

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):

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- MENURIDAE (lyrebirds): two species in one genus; endemic to Aust.;
- ATRICHORNITHIDAE (scrub-birds): two species in one genus; endemic to Aust.;
- CLIMACTERIDAE (A'asian treecreepers): six species in two genera breeding in Aust.;
- MALURIDAE (Australopapuan fairy-wrens, emu-wrens and grasswrens): 22 breeding species in three genera in Aust.;
- MELIPHAGIDAE (honeyeaters and Aust. chats): 76 species in 26 genera in Aust. and NZ, all breeding;
- PARDALOTIDAE (pardalotes, scrubwrens, thornbills and allies): 51 species (one extinct) in 15 genera in HANZAB region, all breeding;
- PETROICIDAE (A'asian robins): 23 species in eight genera in HANZAB region, all breeding;
- ORTHONYCHIDAE (logrunners): two breeding species in one genus in Aust.;
- POMATOSTOMIDAE (A'asian babblers): four breeding species in single genus in Aust.;
- CINCLOSOMATIDAE (whipbirds, wedgebills, quail-thrushes and jewel-babblers): eight breeding species in two genera in Aust.;
- NEOSITTIDAE (sitellas): single species breeding in Aust.;
- PACHYCEPHALIDAE (whistlers, shrike-thrushes and allies): 17 species in seven genera in HANZAB region, all breeding;
- DICRURIDAE (monarchs, flycatchers, fantails and drongos): 19 species in seven genera in HANZAB region, all breeding;
- CAMPEPHAGIDAE (cuckoo-shrikes, trillers and minivets): eight species (one extinct) in two genera in HANZAB region, all breeding;
- ORIOIDAE (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.;
- DICAEDIDAE (flowerpeckers): single breeding species in Aust.;
- HIRUNDINIDAE (swallows and martins): eight species in four genera in HANZAB region, including four breeding species in Aust. and NZ, one non-breeding visitor and three accidentals;
- PYCNONOTIDAE (bulbuls): one successfully introduced species in Aust.;
- SYLVIIDAE (Old World warblers): 13 species in eight genera in HANZAB region, including ten breeding species (one extinct) in Aust. and NZ, and three accidental to region;
- ZOSTEROPIDAE (white-eyes): seven species (one extinct) in single genus in HANZAB region, all breeding;
- MUSCICAPIDAE (Old World flycatchers, thrushes and chats): eight species in six genera in HANZAB region, including five breeding species (two introduced), and four accidentals (including one on Prince Edward Is);
- STURNIDAE (starlings and mynas): five species in four genera, four breeding in HANZAB region (including two species successfully introduced, and one species now extinct), and one accidental.
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The Aust. oscines fall into two distinct clusters, each with at least three major supra-familial lineages (DAB): One cluster is the Passerida, comprising the Muscicapoida (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 Dicuridae and Corvidae (cf. Dicuridae–Campephagidae–Oriolidae–Artamidae–Paradisaeidae–Corvidae in Christidis & Boles); (3) and use of the more traditional muscicapoid (flycatcher) – sylvioid (warbler) – passeroid (finch) sequence of Sibley *et al.* (1988), Sibley & Ahlquist (1990) and Sibley & Monroe (1990) and much contemporary literature of n. hemisphere, with families in the sequence Muscicapidae–Sturnidae–Hirundinidae–Pycnonotidae–Zosteropidae–Sylviidae–Alaudidae–Dicaeidae–Nectariniidae–Passeridae–Motacillidae–Estrildidae–Fringillidae and noting recognition of the Estrildidae as a separate family (cf. the reversed sequence of Christidis & Boles, as given above, and which submerges the Estrildidae within the Passeridae). For discussion of the reasons for these changes, see DAB (and discussion under these families in future volumes of HANZAB).

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

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

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

Volant; extinct Stephens Island Wren *Traversia lyalli* probably the only flightless passerine (Millener 1988). Movements vary greatly: some species long-distance migrants (e.g. Barn Swallow *Hirundo rustica*, Nightingale *Luscinia megarhynchos* and many Old World warblers, such as *Acrocephalus* and *Locustella*, breed in temperate Palaearctic and migrate to Africa or Indian subcontinent [BWP]; Acadian Flycatcher *Empidonax 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 widespread, and of two distinct types: (1) lateral posture, in which sunning bird squats or sits down, usually on ground, and leans to one side exposing the flank or the 'sun-wing', which has been lowered and partly unfolded, and the fanned tail, which has been brought round to the same side; and (2) spread-eagle posture, in which bird squats or lies flat with both wings open and tail fanned (details in Campbell & Lack 1985; Simmons 1986).

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

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

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Family STURNIDAE starlings, mynas and oxpeckers

A fairly large family of morphologically rather homogeneous, small to medium-large and usually gregarious passerines, with robust bodies, rather long pointed wings, fairly pointed bills and rather short legs and, in adults, often glossy plumage. As defined here (see below), the family comprises 110–115 species in 26–27 genera, distributed through Africa, Eurasia, including the Indian subcontinent, Japan, the Philippines and Indonesia, islands of Indian Ocean (Réunion, Andaman and Nicobar Is), Australo-Papuan region and islands of sw. Pacific Ocean (Amadon 1956; Sibley & Monroe 1990; Monroe & Sibley 1993; Feare & Craig 1998; Peters). Several early works consider starlings to be related to various other groups, including weaverbirds, crows, birds of paradise, butcherbirds, Old World orioles and drongos (Sharpe 1890; Reichenow 1914; Stresemann 1927–34; Amadon 1943; Delacour & Vaurie 1957; Bock 1963). Starlings have been placed in, or alongside, weaverbirds (Ploceidae) by several authors (Mayr & Amadon 1951; Berndt & Meise 1960; Peters). Wetmore (1960) placed starlings near NZ wattlebirds (Callaeidae), shrike-vireos *Vireolanius* and shrikes (Laniidae). However, DNA–DNA hybridization data (Sibley & Ahlquist 1984, 1990) indicate: (1) the nearest relatives to starlings are mockingbirds *Mimus* and thrashers *Toxostoma*, whose next closest relatives are true thrushes (subfamily Turdinae within the Muscicapidae); (2) starlings are part of the superfamily Muscipoidea, which includes waxwings, dippers, true thrushes, Old World flycatchers and allies; and (3) mockingbirds and thrashers diverged from starlings 23–28 million years ago. Consequently, Sibley & Monroe (1990) and Monroe & Sibley (1993) placed mockingbirds and thrashers in a tribe (Mimini) separate from starlings, mynas and oxpeckers (tribe Sturnini). In this study, we follow conventional treatments (Mayr & Greenway 1962; BWP; Peters; DAB) in treating starlings, mynas and oxpeckers as Sturnidae and keeping mockingbirds and thrashers as a separate family Mimidae. Fry *et al.* (2000) treat oxpeckers as a full family Buphagidae, but most works (Mayr & Greenway 1962; Feare & Craig 1998; BWP; Peters) treat them as a subfamily, Buphaginae, within the Sturnidae.

Seven species, in four genera, recorded in HANZAB region: three species of *Aplonis*, one of which, Tasman Starling *A. fusca*, is extinct; three species of *Sturnus*, two of which are vagrants and one introduced; and one species of *Acridotheres*, Common Myna *A. tristis*, which is introduced. In addition, two other species were unsuccessfully introduced to Christmas I.: PALE-BELLIED MYNA *Acridotheres cinereus*, c. 1904 and HILL MYNA *Gracula religiosa*, c. 1923. Neither became established (Chasen 1933; Long 1981; Christidis & Boles 1994).

Size varies from fairly small (e.g. Violet-backed Starling *Cinnyricinclus leucogaster*: total length 15–17 cm, weight 38 g) to medium-large (e.g. Bristle-crowned Starling *Onychognathus salvadorii*: total length 39–42 cm, weight 160 g). In HANZAB region, smallest is Purple-backed Starling *Sturnus sturninus* (total length 16–19 cm, weight 50 g) and largest is Common Myna (total length 22–27 cm, weight 130 g). Following characteristics shared by the family (summarized from Beecher [1953], Bock [1962], Warner [1972], Feare & Craig [1998], Fry *et al.* [2000], BWP and DAB). Wings usually rather long and pointed at tips, but fairly short, broad and rounded at tips in a few (e.g. Babbling Starling *Neocichla gutturalis*). Ten primaries; p10 short, and vestigial in some species. Nine secondaries, including three tertials. Tail varies from rather short and square at tip (e.g. Singing Starling *Aplonis cantaroides*) to very long and graduated (e.g. some *Onychognathus*); 12 rectrices. Bill varies according to diet and foraging behaviour: rather short to moderately long, fairly pointed, strong, and slightly decurved in some (e.g. most *Sturnus*, *Aplonis*) to more robust and rather straight in others (e.g. *Acridotheres*, *Gracula*); oxpeckers have very robust and thickened bills adapted for removing ticks from ungulates. Slight notch near tip of upper tomium. Nostrils semi-operculate; usually unfeathered, but some (e.g. most *Acridotheres*, *Gracula*) have more extensive feathering over nares. Rictal and nasal bristles vary from prominent to very weakly developed. Many species have modified structures of head, including wattles (e.g. Wattled Starling *Creatopthera cinerea*, Hill Myna *Gracula religiosa*) or bare periopthalmic skin (e.g. some *Acridotheres* and *Sturnus*). Tongue has bifid tip; nectarivorous Brahminy Starling *Sturnus pagodarum* has brush-like tip. Legs and feet rather strong; tarsus fairly long in some (e.g. *Acridotheres*), rather short in others (e.g. some *Sturnus*). Tarsal scaling laminiplantar. Syrinx has wide pessulus. Skull often rather narrow anteriorly (see Moreno 1986 for illustration of skull of Common Starling *Sturnus vulgaris*). Ectethmoid foramina usually doubled. Medial palatine plate back-sloped, with vestigial or no medial palatine processes. Humerus usually with double pneumatic fossae.

The family has the following plumage characteristics (summarized from Feare & Craig [1998], Fry *et al.* [2000], BWP and DAB). Colour of plumage varies greatly. Adults of many species have glossy black, purplish, violet or dark-greenish plumage, particularly on upperparts (e.g. *Lamprotornis*, *Aplonis*, Violet-backed Starling, some *Sturnus*); some have boldly pied appearance (e.g. *Streptocitta mynas*, Asian Pied Starling *Sturnus contra*); while others have rather dull combinations of brown, white, grey, russet or buff tones. Some species have bright areas of yellow or rufous on head or wing (e.g. Golden-crested Myna *Ampeliceps coronatus*, red-winged starlings *Onychognathus*); and a few species have other distinctive markings, including black hoods (e.g. Rose-backed Starling *Sturnus roseus*), pale scapular bands (e.g. some *Sturnus*), supercilia (e.g. Fiery-browed Starling *Enodes erythrophris*) or white patches at base of primaries (e.g. Common Myna, Hill Myna). Many species have distinctive feather-modifications, including

erect feathering on forehead and narial area (e.g. some *Acridotheres* and *Aplonis*), prominent helmets or crests (e.g. Rose-backed Starling, *Basilornis mynas* and some *Acridotheres mynas*), ear-tufts or 'lappets' (e.g. *Basilornis mynas*) and lanceolate feathering on throat and breast (e.g. some *Sturnus* and *Aplonis*). Sexes usually alike, but obviously plumage-dimorphic in some species (e.g. red-winged starlings, Golden-crested Myna, Chestnut-cheeked Starling *Sturnus philippensis*). Juveniles duller than adults and often very different (e.g. juvenile *Aplonis* lack glossy plumage and have dark streaking to otherwise whitish underparts). Nestlings vary at hatching: naked (e.g. African Pied Starling and at least some *Lamprotornis*), naked except for a few patches of sparse down (e.g. Rose-backed Starling) or covered with dense down (e.g. Common Starling). Nestlings lack markings of mouth or tongue. Fledge in juvenile plumage. Moults of most Asian and African species poorly understood and following based mainly on European species. Usually undergo a complete post-juvenile (first pre-basic) moult to adult plumage or adult-like first immature plumage; some undergo a partial post-juvenile (first pre-basic) moult to adult-like first immature plumage, extent of which can even vary between individuals within species (e.g. Common Starling). Adults undergo a single complete post-breeding (pre-basic) moult annually. Primaries moult outward, starting at p1. Moult of tail starts during early stage of moult of primaries; moult of body possibly starts just before start of moult of primaries.

Occupies a wide range of habitats, including rainforest, forest, forest edges and clearings, woodlands, shrublands and grasslands, heathland, rocky areas, and a wide range of modified habitats including pasture, cultivation, cattle yards, plantations, and streets, parks and gardens of cities, towns and villages, including heavily built-up areas; some species very well adapted to modified habitats and often commensal with humans, including Common Starling and Common Myna of HANZAB region (and similarly elsewhere where introduced). *Onychognathus* starlings often in montane rocky habitats; *Sturnus* starlings tend to occupy open areas; and *Aplonis* starlings typically in forest, forest edges, clearings and regrowth, sometimes in modified areas with trees (White & Bruce 1986; Coates 1990; Dickinson *et al.* 1991; Doughty *et al.* 1999; Fry *et al.* 2000; Robson 2000; BWP).

Range from sedentary or resident (e.g. White-billed Starling *Onychognathus albirostris*), resident with local dispersion (e.g. Red-winged Starling *O. morio*) or altitudinal movements (e.g. Kenrick's Starling *Poeoptera kenricki*), partly migratory (e.g. Common Starling) to wholly migratory over long distances (e.g. Rose-backed Starling). African breeding species tend to be restricted to local dispersive movements or partial short-distance migration mostly within breeding range (e.g. Chestnut-bellied Starling *Lamprotornis pulcher*); Eurasian breeding species often partly migratory or migratory (e.g. Purple-backed Starling); see Asian and Melanesian species generally sedentary or resident (e.g. *Aplonis* starlings). In HANZAB region: Metallic Starling *Aplonis metallica* partly migratory, with a large proportion moving N in Mar.–Apr., probably to winter in New Guinea; Singing Starling either irregular visitor or resident on some islands of Torres Str.; introduced Common Myna and Common Starling sedentary or resident, with no evidence of seasonal movements; and vagrant Rose-backed and Purple-backed Starlings migratory (White & Bruce 1986; Coates 1990; Dickinson *et al.* 1991; Doughty *et al.* 1999; Fry *et al.* 2000; Robson 2000; Griffioen & Clarke 2002; BWP; see species accounts).

Omnivorous. Mainly eat fruit and insects, but diet in many species supplemented with other foods, including nectar, other invertebrates (e.g. spiders, snails, centipedes, worms, ticks), seeds and grain, food scraps, small vertebrates (e.g. lizards, frogs, mice, nestlings), leaves, flowers, buds, carrion, and eggs of birds; some specialize on certain foods such as nectar (e.g. Brahminy Starling) or orthopteran insects (e.g. Wattled Starling, Rose-backed Starling). Mostly arboreal, foraging in trees and shrubs: glean from foliage; probe bark, crevices, lichens, moss and the like; pluck or peck at fruit; and probe flowers for nectar or, occasionally, insects. Some species forage to varying degree on ground, and a few (e.g. *Neocichla*, *Zavattariornis*, *Acridotheres* and especially *Sturnus*) primarily terrestrial. On ground, walk, hop, or sometimes run after mobile prey, and glean food from surface of ground; some (e.g. *Creatophora* and especially *Sturnus*) also take prey from below surface by probing with bills; when probing soft soil, bill thrust into soil and then opened to expose prey. Some also take insects from air by sallying from perches or from ground, and Chestnut-bellied Starling seen to pluck fruit while hovering. Some species opportunistic, scavenging for food round human habitation or activity. Many species associate with other birds, often other Sturnidae, when foraging; and some associate with grazing mammals, usually to capture prey disturbed by mammals, or to pick ectoparasites from mammals themselves, but sometimes to perch on and use mammals as vantage points to detect prey on ground. Some species (e.g. Common Starling, Rose-backed Starling, Common Myna) feed on commercial fruit or cereal crops or both; and Common Starling, and to lesser extent Common Myna, considered agricultural pests for this reason, both in HANZAB region and extralimally (Ali & Ripley 1972; Fry *et al.* 2000; BWP).

All are gregarious; gather in large flocks both for foraging (see above) and for roosting. Some gather in huge flocks at sources of food, e.g. Wattled Starling can congregate in hundreds of thousands. Usually monogamous. Some form new pair-bonds each season, or even after each breeding attempt, but pair-bonds long-term in others. Co-operative breeding usual in several species (e.g. Chestnut-bellied Starling, Golden-breasted Starling *Lamprotornis regius*). Usually only female incubates, but in some species male does so occasionally. Feeding of nestlings and fledgelings usually shared between sexes, and with helpers in co-operatively breeding species. Most loosely colonial when breeding, and usually defend small territory near nest; sometimes only defend nest-entrance. Co-operatively breeding species maintain a group territory. Extra-pair copulation and egg-dumping fairly common.

Most tend to be rather conspicuous in their habits, and some rather bold (e.g. Common Myna), but others tend to be shy and flighty (e.g. Wattled Starling). Scratch head indirectly. Anting recorded in many species. Tend to avoid physical contact and do not clump, but some species allopreen. Usually show little agonistic behaviour when foraging, but can be aggressive in defence of nest, and in some species altercations often lead to physical fights. In Common Starling, fights often result in death of one or sometimes both participants (Ali & Ripley 1972; Skutch 1987; Coates 1990; Fry *et al.* 2000; BWP; DAB; see species accounts).

All rather vocal, though vocalizations rather unspecialized, consisting of wheezing creaks, rattles and whistles, often mixed with mimicry. Some mynas can be trained to imitate human speech with surprising accuracy. Calls mostly simple and often loud, harsh and grating (Coates 1990; Fry *et al.* 2000; BWP; DAB).

