and Shining Bronze-Cuckoos lay in the normal way in the nests of fairy-wrens *Malurus* and thornbills *Acanthiza*. The entrances of nests of Brown Thornbills *A. pusilla* parasitized by Fan-tailed Cuckoos are characteristically enlarged, damaged or distorted compared with those of unparasitized nests (S. Marchant). In HANZAB region, all species except Channel-billed Cuckoo lay single egg per host-nest, and most species usually remove egg of host after laying; the whole process takes only a few seconds. Channel-billed Cuckoos (and, extralimitally, *Clamator*) usually lay two or three eggs per host-nest but can lay up to five; they also do not necessarily remove an egg of host. Extralimitally, Common Koels lay more than one egg per nest (Baker 1934). Clutch-size of an individual female cuckoo has rarely been established but may be about ten in Common Cuckoo (Chance 1922, 1940); probably fewer in Aust. species. Some nests can contain eggs of more than one species of cuckoo, and cuckoos will remove eggs of other cuckoos. Laying usually occurs during or shortly after laying of host-clutch; eggs laid before those of host usually deserted or buried in nest. Eggs have hard and thick shell that resists cracking when female lays from above nest (Payne 1997).

In some species, the eggs closely match those of the host. Such mimicry is well known in Common Cuckoo and several Indian species (e.g. Baker 1942). In HANZAB region, mimicry is known for eggs of Horsfield's Bronze-Cuckoo, Pallid and Channel-billed Cuckoos; sometimes the match is so close that it is almost impossible to distinguish between cuckoo's eggs and those of the host. Other cuckoos, such as Shining Bronze-Cuckoo and Fan-tailed Cuckoo, make no attempt to mimic host-eggs; both these cuckoos use as hosts species that build covered and domed nests, where light inside nest is probably very poor and mimicry rather pointless (Marchant 1972b; S. Marchant). Although long lists of host-species are known for many parasitic cuckoos, most use the nests of only a few species regularly, and female cuckoos of the same species may lay eggs that closely mimic those of different hosts; non-mimetic eggs are possibly laid in nests of other hosts when suitable nests of preferred host are not available (Baker 1942; Rowan 1983). However brood parasitism by cuckoos arose, the evolution of egg-mimicry can most reasonably be assumed to be an effort to mislead the host-species and to lessen the chance of it removing a strange egg from its nest or deserting it altogether, thus ensuring the breeding success of the cuckoo; no doubt the more closely the parasite's eggs resemble those of host, the less chance of the host rejecting them or deserting its nest. A full discussion of the evolution of mimicry of host-eggs is beyond this summary; see Marchant (1972b), Brooker & Brooker (1989a,b), Baker (1942), Rowan (1983) and Payne (1997) for further discussion.

Mean size of eggs varies from 17.9 × 12.1 for Horsfield's Bronze-Cuckoo to 43.7 × 30.5 for Channel-billed Cuckoo

(Campbell; North); extraliminally, smallest eggs 16.9×12.3 , of Asian Emerald Cuckoo *Chrysococcyx maculatus* (Baker 1934). Cuckoos sometimes destroy contents of nests, probably to induce hosts to nest again and provide a suitable nest for parasitizing (Fien 1970; Marchant 1972a). Incubation period ranges from 12 to 25 days and is generally shorter than that of host-species. Young altricial, nidicolous. Generally do not develop down, but young of some species can hatch with a few trichoptiles or wisps of short down (Brooker & Brooker 1989a). Young of most species (and all species in HANZAB region except Channel-billed Cuckoo) eject eggs or young of host, usually within 48 h; Channel-billed Cuckoos generally do not evict eggs or young of host and will share nest with both conspecifics and young of host. Extraliminally, in India, Common Koel do not eject eggs or young of host, and young of Common Koel and host often found together in nest, though, like Channel-billed Cuckoo, young of cuckoo usually out-compete young of host, which often disappear from nest (Baker 1934; Ali & Ripley 1969; Goddard & Marchant 1983). Cuckoo young specially adapted, with broad flattened back to evict eggs or young of host by manoeuvring them onto its back tipping them out of nest (see above). Method of evicting young of host well-described for Brush (Hindwood 1930), Fan-tailed and Pallid Cuckoos (Cole 1908; Campbell 1915), Horsfield's Bronze-Cuckoo (Campbell), and Common Koel (Gosper 1964): chick works to gain a position under eggs or young of host till they are lodged on Cuckoo's back and against wall of nest; Cuckoo stiffens neck and rests head against bottom of nest for extra support; then reaches behind with wings to gain purchase on rim of nest for extra leverage and by pushing and pulling up and backward with legs, wings and shoulders, ejects eggs or young of host from nest. Little data for other species but method of eviction probably similar. Develop rapidly; most cuckoos fledge at 16–20 days, depending on host-species; up to c. 4 weeks for Channel-billed Cuckoo, Common Koel and Long-tailed Cuckoo. Fledgelings dependent on foster parents for up to 6 weeks; may be fed by birds other than hosts, and by more than one species. Adult Pallid Cuckoos known to feed fledgeling Cuckoos; extraliminally, Common Koel females will feed fledgelings (Ali & Ripley 1969).

It is worth noting that correct identification of the eggs of parasitic cuckoos can be difficult. In preparing these accounts, we have been made aware of one probable example of misidentification. We have been informed that cards in the NRS for the Fan-tailed Cuckoo from the se. coast of NSW in the 1970s and 1980s ought to be disregarded because identification of the cuckoo was not positively confirmed: the eggs and young could just as likely have been those of the Brush Cuckoo (S. Marchant). Rowan (1983), when dealing with S. African cuckoos, found herself faced with similar problems and rejected every record that was not supported by clearly identified fledgeling cuckoos. This has not been done in this summary, and caution needs to be exercised in interpreting the data presented.

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Cuculus saturatus Oriental Cuckoo

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Cuculus saturatus Hodgson, 1843, *J. Asiat. Soc. Bengal* 12: 942 — no locality = Nepal (see Schodde & Mason [1997] for discussion of authorship).

The Oriental Cuckoo was distinguished from the Indian Cuckoo *C. micropterus* by its dark ash-coloured upperparts (Latin *saturatus*, deeply coloured, from *saturare*, to satisfy).

OTHER ENGLISH NAMES Australian, Blyths', Himalayan or Saturated Cuckoo; Hawk-cuckoo.

POLYTYPIC Subspecies *optatus*, Gould, 1845, breeds Russia E to Pacific Ocean and S to Japan and Yangtze R. in China; winters in Indonesia, Philippines, New Guinea and coastal n. Aust., from Kimberley Div. in W through n. Top End, n. and e. Qld, and n. NSW. Extralimittally, three subspecies: nominate *saturatus*, n. Pakistan and Kashmir, E through Himalayas to s. China and Taiwan; subspecies *lepidus*, Müller, 1845, Malay Pen., Sumatra, Java and Lesser Sundas E to Timor; subspecies *insulindae*, Hartert, 1912, Borneo.

FIELD IDENTIFICATION Length 30–32 cm; wingspan 53–55 cm; weight 90–115 g. Medium-large cuckoo with rakish, falcon-like jizz characteristic of genus. Very similar in shape to Pallid Cuckoo *Cuculus pallidus* but slightly bigger. Sexes differ in adult and immature plumages. No seasonal variation. Adult male mostly plain grey, with white breast to undertail-coverts, narrowly barred black below. Females and juveniles have grey and rufous morphs. In adult females, grey morphs like adult male but with rufous on neck and breast; rufous morph striking: rufous above and white below, boldly barred black throughout. In juveniles, grey morph mostly dark brown-grey above with fine white scaling, and white below with narrow dark barring; rufous morph very similar to adult female rufous morph but finely scaled white above. Immatures very similar to adults but sometimes separable; sexes differ and females dimorphic. **Adult male** Mostly plain grey, distinctly paler on chin, throat, foreneck and upper breast and slightly darker on mantle and scapulars; lower breast and belly, white, grading to buff on vent and undertail-coverts, all finely barred black (barring sparser and broader on undertail-coverts and, in some, buff suffusion extends onto rear-flanks and midline of belly). Tail, grey-black, narrowly tipped white and with white spots in centre of tail and white notches at sides; contrasts strongly with paler body above. Upperwing, dark grey, as mantle and scapulars, slightly darker on outerwing; often have prominent narrow white strip on leading edge of folded wing, below carpal joint. Underwing: leading coverts, off-white finely barred darker; greater coverts and remiges, dark grey with bold white barring across all but distal third of primaries and middle of secondaries, with broad white band across bases of outer secondaries and inner primaries, prominent in flight. Bill, grey-black with orange to orange-yellow basal half or less of lower mandible and basal cutting edge of upper mandible (to about level with nostrils). Mouth, orange to orange-yellow, often prominent when calling. Iris, yellow or, less often, brownish orange. Prominent orbital ring, yellow. Legs and feet, yellow to orange. **Adult female** **GREY MORPH:** Very similar to adult male, differing mainly by varying rufous neck and breast. Heavily marked birds have rufous-brown collar, covering foreneck and upper breast, which is coarsely barred dark-brown and extends narrowly round hindneck; can also have small rufous-brown spots along edges of remiges, greater secondary coverts and some scapulars. Duller birds have incomplete rich-brown collar, not extending to

