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 AXY (AX in *Dicrurus* [drongos]). Ambiens absent. Iliofemoralis externus usually absent, but present in some groups as 'developmental anomaly' (Raikow 1982). Tensor propatagialis 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):

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.

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, taxomony 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 virescens* 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 widepread, 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 (Kroodsma 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).

REFERENCES

Ames, P.L. 1971. *Bull. Yale Peabody Mus. Nat. Hist.* 37: 1–194.
—— 1987. *Emu* 87: 192–5.
Baverstock, P.R., *et al.* 1991. *Aust. J. Zool.* 39: 417–25.
——, *et al.* 1992. *Aust. J. Zool.* 40: 173–9.
Beddard, F.E. 1898. *The Structure and Classification of Birds.* Longmans, Green & Co., London.
Berger, A.J. 1956. *Am. Midl. and Nat.* 55: 326–33.
Boles, W.E., & N.W. Longmore. 1985. *S. Aust. Orn.* 29: 213–19.
Brown, J.L. 1987. *Helping and Communal Breeding in Birds.* Princeton Univ. Press, Princeton, New Jersey.
Campbell, B., & E. Lack. (Eds) 1985. *A Dictionary of Birds.* T. & A.D. Poyser, Calton, England.
Christidis, L. 1991. *Chromosomes Today* 10 (1990): 279–94.
——, & W.E. Boles. 1994. *RAOU Monogr.* 2. Melbourne.
——, & R. Schodde. 1991. *Ibis* 133: 277–85.
Clench, M.H. 1978. *Condor* 80: 423–30.
Dow, D.D. 1978. *Int. Orn. Cong. Proc.* 17: 875–81.
—— 1980. *Emu* 80: 121–40.
Ehrlich, P.R., *et al.* 1986. *Auk* 103: 835.
——, *et al.* 1988. *The Birder's Handbook: A Field Guide to the Natural History of North American Birds.* Simon & Schuster, New York.
Farner, D.S., *et al.* (Eds) 1971. *Avian Biology. 1.* Academic Press, New York.
Ford, H.A. 1989. *Ecology of Birds.* Surrey Beatty, Sydney.
Frith, C.B. 1994. *Condor* 96: 552–5.
Hartshorne, C. 1973. *Born to Sing.* Indiana Univ. Press, Bloomington, Indiana.
Heather, B.D., & H.A. Robertson. 1997. *The Field Guide to the Birds of New Zealand.* OUP, Auckland.
Kroodsma, D.E. 1996. Pp 3–19 **In**: Kroodsma & Miller 1996.
——, & E.H. Miller. (Eds) 1996. *Ecology and Evolution of Acoustic Communication in Birds.* Comstock, Ithaca, New York.
Marshall, A.J. 1950. *Emu* 50: 5–16.

Millener, P.R. 1988. *J. R. Soc. NZ.* 18: 383–406.
Morlion, M.L. 1985. *Rec. Aust. Mus.* 37: 143–56.
Morony, J.J., *et al.* 1975. *Reference List of the Birds of the World.* Am. Mus. Nat. Hist., New York.
Pizzey, G. 1980. *A Field Guide to the Birds of Australia.* Collins, Sydney.
Raikow, R.J. 1982. *Auk* 99: 431–45.
Ricklefs, R.E. 1975. *Condor* 77: 34–45.
Ridgely, R.S., & G. Tudor. 1994. *The Birds of South America. 2. The Suboscine Passerines.* OUP, Oxford.
Ridgeway, R. 1901. *Bull. US Natn. Mus.* 50(1): 1–715.
Rowley, I., & E. Russell. 1997. *Fairy-wrens and Grasswrens.* OUP, Oxford.
Schodde, R. 1975. *Interim List of Australian Songbirds: Passerines.* RAOU, Melbourne.
——, & I.J. Mason. 1999. *The Directory of Australian Birds: Passerines.* CSIRO Publ., Melbourne.
Sibley, C.G. 1974. *Emu* 74: 65–79.
——, & J.E. Ahlquist. 1985a. *Emu* 85: 1–14.
——, —— 1985b. *Int. Orn. Congr. Proc.* 18: 83–121.
——, —— 1990. *Phylogeny and Classification of Birds: A Study in Molecular Evolution.* Yale Univ. Press, New Haven.
——, & B.L. Monroe. 1990. *The Distribution and Taxonomy of Birds of the World.* Yale Univ. Press, New Haven.
——, *et al.* 1988. *Auk* 105: 409–23.
Simmons, K.E.L. 1966. *J. Zool., Lond.* 149: 145–63.
—— 1986. *The Sunning Behaviour of Birds.* Bristol Orn. Club, Bristol.
Storer, R.W. 1971. Pp 1–18 **In**: Farner *et al.* 1971.
van Tyne, J., & A.J. Berger. 1976. *Fundamentals of Ornithology.* John Wiley & Sons, New York.
Voous, K.H. 1977. *Ibis* 119: 223–250, 376–406.
Wetmore, A. 1960. *Smithson. Misc. Collection* 139.
Winkler, R., & L. Jenni. 1996. *Auk* 113: 968–9.
Zeidler, K. 1966. *J. für Orn.* 107: 113–53.

Family DICRURIDAE fantails, drongos, monarch-flycatchers and boatbills

A large and highly diverse family of small to medium-sized passerines, often with short and rounded wings and long tails. The family comprises 160–170 species in 21 genera, distributed from Africa, across much of s. Asia, including the Indian subcontinent, to e. and se. Asia, including Japan, the Philippines and Wallacea, to A'asia and islands of w. Pacific Ocean as far E as Hawaii (Sibley & Monroe 1990; Monroe & Sibley 1993; Peters; DAB). Within HANZAB region there are 19 species generally recognized, in seven genera (Sibley & Monroe 1990; Monroe & Sibley 1993; Christidis & Boles 1994), but up to 22 species recognized in DAB. The taxonomy of the family has been the subject of considerable confusion. Here we recognize the following four subfamilies within the family Dicruridae (largely following DAB):

RHIPIDURINAE (FANTAILS): Comprises a single genus *Rhipidura*, with 37–42 species; five species in HANZAB region according to most authors (Sibley & Monroe 1990; Monroe & Sibley 1993; Christidis & Boles 1994), but seven species according to DAB.

DICRURINAE (DRONGOS): Comprises two genera: monotypic *Chaetorhynchus*, endemic to New Guinea; and *Dicrurus*, with 19–23 species, one of which occurs in HANZAB region. Characters present in this subfamily but absent from the others include an extended maxillary plate in the roof of the palate, thickened nasal bars, a large temporal fossa to the muscle of the mandible, and a long, double zygomatic process (DAB).

MONARCHINAE (MONARCH FLYCATCHERS): Four genera in HANZAB region: *Monarcha*, with 26–31 species, four of which occur in HANZAB region according to most authors (Sibley & Monroe 1990; Monroe & Sibley 1993; Christidis & Boles 1994; DAB); *Arses*, with three species according to most authors (four according to DAB), two (or three according to DAB) of which occur in HANZAB region; *Myiagra*, with 15–18 species, five in HANZAB region according to most authors, but six species according to DAB; and *Grallina*, with two species, and one in HANZAB region (see below for discussion on taxonomic position of this genus). The subfamily contains a further 42–44 species, in 13 genera, extralimitally (Sibley & Monroe 1990; Monroe & Sibley 1993).

MACHAERIRHYNCHINAE (BOATBILLS): *Machaerirhynchus*, with two species, one in HANZAB region. These have a number of structural characteristics rather divergent from other subfamilies, including fully perforate nasal and orbital septa, a much narrowed palatine shelf with long, subulate trans-palatine processes with slightly swollen ends, and much reduced ectethmoid wings with vestigial lachrymals on the latero-ventral face (DAB).

Early studies placed the monarch flycatchers and fantails in the superfamily Muscicapidae, which includes Old World flycatchers and thrushes among other passerine groups (Mayr & Amadon 1951; Vaurie 1953; Wetmore 1960; Aust. CL 1926). Later studies on syringeal morphology (Ames 1975) and egg-white proteins (Sibley 1970, 1976) showed that Australo-Papuan flycatchers are not closely related to members of the Old World family Muscicapidae. Beecher (1953), in his studies of passerine cranial osteology and myology, was the first to group monarch flycatchers and drongos together, along with whistlers (Pachycephalidae) and vireos (Vireonidae), in the family Monarchidae (see DAB for further discussion). Wolters (1975–82) considered drongos as a sister family to the monarchs and fantails. Based largely on syringeal morphology, electrophoretic patterns of egg-white proteins and juvenile plumage, Boles (1979) proposed that the Australo-Papuan flycatchers, monarchs, fantails, robins, whistlers and shrike-thrushes form a monophyletic group, centred in Aust. and New Guinea, and were not related to muscicapine flycatchers.

DNA–DNA hybridization studies (Sibley & Ahlquist 1985, 1990) led to our current understanding of the taxonomic position of Australo-Papuan monarchs and flycatchers. These studies, along with those of Christidis & Schodde (1991), indicate they nevertheless form part of the corvoid (not the muscicapoid) assemblage and are probably most closely related to the Aegithinidae (ioras) and Malaconotidae (bush-shrikes and allies), and within the HANZAB region to the Pachycephalidae (whistlers). DNA–DNA hybridization studies (Sibley & Ahlquist 1985) also suggest a relationship between Australo-Papuan flycatchers and their allies, and several genera of African flycatchers and monarchs, including *Erythrocercus*, *Elminia*, *Trochocercus*, *Terpsiphone*, *Clytorhnychus* and other genera. However, osteological data (Olson 1989) suggests at least some of these African genera are not monarchs.

The taxonomic position of the magpie-larks *Grallina* has been the subject of much debate. Amadon (1950) considered *Grallina* related to the other Aust. mud-nesters, the Apostlebird *Struthidea cinerea* and White-winged Chough *Corcorax melanorhamphos*, and placed them in a family Grallinidae. Beecher (1953) assigned *Grallina* to the Artamidae (butcherbirds and woodswallows). McEvey (1976) suggested *Grallina* was a linking group between the other mud-nesters and Artamidae. More recent osteological (Olson 1989) and DNA–DNA hybridization data (Sibley & Ahlquist 1985) indicate that *Grallina* is allied to the Australo-Papuan flycatchers. Based on DNA–DNA hybridization data, Sibley & Ahlquist (1985) combined the monarchs, fantails, magpie-larks and drongos as a subfamily Dicrurinae within an expanded family Corvidae. The latter authors combine *Grallina* with *Monarcha* ($\Delta T_{50}H$ 2.9) and African genera of monarchs, and they place these as a tribe Monarchini within the subfamily.

Their data also supports the inclusion of the drongos *Dicrurus* and *Chaetorhynchus* with the *Monarcha* and *Grallina* ($\Delta T_{50}H$ 5.0), and accordingly they consider drongos as a tribe Dicrurini. The fantails are a sister group to the other monarchines ($\Delta T_{50}H$ 6.1) and are considered as the tribe Rhipidurini. In the present study we follow Christidis & Boles (1994) and DAB in elevating the subfamily Dicrurinae to family status, and consider the tribes of Sibley & Ahlquist (1993) as subfamilies (as above).

Within the HANZAB region, the smallest is Mangrove Grey Fantail *Rhipidura phasiana* (length *c.* 14.5 cm, weight *c.* 7 g) and the largest is Magpie-lark *Grallina cyanoleuca* (length *c.* 28 cm, weight *c.* 85 g). The Dicruridae are characterized by (Olson 1989; DAB): Single humeral fossa that is of pachycephaloid form, except in drongos and magpie-larks, which have weakly developed ventral tubercle tuberosity and depression above it. Palate with extensive ossification of the internasal septum. In some *Myiagra* and in *Grallina* (magpie-larks), nares virtually imperforate (amphirhinal). Vomer simple and shortly bifid with cartilaginous extensions. Ectethmoid plate thin with narrowed wing and no lachrymals (except boatbills *Machaerirhynchus*). Maxillo-palatine processes dorsoventrally flat. Palatine shelf varyingly narrow with attenuate but usually round-tipped trans-palatine processes. In the Rhipidurinae (fantails) and Dicrurinae (drongos), the interorbital septum is extensively ossified. Bill typically broad (not *Grallina*), with shortly hooked tips and notched maxillary tomia. Usually have dense, well-developed rictal bristles. Ten primaries, with p10 moderately developed; nine (Rhipidurinae), nine plus a vestigial s10 (Dicrurinae, most species of Monarchinae) or ten (*Grallina*) secondaries (including tertials). Usually 12 rectrices, but Pygmy Drongo *Chaetorhynchus papuensis* has ten. Tarsal scaling laminiplantar.

Plumage of adults usually contrasting patterns of rich greys, russets, whites and glossy blacks, often with iridescent sheens (DAB). Many species sexually dimorphic in adult plumage. Juveniles often like dull versions of adults, often with pale or brownish fringes to upperwing-coverts. Post-juvenile (first pre-basic) moult usually occurs soon after fledging and is usually partial, resulting in adult-like first immature (first basic) plumage. Adults undergo a single complete post-breeding (pre-basic) moult annually. Primaries moult outward, usually starting at p1. Most species have rather long tails, and short, well-rounded wings. Fantails and some monarchs often fan or flirt tail while foraging (possibly as foraging manoeuvre); *Myiagra* flycatchers and boatbills *Machaerirhynchus* vibrate tails when perched; in drongos, tails commonly forked and twisted at tips. Feet usually rather weak.

Throughout range, predominantly birds of forested habitats, but with a few exceptions, such as Torrent-lark *Grallina bruijni* which is found along small, rocky and swift-flowing montane forest streams of New Guinea; Fork-tailed Drongo *Dicrurus adsimilis* which inhabits mainly open country, including savanna; and Willie Wagtail *Rhipidura leucophrys* which is also often found in open country, including grassslands and forest clearings. Many species (e.g. many fantails and drongos) associate with forest edge and ecotones between forests and open habitats, or with watercourses, lakes or swamps and riparian vegetation (Sibley & Monroe 1990; Maclean 1993; Cheke & Walsh 1996; Coates *et al.* 1997). In HANZAB region, mainly associated with sclerophyll forests and woodlands, predominantly eucalypt or acacia associations, and rainforests; less often in shrublands or heath, regrowth forest, and mangrove associations; in HANZAB region, Mangrove Grey Fantail and Broad-billed Flycatcher *Myiagra ruficollis* mainly confined to mangrove associations. Some species commonly in modified habitats, e.g. Willie Wagtail and Magpie-lark both common and familiar urban birds and often also found in farmland, parklands and gardens, commonly nesting in close association with human habitation. Association with forested habitats in Aust. results in distribution largely confined to wetter forested N, E, SE and SW. However, Willie Wagtail found throughout the continent, and Magpie-lark found throughout except for arid deserts of SA–WA–NT; Grey Fantail also extends into arid inland WA–NT. Recorded from lowlands to mountains; occur from coastal lowlands to alpine uplands in Aust.; common to 1500 m asl in NZ; in New Guinea and Wallacea recorded to 3600–3900 m asl (e.g. Dimorphic Fantail *R. brachyrrhyncha*, Friendly Fantail *R. albolimbata*). Clearing of forests has reduced suitable habitat for some species (Pied Monarch *Arses kaupi*, Restless Flycatcher *M. inquieta*, Rufous Fantail *R. rufifrons* and Satin Flycatcher *M. cyanoleuca*). In contrast, Magpie-lark and Willie Wagtail have benefited from clearing and agricultural development (Coates 1990; Sibley & Monroe 1990; Maclean 1993; Coates *et al.* 1997; Urban *et al.* 1997; Heather & Robertson 2000; Aust. Atlas 1, 2; DAB; see species accounts).

Most species are resident or sedentary, though some are migratory or partly migratory. In HANZAB region, many species (about half of those occurring) resident or sedentary, with some local movements or dispersion (e.g. Willie Wagtails, while largely sedentary, show some local movements to more open areas in winter). Remaining species partly or wholly migratory, with populations moving N for austral winter, mainly wintering in n. Aust., especially ne. Qld, and New Guinea, and returning to s. parts of range to breed (e.g. Leaden *Myiagra rubecula* and Satin Flycatchers, and Black-faced Monarch *Monarcha melanopsis*). However, patterns of movement can vary within some species, e.g. subspecies *allisteri* of Grey Fantail migrates from e. Aust. to WA and n. Aust., perhaps as far as New Guinea, and *preissi* moves from sw. WA, N and E in winter, while *keasti* of ne. Qld is resident or sedentary. A few species in e. Aust., particularly those ocurring in se. highlands and tropical uplands, are partial altitudinal migrants, moving to lowlands, often near coasts, for autumn–winter; in NZ, Grey Fantail possibly also a partial altitudinal migrant. Readily cross water; in Aust., at least six (and probably eight) species regularly migrate across Torres Str., and Satin Flycatcher migrates across both Bass Str. and Torres Str. Extralimitally, drongos (Dicrurinae)

and boatbills (Machaerirhynchinae) generally resident or sedentary, except Crow-billed Drongo *D. annectaus*, which winters in Greater Sundas after breeding in India and China, and Ashy Drongo *Dicrurus leucophaeus*, a resident and winter visitor to se. Asia, and altitudinal migrant to lowland India and Sri Lanka from Himalayan breeding grounds; several other show local movements. Fantails (Rhipidurinae) also largely sedentary or resident throughout se. Asia, Melanesia and Pacific region, but two species of Indian subcontinent show altitudinal move-ments. Monarch flycatchers (Monarchinae) mostly sedentary or resident, with a few migratory or partly migratory species, mainly *Terpsiphone* paradise-flycatchers extralimitally, e.g. Japanese Paradise-Flycatcher *T. atrocaudata* is migratory, breeding in Japan, Taiwan and extreme n. Philippines, and wintering in Sumatra, n. Borneo and Philippines; and African Paradise-Flycatcher *Terpsiphone viridis* partly migratory, with some populations moving towards Equator after breeding. For migratory species, birds usually occur singly or in pairs on passage, but some species observed in small flocks on passage, such as Rufous Fantail and Spangled Drongo (Britton 1980; Pratt *et al.* 1987; Coates 1990; Sibley & Monroe 1990; Maclean 1993; Coates *et al.* 1997; Robson 2000; see species accounts).

Mostly arboreal and aerial insectivores, and, with few exceptions, birds of middle and lower strata of forested habitats. However, *Grallina* predominantly ground foragers (Magpie-lark mainly in open, terrestrial habitats, and Torrent-lark in and along montane streams), and others also forage much on ground, such as Sooty Thicket-Fantail *Rhipidura threnothorax*. Mostly search for food from vantage perches, attacking by sally-striking in air or from foliage, branches or trunks of trees; some species sally-pounce to ground or sally-hover (e.g. Restless Flycatcher, Black-faced Monarch *Monarcha melanopsis*, fantails *Rhipidura* and paradise-flycatchers *Terpsiphone*), taking prey from foliage or flowers. Almost all species, especially monarchs and *Myiagra* flycatchers, also forage by flush-pursuit (though most Aust. literature does not distinguish between sallying and flush-pursuit). Some birds, especially fantails and *Elminia* flycatchers, intentionally use movements of tails and wings during foraging to flush prey (flush-pursuit) before chasing them. Some birds, such as paradise-flycatchers, follow other bird species along branches, gleaning prey that may be dislodged. In HANZAB region, two exceptions to typically flycatcher foraging: *Arses* commonly glean their food by spiralling up and round trunks of trees by foot (also typified, extralimitally, by *Erythrocercus* flycatchers, e.g. Chestnut-capped Flycatcher *E. mccallii*); and Magpie-lark, which forages primarily on ground (Coates 1990; Urban *et al.* 1997; Coates & Peckover 2001; see species accounts).

Social organization and behaviour poorly known for most species, but well known for a few in HANZAB region (Leaden Flycatcher, Grey Fantail, Willie Wagtail and Magpie-lark) and reasonably well known for some in Africa (e.g. African Paradise-Flycatcher). Usually solitary or in pairs, sometimes in small family groups. However, Grey Fantails and Willie Wagtails sometimes gather in loose congregations outside breeding season, and some species observed in small flocks on passage (see Movements summary above). Magpie-larks also sometimes form large flocks, of 100+, in winter. In most species, pair-bond monogamous and often long-term, pairs are territorial, and both sexes share parental care. At least two species in Africa, African Blue Flycatcher *Elminia longicauda* and Chestnut-capped Flycatcher, thought to be sometimes polygamous and have been recorded breeding co-operatively. In HANZAB region, co-operative breeding once recorded in Magpie-larks, and possibly once in Willie Wagtail. Most other species appear also to nest in simple pairs and share parental care between sexes; also appear to have distinctive, probably territorial, songs. Some species loosely colonial or at least show some clustering of nests (e.g. Satin Flycatcher, Spangled Drongo). Much aggression in defence of nest and young. Several species harass poten-tial predators in fluttering, hovering flight, e.g. African Paradise-Flycatcher and Willie Wagtail. Often noisy (par-ticularly drongos Dicrurinae) and conspicuous. Displays tend to be poorly known; and functions of several described displays are not known (such as some social displays in the monarch flycatchers, e.g. *Arses*). In HANZAB region, distraction displays recorded in Willie Wagtail, Rufous Fantail and Satin Flycatcher. In well-studied species, such as Willie Wagtail, young evicted from natal territory soon after independence, though young of migratory Rufous Fantail stay near natal territory until leaving on passage. Young of some species fully independent 4–7 weeks after fledging, but for most species period of dependence not known (Urban *et al.* 1997; DAB; see species accounts).

Dicrurids are noisy, particularly when breeding (DAB). Calls of the subfamily of monarch flycatchers (Monarchinae) are short and simple, the quality variously described as dry, grating, harsh, rasping, buzzing or scolding, with notes often rising in inflexion; the songs of *Myiagra* species have been described as a series of simple whistles, those of *Arses* species as slow rattled ringing trills, and those of *Monarcha* species as a musical jumble of loud mellow notes and fluting whistles; and *Grallina* (Magpie-lark and Torrent-lark) have loud and penetrating calls, often accompanied by conspicuous displays. Calls of the boatbills (Machaerirhynchinae) metallic or grating, and songs contain musical trills. Calls of fantails (Rhipidurinae) are simple chips, clucks and grating notes, and song is typically a weak, high-pitched but melodious phrase consisting of short clear whistles and climbing and tumbling series of shorter notes; a few species have louder and more forceful songs (e.g. Willie Wagtail). Within the drongos (Dicrurinae) vocalizations typically a mixture of harsh, scolding notes and pleasant musical whistles, and some species are good mimics (Campbell & Lack 1985; Beehler *et al.* 1986; see species accounts).

Breed solitarily. Seasonality varies geographically. In Aust. most species do not breed, or breed least often, in colder months (May–June) and a similar pattern, with birds breeding mostly in spring and summer, is followed in n. hemisphere. In tropical regions, birds may breed throughout year, e.g. in PNG, Willie Wagtail lays in all months,

while in Aust. eggs recorded only July–Feb. Usually nest in trees, shrubs or vines, on horizontal branches or in vertical or horizontal forks, though Frilled Monarch *Arses telescophthalmus* often builds between two parallel vertical hanging vines. Some species (e.g. Magpie-lark, Willie Wagtail, Grey Fantail) also build on and within assorted artificial structures. Usually show some evidence of site-fidelity, and some species show quite strong associations with other species, often others members of the family, e.g. Magpie-lark with Willie Wagtail. Build open nests: variously shallow, saucer, basket, basin or hammock-shaped in Yellow-breasted Boatbill *Machaerirhynchus flaviventer*, drongos *Dicrurus* and Frilled and Fantail *Monarcha axillaris* Monarchs, but cup-shaped in most other species; fantails often add tail to cup, making nest appear like a wine glass without a base. Nests usually made of plant material, sometimes with animal hair or spider web. In contrast, nests of Magpie-lark and Torrent-lark of New Guinea cup or bowl-shaped but often made of mud. Rarely, nests of Willie Wagtail also made of mud. Nests usually lined with soft or springy materials such as vine tendrils, hair, feathers, or soft plant material. Usually both sexes build, though on occasions workload may be shared unevenly, with female usually contributing more; in Yellow-breasted Boatbill, thought that males do all or most nest construction. Nest takes from <1 week to 6 weeks to build. Eggs vary in shape, but usually oval, elongate oval or swollen oval; also usually smooth and slightly lustrous. Ground-colour typically pale, from various shades of white (pure or creamy white, reddish, pinkish, yellowish, bluish or greenish white) to creamy brown or light buff, and, in Magpie-Lark, to rich buffy-red or reddish-buff; eggs of Ashy Drongos also quite dark. Eggs have various combinations of darker markings, sometimes mostly at, or forming a zone or band near, large end. Within the family, eggs of Grey and Mangrove Grey Fantails rather small ($14–17 \times 10–13$ mm), ranging to large in Spangled Drongo and Magpie-lark ($26–33 \times 18–22$); this range probably covers that of most extralimital species, though there is little data for many species (such as New Ireland Drongo *Dicrurus megarhynchus*). Clutch-size is one to four in most smaller species, but usually two or three in rest; apparently always two in Yellow-breasted Boatbill and Spectacled Monarch *Monarcha trivirgatus albiventris*; up to five in drongos (Ali & Ripley 1972a) and possibly six in Grey Fantail in NZ and Magpie-lark; Torrent-lark usually lays single egg, as does Silktail *Lamprolia victoriae* of Fiji. Laying interval usually *c.* 24 h, occasionally 48 h. Single- or multiple-brooded: in Aust., Willie Wagtails, Grey Fantails and Magpie-larks known to rear up to four or five broods in a season, Restless Flycatchers up to three, Satin and Leaden Flycatchers, Rufous and Northern Fantails two, and Yellow-breasted Boatbill, monarchs and Shining and Broad-billed Flycatchers only one. Both parents usually incubate, though sexes may not contribute equally, and in Spectacled Monarch, females incubate and are fed by males. Incubation period 12–19 days. Both parents feed nestlings; faecal sacs removed till late in nestling period; may perform distraction displays in defence of young. Both sexes also feed fledgelings, though broods sometimes divided; young usually fully independent 4–7 weeks after fledging. Fledging period usually 11–18 days in smaller species (fantails, flycatchers); 17–20 days in Spectacled Monarch; and 17–24 days in larger species (Spangled Drongo, Magpie-lark). In Aust., success varies: Willie Wagtail had most data in NRS (success data for 3091 eggs, in 1069 nests) and averaged 0.93 fledged young/nest; success in other species sometimes similar (e.g. Restless Flycatcher 0.97, Magpie-Lark 1.05), rarely higher (e.g. Spangled Drongo 1.25) and often substantially lower (e.g. Grey Fantail 0.46, Rufous Fantail 0.32, Leaden Flycatcher 0.24, Black-faced Monarch 0.10). Causes of failure include: extreme weather conditions, including heatwaves, drought, and cold, wet or windy weather; interference from people (some species desert nest readily); and cuckoos. Predators include Cats, rats *Rattus*, and other mammalian predators; rarely, lizards and snakes; and range of avian predators, including kookaburras *Dacelo*, crows and ravens *Corvus*, currawongs *Strepera* and butcherbirds *Cracticus* and various birds of prey (Ali & Ripley 1972a,b; Watling 1982; Coates 1990; Roberts 1992; see species accounts).

Some 21 species globally threatened, many of which are endemic island forms, e.g. Flores Monarch *Monarcha sacerdotum* confined to w. Flores, and White-tipped Monarch *M. everetti* restricted to island of Tanahjampea, between Sulawesi and Flores, in Wallacea (White & Bruce 1986; Coates *et al.* 1997); five considered critically endangered, including Caerulean Paradise-Flycatcher *Eutrichomyias rowleyi* of n. Sulawesi, and Black-chinned Monarch *Monarcha boanensis* of s. Moluccas; six species endangered, ten vulnerable and 18 near threatened (Stattersfield & Capper 2000). Most are threatened by degradation or fragmentation of habitat, both through deforestation for agriculture or logging, or by recurrent cyclonic activity, which has allowed spread of invasive weeds. Populations of some island species, e.g. Elepaio *Chasiempis sandwichensis* and Tahiti Monarch *Pomarea nigra*, are threatened by predation by Black Rats *Rattus rattus* (Stattersfield & Capper 2000). In HANZAB region, Lord Howe Island Grey Fantail *Rhipidura fuliginoas cervina* extinct, owing to predation by Black Rats, and Norfolk Island Fantail *R.f. pelzelni* considered vulnerable; five other taxa considered near threatened (Garnett & Crowley 2000).

REFERENCES

Ali, S., & S.D. Ripley. 1972a. *Handbook of the Birds of India and Pakistan. 5.* OUP, Bombay.
——, —— 1972b. *Handbook of the Birds of India and Pakistan. 7.* OUP, Bombay.
Amadon, D. 1950. *Emu* 50: 123–7.
Ames, P.L. 1975. *Bonn. Zool. Beitr.* 26: 107–34.

Beecher, W.J. 1953. *Auk* 70: 270–337.
Beehler, B.M., *et al.* 1986. *Birds of New Guinea.* Princeton Univ. Press, Princeton, NJ.
Boles, W.E. 1979. *Emu* 79: 107–10.
Britton, P.L. (Ed.) 1980. *Birds of East Africa.* East African Nat. Hist. Soc., Nairobi.

Campbell, B., & E. Lack. 1985. *A Dictionary of Birds*. Poyser, Calton, England.

Cheke, R.A., & J.F. Walsh. *BOU Check-list* 14.

Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.

——, & R. Schodde. 1991. *Ibis* 133: 277–85.

Coates, B.J. 1990. *The Birds of Papua New Guinea*. 2. Dove Publs, Alderley, Qld.

——, & W.S. Peckover. 2001. *Birds of New Guinea and the Bismarck Archipelago*. Dove Publs, Alderley, Qld.

——, *et al.* 1997. *A Guide to the Birds of Wallacea*. Dove Publs, Alderley, Qld.

Doughty, C., *et al.* 1999. *Birds of the Solomons, Vanuatu & New Caledonia*. Christopher Helm, London.

Ford, J.R. 1981. *Emu* 81: 128–44.

Garnett, S.T., & G.M. Crowley. 2000. *The Action Plan for Australian Birds. 2000*. Env. Aust., Canberra.

Gosper, D.G. 1981. *Corella* 5: 1–18.

Heather, B.D., & H.A. Robertson. 2000. *The Field Guide to the Birds of New Zealand*. Viking, Auckland.

Maclean, G.L. 1993. *Roberts' Birds of Southern Africa*. John Voelcker Bird Book Fund, Cape Town.

Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496: 1–42.

McEvey, A. 1976. *Int. Orn. Congr. Proc.* 16: 150–60.

Monroe, B.L., Jr, & C.G. Sibley. 1993. *A World Checklist of Birds*. Yale Univ. Press, New Haven, CT.

Olson, S.L. 1989. *Riv. Ital. Orn., Milano* 59: 183–95.

Pratt, H.D., *et al.* 1987. *The Birds of Hawaii and the Tropical Pacific*. Princeton Univ. Press, Princeton, NJ.

Roberts, T.J. 1992. *The Birds of Pakistan*. OUP, Karachi.

Robson, C. 2000. *A Field Guide to the Birds of South-East Asia*. New Holland Publs, London.

Sibley, C.G. 1970. *Bull. Yale Peabody Mus. Nat. Hist.* 32: 1–131.

—— 1976. *Int. Orn. Congr. Proc.* 16. 557–70.

——, & J.E. Ahlquist. 1985. *Emu* 85: 1–14.

——, —— 1990. *Phylogeny and Classification of Birds*. Yale Univ. Press, New Haven, CT.

——, & B.L. Monroe, Jr. 1990. *Distribution and Taxonomy of Birds of the World*. Yale Univ. Press, New Haven, CT.

Stattersfield, A.J., & D.R. Capper. (Eds) 2000. *Threatened Birds of the World*. Lynx Edicions, Barcelona, and Birdlife International, Cambridge, UK.

Urban, E.K., *et al.* (Eds) 1997. *The Birds of Africa. 5*. Academic Press, San Diego, CA.

Vaurie, C. 1953. *Bull. Am. Mus. Nat. Hist.* 100: 453–538.

Watling, D. 1982. *Birds of Fiji, Tonga and Samoa*. Millwood Press, Wellington.

Wetmore, A. 1960. *Smithson. Misc. Coll.* 139: 1–37.

White, C.M.N., & M.D. Bruce. 1986. *BOU Checklist* 7.

Wolters, H.E. 1975–82. *Die Vogelarten der Erde*. Paul Parey, Hamburg.

Rhipidura fuliginosa **Grey Fantail**

Muscicapa fuliginosa Sparrman, 1787, *Mus. Carlsonianum* 2: no. 47 — 'In Deserto Africano inter rivulum Heuj et Fontem Quamedacka' = South Island, New Zealand.

The specific name describes the New Zealand black morph of this dimorphic fantail, from Late Latin *fuliginosus*, sooty (from Latin *fuligo*, soot).

OTHER ENGLISH NAMES AUST.: Black, Dusky, Fawn-breasted, Grey-collared, Land, Pied, Western, White-fronted, White-shafted or White-tailed Fantail; Cranky Fan or Fantail; Mad Fan; Devilbird; Fanny or Fanny Devilbird, Fantail or Greyfan; Fantailed Flycatcher; Snapper. NZ: Fantail; New Zealand, North Island, South Island, Chatham Island, Pied or Black Fantail.

MAORI NAME Piwakawaka.

POLYTYPIC Subspecies *keasti* Ford, 1981, ne. Qld; *alisteri* Mathews, 1911, se. Qld, NSW, Vic. and se. SA; *albiscapa* Gould, 1840, Tas., and Flinders and King Is; *preissi* Cabanis, 1850, sw. WA; *albicauda* North, 1895, central WA, s. NT and nw. SA; *cervina* Ramsay, 1879, Lord Howe I. (extinct); *pelzelni* G.R. Gray, 1862, Norfolk I.; *placabilis* Bangs, 1921, NI, NZ and adjacent islands; nominate *fuliginosa*, SI and Stewart I. and adjacent islands, NZ; *penita* Bangs, 1911, Chatham Is. Extralimitally: *bulgeri* Layard, 1877, New Caledonia, including Loyalty Is; and *brenchleyi* Sharpe, 1879, Solomon Is, and Vanuatu, including Banks Is.

FIELD IDENTIFICATION Length 15.5 cm (14–16.5); wingspan 21 cm (18–22.5); weight 8 g. Widespread and familiar medium-small fantail, with Aust. populations appearing roughly intermediate in size between Mangrove Grey *Rhipidura phasiana* and Northern *R. rufiventris* Fantails, and similar in size and shape to e.-Aust. populations of Rufous Fantail *Rhipidura rufifrons*; NZ birds have proportionately slightly longer tail. Dimorphic, with pied morph occurring throughout Aust. and NZ, Chatham, Lord Howe and Norfolk Is, and black morph confined to main islands of NZ (comprising 12–25% of population on SI but <1% of population on NI). Sexes alike. No seasonal variation. Pied-morph adults, grey above with prominent short white supercilium and (except in NZ forms) ear-streak, double white wing-bars, white shafts and varying amount of white edging to rectrices; and cream to buff below, with varying grey wash on sides of breast and contrasting white chin and throat bordered by prominent narrow dark breast-band. Black-morph adults wholly blackish except for varying white spot on ear-coverts. Juvenile distinct; those of pied morph similar to adult but duller, with upperbody, breast and pale head- and wing-markings suffused rufous-brown or buff; those of black morph similar to adult but with rufescent suffusion throughout plumage. Immature separable in close view by moult-contrast in secondary coverts of upperwing. Slight geographical variation, with nine extant subspecies that fall into two main groups: (1) *albiscapa* group, comprising six subspecies (all pied morph) in Aust. and on Norfolk I.; and (2) *fuliginosa* group, comprising three subspecies (pied and black morphs) in NZ and on Chatham Is. Within each group, subspecies differ most obviously in colour of upperbody, underbody and face; colour and width of dark breast-band; shade and extent of grey on sides of breast; amount of white in tail; and strength of white wing-bars and white edges to secondaries and tertials. PIED MORPH: Adult MAINLAND SE. AUST.

and SW. WA (subspecies *alisteri* and *preissi*): Head, neck and upperbody, grey, merging to grey-black on face (lower forehead, narrow line along upper edge of supercilium, lores and ear-coverts) with contrasting white chin and throat, prominent short white supercilium above and just in front of eye, and short white streak through upper ear-coverts. Uppertail largely grey-black, clearly contrasting with slightly paler grey upperbody, and with: narrow white outer edge to tail, narrow white tips to outer three feathers (t3–t5, with white tips extending well along inner edges of feathers), contrastingly paler grey inner webs to outer rectrices (t3–t5), and white shafts to all but central pair (t1) of rectrices; when spread, uppertail appears blackish in centre, with paler grey outertail boldly streaked and narrowly edged and tipped white. In fresh plumage, folded wing marked with prominent narrow double white wing-bars across median and greater secondary coverts and narrow white fringes to tertials and inner few secondaries; folded wing becomes increasingly browner and more uniform with wear, with white edges of tertials and secondaries less prominent and white wing-bars reduced to chains of scruffy white spots before disappearing altogether. Underbody mostly cream, fading to off-white with wear, and separated from white of throat by prominent narrow grey-black band across upper breast, and with grey wash to sides of breast. Closed undertail distinctive, with dark brown-grey base narrowly edged white and extending in tapering dark 'fingers' into broad white area at tip (formed by strongly graduated white tips of rectrices). Bill, black with contrasting flesh or cream base to lower mandible (usually apparent in side view and obvious from below); gape, black or cream. Iris, black-brown. Legs and feet, grey-black. VARIATION: TAS. AND BASS STR. ISLANDS (*albiscapa*): Very similar to birds of mainland se. Aust. (above), differing by: Upperparts slightly darker, sooty grey, usually with brown cast to saddle, appearing almost concolorous with

blackish uppertail-coverts and uppertail, and contrasting little with blackish face; usually have narrower white edges and tips to inner webs of rectrices, most obvious on closed undertail, and giving generally darker appearance to spread uppertail; and underbody richer, buff, with more extensive and darker sooty-grey wash on sides of breast (reaching onto fore-flanks) and slightly broader and consistently black breast-band. With experience, most migrant *albiscapa* usually separable from *alisteri* in fresh plumage in autumn and early winter by combination of above differences. However, some not safely separable owing to individual variation and overlap in colour of upper-parts and amount of white in tail (e.g. some *alisteri* have rather dark-grey upperparts approaching *albiscapa*, though typically have more white in tail; while some *albiscapa* have similar amount of white in tail to typical *alisteri*, though typically have richer buff underbody and other ventral pattern differ-ences of *albiscapa*). Separation much more difficult in late winter and spring, when both forms in worn plumage and colour of underbody little different; then best separated by differences in colour of upperparts and pattern of tail. NE. QLD (*keasti*): Distinctive melanistic form of upland rainforests, like darker version of Tas. *albiscapa*. Differ from birds of mainland se. Aust. by: upperparts much darker, grey-black, appearing concolorous with blackish tail and almost so with black face; white wing-markings average narrower; tail usually darker (as *albiscapa*); have dusky spot on chin (visible from below, and faint or absent in *alisteri*); and underbody richer, cream-buff when fresh, with more extensive and darker sooty-grey wash on sides of breast (extending along most of flanks) and clearly broader and consistently black breast-band. CENTRAL AND INLAND AUST. (*albicauda*): Palest and whitest-tailed Aust. form. Differ from birds of mainland se. Aust. by: Upperparts slightly paler grey and face slightly paler, greyer and less con-trasting; white wing-markings slightly broader; underbody slightly paler, creamy white, with slightly paler grey wash on sides of breast and slightly paler and greyer breast-band. Much whiter tail is clearest distinction: central pair blackish, but rest entirely white except for progressively shorter and narrower dark edges to outer webs of t2–t5, so that spread uppertail appears largely white except for contrasting blackish centre, and closed undertail appears almost wholly white. NORFOLK I. (*pelzelni*): Very similar to birds of mainland se. Aust. but: grey of upperparts tinged brown; breast-band slightly narrower and greyer; white margins of tertials and secondaries finer, and white wing-bars much finer or obsolete; and white fringes of outer rectrices narrower and duller, off-white. SI, NZ (nomi-nate *fuliginosa*): Broadly similar to *alisteri* of mainland se. Aust. but with much more white in tail. Differs from se. Aust. birds by: No white streak on ear-coverts, and many are strongly suffused grey on chin and upper throat, reducing area of clean white to lower throat, which in some postures often shows as narrow white band above dark breast-band. Mantle, back, rump and scapulars, dark brown, giving noticeable contrast with dark-grey head and neck. On uppertail, all rectrices have prominent white shafts, and blackish central pair (t1) are nar-rowly tipped white and give striking contrast with narrowly dark-edged but predominantly (t2–t5) or wholly white (t6) rest of rectrices (giving tail-pattern reminiscent of inland Aust. *albicauda*). Wing-bars usually white but tinged light brown in some. Underbody richer, light brown or yellow-brown, with narrow zone of fine dusky mottling or coarser dusky blotching immediately below narrow to rather broad blackish breast-band. NI, NZ (*placabilis*): As *fuliginosa* of SI but white inner webs of outer rectrices (t2–t6) weakly suffused dusky, giving less cleanly white-tailed appearance. CHATHAM IS (*penita*): As *fuliginosa* of SI but dark central rectrices (t1) have slightly broader white tip (extending up edges as fringe), and dark edges of rest of rectrices narrower and do not abut shafts, giving whiter-tailed appearance. **Juvenile** Similar to adults of respective subspecies but plumage has slightly softer, looser texture and is suffused rufous-brown. Differ from respec-tive adults by: Grey of head and neck finely suffused rufous-brown, with small and diffuse rufous-brown to buff patch on ear-coverts (faint or lacking in some in Aust. and absent in NZ and Chatham Is subspecies); more diffuse, and rufous-brown to buff supercilium and ear-streak (with supercilium over and behind eye, not over and in front of eye); and grey suffusion to white chin and throat. Rest of upperbody suffused rufous-brown, most strongly on back, rump and uppertail-coverts. Breast and fore-flanks strongly suffused rufous-brown, often reducing prominence of dark breast-band and grey wash on sides of breast. On folded wing: marginal secondary coverts diffusely tipped rufous-brown to buff; wing-bars tend to be slightly broader and always duller, buff; and tips of alula feathers narrowly tipped rufous-brown to buff. Bill, as adult or slightly duller and greyer, with larger and brighter flesh, orange or orange-brown base to lower mandible (extending onto basal cutting edges of both mandibles and appearing more promi-nent in side view, and covering basal half or so of bill when viewed from below); at fledging, gape puffy and paler, flesh, orange, pale yellow or off-white, later changing to grey; and legs and feet, dark grey in Aust. and on Norfolk I., pale grey in NZ and on Chatham Is. **Immature** As adults of respective subspecies, but retain juvenile remiges, rectrices, alula, greater primary coverts and varying number of greater secondary coverts. Best distinguished in autumn and early winter by: (1) usually obvious moult-contrast in greater secondary coverts between new, adult-like and white-tipped inner coverts and buff-tipped juvenile outer greater coverts; (2) narrowly buff-tipped feathers of alula (lacking clear pale tips in adult); and (3) at first, pale (yellowish or yellowish-orange) gape, and more extensive and prominent pale base to lower mandible (including basal cutting edges of mandibles [cf. dark tomia and gape of adult]). Note that close and sustained views often required to discern buff-tipped outer greater coverts and feathers of alula, especially in those retaining only a few such outer coverts; also because often hidden by overlapping feathers on flanks. Moreover, immatures become increasingly difficult to identify over winter, as bare parts become more like those of adult, and buff tips wear and fade so that most not safely separable from adult in spring unless at least a trace of one or more age-diagnostic buff-tipped feathers discernible. BLACK MORPH of NI and SI, NZ: **Adult** Wholly sooty black, suffused brown on saddle and merging to chocolate-brown on under-body, usually with small white spot on upper rear corner of ear-coverts. **Juvenile** Differ from adult in much the same ways as juvenile and adult pied morph; similar to adult but with rufescent suffusion throughout. Differences from adult black morph: Head and neck, sooty black suffused with rufous-brown and grading to dark grey on chin and throat, with prominent rufous-brown supercilium centred over eye (as pied morph); upperbody suffused rufous-brown; underbody strongly suffused dark rufous-brown on breast and grading to paler rufous-brown on belly, vent and flanks, with undertail-coverts diffusely tipped same; and folded wing marked with red-brown tips to marginal and greater secondary coverts. Bare parts as pied-morph juvenile. **Immature** Differ from adult in much the same ways as described for pied morph. Best distinguished in autumn and early winter by: (1) obvious moult-contrast in greater secondary coverts between adult-like new wholly blackish inner coverts and varying number of rufous-tipped juvenile outer coverts; (2) narrowly rufous-tipped alula feathers (lacking pale tips in adult); and (3) same bill and gape char-acters as pied-morph juvenile.

Similar species The only fantail in NZ and on Norfolk I., and unmistakable. Unlikely to be confused over most of Aust. range, where only fantail with predominantly grey plumage, and easily recognized by combination of (1) small size; (2) long,

strongly graduated fan-like tail, with greyish outer rectrices prominently edged, tipped and streaked white; (3) predominantly grey upperparts with broken white supercilium and double white wing-bars; (4) cream to buff underbody separated from contrasting white chin and throat by narrow dark breast-band; (5) active and restless behaviour, with wings often lowered slightly and tail angled up and constantly fanned and swung from side to side; and (6) high-pitched *chip* Contact call and squeaky ascending whistled Song. These characters readily distinguish it from **Rufous Fantail** and, in n. Aust., from superficially similar but distinctly bigger and much more sedate **Northern Fantail**; see those texts for details. Main identification problem is need to separate migrant Grey Fantails (*alisteri* and *preissi*) from very similar but smaller and paler **Mangrove Grey Fantail**; see that text for full distinctions).

Usually seen singly or in twos; sometimes in loose feeding flocks of up to 30 birds during autumn and winter dispersal and, exceptionally, in flocks of 100–300 birds. Often join mixed-species feeding flocks of mostly small insectivorous passerines. Conspicuous, noisy and usually confiding, often allowing close approach. Restlessly active, more so than other fantails: almost continually on the move, switching back and forth on perch, often with wings lowered and tail held partly cocked, swung from side to side and often widely fanned; and calling often. Forage by fluttering about undergrowth and lower to mid-levels of canopy, spiralling up and down trunks of trees and zigzagging out along branches in search of insect prey; often also hover and flutter in upper canopy of tall trees, and sally for insects by setting out from perch in remarkably intricate aerobatic flights which sometimes carry bird for 50 m or more, twisting, turning and looping this way and that before returning to perch; very occasionally seek prey on ground. Common calls characteristic, and include: repeated sharp high-pitched single or double *chip* or *cheep* notes to maintain contact; and Song (usually uttered from perch): a cheery outpouring of high-pitched squeaky and usually ascending series of eight to ten short notes with twangy whistled quality, often ending in several drawn-out rising notes of silvery quality.