Most species loosely colonial. Typically monogamous; some species breed co-operatively. Most species nest in holes, especially in trees, but also in cliffs and buildings. However, some build nests in forks of tree (e.g. Brown-winged Starling *Aplonis grandis*), and Metallic Starlings build nest suspended from branches; several species will use nest-boxes. Most build bulky bowl-shaped nest within cavity, but some build globular or domed nests with entrance at side or top (e.g. Superb Starling *Lamprotornis superbus*, Metallic Starling). Nests variously made of grass, twigs, leaves and other plant material; and lined with softer material, including feathers, hair, wool, moss and fine plant material such as down. Sometimes shed snakeskin incorporated into nests. Nests usually built by both sexes or by female only, but in Common Starling, usually built by male. Material may be added after laying has begun. Eggs usually oval or sub-elliptical; smooth and slightly glossy. Usually pale bluish-green with brownish or reddish spots, but lack spots in *Sturnus*, *Acridotheres* and *Creatophora*. Usual clutch-size 2–6, with tropical species usually laying smaller clutches. Where known, eggs usually laid on successive days. In most, only female incubates but in some species male does so occasionally. Incubation period 11–18 days. Nestlings usually brooded by female only. Feeding of nestlings and fledgelings usually shared between sexes, and with helpers in co-operatively breeding species. Fledging period 18–35 days. Fledgelings typically dependent on parents for 1–2 weeks or more. Most species rear two or more broods per season, but some species produce only single broods at some localities (Ali & Ripley 1972; Campbell & Lack 1985; Skutch 1987; Coates 1990; Fry *et al.* 2000; BWP; DAB; see species accounts).

A total of 14 species considered globally threatened, with all but one of which (Abbott's Starling *Cinnyricinclus femoralis*) island species. Five species **EXTINCT**, all island species, including one from HANZAB region, Tasman Starling of Norfolk and Lord Howe Is; rest extralimital (Kosrae Starling *Aplonis corvina*, Mysterious Starling *A. mavornata*, Rodrigues Starling *Necropsar rodericanus* and Réunion Starling *Fregilupus varius*). Another two species, Pohnpei Mountain Starling *A. pelzelni* of Micronesia, and Bali Starling *Leucopsar rothschildi*, **CRITICALLY ENDANGERED**, the latter primarily through unregulated trapping for avicultural trade; two species, White-eyed Starling *A. brunnei-capillus* of Bougainville and Solomon Is, and Black-winged Starling *Sturnus melanopterus* of Java and Bali considered **ENDANGERED**; and four species considered **VULNERABLE** (Santo Mountain Starling *A. santovestris*, Rarotonga Starling *A. cinerascens*, Abbott's Starling of e. Africa, and White-faced Starling *Sturnus albofrontatus*). A further nine species are near threatened (Stattersfield & Capper 2000; BirdLife International Species Factsheets, available at <http://www.birdlife.org/datazone/species/index.html> [accessed Sept. 2005]). Within HANZAB region, Torres Str. population of Singing Starling considered near threatened (Garnett & Crowley 2000; see species accounts).

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Acridotheres tristis Common Myna

COLOUR PLATE FACING PAGE 769 PART A

Paradisea tristis Linnaeus, 1766, *Syst. Nat.* 12(1): 167 — Philippines = Pondicherry, India.

The Common Myna assists farmers in Asia by preying on serious agricultural pests such as locusts, beetles, and weevils (Greek *ἀκρίς*, *ἀκρίδος*, a locust, and *θήρη*, hunting, the chase). The specific name refers to the dusky brown plumage (Latin *tristis*, sad, gloomy).

OTHER ENGLISH NAMES Myna or Mynah; Calcutta, Indian or House Myna or Mynah; Tickbird; Tasmanian Starling; Chocolate Bird or Chocolate Dollar-bird; White-wings; Thynne Bird; Flying Cane-toad.

POLYTYPIC Nominate *tristis* introduced to urban mainland e. Aust., from Cairns, Qld, S to metropolitan Melbourne and Geelong, Vic., with outliers N to e. C. York Pen. and islands in s. Torres Str.; indigenous to area from e. Iran and s. Kazakhstan, E through India to IndoChina, and S to w. Malaysia. Extralimitally, subspecies *melanosternus* Legge, 1879, Sri Lanka.

FIELD IDENTIFICATION Length 25 cm (22–27); wing-span 40 cm (33–43); weight 130 g (80–150). Distinctive medium-sized passerine with large head, short bill, short, rounded wings, short, rounded tail and long legs. Slightly larger than Common Starling *Sturnus vulgaris*, but noticeably bulkier, with deeper chest and longer legs. Sexes similar; juvenile separable. No seasonal variation. No geographical variation in HANZAB region. **Adult** Head and nape, glossy black; feathers on crown slightly elongated, sometimes giving appearance of small crest. Eye-ring, black. Hindneck and sides of neck, dark grey, separating black of head from rest of body. Mantle, back and uppertail coverts, warm chocolate-brown. Tail, dull black, with white tips to feathers, narrow on inners, increasing in thickness outward to form striking white corners on spread tail. Folded wing mostly uniform warm chocolate-brown, as upperparts, with primaries blackish, and white bases showing as narrow white patch below greater coverts; secondaries and tertials, dark olive-brown; alula, black, with white outer web on middle feather, not always visible. In flight, white bases to primaries and white greater primary coverts form bold white 'dollar spots' in wings. Chin and throat, glossy black. Upper breast, dark grey, merging into warm chocolate-brown on lower breast, upper belly, flanks and thighs. Lower belly, vent and undertail coverts, white. Underwing, white. Bill, yellow. Patch of yellow facial skin extends from just in front of eye, beneath eye to ear coverts. Iris usually yellow. Legs and feet, yellow. **Juvenile** Like adult but duller. Head, dull sooty-black, grading to brown-black on hindneck; tips of feathers on head narrowly fringed brown when fresh; feathers of crown not elongated. Mantle and scapulars, brown with slight chestnut tinge; scapulars tinged grey. Back, rump and uppertail-coverts, buff-brown, with faint darker bars visible at close range. Folded wing, brown with slight chestnut tinge, with remiges, blackish-brown, and primaries have narrow off-white edges, with white bases visible as narrow white patch below greater coverts, like adult. Chin, dull sooty-black; throat and breast, grey-brown, with feathers narrowly fringed buff and with blackish centres or shaft-streaks, sometimes giving streaked appearance, and sometimes appearing faintly barred rufous-brown at close range; grey-brown of breast grades to buffy grey on upper belly and flanks, which in turn grades to off-white on lower belly, vent and undertail-coverts. Tail as adult, but duller, with tips to feathers, off-white and less sharply defined. In flight, white 'dollar spots' in upperwing less sharply defined, and white greater primary coverts tipped black. Facial skin, duller yellow and larger than in adult, extending in front of and farther behind eye. Iris, brown to dull yellow. Bill and legs, dull yellow. **Immatures** Like adult but white of tail-tips sometimes with all or partly black shaft. Sometimes retain some juvenile remiges.

Similar species Distinctive; unlikely to be mistaken for any other species.

During day, usually seen singly, in pairs or small flocks, but in evening, often congregate into large flocks at communal roosts in trees, buildings or beneath bridges, where birds squabble noisily. Mostly forage on ground, usually taking invertebrates, but also occasionally forage in vegetation or in air. Gait varies between hopping, running and strutting walk. Aggressive; often seen in aggressive intraspecific interactions, and often attack other species, sometimes to usurp their nests, but at other times apparently just to be nasty. Often tame round human habitation. Flight has noticeably flapping action, lacking directness of Starling. Noisy; utter raucous Song and at least four calls, most of which are harsh, and unknown number of other vocalizations uttered during various agonistic or sexual displays.

HABITAT In HANZAB region, mostly inhabit built-up areas, in parks and gardens, and in street trees; also occur in farmland, usually having spread from urban areas along major roads. Very occasionally recorded in woodlands or forests, but usually round edges or in modified areas, e.g. along roads through forest or in logged areas; and very occasionally on beaches, in heathlands or grasslands (see below). Though usually occur in association with human settlement or disturbed areas, occurred on uninhabited Poor Knights Is, but population did not persist (Gaze 1973; Bell 1976). Extralimitally, occur round settlements, in farmland and other modified habitats (Ali & Ripley 1972; BWP).

Aust. Mostly recorded in built-up areas, including urban and suburban areas and rural centres, inhabiting open spaces, often with lawns, such as parks and gardens, streets with nature strips and street trees, and sports ovals (e.g. White 1946; Bourke & Austin 1947; Tarr 1950; Gill 1970; Fleming 1976; Paton 1976; Price 1977; Green 1984; Gregory-Smith 1985; McKilligan & McKilligan 1987; Green *et al.* 1989; Davey 1991, 1992; Purchase & Purchase 1991; Wood 1995a; Peter 1998; Jones & Wieneke 2000); also car parks (Reilly 1981). On Quail I., in Western Port, Vic., recorded only near habitation on island (Hyett & Gottsch 1963). One of the first species to move into newly developed residential areas (Mason 1985); also often roost in buildings in industrial areas (see Social Organization: Roosting). Extend into rural areas along roadsides (e.g. Gibson 1977; Hone 1978; Loyn 1985b; Peter 1998; Chafer *et al.* 1999; Gosper & Holmes 2002); and occasionally occur in farmland (Forster 1951; Loyn 1980; Leach & Hines 1987; Gosper & Holmes 2002), sometimes in cultivated land, such as cane fields (Tarr 1950), market gardens (Vic. Atlas), ploughed paddocks (White 1946) or orchards (Ryan 1953; Vic. Atlas), though probably more often round livestock (Walker 1952; Roberts 1979; Wright & Wright 1991a,b; Peter 1998). Also often occur round animals in zoos (Morris 1983; Dunn 1989). Less often recorded in natural habitats, particularly in dry woodland or forest, usually

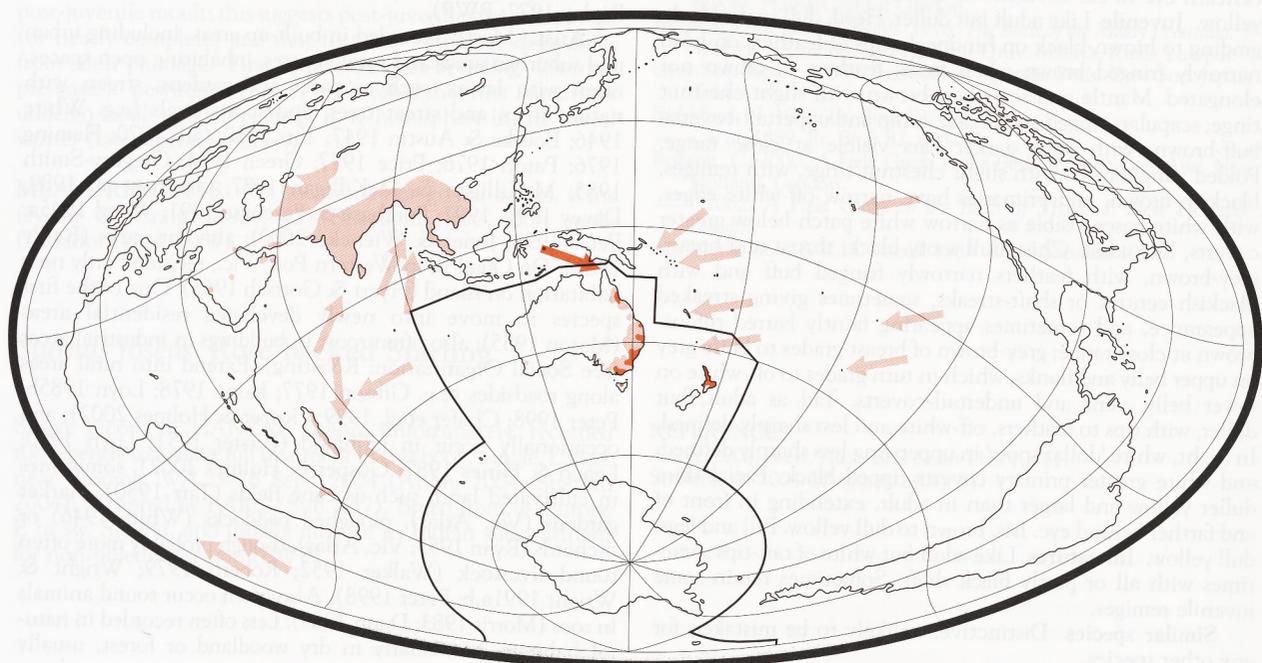
dominated by eucalypts, with sparse shrubby or grass understorey, especially round margins (Loyn 1985b; Leishman 1994; Pell & Tidemann 1997a; NSW Bird Rep. 1980), e.g. at Inverleigh, Vic., in grassy woodland dominated by River Red Gum and Manna Gum (Conole 2002); in ACT, in remnant woodland dominated by Yellow Box and Blakely's Red Gum, usually with other scattered eucalypts, such as Apple Box, Inland Scribbly Gum *Eucalypts rossii*, Red Stringybark and Brittle Gum, usually with sparse shrub-layer and grass ground-cover (Er *et al.* 1988; Pell & Tidemann 1994, 1997a; Er & Tidemann 1996, 2001; Er 1997; McDonald 2001); and at Scheyville, NSW, in woodland dominated by Gum-topped Box *Eucalyptus moluccana* and Narrow-leaved Ironbark with shrubby understorey comprising mainly Sweet Bursaria and scattered acacias (Egan *et al.* 1997). Very occasionally recorded round margins of wet sclerophyll forests, e.g. in Dandenong Ras, Vic., a few birds enter edge of forest dominated by Mountain Ash from nearby gardens and roads (Loyn 1985a). Also very occasionally recorded in coastal heathland, mainly round edges (Preston 1983; Pyke 1985; Morris 1986); salt-marsh (Watson 1955); and grasslands, including mixture of native and exotic grasses (Cooper 1974, 1975).

NZ Mostly inhabit built-up areas, including city streets, rural towns, parks and gardens (Cunningham 1948; Watson & Wodzicki 1954; Booth 1962; Councilman 1974a,b; Guest & Guest 1987; Day 1995; Heather & Robertson 2000; CSN 4, 30), e.g. in Auckland Domain, usually recorded in mixture of native and exotic trees, round edge of forest (Gill 1989). Also often occur in farmland, using paddocks and hedges (Williams 1958; McKenzie 1960), often round stock (Cunningham 1948; Wright 1962); also occur in orchards (CSN 24). Recorded in eucalypt plantation round Tauranga (Hodgkins 1949). Sometimes occur in native forests, mostly in disturbed areas, especially round margins (Innes *et al.* 1982; Pierce *et al.* 1993; CSN 19 Suppl.), and in Hunua Ras, NI, penetrate dense forests of Tawa and podocarps along roads and tracks (St Paul & McKenzie 1974; McKenzie 1979); in Kaingaroa Forest, NI, recorded in area that had been clear-felled in previous year (CSN 23). In coastal areas and offshore islands, sometimes recorded in canopy of Pohutukawa *Metrosideros excelsa* forest (Gaze 1973) or in mangroves (CSN 31); and seen foraging on

beaches, mudflats, or rock pools, or round coastal cliffs (Edgar 1971; Gaze 1973; Cunningham & Moors 1985; CSN).

DISTRIBUTION AND POPULATION Widespread in s. and se. Asia: occur from se. Iran, extending to Indian sub-continent, where widespread from Pakistan E to Bangladesh and N to Uzbekistan, s. Kazakhstan and Nepal, thence E to Vietnam and s. China, and S to s. Malay Pen. (de Schauensee 1984; Flint *et al.* 1984; Grimmett *et al.* 1999; Robson 2000; BWP). Widely introduced, successfully to A'asia, S. Africa (from whence expanding range into Botswana, Zimbabwe and Mozambique) and Madagascar (Long 1981; Fry *et al.* 2000; Aust. Atlas 1, 2; NZ Atlas). Status on Arabian Pen. and in parts of se. Asia is unclear, as possibly introduced or part of natural expansion of range, or both (Long 1981). Feral populations occasionally recorded round various metropolises, though often short-lived, e.g. Los Angeles, London, Dunkerque Harbour, and Sochi and Gagra on e. coast of Black Sea (Long 1981; BWP). Introduced to many oceanic islands, e.g. in Atlantic Ocean, on St Helena, Ascension and Canary Is; in Indian Ocean, various scattered islands from Réunion, Mauritius and Rodrigues, N to Laccadive and Maldive Is, and E to Andaman and Nicobar Is and Sumatra; and in Pacific Ocean, from Hawaii S to Society Is, and W to New Caledonia, Vanuatu and Solomons, from whence Bougainville colonized (Delacour 1966; Long 1981; Pratt *et al.* 1987; van Marle & Voous 1988; Coates 1990; Bregulla 1992; Doughty *et al.* 1999; BWP).

