

## Order PASSERIFORMES

The largest and most diverse order of birds, commonly called passerines or perching birds, and comprising some 5712 species in 45 families (based on Sibley & Monroe 1990; Sibley & Ahlquist 1990), and well over half the world's known bird species. In the HANZAB region, Passeriformes represented by some 382 species in 39 families. Tiny to large: smallest passerine is Pygmy Tit *Psaltria exilis* of Java, with a total length c. 8 cm; largest is Greenland Raven *Corvus corax principalis*, with a total length c. 64 cm and weighing up to 1.7 kg. Superb Lyrebird *Menura novaehollandiae* of e. Aust. probably second largest in Order, with a total length (in adult male) of c. 103 cm, including tail of c. 70 cm, and weight up to c. 1.1 kg. Cosmopolitan except Antarctica and some oceanic islands; and occupying all terrestrial habitats.

Overall, Passeriformes are characterized by (based on Raikow 1982; Sibley & Ahlquist 1990; and DAB [=Schodde & Mason 1999]): Palate aegithongnathous (except Conopophagidae [gnateaters]). Intestinal caeca rudimentary. Single left carotid artery (except paired in *Pseudocalyptomena* and possibly other broadbills [Eurylaimidae]). Aftershaft reduced or absent. Neck short, with 14 cervical vertebrae in most, but 15 in Eurylaimidae (broadbills); atlas perforated; metasternum usually two-notched (rarely four-notched). Bicep slip absent. Expansor secundariorum often present (Berger 1956; Raikow 1982; *contra* Beddard 1898; Ridgeway 1901). Pelvic muscles AX1 (AX in *Dicrurus* [drongos]). *Ambiens* absent. Iliofemoralis externus usually absent, but present in some groups as 'developmental anomaly' (Raikow 1982). Tensor proptagialis brevis tendon present. Hypocleideum present (except Menuridae [lyrebirds]). Wings eutaxic. Usually ten primaries, but p10 often reduced or absent; 11 primaries in Menuridae (lyrebirds), most Eurylaimidae (broadbills), most Furnariidae (ovenbirds), and some Passeri (oscines [see below]). Usually nine secondaries (ten in Menuridae [lyrebirds]). Usually 12 rectrices, but from six (*Stipiturus* [Maluridae]) to 16 (Menuridae). Lesser primary and secondary coverts usually reduced or absent (Zeidler 1966; Morlion 1985; Winkler & Jenni 1996), but a few well-developed lesser primary coverts are present in Superb Lyrebird (Morlion 1985). Uropygial preen glands naked. No basipterygoid process. Nasal glands minute. Foot anisodactyl. Hallux incumbent, large and directed backwards; toes 2, 3 and 4 directed forward; digital formula 2-3-4-5. Deep plantar tendons usually of type VII (lacking vinculum), but often type I in Eurylaimidae (broadbills). Spermatozoa bundled with coiled head and large acrosome.

The DNA-DNA hybridization studies of Sibley & Ahlquist (1985a, 1990) revealed much about the relationships within the Passeriformes and resulted in fundamental changes to the higher level taxonomy of passerines, not least to the taxonomy of the Australo-Papuan oscine passerines. Importantly, these studies showed that many elements of the Australo-Papuan avifauna (e.g. the A'asian wrens [Maluridae], robins [Petroicidae], babblers [Pomatostomidae], and so on), represent an endemic radiation of forms that bear an external resemblance to Eurasian families. Many of the findings of DNA-DNA hybridization studies regarding the Australo-Papuan oscines have since been broadly corroborated by studies using protein allozymes (e.g. Christidis 1991; Christidis & Schodde 1991) and microcomplement fixation (e.g. Baverstock *et al.* 1991, 1992), though there are also many points that remain uncertain and many familial relationships within the Passeriformes are unresolved (Christidis & Boles 1994). (For discussion of historical taxonomic arrangements preceding results of DNA-DNA hybridization studies, see BWP, and Sibley & Ahlquist [1985a,b, 1990]).

The Passeriformes divide into two main groups:

**SUBORDER TYRANNI (SUBOSCINES):** The distribution of the suboscines is centred in the American and Afro-Asian Tropics, with a massive radiation in South America (Sibley & Ahlquist 1990; DAB). Suboscines characterized by mesomyodian syrinx, with or without a single pair of intrinsic syringeal muscles (van Tyne & Berger 1976; Campbell & Lack 1985; DAB). Suborder sometimes named Oligomyodi (e.g. Sibley & Ahlquist 1985a,b), Deutero-Oscines (e.g. Morony *et al.* 1975; Voous 1977), or Clamatores (Campbell & Lack 1985). Poorly represented in the HANZAB region: only TYRANNIDAE (tyrant-flycatchers), with two species, both accidental to South Georgia; ACANTHISITTIDAE (NZ wrens), with four species (one extinct) in three genera, endemic to NZ; and PITTIDAE (pittas), with four species in one genus in HANZAB region (three breeding, one accidental). Tyranni formerly included the Menuridae and Atrichornithidae (e.g. Wetmore 1960; Storer 1971), though subsequently shown that these two families should be included in Passeri (e.g. Sibley 1974; Sibley & Ahlquist 1985, 1990).

**SUBORDER PASSERI (OSCINES OR SONGBIRDS):** Cosmopolitan in distribution. Within the HANZAB region there are 36 families of Passeri. The Australo-Papuan Passeri can be subdivided into several supra-familial groups, but those recognized differ between authors (for further information, see Sibley & Ahlquist 1985, 1990; DAB). Oscines are

characterized by acromyodian syrinx, with three or four pairs of intrinsic syringeal muscles (van Tyne & Berger 1976; Campbell & Lack 1985; Sibley & Ahlquist 1990; DAB).

Suborder Passeri comprises the major element of the Aust. and NZ passerine avifauna. The families recorded in the HANZAB region, and the representatives in the region, are (following Christidis & Boles [1994] for Aust., with additional species for wider region added as appropriate):

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- MENURIDAE (lyrebirds): two species in one genus; endemic to Aust.;
- ATRICHORNITHIDAE (scrub-birds): two species in one genus; endemic to Aust.;
- CLIMACTERIDAE (A'asian treecreepers): six species in two genera breeding in Aust.;
- MALURIDAE (Australopapuan fairy-wrens, emu-wrens and grasswrens): 22 breeding species in three genera in Aust.;
- MELIPHAGIDAE (honeyeaters and Aust. chats): 76 species in 26 genera in Aust. and NZ, all breeding;
- PARDALOTIDAE (pardalotes, scrubwrens, thornbills and allies): 51 species (one extinct) in 15 genera in HANZAB region, all breeding;
- PETROICIDAE (A'asian robins): 23 species in eight genera in HANZAB region, all breeding;
- ORTHONYCHIDAE (logrunners): two breeding species in one genus in Aust.;
- POMATOSTOMIDAE (A'asian babblers): four breeding species in single genus in Aust.;
- CINCLOSOMATIDAE (whipbirds, wedgebills, quail-thrushes and jewel-babblers): eight breeding species in two genera in Aust.;
- NEOSITTIDAE (sitellas): single species breeding in Aust.;
- PACHYCEPHALIDAE (whistlers, shrike-thrushes and allies): 17 species in seven genera in HANZAB region, all breeding;
- DICRURIDAE (monarchs, flycatchers, fantails and drongos): 19 species in seven genera in HANZAB region, all breeding;
- CAMPEPHAGIDAE (cuckoo-shrikes, trillers and minivets): eight species (one extinct) in two genera in HANZAB region, all breeding;
- ORIOLIDAE (Old World orioles and figbirds): three species in two genera in Aust., all breeding;
- ARTAMIDAE (woodswallows, butcherbirds and currawongs): 14 species in four genera in HANZAB region, all breeding;
- PARADISAEIDAE (birds of paradise): five breeding species in two genera in Aust.;
- CORVIDAE (crows and jays): six breeding species in single genus in Aust. and NZ, including one introduced to NZ;
- CORCORACIDAE (Aust. mudnesters): two species in two monospecific genera, endemic to Aust.;
- CALLAEIDAE (NZ wattlebirds): three species (one extinct) in three monospecific genera, endemic to NZ;
- LANIIDAE (shrikes): two species in HANZAB region, one accidental to Prince Edward Is, the other accidental to Christmas I.;
- PTILONORHYNCHIDAE (bowerbirds): ten species in seven genera in Aust. (nine species) and NZ (one species), all breeding; Piopio of NZ probably extinct (Heather & Robertson 1997);
- ALAUDIDAE (larks): two breeding species in HANZAB region (including one successfully introduced to Aust. and NZ);
- MOTACILLIDAE (wagtails and pipits): eight species in two genera in HANZAB region, only two breeding (one on South Georgia), the rest non-breeding visitors or accidentals;
- PRUNELLIDAE (accentors): one species successfully introduced to NZ;
- PASSERIDAE (Old World sparrows and A'asian finches): 22 species in nine genera (including four successful introductions) in HANZAB region, all breeding;
- FRINGILLIDAE (Old World finches): seven species in four genera in HANZAB region, all introduced except one naturally occurring vagrant to South Georgia;
- EMBERIZIDAE (buntings, cardinals, tanagers and allies): two successfully introduced species, occurring NZ and Lord Howe I.;
- NECTARINIIDAE (sunbirds and spiderhunters): single breeding species in Aust.;
- DICAEIDAE (flowerpeckers): single breeding species in Aust.;
- HIRUNDINIDAE (swallows and martins): eight species in four genera in HANZAB region, including four breeding species in Aust. and NZ, one non-breeding visitor and three accidentals;
- PYCNONOTIDAE (bulbuls): one successfully introduced species in Aust.;
- SYLVIIDAE (Old World warblers): 13 species in eight genera in HANZAB region, including ten breeding species (one extinct) in Aust. and NZ, and three accidental to region;
- ZOSTEROPIDAE (white-eyes): seven species (one extinct) in single genus in HANZAB region, all breeding;
- MUSCICAPIDAE (Old World flycatchers, thrushes and chats): eight species in six genera in HANZAB region, including five breeding species (two introduced), and four accidentals (including one on Prince Edward Is);
- STURNIDAE (starlings and mynas): five species in four genera, four breeding in HANZAB region (including two species successfully introduced, and one species now extinct), and one accidental.
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The Aust. oscines fall into two distinct clusters, each with at least three major supra-familial lineages (DAB): One cluster is the Passerida, comprising the Muscicapoidea (including true thrushes and allies), Sylvioidea (true warblers and babblers, and swallows, and others), and Passeroidea (including larks, pipits, sunbirds, flowerpeckers and all finches and their allies). The other cluster is the Corvida, which is centred on the Australo-Papuan region (though its origins are not certain) and which also comprises three main lineages: Menuroidea (lyrebirds, scrub-birds, treecreepers and bowerbirds), Meliphagoidea (A'asian wrens, pardalotes, acanthizid warblers, and honeyeaters), and Corvoidea (A'asian robins, logrunners, A'asian babblers, whipbirds and quail-thrushes, sitellas, whistlers, fantails and monarchs, birds of paradise, butcherbirds and woodswallows, cuckoo-shrikes, Old World orioles, crows and mudnesters).

Throughout this volume, arrangement of families follows that of Christidis & Boles (1994) except that the Meliphagidae precedes the Pardalotidae. This change was made to ensure the Meliphagidae were dealt with in a single volume, rather than split between volumes, and because the switch meant no change to the positioning of Meliphagidae relative to the Pardalotidae (including Acanthizidae), one another's closest relatives, and because there is little overriding evidence of the exact taxonomic positioning of all families within the Meliphagoidea; Sibley & Monroe (1990) also placed the Meliphagidae between the Maluridae and Pardalotidae. However, DAB points out that based on structure of humeral fossa, positioning of Meliphagidae between the Maluridae and Pardalotidae is not correct.

DAB, however, varies from the familial arrangement of Christidis & Boles (1994) in several ways. The main differences are: (1) recognition of Pardalotidae and Acanthizidae as separate families (combined in Pardalotidae in Christidis & Boles); (2) minor rearrangement of the sequence of the families Paradisaeidae–Artamidae–Campephagidae–Oriolidae between the Dicruridae and Corvidae (cf. Dicruridae–Campephagidae–Oriolidae–Artamidae–Paradisaeidae–Corvidae in Christidis & Boles); (3) and use of the more traditional muscicapoid (flycatcher) – sylvioid (warbler) – passeroid (finch) sequence of Sibley *et al.* (1988), Sibley & Ahlquist (1990) and Sibley & Monroe (1990) and much contemporary literature of n. hemisphere, with families in the sequence Muscicapidae–Sturnidae–Hirundinidae–Pycnonotidae–Zosteropidae–Sylviidae–Alaudidae–Dicaeidae–Nectariniidae–Passeridae–Motacillidae–Estrildidae–Fringillidae and noting recognition of the Estrildidae as a separate family (cf. the reversed sequence of Christidis & Boles, as given above, and which submerges the Estrildidae within the Passeridae). For discussion of the reasons for these changes, see DAB (and discussion under these families in future volumes of HANZAB).

Arrangement of genera and species within families also follows Christidis & Boles (1994), which was in turn largely based on Schodde (1975) unless there were specific reasons for change. Lastly, with few exceptions, which are discussed in individual species accounts, taxonomy of subspecies follows DAB.

Passerines are extremely diverse in body form and plumage, and vary greatly in rates of maturation. Some attain adult plumage within months or weeks of fledging; others can take up to 9 years to attain adult plumage (e.g. Superb Lyrebird). Degree of sexual dimorphism also varies greatly: some monomorphic, others vary in either size, plumage or both. Common pattern of annual moult is a single complete post-breeding (pre-basic) moult, but some groups (e.g. Maluridae) or species (e.g. Banded Honeyeater *Certhionyx pectoralis*) also undergo a partial pre-breeding (pre-alternate) moult annually. Moult of primaries usually outward. Secondaries moult from innermost and outermost toward s5. Moult of tail usually centrifugal (outward from centre). Young altricial, nidicolous and dependent on adults for food; usually hatch with sparse to very sparse covering of down, mainly on dorsum; Menuridae (lyrebirds) have heavy natal down. Juvenile plumage usually duller than adult, and in many sexually dimorphic species, often similar to that of adult female.

There are few common features of food, feeding behaviour, social organization and behaviour, voice or breeding in such a large and diverse group of birds.

Volant; extinct Stephens Island Wren *Traversia lyalli* probably the only flightless passerine (Millener 1988). Movements vary greatly: some species long-distance migrants (e.g. Barn Swallow *Hirundo rustica*, Nightingale *Luscinia megarhynchos* and many Old World warblers, such as *Acrocephalus* and *Locustella*, breed in temperate Palaearctic and migrate to Africa or Indian subcontinent [BWP]; Acadian Flycatcher *Empidonax vireescens* breeds North America and migrates to South America [Ridgely & Tudor 1994]), others sedentary in small territories (e.g. Cactus Wren *Campylorhynchus brunneicapillus* of sw. USA and Mexico [Ricklefs 1975; Ehrlich *et al.* 1988]). In HANZAB region, movements also vary widely: e.g. Yellow-faced Honeyeater *Lichenostomus chrysops* regular annual migrant in parts of e. Aust.; Rifleman *Acanthisitta chloris* of NZ sedentary in small territories. In Aust., movements often poorly known and unstudied; many species often said to be nomadic, with such claims often based on no or very poor knowledge of actual movements and based only on apparently irregular occurrence in an area (see General Introduction [Movements] for fuller discussion of this point).

Arboreal or terrestrial or both; some strictly arboreal (e.g. Hirundinidae), others strictly terrestrial (e.g. Menuridae, Pittidae); most combine both arboreal and terrestrial foraging to varying degrees, but usually with one predominating. Feed on almost all known food, from plant material to vertebrate animals, but most show some specialization for certain food, such as feeding on nectar (Nectariniidae), seeds (Passeridae), fruit (Zosteropidae), small vertebrates (Artamidae) and, commonly, insects (e.g. Maluridae, Pardalotidae, Petroicidae and others). Mostly feed by gleaning

and probing, including probing flowers for nectar; and other substrates for invertebrates; also feed by sallying, including various sallying techniques (sally-hovering, sally-striking and sally-pouncing), each suited for one group of prey, particularly moving animals.

In passerines, parental care in both sexes is well developed. However, a few species are parasitic, e.g. cowbirds *Molothrus* (Campbell & Lack 1985). Young are dependent on parents for food. Young beg by gaping, typically exposing brightly coloured inside of mouth, often with contrasting pale or dark spots; in non-passerines, bright gape present only in hoopoes (Upupidae), mousebirds (Coliiformes) and cuckoos (Cuculiformes) (BWP). See Boles & Longmore (1985) for descriptions of colours and markings inside the mouths of some Aust. passerines.

Anting is a highly specialized behaviour: ants are held in the bill and applied to the plumage, usually to the underside of the wing-tip (direct or active anting, or ant-application), or ants are allowed access to the plumage (indirect or passive anting, or ant-exposure), or both, e.g. anting recorded in Regent Honeyeaters *Xanthomyza phrygia* in HANZAB region, with bird then seen eating ant. Thought to be unique to Passeriformes (e.g. Simmons 1966; Campbell & Lack 1985; BWP). Suggested this may be comfort behaviour related to maintenance of feathers, by perhaps reducing ectoparasite load, removing stale or excess lipids, or adding supplementary essential oils (Campbell & Lack 1985); some secretions of ants are antibiotic, inhibiting growth of both fungi and bacteria, and the secondary acquisition of these antibiotic secretions would be an important advantage of anting (Ehrlick et al. 1986).

Other behavioural characters include head-scratching indirectly (or over the wing) in most families, with the foot brought up above the lowered wing. Head oiled indirectly, as seen in most taxa, but passerines also oil head by head-scratching, in which bird oils the bill directly, then transfers the oil first to one foot by scratching the bill, and then to the head by scratching the head with foot. To oil the undersurface of the wings, use bill or bill and head together, extending one wing at a time sideways and forward, carpus uppermost, and often alternating rapidly from one wing to the other. The stretching of one wing as a comfort movement seems common to all birds, but in passerines it is often accompanied by sideways fanning of tail. After both wings are stretched, passerines often give a two-leg stretch as they straighten the tarsal joints and lift the body. Heat is dissipated by gaping and panting (not by gular-fluttering, so far as known) (Campbell & Lack 1985; BWP). Bathing widespread, mainly by standing in shallow water, but some groups jump into and out of water repeatedly, or flight- or plunge-bathe, while others bathe only or mainly in rain or among wet foliage; for further details of bathing, see Campbell & Lack (1985). Passerines do not flap wings in the manner of non-passerines to dry, but perform various shaking movements, as well as preening (Campbell & Lack 1985). Dusting confined to only a few groups, but sunning, both for gaining heat (sun-basking) and other purposes (sun-exposure), is widespread, and of two distinct types: (1) lateral posture, in which sunning bird squats or sits down, usually on ground, and leans to one side exposing the flank or the 'sun-wing', which has been lowered and partly unfolded, and the fanned tail, which has been brought round to the same side; and (2) spread-eagle posture, in which bird squats or lies flat with both wings open and tail fanned (details in Campbell & Lack 1985; Simmons 1986).

There is a high incidence of co-operative breeding in Aust. and NZ, and it is especially common and well-studied in the Maluridae but is more widely recorded, including within the Acanthisittidae, Meliphagidae, Petroicidae, Pomatostomidae and Corcoracidae (see Dow 1978, 1980; Brown 1987; Ford 1989; Rowley & Russell 1997).

In vocal abilities, species of Passeriformes are more accomplished than those of any other order, but songs may be simple or highly complex, and repertoires small or large. Mimicry of calls of other species is practised by many species; c. 15% of Australian passerine species have been reported to mimic (Marshall 1950). The Superb Lyrebird and the Tui *Prosthemadera novaeseelandiae* have been classed among the best seven of the world's songsters (Hartshorne 1973). Oscines, or songbirds, have specialized forebrain song nuclei, and, through auditory feedback, learn their songs from those of adults, in much the same way as human young learn their spoken language from adults. In contrast, the songs of suboscines are relatively simple (like the non-learned call-notes of songbirds), repertoires are small, geographical variation is minimal, and development of song appears to take place without any imitative or feedback process. Some oscine species use vocal learning to generate large song repertoires and may vary them geographically, even locally. Other oscine species forgo these possibilities and have song repertoires more like those of suboscines; how the learning process maintains stereotypy of song over the range of such species is a mystery (Kroodma 1996).

Apart from the five families discussed hereunder, syringeal structure of passeriform species of our area is similar, there being four pairs of intrinsic muscles. Pittidae have no intrinsic muscles (Ames 1971); calls are mostly loud strong whistles (Pizzey 1980). Acanthisittidae also have no intrinsic muscles, but the presence of a well-developed drum (fusion of posterior tracheal elements) suggests they may have once been present; vocal repertoire is not great (Ames 1971). Menuridae and Atrichornithidae have similar syringeal structures, with three pairs of intrinsic muscles; songs are highly developed, and there can be much mimicry (Ames 1971). Climacteridae, with four pairs of intrinsic muscles, exhibit gross asymmetry of the extrinsic muscles, unusual directions of muscle fibre in the intrinsic muscles, and an exceptionally robust sternotracheal muscle (Ames 1987); calls are brisk, sharp and piping (Pizzey 1980).

Extended tracheae are found in the genus *Manucodia* (Paradisaeidae), the calls of which are deep, loud or far-carrying (Frith 1994). In the only species occurring in our area, the Trumpet Manucode *M. keraudrenii*, the trachea forms a flat coil between the skin and the pectoral muscles, sometimes extending over the abdominal muscles as well,

and may be up to 828 mm in length, compared with body-length, from bill to pygostyle, of c. 150 mm (Ames 1971; Clench 1978).