HABITAT   Occupy wide range of habitats in Aust. and NZ, on Norfolk and Chatham Is and, formerly, on Lord Howe I., and all described separately below. **Aust.** Occur in many habitats, preferring eucalypt forests and woodlands and, inland, acacia shrublands and woodlands; also inhabit rainforest, riparian vegetation, shrublands and heathlands (Ridpath & Moreau 1966; Bravery 1970; Recher 1975; Roberts & Ingram 1976; Mills 1984; Cameron 1985; Loyn 1985b; Green 1995; Saunders & Ingram 1995; Johnson & Mighell 1999; Aust. Atlas 1; Hall); and often occur in rural and suburban parks and gardens. Recorded from coasts (Cooper 1947; Serventy 1948; Smith 1984; Loyn 1985b; Gosper 1992) to subalpine regions (Ridpath & Moreau 1966; Wheeler 1966; Anon. 1977; Gall & Longmore 1978; Osborne & Green 1992) and, rarely, in alpine region (Osborne & Green 1992). In Vic., leave wet upland forests during autumn and winter, moving into drier habitats, including mallee scrubs (Loyn 1985a; Vic. Atlas); in ne. Qld (*keasti*), confined to upland rainforest (Aust. Atlas 1). **NZ** Occur wherever there are trees and shrubs, either native or introduced, that provide cover (Turbott 1967), including native forests, plantations of exotic pines, suburban gardens, farmland and orchards (St Paul 1975; Moon 1992; Freeman 1994; Heather & Robertson 1997; see below). Occur from coasts to elevations of up to 1500 m asl (Riney *et al.* 1959; Onley 1980; Heather & Robertson 1997), though usually recorded at low and mid-altitudes (Wilkinson & Wilkinson 1952; Sibson 1958; Skegg 1964; Guest 1975; Dawson *et al.* 1978; Elliott & Ogle 1985; Wilson *et al.* 1988; Freeman 1999). Often recorded in gullies

and lower slopes of valleys (Challies 1966; CSN 19 Suppl.). Scarce in dry open country of some inland areas that are prone to severe frosts and snow in winter (Heather & Robertson 1997).

Aust. Mainly inhabit SCLEROPHYLL FORESTS AND WOODLANDS, usually dominated by eucalypts and with dense to moderately dense and low to tall shrub understorey; much less often in habitats with no shrubs but with grassy understorey (Kikkawa *et al.* 1965; Recher *et al.* 1971; Roberts & Ingram 1976; Driscoll 1977; Emison & Porter 1978; Degabriele *et al.* 1979; Ford *et al.* 1985; Loyn 1985b; Gibson & Cole 1988); said to prefer forests or woodlands with dense shrub layer, and either an open subcanopy in which to forage (Wykes 1985) or continuously layered without open subcanopy (Beck & Chan 1999); on Northern Tablelands of NSW, recorded least often in woodland habitats that contained fewer shrubs per ha and more trees per ha (Chan 1995); and in Brisbane, se. Qld, recorded at lower densities in large eucalypt remnants where shrubby understorey had been removed (Sewell & Catterall 1998). In Vic., recorded in all forest and woodland types from coast to inland, but most abundant in coastal dry sclerophyll forests, wet sclerophyll forests of foothill gullies and uplands, and dry sclerophyll forests of foothill ridges (Loyn 1985a,b; Vic. Atlas); most numerous in forests and woodlands with Silver Wattle or Late Black Wattle *Acacia mearnsii* in understorey (Vic. Atlas). Commonly in WET SCLEROPHYLL FORESTS dominated by eucalypts such as Tallow-wood, Blackbutt, Red Mahogany, Mountain Ash, Brown Barrel, Mountain Gum, Manna Gum, Mountain Grey Gum, Narrow-leaved Peppermint or Messmate and Karri, and usually with dense understorey of low to tall shrubs, small acacia trees and tree-ferns (Driscoll 1977; Abbott 1981; Smith 1984, 1985; Loyn 1985a,b, 1993; Gosper 1992; Mac Nally 1997); in open EUCALYPT WOODLANDS with dominants such as Broad-leaved Stringybark, Blakely's Red Gum, Manna Gum, Yellow Box, Yellow Gum, Pink Gum, Wandoo and Powderbark *Eucalyptus accedens*, usually with a shrub layer containing various species including *Acacia*, *Hibbertia* and *Bossiaea* (Ford & Bell 1981; Nichols & Nichols 1984; Halse *et al.* 1985; Ford *et al.* 1986; Arnold 1989; Chan 1995; Possingham & Possingham 1997; Er *et al.* 1998; Recher & Davis 1998); and in DRY SCLEROPHYLL FORESTS dominated by eucalypts such as Spotted Gum, Silvertop Ash, Woollybutt, White Stringybark, Brown Stringybark, Broad-leaved Stringybark, River Red Gum and Jarrah, often with a patchy to dense and low to tall understorey of acacias, banksias, paperbarks or other shrubs, often heathy, and small trees (Chesterfield *et al.* 1984; Nichols & Nichols 1984; Smith 1984, 1985; Wooller & Calver 1988; Gosper 1992; Loyn 1993; Chan 1995; Recher & Davis 1998). Often recorded in eucalypt forests and woodlands regenerating after disturbance, such as logging or fire, and in remnant patches of habitat (Chesterfield *et al.* 1984; Smith 1984, 1985; Loyn 1985a,b; Kutt 1996; Taylor *et al.* 1997; see Threats and Human Interactions). Sometimes occur in OPEN MALLEE WOODLAND OR SHRUBLAND (Howe & Burgess 1942; Rix 1943; Jones 1952; Close & Jaensch 1984; Possingham & Possingham 1997), especially in autumn and winter in Vic. (Vic. Atlas), and including mallee eucalypt woodland with ground-cover of spinifex *Triodia*, and mixed eucalypt–Mulga or eucalypt–Moonah *Melaleuca lanceolata* associations (Ford 1971; said to avoid dense mallee (Mack 1970). Inland, widespread in ACACIA WOODLANDS, SHRUBLAND OR THICKETS, especially those dominated by Mulga, but also Brigalow or Pindan associations, sometimes with scattered eucalypts admixed, and with understorey of shrubs such as *Cassia* or *Eremophila* (Shilling 1948; Sedgwick 1964; Storr 1965; Ford 1971; Roberts 1980; Gibson 1986; Leach & Watson 1994; Recher & Davis 1997; Storr 7, 16). Occasionally recorded in OTHER SCLEROPHYLL ASSOCIATIONS, including: mixed *Eucalyptus–Banksia* communities,

such as low coastal forest dominated by Coast Banksia and Southern Mahogany (Smith 1984; Possingham & Possingham 1997); low banksia woodland dominated by Firewood Banksia *Banksia menziesii* and Slender Banksia *B. attenuata*, over floristically diverse heath layer (Tullis *et al.* 1982); woodlands of cypress pine *Callitris* or Belah (Jones 1952; Cooper 1972); and low woodland of Black Sheoak (Roberts & Ingram 1976). Often occur in RIPARIAN OR LITTORAL vegetation, dominated by eucalypts, acacias, casuarinas or paperbarks or combinations of these (White 1946; Storr 1953; Sedgwick 1964; Clarke 1967; Napier 1969; Ford 1971; Baldwin 1975; Schodde 1976; Wyndham 1978; Badman 1979; Wykes 1985; Woinarski *et al.* 1988; Chan 1995; Johnson & Mighell 1999; Storr 16; ACT Atlas; NSW Bird Rep. 1989; also see sclerophyll forests and woodlands above); in Top End, NT, recorded in small numbers in riverine vegetation consisting of various combinations of screw-palms *Pandanus*, eucalypts, paperbarks, casuarinas, *Lophostemon*, Leichhardt Tree and figs *Ficus* (Woinarski *et al.* 2000); and in sw. Qld and ne. SA, recorded among dense Lignum (Cox & Pedler 1977; Schrader 1981). Once recorded among willows along Murray R. (Rix 1943). Sometimes also recorded in or at edges of RAINFORESTS, including: tropical rainforests and dry monsoon forest, such as mixed mesophyll or complex notophyll vine forests (Wheeler 1967; Bravery 1970; Crome 1978; Frith 1984; Griffin 1995; Laurance *et al.* 1996; Johnson & Mighell 1999); subtropical rainforests (Kikkawa *et al.* 1965; Howe *et al.* 1981; Gosper 1992); warm-temperate rainforests dominated by Lilly Pilly (Smith 1984; Loyn 1985b); and cool-temperate rainforest dominated by Myrtle Beech (Ridpath & Moreau 1966; Anon. 1977; Aust. Atlas 1). SHRUBLANDS AND HEATH: Sometimes recorded in coastal shrubland, e.g. dominated by tea-tree or Sallow Wattle (Recher 1975; Green 1995; Thoday 1995) or occasionally shrub heathland (Ridpath & Moreau 1966; Abbott 1976; Rose 1980; McFarland 1988). Occasionally occur in samphire and saltbush, sometimes with scattered trees (Matheson 1976; Halse *et al.* 1985). Sometimes recorded among MANGROVES (Matheson 1976; Roberts & Ingram 1976; Schodde 1976; Storr 16; Hall). MODIFIED HABITATS: Often recorded in rural and suburban parks and gardens (Brown 1950; Binns 1953; McEvey 1965; Napier 1969; Sedgwick 1973, 1988; Masters & Milhinch 1974; Nichols & Nichols 1984; Wieneke 1988; Green *et al.* 1989; Slater 1995; Woodall 1995; Wood 1996; ACT Atlas), and occasionally in orchards (McEvey 1965; Ridpath & Moreau 1966; Fielding 1979), plantations of exotic pines, especially mature stands with shrubby understorey (Hobbs 1961; Pawsey 1966; Disney & Stokes 1976; Driscoll 1977; Friend 1982; Debus 1983; Traill 1985) and in remnant strips of roadside vegetation, surrounded by otherwise treeless paddocks (J.M. Peter).

NZ Mainly inhabit MIXED NATIVE PODOCARP–HARDWOOD FORESTS (CSN 19 Suppl.), usually also with beech *Nothofagus* and with subcanopy of taller shrubs or small trees (including Kamahi *Weinmannia racemosa*) and understorey of shrubs and tree-ferns (including Soft Tree Fern *Cyathea smithii*, *Ripogonum* and *Coprosma*). Forests dominated by various combinations of PODOCARPS, such as Rimu *Dacrydium cupressinum*, Kahikatea *Dacrycarpus dacrydioides*, Totara *Podocarpus totara* or Miro *Prumnopitys ferruginea*; HARDWOODS (broadleafs) such as Hinau *Elaeocarpus dentatus*, Kamahi or rata *Metrosideros*; and BEECH such as Hard Beech *Nothofagus truncata* (Riney *et al.* 1959; Challies 1962, 1966; Guest 1975; Onley 1980, 1983; Clout & Gaze 1984; Fitzgerald *et al.* 1989; McLean 1989; CSN 19 Suppl.). Less often in BEECH FORESTS (Riney *et al.* 1959; CSN 19 Suppl.;), mainly mixed forests, such as those dominated by Red *Nothofagus fusca*, Silver *N. menziesii* and Mountain Beech *N. solandri*; occasionally in pure Mountain Beech forest (Guest 1975). Often recorded in riparian forests (Graham 1948; Challies 1962, 1966; St Paul 1975; CSN 38).

Also often recorded in forests regenerating after disturbance, such as logging (St Paul 1975; Reed 1976; Onley 1980; Freeman 1999), and also in clearings in forest (Blackburn 1967; St Paul 1975). Sometimes also occur in dense MANUKA OR KANUKA SCRUB, usually with sparse grassy understorey (Dawson 1950; Hunt & Gill 1979; CSN 19); in Kowhai Bush, mainly in Manuka–Kanuka scrub with a sparse grassy ground-cover, and less often where undergrowth moderately dense and dominated by French Broom *Cytisus monspessulanus* and Tutu *Coriaria arborea*, and least often where understorey diverse and dense (Hunt & Gill 1979). Sometimes move from forests and woodlands into open habitats during autumn–winter (Moncrieff 1929, 1931; Hodgkins 1949; Dell 1959; CSN 1; *contra* Gibb 2000b). Once recorded among mangroves in far N of NI (CSN 31). MODIFIED HABITATS: Often occur in plantations of exotic conifers, such as pines or firs, including Monterey Pine, *Pinus nigra*, *P. ponderosa* and *Pseudotsuga taxifolia* (Lindsay *et al.* 1959; Gibb 1961; Falla *et al.* 1979; Clout & Gaze 1984), especially where in less dense stands, and with patchy understorey of native shrubs (Weeks 1949). Also often recorded in rural and suburban parks and gardens (Moncrieff 1931; Secker 1963; Turbott 1967; Stidolph 1973; Falla *et al.* 1979; Guest & Guest 1987; Gill 1989; Cooper 1991; CSN 19 Suppl., 35, 38); round Hamilton, NI, most abundant in urban gardens with high proportion of native plants (Day 1995). Also recorded in farmland with scattered trees, shelter belts or hedgerows (Edgar 1974; Falla *et al.* 1979; Heather & Robertson 1997); and in orchards (Baker 1980; CSN 37, 39).

**Lord Howe I.** Said to have inhabited open forest (Hutton 1991); no other information.

Norfolk I. Occur in most habitats with trees or shrubs, ranging from rainforest to ornamental gardens, commonly using modified habitats (Turner *et al.* 1968; Smithers & Disney 1969; De Ravin 1975; Hermes 1985).

Chatham Is Occur in open forest dominated by Tarahinau *Dracophyllum arboreum*, Chatham Islands Karamu *Coprosma chathamica*, *Pseudopanax chathamica* and Chatham Island Violet *Hymenanthera chathamica* (Dennison *et al.* 1978).

Snares Is Recorded in *Olearia* forest and in *Olearia–Senecio stewartiae* shrubland (Horning & Horning 1974).

DISTRIBUTION AND POPULATION Occur San Cristobal I. in s. Solomon Is, Vanuatu (including Banks Is) and New Caledonia (including Loyalty Is) in sw. Pacific Ocean (Delacour 1966; Stokes 1980; Bregulla 1992; Doughty *et al.* 1999). Widespread in Aust. and NZ and associated islands, and Chatham Is.

Aust. Widespread, especially in E and SW. **Qld** Widespread, though sparsely scattered in Western Central Region (Aust. Atlas 1, 2; Storr 19), and absent from islands in Torres Str. (Draffan *et al.* 1983). **NSW** Widespread, but scattered in Upper and Lower Western Regions (Morris *et al.* 1981; Cooper & McAllan 1995; Aust. Atlas 1, 2; NSW Bird Reps). **Vic., Tas.** Widespread (Thomas 1979; Aust. Atlas 1, 2; Vic. Atlas). **SA** Widespread in area from n. Flinders Ras, S to coast and W to Eyre Pen. (Ford 1981; Aust. Atlas 1, 2). Recorded at a few scattered sites elsewhere, including: in NE, e.g. Dalhousie Springs (Cox & Pedler 1977; Badman 1979, 1989; Ford 1981; Aust. Atlas 1, 2); in SW, e.g. near Yalata and Border Village (Carpenter & Matthew 1997); and in NW, in Everard Ras and Krewinkel Hill (Close & Jaensch 1984) and at Stockyard Bore, near Fregon Stn (Aust. Atlas 2). **WA** Recorded in all areas except e. deserts, where occur only very occasionally (Ford 1971, 1981; Aust. Atlas 1, 2). Recorded at scattered sites on Nullarbor Plain (e.g. Brooker *et al.* 1979; Ford 1981; Congreve & Congreve 1985; Ashton *et al.* 1996; Aust. Atlas 1). Widespread in area S and W of line joining Newman Rock and Carnarvon (Ford 1971, 1981; Saunders & Ingram 1995; Aust. Atlas 1, 2; Storr 21, 27, 28) with other
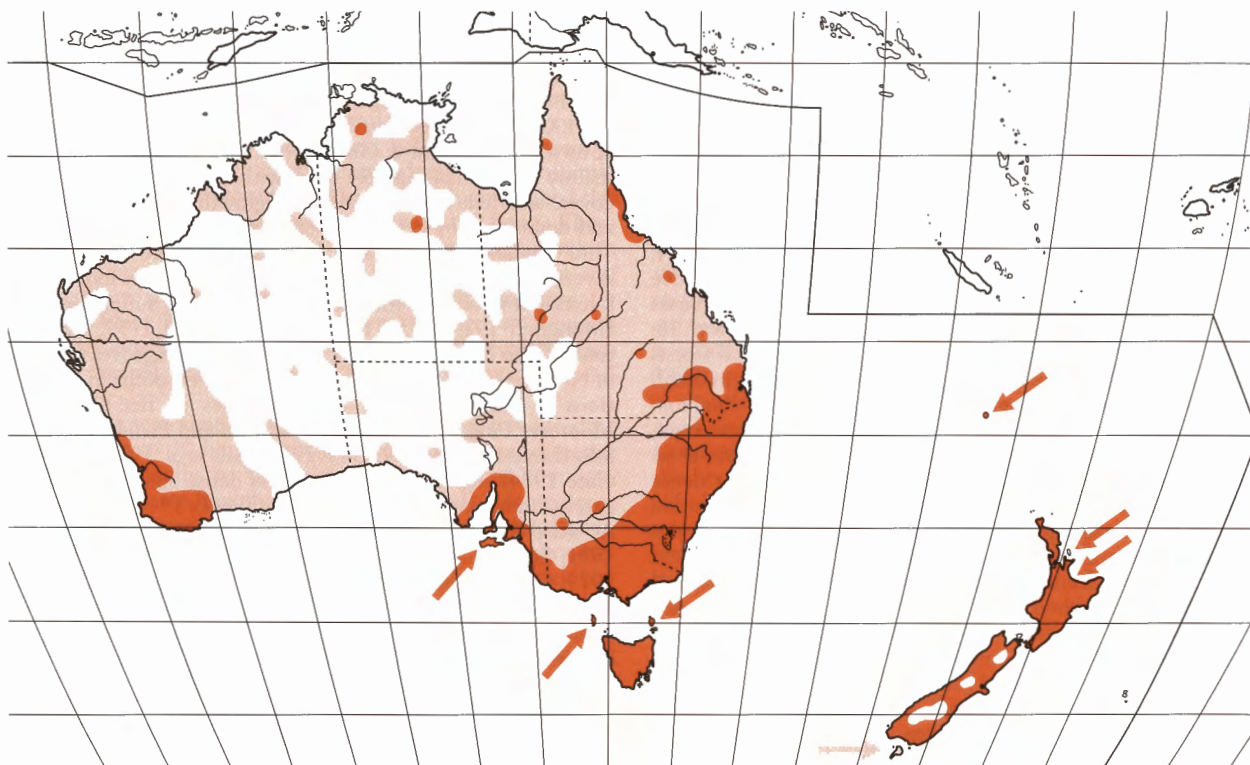
records farther inland in South-eastern Interior Region (Ford 1981; Storr 26). In Pilbara Region, mostly recorded along major rivers; and scattered in Kimberley Div., mainly in SW and S, but occasionally farther N, from Prince Regent R. to Kununurra (Storr *et al*. 1975; Aumann 1991; Aust. Atlas 1, 2). **NT** Widespread but scattered in Top End, mainly S to *c*. 16°S, though largely absent from Arnhem Land. Farther S, scattered records at a few sites S of Barkly Tableland, from Muckaty Stn, N of Tennant Ck, E to near Brunette Downs, and in Tanami Desert. Still farther S, recorded from Kings Canyon E to round Alice Springs, with isolated records farther W at Sandy Blight Junction, and farther E to Field R. in Simpson Desert (Rix 1970; Roberts 1980; Ford 1981; Gibson 1986; Gibson & Cole 1988; Goodfellow 2001; Storr 7; Aust. Atlas 1, 2).

NZ NI: Widespread, including most offshore islands, e.g. Great and Little Barrier Is (NZ Atlas; CSN). **SI**: Widespread in most areas, though absent or very sparsely scattered in uplands of Marlborough (Inland Kaikoura Ras), Canterbury and Otago. Also occur on most offshore islands, including Stewart I. (NZ Atlas; CSN).

Lord Howe I. Extinct. Probably died out between 1924 and 1928 (Hindwood 1940; see Threats and Human Interactions, below). Formerly common (Hutton 1991).

Norfolk I. Widespread (Schodde *et al*. 1983).

Chatham Is Occur on Chatham, Pitt and South East Is (Freeman 1994; Nilsson *et al*. 1994; CSN).

Snares Is Widespread breeding resident; third most common passerine (Miskelly *et al*. 2001). Three records of vagrants before 1980s (all singles): specimen, before 1905 (Buller 1905); records, 24 Mar.–7 Sept. 1972 and 29 Jan. 1975 (Horning & Horning 1974; Horning 1976). Apparently colonized Snares between 1977 and 1981 (see Change in range, populations, below).

Breeding Isolated record at Edward R., w. C. York Pen. (Garnett & Bredl 1985). In NE, recorded in Atherton Region (Wet Tropics), and in Eungella NP. Widespread along Great Divide, from se. Qld, through e. NSW and e. and s. Vic., to Eyre Pen., SA (Aust. Atlas 1, 2; NRS). Also widespread in

sw. WA, though not recorded in some parts of Wheatbelt (Ford 1971). A few isolated records elsewhere (Aust. Atlas 1, 2; NRS). Widespread throughout NZ (CSN), and on Norfolk (Schodde *et al*. 1983), Snares (Miskelly *et al*. 2001) and Chatham Is (Freeman 1994; Nilsson *et al*. 1994).

Change in range, populations Populations on Redcliffe Pen., se. Qld, have declined since vegetation cleared (Bielewicz & Bielewicz 1996). Numbers recorded in Sydney Harbour NP said to have 'declined in recent decades' (Morris 1986). Apparently colonized Snares Is in late 1970s or early 1980s; vagrants recorded till 1977, but several birds present in June 1981, and large population observed in Dec. 1982; by early 2000s, third most common passerine (Miskelly *et al*. 2001). On Chatham Is, populations fluctuate greatly; declines associated with prolonged periods of cold or unusually severe climatic conditions (Nilsson *et al*. 1994); similar fluctuations recorded elsewhere in NZ after harsh seasons (e.g. Heather & Robertson 1997; Wood 1998; CSN 20, 37, 38).

Populations   RECORDED DENSITIES: In AUST.: 2.44 birds/ha (4.6; 1.0–3.6; 10 sites), Rockhampton, Qld (Beck & Chan 1999); 0.08–0.92 and 0.01–0.15 birds/ha, near Armidale, NSW (Ford & Bell 1981; Ford *et al*. 1985); 0.2–0.8 birds/ha, Wollomombi, NSW (Aust. Atlas 1); 0.25–5.25 birds/ha, near Bathurst, NSW (Disney & Stokes 1976); 1.3 birds/ha, Hawkesbury R., NSW (Keast 1985); up to 0.19 birds/ha, Puckeys Reserve, near Wollongong, NSW (Wood 1995); 0.04–1.84 birds/ha, near Canberra (Bell 1980b); 0.4–1.0 birds/ha, Moruya, NSW (Marchant 1992); 0.1–2.2 birds/ha, near Eden, NSW (Kavanagh *et al*. 1985); 1.9–2.03 birds/ha, near Bombala, se. NSW–ne. Vic. (Recher & Holmes 1985); 0.70–0.89 birds/ha, Cabbage Tree Ck, Vic. (Loyn 1993); 0.6–1.2 birds/ha, Jamieson, Vic. (Aust. Atlas 1); maximum of 0.95 birds/ha, Olinda SF, Vic. (Mac Nally 1997); 1.11 birds/ha, near Campbell Town, Tas. (Recher *et al*. 1971); 0.14–0.64 birds/ha, near Woodsdale, Tas. (Taylor *et al*. 1997); 1.2 birds/ha, Margaret R., WA (Keast 1985); 0.07 birds/ha, Wellard, WA (Plumb 1948); 0.08–0.24 birds/ha, Howards Pen., NT (Woinarski *et al*. 1988; see Habitat). In NZ: 0.59

breeding birds/ha, Taranga (Hen) I., Hen and Chickens Grp, NZ (Turbott 1940); 0.07 and 0.05 birds/ha, Kaingaroa Forest, NI (Gibb 1961). TRANSECT COUNTS: 0.54 birds/100 m along 1.2 km transect, New England NP, NSW (McFarland 1984); 0.22–4.17 birds/100 m along 600-m transect, near Morwell, Vic. (Traill 1985). At Rotorua, NI, *c.* 90 seen along *c.* 450 m of Whaka Ck (CSN 6).

Status Norfolk I. subspecies vulnerable; extinct on Lord Howe I. (Garnett & Crowley 2000).

THREATS AND HUMAN INTERACTIONS Often recorded in regenerating forest after disturbance such as logging, bushfire or mining (Onley 1983; Loyn 1985a,b, 1998; Freeman 1999; see below). However, response to such disturbance varies: in some studies, densities or abundance differ little between mature or old-growth habitats and disturbed habitats (e.g. Wykes 1985; Reilly 1991; Loyn 1998; see Habitat); in other studies, more abundant or at higher densities in more mature habitats than more recently disturbed habitats (Kutt 1996; Laurence *et al.* 1996; see Habitat), e.g. in Karri forests of s. WA, found mainly in 10–12-year-old regrowth and mature forests and less often in 3–5-year-old regrowth (P. Atkinson), and near Eden, se. NSW, most abundant in unburnt–unlogged and unburnt–logged sites, and much less abundant in burnt–unlogged sites and burnt–logged sites (Recher *et al.* 1985a). Also use remnant patches of habitat of varying size, e.g. in subtropical rainforest of NE. In NSW common to abundant in small forest patches 0.1–0.75 ha and 1.0–2.5 ha in area (Howe *et al.* 1981). In suburbs and remnant forests and woodlands of Brisbane, found mainly within large forest remnants (>500 ha), and less often in small remnants and parkland habitat consisting of a few large trees with a cleared understorey, and absent from suburban sites (Evans *et al.* 1997; Hudson *et al.* 1997). In NZ, recorded from small, fragmented bush remnants, degraded by grazing animals (Freeman 1999).

Often killed by Cats (ABBBS 1991; Dowling *et al.* 1994; Gibb 2000a). Extirpated on Lord Howe I. soon after rats introduced in 1918; practically wiped out by 1924, and not recorded in 1928 (Sharland 1929; Hindwood 1940). Occasionally killed by cars (Kinsky 1965; Brown *et al.* 1986; Lepschi 1992). In NZ, eggs eaten by introduced Common Brushtail Possums *Trichosurus vulpecula* (Brown *et al.* 1993) and Common Mynas *Acridotheres tristis* (Blackburn 1966).

MOVEMENTS Complex and varying geographically, and not fully understood. Throughout range, partly resident or sedent-ary, and partly migratory. In some places, local populations wholly or partly replaced, or augmented, by migrants from elsewhere. In Aust. and Tas., much more widely distributed in autumn–winter–spring, when on passage or wintering, than in summer (Keast 1958; Ford 1981; Ford 1985; Ambrose 1991; Aust. Atlas 1, 2; see below). In analysis of e. Aust. Atlas movement and distributional data, strong evidence for whole e. coast pattern of movement (Griffioen & Clarke 2002). Patterns of movements vary with subspecies: *keasti* of ne. Qld uplands resident or sedentary; *alisteri* of se. mainland Aust., partly resident and partly migratory, latter mainly moving N and W from breeding range, to n. Aust. and possibly New Guinea; *albiscapa* of Tas. and islands of Bass Str. also partly resident and partly migratory, migrants crossing Bass Str. in autumn, to winter in mainland se. Aust., as far N as Richmond–Tweed Rs in ne. NSW; *preissi* of sw. WA partly resident and partly migratory or dispersive, with movement N and E in late summer to winter; movements of *albicauda* of nw. SA–central inland WA–s. NT poorly known, and often described as nomadic, or occurring irregularly, with movements or presence possibly determined by seasonal conditions; *placabilis* and nominate *fuliginosa* of NI and SI of NZ, mainly

resident, but with seasonal occurrences; subspecies of Norfolk (*pelzelni*) and Chatham (*penita*) Is sedentary or resident (Ford 1971, 1981; Aust. Atlas 1, 2; DAB; see below). Subspecies discussed separately below. Within breeding and wintering ranges in Aust. and NZ, undertake some apparently local movements (Keast 1958; Ford 1981; Ford 1985; Ambrose 1991; Aust. Atlas 1; see below). Further, occurrence or abundance at some sites in Aust. irregular, possibly related to seasonal conditions: e.g. in NSW, extend farther W, or occur there in larger numbers, in winter when conditions good (NSW Bird Reps 1973, 1987); occur in interior of WA only during good seasons (Ford 1980, 1981); and suggested that movements in Wheatbelt of WA influenced by availability of water (Sedgwick 1949b). Sometimes described as nomadic in Aust. (see below), possibly in reference to such local movements, or irregularity of occurrence and abundance. In NZ, movements possibly associated with availability of food (Moncrieff 1929; see below). NATURE OF PASSAGE: On migration in Aust., often in small to large flocks of up to 40 birds and occasionally hundreds; and large numbers sometimes seen in a continuous stream flying through an area (Hobbs 1961; Burbidge 1985; Anon. 1989; Dow & Dow 1989; Garnett *et al.* 1991; Rolland & Rolland 1996b; NSW Bird Reps); also seen on passage singly and in pairs; see Social Organization for details of gregariousness throughout year. In sw. NSW, birds arrived in non-breeding range on a broad front singly or in small parties, while those leaving on migration in spring tended to congregate into large loose flocks of up to 200 (Hobbs 1961). On Wilsons Prom., Vic., autumn passage described as spasmodic; and birds appear to arrive mostly during morning, 05:00–12:00, on days with light or varying winds (Garnett *et al.* 1991). Autumn departure from ACT more abrupt than arrival (ACT Atlas). Very regular in their dates of arrival and departure round Maryborough, Qld (Jones 1981) and Mildura, Vic. (Thomas 1962). Birds caught Wilsons Prom. during autumn passage weighed much less than those caught on Deal I. during autumn passage and those caught at Wilsons Prom. on return passage in following spring (Garnett *et al.* 1991). Able to cross large stretches of water: regularly cross Bass Str. between Tas. and mainland se. Aust. (see below); several seen passing boat off Torquay, flying towards land from SE (Dedman 1998). In Noises Is, NZ, one banded bird crossed 150 m of open water to adjacent Ilk I. and back again (Cunningham & Moors 1985). Early vagrant records on Snares Is (see Distribution) *c.* 130 km from nearest breeding population.

NE. Qld (Subspecies *keasti*.) Considered resident, between Daintree and Townsville (Wieneke 1992), including round Atherton (Bourke & Austin 1947; Bravery 1970) and in Paluma Ra. (Griffin 1974, 1995); also present throughout year round Innisfail at elevations >500 m asl (Gill 1970). Fantails in coastal areas round Innisfail Mar.–May and Aug.–Oct. (Gill 1970) almost certainly migratory *alisteri* from farther S.

E. mainland Aust. and Tas. (Subspecies *alisteri* and *albiscapa* respectively.) Partly resident and partly migratory throughout. Broad-scale analysis of bird atlas and count data in e. Aust. found strong evidence of N–S movement along whole e. coast of Aust. and Tas. (Griffioen & Clarke 2002), with birds moving N and W for autumn–winter and returning S to breeding range in spring–summer. Within breeding range in Tas. and e. mainland Aust., often considered partly resident, or recorded throughout year; in any one area, local populations may be wholly or partly replaced, or augmented, by migrants from elsewhere; in non-breeding months, also recorded much more widely than in summer, with scattered records across n. Aust. and possibly New Guinea (Storr 1973; Ford 1981; Ambrose 1991; Clarke *et al.* 1999; Storr 19; Aust. Atlas 2).

Breeding Recorded breeding mainly on and S or E of Great Divide, from se. SA through s. and e. Vic. and e. NSW

to se. Qld, with scattered records N and W of Great Divide, and in Tas. and Flinders and King Is. Summer distribution likely to be more widespread than recorded breeding, extending farther N and W of Great Divide and farther N along central Qld coast in small numbers (Aust. Atlas 1, 2; see Distribution).

While part of population migratory (see below), widely considered RESIDENT, or recorded throughout year or in all seasons, at sites throughout e. mainland Aust. (Aust. Atlas 1, 2): in SE. QLD (Agnew 1913, 1921; Vernon 1968; Roberts & Ingram 1976; Roberts 1979; Templeton 1991, 1992; Durrant & MacRae 1994; Bielewicz & Bielewicz 1996; Woodall 1999); in NSW, on coastal regions generally (Morris et al. 1981), and at sites in NE (Holmes 1987; Gosper 1992), Northern Tablelands (Kikkawa et al. 1965; Baldwin 1975; Cameron 1985; Ford et al. 1985), Hunter Region (Morris 1975), Sydney Region, including Blue Mts (Morris 1975; Hardy & Farrell 1990; Leishman 1994, 2000; Egan et al. 1997), Illawarra Region (Gibson 1977; Smith & Chafer 1987; Bramwell 1990), SE (Smith 1984; Marchant 1992; Andrew 1999) and SW (Hobbs 1961; Winterbottom 1981); in VIC., widely S of Great Divide (Vic. Atlas), from Gippsland W to Central Districts and e. Western District, including round Western Port and Port Phillip Bays (Campbell 1937; Binns 1953; Hore-Lacy 1964; Cooper 1975a,b; Mitchell & Mitchell 1975; Fleming 1976; Price 1977; Aston & Balmford 1978; Bedggood 1980; Dow & Dow 1989; Rolland & Rolland 1996b; Dedman 1998; Twaits 1998a,b), and at a few sites on and N of Great Divide (Payne 1931; Bedggood 1972; BFNC 1976; Thomas & Wheeler 1983; Traill et al. 1996); and in E. SA, on Adelaide Plain and s. Mt Lofty Ras (Clarke 1967; Baxter 1980; Paton & Paton 1980a; Ashton 1985, 1996), Yorke Pen. (Souter 1942), and on Kangaroo I. (Baxter & Berris 1995). TAS.: Reporting rates only slightly lower in winter: 60% in spring, 52% in summer, 50% in autumn, and 40% in winter (Aust. Atlas 1). Resident or recorded throughout year at many sites in Tas. mainland (Fletcher 1924; Legge 1932; Green & Mollison 1961; Fielding et al. 1976; Rounsevell et al. 1977; Ratkowsky & Ratkowsky 1978; Hird 1995), and on King and Flinders Is, though more abundant in spring–summer (Green 1969; Green & McGarvie 1971).

Departure   Leave on n. passage in autumn, usually Mar.–Apr. from Tas. and slightly later, Apr.–May, from se. mainland. TAS.: Part of mainland and King and Flinders Is populations migrates across Bass Str. to winter in mainland se. Aust., at least as far N as ne. NSW (Ridpath & Moreau 1966; Green 1969, 1989, 1995; Green & McGarvie 1971; Ford 1981; Vic. Atlas; see below). Migrants recorded on passage in n. Tas. and islands in Bass Str. in late Feb. to Apr. or early May (Thomas 1968, 1969; McGarvie & Templeton 1974; Brothers 1978), which coincides with peak in numbers in s. Vic. (e.g. Watson 1955; Ford 1981). Wilsons Prom. in Vic. an important point of arrival for Tas. birds moving through Furneaux Grp (Garnett et al. 1991; see Vic. below; also see Nature of passage), though birds also arrive elsewhere along s. Vic. coast, e.g. several recorded passing boat offshore from Torquay, Vic., c. 11 Apr. 1982, flying towards land from SE (Dedman 1998). After arrival in Vic., most probably continue to move N, probably along e. coast, at least as far N as Tweed–Richmond Rs, ne. NSW, with some moving inland as far as Bathurst, in central NSW, though exact winter range not known (Ford 1981; DAB); some Tas. birds appear to winter Geelong (Dedman 1998), and also SA (SA Bird Rep. 1975). VIC.: Leave late Mar. to May, mostly Apr.–May (Aston & Balmford 1978; Loyn 1985a; Twaits 1998b; Vic. Atlas); in Upper King R. area departure reported as late as June (Shanks 1949); also described as 'probably' on passage in s. Vic. as early as late Feb. (Thomas 1968). Also recorded on n. passage at several sites S of Great Divide, mainly Mar.–Apr. (Watson 1955; Burbidge

1985; Dow & Dow 1989; Twaits 1998b), but near Cressy recorded Apr.–May (Russell 1921). On Rotamah I., occasionally recorded in large numbers on certain days, presumed to be on passage, as early as 25 Jan. through to 9 Apr. (Burbidge 1985; Anon. 1989). N. passage of Tas. albiscapa through Wilsons Prom. occurs spasmodically, in small flocks, recorded from 16 Mar. to 3 May (Garnett et al. 1991; see Tas. above). SA: Poorly understood, but suspected to expand out from breeding range in se. SA and s. Eyre Pen. to cover most, if not all, of state during winter months (SA Bird Rep. 1975). ACT: Leave Apr. (Lamm & Wilson 1966; ACT Atlas), numbers decreasing sharply in Canberra area in May (Anon. 2001). Peak in numbers in Mar. probably reflects passage migration through Canberra area (Veerman 2003). NSW: Leave mainly Apr.–May (Chisholm 1929; Heron 1973; Gall & Longmore 1978; Ford 1981; Morris et al. 1981; Jordan 1984; McFarland 1984; Recher & Holmes 1985; Aust. Atlas 1; NSW Bird Rep. 1987). Departed Katoomba 14 May (NSW Bird Rep. 1987). Recorded on n. passage in Mar.–Apr. in N (Costello 1981; Ford et al. 1985) and W of Great Divide (Chisholm 1938); in w. Sydney, recorded on passage Mar.–May (Leishman 1994). At Moruya, leave Feb.–Apr. or May; show a peak in records Mar.–Apr. with a decline in numbers to July–Aug., and suggesting departure of breeding population from late Jan. with influx of migrants from farther S in Mar.–May, with some birds wintering (Marchant 1979, 1992; Whiter 1991). QLD: Leave Feb.–May (Storr 1973; Storr 19); recorded on passage to N or NW in Mar.–Apr. in SE, e.g. at Fraser I. (Sutton 1990) and Lamington NP (Nielsen 1991). WA: Recorded on n. passage in Mid-Eastern Interior Region of WA, May (Storr 22); and records of birds on passage at Eyre Bird Observatory in Apr.–May (Congreve & Congreve 1985; Dymond 1988) probably alisteri.

Non-breeding   Aust. Atlas 2 shows non-breeding records throughout breeding range in se. mainland Aust. and Tas., as well as more widespread distribution N and W into n. Aust., mainly to ne. Qld, in autumn–winter. Migrant Tas. albiscapa move as far N as ne. NSW and appear to extend NW into SA; alisteri of se. mainland Aust. distributed more widely throughout e. Aust. to n. Qld and, possibly, New Guinea, and widely scattered through w. NSW and Qld, n. SA, NT and e. and n. WA (see below). Subspecies, however, not usually identified in reports. Within breeding range, autumn–winter records could represent resident local populations, or s. migrants replacing or augmenting migratory or partly migratory local populations (see Breeding above, and see below); within breeding range, widely described as autumn–winter visitor to many areas. TAS.: Many remain through autumn–winter (Sharland 1958; Thomas 1968; Fielding et al. 1976; Rounsevell et al. 1977; Green 1977, 1995; Aust. Atlas 1, 2; see Breeding [Resident] above); reporting rates in autumn and winter 50% and 40% respectively (Aust. Atlas 1). VIC.: Recorded throughout in autumn–winter (McEvey 1965; Bedggood 1970; Loyn 1980; Aust. Atlas 2), e.g. at Gemmills Swamp, near Mooroopna, recorded Mar.–Oct. (Roberts 1975). Move into drier habitats, e.g. mallee scrub, in autumn and winter (Vic. Atlas); departure from Beulah area 10 Sept. described as late (Vic. Bird Rep. 1986–87). In some n. Vic. districts, e.g. Kangaroo L. and Wangaratta S, generally present Mar.–Sept. (Vic. Bird Reps 1982, 1984, 1985). Winter movement out of state by breeding population may be masked by movement into and through Vic. of Tas. migrants (Vic. Atlas); Tas. albiscapa recorded Geelong area, Apr.–Oct. (Dedman 1998). ACT: Many winter in milder parts, including Canberra (Anon. 2001; Veerman 2003; ACT Atlas); a few winter in Black Mt reserve (Bell 1980b). NSW: Considered autumn–winter visitor to many areas in breeding range on and E of Great Divide, mainly Mar.–Oct., including: parts of Northern Rivers Region (Holmes 1987; Gosper 1992; NSW Bird Rep.

1988), e.g. at Murwillumbah, arrive 24 Mar.–1 Apr. and leave late Sept. to early Oct. (Pratt 1970a,b, 1971, 1972a,b; Perkins 1973; NSW Bird Rep. 1977); and parts of Sydney Region, May–Sept. (Morris 1986; NSW Bird Rep. 1991); small numbers winter at Barren Grounds, Illawarra Region, either remnants of breeding population or migrants from further S (Jordan 1984, 1987; Bramwell 1990). Also recorded much more widely W of Great Divide, Mar.–Oct. or occasionally Nov. (Ford 1981; Morris *et al.* 1981; Aust. Atlas 1, 2; NSW Bird Reps 1991, 1998), e.g. recorded Cobar from mid-Mar.–early Apr. to Sept.–Nov. (Schmidt 1978; NSW Bird Rep. 1991), at Pulletop NR, present 16 Apr.–30 Aug. (NSW Bird Rep. 1993), at Griffith, arrive 27 Mar.–19 Apr., and leave early Sept. (NSW Bird Reps 1985, 1988, 1989, 1990, 1994), present along Murray R. in SW, Mar.–Apr. to Aug.–Sept. (Thomas 1962; Ford 1981; NSW Bird Reps 1975, 1984, 1985) with movement out of area reaching a peak in early Sept., and suggested that a large percentage of wintering birds originate near Murray R. headwaters; Murray R. described as a well-marked migratory route (Hobbs 1961). Said to move farther into w. NSW in winter when conditions good (NSW Bird Reps 1973, 1987). QLD: Non-breeding migrant throughout, including breeding range in SE, from Mar. to Sept. or Oct. (Alexander 1926; Storr 1973; Ford 1981; Storr 19; see below). Non-breeding autumn–winter migrant: in NE (excluding *keasti*), between Townsville and Cooktown, mainly from Mar.–Apr. to Aug.–Sept. (Hopkins 1948, 1972; Lavery & Hopkins 1963; Ford *et al.* 1980; Jones 1983; Garnett & Cox 1988; Wieneke 1992; Griffin 1995; Britton 1997; Britton & Britton 2000), e.g. on Magnetic I., Mar.–Oct. (Wieneke 1988), and round Atherton 20 Apr.–25 Sept. (Bravery 1970); and widely W of Great Divide, including Yowah Yowah Opal Fields (Sharrock 1982), and in North-Central and North-Western (Gulf Country) Regions, e.g. round Richmond, mid-Apr. to mid-Aug. (Berney 1904, 1905) and Mt Isa, May–Sept. (Horton 1975). In central-E, widespread between Mar.–Apr. and Aug.–Sept., e.g. round Rockhampton, present late Mar. to Aug.–Oct. (Longmore 1978; Beck & Chan 1999). Also considered autumn–winter visitor within parts of breeding range in SE, Mar. to early Oct. (e.g. Jones 1981; Porter & Henderson 1983; Dawson *et al.* 1991; Woodall 1995), e.g. round Marburg, present 18 Mar.–5 Oct. (Leach & Hines 1987), and at Murphys Ck, mean date of arrival 17 Apr. (earliest 13 Mar.), and leave Sept. to early Oct. (Lord 1933, 1937, 1939a, 1943, 1956); in Brisbane, arrive late Mar. to early Apr., depart mid-Sept. (Morgan 1970, 1972). SA: Recorded between Mar.–Apr. and Sept.–Oct., mainly Apr.–Sept., with records of migrants from Vic. and Tas. (SA Bird Rep. 1975; Aust. Atlas 2; see below). During autumn–winter, records concentrated within breeding range in SE, including Mt Lofty Ras and adjacent Adelaide Plain, Mar.–Oct., though usually in lower numbers than in breeding season (White 1919, 1925; Symon 1946; Clarke 1967; Ford & Paton 1976; Baxter 1980; Paton & Paton 1980a; Saunders 1983; Ashton 1985, 1996; Taylor 1987; SA Bird Reps 1975, 1977–81; Aust. Atlas 2); also recorded: Kangaroo I. (Baxter & Berris 1995); Murray–Mallee, Apr.–Sept. (Cox 1973; Ford 1981); Yorke Pen. (Souter 1942; SA Bird Rep. 1968–69); from n. Eyre Pen. and L. Gairdner–L. Torrens through Flinders Ras–L. Frome to L. Eyre Basin and NE, Apr.–Sept. (McGilp 1923; Badman 1979, 1989; Ford 1981; Read *et al.* 2000; SA Bird Rep. 1977–81); and NW (Badman 1979; SA Bird Rep. 1977–81). NT: Uncommon winter visitor to s. highlands and Top End and n. interior, May–June to Sept. (Schodde 1976; Gibson 1986; Storr 7; H.A.F. Thompson & D.K. Goodfellow), possibly *alisteri* from se. Aust., though s. birds could be *preissi* from sw. Aust., or inland *albicauda* (Storr 7). WA: Occasional autumn–winter visitor to E and N, including: e. Eucla Div., late Apr. to early Nov. (Congreve & Congreve 1985; Dymond 1988; Ashton

1996; Storr 27), where visitors considered to be *alisteri* (Storr 27), and w. Eucla Div., Apr.–mid-Sept., where considered to be *preissi* (Storr 27); e. South-Eastern Interior Region (Storr 26); Pilbara Region (Storr 16); and Kimberley Div., June–July (Johnstone 1983; Johnstone & Burbidge 1991; Storr 11). NEW GUINEA: Subspecies *alisteri* possibly reaches New Guinea on n. migration (Rand & Gilliard 1967; Ford 1981; Beehler *et al.* 1986; Coates 1990; Aust. Atlas 1).