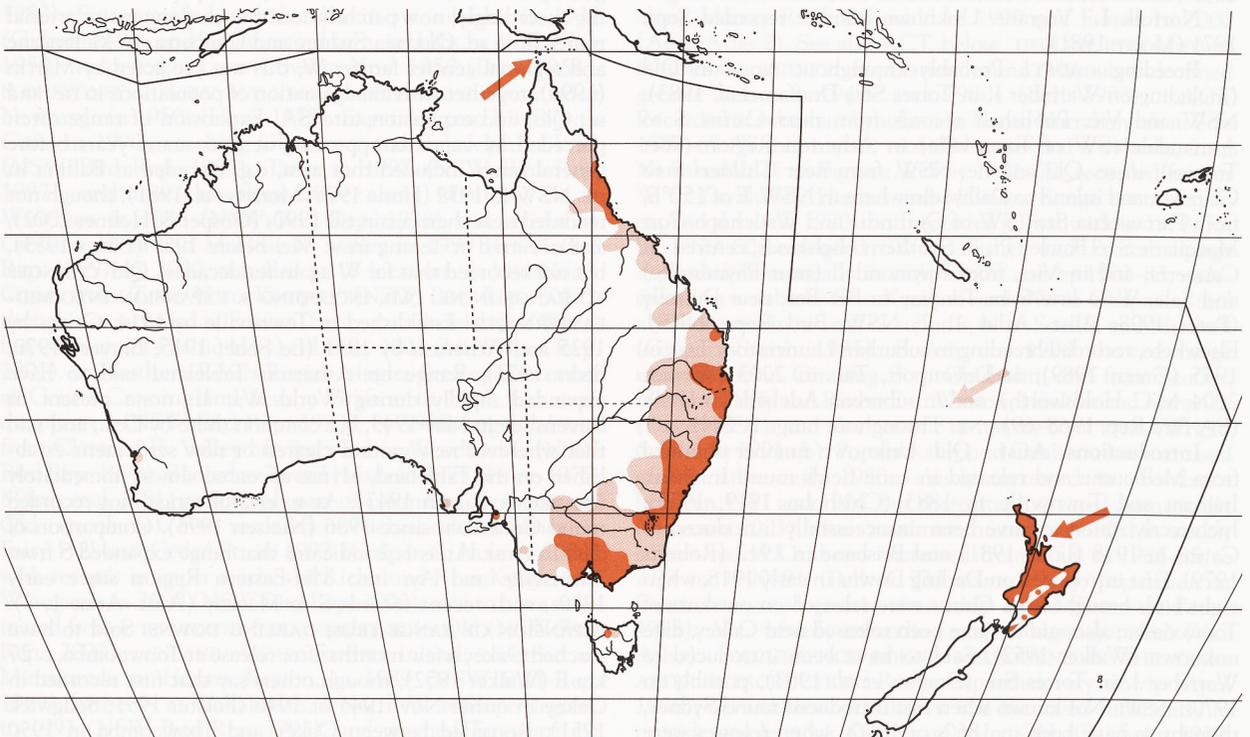
Aust. Introduced. Widespread in ne., e. and se. mainland Aust. **Qld** Widespread in Atherton Region (Wet Tropics) and South-East Region, with scattered records elsewhere. Recorded on Warraber I. in Torres Str., Oct. 1979 (Druffan *et al.* 1983; Aust. Atlas 1) and unconfirmed report from Thursday I., 5–6 Jan. 1991 (Andrew & Eades 1992); and near Bamaga, C. York, 4 Mar. 2000 (Aust. Atlas 2). Widespread in Atherton Region (Wet Tropics), where formerly occurred N to Cooktown, but not recorded there since 1986 (Nielsen 1996); now recorded from Lakeland Downs and Home Rule (40 km S of Cooktown), S to round Ayr, and inland to Campbell Ck (NW of Mt Carbine) and Mt Surprise (Nielsen 1996; Aust. Atlas 1, 2). In Mid-East Region, occur at a few



scattered sites including Charters Towers, Bowen, Eungella and Mackay (Aust. Atlas 1, 2). More widespread in SE, though N of 25°S only recorded at a few scattered sites between Moura and Bundaberg. Farther S, widespread but scattered S to NSW border and inland to Munduberra, Meandarra and near Goondiwindi (Aust. Atlas 1, 2). **NSW** Widespread in E and increasingly so in S. More or less continuous in coastal areas from Richmond R. district in Northern Rivers Region S to near Bega in South Coast. Also occur farther inland, generally to w. slopes of Great Divide; N of 30°S, away from coast, recorded from Lyndhurst Dam, S of Tenterfield, W to Moree; farther S, occur inland to line joining Narrabri, Gunnedah, Dubbo and Cowra and Murrumbateman; even farther S, extend farther inland, from s. South-West Slope Region W to site between Wakool and Barham in s. Riverina, and NW to site between Ungarie and Naradhan. Also very occasionally occur well downstream along Murray R., with recent records of vagrants at Balranald and Euston in Lower Western Region (Gosper & Holmes 2002; Aust. Atlas 1, 2; NSW Bird Reps). **Vic.** Widespread in w. Gippsland, Central and North-Central Districts, mainly from round Maffra SW to Yanakie Isthmus on n. Wilsons Prom., NW to Seymour and W to Geelong and w. Bellarine Pen. Recorded at scattered sites (mostly along main roads) outside this area, E to Mallacoota, NE to Chiltern and Wodonga, N to Yarrawonga, NW to Swan Hill, W to Ararat and SW to Port Fairy (Aust. Atlas 1, 2; Vic. Atlas). **Tas.** A few records in second half of 20th century. Recorded breeding at Mayfield, suburban Launceston, in Mar. 1955; up to six birds said to have been present since 1954 (Sharland 1958; Green 1989); and unconfirmed reports from near Scottsdale and Cressy round same time (Jones 1955). Said to have occurred round Launceston in 1967 (Sharland 1967), including Newstead, in suburban Launceston, till 1975 (Green 1989), but no published records. Recently recorded at Devonport, 2003 (Weston 2004; M.C. Holdsworth). Formerly occurred round Hobart in early 20th century (see below). Not listed in Tas. Bird Reps 1–29 (1971–2001). **SA** Very occasionally recorded round suburban Adelaide. Numerous records

of up to 84 birds in n. suburbs, centred on Enfield and a few adjacent suburbs from 1957 till 1981 (Paton *et al.* 1994; SA Bird Reps). Records round Adelaide since 1970s (excluding Enfield and surrounds up to and including 1981) include (singles unless otherwise stated): Adelaide Botanic Park and Gardens, Jan.–Feb. 1973 (Paton 1976; SA Bird Rep. 1972–73); one or two, Taperoo, Le Fevre Pen., Feb. 1973–Dec. 1975 (Winslet & Winslet 1987; SA Bird Rep. 1975); Somerton Park, 14 Nov. 1982 (SA Bird Rep. 1982–99); three, Cheltenham Racecourse, 7 Feb. 1979 (SA Bird Rep. 1977–81) and single at same site, 24 Oct. 1985 (Stove 1994; SA Bird Rep. 1982–99); Hackney, 19 June 1979 (SA Bird Rep. 1977–81); Enfield, 12 Aug. 1991 (SA Bird Rep. 1982–99); Bellevue Heights, 17 Jan. 2001 (Aust. Atlas 2). Vagrant elsewhere, with record near Bool Lagoon, 16 Dec. 1999 (SA Bird Rep. 1982–99); Martin (1996) appears to show a record near Coffin Bay, s. Eyre Pen. **WA** Single, Fremantle, Jan. 1980 (Johnstone & Storr 2004); single, Brentwood, suburban Perth, 2 Sept. 1987 (Vervest *et al.* 1987); single, Port Hedland, early 1991 (Johnstone & Storr 2004); two, Dampier, early 1994 (Johnstone & Storr 2004); single, Guildford, 6 Feb. 2004 (M. Massam). **NT** Two records from s. Top End; no details available (Goodfellow 2001).

NZ Introduced. **NI** Widespread N of 40°S. **N OF 40°S:** Widespread from C. Reinga and North C. in Northland, S through Auckland and S. Auckland to line from Awakino in sw. Waikato, through Taumarānui in s. Waikato, Turangi in s. Volcanic Plateau and to Potaka in e. Bay of Plenty. Elsewhere, widespread in East Coast, mainly in coastal and near-coastal areas, from Te Araroa S to Mahia Pen., and thence W to beyond Wairoa; generally not recorded far inland, but occur inland along much of road between Gisborne and Opotike, parts of inland road linking Gisborne and Wairoa, and also occur inland nearly to L. Waikaremoana (NZ Atlas; CSN). In Hawkes Bay, widespread in n. coastal and near-coastal areas, between lower reaches of Mohaka and Tukituki Rs, and only very occasionally farther S (see below for s. records); occur along Napier–Taupo Road, inland to near Tarawera, and also very occasionally recorded inland to e. slopes of Ruahine Ra.



(NZ Atlas; CSN). In Wanganui, occasionally recorded in S, especially round lower reaches of Wanganui R. and adjacent suburban areas, and also at nearby Kai Iwi; most records are from farther N, at scattered sites N of Raetihi and Ohakune, including Tongariro NP (Innes *et al.* 1982; NZ Atlas; CSN 22, 30, 32). In Taranaki, mostly recorded W of line (and road) joining Hawea and Waitara, but generally absent from Egmont NP (NZ Atlas; CSN); this contrasts with early records in late 1930s and early 1940s, when seldom recorded W of that line (Cunningham 1948; see below). Also occur in coastal areas N to Mokau, and only very occasionally recorded at a few inland sites (NZ Atlas; CSN). Also occur on various offshore islands, such as Three Kings Is and Great Barrier I. (Ramsay & Watt 1971; Bell 1976). **S OF 40°S:** Very occasionally recorded. In s. Hawkes Bay, no recent records S of Tukituki R. (NZ Atlas; CSN 41) except isolated record at Dannevirke (CSN 22). A few records in Wairarapa from round Greytown NE to Masterton (NZ Atlas; CSN 42, 47, 48). Recently recorded at a few sparsely scattered sites in Wellington from Trentham, near Upper Hutt, Stokes Valley and Tawa, with NZ Atlas record from farther N near Paraparaumu (NZ Atlas; CSN). No records in Manawatu S of 40°S in NZ Atlas, but recent records at Bulls in Sept. 1989 (CSN 38) and Mt Bruce in May 1998 (CSN 47), and occasionally recorded farther N, e.g. between Hunterville and Taihape (NZ Atlas; CSN 22). **SI** Said to have been extinct since 1890 (Thomson 1922); there have, nevertheless, been several records in 20th century, possibly aviary escapes (singles unless stated): two, near Stoke, 22 June 1956 (Williams 1958); unknown numbers in Marlborough in 1961, 1962 and 1967 (CSN 19 Suppl.); near Christchurch, 1969–79 (NZ Atlas); Blenheim, Dec. 1974 (CSN 22) and two in Feb. 1978 (CSN 26); four, Puriri Bay, Queen Charlotte Bay, May 1981 (Tunncliffe 1982); Ashley, Dec. 1981 (Tunncliffe 1982); New Brighton, 1981–82 (Tunncliffe 1982); near Sumner, 17 Jan. 1982 (Tunncliffe 1982); Bromley, 29 Jan. 1982 (Tunncliffe 1982); two, near Dunsandel, 3 Feb. 1982 (Tunncliffe 1982); Rabbit I., 1 Aug. 1985 (CSN 34); Linwood Park, Christchurch, 10 May 1986 (CSN 34); Woolston, 6 Nov. 1985 (CSN 34); and Gore, 18 Feb. 1998 (CSN 48).

Norfolk I. Vagrant. Unknown number recorded Sept. 1971 (Moore 1981).

Breeding **AUST.:** Probably throughout range in Qld (including on Warraber I. in Torres Str.; Draffan *et al.* 1983), NSW and Vic. Published records from near Cairns S to Annandale (SW of Townsville) in Atherton Region (Wet Tropics); in se. Qld and ne. NSW, from near Childers S to Clarenza, and inland to Dalby; elsewhere in NSW, E of 150°E, from Parraweena Stn (SW of Quirindi) and Wauchope–Port Macquarie S to Bawley Pt; in Southern Highlands, centred on Canberra; and in Vic., from Raymond I. (near Paynesville) and Sale, W to line from Torquay to Bet Bet, near Dunolly (Peter 1998; Aust. Atlas 1, 2; NSW Bird Reps; NRS). Elsewhere, recorded breeding in suburban Launceston, Tas., in 1955 (Green 1989); at Devonport, Tas. in 2003 (Weston 2004; M.C. Holdsworth); and in suburban Adelaide in 1960s (SA Bird Rep. 1968–69). **NZ:** Throughout range (CSN).

Introductions **Aust.:** **Qld** Unknown number obtained from Melbourne and released in cane fields round Innisfail, Ingham and Townsville in 1883 (Chisholm 1919, 1950). Incorrectly stated to have been unsuccessfully introduced to Cairns in 1918 (Long 1981) and Brisbane in 1912 (Roberts 1979). First introduced on Darling Downs in early 1918, when eight birds brought from Cairns were released on outskirts of Toowoomba; also said to have been released near Oakey, date unknown (Walker 1952). Said to have been introduced to Warraber I. in Torres Str. (Draffan *et al.* 1983), possibly in 1970s. **NSW:** Not known when first introduced round Sydney, thought to have been in 1860s or 1870s, when releases were

occurring round Melbourne, and certainly before 1880 (Hindwood 1948; Hone 1978). **ACT:** First introduced at Forrest, in suburban Canberra in Nov. 1968, when 12 birds released; several further releases conducted till Sept. 1971, by which time 110 birds liberated (Gregory-Smith 1985). **VIC.:** First introduced round Melbourne, in Royal Botanic Gardens and Royal Park (Hardy 1928; Balmford 1978): 42 released in 1863; another 40 in 1864; a small lot in 1866; and 70 in 1872 (Ryan 1906; Hall 1907); said to have originated from either India or Afghanistan (Hall 1907; Cunningham 1948). Jenkins (1977) stated that introductions occurred in 1862 (at least 100 birds released in metropolitan area), 1865 (20 birds at Royal Park and unknown number on Phillip I.) and 1866 (50 birds at Royal Park). **TAS.:** Unknown number released round Hobart in late 1890s or early 1900s; persisted till c. 1914 (Sharland 1958). **SA:** Unknown number released in n. suburban Adelaide, possibly round Enfield, in c. early 1957 (Condon 1962; SA Bird Reps). **NT:** Proposed to introduce Mynas into NT to combat cattle ticks in c. 1916 (Dickison 1951), though apparently never acted on. **NZ** Based on Thomson (1922) unless otherwise stated. 'Scores and hundreds' released in 'all centres', generally with no details published (Thomson 1922; Cunningham 1948); all birds released apparently originated as birds acclimatized in Aust. **NI:** **AUCKLAND:** None documented, but said to have been unsuccessfully introduced in c. 1895–1900 (Cunningham 1951), and certainly present between c. 1891 and 1906 (Cunningham 1948). **HAWKES BAY:** Repeated releases of unknown numbers, though two known to have been in 1877 and 1879 (Thomson 1922; Cunningham 1948); said to have been released at Matahura Stn, possibly inland from Tolaga Bay, in c. 1890 (Cunningham 1948). **WELLINGTON:** 30 birds released in 1875 and another 40 the following year. **MANAWATU:** Two released at Foxton, before 1917, and two more (brought from Napier) c. 15 km N of Levin, date unknown (Cunningham 1948). **SI:** **CANTERBURY:** Total of 18 Mynas imported from Melbourne and released round Christchurch in 1870. **OTAGO:** Unknown number released in Dunedin in early 1870s.

Change in range, populations **Aust.** Range has expanded greatly since various introductions, with populations increasing accordingly; now patchily continuous along major arterial routes from se. Qld, via Sydney and Canberra, to Melbourne and regional centres farther W; this was predicted by Martin (1996), together with amalgamation of populations in ne. and se. Qld, and expansion into SA. Expansion of range often preceded by vagrants appearing at sites many years before general range included that area, e.g. recorded at Ballina in ne. NSW in 1959 (Hone 1978; Morris *et al.* 1981), though not recorded near there again till 1990s (Gosper & Holmes 2002), and occurred at Terang in w. Vic. before 1953 (Binns 1953), but not recorded that far W again for decades. **Qld** **CHANGES TO RANGE IN NE. QLD, INCLUDING S. EXPANSION INTO MID-EASTERN QLD:** Established in Townsville by 1914, Cairns by 1925 and Atherton by 1931 (Le Souëf 1915; Bravery 1970; Storr 1973). Range on Atherton Tableland said to have expanded rapidly during World War II: none present at Ravenshoe in May 1943, but common there by Dec., and said that wherever new ground cleared or new settlement established on the Tableland, Mynas appeared almost immediately (Bourke & Austin 1947). At n. end of range, not recorded round Cooktown since 1986 (Nielsen 1996). Comparison of data in Aust. Atlas 1, 2 indicates that range expanded S from Townsville and Ayr into Mid-Eastern Region since early 1980s, with recent records S to Mackay (Aust. Atlas 1, 2). **EXPANSION OF RANGE FROM DARLING DOWNS:** Said to have reached Oakey a few months after release at Toowoomba, c. 27 km E (Walker 1952), though others say that first recorded in Oakey in either Nov. 1945 or 1946 (Forster 1951; Sedgwick 1951). Recorded between Oakey and Toowoomba in 1950