hindneck. Dullest have scattered rufous-brown scaling over foreneck and rufous-brown suffusion to bottom of grey upper breast. Bare parts as male, though iris varies more, from yellow to orange or red, sometimes with red-brown or brown inner ring or, rarely, iris wholly dark brown. **RUFIOUS MORPH:** Less common than grey morph and very different. Cap, hindneck and upperbody, rufous-brown with coarse black barring (slightly sparser on rump and uppertail-coverts), grading across sides of head and neck to off-white with fine black barring on chin, throat, foreneck and upper breast; rest of underbody, white with narrow black barring. Tail, rufous-brown with broad V-shaped black barring, black subterminal bar, narrow white tip, and white spots and white notches on tail; slightly duller below. Upperwing coarsely barred rufous-brown and blackish, as upperbody. Underwing: much as grey morph but greater primary coverts finely barred light rufous-brown; white barring of primaries grades to light rufous-brown toward tips of feathers; and all secondaries barred light rufous-brown. Bare parts as grey morph. **Juvenile** **GREY MORPH:** Top of head, hindneck and upperbody, dark grey-brown, finely scalloped white; some have off-white speckling on forehead and lores; rest of head and neck, white, with dark-brown barring that becomes messy and blurred on chin, ear-coverts and sides of neck. Underbody like that of adult male but barring black-brown, finer and less regular and often broken in midline of breast and belly. Uppertail, dark brown, with narrow white tip and alternating small black-brown and buff notches along edges. Upperwing, dark grey-brown, with fine white scalloping to coverts and tertials, fine light rufous-brown spots to greater secondary coverts and remiges, and narrow white trailing edge to outerwing (when fresh); at rest, show prominent narrow white strip along leading edge, just below carpal joint, as in adult. Undertail, as in adult male but with larger white spots and notches that grade to clear white barring on tips of outertail. Underwing similar to adult male except dark barring on leading coverts narrower, and lesser primary coverts and all marginal coverts appear off-white. Bill similar to adult but paler basal area duller, grey to greenish yellow or yellow. Iris, cream to black-brown. Orbital ring and legs and feet may be slightly paler than in adult. **RUFIOUS MORPH:** Very similar to rufous-morph adult female; best distinguished by: crisp and narrow white scalloping to upperbody and secondary coverts in fresh plumage; and narrow white trailing edge to outerwing. Further differ by: cap appears noticeably darker and

more uniform, especially forehead and crown, which appear dark brown with fine white scaling, grading to barred dark-and-rufous on nape and hindneck; rufous ground-colour of rest of upperparts slightly duller and dark barring slightly broader and straighter; below, dark barring slightly narrower and sparser, and vent can appear unbarred; and on underwing, dark barring on leading coverts finer and some have large unbarred area behind carpal joint. Bare parts as juvenile grey morph. **Immature** Very similar to adults; only separable in close views by presence of retained juvenile remiges or rectrices (see Plumages; Ageing).

Similar species Combination of boldly and regularly barred underbody, conspicuous orange or yellow legs and feet, prominent yellow orbital ring, and pale base to bill readily identifies all plumages of Oriental from other cuckoos; for further distinctions from **Pallid Cuckoo**, see that text.

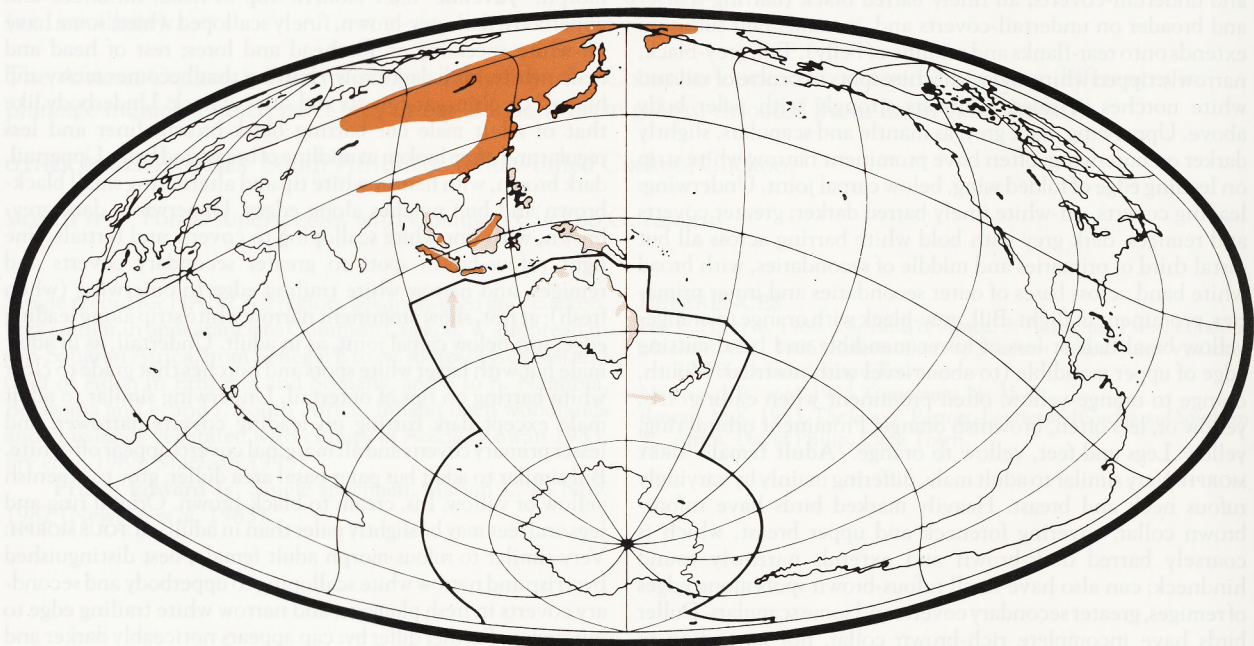
Usually seen singly or in twos, occasionally in small groups at abundant food. Inhabit dense to open woodlands and forests, including rainforests; occasionally also in more open habitats, such as farmland and even suburban gardens. Mainly arboreal, but occasionally forage on ground. Generally silent and unobtrusive and sit quietly within cover of foliage; wary and not easily approached, and often slip quietly and swiftly from cover and leave area. General gait and actions similar to those of Pallid Cuckoo; often hold wings loosely and lowered when perched. Flight-actions and silhouette also similar to those of Pallid Cuckoo; normal flight, in open areas, swift, direct and falcon-like, sometimes slightly undulating; when flushed from cover, flight can be low, swift and erratic as bird weaves away through trees. Quiet in HANZAB region (see Voice).