Return Mostly leave from non-breeding sites (see above) and return to breeding grounds throughout mainland se. Aust. Aug.–Sept., and slightly later, late Aug.–Oct., to Tas. (see below). However, return much less well described than other aspects of movements in se. Aust., possibly because departure more abrupt than return, e.g. in Canberra (ACT Atlas). WA: Probable *alisteri* recorded on s. passage in inland, e.g. through North-Eastern Interior Region in Sept. (Storr 1981) and South-Eastern Interior in Aug. (Storr 26). Some records of birds on passage at Eyre Bird Observatory in Aug. (Congreve & Congreve 1985; Dymond 1988) possibly *alisteri* (though some records of *preissi* at Eyre; Storr 27; see below). QLD: In NE, recorded on s. passage at Lockerbie, C. York Pen., in Sept. (Barnard 1911). Return to SE, Aug.–Oct. (Storr 1973; Ford 1981; Storr 19). NSW: Return or on passage Aug.–Oct. or occasionally Nov., and mostly Aug.–Sept.: on and E of Great Divide (Marchant 1979, 1992; McFarland 1984; Recher & Holmes 1985; Aust. Atlas 2; NSW Bird Rep. 1987); and at sites W of Great Divide (Morse 1922; Chisholm 1938, 1940; Heron 1973; Costello 1981). Return to Thredbo Valley, early Oct. (Gall & Longmore 1978). At Barren Grounds NR, return, and recorded on passage in large numbers, Sept.–Oct. (Jordan 1984, 1987; Bramwell 1990). ACT: Return, or on s. passage, mid-Aug. to mid-Sept. (Lamm & Wilson 1966; Er & Tidemann 1996; Veerman 2003; ACT Atlas). VIC.: Return or recorded on s. passage Aug.–Oct. Return mainly recorded Aug.–Sept. (Shanks 1949; Loyn 1985a; Twaits 1998b); and s. passage, Aug.–Oct., mainly Sept.–Oct., in S (Russell 1921; Thomas 1969; Burbidge 1985; Anon. 1989; Dow & Dow 1989; Rolland & Rolland 1996b), including Rotamah I., Sept.–Oct. (Burbidge 1985; Anon. 1989; Dow & Dow 1989; Rolland & Rolland 1996b), and w. Melbourne, Aug.–Sept. (Watson 1955; Humphreys 1986). Suggested those wintering along Murray in sw. NSW–nw. Vic. (see Non-breeding: NSW) migrate S in Aug.–Sept. to Great Divide to nest, though a few stay and breed in Murray Valley (Disher 1960); also suggested that many migrate to Murray R. headwaters (Hobbs 1961). SA: Range largely contracts to SE in mid- to late spring, Sept.–Oct., with migrants from Vic. and Tas. assumed to return there (SA Bird Rep. 1975; Aust. Atlas 2; see Non-breeding above). TAS.: S. migration across Bass Str., including through Furneaux Grp, occurs late Aug. to Oct. (Thomas 1968, 1969; Norman 1970; Brothers 1978; Ford 1981; Green 1995).

ALTITUDINAL MOVEMENTS: Suggested that undertake some altitudinal migration from uplands to lower altitudes during autumn–winter, with a significant decrease in abundance in high-altitude regions of s. Qld and NSW in winter (Ambrose 1991; see below). However, altitudinal movements difficult to ascertain given extensive movements throughout se. Aust. in autumn–winter and, in some places, apparent replacement of local populations by migratory populations from farther S; differential N–S migration of populations at different altitudes also not excluded. Much study, using banded populations, needed. Nevertheless, often described as more abundant at high altitudes during spring–summer or less abundant in autumn–winter on Great Divide in se. Qld and NSW (Ford 1981; Cameron 1985; Recher & Holmes 1985; Hardy & Farrell 1990; Ambrose 1991; Nielsen 1991), though movements of such population not known, e.g. while leave higher areas in ACT during Apr. (Lamm & Wilson 1966; Tidemann

et al. 1988; see Departure, above), and some winter in lowland ACT (Bell 1980b; ACT Atlas); not known if these populations linked.

LOCAL AND IRREGULAR MOVEMENTS: Within breeding and wintering ranges, undertake some apparently local movements (Keast 1958; Ford 1981; Ford 1985; Aust. Atlas1; see below). In some areas, move locally to open habitats for winter (Le Souëf & MacPherson 1920; Morris 1975; Gibson 1977; Thomas & Wheeler 1983; Cameron 1985; Dedman 1998; Clarke *et al.* 1999), e.g. in Vic., move from wet upland forests in autumn–winter into drier habitats, including mallee scrubs (Loyn 1985a; Vic. Atlas). Further, occurrence or abundance at some sites irregular (e.g. Whatmough 1978; Whitmore *et al.* 1983; see above), possibly related to seasonal conditions: e.g. in NSW, extend farther W, or occur there in larger numbers, in winter when conditions good (NSW Bird Reps 1973, 1987). Sometimes described as nomadic (e.g. Hindwood & McGill 1958; Officer 1969; Mack 1970; Morris 1975; Gibson 1977; Morris *et al.* 1981; Hoskin 1991; Green 1995), possibly in reference to such local movements, or irregularity of occurrence and abundance. Where local populations replaced or augmented by migratory birds during non-breeding season, often interpreted as nomadism or local movements (Keast 1958), e.g. e. NSW (Le Souëf & MacPherson 1920; Hindwood & McGill 1958; Morris 1975; Gibson 1977; Morris *et al.* 1981; Hoskin 1991; Ballarat, Vic. (Thomas & Wheeler 1983); Tas. (Green 1995); and Mid-Murray and Lower North Regions of SA, between Gluepot and L. Frome (Mack 1970).

SW. WA (Subspecies *preissi.*) Mostly resident or sedentary, partly migratory or dispersive. However, nature and extent of movements not well known (and not as well known as e. Aust. populations). Breeding range in SW restricted mainly to South-West Div., N to line joining Jurien, Dandaragan, Northam, Emu Rock *c.* 50 km E of Hyden, and Fitzgerald R. NP; also recorded breeding at Esperance (Aust. Atlas 2). Breeding within Wheatbelt area described as restricted to areas of higher rainfall (Sedgwick 1949b; Saunders & Ingram 1995), e.g. congregate in valleys in Northam district to breed (Jenkins 1931). Undertake some local movements, moving to more open and drier habitats for autumn–winter (see below). Further, occurrence or abundance at some sites irregular, such as on Rottnest I. (Storr 1965), and sometimes possibly related to seasonal conditions, e.g. occur in interior of WA only during good seasons (Ford 1980, 1981); and suggested that movements in Wheatbelt of WA affected by presence of water (Sedgwick 1949b).

Breeding Widely described as RESIDENT in South-West Div. (Storr 35), including Porongorup Ra. (Abbott 1981, 1995), Manjimup (Brown & Brown 1981, 1991), Darling Ra. (Dell 1965), Swan Coastal Plain (Alexander 1921; Heron 1970; Sedgwick 1973, 1988; Abbott 1980; Brooker *et al.* 1995; Mawson & Massam 1995; Storr 28) and higher rainfall areas of Wheatbelt (Masters & Milhinch 1974; Saunders & Ingram 1995). Also recorded throughout year (probably indicating residency) at various sites on s. Swan Coastal Plain (Plumb 1948; Serventy 1948, 1970), Wooroloo (Sedgwick 1956b), and in Mt Saddleback SF (Nichols & Nichols 1984) and at Williams, South-West Div. (Sedgwick 1962). Breeding population in Broome Hill district possibly augmented by winter visitors (Carter 1924). Also described as resident in Hammersley Ra. NP, Pilbara Div. (Howard 1986).

Non-breeding Where resident in South-West Div., abundance can fluctuate seasonally. On Swan Coastal Plain and in n. Wheatbelt, numbers increase Apr.–Oct. (Sedgwick 1940, 1949b; Ambrose 1991; Saunders & Ingram 1995; Serventy & Whittell; Storr 28, 35). Some changes in abundance appear to be a result of local movements to more open habitats for autumn–winter, e.g. present throughout year at Northam but move into local gardens between late summer and early winter, and generally less common in summer (Jenkins 1931; Masters

& Milhinch 1974). Other changes appear to be result of influx of birds from elsewhere moving to areas with resident local populations, e.g. part of population in Darling Ra. disperses onto Swan Coastal Plain, Apr.–Oct. (Serventy 1937, 1948; Storr 1965; Heron 1970; Sedgwick 1973, 1988; Serventy & Whittell; Storr 28).

Part of population leaves breeding range in SW in autumn–winter, moving N and E in Mar.–May and returning in Aug.–Oct. (Ford 1981; Aust. Atlas 1, 2), though said to be no strong evidence of long-range movements (Ambrose 1991). Most movements appear to be autumn–winter expansion into parts of South-West Div. bordering breeding range, especially in Wheatbelt: e.g. at Moora, arrive late Apr. or with first rains, staying till late June to Aug. (Orton & Sandland 1913; Serventy & Whittell); recorded Tardun Apr.–May to Sept.–Oct.; Arrino, Apr.–May to Aug.–Sept.; Bruce Rock, May–June to Sept. (Saunders & Ingram 1995); and along Marchagee Track, Apr.–Sept. (Halse *et al.* 1985). In Kellerberrin–Kwolyin district, present Apr.–June to Nov.–Dec. (Ford & Stone 1957), though also described as breeding near Kellerberrin (Saunders & de Rebeira 1991). Sometimes noted on passage in South-West Div., including Swan Coastal Plain (Storr 28, 35).

Also extend farther N and E, usually in small numbers: occur Gascoyne Region late Apr. to early Sept. (Brooker & Estbergs 1976; Storr 21); and sw. Pilbara Region, including North West C., late Mar. to early Aug. (Carter 1903; Ford 1971, 1981; Storr 16). In E, recorded on passage and during autumn–winter in SW of Mid-e. Interior (Storr 22); and recorded South-Eastern Interior, mid-Apr. to mid-Sept. (Storr 26). In w. Eucla Div., recorded Apr. to mid-Sept., sometimes on passage (Storr 27); at Eyre Bird Observatory, mostly recorded May–Aug., sometimes late Apr. through till Nov. (Martindale 1980; Dymond 1988; Ashton *et al.* 1996), sometimes on passage (Congreve & Congreve 1985). Subspecies *priessi* possibly also recorded n. interior of NT (Storr 7) and, possibly, in winter, nw. Qld in winter (Storr 1973). (Note that e. Aust. *alisteri* and centralian *albicauda* recorded in e. and n. WA and NT; see above and below.)

NW. SA, central-inland WA and s. NT (Subspecies *albicauda.*) Very poorly known. Possibly resident in Pilbara Region (Storr 16). Elsewhere, said to be nomadic in mulga deserts of WA and NT, being recorded when good conditions prevail and absent when conditions deteriorate (Ford 1980, 1981); considered a rare autumn–winter visitor to Mid-E. Interior Region from S. Interior of WA (Storr 22) and possibly winter visitor to NT (Storr 7). Occasionally recorded in Eucla Div. (five records to 1987), Apr.–May or Sept.–Nov. (Storr 27). One also captured near Broome, Kimberley Div., in winter 2001 (C.J. Hassell). (Note that e. Aust. *alisteri* and sw. *priessi* recorded as winter migrants to e. and n. WA and NT; see above.)

NZ (Subspecies *placabilis* and nominate *fuliginosa.*) Resident or present throughout year at sites throughout NI and SI and associated islands. However, seasonal changes in occurrence or abundance widespread, and often associated with local movements or seasonal shifts in use of habitats, and attributed to availability of food in winter (e.g. Moncrieff 1929), though at Port Hills, Christchurch, decreases result from mortality associated with heavy snowfalls (Freeman 1999).

NI: Resident or present throughout year at Parua Bay (Moncrieff 1929); on Motuhoropapa and Otata Is, Noises Is (Cunningham & Moors 1985); Auckland (MacDonald 1973); Te Kuiti (Guest & Guest 1987); Palmerston North (Guest & Guest 1993); round Lower Hutt (Gibb 2000a); and Wellington (Moncrieff 1929). SI: Resident or present throughout year at: Reefton (Dawson *et al.* 1978); Kowhai Bush, Kaikoura (Powlesland 1982; Dean 1990); Port Hills,

Christchurch (Freeman 1999); L. Wainono (Pierce 1980); Dunedin (Kikkawa 1966); and Pembroke (Moncrieff 1929).

Throughout range, some seasonal changes in occurrence or abundance recorded at sites where considered resident. At some sites where resident or present throughout year, numbers lower in autumn–winter, e.g. in SI, at Gouland Downs, nw. Nelson (Williams 1960), at Kowhai Bush, Kaikoura (Powlesland 1982; Dean 1990), Christchurch (Freeman 1999), and Paparoa Ra. (Wilson *et al.* 1988). Conversely, at some sites, maximum numbers recorded in autumn and winter and recorded less often in spring and summer, e.g. round Wellington and Orongorongo R. Valley, s. NI (Gibb 1996, 2000b), and round Greymouth, SI (CSN 33, 34).

Some seasonal changes appear to result from changes in use of habitats, usually local movements from breeding habitat in forest and woodland to more open, settled and coastal areas during non-breeding season, in late summer to early winter, in both NI (Moncrieff 1929; Bull 1959; CSN 1) at sites in Bay of Plenty (Hodgkins 1949), Volcanic Plateau (St Paul 1975) and Wairarapa (Oliver); and SI, at sites in Canterbury (Oliver; CSN 1, 19 Suppl.), Southland (CSN 35) and West Coast (Onley 1980; CSN 34, 35). In contrast, at Nelson and Dunedin, SI, recorded more often in bushland in winter and in built-up areas in summer (Moncrieff 1929, 1931; CSN 1). Local movements also recorded at confluence of Hutt and Wakatikei Rs in late autumn and early winter (Secker 1960).

In some places, considered mainly an autumn–winter visitor: in NI (Hodgkins 1949 [Tauranga district]; Gibb 1996 [Orongorongo Valley], 2000b [Wellington]), e.g. recorded at Hautura, Apr.–May to Oct., and Toko, from mid- or late autumn to Aug.–Sept., and leave Paekakariki in summer and return in Mar. (Moncrieff 1929); and in SI (Miller 1993 [lower reaches of Kaikorai R.]; CSN 1 [Te Waimate], 19 Suppl. [Timaru], 33, 34 [Greymouth]), e.g. at Hororata, Mar.–Sept. (Moncrieff 1929), at Dunedin, 20 Mar.–17 July, but once present till 6 Nov. (Moncrieff 1929; *contra* Kikkawa 1966, who stated present throughout year). Absent from Nelson, July–Aug. (Moncrieff 1931).

Some seasonal occurrence possibly reflects more substantial movements, including possible altitudinal movements, e.g. arrival at Cromwell in early May 1946 coincided with bad weather in high country (Middleditch 1947) and in Canterbury, said to leave breeding areas in inland hills and move onto plains in winter (Oliver).

Norfolk I. (Subspecies *pelzelni*.) Sedentary (see Distribution). Disperse into bush to breed after Aug. (Wakelin 1968). **Chatham Is** (Subspecies *penita*.) Sedentary. Present throughout year on South East I. (Nilsson *et al.* 1994).

Banding Aust. Of 14,231 banded in Aust., New Guinea and sw. Pacific, 1953–Aug. 2001, 1323 recoveries (9.3%). Of 844 recoveries, of 697 birds, July 1984–Aug. 2001: 842 (99.8%) <10 km from banding site; two (0.2%) ⩾100 km. LONG-DISTANCE RECOVERIES: Little Chinaman Bay, se. Tas, to Pampoola, Taree, NSW (1276 km, 20°, 38 months[D], Feb.; J); and Wilsons Prom., Vic., to Keiraville, NSW (657 km, 38°, 23 months[D], Sept.; 2-) (ABBBS). LONGEVITY: One banded near Beerburrum, Qld, 21 Aug. 1976, retrapped at banding place over 9 years 8 months after banding (ABBBS 1989). BANDING STUDIES: **Aust.** NSW: At Winmalee, Blue Mts, 96 banded, and 15 retrapped (15.6%); longest period between banding and recapture, 3 years 11 months (Hardy & Farrell 1990). Near Campbelltown, 222 banded 1973–93, and 27 retrapped (12.2%); 118 (53%) captured Mar.–May; longest period between banding and recapture, 7 years 10 months (Leishman 1994); at same site up till 1994, 236 banded, and 30 retrapped (12.7%) (Leishman 2000). In Barren Grounds NR, 70 banded 1982–88, and one retrapped (1.4%) nine times; longest period between banding and recapture, 1 year 1 month (Jordan 1987, 1988). ACT: In Brindabella Ras: 215 banded 1961–70, and 22 retrapped (10.2%) (Horey & Wilson 1971); 340 banded 1961–79, and 47 retrapped (13.8%); longest period between banding and recapture, 3 years 10 months (Tidemann *et al.* 1988); suggested that low rate of recapture at this site because birds were able to evade nets (Lamm & Wilson 1966). VIC.: On Rotamah I., 189 banded 1980–96, and eight retrapped (4.2%), one 1.6 km from banding place and 11 months after banding, and another retrapped at banding place 36 months after banding (Burbidge 1982, 1985; Dow & Dow 1989; Hall & Hall 1990; Anon. 1992; Rolland & Rolland 1996a,b). WA: Near Kellerberrin, 42 banded 1985–89, with single retrapped (2.4%), 1 km from banding site, over 14 months after banding (Saunders & de Rebeira 1991). Near Manjimup, 859 banded 1972–91, and 256 retrapped (29.8%), including multiple retraps of some individuals (Brown & Brown 1981); longest period between banding and recapture, 5 years 5 months (Brown & Brown 1991).

NZ Total of 1609 banded 1950–96: 701 in NI, 908 in SI (Cossee 1989, 1991, 1993, 1995, 1997, 1998a,b; Cossee & Wakelin 1991; see Cunningham 1951, 1952, Bull 1953, 1956, and Kinsky 1957 for earlier summaries). From before 1964–74: of 160 banded NI, 37 recoveries (23.1%); and of 151 banded SI, one recovery (0.7%) (Robertson 1972, 1975). At Kowhai Bush, SI, 372 banded 1976–79; of 280 nestlings banded, 31 resighted during next autumn and winter (11.1%), and three present in following breeding season (1.1%); of 92 adults, 29 resighted during next autumn and winter (31.5%) with seven present in following breeding season (7.6%) (Powlesland 1982). LONGEVITY: On Noises Is, NI, three banded birds known to be at least 3.5 years old when last seen (Cunningham & Moors 1985).

FOOD Invertebrates, mainly insects; very occasionally small vertebrates, fruit or seeds. **Behaviour** Well known. Arboreal, though very occasionally forage from ground. In Aust. and NZ, forage at nearly all levels of vegetation, though most often in mid-levels of forest. Usually forage by sallying or flush-pursuit, less often by gleaning or snatching from foliage and branches of trees and shrubs, and occasionally on ground (AUST.: Littler 1903; Mellor 1907, 1925; Wolstenholme 1922; Pawsey 1966; Milledge 1972; Harrison 1976; Crome 1978; Calver & Wooller 1981; Tullis *et al.* 1982; Frith 1984; Cameron 1985; Loyn 1985b; Recher *et al.* 1985b; Wykes 1985; Ford *et al.* 1986; Laurance *et al.* 1996; Er 1997; Recher & Davis 1997; North; Hall; NZ: Guthrie-Smith 1910; McLean 1912; Oliver 1922; Wilkinson 1927; Moncrieff 1928; Stead 1932; Wilkinson & Wilkinson 1952; Kikkawa 1966; Merton 1966; Turbott 1967; Gravatt 1969, 1971; Craig 1972; St Paul 1975; Ude Shankar 1977; Gill *et al.* 1983; Moon 1992; O'Donnell & Dilks 1994; Oliver; CSN 19). DETAILED STUDIES: AUST.: At Laceys Ck, ne. Qld, May 1971–Apr. 1972 (Crome 1978); in Paluma Ra., ne. Qld, Aug. 1978 to Apr. 1979 (Frith 1984); in Imbota NR, near Armidale, n. NSW, 1981–82 and 1984 (Ford *et al.* 1986); in Five Day Ck Valley, New England Tableland, n. NSW, over three years (Cameron 1985); near Bombala, in se. NSW and ne. Vic., Oct.–Jan. 1980 and 1981 (Recher & Holmes 1985; Recher *et al.* 1985b); in Big Brook SF, near Pemberton, sw. WA, in May 1979 and May and late Sept. 1980 (Calver & Wooller 1981; Wooller & Calver 1981); at Dryandra, sw. WA, 6–15 Aug. 1995 (Recher & Davis 1998); at Jandakot, near Perth, sw. WA, Apr.–July 1980 (Tullis *et al.* 1982); and on Hamilton Downs Stn, NT, 23 July–2 Aug. 1995 (Recher & Davis 1997). NZ: On Little Barrier I., NI, Nov. 1967–Oct. 1968 (Gravatt 1969, 1971); on Tiritiri Matangi I., 1981–82, and Little Barrier I., NI, 1985 (McLean 1989); on Cuvier I., 1973 and 1981 (McLean 1984b, 1989); round Christchurch (Riccarton Bush and Botanic Gardens), Mar. 1975–Mar. 1976 (Ude Shankar 1977); and in Windbag Valley, s. Westland, SI, 1983–85 (O'Donnell & Dilks 1994).

FORAGING ASSOCIATIONS: No published data on foraging associations in Aust. or NZ, but many anecdotal reports of large flocks (see Social Organization for non-foraging associations and flocks). In Aust. and NZ, appear to forage mostly singly or in twos or in small flocks, possibly family parties, of up to six (Dennison *et al.* 1978; K. Al-Dabbagh; D.W. Eades). In NZ, occasionally in flocks of 12–30 (Stead 1932; Cunningham & Moors 1985; Bourke 1989; CSN 19, 20, 31, 41). Very occasionally forage in large flocks, e.g. 160 birds (CSN 33), >100 birds feeding on insects over a stream and hillside (CSN 47), and up to 300 sallying for insects (CSN 34). ASSOCIATIONS WITH OTHER SPECIES: Often join mixed-species feeding flocks, usually of other small insectivorous passerines, more often in non-breeding season. AUST.: Many records in mixed-species flocks, usually comprising small insectivorous passerines, particularly thornbills, robins and treecreepers, and honeyeaters: White-throated Treecreepers *Climacteris leucophaeus*, Splendid Fairy-wren *Malurus splendens*, Spotted Pardalote *Pardalotus punctatus*, White-browed Scrubwren *Sericornis frontalis*, Weebill *Smicrornis brevirostris*, Western Gerygone *Gerygone fusca*, Brown *Acanthiza pusilla*, Inland *A. apicalis*, Chestnut-rumped *A. uropygialis*, Western *A. inornata*, Buff-rumped *A. reguloides*, Yellow-rumped *A. chrysorrhoa* and Striated *A. lineata* Thornbills, honeyeaters, including Lewin's *Meliphaga lewinii*, Singing *Lichenostomus virescens* and Brown *Lichmera indistincta* Honeyeaters, Scarlet Robin *Petroica multicolor*, Eastern Yellow Robin *Eopsaltria australis*, and other robins *Petroica*, Varied Sittella *Daphoenositta chrysoptera*, Rufous *Pachycephala rufiventris* and Golden *P. pectoralis* Whistlers, Rufous Fantail and Willie Wagtail *Rhipidura leucophrys* (Gannon 1934; Chisholm 1936; Hindwood 1937; Sedgwick 1949a, 1956a; Erickson 1951; Sharland 1958; Gibson 1977; Hughes & Hughes 1980; Cameron 1985; Dawson *et al.* 1991; Tzaros 1996). Round Charters Towers, ne. Qld, May–July, recorded in 47 (37%) of 127 mixed-species feeding flocks, with mean number of 1.8 Fantails/flock (1–5); flocks usually dominated by Willie Wagtails, Striated Pardalotes *Pardalotus striatus*, Rufous Whistlers and Weebills, and often included other small insectivorous birds. In s. Qld, recorded in three (19%) of 16 flocks, with mean of 3.3 Fantails/flock (1–6) (Britton 1997). In Five Day Ck Valley, recorded in 26 mixed-species feeding flocks (21 flocks recorded Mar.–June), usually led by Brown Thornbills or Brown Gerygones *Gerygone mouki* or both; association between Fantails and other species of flocks possibly not random: on five occasions, Fantail followed a treecreeper or gerygone, staying within 1 m of it, catching insects flushed by it (Cameron 1985). In ACT, recorded in 22 (42%) of 53 mixed-species flocks, with mean of 1.9 Fantails/flock (Hermes 1981). At same site, 35% of 320 Fantails observed were in 62 mixed-species feeding flocks: 40 in autumn, two in winter, five in spring and 15 in summer (Bell 1980a). In sw. WA, recorded in 42 (612%) of 69 feeding flocks, usually dominated by thornbills and which comprised 2–13 small insectivorous species and a few honeyeaters, up to three species per flock (Sedgwick 1949a, 1956a). Also reported foraging with other species at source of abundant food: seen foraging with Rufous Fantail and Spectacled Monarch *Monarcha trivirgatus* on swarming insects *c.* 1 m above surface of small dam at Widgee, Qld (Hughes & Hughes 1980). Sometimes flutter round people to catch insects flushed by them (J.M. Peter). NZ: Often associate with other species in mixed-species feeding flocks, usually closely following other birds and feeding on insects dislodged or flushed by them. Often forage with Silvereyes *Zosterops lateralis*, Whiteheads *Mohoua albicilla*, parakeets *Cyanoramphus*, including Yellow-crowned Parakeets *C. auriceps*, and Saddlebacks *Philesturnus carunculatus*; also recorded with Yellowheads *Mohoua ochrocephala*, Grey Warblers *Gerygone igata*, Chatham Island Warblers *G. albofrontata*, New Zealand Tomtits *Petroica macrocephala*, and Brown Creepers

Finschia novaeseelandiae (Blackburn 1967; Craig 1972; St Paul 1975; Reed 1976; Ude Shankar 1977; Dennison *et al.* 1978, 1979; McLean 1984b; Read & McClelland 1984; Dean 1990; Heather & Robertson 1997; CSN 5). Round Christchurch, foraged mainly with small groups of Silvereyes (95% of 133 feeding associations between Fantails and other passerines) with other flocks comprising Fantails with Grey Warblers, Common Redpolls *Carduelis flammea* and Song Thrushes *Turdus philomelos* (Ude Shankar 1977). At Kowhai Bush, often foraged with Brown Creepers, Silvereyes, Grey Warblers, Common Chaffinches *Fringilla coelebs* and Common Redpolls; recorded in 30 (39.5%) of 76 mixed-species feeding flocks (containing 2–6 species/flock) with mean of 1.7 Fantails/flock (1.0; 1–6; 30); mostly in mixed flocks during non-breeding season (Dean 1990). On Little Barrier I., often in mixed-species feeding flocks with Whiteheads, which usually led flocks, and parakeets, and more often in such flocks than not; Fantails commonly found in centre of flocks (McLean *et al.* 1987). On Cuvier I., often forage in association with Saddlebacks; when feeding together, Fantail usually stays 40–60 cm below Saddleback, because prey disturbed by Saddleback fly or fall down, and would be silhouetted against sky from below; that Fantails seldom forage with Saddlebacks on ground supports this. Association between Saddlebacks and Fantails occurred significantly more often in non-breeding season: in May and Aug., 32% of 202 sightings of Fantails were foraging with Saddlebacks; in Nov. and Dec., only 8% (of 123 sightings) were with Saddlebacks (McLean 1984b). On Cuvier and Tiritiri Matangi Is, Fantails often associated briefly (usually less than a few seconds) with many species of forest birds, though if other species was messy or clumsy feeder (such as Saddlebacks) or member of a flock, association lasted longer; when within a flock, rarely stayed with same individual for long (McLean 1989). Also often associate with people and dwellings, even entering houses to feed on insects and spiders (Hutton & Drummond 1904; Guthrie-Smith 1910; McLean 1912; Stidolph 1923; Moncrieff 1931; Stead 1932; Hodgkins 1949; Wilkinson & Wilkinson 1952; Moon 1982; Oliver; CSN 21). Occasionally forage round farm animals such as Horses or Cattle (Hutton & Drummond 1904; Bourke 1989; CSN 20, 41) or accompany people, catching insects flushed by them (Moon 1982).

FORAGING HEIGHTS: In Aust. and NZ, forage at all levels, from near ground to canopy and, where present, emergents above canopy, and only very rarely on ground; depending on vegetation structure, mostly forage in subcanopy or midstorey, and canopy. In NZ, said to forage high above tree-tops on sunny days, but at much lower levels, within a few metres of ground in understorey, on damp, dull days (McLean 1912). AUST.: At Laceys Ck, foraged mostly in canopy (height of canopy, 12–18 m), and not seen foraging on ground; of 81 observations of foraging: 1% in vegetation up to 1 m above ground; 11% in low canopy, from 1 m to one-third height of canopy; 42% in middle canopy, from one-third to two-thirds height of canopy; and 46% in upper canopy, from two-thirds to top of canopy, including emergents up to 25 m high. In Paluma Ra., foraged at all heights and with little difference in foraging height between dry and wet seasons; of 517 observations of foraging during study period: 0.4% on ground; 7.0% in herb layer, <1 m above ground; 13.2% in understorey, among tree-ferns, shrubs and saplings, 1–5 m above ground; 18.4% in subcanopy, among small trees, tree-trunks and climbing plants, 5–10 m above ground; 34.5% in lower canopy, 10–17.5 m above ground; 24.4% in upper canopy, 17.5–25 m above ground; and 2.1% in emergents >25 m above ground. Birds foraged lower in wet season (n=232 foraging obs.) than dry season (n=226), due mostly to increased foraging in understorey and decreased foraging in upper canopy during wet season (see Frith 1984 [Fig. 3] for further detail). In Five Day Ck

Valley, foraged at all levels up to 40 m, though nearly half of all perches used when foraging were <6 m above ground (n=3450 foraging obs.) (see Cameron 1985 [Fig. 1] for seasonal breakdown and further detail). In Imbota NR, of 174 observations foraging: 0.6% on, and up to 1 m above, ground; 34.5%, 1–2 m above ground; 17.2%, 3–5 m; 22.4%, 6–9 m; 23.6%, 10–14 m; and 1.7%, >15 m. Near Bombala, mean height of foraging 5.8 m (5.5; 2354 obs. foraging): 9% on ground; 43%, 0.2–4 m above ground (shrub layer); 36%, 4.1–10 m (sub-canopy); and 12% >10 m (canopy). In Big Brook SF, of 108 observations foraging: 24% on ground; 11%, <1 m above ground; 17%, 1–2 m; 35%, 2–5 m; 5%, 5–10 m; 4%, 10–15 m; and 4%, 15–20 m. At Jandakot, of 141 observations foraging: 3% on ground; 20%, <1 m above ground; 46%, 2–3 m; and 31% at 4–6 m. At Dryandra, took much prey within 1 m of ground; of 182 observations foraging: 14% on ground (0–0.1 m); 37%, 0.2–1 m above ground; 41%, 1.1–5 m; and 8% above >5 m. On Hamilton Downs Stn, foraged in and round crowns of Mulga trees, at mean height of 3.5 m (1.0; 12 obs. foraging). In areas where both Grey and Rufous Fantails occur (e.g. Laceys Ck, Paluma Ra., Five Day Ck Valley and near Bombala), Grey Fantails foraged at higher levels (Crome 1978; Frith 1984; Cameron 1985; Recher *et al.* 1985b). NZ: Round Dunedin, SI, foraged mostly in canopy of trees, and less often in subcanopy, in shrubs or on ground; black morphs tended to forage at lower levels than pied morphs, in lower part of canopy, in shrub layer and on ground, and less often in upper canopy (Craig 1972). Round Christchurch, foraged mostly in understorey and foraged on ground and in lower understorey more often in winter than in other seasons, but shifted to use of high perches in breeding season. Of 1532 observations of foraging: 17% on ground; 3% just above ground (<0.5 m above ground); 21% in lower understorey (0.5–1.5 m above ground); 31% in mid-storey (1.5–3 m); 21% in upperstorey (3–6 m); and 7% in canopy (6–15 m) (Ude Shankar 1977). In Windbag Valley, mostly foraged in under-storey; of 5161 observations of foraging: 3% on ground; 38% in lower understorey; 26% in upper understorey; 12% in shaded canopy (within canopy); 10% in unshaded canopy (on top of canopy); 3% among emergent leaves above canopy; and 7% above canopy. On Little Barrier I., mostly foraged aerially and mainly in open, typically round bare branches and tree-trunks; of 200 observations foraging: 32.0% in lower understorey; 4.0% in mid-storey; 57.5% in upper understorey; and 6.5% above canopy. Heights of foraging were: 7.1% on ground; 22.6%, 0.1–1.5 m above ground; 13.8%, 1.6–3.0 m; 15.5%, 3.1–4.5 m; 23.0%, 4.5–6 m; 5.9%, 6.1–7.5 m; 4.2%, 7.6–9.0 m; 2.5%, 9.1–10.5 m; and 5.5%, >10.5 m. On Cuvier I., mainly foraged in middle strata; of 619 observations of foraging (1973 and 1981 combined; data estimated from graphs): *c.* 13.6% on ground; *c.* 15.6%, <1 m above ground; *c.* 18.4%, 1.1–2 m; *c.* 16.0%, 2.1–3 m; *c.* 9.8%, 3.1–4 m; *c.* 10.4%, 4.1–5 m; *c.* 2.4%, 5.1–6 m; *c.* 2.4%, 6.1–7 m; *c.* 1.4%, 7.1–8 m; *c.* 1.4%, 8.1–9 m; and *c.* 7.6%, ≥10 m. Fantails foraged significantly higher when feeding with Saddlebacks (see Foraging associations above) than when feeding alone in 1973, but not in 1981. On Hen I., NI, foraged in upper parts of understorey of Pohutukawa *Metrosideros excelsa* forest (Merton 1966).

FORAGING SITES: AUST.: Mainly forage aerially, less often from foliage, twigs or branches of shrubs and trees. At Laceys Ck (n=81 obs. foraging), unlike most studies, foraged mainly in foliage of trees (74% of obs.) with rest in air (22%) and occasionally from tree-trunks (4%). In Paluma Ra., of 371 observations of foraging: 75.0% in air; 19.9% from small leaves (<15 × 10 cm), twigs and small branches; 0.96% from large leaves (>15 × 10 cm); 0.8% from branches >5 cm in diameter; 0.2% from dead branches; 0.2% from tree-trunks; 0.2% among pendant vines; 0.6% among lawyer vines *Calamus*; 0.8% among tangles of vines and dead vegetation; 1% among

leaf-litter; and 0.4% among fruits and seeds. Use of foraging sites differed slightly between dry and wet seasons: foraged more often in air and less often from foliage of trees in dry sea-son (*c.* 86.4% and *c.* 9.3% respectively) than in wet (*c.* 65.2% and *c.* 29.4%). In Imbota NR, of 174 observations of foraging: 78% were in air, 0.6% on ground, 14.5% among foliage, 0.6% from twigs, 4.6% from branches, and 1.7% on tree-trunks; of these observations, prey was collected mostly from air (77.3%), with rest from plants, mostly eucalypts, including Broad-leaved Stringybark (17.6%), Blakely's Red Gum (1.1%) and Yellow Box (1.7%), and from Fern-leaf Wattle *Acacia filici-folia* (2.3%). Near Bombala (n=2354 obs. foraging), foraged mainly in air (78% obs.) with rest among foliage (14%), from bark on trunks and branches (4%), and on ground (4%). In Five Day Ck Valley, mostly foraged in and adjacent to outer foliage of trees and shrubs but also seen foraging in open space above foliage and over creek; rarely foraged among low shrubs or ferns in understorey of closed habitats or on flats, though often foraged above shrubs and bracken. When foraging in trees or shrubs: during Oct.–Mar. (n=1183 obs. foraging), 55% of observations in outer foliage, 26% on distal branches, 11% on proximal branches, and 8% on tree-trunks; during Apr.–Sept. (n=710 obs.), 46% in outer foliage, 34% in distal branches, 15% in proximal branches, and 5% on trees-trunks. At this site, perches used while foraging (n=5399 perches, throughout year): 42% sclerophyllous foliage, such as that of eucalypts and acacias; 14% mesophyllous foliage, mostly understorey plants; 16% needle-like foliage, such as that of casuarinas; 8% in dead plants; 9% in tall shrubs; 2% in low shrubs; 4% on logs, stumps or fences; and 5% on sticks, rocks or ground. Used different perches for different feeding methods: when scanning from a fixed perch and sallying for prey, mostly used dead leafless twigs in outer crown of living tree, or dead branch below crown; when searching and flushing prey by continuous movement, used live twigs and branches within crown. In Snow Gum woodland in Kosciuszko NP, s. NSW (n=80 obs. of foraging during snow-free months or when snow cover patchy [absent during winter]), foraged almost exclusively in air (97% of obs.) with rest in shrubs (1%), and on snow-free ground (2%) (Osborne & Green 1992). In ne. Tas., of 165 foraging obser-vations in summer and 162 in winter: 77% and 86% in air, 17% and 6% from foliage, 0% and 4% from ground, 5% and 3% from branches, and 1% and 1% from trunks; not observed foraging from loose bark or fallen logs (Cale 1994). On Culeenup I., WA, of 72 foraging observations: 60% in air, 20% among foliage, 5% among twigs, 5% among outer branches, 5% among foliage of saplings, and 5% on trunks and branches of saplings (Keast 1975). In Big Brook SF, of 108 observations of foraging: 49% in air, 24% on ground, 23% among foliage, 3% on branches and 1% on tree-trunks. At Jandakot (n=141 obs. foraging), mostly foraged in air (86% obs.; other substrates not specified). At Dryandra, of 182 observations of foraging: 77% in air, 7% among foliage, 14% on tree-trunks and 2% on ground. On Hamilton Downs Stn (n=12 obs.), foraged mainly in air (10 obs.) and among foliage (2 obs.). In Mountain Ash forests in central Vic., foraged in air and among foliage, often of tall Silver Wattles, and, in autumn, on ground (Loyn 1985b). Other sites: seen catching insects disturbed by people walking along bush track (Dove 1916); feeding on flies on beachcast seaweed (Carter 1903; North); sallying round brambles of blackberries (McNamara 1937); observed glean-ing insects from surface of nest-mounds of Australian Brush-turkey *Alectura lathami*, and sallying for flying insects disturbed by raking of Brush-turkey working on mound (Jones 1987); sallying above tall, dense shrub layer beneath an often open, depleted tree layer (Wykes 1985); and taking insects from bird bath (Sympson 2003). NZ: Forage mainly in air, usually near tree-tops, less often in low shrubs, among foliage and branches of trees, and on ground; often forage along tracks or in clearings

in forests, or in riparian vegetation (Guthrie-Smith 1910; Moncrieff 1929; Turbott 1967; St Paul 1975; Heather & Robertson 1997; Oliver; CSN 6); occasionally forage on beachcast debris, over exposed rocks at low tide, sometimes dipping to forage from surface of water (McKenzie 1948; Heather 1957; Edgar 1962; Skegg 1963, 1964; CSN 19). On Kapiti I., observed foraging above shrubs on foreshores and swamps (Wilkinson & Wilkinson 1952). On Hen I., forage in upper-understorey of Pohutukawa forest; one obtained prey from twig it was perched on, and another foraged on ground among litter (Merton 1966). On Noises Is, Hauraki Gulf, NI, forage in all habitats, from wave-cut rock platforms exposed at low tide to canopy of forest; regularly sally for insects above open slopes, rocky coves, reefs and water (Cunningham & Moors 1985). Round Christchurch, foraged mostly in foliage; of 1213 observations of foraging: 43% among foliage, mainly on small branches; 38% in air; 17% on ground; and 2% on tree-trunks. Foraged on ground more often between May and Aug. than at other times, and foraged in air more often between Sept. and Nov. than at other times. On Little Barrier I., foraged only in air (Gravatt 1969). On Cuvier I. (n= 619 obs. foraging; data from 1973 and 1981 combined, estimated from graphs), main perches used from which to launch attacks were: twigs (c. 43%); branches, mainly small ones (c. 27%); foliage (c. 13%); tree-trunks (c. 4%); and ground (c. 13%). At this site, when foraging with Saddlebacks (n=278 obs.), foraged from significantly larger perches than when foraging alone, such as increasing use of branches and tree-trunks (to c. 77%), and not seen to forage on ground. In Windbag Valley, of 5161 observations of foraging, used ≥46 species of plants, including 11 canopy species, and 24 shrubs and other plants in understorey. Of these observations, most (86.5% obs.) were of unidentified prey, but were mainly invertebrates; 13.1% positively identified as feeding on invertebrates (mostly insects), from 33 species of plant, most commonly Silver Beech *Nothofagus menziesii* and Kamahi *Weinmannia racemosa*; 0.3% identified as feeding on fruit, from four species of plant; and <0.1% (2 obs.) identified as feeding on nectar, from two species of plant; a large proportion of total observations was in air (38%); see Table 1 for summary of plants used for foraging.

FORAGING METHODS: Usually search for prey by scanning from vantage perch, but also by moving continuously through vegetation (e.g. Cameron 1985 [Five Day Ck Valley studies below]; O'Donnell & Dilks 1994). Most prey taken in air, mainly by various forms of sallying or by flush-pursuit, and less often by flutter-chasing; some also taken by gleaning (AUST.: Littler 1903; Milledge 1972; Recher et al. 1985b; Ford et al. 1986; Recher & Davis 1997; and see below; NZ: McLean 1912; Oliver 1922; Wilkinson 1927; Moncrieff 1928; Stead 1932; Horning & Horning 1974; Dennison et al. 1978, 1979; Gill et al. 1983; Heather & Robertson 1997; CSN 8; see below). However, as with other fantails *Rhipidura*, much foraging by sallying or flutter-chasing probably actually flush-pursuit *sensu* HANZAB; flush-pursuit also sometimes treated as a search, rather than an attack, method (e.g. Cameron 1985; see below). Fanned tail possibly used to disturb prey (Moon 1982; see below); tail possibly important in aiding abrupt foraging manoeuvres (Harrison 1976). AUST.: **Search** In Five Day Ck Valley, used two methods for searching: (1) remain on vantage perch for ≥5 s while scanning for prey; and (2) search while continually moving among vegetation. Most prey was located by first method, using a series of vantage points, and changing perches at mean of 7–9 times/min. On locating prey, often made three or four flights in pursuit of prey in quick succession, from same perch; also performed dives, horizontal sweeps and cone flights over surrounding vegetation or water from low perches to catch a single prey. Also made long roundabout flights in open air after launching from vantage perches, especially in tall trees; such flights often included five or six

changes of direction (maximum of 12 observed) and lasted for up to 20 s. When searching by continuous movement among vegetation, moved rapidly in short flights, hops and occasional spins, sometimes using >20 perches/min; in this method, wings were lowered and tail fanned wide, greatly increasing size of bird and its shadow, which thought to have effectively dislodged or flushed concealed prey. **Attack** At Laceys Ck (n=81 foraging obs.), foraged mainly by flutter-chasing (74% of obs.) with rest by flush-pursuit (4%) and sallying (22%), mainly in air. In Paluma Ra., of 371 observations of foraging: 73.6% by sallying, including sally-striking in air (70.9%), sally-striking on vegetation (2.5%) and sally-hovering (0.2%); 25% by flutter-chasing (possibly partly or wholly flush-pursuit); and 1.4% by gleaning. In Five Day Ck Valley (n=1578 obs. foraging over year), most prey caught aerially, almost exclusively by sallying (>98% over year) and very occasionally by gleaning (maximum 2% of observations throughout year); sallying comprised sally-hovering (13.6% over year) and sally-striking, mostly or wholly in air (some might have been sally-striking on vegetation). Further, at least some attacks were flush-pursuit, especially sallying attacks following searching by continuous movements (see above), because wing and tail used deliberately to disturb prey before chasing them. In Imbota NR, of 174 observations of foraging: 97.7% by sallying, including sally-striking in air (77.6%), sally-striking on vegetation (18.4%) and sally-hovering (1.7%); and 2.3% by gleaning. Near Bombala, of 2354 observations of foraging: 92% by sallying, including sally-striking in air (78%), sally-striking on vegetation (13%) and sally-hovering (1%); and 8% by gleaning. In ne. Tas., fed mainly by sally-striking in air throughout year: of 162 foraging observations in winter and 165 in summer: 86% and 77% by sally-striking in air; 2% and 8% by sally-striking on hard substrate; 0% and 1% by sally-hovering; 11% and 14% by gleaning; and 1% and 0% by hanging; not observed probing or pouncing (Cale 1994). At Dryandra (n=182 foraging obs.), foraged mainly by sallying (99% obs.), including sally-striking in air (77%), sally-striking on vegetation (7%), sally-hovering (14%) and sally-pouncing (1%); and rarely by gleaning (1%). On Hamilton Downs Stn (n=100 foraging obs.), foraged exclusively by sallying: mainly sally-striking in air (84% obs.), as well as sally-hovering (8%) and sally-striking on vegetation (8%). NZ: On Cuvier, Tiritiri Matangi and Little Barrier Is, foraged by: (1) SALLYING for flying insects by flying between perches or returning to same perch; often sallied through swarms of insects in clearing, above canopy of forest or at edge of forest, and sometimes took more than one prey item in a sally; (2) FLUSH-PURSUIT, disturbing resting prey and capturing them in flight, and taking only one item per flight; often occurred in dense vegetation, where visibility limited; and (3) FOLLOWING OTHER BIRDS in foraging association, perching close to host, moving at same pace, and making short flights to capture prey disturbed by host; feeding site and availability depend mainly on habits of species being followed (McLean 1984b, 1989). Round Christchurch, foraged by gleaning from foliage, ground and tree-trunks, and by sallying, especially during breeding season. When gleaning from foliage, birds adopted characteristic posture in which tail fanned and positioned slightly above level of back, and wings slightly spread and lowered; birds moved between branches mainly by hopping or, sometimes, gliding slowly with tail and wings fanned or fast flapping flights with tail closed. When foraging on ground: hopped across leaf-litter, walked or ran over twigs on ground with tail fanned, or jumped up and flew low over ground, at height of c. 8–30 cm, disturbing and chasing prey. When gleaning from tree-trunks, clung to trunk, moving up, down and round trunk, flicking fanned tail and wings; occasionally, after ascending trunk, darted out from surface then returned to lower point on trunk to repeat sequence; rarely pecked at trunk. Sallied for flying

insects either in slow fluttering flights or faster and more direct flights to capture fast-flying prey, such as blowflies, sallying from all stages of vegetation from fallen logs to heights of 12 m above ground. In Windbag Valley, of 5161 observations of foraging (data estimated from graph): *c.* 20% of observations were searching, scanning for prey from perches; *c.* 49% sally-striking in air; *c.* 1% sally-hovering; and *c.* 30% gleaning. On Kapiti I., foraged mostly by sallying for flying insects (Wilkinson & Wilkinson 1952). On Cuvier I., showed significant differences between sallying and flush-pursuit in: (1) height of foraging; (2) perches used; (3) length of foraging flights; and (4) time spent perched. When sallying, used all perches between ground and top of lower canopy or in open canopy above forest; during flush-pursuit, mainly used small perches in dense vegetation of lower canopy or ground. Of 273 observations of sallying and 96 of flush-pursuit: 11% of sallying, and 22% of flush-pursuit from ground; 2% and 0% from trunks of trees; 7% and 3% from large branches; 40% and 5% from small branches; 38% and 64% from twigs; and 2% and 6% from foliage. During breeding season, no significant difference between sexes in method or heights of foraging, but was significant difference in both between breeding and non-breeding birds: breeding birds tended to take more prey by sallying than flushing, especially when fledgelings being fed (McLean 1989). Sometimes also hang upside-down along fronds of tree-ferns or among foliage to pick prey from underside of leaves (Heather & Robertson 1997).