(Chisholm 1951; Forster 1951). Despite this, numbers and range on Darling Downs appear to have remained small, as only very occasionally recorded by mid-1950s (Lord 1956, 2001), but by late 1960s said to have been spreading rapidly in some areas (Jack 1969). **EASTWARD HO:** By 1970s, range began to expand E towards Brisbane; present round Gatton and Laidley by early to mid-1970s, but no closer to Brisbane (Perkins 1974, 1975; Roberts 1979); in 1977, only recorded W of Marburg, but within 10 years occurred well E of town (Leach & Hines 1987); and by late 1970s, one was recorded E to Gold Coast (Aust. Atlas 1). By late 1980s and early 1990s, population round suburban Brisbane was expanding (Qld Bird Rep. 1990, 1991): first recorded in various suburbs between 1989 and 1991 (Qld Bird Reps 1989, 1990, 1991), e.g. in s. suburbs of Jindalee in 1989 (Qld Bird Rep. 1989) and Pallara in 1991 (Qld Bird Rep. 1991); and first recorded on Redcliffe Pen., N of Brisbane, in 1993 (Bielewicz & Bielewicz 1996). This expansion illustrated by study in suburban Brisbane: reported in 5% of gardens round Brisbane in weekly surveys conducted in 1979–80, but by 1999–2000 present in 28% of gardens (Woodall 1995, 2002). By late 1990s and early 2000s, range expanded N from Brisbane, reaching Rainbow Beach by 1998 and Mundubbera in 2000 (Aust. Atlas 2). **HOW THE WEST WAS WON:** Expansion W of Darling Downs apparently slower and later than e. expansion; first recorded at Dalby in Nov. 1983 (Qld Bird Rep. 1984), and not farther W till 1990, though established N of town by then (Qld Bird Rep. 1990). **NSW** Main roads used as axes of dispersal (Gibson 1977; Hermes 1986; Chafer *et al.* 1999). **OCCURRENCE ROUND SYDNEY IN YEARS AFTER INTRODUCTION:** By late 1890s still not very numerous, though numbers said to have been increasing in w. suburbs (Hone 1978); by 1913, considered common round Sydney Botanic Gardens (Leishman 1997); and in following year, occurred round s. shores of Sydney Harbour, between Double Bay and Vaucluse, within 6 km of the city, and said to have been there for some years (Hone 1978). Range had not expanded to any extent by late 1940s and early 1950s, with most records within radius of 8–16 km from city, and most of those in e. or s. suburbs between Sydney Harbour and Botany Bay (Roberts 1938; Gilbert 1939; Hindwood 1948; Tarr 1950). First recorded at Lakemba, in sw. suburbs, in 1937 (Gilbert 1939), and single record in n. suburbs by 1950 (Tarr 1950); recorded at Lane Cove in Nov. 1950 (Lane 1964). **N OF SYDNEY: COASTAL AND NEAR-COASTAL AREAS:** Recorded at Newcastle in 1950s (Hone 1978). Expanded into Mid-North Coast in 1990s, reaching Gloucester and Buladelah in 1993 (NSW Bird Rep. 1993), Taree in 1997 (NSW Bird Rep. 1997), and upstream from there along Manning R. at Wingham in 1998 (NSW Bird Rep. 1998) and arrived at Crescent Head and Macleay R. Valley in 1999 (NSW Bird Rep. 1999); by 2000, recorded at 18 locations in Mid-North Coast, from Taree N to Kempsey (NSW Bird Rep. 2000), though not recorded at Forster (between Buladelah and Taree, but off route of Pacific Hwy) till Dec. 2001 (NSW Bird Rep. 2001). In Northern Rivers Region, singles fleetingly recorded at Coutts Crossing and nearby Grafton in 1993, but soon disappeared (NSW Bird Rep. 1993); by 1998, largely absent from Clarence R. Valley but recorded at Woodford I. (NSW Bird Rep. 1998). Record at Tweed Heads in 1975 (Hone 1978; Morris *et al.* 1981) presumably part of expansion of range in se. Qld (see above). First recorded in Richmond R. district, at Fairy Hill and Cedar Pt, in 1997 (Gosper & Holmes 2002) with records in upper reaches of Richmond R. at Kyogle and Wiangaree in 2000 (NSW Bird Rep. 2000); said to have originated from s. movement from population in Qld (NSW Bird Rep. 2000). **INLAND AREAS:** Farther inland, recorded at Murrurundi, n. Hunter Region, in 1989 (NSW Bird Rep. 1989), farther N at Wallabadah, s. North-West Slope Region, in 1993 (NSW Bird Rep. 1993), and reached Tamworth by

1999 (NSW Bird Rep. 1999). Recorded at Moree, in North-West Plain Region, in 1994, possibly originating from s. Qld (NSW Bird Rep. 1994). Comparison of data in Aust. Atlas 1, 2 shows that between early 1980s and early 2000s, range expanded inland to near Narrabri in 1999 (Aust. Atlas 1, 2). **W OF SYDNEY:** Not clear when range expanded W into Central Tableland, but recorded at Richmond in 1957 (Hone 1978); recorded W to Orange in 1978 (Aust. Atlas 1), and first recorded at Cowra in Mar. 1999 (Aust. Atlas 2; *contra* NSW Bird Rep. 2001). Aust. Atlas 2 has records farther W into Central-West Slope Region, at Eugowra in Apr. 1999 and Dubbo in 2001 (Aust. Atlas 2). **S AND SW OF SYDNEY: COASTAL AND NEAR-COASTAL AREAS:** First recorded at Thirroul in Nov. 1960 (Sefton & Devitt 1962) and Wollongong in 1961 (Gibson 1977). By 1978, recorded S to Nowra (NSW Bird Rep. 1978) and vagrants recorded farther S to Tomakin in late 1979 (Aust. Atlas 1) and Batehaven in 1989 (Whiter 1991); became established in Eurobodalla Shire in 1993–95 (Whiter 1994, 1996), though not considered properly established till 1996, when small groups established at Batemans Bay and Moruya (Whiter & Andrew 1997); recorded farther S at Bega and Candelo in 2000 (NSW Bird Rep. 2000). Population in Eurobodalla Shire was increasing in late 1990s and early 2000s, despite eradication program (Andrew 2002). **INLAND AREAS:** Range spread SW from Sydney along Hume Hwy; first recorded at Moss Vale in 1971 (NSW Bird Rep. 1971) and, by 1980, recorded SW from Mittagong to Goulburn (Hermes 1986), though already recorded farther afield, at Queanbeyan in 1969 (Peters 1970; Gregory-Smith 1985). **EXPANSION INTO INLAND S. NSW:** Since early 1980s, range has expanded to include parts of Southern Tableland, South-west Slope and Riverina Region; comparison of data from Aust. Atlas 1, 2 shows that between early 1980s and early 2000s, range expanded from Jindabyne in Southern Tableland W to site between Conargo and Deniliquin in s. Riverina, forming patchily continuous range. Aust. Atlas 2 also shows progress N from se. Riverina, with records at Jindera in 1998, Lockhart and Dellapool, near Narrandera, in 1999, extending N to near Whitton in 2000, and between Ungarie and Naradhan in 2001. Also recorded downstream along Murray R. at Balranald in 1999 and Euston in 2000 (Aust. Atlas 2). See also ACT, below. **DECLINE RECORDED IN SUBURBAN SYDNEY:** Population round Maroubra declined greatly between 1940s and 1980s (Bell 1983). **ACT** Recorded at suburban Lyneham in N and Narrabundah in S in 1968–69. Within a year, recorded in several s. suburbs, from Narrabundah N to Barton; and by 1971–72, recorded farther W to Yarralumla, Hughes and Mawson. Range continued to expand slowly in 1970s, and recorded at Fyshwick in 1977–78; by 1979–80, extended SW to Fisher and Pearce. Range expanded dramatically in early 1980s, and by 1982–83, widespread in s. suburbs S to Kambah and SW to Chapman, and also occurred in several n. suburbs, N to Scullin and Mitchell (Gregory-Smith 1985). Surveys in 1990 showed range extended from Giralang S to Chisholm, and from Scullin, Hawker, Duffy and Rivett E to Watson, Hackett and Fyshwick (Davey 1991), and also present in nearby rural areas (Wright & Wright 1991a,b). Population round Canberra has increased greatly since early 1980s: slowly increased in abundance between 1981 and 1986, but thereafter increased dramatically (Veerman 2003); mean maximum number recorded in weekly counts round Canberra increased from 0.58 in 1984–85 to 2.79 in 1990–91 (Pell & Tidemann 1994); population at Curtin increased greatly after early 1990s (Peters & Peters 1993). **Vic.** Mainly expanding range along major roads (Vic. Atlas). **OCCURRENCE ROUND MELBOURNE IN THE YEARS AFTER INTRODUCTION:** Range expanded very slowly (Ryan 1906); nevertheless, population had increased sufficiently to provide ample stock for release in n. Qld (Chisholm 1919;

Long 1981; Peter 1998); certainly established ('in full swing') round Box Hill, c. 15 km E of Melbourne, by 1893 (Hall 1899), and population said to have been mainly confined to 'the neighbourhood of the metropolis' and a few nearby large towns by 1905 (Ryan 1906). **EXPANSION OF RANGE E AND NE OF MELBOURNE:** By 1950s, recorded at Kallista and Tecoma in Dandenong Ra. and E along Princes Hwy to Traralgon (Tarr 1950), reaching Sale, Maffra and Stratford by late 1960s (Bedgood 1970) and Bairnsdale in early 1990s (Phillipps 1994), though recorded at Lakes Entrance, farther E, in 1979 (Aust. Atlas 1). Range extended NE along Hume Hwy, reaching Wangaratta by at least 1997 and present round Albury–Wodonga by 1998 (Aust. Atlas 2). **EXPANSION OF RANGE NW AND W OF MELBOURNE:** Range expanded NW along McIvor Hwy, with occasional records of small numbers between Heathcote and Bendigo by mid-1970s (BFNC 1976; Aust. Atlas 1), but not established round Bendigo, e.g. Strathfieldsaye, till early 1990s (Bridley 1991; C.L. Tzaros). Comparison of data from Aust. Atlas 1, 2 shows that between early 1980s and early 2000s range expanded NW to Kerang by 1998 and Swan Hill by 1999 (Aust. Atlas 1, 2). Range also expanded W, reaching Ballan in 1985 (Vic. Bird Rep. 1985), and though unclear when reached Ballarat, farther W, certainly recorded there in 1998 (Aust. Atlas 2), though single record at Maryborough, farther W, much earlier, in 1981 (Aust. Atlas 1). **EXPANSION OF RANGE SW OF MELBOURNE:** Summarized in Peter (1998). Reached Geelong by 1950s (Pescott 1996), though at Altona, c. 14 km SW of Melbourne, between Melbourne and Geelong, confined to area round township in mid-1950s and not present at all in surrounding countryside (Watson 1955); by 1960s, vagrant recorded at Paraparap (SW of Geelong) and established at Queenscliff (E of Geelong) (Pescott 1983). Established in s. suburbs of Geelong by mid- to late 1970s, and also recorded at various towns between Barwon Heads and Anglesea (though not Torquay) (Peter 1998; Aust. Atlas 1). A survey conducted in Geelong in 1993–94 showed that the species was widespread throughout most of Geelong (Bottomley & Calvert 1994), and still expanding range in some suburbs (Peter 1998). Colonization of Torquay, S of Geelong, was much slower: first recorded there in 1980, and twice more by 1992, but not established; between 1992 and 1994, reporting rates at Torquay were low (4–14%), but increased to 32% in 1995, and established by 1996 (79%) (Peter 1998); first breeding recorded in 1999 (J.M. Peter). Comparison of data from Aust. Atlas 1, 2 shows that between early 1980s and early 2000s, range expanded SW to include Port Fairy by 1999 (Aust. Atlas 1, 2). **Tas.** Said to have persisted round Hobart till 1914 (Sharland 1958) or 1918 (Tarr 1950), and claimed to be 'doing well in the field' in 1920 (Hall 1920). Said to have colonized n. Tas., round Launceston, from Vic. in 1950s (Sharland 1958). **SA** Population in n. suburban Adelaide increased from up to 20 birds in 1957 (Anon. 1957) to 84 by Apr. 1964 (SA Bird Rep. 1964), but subsequently declined to maximum of 26 in June 1968 (SA Bird Rep. 1967–68) with numbers dwindling to one or two in May 1981, and single bird remained by Sept. 1981, shortly before dying out (Paton *et al.* 1994; SA Bird Rep. 1977–81). **NZ** After initial increases in populations soon after release, numbers gradually declined after a few years, in some cases resulting in local extinctions, said to have been caused by displacement by Common Starlings (Thomson 1922; Moncrieff 1931). **NI** Expansion of range till 1947 detailed in Cunningham (1948); text summarized from that source unless otherwise stated. **EXPANSION OF RANGE FROM WELLINGTON:** Formerly common round Wellington soon after release, but numbers had declined by early 20th century (see below), though range had expanded E into Wairarapa (Thomson 1922; Cunningham 1948), where occurred N to Masterton (Cunningham 1948) with numbers initially

increasing, but later declined (see below). **EXPANSION OF RANGE THROUGH MANAWATU, WANGANUI AND TARANAKI:** Timing, number and locations of releases unclear, and this affects assessment of expansion of range in these areas. Recorded in Manawatu in mid-1870s (Thomson 1922). Plentiful in Kopane, Palmerston N, in c. 1910 (Cunningham 1954), and by 1917 recorded in Manawatu from Foxton N to Taihape and, within another 10 years, E to Ashurst. Still present in Foxton 1942–45 (Savell 1946; CSN 1), but by 1947 not recorded in Manawatu S of Palmerston N (see below), and extended N to Turakina, and not as far W as Ashurst, where last recorded in 1942 (Cunningham 1948, 1954). In Wanganui, common in some parts by early 1920s, and recorded N to Raeiti by 1928; and by 1947, range extended from suburban Wanganui NW along coast to Waitotara and N to Raeiti (Cunningham 1948). Recorded in Taranaki in mid-1870s and common by late 1890s, though numbers had declined a little by 1916 (Thomson 1922). Numerous round Waverley by 1907 and Eltham by 1920, and by 1928, common round parts of New Plymouth and elsewhere nearby. In early 1930s, first recorded at several inland sites, e.g. along Ohura Valley to Matiere in 1931, and Te Wera in 1933. In area W of road joining Hawera and New Plymouth, recorded at Opunake since c. 1938 and at Egmont Village in 1941 (Cunningham 1948). By 1947, recorded throughout much of Taranaki, from Waverley and Hawera, N to New Plymouth, and thence E to Mt Messenger and N to Mokau, and also along Ohura Valley, where approached s. extent of range in Waikato (Cunningham 1948, 1951; CSN 1), and by 1950, recorded along road between Awakino and Te Kuiti (CSN 5). **NORTHWARD EXPANSION OF RANGE FROM WAIKATO:** By 1912, recorded N to Morrinsville in Waikato but soon died out there; and present at Piopio in 1912 and Te Kuiti in 1914, from whence range said to have expanded N (Cunningham 1948, 1951; McKenzie 1960). In 1917, recorded at Pirongia, and in 1919, near Kawhia Harbour (Cunningham 1954). Reached Te Mawhai, S of Te Awamutu, in Sept. 1923, and first recorded in Matamata in same year. By late 1920s, recorded N to Taupiri and W to Tairau and Morrinsville (again). Reached Huntly by early 1930s, having advanced 13–16 km per year. Range extended N to Patetonga on s. Hauraki Plains and NE to Te Aroha by 1936 (Cunningham 1948). Expansion of range slowed briefly for a few years thereafter, but by 1943 range had expanded across Hauraki Plains E to Paeroa and N to Hikutaia (Cunningham 1948) and also Clevedon, on outskirts of Auckland, where numbers increased to >200 in 1952, >400 in 1954 and c. 950 by 1956 (McKenzie 1960); by 1945, recorded N to s. suburban Auckland, at Tamaki and Howick; and by 1947 occurred in various suburbs round Auckland, and on n. Awhitu Pen. At this time, recorded at a few places on w. Firth of Thames, N to Wharekawa (Cunningham 1948; CSN 1), and W to Moumoukai in Hunua Ras (CSN 6); populations on Hauraki Plains and round Firth of Thames continued to increase in 1949 (CSN 3). Expansion of range apparently continued more slowly N of Auckland (Cunningham 1954; McKenzie 1960); first recorded at Birkenhead in 1952 (CSN 5) and Manly on Whangaparaoa Pen. in Dec. 1953 (CSN 6), but not recorded on Noises Is till early 1960s (Cunningham & Moors 1985); population on nearby Tiritiri Matangi I. increased slowly, with 11 present in 1969 and 23 in 1974 (CSN 22). Numbers round Auckland continued to increase in early to mid-1950s (CSN 4, 6); farther N, recorded at Wellsford in Nov. 1954, with population increasing steadily within a year (CSN 6) and at S Kaipara Head in Oct. 1955 (CSN 6). Range also expanded in 1950s to include Coromandel Pen., colonization of which apparently complete by 1960, as Mynas present at all settlements by then; plentiful between Paeroa and Waiki in 1954 (CSN 6) and large numbers recorded at Thames in 1960 (CSN 9). Various nearby offshore

islands colonized round this time: first recorded on Great Barrier I. in 1960, but had probably been present for c. 1 year (Bell & Brathwaite 1964), and though initially thought not to have become established, was moderately plentiful by 1970 and widespread by 1975 (Bell 1976); and first recorded on Great Mercury I. in 1961, with population greatly increased within 2 years (Skegg 1963). In 1960s, range continued to expand rapidly into Northland, though not recorded on Poor Knights Is till Jan. 1973 (Gaze 1973); a few present on Aupouri Pen. by 1967, but several arrived in Oct. of that year, and immediately dispersed and began to breed; within a month, recorded N to Te Pahi and Spirits Bay, and by late 1968, numerous round North C. (Edgar 1971). Recorded on Three Kings Is in Nov. 1970 (Ramsay & Watt 1971). **EXPANSION OF RANGE INTO BAY OF PLENTY AND VOLCANIC PLATEAU:** Range apparently expanded E into Bay of Plenty from Waikato in mid- to late 1930s: first recorded at Tauranga in 1937 (Hodgkins 1949) with small numbers recorded in 1943 (Cunningham 1948; CSN 1), and first recorded at Te Puke in 1944 or 1945, but few other records in Bay of Plenty by 1947, though population round Tauranga increased greatly between 1947 and 1949 and began to spread (Hodgkins 1949; Cunningham 1951). By 1953, range had expanded E to Whakatane, with population increasing rapidly, and recorded at Awakeri and Taneatua the following year (Cunningham 1951; CSN 6); population continued to increase in mid- to late 1950s (CSN 6, 8) and large flocks present by 1960 (CSN 9). Few records in Volcanic Plateau in by 1947, mainly round Rotorua (Cunningham 1948), and single record much farther S at Rotokawa in July 1949 (CSN 3), but vanguard had not yet reached nearby Taupo (CSN 6), even though a vagrant had been recorded there in 1931 (Cunningham 1948; Phillipps & Lindsay 1948); s. expansion of range in Volcanic Plateau detected in 1952–53 (Watson & Wodzicki 1954) and widely distributed over Volcanic Plateau by 1955, with population increasing rapidly in mid- to late 1950s, especially round Rotorua (CSN 7, 8), and first recorded at Mamaku, at elevation of c. 600m asl, in Jan. 1957 (Sibson 1958). **EXPANSION OF RANGE IN HAWKES BAY AND EAST COAST:** Very common round Napier soon after release in Hawkes Bay, where thousands present by early 20th century, and though range had expanded to include nearby Tutira in 1884 (5 years after release), numbers there did not increase greatly till c. 1890 (Thomson 1922; Cunningham 1948). By 1947, widespread in coastal and subcoastal areas in E from Porangahau N to Te Araroa, but not far inland into hills (Cunningham 1948; Cunningham & Wodzicki 1948), though said that few records N of Gisborne (CSN 2); common round Totangi, NW of Gisborne, in 1947 (CSN 2), and one of the most common species on Mahia Pen. in 1948 (Phillipps 1948). By early to mid-1950s, occurred inland to Te Karaka, on Gisborne–Opotiki road, where numerous (Cunningham 1948, 1954). **CONTRACTION OF RANGE IN S. NI AND OTHER POPULATION DECLINES:** Soon after introduction in 1870s, began breeding successfully in many areas, with populations increasing and range expanding, but some populations began to decrease soon afterwards, ultimately disappearing from some areas (Cunningham 1948). **NI** After release in Auckland in 1890s, said to have survived for only a year or two (Cunningham 1951). Population in Wellington formerly large in first few years after release, but subsequently declined dramatically, and apparently gone by 1890s (Cunningham 1948). Also formerly numerous in Wairarapa, but population apparently declined there too, and by 1947 confined to a few small isolated populations from Featherstone and Martinborough N to Masterton, though by that time numbers had remained stable for some years (Cunningham 1948). By 1950, the species retained a 'precarious foothold' in Featherston, Greytown, Carterton and Martinborough, and last recorded in Masterton in 1950 (Cunningham 1951); by