HABITAT In Aust., inhabit canopy or shrub layer of monsoon rainforest, vine-thickets, wet sclerophyll forest, or open casuarina, *Acacia* or *Eucalyptus* forest or woodland (Campbell 1920; Bravery 1965; Bravery 1967, 1970; Fien 1971; Crawford 1972; Morris 1975; Ford 1978; Porter & Henderson 1983; Woinarski *et al.* 1988; Johnstone & Burbidge 1991; Woinarski

1993); near Edward R., Qld, in semi-deciduous woodland on sand-dunes, dominated by figs *Ficus*, kapok *Bombax*, peanut tree *Sterculia* and stinkwood *Gyrocarpus* (Garnett & Bredl 1985), and sometimes among mangroves (Draffan *et al.* 1983; Thompson 1983; Garnett & Bredl 1985; Storr 11). Often in gardens or plantations (Hutcheson 1956; Bravery 1967; Boekel 1980; Bigg & Bigg 1988; Read 1995). Sometimes occur in lightly wooded farmland (Bravery 1967, 1970). Often at edges of forest, or ecotone between different types of forest (Dowling 1962; Zillman 1965; Morris 1975; Beruldsen 1990); or near wetlands, especially in thick riparian vegetation along rivers or creeks (Zillman 1965; Bravery 1967; Seton 1972; Ford 1978; Johnstone & Burbidge 1991; Storr 11); sometimes in swamps, often dominated by paperbarks *Melaleuca* (Campbell 1920; White 1946; Haselgrove 1975). In NZ, vagrants often recorded in gardens (Watt 1953; Roberts 1962; Grant 1964; Reed 1972; Latham 1980; Sutton 1983; CSN 33); once in clumps of willows *Salix* beside river (CSN 26).

Feed arboreally, in trees and shrubs, and, less often, on ground. When feeding arboreally, forage for invertebrates on loose bark on trunks and branches of trees and among foliage, including that of pendulous mistletoes (Zillman 1965; Bravery 1967; Boekel 1980; Bigg & Bigg 1988; Dawson *et al.* 1991; Qld Bird Rep. 1984). Rarely feed on ground (Brooker *et al.* 1990): in grassy areas, including lawns and clearings within forest, usually with low shrubs or other perches nearby, from which birds fly to ground and to which they return to eat (Campbell 1920; Storr 1953; Roberts 1962; Grant 1964; Bravery 1967; Reed 1972; Sutton 1983; see Food). Once seen foraging in freshly ploughed paddock (NSW Bird Rep. 1992).

No information on roosting habitat. Often perch in low shrubs and on branches of large trees, sometimes close to trunk (Berney 1906; Bravery 1967; Fien 1971; Reed 1972; Read 1995). Sometimes also perch on posts and sometimes on wire of fences (Hutcheson 1956; Grant 1964; Latham 1980). May loaf in shade of shrubs (Read 1995). Once seen loafing on blocks of coral rubble on island (Fien 1971).





DISTRIBUTION AND POPULATION Breed ne. Europe and n. and e. Asia, from c. 50°E in Russia, near middle reaches of Pechora and Volga Rs, E to Anadyr Lowland and Kamchatka Pen.; in central and e. Siberia, occur N to c. 70°N and S to c. 50°N near headwaters of Ob R. and n. Mongolia; farther E, occur S through Japan, Korean Pen., ne. and e. China and Taiwan, and, S of Yangtze R., W through Yunnan and Szechwan Provinces to Bangladesh, Nepal and ne. India; also breed Indonesia. In non-breeding season mostly S of breeding range: India and se. Asia in Philippines, Peninsular Thailand, Malaysia and Indonesia; New Guinea, Bismarck Arch. and Solomon Is and n. and e. Aust.; rarely NZ (Ali & Ripley 1969; de Schauensee 1984; Coates 1985; Inskipp & Inskipp 1985; White & Bruce 1986; Gavrillov *et al.* 1993; BWP).

Aust. Mostly n. and e. coasts, from Kimberley Div. to near Sydney. **WA** Vagrant to Pilbara: single, Dampier, 28 Nov. 1977 (Perry 1978); single, Mt Goldsworthy, 19 Mar. 1973 (Serventy & Whittell); two records, with no details, from Roebourne and Karratha (Storr 16). More widespread in n. and w. Kimberley Div., with scattered records from sw. Dampier Pen. and lower Fitzroy R. between Mt Anderson and Liveringa, N to Mitchell Plateau and Kalumburu, and E to Parys Ck and Kununurra (Mathews 1910; Johnstone 1983; Johnstone & Burbidge 1991; Storr 11; Aust. Atlas). **NT** Widespread in Top End, from Darwin N to Melville and S. Goulburn Is, E to Gove Pen., Groote Eylandt and Sir Edward Pellew Grp, and S to Roper R. (Humphries 1947; Crawford 1972; Haselgrove 1975; Boekel 1976; Schodde 1976; Thompson 1983; Storr 7; Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow); sometimes farther S, to Victoria R. Downs (Boekel 1980; Storr 7). **Qld** Single record at Mt Isa (Qld Bird Rep. 1983); and scattered records near se. and e. edges of Gulf of Carpentaria, from Gregory R. and Normanton N to Edward R. and Aurukun (Bravery 1967; Garnett & Bredl 1985; Storr 19; Aust. Atlas); also observed once on Pisonia I. in Gulf (Lavery 1964). Often recorded on islands in Torres Str. (Campbell 1920; Lavery 1964; Draffan *et*

al. 1983; Stokes 1983; Traill 1983; Ingram *et al.* 1986; Aust. Atlas). A few records from C. York Pen. (Barnard 1911; MacGillivray 1914; Officer 1967; Storr 19). Widespread on tablelands and e. slopes of Great Divide from near Cooktown to NSW border. Sometimes inland as far as Richmond, Prairie, Springsure, Wealwanganie Stn and Carnarvon NP; farther S, occasionally inland to Mitchell and Chinchilla (Storr 1953; Storr 19; Aust. Atlas; Qld Bird Reps). Sometimes on nearshore (e.g. Moreton and Stradbroke Is) or offshore islands (e.g. Willis I.) (Davis 1923; Hogan 1925; Fien 1971; Vernon & Martin 1975; Kikkawa 1976). **NSW** Mainly in coastal areas, S to near Newcastle; once inland to Thornleigh, near Boggabilla, but usually inland only to near Armidale and Apsley R. (Morris *et al.* 1981; Aust. Atlas; NSW Bird Reps). Rarely round Sydney (Bigg & Bigg 1988; Hoskin 1991; NSW Bird Reps). Vagrant farther S, between Barren Grounds and Candelo (Jordan 1987; Whiter 1994; Aust. Atlas; NSW Bird Reps). **SA** Single, Olympic Dam, 12 Nov. 1993 (Read 1995).

NZ Few, scattered records; all singles. Only four records before 1950. First recorded before or in 1889 at unknown site (Hamilton 1889; Brathwaite 1969). Two beachcast birds recovered in 1977 and 1983 (Veitch 1979; Powlesland 1985), without location. **NI** Mostly N of 38°S: Te Koa, 18 Dec. 1952 (Watt 1953); Whangaroa, Jan.–Feb. 1962 (Roberts 1962); Muriwai Beach (beachcast), 21 Dec. 1969 (Reed 1970; Imber 1971); Little Barrier I., 20–25 Oct. 1971 (Reed 1972); Ponatahi, Ruamahanga R., 28 Dec. 1977–1 Jan. 1978 (CSN 26); Tauranga, 6–16 Jan. 1980 (Latham 1980). **SI** Mostly along w. coast: specimen, L. Te Anau, Feb. 1902 (Stidolph 1927; Oliver); Motupipi, 17 Dec. 1944 (CSN 4); Codfish I., 16 July 1948 (Blackburn 1968); Kaihinu, c. 12 Jan.–3 Feb. 1964 (Grant 1964); Kapuka, 15–16 Jan. 1983 (Sutton 1983); Tukura, Golden Bay, 2–4 Dec. 1984 (CSN 33); specimen, Seddonville, Jan.–Mar. 1985 (CSN 33); Cobden, Feb. 1985 (CSN 33); near Mattai, 19 Mar. 1988 (CSN 36).

Lord Howe I. Few records, all specimens: singles 15, 28

and 29 Dec. 1913; two 15 Dec. 1915; four 16–17 Feb. 1915; single 16 May 1915 (Hindwood 1940).

Norfolk I. Single, 12 Jan.–3 Feb. 1997 (Anon. 1997).

Christmas I. Single, 7 Nov. 1982 (Stokes 1988).

Snares Is Single, Dec. 1986 (NZCL).

Populations On Howards Pen., NT, recorded at density of 0.08 birds/ha (Woinarski *et al.* 1988). In Arnhem Land, 10–20 birds recorded daily along 20 km transect (Aust. Atlas). Sometimes killed by cats (NSW Bird Rep. 1985); also killed by striking windows (NSW Bird Rep. 1993) and lighthouses (Stokes 1983).