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## Family CAMPEPHAGIDAE cuckoo-shrikes, minivets and trillers

A fairly large and rather homogeneous family of sleek, small to medium-sized passerines with rather large heads, and long, tapered wings and tails. The family comprises 67–86 species in 6–9 genera, distributed from sub-Saharan Africa to the Indian subcontinent, much of e. and se. Asia, including Wallacea, to A'asia and islands of the sw. Pacific Ocean, with high species diversity in se. Asia and the Australo-Papuan region (Sibley & Monroe 1990; Monroe & Sibley 1993; Taylor 2005; Peters; DAB). As recognized here, the family comprises: the cuckoo-shrikes (genera *Coracina*, *Campephaga* and *Campochaera*), trillers (*Lalage*), minivets (*Pericrocotus*), and flycatcher-shrikes (*Hemipus*); the Ground Cuckoo-shrike *Coracina maxima* is sometimes placed in a monotypic genus *Pteropodocys*, and the two wattled cuckoo-shrikes from Africa are sometimes placed in *Campephaga* (as here) or in a separate genus *Lobotos*. In the HANZAB region, eight species in two genera (*Coracina*, *Lalage*); the Long-tailed Triller *Lalage leucopyga*, which once occurred on Norfolk I., is now extinct there, but remains extant on other islands in the sw. Pacific Ocean. Minivets are confined to Asia, and not recorded from the HANZAB region. Members of the Campephagidae are closely related to the Old World orioles as shown by DNA–DNA hybridization ( $\Delta T_{50H} = 4.8$ ) studies (Sibley & Ahlquist 1985, 1990) and protein electrophoresis (Christidis & Schodde 1991). Accordingly, the Old World orioles *Oriolus* and figbirds *Sphecotheres* have been combined with the cuckoo-shrikes, trillers and minivets in one tribe, Oriolini, within the subfamily Corvinae of the expanded family Corvidae (Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990; Monroe & Sibley 1993). However, we follow Christidis & Boles (1994) and DAB in placing the Old World orioles and figbirds in a separate family Oriolidae (see that family introduction for justification) within the corvoid lineage of songbirds (DAB).

Overall, length ranges from 13 cm (Samoan Triller *Lalage sharpei*) to 38 cm (Ground Cuckoo-shrike), and weights from 6–12 g (Small Minivet *Pericrocotus cinnamomeus*) up to 180 g (South Melanesian Cuckoo-shrike *Coracina caledonica*). Within HANZAB region, smallest is White-winged Triller *Lalage sueurii* (length c. 18 cm, weight c. 26 g) and largest is Ground Cuckoo-shrike (length 31–38 cm; weight 120–155 g). The family is characterized by (mainly from Beecher 1953 and DAB): wings rather long and pointed at tips; ten primaries, outermost well developed; and ten secondaries, including three tertials. Tail rather long and tapered, usually with gently rounded or rather square tips, but deeply forked in Ground Cuckoo-shrike; 12 rectrices. Bills rather short and broadly based, with small hook at tip and distinct notch near tip of upper tomium; nasal groove with several short bristles. Rictal bristles present. Tongue with quadrifid tip and papillae which ventrally aligned in two ranks. Tarsi short with laminiplantar scaling; and feet rather small and weak in most species. However, Ground Cuckoo-shrike has rather long and robust legs and long toes. Osteological features include: single, well-developed and trabeculated (with cross-barred framework) humeral fossa, but almost completely doubled in *Pericrocotus* (Bock 1962); fully aperturate nasal cavity; vomers broad and bi-crested at tips; nasal bars narrow; tips of maxillo-palatines bulbous, with lateral grooves; palatine shelves broad, with well-developed interpalatine process; ectethmoid plate truncate, with broad slit-like foramen and free lachrymals below wing on latero-ventral face; large temporal fossae; lack heavy ossification to nasal cavity; and zygomatic processes often doubled.

Plumages dense and soft. Cuckoo-shrikes *Coracina* usually have fine powder-downs and reduced uropygial glands, and lack an apterium in the spinal feather-tract; cuckoo-shrikes and trillers have rather thin and fragile skin (DAB). Plumage varies from predominantly grey and white (cuckoo-shrikes), to pied or with varying brownish or buff tones (trillers) or brightly red and yellow (minivets). Some species are strongly sexually dimorphic (White-winged Triller, Cicadabird *Coracina tenuirostris*), but others are not (Ground Cuckoo-Shrike) or only slightly so (e.g. White-bellied Cuckoo-shrike *Coracina papuensis*). Females, immatures and juveniles of some species have duller and often distinctly barred plumage compared with adult males. Nestlings develop down within a few days of hatching; not known if any species hatch with natal down. Fledge in juvenile plumage. Post-juvenile (first pre-basic) moult partial, usually resulting in adult female-like first immature non-breeding (first basic) plumage (in cuckoo-shrikes and trillers). Acquire adult plumage in complete first immature post-breeding (second pre-basic) moult. Once adult plumage attained, most species undergo one complete post-breeding moult each year resulting in non-breeding (basic) plumage. A few species (e.g. White-winged Triller) undergo partial pre-breeding (pre-alternate) moult to a breeding plumage, this sometimes also occurring in first immatures; the Ashy Minivet *Pericrocotus divaricatus* undergoes two complete moults annually (Taylor 2005). Primaries moult outward, usually starting at p1. Moult of rectrices usually centrifugal; usually occurs at same time as moult of primaries. Moult of head and body usually begins before start of primary moult and finishes after end of primary moult.

Most species mainly or exclusively arboreal, often in upper levels or canopy of tall trees. In many species, flight strongly undulating and cuckoo-like (especially in larger cuckoo-shrikes), in which flapping to gain height alternates with glides on wings held stiffly downward or held to body. A characteristic habit of some of the larger

cuckoo-shrikes is shuffling or flicking of wings on alighting and when perched, and differences in such behaviour can be a useful field character (e.g. see White-bellied Cuckoo-shrike). All strictly diurnal, though in migratory forms some passage nocturnal (see discussion of Movements below).

Throughout range, predominantly birds of forested habitats, occupying a wide range of forests, including tropical and subtropical rainforest, dense montane forests, monsoon and swamp forests, bamboo forest, mangrove associations, deciduous forest, and pine *Pinus* forest; most species also use secondary forest, forest edges and the edges of clearings, and other modified forest habitats, though a few species apparently restricted to primary forest (e.g. New Caledonian Cuckoo-shrike *Coracina analis* and Hooded Cuckoo-shrike *C. longicauda*). Also use a range of other wooded habitats, such as many types of woodland, including savanna, evergreen thickets and orchards, and some species appear to prefer woodland or more lightly timbered habitats (e.g. White-breasted Cuckoo-shrike *Coracina pectoralis* of Africa occurs in acacia savanna and tall broadleaf woodland). Some species readily use modified habitats, such as overgrown plantations and parks. Many species are generalists, occurring in a wide range of habitats (e.g. White-bellied Cuckoo-shrike found in savanna, primary woodlands and forests, secondary and riparian forests and woodlands, mangroves and modified habitats including plantations, farmlands and suburban gardens). In HANZAB region, many species commonly in sclerophyll woodlands and forests dominated by eucalypts and acacias (e.g. White-winged Triller, Black-faced Cuckoo-shrike *Coracina novaehollandiae*, White-bellied Cuckoo-shrike and Ground Cuckoo-shrike). Other species commonly in more closed forests, such as rainforests and mangrove associations (e.g. Varied Triller *L. leucomela*, Barred Cuckoo-shrike *C. lineata* and Cicadabird). Black-faced Cuckoo-shrike a common species of cities, urban areas, rural towns and settlements. Throughout range, predominantly birds of lowlands and middle altitudes, though a few species primarily montane species (e.g. Hooded Cuckoo-shrike of montane New Guinea occasionally reaches 3700 m) (King *et al.* 1978; Mackworth-Praed & Grant 1980; Coates 1990; Sibley & Monroe 1990; Maclean 1993; Orn. Soc. Japan 2000; Robson 2002; Taylor 2005; see species accounts).

Patterns of movements in Aust. vary, with species variously considered resident (e.g. White-bellied Cuckoo-shrike), dispersive (Ground Cuckoo-shrike) or partly migratory (Black-faced Cuckoo-shrike, Cicadabird). Movements of migratory species complex and patterns include an inland slope-line pattern, in which birds move on SE-NW axis within e. Aust., regularly (Black-faced Cuckoo-shrike) or occasionally (White-winged Triller) reaching New Guinea. Several Aust. species also show irregular movements (e.g. Ground Cuckoo-shrike, White-winged Triller). Black-faced Cuckoo-shrikes migrate over broad front from Aust. to PNG across Coral Sea, arriving from early Apr. Subspecies *tenuirostris* of Cicadabird also migrates to New Guinea in the dry season, mostly by a direct N-S route, with local subspecies regarded as breeding residents (Coates 1990; Griffioen & Clarke 2002; Aust. Atlas 1; see species accounts). Extralimitally, mostly considered sedentary or resident. Extralimital populations of White-bellied Cuckoo-shrike, Cicadabird, Barred Cuckoo-shrike and Varied Triller are all sedentary; other A'asian species also described as sedentary (e.g. Boyer's Cuckoo-shrike *Coracina boyeri*). Asian species mostly described as resident (e.g. Bar-bellied Cuckoo-shrike *Coracina striata*, Pied Triller *Lalage nigra*, Fiery Minivet *Pericrocotus ignens*), but several of the minivets are migratory (e.g. Brown-rumped Minivet *Pericrocotus cantonensis* breeds in China and winters in se. Asia), or altitudinal migrants (e.g. Scarlet Minivet *P. flammeus*, descends to lower elevations after breeding in the Himalayas); a few species make seasonal movements (e.g. Black-headed Cuckoo-shrike *Coracina melanoptera*). Similarly, most species in Africa described as resident (e.g. White-breasted Cuckoo-shrike), though some make seasonal movements, including two that include migratory populations that move to equatorial Africa to breed (Red-shouldered Cuckoo-shrike *Campephaga phoenicea*) or after breeding (Black Cuckoo-shrike *Campephaga flava*). Some passage occurs at night, as evidenced by bird strikes at lighthouses in Aust. and attraction to lights in Africa, but diurnal passage also seen (Newman 1983; Grimes 1987; Coates 1990; Maclean 1993; Elgood 1994; Penry 1994; Cheke & Walsh 1996; Dean 2000; Robson 2000; Taylor 2005; see species accounts).

Mainly eat arthropods, predominantly insects, and fruit (especially wild figs *Ficus*), occasionally small vertebrates (including lizards and birds), seeds, buds, nectar or other vegetable matter, such as leaves. Some species primarily insectivorous (e.g. most cuckoo-shrikes, minivets *Pericrotus* and flycatcher-shrikes *Hemipus*), others primarily frugivorous (e.g. Varied and Black-browed *Lalage atrovirens* Trillers, and Barred, Boyer's, Black-headed Cuckoo-shrikes); many cuckoo-shrikes *Coracina* and trillers *Lalage* eat both insects and fruit. A few species recorded eating nectar (e.g. Cicadabird and White-bellied Cuckoo-shrike). Some species eat mostly caterpillars, e.g. Cicadabird and White-breasted, Grey *Coracina caesia* and Grauer's *C. graueri* Cuckoo-shrikes. One species, the Ground Cuckoo-shrike, once recorded eating a House Sparrow *Passer domesticus*. Mostly arboreal; tend to forage in small groups, mainly gleaning food from tree-trunks, branches and foliage in mid-levels to canopy of trees, and sally-striking from perches in trees; also capture prey by sally-pouncing, flutter-chasing and sally-hovering. Exceptionally, Ground Cuckoo-shrike forages mostly on or near ground, walking and running to glean food from ground or leaping into air for insects; some other species, such as wood-shrikes and some trillers, also occasionally forage on ground. White-bellied Minivet *Pericrocotus erythropygius* forages mainly in low shrubs, grasses and on ground (Coates 1990; Keith *et al.* 1992; Robson 2002; Taylor 2005; see species accounts).

Social organization and behaviour not well known. Group-size varies. Most species usually occur singly or in pairs, and in small family groups after breeding. Some species form small flocks, particularly in non-breeding season, e.g. Black-faced Cuckoo-shrike in flocks of up to 50+ in non-breeding season, and minivets considered generally gregarious in non-breeding season. Some species often encountered in small groups at any time of year, e.g. Ground Cuckoo-shrike and Hooded Cuckoo-shrike. Migratory forms also sometimes occur in flocks before departure, on passage and on arrival, e.g. Black-faced Cuckoo-shrikes observed in flocks of up to 170 or more. Many species regularly occur in mixed-species flocks when foraging, e.g. in Aust., Black-faced Cuckoo-shrikes forage with other cuckoo-shrikes and species such as Spangled Drongos *Dicrurus bracteatus*, Figbirds *Sphecotheres viridis* or Olive-backed Orioles *Oriolus sagittatus*. Most species are monogamous, at least socially, and most nest in discrete pairs; bonds probably maintained throughout year. Polygyny reported once in White-winged Triller. Ground Cuckoo-shrike sometimes breeds co-operatively, with up to three helpers at the nest, and co-operative breeding occurs occasionally in other species (e.g. Black-faced Cuckoo-shrike). Apparent plural breeding also reported in Ground Cuckoo-shrike. Parental care usually shared between sexes (see Breeding summary below). Fledgelings fed by both parents, for up to 2, or exceptionally 3, months. Immatures may remain in natal territories until start of next breeding season, when they may be driven away (e.g. Black-faced Cuckoo-shrike), though if second brood raised in a season, young of first brood may be driven off when second attempt begun (e.g. White-winged Triller). Age of first breeding not known, but probably c. 1 year old. Most species territorial and nest solitarily, but at least one species, White-winged Triller, often nests colonially; some resident species or populations are territorial throughout year. Details of roosting poorly known; appear usually to roost singly or in twos, but some have been recorded roosting communally (e.g. Barred Cuckoo-shrike). Social behaviour not well known in most species. Little known of maintenance behaviour. Allopreening not reported. Seen bathing in streams and pools, and Black-faced Cuckoo-shrikes seen bathing in rain and wet foliage; White-winged Trillers seen sun-bathing. Little information on displays of most species. Agonistic displays, fighting and chases known for some species during breeding season, many from anecdotal reports; but no observations of agonistic behaviour in non-breeding season. Sexual behaviour generally poorly known; aspects of courtship known in a few species, including courtship chases and pre-copulatory displays, and some minivets have conspicuous aerial courtship displays (Campbell & Lack 1985; Coates 1990; Keith *et al.* 1992; Taylor 2005; see species accounts).

Most species have loud and distinctive vocalizations, though birds tend to be rather quiet and often unobtrusive when foraging. Songs and calls typically simple, often loud and repeated whistles, trills, twitters, churrs, harsh buzzing, chatters or squawks, sometimes with nasal or metallic quality or resembling insect sounds. The cicadabirds are named for their loud songs reminiscent of the loud mechanical noises produced by cicadas (Homoptera: Cicadidae); Cicadabird can be heard from up to 800 m. In many species, calls apparently given largely or only by males. Several species have been heard to duet, e.g. Golden *Campochaera sloetii* and Boyer's Cuckoo-shrikes, and Black-bellied Cuckoo-shrike *Coracina montana* sings antiphonal duets; Black-browed Trillers *Lalage atrovirens* heard to counter-sing. Marked geographical variation in vocalizations noted within some species, but no detailed analyses (Coates 1990; Taylor 2005; see species accounts).

Usually nest solitarily (e.g. Cicadabird, Varied Triller), but co-operative breeding reported in Ground Cuckoo-shrike (and possibly occurs in others) and colonial nesting reported in White-winged Trillers). All build small, inconspicuous and usually shallow cup- or saucer-shaped nests; nest of Ground Cuckoo-shrike sometimes has tail hanging below nest. Nests usually made of twigs, roots, bark, grass, casuarina needles, vine tendrils, lichens and moss, sometimes with moss, lichen or bark attached to outside, probably as camouflage, and bound together and anchored to branch with spider web and, possibly in some, saliva; nests usually lined with fine twigs, rootlets, grass, moss, hair or wool or other fine material, though nests of some larger *Coracina* unlined. Occasionally build in old nests of other species (e.g. Ground Cuckoo-shrikes sometimes build in mud-nests of Magpie-larks *Grallina cyanoleuca*). Nests usually placed on fork or on top of horizontal branch, often towards end of branch. Nests usually placed quite high; though recorded nest heights in family range from c. 1 to 70 m, many nests placed at  $\geq 4$  m; some, such as Large Cuckoo-shrike *Coracina macei* and Grey-chinned *Pericrocotus solaris* and Long-tailed *P. ethologus* Minivets, rarely, if ever, nest below 10 m; one exception is White-bellied Minivet *P. erythropgius*, which nests at 1–2 m. White-winged Triller often nests close to other black-and-white birds, such as Magpie-larks or Willie Wagtails *Rhipidura leucophrys* or both. Nests either built by both sexes or, in some, female collects material and builds while accompanied by male, or both may collect material but only one build nest. Eggs typically oval to elongate oval but also rounded oval to pyriform; usually smooth and often glossy. Ground-colour varies substantially, from white, buff and pale greens and blues to green, olive, blue-green and blue. Eggs almost always spotted or blotched or both, and sometimes streaked or mottled, mostly with shades of brown, though some have underlying markings of shades of grey; markings sometimes form zone, or occasionally a ring, at large end; eggs of Ground Cuckoo-shrike can be unmarked. Clutch-size one to five, usually two or three; several species of *Coracina* and *Lalage* lay clutches of one (e.g. Varied Triller); minivets and woodshrikes lay largest clutches, of 3–5. In Aust., occasional reports of clutches of 5–6 probably laid by more than one female. In White-winged Triller, laying interval 48 h, occasionally shorter; in Black-faced Cuckoo-shrike, interval 24 h or more. Usually single-brooded, but double-brooding recorded in some



(e.g. White-winged Triller) and Black-faced Cuckoo-shrike can raise three broods in a season. In most species, incubation by both sexes, though in some (e.g. Purple-throated Cuckoo-shrike, Cicadabird, and several Minivets) only female incubates; probably begins when clutch complete, and hatching possibly synchronous. Incubation period ranges from 14 days to 27 days; 20–24 days in *Coracina* and *Campephaga*, 14–16 days in White-winged Triller. Young usually fed and brooded by both parents, who also dispose of faecal sacs; in some species, parental care by female alone, while in others only female broods but both parents feed young. Helpers attend nestlings in some species (e.g. Ground Cuckoo-shrike, Small Minivet *P. cinnamomeus*; see above). Fledging periods often long, up to 30 days; 22–29 days in *Campephaga* and *Coracina*, but short, usually 12–14 days, in White-winged Triller. Young remain with parents after fledging, and may be fed for up to 2, or exceptionally 3, months. Brood parasitism by cuckoos reported in Aust. but not known for African species (Ali & Ripley 1971; Coates 1990; Keith *et al.* 1992; Roberts 1992; Grimmett *et al.* 1999; Robson 2000; Taylor 2005; NRS; see species accounts).

Four species considered globally threatened: the Reunion Cuckoo-shrike *Coracina newtoni* considered endangered (because population small [60–160 pairs in 2000], and restricted island distribution); and the Mauritius Cuckoo-shrike *Coracina typica* of s. Mauritius, the White-winged Cuckoo-shrike *Coracina ostenta* of the Philippines, and the Western Wattled Cuckoo-shrike *Campephaga lobata* of w. Africa are considered vulnerable. The major threats are deforestation, timber harvesting, forests fires and habitat loss generally. A further nine species considered near threatened globally, seven of which are island forms (in Indonesia, Philippines, Solomon Is, and Samoa). None known to have become extinct since 1600, but three subspecies have disappeared (Taylor 2005). In HANZAB region, nominate subspecies of Long-tailed Triller *Lalage leucopygia* formerly restricted to Norfolk I. and last seen in 1942, though said to have been abundant in 1941; disappearance coincided with arrival of Black Rats on island, which most likely caused extinction, but also with construction of airport in centre of island and which involved clearing of large area of remnant native forest (Garnett & Crowley 2000; see species text). Two taxa endemic to Cebu, central Philippines, also extinct: subspecies *cebuensis* of Bar-bellied Cuckoo-shrike (thought to have become extinct by 1959), and subspecies *altera* of Blackish Cuckoo-shrike *Coracina coerulescens* also considered to be extinct, as a result of widespread deforestation on the island (Taylor 2005).

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## *Coracina novaehollandiae* Black-faced Cuckoo-shrike

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*Turdus novaehollandiae* Gmelin, 1789, *Syst. Nat.* 1(2): 814 — Nova Hollandia = Adventure Bay, Tasmania.

The generic name alludes to the crow-like appearance and grey plumage of the White-bellied Cuckoo-shrike, from the Greek *κορακίνος*, a little raven (dim. from *κόραξ*, a raven). The specific name is a toponym.

**OTHER ENGLISH NAMES** Cuckoo-shrike, Large Cuckoo-shrike or Small-billed Cuckoo-shrike; Black-faced Greybird or Graucalus; Blue or Grey Jay, Blue or Mountain Pigeon, Blue Peter or Bluebird; Rainbird, Stormbird or Summerbird; Shufflewing; Cherry Hawk; Lapwing; Leatherhead; Banded Thickhead. English name often also abbreviated to BFCS or Bifcus.

**POLYTYPIC** Nominate *novaehollandiae*, Tas. and islands of Bass Str. (King I., Furneaux Grp), migrating after breeding at least to se. mainland Aust., and possibly farther N, in autumn–winter; *melanops* (Latham, 1802

[1801]), all mainland Aust. and main offshore islands, except treeless deserts, n. C. York Pen., Qld, and Pilbara, WA; disperse N after breeding to Lesser Sundas, Moluccas, New Guinea, Bismarck Arch. and w. Solomons in autumn–winter; *subpallida* Mathews, 1912, Pilbara Region, central-w. WA. Species limits contentious and here circumscribed to Aust. breeding populations and excluding related extralimital forms (see Geographical Variation).