1954, one or two left at Martinborough, a few remained at Carterton and Greytown, and gone from Featherston and Masterton (Cunningham 1954). At Foxton, site of release, numbers quickly increased; common there by 1917 and still present in 1940s (Cunningham 1948), but subsequently disappeared as no records there 1969–79 (NZ Atlas). At nearby Tokomaru, said to have been common till 1937, but not recorded since then (Cunningham 1948). By 1947, not recorded in Manawatu S of Palmerston N, and not as far W as Ashurst, where last recorded in 1942 (Cunningham 1948); by 1954, Fielding was last stronghold of the species in Manawatu (Cunningham 1954), but almost completely disappeared by 1963 (CSN 19 Suppl.). No NZ Atlas records from S of Tukituki R., 1969–79, but recorded much farther S, to round Porangahau, in 1940s (Cunningham 1948). By mid-1970s, seldom recorded round Dannevirke and Hunterville, though formerly fairly common (CSN 22). Thus, in general, s. part of range has gradually contracted northward (Heather & Robertson 2000). Farther N, population at Ruatoria, East Coast, said to have declined between 1920 and 1950 (Cunningham 1951); and more recently, decline recorded at Kawerau, in Bay of Plenty, in early 1990s (CSN 39). On Poor Knights Is, first recorded in Jan. 1973, when up to 16 birds appeared; population declined to five birds by July 1975, and none left by Oct. 1975 (Gaze 1973; Bell 1976). **SI** Formerly common round Christchurch after release in 1870, but later declined, and gone by early 1890s (Thomson 1922; Cunningham 1948). Similarly, common round Dunedin in 1877, soon after release, but not recorded a few years later and certainly gone by 1890 (Thomson 1922; Cunningham 1948). Formerly common in Nelson but gone by late 1920s (Moncrieff 1929; Cunningham 1948), though 'one or two birds' said to have persisted round Richmond till c. 1929 (Moncrieff 1929); occurred in small numbers round Blenheim, but no longer, having disappeared after 1970s (Cunningham 1948; CSN 22, 26).

Populations Total population in suburban Canberra estimated at c. 1220 birds (Davey 1991). **RECORDED DENSITIES:** **AUST.:** In Townsville, ne. Qld, mean 2.46 birds/ha in wet season 1980 and 2.24 birds/ha in dry season 1980 (Jones 1983), and mean 4.51 birds/ha in wet season 1997 and 8.23 birds/ha in dry season 1997 (Jones & Wieneke 2000); on trips between Liverpool and Goulburn, NSW, (180 km; n=20 trips), 0.32 birds/km (Hermes 1986); 1.45 birds/ha, Wollongong, NSW (Wood 1995a); in suburban Canberra (densities of <0.2 birds/ha, excluded; see Davey 1991 for details): 0.31 birds/ha, Red Hill (Davey 1991); 0.3 birds/ha, Hughes (Davey 1991); 0.28 birds/ha, Torrens (Davey 1991); 0.25 birds/ha, Rivett (Davey 1991); 0.2 birds/ha, Kambah (Davey 1991); 0.73–1.25 birds/ha, Lyons, suburban Canberra (Pell & Tidemann 1994); 1.35–1.42 birds/ha and 1.24 birds/ha, Weston, suburban Canberra (Pell & Tidemann 1994, 1997a); 0.16–0.48 birds/ha and 0.43 birds/ha, Oakey Hill Nature Park, ACT (Pell & Tidemann 1994, 1997a); 1.5 birds/ha (0.93; 0–7.74; 522 surveys), Gardiners Creek, Bennettswood, e. suburban Melbourne (J.M. Peter); 3.57 birds/ha (3.38; 0–13.9; 86 surveys), Darling Square, Melbourne (W.K. Steele). **NZ:** 0.12 birds/5-min count, Raetea, Northland, 1979 (Pierce *et al.* 1993); 0.17 birds/5-min count, same site, 1993 (Pierce *et al.* 1993); 0.77 birds/5-min count, Puketi, Northland, 1979 (Pierce *et al.* 1993); 1.18 birds/5-min count, same site, 1993 (Pierce *et al.* 1993); 0.08 birds/5-min count, Mataraua, Northland, 1979 (Pierce *et al.* 1993); 0.33 birds/5-min count, same site, 1993 (Pierce *et al.* 1993); 0.35 birds/5-min count, Russell, Northland, 1979 (Pierce *et al.* 1993); 0.81 birds/5-min count, same site, 1993 (Pierce *et al.* 1993); 0.85 birds/5-min count, Omahuta, Northland, 1979 (Pierce *et al.* 1993); 1.50 birds/5-min count, same site, 1993 (Pierce *et al.* 1993); 1.65 birds/5-min count, Waipoua, Northland, 1979 (Pierce *et al.*

1993); 1.97 birds/5-min count, same site, 1993 (Pierce *et al.* 1993).

THREATS AND HUMAN INTERACTIONS Usually, but not always, commensal with human settlement. Considered a pest in orchards and vineyards, damaging fruit, Grapes and berries (see Food: Pest status); said to be responsible for the dispersal of olive seeds (Spennemann & Allen 2000). Said to delouse pigs in piggeries (Cunningham 1948) and take ticks from cattle (Dickison 1951). Formerly protected by law, at least in Vic. and Qld, where considered helpful in eating invertebrate pests (Cameron 1933b; Le Souéf 1958), but more recently, eradication programs initiated in some areas, e.g. Eurobodalla Shire in se. NSW and Bairnsdale, e. Vic. (Phillipps 1994; Whiter 1995); any Mynas recorded in WA are extirpated immediately by The Authorities (M. Massam). Sometimes swoop at people, Dogs and Cats (Booth 1963), and once recorded fiercely attacking a Cat (CSN 22). Nevertheless, often killed by Cats (Rose 1975; Dowling *et al.* 1994); and once killed by Stoat (CSN 41). Often struck by vehicles in urban areas (J.M. Peter). Sometimes considered a pest when congregating to roost in large numbers, with accumulation of faeces a health hazard, and noise levels that are deafening (White 1946; Davis 1964; Nielsen 1996); nests in wall-cavities or roofs cause a nuisance, and those blocking spouting on roofs often cause water-damage to buildings (Hopkins 1948; Bomford & Sinclair 2002). Often blamed for destruction of eggs and nestlings of native and introduced species alike, and evicting birds from their nests (e.g. Thorn 1950; Macdonald 1951; Walker 1952; Wright 1962; Blackburn 1966; St Paul & McKenzie 1974; McKenzie 1979; Hoskin 1991; Moon 1991; Peters & Peters 1993; Phillipps 1994; Pell & Tidemann 1997b; Armstrong *et al.* 2000; Walker 2000; CSN 19 Suppl., 41). Often attracted to sites of artificial abundance of food (see Food: Foraging heights and sites). Range has expanded with spread of urban development, market gardens and small farms (Aust. Atlas 1; Vic. Atlas). Adversely affected, however, by some revegetation programs (Morris 1986).

MOVEMENTS Sedentary or resident. Broad-scale analysis of bird atlas and count data from e. Aust. found strong evidence for no movement (Griffioen & Clarke 2002); and no evidence of migration in NZ (Heather & Robertson 2000). Extraliminally, considered non-migratory, sedentary or resident in natural range (Long 1981; de Schauensee 1984; Flint *et al.* 1984; Lekagul & Round 1991; Grimmer *et al.* 1999; Robson 2000).

Aust. Widely described as resident or seen throughout year (equivalent to sedentary of HANZAB) throughout range: in QLD (Gill 1970; Noyce 1997); NSW (Morris 1975, 1986, 1989; Gibson 1977; Hardy & Farrell 1990; Leishman 1994; Egan *et al.* 1997; Chafer *et al.* 1999; NSW Bird Repts 1980); ACT (Anon. 1976; Clark & Lenz 1978; Taylor 1984; Taylor & Davey 1985; Er & Tidemann 1996; COG 2002; ACT Atlas); and VIC. (Fleming 1976; Humphreys 1986; Vic. Atlas). **NZ** Described as resident or seen throughout year in NI, at Port Whangarei in Northland (Beauchamp & Parrish 1999), Auckland (Councilman 1974b), Te Araroa in East Coast, Opunake in Taranaki, Napier and Hastings in Hawkes Bay, Palmerston N in Monawatu and Masterton in Wairarapa (Cunningham 1948).

Some local movements reported. Seasonal movement between habitats detected in Canberra: numbers recorded in suburbs declined in spring and summer, and peaked in May; conversely, in nearby bush reserves, numbers highest in spring and summer and lowest in winter (Taylor 1983; Gregory-Smith 1985; Pell & Tidemann 1997a). Similarly, in Northland, move from suburbs to bush in summer, returning

in May (Moncrieff 1929). Regularly move between roost-sites and foraging areas; in breeding season may roost 100–700 m from foraging areas, though some of these roosts may be temporary (Pell & Tidemann 1997a), but at other times of year may travel up to 12 km between the two sites (Wood 1995a; Heather & Robertson 2000). Able to cross stretches of open sea, as indicated by apparent colonization of n. Tas. from Vic. (Sharland 1958) and arrival on various offshore islands in NZ (Gaze 1973; Bell 1976; Heather & Robertson 2000); and vagrants also recorded on Norfolk I. and Three Kings Is (Ramsay & Watt 1971; Moore 1981). Other seasonal patterns include: non-breeding visitor to Noises Is, mainly in winter (Cunningham & Moors 1985); and said to appear in spring at New Plymouth, NI (Moncrieff 1929). Said to be irregular visitor to Kooragang I., in lower reaches of Hunter R., NSW (Hone 1978), though resident elsewhere in Hunter Region (Morris 1975).

Banding Of 491 banded in Aust., 1953 to June 2003, 16 recoveries (3.3%) of 16 birds, all <10 km from banding place (ABBBB). **LONGEVITY:** Adult banded at W Pymble, in Sydney, 16 June 1974, recaptured at Turramurra, in Sydney, 26 July 1981, over 7 years 1 month after banding (ABBBB).

FOOD Mostly insects, fruit and food scraps; also bird eggs, nectar and carrion. **Behaviour** Forage mostly on ground, taking invertebrates or fallen fruit; but also take fruit from trees and shrubs, and sally after flying insects. Often forage round human habitation, seeking insects, food scraps and carrion round roads, rubbish bins and the like. Often considered a pest, damaging cultivated fruits; also eat eggs of native and introduced birds (see below). **DETAILED STUDIES:** Near Hastings, NI, Jan. 1964–July 1965 (Wilson 1965); and at Havelock N, NI, Dec. 1974 (Moeed 1975). **FORAGING ASSOCIATIONS:** Usually forage in twos or, during non-breeding season, in small flocks of up to c. 20 birds (Forster 1951; Betts 1970; Councilman 1974a; Falla *et al.* 1981; Purchase & Purchase 1991; Davey 1992; Heather & Robertson 2000; Simpson 2000; CSN 24), and occasionally in larger flocks, e.g. flock of 50 (CSN 24). Sometimes forage with other species (Lindenmayer 1993). Often forage on ground with Common Starlings and Spotted Turtle-Doves *Streptopelia chinensis* (Lord 1956; Purchase & Purchase 1991; J.M. Peter). Once seen sallying for flying ants with Rainbow Bee-eaters *Merops ornatus*, Figbirds *Sphecotheres viridis* and House Sparrows *Passer domesticus* (Johnson 1993); seen taking ants on ground with Red Wattlebirds *Anthochaera carunculata*, Magpie-larks *Grallina cyanoleuca*, Grey Butcherbirds *Cracticus torquatus*, Pied Currawong *Strepera graculina*, Grey Shrike-thrush *Colluricincla harmonica* and Australian Magpie *Gymnorhina tibicen* (Simpson 2000); and once recorded feeding among waders (CSN 20). Often feed round livestock (Walker 1952), sometimes perching on back of beast to take parasites (Cunningham 1948; Oliver). Said to occasionally follow plough to obtain invertebrates thus exposed (Cunningham 1948). **FORAGING TERRITORIES:** In Canberra, foraged in apparently undefended communal feeding areas (Pell & Tidemann 1997a). In NZ, strongly territorial during breeding season, mostly foraging in breeding territories (Councilman 1974b). **FORAGING HEIGHTS AND SITES:** Forage mainly on ground, especially on lawns and roads (Tarr 1950; McKenzie 1960; Betts 1970; Councilman 1974b; Wilson 1979; Loyn 1985b; Purchase & Purchase 1991; Davey 1992; Pell & Tidemann 1994; Wood 1995b; Heather & Robertson 2000; CSN 23, 24); and occasionally on beaches, among clumps of seaweed (Gaze 1973; Falla *et al.* 1981; CSN 9, 19 Suppl.). In vegetation, take fruit from trees and shrubs (Pell & Tidemann 1994; CSN 24), and forage at flowers (Gosper 1999; CSN 19 Suppl., 24, 29). Of 169 observations of foraging in e. suburban Melbourne: 160 (94.7%) on ground, eight (4.7%) in native plants (mostly eucalypts [n=7]) and

one (0.6%) on unknown substrate (Green 1984). Take flying insects in air (Clark 1990; Johnson 1993; Perkins 2000a; Simpson 2000). Take eggs from nests of other birds (CSN 21). Recorded taking cicadas from buildings, trees and telephone poles (Councilman 1974b). Also take scraps from sites where refuse accumulates, such as bins, rubbish tips, picnic areas, railway stations and backyards where people 'feed the birds' (Jones 1938; Hindwood 1948; Councilman 1974a; Fleming 1976, 1987; Gibson 1977; Loyn 1985b; Morris 1986; Larkins 1993; Wood 1995a; CSN 9, 26, 35); at Chatswood railway station, in Sydney, observed foraging under stationary trains, and when train stopped at station, one entered carriage and ate scraps from floor, leaving when warning bell sounded (Larkins 1993). Also often forage round pig and poultry runs (Cunningham 1948; Walker 1952; Wright 1962; Heather & Robertson 2000; Oliver). **FORAGING METHODS:** Usually glean food on ground and in vegetation (Ryan 1953; Heather & Robertson 2000; CSN 24). Once recorded dashing across bowling green, 5–10 m at a time, to glean ants from ground (Buckingham 1994). Sometimes also probe ground with bill opened slightly (Moeed 1975), or probe flowers, pulling them apart (CSN 19 Suppl.). Often sally for flying insects (Clark 1990; Johnson 1993; Perkins 2000a; Simpson 2000; CSN 21). Once sally-struck a Two-lined Dragon *Diporiphora australis* from trellis in garden (Kutt & Kemp 1997). At Wahroonga, in Sydney, one seen gleaning insects from corners of window-frame, and flutter-chasing after those that escaped (Rose 1973). Sometimes eat ants after anting (see Social Behaviour: Maintenance behaviour [Anting]). **KLEPTOPARASITISM:** Once seen unsuccessfully attempting to steal food from Common Blackbirds *Turdus merula* (Councilman 1974b). **HANDLING OF FOOD:** European Wasps *Vespula germanica* killed by having abdomen crushed, followed by head, then thorax with 2–3 quick snaps of bill before being swallowed; twice, held bill agape for 5–10 s after swallowing wasp (CSN 20). Once, having caught a Two-lined Dragon, Myna repeatedly shook and beat it against wooden beam (Kutt & Kemp 1997). **PEST STATUS:** Sometimes considered a pest in HANZAB region, damaging fruit and vegetable crops, and taking food from pig and poultry yards (Campbell 1905; Ryan 1906; Thomson 1922; Cunningham 1948, 1951; Walker 1952; Ryan 1953; Wilson 1965; Dawson & Bull 1970; Gregory-Smith 1985; Heather & Robertson 2000; Bomford & Sinclair 2002; Oliver; CSN 5, 24); in NZ, rated by fruit-growers as among most troublesome bird species (Dawson & Bull 1970). Also said to be responsible for dispersal of olive seeds (Spennemann & Allen 2000). Eat eggs and chicks of some native bird species (McKenzie 1979; Heather & Robertson 2000): considered predator of Kokako *Callaeas cinerea* (St Paul & McKenzie 1974), and suspected predator of New Zealand Robin *Petroica australis longipes* (Armstrong *et al.* 2000). Also considered a pest when congregating to roost in large numbers, or nesting in buildings (see Threats and Human Interactions).