MOVEMENTS Partly migratory and partly resident or sedentary. Four subspecies (see Geographical Variation): two tropical subspecies (*lepidus* of Malay Pen. to Lesser Sundas, and *insulinidae* of Borneo) thought to be sedentary or resident; subspecies *saturatus* and *optatus* migratory or mostly migratory, breeding Asia and migrating S of Equator for boreal winter. Subspecies *optatus* breed n. Asia and Japan (recent evidence suggests also probably nw. Himalayas, such as parts of Pakistan) and spend non-breeding period in e. Indonesia, New Guinea, Bismarck Arch., Solomon Is and Aust.; *saturatus* mainly migratory (but birds in n. India possibly sedentary or resident), breeding s. Asia, from Himalayas to s. China and Taiwan; non-breeding range of *saturatus* poorly known, but some spend non-breeding period in n. India, and in Indonesia and New Guinea, where thought to overlap with *optatus*, and possibly Aust. (Medway & Wells 1976; Smythies 1981; Andrew 1985; Coates 1985; van Marle & Voous 1988; Roberts 1991; BWP; see Geographical Variation). Wholly migratory in HANZAB region; most or all occurring Aust. and NZ said to be *optatus* (BWP), but possible that some *saturatus* also occur. Only *optatus* and *saturatus* discussed further.

Departure On breeding grounds in Siberia (*optatus*), stop calling mid- to late July; s. passage in Russian Far East, in late Aug.–Sept. (Gavrilov *et al.* 1993). Both migratory subspecies move S and E from breeding grounds, with some overlap on passage and in non-breeding grounds; not enough data to determine exact routes of different subspecies. Nominate recorded Nepal till Sept. (Inskipp & Inskipp 1985); *optatus* passage migrant in n. India (Ripley 1982) and mainly passage migrant, but also non-breeding visitor, in e. Indonesia where collected from late Aug. (see BWP). Large numbers (*optatus*) pass through Korea in Sept. and Oct. (Gore & Won 1971). Probable passage recorded e. China, Sept. (La Touche 1931–34). Common migrant Taiwan (Severinghaus & Blackshaw 1976). Scarce passage migrant Hong Kong, Aug.–Oct. (Chalmers 1986). Uncommon passage migrant (both subspecies) Malay Pen.; migrating *saturatus* caught Oct. and Nov. 1972 (Glenister 1974; Medway & Wells 1976). Recorded on passage through Philippines, with earliest date 12 Sept. (Dickinson *et al.* 1991). In Borneo, both subspecies appear to occur in about equal numbers (Smythies 1981). Only one (van Marle & Voous 1988) or two (BWP) records of *optatus* from Sumatra. Passage to Aust. probably through Wallacea, where migrants recorded from Sept. (White 1976; White & Bruce 1986). Said to be most common in New Guinea as southbound migrant (Beehler *et al.* 1986); usually arrive Port Moresby area late Sept., earliest date 7 Sept. (Hicks 1990). Specimen found 4400 m asl on Carstensz Massif, w. New Guinea (Schodde & van Tets 1975); assumed to have died while crossing central cordillera (Coates 1985).

Despite arrival in New Guinea in Sept., few records Aust. Sept.–Oct. Lighthouse casualties, Booby I., Torres Str., Dec.

and Jan. (Ingram *et al.* 1986). Probably regular to Darwin, where earliest date, 2 Dec. (Crawford 1972); one Sept. record probably atypical (Thompson 1982). Single recorded Lady Elliot I. in Nov. assumed to be on passage (Fien 1971). One group said to have 'arrived' near Cooktown 7 Dec. 1948 (Storr 1953). Arrive Cardwell, n. Qld, Nov. (Broadbent 1910). Pass through Magnetic I. usually in Nov. (Wieneke 1988). Recorded n. Qld as early as Sept. (Wheeler 1967). Straggler to Lord Howe I. where collected Dec. (Hindwood 1940). Earliest arrival Sydney area, 1 Aug. 1963 (Hoskin 1991). Most literature does not specify age of birds, but immatures and juveniles recorded Aust. as early as Oct. (Lavery & Hopkins 1963; Qld Bird Rep. 1988).

Non-breeding In Aust., mainly present Nov.–May (Aust. Atlas), but recorded as early as Aug.–Sept. In Kimberley Div., mostly Oct.–Apr. (Storr 11); vagrant to Pilbara, Nov.–Mar. (Storr 16). In NT, scarce visitor, Dec.–Apr. (Storr 7); in Lower McArthur R. region and Pellew Is, frequent Dec.–Mar. (Schodde 1976); in Darwin, numerical peaks either side of wet season suggest possibility of passage to and from other areas (Thompson 1982). Most records Qld, Nov.–Apr. (Wieneke 1992; Storr 19), with Oct. records from s. Qld (Porter & Henderson 1983; Templeton 1992; Qld Bird Rep. 1986). Occur throughout Torres Str. in wet season (Draffan *et al.* 1983). In Burdekin region, n. Qld, records Dec.–Mar. (Seton 1972); at Gin Gin, near Bundaberg, appear most common from Jan.–Feb. to May (Zillman 1965); recorded Innisfail, Nov.–Mar. (Gill 1970); recorded Atherton Shire, Dec.–Apr. (Bravery 1967, 1970). In NSW, most records Sept.–May (Anon. 1971; NSW Bird Reps); irregular and rare to Big Scrub region, NSW, Nov.–May (Holmes 1987). Appearance at any site unpredictable (Aust. Atlas), e.g. round Edward R. settlement, Qld, irregular in wet season (Garnett & Bredl 1985) and considered regular at only a few places, e.g. Townsville Town Common (Garnett & Cox 1988). Immatures reported Aust. between Oct. and Apr. (e.g. Bigg & Bigg 1988; Qld Bird Reps 1983, 1986; NSW Bird Rep. 1985); but immatures very difficult to identify in field, and some reports probably refer to juveniles; immatures definitely recorded as far S as Sydney (Bigg & Bigg 1988) and collected NZ (Stidolph 1927; Hutcheson 1956), indicating that at least some young migrate to s. limits of non-breeding range.

Extralimitally, recorded Wallacea, Sept.–Mar. (White 1976). Occur throughout New Guinea, Sept.–May, mostly from late Oct. to mid-Apr. (Coates 1985; Beehler *et al.* 1986); recorded Oct.–Mar. in Ok Tedi area (Gregory 1995). Proportions of *saturatus* compared with *optatus* decline from W to E in Indonesia (BWP). Both subspecies also occur Philippines, where uncommon non-breeding visitor and passage migrant (Dickinson *et al.* 1991).

Return One immature collected in Apr. near Sydney had much subcutaneous fat, which may indicate it was preparing to migrate (Bigg & Bigg 1988). Latest departure from Sydney, 14 Apr. 1984 (Hoskin 1991). Straggler to Lord Howe I. where collected after storm in May (Hindwood 1940). Leave Cardwell, Qld, end Feb. (Broadbent 1910). Pass through Magnetic I., usually in Mar. and Apr. (Wieneke 1988). Lighthouse casualties Torres Str., Mar. and Apr. (Ingram *et al.* 1986). Latest date Darwin, 6 Apr. (Crawford 1972). Recorded Broome, Feb. (Collins 1995).

Extralimitally, Feb. and Mar. specimens from Vogelkop, nw. New Guinea (apparently *optatus*) (Hoogerwerf 1971). Usually leave Port Moresby area early Mar., with latest date 26 Apr. (Hicks 1990). Recorded central New Guinea in May (Mayr & Gilliard 1954) and Bismarck Arch. at least as late as Apr. (Finch & McKean 1987). *Optatus* recorded Indonesia till

early May (BWP). Migrants recorded Wallacea till Mar. (White & Bruce 1986), with single recorded Sulawesi in Apr. (Rosendaal & Dekker 1989). Pass through Philippines, where most numerous Apr.–May; latest date 8 June (Dickinson *et al.* 1991). Mainly passage migrant in Thailand, mostly in boreal spring (Lekagul & Round 1991). Scarce passage migrant Hong Kong, Mar.–May (Chalmers 1986). Common migrant Taiwan (Severinghaus & Blackshaw 1976). Probable passage recorded e. China in Mar.–Apr. (La Touche 1931–34). Large numbers (*optatus*) pass through Korea in May (Gore & Won 1971). In Middle Asia, passage occurs early May (Gavrilov *et al.* 1993). Arrive Japan late Apr. (Orn. Soc. Japan 1974). Arrive s. Russia (*optatus*), in late May; and near Arctic Circle, early June (Dement'ev & Gladkov 1951; Gavrilov *et al.* 1993). *Saturatus* recorded Nepal from Mar. (Inskipp & Inskipp 1985).