**FIELD IDENTIFICATION** Length 32.5 cm (29–39); wing-span 53.5 cm (44.5–59); weight 115 g. Medium-large, rather elongated and slender cuckoo-shrike, with long wings, long square-tipped tail, and short, robust bill with slightly hooked tip; legs short. Significantly larger than White-bellied Cuckoo-shrike *Coracina papuensis*, especially in n. Aust., but with similar shape and jizz, though bill slightly longer and less robust and tail proportionally longer. Appear rather sparrowhawk-like in some flight and perched postures; flight undulating and rather cuckoo-like; virtually always shuffle wings on alighting. Adults bluish grey above and slightly paler below with large and conspicuous black mask extending to uppermost breast. Sexes alike. No seasonal variation. Juvenile very different from adult, heavily barred and mottled brown above and over breast with diffuse blackish eye-stripe (not large black mask). First immature like adult but with distinct broad black eye-stripe (not mask) and whitish chin and throat, and retains some juvenile plumage of wing and tail. Only slight geographical variation, in size and in tone of plumage. **Adult** Head, neck and upperbody, bluish grey, can look very pale, almost white in very bright light, with large and conspicuous black mask covering forehead over eye, lores, ear-coverts, malar area, chin and throat. Uppertail: central feathers, bluish grey grading to dark grey towards tips, and with narrow white edges and tips; rest of tail, brownish black with broad white tips and narrow white outer edges to feathers, both of which become broader outward; tips and edges reduced with wear and lost from central rectrices. Folded wing mostly bluish grey, as upperbody, with: narrow pale-grey fringes to secondary coverts; blackish primary coverts, narrowly fringed white, and with white strip on lower (leading) edge of wing below alula; mostly concealed blackish inner webs to tertials, which are finely fringed white when fresh (readily lost with wear); black secondaries and inner primaries, with white fringes to tips and pale bluish-grey outer edges, which very broad on inner secondaries and become narrower outward; and rest of primaries, black with neat white fringes (which grade to pale blue-grey at base of outer edges), narrowest on outermost, and reduced or lost with wear. In flight, upperwing appears light bluish-grey with broad blackish rear-edge and outerwing. Uppermost breast, black, continuous with mask, grading into bluish grey of lower breast; rest of underbody, white, often with faint bluish-grey barring on upper belly and flanks. Undertail, light grey, with white tips and edges as on uppertail; at rest, white undertail-coverts conceal all except tip of tail, so that undertail can appear mostly white with light grey towards tip. Underwing: coverts, white; remiges, light grey, grading to grey on outer primaries, and with conspicuous white bases to inner webs and very narrow white tips; in flight, underwing appears mostly white with dark rear edge. Bill, gape, iris, and orbital ring, black. Legs and feet, dark grey. **Juvenile** Very different from adult, with heavily barred and mottled brown plumage and diffuse broad eye-stripe, lacking large black mask, but plumage held for only a short time after fledging (see Moults). At least some fledged juveniles noticeably smaller than adults; and plumage softer and more loosely textured than in adult. Top of head, hindneck and sides of neck, dark brown with bold white scalloping. Broad, diffuse blackish-brown eye-stripe extends from lores, narrowly above and below eyes to ear-coverts, latter flecked with white in fresh plumage. Malar area, chin, throat and breast, off-white

to light brown with off-white mottling. Upperbody and upperwing-coverts, grey, broadly barred blackish brown and with heavy light-grey or white scalloping, combining to give distinctly scaly pattern with, in some, scattered pale-grey patches, particularly on uppertail-coverts. On folded wing, remiges much as adult but ground-colour slightly duller, blackish brown; and white fringes and tips to tertials much broader, forming series of white stripes on innerwing; and pale fringes to secondaries and primaries broader and duller, more neatly outlining feathers. Tail as adult but tips to rectrices pointed. Belly, flanks, vent and undertail-coverts, white, often with brown mottling on upperbelly and flanks. Bill, dark grey with yellow base to lower mandible and gape. Iris as adult. Legs and feet, greyish brown. **Immature** Like adult but with broad black eye-stripe rather than large black mask, and with some retained juvenile plumage of wing and tail. Top of head, hindneck and sides of neck, bluish grey, with broad grey-black eye-stripe extending from lower forehead and lores, narrowly over and broadly below eye, to rear ear-coverts; unlike juvenile, eye-stripe contrasts markedly with grey of head and neck; chin and throat usually white heavily barred grey but occasionally uniformly grey. Upperbody, bluish grey, as adult. Breast and upper belly, bluish grey with faint white barring, grading into white lower underbody. On upperwing, most coverts as adult but retain nearly all juvenile outer greater secondary coverts, which contrast strongly with new, bluish-grey adult-like inner coverts; also retain juvenile alula, greater primary coverts and primaries and secondaries, and most or all tertials; even with wear, retained juvenile remiges show conspicuous white fringes, especially noticeable on tertials. Usually retain juvenile tail, with pointed tips to rectrices, but some replace outer feathers, which are as in adult. Bare parts as adult but retain pale-grey gape and some have pinkish wash at base of lower mandible, at least at first; not known if attain adult bare parts coloration in this plumage.

**Similar species** Highly distinctive and easily distinguished from most species; when known, diagnostic call (see below and Voice) also sufficient for identification from other species, including other cuckoo-shrikes. However, can be confused with some plumages of **White-bellied Cuckoo-shrike**, especially in se. and e. Aust.; see that text for details. With brief views, particularly in flight, beware larger cuckoos, such as **Pallid *Cuculus pallidus*** and **Oriental *C. saturatus* Cuckoos**, which have similar undulating flight; **Black-faced** instantly distinguishable with good views, but with poor views look for narrow, pointed and barred tail of Pallid and barred underparts of Oriental. Could also be confused briefly with adult **Collared Sparrowhawk *Accipiter cirrhocephalus***, which has remarkably similar undulating flight; again, while instantly distinguishable with adequate views of plumage, in poor views note brown-barred underparts and rufous collar of Sparrowhawk. Should not be confused with **Masked Woodswallow *Artamus personatus***, which has superficially similar plumage (predominantly grey with black mask); Cuckoo-shrike easily distinguished by: much larger size (Masked about half size of Black-faced) and very different shape when perched or in flight (Masked has much shorter square-tipped tail and angular pointed wings); wholly black bill (blue in Masked); and very different undulating flight (flight of Masked includes much gliding and wheeling but no undulating).

Usually occur singly or in twos (probably pairs); occasionally move in loose flocks of up to 30, sometimes more. Forage

mostly among branches and foliage in canopy, sometimes on or close to ground when swooping down to catch prey; occasionally sally for flying insects, but never far from perch; often repeatedly beat large prey against branches before eating them. Flight undulating and rather cuckoo-like, and often noted flying across open areas; typically hold wings forward, with outerwing angled back at carpal joint with tips almost parallel to body; flap wings rapidly to crest of undulation then glide to low point before repeating flapping and upward climb. Sometimes hover over canopy. Often alight on tops of stumps, telegraph poles or wires, or exposed branches, from which survey surroundings; upon alighting, obsessively shuffle wings up and down against each other in an almost mechanical fashion; often sit still in same spot for a while after settled down. Can appear sparrowhawk-like in flight and in some perched postures. Voice distinctive, an almost mechanical, rolling, harsh, creaky *chereer-chereer* and other harsh notes.

**HABITAT** Occupy wide variety of forested habitats, predominantly drier sclerophyll forests and woodlands, usually dominated by eucalypts, and with understorey varying from sparse to dense; often also in farmland or urban areas where trees remain. Less often in wet forests and rarely in closed forests (Serventy 1948; Storr 1953; Ridpath & Moreau 1966; Brooker & Estbergs 1976; Gibson 1977; Emison & Porter 1978; Forshaw & Muller 1978; Roberts 1979; Boekel 1980; Gibson 1986; Slater 1995; Traill *et al.* 1996; Hall; Storr 7, 16; Vic. Atlas; ACT Atlas; R.H. Loyn; see below). In arid zone, largely confined to riparian vegetation (Fletcher 1980; Storr 1981; Gibson & Cole 1988; see below), and generally absent from sandy deserts and grassy plains (Boekel 1980; McKean 1985; Storr 7). In Top End, NT, showed no apparent preference for structure of eucalypt associations, occurring in tall shrublands and wide variety of woodland and forest types (Woinarski *et al.* 1988). Also show no obvious preferences for age of eucalypt forests or woodlands, occurring in early to advanced regrowth forests, through to rather undisturbed mature forests (Loyn 1980; Smith 1984, 1985; Recher & Holmes 1985; Taylor *et al.* 1997; Fisher 2001; see below). In Vic., most abundant along timbered watercourses in farmland, at edges of forest and farmland, and in clearings in forests (Vic. Atlas). In Top End of NT, use of non-riparian and riparian vegetation varied, with no significant differences between the two in systematic sampling, but recorded significantly more often in non-riparian habitats using a large distributional database; found to be characteristic of northerly, high-rainfall riparian zones, round wide rivers and lagoons that rarely flooded high into the riparian vegetation, and which had low canopies (Woinarski *et al.* 2000). Occur at all elevations, from sea level to highlands (Gall & Longmore 1978; Vic. Atlas).

Mainly in DRY EUCALYPT FORESTS AND WOODLANDS (Recher 1975; Disney & Stokes 1976; Roberts & Ingram 1976; Emison & Porter 1978; Ratkowsky & Ratkowsky 1980; Johnstone 1983; Nichols & Nichols 1984; Halse *et al.* 1985; Wykes 1985; Ford *et al.* 1986; Woinarski *et al.* 1988; Woinarski & Tidemann 1991; Tidemann & Wilson 1992; Slater 1995; Taylor & Haseler 1995; Kutt 1996; Possingham & Possingham 1997; Er *et al.* 1998; Major *et al.* 2001; Kavanagh & Stanton 2003; see below) with understorey of shrubs, grasses, ferns, herbs and forbs, varying from sparse to well developed, but tending to be sparse or open with a grassy ground-cover (Kikkawa *et al.* 1965; Recher *et al.* 1971; Crawford 1972; Driscoll 1977; Gell 1977; Emison & Porter 1978; Hunt 1979; Ratkowsky 1979; Ford & Bell 1981; Nichols & Nichols 1984; Reilly 1991; Traill *et al.* 1996), e.g. forests and woodlands dominated by Spotted Gum, Blackbutt, Broad-leaved Stringybark, Red Stringybark, White Box, Manna Gum, Snow Gum, Variable-barked Bloodwood, Darwin Stringybark, Darwin Woollybutt, Darwin Box and Northern Salmon Gum

*Eucalyptus tintinnans* (Disney & Stokes 1976; Ford *et al.* 1986; Woinarski *et al.* 1988; Woinarski & Tidemann 1991; Gosper 1992). Near Bega, se. NSW, found mainly in dry eucalypt forests on ridges, either mature or logged, dominated by species such as Woollybutt, Silvertop Ash, Blue-leaved *Eucalyptus agglomerata*, White and Yellow Stringybarks, Coastal Grey Box *E. bosistoana* and Red Ironbark; and only occasionally recorded in moist forests in gullies, dominated by Mountain Grey Gum, Messmate, Yellow and White Stringybarks, Brown Barrel and peppermint eucalypts (Smith 1984, 1985). On Howards Pen., NT, mainly recorded in eucalypt associations dominated by Darwin Stringybark and Darwin Woollybutt (Woinarski *et al.* 1988). Inland, often in dry eucalypt woodlands and forests of River Red Gum, Black Box and Coolibah, especially riparian associations along watercourses or round wetlands (Bedgood 1973; Brooker & Estbergs 1976; Badman 1981; Storr 1981; Jones 1986; Gibson & Cole 1988; Henle 1989; Major *et al.* 2001; Storr 22, 26), including associations with understorey of Lignum (Brandle 1998). Also occur in mallee shrublands and woodlands, with varied understorey of shrubs or spinifex *Triodia* or both (Jones 1952; Ford & Sedgwick 1967; McEvey & Middleton 1968; Pianka & Pianka 1970; Cooper 1972; Moriarty 1972; Possingham & Possingham 1997; Luck *et al.* 1999), e.g. mallee woodlands dominated by Giant Mallee, Yorrell, Pear-fruited Mallee, Kingsmill's Mallee *Eucalyptus kingsmillii* or Blue Mallee (Ford & Sedgwick 1967; McEvey & Middleton 1968; Luck *et al.* 1999); tall mallee shrublands dominated by Red, Desert and Kopi *E. striatocalyx* Mallees, Gimlet, Redwood *E. transcontinentalis* and Port Lincoln Mallee *E. conglobata* (McEvey & Middleton 1968; Black & Badman 1986); and mixed woodland of Dwyer's Mallee Gum *Eucalyptus dwyeri* and cypress-pine *Callitris* (Major *et al.* 2001). Also sometimes in other eucalypt shrublands, e.g. in n. NT, in tall eucalypt shrubland dominated by Darwin Stringybark and Darwin Woollybutt (Woinarski *et al.* 1988). Less often in WET SCLEROPHYLL FORESTS dominated by eucalypts than in drier associations, and said never to be common in them (Disney & Stokes 1976; Roberts & Ingram 1976; Emison & Porter 1978; Ratkowsky & Ratkowsky 1980; ACT Atlas); e.g. recorded in tall, open and regenerating coastal wet sclerophyll forest dominated by Tallow-wood, Blackbutt and Red Mahogany (Gosper 1992); open forest dominated by Brown Barrel, Manna Gum and Mountain Gum (Disney & Stokes 1976); forest dominated by Narrow-leaved Peppermint, Messmate and Mountain Grey Gum (Mac Nally 1997); and highland Mountain Ash forests (Loyn 1985, 1998; R.H. Loyn). Also occur in variety of other SCLEROPHYLL FORESTS, WOODLANDS AND SHRUBLANDS, including: open woodlands of White Cypress-pine, sometimes mixed with box eucalypt (Emison & Porter 1978; Major *et al.* 2001); Buloke–Belah woodland (Major *et al.* 2001); low woodland dominated by Black Sheoak, with sparse foliage cover (Roberts & Ingram 1976; McLean 1993); woodland of Western Sheoak and Bull Banksia with a sparse understorey (Nichols & Nichols 1984); and low open forest dominated by Wallum Banksia with moderately dense foliage cover, often with a thick heath understorey (Roberts & Ingram 1976); dense, low forest dominated by Coast Banksia and Southern Mahogany (Smith 1984, 1985); and open forest dominated by Woolly Tea-tree *Leptospermum lanigerum* (Emison & Porter 1978). Also often inhabit other riparian sclerophyll associations, dominated by combinations of *Pandanus*, *Grevillea*, *Melaleuca*, *Lophostemon*, casuarinas and rainforest trees and shrubs, such as Leichhardt Tree and figs *Ficus*, sometimes with eucalypts admixed (Johnstone 1983; Woinarski *et al.* 1988, 2000; Verbeek *et al.* 1993), e.g. tall, dense paperbark swamp forest dominated by Weeping Paperbark, Cajuput and Liniment Tree; mixed riparian fringe open forest dominated by Milky Box *Lophostemon lactifluus* and Ghost Gum; and low open

*Pandanus* and *Grevillea* woodland dominated by Screw Palm *Pandanus spiralis*, Fern-leaved *Grevillea* and Cooktown Ironwood (Woinarski *et al.* 1988). Inland, also often in tall open ACACIA SHRUBLANDS, WOODLANDS AND LOW FORESTS, such as Mulga woodlands with low open shrub understorey (Ford & Sedgwick 1967; Pianka & Pianka 1970; Moriarty 1972; Brooker & Estbergs 1976; Wyndham 1978; Johnstone 1983; Black & Badman 1986; Brandle 1998); Myall woodland (Major *et al.* 2001); Western Myall woodland with a shrub stratum of saltbush *Maireana* and *Atriplex* (Ford & Sedgwick 1967; Brooker *et al.* 1979); and low, closed forest (softwood scrub) dominated by Brigalow (Leach & Watson 1994; Leach 1995). Sometimes in RAINFORESTS, including dry monsoon forests (Crawford 1972; Roberts & Ingram 1976; Gosper 1992; Woinarski 1993; Storr 11), vine thickets (Johnstone 1983), and tall, closed subtropical rainforest (Gosper 1992). However, in study of forests near Bega, se. NSW, not recorded in rainforest along creeks in coolest, wettest gullies (Smith 1984, 1985). Occasionally in coastal or inland HEATHLANDS (Ford & Stone 1957; Sedgwick 1964; Ridpath & Moreau 1966; Recher 1975; Gell 1977), such as low heath dominated by Dwarf Sheoak (Possingham & Possingham 1997), and wet heathland 40–80 cm in height with 80–100% cover and dominated by *Banksia*, *Boronia*, *Epacris*, *Hibbertia* and *Leptospermum*, with various monocotyledons (McFarland 1988). Occasionally in GRASSLANDS (Mollison 1974; Longmore 1978; Congreve & Congreve 1985; Jones 1986), e.g. in Top End, in open grazed grassland dominated by *Sorghum*, and tall dense grassland dominated by *Ischaemum rugosum* and *Eriachne burkittii* (Woinarski *et al.* 1988); grasslands dominated by spear grass *Heteropogon* with scattered trees including Lemon-scented Gum, Ghost Gum and Bimble Box (Longmore 1978). Occasionally recorded on sedge-plains (Crawford 1972). Uncommon in mangroves (Crawford 1972; Smith *et al.* 1978; Abbott 1982; Storr 11, 19). MODIFIED HABITATS: Common in RESIDENTIAL areas (Serventy 1948; Recher 1975; Howard 1983; Jones 1983; Sedgwick 1984; Catterall *et al.* 1989; Green *et al.* 1989; Lenz 1990; Wood 1994; Woodall 1995; Jones & Wieneke 2000). In study in se. Qld, found mainly in large (>100 ha) and small (5–10 ha) eucalypt remnants, but also occurred in residential suburbs, usually with well-established gardens of native or exotic shrubs and trees, but also in residential suburbs with few established garden shrubs and trees (Sewell & Catterall 1998). In suburban Wagga Wagga, NSW, recorded in newly developed suburbs (2 years old) to well-established suburbs 15–30 years old (Jones 1981). In study in outer suburban Melbourne, recorded only in two undeveloped sites but not in housing developments ranging from newly developed to 50+ years old (Mason 1985). Also occur in FARMLAND AND PASTURES, often with native trees restricted to roadsides and fence-lines (Emison & Porter 1978; Sedgwick 1984, 1986; Traill *et al.* 1996; Possingham & Possingham 1997), e.g. in partly cleared pasture, mainly grazing lands, consisting primarily of grasslands with remnants of original vegetation (mainly eucalypts such as Mountain Gum, Black Sallee, Brittle Gum and Manna Gum) scattered along watercourses and roadsides (Emison & Porter 1978). In n. Qld, recorded from cane fields (White 1946); in Rutherglen District, Vic., also recorded from orchards and vineyards (McEvey 1965). Rarely, recorded in plantations of EXOTIC PINES (Stevens 1975; Disney & Stokes 1976; Suckling *et al.* 1976).

In study of effects of intensive logging in forest near Eden, se. NSW, occurred in logged and unlogged open forest, though significantly less abundant in early regrowth 4 years after logging, with dense understorey of shrubs below regenerating eucalypts to 6 m tall, than in forest 13 years and 22 years after logging when understorey sparser but regenerating eucalypts similar in height to unlogged forest (Kavanagh & Stanton 2003). In lowland forests of E. Gippsland, Vic. (Jan.–Mar.

1993) found mainly in old forest selectively logged 50 years before (mean of 0.81 birds/transect; n=5 transects), and less often in 25–35-year-old regrowth forest coupes, thinned between 1988 and 1992 (0.24; 11 transects) and unthinned 25–35-year-old regrowth forest coupes (0.1; 10 transects) (Kutt 1996). Near Bega, se. NSW, recorded in both mature and regenerating forests (Smith 1984, 1985). In study of effects of different logging treatments in dry sclerophyll forest in e. and central Tas., recorded in all four sites in mature dry sclerophyll forest; and four of five logged sites of various ages and treatments (Taylor & Haseler 1995). In se. Qld, occurred both in eucalypt remnants where understorey had been removed, and in remnants where understorey was undisturbed (Sewell & Catterall 1998). In remnant native vegetation of sw. slopes of NSW, tended to be more common in large remnants, but not significantly so (Major *et al.* 2001). In Darwin area, NT, numbers increased in habitats that had been burnt (Crawford 1979). In study of eucalypt woodland varying affected by dieback near Armidale, NSW, found in: (1) largely unmodified woodland with occasional light grazing, and few trees dead or severely defoliated (density 0.09 birds/ha [June–Sept. 1978], and 0.21 birds/ha [Aug.–Dec. 1979]); (2) regenerating woodland that had been partly cleared and grazed till the late 1960s, with trees ranging from dead to healthy (density 0.25 birds/ha [1979]); (3) uncommon at site that had been grazed by stock, with dead or moribund tall eucalypt trees and saplings, and a moderate density of sapling and seedling eucalypts (most of which dead) (density 0.03 birds/ha [Aug.–Dec. 1979]); not recorded at other grazed site comprising open native grassland with only a few trees, and scattered dead eucalypt saplings and small shrubs (Ford & Bell 1981 [also see Ford *et al.* 1985 for further results at sites overlapping preceding study]).

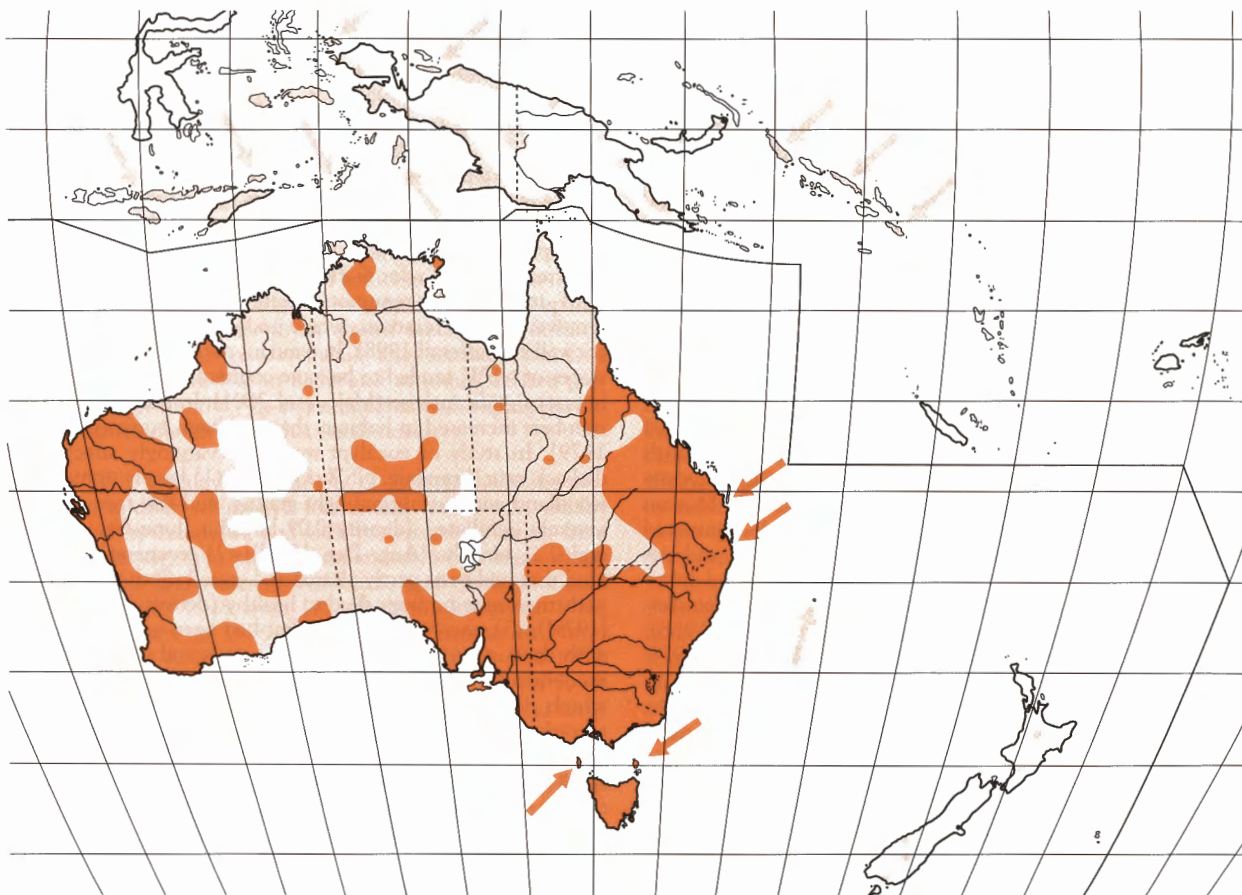
**DISTRIBUTION AND POPULATION** Widespread from Wallacea, E through New Guinea to Solomon Is, and throughout Aust. (Hadden 1981; White & Bruce 1986; Coates 1990; Coates *et al.* 1997; Doughty *et al.* 1999; see below).