Detailed studies Near HASTINGS, HAWKES BAY, NI (gut contents of 29 birds; Wilson 1965): **Plants** Unident. seeds 13 (total number of items), 3.3 (mean % vol.), 4 (number of birds containing item), unident. vegetable matter –, 15.5, 11. **DICOTYLEDONS:** Flowers 15, 20, 1; Rosaceae: *Malus sylvestris* –, 39.2, 5; *Pyrus communis* –, 45.5, 10; Solanaceae: *Lycopersicon esculentum* –, 20.9, 7; *Solanum nigrum* –, 41.3, 17; fru. 204, –, 17, sds 2964, –, 17. **Animals** **ANNELIDS:** Oligochaetes –, –, 4. **TICKS:** 1, 1, 1; **SPIDERS:** 5, –, 4. **SPRINGTAILS:** Sminthuridae 1, 1, 1. **INSECTS:** Coleoptera 111, 15.6, 18: ads 64, –, 17, larv. 47, –, 4; Carabidae: *Clivina rugithorax*; Cerambycidae; Curculionidae: ads, larv.; *Graphognathus leucoloma*; *Hyperodes bonariensis*; *Listroderes costirostris*; Elateridae; Hydrophilidae; Scarabaeidae: *Aphodius granarius*; Staphylinidae: *Cafius*; Diptera 620, 26.7, 14: ads 616, –, 14, larv. 4, –, 3; Calliphoridae: *Lucilia*; *Sarcophaga milleri*; Chironomidae;

Dolichopodidae; Muscidae: *Musca*; Syrphidae; Hemiptera 95 (all adults), 10.4, 11: Aphididae; Cicadidae; Nabidae; *Reduviolus capsiformis*; Pentatomidae: *Dictyotus caenosus*; Hymenoptera 23, 4.3, 13: ads 22, –, 13, larv. 1, –, 1; Braconidae: *Apanteles*; Ichneumonidae: *Ichneumon promissorius*; Vespidae: *Vespula germanica*; Lepidoptera 120, 20.3, 15: ads 9, –, 4, larv. 111; –, 11; Coleophoridae: *Coleophora spissicornis* cocoons (included under larv. above); Crambidae: larv.; Noctuidae: ads, larv.; Pyralidae: larv.; Mantodea 1, 3, 1: Mantidae; Orthoptera 23, 80, 1: Tettigoniidae: *Xiphidium semivittatum*; Trichoptera 1, 1, 1.

Other records—Aust. Plants Fruit^{1,2,8,9,25,34}, seeds^{2,11,13,14}, nectar²⁹, vegetable matter¹³. **MONOCOTYLEDONS:** Liliaceae: *Dianella* sds¹¹; Poaceae: sds¹³. **DICOTYLEDONS:** Asteraceae: *Sonchus oleraceus* fl. buds¹⁸; Ericaceae: *Arbutus unedo* fru.¹⁸; Fabaceae: *Pisum* fru.¹³; Mimosaceae: *Acacia* sds^{11,28}; Moraceae: *Ficus* fru.^{2,8}; *Morus* fru.³⁰; Myrtaceae: *Eucalyptus robusta* nectar²⁹; Oleaceae: *Olea europaea* fru.³³; Proteaceae: *Grevillea robusta* nectar³⁷; Rosaceae: *Malus* fru.¹⁸; *M. sylvestris* fru.¹; *Prunus domestica* fru.¹⁸; *Pyracantha* fru.^{24,25}; *Pyrus communis* fru.¹; Rutaceae: *Citrus sinensis* fru.³⁴; Solanaceae: *Capsicum* fru.²¹; Vitaceae: *Vitis vinifera* fru.². **Animals** Invertebrates^{14,24,25}. **TICKS**⁸. **INSECTS**^{1,2,13,16,18,18,31}; Coleoptera¹³: larv.¹¹; Carabidae¹¹; Curculionidae¹³; Scarabaeidae^{11,34}: larv.³; *Heteronychus arator*^{13,34}; Staphylinidae³⁴; Diptera^{19,34}; Muscidae¹¹; Stratiomyidae¹⁷; Hemiptera¹³: Cicadidae¹⁸: *Cyclochila australasiae*³⁷; Hymenoptera: Apidae^{11,26}; Formicidae^{10,11,13}; *Camponotus*¹²; alates³²; *C. nigriceps*¹¹; *Oecophylla smaragdina* alates²²; *Rhytidoponera*³⁴; Sphecidae¹¹; Lepidoptera: ads^{13,34}, larv.^{11,13}; Pyralidae: Crambinae⁶; Mantodea: Mantidae: *Tenodera australasiae*¹³; Orthoptera¹⁶: Acrididae: *Chortoicetes terminifera*⁴. **BIRDS:** Eggs⁵. **Other matter** Food scraps, including bread and crumbs^{7,13,15,20,23,25}; pet food^{35,36}.

REFERENCES: ¹ Campbell 1905; ² Ryan 1906; Anon. ³ 1910, 4 1948, ⁵ 2000; ⁶ Chapman 1915; ⁷ Barrett 1916; ⁸ Walker 1952; ⁹ Ryan 1953; ¹⁰ Carter 1966; Rose ¹¹ 1973, ¹² 1974, ¹³ 1999; ¹⁴ Jones 1983; ¹⁵ Morris 1983; ¹⁶ Gregory-Smith 1985; Lepschi ¹⁷ 1986, ¹⁸ 1993; ¹⁹ Clark 1990; ²⁰ Wells 1991; ²¹ Magarry 1992; ²² Johnson 1993; ²³ Larkins 1993; Pell & Tidemann ²⁴ 1994, ²⁵ 1997a; ²⁶ Ramm 1996; ²⁷ Kutt & Kemp 1997; ²⁸ McCulloch 1997; ²⁹ Gosper 1999; ³⁰ Hubregtse 1999; ³¹ Perkins 2000a; ³² Simpson 2000; ³³ Spennemann & Allen 2000; ³⁴ FAB; ³⁵ R.H. Loyn; ³⁶ M. Onty; ³⁷ J.M. Peter.

Other records—NZ **Plants** Fruit^{4,5,7,10,13,15}, vegetables², seeds¹⁴. **GYMNOSPERMS:** Podocarpaceae: *Dacrycarpus dacrydioides* fru.¹⁷. **MONOCOTYLEDONS:** Agavaceae: *Phormium* nectar^{17,20,21}; Poaceae: seeds¹⁴. **DICOTYLEDONS:** Moraceae: *Ficus* fru.¹⁶; Myrtaceae: *Feijoa* calyx¹⁸; Rosaceae: *Fragaria vesca* fru.³; *Malus sylvestris* buds³, fru.^{2,3,20}; *Prunus avium* fru.³; *P. domestica* fru.³; *P. persica* buds³, fru.³; *Pyrus communis* fru.³; *Rubus* fru.³; Solanaceae: *Lycopersicon esculentum* fru.³; Vitaceae: *Vitis vinifera* fru.^{3,13}. **Animals** Carrion^{5,20}; animal matter⁷; invertebrates¹³. **ANNELIDS:** Oligochaetes: earthworms^{13,15}. **MOLLUSCS:** Gastropods¹³. **SPIDERS**¹³. **INSECTS**^{9,15,19}: larv.¹⁵; Coleoptera¹³: larv.¹³; Diptera¹³; Hemiptera¹³: Cicadidae: *Amphisalta*⁵; Hymenoptera: Vespidae: *Vespula germanica*¹⁸; Lepidoptera: larv.^{13,14,15}; Phthiraptera¹. **REPTILES:** Lizards^{12,13}. **BIRDS:** Eggs¹³; chicks¹³; Alcedinidae: *Todiramphus sanctus* eggs¹¹; Columbidae: *Hemiphaga novaeseelandiae* eggs^{6,8}; Meliphagidae: *Prosthemadera novaeseelandiae* eggs^{6,8}; Platycercidae: *Platycercus* eggs²²; Callaeidae: *Callaeas cinerea* eggs⁶; *Sturnus vulgaris* eggs¹⁹. **Other matter** Bread^{4,5}; scraps^{4,5,13}; milk^{1,15}; mash¹⁵.

REFERENCES: Cunningham ¹ 1948, ² 1951; ³ Dawson & Bull 1970; Councilman ⁴ 1974a, ⁵ 1974b; ⁶ St Paul & McKenzie 1974; ⁷ Watling 1975; ⁸ McKenzie 1979; ⁹ Wilson 1979; ¹⁰ Dunn 1981; ¹¹ Moon 1991;

¹² Bell 1996; ¹³ Heather & Robertson 2000; ¹⁴ Oliver; ¹⁵ NZRD; CSN 16 4, 17 19 Suppl., 18 20, 19 21, 20 24, 21 29, 22 41.

Young Fed by both sexes (see Breeding). Nestlings up to 10 days old fed only on invertebrates, mostly insects; thereafter, also fed small amounts of fruit and bread. In Auckland, cicadas comprised up to 90% of items given to nestlings ≥ 2 weeks old (Counsilman 1974b). At Stirling, ACT, pair made four feeding visits in one 10-min period, and six visits in another (Johnson 2000). Insects fed to young near Hastings, NI, were larger than those eaten by adults (Wilson 1965).

Detailed studies At HASTINGS, HAWKES BAY, NI (gut contents of four nestlings; Wilson 1965): **ANIMALS** INSECTS: Coleoptera (ads) 17 (total number of items), 40.0 (mean % vol.), 4 (number of nestlings containing item): Cerambycidae; Curculionidae: *Graphognathus leucoloma*; Staphylinidae: *Cafius*; Diptera 1, 10, 1: Syrphidae: ad.; Hemiptera (ads) 11, 29.5, 4: Cicadidae: *Kikihia muta*; *Notopsalta sericea*; Nabidae: *Reduviolus capsiformis*; Pentatomidae: *Dictyotus caenosus*; *Nezara viridula*; Lepidoptera 13, 14.3, 4: ads 1, -, 1, larv. 12, -, 4; Crambidae: larv.; Coleophoridae: *Coleophora spissicornis* cocoons; Noctuidae: ads, larv.; Pyralidae: larv; Orthoptera 3, 27.5, 2: Acrididae: *Phaulacridium*.

At HAVELOCK N., HAWKES BAY, NI (Gizzard contents, including 218 invertebrate items, of 16 nestlings 3–18 days old; Moeed 1975): **Plants** DICOTYLEDONS: Rosaceae: *Malus sylvestris* fru. 4 (number of birds containing item); *Prunus persica* fru. 4; Solanaceae: *Solanum nigrum* fru. 3. **Animals** (First figure refers to % no. of invertebrate items [excluding Oligochaetes]; second figure refers to number of birds containing item.) ANNELIDS: Oligochaetes -, 7. MOLLUSCS: Gastropods: snails 3.2, 6. CRUSTACEANS: Isopods 1.8, 2. DIPLOPODS 0.9, 1. SPIDERS: Lycosidae 3.7, 4. INSECTS (All adults): *Macylothorax* 0.9, 1; Coleoptera: Cerambycidae: *Oemona hirta* 1.8, 3; Carabidae: *Hypharhax* 3.2, 4; Curculionidae: *Graphognathus leucoloma* 5.0, 4; *Hyperodes* 3.7, 2; *Listroderes* 1.8, 1; Elateridae: *Lacon variabilis* 3.7, 3; Scarabaeidae: *Costelytra zealandica* 6.9, 8; *Saprosites* 4.1, 4; Staphylinidae: 1.4, 2; Dermaptera: Forficulidae: *Forficula auricularia* 0.5, 1; Diptera: Calliphoridae 2.3, 2; Muscidae 11.9, 8; Hemiptera: Cicadidae: *Rhodopsalta* 18.3, 15; Pentatomidae: *Dictyotus* 6.4, 5; Hymenoptera: Ichneumonidae: 5.0, 3; Lepidoptera: Noctuidae 1.4, 1, larv. 3.2, 3; Pyralidae: *Crambus* 4.1, 2, larv. 0.9, 1; Odonata: Coenagrionidae: *Xanthocnemis* 3.7, 4. **Other matter** Eggshell -, 3; rubber band -, 2.

Other records—Aust. **Plants** Fruit². MONOCOTYLEDONS: Poaceae: lvs². DICOTYLEDONS: Anacardiaceae: *Mangifera indica* fru.¹; Solanaceae: *Capsicum* fru.¹. **Animals** MOLLUSCS: Piece of shell². INSECTS: Coleoptera²; Lepidoptera². (REFERENCES: ¹ Magarry 1992; ² Rose 1999.)

Other records—NZ **Plants** Fruit^{1,2}. **Animals** Invertebrates¹. ANNELIDS: Oligochaetes³. INSECTS¹: Hemiptera: Cicadidae (probably *Amphisalta*)¹. **Other matter** Bread¹. For items fed to nestlings in aviary, see Counsilman (1974b). (REFERENCES: ¹ Counsilman 1974b; ² Wilson 1979; ³ NZRD.)

Interspecific comparisons: For comparison of diets of nestlings of Mynas and Common Starlings, see Common Starling: Food (Interspecific and intraspecific comparisons).

Intake In NZ, diet reported to comprise 50–60% fruit and 40–50% animal material (Watling 1975). At Whangarei, NI, one ate eight wasps in 2 min (CSN 20).

SOCIAL ORGANIZATION Some aspects well known in HANZAB region; and some additional extralimital information available (Feare & Craig 1998; BWP). **DETAILED STUDIES:** Ecology studied in Canberra, Feb.–Dec. 1994 (Pell & Tidemann 1997a); and breeding biology and communal roosting activity studied over 2 years in Auckland, July 1969–June 1971 (Counsilman 1974a,b). **GREGARIOUSNESS:** In HANZAB region,

usually seen singly, in twos, or small flocks of up to ten (e.g. Hodgkins 1949; Watson & Wodzicki 1954; Condon 1958; McKenzie 1960; Gibson 1977; Gosper & Holmes 2002; CSN). In Aust., sometimes occur in larger flocks of up to 50 (e.g. White 1946; Forster 1951; Anon. 1957; Leach & Hines 1987; NSW Bird Rep. 1980), though tend to form larger foraging flocks in autumn and winter, occurring in smaller numbers in late spring and summer (Pell & Tidemann 1994; see also Food). In NZ, often occur in flocks of 15–50 in autumn and winter (e.g. Bell 1976; Counsilman 1977; CSN 3, 5, 8, 24), and occasionally in larger flocks of 200–400 (CSN 6, 8, 9). During non-breeding season, first-year birds and unpaired adults regularly form flocks; birds with breeding experience usually seen in pairs, but sometimes briefly join flock or congregate with other pairs of adults (Counsilman 1974a). In both Aust. and NZ, sometimes occur in huge flocks when gathering to roost, and at roost-site (see Roosting).

Bonds Monogamous; form lifelong pair-bond after completing first successful breeding effort (Wilson 1973). Initially form temporary pair-bond within flock during first winter and spring (Wilson 1973). If partner dies, obtain new partner from within flock or on territory (Wilson 1973). **Co-operative breeding** One nest said to have been attended by three birds (Fitzsimons 2001). **Parental care** Both sexes incubate and feed young (see Breeding). In Auckland, in Jan. and Feb., fledgelings from first brood remained in parental territory for 1–2 weeks, before being chased out; but in Mar. and Apr. adults with fledgelings seldom attempt to re-nest, and family groups may persist for 3–4 weeks (Counsilman 1974b).

Breeding dispersion Breed in pairs (e.g. Booth 1963; Counsilman 1974b; Draffan *et al.* 1983); in Auckland, recorded at c. 0.22 pairs/ha (Counsilman 1974a). **Territories** Defend territory during breeding season (Booth 1963; Wilson 1973). In NZ, defended from Oct. to late Jan. or early Feb. (Counsilman 1974a, 1977); of 53 territories in Auckland, 20 developed from home-ranges (see below) in late Oct., and rest formed by non-resident pairs early Nov. to late Dec. (Counsilman 1974b). Mean size of territory 0.83 ha (0.27; 0.09–1.38; 51), and territories comprised large areas in which both nesting and most foraging occurred, though most pairs spent part of each day outside territory. Time spent outside territory varied with location, stage of reproduction, time of day, and day of week; most pairs with active nests left for only short periods (Counsilman 1974b). In Hawkes Bay, NI, territories 0.8–2.0 ha (Wilson 1973); at unknown location, one territory c. 0.4 ha (Booth 1963). In Canberra, area of territory defended varied much; nest-site actively defended, but apparently did not defend large feeding territories (Pell & Tidemann 1997a). **Home-ranges** Outside breeding season, many pairs with breeding experience continue to visit former territory (Counsilman 1974a,b, 1977; Pell & Tidemann 1994), and some pairs spend much of day in particular trees or areas that correspond to former territory (Counsilman 1974a; Pell & Tidemann 1994); that area not defended, and has been termed 'home range' (Counsilman 1974a,b; Pell & Tidemann 1994), though movements not confined to home-range, and pairs commute daily between home-range and communal roost each morning and evening (Counsilman 1974a; see also Roosting). In Auckland, some territories and home-ranges occupied throughout 19-month study (Counsilman 1974b).