Breeding Few records from Aust. during this period; June–Aug. (White 1946; Lord 1956; Zillman 1965; Templeton 1992). Said to be recorded Kimberley Div., June–Aug. (Storr 11) and in Qld in all months (Storr 19). Recorded near Tweed R., NSW, in Aug. (Anon. 1906), but could be early arrivals rather than wintering birds (Hoskin 1991).

Banding Of 20 banded in Aust. and New Guinea, 1953–96, no recoveries.

FOOD Poorly known. Invertebrates, especially caterpillars. **Behaviour** Mainly arboreal, taking prey from foliage and tree-trunks; occasionally forage on ground (Zillman 1965; Bravery 1967). Feed solitarily (Bravery 1967) or in pairs, and on several occasions in groups of three (Zillman 1965). At Atherton, Qld, five birds fed singly, c. 20 m apart, over area of 3.2 ha; another time, eight birds fed over 2 ha (Bravery 1967). In PNG, occasionally form larger groups to exploit abundant food (Coates 1985). **METHODS OF FORAGING:** Mostly by sallying from vantage perches; usually sally-pounce when catching prey from tree-trunks and ground (Campbell 1920; Storr 1953; Bravery 1967), or sally-stall when catching prey from foliage (Zillman 1965). After capture, prey carried to perch and eaten (Zillman 1965; Bravery 1967). In n. Qld and Torres Str., seen to pounce on insects in long grass from low perches in shrubs in clearings (Campbell 1920; Storr 1953). At Gin Gin, Qld, fed on stick insects by crashing into foliage of trees and, while flapping wings to maintain balance, extracted prey from foliage; then flew to a bare limb, beat insect and scissored it from end to end before swallowing it (Zillman 1965). At Atherton, Qld, captured hairy larvae of White Cedar Moth *Leptocneria reducta*; pouncing from low limb of a tree to take larvae from trunks, branches, foliage and from grass under trees in which birds perched; often seen perched sideways on loose bark taking caterpillars as they emerged from beneath bark (Bravery 1967). In NZ, vagrant birds often seen feeding by pouncing from low perches on insects in garden lawns (Roberts 1962; Grant 1964; Reed 1972).

No detailed studies. **ANNELIDS:** Oligochaetes: Lumbricidae^{6,9} **INSECTS:** Coleoptera: beetles⁷; Hemiptera: Cicadidae: cicadas^{4,9}; Hymenoptera: Symphyta: sawfly larv.⁷; Lepidoptera: caterpillars^{1,2,4,5,7}; Lymantriidae: *Leptocneria reducta*^{4,8}; Phasmatodea: Phasmatidae: stick-insects^{3,4}. (REFERENCES: ¹ Mathews 1910; ² Campbell 1920; ³ Zillman 1965; ⁴ Bravery 1967; ⁵ Boekel 1980; ⁶ Sutton 1983; ⁷ Bigg & Bigg 1988; ⁸ Wieneke 1988; ⁹ NZRD.)

For extralimital data, see Cain & Galbraith (1956), Bell (1979), Lamothe (1979), Smythies (1981), Coates (1985), Gavrilov *et al.* (1993) and BWP.

VOICE Little information for HANZAB region, and no

recordings available; sonagrams in BWP and Wells & Becking (1975). In w. Palaearctic, five calls recognized (BWP) and nomenclature of BWP followed here. Vocal during breeding season (BWP); quiet in HANZAB region and only heard to call infrequently (e.g. Broadbent 1910; Zillman 1965; Bravery 1967), *contra* claims that do not call (e.g. Storr 1953; Bravery 1965). See Geographical Variation for discussion of extralimital taxa.

Adult ADVERTISING CALL: In Palaearctic (subspecies *optatus*), described as rapid *bu-bu-bu-bu*, followed by 6–8 muted disyllabic *bu-bu* sounds; or *pupu ... pupu ...* repeated up to 50 times; or rapid *pupupupupu ...* of 5–8 syllables; or slower *po po po po ...* (BWP). Also described as disyllabic *po-poo*, each syllable of similar pitch and duration, repeated 6–8 times; often preceded by more rapid series *po-poo-poo-poo-poo* (Jonsson 1992). Given by male (BWP). In HANZAB region: a quiet but very regular *tsoo-tsoo-tsoo ...*, with *tsoo* repeated c. 12 times, at intervals of c. 1 s (Reed 1972), probably this call, as are muttered *coos* associated with feeding (Zillman 1965). In revision of species, Advertising Call of *optatus* (= *C. s. horsfieldi*) described as four low *hoop* notes; that of smaller *saturatus* as a high note followed by 2–3 lower notes *hoop, hoop-hoop* (del Hoyo *et al.* 1997; R.B. Payne). **KUK CALL:** Laughing *kuk-kuk-kuk ...*, audible to 20 m (Zillman 1965); also described as cackling *gak-gak-gak-ak-ak-ak* (Bravery 1967); and as low harsh *churr-churr-churr ...*, audible for only a few metres (Campbell 1920). Often given just before bird leaves perch to feed (Zillman 1965). **TRILLING CALL:** Ringing mournful trilling, of three notes, repeated with rising crescendo (Zillman 1965). Trilling, like call of Fan-tailed Cuckoo *Cacomantis flabelliformis*, also reported by Bravery (1967). **BUBBLING CALL:** A deep sonorous rolling laugh; given by female (BWP). Not yet reported in HANZAB region. **KAU CALL:** Striking *kau*, like call of small falcon *Falco*; given in flight after being mobbed (BWP). Not yet reported in HANZAB region. **Other calls** Said to utter *pi-pi-pi-pi*, like call of Nankeen Kestrel *Falco cenchroides* (Strahan).

PLUMAGES Prepared by D.I. Rogers. Fledge in distinctive juvenile plumage. Post-juvenile (first pre-basic) moult nearly complete; occurs in first austral summer, largely in non-breeding areas, but may start before arrival. Resultant immature plumage similar to adult plumage but generally retain a few juvenile remiges and rectrices. Adult plumage attained with complete post-breeding (second pre-basic) moult in second austral summer, when 14–18 months old. Juvenile males and all age-classes of females polymorphic; sexes differ in adult and immature plumages. Subspecies *optatus* from Aust. described below.

Adult male (Second and subsequent basic). **HEAD AND NECK:** Top of head and hindneck, grey (87), grading to light or pale grey (85–86) on chin, throat and foreneck. **UPPERPARTS:** Uppermost mantle, back, rump and uppertail-coverts, grey (87) grading into darker-grey (c83) lower mantle and scapulars. Lateral uppertail-coverts have narrow white outer edges, which are sometimes broken into series of small white spots along outer edge. **UNDERPARTS:** Upper breast, light (85) to pale (86) grey. Ground-colour of rest, white grading to buff (54–124) on vent and undertail-coverts; in some, buff tinge extends onto rear-flanks and midline of belly. All except upper breast broadly barred black (82–89): bars mostly 2–3 mm wide and spaced at intervals of c. 5 mm; bars broader on flanks, 3–4 mm wide; and bars broader, c. 5 mm wide, and spaced farther apart, at intervals of c. 8 mm, on most undertail-coverts; shorter lateral undertail-coverts have little or no barring and in some postures conceal coarse barring round vent. **UPPERTAIL:** Grey-black (82), with:

(1) small but boldly contrasting white tips to all feathers; (2) series of small white spots along shafts, smallest on inner feathers and occasionally absent from t1; (3) series of small white spots along inner edges of all feathers; and (4) small white spots along outer edges of t1 (often) and t2–t5 (rarely). **UNDERTAIL:** Patterned as above, but ground-colour grades to grey (83–84) in centres and at bases; white markings more exposed, so undertail looks grey, grading to black at edges and tips, and evenly speckled white. **UPPERWING:** Dark grey (c83) with slightly brown (ne) tinge on remiges that becomes more pronounced with wear. Edges of feathers always look clearly delineated. Lesser primary coverts directly below alula, white and often exposed as small white flash on folded wing. **UNDERWING:** Most coverts, white with a cream (54) or buff (124) tinge (which can be almost as strong as tinge of undertail-coverts) and dark-grey (83) to black (82) barring; bars usually 1–2 mm wide and spaced at 3–4 mm intervals; barring narrowest, often absent, on leading edge just inside carpal joint. Marginal coverts on leading edge just outside carpal joint, uniform grey (c87); those covering carpal joint have white outer webs and tips (for illustrations of variations, see Becking 1975). Greater primary coverts, dark grey (c83) and unmarked; greater secondary coverts similar but with white barring in centre of outer coverts that grades to broad diffuse white bar across centres of central and inner coverts. Ground-colour of remiges, glossy grey (84). Secondaries unmarked except for white bases that are concealed on all but outer secondaries; white at base of outer secondaries meets white of inner greater secondary coverts, forming broad white wing-bar that extends onto inner primaries across bases of p1–p5. Primaries are also heavily barred white elsewhere, with basal 75% of p5–p9 coarsely barred; similar white barring on inner primaries, but does not extend so close to tips of feathers.

Adult female (Second and subsequent basic). **GREY MORPH:** Similar to adult male, typically differing in having some rufous on foreneck. At most rufous extreme, foreneck and upper breast rufous-brown (38) with coarse dark-brown (121) barring; the resultant rich-brown collar wraps round sides of neck and narrowly over hindneck; such birds can also have series of small rufous-brown (38) spots along edges (especially outer edges) of secondaries and greater secondary coverts and to a lesser extent on primaries, alula, tertials and longest scapulars. Duller birds lack rufous-brown spotting on wings and upperparts and rich-brown collar incomplete, not extending onto hindneck and sometimes restricted to sides of breast. At dullest extreme, foreneck mainly grey and sharply demarcated from breast, as in adult males, except that some feathers of foreneck and upper breast have a light rufous-brown (39) subterminal band narrowly bordered black-brown, and some feathers on foreneck have light rufous-brown (39) tips. By analogy with similar plumages of Common Cuckoo *Cuculus canorus*, a small proportion of females may have plumage identical to adult males, but no reliably sexed specimens in this condition examined.

RUFIOUS MORPH (also called hepatic morph): Less common than grey morph; of 21 females examined from our region, only six were rufous morph. **HEAD AND NECK:** Top of head and hindneck coarsely barred dark brown and rufous-brown; feathers, rufous-brown (38), often grading to light rufous-brown (39) on forehead and hindneck, with irregular broad dark-brown (121) subterminal barring; ground-colour grades to darker rufous-brown (340) at tips of feathers. Chin and throat, off-white with dark-brown (121) barring that, while broad, is narrower and more regular than that on top of head. Ear-coverts and sides of neck intermediate in appearance between top of

head and throat: light rufous-brown (c39), often grading to pale brown (c119D) or off-white on auriculars, with dark-brown (121) barring that is slightly broader and less regular than that of throat. **UPPERPARTS:** Rufous-brown (340) with coarse dark-brown (121) barring; bars 2–4 mm wide on upper mantle, up to 5–7 mm wide on lower mantle and scapulars, and 2–3 mm wide on rump and uppertail-coverts. Barring of rump and uppertail-coverts often chevron-shaped and often do not reach edges of feathers; net effect is for dark barring in this area to look much more sparse and tracts to appear more speckled than rest of upperparts. **UNDERPARTS:** Uppermost breast, off-white with dense dark-brown (121) barring like that of foreneck. Rest, clean white grading to pale buff (92) on undertail-coverts, vent, and, in some, midline of belly; and slightly more broadly barred dark brown (121) throughout than grey morph. **UPPERTAIL:** Rufous-brown (340) with evenly spaced, broad (c. 6 mm) dark-brown (121) barring that is progressively more V-shaped toward base of tail (apex of V pointing to base of tail); subterminal bar broader (c. 15 mm) and straighter than others. Feathers narrowly tipped white and usually have series of very small white spots along shafts (smallest on central feathers). **UNDERTAIL:** Patterned as uppertail, but barred light rufous-brown (c39) and dark glossy grey (c83). Tinged paler and greyer than uppertail, though this reduced with wear. **UPPERWING:** Secondary coverts as scapulars. Primary coverts, alula and remiges, dark brown (121) with series of small rufous-brown (340) spots or half-bars along outer edges of feathers; these markings broadest on remiges (4–5 mm), smaller on primary coverts (2–3 mm) and often absent from alula. **UNDERWING:** Patterned much like grey morph, with broad white central stripe, but: (1) greater primary coverts barred dark glossy grey (c83) and light rufous-brown (c39); (2) scattered median, lesser and marginal coverts have rufous-brown (340) ground-colour and tip; (3) on leading edge of wing outside carpal joint, marginal coverts coarsely barred rufous-brown (340) and dark brown (121); (4) on primaries, ground-colour of pale bars grades to light rufous-brown (c39) toward tips of feathers; and (5) secondaries have light rufous-brown (38–39) barring, 4–5 mm wide, which tapers out c. 15 mm from trailing edge.

Juvenile Plumages treated as dimorphic below, but too few Aust. specimens available to determine whether intermediates occur here. BWP regarded intermediates as less common than in Common Cuckoo but stressed that variation still substantial and not obviously related to sex. In all, white fringes to feathers of head, body and upperwing-coverts diagnostic of juvenile plumage. **GREY MORPH: HEAD AND NECK:** Top of head and neck, dark greyish-brown, scalloped by off-white fringes to feathers; feathers grade from dark greyish-brown (121) near tips to greyish brown (c119B) at bases, giving uneven appearance. Feathers of forehead and nape have broad, partly exposed white central bands; in very fresh plumage there can be a few wholly white feathers in these areas, but these apparently lost before arrival in HANZAB region. Throat and foreneck, white, with dense dark-brown (119A) barring that becomes increasingly broad and messy toward chin, ear-coverts and sides of neck. **UPPERPARTS:** Mainly dark brownish-grey (ne), becoming slightly darker and browner (c121) on longest scapulars and mantle, and slightly greyer (c79) on rump and uppertail-coverts. All feathers have narrow white fringes at tips, giving scalloped appearance. Ground-colour of longest uppertail-coverts browner (c119A) than rump, and these coverts have series of small white spots along shafts and outer edges, narrowly joined by buff (c121C) bars. **UNDERPARTS:**

Upper breast, white with dense dark-brown (119A) barring like that of foreneck. Rest of underparts similar to those of adult male, but black-brown (119) barring slightly narrower and less even, and often broken in midline of breast and belly. **UPPERTAIL:** Similar to adult male but: (1) ground-colour, dark brown (119A) grading to black-brown (119) at tips and distal edges of rectrices; (2) white spots along shafts slightly larger than in adult, and probably never absent from t1; (3) have series of small buff (124–39) spots along edges of t1 and outer edges of t2–t5. **UNDERTAIL:** As adult male except that white spots larger; on outermost feathers, white spots along shafts and edges can meet to form clear white barring on distal parts of feather. **UPPERWING:** Dark greyish-brown (c121), all feathers with small off-white fringes at tips. Outer secondaries and inner primaries have series of small light rufous-brown (c39) spots along outer edges; outer primaries similar but spots grade to white at base. **UNDERWING:** Similar to adult male but dark-grey barring of median, lesser and marginal coverts narrower and far less extensive, generally petering out before carpal joint so that lesser primary coverts and all marginal coverts look entirely off-white. White barring of outer primaries possibly more extensive than in adults, extending closer to tip of wing.