**Aust.** Widespread (Aust. Atlas 1, 2); Aust. Atlas 1 indicated a large gap in distribution in sandy deserts of e. WA and smaller one in parts of Simpson Desert, but these largely filled in by records in Aust. Atlas 2, which possibly indicate the species only sporadically recorded in these areas.

**NZ** Occasional visitor. Singles recorded at: Motueka, c. 1869 (Stidolph 1927; Oliver; NZCL); Invercargill, 8 Apr. 1870 (Stidolph 1927; Oliver; NZCL); Westport, c. 1895, 1931 (Oliver; NZCL); Rabbit I., L. Ellesmere, 11 June 1904 (Stidolph 1927; Oliver; NZCL); Greymouth, c. 1914 (Oliver; NZCL); Okato, 1914 (Oliver; NZCL); Pouto, N. Kaipara Head, June (not Jan. as shown in NZCL)–Sept. 1953 (Oliver); Himatangi, near Foxton, 1 Jan. 1955 (Wilson 1955); Feilding, 1965 (NZCL); Okuru, 14 Sept. 1967 (Wright 1968); Daffodil Bay, Invercargill, 15 June 1976 (Smith 1978); near Rotorua, 1987 (NZCL); Tarras, 4 Mar. 1990 (Guest 1991). Undated historical reports from Bulls, Port Chalmers, L. Guyon and L. Hawea (Wilson 1955; Oliver).

**Lord Howe I.** Occasional visitor. First recorded Oct. 1892 (Hindwood 1940), and said to be a frequent visitor in early 20th century (Hull 1910). Few published records since late 1960s: single, 8 Mar. 1969 (McAllan *et al.* 2004); single, much of 1971 (NSW Bird Rep. 1971); single, Apr. 1977 (NSW Bird Rep. 1977); two, 28 Sept. 1991 (NSW Bird Rep. 1991); single, 10–14 Sept. 1996 (NSW Bird Rep. 1996); unknown number, early Oct. and 2 Nov. 2001 (McAllan *et al.* 2004); single, 23 Nov. 2002 (McAllan *et al.* 2004); and single, 13 Oct. 2003 (McAllan *et al.* 2004).

**Breeding** Widespread in most regions of Aust. Not recorded coastal ne. Qld and Torres Str., and single record from C. York; only very occasionally in Gulf Country and



rarely elsewhere in w. Qld. Widespread elsewhere in e. Aust., including Tas., W to Eyre Pen. In WA, a few records on Nullarbor Plain, and widespread in most other regions, though very sparsely scattered in Kimberley Div., and largely absent from Great Sandy, Gibson and Great Victoria Deserts. Recorded at scattered sites in Top End, but more widespread in s. NT (Aust. Atlas 1, 2; DAB; NRS). Claim of extralimital breeding in PNG doubtful, based on record of young birds being fed by adults in Waigani Valley in Jan. 1944, and while said to be 'obviously just out of the nest' (Tubb 1945), description better matches first immature (this study) which could have fledged Aust. and migrated with parents.

**Change in range, populations** Rarely recorded at Maroubra, suburban Sydney, in 1940s, but common by early 1980s (Bell 1983).

**Populations RECORDED DENSITIES:** QLD: Mean 0.2 birds/ha (wet season) and 0.77 birds/ha (dry season), at Townsville (Jones 1983); mean 0.14 birds/ha (wet season) and 0.23 birds/ha (dry season), also at Townsville (Jones & Wieneke 2000); 0.32 and 0.97 birds/ha, Tallegalla (Leach & Watson 1994); c. 0.01 birds/ha, Archerfield Airport, Brisbane (Woodall 1999b); up to 1.43 birds/ha, Corinda (Walters 1985); 0.03 birds/ha, Cooloolo NP (McFarland 1988); NSW-ACT: 0.03–0.25 and 0.06–0.20 birds/ha, near Armidale (Ford & Bell 1981; Ford *et al.* 1985); 0.6 birds/ha, Hawkesbury R. (Keast 1985); 0.2–2.2 birds/ha, near Canberra (Bell 1980); 0.4 birds/ha, Moruya (Marchant 1979a); 0.1–1.3 birds/ha, near Eden (Kavanagh *et al.* 1985); 0.13–0.33 birds/ha, Bondi SF, near Bombala (Recher & Holmes 1985); VIC.: up to 0.12 birds/ha, Olinda SF (Mac Nally 1997); 0–0.31 birds/ha, near Moyston (Kennedy 2003); TAS.: 0.12–0.74 birds/ha, near Campbell Town (Recher *et al.* 1971); 0.18–0.39 birds/ha, near Woodsdale (Taylor *et al.* 1997); WA: 0.07–0.3 birds/ha, Eyre

Bird Observatory (Davies 1982); NT: 0.2 birds/ha, S. Alligator R. (Keast 1985); 0.08–0.96 birds/ha, Howards Pen. (Woinarski *et al.* 1988); and 0.01 birds/ha, Yinberrie Hills (Woinarski & Tidemann 1991).

**THREATS AND HUMAN INTERACTIONS** Possibly not adversely affected by logging, as occur in various age-classes of forests (e.g. Loyn 1980, 1985; Smith 1984, 1985; see Habitat). In Mountain Ash forests of central Vic., forage in recently harvested areas in canopy of retained trees (Loyn 1985) as well as using patches of old forest, especially where there are clumps of mistletoe (Loyn 1998; R.H. Loyn).

Occasionally killed by Cats (Chandler 1944; Dowling *et al.* 1994) or on roads (Vestjens 1973; Taylor & Goldingay 2004). Very occasionally collide with lighthouses (Le Souëf 1907; Kinghorn 1928; Stokes 1983).

**MOVEMENTS** Not well known. Partly migratory and partly resident or sedentary. Lack of significant differences between regional populations in Aust. makes it difficult to determine where populations move in winter (DAB). Broad-scale analysis of bird atlas and count data from e. Aust. found strong evidence of inland slope-line pattern of movement, showing apparent movement NW away from se. Aust. in winter (Griffioen & Clarke 2002). Atlas data shows highest reporting rate in se. Aust. in spring–summer and in nw. Aust. in winter (Aust. Atlas 2). Partial migrant in e. Aust., including Tas., with part of population migrating N each winter (Keast 1958b; Aust. Atlas 1; see below). Populations elsewhere in Aust. not well known; populations breeding n. Aust. poorly known but apparently resident, augmented by migrants from farther S or on passage; in WA, apparently partly resident and partly migratory, with passage and some seasonal occurrences

observed over much of state (Serventy & Whittell; Aust. Atlas 1; see below). Some movements described as nomadic (Chisholm 1938; Keast 1958b; Condon 1962; Storr 1967; Storr 7), e.g. in Sydney area during non-breeding season (Hindwood 1935; Hindwood & McGill 1958; Hoskin 1991); nature of such claimed movements not known.

**NATURE OF PASSAGE:** In migratory populations, move in pairs and small, possibly family, groups to loose flocks of up to 170 birds or more, on n. and s. passage (e.g. Dove 1939a; Lord 1956a; Sharland 1958; Hobbs 1961; Gill 1970; Bedggood 1970, 1972, 1973; Masters & Milhinch 1974; McGarvie & Templeton 1974; Garnett & Bredl 1985; Dymond 1988; Coates 1990; Schulz 1991; Baxter & Berris 1995; Ashton *et al.* 1996; Storr 11, 22, 26, 27; ACT Atlas; Vic. Bird Rep. 1981; Tas. Bird Rep. 1, 3, 8; H.A.F. Thompson & D.K. Goodfellow). Large numbers (estimated total of 800–1000 birds) reported on passage in ne. Vic. in Mar. and Aug. (Bedggood 1973). Near Devonport, Tas., migrants seen in large flocks, followed by stragglers in twos and threes, all seeming somewhat fatigued (Dove 1921). May form flocks before departure on n. and s. passage, and may also move to more open areas before departure and can occur in more open habitats on passage (MacGillivray 1914; Sullivan 1929; Sharland 1958; Thomas & Wheeler 1983; Baxter & Berris 1995; Storr 27), e.g. at Moruya, se. NSW, birds noted congregating in open country in first three months of year, and suggested that these may have been pre-migratory assemblages of local birds (Marchant 1992). Movement may be unhurried, especially in autumn, with flocks moving through trees and foraging while moving in general direction (Dove 1924, 1926, 1929b, 1939a; Campbell 1938; Rose 1973). However, in ACT, autumn departure abrupt (ACT Atlas). Autumn passage described as being less conspicuous than spring passage in some areas (Rix 1976; Marchant 1992). In Darwin area, in May, noted flying N, out to sea in parties, but with no conspicuous return passage seen (McKean 1986; H.A.F. Thompson & D.K. Goodfellow). Migration observed throughout day (Dove 1906, 1910, 1921; Morgan 1932; Hopkins 1949). Readily cross large stretches of water, including Bass Str. (Sharland 1958; Ridpath & Moreau 1966; Cooper 1974, 1975a,b; Green 1977a, 1995), flying c. 10–12 m above water, near Devonport (Dove 1906, 1910; Cooper 1975a), or at c. 30 m above water, from Booby I., Torres Str. (Warham 1962); seen flying with and against the wind (Dove 1906, 1910, 1921). Migration between Aust. and PNG probably takes place on a broad front across Coral Sea (Coates 1990).

**E. Aust., SA and NT** Partly migratory, and partly resident or sedentary; migrants move N in autumn–winter to n. Aust. and New Guinea; Tas. population, which also partly migratory, possibly rarely moves beyond se. Aust. in non-breeding period (Keast 1958b; Aust. Atlas 1; DAB). Migration reflected in reporting rates in e. Aust.: reporting rate higher in summer and lower in winter in Tas. (30% in summer, 8% in winter) and se. Aust. regions (45%, 35%) with reverse pattern in NE, where reporting rates higher in winter and lower in summer on C. York Pen. (winter 44%, summer 13%) and Atherton regions (34%, 21%).

**Breeding** Breed throughout Aust. range except coastal ne. Qld and Torres Str.; in spring–summer in S, and most months in N (see Distribution, Breeding [Season]). After breeding, may form pre-migratory flocks before leaving (see Nature of passage, above).

**Departure** Move N from se. Aust. in autumn, though not wholly migratory and recorded throughout se. Aust. in winter (see Non-breeding). Tas. populations cross Bass Str., to winter in se. mainland Aust., at least as far N as Murray R. (possibly, occasionally extending as far as Alice Springs, NT [DAB]); populations breeding se. mainland Aust. move N to n. Aust. and New Guinea (see below). TAS.: Leave Mar.–Apr., mainly

Apr. (Fletcher 1903, 1909b, 1924; Sharland 1958; Green 1995), but also recorded leaving early Feb. (Green 1977b). At Devonport, departure recorded late Mar. to mid-May (latest 11 May), usually Apr., with birds moving W or NW through area, usually in small parties, moving slowly and foraging en route (Dove 1906, 1910, 1916, 1918, 1919a,b, 1924, 1926, 1928a,b, 1929a,b, 1932, 1934, 1935, 1937, 1939c, 1940; Campbell 1938; Lawrence 1945); suggested that may be moving towards nw. Tas. before crossing Bass Str. to King I. or mainland (Dove 1939a). Passage across Bass Str., possibly via Flinders I., where present spring–summer but absent winter (Green 1969), or via King I. (Green & McGarvie 1971). However, no records from King I. in autumn–winter (after 23 Mar.) 1998–2002 (Aust. Atlas 2), suggesting that, at least sometimes, may fly directly to mainland Aust. SA: Timing of departure not clear. Said to be few records in S in Dec.–Mar. (Cox 1973; SA Bird Rep. 1977–81) but still common and breeding in Belair CP in summer and rarely recorded autumn (Baxter 1980), and most leave Kangaroo I. in Mar. (Baxter & Berris 1995). Passage noted Sandy Creek CP in May (Rix 1976), and at Netherby in Apr.–May, moving NE (Sutton 1927b). Passage observed Adelaide, 19 June 1932, to W (Morgan 1932), and seasonal movement through area inferred by observation of consistently higher numbers in Mar. 1992 (Paton & Peddler 1999). In L. Frome district, typically most leave Oct. (McGilp 1923). VIC.: Leave or on passage Mar.–May, mainly Apr. (Ingle 1910; Sullivan 1929; Campbell 1937, 1938; Watson 1955; McEvey 1965; Bedggood 1970, 1972, 1973, 1980; Loyn 1980; Thomas & Wheeler 1983; Twaits 1998b; Aust Atlas 1; Vic. Atlas), e.g. round Colac, leave Apr.–May (Brown 1950), and at Rotamah I., leave Apr. (Burbidge 1982, 1985; Anon. 1989, 1992; Dow & Dow 1989; Hall & Hall 1990; Rolland & Rolland 1996a,b). ACT: Leave mid-Apr. to early May (Frith 1969; Er & Tidemann 1996; Veerman 2002; ACT Atlas) and completely vacate areas >800 m asl (ACT Atlas). NSW: Mainly leave, and passage recorded, Mar.–May, from both inland and coastal regions (Chisholm 1934, 1938; Hobbs 1961; Heron 1973a; Rose 1973; Baldwin 1975; Gall & Longmore 1978; Schmidt 1978; Morris *et al.* 1981; Jordan 1984, 1987, 1988; Bramwell 1990; Aust. Atlas 1). At Moruya, on se. coast, numbers declined steadily from Jan., when breeding finished, till few birds present June–Aug.; parties noted moving N in Mar.–May may move only locally (Marchant 1992). S. QLD: Move N in Mar.–June (Storr 1973; Storr 19); leave Murphys Ck in Apr., moving W (Lord 1956a).

N. passage also observed in n. Aust. in autumn: QLD: Move across Coral Sea, including from Townsville area (Garnett & Cox 1988; Coates 1990), and coast near Innisfail (Gill 1970). Said to leave C. York Pen. after breeding (Mack 1953). However, flocks also seen flying S, 1 May 1980, near Edward R., w. C. York Pen. (Garnett & Bredl 1985). No large-scale movements observed Torres Str., and suggested that birds reaching New Guinea must fly at high altitude or cross Coral Sea (Draffan *et al.* 1983). NT: Leave Darwin area in May, moving N over sea (McKean 1986; H.A.F. Thompson & D.K. Goodfellow).

**Non-breeding** Extent of migration of Aust. populations not certainly known; some remain throughout se. Aust., including Tas., in winter (see below); Tas. populations probably extend only to se. mainland, not normally extending beyond Murray R. (see above); se. mainland populations winter mainly in n. Aust. and New Guinea. Large flocks containing a high proportion of immatures seen in n. and central Aust. during winter (Frith 1969); and wintering records C. York Pen. and Torres Str., mainly of immatures (Storr 1973; Draffan *et al.* 1983; Storr 19). N. AUST.: Arrive autumn. NT: Often observed Alice Springs May–July, after which numbers decrease (Hitchcock & Jarman 1944). In N, present Melville I.,

May–Nov. (Mathews 1914); Darwin region, May–Sept. (Crawford 1972; Thompson 1978; McKean 1986; J.L. McKean; H.A.F. Thompson & D.K. Goodfellow); and Lower McArthur R. region in winter, apparently non-breeding migrants from S (Schodde 1976). QLD: Mainly winter on n. coastal lowlands but some present in all parts of state (Storr 1973; Wieneke 1992; Storr 19). In Townsville area in May seen in flocks that broke up and spread out over winter (Hopkins 1949); and present Atherton area (where also considered resident or present throughout year; see below), Apr.–Aug. (Bravery 1970). Winter throughout C. York Pen. (MacGillivray 1914; Storr 1973; Garnett & Bredl 1985; McLean 1993; Storr 19) and major islands of Torres Str. (Storr 1973; Draffan *et al.* 1983; Storr 19); said to be nomadic on islands of Torres Str. during dry season (Draffan *et al.* 1983), but confirmation needed.

Some remain in se. Aust. through winter: in SE. QLD (Lord 1956a; Vernon 1968; Storr 1973; Woodall 1995; Storr 19); NSW (Morris 1975; Frith 1985); ACT, at lower altitudes, including Canberra (Frith 1969; Veerman 2002; ACT Atlas); VIC. (Howe 1928; Wheeler 1967; Bedggood 1972; Vic. Atlas), including many in coastal e. Gippsland (Bedggood 1970, 1980); and s. SA (SA Bird Rep. 1977–81), including central Yorke Pen., where a few seen Mar.–Sept. (Souter 1942), Mannum area, where more common June–Dec. (Cox 1973), and Kangaroo I. (mostly single birds) (Baxter & Berris 1995). Also remain TAS. in winter (Sharland 1958; Cooper 1975a,b; Green 1977a, 1995), though appear to move from higher and colder areas to lowland and milder sites (Littler 1903; Anon. 1904; Sharland 1958); recorded wintering Devonport (Dove 1918, 1928b, 1931, 1936, 1938, 1939b), Launceston (Littler 1903) and occasionally in Florentine and Styx Valleys (Mollison 1974). In Barrington area, NSW, may move locally from open country, where breed, to more heavily forested areas for winter (Hyem 1937). However, in Vic., rare or absent in forests in winter (Loyn 1980, 1985), with most occurring in partly cleared or suburban habitats (R.H. Loyn).

NZ Occasional visitor, with most records in autumn–winter (Mar.–Apr., June–Sept.) and single record in Jan.; most records are of immatures (see Distribution).

**Extraliminally** Widespread winter visitor to Wallacea (including Sulawesi, Sula Is, s. Moluccas, and Lesser Sunda Is), New Guinea and associated islands, Bismarck Arch. and Solomon Is (Mayr 1941; Bell 1967, 1982; Rand & Gilliard 1967; Diamond 1972; Peckover & Filewood 1976; Beehler *et al.* 1986; White & Bruce 1986; Coates 1990; Johnstone & Jepson 1996; Coates *et al.* 1997). Arrive PNG in May (Keast 1958b; Beehler *et al.* 1986; Coates 1990; Aust. Atlas 1); present Tabubil and Ok Tedi Valley, late May to Sept. (Murray 1988). Round Port Moresby, PNG, present throughout year but with influx of migrants in winter (Tubb 1945; Mackay 1970; Peckover & Filewood 1976; Bell 1982; Beehler *et al.* 1986; Coates 1990).

**Return** Leave non-breeding areas in spring, moving S. Leave Sogeri Plateau and Trans-Fly Region, Oct. (Coates 1990). Migration from New Guinea probably via Coral Sea, or Torres Str. or through Darwin, but rarely noted (Draffan *et al.* 1983; McKean 1986; Garnett & Cox 1988; Coates 1990; H.A. Thompson & D.K. Goodfellow 1990). However, small flock seen moving S on Booby I., Torres Str., late Oct. (Warham 1962). QLD: Move S in Aug.–Nov. (Storr 1973; Storr 19); s. passage seen near Innisfail, Oct. (Gill 1970), at Cardwell, Nov. (Barnard 1930), and in Townsville area in spring (Garnett & Cox 1988). Mainly arrive SE in Sept. but no details (Vernon & Martin 1975; Nielsen 1991); arrive Murphys Ck, Aug.–Sept. (Lord 1956a). NSW: Return Aug.–Sept., to coast and inland (Chisholm 1934, 1938; Hobbs 1961; Heron 1973a; Rose 1973; Baldwin 1975; Gall & Longmore 1978; Schmidt 1978; Morris *et al.* 1981; Jordan

1984, 1987, 1988; Ford *et al.* 1985; Bramwell 1990; Aust. Atlas 1), including s. Murray–Darling Basin, where passage noted Aug.–Sept. (Hobbs 1961); at Moruya, on se. coast, return Sept. (Marchant 1992). ACT: Return to lowland areas, including Canberra, late Aug. to Oct., mainly Sept. (Bell 1980; Hermes 1981; Er & Tidemann 1996; Veerman 2002); and to higher altitudes by Oct.–Nov. (Frith 1969; ACT Atlas). VIC.: Return Aug.–Oct., mainly Sept. (Ingle 1910; Howe 1928; Sullivan 1929; Campbell 1937; Brown 1950; Bedggood 1970, 1972; Twaits 1998b; Aust. Atlas 1); return Rotamah I., spring (once 12 Sept.) (Burbidge 1982, 1985; Anon. 1989, 1992; Dow & Dow 1989; Hall & Hall 1990; Rolland & Rolland 1996a,b). Mainly spring–summer visitor throughout Vic. (Ford 1908; Payne 1931; McEvey 1965; Wheeler 1967; Fleming 1976; Loyn 1980; Preston 1983; Traill *et al.* 1996; Twaits 1998a; Vic. Atlas). Large numbers move through Caniambo district in spring (Bedggood 1973) and through Strathbogie Ras in Sept. (Bedggood 1972); and seen on passage through Laverton Saltworks, July–Sept. (Watson 1955). SA: Return spring–summer (Boehm 1928; Baxter 1980); return Sandy Creek CP, July–Oct., mainly Sept.–Oct. (Rix 1976), and Kangaroo I., Aug. (Baxter & Berris 1995). Usually appear about Aug. in L. Frome district (McGill 1923). TAS.: Cross Bass Str. in spring (Sharland 1958; Green 1995), with passage noted on King I., Oct.–Nov. (Aust. Atlas 2; Tas. Bird Rep. 1). Return Devonport, Sept.–Oct., with passage noted from sea to SE towards inland, from early Sept. (Dove 1906, 1910, 1916, 1918, 1919a,b, 1928a,b, 1929a, 1932, 1934, 1935, 1937, 1939a,c, 1940; Campbell 1938; Lawrence 1945). Observed on passage at Loorana, 26 Nov. 1971 (McGarvie & Templeton 1974). Generally return Sept.–Oct., mainly in Sept. (Fletcher 1903, 1908, 1909a,b; Le Souéf 1907; Sharland 1958; Ridpath & Moreau 1966; Cooper 1974, 1975b; Green 1977a,b, 1995) or described as returning spring–summer (Sharland & Crane 1922; Fletcher 1924; Ratkowsky & Ratkowsky 1978; Hird 1995).