Roosting Usually roost communally at night in roosts that vary in size from a few birds to several thousand (see below). Most roost communally throughout year (Counsilman 1974a). When incubating and brooding, female roosts in nest at night for 14–17 days before joining male partner at communal roost (Wilson 1973; Counsilman 1974a,b). Fledgelings roost with parents at communal roost, but not known how soon after fledging (Counsilman 1974a,b). **SIZE OF ROOSTS:** **AUST.:** Usually congregate in large roosts that vary from

c. 50–100 birds (e.g. Coleman 1945; Vic. Bird Rep. 1985) up to several thousand birds (e.g. Hindwood 1948; Davis 1964). In Wollongong, NSW, trees used for roosting usually held 40–80 roosting birds, with maximum 140 recorded in one tree; some held only 2–4 roosting birds (Wood 1995a). NZ: Usually congregate in large roosts of c. 100–300 birds (e.g. Councilman 1974a; CSN 5, 6, 21, 35), but larger roosts of 400 and c. 1000 birds have also been recorded (McKenzie 1960). SITES: AUST.: Recorded roosting in various sites. Most often roost in trees and shrubs, including cypress *Cupressus*, palms *Phoenix*, introduced pines, fig trees, and fir trees *Abies* (Coleman 1945; White 1946; Wood 1995a; Pell & Tidemann 1997a; Waterhouse 1997; Vic. Bird Rep. 1985); one roost in ivy *Hedera* growing through dead eucalypt (Pell & Tidemann 1997a). Also often roost in huge numbers on girders within roofs of buildings or under bridges (Hindwood 1948; Davis 1964; J.M. Peter). In Canberra, roosts were 100–700 m from breeding sites, but were probably temporary summer roosts (Pell & Tidemann 1997a). Sometimes share roosts with other species including Rainbow Lorikeets *Trichoglossus haematodus* (Waterhouse 1997), House Sparrows (Wood 1995a) and Common Starlings (Davey 1992; Wood 1995a,b). NZ: Usually roost in trees and shrubs, including cypress *Cupressus* (CSN 5), palms *Phoenix*, and pines *Pinus* (McKenzie 1960; Councilman 1974a; CSN 5, 35), and once recorded roosting in hedge (CSN 6). Also use buildings (Wilson 1973). Distance from foraging areas to roost-site probably up to c. 3 km (Hindwood 1948; Councilman 1974a). Often share roosts with House Sparrows and Common Starlings (Councilman 1974a). PATTERNS OF USE: Some roost-sites used throughout year, others used temporarily, e.g. only for c. 2 weeks in spring and summer (Coleman 1945; Councilman 1974a,b; Pell & Tidemann 1997a); in 2 years in Auckland, temporary roosts were formed in late Oct. and abandoned late Jan. and early Feb. (Councilman 1974a,b). For most of year in both Aust. and NZ, birds usually assemble near roost-site, usually starting to gather c. 25–40 min before sunset, before entering roost (Coleman 1945; Hindwood 1948; McKenzie 1960; Wood 1995b), but sometimes up to 80 min before sunset (Councilman 1974a; Wood 1995b). Most usually enter roost round sunset, with some starting 5–30 min before sunset, and all usually in roost by 5–10 min after sunset (Coleman 1945; White 1946; Hindwood 1948; Peart 1960; Councilman 1974a; Wood 1995a,b), though during breeding season sometimes continue to enter roost till 15–20 min after sunset (Peart 1960; Councilman 1974a), with those arriving late probably breeding males that remained on breeding territory till sunset (Pell & Tidemann 1997a). In Auckland, earliest time when at least half had assembled at roost was 23 min before sunset. All had usually entered roost before evening civil twilight, and at least half had usually assembled at roost within period between 18 min before sunset and 18 min after sunset. For roosts of >50 birds, in Sept.–Apr., assembly at roost-site took 44 min (12.0; 15–70; 58). Periods of arrival tend to be shorter in winter (by up to 15 min) than in other seasons (Councilman 1974a). In both Aust. and NZ, departure from roost-site in morning corresponds closely with start of morning civil twilight (MCT) (Coleman 1945; Councilman 1974a). In Auckland, timing of departure also affected by weather; on clear mornings, first departures were mean 5 min before MCT (from 9 min before to 3 min after), but on overcast or rainy mornings, mean 2 min before MCT (from 8 min before to 7 min after); difference significant ($P < 0.01$). Furthermore, on sunny mornings, all roosting birds departed over mean of 20 min, significantly less than mean 31 min on cloudy or rainy mornings ($P < 0.01$). For roosts of >50 birds in Sept.–Apr., departure from roost-site took mean 23 min (4.7; 16–36; 19). Departure times differed only slightly between summer and winter; in winter, mean 20 min ($n=4$) and in summer, mean 29 min ($n=5$). In Auckland, first departures

from roosts occurred in lower light-levels (i.e. departed roost earlier) during breeding season than at other times of year. Territory-owners probably first to leave roost during summer, since first call from territory usually heard a few minutes after first departure from roost, and calling of territorial birds was greatest c. 8–10 min later (Councilman 1974a). APPROACH TO ROOST SITES: Arrive at roost from all directions (Davis 1964). At some roosts, usually arrive singly or in twos, or sometimes in flocks of 10–25 (Hindwood 1948; Peart 1960; Councilman 1974a; CSN 5), and at other roosts, usually arrive in flocks of 6–12, sometimes in larger flocks of up to 50 (McKenzie 1960); at one roost in Sydney, about one third arrived in twos, presumably pairs (Hindwood 1948). Often fly directly from foraging areas to roost-site (e.g. Wood 1995b; Pell & Tidemann 1997a). Near Clevedon, NI, did not always fly in straight line to roost, and occasionally landed and foraged *en route* (McKenzie 1960). Often assemble on ground before entering roost (see Social Behaviour). When entering roost in palm, usually perched for several minutes on uppermost fronds before moving closer to trunk, landing among bases of fronds, where other birds clustered (Wood 1995b). DEPARTURE FROM ROOST SITES: Usually leave roost in twos, sometimes singly, and occasionally in groups of three or more (Coleman 1945; Councilman 1974a). In non-breeding season, birds flew from roosts directly to foraging areas, and in breeding season, territory-owners appear to fly directly to territories (Councilman 1974a).

SOCIAL BEHAVIOUR Some aspects of behaviour well known in HANZAB region; some additional extralimital information available (see Feare & Craig 1998; BWP). **DETAILED STUDIES:** Visual displays studied in Auckland, using both captive and free-living birds; free-living birds observed July 1969–June 1971 (Councilman 1971, 1977). Described as pugnacious (Cobcroft 1993). **Maintenance behaviour** Both in Aust. and NZ, often recorded ANTING by placing ants directly onto plumage, usually beneath wings (Chisholm 1935; Wheeler 1951; McLintock 1959; Bathgate 1960; Ordish 1980). With wings held slightly away from body, bird picks up ant in bill, then quickly rubs it into plumage under wing, then discards ant and repeats action (Wheeler 1951; Bathgate 1960). Sometimes also rub ants on thigh, through tail-feathers or onto breast (McLintock 1959; Ordish 1980). Very occasionally eat the ants after finishing anting (Carter 1966; *contra* McLintock 1959). While anting, move about continuously, sometimes jumping and sometimes appearing frenzied (Wheeler 1951; Bathgate 1960; Ordish 1980); once described as almost sitting right back on tail while anting (Bathgate 1960). Once, anting lasted for at least 15 min (Wheeler 1951). Sometimes ant in company with other species, including House Sparrows and Common Starlings (Wheeler 1951; Ordish 1980). **Behaviour at or near roost** Sometimes utter short calls while flying to roost (McKenzie 1960). Occasionally individuals fly to roost-site in fast, twisting approach; usually performed by single late arrivals, possibly to avoid predators (Councilman 1974a). While assembling near roost-site before entering roost, spend most time foraging, and rest in social interaction or resting (McKenzie 1960; Councilman 1974a). Sometimes individuals fly from roost-site and circle round before settling (Coleman 1945). Usually perform chorus of calling at roost-site each evening (see Voice). **Flock behaviour** Movement of flock co-ordinated by Flight-calls (Councilman 1971; see Voice). Near Clevedon, NI, when approaching roost-site, most flew low over paddocks towards roost, just clearing hedges and other obstacles (McKenzie 1960). **Aberrant behaviour** Once, two adults pecked and tossed about a dead Myna nestling, probably from their own nest; alternately, one perched nearby while other pecked corpse, tossed it about and danced around,

fluttering; continued in turns for >20 min till one flew off with corpse (Johnson 2000).

Agonistic behaviour Vocalizations, including Song, appear to be used for territorial defence during breeding season, but also used in sexual contexts (Councilman 1971, 1974b). Territories defended by both sexes with vocalizations, supplanting attacks and physical combat (Councilman 1974b). In interactions between two birds, several threat displays have been described by Councilman (1971, 1977): **HEAD-FORWARD DISPLAY**: Performed while facing opponent with body nearly horizontal, legs flexed, feathers of body sleeked, and bill open. Often thrust head forward, either as single jab that does not contact opponent, or as peck that apparently causes no injury. While performing display, patch of yellow skin below eye appears larger than when resting, and seldom call, though a loud single note uttered occasionally. Most commonly observed threat display, and often performed between both paired (see Sexual Behaviour) and unpaired birds. **FENCING DISPLAY**: Consists of counter-jabbing movements that usually develop from both opponents performing Head-forward Display. Each bird withdraws head, closes bill, fluffs feathers of body, and raises feathers of crown and nape to create small crest. Bill often lowered, but promptly raised and opened to block jab from opponent. As Fencing progresses, feathers of breast raised, birds stand taller, thrusting and blocking become weaker, and calling becomes louder. Usually lasts 5–10 s, sometimes 30 s, and ends when one flees, both perform Standing Display (see below), or both stop displaying. Sometimes both behave similarly, sometimes one clearly more dominant. Dominant bird usually thrusts vigorously and often. Submissive bird usually crouches, often leaning away, raises feathers of crown and nape more than opponent, thrusts weakly, and calls loudly. **STANDING DISPLAY**: Usually performed during territorial disputes. Both birds stand fully erect, facing each other with bills held high and close together, calling loudly and weakly thrusting at each other. Feathers of upperparts, crown and nape raised, tail partly spread and wings held away from side of body. **JUMPING**: Usually performed by two pairs during territorial disputes, and occasionally at pre-roosting assembly; sometimes performed by up to four pairs. Birds leap c. 1 m into air, apparently displaying white patches of wings and attempting to grab head of an opponent with claws. Sometimes accompanied by single call-notes (Councilman 1971, 1977). **SUPLANTING**: One flies directly at another, which rapidly concedes its position, fleeing before threat or fighting can occur; neither bird calls. Only observed during defence of territory (Councilman 1971, 1977; Pell & Tidemann 1997a). **Fighting** Consists of pecking, especially at crest, while wrestling on ground and calling loudly and almost continuously. Often occurs between periods of Jumping, Standing Display and Bowing Display (see Sexual Behaviour). During territorial disputes, often fight with no preliminary threat display, and fights over food and at roost-sites are brief and seldom include other displays (Councilman 1977). Males fight with males and females fight with females (Wilson 1973). Often occur early in breeding season but seldom after mid-Jan., when most pairs had active nests or fledgelings (Councilman 1974b). Occasionally several attack one lying on ground with wings outstretched; victim usually killed (CSN 20). Once, one attacked its own reflection in car bumper (CSN 22). **Submissive displays** On surfaces that can be grasped with feet, submissive bird sometimes performs **LEANING DISPLAY**: Body and neck extended and leaned away from bird approaching from side; feathers of body sleeked and face turned away, possibly to hide bill, eye-patches or both; do not call. Sometimes occurs at communal roosts (Councilman 1977). **Intra-pair aggression** Occasionally on day before laying or when nest had eggs, male violently attacked and chased mate for 5–15 s; also observed in captivity (Councilman

1977). Motive unknown, possibly a form of mate-guarding, or possibly sexual in nature. **Interspecific interactions** Aggressive towards other species; seen harassing Silver Gulls *Larus novaehollandiae*, Black-billed Gulls *Larus bulleri*, Rock Doves *Columba livia*, Spotted Turtle-Doves, Superb Parrot *Polytelis swainsonii*, Red Wattlebirds, Australian Magpie, House Sparrows, Common Blackbirds and Common Starlings (Booth 1963; Councilman 1974b; Peters & Peters 1993; Perkins 2002; CSN 41). Often usurp nest-hollows of other species (see Breeding); once, two Mynas attacked pair of Eastern Rosellas *Platycercus eximius* for c. 5 min till Rosellas flew away from nest-site (Wright & Wright 1991a). Often recorded destroying nests or eggs, or killing nestlings of Common Starlings (Stoddart 1956; Wright 1962; Councilman 1974b; Moed 1975; CSN 21). At one Starling nest, two Mynas pulled large, partly feathered nestling from nest; each gripped wing of nestling with bill; they flew together for c. 20 m before dropping nestling to ground from height of c. 5 m; repeated with three more nestlings, which were not killed by fall but died soon afterwards (Stoddart 1956). Similar behaviour seen at other nests (e.g. Wright 1962). Once recorded killing four fledgeling and one immature House Sparrow with pecks to side of neck (Macdonald 1951). Once, three seen attacking Cat (CSN 22). Once, over 20 min, two repeatedly killed individual bees *Apis* that were attempting to inspect hollow; each Myna repeatedly flew from perch c. 1 m from hollow and grabbed bee in bill, usually dropping it after biting it, but sometimes returned to perch and killed it by scraping bill on bark (Ramm 1996). **Alarm** Utter Alarm Calls upon detecting predator such as Brown Goshawk *Accipiter fasciatus* or New Zealand Falcon *Falco novaeseelandiae* (e.g. Porter & Dawson 1968; Bounds 2000), or on approach of predator near nest (Councilman 1971; see also Voice). One evaded capture by Australian Hobby *Falco longipennis* by flying into dense foliage of tree (Cameron 1933a). In presence of predator, said to watch from conspicuous perch or fly towards predator in small noisy group rather than take refuge (Ryan 1906). Sometimes join other species in chorus of Alarm Calls, e.g. once, several perched on power-lines among group of 30 birds comprising five other species, and all called in response to presence of Brown Goshawk (Bounds 2000); and once, one joined alarm calling of eight Blue-faced Honeyeater *Entomyzon cyanotis* and two Noisy Miners *Manorina melanocephala* in response to fight between two Magpie-larks and an immature Blue-faced Honeyeater (Cobcroft 1993). Once when Tawny Frogmouth *Podargus strigoides* near nest-hollow, Mynas appeared agitated and hopped round branches, but were not very vocal (Fitzsimons 2001); contents of nest unknown.

Sexual behaviour Both sexes use vocalizations (probably Song) in sexual context as well as for territorial defence (Councilman 1971). When partner dies during breeding season, Loud Calls appear to serve as advertisement to opposite sex (Councilman 1974b). When nesting, male occasionally attacks or chases mate, but motive for these not known, but possibly sexual (see Agonistic behaviour). **Pair formation** In early stages of pairing, male and female repeatedly perform prolonged Head-forward and Fencing Displays (see Agonistic Behaviour), though fleeing delayed or absent. Light pecking also often seen, especially by males. As pair-formation progresses, threatening and fleeing behaviour gradually decline, being replaced by Placing and Bowing Displays (see below) (Councilman 1971, 1977). **Pair-bond maintenance** Vocalizations thought to maintain pair-bonds throughout year (Councilman 1974b). Several displays thought to be important in formation and maintenance of pair-bond, including Head-forward, Fencing (see Agonistic Behaviour), Placing and Bowing Displays (see below); these occur throughout year (Councilman 1977). **PLACING DISPLAY**: Mates stand side by

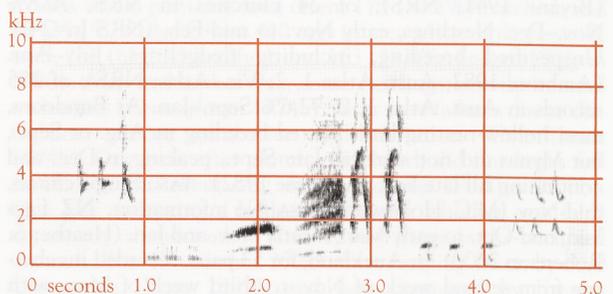
side and place their open bills together in stylized manner while crouching slightly, extending necks forward slightly and vocalizing; usually lasts 5–10 s and bills occasionally touch (Counsilman 1977). Vocalizations probably include Song and other calls (BWP). Often one of pair does not call, but sometimes gives Bowing Display (Counsilman 1977; see below). Sometimes performed at roost (Counsilman 1974a). **BOWING DISPLAY:** Initially, feathers of crown, neck and scapulars rapidly ruffled, tail partly spread and wings slightly drooped. Tail then spread widely and neck extended as bill lowered to within few centimetres of ground or perch. Movement rigidly stylized and lasts 0.4 s. Head then raised to three-quarters of usual position, usually followed by three or four short bows (range 1–10), in which head dropped to level of first bow, but not fully raised. Time between successive short bows 0.3–0.7 s, and c. 0.6 s for final raising of head. After completing bows, retract neck and close tail, but feathers of body remain ruffled for many seconds before relaxing or bowing resumes (Counsilman 1977). Accompanied by several vocalizations (Counsilman 1977); these probably include Song and other calls (BWP). Sometimes performed without raising feathers of body, and sometimes with little or no spreading of tail, especially in females. Often give intention to bow by performing all components of Bowing Display except actual bowing action. Most often performed by pairs on territory or home-range, but can be given by both paired and unpaired birds in many situations, e.g. while foraging or at roost (Counsilman 1977). **Allopreening** Not observed (Counsilman 1977). **Copulation** Occasionally, Placing Display results in both mates simultaneously performing Bowing Display, followed by copulation. After bowing, female sleeks body-feathers, crouches deeply, raises head and vibrates tail from side to side. Male then stops bowing but his feathers remain ruffled as he mounts female and balances on her back with partly opened wings. Male then lowers half-spread tail and pushes tail of female aside. Copulation lasts 1–2 s, after which pair preen, forage or rest. Observed only in Nov.–Jan., but at varied times of day; seen on ground (n=2), in trees (n=3), and on buildings (n=2) (Counsilman 1977).

Relations within family group, Anti-predator responses of young No information. **Parental anti-predator strategies** At nests with nestlings, parents swoop at potential predators such as Cats, Dogs and people that approach (Booth 1963).