TIMES OF FEEDING: During summer in Aust., sometimes forage actively till 20:00 or even later (Bedggood 1970). In Paluma Ra. (n=517 foraging obs. during six 2-h periods; data estimated from graph), foraged at similar rates throughout day: *c.* 18% of observations 06:30–08:29; *c.* 14%, 08:38–10:29; *c.* 22%, 10:30–12:29; *c.* 16%, 12:30–14:29; *c.* 15%, 14:30–16:29; and *c.* 15%, 16:30–18:30. In NZ, foraging started late in morning, continued into afternoon and stopped after dusk (Stead 1932; Wilkinson & Wilkinson 1952). FOOD HANDLING: Use feet and claws to hold large prey against perches to dismember them before eating (Stead 1932; Hyem 1936; St Paul 1975; Dennison *et al.* 1979; CSN 4); after catching moth, held it in one foot and rubbed it against perch to remove scales, then dismembered and ate it in small pieces (Wakelin 1971; CSN 19). Round Christchurch, small prey swallowed in air; large prey brought back to perch where immediately eaten, or subdued by bashing against perch up to 50 times, before being swallowed or dismembered then swallowed. Prey carried to nestlings sometimes dropped and re-caught during flight. RATES OF FEEDING: Near Bombala (n=110 foraging acts in 121 min; based on assumption that all attacks successful), made 6.1±0.2 attacks/min; when searching, birds made 10.0±0.9 hops/min, 5.4±0.3 short flights/min, changed perch 15.4 times/min and moved mean distance of 2.3 m (2.5; 1–5+; 588). When sally-striking in air, moved mean distance of 1.2 m (1.1; 1–5; 44), and when attacking prey on hard substrates, moved mean distance of 1.1 m (1.1; 1–5+; 75) (Holmes & Recher 1986). In Five Day Ck Valley, made mean of *c.* 3–3.5 captures/min throughout year. DRINKING: Observed drinking at water trough set up in mallee heath at Mt Monster, SA (Paton & Paton 1980b), and in a bird bath (Sympson 2003). Round Christchurch, drank from streams, ponds and puddles; stood at edge of water, lowered bill into water and then raised head into vertical position; same movements made when drinking from raindrops adhering to foliage.

Detailed studies Aust. In FIVE DAY CK VALLEY, NSW (853 items from 24 stomachs; Cameron 1985): SPIDERS 1% no. INSECTS: Coleoptera 12; Diptera (including Chironomidae, Culicidae, Empididae, Muscidae, Sciaridae; Tabanidae) 36; Ephemeroptera 1; Hemiptera 4; Hymenoptera: wasps, bees, ants 44; Lepidoptera: ad. 2.

In BIG BROOK SF, WA (23 items from faeces of four birds in May [non-breeding]; and 65 from nine birds in Sept. [breeding]; Calver & Wooller 1981): SPIDERS: 0% no. May, 9% no. Sept. INSECTS: Coleoptera 24, 26; Diptera 42, 28; Hemiptera 0, 3; Hymenoptera 34, 25; Formicidae 0, 9. (See Wooller & Calver [1981] for breakdown of May data.)

At JANDAKOT, WA (49 items from faeces of 11 birds; Tullis *et al.* 1982): INSECTS: Coleoptera 27% no.; Diptera 69; Hemiptera 2; Hymenoptera: wasps and bees 2.

NZ In ORONGORONGO VALLEY, NI (41 faecal samples from adults mist-netted Oct. 1973–Aug. 1976; Moeed & Fitzgerald 1982): **Plants** Unident. 9.8% freq. GYMNOSPERMS: Podocarpaceae: *Dacrydium cupressinum* sds and fru. 2.4. **Animals** CRUSTACEANS: Amphipods 2.4. DIPLOPODS 4.8. SPIDERS 46.3: Opiliones 4.8. INSECTS: Coleoptera 75.6: Curculionidae 22.0; Elateridae 2.4; Diptera 87.8: Tipulidae 12.2; Ephemeroptera 17.0; Hemiptera 34.1: Cicadellidae 14.6; Cixiidae 7.3; Hymenoptera: wasps 95.0; Lepidoptera ads 95.0, larv. 2.4; Neuroptera 39.0; Odonata 7.3; Orthoptera: Anaststomatidae or Rhaphidophoridae 9.8; Phasmatodea 2.4; Plecoptera 2.4.

Other records Aust. Plants DICOTYLEDONS: Rosaceae: *Rubus* fru.[22].**Animals** SPIDERS[11,27]. INSECTS[3,7,11,12,19,21,25, 26,28]: Coleoptera[5,18,20,24,27,28,29]: Bostrychidae[29]; Carabidae[29]; Chrysomelidae[20,27,29]: *Haltica ignea*[29]; *Monochirus*[17]; *Tomyris*[27]; Coccinellidae: *Rhyzobius*[27]; Curculionidae[20,24,27,29]; Scarabaeidae[27,29]; Staphylinidae[17,29]; Dermaptera[20]; Diptera[2,4,5, 6,16,18,20,25,27,29]: Calliphoridae: *Calliphora*[27]; Cecidomyiidae[27]; Ceratopogonidae[8]; Culicidae[1,29]; Drosophilidae: *Drosophila*[27]; Muscidae[17]: *Musca domestica*[10,27]; Otitidae[16]; Syrphidae[27]; Tabanidae[9,27]; Hemiptera[18,29]: Cercopidae[26]; Cicadellidae[27]; Pentatomidae[17]; Psyllidae[27]; Hymenoptera: wasps[18,29]; bees[26,27]; Chalcididae[27]; Formicidae[15,18,24,26,27]: *Pheidole*[23]; *Rhytidoponera metallica*[27]; Halictidae: *Nomia*[27]; Ichneumonidae[27]; Mutillidae[27]; Isoptera: Rhinotermitidae: *Coptotermes*[13]; Lepidoptera[14,18,20,25,27]: Lycaenidae: *Zizina labradus*[24]; Mantodea[29]; Orthoptera: grasshoppers[11]. REPTILES: Lizards[11].

REFERENCES: Carter [1] 1902, [2] 1903; [3] Littler 1903; [4] Campbell 1904; [5] Berney 1907; [6] Littler 1910b; [7] White 1917; [8] Stuart-Sutherland 1919; [9] Jackson 1920; [10] Stidolph 1923; [11] Jarvis 1929; [12] McKeown 1934; [13] Keast 1944; [14] Cooper 1947; [15] Bedggood 1965; [16] Green 1966; [17] Green & McGarvie 1971; [18] Matthiessen 1973; [19] Keast 1975; [20] Vestjens 1977; [21] Hughes & Hughes 1980; [22] French 1990; [23] Lepschi 1993; [24] Rose 1999; [25] North; [26] Cleland; [27] Lea & Gray; [28] Hall; [29] FAB.

NZ Plants DICOTYLEDONS: Chloranthaceae: *Ascarina lucida* fru.[14]; Onagraceae: *Fuchsia excorticata* fru.[14]; Rubiaceae: *Coprosma foetidissima* fru.[14]. **Animals** SPIDERS[4,15]. INSECTS[7,10,16]: Coleoptera[15]; Diptera[2,4,8,9,13,17]: Calliphoridae[5,11,19]: *Calliphora huttoni*[10]; Ceratopogonidae[5,6,16,18]; Chironomidae[6]; Culicidae[6]; Muscidae: *Musca domestica*[3,6]; Tabanidae[5]; Hymenoptera: wasps[15]; Lepidoptera[1,2,6,11,12, 15,18]; Neuroptera[5]; Orthoptera: grasshoppers[2]. **Other matter** Cooked vegetables[19]; pieces of meat[19]; bread[19].

REFERENCES: [1] Guthrie-Smith 1910; [2] McLean 1912; [3] Stidolph 1923; Moncrieff [4] 1929, [5] 1931; [6] Stead 1932; [7] Merton 1966; [8] Turbott 1967; [9] Ramsay & Watt 1971; [10] Horning & Horning 1974; [11] St Paul 1975; [12] Dennison *et al.* 1979; [13] Baker 1980; [14] O'Donnell & Dilks 1989; [15] Heather & Robertson 1997; [16] Oliver; CSN [17] 6, [18] 19, [19] 21.

Young Nestlings and fledgelings fed by both parents (see Breeding). Round Christchurch, nestlings were usually fed blowflies; also two records of young being fed moths (Dennison *et al.* 1979; Sedgwick 1983). On Chatham I., moths had wings removed before being fed to nestlings. Nestlings were fed once every 2.25 min, increasing to one feed per min in last hour before dusk. When feeding young, adults

usually collected food within 18.3–27.4 m of nest (Dennison et al. 1979). For feeding rates on Cuvier I., see McLean (1975 [Fig. 1.5]). Round Christchurch, food for nestlings was captured 1–8 m from nest. During 27-h observation at two nests, parents made mean 25.5 visits/h to nest. There appeared to be general increase in feeding frequency as fledging period progressed (see Ude Shankar 1977 [Table 23] for details). At one nest in Aust., nestlings were fed c. every 5 min (NRS).

Intake   At Jandakot, WA, fed on insects 1–6+ mm long (n=49 insects): 7% up to 2 mm long, 39% 2–4 mm, 26% 4–6 mm, and 28% >6 mm (Tullis et al. 1982). At Big Brook SF, fed mostly on prey 3–8 mm long (Wooller & Calver 1981).

Table 1.   Plant species from which food taken in Windbag Valley, s. Westland, NZ. Figures are % of total observations for each column. Of 5161 observations of foraging: only 13.1% (677 obs.) positively identified as feeding on invertebrates (mostly insects); 0.3% (13 obs.) identified as feeding on fruit; and <0.1% (2 obs.) identified as feeding on nectar (O'Donnell & Dilks 1994).

| PLANT SPECIES | FOOD ITEMS | | | |
| | All feeding | Invertebrates | Fruit | Nectar |
N	5161 obs.	677 obs.	13 obs.	2 obs.
CANOPY SPECIES				
Dacrydium cupressinum	8.0	6.4	–	–
Dacrycarpus dacrydioides	1.2	1.2	–	–
Elaeocarpus hookerianus	0.2	0.6	–	–
Lagarostrobos colensoi	0.1	0.4	–	–
Metrosideros umbellata	1.9	1.5	–	–
Nothofagus menziesii	9.2	10.6	–	–
Podocarpus hallii	0.7	0.3	–	–
P. totara	0.1	–	–	–
Prumnopitys ferruginea	3.2	1.5	–	–
Weinmannia racemosa	14.7	10.0	–	–
Dead trees (various species)	1.8	1.0	–	–
SHRUB HARDWOODS				
Aristotelia serrata	0.2	–	–	–
Ascarina lucida	1.2	–	61.5	–
Brachyglottis	<0.1	0.2	–	–
Carpodetus serratus	0.1	–	–	–
Coprosma	0.4	0.4	–	–
C. foetidissima	0.5	0.3	7.7	–
C. lucida	<0.1	–	–	–
C. rotundifolia	0.1	0.1	–	50.0
Coriaria arborea	<0.1	–	–	–
Fuchsia excorticata	0.5	0.7	15.4	50.0
Griselinia littoralis	0.5	0.4	–	–
Hedycarya arborea	0.5	0.4	–	–
Lepidothamnus intermedius	<0.1	0.2	–	–
Melicytus ramiflorus	0.2	0.2	–	–
Myrsine australis	0.2	0.3	–	–
M. divaricata	0.2	0.7	–	–
Neomyrtus pedunculata	0.5	–	–	–
Phyllocladus aspleniifolius	1.0	1.0	–	–
Pseudopanax colensoi	0.2	–	–	–
P. crassifolius	0.9	1.2	–	–
P. edgerleyi	0.4	–	15.4	–
P. simplex	0.6	0.2	–	–
Pseudowintera colorata	1.0	0.2	–	–
Schefflera digitata	0.2	0.3	–	–
Tree-ferns	4.0	1.8	–	–
OTHERS				
Astelia	<0.1	–	–	–
Ferns	0.8	0.6	–	–
Freycinetia baueriana	0.5	0.2	–	–
Metrosideros	1.7	0.4	–	–
Moss	1.1	0.2	–	–
Muehlenbeckia australis	0.2	0.3	–	–
Orchids	0.1	–	–	–
Phormium tenax	<0.1	–	–	–
Ripogonum scandens	1.9	0.7	–	–
Rubus	0.4	0.3	–	–
NOT IN PLANTS				
Ground/Air	39.7	54.8	–	–

SOCIAL ORGANIZATION   Reasonably well known from several detailed studies: in AUST., of foraging ecology in Five Day Ck Valley, on New England Tableland, n. NSW, over 3 years (Cameron 1985); and in NZ: of behaviour round Christchurch (Riccarton Bush and Botanic Gardens), Mar. 1975–Mar. 1976 (Ude Shankar 1977); and of breeding biology of 10–12 breeding pairs over two seasons on Cuvier I., NI, in 1972–1973 (McLean 1980; McLean & Jenkins 1980), of nesting attempts of pairs in two territories over three seasons (Aug. 1959–Mar. 1960, Sept. 1964–Jan. 1965 and Aug. 1965–Feb. 1966), near Gisborne, NI (Blackburn 1965, 1966), and of breeding over three seasons at Kowhai Bush, Kaikoura, SI, in 1976–78 (Powlesland 1982); also see Breeding and additional references therein. GREGARIOUSNESS: AUST.: Usually occur singly or in twos, which sometimes probably pairs (e.g. Green & Mollison 1961; Hobbs 1961; Thomas 1962; Heron 1970; Rix 1970, 1976; Ford 1971; Milledge 1972; Bedggood 1973; Abbott 1976; Gibson 1977; Gall & Longmore 1978; Badman 1979; Marchant 1979; Roberts 1980; Close & Jaensch 1984; Nichols & Nichols 1984; Cameron 1985; Halse et al. 1985; Jones 1986; Olsen et al. 1991; Templeton 1991; Hall; Storr 16; 21, 22, 26, 27, 28, 35); less often in small groups of 3–5 birds (e.g. Le Souëf & MacPherson 1920; Watson 1955; Morris 1975; Cooper 1979; Ford 1981; Gould; SA Bird Rep. 1977–81) or up to ten (Storr 28). Tend to be more gregarious in non-breeding season, especially just before or during migration, when reported in larger flocks of up to 40 birds (Gilbert 1935; Sedgwick 1973; Gibson 1977; Cameron 1985; Vic. Bird Rep. 1982; see below) and, exceptionally, in hundreds (see below). Where populations migratory or dispersive (see Movements), notably in e. and se. mainland Aust. and Tas. (alisteri and albiscapa) and sw. Aust. (priessi), often form small flocks of up to 40 birds just before and during passage (Sedgwick 1968; McGarvie & Templeton 1974; Brothers 1978; Aust. Atlas 1; Storr 35; NSW Bird Reps 1970, 1997; Vic. Bird Rep. 1982; Tas. Bird Rep. 19), though flocks often up to ten (McGarvie & Templeton 1974; Templeton 1991); sometimes occur singly and in pairs (Alexander 1926; Nielsen 1991). Exceptionally, loose flocks of 200 or more occasionally reported in NSW and Tas., Aug.–Oct. (Hobbs 1961; NSW Bird Reps 1976, 1990; Tas. Bird Rep. 9). NZ: Much as Aust. Usually occur singly and in twos, which probably often pairs (McLean 1912; Stuart-Sutherland 1919; Cottrell 1923; Wilkinson 1924; Moncrieff 1929, 1931; Fleming 1939; Ude Shankar 1977; Freeman 1994; Miskelly et al. 2001). However, more gregarious in non-breeding season, when form small flocks (Moncrieff 1929; St Paul 1975; Powlesland 1982; Freeman 1999; Oliver; CSN), e.g. 40–50 in clump of trees in Feb. (Studholm 1948); on Snares Is, 15 Feb., loose flock of ≥40 (Miskelly et al. 2001). Recently independent juveniles sometimes form flocks (McLean & Jenkins 1980; Freeman 1999; CSN 37). Exceptionally, reported in hundreds: in Kaitieke Valley, NI (at some 244–683 m asl), gather in large numbers, up to hundreds, in autumn but fewer reported on return movements in spring (Moncrieff 1929). ASSOCIATIONS WITH OTHER SPECIES: Commonly associate with other birds, and often join mixed-species feeding flocks, usually of other small insectivorous passerines (particularly thornbills, gerygones, robins and treecreepers), and Silvereyes and honeyeaters (e.g. Sedgwick 1968; Baxter 1980; Bell 1986; CSN 39; see Food [Foraging Associations] for details of mixed-species feeding flocks), though rarely join mixed flocks in breeding season (McLean 1989; Dean 1990; see Food: Foraging associations).

Bonds Monogamous (McLean 1980; McLean & Jenkins 1980). Breed in simple pairs, within all-purpose territories (e.g. Disher 1960; Blackburn 1963, 1965, 1966; Soper 1964; Craig 1972; Rix 1976; Dennison *et al.* 1978; Marchant 1979; McLean & Jenkins 1980; Ashton 1985, 1987; Cameron 1985; Keast 1985; NRS; see Territories below). No information on duration of bonds. Once, a male took over part of a territory occupied by a female after her previous mate disappeared; the new male later paired with female and fed fledgelings of original pair (Craig 1972). AGE OF FIRST BREEDING: Both sexes able to breed when 1 year old, though males possibly breed as immatures within 1–2 months of fledging (Powlesland 1982). **Parental care** Both sexes incubate, brood and feed nestlings, remove faecal sacs, and feed and attend fledgelings (see Breeding). In NZ, fledged broods occasionally join another pair of adults and are fed by them (Powlesland 1982), and once when female parent re-paired, new male partner fed fledgeling of previous pairing (Craig 1972). Round Christchurch, pair often started second nest while still feeding fledgelings; male then fed fledgelings more than female (Ude Shankar 1977). DEPENDENCE AND DISPERSAL OF YOUNG: Fledgelings fed and attended by both parents, and remain in natal territory, for several weeks after fledging, then disperse (Blackburn 1965; Coates 1966; Wheeler 1971; Brown & Brown 1981, 1991; see Breeding). On Cuvier I., NZ, fledgelings remained with both parents for mean 12.5 days (3–30; 6), though male possibly continued to feed fledgelings after female re-nested (McLean & Jenkins 1980). Young in one brood fed by parents for ⩾24 days after fledging (Powlesland 1982). When near independence, young seen to be driven away, mildly, by both parents (Blackburn 1966).

Breeding dispersion Nest in solitary pairs, and territorial while breeding (see below) but little information on breeding dispersion. On Cuvier I., distance between active nests of different pairs 25–180 m (McLean 1980); on Kapiti I., estimated to be one pair every 4 ha (Wilkinson 1927). In Aust., at Moruya, se. NSW, estimated 13 pairs in 20 ha (Marchant 1979). **Territories** Territorial (McLean 1980; Cameron 1985; Sedgwick 1988), defending large, all-purpose territories (McLean 1980) during breeding season and, at least in some places where resident, in non-breeding period (Blackburn 1965, 1966; see below). On Cuvier I., during breeding season, males sing from many perches within territory but, at dawn, sing from particular, regularly used song-posts, most of which within 20 m of nest (15 of 18); mean 18.7 m (14.29; 7–60; 18) from nest. On Cuvier I., nests appeared to be built anywhere in territory, from near centre to near edge, though pairs tended to build new nests away from neighbouring nest-sites (McLean 1980; which see for locations of sites in 12 territories). Near Gisborne, one pair preferred particular part of territory in which to build nest over several seasons (Blackburn 1966). At Kowhai Bush, one male occupied same territory in at least two breeding seasons (with different mates) and during intervening non-breeding season (Powlesland 1982). SIZE OF BREEDING TERRITORIES: In Aust.: on New England Tableland, n. NSW, mean 0.9 ha (n=12) (Cameron 1985); at Moruya, se. NSW, estimated 1–2 ha or larger (Marchant 1992). Adults tend to forage close to nest (Cameron 1985); one pair remained within *c.* 50 m of nest (Plumb 1948); see Breeding (Site) for distances travelled to collect nesting material. In NZ: near Gisborne, one territory *c.* 0.3 ha (Blackburn 1965); on Cuvier I., minimum diameter of territories 100 m (McLean 1980). NON-BREEDING TERRITORIES: Use larger area than when breeding; one territory in NZ estimated to be *c.* 0.35 ha (Blackburn 1965). No information on migratory populations.

Roosting At night. In ne. Qld, roosted in small tree (Hopkins 1972). Communal roosting recorded in winter in SI, NZ: seven birds clustered together on a wire loop in doorway of shed (Tunnicliffe 1980); 16 birds roosted together on wire in garage (Powlesland 2002); three birds (two pied and one black morph), seen going to roost together in July, but kept separate during day (Moncrieff 1941–42); and late on one evening in June, two birds roosted together inside house, apparently with their heads tucked into each other's necks (Burrows 1955).

SOCIAL BEHAVIOUR Well known. Detailed study of behaviour round Christchurch (Riccarton Bush and Botanic Gardens), SI, NZ, 1975–76 (Ude Shankar 1977), on which account based unless stated; some information also from studies of breeding in NZ (as in Social Organization: Blackburn 1965, 1966; McLean 1980; McLean & Jenkins 1980; Powlesland 1982); no detailed studies in Aust. Often described as tame or confiding, especially when foraging and incubating (e.g. Carter 1902; Milligan 1902; Littler 1903; Legge 1908; Dove 1916; Alexander 1917; Littlejohns & Lawrence 1917; Jackson 1920; Oliver 1922; Sharland & Crane 1922; Fletcher 1924; Ross 1926; Leach 1929; Bryant 1930; Austin 1950; Cunningham 1954; Campbell; North; Mathews; Oliver), though such descriptions sometimes disputed (e.g. Wolstenholme 1922, 1929; Ude Shankar 1977). Said to appear inquisitive or tame because foraging behaviour often includes close approach to other animals, including people (Hermes 1981; McLean 1989; see Food). Once, perched on muzzle of gun (Kendall 1901). While said to desert nest if closely inspected or disturbed by human observer, especially before hatching, this not always so, and will continue building nests in presence of observer (see Breeding: Success). During and just before migration, sometimes gather in large, loose flocks (see Social Organization). **Maintenance behaviour** BILL-WIPING: Head lowered below level of perch (usually branch), and drawn against perch as head raised. Usually repeated, and during long episodes, often turn body. Used to clean bill and often occurs after feeding, nest-building or removal of faecal sacs of nestlings. Also occasionally occurs after aggressive interactions with conspecifics. HEAD-SCRATCHING: Scratch head directly by bringing foot straight up to head without moving wing. Sometimes scratch rapidly and briefly after stop foraging, after standing in nest, or after nest-relief. Prolonged scratching often performed when preening, using first one foot and then the other. STRETCHING: Stretch wings and legs. Often extend one wing and corresponding leg, with leg extended backward and held under tail which fanned on same side of body. Occurred in 55% of stretches (n=41). At other times (45%), stretched both wings upward simultaneously, with little extension of wing and no tail-spread. Occasionally, stretching on one side followed by either stretching on other side or upward stretch of wings. Often occurs after long periods of rest or sitting on nest. Usually followed by tail-fanning and either foraging or flight. FACE-RUBBING: Base of bill placed against perch (usually branch) and head slowly rotated once or twice, to rub area between eye and bill against perch. Occasionally performed while preening, nest-building, or after nest-relief. HEAD-FORWARD MOVEMENT: Neck rapidly extended and relaxed on re-settling on nest. Occurs when incubating or brooding, often after standing to preen or rearrange eggs. YAWNING: Bill opened wide in manner resembling yawn. Occurs when attending nest. PECKING: Vigorous pecking at leg or foot. Occasionally occurs after leaving nest or when preening (Ude Shankar 1977). PREENING: Of two types: (1) Nibbling, in which bird takes feathers in tips of mandibles and repeatedly passes them between mandibles, working from base to tip of feather; and (2) Drawing, which is similar to Nibbling, but feather pulled through mandible in one movement. Long bouts of preening, lasting up to 20 min, usually occur after bathing or during inactive periods. Shorter bouts of preening, lasting only a few seconds, often occur after nest-building, at change-over at nest during incubation and

brooding, after displays, or after foraging. Displacement preening, also lasting only a few seconds, occasionally observed when preening would not normally be expected, such as when startled or during conflicts (Ude Shankar 1977; Dennison *et al.* 1978). Fledgelings also allopreen (Blackburn 1966); not recorded in adults. BATHING: In NZ, bathe in streams and puddles throughout year: bird crouches in water, dunking head and lowering body farther into water, lowering tail to horizontal and rapidly flicking it from side to side, and flicking wings upward from body; after hopping from water, bird perches and ruffles feathers of body, and shakes tail vigorously (Ude Shankar 1977). One seen bathing under spray from house (Stidolph 1973). Also recorded bathing in Aust. (Fletcher 1924; Paton & Paton 1980b); once, sat in pool of water, *c.* 50 cm from edge and immersed up to belly, and fluttered vigorously for *c.* 10 s before flying to shore, then repeating actions several times (Hewish 1998), and sometimes in a bird bath (Sympson 2003). SUNNING: One bird sat side-on to sun, with wing and half of tail spread, and head turned away from sun; held this position for 2 min, then returned to shade to preen; another bird sat in sun on nest with tail and both wings fully spread for 1–2 min. RESTING: Most often rest in middle of day and late afternoon. Hunch head into shoulders, raise contour feathers, close and slightly depress tail, fold wings tightly together above tail, and flex legs slightly, often standing on one leg with other tucked into feathers. In full sleeping posture, head is turned sideways so that bill rests on scapulars (Ude Shankar 1977).

Agonistic behaviour Territorial while breeding and, at some places where resident, throughout year (see Social Organization). **Territorial advertising** Song functions in advertising ownership of territories (as well as in sexual behaviour [q.v.]). Sing throughout year, though more in breeding than non-breeding season. During breeding season on Cuvier I., males sing from many perches within territory but at dawn sing from particular, regularly used song-posts; rates of singing higher at dawn than at any other time of day. Both sexes sing, though females less often than males (McLean 1975, 1980; Ude Shankar 1977; McLean & Jenkins 1980). Will also sing on or near nest (Ross 1926; Moncrieff 1931; Ude Shankar 1977). For discussion of seasonal and diurnal use of Song, see Voice (NZ). Birds do not usually respond to Song of territorial neighbours, though countersinging by males occurs sometimes, rarely by females (see Voice [NZ]). On Cuvier I., respond more aggressively to playback of Song of a stranger than to playback of Song of a neighbour (McLean 1975; see Voice). Agonistic interactions occur: between members of pair at beginning of breeding season, and usually associated with sexual activity; and, more commonly, with other individuals in territorial disputes involving neighbouring Fantails. Aggression towards other Grey Fantails mostly recorded during breeding season (McLean 1975; Powlesland 1982); also occasionally recorded at other times of year (Ude Shankar 1977). Round Christchurch, territorial boundaries established at start of breeding season (Aug.), when there was a rapid increase in Chattering calls (Ude Shankar 1977). Agonistic interactions take form of boundary-flights, bill-snapping, several threat postures and chases. **Threat** During territorial disputes sometimes give BOUNDARY-FLIGHT, which includes BILL-SNAPPING. On Chatham I., during a territorial dispute, one bird chased another through its territory to boundary; the two then performed Boundary-flights in which they repeatedly flew parallel along boundary for 10 m, a few centimetres apart and *c.* 1 m above ground, snapping bills loudly; between Boundary-flights, birds perched facing one another, flicking wings open and calling harshly before, after 10–15 s, resuming boundary-flight with Bill-snapping. Performed Boundary-flights four times before birds returned to respective territories (Dennison *et al.* 1979). Adults attack recently independent young less aggressively than they attack adults; juveniles usually allowed to continue feeding (McLean & Jenkins 1980). Birds apparently on autumn passage in sw. WA, seemed not to experience active aggression from resident Fantails (Sedgwick 1988). WING-SHIVERING: Bird faces and points bill towards opponent, lowers body, flexes legs, lifts and spreads wings and vibrates them rapidly without raising them above level of back or below level of chest and keeps tail folded and in line with body. Performed by either member of pair at beginning of breeding season and directed towards partner, or directed towards other species (such as Silvereyes and thrushes *Turdus*) during breeding season. Thought to be hostile (Ude Shankar 1977); function not stated, possibly threat. HEAD-SWAYING: Male sleeks his body, holding wings back and close to body, extending legs, raising and pointing bill towards female partner and moving head from side to side while stretching his neck. Only performed by male during later stages of nest-building. Recorded 31 times in three circumstances: after female sang near nest; after she Wing-shivered at male; or after she chased him. Female responded to display by crouching, lowering head, closing and raising tail vertically, and often ruffling her body-feathers. Male usually stops displaying when female turns away, but, rarely, copulation or courtship feeding follows. Display thought to be used to threaten female. PIVOTING: While facing opponent, bird holds body horizontal and swings rapidly from side to side while standing on one spot, and folded tail is also whipped rapidly from side to side. Identity of opponent not known, but probably usually bird from neighbouring territory. Circumstances of use not described further. BILL-LOWERING: Face opponent with head and body lowered and horizontal and tail folded and aligned with body. Identity of opponent not known, but probably usually bird from neighbouring territory. Circumstances of use not described further. CHASE: When others intruded into terri-tory, territory-holder usually first chased intruder out then gave threat displays at territory boundary (e.g. McLean 1975; Dennison *et al.* 1979). During chases near territory borders, often flew in fast, twisting flight, or in series of tight circles (McLean 1975). Occasionally, female chased male, probably resulting from rejected sexual approach. Chatter often given while chasing (Ude Shankar 1977). Occasionally perform Bill-wiping after chase (see above). **Submission** SUBMISSIVE POSTURE: Perch, slightly crouched, with head hunched into body and contour-feathers raised, and usually facing away from aggressor. Submission seen in interactions between neighbours (n=10) and mates (n=4). **Alarm** Call when alarmed, with variety of different sounds (see Voice), e.g. when see intruder within territory, when hear sudden noise, when observer near nest, if frightened by bird of another species (McLean 1975), when Tui close to nest (Moncrieff 1931) or when person approached fledgelings (Dennison *et al.* 1978). Once, in mixed-species flock, gave alarm call which resulted in other members of flock scattering and remaining silent and still for several seconds; flock then re-formed (Hindwood 1937). **Interactions with other species** Most, if not all, interspecific aggression occurs during breeding season and near nest, when eggs, nestlings or fledgelings potentially threatened. Such interactions initiated by both sexes but more often by male (Ude Shankar 1977). Call in response to threats near nest (see Alarm). Round Christchurch, NZ, seen to attack or confront birds and mammals, including New Zealand Falcon *Falco novaeseelandiae*, New Zealand Pigeon *Hemiphaga novaeseelandiae*, Grey Warbler, House Sparrow *Passer domesticus*, Common Chaffinch, Silvereye, Common Blackbird *Turdus merula* and Song Thrush and Cats, Dogs and Hedgehogs *Erinaceus europaeus*. Confrontation and attacks on passerines included diving at intruder, fluttering round intruder, pecking, and alarm, mobbing or aggressive calls (see Voice), and often followed by chasing. When confronting non-passerines and

mammals, gave alarm, mobbing or aggressive calls, and much Pivoting, sometimes fluttering above intruder; did not usually approach closer than c. 1 m, and when confronting cats, did not approach closer than c. 2 m (Ude Shankar 1977). On Cuvier I., NZ, attacked birds near nest, including Bellbird *Anthornis melanura* (n=27), Saddleback (n=11) and Dunnock *Prunella modularis* (n=1) (McLean 1975). In Aust., seen to be aggressive to Hooded Robins *Melanodryas cucullata*, Rufous Fantails and other small passerines, including thornbills *Acanthiza* and robins *Petroica* (Mayo 1938; Woinarski 1984; Cameron 1985; Robinson 1993; Fitri & Ford 1998; Trémont 2000; Mathews; Vic. Bird Rep. 1987); in Tas., when feeding fledgelings, adults drove away Green Rosellas *Platycercus caledonicus* (Green 1950); and, once, a Willie Wagtail grasped tail of Fantail sitting on nest with its bill and was then attacked by the pair of Fantails (Elliott 1933). **Mobbing** Seen to mob mammals, including people (Ude Shankar 1977); not recorded mobbing birds.

Sexual behaviour As well as territorial advertisement, Song used in formation and maintenance of pair-bond (Ude Shankar 1977). During breeding season, male and female sometimes duet while perched close together (within 1–2 m) (see Voice). **Courtship** Courtship consists of brief, rapid but noisy AERIAL CHASES, interspersed with shorter periods of perching and bouts of loud Song from perched male (Blackburn 1966; Dennison *et al.* 1979); said male usually perches 50–100 cm below female, and sometimes quivers wings (Blackburn 1966); vocalizations during chases not described. Chases sometimes end in courtship feeding (Dennison *et al.* 1979). Near Gisborne, such courtship behaviour mostly took place early in morning or late in evening (Blackburn 1966). Once, both sexes recorded displaying to each other, 'with little flight and much quiet song' for 15 min from 04:35 on 10 Jan.; at 07:00 on same day, female was seen building new nest (Blackburn 1966). GREETING DISPLAY: Wings fully spread horizontally and vibrated rapidly, with head lowered; display sometimes performed by either bird, when one, usually male, returns from long foraging trip (Blackburn 1966). SELECTION OF NEST-SITE: On finding suitable site, one member of pair repeatedly flies below site, giving loud Cheep Calls in flight, to attract mate to site; birds then perform Body-contact and Hop-over displays (see below). After perching in tree for 30–60 s, either pair flew out in opposite directions but perching nearby, or one flew out, leaving the other preening. Birds then either foraged or repeated behaviour. Also said to inspect potential sites by sitting in spot and turning around, doing so in several sites before pair agrees on one (Fletcher 1924). Male and female call to each other when building nest (Moncrieff 1931). SEXUAL PURSUIT: Near Christchurch, male often followed female in flight, to and from nest or through vegetation. Possibly same as Aerial Chases (see above). Occurred during nest-site selection and nest-building; said to also occur during pair-formation, which not further described (Ude Shankar 1977). **Courtship feeding** With insect in bill, male sought out female by sight or by going to nest and giving call (see Voice: Other Buzz Calls), to which female responded by calling or approaching male. On locating female, male lands beside or in front of female. Female then gaped, showing bright-yellow markings in mouth, while adopting submissive posture, crouching down with head lowered, tail closed and wings held close to body. Male then fed female while standing in upright posture with tail cocked and slightly fanned. Round Christchurch, male fed female, up to 30 times/h during pair-formation and nest-building; courtship feeding stopped after incubation began (Ude Shankar 1977). Male also seen to feed incubating female on nest (McGilp 1920). BODY-CONTACT: Performed by both sexes on branches or on nest, during selection of nest-site and building of nest. Bird hops sideways to bump into side of partner, maintaining contact for 1–4 s before

flying away or turning on perch to face away from partner. HOP-OVER: Performed by both sexes as part of selection of nest-site, during building of nest and before feeding fledgelings. One bird approaches mate, either in parallel or from right angle, then hops over back of mate, which stands rigid, with head lowered and always turned away from mate; either bird then flies away or continues with more Hop-overs, or displaying bird begins singing, preening or resting. Fledgelings also perform Hop-over. PRE-COPULATORY DISPLAY: Copulation usually preceded by Pre-Copulatory Display (*contra* Blackburn 1966); round Christchurch, performed by female in 81% of 31 copulations observed. Female faces male, with legs flexed, body lowered and horizontal to ground, bill pointed slightly upward and vibrating wings slightly spread, and held well above back, all the while uttering high-pitched calls. Once, when female did not respond to Display by male, he deserted territory 3 days later (Blackburn 1965). **Copulation** During copulation, male aligns his body parallel with that of female. When male mounts female, she stops vibrating wings and moves her tail to one side while tail of male held to side of and below that of female. Male fanned tail when copulation nearly finished. Males often fell off female, after which they performed Head-swaying below female (see above). After copulation, female usually flies off. Copulation sometimes follows courtship feeding; and recorded 5 days before laying (Ude Shankar 1977; Dennison *et al.* 1979). Twice, copulation followed much singing (McLean 1975). Copulation once seen at 05:30 (Blackburn 1966). **Greeting** AERIAL NEST-RELIEVING: During change-over at nest during incubation and brooding, birds perform a lot of acrobatics above or in front of nest; if sitting bird does not respond by flying off, relieving bird displays repeatedly.

Relations within family groups Male and female call to each other during incubation and nestling periods, usually at change-over and before feeding nestlings (Moncrieff 1931; Dennison *et al.* 1979; Sedgwick 1983; see Voice); adult will also call from nest while sitting (Campbell 1906). During incubation, female usually returned to nest quickly when male departed; thought that she responded to singing near nest (Ude Shankar 1977). Parents give Buzz-Zit calls or Feeding Vocalization to encourage nestlings to beg (McLean 1975; Ude Shankar 1977). Nestlings respond to calls or presence of parents with peeping, and juveniles respond with cheeps (McLean 1975; see Voice). When parents approach with food, fledgelings give Buzz call (see Voice) and assume a BEGGING POSTURE in which bird crouches, holds wings slightly away from body and flutters them, and points open bill slightly upward (McLean 1975; Ude Shankar 1975). For 3–4 days after fledging, siblings stay close together in tight group near nest; such groups break up over next few days but may re-form, especially towards evening. When in tight groups, fledgeling siblings sometimes fly together round and through trees, and jockey for position after landing together (Blackburn 1965, 1966). When feeding tight group, sometimes parent hops over backs of fledgelings to feed one on other side of group (Ude Shankar 1975). Sometimes, juveniles from one family join juveniles from another family and are adopted and fed by new parents (Powlesland 1982). **Anti-predator responses of young** Fledgelings stayed motionless on close approach of a Tui *Prosthemadera novaeseelandiae* (Blackburn 1966). Round Christchurch, groups of siblings disband and sit quietly in foliage when parent attacking Silvereyes or thrushes *Turdus* near nest-site (Ude Shankar 1977). On Cuvier I., juveniles crouched or scattered when heard Alarm Cheep (see Voice), then stayed still till calling stopped (McLean 1975). Sometimes fledge prematurely on approach of human observer (North). **Parental anti-predator strategies** Some adults sit tight on nests (Dove 1916; Blackburn 1966; St Paul 1975; Dennison *et al.* 1978; North; Mathews). Adults become agitated

and give alarm calls or Mobing Cheep (see Voice) when nest or young approached or interfered with by potential predator, including people (e.g. Rix 1943; North; Serventy & Whittell); and vigorouslydefend nest with eggs, nestlings or fledgelings (McLean 1975 Ude Shankar 1977; Dennison *et al.* 1979); see Interactions wth other species (above) for details of such behaviour. Wher Saddlebacks (n=2) and Bellbirds (n=3) peered into nest, sitting bird crouched lower in nest (McLean 1975). Once, when young fledged on approach of observer, adults fluttered about and landed on observer's head (Stidolph 1923). Adult nale will lead fledged young away from nest of subsequent brood (Blackburn 1966).

VOICE Vocalizations from Aust. and NZ are treated separately below. The Songs of nominate *fuliginosa* from SI of NZ (sonagrams in Ude Shankar 1977) and of subspecies *placabilis* from NI (sonagrams in McLean 1975, 1980) are a series of short, moderately loud, broad-band notes followed by very short notes louder and purer in tone, and higher in frequency (see NZ, below); are quite unlike whistled Songs of Aust. subspecies (sonagrams in Ford 1981, Keast 1993; see Aust. below) (Ford 1981; T. Howard). Extralimitally, Song of New Caledonian populations said to closely resemble that of Vic. birds (Leach 1929); these subspecies part of same subspeciesgroup (or species if DAB followed). For regional differences within Aust. and NZ, see below.

Aust. Reasonably well known, though much less so than NZ populations, which see for more detailed analysis and discussion of most aspects, including repertoire, frequency of use and function of vocalizations and development of vocalizations (though vocalizations of subspecies differ). Study of regional variation of Song by Ford (1981) includes sonagrams; additional sonagrams in Keast (1993) and Jurisevic & Sanderson (1994). Song cheerful and varied, described as one of the more beautiful bird songs, if a little weak and tinny (Lord 1939b; Frith 1969; Mathews); some notes are modulated, sharp and musical, like the high notes of a violin (Sharland 1958). ANNUAL AND DIURNAL PATTERN OF SONG: At Ebenezer, NSW, a major contributor to dawn chorus for much of Aug., Nov. and Dec., and a lesser contributor in Sept.–Oct.; first call 35–15 min before sunrise (Keast 1994). REGIONAL VARIATION: Within Aust. subspecies, Song said to be fairly stereotypical. However, one bird near Busselton, WA (well within range of *preissi*), had a Song with phrases similar both to *preissi* and *albicauda* (Ford 1981). Songs of *preissi*, *alisteri* and *albiscapa* very similar (Ford 1981), *contra* claim that Songs from King I. in Bass Str. (*albiscapa*) differ from those of mainland Aust. (Campbell 1906). For further descriptions of Song of Aust. subspecies, see Song. RESPONSE TO PLAYBACK: Usually easy to call up with imitation, but sometimes wary (Ford 1981; Hall). Playback experiments on *preissi* and *albicauda* showed that each usually responds only to its own Song (Ford 1981). MIMICRY: Noted mimicking Superb Fairy-wren *Malurus cyaneus*, Speckled Warbler *Chthonicola sagittata* and Scarlet Robin (Lord 1939b, 1956; Chisholm 1946, 1949).

Adult SONG: Songs of *preissi*, *alisteri* and *albiscapa* very similar, consisting of series of sweet whistles, usually with little variation in frequency, except last whistle of Song, which is usually of lower pitch, and virtually no variation in amplitude; Song of *albicauda* consists of rapid series of short whistles descending in frequency, which sounds like a trill; Song of *keasti* somewhat similar, except that whistles are more or less continuous, so that Song seems to be a single utterance (Ford 1981). Sonagram **A** shows Song from *alisteri*. Other descriptions of Song from Aust.: a sweet twittering song (Gould); a weak but pretty little run of notes, heard to best advantage during breeding season (Littler 1903, 1910a); a low but sweet warbling song, comprising a quickly uttered *chip chip*, followed by a succession of clear and varied musical notes (North); a
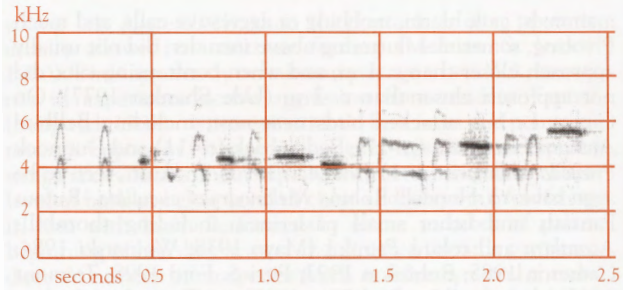
**A** R. Buckingham; Noorinbee, Vic., Jan. 1983; P50

rapid, squeaky, high-pitched phrase, animated, stereotyped and complex, and varied sometimes by truncation (Keast 1993); and clear and musical, but giving the impression of never quite being completed (Officer 1969). No analysis of circumstances of use of Song in Aust.; see NZ (below) for discussion; also see Social Behaviour. CHIP: Said to be a rapid single or double *chip* (Aust RD). ALARM CALL: Rapid piping notes, e.g. series of ten notes, each *c.* 0.06s duration and total duration of call *c.* 1.0 s (Jurisevic & Sanderson 1994). Sharp, high-pitched notes in alarm (Hindwood 1937) possibly same call. CHATTER: Undescribed (Austin 1950). **Other calls** Change-over during incubation usually preceded by an undescribed call, not always from sitting bird (Sedgwick 1983).

Young No information for Aust. Very well known in NZ (see below).

NZ Very well known from studies on Cuvier I., NI (McLean 1975) and near Christchurch, SI (Ude Shankar 1977), each of which includes sonagrams; McLean (1980) also includes a sonagram; calls in musical notation in Andersen (1909, 1911, 1913, 1917, 1918, 1926). Many vocalizations consist of combinations or modifications of two note-types, termed *cheep* and *buzz*. Calling, particularly utterance of *cheep* notes, common at all times, and is usual means by which birds detected (McLean 1975). *Cheep* notes, Chatter or a cheery whistled Song of considerable variation uttered every few minutes throughout day (Andersen 1926; McLean 1975). Second phrase of Song Type I is very loud, and in good conditions and if uttered from above canopy, sometimes audible up to 300 m (McLean 1975, 1980). Said that bill kept closed while bird sings, or not opened perceptibly (Andersen 1926). ANNUAL AND DIURNAL PATTERN OF SONG: Patterns of use of calls, if known, given with description of calls below. Song more noticeable in spring, and pairs sometimes quite noisy, with male singing from nest and from nearby during its construction (McLean 1912; Moncrieff 1931). During breeding season on Cuvier I., rates of singing higher at dawn than at any other time of day (McLean 1980); at dawn, began singing *c.* 2 min after Bellbirds, then sang continuously for up to 30 min; thereafter, during morning and also in late afternoon, sang periodically with continuous bouts of Song that lasted 1–10 min; song heard least often during early afternoon (McLean 1975); sang from song-posts (see Social Behaviour) only at dawn (McLean 1980). Near Christchurch, males sang continuously for *c.* 30 min round sunrise, and then slightly less over next 2 h, after which there was a much greater decline. Sang throughout year, with no change in length of Songs from breeding season to non-breeding season; in breeding season, appeared to sing more often during incubation, and less often once there were nestlings or fledgelings; on approach of winter, there was an abrupt cessation of dawn singing and a general decline in number of Songs per day (Ude Shankar 1977). Elsewhere, Song heard over much of year, though less often between Mar. and May (Andersen 1926). At Dunedin, SI, usually heard every day in Mar.–Apr. but, except in one year, few if any Songs noted Aug.–Dec., possibly because birds

moved away from area (Marples 1944). On Chatham I., noisy aerial chases occurred during courtship, interspersed with bouts of Song; when incubation began, singing, especially near nest, became infrequent, and noisy chases stopped (Dennison *et al.* 1979). DIFFERENCES BETWEEN SEXES: Both sexes sing, though females less often than males and only infrequently outside breeding season (McLean 1975; McLean & Jenkins 1980). Females occasionally sing during nest-building and after leaving nest during incubation and brooding (Ude Shankar 1977). For differences in structure of Song between sexes, see Song below. DUETS: Male usually responds to Song of female with Song or Chatter. Near Christchurch, during breeding season, male and female occasionally sang in unison, both singing identical phrases at same time; in seven of 14 such duets, both began singing at same time; in most duets, singing did not finish at same time, with one bird giving an additional phrase or two (Ude Shankar 1977). On Cuvier I., members of a pair also duetted (labelled counter-singing), and pairs often counter-cheeped when foraging together (McLean 1975). COUNTER-SINGING: Birds do not usually respond to Song of neighbour, though counter-singing sometimes occurs in which Song of male alternates with Song of male from neighbouring territory; females rarely participate (McLean 1975; Ude Shankar 1977). INDIVIDUAL DIFFERENCES: On Cuvier I., individuals showed some variation in Songs they sang. Under visual inspection, sonagrams of Songs of same individual were not obviously more similar than sonagrams of different individuals. However, when sonagrams analysed statistically, similarity values were higher for two Songs of an individual than for two Songs of different birds, indicating that structure of Song of an individual had characteristics that were consistent and individually distinct (McLean 1975). Near Christchurch, there appeared to be no difference between individuals in number of three-note phrases given in Song (Ude Shankar 1977). See also discussion under Identification Cheep, below. REGIONAL VARIATION: General structure of Song observed on Cuvier I. (see Song, below) was same throughout NI and its offshore islands, and, in SI, in Nelson, Kaikoura and Christchurch (McLean 1975). RESPONSE TO PLAYBACK: Respond to imitation of calls (Andersen 1926). On Cuvier I., responded more aggressively to playback of Song of a stranger than to playback of Song of a neighbour. Response of older nestlings or fledgelings to replay of *cheep* notes from a parent and from a stranger varied, but tended to respond more strongly to *cheep* of a parent (McLean 1975). NON-VOCAL SOUNDS: Audible snaps of bill, usually 3–6 at a time, are directed at members of own or other species in aggressive situations, usually in conjunction with aggressive calling, or in territorial disputes; also heard when snapping up prey from swarms of insects, or when making successive attempts to capture one item of prey (Buller 1888; Andersen 1926; Moncrieff 1931; Stead 1932; McLean 1975; Dennison *et al.* 1979).