Considered **RESIDENT**, or **RECORDED THROUGHOUT YEAR**, at sites throughout e. Aust., SA and NT, at many of which also considered migratory or where numbers fluctuate through year; not known if such records represent locally resident populations or replacement of locally breeding populations with migrants from elsewhere, e.g. at Moruya, se. NSW, suggested that breeding population migrates N and is replaced by migrants from farther S that winter in cleared and partly cleared land (Marchant 1992). Considered resident, or recorded throughout year: in N. QLD, on Atherton Tableland (Bravery 1970; Gill 1970), round Townsville (Hopkins 1948; Garnett & Cox 1988; Wieneke 1988; Jones & Wieneke 2000), and round Charters Towers (Britton & Britton 2000); in CENTRAL AND S. QLD (Berney 1905; Roberts & Ingram 1976; Longmore 1978; Porter & Henderson 1983; Whitmore *et al.* 1983; McKilligan & McKilligan 1987; Dawson *et al.* 1991; Nielsen 1991; Templeton 1992; Durrant & MacRae 1994; Sharp & Sewell 1995; Bielewicz & Bielewicz 1996; Woodall 1999a), including Mt Isa in W (Horton 1975); NSW–ACT, both inland (Althofer 1934; Heron 1973b; Schmidt 1978; Debus 1985; Henle 1989; Veerman 2002), and on and E of Great Divide (Campbell 1938; Morris 1975, 1986, 1989; Gibson 1977; Sontner 1980; Bell 1983; Hardy & Farrell 1990; Leishman 1994; Egan *et al.* 1997; A.K. Morris); at Moruya, se. NSW, suggested breeding population may be replaced by winter migrants from farther S (Marchant 1992; see above); VIC. (Rowley 1961; Hore-Lacy 1964; McEvey 1965; Bedggood 1973; Mitchell & Mitchell 1975; Roberts 1975) including n. lowlands (Vic. Atlas); in SA (Boehm 1957; Clarke 1967; Leiblich 1971; Ford & Paton 1976; Paton & Paton 1980; Ashton 1985, 1996; Taylor 1987; Read *et al.* 2000; SA Bird Rep. 1977–81); round Adelaide, present throughout year but numbers higher in autumn (White 1919; Whatmough 1978;

Paton & Pedler 1999); and in n. NT (Jarman 1944; Storr 1967; Schodde 1976; McKean 1985), including Cobourg Pen. (Frith & Calaby 1974) and Groote Eylandt (Haselgrove 1975).

**WA** Probably partly migratory and partly resident, but exact situation not clear. While considered resident (Serventy & Whittell; see below), also described as passage migrant in all divisions and winter visitor to many of them (see below), consistent with observations of seasonal patterns of occurrence (see below). Movements of subspecies may differ: in Pilbara region, *subpallida* described as resident, while *novae-hollandiae* considered a passage migrant and winter visitor (Storr 16; see below); regional populations elsewhere may also differ, especially where described both as resident and winter visitor, as well as passage migrant (see below). Apparently a strong tendency to form flocks in mid- to late summer (Serventy & Whittell; Aust. Atlas 1). Considered **RESIDENT**, or **PRESENT THROUGHOUT YEAR**, at sites throughout S (Alexander 1921; Whitlock 1937; Campbell 1938; Serventy 1948; Heron 1970; Brooker *et al.* 1979; Brown & Brown 1981; Mawson & Massam 1995; Storr 28), including South-West Div. (Sedgwick 1937, 1940, 1988; Saunders & Ingram 1995; but see below) and Eyre (Davies 1982; Congreve & Congreve 1985; Dymond 1988; Ashton *et al.* 1996); in central WA, including Gascoyne region (Brooker & Estbergs 1976; Storr 21) and mid-e. interior (Storr 22); and in N, including Pilbara Region (Lindgren 1961; Howard 1986; Storr 16), Kimberley Div. (Collins 1995; Storr 11) and ne. interior (Storr 1981). **PASSAGE**: Passage noted in Eucla Div. late Feb. to early Nov. (Storr 27); in South-West Div., mid-Jan. to early Nov., mostly Mar.–Aug. (Storr 35), including Swan Coastal Plain, mostly Apr.–May and July–Aug. (Storr 28); in South-Eastern Interior Region, late Mar. to early June and late July to early Sept., with flocks smaller and less frequent in s. spring passage (Storr 26); in Gascoyne Region, late Feb. to early Sept. (Storr 21); in Mid-Eastern Interior Region, late Mar. to late May and early June to early Sept. (Storr 22); in Pilbara Region (*novae-hollandiae*) Feb.–Oct. (Storr 16); and in ne. interior, Apr.–Sept. (Storr 1981). **SEASONAL OCCURRENCES**: Further, described as winter visitor to all regions except South-Eastern Interior and Mid-Eastern Interior (Storr 1981; Storr 11, 16, 21, 27, 35); some birds probably pass through while others remain. Described as winter visitor in South-West Div. (Storr 35), including Swan Coastal Plain area (Storr 28) and Rottnest I., late Mar. to late Sept. (Storr 1965; Saunders & de Rebeira 1993), though considered as spring–summer visitor to other parts of South-West Div.

**Banding** Of 926 banded in Aust. and New Guinea, 1953–Aug. 2001, 54 recoveries (5.8%). Of 42 recoveries, of 31 birds, July 1984–Aug. 2001: 34 (80.9%) <10 km from banding site; seven (16.7%), 10–49 km; one (2.4%), 50–99 km (ABBBS). Long-distance recovery: Sutherland to Young, NSW (257 km, 261°, 15 months, Nov.; P) (ABBBS), though bird had been caught by Cat and may have been carried some of distance (ABBBS 1965). Near Manjimup, sw. WA, 1972–91, of 21 banded, one retrap (4.8%) within a year of being banded (Brown & Brown 1981, 1991). **LONGEVITY**: Adult banded near Mt Cotton, Qld, 8 Oct. 1988, recaptured at banding place over 8 years 11 months after banding (ABBBS 1999).

**FOOD** Invertebrates, mainly insects, fruit and some other plant material. **Behaviour** Primarily arboreal, occasionally terrestrial. Forage among foliage, from branches and under bark of trees and shrubs; also on ground, among grass and in air. Mostly forage by sallying, also by hovering and snatching prey or fruit from various substrates and by gleaning (Campbell 1903; Littler 1903; McLennan 1908; Cole 1909; Hill 1909; Thompson 1911; Chisholm 1924; Mellor 1926; Barnard 1930; MacGillivray 1931; Lawrence 1945; Lord

1956a; Boehm 1957; Wheeler 1959; Frith 1969; Bravery 1970; Ford & Bell 1981; Loyn 1985; Recher *et al.* 1985; Ford *et al.* 1986; Paton *et al.* 1988; Woinarski 1990; Wood 1994; Taylor *et al.* 1997; Rose 1999; North; Hall; see below). **DETAILED STUDIES**: In Kakadu NP, NT, Feb.–Mar. 1982 and 1983 and Aug.–Sept. 1983 (Brooker *et al.* 1990); in Imbota NR, near Armidale, n. NSW, 1981–82 and 1984 (Ford *et al.* 1986); and near Bombala, in se. NSW and ne. Vic., Oct. 1980–Jan. 1981 (Recher & Holmes 1985; Recher *et al.* 1985). **FORAGING ASSOCIATIONS**: Forage singly (Bourke 1946; Rose 1999), in twos (Cameron 1932; Heathcote 1933), and commonly in small flocks of unspecified number (Whitlock 1923; Dove 1926; Crouther & Crouther 1984; Debus 1985), including flocks of 6–20 (Pearse 1933; Hobbs 1986), or larger flocks of 21–50 (Littler 1903; NSW Bird Rep. 1994); once seen in flock of 60–70 (Barnard 1930). Often forage with Figbirds *Sphecotheres viridis* and Olive-backed Orioles *Oriolus sagittatus* in fruiting trees (Crouther & Crouther 1984) and with Spangled Drongos *Dicrurus bracteatus* (Rose 1999). In ne. Qld, sometimes in mixed-species feeding flocks; recorded in 30% of 127 flocks, with mean of 2.1 Cuckoo-shrikes/flock (1–8 Cuckoo-shrikes) (Britton 1997). In Kimberley Div., n. WA, seen feeding in fig *Ficus* tree with Silver-crowned Friarbirds *Philemon argenticeps*, White-bellied Cuckoo-shrikes, Figbirds, Olive-backed Orioles and Great Bowerbirds *Chlamydera nuchalis* (Butler 1971). **FORAGING HEIGHTS**: Forage at all heights; mostly in canopy and subcanopy, but also on or close to ground (Thompson 1911; Cameron 1932; Pearse 1933; Debus 1985; Loyn 1985; Woinarski 1990; Wood 1994). In Kakadu NP, of 19 foraging observations in dry season (Aug.–Nov.; absent in wet season): 16% on ground; 5%, 0–1 m above ground; 16%, 2–3 m; 42%, 4–7 m; 16%, 8–14 m; and 5%, >14 m. In Imbota NR, mostly foraged in upper strata; of 155 observations of foraging: 12.0%, 1–2 m above ground; 5.9%, 3–5 m; 17.0%, 6–9 m; 47.1%, 10–14 m; and 28.8%, >15 m. Near Bombala, foraged mainly in canopy and subcanopy; mean height of foraging, 11.4 m (6.0; 75 obs. foraging): 7% on ground, 4% in shrubs (0.2–4 m), 38% in subcanopy (4–10 m), and 51% in canopy (>10 m). **FORAGING SITES**: Mostly forage among foliage of trees and shrubs, especially of eucalypts; also in air and on ground and from branches and bank (Thompson 1911; Chisholm 1924; Dove 1926; Heathcote 1933; Lawrence 1945; Bourke 1946; Loyn 1985; North). In Imbota NR, of 155 observations of foraging: 89.7% among leaves, 6.5% on branches, 0.7% on trunks of shrubs and trees, and 3.2% in air. Food collected mainly from eucalypts (82.5%) with rest from bipinnate acacias (13.0%), mistletoe *Amyema* (1.2%), and non-vegetative substrates, such as air (3.3%). In Kakadu NP (n=19), foraged mainly in foliage (63% of obs.), and less often on ground (21%), in shrubs (5%) and in air (10%). Near Bombala, of 75 observations of foraging: 59% in foliage, 26% from bark on branches (including 1% from trunks), 8% on ground and 7% in air. At Munmarlary, NT, foraged mainly in foliage of eucalypt trees and less often from branches (Woinarski 1990). At Wollongong, NSW, breeding adults foraged mostly in eucalypt trees, less often in other native and introduced trees and, only occasionally, from low shrubs (<1 m); did not forage on ground (Wood 1994). At Armidale, n. NSW, took food scraps from school playgrounds, birds arriving in groups and foraging on lawn, particularly after lunch break or after school hours, when playground deserted (Debus 1985); in Sydney, seen feeding from bird-feeding station (Kloot & McCulloch 1990). **FORAGING METHODS**: Attack mainly by sallying, and less often by gleaning; often sally-pounce to ground, either from hovering flights (Heathcote 1933; Bourke 1946; Rose 1999), during which prey may be eaten (Lord 1956a), or from perches, to which they return to eat prey (McGilp 1921; Heathcote 1933; Hall). Also often hover in air like raptors, over open grass, low



pasture or low shrubland, in flights lasting up to 15 s (Heathcote 1933; Bourke 1946; Lord 1956a; Boehm 1957; Bravery 1970; Rose 1999). Sometimes obtain fruit or insects by sally-hovering (Chisholm 1924; Mellor 1926; Wheeler 1959; Paton *et al.* 1988; Rose 1999). In Kakadu NP (n=19), forage mostly by sallying (63% sally-strike on foliage, 11% in air) and less often by gleaning (21%) and flutter-chase (5%). In Imbota NR (n=155 obs. foraging): foraged mainly by sallying (86.4% obs.), including sally-strike on foliage (81.9%), sally-strike in air (3.2%), and sally-hover (1.3%), with rest by gleaning (13.6%). Near Bombala (n=75 obs.), foraged mostly by sallying (87%), including sally-strike on vegetation (74%), sally-strike in air (6%), and sally-pounce to ground (7%); also foraged by gleaning (12%) and, rarely, by probing (1%). At Wollongong, most food obtained by gleaning and by sally-striking vegetation, usually after long periods, 10–15 min, of searching; less often, caught prey by sally-striking in air (Wood 1994). Beat large prey before eating it (Rose 1999; Hall). When feeding on larvae of case-moths, hold them with bill and bash them against perch for long time till larva forced out of case, then eaten (Cole 1909).

**Detailed studies** At L. COWAL, NSW (five stomachs; Vestjens 1977): INSECTS: Coleoptera: Chrysomelidae 40% freq.; Curculionidae 20; Scarabaeidae: *Anoplognathus* 20; Hemiptera: Pentatomidae 20; Hymenoptera: wasps 20; Mantodea 20; Odonata: dragonflies 20; Orthoptera: Acrididae 60; Tettigoniidae 20.

**Other records** **Plants** (Fruit unless stated.) Fruit<sup>6,12,16,20,27,30,57,73,74</sup>, seeds<sup>30,69,73,76,77</sup>, leaves<sup>27,75</sup>, flowers<sup>27</sup>, vegetable matter<sup>76</sup>. **MONOCOTYLEDONS:** Musaceae: *Musa paradisiaca*<sup>73</sup>; Smilacaceae sds<sup>77</sup>. **DICOTYLEDONS:** Asteraceae: *Chrysanthemoides* sds<sup>71</sup>; Caesalpiniaceae: *Cassia* sds<sup>53</sup>; Cucurbitaceae: *Mukia maderaspatanus* sds<sup>11</sup>; Euphorbiaceae: *Omalanthus novoguineensis*<sup>79</sup>; Epacrididae: *Leucopogon parviflorus*<sup>71,72</sup>; Fabaceae: *Gompholobium* seed pod<sup>74</sup>; Lauraceae: *Cinnamomum camphora*<sup>63,64,79</sup>; Loranthaceae<sup>9,40</sup>; *Lysiana exocarpi*<sup>1,11</sup>; Mimosaceae: *Acacia* sds<sup>73</sup>; Moraceae: *Ficus*<sup>3,30,41,50,64,77</sup>; *F. fraseri*<sup>63,67,79</sup>; *F. hillii*<sup>72</sup>; *F. macrophylla*<sup>15,79</sup>; *F. microcarpa*<sup>79</sup>; *F. obliqua*<sup>63,67,78,79</sup>; *F. platypoda*<sup>69</sup>; *F. rubiginosa*<sup>72,79</sup>; *F. virens*<sup>61</sup>; *Morus*<sup>16,28,73,80</sup>; *M. nigra*<sup>59,70</sup>; Oleaceae: *Ligustrum lucidum*<sup>63,79</sup>; *Olea*<sup>74</sup>; *O. europaea*<sup>6,13,16,31,65,66</sup>; Rosaceae: *Fragaria*<sup>72</sup>; *Prunus armeniaca*<sup>73</sup>; *P. avium*<sup>73</sup>; *P. domestica*<sup>73</sup>; *P. persica*<sup>73</sup>; Rubiaceae<sup>71</sup>; Santalaceae: *Exocarpos*<sup>59</sup>; *E. aphyllus*<sup>60</sup>; *E. cupressiformis* sds, fru.<sup>71,74</sup>; Sapindaceae: *Alectryon connatus*<sup>79</sup>; *Cupaniopsis anacardioides*<sup>79</sup>; Solanaceae: *Lycium*<sup>21</sup>; *L. ferocissimum*<sup>1,16,17</sup>; *Solanum mauritianum*<sup>63,79</sup>; Ulmaceae: *Aphananthe philippinensis*<sup>63,67,79</sup>; Vitaceae: *Vitis vinifera*<sup>4,15,43,73</sup>. **Animals** **ANNELIDS:** Oligochaetes<sup>33</sup>. **MOLLUSCS:** Gastropods<sup>72</sup>. **SPIDERS**<sup>6,46,75,77</sup>; Sparassidae<sup>72</sup>. **INSECTS**<sup>2,5,6,19,22,23,30,36,49,54,72,74,75</sup>; Blattodea<sup>75</sup>; Coleoptera<sup>6,12,25,26,27,33,52,72,74,75,76,77</sup>; Atteblabidae<sup>77</sup>; Belidae: *Belus*<sup>75</sup>; *Rhinotia*<sup>75</sup>; Buprestidae<sup>74,75</sup>; Carabidae<sup>77</sup>; Cerambycidae<sup>9,51,75,77</sup>; Chrysomelidae<sup>77</sup>; *Cadmus*<sup>77</sup>; *Cryptocephalus*<sup>75</sup>; *Paropsis*<sup>25,51,74,75,77</sup>; Cleridae: *Trogodendron fasciculatum*<sup>74</sup>; Curculionidae<sup>46,51,74,75,77</sup>; *Catasarcus*<sup>47</sup>; *Gonipterus*<sup>74,75</sup>; *Oxyops*<sup>10</sup>; *Polyphrades*<sup>11</sup>; Lucanidae: *Lamprima aurata*<sup>75</sup>; Scarabaeidae<sup>74,75,77</sup>; *Anoplognathus*<sup>19,77</sup>; Tenebrionidae<sup>75</sup>; *Lepispilus*<sup>75</sup>; *Pterohelaeus*<sup>74</sup>; Hemiptera: Cercopidae<sup>75</sup>; Cicadidae<sup>75</sup>; Psyllidae lerp<sup>11,77</sup>; Pentatomidae<sup>77</sup>; Hymenoptera: wasps<sup>10,47,51,74,75</sup>; Apidae<sup>20</sup>; Chrysididae<sup>10</sup>; Formicidae<sup>47,77</sup>; *Camponotus*<sup>42</sup>; *Iridomyrmex*<sup>75</sup>; *Myrmecia*<sup>77</sup>; Siricidae: *Sirex noctilio*<sup>55</sup>; Isoptera<sup>38,72</sup>; Lepidoptera: larv.<sup>7,25,27,30,34,36,37,45,48,73,74,75</sup>, ads<sup>14,51</sup>; Limacodidae: larv.<sup>72</sup>; *Doratifera vulnerans*<sup>25,74,75</sup>; Limntriidae: *Teia anartoides* larv.<sup>6</sup>; Noctuidae: *Agrotis infusa*<sup>18,72</sup>; Pieridae: *Pieris rapae*<sup>62</sup>; Psychidae<sup>6</sup>; Sphingidae<sup>74</sup>; *Psilogramma menephron*<sup>72</sup>; Mantodea: eggs<sup>77</sup>, ads<sup>47,72,74,77</sup>; Odonata: dragonflies<sup>75</sup>; Orthoptera: grasshopper eggs<sup>47</sup>, nymphs<sup>29</sup>, ads<sup>8,14,24,26,27,32,34,73,74,76</sup>; Acrididae<sup>77</sup>; *Austroicetes* nymphs, ads<sup>70</sup>;

*Chortoicetes terminifera*<sup>35,72,75</sup>; *Phaulacridium vittatum* nymphs, ads<sup>70</sup>; *Praxibulus* nymphs, ads<sup>70</sup>; Gryllidae<sup>75,77</sup>; Tettigoniidae<sup>77</sup>; Phasmatodea: Phasmatidae<sup>32,39,72,73</sup>; *Didymuria violascens*<sup>44</sup>; *Phacanthus*<sup>53</sup>. **REPTILES:** Small lizard<sup>8</sup>. **Other matter** Meat pieces<sup>46,55,68</sup>; bread, pie crusts<sup>58</sup>.

**REFERENCES:** <sup>1</sup> Johncock 1903; <sup>2</sup> Littler 1903; <sup>3</sup> Anon. 1905; <sup>4</sup> Batey 1907; <sup>5</sup> McLennan 1908; <sup>6</sup> Cole 1909; <sup>7</sup> Hill 1909; <sup>8</sup> Mathews 1909; <sup>9</sup> Barnard 1914; <sup>10</sup> Lea 1914; <sup>11</sup> 1915; <sup>12</sup> White 1917; <sup>13</sup> Edwards 1921; <sup>14</sup> Mellor 1921; <sup>15</sup> 1923; <sup>16</sup> 1926; <sup>17</sup> 1931; <sup>18</sup> Slaney 1922; <sup>19</sup> Sutton 1926; <sup>20</sup> De Warren 1928; <sup>21</sup> Sargent 1928; <sup>22</sup> Cameron 1932; <sup>23</sup> Mules 1932; <sup>24</sup> Heathcote 1933; <sup>25</sup> McKeown 1934; <sup>26</sup> 1936; <sup>27</sup> 1944; <sup>28</sup> Marshall 1935; <sup>29</sup> McGilp 1935; <sup>30</sup> Thomson 1935; <sup>31</sup> Rau 1938; <sup>32</sup> Chisholm 1940; <sup>33</sup> Rix 1943; <sup>34</sup> Chandler 1944; <sup>35</sup> Basse 1948; <sup>36</sup> Lord 1956a; <sup>37</sup> 1956b; <sup>38</sup> 1961; <sup>39</sup> Sedgwick 1956; <sup>40</sup> Keast 1958a; <sup>41</sup> Wheeler 1959; <sup>42</sup> Beddgood 1965; <sup>43</sup> McEvey 1965; <sup>44</sup> Readshaw 1965; <sup>45</sup> McCulloch 1966; <sup>46</sup> Oakley 1966; <sup>47</sup> Jenkins 1968; <sup>48</sup> Bravery 1970; <sup>49</sup> Lavery & Blackman 1970; <sup>50</sup> Butler 1971; <sup>51</sup> Green & McGarvie 1971; <sup>52</sup> Elliot 1973; <sup>53</sup> Frith & Calaby 1974; <sup>54</sup> Fleming 1976; <sup>55</sup> Walters 1980; <sup>56</sup> Madden 1982; <sup>57</sup> Crouther & Crouther 1984; <sup>58</sup> Debus 1985; <sup>59</sup> Forde 1986; <sup>60</sup> Hobbs 1986; <sup>61</sup> Kowalick 1986; <sup>62</sup> Brown 1988; <sup>63</sup> Holmes 1987; <sup>64</sup> 1990; <sup>65</sup> Paton & Paton 1987; <sup>66</sup> Paton *et al.* 1988; <sup>67</sup> Floyd 1989; <sup>68</sup> Kloot & McCulloch 1990; <sup>69</sup> Green 1993; <sup>70</sup> Lepschi 1993; <sup>71</sup> Gosper 1999; <sup>72</sup> Rose 1999; <sup>73</sup> North; <sup>74</sup> Cleland; <sup>75</sup> Lea & Gray; <sup>76</sup> Hall; <sup>77</sup> FAB; <sup>78</sup> NSW Bird Rep. 1995; <sup>79</sup> G. Holmes; <sup>80</sup> R.H. Loyn.