RUFIOUS MORPH: Differences from adult female rufous morph:

HEAD AND NECK: On top of head and hindneck, dark-brown (119A–121) barring slightly broader, and pale barring narrower and duller, ranging from off-white to light rufous-brown (c39). Dark barring on chin and throat slightly narrower than in adults. All feathers narrowly fringed white at tips, at least when fresh. **UPPERPARTS:** Broadly barred dark-brown (119A–121) and rufous-brown (c38, duller than in adult). Dark barring slightly broader; this most marked on rump and uppertail-coverts, where dark barring is 3–4 mm wide and rather straight and uniform (cf. narrower and more chevron-shaped in adults). All feathers narrowly fringed white at tips, at least when fresh. **UNDERPARTS:** Dark-brown barring slightly narrower and sparser; as in grey morph, shorter lateral undertail-coverts almost unbarred and can make vent look plain. **TAIL:** White spots along shafts of rectrices much broader, 3–5 mm in diameter. Dark barring broader, 7–10 mm wide, and spaced at intervals of about 3–4 mm. **UPPERWING:** Coverts as scapulars, with broader dark-brown barring and narrower, duller rufous-brown (38) barring; all feathers narrowly fringed white at tips. Secondaries slightly narrower, with rounded outer corner (cf. square in adult; see Fig. 1). **UNDERWING:** Dark barring of lesser, median and marginal coverts much narrower, and there can be a large unbarred area behind carpal joint formed by outer secondary coverts and inner primary coverts. As in juvenile grey morph, pale barring of primaries appears to extend closer to wing-tips than in adults.

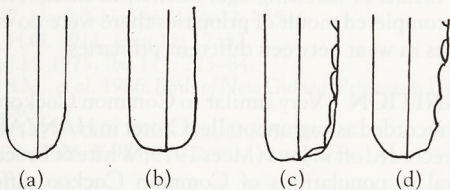


Figure 1 Secondaries: (a) Juvenile grey morph, fresh; S3 (b) Adult grey morph, fresh S3; (c) Adult rufous morph, fresh S3; (d) Adult rufous morph, worn S2

First immatures (First basic). Similar to adults and, like adults, sexes separable and females dimorphic. Usually, and probably always, differ from adults in retaining some juvenile secondaries (typically 1–3 of s2–s4, and sometimes more),

which, unlike adult remiges at this time, are worn and faded and apt to have more buff and more extensive pale spots on outer edges (though this varies with morph and is difficult to detect when plumage very worn and faded). Juvenile primaries also shorter and narrower than basic primaries, with more tapered tips, especially to outer webs. For discussion of separating second immatures (second basic) from adults, see Ageing.

BARE PARTS From photos (Kennerley & Leader 1991; Flegg & Longmore 1994; Wild Bird Soc. Japan 1996; Aust. RD; Strahan; unpubl.: P. Collins & R. Jessop; D.I. Rogers; P. Slater) and museum labels (ANWC, HLW, NMNZ, QM). **Adult male** Most of upper mandible and tip of lower mandible, dark grey (83) to grey-black (82). Basal fifth to half of lower mandible, orange (17) to orange-yellow (153), often separated from dark tip of lower mandible by varying smudgy area of greenish yellow (57) or yellowish grey (ne) that can extend almost to tip of bill, or can be wholly absent. Base of cutting edge of upper mandible, orange-yellow, as base of lower mandible; in about half, it peters out short of nostrils, and in rest it tapers gradually to peter out at level of distal edge of nostrils or 1–2 mm beyond; does not wrap around nostrils to any extent, unlike most Common Cuckoos. Palate, orange (16) to orange-yellow. Gape, dull yellow (157) to orange-yellow (153–18), often concealed by feathering. Iris usually yellow or pale yellow, less often brownish orange (c118); post-mortem discoloration probably responsible for occasional records of black-brown irides on labels. Orbital ring, yellow (55, 157) to buff-yellow (c153). Feet, yellow to orange-yellow (c153–18) or orange (17); claws often brownier (c223C), especially at base. **Adult female** Similar to adult males but iris varies more, from yellow (–) or orange (–) to red (c11), sometimes with red-brown (32) or brown (–) inner ring; some have wholly brown (–) iris. **Juvenile** Bill similar to adult, but gape, pale base of lower mandible and extreme base to cutting edges of upper mandible appear to be duller, ranging from grey (c87) to greenish yellow (157) or yellow. Palate, orange (16). Iris ranges from cream (sometimes with varying grey or brown tinge) to black-brown (119). Orbital ring, yellow (c157–55), possibly paler than in adults. Feet, orange-yellow (c153) or yellow (possibly paler at fledging than in adult). **Immature male** Similar to adult but more apt to have red-brown (340) iris (BWP). **Immature female** As adult.

MOULTS Based on Aust., NZ and PNG skins of 26 adults and 28 younger birds (AM, ANWC, HLW, MV, NMNZ, QM, SAM, WAM) and studies of subspecies *optatus* in Indonesia (Stresemann & Stresemann 1961; BWP). **Adult post-breeding** (Third and subsequent pre-basic). Complete. In Indonesia, begin moult of primaries between late Aug. and Nov., and finish late Nov. to early Apr., often after brief suspension (BWP). Timing in HANZAB region roughly similar, though few examined had suspended moult: in Dec.–Jan., two had finished moult (though one had suspended moult of p3) and one had yet to start; in Feb., four were actively moulting primaries (PMS 26–47) and two had finished moult; in Mar., three were actively moulting primaries (PMS 30–46) and two had finished. Sequence of moult of primaries complex; transient, growing 1–4 primaries concurrently, but gaps induced by moult almost always separated by at least one full-length primary. Two groups of moulting primaries identified — p1–p4 and p5–p10: outer group moults in sequence p7–p9–(short suspension)–p5–p8–(short suspension)–p6–p10 or –p10–p6; inner group in sequence p1–p4–p2–p3. P4 moulted at about same time as p7, p2 with p5 or p8, p3 with p6 or p10 or after all other primaries

moulted (Stresemann & Stresemann 1966; BWP). Aust. birds generally follow this sequence but are perhaps more prone to deviate from it; in Aust., seven of 14 moulting outer group of primaries differed (cf. 12 of 30 in Indonesia) and five of nine moulting inner group differed (cf. two of 30 in Indonesia; Stresemann & Stresemann 1966). However, deviations only slight (and some might have been caused by failure to distinguish second-year immatures from full adults; see Ageing). Molt of tail occurs when PMS 15–35, usually in sequence t5–t4–t1–t3–t2. Molt of secondaries starts when PMS about 25 and finishes at about end of molt of primaries; sequence approximately s9–s7–s8–s6–s1–s5–s4–s2–s3. A few birds arrest molt before replacing all secondaries (one of 28 examined in this study). **Post-juvenile** (First pre-basic). Nearly complete but usually retain a few juvenile feathers: one or more of s2–s4; often p3, p6 or p10; and t3 or t4. In Indonesia, start mid-Sept. to mid-Nov. with scattered feathers of body, then primaries (in sequence like adult post-breeding) between late Sept. and early Jan.; usually finish molt of primaries late Feb. to early May, but late-starting birds retain a few primaries (p3, p6 or p10, exceptionally as many as seven primaries) until 1 year old (BWP). Aust. data broadly consistent with BWP. Some birds retain at least 40% of juvenile plumage of body and all juvenile remiges on arrival in Aust.; others may moult one or two primaries before arrival, as suggested by collection of some in HANZAB region with early suspended molt of primaries. **Immature post-breeding** (Second pre-basic; age of first breeding not known). Complete. Like subsequent moults of adults, but any retained juvenile feathers moulted first, outside usual adult sequence (BWP).

MEASUREMENTS (1–3) Aust., NZ and PNG, skins (AM, ANWC, HLW, MV, NMNZ, QM, SAM, WAM): (1) Adults; (2) Juveniles; (3) Immatures with first basic primaries.