Adult SONG OF MALE: Near Christchurch, Song of male is a trill-like series of notes in quick succession, lasting 0.5–1.5 s, followed by a three-note phrase repeated 1–19 times, mostly 2–4 times; range of total duration very large, 0.6–11 s (Ude Shankar 1977). On Cuvier I., all birds uttered two Song types, though Song Type I was heard more often than the other. Distinguishing types by ear difficult, and required experience. Two birds were recognizable from unusual features of their Song type, but types were too similar for this to be generally possible. Song was of two phrases: the first of varying length, the second a series of repeated units given at very loud volume; one or two final notes sometimes given. Sonagram **B** shows a Song given in flight (McPherson 1990) with four repetitions in second phrase (fourth repetition somewhat abbreviated) and a final note. SONG TYPE I consists of two phrases: (1) First consists of 10–15 harsh notes, each of which covered wide frequency range and began and ended abruptly, with last ten
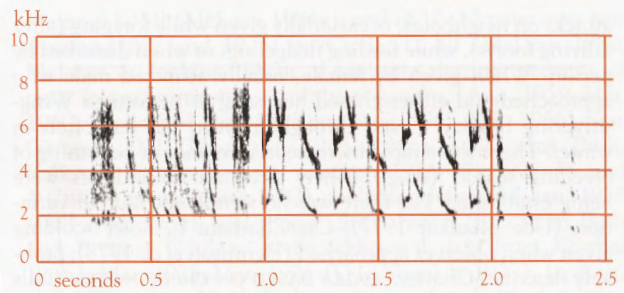
B L.B. McPherson; Mapra, NI, Jan. 1988; P106

notes always of same pattern; often give other calls in build-up to Song giving appearance of varied length to first phrase; (2) second phrase loud and comprised a repeated series of pairs of notes, each pair a short note of wide frequency followed by a longer note of 100–200 ms duration, and followed by one or two final notes. Uttered from song-posts in early morning, from any point in territory during day, and during duets and counter-singing. SONG TYPE II: Similar to Song Type I, in that it consists of a series of short, sharp notes making up two phrases but differs mainly in length of phrases, first being shorter (5–7 notes) than that of Song Type I, and second being longer and comprising a series of slightly varying repetitions of same 4–6 notes, followed by a long (200 ms) *cheep* note. Seemed to be intermediate in structure between Song Type I and Subsong (See Young, below), with notes similar to those of Subsong but, unlike Subsong, following a pattern that was, particularly for second phrase, less definite than that of Song Type I. Always given in conjunction with other calls, particularly if calling aggressively (McLean 1975). Function appeared to be territorial advertisement and establishment and maintenance of pair-bond; also given after leaving nest, while waiting for female to return to incubate, while foraging, when perched, and after threatening person (Ude Shankar 1977). Other descriptions of Song from NZ: squeaky twittering *te-wa*, repeated 8–10 times in quick succession (McLean 1912); a squeaky chatter or twittering, uttered from a perch (Oliver 1922; St Paul 1975); a song with a squeaky disyllabic note given by a male during courtship display (Blackburn 1966); and a chattering *tweeta-tweeta-tweeta...* of regular rhythm, becoming a pleasant, high-pitched, ecstatic song when displaying (NZRD). SONG OF FEMALE: Females sing less than males (see Differences between sexes above). Song of female similar in structure to that of male, though: on Cuvier I., they rarely use Song Type II (McLean 1975); and near Christchurch, Song weaker, less rhythmic and of fewer phrases than Song of male, with Songs of trill only or of trill and one phrase often given; the longest female Song was a trill and eight phrases (Ude Shankar 1977). BOUTS OF AGGRESSIVE CALLING: On Cuvier I., in breeding season, males sometimes give bouts of calling lasting up to 1 h, during which they move rapidly through their territory giving Aggressive, Alarm and Mobbing Calls, as well as Song, in a continuous sequence. No cause for behaviour apparent, though sometimes initiated by a territorial interaction or by presence of an observer (but continued long after observer left); bouts do not appear to be correlated with stage of breeding, and there is no evidence of aggression, though most calls uttered in bout are normally given in aggressive situations (McLean 1975). CHATTER (= Type 2 Call of Ude Shankar 1977): On Cuvier I., described as a low, rhythmic sawing note. Given most often during territorial interactions with conspecifics, and during Bouts of Aggressive Calling; occasionally given when attacking another species (McLean 1975). Near Christchurch, described as a series of broad-band notes, given in quick succession; a short phrase of about five notes often occurs in middle of Chatter. Given during chases and

attacks on neighbours; occasionally given while foraging (after sallying forays), while feeding fledgelings or when disturbed by person. When given by female, usually attracted male who approached and either chased her, sang or performed Wing-shivering Display. Given throughout year, but less often in winter. There was a rapid increase in utterance at beginning of breeding season (Aug.), when territorial boundaries were being established, but there was no significant diurnal variation (Ude Shankar 1977). On Chatham I., noisy scolding given when observer approached (Dennison *et al.* 1978); probably describes Chatter. CALLS BASED ON CHEEP NOTES: Calls based on *cheep* notes are most commonly heard calls (McLean 1975). *Cheep* also described as a penetrating *cheet* (Falla *et al.* 1979). Calls below are those based on *cheep* notes reported by McLean (1975); calls based on *cheep* notes reported by Ude Shankar (1977) do not correspond exactly and are given under Other Cheep Calls, below. With slight modifications in structure given in a number of different situations, sometimes in series, and sometimes with other note-types. Harmonic in structure; one or several of middle harmonics loudest, depending on individual giving call and situation in which given (McLean 1975). Cheeps have been heard long after dusk (McLean 1912). Sonagram C shows four cheeps, spacing artificial. (1) FEEDING CHEEP: Given when foraging. Those uttered by an individual were just as varied in structure as those by different individuals. Given when in flocks, in pairs or when alone; pairs often counter-cheep when foraging together, and rate of cheeping of both birds always increased when members of pair came together. (2) IDENTIFICATION CHEEP: Similar to Feeding Cheep, and appeared to be used for identification. Always given when coming to nest at change-over, with cheeps first given from 40 m away, and then every 5–15 s as bird moved directly towards nest. On at least eight occasions, exchange occurred without sitting bird sighting the other; on the few occasions when strange birds were found cheeping near a nest, the sitting bird sat closely, and even crouched lower, suggesting that it knew the bird was not its mate. Often, birds did not investigate when their mate suddenly began cheeping nearby, but cheeps from strange birds were usually investigated, further suggesting that mates could identify each other by their cheeping. (3) HIGH-FREQUENCY ALARM CHEEP: Louder, longer (125–150 ms) cheeps, of higher frequency, and of more consistent structure than Feeding Cheep, with 3–6 cheeps given at constant intervals of 200–250 ms. Given in sudden alarm, e.g. on seeing strange conspecific within territory, on hearing a sudden noise such as breaking of a branch, on seeing observer near nest, or if frightened by a bird of another species. Also given by owner of territory during territorial interactions, and during bouts of Aggressive Calling. On hearing High-frequency Alarm Cheep, juveniles crouched or scattered, then stayed still till calling stopped, or till Song was heard. (4) MOBBING CHEEP: Of same note structure as Alarm Cheep but given for longer periods, up to several minutes, with each *cheep* given at longer intervals (0.5–1.0 s). Not directed at conspecifics, but at Saddlebacks and Bellbirds that came near nests or fledgelings, at observers interfering with nests, and once directed by pair at a Long-tailed Cuckoo *Eudynamys taitensis*. (5) ALARM CALL: A series of pairs of notes, usually 3–4 pairs, given at intervals of *c.* 150 ms; first note of each pair loud and short (25 ms), followed after 75 ms by the second, a modified *cheep* note. Usually followed other alarm or aggressive calling when danger had been identified. Much less commonly heard than High-frequency Alarm Cheep, and only given when bird could do nothing about an immediate danger, e.g. when observer interfering with nest. (6) AGGRESSIVE CALL: Series of short (50 ms) *cheep* notes given in rapid staccato at intervals of 100 ms. Given by aggressor during territorial interactions, and during chases between members of a pair. Occasionally directed at an observer, but
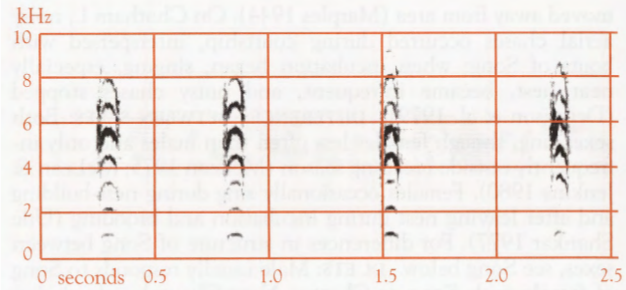
C J.L. Kendrick; P100

not otherwise observed being directed at other species; sometimes given during Bouts of Aggressive Calling (McLean 1975). CALLS BASED ON BUZZ NOTES: A *buzz* is a rapid series of sound-pulses covering a wide frequency range, with most energy in range 1.0–4.0 kHz, with a few higher harmonics. (1) COURTSHIP BUZZ: Utter 2–4 pulses of sound at intervals of *c.* 5 ms. A full call consisted of single buzz only, though given at varying rates of up to 2/s. Quiet, carrying 4–6 m, and given between members of pair when moving and foraging in close association. Heard throughout year, but most common during nest-building and laying, when birds were also courtship-feeding and copulating. Sometimes given when coming to nest for change-over during incubation. (2) AGGRESSIVE BUZZ: Similar in structure to Courtship Buzz, but consisted of up to ten sound-pulses and usually 3–4 buzzes given at intervals of *c.* 300 ms. Given during territorial interactions, and when attacking other species. Very occasionally given during Bouts of Aggressive Calling. (3) BUZZ-ZIT: A short buzz, followed after *c.* 300 ms by a much louder, short (25 ms) *zit* note of broad frequency. The next buzz (buzzes always preceded *zits*) was always given after a much shorter interval (*c.* 100 ms). Usually given in a series of up to six calls to encourage very young nestlings to beg for food. Nestlings began to respond to other calls when 3–4 days old, and this call was seldom heard after nestlings 6 days old, though *buzzes* and *cheep* notes were used separately to alert chicks for feeding. Given when building nest (directed at nest), while turning eggs, or before settling after change-over during incubation (McLean 1975). **Other calls** OTHER CHEEP CALLS: The following calls reported by Ude Shankar (1977) appear to be based on *cheep* notes. (1) A single note (Type 1 Call), given while foraging (at a rate of 2 calls/7 s), while preening, while collecting nest-material and while flying towards nest to build or to relieve an incubating or brooding mate (when within 8 m of nest, given at a rate of 7 calls/7 s). Given by both sexes throughout year, but less often in winter. Given by solitary birds in winter, members of pair in breeding season, and groups of birds in post-breeding season. Appears to have peaks in mid-morning and mid-afternoon, with noticeable decreases before nightfall and at dawn. The most common call, but function not clear. Probably corresponds to Feeding Cheep and Identification Cheep above. (2) Slightly harsher notes (Contact Type 1 Call), audible only over a short distance. Given by both sexes, only in breeding season, usually when collecting nesting material. (3) Notes (Fast Type 1 Call), often loud, and emitted at rate of 14 calls/7 s. Given by both sexes throughout year, including during flight, during chases, during mobbing and before bathing. Often precedes Chatter and Songs. Occasionally given by female when approached by male. Probably corresponds to Mobbing Call, Alarm Call and Aggressive Call (above). OTHER BUZZ CALLS: The following call reported by Ude Shankar (1977) appears to be based on *buzz* notes. A series of phrases of two notes (Feeding Vocalization), first note of each phrase of higher pitch. Given only when male or female pivoted on nest-rim when about to feed nestlings, and by male near the nest when

apparently wanting to feed female in courtship. Probably corresponds to Courtship Buzz and Buzz-zit (above). MIS-CELLANEOUS OTHER CALLS: Incessant 'talk' by both members of pair to each other when building nest (Moncrieff 1931). Incessant twitter of birds following an observer, and which stopped as nest approached (Buller 1888). Shrill squeaks when fighting own image in mirror (Stead 1932). Urgent piercing disyllabic note from male whose mate had probably been killed on nest (Blackburn 1966). On Chatham I., bird return-ing to nest began calling 20 m away, prompting incubating partner to leave, and a pair with a single flying chick called constantly when feeding (Dennison *et al.* 1978). Harsh saw-like notes during boundary disputes (Dennison *et al.* 1979) probably correspond to Chatter.

Young Juveniles developed adult calls sequentially by changing rather abruptly from one call-type to another in conjunction with similarly abrupt changes in stages of develop-ment. No evidence that calls, in contrast to Song, were devel-oped by practice. All adult calls, except those associated with court-ship, were uttered soon after abandonment by parents, and some flocking juveniles gave full Song before post-juve-nile moult began in Jan. NESTLING PEEPING: A thin wavery tone at 6–7 kHz, with beginning and end attenuated, each call lasting 75–100 ms and uttered at rate of *c.* 5/s. Difficult to locate and was not possible to find nests by following this sound. Sound carried 1 m when young 2 days old, and up to 6 m at 10 days. Usually given in response to calling of adult nearby, but also when being brooded. JUVENILE CHEEPS: Uttered at varying rates, always increasing at approach of adult with food. Given by all young after leaving nest. Very occasionally heard from nest, though uttered by older nestlings when handled. Given in response to calling of nearby adult. Sound easily located, and probably used by adults to find fledgelings. JUVENILE ALARM CHEEP: Similar to High-frequency Alarm Cheep of adult, but with fewer harmonics, and lasting *c.* 125 ms. Any number given, at intervals of *c.* 250 ms, when handled. Also given, but as a few cheeps only, when suddenly alarmed by another bird or by observer. JUVE-NILE BUZZ: As adult approached with food, calling changed from a cheep to a buzz, and a Begging Posture adopted. Series of short buzzes uttered as adult approached became a continu-ous buzz while actually feeding, and stopped immediately adult left. DEVELOPMENT OF ADULT CALLS AND SONG: Juveniles gave adult cheeps immediately on being abandoned by parents. If they re-found parents after several days, or approached other adults to be fed, they reverted to Juvenile Cheep and associated begging behaviour. When foraging alone or in flocks, only normal adult Feeding Cheep given. Independent juveniles also gave adult High-frequency Alarm Cheeps and adult Alarm Calls. Some young birds began giving SUBSONG soon after becoming independent, and one began while still being fed. Subsong consisted of a long series of notes showing some similarity to pattern of adult Song, particularly Song Type II. Notes were well formed, but a greater variety of notes was found than in either of the two adult Song-types, and birds sang continuously for periods up to 1 min. During early attempts at Subsong, birds could not produce any notes similar to very loud, high-frequency notes found in second phrase of Song Type I. After several weeks, these notes began to be given, usually one or two at a time, till full adult Song pattern was developed. Juveniles were first heard giving Song in late Nov., and full Song being given in Jan. while still in juvenile plumage (McLean 1975).

BREEDING Well known. No detailed studies in Aust., though 1367 records in NRS to Dec. 1999, and Ford (1981) provides detailed analysis of season throughout Aust. (using clutches from throughout breeding range). In NZ, detailed studies: of 11 pairs during one season (1981–82) on Tiritiri

Matangi I., NI (McLean 1984a); and of 10–12 pairs over two seasons (1972 and 1973) on Cuvier I., NI (McLean 1980; McLean & Jenkins 1980); of multiple nesting attempts of pairs in two territories over three seasons (Aug. 1959–Mar. 1960, Sept. 1964–Jan. 1965 and Aug. 1965–Feb. 1966) near Gisborne, NI (Blackburn 1965, 1966); at Kowhai Bush, Kaikoura, SI, over three seasons (1976–77, 1977–78 and 1978–79) (Powlesland 1982), including July 1977–Jan. 1978 (Gill *et al.* 1983); and round Christchurch (Riccarton Bush and Botanic Gardens, some additional data from Kowhai Bush), Mar. 1975–Mar. 1976 (Ude Shankar 1977). In Aust. and NZ, many detailed observations of individual nesting attempts. Nest in solitary pairs in all-purpose territories (see Social Organization).

Season In Aust. and NZ, clutches Aug.–Jan., mainly Oct.–Dec. (see below). **Aust.** Throughout range, clutches recorded Aug.–Jan., mostly Oct.–Dec. (Ford 1981; NRS; see below). Of 769 clutches in NRS: 44 (5.7%) in Sept., 197 (25.6%) in Oct., 241 (31.3%) in Nov., 209 (27.2%) in Dec., and 78 (10.1%) in Jan.; none recorded Feb.–Aug. (NRS). Of 659 clutches in Ford (1981): three (0.5%) in Aug., 62 (9.4%) in Sept., 167 (25.3%) in Oct., 192 (29.1%) in Nov., 184 (27.9%) in Dec. and 51 (7.7%) in Jan. (Note: Ford [1981] presented analysis of clutches in half-month periods, which lumped to months here.) Nestlings recorded mid-Sept. to mid-Feb. (NRS [n=649]; see below). All populations of *alisteri*, *albiscapa* and *preissi* breed Aug.–Jan., though season said to be longer and to peak a month later in S of range; season of *preissi* similar to that of *alisteri* in SA, but both differ from *alisteri* in Vic., where season longer than that of populations farther W (Ford 1981). These observations appear to be supported by analysis of NRS here. SUBSPECIES KEASTI, NE. QLD: Eggs, early Sept. to Jan. (Lavery *et al.* 1968; Ford 1981); of ten clutches in Ford (1981): three (30.0%) in Sept., two (20.0%) in Oct., three (30.0%) in Nov., and two (20.0%) in Dec. Single records of nestlings in Nov. and Jan. (NRS), and of fledgelings in Oct. (Garnett & Bredl 1985). Round Innisfail, nests recorded Sept. (1), Nov. (2), Dec. (2), Jan. (1) (Gill 1970). Otherwise, breeding recorded Sept. and Nov.–Dec. (Aust. Atlas 2 [n=7]). SUB-SPECIES ALISTERI: SE. QLD: Eggs, early Sept. to late Dec.; of 19 clutches from Ford (1981 [n=14]) and NRS (n=5) combined: three (15.8%) in Sept., four (21.1%) in Oct., five (26.3%) in Nov., and seven (36.8%) in Dec. Single record of nestlings in Oct. (NRS). Outside these months, said to breed till Feb., with records of fledgelings in late Oct. and late Feb. (Ford *et al.* 1980; Storr 19; NRS [n=1]). Adult once observed feed-ing two juveniles in Mar. (Ford 1981). Otherwise, breeding recorded Sept.–Feb. (Aust. Atlas 2 [n=22]). NSW, ACT: Eggs, late Aug. to mid-Feb., mostly Oct.–Dec. (Ford 1981; Morris *et al.* 1981; North; ACT Atlas; NSW Bird Rep. 1982; NRS); of 381 clutches in NRS: 11 (2.9%) in Sept., 82 (21.5%) in Oct., 133 (34.9%) in Nov., 116 (30.4%) in Dec., and 39 (10.2%) in Jan.; of 319 clutches in Ford (1981): one (0.3%) in late Aug. (from N of Hunter R.), 15 (4.7%) in Sept., 75 (23.5%) in Oct., 99 (31.0%) in Nov., 99 (31.0%) in Dec., and 30 (9.4%) in Jan., with little difference between areas N and S of Hunter R. or ACT (Ford 1981, which see for breakdown for these three areas). Elsewhere: at Moruya, most clutches laid early Oct. to end Dec., although three (replacement clutches or second broods) recorded in Jan. (Marchant 1981, 1992). Nestlings, late Sept. to mid-Feb. (ACT Atlas; NRS [n=312 broods]). At Five Day Ck Valley, laying and nestlings recorded late Sept to mid–late Jan., though fledgelings still being fed early Feb. (Cameron 1985). Dependent young have also been recorded late Feb. (ACT Atlas). Unspecified breeding recorded Aug.–Apr. (Aust. Atlas 2 [n=294]). VIC.: Eggs, Sept.–Jan., mainly Oct.–Dec. (Young & Young 1902; Lendon 1919; Thomas 1962; Wheeler 1971; Ford 1981; NRS); of 171 clutches in NRS, four (2.3%) in Sept., 46 (26.9%) in Oct., 43

(25.1%) in Nov., 51 (29.8%) in Dec. and 27 (15.8%) in Jan.; of 145 clutches in Ford (1981): seven (4.8%) in Sept., 37 (25.5%) in Oct., 35 (24.1%) in Nov., 49 (33.8%) in Dec., and 17 (11.7%) in early Jan. (Ford 1981). Nestlings, early Oct. to mid-Feb. (NRS [n=158]). Fledgelings, mid-Oct. to early Feb. (NRS [n=52]). Unspecified breeding recorded Sept.–Apr. (Aust. Atlas 2 [n=238]); also Sept.–Feb. (n=130), with single records July, Aug., Mar. and May, and most records (88.1%) Oct.–Jan. (Vic. Atlas). SE. SA: Eggs, Sept.–Jan. (Ford 1981; NRS); of 73 clutches in NRS: 15 (20.5%) in Sept., 27 (37.0%) in Oct., 20 (27.4%) in Nov., nine (12.3%) in Dec., and two (2.7%) in Jan.; of 56 clutches in Ford (1981): 15 (26.8%) in Sept., 16 (28.6%) in Oct., 17 (30.4%) in Nov., eight (14.3%) in Dec. Round Naracoorte, eggs, 26 Sept.–3 Dec. (Attiwill 1972). Otherwise, breeding recorded Aug.–Feb., and one record in Apr. (Aust. Atlas 2 [n=47]. SUBSPECIES ALBISCAPA, TAS.: Eggs, Sept. to early Jan., mostly Nov.–Dec. (Green 1950; Ford 1981; North; NRS); of 36 clutches in NRS, two (6%) in Oct., 14 (39%) in Nov., 15 (42%) in Dec., five (14%) in Jan.; of 50 clutches in Ford (1981): three (6.0%) in Sept., four (8.0%) in Oct., 26 (52.0%) in Nov., 13 (26.0%) in Dec., and four (8.0%) in early Jan. Nestlings, Oct.–Feb. (Legge 1932; NRS [n=28]). Fledgelings, Nov.–Jan. (NRS [n=5]). Otherwise, breeding recorded Oct.–Feb., and single record in July (Aust. Atlas 2 [n=45]). SUBSPECIES PREISSI, SW. WA: Eggs, late Aug. to early Jan. (Carter 1924; Plumb 1948; Carnaby 1954; Serventy 1958; Slater 1962; Ford 1981; North; NRS); of 103 clutches in NRS (all S of 30°S): 13 (12.6%) in Sept., 40 (38.8%) in Oct., 30 (29.1%) in Nov., 15 (14.6%) in Dec., five (4.9%) in early Jan.; of 56 clutches in Ford (1981): two (3.6%) in late Aug., 17 (30.4%) in Sept., 24 (42.9%) in Oct., seven (12.5%) in Nov., and six (10.7%) in early Dec. Nestlings recorded mid-Sept. to mid-Jan. (NRS [n=88]). Fledgelings noted early Oct. to early Feb. (Masters & Milhinch 1974; NRS [n=35]). At Gooseberry Hill, nestlings (n=6) recorded 26 Sept.–3 Dec., and fledgelings (n=6) 3 Nov.–31 Dec. (Brooker 2001). Otherwise, breeding recorded July–Feb., with single records in Mar. and May. (Aust. Atlas 2 [n=155]). SUBSPECIES ALBICAUDA: Very poorly known. Clutches recorded May (1), Oct. (4) and Dec. (1), but otherwise said to breed in spring (Ford 1981). INLAND WA: Breeding recorded mid-Aug. to early Oct. (Storr 26), one clutch in Sept. (Storr 21). Some birds had partly enlarged gonads in Mar. (Ford 1981). NT: Single clutches in May, Oct. and Dec. (Ford 1981; North) (Ford 1981). INLAND SA: No information.

NZ   Eggs, late Aug. to mid-Jan., mainly Sept.–Oct. to Dec. (Blackburn 1965, 1966; Gill et al. 1983). Of 44 clutches from throughout range (figures taken from graph): one (2.3%) in late Aug., 13 (29.5%) in Sept., 15 (34.1%) in Oct., seven (15.9%) in Nov., seven (15.9%) in Dec., and one (2.3%) in early Jan. (from NZ NRS, published in Blackburn 1965). Otherwise, said to breed Aug. to early Feb. (Wilkinson & Wilkinson 1952; Blackburn 1965; Flux 1974; McLean & Jenkins 1980; Oliver). Birds on offshore islands possibly have shorter breeding seasons than mainland populations (Dennison et al. 1979; McLean 1984a). In NZ, said to build nests in response to rain outside normal breeding period (Apr., May) without laying (Blackburn 1983). NI: Eggs, Aug.–Jan. (Blackburn 1965, 1966; CSN 1, 3, 4). Nestlings, Sept.–Jan. (Blackburn 1965; CSN 1, 3, 4, 5). Fledgelings, Sept.–Mar. (Bell & Braithwaite 1963; Blackburn 1965, 1966; CSN 1, 2, 3, 5, 8). On Tiritiri Matangi I., season apparently shorter than on mainland; breeding not attempted till late Sept., and most pairs did not lay till Nov.; most pairs had only one successful nest, and nests were not begun after early Dec. (McLean 1984a). On Cuvier I., breeding had just started end of Aug. and continued till Jan. (McLean & Jenkins 1980). Near Gisborne, NI, of 20 clutches: one (5.0%) begun in Aug., four

(20.0%) in Sept., three (15.0%) in Oct., four (20.0%) in Nov., six (30.0%) in Dec. and two (10.0%) in Jan.; another nest with four eggs was found 2 Nov. In 1959–60 season: one pair laid first egg on 22 Aug. and fledged five broods of three young by 21 Mar.; another pair laid first egg 19 Sept. (after losing first nest before laying, and then rebuilding), then fledged seven young from three broods by 7 Jan. In 1964–65 season, one pair laid first egg on 26 Sept. and fledged five young from three broods by 6 Jan.; another pair lost eggs on 29 Sept., then raised two broods between 6 Oct. and 12 Dec., and lost eggs on 16 and 27 Dec. In 1965–66 breeding season, pair laid first egg on 9 Sept. in third nest of season, and laid first egg of final clutch on 14 Jan., and fledgelings observed on 18 Feb. and for c. 2 weeks after; second pair laid first eggs on 18 Sept. in fourth nest of season and last clutch laid on 1 Dec., but this failed and female disappeared. Earlier breeding in 1959–60 season suggested to have been due to heavier rainfall in July–Aug., possibly leading to increased food supply (Blackburn 1965, 1966). SI: Eggs mid-Sept. to late Dec. (Powlesland 1982; Gill et al. 1983; CSN 4). Nestlings, Oct. and Jan. (Powlesland 1982; CSN 8). Fledgelings, Oct.–Nov. to early Feb. (Powlesland 1982; CSN 6, 8, 19, 33, 34). One brood still being fed on 1 Mar. at Arthurs Pass (CSN 8). At Kowhai Bush, SI, 1976–79, first eggs laid 10 Sept. 1976, 17 Sept. 1977 and 11 Sept. 1978; last broods fledged around 8 Feb. 1977 and 21 Jan. 1978; and last nestlings hatched 20 Jan. 1979 but did not fledge (Powlesland 1982). Also at Kowhai Bush, during 1977–78 season, eggs recorded mid-Sept. to late Dec. (n=149 clutches); breakdown by week from mid-Sept.: 6, 3, 11, 19, 7, 0, 3, 12, 14, 14, 17, 6, 19, 5, 13 (Gill et al. 1983; figures taken from graph).

Lord Howe I. Eggs (n=7 clutches) recorded Oct.–Nov. (Basset Hull 1909; Hindwood 1940). One sighting of dependent fledgelings in Oct. (Basset Hull 1909). **Norfolk I.** Eggs, Sept. (Hermes et al. 1986); nestlings, Dec. (Schodde et al. 1983). **Chatham Is** Breeding recorded Oct. to late Jan. (Dennison et al. 1979; Nilsson et al. 1994). Two clutches Dec. and one in Jan., latter clutch completed on 21 Jan. (Dennison et al. 1978, 1979). Nestlings, Oct. and Dec. (Dennison et al. 1979; Nilsson et al. 1994). Fledgelings, Nov.–Dec. (Dennison et al. 1979; Nilsson et al. 1994).

Site Usually low in trees or shrubs, occasionally in man-made structures, in wide variety of habitats (Young & Young 1902; Littler 1910a; Dove 1916; Alexander 1917; Wolstenholme 1922; Moncrieff 1931; Legge 1932; Green 1950; McLean & Jenkins 1980; Saunders & Ingram 1995; NRS; see below; also see Habitat). Nest usually placed on thin horizontal branch or fork, though sites vary greatly and include near-vertical branches or forks (Littler 1903, 1910a; Basset Hull 1909; Alexander 1917; Dickison 1929; Legge 1932; Lashmar 1942; Thomas 1962; Blackburn 1966; Hermes 1985; Campbell; North; NRS). Once, nest woven onto stems of bamboo (Moncrieff 1931); another suspended in roots, dangling c. 30 cm below roof of cave; and another attached to roots protruding from a bank (Moncrieff 1931). One placed on frond of tree-fern (Cunningham 1954). Often in dense vegetation (Cameron 1985). Usually well sheltered by surrounding foliage and vegetation (Ude Shankar 1977; Powlesland 1982). On Cuvier I. (n=46 nests), 44 (96%) sheltered by canopy overhead, 43 (93%) in fork of branch, and 44 (96%) on a horizontal branch (McLean & Jenkins 1980). Will nest in riparian vegetation, sometimes very close to water or on branch overhanging water (Littler 1903; Legge 1908; McLean 1912; Alexander 1917; McGilp 1920; Carter 1924; Cunningham 1954; Hinsby 1954; Napier 1969; Heron 1970; Bedggood 1980; Cameron 1985; Keast et al. 1985; Campbell; Oliver), though few records of this in Aust. NRS. In Tararua Ra., NI, said to nearly always nest near water (Wilkinson 1924). AUST.: Usually nest in trees, saplings or shrubs, especially

tea-trees (McGilp 1920; White 1925; Lashmar 1942; North), paperbarks (Young & Young 1902; Heron 1970; Masters & Milhinch 1974) and eucalypt or acacia saplings (Fletcher 1924; Sutton 1927; Hitchcock 1938; Disher 1960; Wheeler 1971; Bedggood 1973; Campbell; North); sometimes also nest in mangroves (Hindwood 1935) or exotic pines *Pinus* (Hobbs 1961; Disney & Stokes 1976; Tas. Bird Rep. 10). From sample of 200 nests in NRS: 50 (25%) were in eucalypts, 35 (18%) in acacias, 19 (10%) in *Melaleuca* or *Leptospermum*, 12 (6%) in broom-heath *Monotoca*, eight (4%) in casuarinas, seven (4%) in banksias, five (3%) in *Pittosporum*, four (2%) in *Olearia*, two (1%) in Blackberry, two (1%) in bracken, and one (1%) in bamboo; 14 (7%) were in unidentified saplings and 41 (21%) in other trees and shrubs. At Gooseberry Hill, WA, three nests found in Marri and one each in Flooded Gum *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (Brooker 2001). Other records from literature (singles unless noted): *Angophora* (Hyem 1936; North), Turpentine (North), poplar *Populus* (Disher 1960), juniper *Juniperus* (Lashmar 1937), *Cotoneaster* (Wheeler 1971), walnut tree *Juglans* (Wheeler 1971), Almond *Prunus* (Hyem 1936), Orange *Citrus sinensis* (Brown & Brown 1983), Cherry Laurel *Prunus laurocerasus*, *Euonymus*, cypress *Cupressus*, ivy *Hedera*, and hawthorn *Crataegus* (Legge 1908; Legge 1932); as well as further records of species in NRS sample (Carter 1924; Fletcher 1924; Hyem 1936; Plumb 1948; Hinsby 1954; Smith 1984; North). NZ: From NZ NRS to 1973, of 185 nests: 74.6% in native trees (many species were used, though Kawakawa *Macropiper excelsum* was one of most common), 23.8% in exotics, and 1.6% in sites other than trees (two on wire, one on rock ledge) (McLean & Jenkins 1980). On Tiritiri Matangi I., NI (n=24 nests), seven nests (29%) were in *Coprosma* (four in large-leafed forms), six (25%) in tree-ferns *Cyathea* or *Dicksonia*, three (13%) in Mahoe *Melicytus ramiflorus*, two (8%) in Kohekohe *Dysoxylum spectabile*, two (8%) in Kawakawa, two (8%) in *Leptospermum*, and singles (4%) in Pohutukawa *Metrosideros excelsa* and Monterey Cypress *Cupressus macrocarpa* (McLean 1984a). On Cuvier I., NI (n=46 nests), 24 nests (52%) were in Kawakawa (the most common shrub in study area), seven (15%) in Rangiora *Brachyglottis repanda*, five (11%) in tree-ferns *Cyathea*, four (9%) in Hangehange *Geniostoma ligustrifolium*, four (9%) in Kohekohe and singles (2%) in Whau *Entelea arborescens* and Karamu *Coprosma robusta* (McLean & Jenkins 1980). At different sites in NI, said to prefer to nest in Rangiora (which has large leaves) and *Coprosma* (Wilkinson 1924, 1927; Moncrieff 1931); or mainly nest in Manuka *Leptospermum scoparium* (Weeks 1949). On Kapiti I., usually nest in trees with large leaves, such as Kawakawa, Karaka *Corynocarpus laevigatus* or *Olearia cunninghamii*, but also in Manuka or Tauhinu *Cassinia leptophylla* (Wilkinson & Wilkinson 1952). Once in an *Olearia forsteri* growing from a rock (Wilkinson 1927). Near Gisborne, NI, in one season, one pair built seven nests: three in Karaka, two in Totara *Podocarpus totara* and singles in Whau and Kawakawa; another pair built six nests: two in Karaka and singles in Mahoe, Karamu, Totara and Matipo *Myrsine chathamica* (Blackburn 1966). At Kowhai Bush, nests (n=202) placed in Mahoe (19.0%), Kanuka *Kunzea ericoides* (17.8%), Karamu (8.0%), Tutu *Coriaria arborea* and Raurekau *Coprosma australis* (4.0% each), and 22 other species (Powlesland 1982). Round Christchurch, of 18 nests: five (27.8%) in *Coprosma*, two (11.1%) each in Cabbage Tree *Cordyline australis*, Rimu *Dacrydium cupressinum*, Mahoe and Horoeka Lancewood *Pseudopanax crassifolius*, and singles (5.6%) in Monterey Cypress, *Hoheria*, Kanuka, Mapou *Myrsine australis* and Kohuhu *Pittosporum tenuifolium*. Other records of plants used from literature include: conifers (CSN 22, 31), rose *Rosa*, a hedgerow, a fern (c. 1 m tall) (CSN 22), tree-fern (Cunningham 1954), hanging roots under a roadside bank (CSN 22), Tawa

Beilschmiedia tawa, Towai *Weinmannia silvicola* (McLean 1912), *Eucalyptus*, *Rhododendron*, oak *Quercus*, bamboo (Moncrieff 1931), willow *Salix* (Stead 1932), Gorse *Ulex europaeus* (Pennycook 1949), rata *Metrosideros* (CSN 9), and Scotch Broom *Cytisus scoparius* (Stidolph 1923); as well as further records of species listed earlier (Wilkinson 1927; Moncrieff 1931; Flux 1974; CSN 22). NORFOLK I.: Recorded nesting in 'wild tobacco', 'currajong' tree and 'bloodwood' (Basset Hull 1909). CHATHAM IS: Recorded in Chatham Islands Karamu *Coprosma chathamica*, Corokia *macrocarpa*, Silver Fern *Cyathea dealbata*, Tarahinau *Dracophyllum arboreum* and Chatham Island Violet *Hymenanthera chathamica* (Dennison et al. 1978, 1979). **Throughout range** Also often nest in artificial structures, including wire or hooks dangling from buildings (Green 1950; Blackburn 1963; NRS). Also recorded nesting in plants on veranda (NRS); once nested in a *Begonia* in a totally enclosed sun-porch, with only entry via a circuitous route through several rooms (Coates 1966). SITE-FIDELITY: Reported to nest regularly in same area annually, but not in exactly the same spot; to rear multiple or replacement broods in same area; and to abandon nests before laying and rebuild nearby (Wilkinson 1927; Moncrieff 1931; Stead 1932; Wilkinson & Wilkinson 1952; Hinsby 1954; Disher 1960; Thomas 1962; Blackburn 1966; North). At Moruya, NSW, replacement nests or second broods often located far from original nests, although one record of three attempts in same nest (Marchant 1992). At Harvey, WA, pair made seven nesting attempts, 1980–82, all within radius of 13 m, including three successive clutches in one nest, apparently without alteration (Sedgwick 1983). Sometimes old nests renovated and re-used after success or failure of previous clutch (Blackburn 1963, 1966; Coates 1966; Wheeler 1971; Flux 1974; Ude Shankar 1977; Dennison et al. 1979; McLean & Jenkins 1980; Ashton 1987), though this considered exceptional, as most nests heavily infested with ectoparasites, a problem that may be partly offset by delaying refurbishment of nest for c. 1 month (Blackburn 1966; Ashton 1987). On Cuvier I., no significant relationship between distance between successive nests and success or failure of previous nest; after failure, distance between successive nests 41.0 m (15.57; 5), and after success, 74.2 m (46.63; 6). However, some indication that replacement nests built away from active nests of conspecifics that were within 70 m (McLean 1980). At Kowhai Bush, 19 of 202 nests (9.4%) were used for two successive broods; 15 were re-used following successful fledging of first broods, three after predation of first attempts; at one nest outcome of first attempt unknown. Nests were re-lined before being re-used. Few banded adults or nestlings were resighted in study area in successive breeding seasons, but at least one pair re-nested within a few metres of previous nest (Powlesland 1982; see Social Organization). On Cuvier I., distance between synchronous nests of neighbouring pairs 25–180 m (McLean 1980). In Aust., once nested 10 m from conspecific, also one other record of two pairs nesting 50 m apart. One observer recorded 22 nests within c. 100 m radius, including several groups of nests clustered together in close proximity. One pair rebuilt 5 m from previous nest, another pair 10 m from first nest (NRS). ASSOCIATIONS WITH OTHER SPECIES: Once nested in same tree as Rufous Fantail, with both on eggs (Howe 1928). Also recorded nesting in same tree with Yellow-rumped Thornbills and Varied Triller *Lalage leucomela*. Occasionally nest near other species, including: Laughing Kookaburra *Dacelo gigas*, Superb and Variegated *Malurus lamberti* Fairy-wren, Brown Thornbill, Yellow-faced *Lichenostomus chrysops* and White-naped *Melithreptus lunatus* Honeyeaters, Eastern Spinebill *Acanthorhynchus tenuirostris*, Jacky Winter *Microeca leucophaea*, Flame and Hooded Robins, Varied Sittella, Golden and Rufous Whistler, Grey Shrike-thrush *Colluricincla harmonica*, Willie Wagtail, cuckoo-shrike *Coracina*, White-

winged Triller *Lalage sueurii*, Dusky Woodswallow *Artamus cyanopterus*, Double-barred *Taeniopygia bichenovii* and Red-browed *Neochmia temporalis* Finches, Diamond Firetail *Stagonopleura guttata*, Welcome Swallow *Hirundo neoxena* and Silvereye (NRS). Once nested near nesting Square-tailed Kite *Lophoictinia isura* and Little Eagle *Hieraaetus morphnoides* (Johnston 1983). SITE SELECTION: One female deposited and regathered a small amount of nest-material at two forks, before placing it on a third fork in which nest was subsequently built (McLean 1975). Round Christchurch, site appeared to be selected by both adults. Interval between selection of site and start of building (0–7 days) decreased as season progressed for all pairs studied (see also Social Organization). MEASURE-MENTS (m): Height of nests varies greatly (Littler 1903; Moncrieff 1931). AUST.: Height of nest, 3.3 (3.49; 0.0–30.0; 1271) in plants of height, 6.58 (5.81; 0.7–42.0; 882); one nest in Blackberries was at ground level (NRS). At Five Day Ck Valley, NSW, mean height 7 (n=14), but ranged from 1–17.5 (Cameron 1985; see Fig. 1 for height distribution). Near Bombala, NSW, 89 of 123 nests (72.4%) were located between 2 and 13 above ground (Recher & Holmes 1985). Other heights of nest 2.6 (1.63; 0.6–7.6; 23) (Dove 1916; Wolstenholme 1922; Carter 1924; Sutton 1927; Legge 1932; Elliott 1933; Hyem 1936; Lashmar 1937, 1942; Hitchcock 1938; Plumb 1948; Green 1950; Hinsby 1954; Disher 1960; Thomas 1962; Wheeler 1971; North) or with ranges between 0.9 and 18 (Fletcher 1924; Hyem 1936; Wheeler 1971). NZ: Height of nest usually 1.5–5 (Stead 1932). From NZ NRS to 1973, 3.7 (0.7–24.0; 190); three nests (1.6%) were over 10, and 61 (32.1%) were over 3 (McLean & Jenkins 1980); at Gisborne, 1.5–7.0 (17 nests of two pairs over two seasons) (Blackburn 1965); on Tiritiri Matangi I., 1.9 (0.63; 1.2–3.2; 24), excluding one at 8.0 (McLean 1984a); on Cuvier I., 1.68 (0.8–3.2; 46), lower than nests on mainland (McLean & Jenkins 1980); at Kowhai Bush, 2.9 (1.1; 0.8–6.9; 176) with little variation from month to month or between seasons (Powlesland 1982; see Fig. 2 for height distribution); round Christchurch, 3.49 (2.57; 1.5–11.0; 19). Other heights in literature: 4.98 (3.86; 1.37–18.3; 29) (McLean 1912; Stidolph 1923; Wilkinson 1927; Moncrieff 1931; Pennycook 1949; Cunningham 1954; Blackburn 1963, 1966; Coates 1966; CSN 9, 22, 31). Said to nest higher in dense vegetation than in open country (McLean 1912). LORD HOWE I.: Height of nest, 0.9–4.6 (Basset Hull 1909). CHATHAM IS: Height of nest, 1.0–5.0 (Dennison *et al.* 1978, 1979; Nilsson *et al.* 1994).