**Young** Both parents feed nestlings and fledgelings. **NESTLINGS:** In one nest at Moruya, se. NSW, adults fed chicks 48 times in 637 min or average of once every 13 min; on Days 4–5, fed about once every 6–18 min, but on other days fed only every 15–30 min (Marchant 1985). In a nest at Wollongong, usually one nestling fed per visit (of 90 visits, one nestling fed on 94.4% and both nestlings fed on 5.6%); mean interval between feeds, 16.9 min (12.2; 1–54; 22) during 18–10 days before fledging and 15.4 min (11.8; 2–40; 25) during 9–0 days before fledging. Nestlings first fed bill to gape but older nestlings seen to place bill in throats of parents (Ashton 1987). **FLEDGELINGS:** In one nest at Wollongong, for first 2 weeks young waited for parents to feed them; from Week 5 followed adults and begged; and first seen killing and eating own prey on Day 40 after fledging; independent of parents after 50–60 days (Wood 1994). In Sydney, two fledgelings fed minced steak by parents at artificial feeding station (Kloot & McCulloch 1990).

**Detailed studies** At WOLLONGONG, NSW (52 items fed to nestlings, 16 to fledgelings; Wood 1994): **CHILOPODS:** 4% no. of items fed to nestlings, 0% no. fed to juvenile (80–120 mm in length). **INSECTS:** Unident. ads 15, 19 (20–30), larv. 19, 0 (15–25); Coleoptera 6, 0 (20–30); Lepidoptera: larv. 6, 50 (40–80); ad. moth 10, 6 (15–25); Orthoptera: grasshoppers (mostly Acrididae: *Acrida conica*) 12, 6 (30–60); Mantodea (mostly Mantidae: *Orthodera ministralis*) 8, 0 (30–40); Phasmatodea (Mostly Phasmatidae: *Ctenomorpha chronus*) 29, 19 (150–220).

**Other records** **INSECTS:** Hemiptera: Cicadidae<sup>3</sup>; Hymenoptera: wasps<sup>2</sup>; Lepidoptera: Cossidae<sup>3</sup>; Odonata: damselflies<sup>2</sup>. Hand-reared nestlings fed on pieces of meat<sup>1</sup>. (REFERENCES: <sup>1</sup> Green 1968; <sup>2</sup> Vestjens 1977; <sup>3</sup> Marchant 1985.)

**SOCIAL ORGANIZATION** Not well known. One study of breeding behaviour of a pair and young in Wollongong, NSW, Feb.–May 1992 (Wood 1994). Occur singly, in twos (possibly pairs), and in small flocks of up to 12 (e.g. Littler 1903; Pearse 1929, 1935; Thomson 1935; Cooper 1972; Emison 1975; Morris 1975; Gibson 1977; Johnstone *et al.* 1981; Storr 1981; Nichols & Nichols 1984; Green 1995; Coate *et al.* 1998; North; Storr 16, 21, 28; ACT Atlas); also often in small family groups at end of breeding season (Frith 1969; Rix 1976;

Schrader 1981; Burbidge 1985; Green 1995; Rolland & Rolland 1996b; Mathews). Occur in larger flocks, usually of up to 50+, mainly during non-breeding season (e.g. Littler 1903; Johnson & Hooper 1973; Gepp & Fife 1975; Schodde 1976; Longmore 1978; Draffan *et al.* 1983; Redhead 1988; Durrant & MacRae 1994; Campbell; North; Storr 28; NSW Bird Reps; Tas. Bird Reps), though, in WA, flocking noted to occur in summer, mainly in coastal localities (Sedgwick & Sedgwick 1950; Sedgwick 1973, 1988; Serventy & Whittell). Where migratory, sometimes form large flocks before departure to and on arrival at breeding sites; and on passage, occur in small to large flocks, of up to 170 or more; also occur singly or in small parties on migration (see Movements). Migrating flocks often include many immatures (Bravery 1970; Ingram 1976; Wieneke 1992; Storr 16), and winter flocks can consist mainly or wholly of immatures (Storr 1973; Brooker & Estbergs 1976; Smith *et al.* 1978; Hobbs 1986; Storr 19, 21). Regularly in mixed-species flocks, more usually in non-breeding season (Britton 1997; Hall) with species such as Spangled Drongos (Robertson & Hamilton 1968; Clancy 1985), White-bellied Cuckoo-shrikes (Clancy 1985) and babblers *Pomatostomus* (Hall); also see Food.

**Bonds** Most nesting records appear to be of simple pairs (Wood 1994; NRS). However, possible co-operative breeding reported: immature birds as well as two adults seen to attend nest (Brooker & Estbergs 1976; NRS), and once, immature seen to brood nestlings (NRS). When one of pair killed by Cat, surviving parent abandoned nest and nestlings, which were within days of fledging (NRS). **AGE OF FIRST PAIRING:** In several pairs, one of two parents apparently subadult (lacking full mask), and once, immature was the more aggressive of the two in defending nest (NRS). **Parental care** Both sexes incubate and brood, feed nestlings and fledglings, and eat or carry away faecal sacs (McGilp 1944; Marchant 1978, 1985; Wood 1994; Green 1995; Mathews). **DISPERSAL OF YOUNG:** After fledging, young remain with parents near nest for up to 30 days (NRS); in one brood in Wollongong, one juvenile reached independence 50–52 days after fledging, the other 61–63 days, after which they left area; parents remained in area for 10 more days (Wood 1994). However, parents and young may also leave nest-area soon after fledging (Sedgwick 1948; Marchant 1992; NRS). Further, young may remain with parents till next breeding season, at which time they may be chased away (Lord 1957; North). Immatures may form flocks during non-breeding season and on passage (see above). Young from previous brood of season seen in tree with parents during construction of second nest (NRS).

**Breeding dispersion** Pairs said to be territorial during breeding season (Lenz 1990; Marchant 1992; North). Nest solitary, but nests occasionally noted close to nests of other species (see Breeding: Site). Round Moruya, nests usually c. 500 m or more apart (Marchant 1992). **Territories, Home-range** At Moruya, territories at least 10 ha (Marchant 1992). In residential areas in Canberra, four breeding territories in 197.2 ha, 1.5 territories in 74.5 ha, and two territories in 35.7 ha (Lenz 1990). In Wollongong, breeding home-range of one pair, 33 ha, with a core-area (in which 80% of sightings made) of 22 ha; during nestling phase, parent birds confined most, if not all, of their activity to c. 15 ha around nest. Area defended, throughout nesting period, much smaller than home-range; average radii in which nestlings and juveniles defended from avian predators, 30 m and 60 m respectively (Wood 1994).

**Roosting** Near Adelaide, during non-breeding season, a flock of c. 20 would arrive in a group of trees bordering an oval just before sunset and were all roosting by sunset (Morgan 1927). At Wollongong, a pair and their two young began daily activity 7.5 min (2–13; 2) after sunrise and stopped 17.8 min (3–29; 4) before sunset (Wood 1994). In Townsville during May, a non-breeding flock of c. 40 seen towards dusk, circling

neighbourhood several times in almost complete silence, flock often dividing and birds alighting in trees, then rising and reuniting in flight before finally settling for night in trees in a reserve. Next morning and next few evenings, flock seen moving restlessly among trees, spreading out and breaking up (Hopkins 1949). Adult brooding a large young slept at night with wings lowered right over nest (Wheeler 1959). In Wollongong, in first 7–10 days after fledging, young rested during day in many different trees, often in exposed sites on branches with no branchlets or foliage, but later rested in more concealed sites in tangles of branchlets and leaves in outer foliage (Wood 1994).

**SOCIAL BEHAVIOUR** Not well known. One study of breeding behaviour of a pair and young in Wollongong, NSW, Feb.–May 1992 (Wood 1994). Described as tamer, allowing closer approach, during winter than at other times (Littler 1903). In PNG, Aust. migrants are conspicuous (Coates 1990). On alighting, have characteristic habit of shuffling their wings, lifting and refolding them repeatedly (e.g. Cole 1909; McGilp 1949; Durrant & MacRae 1994; North; Mathews; Serventy & Whittell). Often perch high on exposed limbs or wires (Gould; ACT Atlas), sometimes for long periods, even hours, remaining motionless and quiet or occasionally making a low rattle-like note (possibly Trill: see Voice), repeated several times in succession (Gould; North; Mathews). **Flock behaviour** On passage, flocks usually silent (Hall 1917; Murray 1988) but sometimes call (possibly Trill) (Mathews). **MAINTENANCE BEHAVIOUR:** Observed bathing in rain (Hall) and fluttering in foliage when it rains (NRS). During hot weather, adults and nestlings open bills and may pant; and adults spend much time shading nestlings from sun with wings; nestlings also seen to hang heads over side of nest, appearing exhausted, but rousing when food brought, before flopping down again (NRS).

**Agonistic behaviour** Appears to be infrequent. During breeding season at Wollongong, aggression observed only once (Wood 1994) but with no details. Once near nest, two adults seen flapping wings and making whirring noises in response to a third adult in nest-tree; when third adult left, parents stopped displaying and calling and returned to nest (NRS). Once, early in breeding season, two birds, possibly a pair, drove away a third bird, possibly offspring from previous season, with much chasing and calling (Lord 1957). Adults seen attacking other Cuckoo-shrikes near nest, sometimes while ignoring other species (NRS). **Interspecific interactions** Disputes and alarm often noted near nests. During aggressive interactions, Trill given at higher volume and repeated more rapidly than normal (Wood 1994). Possible threat behaviour seen at nest with young c. 1 week old (observations on 2 days, 3 days apart). On approach of observers, both parents (one flying from nest on second day) dived continually at observers, approaching to within 0.3–1.5 m, and calling repeatedly; both also flew about in trees above nest, constantly changing position and calling, and wiping bills repeatedly on branches; between attacks, birds would land in a tree, raise feathers of crown and nape, fan tails and undertail-coverts, and hold bills open showing reddish palates, but not call. On first day, after one bird flew off, other perched and preened, puffing out and raising its feathers, raised wings slightly and constantly flicked them higher than normal; after 5 min, stopped preening but held feathers of body raised, then turned away from observers and raised feathers of rump and back even more, with wings held lowered and knife-like on either side of dorsum. On first day, after observers moved away, bird hopped and flew closer to nest before settling on it (McCulloch 1970; which see for further detail). Once, at one nest within c. 9 m of nest of Blue-winged Kookaburra *Dacelo leachii* in same tree, one of pair flew to where Kookaburra was perched, opened bill and sidled up to it; Kookaburra then gave Cuckoo-shrike a peck and it flew

away; much chasing occurred over following days, with Kookaburra being chased away at times, while Cuckoo-shrikes were dived at and chased on other occasions (NRS). Immature seen chasing a Spangled Drongo (NRS). When nesting, seen to chase other species of bird, including Spotted Turtle-Dove *Streptopelia chinensis*, goshawks *Accipiter*, Brown Falcon *Falco berigora*, Laughing Kookaburras *Dacelo novaeguineae*, Noisy Friarbirds *Philemon corniculatus*, Red Wattlebirds *Anthochaera carunculata*, Magpie-lark *Grallina cyanoleuca*, Olive-backed Oriole, Figbird, butcherbirds *Cracticus*, Australian Magpie *Gymnorhina tibicen*, Pied Currawong *Strepera graculina*, Corvus, and Common Myna *Acridotheres tristis* (Fleming 1976; Wood 1994; NRS); and to attack other predators near nest, such as goannas *Varanus* and Cats (NRS). At Wollongong, interspecific interactions most frequent and intense in the first 7–8 days after young fledged; and last parental attack on an intruder was 19 days after fledging; 3 days later, fledgelings were seen to defend themselves. **Alarm** On sighting a pair of Peregrine Falcons *Falco peregrinus*, a small flock immediately dived into trees they were flying over (Walsh 1978). One called in a loud, but not deep or harsh, *cree-eu-cree-eu* after its mate was shot (Hall). **Mobbing** Once, seen mobbing a Channel-billed Cuckoo *Scythrops novaehollandiae* (Kellam 1974). Mob Laughing Kookaburras with Red Wattlebirds (Fleming 1976).

**Sexual behaviour** At start of breeding season, birds seen to fly about over tree-tops, displaying and chasing one another, calling loudly (Marchant 1992; Mathews), though displays not described. When selecting nest-site, seen to squat in fork of tree or other sites (NRS). One display seen 11 days before young fledged: both parents flew towards top of a tree while uttering a few Rolling Trills; upon landing, 30–40 cm apart, they faced each other and synchronously performed 3–4 bouts of shuffling each wing 6–9 times while singing lengthy Rolling Trills; possibly functioned in maintenance of pair-bond. Flute-like Call may also function in maintenance of bonds, and usually uttered while birds within 1 m of each other (Wood 1994). **Copulation** At Moruya, a female seen to fly and settle close by a male, then half-spread her wings; the male twisted towards her, peered at her rigidly, then mounted; copulation took place quickly and female immediately flew off and began to collect thin twigs for nest (Marchant 1978). Copulation also observed elsewhere during construction of nest, once 50 m from nest and once on partly built nest (NRS).

**Relations within family group** Both sexes brood and feed nestlings. During heavy and protracted rain, parents brood for longer periods, face into wind, and depress tail and spread wings to shield nestlings from wind and rain (Wood 1994; NRS). Young do not seem to gape constantly while adult at nest, and may refuse food, which adult then eats (NRS). Nestlings may outgrow nest well before they fledge and sit on it rather than in it (Frith 1969); 4 days before fledging, young begin to stand on rim of nest and stretch, then flap, wings. After fledging, young may remain in nest-tree, often returning to nest, or can move up to 200 m from nest for short periods (<10 min) (Sedgwick 1948; Marchant 1992; Wood 1994; NRS). Adults entice fledgelings to fly using food, e.g. adult landed in tree near nest with berry in its bill, and fledgeling then flew to it (NRS). On day young fledged, adult seen to take food to empty nest, call at nest, then fly away with food (NRS). Adults and young may leave area of nest soon after young fledge or may remain near nest for quite some time (see Social Organization: Parental care). Young remain with parents for up to 63 days after fledging, following parents, calling and soliciting food while learning to forage for themselves (McGilp 1944; Marchant 1985; Wood 1994; Green 1995; Mathews). During first 2 weeks after fledging, young waited for parents to bring food to them; then began to follow parents and beg and wait less; during first 5 days after fledging, young waited motionless for parents to feed them and gave monotonous call for 10–

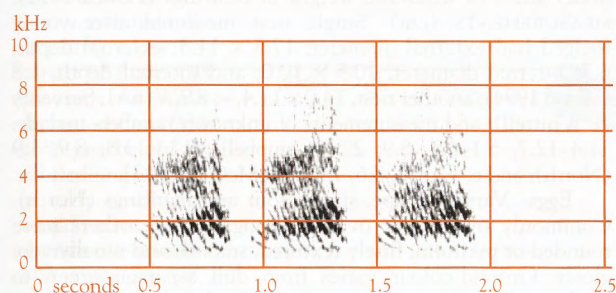
15 min at a time. In 20–30 days after fledging, young seen to peck at potential food items and to squeeze items in bill; first seen to catch prey on Day 40, after which parental feeding decreased steadily to Day 63 when both juveniles of clutch independent and had left area (Wood 1994). Fledgelings sometimes rest side by side during day. Once, one fledgeling mounted another as if in copulation; another juvenile opened bill and begged for food from its sibling (Wood 1994). One fledgeling seen to try to enter a nest of Dusky Woodswallows *Artamus cyanopterus*, which chased it off (NRS). **Anti-predator response of young** During first 20 days after fledging, resting young perched motionless (Wood 1994). Young seen to adopt a stick-like posture, similar to that of Tawny Frogmouth *Podargus strigoides* in tree (NRS). Once, two nestlings flew into trees when alarmed by observer, though youngest and weakest stayed in nest (Dickinson 1930). **Parental anti-predator strategies** During change-over at nest, approaching bird calls and sitting bird leaves in opposite direction, giving impression of single bird flying through nest-tree (NRS). Usually very secretive at nest, flying away when nest approached, but attack if observer too close (NRS; see above). Response to interference at nest during incubation not clear and may vary: may desert at slightest interference but also said to sit closely and quickly return to nest after disturbance (see Breeding: Incubation). Both parents watch for danger round nest, perching in tall trees within 50 m of nest in shifts of 11–25 min (Wood 1994). Very aggressive at nest at hatching, and said to be more aggressive towards intruders than when on eggs (NRS). Both parents swoop at other birds and human observers near nest, often leaving nest to do so, and snapping bill or giving loud, sharp scolding note (Cleland 1946; Frith 1969; Ashton 1987; Wood 1994; North; Mathews; NRS; see Agonistic behaviour). Also defend fledgelings from other birds and people (McCulloch 1970; NRS). Young that were hanging over edge of nest on a hot day pulled back into nest by parent bird when human observers sighted (NRS). At Wollongong, parents defend young from interspecific intruders up to 19 days after fledging, after which fledgelings able to defend themselves (Wood 1994).

**VOICE** Quite well known. Study of behaviour and calls at Wollongong, NSW, by Wood (1994), including sonagrams. Utter variety of calls, in flight and when perched, described as slurred and liquid, giving impression of leisureliness, even lethargy (Littler 1903, 1910; Marchant 1978; Mathews; Hall). At Wollongong, Rolling Trill, Single Trill, and Flute-like Call most common calls; no calls heard in twilight hours. Before breeding or perhaps when about to migrate, flocks can be very noisy (North; Mathews). In Tas., in mid-Sept., said to utter a very short call differing greatly from those uttered in other seasons (Littler 1904). **NON-VOCAL SOUNDS:** Snap bill when diving at intruders near nest (Wood 1994; Mathews).

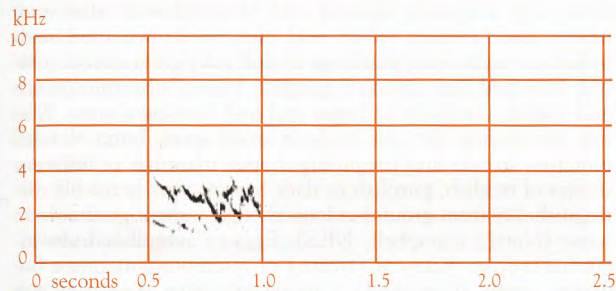
**Adult ROLLING TRILL AND SINGLE TRILL:** Rolling Trill described as a repeated *cher-reer* (sonagram A) with a harmonic structure. Single Trill described as a *cher-reer* (sonagram B) (Wood 1994). Amplitude modulation evident in these calls (T. Howard). Trills vary in number of phrases, amplitude and rate of delivery: a Rolling Trill of 3–5 *cher-reers* or a Single Trill is given as a contact call; a rolling Trill of 6–10 *cher-reers* is given during possible pair-bond maintenance display; and a louder and faster Rolling Trill of 4–7 phrases is given in aggression (Wood 1994; see Social Behaviour). Following descriptions probably also refer to Trills: somewhat plaintive whirring, whistling notes (Littler 1903, 1910); mewing (North); strange rattling (North; Mathews); liquid churring (Tubb 1941); loud, but not deep or harsh, *cree-eu* (Hall); *wark* (Mathews); *char char char* (Lord 1957); and *chereer-chereer* (Frith 1969). **FLUTE-LIKE CALL:** A flute-like *m-eow* (sonagram C), like a Cat; associated with breeding (Wood 1994). **PURR:** A soft purring, given near nest (Wood 1994). Sometimes uttered by incoming bird at

change-over during incubation, though change-over sometimes silent (Marchant 1985). **HARSH TRILL:** A trill, thought to be harsher than Single Trill, and repeated 7–8 times at intervals of c. 1 s, was heard twice in Apr. (Wood 1994). **Other calls** Various shrieks or croaks (Hall). Harsh scolding note when diving at intruder near nest (Frith 1969; McCulloch 1970).

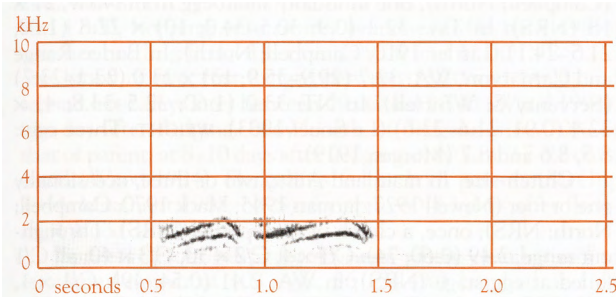
**Young CHER-REER:** A single begging *cher-reer* most common call (Wood 1994) and much like Single Trill of an adult (Lord 1956a). Most often heard in first few days after fledging, when uttered, sometimes monotonously, for 10–15 min at up to 6–9 calls/min, while waiting for food from parents; average rate of calling of one fledgeling was 5.6 phrases/min (n=20 min obs.) and longest periods of silence were 190 s and 90 s. Call did not alter whether parents were in attendance or foraging out of sight. Became less frequent, less repetitious and softer as juveniles developed; by 2 months after fledging, *cher-reer* developed into a call almost identical to Single Trill of adult. **BZZZ:** From c. 30 days after leaving nest, fledgelings follow parents and beg by ‘buzzing’ when near a parent with food. **SQUARK:** A satisfied *squark* was given immediately after receiving food (Wood 1994).



A H. Crouch; P19



B K.A. Wood; Wollongong, NSW; X149



C K.A. Wood; Wollongong, NSW; X149

**BREEDING** Not well known. Some information from detailed observations of one nest at Wollongong, NSW (Wood 1994); 825 records in NRS to Aug. 2001.