	MALES	FEMALES	
WING	(1) 210.3 (6.92; 199–219; 11)	189.1 (7.02; 175–200; 11)	**
	(2) 194.7 (5.66; 187–203; 6)	180, 194	
	(3) 196, 199, 201	191.1 (4.94; 184–197; 8)	
TAIL	(1) 159.8 (5.34; 153–168; 11)	149.7 (7.38; 138–161; 11)	**
	(2) 149.6 (4.58; 144–155; 7)	132, 145	
	(3) 146, 159, 160	147.3 (7.25; 132–153; 7)	
BILL S	(1) 27.7 (1.81; 25.1–31.4; 9)	26.6 (1.22; 25.5–29.1; 8)	ns
	(2) 27.3 (0.76; 26.4–28.2; 6)	25.5	
	(3) 26.7, 27.2, 29.5	25.9 (1.22; 24.0–27.8; 7)	
BILL N	(1) 16.2 (1.16; 14.8–18.7; 9)	15.7 (0.54; 14.8–16.3; 8)	ns
	(2) 16.1 (0.75; 15.2–17.3; 6)	15.4	
	(3) 16.0, 16.2, 17.5	15.6 (0.25; 15.3–16.0; 6)	
TARSUS	(1) 21.0 (1.24; 19.7–23.6; 9)	19.9 (1.43; 17.7–22.1; 11)	ns
	(2) 20.5 (1.48; 18.2–22.1; 7)	20.4, 21.7	
	(3) 18.1, 19.4, 20.7	19.2 (1.32; 16.9–21.2; 7)	
TOE C	(1) 27.8 (1.79; 25.7–29.4; 4)	26.5, 29.2	
	(2) 26.2 (0.96; 25.6–27.6; 4)	24.5, 28.8	
	(3) 23.6	25.0, 26.8	

For measurements of birds from breeding areas, see BWP. Wing and Tail of females significantly smaller than in males; larger samples from BWP also show bill of *optatus* significantly shorter in females. Wing and tail of juveniles significantly shorter than those of adults; according to BWP, juvenile bill not fully grown till Dec.–Jan. Immature females do not differ significantly from adults; too few data to test whether this is so for males. (Note that differences in tail-length between Aust. data and measurements of *optatus* from BWP probably caused by a difference in measuring method.)

WEIGHTS Subspecies *optatus*: (1–2) Adults and immatures: (1) Siberia and China (BWP); (2) Aust. and NZ, from museum labels (ANWC, NMNZ, QM, WAM).

	MALES	FEMALES
MAY–JULY	(1) 116.2 (91–139; 23)	93.8 (74–156; 14)
FEB.–MAY	(2) 91.8 (15.58; 73–114; 5)	97.7 (15.63; 78–131; 14)

Two juvenile males weighed 55.8 (Nov.) and 82 (Jan.); unsexed juvenile 58 (M. Crouther). Low weights may not be unusual on arrival. Too few data to examine seasonal changes in weight; adult and immature males in Aust. apparently substantially lighter than in breeding areas; adult and immature females from Aust. do not differ so markedly from females on breeding grounds.

STRUCTURE Wing long and narrow; pointed. Ten primaries: p8 longest; p10, 51–64 mm shorter, p9 4–12, p7 6–13, p6 19–28, p5 35–44, p4 46–60, p3 58–72, p2 72–85, p1 82–99. Primaries taper slightly toward rounded tip. Nine secondaries, including two tertials (but not including an unidentified feather that may be a very small innermost tertial or a greater secondary covert). Tail long and graduated; ten feathers; t5 35–47 mm shorter than t1. Bill rather short and slender; culmen and cutting edges curve down to sharply pointed tip while gonyes almost straight. Most of bill slightly laterally compressed but broad at base; nostrils small, round, with rims raised to form crater-like appearance. Tarsus short, scutellate; upper half feathered in front and at sides; rear edge of tarsus and tibio-tarsal joint unfeathered. Toes and claws rather short and slender, zygodactyl; outer hindtoe c. 78% of outer front, inner front c. 67%, inner hind c. 48%.

AGEING First basic immatures can usually be distinguished from adults by scattered retained juvenile remiges and rectrices. After these feathers replaced in complete second pre-basic molt, difficult to age, but BWP proposes a method which may work in Aust. In second immature retained juvenile feathers are first to be replaced and usually include p6, s2–s4 and t3–t4; these are among last feathers to be replaced in adults, so sequence of molt can be used to identify these birds. Further, once this molt finished, p6, s2–s4 and t3–t4 slightly older than other remiges and rectrices (cf. slightly newer than other remiges and rectrices in adults) and this may allow ageing up to 3 years old. Reliability of this method in Aust. not known; birds have been collected in our region that show molt characters as described for second-year immatures in BWP, but no independent means of assessing age; further, in many birds with recently completed molt of primaries there were no clear-cut differences in wear between different primaries.

RECOGNITION Very similar to Common Cuckoo, which has been recorded as vagrant on Iles Crozet in HANZAB region and also recorded off w. Java (Mees 1979; White & Bruce 1986). In general e. populations of Common Cuckoo differ from Oriental Cuckoo in narrower barring on underparts (0.7–2.1 mm wide on breast [BWP]), lack of a strong buff tinge to undertail-coverts and less contrasting white bar across underwing (see Redman 1985; Blom 1989; Parkes 1990; Kennerley & Leader 1991; Jonsson 1992; BWP).

GEOGRAPHICAL VARIATION Marked variation in size but little in colour of plumage. Four subspecies recognized here.

Subspecies *optatus*¹ (described above), which breeds Siberia, Japan and n. China and is subspecies that usually occurs in Aust., is largest subspecies. Nominate *saturatus*, which breeds from Himalayas to s. China and Taiwan, only differs from *optatus* in smaller size (see Measurements). Both *optatus* and *saturatus* commonly migrate as far S and E as Indonesia for the non-breeding season (e.g. Becking 1975; White & Bruce 1986; BWP), where measurements (separated by age and sex) fall into non-overlapping clusters. Lack of intermediates in Indonesian non-breeding areas suggests there is little or no mixing of *saturatus* and *optatus* on breeding grounds, a point that had been debated in earlier literature (e.g. Vaurie 1965; White & Bruce 1986). Of Aust. and NZ birds measured in this study, all 21 males had measurements consistent only with *optatus*, but several of the 21 females examined were small for *optatus*, notably AMS 12260 (C. York Pen., an adult with Wing 175, and Tail 138) and ANWC 16070 (NT, an adult with Wing 183 and Tail 148), both of which considered to be *saturatus* on measurements. Seven other females also had unusually short wings for *optatus*: three adults with Wing 185–189, two immatures with Wing 184, and juvenile with Wing 180. Identity of these specimens uncertain; they may be intermediates between *saturatus* and *optatus*, or they may be small *optatus* and simply indicate that this subspecies varies more in size than indicated by small samples for females in BWP.

Subspecies *lepidus* of Malay Pen. to Lesser Sundas, and *insulindae* of Borneo, previously thought to be subspecies of Little Cuckoo *C. poliocephalus*. Studies of eggshell morphology, breeding biology, plumage, bill-shape and, especially, vocalizations have shown that they are best regarded as sedentary, montane subspecies of Oriental Cuckoo (Becking 1975; Wells & Becking 1975; Wells 1982).

In all subspecies, 30–60% of females are rufous morph (BWP).

It has recently been proposed (Payne 1997) that the complex involves two species: monotypic *Cuculus horsfieldi* (= *optatus* of above, the common bird in HANZAB region) and Himalayan Cuckoo *C. saturatus* (including subspecies *saturatus*, *lepidus* and *insulindae*). Birds treated as Himalayan Cuckoos apparently differ consistently in calls on breeding areas (Payne 1997; see also Wells & Becking 1975, Martens & Eck 1995) and probably occur occasionally in Aust. (see above). Further work on the taxonomy of this complex is in progress (R.B. Payne).

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¹ Subspecies *optatus*, Gould, 1845, was called *horsfieldi*, Moore, 1857, in much previous literature (including BWP) because Gould's adult male type-specimen was considered to be *saturatus* (e.g. Junge 1937). However, the type-locality was Port Essington, NT, which would be an unusual distribution record for *saturatus* (see discussion above). Further, Gould's measurements of the type (Wing 7³/₄" , 197 mm) suggest it was too large to be *saturatus*, especially since Gould's measurement was unlikely to be maximum chord and was thus probably an underestimate of wing-length. See also Schodde & Mason (1997).

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Dedicated to the memory of John McKean



Volume 4, Plate 31

Oriental Cuckoo *Cuculus saturatus* (page 653)

1 Adult male; 2 Adult female, grey morph; 3 Adult female, rufous morph; 4 Juvenile male, grey morph; 5 Juvenile female, rufous morph; 6 Immature female, grey morph; 7 Adult male; 8 Adult female, rufous morph

Pallid Cuckoo *Cuculus pallidus* (page 662)

9 Adult male, light-grey morph; 10 Adult female, light-rufous morph; 11 Adult female, dark-rufous morph; 12 Juvenile; 13 Immature male, dark-grey morph; 14 Adult male, light-grey morph; 15 Adult female, dark-rufous morph