Nest, Materials Cup-shaped, usually with pendulous tail (Dove 1916; Alexander 1917; Carter 1924; Chisholm 1924; Dickison 1929; Wilkinson & Wilkinson 1952; Blackburn 1965; St Paul 1975; McLean & Jenkins 1980; Oliver) giving appearance of wine glass with base of stem broken off (Littler 1903, 1910a; Basset Hull 1909; McGilp 1920; Green 1950; North; Serventy & Whittell; NRS). However, some nests lack tail (Howe 1928; Elliott 1933; Lashmar 1942; Wilkinson & Wilkinson 1952; Blackburn 1965; NRS), then appearing similar to miniature nest of Willie Wagtail (Howe 1928). Claim that tail rudimentary or absent on Norfolk I. (Basset Hull 1909; Hermes 1985) not confirmed by detailed survey (Schodde *et al.* 1983). On Chatham Is, one of five nests found lacked a tail (Dennison *et al.* 1979). Said that tails not added to nests in enclosed positions (Blackburn 1965) or in unsuitably shaped forks (Blackburn 1966). Suggested that tail used to drain nest, for camouflage, or to provide stability or strength (Hill 1904; Hinsby 1954; Wheeler 1971; Campbell). Same pairs may build nests with and without tail (Blackburn 1965; Wheeler 1971). Said that nests of *albiscapa* of Tas. more heavily built than those of *alisteri* of se. mainland Aust. (Campbell). Photos in Andersen (1926: p. 20) show a double nest, with a common central wall, higher than the outer walls; this was blown down before lining of cups was finished. MATERIALS: Usually made of fine grass and shreds of bark (e.g. of paperbarks), and sometimes moss, lichen, twigs, leaves, rootlets, casuarina needles, plant fibre, plant down, rotten wood or brown velvet from *Banksia* cones, occasionally sheep's wool; usually held together, and external walls thickly bound, with spider web, and sometimes Horse or Cow hair or wool, giving a neat, smooth finish. Usually lined with materials such as fine grass, rootlets and hair, and sometimes with plant down, fuzz from fern fronds, bark fibre, moss (including fruiting stalks) or feathers, and, on Chatham Is, needles of Tarahinau (North 1899; Littler 1903, 1910a; Legge 1908; Basset Hull 1909; McLean 1912; Dove 1916; Stidolph 1923; Carter 1924; Chisholm 1924; Fletcher 1924; Dickison 1929; Lang 1930; Stead 1932; Green 1950; Wilkinson & Wilkinson 1952; Hinsby 1954; Blackburn 1966; Frith 1969; Wheeler 1971; Ude Shankar 1977; Dennison *et al.* 1979; McLean & Jenkins 1980; Hermes 1985; Dedman 1998; Campbell; North; Oliver; Serventy & Whittell; NRS). Materials usually reflect what is available (Legge 1908); and some nests made of only one material, e.g. one made entirely of grass (lined with hair from fern fronds), and another entirely of long fibres of green moss (lined with fine grass) (Littler 1903). One nest said to be made entirely of spider web (Wheeler 1971). Details of materials from one nest in NZ: 10,000 hairs or hair-like material; 2164 chips of rotten wood; 631 pieces of dry grass and stems; 257 pieces of fine rootlets; 167 pieces of moss; two leaves (probably accidental) and *c.* 100 strands of spider web (Stidolph 1924). At Kowhai Bush, early nests appeared larger and bulkier than those built later in season (Powlesland 1982). ROLE OF SEXES: Nests built by both sexes (Fletcher 1924; Wilkinson 1927; Lang 1930; Moncrieff 1931; Wilkinson & Wilkinson 1952; Wheeler 1971; Powlesland 1982; Mathews; Oliver; Serventy & Whittell; NRS), though females may put more effort into building than male (McLean 1975; Ude Shankar 1977). On Cuvier I., of seven nests observed during building, and for which previous nest known, two built entirely by female soon after previous brood had fledged, and five built by both sexes once fledgelings became independent (McLean 1975). On Tiritiri Matangi I., males did not assist with building at any stage (Powlesland 1982). Round Christchurch, four pairs made combined 792 visits to nest during building; of these, 580 (73.2%) were by females; females also built for longer periods. Participation by male decreased as nest approached completion: birds alternated visits to nest at start of building period, one leaving as other arrived, but as building progressed, male tended to follow female and stood watching her build, though he occasionally assisted with building or fed female in nest. Males built even less if young from a previous nest remained dependent. A male of one pair made 60 of 262 visits (22.9%) at beginning of construction, and eight of 126 visits (6.3%) as building approached completion (data for three nests combined). In one pair, male mostly carried materials while female did most building (Oliver). Second and subsequent nests sometimes built by female alone, particularly when dependent juveniles are present from previous attempt (Blackburn 1965, 1966; Powlesland 1982). Even then, both parents may engage in building activity (Powlesland 1982). Male appeared to bring more large pieces of material and female more spider web (Moncrieff 1931). Round Christchurch, appeared to be no difference in size of loads carried by males and females, though males often entered nest without material. At Kowhai Bush, males fed females throughout building and pre-laying periods (Powlesland 1982). CONSTRUCTION: Birds commonly perform four types of action when building: (1) tucking in material, occasionally while clinging to outside of nest; (2) moulding nest into compact and symmetrical shape with breast, shuffling or gently moving round and round, turning both clockwise and anti-clockwise, occasionally pressing material down with chin; (3) smearing nest with web, using

bill, chin or wings to smooth external wall, at same time fanning wings to maintain balance; and (4) treading in nest to make it smooth inside (McLean 1912; Wilkinson 1927; Moncrieff 1931; Wilkinson & Wilkinson 1952; McLean 1975; Ude Shankar 1977; Campbell). Round Christchurch, closed tail was pressed and vibrated from side to side against nest-rim while shaping nest with body. Birds usually perform 1–3 'body presses' (i.e. press against nest with body) per nest visit (n=250 nest visits), though 32 were recorded during one visit. On entering nest (n=108 observations), material is usually tucked in (53.7%) or exterior wiped with bill (36.1%), though body-pressing (10.2%) occurs occasionally. When exiting nest (n=108 observations), body-pressing (67.6%) is preferred to both tucking (23.1%) and bill-wiping (9.3%) (Ude Shankar 1977). Covering of web runs round circumference, unlike Satin Flycatcher *Myiagra cyanoleuca* where web woven vertically, from limb to nest-rim (Hinsby 1954). At Nelson, SI, birds built continuously, sometimes making several visits per minute, but apparently stopped building in early afternoon (Moncrieff 1931). When building round Maungahaumi, NI, one bird left nest when other arrived with material (McLean 1912). Once seen tearing at nest as though dismantling it, but was actually renovating nest: it was relined with spider web, cottonwool and palm fibre, and sides were built up with palm fibre overlaced with spider web (Coates 1966). Construction of nest begun by using spider web to bind dried grass and fibres to twigs of fork (Blackburn 1965; McLean 1975; Powlesland 1982). Tail always built early in construction (Wilkinson & Wilkinson 1952; Campbell), and made by joining three strands of grass, fibres and spider web together, and adding more material (Blackburn 1965); tail not replaced if it comes free during building, even if a bird is present when it falls (McLean 1975). Base of nest (c. 2.5 × 1.3 cm) then woven into existing material; next, walls, c. 1.3 cm thick, are built up from base (McLean 1975; Blackburn 1965). Lining then added (Blackburn 1965), though on Cuvier I., nests were not lined once bowl was completed (McLean 1975). Material usually overlaps twigs and meets underneath to form tail (Campbell); one nest was woven into several branches of a shrub (Stidolph 1923). No attempt is made to correct nests that slip sideways on branches (McLean 1975). Two nests were abandoned after construction of tail and a base c. 3 cm across (Sedgwick 1983). At Gisborne, nests of a pair throughout season were identifiable and made of identical materials (Blackburn 1965). Sometimes collect material, including rootlets, from near ground; bark taken from butts of trees within 40 m of nest-site (McLean 1912; Stead 1932; St Paul 1975), rotten wood from fallen trees (Pennycook 1949), fuzz taken from tree-ferns (Blackburn 1966), cow hair from sticks and thorns (Hinsby 1954), and one bird repeatedly collected hair from rump of pony (Stead 1932). Cobwebs are pecked from webs (Ude Shankar 1977) or collected by flying back and forth across a web, and are carried draped from bill to chest (McLean 1975). Pieces of bark or vegetation are removed from branches by grasping item in bill and pulling sideways with head; rotten wood is scraped with bill. Material that is picked up is often rejected (Ude Shankar 1977). Unfinished nests sometimes dismantled and materials used to build new nests (Ashton 1987; North). One bird flew c. 90 m to collect bark (Hitchcock 1938); another collected material 150 m from nest-site (NRS). On Cuvier I., usually collected material from ground within 15 m of nest-site, though two flights of 40–50 m were observed (McLean 1975; McLean & Jenkins 1980). Round Christchurch, material was collected 0.5–10.0 m from nest, usually from ground (Ude Shankar 1977). On Cuvier I., males built in bouts of 15–45 min, punctuated by short singing forays away from nest while female continued building (McLean 1975). At one nest, most building occurred between 06:00 and 12:00; activity much decreased after 13:00

(see Ude Shankar 1977 [Fig. 4]). Another nest started at 14:30 (CSN 7). Round Christchurch, building activity (no. of visits to nest) decreased day by day as construction progressed: at one nest, no. of visits decreased from >70/day in early stages of building to <5 just before completion (see Ude Shankar 1977 [Fig. 5]). This trend may not be apparent in nests built over 1–2 days. Nests can be built in as little as 2–3 days but usually take longer (Wilkinson 1927; Lang 1930; Wilkinson & Wilkinson 1952; Cunningham 1954; Blackburn 1965; NRS), up to 3 weeks (Wheeler 1971): in NSW, 7–9 days (Ford 1981) or 10 days (North); in SA, 14–20 days (Ashton 1987). Near Waitama R., NI, building took 6.13 days (3.52; 2–13; 8) with duration apparently influenced by weather (Blackburn 1965). A nest at Minginui, NI, was completed in 42 h 30 min (CSN 7). At Masterton, NI, one nest took c. 3.5 days to build (Cunningham 1954). Replacement nests usually built more quickly than first nest of season (Blackburn 1966; North): on Cuvier I., nests late in season (Nov.–Dec.) took 4–6 days to complete, but an early nest (Aug.) had only part of tail completed after 1 week (McLean & Jenkins 1980). At Kowhai Bush, building took 13.9 days (1.4; 12–16; 7) during Aug. to early Oct., and 4.6 days (1.3; 3–7; 11) in late Oct. and Nov. (Powlesland 1982). Round Christchurch, first nests took 11–26 days to build; third and fourth nests were built in 2–3 days. At Moruya, NSW, usually made abortive attempts at building before selecting final site; some nests were abandoned soon after building commenced, others once complete (Marchant 1992). Similar behaviour has been recorded in NZ, with desertion before laying sometimes attributed to inclement weather (Wilkinson & Wilkinson 1952; Blackburn 1966; Powlesland 1982). RE-NESTING: After loss of a nest, rebuilding of new nest usually begins on day after, or within a few days of, loss (Blackburn 1965; Gill *et al.* 1983). After success: on Cuvier I., females twice recorded re-nesting 3 days after previous brood fledged (McLean & Jenkins 1980); once, female was building new nest on same day that young fledged (Blackburn 1965), and, once, re-nesting 12 h before young of previous brood fledged (Blackburn 1966). As nestlings grow, nests sometimes lose rounded appearance, becoming frayed and flattening out; once, nestlings were observed standing on a shapeless mass of nesting material (North). MEASUREMENTS (cm): Nests seem small for size of broods (Wilkinson & Wilkinson 1952; Wheeler 1971; North), but vary little in size (Wheeler 1971). Nests of *preissi* said to be generally smaller than that of *alisteri* (Campbell); nests in NZ apparently larger than those from Aust. However, few data and further study needed. All below arranged external diameter, external depth, internal diameter, internal depth. AUST.: SE. MAINLAND AUST. (*ALISTERI*): 6.4, 6.9–8.2 (including tail 2.5–3.8), 3.8, 2.9 (Campbell); average nest, 5.1, 11.4 (including tail 6.4), 4.4, 3.2 (North). TAS. (*ALBISCAPA*): One, 5.7, 11.4 (including tail 5.1), 4.4, 2.9 (Littler 1903). Once, tail 7.6, but can reach 15.2–17.8; internal diameter usually ≥3.8 and internal depth <3.8 (Dove 1916). SW. WA (*PREISSI*): 5.7, 5.7 (including tail 2.5), 3.8, 2.5 (Campbell); average nest, 6.4, 3.8 (plus tail of up to 10.2), –, – (Serventy & Whittell). NZ NI (*PLACABILIS*): Two nests from Wairarapa, NI: 9.5, 12.7 (including tail), 5.1, 3.8; and 8.3, 10.2 (including tail), 5.1, 2.5 (Stidolph 1923); on Cuvier I., overall nest-length 15.5 (5.0–33.0; 21) (McLean 1975); external depth 6.7 (5.0–8.5; 21) (McLean 1975); mean length of tail 10.5 (0.0–28.5; 21) (McLean & Jenkins 1980). One nest built up over at least four nesting attempts had external height (excluding tail), 16.5 cm (Blackburn 1963). LORD HOWE I. (*CERVINA*): One 5.1, 7.6 (including tail), 4.4, 2.5 (Basset Hull 1909).

Eggs Oval, short oval, swollen oval or rounded oval (Basset Hull 1909; Campbell; North), though on Kapiti I., NZ, described as small and tapering (Wilkinson & Wilkinson 1952). Dull and lustreless (North); though described as glossy

on Norfolk I., and finely textured and slightly glossy on Lord Howe I. (Basset Hull 1909; Hindwood 1940). AUST.: Ground-colour usually white, though sometimes dull, dirty or creamy white, buff-white, light yellowish-buff or light yellowish-white; marked with small, sometimes indistinct, spots, streaks, freckles, mottles or blotches of shades of brown, e.g. pale brown, creamy brown, light brown, pale yellow-brown, yellowish brown, wood-brown, reddish brown, light umber or rufous, and once, pale purplish-buff; and, usually, other, often under-lying, markings of pale lavender, dull bluish-grey or slate. Markings usually form a zone or cap at or round large end, sometimes forming confluent belt round apex or broadest part of egg, or scattered over whole shell (North 1899; Littler 1903, 1910a; Basset Hull 1909; Campbell; North; Serventy & Whittell). Eggs of *preissi* possibly more spotted than those of *alisteri* (Campbell); eggs of *albiscapa* possibly have darker markings than those of *alisteri* (Campbell), but also possibly indistinguishable (North). NZ: White with fine brown spots (Wilkinson & Wilkinson 1952; McLean 1975; McLean & Jenkins 1980); eggs of one set from Wairarapa, NI, were pink-ish white with spots, mostly of very light brown but some of darker brown and mostly at large end (Stidolph 1923). Eggs of each female have a distinctive pattern of spots (McLean 1975). MEASUREMENTS: AUST.: *SUBSPECIES COMBINED*: 15.8 (0.64; 14–17; 38) × 12.0 (0.80; 10–13): SE. MAINLAND AUST. (*ALISTERI*): 16.0 (0.59; 15.2–17.0; 10) × 12.1 (0.72; 10.4–13.0) (Campbell; North); TAS. (*ALBISCAPA*): 15.5 (0.81; 14–16.5; 10) × 11.3 (0.84; 10.0–12.2) (Littler 1910a; Campbell; North); SW. WA (*PREISSI*): 15.2 (0.43; 14.7–15.7; 4) × 11.9 (0.55; 11.4–12.7) (Campbell; North); three averaged 16 × 12 (Serventy & Whittell); INLAND W. AUST. (*ALBICAUDA*): 16.5 × 12.7 (North). NZ: NI (*PLACABILIS*): 16.5 × 14.0, 16.0 × 12.5 (Oliver); 16.0–17.0 × 11.5–12.5 (McLean 1975); SI (*FULIGI-NOSA*): 16.2 (0.22; 16.0–16.5; 4) × 12.2 (0.22; 12.0–12.5) (Powlesland 1982; Oliver). Black morph, from unknown location, 16.6 × 12.6, 16.4 × 12.4 (Oliver). LORD HOWE I. (*CERV-INA*): 16.5 × 13.0, 16.5 × 12.7 (Basset Hull 1909); 16.5 × 13.0 (Hindwood 1940). NORFOLK I. (*PELZELNI*): 16.0 (0.34; 15.2–16.5; 11) × 12.5 (0.4; 11.7–12.7) (North 1899; Basset Hull 1909). WEIGHT: NZ: 1.0 (McLean 1975).

Clutch-size From one to five; usually three or possibly two in Aust., usually three or four in NZ (Littler 1903, 1910a; Legge 1908; Austin 1918; Stead 1932; Ey 1944; on Kapiti I., Wilkinson & Wilkinson 1952; Saunders & Ingram 1995; Campbell; North; Oliver; see below). Possibly six in Aust., very rarely: clutch of six at Myponga, SA, thought to have been laid by a single female, but another report of six eggs in nest at Tenterfield, NSW, thought to have been laid by two females (Ford 1981). AUST.: Overall, 2.66 (0.53; 1–4; 469). Clutch-size of *preissi*, *alisteri*, *albicauda* and *albiscapa* usually three, with C/1 and C/2 possibly incomplete clutches or result of loss of an egg or parasitism by cuckoo; clutch-size of *keasti* usually two (Ford 1981). KEASTI, NE. QLD: Apparently two; no records of nests with three eggs (Ford 1981). ALISTERI, S. QLD: 2.67 (0.58; 2–3; 3); NSW: 2.66 (0.53; 1–3; 242) (NRS); in Five Day Ck Valley, mean 2.4 (n=5) (Cameron 1985); VIC.: 2.70 (0.55; 1–4; 93); S. SA: 2.84 (0.42; 1–3; 45) (NRS); in Aldinga Scrub CP, C/2 × 6, C/3 × 27 (Ashton 1987). ALBISCAPA, TAS.: 2.89 (0.47; 2–4; 18) (NRS). PREISSI, SW. WA: 2.44 (0.50; 2–3; 68) (NRS); on Swan Coastal Plain C/2 × 14, C/3 × 12 (Storr 28). ALBICAUDA, INLAND W. AUST.: Few data; C/1 × 1, C/2 × 1, C/3 × 2 (Storr 21, 26). NZ: SUBSPECIES COMBINED: Two sepa-rate analyses of NZ NRS: (1) 3.52 (0.58; 2–5; 50): C/2 × 1, C/3 × 23, C/4 × 25, C/5 × 1; clutch-size increased late in season (McLean & Jenkins 1980); (2) 3.39 (0.49; 3–4; 51): C/3 × 31, C/4 × 20; mean size of 30 clutches laid before 31 Oct., 3.2, and mean of 19 laid after 31 Oct., 3.7 (Blackburn 1965). Probable that no C/4 were first clutches as none were recorded before 16 Sept. (Blackburn 1965). However, when laying delayed, first

and subsequent clutches can be C/4 (see Blackburn 1966 below). Where multiple broods reared, probable laying patterns are: C/3, C/4, C/3 or C/3, C/3, C/4, C/3 (Blackburn 1965). PLACABILIS: On Tiritiri Matangi I., 3.00 (0.50; 2–4; 9): C/2 × 1, C/3 × 7, C/4 × 1 (McLean 1984a); on Cuvier I., C/3 × 3, C/4 × 3 (McLean & Jenkins 1980). Near Gisborne, 3.53 (0.51; 3–4; 17): C/3 × 8, C/4 × 9 (Blackburn 1965, 1966); one pair laid four clutches of four in one season (Blackburn 1966); clutch of five once recorded (Blackburn 1963). NOMINATE FULIGINOSA: At Kowhai Bush, 3.5 (0.5; 142): C/3 × 71, C/4 × 68, C/5 × 3 (Powlesland 1982); mean 3.5 (Gill *et al*. 1983). Four nests were found with two eggs, but these may have resulted from reduction of clutch. Clutch-size varied through-out season (see Powlesland 1982 [Fig. 3]), mean clutch-size each month: 3.0 (0.2) Sept., 3.3 (0.5) Oct., 3.8 (0.5) Nov., 3.0 (0.0) Jan. Nearly all first clutches contained three eggs; the proportion of four-egg clutches increased as season progressed, then decreased towards end of season (Powlesland 1982). NORFOLK I., PELZELNI: 2–4 (Basset Hull 1909). LORD HOWE I., CERVINA: C/2 × 1 (Basset Hull 1909). CHATHAM I., PENITUS: C/3 × 1, C/4 × 2 (Dennison *et al*. 1978, 1979).

Laying On consecutive days, i.e. at intervals of *c*. 24 h (Green 1950; Cunningham 1954; Blackburn 1966; Dennison *et al*. 1979; McLean & Jenkins 1980; Powlesland 1982; Sedgwick 1983; Hermes *et al*. 1986; North; NRS), though once on Cuvier I., NI, fourth egg of clutch was apparently laid on fifth day (McLean & Jenkins 1980), and once on Kapiti I., second egg *c*. 2 days after first (Wilkinson & Wilkinson 1952). Time between apparent completion of nest and start of laying: in two nests in SA, 21 and 27 days (Ashton 1987); near Waitama R., NI, 1.77 days (1.589; 0–5; 13) (Blackburn 1965); at Masterton, NI, *c*. 2 days (Cunningham 1954). At Kowhai Bush, interval between completion of nest and laying decreased over course of season, from 7–14 days (n=6) in Sept. to 1–5 days (n=12) in Oct. and Nov.; birds laid immediately on completion of three nests in Dec. (Powlesland 1982). First egg sometimes laid *c*. 1 week after start of building (Wilkinson 1927; Green 1950). Of 15 records in NZ NRS, ten eggs laid in morning before 10:00, two after 09:00, and three in afternoon (Blackburn 1965). At Kowhai Bush, one egg was laid between 04:30 and 04:40 (Powlesland 1982). Often raise two or more broods in a season (Napier 1969; Wheeler 1971; Ford 1981; Sedgwick 1983; North). In NZ, usually raise 2–4 broods in a season (Stead 1932; Blackburn 1965; Powlesland 1982; Gill *et al*. 1983; Oliver), but, once, a pair raised five broods and a total of 15 young (Blackburn 1965). When replacement clutches included, pairs often lay up to five clutches in a sea-son (Powlesland 1982; Gill *et al*. 1983); once, pair made seven attempts in a season, in seven nests, though not all laid in (Blackburn 1966). On Tiritiri Matangi I., of 11 pairs under observation, four (36.4%) made three attempts, six (54.5%) made five attempts and one pair (9.0%) made one attempt; up to two broods reared successfully by a pair (McLean 1984a). In WA, interval between laying of three successive clutches, 39 and 37 days (Sedgwick 1983). In NZ, interval between laying of successive clutches where first clutch successful, 40.2 days (6.18; 34–53; 9); one replacement clutch laid 11 days after first egg of previous clutch laid, but time from loss not known (Blackburn 1965). At Kowhai Bush, interval between success and re-nesting decreased over course of season; time between fledging of one brood and commencement of second nest varied from up to 14 days in Oct. to 1–2 days in Nov. and Dec. (Powlesland 1982). Capable of replacing eggs quickly after loss: once, nest contained four eggs within 6 days of loss of C/2 (Flux 1974); another time, new nest contained two fresh eggs 10 days after removal of previous clutch (North). Often lay new clutch while fledgelings of previous brood still being fed (Stead 1932; Blackburn 1965, 1966; McLean & Jenkins 1980).

Incubation Usually begins after completion of clutch (Green 1950; Blackburn 1966; McLean & Jenkins 1980), but at three nests on Chatham Is, incubation began with laying of penultimate egg (Dennison *et al.* 1979). At Kowhai Bush, birds were sometimes seen on nests after first, and frequently after second, egg had been laid, though full incubation did not begin until clutches were complete (Powlesland 1982). Birds on Cuvier I. also sat sometimes before laying was complete, but did not remain consistently on nest (McLean 1975). Round Christchurch, attentiveness increased from mean of 60% on first day of sitting to 89% on third day, when regular incubation began. Interval between laying of first egg and start of incubation 2.75 days (0.75; 2–4; 12): assuming a laying interval of 24 h, in seven nests, incubation began on day final egg laid, and a day later in remaining five nests (Blackburn 1965). Often attended nests despite constant nearby human activity (Green 1950; Blackburn 1963). Both sexes incubate (Howe 1928; Elliott 1933; Green 1950; Wilkinson & Wilkinson 1952; Blackburn 1966; Ude Shankar 1977; Dennison *et al.* 1978, 1979; Powlesland 1982; Sedgwick 1983; North; Oliver; NRS) and change-over at nest is quick, often 1–2 s (Pennycook 1949; Powlesland 1982; Sedgwick 1983). However, female once apparently incubated and reared brood alone (Powlesland 1982); and sometimes female incubates second clutch while fledgelings of previous brood fed by male (Blackburn 1965; McLean & Jenkins 1980), though at Kowhai Bush, both adults incubated, even when feeding a previous brood (Powlesland 1982). Twice, both birds were on nest at same time, and sat one on top of other, possibly to protect eggs during strong winds (Cunningham 1954); similar behaviour has been recorded while brooding (Wheeler 1971). Sometimes incubating bird remains on nest and allows itself to be touched by observer (Legge 1908; Dove 1916; Austin 1918; Ross 1926; Stead 1932; Cunningham 1954; St Paul 1975; Campbell; North; NRS), though sometimes attacks intruder (see Social Behaviour). Mean length of bouts of incubation of a pair, 11.6 min (5.47; 4–21; 15 bouts over 233 min obs. on 7 days) (Sedgwick 1983). On Cuvier I., both adults sat for alternating periods of 10–30 min, though female was usually absent for shorter periods than male and vacated nest less readily. Only female sat on nest at night (McLean 1975; McLean & Jenkins 1980). At Kowhai Bush, mean length of incubation bouts for normal pairs (two adults, shared incubation) was 17 min 26 s, though one pair incubated for stints of 40 min or more. Two pairs comprised an adult female with an immature male; mean incubation bout was 31 min 5 s for adult females, and 17 min 6 s for immature males; longest stint recorded was 75 min 11 s by a female. At two nests, attended by lone females, mean stint on nest was 34 min 23 s; mean interval off nest was 3 min 53 s (Powlesland 1982). Round Christchurch, females incubated for bouts of 8 min (1.5–26.5; 72) for first clutches, 14 min (0.5–58.0; 91) for second nests and 18 min (6.5–39; 14) for third clutches; corresponding values for males were 8.5 min (0.5–17.5; 78), 14.5 min (0.5–41.0; 81) and 14 min (2–25; 18). Extreme values were attributed to infrequent occurrences such as hailstorms or attacks on neighbouring conspecifics. Comparison of male and female of one pair showed no significant difference (P=0.1) in mean bout-length, though a significant difference (P=0.01) in mean bout-length between first and second nests of this pair. There appeared to be a trend towards general increased bout-length as season progressed at several nests (for more detail, see Ude Shankar 1977). Nests were left unoccupied for 29.6 s (0.5–551; 154) by females (one additional nest left unattended for 0.5–7.0 s, n=12), and 69.7 s (0.5–630; 113) by males (one additional nest left unattended for mean of 90 s, range 0.5–561, n unknown). Short absences occurred when one bird remained until mate arrived; long absences due to failure of one bird to return or desertion of nest by one bird soon after change-over, e.g. to chase an intruder. Females tended to remain on nest until males were nearby; males often left before females returned; for females (n=32 observations): 50.0% left before mate reached nest, 43.8% left when mate arrived, and 6.3% left before mate entered nest site; corresponding figures for males (n=29) were 58.6, 24.1 and 17.2% respectively. Comparison of sexes at one nest showed male left nest unoccupied for significantly longer periods than female (P=0.01). Attentiveness (% time on nest) of one male declined from 44% (183 min observation) to 29% (137 min observation) following desertion of a neighbouring pair; decrease was due to increased bouts of calling and fighting on territorial boundary with male from newly deserted nest. Females made 3 visits/h (0–6; 29) to first nests and 2 visits/h (0–5; 35) to second nests; males, 3 visits/h (1–7; 29) to first nests and 1.8 visits/h (0–5; 35) to second nests. On Chatham I., one pair exchanged places on nest at 15–25-min intervals (Dennison *et al.* 1978). At Kowhai Bush, normal pairs covered eggs for 96.8% (91.4–99.2) of 10.1 h observation time. In three cases where sexes were known, female incubated more than male: 58.8% for female and 33.0% male (1.2 h of observation), 53.2% for female and 45.9% for male (3.3 h), and 47.9% for female and 43.5% for male (1.5 h). One nest was observed during laying; coverage increased from 40.3% (1.0 h) for two eggs, to 73.8% (1.5 h) for three and 98.2% (1.0 h) for four eggs, the completed clutch (Powlesland 1982). Adult-immature pairs covered eggs for about 97% of 5.8-h observation time, with adult females (71.9%) spending more time on nest than immature males (24.7%). Lone females incubated for 79.7% of 2.9-h observation time (Powlesland 1982). Round Christchurch, daily nest-attentiveness was usually maintained at 90–98% (see Ude Shankar 1977 [Fig. 9]); attentiveness appeared to remain constant throughout day. On Cuvier I., infertile eggs broken by adults during incubation (McLean 1975). Hatched eggshells possibly eaten by adults (Ude Shankar 1977). INCUBATION PERIOD: Estimates from 8 to 20 days; usually 14 days, though sometimes 15 days, and occasionally <14 days (Ford 1981; Oliver; see below). AUST.: SE. MAINLAND AUST. (*ALISTERI*): 12 days (North); at Moruya, NSW, for four nests, mean of 13 days 19.5 h (maximum range 13 days 3 h–14 days 8.5 h): 13 days 15 h ± 12 h, 13 days 17 h ± 6.5 h, 13 days 20.75 h ± 11.75 h, 14 days 1 h ± 2 h (Marchant 1980); Geelong, Vic., once *c.* 20 days (Wheeler 1971); in Aldinga Scrub CP, SA, 14 days ± 5 h (Ashton 1987). TAS. (*ALBISCAPA*): Thought to be 8–10 days (Legge 1908). SW. WA (*PREISSI*): At Harvey, 14 days (n=4) (Sedgwick 1983); 15 days (Serventy & Whittell). NZ: NI (*PLACABILIS*): Near Gisborne, best estimates of five incubation periods (of two pairs): twice 14 days 8 h, 14 days 9 h, 14 days 10 h, and 15 days; using all data from same two pairs over two seasons, from laying of first egg to hatching, 17.5 days (0.80; 16.5–19; 12), and, assuming laying interval of 24 h, incubation period 15.2 days (0.49; 14.5–16; 12) (Blackburn 1965). At Rangiora, for two successive clutches, assuming laying interval of 24 h, incubation periods 15 and 13 days (Coates 1966). Also: 13 days (Wilkinson & Wilkinson 1952); twice, 14 days (Blackburn 1966; McLean & Jenkins 1980); once, 15 days (Cunningham 1954); once, in Wairarapa, ≥14 days (Stidolph 1923). SI (*NOMINATE FULIGINOSA*): At Kowhai Bush, from completion of clutch to hatching of first egg: 14.2 days (0.6; 13–16; 32): 13 days × 3, 14 days × 21, 15 days × 7, 16 days × 1 (Powlesland 1982). Round Christchurch, from start of incubation to first indication of young, 13.5 days (0.58; 13–14; 4). Once, probably 10 or 11 days (Stead 1932). CHATHAM IS (*PENITA*): Twice, 15 days (Dennison *et al.* 1979).

Young Altricial, nidicolous. Nestlings all hatch on same day or over two days (Blackburn 1966; Coates 1966; McLean & Jenkins 1980; Powlesland 1982; Sedgwick 1983). Hatch blind and naked (Stead 1932; McLean & Jenkins 1980; NRS) or sparsely covered with brown down (Powlesland 1982).

Quills become visible soon after hatching, and by 4 days old measure 5–10 mm long on wings and 1–2 mm on back and underside (Powlesland 1982). Eyes remain closed at 5 days (Dennison et al. 1979). Feathers erupt from quills by 7 days, and at 10 days are well developed everywhere except tail, where they protrude only about 5 mm (Powlesland 1982). At Kowhai Bush, mean weight on day of hatching was 1.2 g (n=3). Mean weight increased to 1.3 g (n=6) the following day, and continued to increase linearly to reach 5.7 g (n=5) by 5 days of age. Growth then slowed, mean weight reaching 7.4 g (n=6) at 9 days, before decreasing to 7.2 g (n=3) on Day 10. Young fledged with very short tails (Powlesland 1982). At fledging on Cuvier I., length of leg, toe and bill and weight all as adult but wing and tail much shorter (less than two-thirds and one-third adult length respectively) (see McLean & Jenkins 1980 [Fig. 1] for growth curves). Growth of tail increased rapidly after fledging, and, though growth of wing began to decrease from 16 days, neither had attained adult length by 20 days old (McLean & Jenkins 1980). Both sexes feed and brood nestlings (Chandler 1920; Wilkinson & Wilkinson 1952; Ude Shankar 1977; Dennison et al. 1979; McLean & Jenkins 1980; Powlesland 1982; Mathews; Serventy & Whittell; NRS). Round Christchurch, brooding was shared between both adults early in nestling period, but role of female increased as period progressed. At one nest, percentage of time spent brooding for female and male on day of hatching was 59% and 41% respectively (149-min. obs.; 11 days after hatching, corresponding figures were 95% and 5% [99-min obs.]). At another nest, three days after hatching, female brooded for 55% of 180-min observation time, and male 45%; 13 days after hatching, corresponding figures were 89% and 11% (166-min obs.) (see Ude Shankar 1977 [Table 26]). Mean length of brooding bouts was 6.5 min (0.5–33.5; 106) for females and 6.4 min (0.5–17.0; 66) for males during first eight days after hatching. Both sexes fed nestlings approximately equally; during 27-h observation at two nests, females made mean 13.9 visits/h, males mean 11.6 visits/h. Nestlings brooded continually when small, one adult leaving nest as other arrived with food (Stead 1932; Dennison et al. 1979; Powlesland 1982). At one nest, four 1-day-old nestlings brooded for 98.9% of 1.2-h observation time, brooding divided fairly evenly between parents. At two other nests, a lone female brooded 1-day-old nestlings for 79.0% of time (Powlesland 1982). At one nest with newly hatched nestlings, one bird remained in, on or beside nest at night (Coates 1966); at one nest, adults visited newly hatched nestlings at intervals of c. 2 min (Coates 1966), and at another, nestlings fed at c. 5 min intervals (NRS). On Cuvier I., individual nestlings were sometimes fed several times in succession. Food was occasionally regurgitated to feed more than one nestling per visit (McLean 1975). As nestlings get older, adults spend more time feeding and less time brooding (Stead 1932; McLean & Jenkins 1980). Round Christchurch, mean attentiveness at two nests during first three days after hatching was 98% (711-min observation); attentiveness began to decline from 4–5 days after hatching, and continued to decrease throughout fledging period (see Ude Shankar 1977 [Fig. 10, Table 25]). Mean length of brooding bouts remained unchanged, however, indicating that birds spent fewer, rather than shorter, periods on nest. On Chatham I., nine 1-day-old nestlings brooded for 10–15 min/h, though still brooded overnight (Dennison et al 1979). At one nest, with observer nearby, female sometimes took food from male and gave it to nestlings (Chandler 1920. Both sexes remove faecal pellets equally, taking them from nest and dropping them in flight 1–2 m from nest; round Christchurch, female removed 48.3% of faecal pellets, male 517% (n=414 observations). At one nest observed for 6 h, faecal pellets removed at intervals of 30 min (Dennison et al. 199). Used nests rarely show evidence of droppings on or near them (Stead 1932), though once chick seen to defecate over side of nest after being fed (Sedgwick 1983). Young stop producing faecal sacs just before fledging, so that 2–3 fresh droppings typically found in nest after young have fledged (Blackburn 1965).

Fledging to independence FLEDGING PERIOD: For all subspecies, between 10 and 16 days; insufficient data to determine if subspecies differ (see below). SE. MAINLAND AUST. (ALISTERI): 10–12 days (North); in Aldinga Scrub CP, SA, once 13 days 6 h ± 24 h (Ashton 1987). TAS. (ALBISCAPA): Once, just over 1 week (Green 1950). SW. WA (PREISSI): 15 days (Serventy & Whittell); at Harvey, 11–12 days (n=4) (Sedgwick 1983); at Wellard Paddock, once ≥16 days (Plumb 1948). NE. QLD (KEASTI) and INLAND AUST. (ALBICAUDA): No information. NI, NZ (PLACABILIS): 15 days (Oliver); on Cuvier I., 11–12 days (n=2) (McLean & Jenkins 1980); on Kapiti I., usually 14 days, and once 13 days (Wilkinson & Wilkinson 1952); in Wairarapa, once ≥9 days (Stidolph 1923); at Masterton, once 14 days (Cunningham 1954); near Gisborne, 14.2 days (1.33; 10.7–15; 12 attempts by two pairs over two seasons) with shortest periods in single-nestling broods (Blackburn 1965); at same site in a later season, once 16 days, and two broods of four fledged in 12 days 11 h and 12 days 18 h, with the shorter fledging period for larger clutches attributed to lack of room in nest (Blackburn 1966). SI, NZ (NOMINATE FULIGINOSA): At Kowhai Bush, from hatching of first nestling to fledging of brood, 12.5 days (0.69; 12–14; 11): 12 days × 6, 13 days × 4, 14 days × 1 (Powlesland 1982). At Rangiora, once 15 days (Coates 1966). CHATHAM IS (PENITA): Once, ≥10 days (Dennison et al. 1979). NORFOLK (PELZELNI) and LORD HOWE (CERVINA) IS: No information. Newly fledged young can barely fly, and are capable of short horizontal flights only, but flying ability develops rapidly (McLean 1975; McLean & Jenkins 1980). Both parents feed and attend fledgelings (Basset Hull 1909; Dennison et al. 1978, 1979; McLean & Jenkins 1980; Powlesland 1982; Garnett & Bredl 1985) for several weeks after fledging, but fledgelings can stay with parents from as little as 3 days to 30 days (see Social Organization: Bonds). Males may feed fledgelings more than females, particularly if female re-nests (Blackburn 1965, 1966; McLean 1975; Ude Shankar 1977; McLean & Jenkins 1980; Powlesland 1982). Near Gisborne, fledgelings were usually fed by male (Blackburn 1965, 1966). On Cuvier I., both adults fed fledgelings for first few days, after which female tended to spend long periods feeding alone while male remained with brood; twice female re-nested 3 days after fledging and young fed by male only (McLean 1975; McLean & Jenkins 1980). One pair began re-feeding fledgelings of previous brood after new nest failed (McLean 1975). Parents appear to feed each fledgeling equally (Ude Shankar 1977). Said to stay near nest for c. 1 week after fledging (Stead 1932). Once, three fledgelings were always fed in same order over c. 1 h (Wilkinson 1924). Sometimes juveniles from one family join juveniles from another family and are adopted and fed by new parents (Powlesland 1982). For behaviour of adults when young threatened, see Social Behaviour (Interactions with other species, Relations within family group).

Success AUST.: Where number of eggs and outcome known, of 1097 eggs, in 443 nests, 450 (41.0%) hatched and 205 (18.7%) young fledged, equal to 0.46 fledged young per nest; from 1633 eggs, in 641 nests, 935 (57.3%) hatched; where outcome known, of 810 nests, 335 (41.4%) nests fledged at least one young and 475 failed (NRS). In Aldinga Scrub CP, SA, 25 nests were successful and 27 failed (Ashton 1987). At Five Day Ck Valley, NSW, 26% of pairs deserted nest before laying; of nests where eggs were laid, 59% produced at least one fledgeling; 20 free-flying young seen over 2 years from 19 pairs (Cameron 1985). NZ: Throughout range (NZ NRS): of 178 eggs, in 53 nests, 138 (77%) hatched; of 107 nestlings, in 34

broods, 84 (79%) young fledged; number fledged from clutches of three and four did not differ significantly (Blackburn 1965). At Kowhai Bush, of 546 eggs: 456 (83.5%) hatched, and at least 251 (46.0%) fledged; 117 eggs (21.4%) hatched but had outcome unknown (calculated from data in Powlesland 1982 [Table 3]); of 280 banded nestlings, at least 208 (74.3%) fledged; mortality of fledgelings probably high (Powlesland 1982). In one season on Tiritiri Matangi I., of 25 attempts by 11 pairs, 12 successful (i.e. raised at least one fledgeling) and produced mean of 2.5±0.80 fledgelings; no obvious relationship between when nesting began and number of fledgelings raised; and no significant difference in height of successful and unsuccessful nests (McLean 1984a). On Cuvier I., success (i.e. fledging at least one young) of nests >70 m from nearest active nest of conspecific 77% (17 of 22 nests), higher than nests within 70 m, which was 25% (2 of 8 nests) (McLean 1980). Overall success, from number of eggs to number of fledgelings surviving after one week, 34.5%; hatching rate at 16 nests 43.6%; nestling success 75% (18 of 24 nestlings at 10 nests); 5.5% (2 of 36) fledgelings died in first week after fledging (McLean 1975; McLean & Jenkins 1980). On Cuvier I., mean clutch-size 3.5 (n=6 nests), mean number of nestlings (immediately after hatching) 2.35 (n=14 nests) and mean number of fledgelings 2.6 (n=17 nests); from throughout range (NZ NRS), comparable figures were: 3.5 (n=50), 3.1 (n=56) and 2.6 (n=38) (see McLean & Jenkins 1980 [Fig. 2] for monthly success from NZ NRS). Number of fledgelings decreased through season, despite increase in clutch-size late in season, mainly as a result of mortality of nestlings in Sept.–Oct., mortality of eggs and nestlings in Nov., and mortality of eggs in Dec. (McLean & Jenkins 1980). Near Gisborne, for two pairs in two seasons where clutch-size known, of total of 40 eggs, 31 nestlings hatched and 27 young fledged; 26 probably survived to independence (Blackburn 1965). One of these pairs laid 16 eggs in four clutches in seven nesting attempts, and probably fledged 15 young; and other pair fledged only two young from at least ten eggs in three clutches in six nesting attempts, with evidence of predation of a clutch of four and a brood of four, probably by Common Mynas (Blackburn 1966). One pair lost three nestlings from C/3, then fledged four young from C/4, and was later seen feeding two nestlings (Coates 1966). CAUSES OF FAILURE: Predation was the major factor affecting success at Kowhai Bush; of 90 eggs that failed to hatch: 64 (71.1%) were predated, five (5.6%) were infertile, five (5.6%) were abandoned, and 16 (17.8%) were lost to other causes (includes eggs that fell from nest, disappeared, were dented, or failed to hatch for unknown reasons); of 88 nestlings that failed to fledge: 63 (71.6%) were predated, 14 (15.9%) died in nest, and 11 (12.5%) were lost to other causes (fell out of nest, disappeared) (calculated from data in Powlesland 1982 [Tables 2 and 3]). On Cuvier I., at least four nests robbed by predators (predation rate approx. 10%). Most fledgeling deaths probably due to starvation (McLean 1975; McLean & Jenkins 1980). Round Christchurch, 57.1% of nests (n=14) deserted prematurely: three before laying, two during incubation, three while brooding. Desertion attributed to cold weather, disturbance by ranger, intraspecific aggression with neighbouring males, and predation. Said to readily desert nest if it is closely watched, inspected or disturbed before hatching by human observer, especially during building (Dickison 1929; Lawrence 1946; Frith 1969; North; Serventy & Whittell), but this not always so (e.g. Cunningham 1954; Campbell); will continue building nests in presence of observer (Ashton 1987) and tolerant of disturbance when nest contains eggs or young (Green 1950; Serventy 1958; North). Once, Willie Wagtail grasped tail of incubating Fantail and tried to evict it from nest; eggs were missing from nest on following day (Elliott 1933). Once, nestlings died during 48 h of constant rain (Sedgwick 1983) and another two broods died

of exposure during cold, wet, windy weather (Stead 1932; Coates 1966). Nest or contents of nest sometimes destroyed when branch supporting nest broken or cut (Stidolph 1923; Carter 1924). Nests sometimes destroyed by vandals (Stidolph 1923). Two nests failed because built on fronds of tree-fern *Cyathea* that fell to ground (McLean & Jenkins 1980). Eggs sometimes blown from nests by strong wind (Disher 1960), and once eggs tipped out of nest when it tilted over (Flux 1974). Once, nest was apparently too small to contain three nestlings, and two later fell out during high winds and died (Wheeler 1971). Once, fledgeling was caught in cutting grass *Uncinia riparia* with hook-like seeds (Wilkinson 1927). Once, nesting decreased in area after paperbarks often used for nesting were removed (Masters & Milhinch 1974). Currawongs *Strepera* repeatedly killed nestlings of one pair over 3 years (NRS). Sometimes killed by Cats, Stoats, Weasels and Black Rats (Legge 1908; Moncrieff 1931; Stead 1932; NRS). Nests and fledgelings possibly predated by Long-tailed Cuckoo (Wilkinson & Wilkinson 1952; McLean & Jenkins 1980). A Yellow-faced Honeyeater seen demolishing one nest with eggs; single egg remained in nest when inspected a few hours later, and was gone next day (NRS). At Kowhai Bush, many nestlings infested with Starling Mites *Ornithonyssus bursa*, a blood-sucking parasite (Powlesland 1982). Two nests heavily infested with lice, but this did not appear to inhibit breeding success (Blackburn 1965). CUCKOOS: Parasitized by Long-tailed, Pallid *Cuculus pallidus*, Fan-tailed *Cacomantis flabelliformis* and Brush C. *variolosus* Cuckoos, and Horsfield's *Chrysococcyx basalis* and Shining C. *lucidus* Bronze-Cuckoos (Brooker & Brooker 1989; HANZAB 4). Once, adults fed Pallid Cuckoo fledgeling near nest, rather than own three nestlings which were on ground near nest (Chaffer 1973).

PLUMAGES Prepared by A.M. Dunn. Fledge in juvenile plumage. Partial post-juvenile (first pre-basic) moult to immature (first basic) probably begins soon after fledging. Attain adult plumage in complete first immature post-breeding (second pre-basic) moult at end of first year or early in second. Thereafter, a complete post-breeding (pre-basic) moult each cycle produces successive adult plumages without change in appearance. Sexes similar. Ten subspecies in HANZAB region; nominate *fuliginosa* from SI, NZ, and *alisteri* from se. mainland Aust. described below. Nominate *fuliginosa* has two morphs: pied and black; descriptions of pied morph based on examination of skins of 17 adults, one juvenile and eight first immatures (AIM, MV, NMNZ, SAM); descriptions of black morph based on examination of skins of 17 adults, three juveniles and two first immatures (AIM, MV, NMNZ). Descriptions of *alisteri* based on examination of skins of 106 adults, six juveniles and 23 first immatures (ANWC, HLW, MV, SAM).

Adult (Definitive basic). NOMINATE *FULIGINOSA*: Polymorphic, with pied and black morphs; pied morph the more common of the two, with black morph comprising <25% of population (but varying with habitat; see Black morph below). Colour thought to be under control of a single gene locus with two alleles, one for pied and one for black plumage, with that for black dominant over the other (Caughley 1969; Craig 1972). **Pied morph** HEAD AND NECK: Forehead, crown, nape, hindneck, sides of neck, lores and ear-coverts, black-brown (119). White supercilium extends from base of upper mandible to above rear of eye. Chin and throat mostly white with black-brown (c119) band across lower throat; all feathers have dark-grey (83) bases. UPPERPARTS: Mantle, back, scapulars and rump, dark brown (121). Uppertail-coverts, black-brown (119). UNDERPARTS: Black-brown (119) band across lower throat extends onto upper breast. Rest of breast, belly, flanks, vent and undertail-coverts, light brown (c26) to yellow-brown (123B); band of feathers just below dark breast-band slightly paler than rest. Thighs, dark brown

(121) with light-brown (c26) tips to feathers. UPPERTAIL: T1, black-brown (119) with white tip and white shaft. T2–t5 mostly white with broad black-brown (119) outer edges. T6, white. UNDERTAIL: As uppertail but ground-colour slightly duller black-brown (119). UPPERWING: Marginal secondary coverts, dark brown (121). Median secondary coverts, dark brown (121) with small off-white (ne) to light-brown (223D) spots at tips. Greater secondary coverts, dark brown (121) with white tips. Alula and all primary coverts, dark brown (121). Tertials and inner 2–3 secondaries, dark brown (121) with narrow off-white (ne) to light-brown (223D) outer edges and fringe at tips, and with concealed, diffuse, off-white (ne) inner edges. Rest of secondaries and primaries, dark brown (121) with concealed off-white (ne) inner edges. UNDER-WING: All coverts mostly off-white (ne) with dark-grey (83) bases. Remiges as upperwing but ground-colour appears slightly browner and with diffuse off-white (ne) inner edges to all remiges.

Black morph A melanistic form. The proportion of black morphs in populations varies with habitat: highest in native hardwood forest, where 21% of birds were black morphs, and lowest in Kanuka *Kunzea ericoides*–Manuka *Leptospermum scoparium*, with only 5% (Craig 1972). In one study in Kowhai Bush, SI, 18.7% of nestlings were black morph (Powlesland 1982). HEAD AND NECK: Mostly black-brown (119), usually with small patch of white on ear-coverts behind eye. UPPER-PARTS: As pied morph. UNDERPARTS, UPPERWING, UNDER-WING: Wholly dark brown (121). TAIL: Black-brown (119).

SUBSPECIES *ALISTERI*: HEAD AND NECK: Forehead, crown, nape, hindneck, sides of neck, lores and most of ear-coverts, dark grey (c83). White supercilium extends from above centre of lores to above rear of eye. Short, narrow white stripe extends over ear-coverts behind eye. Chin and throat mostly white with dark-grey (c83) to grey-black (82) band extending across lower throat; some birds have faint and diffuse greyish-black (c82) spot on upper chin. UPPERPARTS: Mantle, back, scapulars and rump, dark grey (c83). Uppertail-coverts, grey-black (c82). UNDERPARTS: Centre of breast, whole of belly, vent, undertail-coverts and lower flanks, cream (c54) when fresh, fading to off-white (ne) with wear. Sides of breast and upper flanks, grey (c84). Thighs, brownish grey (79). UPPER-TAIL: T1, grey-black (82). T2, grey-black (82) with white shaft and narrow white fringe to tip. T3–t5, grey-black (82) on outer webs, grading to dark grey (83) on inner webs with white fringe to distal half of inner webs, broad white tips, and white shafts. T6, white on outer web and shaft, dark grey (83) on inner web with broad white fringe, with rather diffuse inner edge to white fringe and usually >5 mm wide at tip; see Figure 1. UNDERTAIL: As uppertail but ground-colour slightly browner grey (ne). UPPERWING: Marginal secondary coverts, dark grey (c83). Median and greater secondary coverts, dark grey (83) with white tips. Alula and all primary coverts, dark grey (c83); some have fine white fringe at tips when plumage fresh.