**Season** In n. Aust. (N of 23°28'S), eggs all months except Mar. and Apr.; in s. mainland Aust. (S of 23°28'S), eggs, Aug.–Jan.; in Tas. and islands of Bass Str., eggs, Aug. and

Oct.–Dec., but poorly known (see below). From 163 clutches throughout range (including Tas.) in NRS, most Sept.–Dec. (85.9%): one (0.6%) in July, eight (4.9%) in Aug., 28 (17.2%) in Sept., 45 (27.6%) in Oct., 47 (28.8%) in Nov., 20 (12.3%) in Dec., ten (6.1%) in Jan., none in Feb., two (1.2%) in Mar., none in Apr., one (0.6%) in May, and one (0.6%) in June. **SUBSPECIES MELANOPS:** N. AUST. (N of 23°28'S): N. WA: Eggs, May–Dec. (Hall 1902; Lindgren 1961; North); nestlings, July–Nov., Jan. and Feb.; fledgelings, Nov., Jan. and Mar. (North; NRS). Said to nest at any time of year immediately after good rains (Carnaby 1946). NT: Eggs, July, Sept.–Dec. and Mar.; nestlings, Aug.–Sept., Nov. and Mar. (Carter 1903; Le Souëf 1903; Frith & Davies 1961; NRS [n=1 clutch, 2 broods]); N. QLD: Eggs, Oct.–Feb. (Lavery *et al.* 1968; NRS [n=3 records]); nestlings, Nov.–Jan., and Mar.; fledgelings, Dec., Jan. and Mar. (Berney 1905; NRS). S. AUST. (S of 23°28'S): S. QLD: Eggs, Oct.–Dec. (NRS [n=6 records]); nestlings, Sept.–Jan.; fledgelings, Sept.–Feb. (Whitmore *et al.* 1983; NRS). NSW–ACT: Eggs, Aug.–Feb. (MacLean 1976; Marchant 1981; Morris *et al.* 1981; North; NRS); of 72 clutches in NRS, most (65.3%) mid-Oct. to late Nov. and late Dec.: one (1.4%) in late Aug., 11 (15.3%) in Sept., 20 (27.8%) in Oct., 25 (34.7%) in Nov., 12 (16.7%) in Dec., and three (4.2%) in early to mid-Jan. Nestlings, early Sept. to early Mar. (Marchant 1985; NRS [n=214 records]); fledgelings, late Oct. to late Mar. (NRS). VIC.: Eggs, Oct.–Dec. (Belcher 1902; Tarr 1964; NRS [n=14 records]); nestlings, Oct.–Feb.; fledgelings, late Oct. to early Mar. (McCulloch 1970, 1973; NRS); dependent fledgelings also recorded mid-Apr. (Vic. Bird Rep. 1987). SA: Eggs, early Sept. to mid-Jan. (Sutton 1930; Hood 1935; Lashmar 1937, 1942; Attiwill 1972; North; NRS [n=28 records]), mostly Sept.–Oct. (Boehm 1957) or Sept.–Nov. (85.7% of 28 clutches in NRS). Nestlings, Sept.–Jan. and Apr.; fledgelings, Oct.–Feb. (Parsons 1928; Sutton 1930; Jarman 1937; Hitchcock 1939; Boehm 1957; Rix 1976; NRS). S. WA: Eggs, late Aug. to mid-Jan. (NRS [n=24 records]); nestlings, mid-Aug. to late Jan.; fledgelings, mid-Sept. to late Jan. (Slater 1962; NRS). Otherwise, breed July–Mar. (Sedgwick 1956; Ford & Stone 1957; Masters & Milhinch 1974; Brooker *et al.* 1979; Storr 22, 26, 27, 28). **SUBSPECIES SUBPALLIDA:** WA: Data from WA and known to be *subpallida* include: Eggs, May–Sept.; nestlings, July–Nov.; fledgelings, Mar.–Apr., Aug., Oct. and Dec. (NRS); in Pilbara, said to breed July–Jan. and Mar. (Storr 16); in Gascoyne (which includes *melanops* in S), usually said to breed Aug.–Oct., occasionally Feb.–Apr. (Storr 21). **NOMINATE NOVAEHOLLANDIAE:** TAS.: Eggs, Aug. and Oct.–Dec. (North; NRS [n=4 records]); nestlings, Sept. and Nov.–Jan. (Tas. Bird Rep. 19; NRS). Otherwise, breed Sept.–Dec. (Littler 1910; North; Tas. Bird Reps 2, 8).

**Site** In fork of live or dead branch of tree, usually horizontal but occasionally slightly angled; often in exposed location and near end of limb. Often nest in eucalypts but also in casuarinas or acacias, particularly inland, and many other species (Le Souëf 1903; Littler 1903; Fletcher 1910; Ross 1926; Anon. 1928; Tubb 1941; McGilp 1949; Lord 1956a; Buchanan 1987; Wood 1994; Campbell; North; Serventy & Whittell; NRS). Of 599 records from NRS: 83.3% in eucalypts, including River Red Gum, Forest Red Gum, Wandoo, Coolibah, Black Box, Pink Gum, Bimble Box and mallee; 3.2% in casuarina, including Belah; 2.5% in *Angophora*, including Rough-barked Apple; 2.0% in *Acacia*, including Weeping Myall, Mulga, and Gidgee; 1.7% in willows; 1.0% in each of *Melaleuca*, *Banksia* and *Poinciana*; and 0.8% in *Pinus*; with rest (3.8%) in other plants, including mangroves (3 records), *Myoporum* (2), *Callitris* (2), *Ficus* (2), pine tree (2), African Mahogany *Khaya senegalensis* (2), and singles in *Syncarpia*, pepper tree *Schinus*, Olive tree *Olea europaea*, mistletoe, jacaranda *Jacaranda*, *Gyrocarpus*, *Cupaniopsis*, coral

tree *Erythrina*, *Cinnamomum* and *Araucaria*. Occasionally re-line old nest of Magpie-lark (Belcher 1902; Dickinson 1930; Binns 1952; Roberts 1955; Lord 1956a). Can use same site for up to four successive seasons (Anon. 1928; Ashton 1987; NRS); one site used five times over three consecutive seasons, even though not all nestings successful; another pair nested in same tree five times despite nest being destroyed twice by Pied Currawongs (NRS). **NESTING ASSOCIATIONS:** Of sample of 100 records in NRS, 11 within 6 m of nest of another species. Recorded nesting in same tree as: White-faced Heron *Egretta novaehollandiae*, Whistling Kite *Haliastur sphenurus*, Little Corella *Cacatua sanguinea*, Tawny Frogmouth, Laughing Kookaburra, Yellow-rumped Thornbill *Acanthiza chrysorrhoa*, Willie Wagtail *Rhipidura leucophrys*, Magpie-lark, Figbird, White-winged Triller *Lalage suevii* and Tree Martin *Hirundo nigricans*. Also recorded nesting near many other species, e.g. within 50 m of Nankeen Kestrel *Falco cenchroides*, White-throated Nightjar *Eurostopodus mystacalis*, Sacred Kingfisher *Todiramphus sanctus*, Striped Honeyeater *Plectorhyncha lanceolata*, White-breasted Woodswallow *Artamus leucorhynchus* and White-winged Chough *Corcorax melanorhamphos* (Carter 1903; Sutton 1927a; Hood 1935; Wheeler 1959; Mendel 1972; Marchant 1974; NRS). At Morawa, se. WA, described as breeding in mixed-species congregations in a small portion of an apparently uniform habitat, often with single pairs of Crimson *Epthianura tricolor* and White-fronted *E. albifrons* Chats, Jacky Winter *Microeca fascinans*, Magpie-lark, Willie Wagtail, White-winged Triller, Black-faced Woodswallow *Artamus cinereus* and Zebra Finch *Taeniopygia guttata* (White 1952). **MEASUREMENTS (m):** Height of nest, 10.3 (5.38; 1.5–38.0; 716) (NRS); 1.2–25 (Tubb 1941; Buchanan 1987; Wood 1994; North; Serventy & Whittell), possibly averaging lower inland (North). Height of nest-plant, 15.5 (6.54; 2.2–40.0; 295) (NRS).

**Nest, Materials** Nest a slight, shallow cup, or saucer shape; built on or across a fork, with rim approximately level with, to slightly above, top of fork (Le Souëf 1903; McGilp 1923; Heathcote 1935; Wood 1994; Campbell; North; NRS). One nest like a doughnut, with no floor, and eggs rested on bare branch (NRS). Usually made of twigs, grass and pieces of bark, occasionally with other bits of plant material; and bound together with spider web. Usually lined, with finer twigs, rootlets or grass. Some nests built largely of fibrous rootlets or casuarina needles (Le Souëf 1903; Littler 1903, 1910; Tubb 1941; McGilp 1949; Mack 1970; Marchant 1985; Wood 1994; Campbell; North; Serventy & Whittell; NRS); one nest unlined (Serventy & Whittell). Some nests have pieces of bark or lichen attached to outer walls or rim or both (Heathcote 1935; North; NRS). Eggs sometimes visible through base of nest (Jarman 1945; North). Possibly use saliva to cement material but confirmation needed: Marchant (1985) and Wood (1994) found no evidence that saliva used in building, but Marchant did observe that birds brought twigs held at back of gape, rather than in tip of bill as is usual, suggesting that birds may salivate on material as they carry it. However, Campbell describes a nest as having material stuck together with some glutinous matter as well as spider web; another nest in ANWC has material stuck together with saliva (Marchant 1979b); and birds seen gaping and wiping bills on nest and branch, which suggested to be use of saliva (NRS). **MATERIALS:** One nest comprised 1211 pieces of material: Framework comprised 25 twigs 1–2 mm thick by 90–120 mm long, 418 thin twigs <1 mm thick by 10–140 mm long, and 187 small pieces of bark 3 × 50 mm to 10 × 10 mm in size, bound with spider web; binding strongest on broken leaf-nodes of thicker twigs, most of which were in rim over branches; and no adhesive material such as saliva used. Lining comprised 486 small twigs <0.5 mm thick by 20–70 mm long, 55 leaves of *Grevillea triloba*, 40 small pieces of bark and a few blades of grass; lining not bound with

spider web (Wood 1994). **ROLE OF SEXES:** Both birds build (Marchant 1984; Serventy & Whittell; NRS), coming to nest separately or together; if arrive at nest together, one bird waits while other builds, before taking its turn (Tubb 1941; Marchant 1985). Usually gather material from near ground (Marchant 1985); search up and down cracks, forks and twigs of trees for spider web (Fletcher 1910). Birds sit on nest and work material into structure; apply spider web by wiping bill round edge of nest and supporting branches (Tubb 1941; Marchant 1985). During 185 min observation at one nest under construction: birds visited 18 times, at intervals of 1–18 min, rarely staying at nest for more than c. 30 s (Tubb 1941). Will lay before nest finished; once, pair laid in incomplete nest after 7 days of building (Marchant 1985). Will dismantle and re-use material from previous nest to build a new nest, including when disturbed during incubation (Tubb 1941; Serventy & Whittell; NRS). One pair built new nest and re-laid within 2 weeks of loss of first nest (Campbell); new nest completed and adult incubating within 16 days of loss of nestlings (NRS). One pair built four nests, probably without laying in any of them (NRS). Nests gradually fall to pieces under stress of wind and weight of nestlings (Hobbs 1971). **MEASUREMENTS (cm):** Single nest measured after young fledged had external diameter, 17.5 × 11.3; external depth, 6.3; internal diameter, 10.5 × 10.0; and internal depth, 1.8 (Wood 1994); another nest, 14.0 × 11.4, –, 8.9, – (n=1; Serventy & Whittell); and measurements of unknown numbers include: 11.4–12.7, 5.1–6.4, 8.9, 2.5 (Campbell); 12.1, 3.8, 8.9, 1.9 (North); and c. 12.7, –, 8.6, 1.3–1.9 (McGilp 1923).

**Eggs** Vary in shape, size, colour and markings (North). Commonly oval, stout oval or elongate oval, others more rounded or pyriform; finely textured, smooth and usually very glossy. Ground-colour varies from dull asparagus-green to bright apple-green, or olive-green to pale olive-brown or yellowish olive, most with a tinge of olive over the green or brown; some eggs uniformly spotted and blotched with shades of umber, dark reddish-brown and chestnut-brown, and with indistinct underlying markings of dull inky-grey; others spotted, blotched and streaked purplish brown, chestnut-brown and umber, confluent at larger end and forming a zone. Also not uncommon for eggs to have small spots, large clouded blotches, streaks and irregularly shaped markings of different shades of reddish, purplish or dark brown, usually readily distinguishable from ground-colour, though indistinguishable in some (North; Campbell; NRS). Eggs of *subpallida* indistinguishable from *melanops* (North) or resembling *melanops* but darker green (Campbell). **MEASUREMENTS:** Location not specified: 34.1 (2.60; 31.2–38.4; 14) × 23.7 (1.31; 22.1–25.4) (Campbell; North); one unusually small egg from NSW, 27 × 18 (NRS). In Tas.: 32.2 (0.9; 30.5–34.0; 10) × 22.8 (1.00; 21.5–24.1) (Littler 1910; Campbell; North). In Barlee Range and Carnarvon, WA: 32.7 (29.9–35.9; 13) × 23.0 (22.1–23.7) (Serventy & Whittell). In NT: 33.0 (1.60; 32.5–33.8; 4) × 22.4 (0.91; 21.6–23.6) (Le Souëf 1903). **WEIGHT:** Three eggs: 8.5, 8.6 and 8.7 (Morgan 1919).

**Clutch-size** In mainland Aust., two or three, occasionally one or four (Newell 1927; Jarman 1945; Mack 1970; Campbell; North; NRS); once, a clutch of six reported (NRS). Throughout range, 2.49 (0.60; 74): C/1 × 4, C/2 × 30, C/3 × 40; all C/1 failed at egg-stage (NRS); in WA, 2.41 (0.54; 49): C/1 × 1, C/2 × 27, 3 × 21 (Storr 11, 16, 21, 22, 26). In Tas., two or three (North; NRS [n=2 clutches]) or three or four (Littler 1903, 1910; Campbell).

**Laying** Interval can be >24 h; third egg of one clutch laid at least 71.75 h after first egg and at least 43 h after second. Will re-lay after failure of eggs or young. Can raise up to three broods in a season (NRS).

**Incubation** By both sexes (Marchant 1985; Serventy & Whittell; NRS). Sitting bird usually leaves as other approaches;

of 373-min observation at one nest towards end of incubation period, one or other bird was on nest for 332 min (89% time); stints of incubation quite long, up to 49 min, though occasionally only 1–2 min (Marchant 1985). When adult first settled on nest, seen to stroke sides of nest and branch with side of bill before fluffing feathers and settling (NRS). Eggs do not always hatch synchronously; sometimes last egg hatches >24 h after first (NRS). Response to disturbance at nest during incubation appears to vary: said to sit closely and quickly return to nest (McGill 1923; NRS), cf. claim that will desert during incubation at slightest interference, pulling nest apart and rebuilding at another site (Serventy & Whittell; NRS). Eggshells removed from nest within 24 h of hatching (Sedgwick 1948). **INCUBATION PERIOD:** 21–23 days and 22–24 days (Marchant 1985); from laying to hatching (assuming eggs hatch in same order as laying), 20 days (n=2 eggs) (NRS); two eggs of C/3 hatched within 20 days (NRS).

**Young** Altricial, nidicolous. Hatch naked (Sedgwick 1948). Develop pale-greyish down within 4 days of hatching; develop pin-feathers within 11 days (NRS). **Parental care, Role of sexes** Both sexes brood and feed nestlings, and eat or remove faecal sacs (Marchant 1985; Wood 1994; NRS). At first, young fed bill to gape, adult placing bill deep into throat of young; older nestlings seen to place bill within throat of parent (Ashton 1987). For rates of feeding of young, see Food (Young). At Wollongong, amount of time spent brooding decreased from 90% of daytime at 16 days before fledging, to <5% just before fledging; young brooded constantly at night till fledging. At Wollongong, at change-over during brooding in early nestling period, sitting bird would leave and other would arrive, feed one young, remove faecal sac, then brood; change-overs usually completed in <40 s. At Wollongong, of 110 visits by either parent to nest (excluding brooding change-overs with no other activity), 93% involved feeding young or removing faecal sacs, and 7% inspection only; faecal sacs were voided during 77% of visits. Usually only one nestling fed on each visit (see Food: Young); feeding visits usually lasted <2 min. Faecal sacs swallowed by adult at nest, except at end of nestling period when carried away from nest, and sometimes eaten (Marchant 1985; Wood 1994); once, bird swooped down to catch a sac that had fallen over side of nest before it hit ground (Marchant 1985).

**Fledging to independence** **FLEDGING PERIOD:** Nestlings can step out onto nearby branch for short periods up to 4 days before leaving nest permanently, which can make accurate determination of period difficult (Sedgwick 1948; Wood 1994; NRS). One nestling, 22 days (Hobbs 1971); for single broods: 25 days (Sedgwick 1948), c. 26 days (Marchant 1985) and 22–24 days (NRS). One brood of two left nest between 07:00 and 12:00, hopping onto nearby branches (Marchant 1985); another nestling fledged between 09:00 and 12:00 (NRS). In one brood of two, first fledged between 13:10 and 14:00, and second left 2 days later between 09:00 and 10:40 (Wood 1994). On day after fledging, body-length of fledgelings 60–70% of that of parent; at 8–10 days after fledging, c. 90%; at 17–22 days, equal (Wood 1994). Fledgelings fed by both parents (McGill 1944; Marchant 1985; NRS), for up to 60–63 days after fledging (Wood 1994).

**Success** From NRS, for 43 nests where clutch-size and outcome known: of 103 eggs, 56 (54.4%) hatched and 31 (30.1%) fledged, equalling 0.72 fledged per nest; of 171 eggs in 68 nests where clutch-size and number hatched known but outcome not always known, 119 (0.70%) hatched; of 317 nests where outcome known, 210 (66.2%) successful and 107 failed. In Canberra Botanic Gardens, of six eggs in three nests, four hatched and four young fledged (Green & McWhirter 1973). Nests can blow down during storms (NRS). Eggs taken by Grey Butcherbird *Cracticus torquatus*, Pied Currawong and people (Roberts 1952; Vic. Bird Rep. 1987; NRS). Nest on

which birds had been sitting for at least 18 days destroyed by Channel-billed Cuckoos; nestlings taken by Laughing Kookaburra and Brown Goshawk *Accipiter fasciatus*; and one nearly fledged young dragged from nest by Pied Currawong, which also resulted in displacement of other two nestlings from nest (NRS). **CUCKOOS:** Parasitized by Common Koel *Eudynamis scolopacea* (Brooker & Brooker 1989; HANZAB 4; NRS); of 826 nests in NRS, two known to have been parasitized by Common Koel. Egg of Pallid Cuckoo found in one nest in Flinders Ras (Waterman & Smith 1963).

**PLUMAGES** Prepared by J.S. Matthew and F.J.G. Copley. Fledge in juvenile plumage. Undergo partial post-juvenile (first pre-basic) moult to distinct first immature (first basic) plumage. Attain adult (basic) plumage in complete first immature post-breeding (second pre-basic) moult, probably when c. 1 year old. After attaining adult plumage, a complete post-breeding (pre-basic) moult each cycle produces successive adult (basic) plumages with no change in appearance. Sexes similar. Three subspecies; *melanops* of most of mainland Aust. described below based on examination of skins of ten adults, 11 first immatures and three juveniles (ANWC, HLW, MV).

**Adult** (Definitive basic). **HEAD AND NECK:** Crown, nape, hindneck and upper sides of neck, light bluish-grey (c85) to bluish grey (pale 87). Rest of head and neck (forehead, lores, eye-ring, feathers above eye, ear-coverts, lower sides of neck, malar area, chin and throat), black (89), forming large and conspicuous black mask. Several short black (89) bristles on lower lores, sides of lower forehead and interramal area. **UPPERPARTS:** Wholly bluish grey (pale 87) to light bluish-grey (c85). Feathers have brownish (c28) shafts, forming very fine streaks, visible in close examination. Feathers of rump rather stiff-spined and partly erectile. Uppertail-coverts have concealed white bases; other feathers have concealed pale-grey (86) bases. **UNDERPARTS:** Breast mainly bluish grey (c85) to pale greyish (dark 86); over most of range, upper breast usually darker, dark grey (c83) to grey-black (c82), grading into black of mask. Most of belly, white, often washed or faintly barred light bluish-grey (c85) on upper belly. Flanks, pale grey (c86) or light bluish-grey (c85); in some, flanks whitish with faint light bluish-grey (c85) barring. Thighs, dark grey (83) or grey (84) with fairly broad white tips to feathers. Undertail-coverts and vent, white; undertail-coverts rather elongated. Axillaries, white. **UPPERTAIL:** T1, grey (84) or bluish grey (c85), grading to dark grey (83) towards tip, and with narrow pale-grey (86) fringe that grades to white and becomes broader at tip; pale tip lost with wear. T2–t6, brownish black (119) grading to dark grey (83) or bluish grey (c85) at base of outer webs, with distinct white tips that merge with narrow white outer edges; tips and outer edges become broader from inner to outer rectrices, with tips grading from c. 15 mm wide at shaft on inner web of t2 (white tip narrow on outer web) to 30–40 mm wide on t6; tips and edges reduced with wear. Shafts, dark reddish-brown (221A) grading to white at tips. **UNDERTAIL:** Patterned as uppertail but ground-colour of rectrices, grey (c84); white tips and edges contrast less with rest of feather; and shafts, white. **UPPERWING:** Secondary coverts, light bluish-grey (c85) to bluish grey (pale 87) with narrow and indistinct pale-grey (86) or off-white (ne) fringes when fresh. Alula, grey-black (82) with narrow white fringes to feathers. Marginal and median primary coverts, dark grey (83) with broad white tips; outermost coverts appear white with dark-grey (83) bases, and form narrow pale strip next to alula. Greater primary coverts, grey-black (82) with narrow light bluish-grey (c85) outer edges, broad pale-grey (c86) inner edges and narrow white fringe to outer webs and tips. Tertiaries have blackish (c89) inner webs with light bluish-grey (c85) tips and outer webs; tertiaries narrowly fringed white when fresh. Secondaries and inner 2–3 primaries, blackish (c89) with white fringe to inner webs and

tips (broadest, but concealed, at base of inner webs) and light bluish-grey (c85) outer edges, which are very broad on innermost secondary (about half width of web) and become narrower outward (less than one-third width of web on p2–p3). Rest of primaries similar to inner 2–3 primaries, but fringes extend round entire margin, grading from white on inner webs and tips to light bluish-grey (c85) towards bases of outer webs; fringes progressively narrower outward and very fine on p10; fringes to primaries reduced or lost with wear. Shafts of remiges, dark reddish-brown (c221A). **UNDERWING:** Coverts mostly white; outer marginal and median primary coverts have partly exposed dark-brown (121) bases. Remiges patterned as upperwing but ground-colour mostly light grey (c85); ground-colour of outer webs of primaries darker, grey (83). When spread, wing appears mostly white on coverts, contrasting with grey remiges and with narrow white trailing edge formed by fringes at tips of remiges.