Tertials and inner 2–3 secondaries, dark grey (c83) with inner white edges. Rest of secondaries and primaries, dark grey (c83). UNDERWING: Secondary coverts mostly white with dark-grey (83) bases. Primary coverts, brownish grey (79) with off-white (ne) tips, giving rather mottled appearance. Remiges as upperwing but ground-colour appears slightly browner (ne).

Nestling NOMINATE *FULIGINOSA*: Sparsely covered with brownish down at hatching (Powlesland 1982). SUBSPECIES *ALISTERI*: Before attaining pennaceous plumage, have a few tufts of dark-brown (c121) down on top of head and upper-parts (photo: Stepnell & Boles undated); nestling more than 4 days old had some brown-buff down on back (NRS).

Juvenile NOMINATE *FULIGINOSA*: Both morphs patterned much as respective adults but with rufescent suffusion over much of plumage. **Pied morph** HEAD AND NECK: Forehead, crown, nape, hindneck, sides of neck, dark grey (c83). Supercilium, rufous-brown (136). Chin, brownish grey (c80), grading to dark grey (83) on throat; feathers have soft, fluffy, down-like texture. UPPERPARTS: Mantle, scapulars, back and rump, dark brown (121) with strong rufous-brown (136) suf-fusion to tips of feathers. Uppertail-coverts as adult, black-brown (119). UNDERPARTS: Breast, rufous-brown (c136), grading to light brown (c223D) on belly and flanks, with cream (c92) vent and undertail-coverts. All feathers have partly concealed grey (c84) bases. Thighs, brownish grey (79) with rufous-brown (c136) tips to feathers. TAIL: As adult. Not fully grown at fledging (Powlesland 1982). UPPERWING: Much browner than adult. Marginal secondary coverts, brown (28). Median and greater secondary coverts, brown (28) with large off-white (ne) tips strongly suffused rufous-brown (c38). Alula, brown (28) with fine rufous-brown (c38) fringe at tips. All pri-mary coverts, brown (28). Tertials and inner 2–3 secondaries similar to adult but with rufous-brown (c38) suffusion to fringe. Rest of secondaries and primaries as adult. UNDER-WING: As adult.

Black morph HEAD AND NECK, UPPERPARTS: Mostly as juvenile pied morph, but chin and throat, dark grey (c83). UNDERPARTS: Breast, dark rufous-brown (ne), grading to light rufous-brown (c139) on belly, flanks and vent. Thighs and undertail-coverts, dark brown (121) with diffuse rufous-brown (c136) tips to feathers. All feathers have partly concealed dark-grey (c83) bases. TAIL, UNDERWING: As adult. UPPER-WING: Similar to adult but with red-brown (c132B) tips to marginal and greater secondary coverts.

SUBSPECIES *ALISTERI*: As nominate, patterned much as adult but with rufescent suffusion throughout. HEAD AND NECK: Forehead, crown, nape, hindneck, sides of neck, lores and most of ear-coverts, dark brownish-grey (ne) with weak rufous-brown (136) suffusion to tips of feathers. Supercilium and short stripe behind eye, rufous-brown (136). Chin and throat, brownish grey (c80); with soft, fluffy, down-like texture to feathers. UPPERPARTS: Mantle, scapulars, back and rump, dark brownish-grey (ne) with strong rufous-brown (136) suffusion to
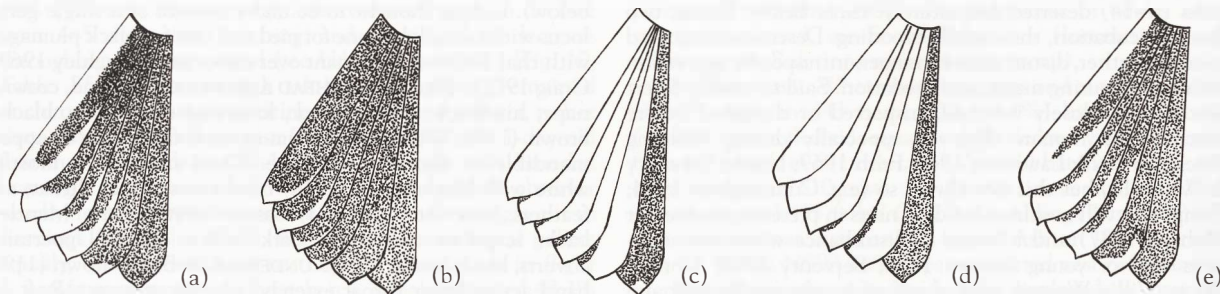

Figure 1 Right side of undertail (t1–t6) of subspecies of Grey Fantail and of Mangrove Grey Fantail: (a) subspecies *alisteri*; (b) subspecies *albiscapa*; (c) nominate *fuliginosa*; (d) subspecies *albicauda*; and (e) Mangrove Grey Fantail *R. phasiana*

tips of feathers. Uppertail-coverts as adult, grey-black (c82). UNDERPARTS: Centre of breast and whole upper belly, cream (c92) with strong rufous-brown (136) wash. Sides of breast and upper flanks, brownish grey (c79) with strong rufous-brown (136) wash. Lower belly, lower flanks, vent and undertail-coverts, off-white. Thighs, brownish grey (79). TAIL: Similar to adult but with weak brownish-grey (c80) suffusion to white parts of feathers, giving slightly dirtier appearance. UPPERWING: Much browner than adult. Marginal secondary coverts, brown (28). Median and greater secondary coverts, brown (28) with large off-white (ne) tips suffused with rufous-brown (136). Alula and all primary coverts, brown (28) with very fine light grey-brown (119D) fringe at tips, which is lost with wear. Tertials and inner 2–3 secondaries, brown (28) with light grey-brown (c119D) fringe to tips and outer webs. Rest of secondaries and primaries, brown (28). UNDERWING: As adult but remiges appear slightly browner (ne).

First immature (First basic). All as adult but with retained juvenile alula, greater primary coverts, remiges, rectrices and some greater secondary coverts. NOMINATE *FULIGINOSA*: **Pied morph** As adult but retained juvenile greater secondary coverts have off-white (ne) tips strongly suffused rufous-brown (c38). **Black morph** As adult but retained juvenile greater secondary coverts have red-brown (c132B) fringes to tips. SUBSPECIES *ALISTERI*: As adult but retained juvenile greater secondary coverts have off-white tips (ne) suffused rufous-brown (136). Some possibly replace all greater secondary coverts and would therefore be difficult to separate from adults, except perhaps by amount of wear to primaries.

Aberrant plumage Single record of albinism in Aust. literature to Dec. 1986 (Lepschi 1990); and an albino recorded near Geelong, Vic. (Dedman 1998). In NZ, one from near Raetihi, NI, had entirely white plumage, yellow bill and black eyes (Bourke 1989).

BARE PARTS Based on photos (Cameron 1979; Macdonald 1987; Pizzey 1988; Gosler 1991; Moon 1992; Clarke *et al.* 1999; NZRD; unpubl.: B. Chudleigh; K. & L. Fisher; R. Mackenzie; P. Marsack; J.S. Matthew; and standard sources) and published information as cited. No geographical variation in bare parts and subspecies combined. **Adult** Bill mostly black (89) with cream (c52) or pale-pink (ne) base to lower mandible. Gape, black (89); or cream (Rogers *et al.* 1986). Inside of mouth, pale grey (Rogers *et al.* 1986); or yellow to orange in WA, and white, pale grey or pinkish elsewhere (Hall). Iris, black-brown (119); or dark brown or brown (Hall). Orbital ring, dark grey (83). Legs and feet, grey-black (82), black-brown (119) or black (89); also dark grey (Rogers *et al.* 1986; Hall). **Nestling** In young unfeathered nestlings, bill mostly dull pink (c5) grading to grey (84) at tip, with off-white (ne) cutting edges. In older, partly feathered nestlings, bill mostly grey (84), grading to yellowish-grey (ne) cutting edges. Gape, off-white (ne) to pale yellow (c157). Inside of mouth, orange (17) or yellow-orange (Boles & Longmore 1985). Bare ventral skin, pink (c3). **Juvenile** Bill, grey (84) to grey-black (82) with pale-pink (ne) base to lower mandible. Gape, puffy and off-white (ne) or pale yellow (c157) at about fledging age, later changing to grey (84). Iris, black-brown (c119). Orbital ring, dark grey (83). Legs and feet, dark grey (83). In NZ, legs paler than adult, pale grey (Heather & Robertson 1997). **First immature** Based on Rogers *et al.* (1986): Upper mandible, black; lower mandible, orange or cream with black tip. Gape, yellowish orange at first, fading to pinkish grey later. Inside of mouth, cream. Legs, pale grey.

MOULTS Based on examination of skins of: 78 adults and 31 juveniles and immatures from e. Aust., including Tas.; 31 adults and two immatures from w. Aust.; and 45 adults and 18 juveniles and immatures from NZ (AIM, AM, ANWC, HLW, MV, NMNZ, SAM); and published information as cited. **Adult post-breeding** (Third and subsequent pre-basic). Complete; primaries outward. Little data from skins as few adults in moult. Insufficient data to determine if timing varies geographically; information from e. Aust., w. Aust. and NZ presented separately. E. AUST.: Moult of primaries appears to start Jan. and finishes Feb.–Mar. From skins: none collected Jan. and one of two in Feb. in moult (PMS 40); all five from Mar. had recently finished moult; and none recorded with active moult of primaries Apr.–Dec. (n=71). In Vic. and se. Tas., moult of primaries (and secondaries) Jan.–Mar. (early Mar. in Tas.) (Rogers *et al.* 1986, 1990). Moult of tail recorded from skins in Feb. (n=1) and Mar. (n=1); in live birds from Vic., moult of tail recorded at same time as moult of primaries, Jan.–Mar. (Rogers *et al.* 1986), and in se. Tas., between Jan. and early Apr. (Rogers *et al.* 1990). Only one skin with active moult of body, in Feb., replacing feathers of upperparts; in Vic., moult of body Jan.–Mar., as tail and primaries (Rogers *et al.* 1986). In NSW, one was finishing moult in Mar. (Hall). W. AUST.: From skins, moult of primaries probably occurs in Jan. or Feb. and Mar. but no skins Jan.–Feb.; one from Mar. moulting primaries (1 of 3, PMS 44); none recorded with active moult of primaries Apr.–Dec. (n=29). Active moult of tail recorded only in Mar. (n=2); one was replacing t2–t6 and the other was replacing t1. Only two, from Mar., had active moult of body, one replacing upperparts and the other both upperparts and underparts. NZ: None of 45 skins had active moult of primaries (with skins from all months except Jan.). Active moult of tail recorded Dec. (1 of 3) and Feb. (2 of 2). Active moult of body recorded Feb. (1 of 2), Mar. (1 of 5) and Apr. (2 of 6); moult was rather heavy in Feb. and Mar., and only slight in Apr. **Post-juvenile** (First pre-basic). Partial; moult most of body and some of wing and tail: retain alula, greater primary coverts, remiges, rectrices and some greater secondary coverts. In e. Aust., those with active moult of body recorded Feb. (n=1), Mar. (n=2) and Apr. (n=1). One from sw. WA was finishing in Mar. (Hall). In NZ, one recorded with active moult of body in Feb. and two in Apr. **First immature post-breeding** (Second pre-basic). Timing and extent probably similar to adult post-breeding. From skins from e. Aust., one in Jan. was moulting primaries with PMS 7 and also had slight moult of body; one in Mar. was moulting primaries with PMS 32, had active moult of body and was replacing t1 in tail; one had active moult of tail in June, and one was replacing t1 in Sept. One in NSW had active moult in Mar. (Hall). None recorded moulting from w. Aust. or NZ.

MEASUREMENTS SUBSPECIES *KEASTI*: (1–2) NE. Qld, between Daintree R. NP and Mackay, skins (ANWC, HLW, SAM): (1) Adults; (2) Juveniles and first immatures. (3) NE. Qld, adults, skins (Ford 1981); includes some skins from (1).

		MALES	FEMALES	
WING	(1)	77.8 (2.48; 73–81; 17)	74.5 (0.58; 74–75; 4)	*
	(2)	72	71, 77	
	(3)	77.0 (2.37; 72.0–80.5; 14)	75.4 (1.75; 73.0–78.5; 13)	*
TAIL	(1)	87.3 (4.27; 80–94; 17)	84.0 (4.24; 79–88; 4)	ns
	(2)	83	80, 81	
	(3)	87.0 (3.45; 81.0–92.5; 14)	87.8 (2.08; 84.5–91.0; 12)	ns
BILL S	(1)	12.5 (0.61; 10.7–13.3; 17)	12.1 (1.31; 10.8–13.3; 4)	ns
	(2)	12.3	12.3, 13.1	
	(3)	12.5 (0.53; 11.6–13.3; 14)	12.5 (0.60; 11.1–13.2; 12)	ns
TARSUS	(1)	17.0 (0.64; 15.4–17.8; 14)	16.7 (0.45; 16.2–17.3; 4)	ns
	(2)	16.5	16.7, 17.2	
	(3)	17.3 (0.48; 17.0–18.0; 9)	17.0 (0.47; 16.5–18.0; 9)	ns

SUBSPECIES *ALISTERI*, SE. SA, Vic., NSW and se. Qld: (4–5) Skins (HLW, MV, SAM): (4) Adults; (5) Juveniles and first immatures. (6) Adults, skins (Ford 1981).

		MALES	FEMALES	
WING	(4)	75.3 (3.21; 67–80; 22)	73.6 (3.26; 67–78; 17)	ns
	(5)	72.4 (1.24; 71–75; 12)	67, 71, 71	
	(6)	75.1 (2.59; 69.0–80.0; 93)	72.7 (2.19; 68.0–79.0; 85)	**
TAIL	(4)	85.4 (3.76; 80–94; 22)	84.8 (3.41; 80–90; 17)	ns
	(5)	82.5 (3.26; 76–87; 12)	80, 81, 81	
	(6)	87.3 (3.31; 80.0–97.0; 92)	86.6 (2.48; 82.0–95.0; 81)	ns
BILL S	(4)	11.7 (0.44; 10.9–12.6; 21)	11.8 (0.42; 11.1–12.4; 14)	ns
	(5)	11.6 (0.46; 11.0–12.2; 9)	11.2 (0.55; 10.7–11.7; 4)	ns
	(6)	11.7 (0.46; 10.2–12.5; 90)	11.5 (0.48; 10.1–12.4; 85)	**
TARSUS	(4)	16.6 (0.51; 15.8–17.6; 21)	16.5 (0.72; 14.8–17.5; 17)	ns
	(5)	16.5 (0.78; 14.7–17.6; 12)	16.0, 16.1, 16.9	
	(6)	16.8 (0.53; 16.0–17.5; 52)	16.8 (0.50; 16.0–17.5; 39)	ns

(7–8) Unsexed, Vic., live (BATH data): (7) Nov.–Mar.; (8) Apr.–Oct., and possibly including migratory *albiscapa*.

		ADULTS	FIRST IMMATURES	
WING	(7)	74.5 (3.16; 68–79; 34)	73.0 (2.32; 68–79; 51)	*
	(8)	75.3 (2.80; 69–83; 56)	72.3 (2.68; 67–78; 43)	**
TAIL	(7)	85.1 (3.04; 79–90; 32)	83.7 (4.20; 65–92; 47)	ns
	(8)	87.1 (3.26; 80–95; 39)	86.1 (2.54; 81–92; 43)	ns
THL	(7)	25.1 (0.70; 23.8–26.7; 17)	25.4 (0.49; 24.3–26.1; 23)	ns
	(8)	25.4 (0.55; 24.2–26.3; 21)	25.1 (0.63; 23.8–26.4; 31)	ns

Adults caught Nov.–Mar. (sample 7) had significantly shorter tails than those caught Apr.–Oct. (sample 8) (P<0.05). Additional measurements, without sample sizes, in Cameron (1985).

SUBSPECIES ALBISCAPA: (9–10) Tas., and Flinders and King Is, skins (ANWC, HLW, MV, SAM): (9) Adults; (10) Juveniles and first immatures. (11–12) Vic. and NSW, migrants identified by plumage, skins (HLW, MV): (11) Adults; (12) First immatures. (13) Tas., and Flinders and King Is, adults, skins (Ford 1981).

		MALES	FEMALES	
WING	(9)	74.2 (1.68; 72–77; 20)	70.4 (2.15; 69–75; 7)	**
	(10)	73.5 (1.29; 72–75; 4)	71.2 (0.50; 71–72; 4)	*
	(11)	75.1 (1.96; 71–77; 8)	72.2 (1.71; 70–74; 4)	*
	(12)	71.5 (2.88; 68–75; 4)	68, 71	
	(13)	74.5 (2.17; 69.5–78.5; 33)	71.6 (2.30; 66.0–77.0; 20)	**
TAIL	(9)	88.2 (2.94; 84–96; 18)	85.4 (2.82; 80–88; 7)	*
	(10)	87.0 (3.46; 82–90; 4)	84.0 (1.83; 82–86; 4)	ns
	(11)	86.3 (4.07; 81–92; 8)	81.5 (2.38; 79–84; 4)	*
	(12)	82.2 (5.50; 77–87; 4)	75, 82	
	(13)	89.4 (3.25; 84.0–95.5; 33)	86.0 (2.93; 81.0–91.0; 20)	**
BILL S	(9)	11.7 (0.61; 10.8–12.7; 19)	11.6 (0.63; 10.9–12.9; 7)	ns
	(10)	11.6 (0.39; 11.3–12.1; 4)	11.4 (0.44; 10.9–11.8; 4)	ns
	(11)	11.2 (0.42; 10.6–11.8; 7)	11.6 (0.17; 11.4–11.8; 4)	ns
	(12)	10.9 (0.34; 10.5–11.3; 4)	11.1, 11.1	
	(13)	11.2 (0.43; 10.4–12.2; 31)	11.2 (0.45; 10.2–12.0; 19)	ns
TARSUS	(9)	17.1 (0.33; 16.5–17.6; 20)	16.8 (0.41; 16.4–17.5; 7)	ns
	(10)	17.1 (0.67; 16.4–17.7; 4)	16.9 (0.91; 16.0–17.8; 4)	ns
	(11)	17.1 (0.51; 16.4–17.8; 8)	16.7 (0.67; 16.1–17.7; 4)	ns
	(12)	16.6 (0.57; 15.8–17.0; 4)	16.1, 16.9	
	(13)	17.2 (0.56; 16.0–18.0; 26)	16.9 (0.48; 16.0–18.0; 15)	*

(14) Unsexed, Tas., live (Rogers *et al.* 1990).

		ADULTS	IMMATURES	
WING	(14)	71.6 (2.70; 68–79; 47)	71.7 (1.90; 69–75.5; 18)	ns
TAIL	(14)	85.2 (4.45; 70.5–95.5; 47)	85.2 (3.61; 81–92; 18)	ns
THL	(14)	24.5 (0.83; 23.1–26.6; 43)	24.5 (0.66; 23.3–25.7; 17)	ns

SUBSPECIES PREISSI: (15–16) SW. WA, skins (ANWC, HLW, MV, SAM, WAM): (15) Adults; (16) Juveniles and first immatures. (17) W. WA, adults, skins (Ford 1981).

		MALES	FEMALES	
WING	(15)	75.3 (2.65; 71–81; 16)	71.1 (1.80; 69–76; 20)	**
	(16)	72, 73	–	
	(17)	74.0 (2.13; 70.0–78.0; 57)	70.6 (1.55; 68.0–73.5; 35)	**
TAIL	(15)	87.6 (3.48; 82–93; 16)	85.8 (3.43; 80–90; 17)	ns
	(16)	88, 90	–	
	(17)	89.5 (2.17; 85.0–95.5; 56)	87.6 (2.46; 82.5–92.0; 34)	**
BILL S	(15)	12.0 (0.63; 10.9–13.0; 16)	11.1 (0.81; 8.7–12.0; 17)	**
	(16)	12.1, 12.5	–	
	(17)	11.8 (0.39; 11.1–12.4; 54)	11.5 (0.45; 10.2–12.3; 34)	**
TARSUS	(15)	17.1 (0.71; 16.0–18.8; 16)	17.4 (0.87; 16.2–19.8; 20)	ns
	(16)	16.8, 18.0	–	
	(17)	17.1 (0.61; 16.0–18.5; 36)	16.7 (0.50; 16.0–17.5; 26)	**

(18) SW. WA, unsexed, adults, skins (Ford 1971).

		UNSEXED
WING	(18)	72.5 (2.38; 68–77; 23)
TAIL	(18)	89.5 (2.27; 85–94; 21)
BILL S	(18)	11.7 (0.39; 11.1–12.4; 23)
TARSUS	(18)	16.8 (0.60; 16–18; 22)

SUBSPECIES ALBICAUDA: (19) NW. SA, central WA, and s. NT, adults, skins (ANWC, SAM, WAM). (20) Mid-WA and s. NT, adults, skins (Ford 1981).

		MALES	FEMALES	
WING	(19)	72.8 (2.45; 69–76; 13)	69.4 (1.63; 66–72; 11)	**
	(20)	73.1 (1.70; 69.0–75.0; 14)	70.3 (1.72; 67.0–74.0; 17)	**
TAIL	(19)	87.5 (3.23; 81–93; 13)	85.3 (1.94; 82–88; 11)	*
	(20)	90.5 (1.65; 88.0–93.0; 14)	89.3 (2.60; 85.0–95.5; 17)	ns
BILL S	(19)	11.1 (0.66; 9.8–12.2; 13)	10.4 (0.54; 9.7–11.2; 11)	*
	(20)	11.4 (0.40; 10.7–12.1; 14)	11.0 (0.42; 10.3–11.7; 17)	**
TARSUS	(19)	16.9 (0.52; 16.0–17.8; 12)	16.7 (0.54; 15.4–17.4; 11)	ns
	(20)	17.3 (0.51; 16.0–18.0; 14)	16.6 (0.39; 16.0–17.0; 16)	**

SUBSPECIES CERVINA: Lord Howe I. No data.
(21) **SUBSPECIES PELZELNI,** Norfolk I., adults, skins (AIM, ANWC, HLW, NMNZ, SAM).

		MALES	FEMALES
WING	(21)	65, 70, 71	67, 69
TAIL	(21)	79, 82, 86	82, 83
BILL S	(21)	11.6, 11.6, 12.5	11.5, 12.2
TARSUS	(21)	18.0, 18.1, 19.2	18.2

SUBSPECIES PLACABILIS, NI, NZ: (22–23) Skins (AIM, NMNZ, SAM): (22) Adults; (23) Juveniles and first immatures. (24) Cuvier I., adults, live; sex determined from observation of laying or from behaviour; Bill X probably = length of bill from tip to feathers, but not specified (McLean & Jenkins 1980).

		MALES	FEMALES	
WING	(22)	73.0 (2.32; 68–77; 17)	72.2 (2.77; 70–77; 5)	ns
	(23)	73.0 (2.83; 70–76; 5)	74, 75	
	(24)	74.2 (71.5–76.0; 6)	70.7 (69.0–73.0; 6)	
TAIL	(22)	92.2 (4.94; 81–100; 17)	92, 96, 102	
	(23)	91.8 (3.56; 89–98; 5)	90, 92	
	(24)	86.7 (80.0–101.0; 7)	84.8 (80.0–91.0; 5)	
BILL S	(22)	11.6 (0.70; 10.7–13.4; 16)	11.7 (0.62; 11.1–12.5; 5)	ns
	(23)	11.3 (0.55; 10.7–11.9; 4)	11.3, 11.6	
BILL X	(24)	7.2 (6.5–8.0; 6)	7.2 (7.0–7.5; 6)	
TARSUS	(22)	19.2 (0.52; 18.1–20.1; 17)	18.8 (0.54; 18.1–19.4; 5)	ns
	(23)	18.8 (0.36; 18.4–19.3; 5)	18.9, 19.3	
	(24)	19.0 (17.5–21.0; 6)	18.2 (18.0–21.0; 6)	
TOE	(24)	13.7 (12.0–15.0; 6)	12.7 (11.0–14.0; 6)	

Unsexed, live: (25) Little Barrier I., adults and first immatures (Gill & Veitch 1990); Wing U = minimum chord of flattened but unstraightened wing; Bill N = length of bill from anterior edge of nostril to tip; Tarsus B = length of tarsus from notch of ankle to edge of bent foot. (26) Orongorongo Valley, adults (Robertson *et al.* 1983).

	UNSEXED	
WING U	(25)	71.3 (2.96; 66–75; 15)
	(26)	73.2 (2.34; 66–80; 89)
TAIL	(25)	89.9 (4.76; 83–98; 14)
	(26)	92.6 (4.02; 76–99.5; 63)
BILL N	(25)	4.9 (0.33; 4.4–5.5; 12)
BILL F	(26)	7.6 (0.85; 6–9; 61)
TARSUS	(26)	19.1 (0.77; 18–21; 39)
TARSUS B	(25)	19.7 (0.71; 18.2–20.6; 15)
TOE C	(26)	13.7 (1.11; 10–16; 62)

NOMINATE *FULIGINOSA*, SI, NZ: (27–28) Skins (AIM, MV, NMNZ, SAM): (27) Adults; (28) Juveniles and first immatures.

		MALES	FEMALES	
WING	(27)	74.9 (2.42; 70–78; 8)	72.8 (2.40; 69–78; 17)	*
	(28)	73.7 (2.06; 72–76; 4)	73.5 (1.00; 73–75; 4)	ns
TAIL	(27)	95.5 (3.34; 89–100; 8)	95.3 (3.46; 88–102; 16)	ns
	(28)	92, 93, 95	93, 96, 97	
BILL S	(27)	11.4 (0.47; 10.7–12.0; 8)	11.3 (0.56; 10.4–12.8; 17)	ns
	(28)	11.8 (0.13; 11.7–12.0; 4)	11.6 (0.36; 11.1–11.9; 4)	ns
TARSUS	(27)	19.2 (0.35; 18.7–19.8; 8)	19.0 (0.71; 18.0–20.4; 16)	ns
	(28)	19.4 (0.44; 19.0–19.9; 4)	19.3 (0.58; 19.0–20.2; 4)	ns

Unsexed, live: (29) Kowhai Bush, adults; Wing U = minimum chord of flattened but unstraightened wing; Tarsus A = length of tarsus from ankle joint to articulation of folded toes (Gill 1980).

	UNSEXED	
WING U	(29)	71.7 (2.44; 68–78; 16)
TAIL	(29)	97.0 (3.04; 88–100; 17)
BILL S	(29)	10.9 (0.46; 10.0–11.6; 17)
BILL W	(29)	3.6 (0.19; 3.2–3.9; 17)
BILL D	(29)	2.5 (0.18; 2.3–3.1; 17)
TARSUS	(29)	20.7 (0.22; 20.3–20.8; 5)
TARSUS A	(29)	21.3 (0.61; 20.5–22.5; 12)
TOE	(29)	10.2 (0.53; 9.4–10.8; 13)

(30) **SUBSPECIES *PENITA*,** Chatham Is, adults, skins (NMNZ).

		MALES	FEMALES
WING	(30)	76	78
TAIL	(30)	100	94
BILL S	(30)	12.6	11.3
TARSUS	(30)	19.2	19.9

EXTRALIMITAL SUBSPECIES: See Mayr (1931) for Wing and Tail measurements of subspecies *brenchleyi* from Solomon Is, Banks Is and Vanuatu.

WEIGHTS SUBSPECIES *KEASTI*: (1–2) NE. Qld, between Daintree R. NP and Mackay, from museum labels (ANWC, SAM): (1) Adults; (2) Juveniles and first immatures. (3) NE. Qld, adults (Ford 1981). SUBSPECIES *ALISTERI*, se. Qld, NSW, Vic. and se. SA: (4–5) From museum labels (ANWC, MV, SAM, WAM): (4) Adults; (5) Juveniles and first immatures. (6) Adults (Ford 1981). (7) Qld and SA only, adults (Hall). SUBSPECIES *ALBISCAPA*: (8–9) Tas. and Flinders and King Is, from museum labels (ANWC): (8) Adults; (9) Juveniles and first immatures. (10) NSW and Vic., adults, migrants identified by plumage (MV). (11) Tas. and Flinders and King Is, adults (Ford 1981). SUBSPECIES *PREISSI*: (12–13) SW. WA, from museum labels (ANWC, MV, WAM): (12) Adults; (13) Juveniles and first immatures. (14) W. WA, adults (Ford 1981). SUBSPECIES *ALBICAUDA*: (15) NW. SA, central WA and s. NT, adults, from museum labels (ANWC, SAM, WAM). (16) Mid-WA and s. NT, adults (Ford 1981). SUBSPECIES *PELZELNI*: (17) Norfolk I., adults, from museum labels (ANWC). SUBSPECIES *PLACABILIS*, NI, NZ: (18–19) From

museum labels (NMNZ): (18) Adults; (19) Juveniles and first immatures. (20) Cuvier I., adults, live; sex determined from observation of laying or from behaviour (McLean & Jenkins 1980). **NOMINATE *FULIGINOSA*, SI, NZ:** (21–22) From museum labels (NMNZ): (21) Adults; (22) Juveniles and first immatures. (23) **SUBSPECIES *PENITA*,** Chatham Is, adult, museum label (NMNZ).

	MALES	FEMALES	
(1)	8.5 (0.91; 7.0–10.0; 15)	8.9 (0.79; 8.2–10.0; 4)	ns
(2)	9.0	7.0, 8.0	
(3)	8.26 (0.88; 7.0–9.5; 9)	8.42 (0.92; 7.4–9.7; 5)	ns
(4)	8.5 (0.93; 6.8–10.2; 39)	8.1 (1.14; 6.0–11.8; 30)	ns
(5)	8.8 (2.99; 6.3–15.0; 7)	7.4 (1.04; 5.0–8.5; 9)	ns
(6)	7.70 (0.53; 6.5–8.5; 14)	7.91 (1.04; 6.0–9.0; 13)	ns
(7)	8.0, 8.0	7.4, 7.4, 7.8	
(8)	8.6 (0.90; 7.0–10.5; 12)	8.7 (1.04; 7.4–9.9; 5)	ns
(9)	8.2 (0.53; 7.8–9.0; 4)	7.2, 7.6, 7.8	
(10)	7.8 (2.42; 5.0–12.0; 6)	8.0	
(11)	7.30 (0.83; 6.0–8.0; 4)	–	
(12)	8.5 (0.86; 6.2–10.0; 13)	7.6 (0.38; 6.9–8.4; 13)	**
(13)	7.0, 7.5		
(14)	7.74 (0.50; 7.0–8.4; 5)	7.74 (0.25; 7.5–8.4; 9)	ns
(15)	7.4 (0.49; 6.4–8.0; 13)	6.84 (0.61; 5.7–7.6; 11)	*
(16)	7.31 (0.53; 6.4–8.0; 14)	6.95 (0.70; 5.7–7.8; 16)	ns
(17)	7.0	–	
(18)	7.7 (1.11; 6.0–9.0; 7)	6.3, 6.8, 8.5	
(19)	7.8, 8.4	8.1	
(20)	7.9 (7.0–9.6; 8)	7.9 (6.8–8.8; 6)	
(21)	7.8 (0.91; 7.0–9.5; 6)	7.7 (0.99; 6.5–9.0; 5)	ns
(22)	6.0, 8.5	8.0	
(23)	7.6	–	

Aust., unsexed, live: (24) SUBSPECIES *ALBISCAPA*, Tas. (Rogers *et al.* 1990). (25–26) SUBSPECIES *ALISTERI*, Vic. (BATH data): (25) Nov.–Mar.; (26) Apr.–Oct., possibly including migratory *albiscapa*.

		ADULTS	FIRST IMMATURES	
(24)		8.4 (0.75; 6.4–10.0; 63)	8.3 (0.69; 7.0–9.8; 20)	ns
(25)	NOV.–MAR.	8.9 (0.67; 7.7–10.6; 35)	8.6 (0.67; 7.3–10.4; 48)	*
(26)	APR.–OCT.	8.6 (0.84; 7.0–11.8; 56)	7.9 (0.80; 6.4–10.1; 41)	**

Adults of *alisteri* caught Nov.–Mar. (sample 25) were significantly heavier than those caught Apr.–Oct. (sample 26) ($P<0.05$). Additional weights of *alisteri* available in Cameron (1985), but sample sizes given as range so not presented here. Additional measurements, without sample sizes, in Cameron (1985).

NZ, unsexed, live: **SUBSPECIES *PLACABILIS*,** NI: (27) Little Barrier I., adults and first immatures (Gill & Veitch 1990). (28–29) Orongorongo Valley: (28) Adults (Robertson *et al.* 1983). (29) Adults (Moeed & Fitzgerald 1982). **NOMINATE *FULIGINOSA*:** Kowhai Bush, SI: (30) Adults (Powlesland 1982). (31) Adults (Gill 1980).

		UNSEXED
(27)		7.6 (0.78; 6.5–8.7; 14)
(28)		8.0 (1.00; 5.55–10; 92)
(29)		7.98 (n=41)
(30)	MAR.	7.8 (1.1; 18)
(30)	APR.	7.4 (0.7; 4)
(30)	MAY	7.5 (0.8; 43)
(31)	MAR.–AUG.	7.9 (0.74; 6.5–9.4; 17)

No data for subspecies *cervina*.

STRUCTURE Wing rather short, broad and wedge-shaped. Ten primaries: p6 longest (p7 usually =); p10 34–41 mm shorter, p9 13–19, p8 3–5, p7 0–1, p5 1–2, p4 7–9, p3 10–13, p2 13–16, p1 15–17. P5–p8 slightly emarginated on outer webs; none on inner webs. Nine secondaries, including three tertials;

tips of longest tertials fall short of tips of secondaries on folded wing. Tail long with graduated tip; 12 rectrices. Bill short and straight; about half length of head. Tarsus short, slender and laterally compressed; scaling holothecal. Tibia fully feathered. Middle toe with claw, 11.9 mm (0.50; 11.5–12.8; 6); outer toe 77–86% of middle; inner 68–72%; hindtoe 84–97%.

AGEING   Adults, juveniles and first immatures readily separable (see Plumages); differences between ages in Aust. also summarized in Boles (1994).

SEXING   Rogers et al. (1986) developed sexing criteria based on THL and Tail of birds from Vic. For adults and first immatures: (1) Using THL, female if THL <25.9 mm, and male if THL >27.7 mm; this correctly sexed 59.9% of birds, incorrectly sexed 0.6% and left 39.5% unsexed; (2) Using Tail, female if Tail <82 mm and male if Tail >89 mm; this correctly sexed 30.8% birds, incorrectly sexed 0.6% and left 68.7% unsexed. Only females develop brood-patches; sex of most adults determinable on examination of cloaca in breeding condition (Rogers et al. 1986). In NZ, only female broods and this can result in much more worn rectrices in females than males (Blackburn 1965).

RECOGNITION   Mangrove Grey Fantail very similar, but much smaller, and plumage differs in having paler upperparts and plainer buff underparts; see Recognition of that text.

GEOGRAPHICAL VARIATION   Extensive, and species limits unsettled and controversial; taxonomic treatment needs review. Forms superspecies with Friendly Fantail *Rhipidura albolimbata* and Chestnut-bellied Fantail *R. hyperythra* from New Guinea, and Mangrove Grey Fantail *R. phasiana* (Sibley & Monroe 1990; DAB). Formerly considered conspecific with Mangrove Grey Fantail (e.g. Keast 1958; Peters), which now widely recognized as separate (see that text, Geographical Variation). Lord Howe I. form *cervina* also sometimes treated as separate species (Hindwood 1940; Fullagar et al. 1974; Hutton 1991). More recently, DAB treated Aust., Norfolk I. and sw. Melanesian forms as separate species, *R. albiscapa* Gould, from NZ and Lord Howe I. forms, *R. fuliginosa* (DAB). Here, we follow Christidis & Boles (1994; also Watson et al. 1986; Sibley & Monroe 1990; Peters; NZCL) in treating NZ and Lord Howe I. forms as conspecific with Aust.–Norfolk I. forms. Under this arrangement, ten subspecies recognized in HANZAB region (characterized below).

Albiscapa subspecies-group   SUBSPECIES *ALISTERI*: Described fully above. Breed se. Qld, NSW, Vic. and se. SA, but migrants range over much of Aust. in non-breeding season (see Movements). Of moderate size, with proportionately short tail (DAB). Much smaller than nominate *fuliginosa* of SI, NZ: both sexes significantly smaller in Tail (P<0.01) and Tarsus (P<0.01) (see also Measurements).

SUBSPECIES *KEASTI*: Breed ne. Qld, between about Daintree R. NP and Mackay; not migratory (see Movements). Within this range, n. and s. populations disjunct, with gap in distribution corresponding with Burdekin Gap of Keast (1961) (DAB). Bill-length of s. population slightly smaller on average than that in n. population, corresponding with Allen's Rule (DAB). Larger than other subspecies. Males have significantly longer Wing (P<0.05) and Bill S (P<0.01) than *alisteri*; differences between females not significant (see Measurements). Following descriptions based on examination of skins of 23 adults, one juvenile and three first immatures. **Adult** Much darker than adult *alisteri*, and dark bar across lower throat and upper breast much darker and broader. Grey of head, neck, upperparts and upperwing-coverts much darker than in adult *alisteri*, grey-black (82); have a small black (89) spot on upper chin. Dark bar across lower throat and upper

breast, black (89). Sides of breast and most of flanks, grey-black (82). White tips to median and greater secondary coverts and white edges to tertials and inner 2–3 secondaries average slightly narrower than on adult *alisteri*; rest of remiges as adult *alisteri*. **Juvenile** Similar to juvenile *alisteri* but tends to be slightly darker. **First immature** Differs from adult in same way as first immature and adult *alisteri*.

SUBSPECIES *ALBISCAPA*: Breed Tas., and Flinders and King Is; some migrate to mainland in non-breeding season, as far as central and ne. NSW, and possibly farther (Ford 1981; DAB; see Movements). Rather small, with short bill and long tail (DAB; this study). Compared with *alisteri*, males had significantly longer Tail (P<0.05) and Tarsus (P<0.01) than male *alisteri*; and females had significantly smaller Wing (P<0.05) (see Measurements). Following descriptions based on examination of skins of 30 adults, two juveniles and seven first immatures from Tas. A further 12 adult and nine first immature skins were identified from material collected in NSW–Vic. during non-breeding season. **Adult** Very similar to adult *alisteri*, but usually differ by: (1) Grey plumage of head, neck and upperparts tends to be slightly darker and with slight brownish (ne) tinge; (2) uppertail-coverts same colour as back (cf. darker than back in *alisteri*); (3) white fringe to inner web of t6 usually narrower (c. 2–5 mm wide at tip) and more sharply defined, and often have dark-grey (83) suffusion near tip of outer web of t6; results in darker appearance to tail (see Fig. 1); and (4) underparts tend to be slightly more buffy (124–121D) with slightly more grey at sides of breast; and dark-grey (84) to grey-black (82) band across lower throat tends to be slightly larger. Identification of migratory *albiscapa* sometimes difficult, since there appears to be some overlap in characters (i.e. some *alisteri* with very white tails have rather dark upperparts, and some *albiscapa* from Tas. have similar amount of white in tail to average *alisteri*). Whether all can be completely distinguished from adult *alisteri* is doubtful (Ford 1981; Boles 1994; this study), but those with dark upperparts and narrow white fringe to t6 most likely to be *albiscapa*. **Juvenile** As juvenile *alisteri* but with tail as adult *albiscapa*. **First immature** Differs from adult in same way as first immature and adult *alisteri*.

SUBSPECIES *PREISSI*: Breeds sw. WA, but some migrate or disperse beyond SW in non-breeding season (Ford 1981; DAB; see Movements). Rather small, with proportionately long tail (DAB). Adult males have significantly longer Tarsus (P<0.05) than male *alisteri*, and adult females have significantly shorter Wing (P<0.01) and significantly longer Tarsus (P<0.01 females) than female *alisteri* (see Measurements). Following descriptions based on examination of skins of 48 adults and two first immatures; no juveniles examined. **Adult** Very similar to adult *alisteri*. Tend to be slightly paler grey on head, neck and upperparts (but no difference in colour match). Dark bar across lower throat tends to be slightly smaller and paler than in adult *alisteri* (DAB; this study). Rest as adult *alisteri*. **Juvenile** No information. **First immature** Differs from adult in same way as first immature and adult *alisteri*.

SUBSPECIES *ALBICAUDA*: Occurs in central WA, s. NT and nw. SA. Rather small, with relatively long tail (DAB). Significantly smaller than *alisteri* in Wing (P<0.01), Bill S (P<0.01) and Weight (P<0.01) (see Measurements). Following descriptions based on examination of skins of 24 adults; no juveniles or first immatures examined. This subspecies characterized by very white tail. **Adult** Grey plumage of head, neck and upperparts slightly paler than that of *alisteri*, brownish grey (c79). Dark band across lower throat and upper breast tends to be slightly smaller and slightly paler than in *alisteri*, grey (84) to dark grey (83). Grey at sides of breast slightly paler, brownish grey (c79), and less extensive than in *alisteri*. Tail much whiter than in *alisteri*: t1, black-brown (c119); t2 mostly white with broad black-brown (c119) outer

edge; on t3–t5, dark outer edge becomes progressively smaller and paler, contracting towards base, and t5 mostly white with narrow, diffuse dark-brown (c121) edge to basal half of outer web; t6 wholly white (see Fig. 1). Rest as adult *alisteri*. **Juvenile, First immature** No information.

SUBSPECIES *PELZELNI*: Occurs Norfolk I. Rather small, with large bill and proportionately long tail (DAB). Too few measurements to compare with other subspecies (see Measurements). Following descriptions based on examination of skins of five adults only. **Adult** Similar to adult *alisteri*, differing by: (1) Grey of head, neck and upperparts with slight brownish tinge, dark brownish-grey (ne); (2) Dark bar across lower throat much smaller and narrower; (3) White tips to median and greater secondary coverts, very fine or absent; and (4) Pale fringes to rectrices off-white (ne) (cf. clean white in *alisteri*) (see Fig 1). **Juvenile, First immature** No information.

Fuliginosa subspecies-group NOMINATE *FULIGINOSA*: Described fully above. Occurs SI, NZ. Of moderate size with relatively long tail. Both sexes significantly larger than *alisteri* in Tail (P<0.01) and significantly smaller in Bill S (P<0.05); adult females also have significantly longer Tarsus (P<0.01) than female *alisteri*.

SUBSPECIES *PLACABILIS*: Occurs in NI, NZ. Of moderate size with relatively long tail. No significant differences in measurements from nominate (see Measurements). Following descriptions based on examination of skins of 35 adults, four juveniles and 13 first immatures. Dimorphic, as nominate *fuliginosa*, though black morph much less common than in nominate, comprising <1% of population (Fleming 1949; Craig 1972; Heather & Robertson 1997). **Adult Pied morph** Very similar to adult pied-morph nominate, differing mainly in pattern of tail: T1 as in adult nominate but with weak dark-brown (c121) suffusion to tip; t2–t5 darker than in adult nominate, with mostly black-brown (119) outer webs, white shafts, and off-white (ne) inner webs and tips weakly suffused dark brown; t6 mostly off-white (ne) with dark-brown (121) suffusion near shaft on inner web. Also tend to be slightly paler below than nominate, but this only evident when large series examined together. **Black morph** None examined but probably not separable from black morph nominate. **Nestling** Hatch naked (McLean & Jenkins 1980). **Juvenile** Mostly as juvenile nominate but with tail as adult *placabilis*. **First immature** Differs from adult in same way as first immature and adult nominate.

SUBSPECIES *CERVINA*: Extinct; formerly occurred Lord Howe I. Of moderate size with shorter tail than other subspecies (DAB). No specimens examined; following description based on published descriptions (Hindwood 1940; DAB). **Adult** Similar to adult *fuliginosa* or slightly darker, from which mainly differs by: (1) Supercilium has yellow-brown wash; (2) Throat, pale yellowish-brown, paler than underbody, and lacking dark band across lower throat; and (3) Rectrices mostly dark brownish-grey with white edges to t4–t6. **Juvenile, First immature** No information.

SUBSPECIES *PENITA*: Occurs Chatham Is. Appear to be of similar size to nominate, but too few specimens for statistical comparison. Following descriptions based on examination of skins of four adults and three first immatures; no juveniles examined. **Adult** Differs only slightly from nominate, in slightly whiter tail: t1 has slightly broader white tip that extends slightly down side of feather as fringe to tip; t2–t5 as nominate but with narrower black-brown (119) outer edges. **Juvenile** No information. **First immature** Differs from adult in same way as first immature and adult nominate.

EXTRALIMITAL SUBSPECIES: Two other subspecies, both part of *albiscapa* subspecies-group: *bulgeri* from New Caledonia and Loyalty Is, and *brenchleyi* from Vanuatu and Solomon and Banks Is. No skins examined; following based on published descriptions (Sharpe 1879; Mayr 1931). In subspecies *bulgeri*,

tail mostly brown with conspicuous white shafts to feathers and white tips and edges to outer rectrices; rest of plumage similar to Aust. forms. Subspecies *brenchleyi* similar to *bulgeri* but with paler underparts and shaft of t1 sometimes brownish.