**Nestlings** One bird developed pale-grey down within 4 days of hatching (NRS). No other information.

**Juvenile** Differs greatly from adult. Plumage of body softer and more loosely textured. **HEAD AND NECK:** Forehead, crown, nape, hindneck and sides of neck, dark brown (119A) with white fringes at tips of feathers forming bold white scalloping. Loes, eye-ring, narrow strip of feathers above and below eye, and ear-coverts, blackish brown (119) or dark brown (121), combining to form fairly broad blackish-brown (c119) eye-stripe; ear-coverts also have narrow off-white (ne) tips showing as pale flecking. Malar area, chin and throat, off-white (ne), or light brown (c25) with fine off-white (ne) mottling formed by off-white tips to feathers. **UPPERPARTS:** Mantle, scapulars, back and rump mostly dark brown (c119A) with distinct off-white (ne) scalloping and scattered light-greyish (c85) or pale-grey (86) patches; feathers, pale grey (86) with broad dark-brown (119A) subterminal band to most feathers, and off-white (ne) fringe at tips. Uppertail-coverts similar to rest of upperparts but longest coverts, light grey (c85) with narrow dark-brown (119A) subterminal fringes and off-white (ne) fringes. **UNDERPARTS:** Breast, off-white (ne), or light brownish (c25, c28) with off-white (ne) fringes at tips of feathers forming off-white mottling. Belly, flanks, vent and undertail-coverts, white, often with scattered brown (28) mottling on upper belly and flanks. **TAIL:** As adult but rectrices narrower and more pointed at tips. **UPPERWING:** Marginal and median secondary coverts, light brownish-grey (c80) with dark-brown (119A) subterminal band and off-white (ne) fringe at tips. Greater secondary coverts, light greyish-brown (c27) to brownish grey (c79), usually darker grey (c83) on inner webs, with narrow dark-brown (119A) subterminal patch and off-white (ne) fringe at tips. Alula as adult but ground-colour slightly paler, blackish brown (c119). Marginal and median primary coverts, brown (c28) with darker brown (119A) subterminal patch and off-white (ne) fringe at tips. Greater primary coverts as in adult but outer edges slightly duller, light grey (85), contrasting less with rest of outer webs. Remiges similar to adult but ground-colour of primaries, secondaries and inner webs of tertials slightly paler, blackish brown (c119) to dark brown (121); outer webs and tips of inner webs of tertials, and outer edges of secondaries and inner primaries, duller, light grey (85), contrasting less with rest of feather; and white fringes, particularly on tertials and tips and inner webs of secondaries, broader and more distinct when fresh, but reduced and more like adult when worn. **UNDERWING:** As adult, but edges and fringes of remiges as juvenile upperwing.

**First immature** (First basic). Similar to adult but with different facial pattern. Differences from adult: **HEAD AND NECK:** Upper forehead, light bluish-grey (c85), as crown, nape, hindneck and sides of neck. Black confined to lower forehead, loes, eye-ring, narrow band of feathers above eye, and broad

area below eye, and ear-coverts, forming broad black (89) eye-stripe, extending well behind eye. Chin and throat usually off-white (ne) with 1–2 greyish (c84) subterminal bars to feathers forming fairly distinct greyish (c84) barring; one skin had uniform dark-grey (83) chin and throat. **UNDERPARTS:** Breast and upper belly, light bluish-grey (c85) with rather faint off-white (ne) barring. **TAIL:** Most birds retain all juvenile rectrices but some replace one or more, often inner, rectrices. **WING:** Retain all juvenile primaries, secondaries, greater primary coverts and alula. Most retain all juvenile tertials but some replace 1–2 inner tertials; some birds retain up to six juvenile outer greater secondary coverts, which contrast with new adult-like inner coverts.

**Aberrant plumage** Skin (MV B16633) of first immature, aged by pointed tips to rectrices, entirely white except for: brown (28) ear-coverts and eye-ring; brown (c28) wash on loes and lower throat; and faint light-brown (c223D) patches on upperparts; outer rectrices (t3–t6), light brown (c223D) with white tips and edges.

**BARE PARTS** Based on photos (Ireland 1988; Frith & Frith 1995; Watts 1999; unpubl.: P. Beaumont; G.S. Chapman; P. Evans; C.H. Sandbrink; also standard sources), museum labels (ANWC, MV, SAM), and other sources as cited. **Adult** Bill and gape, black (89) or grey-black (c82). Palate, white to pinkish grey (Hall). Iris, blackish (c89); or dark brown (Hall). Orbital ring, grey-black (c82). Legs and feet, grey-black (c82). **Nestlings** Bill, blue-grey (87), darkening as acquire juvenile plumage; gape, pale yellow (c157) or pinkish grey (ne); palate, orange-rufous (c132C), becoming paler towards tip of upper mandible. Rest as adult. **Juvenile** Differs from adult by: bill, grey-black (82) with flesh-grey (ne) base to lower mandible; gape, pale yellow (c157) or pinkish (c3). Skins have paler greyish-brown (c91) legs and feet compared with black (89) in adult skins. **First immature** Bill, grey-black (c82) with dull-pinkish (c5) tinge on underside at base of lower mandible; also described as black (Smith 1978). Gape, pinkish grey (ne). Palate, dull pinkish (c5). Rest as adult. Not known if attain adult bare parts coloration in this plumage.

**MOULTS** Based on examination of skins of 21 adult, nine first immature and two juvenile nominate; ten adult and one first immature *subpallida*; and 51 adult, 23 first immature and three juvenile *melanops* (AM, ANWC, HLW, MV, SAM); and other sources as cited. Subspecies combined unless stated otherwise. **Adult post-breeding** (Third and subsequent pre-basic). Complete; primaries outward. Moulting of primaries starts Dec. and finishes late Apr. to May; active moulting of primaries recorded: Dec. (2 of 7; PMS 6, 9); Jan. (1 of 2; PMS 21); Feb. (5 of 8; PMS 34 [7.04; 25–41]); Mar. (5 of 8; PMS 38.4 [8.41; 29–47]); Apr. (5 of 7, including two *subpallida*; PMS 47.4 [1.26; 46–49]); and May (1 of 6; PMS 47). No moulting of primaries recorded in 45 skins collected across range from June to Nov. In Vic., moulting of primaries nearly finished by Apr. (Rogers *et al.* 1986); and one from se. NSW nearly finished moulting of primaries in Mar. (Hall); no moulting of primaries observed May–July through inland Aust. and Kimberley Div., WA (Hall). These results suggest timing of moulting similar across most of Aust., but few data for n. Aust. Moulting of secondaries starts when moulting of primaries about halfway through. Moulting of tail centrifugal; timing much as moulting of primaries. Moulting of body starts before start of moulting of primaries, and recorded as early as Aug.; not finished till after finish of moulting of primaries. Heavy moulting of body recorded in birds from w. WA in Feb. and Mar. and in NSW in June, and slight moulting recorded in NSW in Sept. (Hall). Timing of moulting probably similar in PNG, where none of four birds, from May, June or Oct., showed any moulting (Mayr & Rand 1937). **Post-juvenile** (First pre-basic). Partial. Involves all or most feathers of body,

all marginal and median coverts, and varying number of tertials, greater secondary coverts and rectrices. Of ten first immatures collected Apr.–Nov.: six retained all juvenile rectrices while four had replaced one or more; six retained outer 2–6 juvenile greater secondary coverts while four replaced all; and seven retained all tertials while three replaced one or more. Molt of body recorded from one in Jan. (Tas.), four in Feb. and one in Apr. (Qld) (this study); molt also recorded in Nov. (SA) and Mar. and May (WA) (tracts not specified; Hall). Timing in relation to fledging not known. **First immature post-breeding** (Second pre-basic). Complete; primaries outward. Timing probably much as adult post-breeding. From skins (n=31), molt of primaries recorded in four, all from Tas., in Dec. (PMS 7, 22, 27) and Jan. (PMS 27). Of six first-year birds collected in Pilbara region and Kimberley Div. in May and June, two with active molt of primaries and five had nearly finished molt of body (acquiring black feathers of throat) (Hall). One from sw. WA in Feb. had nearly finished molt, with plumage as adult except for a few pale feathers on throat (Hall). One first immature collected from Pilbara region in July with no active molt (Mees 1961). In PNG, in Sept., molt of tail recorded in an immature (Mees 1982), but not known if this refers to post-juvenile or second pre-basic molt.

**MEASUREMENTS** NOMINATE NOVAEHOLLANDIAE: (1–2) Tas., skins (AM, ANWC, HLW, MV, SAM, QVM): (1) Adults; (2) Juveniles and first immatures. (3) Tas., adults, skins (Keast 1958b).

	MALES	FEMALES	
WING	(1) 197.5 (3.59; 189–201; 11) (2) 195.3 (4.39; 189–202; 7) (3) 199 (195–202, 12)	194.4 (4.89; 189–202; 5) 189.6 (2.69; 186–193; 6) –	ns *
TAIL	(1) 147.6 (3.27; 142–153; 13) (2) 148.1 (8.03; 141.5–160.5; 7) (3) 142 (138–151, 12)	146.3 (5.79; 140–154.5; 6) 147.8 (7.13; 140.0–156.5; 5) –	ns ns
BILL S	(1) 27.8 (1.32; 26.2–30.6; 12) (2) 27.9 (1.89; 24.1–29.6; 7)	28.3 (1.37; 26.4–29.7; 5) 27.7 (1.89; 25.7–30.8; 6)	ns ns
BILL F	(3) 17.4 (16.8–18.3, 12)	–	
TARSUS	(1) 25.6 (0.90; 24.2–27.0; 13) (2) 27.1 (1.20; 24.6–28.3; 7)	25.3 (1.73; 23.5–27.5; 6) 25.0 (2.15; 22.4–28.3; 6)	ns **

**SUBSPECIES MELANOPS:** (4–5) Mainland Aust. excluding Pilbara region, WA, skins (ANWC, HLW, MV, SAM): (4) Adults; (5) Juveniles and first immatures. (6–9) Adults, skins (Keast 1958b): (6) Melbourne, Vic.; (7) Sydney, NSW; (8) SE. Qld; (9) SW. WA. (10) NSW, adults and immatures, skins (AM) and live birds (Hardy 1986). (11) S. PNG, first immatures (Mees 1982); assumed to be this subspecies.

	MALES	FEMALES	
WING	(4) 201.8 (6.68; 183.0–212.5; 25) (5) 188.6 (7.04; 177.0–199.5; 12) (6) 206 (202–214; 8) (7) 202 (198–210; 12) (8) 201 (197–207; 6) (9) 206 (198–212; 10) (10) 196.9 (6.70; 187–209; 14) (11) –	197.5 (8.41; 184.5–211.5; 24) 189.2 (7.07; 174.0–198.0; 13) – – – 193.9 (8.90; 183–209; 11) 184.5 (2.38; 181–186; 4)	ns ns ns ns ns ns
TAIL	(4) 141.8 (9.41; 121.5–162.0; 25) (5) 137.9 (6.90; 127.5–148.5; 12) (6) 145 (140–153; 8) (7) 143 (138–151; 12) (8) 143 (141–151; 6) (9) 143 (140–152; 10) (10) 144.7 (6.90; 133–155; 14) (11) –	138.4 (8.60; 124.0–151.0; 24) 136.6 (7.40; 125.5–149.0; 13) – – – 143.1 (10.10; 128–155; 11) 128.5 (4.43; 125–135; 4)	* ns ns ns ns ns
BILL S	(4) 30.0 (1.56; 26.9–32.5; 23) (5) 29.8 (3.05; 22.6–33.6; 12) (10) 28.3 (1.30; 26.2–30.8; 14) (11) –	30.3 (2.06; 26.0–35.4; 24) 29.7 (2.38; 26.4–33.7; 13) 28.7 (1.30; 27.0–31.5; 11) 30.4 (0.48; 30.0–31.0; 4)	ns ns ns
BILL F	(6) 18.9 (18.3–19.9; 8)	–	

	(7) 19.8 (19.2–20.5; 12)	–	
	(8) 20.2 (20.0–20.5; 6)	–	
	(9) 18.0 (16.8–18.9; 10)	–	
TARSUS	(4) 25.7 (2.62; 22.0–29.6; 25)	25.8 (1.64; 22.4–28.5; 24)	ns
	(5) 23.9 (2.15; 20.8–27.9; 12)	25.3 (2.21; 22.4–28.8; 13)	ns

**SUBSPECIES SUBPALLIDA:** (12) Pilbara region, WA, adults, skins (AM, ANWC). (13) Hamersley Ras, WA, adults, skins (Keast 1958b). (14) Pilbara region, WA, adults, skins (Mees 1961).

	MALE	FEMALE	
WING	(12) 197.6 (6.42; 188.5–203.0; 4) (13) 196 (190–200, 5) (14) 193, 197	195.8 (5.21; 189.0–201.0; 6) – 188, 201	ns
TAIL	(12) 146.1 (4.09; 141.0–150.5; 4) (13) 141 (136–145, 5) (14) 143, 145	145.8 (9.03; 134.0–155.0; 6) – 142, 147	ns
BILL S	(12) 30.1 (2.15; 27.9–32.9; 4) (14) 30.5, 34.0	30.0 (0.62; 29.3–31.1; 6) 27.0, 28.3	ns
BILL F	(13) 20.2 (19.3–21.3; 5) (14) 24.5, 25.0	– 21.5, 23.0	
TARSUS	(12) 26.1 (0.50; 25.6–26.8; 4)	25.0 (1.26; 23.9–27.1; 6)	ns

**WEIGHTS** From museum labels (AM, ANWC, MV, SAM, QVM) unless stated. **NOMINATE NOVAEHOLLANDIAE:** (1–2) Tas.: (1) Adults; (2) Juveniles.

	MALE	FEMALE	
	(1) 116.5 (17.11; 86.5–145.6; 8) (2) –	112.3 (13.57; 102.0–132.0; 4) 106.0, 107.0	ns

**SUBSPECIES MELANOPS:** (3–5) Mainland Aust., excluding Pilbara region, WA (from museum labels and Hall): (3) Adults; (4) First immatures; (5) Juveniles. (6) NSW, adults and first immatures, from museum labels (AM) and live birds (Hardy 1986). (7) S. PNG, first immatures (Mees 1982); assumed to be this subspecies.

	MALE	FEMALE	
	(3) 119.5 (13.23; 97.0–137.0; 7) (4) 100.0, 101.1, 135.2 (5) 70.0 (6) 119.6 (9.5; 105–127; 7) (7) –	116.1 (17.75; 93.0–148.0; 9) 122, 125 76.5 112.2 (12.8; 88.5–130; 7) 108.5 (6.35; 102–117; 4)	ns ns

**SUBSPECIES SUBPALLIDA:** (8) Pilbara region, WA, adults.

	MALES	FEMALES	
	(8) 110.0, 113.0, 119.0	113.6 (9.94; 103.0–126.0; 5)	

**STRUCTURE** Body rather elongated. Wings long and rather pointed at tips; when wing folded, tip of longest primary falls just over half length of tail. Ten primaries: p7 longest (p8 sometimes =); p10 74–92 mm shorter than p7, p9 16–25, p8 0–2, p6 2–9, p5 17–30, p4 36–47, p3 46–57, p2 56–69, p1 66–79. Slight emargination on outer webs of p5–p8, and inner webs of p7–p10. Ten secondaries, including three tertials; tip of longest tertial does not reach tip of secondaries on folded wing; s10 much reduced (I.J. Mason). Tail long and rather narrow, slightly rounded or square at tip when folded; 12 rectrices, longest one or more of t2–t5; t1 and t6 slightly shorter. Bill rather robust, fairly short and slightly hooked. Tibia fully feathered. Tarsus fairly short with slight lateral compression; scaling laminiplantar. Middle toe with claw 28.2 mm (2.25, 25.0–31.9, 6); outer toe 76–82% of middle, inner 63–73%, hindtoe 59–81%.

**RECOGNITION** Some White-bellied Cuckoo-shrikes *Coracina papuensis* subspecies *robusta* similar to Black-faced



Cuckoo-shrike; see Recognition section, and comments in Field Identification, of White-bellied Cuckoo-shrike.

**GEOGRAPHICAL VARIATION** Species limits unsettled and controversial. Circumscription of Black-faced Cuckoo-shrike *C. novaehollandiae* limited here to Aust. breeding populations (after Sibley & Monroe [1990] and DAB), and excluding Wallacean Cuckoo-Shrike *C. personata* (S. Müller, 1843) and other Moluccan, and Lesser and Greater Sundan populations (cf. Ripley 1941; Voous & van Marle 1949; White & Bruce 1986; Peters; see below). *C. novaehollandiae* considered part of Asian-Pacific *C. caledonica* superspecies comprising the following eight species (White & Bruce 1986; Sibley & Monroe 1990): *C. novaehollandiae* breeding in Aust. and non-breeding winter migrant as far N as Lesser Sundas, New Guinea, and E to Solomon Is (Ripley 1941; Peters); Large Cuckoo-Shrike *C. macei* from altitudes of  $\leq 2100$  m in s. Asia in n. Pakistan, India, Sri Lanka, Burma, Andaman Is, s. China, Taiwan and se. Asia; Malaysian Cuckoo-Shrike *C. javensis* from Java and Bali; Slaty Cuckoo-Shrike *C. schistacea* from islands off e. Sulawesi; Wallacean Cuckoo-Shrike *C. personata* from Lesser Sunda Is (Sumbawa, Romang, Sermata, Timor, Timbar and Kai Is); Moluccan Cuckoo-Shrike *C. atriceps* from altitudes  $\leq 1000$  m in Moluccas (Ternate, Halmahera, Bacan, Seram); Buru Cuckoo-Shrike *C. fortis* from Buru in s. Moluccas; and Melanesian Cuckoo-Shrike *C. caledonica* from Melanesia (Solomon Is, Vanuatu, New Caledonia). These extralimital allospecies differ from *C. novaehollandiae* by: pronounced sexual dimorphism, adult females having black extending from forehead through eye, males having black also extending to ear-coverts and throat (*C. novaehollandiae* not plumage-dimorphic); uniformly darker plumage with black edges to underwing-coverts and grey vent and undertail-coverts (*C. novaehollandiae* has paler plumage with plain white vent, undertail-coverts and underwing-coverts); and rather short bill (DAB). In addition to these differences, the Wallacean Cuckoo-shrike *C. personata* has shorter (164–174 mm in adults) and more rounded wing compared with *C. novaehollandiae*, and has very different vocalizations (Mason & McKean 1982).

Within Aust., variation slight, mainly involving clinal variation in length of wing. Three subspecies recognized here, following DAB (which examined large series of skins collected during breeding season): nominate *novaehollandiae* breeding in Tas.; *subpallida* from Pilbara and Gascoyne R. regions, WA; and *melanops* from rest of mainland Aust. and adjacent islands. Aust. populations migrate to New Guinea, Bismarck Arch., Lesser Sundas, the Moluccas (DAB) and NZ (NZRD) during non-breeding season (see Distribution, Movements). Formerly, treatment of subspecies has varied: Keast (1958b) recognized four subspecies: nominate breeding in Tas.; *melanops* breeding in s. mainland Aust.; *didima* breeding in n. Aust. (these birds having longer bill and shorter wing than *melanops*); and *subpallida* from Gascoyne to De Grey Rs. Mees (1961) found little difference in length of bill between populations in n. and s. mainland Aust. and consequently did not recognize *didima*, recognizing only *melanops* and *subpallida* on mainland Aust. This largely supported in other studies (Hall; DAB), which found N–S cline of increasing wing-length (see below). Mees (1961, 1982) was undecided if Tas. populations differed from those from mainland Aust. Ripley (1941) combined populations from Tas. and se. Aust. as nominate *novaehollandiae*, and treated populations from n. Aust. as *melanops*.

**SUBSPECIES MELANOPS:** Variation within *melanops* (see main description above) slight and probably clinal, apparently involving measurements only, with no differences in coloration of plumage (DAB; this study). Examination of skins collected during breeding season (Oct.–Mar.) indicates length of wing increases from N to S (DAB), supporting earlier findings of Keast (1958b). In contrast, Keast (1958b) found length

of bill decreases from N to S, the opposite trend to wing-length, but this not supported by DAB. Ranges for length of wing and bill (exposed culmen) for adults (sexes combined, from mainland Aust. in breeding season [Oct.–Mar.]) with latitude are: N of 16°S (n=13), Wing 180–195, Bill 23.4–24.4; 16–22°S (n=13), 185–203, 21.7–24.8; 22–28°S (n=18), 191–204, 21.6–24.0; 28–34°S (n=16), 196–210, 21.4–25.0; and S of 34°S (n=16), 200–212, 22.0–24.8 (DAB). Skins collected s. New Guinea (mostly immatures) similar to *melanops* in length of wing and bill, supporting suggestion that non-breeding migrants to New Guinea are from mainland Aust. (DAB).

**NOMINATE NOVAEHOLLANDIAE:** Plumage identical to *melanops* but differ significantly in size (Keast 1958b; DAB; this study): adult nominate have significantly shorter Bill S ( $P < 0.01$  males,  $P < 0.05$  females) and longer Tail ( $P < 0.05$ , sexes analysed separately) than adult *melanops* (this study). However, there is considerable overlap in measurements with *melanops* (DAB; this study) and on available data it is not possible to conclusively identify Tas. birds (and thus extent to which they move to se. Aust. during non-breeding season not known). Trend in size of Tas. populations inconsistent with clinal increase in wing-length from N to S evidenced by *melanops*, supporting treatment as a separate subspecies (Keast 1958b; DAB).

**SUBSPECIES SUBPALLIDA:** Similar to *melanops* but with paler, silvery-grey (ne) top of head and upperparts, and paler whitish-grey (ne) breast (Keast 1958b; Hall; DAB; this study). No difference between *subpallida* and *melanops* for any measurement, but sample size small for *subpallida* (this study). Appears to intergrade rather broadly with *melanops* round s. and e. fringes of Pilbara Region, from Shark Bay to Gibson and Great Sandy Deserts, and possibly towards s. edge of Kimberley Div. (DAB; cf. Keast 1958); skins from these areas have tone of plumage intermediate between the two subspecies (Keast 1958b; Hall; DAB).

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**Sponsors: PD Boag, Prof. MA Cameron, KL Cross, S & A Robertson, MS Ross AM, SA Rowell, JR Wood, Victorian Ornithological Research Group**



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Volume 7 (Part A), Plate 7

Black-faced Cuckoo-shrike *Coracina novaehollandiae* (page 266)  
 SUBSPECIES MELANOPS: 1, 2 Adult; 3 Juvenile; 4 Immature; 5 Adult

White-bellied Cuckoo-shrike *Coracina papuensis* (page 291)  
 SUBSPECIES HYPOLEUCA: 6 Adult male; 7 Adult female

SUBSPECIES ROBUSTA: 8 Adult male (light morph); 9 Adult female (light morph); 10 Adult (dark morph); 11 Immature (light morph)

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