REFERENCES
ABBBS. 1989. *Corella* 13: 93–5.
—— 1991. *Corella* 15: 26–8.
Abbott, I. 1976. *West. Aust. Nat.* 13: 158–9.
—— 1980. *West. Aust. Nat.* 14: 189–93.
—— 1981. *Emu* 81: 91–6.
—— 1995. *West. Aust. Nat.* 20: 125–32.
Agnew, N.V.I. 1913. *Emu* 13: 93–7.
—— 1921. *Emu* 21: 131–7.
Alexander, W.B. 1917. *Emu* 17: 53.
—— 1921. *Emu* 20: 149–68.
—— 1926. *Emu* 25: 245–60.
Ambrose, S. 1991. *Wingspan* 4: 13.
——. 1909. *Trans. NZ Inst.* 41: 422–8.
—— 1911. *Trans. NZ Inst.* 43: 656–69.
—— 1913. *Trans. NZ Inst.* 45: 387–97.
—— 1917. *Trans. NZ Inst.* 49: 519–30.
—— 1918. *Trans. NZ Inst.* 50: 282–95.
—— 1926. *Bird-Song and New Zealand Song Birds*. Whitcombe & Tombs, Auckland.
Andrew, E. 1999. *Nature in Eurobodalla* 13: 4–57.
Anon. 1977. *Tasm. Nat.* 48: 6–8.
—— 1989. *RAOU Rep.* 63: 10–28.
—— 1992. *RAOU Rep.* 86: 18–35.
—— 2001. *Canberra Bird Notes* 26(4): 105–99.
Arnold, G.W. 1989. *Corella* 13: 81–5.
Ashton, C.B. 1985. *S. Aust. Orn.* 29: 169–79.
—— 1987. *Aust. Bird Watcher* 11: 73–82.
—— 1996. *S. Aust. Orn.* 32: 93–8.
Ashton, I., *et al.* 1996. *RAOU Rep.* 97: 24–76.
Aston, H.I., & R.A. Balmford. 1978. *A Bird Atlas of the Melbourne Region*. Vict. Orn. Res. Grp, Melbourne.
Attiwill, A.R. 1972. *S. Aust. Orn.* 26: 59–64.
Aumann, T. 1991. *Aust. Bird Watcher* 14: 51–67.
Austin, C.N. 1950. *Emu* 49: 225–31.
Austin, T.P. 1918. *Aust. Zool.* 1: 109–37.
Badman, F.J. 1979. *S. Aust. Orn.* 28: 29–81.
—— 1989. *The Birds of Middle and Lower Cooper Creek in South Australia*. Nature Conserv. Soc. S. Aust., Adelaide.
Baker, R.T. 1980. *Notornis* 27: 331–4.
Baldwin, M. 1975. *Emu* 75: 113–20.
Barnard, H.G. 1911. *Emu* 11: 17–32.
—— 1914. *Emu* 14: 39–57.
Basset Hull, A.F. 1909. *Proc. Linn. Soc. NSW* 34: 636–93.
Baxter, C.I. 1980. *S. Aust. Orn.* 28: 90–7.
——, & B. Berris. 1995. *An Annotated List of Birds of Kangaroo Island.* S. Aust. Natl Pks Wildl. Serv., Adelaide.
Beck, J., & K. Chan. 1999. *Sunbird* 29: 41–51.
Bedggood, G.W. 1965. *Bird Obs.* 405: 6.
—— 1970. *Aust. Bird Watcher* 3: 252–65.
—— 1972. *Aust. Bird Watcher* 4: 116–28.
—— 1973. *Aust. Bird Watcher* 5: 12–22.
—— 1980. *Aust. Bird Watcher* 8: 147–62.
Beehler, B.M., *et al.* 1986. *Birds of New Guinea*. Princeton Univ. Press, Princeton, NJ.
Bell, B.D., & D.H. Braithwaite. 1963. *Notornis* 10: 363–83.
Bell, H.L. 1980a. *Emu* 80: 227–32.
—— 1980b. *Corella* 4: 8–19.
—— 1986. *Emu* 86: 2–11.
Berney, F.L. 1904. *Emu* 4: 43–7.
—— 1905. *Emu* 5: 72–8.
—— 1907. *Emu* 7: 79–81.
BFNC (Bendigo Field Nat. Club). 1976. *Aust. Bird Watcher* 6: 186–208.
Bielewicz, J., & F. Bielewicz. 1996. *Sunbird* 26: 81–120.
Binns, G. 1953. *Emu* 53: 211–21.
Blackburn, A. 1963. *Notornis* 10: 242.
—— 1965. *Notornis* 12: 127–37.
—— 1966. *Notornis* 13: 189–96.
—— 1967. *Notornis* 14: 3–8.
—— 1983. *Notornis* 30: 336–7.
Boles, W.E. 1994. *Corella* 18: 162.
——, & N.W. Longmore. 1985. *S. Aust. Orn.* 29: 213–19.

Bourke, P. 1989. *Notornis* 36: 260.
Bourke, P.A., & A.F. Austin. 1947. *Emu* 47: 87–116.
Bramwell, M. 1990. *RAOU Rep.* 76: 37–48.
Bravery, J.A. 1970. *Emu* 70: 49–63.
Bregulla, H.L. 1992. *Birds of Vanuatu*. Anthony Nelson, Oswestry, Shropshire, England.
Britton, P.L. 1997. *Sunbird* 27: 29–37.
——, & H.A. Britton. 2000. *Sunbird* 30: 61–88.
Brooker, M.G. 2001. *West. Aust. Nat.* 23: 62–106.
——, & L.C. Brooker. 1989. *Aust. Zool. Rev.* 2: 1–67.
——, & A.J. Estbergs. 1976. *West. Aust. Nat.* 13: 160–70.
——, *et al.* 1979. *Emu* 79: 176–90.
——, *et al.* 1995. *West. Aust. Nat.* 20: 169–84.
Brothers, N. 1978. *Emu* 78: 163–4.
Brown, A.G. 1950. *Emu* 50: 105–13.
Brown, K., *et al.* 1993. *Notornis* 40: 169–77.
Brown, R.J., & M.N. Brown. 1981. *RAOU Rep.* 4.
——, —— 1983. *RAOU Rep.* 5.
——, —— 1991. *RAOU Rep.* 77.
——, *et al.* 1986. *Corella* 10: 118–22.
Bryant, C.E. 1930. *Emu* 29: 297–301.
Bull, P.C. 1953. *Notornis* 5: 138–41.
—— 1956. *Notornis* 7: 9–13.
—— 1959. *Proc. NZ Ecol. Soc.* 6: 52–8.
Buller, W.L. 1888. *History of the Birds of New Zealand*. Second edn. Author, London.
—— 1905. *Supplement to the Birds of New Zealand*. Author, London.
Burbidge, A. 1982. *RAOU Rep.* 2: 8–36.
—— 1985. *RAOU Rep.* 16: 23–55.
Burrows, W.M. 1955. *Notornis* 6: 177–8.
Cale, P. 1994. *Emu* 94: 116–26.
Calver, M.C., & R.D. Wooller. 1981. *Aust. Wildl. Res.* 8: 653–7.
Cameron, E. 1979. *Aust. Nat. Hist.* 19: 298–303.
—— 1985. Pp 177–91 In: Keast *et al.* 1985.
Campbell, A.G. 1906. *Emu* 5: 199–201.
—— 1937. *Emu* 37: 131–2.
Campbell, A.J. 1904. *Emu* 3: 185.
Carnaby, I.C. 1954. *West. Aust. Nat.* 4: 149–56.
Carpenter, G.A., & J.S. Matthew. 1997. *S. Aust. Orn.* 32: 134–40.
Carter, T. 1902. *Emu* 2: 77–84.
—— 1903. *Emu* 3: 30–8.
—— 1924. *Emu* 23: 223–35.
Caughley, G. 1969. *Notornis* 16: 237–40.
Chaffer, N. 1973. *Aust. Bird Watcher* 5: 10–12.
Challies, C.N. 1962. *Notornis* 10: 118–27.
—— 1966. *Notornis* 13: 18–26.
Chan, K. 1995. *Aust. Bird Watcher* 16: 11–20.
Chandler, L.G. 1920. *Emu* 19: 312.
Chesterfield, E.A., *et al.* 1984. *Flora and Fauna of Barmah State Forest and Their Management*. Forests Commission Vic., Res. Branch Rep. 240. Forests Commission Vic., Melbourne.
Chisholm, A.H. 1924. *Emu* 24: 102–6.
—— 1946. *Nature's Linguists*. Brown Prior Anderson, Melbourne.
—— 1949. *Emu* 49: 60–1.
Chisholm, E.C. 1929. *Emu* 29: 143–51.
—— 1936. *Emu* 36: 32–8.
—— 1938. *Emu* 37: 301–13.
—— 1940. *Emu* 39: 267–72.
Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.
Clarke, G. 1967. *S. Aust. Orn.* 24: 119–34.
Clarke, M.F., *et al.* 1999. *Wingspan* 9(4) (Suppl.).
Close, D.H., & R.P. Jaensch. 1984. *S. Aust. Orn.* 29: 81–99.
Clout, M.N., & P.D. Gaze. 1984. *J. Appl. Ecol.* 21: 795–815.
Coates, B.J. 1990. *The Birds of Papua New Guinea*. 2. Dove Publs, Alderley, Qld.
Coates, N.F. 1966. *Notornis* 13: 197–8.
Congreve, D.P., & P. Congreve. 1985. *RAOU Rep.* 9: 20–39.
Cooper, R.M., & I.A.W. McAllan. 1995. *The Birds of Western New South Wales: A Preliminary Atlas*. NSW Bird Atlassers, Albury, NSW.
Cooper, R.P. 1947. *Wild Life* 9: 68.
—— 1972. *Aust. Bird Watcher* 4: 171–81.
—— 1975a. *Aust. Bird Watcher* 6: 87–102.
—— 1975b. *Wilson's Promontory National Park and Its Avifauna*. Bird Obs. Club, Melbourne.
Cooper, V. 1979. *Sunbird* 10: 77.
Cooper, W.J. 1991. *Notornis* 38: 103–9.
Cossee, R.O. 1989. *NZ Dept Conserv. Sci. & Res. Ser.* 19.

—— 1991. *NZ Dept Conserv. Sci. & Res. Ser.* 49.
—— 1993. *NZ Dept Conserv. Sci. & Res. Ser.* 59.
—— 1995. *NZ Dept Conserv. Sci. & Res. Ser.* 87.
—— 1997. *NZ Dept Conserv. Sci. & Res. Ser.* 64.
—— 1998a. *NZ Dept Conserv. Sci. & Res. Ser.* 72.
—— 1998b. *NZ Dept Conserv. Sci. & Res. Ser.* 93.
——, & M. Wakelin. 1991. *NZ Dept Conserv. Sci. & Res. Ser.* 33.
Costello, J. 1981. *Aust. Bird Watcher* 9: 55–67.
Cottrell, H.S. 1923. *Emu* 23: 101–4.
Cox, J.B. 1973. *S. Aust. Orn.* 26: 103–14.
——, & L.P. Pedler. 1977. *S. Aust. Orn.* 27: 231–50.
Craig, J.L. 1972. *Notornis* 19: 42–55.
Crome, F.H.J. 1978. *Aust. J. Ecol.* 3: 195–212.
Cunningham, D.M., & P.J. Moors. 1985. *Notornis* 32: 221–43.
Cunningham, J.M. 1951. *Notornis* 4: 140–2.
—— 1952. *Notornis* 5: 20–3.
—— 1954. *Notornis* 6: 47–8.
Dawson, D.G., *et al.* 1978. *Notornis* 25: 257–78.
Dawson, E.W. 1950. *Notornis* 4: 27–31.
Dawson, P., *et al.* 1991. *Sunbird* 21: 93–110.
Day, T.D. 1995. *Notornis* 42: 175–86.
De Ravin, J.A. 1975. *Aust. Bird Watcher* 6: 4–10.
Dean, S. 1990. *Notornis* 37: 27–36.
Debus, S.J.S. 1983. *Corella* 7: 14–16.
Dedman, V. 1998. *Geelong Nat.* 34(3): 8.
Degabriele, R., *et al.* 1979. *Emu* 79: 87–9.
Delacour, J. 1966. *Guide des Oiseaux de la Nouvelle-Caledonie et de ses Dépendances*. Éditions Delachaux & Niestlé, Neuchatel, Switzerland.
Dell, R.K. 1959. *Proc. NZ Ecol. Soc.* 8: 49–52.
Dennison, M.D., *et al.* 1978. *Notornis* 25: 254–5.
——, *et al.* 1979. *Notornis* 26: 392–5.
Dickison, D. 1929. *Emu* 28: 315.
Disher, P.A. 1960. *Aust. Bird Watcher* 1: 118–19.
Disney, H.J. de S., & A. Stokes. 1976. *Emu* 76: 133–8.
Doughty, C., *et al.* 1999. *Birds of the Solomons, Vanuatu and New Caledonia*. Christopher Helm, London.
Dove, H.S. 1916. *Emu* 15: 234–43.
Dow, M., & C. Dow. 1989. *RAOU Rep.* 64: 7–22.
Dowling, B., *et al.* 1994. *Tech. Rep. Arthur Rylah Inst. Environ. Res.* 134.
Draffan, R.D.W., *et al.* 1983. *Emu* 83: 207–34.
Driscoll, P.V. 1977. *Aust. Wildl. Res.* 4: 281–8.
Durrant, B.M., & I.C. MacRae. 1994. *Birds of Bribie Island, Pumicestone Passage and Environs*. Bribie I. Environ. Prot. Assoc., Bribie I., Qld.
Dymond, N. 1988. *RAOU Rep.* 38: 13–47.
Edgar, A.T. 1962. *Notornis* 10: 1–15.
—— 1974. *Notornis* 21: 250–9.
Egan, K.H., *et al.* 1997. *Corella* 21: 1–16.
Elliott, A.J. 1933. *Emu* 32: 312–13.
Elliott, G.P., & C.C. Ogle. 1985. *Wildlife & Wildlife Habitat Values of Waitutu Forest, Western Southland*. NZ Wildl. Serv. Dep. Int. Aff., Fauna Survey Unit Rep. 39.
Emison, W.B., & J.W. Porter. 1978. *Emu* 78: 126–36.
Er, K.B.H. 1997. *Corella* 21: 101–11.
——, & C.R. Tidemann. 1996. *Corella* 20: 117–28.
——, *et al.* 1998. *Aust. Bird Watcher* 17: 370–82.
Erickson, R. 1951. *Emu* 51: 153–65.
Evans, R., *et al.* 1997. *Sunbird* 27: 38–44.
Ey, A.E. 1944. *S. Aust. Orn.* 17: 32–7.
Falla, R.A., *et al.* 1979. *The New Guide to the Birds of New Zealand*. Revised edn. Collins, Auckland.
Fielding, P. 1979. *Tasm. Nat.* 57: 1–11.
——, *et al.* 1976. *Tasm. Nat.* 44: 1–9.
Fitri, L.L., & H.A. Ford. 1998. *Corella* 22: 24–9.
Fitzgerald, B.M., *et al.* 1989. *Notornis* 36: 311–21.
Fleming, A.M. 1976. *Aust. Bird Watcher* 6: 151–60.
Fleming, C.A. 1939. *Emu* 38: 492–509.
—— 1949. *NZ Bird Notes* 3: 188–90.
Fletcher, J.A. 1924. *Emu* 24: 107–17.
Flux, J.E.C. 1974. *Notornis* 21: 184.
Ford, H.A. 1985. Pp 249–54 In: Keast *et al.* 1985.
——, & H. Bell. 1981. *Emu* 81: 202–8.
——, & D.C. Paton. 1976. *S. Aust. Orn.* 27: 88–95.
——, *et al.* 1985. *Corella* 9: 97–107.
——, *et al.* 1986. *Emu* 86: 168–79.
Ford, J.R. 1971. *Emu* 71: 103–20.
—— 1980. *Emu* 80: 97–120.

—— 1981. *Emu* 81: 128–44.
——, & P.S. Stone. 1957. *Emu* 57: 9–21.
——, *et al.* 1980. *Sunbird* 11: 58–70.
Freeman, A.N.D. 1994. *Notornis* 41 (Suppl.): 127–41.
—— 1999. *Notornis* 46: 388–403.
French, K. 1990. *Emu* 90: 185–9.
Friend, G.R. 1982. *Emu* 82: 80–91.
Frith, D.W. 1984. *Aust. Wildl. Res.* 11: 325–47.
Frith, H.J. (Ed.) 1969. *Birds in the Australian High Country.* Reed, Sydney.
Fullagar, P.J., *et al.* 1974. Pp 55–72 In: Recher & Clarke 1974.
Gall, B.C., & N.W. Longmore. 1978. *Emu* 78: 189–96.
Gannon, G.R. 1934. *Emu* 34: 122–34.
Garnett, S.T., & R. Bredl. 1985. *Sunbird* 15: 25–40.
——, & J.B. Cox. 1983. *Birds of the Townsville Town Common.* Authors, Townsville, Qld.
——, & G.M. Crowley. 2000. *The Action Plan for Australian Birds 2000.* Env. Aust., Canberra.
——, *et al.* 1991. *Corella* 15: 1–7.
Gibb, J.A. 1961. *Proc. NZ Ecol. Soc.* 8: 29–38.
—— 1996. *Notornis* 43: 7–13.
—— 2000a. *Notornis* 47: 13–35.
—— 2000b. *Notornis* 47: 184–91.
Gibson, D.B., & J.R. Cole. 1988. *Tech. Rep. Cons. Comm. North. Terr.* 40.
Gibson, D.F. 1986. *Tech. Rep. Cons. Comm. North. Terr.* 30.
Gibson, J.D. 1977. *Aust. Birds* 11: 41–74.
Gilbert, P.A. 1935. *Emu* 34: 200–9.
Gill, H.B. 1970. *Emu* 70: 105–16.
Gill, B.J. 1980. *NZ J. Zool.* 7: 235–46.
—— 1989. *Notornis* 36: 81–7.
——, & C.R. Veitch. 1990. *Notornis* 37: 141–5.
——, *et al.* 1983. *Notornis* 30: 81–5.
Goodfellow, D.L. 2001. *Birds of Australia's Top End.* Scrubfowl Press, Darwin.
Gosler, A. 1991. *The Hamlyn Photographic Guide to Birds of the World.* Paul Hamlyn, London.
Gosper, D.G. 1992. *Corella* 16: 78–88.
Graham, D.H. 1948. *Notornis* 2: 178–80.
Gravatt, D.J. 1969. Unpubl. MSc thesis, Univ. Auckland, Auckland.
—— 1971. *Emu* 71: 65–72.
Green, R.H. 1950. *Emu* 50: 58–9.
—— 1966. *Emu* 66: 105–10.
—— 1969. *Rec. Queen Vic. Mus.* 34.
—— 1977. *Birds of Tasmania.* Author, Launceston.
—— 1989. *Birds of Tasmania.* Potoroo Publs, Launceston, Tas.
—— 1995. *The Fauna of Tasmania: Birds.* Potoroo Publs, Launceston, Tas.
——, & A.M. McGarvie. 1971. *Rec. Queen Vic. Mus.* 40.
——, & B.C. Mollison. 1961. *Emu* 61: 223–36.
Green, R.J., *et al.* 1989. *Emu* 89: 216–22.
Griffin, A.C.M. 1974. *Sunbird* 5: 29–39.
—— 1995. *Sunbird* 25: 73–92.
Griffioen, P.A., & M.F. Clarke. 2002. *Emu* 102: 99–125.
Guest, R. 1975. *Notornis* 22: 23–6.
——, & G. Guest. 1987. *Notornis* 34: 59–64.
——, —— 1993. *Notornis* 40: 137–41.
Guthrie-Smith, H. 1910. *Birds of the Water, Wood & Waste.* Whitcombe & Tombs, Christchurch.
Hall, G., & C. Hall. 1990. *RAOU Rep.* 73: 12–44.
Halse, S.A., *et al.* 1985. *West. Aust. Nat.* 16: 57–69.
Hardy, J.W., & J.R. Farrell. 1990. *Corella* 14: 1–15.
Harrison, C.J.O. 1976. *Emu* 76: 115–19.
Heather, B.D. 1957. *Notornis* 7: 171–4.
——, & H.A. Robertson. 1997. *The Field Guide to Birds of New Zealand.* OUP, Oxford.
Hermes, N.L. 1981. *Corella* 5: 41–5.
—— 1985. *Birds of Norfolk Island.* Wonderland Press, Norfolk I.
——, *et al.* 1986. *Notornis* 33: 141–9.
Heron, S.J. 1970. *Emu* 70: 155–8.
—— 1973. *Emu* 73: 1–8.
Hewish, M. 1998. *Geelong Nat.* 34(5): 4–5.
Hill, H.E. 1904. *Emu* 3: 186.
Hindwood, K.A. 1935. *Emu* 34: 181–9.
—— 1937. *Emu* 36: 254–61.
—— 1940. *Emu* 40: 1–86.
——, & A.R. McGill. 1958. *The Birds of Sydney.* Roy. Zool. Soc. NSW, Sydney.

Hinsby, H.B. 1954. *Emu* 54: 59–61.
Hird, D.G. 1995. *Tasm. Nat.* 117: 52–66.
Hitchcock, W.B. 1938. *S. Aust. Orn.* 14: 151–3.
Hobbs, J.N. 1961. *Emu* 61: 21–55.
Hodgkins, M. 1949. *Notornis* 3: 116–25.
Holmes, G. 1987. *Avifauna of the Big Scrub Region.* NSW Natl Pks Wildl. Serv., Sydney.
Holmes, R.T, & H.F. Recher. 1986. *Auk* 103: 515–30.
Hopkins, N. 1948. *Emu* 47: 331–47.
—— 1972. *Sunbird* 3: 1–5.
Hore-Lacy, I. 1964. *Emu* 64: 29–32.
Horey, G.M., & S.J. Wilson. 1971. *Aust. Bird Bander* 9: 27–33.
Horning, D.S. 1976. *Snares Islands Expedition.* Unpubl. rep. to Dept Lands & Surv., Wellington.
——, & C.J. Horning. 1974. *Notornis* 21: 13–24.
Horton, W. 1975. *Sunbird* 6: 49–69.
Hoskin, E.S. 1991. *The Birds of Sydney.* Surrey Beatty, Sydney.
Howe, F.E. 1928. *Emu* 27: 252–65.
——, & W. Burgess. 1942. *Emu* 42: 65–73.
Howe, R.W., *et al.* 1981. *Aust. Wildl. Res.* 8: 637–51.
Hudson, K., *et al.* 1997. *Sunbird* 27: 57–64.
Hughes, B., & P. Hughes. 1980. *Sunbird* 11: 22–3.
Humphreys, J.S. 1986. *Aust. Bird Watcher* 11: 153–66.
Hunt, D.M., & B.J. Gill. 1979. *Mauri Ora Spec. Publ.* 2.
Hutton, F.W., & J. Drummond. 1904. *Animals of New Zealand.* Whitcombe & Tombs, Christchurch.
Hutton, I. 1991. *Birds of Lord Howe Island. Past and Present.* Author, Coffs Harbour, NSW.
Hyem, E.L. 1936. *Emu* 36: 109–27.
Jackson, S.W. 1920. *Emu* 19: 257–72.
Jarvis, H. 1929. *Qld Agric. J.* 32: 8–12.
Jenkins, C.F.H. 1931. *Emu* 31: 30–5.
Johnson, D.D.P., & J.S. Mighell. 1999. *Emu* 99: 108–20.
Johnston, D. 1983. *Aust. Birds* 17: 35–7.
Johnstone, R.E. 1983. *Wildl. Res. Bull. West. Aust.* 11: 54–69.
——, & A.H. Burbidge. 1991. Pp 361–91 In: McKenzie *et al.* 1991.
Jones, D.N. 1983. *Emu* 83: 12–18.
—— 1986. *Sunbird* 16: 1–11.
—— 1987. *Sunbird* 17: 32–5.
Jones, J. 1952. *Emu* 52: 225–54.
Jones, M.V. 1981. *Aust. Bird Watcher* 9: 1–13.
Jordan, R. 1984. *RAOU Rep.* 11: 13–27.
—— 1987. *RAOU Rep.* 27: 11–18, 25–38.
—— 1988. *RAOU Rep.* 51: 8–10.
Jurisevic, M.A., & K.J. Sanderson. 1994. *Emu* 94: 69–77.
Kavanagh, R.P., *et al.* 1985. Pp 273–81 In: Keast *et al.* 1985.
Keast, A. 1944. *Emu* 43: 218–19.
—— 1958. *Rec. Aust. Mus.* 24: 73–108.
—— 1961. *Bull. Mus. Comp. Zool., Harv.* 123: 305–495.
—— 1975. *West. Aust. Nat.* 13: 25–9.
—— 1985. Pp 97–116 In: Keast *et al.* 1985.
—— 1993. *Emu* 93: 259–68.
—— 1994. *Corella* 18: 133–40.
——, *et al.* (Eds) 1985. *Birds in Eucalypt Forests and Woodlands.* Surrey Beatty, Sydney.
Kendall, H. 1901. *Emu* 1: 19–23.
Kikkawa, J. 1966. *Trans. R. Soc. NZ* 7: 215–77.
——, *et al.* 1965. *Emu* 65: 139–43.
Kinsky, F.C. 1957. *Notornis* 7: 123–35.
—— 1965. *Notornis* 12: 187.
Kutt, A.S. 1996. *Emu* 96: 280–4.
Lamm, D.W., & S.J. Wilson. 1966. *Emu* 65: 183–205.
Lang, C.L. 1930. *Emu* 30: 155–6.
Lashmar, A.F.C. 1937. *S. Aust. Orn.* 14: 59–64.
—— 1942. *S. Aust. Orn.* 16: 37–40.
Laurance, W.F., *et al.* 1996. *Sunbird* 26: 1–15.
Lavery, H.J., & N. Hopkins. 1963. *Emu* 63: 242–52.
——, *et al.* 1968. *Emu* 68: 133–47.
Lawrence, C.C. 1946. *Emu* 46: 186.
Le Souëf, A.S., & J. MacPherson. 1920. *Emu* 20: 82–91.
Leach, G.J., & H.B. Hines. 1987. *Sunbird* 17: 65–95.
——, & D.J. Watson. 1994. *Corella* 18: 155–61.
Leach, H.A.C. 1929. *Emu* 28: 83–99.
Legge, R.W. 1932. *Emu* 31: 272.
Legge, W.V. 1908. *Emu* 7: 142–52.
Leishman, A.J. 1994. *Aust. Birds* 28: 14–26.
—— 2000. *Corella* 24: 6–12.
Lendon, A. 1919. *S. Aust. Orn.* 4: 47–51.

Lepschi, B.J. 1990. *Corella* 14: 82–5.
—— 1992. *Corella* 16: 75–7.
—— 1993. *Emu* 93: 195–9.
Lindsay, C.J., *et al.* 1959. *Notornis* 8: 99–106.
Littlejohns, R.T., & S.A. Lawrence. 1917. *Emu* 16: 236–8.
Littler, F.M. 1903. *Emu* 3: 23–30.
—— 1910a. *A Handbook of Birds of Tasmania and its Dependencies.* Author, Launceston, Tas.
—— 1910b. *Emu* 9: 141–8.
Longmore, N.W. 1978. *Sunbird* 9: 25–53.
Lord, E.A.R. 1933. *Emu* 32: 207–10.
—— 1937. *Emu* 37: 88–9.
—— 1939a. *Emu* 38: 372–6.
—— 1939b. *Emu* 38: 418–19.
—— 1943. *Emu* 43: 18–23.
—— 1956. *Emu* 56: 100–28.
Loyn, R.H. 1980. *Emu* 80: 145–56.
—— 1985a. Pp 33–46 In: Keast *et al.* 1985.
—— 1985b. *Emu* 85: 213–30.
—— 1993. *Effects of Previous Logging on Bird Populations in East Gippsland: VSP Retrospective Study.* Value-adding & Silvicultural Systems Prog. Tech. Rep. 18. Dept. Conserv. Nat. Res., Melbourne.
—— 1998. *Pacific Conserv. Biol.* 4: 111–21.
McLean, J.C. 1912. *Emu* 11: 171–87.
Mac Nally, R. 1997. *Emu* 97: 253–8.
MacDonald, A. 1973. *Notornis* 20: 377–8.
Macdonald, J.D. 1987. *The Illustrated Dictionary of Australian Birds by Common Name.* Reed, Sydney.
Mack, K.J. 1970. *S. Aust. Orn.* 25: 126–41.
Marchant, S. 1979. *Aust. Birds* 13: 59–68.
—— 1980. *Corella* 1: 2–3.
—— 1981. *Corella* 5: 19–25.
—— 1992. *Occ. Publ. Eurobodalla Nat. Hist. Soc.* 1.
Marples, B.J. 1944. *NZ Bird Notes* 1: 62–3.
Martindale, J. 1980. *RAOU Rep.* 1: 4–40.
Masters, J.R., & A.L. Milhinch. 1974. *Emu* 74: 228–43.
Matheson, W.E. 1976. *S. Aust. Orn.* 27: 125–30.
Matthiessen, J.N. 1973. *Emu* 73: 191–3.
Mawson, P.R., & M.C. Massam. 1995. *West. Aust. Nat.* 20: 37–47.
Mayo, L.M. 1938. *Emu* 37: 238–9.
Mayr, E. 1931. *Am. Mus. Novit.* 502: 1–21.
McEvey, A. 1965. *Emu* 65: 1–56.
McFarland, D.C. 1984. *Aust. Bird Watcher* 10: 255–63.
—— 1988. *Emu* 88: 249–57.
McGarvie, A.M., & M.T. Templeton. 1974. *Emu* 74: 91–6.
McGilp, J.N. 1920. *S. Aust. Orn.* 5: 24–8.
—— 1923. *Emu* 22: 274–87.
McKenzie, H.R. 1948. *Notornis* 3: 4–9.
McKenzie, N.L., *et al.* (Eds) 1991. *Kimberley Rainforests.* Surrey Beatty, Sydney.
McKeown, K.C. 1934. *Rec. Aust. Mus.* 19: 113–35.
McLean, I.G. 1975. Unpubl. MSc thesis, Univ. Auckland, Auckland.
—— 1980. *Ibis* 122: 98–102.
—— 1984a. *Notornis* 31: 279–83.
—— 1984b. *NZ J. Ecol.* 7: 165–8.
—— 1989. *Notornis* 36: 99–106.
——, & P.F. Jenkins. 1980. *Notornis* 27: 105–13.
——, *et al.* 1987. *NZ J. Zool.* 14: 143–7.
McLean, J.C. 1912. *Emu* 11: 171–87.
McNamara, E. 1937. *Emu* 37: 99–102.
McPherson, L.B. 1990. *New Zealand Birds: A Sound Guide.* 6. Author, Christchurch.
Mellor, J.W. 1907. *Emu* 6: 159–71.
—— 1925. *S. Aust. Orn.* 8: 95–6.
Merton, D.V. 1966. *Notornis* 13: 179–84.
Middleditch, J. 1947. *Notornis* 2: 126.
Milledge, D. 1972. *Emu* 72: 167–70.
Miller, M.A. 1993. *Notornis* 40: 273–84.
Milligan, A.W. 1902. *Emu* 2: 68–77.
Mills, K. 1984. *Aust. Birds* 18: 76–9.
Miskelly, C.M., *et al.* 2001. *Notornis* 48: 1–40.
Mitchell, H., & P. Mitchell. 1975. *Peninsula Nat.* 10: 4–9.
Moeed, A., & B.M. Fitzgerald. 1982. *NZ J. Zool.* 9: 391–402.
Moncrieff, P. 1928. *Emu* 28: 100–10.
—— 1929. *Emu* 28: 215–25.
—— 1931. *Emu* 31: 111–17.
—— 1941–42. *Bull. Orn. Soc. NZ* 1: 7–8.

Moon, G. 1992. *The Reed Field Guide to New Zealand Birds.* Reed, Auckland.
Morgan, J. 1970. *Sunbird* 1: 100.
—— 1972. *Sunbird* 3: 18.
Morris, A.K. 1975. *Aust. Birds* 9: 37–76.
—— 1986. *Aust. Birds* 20: 65–81.
——, *et al.* 1981. *Handlist of Birds in New South Wales.* NSW Field Orn. Club, Sydney.
Morse, F.C. 1922. *Emu* 22: 24–38.
Napier, J.R. 1969. *Aust. Bird Watcher* 3: 179–92.
Nichols, O.G., & F.M. Nichols. 1984. *West. Aust. Nat.* 15: 179–89.
Nielsen, L. 1991. *Birds of Lamington National Park and Environs.* Author, Canungra, Qld.
Nilsson, R.J., *et al.* 1994. *Notornis* 41 (Suppl.): 109–25.
Norman, F.I. 1970. *Victorian Nat.* 87: 131–41.
North, A.J. 1899. *Aust. Mus. Cat.* 12 (Appendix II): 407–16.
O'Donnell, C.F.J., & P.J. Dilks. 1989. *Notornis* 36: 72–6.
——, —— 1994. *NZ J. Ecol.* 18: 87–107.
Oliver, W.R.B. 1922. *Emu* 22: 45–51.
Officer, H.R. 1969. *Australian Flycatchers and Their Allies.* Bird Obs. Club, Melbourne.
Olsen, P., *et al.* 1991. *Aust. Bird Watcher* 14: 13–23.
Onley, D.J. 1980. *Notornis* 27: 335–62.
—— 1983. *Notornis* 30: 187–7.
Orton, C.L.E., & P.T. Sandland. 1913. *Emu* 13: 75–80.
Osborne, W.S., & K. Green. 1992. *Emu* 92: 93–105.
Paton, D.C., & J.B. Paton. 1980a. *S. Aust. Orn.* 28: 120–6.
——, & P.A. Paton. 1980b. *S. Aust. Orn.* 28: 137–8.
Pawsey, C.K. 1966. *S. Aust. Orn.* 24: 93–5.
Payne, H.W. 1931. *Emu* 30: 228–32.
Pennycook, C. 1949. *Notornis* 3: 135–6.
Perkins, D.L. 1973. *Sunbird* 4: 13–17.
Pierce, R.J. 1980. *Notornis* 27: 21–44.
Pizzey, G. 1988. *A Garden of Birds.* Viking O'Neil, Melbourne.
Plumb, W.M. 1948. *Emu* 47: 291–303.
Porter, J.W., & R. Henderson. 1983. *Sunbird* 13: 61–8.
Possingham, M.L., & H.P. Possingham. 1997. *S. Aust. Orn.* 32: 145–60.
Powlesland, M.H. 1982. *Notornis* 29: 181–95.
Powlesland, R.G. 2002. *Notornis* 49: 125–6.
Pratt, E. 1970a. *Sunbird* 1: 79.
—— 1970b. *Sunbird* 1: 99.
—— 1971. *Sunbird* 2: 59–60.
—— 1972a. *Sunbird* 3: 17.
—— 1972b. *Sunbird* 3: 62–4.
Price, G. 1977. *Aust. Bird Watcher* 7: 134–6.
Ramsay, G.W., & J.C. Watt. 1971. *Notornis* 18: 287–90.
Rand, A.L., & E.T. Gilliard. 1967. *Handbook of New Guinea Birds.* Weidenfeld & Nicolson, London.
Ratkowsky, A.V., & D.A. Ratkowsky. 1978. *Emu* 78: 223–6.
Read, A., & P. McClelland 1984. *Notornis* 31: 266–7.
Read, J.L., *et al.* 2000. *S. Aust. Orn.* 33: 71–83.
Recher, H.F. 1975. *Emu* 75: 213–25.
——, & S.S. Clarke. (Eds) 1974. *Environmental Survey of Lord Howe Island.* Unpubl. Rep. to Lord Howe I. Board, Aust. Mus., Sydney.
——, & W.E. Davis. 1997. *Wildl. Res.* 24: 27–43.
——, —— 1998. *Aust. J. Ecol.* 23: 514–27.
——, & R.T. Holmes. 1985. Pp 79–96 In: Keast *et al.* 1985.
——, *et al.* 1971. *Emu* 71: 40–3.
——, *et al.* 1985a. Pp 283–90 In: Keast *et al.* 1985.
——, *et al.* 1985b. *Aust. J. Ecol.* 10: 399–419.
Reed, S.M. 1976. *Notornis* 23: 259–62.
Reilly, P. 1991. *Emu* 91: 100–6.
Ridpath, M.G., & R.E. Moreau. 1966. *Ibis* 108: 348–93.
Riney, T., *et al.* 1959. *Bull. NZ Dep. Scient. Ind. Res.* 135.
Rix, C.E. 1943. *S. Aust. Orn.* 16: 57–78.
—— 1970. *S. Aust. Orn.* 25: 147–90.
—— 1976. *Aust. Bird Watcher* 6: 255–88.
Roberts, G.J. 1979. *The Birds of South-East Queensland.* Qld Cons. Council, Brisbane.
—— 1980. *S. Aust. Orn.* 28: 99–102.
——, & G.J. Ingram. 1976. *Sunbird* 7: 1–20.
Roberts, R.G. 1975. *Aust. Bird Watcher* 6: 61–8.
Robertson, C.J.R. 1972. *Notornis* 19: 61–73.
—— 1975. *Notornis* 22: 58–65.
Robertson, H.A., *et al.* 1983. *NZ J. Zool.* 10: 87–98.
Robinson, D. 1993. *Corella* 17: 107–10.
Rogers, K.G., *et al.* 1986. *Banders Aid.* A. Rogers, St Andrews, Vic.
——, *et al.* 1990. *RAOU Rep.* 67.

Rolland, T., & J. Rolland. 1996a. *RAOU Rep.* 110: 13–29.
——, —— 1996b. *RAOU Rep.* 111: 18–38.
Rose, A.B. 1999. *Aust. Bird Watcher* 18: 106–20.
Rose, R.W. 1980. *Pap. Proc. R. Soc. Tasm.* 114: 209–18.
Ross, J.A. 1926. *Emu* 25: 137–46.
Rounsevell, D.E., *et al.* 1977. *Tech. Rep. Tas. Natl Pks Wildl. Serv.* 77/3.
Russell, J. 1921. *Emu* 21: 137–42.
Saunders, D.A., & C.P. de Rebeira. 1991. Pp 221–40 **In**: Saunders & Hobbs 1991.
——, & R.J. Hobbs. (Eds) 1991. *Nature Conservation 2: The Role of Corridors*. Surrey Beatty, Sydney.
——, & J.A. Ingram. 1995. *Birds of Southwestern Australia*. Surrey Beatty, Sydney.
Saunders, J. 1983. *S. Aust. Orn.* 29: 40–1.
Schmidt, B.L. 1978. *Aust. Birds* 12: 61–86.
Schodde, R. 1976. *A Survey of the Fauna of the Lower McArthur River Region, Northern Territory*. CSIRO Div. Wildl. Res. for Mimets Dev't, Canberra.
——, *et al.* 1983. *Spec. Publ. Aust. Natl Pks Wildl. Serv.* 8.
Schrader, N.W. 1981. *Aust. Bird Watcher* 9: 80–7.
Secker, H.L. 1960. *Emu* 60: 284.
—— 1963. *Emu* 62: 263–4.
Sedgwick, E.H. 1949a. *Emu* 49: 9–13.
—— 1949b. *West. Aust. Nat.* 2: 25–33.
—— 1956a. *Emu* 56: 425–9.
—— 1956b. *West. Aust. Nat.* 5: 63–70.
—— 1962. *West. Aust. Nat.* 8: 87–96.
—— 1968. *West. Aust. Nat.* 10: 189–94.
—— 1973. *West. Aust. Nat.* 12: 131–9.
—— 1983. *Aust. Bird Watcher* 10: 22–4.
—— 1988. *Aust. Bird Watcher* 12: 222–32.
Sedgwick, L.E. 1964. *Emu* 64: 7–19.
Serventy, D.L. 1937. *Emu* 37: 90–4.
—— 1948. *Emu* 47: 241–86.
—— 1970. *West. Aust. Nat.* 11: 160–7.
Serventy, V. 1958. *Emu* 58: 5–20.
Sewell, S.R., & C.P. Catterall. 1998. *Wildl. Res.* 25: 41–63.
Shanks, D. 1949. *Emu* 49: 132–41.
Sharland, M.S.R. 1929. *Emu* 29: 5–11.
—— 1958. *Tasmanian Birds*. Angus & Robertson, Sydney.
——, & S.W. Crane. 1922. *Emu* 22: 127–33.
Sharpe, R.B. 1879. *Catalogue of the Birds in the British Museum. 4. Cichlomorphae*. Br. Mus. Nat. Hist., London.
Sharrock, R.E. 1982. *Aust. Bird Watcher* 9: 241–5.
Shilling, D. 1948. *Emu* 48: 64–72.
Sibley, C.G., & B.L. Monroe, Jr. 1990. *Distribution and Taxonomy of Birds of the World*. Yale Univ. Press, New Haven, CT.
Sibson, R.B. 1958. *Notornis* 7: 213–19.
Skegg, P.D.G. 1963. *Notornis* 10: 153–68.
—— 1964. *Notornis* 11: 159–76.
Slater, P.J. 1962. *West. Aust. Nat.* 8: 124–6.
—— 1995. *Emu* 95: 194–207.
Smith, L.E., & C.J. Chafer. 1987. *Aust. Birds* 21: 1–18.
Smith, P. 1984. *Emu* 84: 200–10.
—— 1985. Pp 259–71 **In**: Keast *et al.* 1985.
Smithers, C.N., & H.J. de S. Disney. 1969. *Aust. Zool.* 15: 127–40.
Soper, M.F. 1964. *Notornis* 11: 195.
Souter, T.G. 1942. *S. Aust. Orn.* 16: 27–30.
St Paul, R. 1975. *Notornis* 22: 273–82.
Stead, E.F. 1932. *The Life Histories of New Zealand Birds*. Search Publs, London.
Stepnell, K., & W. Boles. Undated. *Australia's Beautiful Birds and Their Young*. Aust. Consolidated Press, Sydney.
Stidolph, R.H.D. 1923. *Emu* 23: 20–7.
—— 1924. *Emu* 24: 101.
—— 1973. *Notornis* 20: 380.
Stokes, T. 1980. *Emu* 80: 81–6.
Storr, G.M. 1953. *Emu* 53: 225–48.
—— 1965. *Emu* 64: 172–80.
—— 1973. *Spec. Publs West. Aust. Mus.* 5.
—— 1981. *Rec. West. Aust. Mus.* 9: 65–99.
——, *et al.* 1975. *Wildl. Res. Bull. West. Aust.* 3: 75–83.
Stuart-Sutherland, R. 1919. *Emu* 19: 133–5.
Studholm, E.C. 1948. *NZ Bird Notes* 3: 3.
Sutton, J. 1927. *S. Aust. Orn.* 9: 5–29.
Sutton, P. 1990. *Sunbird* 20: 41–58.
Symon, O. 1946. *S. Aust. Orn.* 18: 24–5.

Sympson, R. 2003. *VORG Notes* 38(2): 12–13.
Taylor, P.W. 1987. *S. Aust. Orn.* 30: 62–73.
Taylor, R., *et al.* 1997. *Emu* 97: 220–30.
Templeton, M.T. 1991. *Sunbird* 21: 19–25.
—— 1992. *Sunbird* 22: 87–110.
Thoday, R. 1995. *VORG Notes* 29: 52–6.
Thomas, D.G. 1968. *Emu* 68: 42–84.
—— 1969. *Emu* 68: 249–71.
—— 1979. *Tasmanian Bird Atlas*. Univ. Tas., Hobart.
Thomas, H.F. 1962. *Emu* 62: 206–8.
Thomas, R., & J. Wheeler. 1983. *Birds of the Ballarat Region*. Author (Thomas), Linton, Vic.
Tidemann, S.C., *et al.* 1988. *Corella* 12: 1–6.
Traill, B.J. 1985. *Aust. Bird Watcher* 11: 74–9.
——, *et al.* 1996. *Aust. Bird Watcher* 16: 309–26.
Trémont, S. 2000. *Emu* 100: 1–11.
Tullis, K.J., *et al.* 1982. *Aust. Wildl. Res.* 9: 303–9.
Tunnicliffe, G.A. 1980. *Notornis* 27: 298–9.
Turbott, E.G. 1940. *Emu* 40: 158–61.
—— 1967. *Buller's Birds of New Zealand*. Whitcombe & Tombs, Christchurch.
Turner, J.S., *et al.* 1968. *The Conservation of Norfolk Island*. Aust. Conserv. Found., Melbourne.
Twaits, D. 1998a. *A Field Guide to the Birds of Emerald and Gembrook Districts, Including the Dandenong Ranges*. Unpubl. Rep.
—— 1998b. *List of Birds Recorded at Cardinia Reservoir Catchment*. Unpubl Rep.
Tzaros, C.L. 1996. *Aust. Bird Watcher* 16: 221–35.
Ude Shankar, M.J. 1977. Unpubl. MSc thesis, Univ. Canterbury, Christchurch.
Veerman, P.A. 2003. *Canberra Birds: A Report on the First 21 Years of the Garden Birds Survey*. Canberra Orn. Grp Rep., Canberra.
Vernon, D.P. 1968. *Birds of Brisbane and Environs*. Qld Mus., Brisbane.
Vestjens, W.J.M. 1977. *Tech. Memo. Div. Wildl. Res. CSIRO, Aust.* 12.
Wakelin, H. 1968. *Notornis* 15: 156–76.
—— 1971. *Notornis* 18: 201.
Watson, I.M. 1955. *Emu* 55: 224–48.
Weeks, M.F. 1949. *Notornis* 3: 83–4.
Whatmough, R.J. 1978. *S. Aust. Orn.* 28: 1–15.
Wheeler, J. 1971. *Geelong Nat.* 8: 82–4.
Wheeler, W.R. 1966. *Emu* 66: 163–85.
—— 1967. *Aust. Bird Watcher* 3: 55–76.
White, H.L. 1917. *Emu* 16: 205–31.
White, S.A. 1919. *S. Aust. Orn.* 4: 101–14.
—— 1925. *S. Aust. Orn.* 8: 29–31.
White, S.R. 1946. *Emu* 46: 81–122.
Whiter, J. (Ed.) 1991. *Nature in Eurobodalla* 5: 3–50.
Whitmore, M.J., *et al.* 1983. *Emu* 83: 19–27.
Wieneke, J. 1988. *Sunbird* 18: 1–22.
—— 1992. *Where to Find Birds in North East Queensland*. Author, Townsville, Qld.
Wilkinson, A.S. 1924. *Emu* 24: 120–31.
—— 1927. *Emu* 26: 237–58.
——, & A. Wilkinson. 1952. *Kapiti Bird Sanctuary*. Masterton Printing Co., Masterton, NZ.
Williams, G.R. 1960. *Notornis* 8: 236–43.
Wilson, P.R., *et al.* 1988. *Notornis* 35: 217–43.
Winterbottom, D. 1981. *Aust. Bird Watcher* 9: 130–5.
Woinarski, J.C.Z. 1984. *Emu* 84: 137–41.
——, *et al.* 1988. *Aust. Wildl. Res.* 15: 171–96.
——, *et al.* 2000. *J. Biogeogr.* 27: 843–68.
Wolstenholme, H. 1922. *Emu* 22: 141–8.
—— 1929. *Emu* 28: 183–91.
Wood, J. 1998. *Notornis* 45: 126–8.
Wood, K.A. 1995. *Corella* 19: 7–11.
—— 1996. *Wildl. Res.* 23: 605–20.
Woodall, P.F. 1995. *Sunbird* 25: 1–17.
—— 1999. *Sunbird* 29: 13–23.
Wooller, R.D., & M.C. Calver. 1981. *Aust. Wildl. Res.* 8: 401–10.
——, —— 1988. *Aust. Wildl. Res.* 15: 331–8.
Wykes, B.J. 1985. *The Jarrah Forest Avifauna and its Re-establishment after Bauxite Mining*. *West. Aust. Inst. Tech. School Biol. Bull.* 11.
Wyndham, E. 1978. *Emu* 78: 179–87.
Young, P., & A. Young. 1902. *Emu* 1: 73.