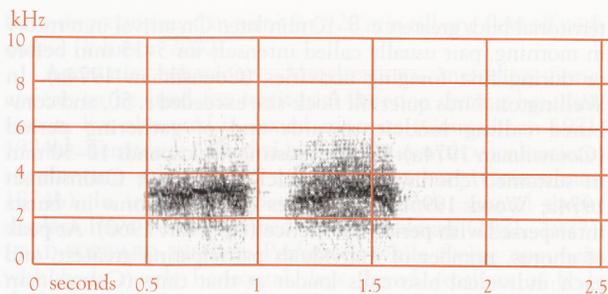
VOICE Familiar, but little published in HANZAB region; slightly better known extraliminally (see Feare & Craig 1998; BWP). Sonagrams in Counsilman (1971). Possess many varied vocalizations, many of which probably form part of Song (see below). Considered to be loud and noisy (e.g. Macdonald 1951; Counsilman 1977; Pizzey 1980; Cobcroft 1993). Make din while gathering at roost in evening that audible some distance away (White 1946; McKenzie 1960; Davis 1964; Wood 1995b; CSN 5), and variously described as loud, discordant chattering and squawking (Hindwood 1948; McKenzie 1960). In roost shared with Common Starlings at Wollongong, NSW, calls of Mynas audibly dominant, largely drowning out those of Starlings (Wood 1995b). **ANNUAL PATTERN:** Loud vocalizations (probably Song) occur throughout year (Counsilman 1974b), though given more often during breeding season (Counsilman 1971). **DIURNAL PATTERN:** Vocalizations given at any time of day, but peak in morning shortly after arrival in territory (Counsilman 1974b). Time of first vocalizations in morning vary from day to day, but periods of sustained calling or singing usually start 32–87 min before sunrise (Counsilman 1974a). Once at Rotorua, NI, started singing at about sunrise (Taylor 1975). In Wellington, estimated that entire roosting flock spent 34 min in sustained calling before any birds left roost in morning, and calling continued during departure. During breeding season, first calls from territory given a few minutes after first departure from roost, and calling of

territorial birds greatest c. 8–10 min later. On arrival in territory in morning, pair usually called intensely for 5–15 min before or during first foraging activities (Counsilman 1974a). In Wellington, birds quiet till flock-size exceeded c. 50, and combined calling loudest towards end of gathering period (Counsilman 1974a). Whole roosting flock spends 10–30 min in sustained chorus of calls (McKenzie 1960; Counsilman 1974a; Wood 1995b), sometimes uttering chorus in bursts interspersed with periods of silence (e.g. Peart 1960). At peak of chorus, number of individuals participating greatest, and each individual also calls louder at that time (Counsilman 1974a). Chorus usually finishes 17–30 min after sunset (White 1946; McKenzie 1960; Peart 1960; Wood 1995b), though some calling heard intermittently throughout night (Coleman 1945; Hindwood 1948). **MIMICRY:** At Opuawhanga, NI, heard imitating a Dog and a duck (CSN 30). Mimicry heard extraliminally (Ali & Ripley 1972; BWP). **NON-VOCAL SOUNDS:** No information.

Adult SONG: Appears to consist of combination of varied notes including raucous, creaky notes, growls, loud, clear and mellow whistles, harsh rattles, and softer chattering (Pizzey 1980; Morcombe 2000; Aust. RD); possibly includes most of the varied sounds that they produce, including calls (A.M. Dunn). One sequence that includes high chips, low croaks, squawks, and grunting sounds shown in Sonagram A. One common sequence rendered as *hee hee chirk-a chirk-a chirk-a*, with other notes described as *pen hawn heal, pip-e* and throaty *donck* (Counsilman 1971). Other sequences include high, clear and vigorous *wheoo wheoo wheoo*, harsh, rattling *carrarrk carrarrk* and sharp *tseit-tseit* (Morcombe 2000). **LOUD CALLS:** Distinction between sequences of Song and Loud Calls not clear; some phrases are repeated several times and possibly used as contact calls rather than Song (A.M. Dunn). Sequences described as *choke him, choke him* (Bryant 1928), or *oh-kick oh-kick* (Aust. RD), could be either Loud Calls, or constitute phrases of Song (A.M. Dunn). Loud Calls thought to function in maintenance of pair-bonds and to proclaim a territory (Counsilman 1974b). When partner dies during breeding season, Loud Calls also appear to serve as advertisement to birds of opposite sex; one bird of unknown sex whose mate had died called at least 293 times during 40 min (Counsilman 1974b). **FLIGHT CALL:** Utter clear, liquid note on taking flight (Pizzey 1980; Morcombe 2000). **ALARM CALLS:** Harsh *scairr!*, somewhat like tearing cloth (Pizzey 1980). See Sonagram B. Once gave alarm calls when New Zealand Falcon flew over (Porter & Dawson 1968). One called loudly, probably Alarm Calls, during noisy dispute between several other species (Cobcroft 1993). **CHIP CALL:** Mostly descending sounds <0.1 s in duration and centred at 2.5 kHz, with harmonics up to 8 kHz or more. Uttered by adults with fledgelings and between mates when physically separated, e.g. at communal roost. Effective over short to long distances (Counsilman 1971). **Other calls** Two squawked loudly while raiding nests of sparrows *Passer* and killing nestlings (Macdonald 1951).



A R. Buckingham; Ashwood, Vic., Jan. 1992; P94



B R. Buckingham; Melbourne, Vic., Jan. 1982; P94

Chatter while foraging near roost-site, and when approaching roost, utter odd short yelping calls and chortles in flight (McKenzie 1960). Utter loud notes during Head-forward Display, Standing Display, Jumping, and nearly continuously during fighting (Counsilman 1977), but not known which calls used. Similarly, calls uttered during Placing Display and Bowing Display (Counsilman 1977) not described. While settling to roost, utter range of vocalizations that all sound similar or identical to those given during day; like those used during day, calls at roost thought to act as contact, recognition, threat and appeasement calls (Counsilman 1974a). Calls heard from roost in last few minutes of twilight included rasping notes and soft contact calls (Wood 1995b).

Young No information in HANZAB region. Extraliminally, nestlings utter thin, tittering squeak, 2–3 days after hatching; older nestling utter rapid twitter on arrival of parent at nest with food (BWP).

BREEDING Fairly well known; single-season studies in Auckland (Counsilman 1974b) and at two reserves in Canberra (Pell & Tidemann 1997a); study of use of tree-hollows and nest-boxes round Bundoora, Vic. (Ambrose 1982); and study over 6 years of effects of organochlorine pesticides on breeding in Hawkes Bay, NI (Wilson 1980). Total of 70 records in NRS to Dec. 2003.

Season Breed later than other hollow-nesting species, with eggs, Aug.–Jan. in s. Aust., though most clutches in Nov. and Dec.; in n. Aust., laying extends till Mar.; in NZ, eggs, Oct.–Mar. (see below). **Aust. QLD:** *N. QLD:* Eggs, Aug.–Mar. (Lavery *et al.* 1968). Nestlings, Oct. and Dec. (NRS). Unspecified breeding, including fledgelings, recorded Aug.–May (Bravery 1970; Storr 19; Aust. Atlas 1, 2; NRS). **SE. QLD:** Unspecified breeding Aug.–Mar. (Aust. Atlas 1, 2). **NSW–ACT:** Eggs, Aug.–Jan. (Morris *et al.* 1981; Perkins 2000b; ACT Atlas; NRS [n=8]). Nestlings, late Sept. to mid-Feb. (FitzGerald 1990; Johnson 2000; ACT Atlas; NRS [n=14]). Unspecified breeding, including fledgelings, late July to Mar. and May (Veerman *et al.* 1989; Pell & Tidemann 1997a; Johnson 2000; NSW Bird Repts 1993, 1998; Aust. Atlas 1, 2; ACT Atlas; NRS); from 201 breeding records in Aust. Atlas 1, 2: 83.9% Oct.–Jan. **VIC.:** Eggs, mid-Sept. to mid-Jan. (Bryant 1941; NRS); of 24 clutches in NRS, 70.8% Nov.–Dec. Nestlings, early Nov. to mid-Feb. (NRS [n=24]). Unspecified breeding, including fledgelings, July–Apr. (Ambrose 1982; Aust. Atlas 1, 2; Vic. Atlas; NRS); of 285 records in Aust. Atlas 1, 2: 92.6% Sept.–Jan. At Bundoora, most hollow-nesting birds started breeding in Aug. or Sept., but Mynas did not start till late Sept., peaking in Dec. and continuing till late Feb. (Ambrose 1982). **TAS.:** Single clutch, mid-Nov. (M.C. Holdsworth). **SA:** No information. **NZ** Eggs laid, mid-Oct. to early Mar., mostly Nov. and Jan. (Heather & Robertson 2000). In Auckland, for 53 pairs, recorded incubating from second week of Nov. to third week of Mar., with peaks in second week of Dec. (38% of pairs) and second week of Jan. (43%), and smaller peak in second week of Feb. (24%)

(Counsilman 1974b). Nestlings, Dec.–Apr. (Counsilman 1974b; Moeed 1975; Wilson 1979; CSN 19); in Auckland, from first week of Dec. to second week of Apr. (Counsilman 1974b). Unspecified breeding, including fledgelings, Nov.–Apr. (Cunningham 1954; Counsilman 1974b; Wilson 1979; CSN 19, 33, 34). In Auckland, onset of breeding coincided with rise in mean monthly temperature to 16° C, an increase in monthly hours of sunshine to 200 h, and a drop in monthly rainfall to <100 mm (Counsilman 1974b).

Site Usually nest in hollows or cavities: in hollow in branch or trunk of tree; or in cavity in artificial structure, such as under roof or in wall; also often in nest-boxes; (Cunningham 1948; Counsilman 1974b; Fleming 1976; Beruldsen 1977; Ambrose 1982; Morris 1986; Lenz 1988; FitzGerald 1990; Wilson 1992; Lindenmayer 1993; Pell & Tidemann 1997a; Waterhouse 1997; Beauchamp & Parrish 1999; Johnson 2000; Fitzsimons 2001; NSW Bird Rep. 1998; NRS). Also occasionally nest in tangle of dense vegetation (Counsilman 1974b; NRS); and in holes in cliffs, rock-stacks or roadside banks (Edgar 1971; CSN 22, 39). Of 64 sites in NRS, 27 (42.2%) in roofs, under balconies or in other cavities in buildings; 21 (32.8%) in tree-hollows, mostly in eucalypts; four (6.3%) in nest-boxes; four (6.3%) in tangles of vines; two (3.1%) between bales of hay in hayshed; two (3.1%) in hollow fence-posts; two (3.1%) in cavities in power-poles; and singles (1.6%) in top of palm tree and in traffic light (NRS). Of 67 nests in Auckland, most in buildings: 17 (25.4%) were under metal roofs, with gutter entrances; 12 (17.9%) in drain funnels on roofs; ten (14.9%) in air-vents; seven (10.4%) in vegetation (tree, palm or ivy); five (7.5%) in crevices beside pipes; five (7.5%) in holes in walls; five (7.5%) under roof tiles; four (6.0%) between drainpipes and walls; and singles (1.5%) in street light and crane (Counsilman 1974b). Round Bundoora, tended to use shallow to moderately deep hollows in medium branches, and avoided spouts; when nesting in unknown number of nest-boxes, c. 50% used those with entrance diameter 6 cm, c. 30% used those with entrance diameter 9 cm, and c. 20% used those with entrance diameter 12 cm; preferred nest-boxes which had been cleared of material to uncleared ones (Ambrose 1982, which see for more detail). Round Bundoora, of unknown number of nests, 69% built on old, flattened nests of Common Starling (Ambrose 1982). Often usurp nest-sites, or destroy nests of other species, including Galah *Eolophus roseicapillus*, Eastern Rosella, Sacred Kingfisher *Todiramphus sanctus*, House Sparrow and Common Starling; material of old nests occasionally removed and replaced; often eject or built on top of eggs, chicks and faecal-encrusted material (Moeed 1975; Moon 1989; Wright & Wright 1990; Lindenmayer 1993; Peters & Peters 1993; CSN 5). Recorded nesting in same tree as Southern Boobook *Ninox novaeseelandiae*, Dollarbird *Eurystomus orientalis* and Common Starling (Bryant 1941; NRS). For first nest of season, pairs usually spend several days inspecting sites; one bird does most inspecting and chooses final site, though continue to inspect other sites after final nest-site chosen; in captive birds, female usually does most inspecting of nest-sites (Counsilman 1974b). **SITE-FIDELITY:** Often use same site in successive years, and for successive broods in same season, but some change sites, whether previous nest successful or not (Counsilman 1974b; Heather & Robertson 2000; NRS); one pair successfully fledged young from same hollow in two or three seasons (Fitzsimons 2001); in Auckland, of 16 re-nestings after successful nest, 12 in same site and four in new one (Counsilman 1974b). **MEASUREMENTS (m):** **HEIGHT OF NEST:** In trees, 7.1 (5.66; 1.0–20; 22) (NRS); 20 (n=1) (FitzGerald 1990). In artificial sites, 3.3 (1.69; 0.2–10.0; 34) (NRS). In Auckland (all sites) c. 7.0 (1.5–25; 67) (Counsilman 1974b). **HEIGHT OF NEST-PLANT:** 22.7 (10.65; 8–40; 9) (NRS).

Nest, Materials Loose, untidy mass of material with

bowl-shaped central depression; made of twigs, grass, straw, leaves, feathers, and refuse, such as of pieces of paper, plastic, foil, cloth and string, and occasionally fur; nests either unlined or lined with soft material such as paper, green leaves and feathers; partly fill bottom or end of hollow with material, sometimes filling tree-hollows up to entrance (Counsilman 1974b; Ambrose 1982; Heather & Robertson 2000; Perkins 2000b; Fitzsimons 2001; NRS). Round Bundoora, nests in tree-hollows mostly made of twigs or straw; and birds nesting near lakes used much *Juncus* in nests; pairs nesting near Ponderosa Pines *Pinus ponderosa* were made almost entirely from pine needles (Ambrose 1982). One pair, occupying a nest-box erected for rosellas *Platycercus*, first removed most of the fine woodchips placed there for rosellas, then added own material (Perkins 2000b). Green leaves sometimes added to nest during incubation or brooding (Perkins 2000b; NRS); in one nest of four eggs, leaves were added after second egg laid, and 3 days after completion of clutch (Perkins 2000b). Extraliminally, said to cover eggs with green leaves, possibly to regulate relative humidity round eggs (Sengupta 1981). Both sexes build (Counsilman 1974b; Ambrose 1982; NRS); one nest took c. 3 weeks to build (Perkins 2000b). In Auckland, time spent building varied with site, date, and individually; first nests of season averaged 7 days between start of building and start of laying, with some taking 14 days; duration of building decreased as season advanced, when site re-used or when previous attempt failed at egg-stage, rather than with nestlings or fledgelings (Counsilman 1974b). Re-line nest for second clutches (NRS). One pair began building new nest in new site within hours of destruction of previous nest (Counsilman 1974b). MEASUREMENTS: Thickness of material in one nest, 5 cm (NRS). No other information.

Eggs Elliptical; usually glossy or very occasionally rough-surfaced; turquoise-green, greenish blue or bright blue, and unmarked (Beruldsen 1980; Perkins 2000b; Oliver). MEASUREMENTS: AUST.: 28.5 (2.34; 25.8–31.0; 7) × 21.1 (1.07; 20.1–22.7) (Perkins 2000b; NRS). NZ: 29 × 22 (Heather & Robertson 2000). WEIGHT: 8.5 (n=3; NRS); 7.5 (no N; Heather & Robertson 2000).

Clutch-size In Aust., two to five, usually three or four (Perkins 2000b; NRS); 3.59 (0.94; 2–5; 17): C/2 × 2, C/3 × 6, C/4 × 6, C/5 × 3 (NRS); in ACT, 3.8 (1.24; 41) (Pell & Tidemann 1997a). In NZ, one to six, usually three or four (Heather & Robertson 2000); four or five (Oliver); in Auckland, 3.88 (0.64; 8): C/3 × 2, C/4 × 5, C/5 × 1 (Counsilman 1974b); at Havelock N, mean size of first clutches, from inexperienced pairs, 3.5; for experienced pairs, 4.1 (Counsilman 1974b).

Laying Eggs laid on consecutive days (Counsilman 1974b; Heather & Robertson 2000; Perkins 2000b; NRS). Probably laid in morning (Perkins 2000b); in captivity, laid 07:00–09:00 (Counsilman 1974b). In one nest, first egg laid on day after building completed (NRS). Dump-laying recorded (Wilson 1979) but no further details. Usually raise two broods in a season, and re-lay after failure (Counsilman 1974b; Heather & Robertson 2000; NRS), though single-brooded round Bundoora (Ambrose 1982). Two replacement clutches started within 7 days of loss of first clutch, and two others within 9 days (NRS). In two nests, clutches were completed and incubation started, but eggs recorded for >30 days before hatching (over twice usual incubation period; see below); in both cases, there was a gap in observation of >2 weeks, and the birds could have removed first clutch and re-laid (NRS).

Incubation By both sexes (Baker 1933; Counsilman 1974b; Heather & Robertson 2000; NRS); mostly by female during day, though male may sit for short periods; by female only at night (Counsilman 1974b). In captivity, females spent 30–40% of daytime incubating, in mean stints of 9 min; males incubated for 4 min per stint; in wild, during 23 h observation,

males and females visited nests with eggs 4.7 times times/h (Counsilman 1974b). Begins with completion of clutch (Heather & Robertson 2000); or with laying of second egg; all eggs usually hatch within 24 h; in captivity, one clutch hatched over 3 days (Counsilman 1974b). INCUBATION PERIOD: 13–14, usually 14 days (Heather & Robertson 2000); from completion of clutch, 15 days (n=3 eggs; NRS); 11–13 days after completion of clutch (n=3 eggs; M.A. Weston).

Young Naked at hatching (M.A. Weston). Both sexes feed nestlings (Counsilman 1974b; Ambrose 1982; Heather & Robertson 2000; NRS). During 33-h observation, pairs visited nests with nestlings 11 times/h (Counsilman 1974b). One pair visited nest-hollow with food at c. 20 min intervals (NRS). Male mostly feeds young nestlings; when nestlings older, female plays greater role; mean interval between feeding visits, 2.5 min (no N); mean duration of visits, 20.4 s (Ambrose 1982). Remove faeces from nest (NRS). Once, Common Starling nestling found in nest with brood of three Mynas; origin unknown (Wilson 1979). WEIGHT (g): Weights of clutch of three nestlings at Altona, w. suburban Melbourne: 1–2 days old, 6.6–7.1; 2–3 days, 7.0–11.0; 3–4 days, 9.4–17.2; 4–5 days, 12.1–21.1; 5–6 days, 15.5–27.6; 6–7 days, 22.2–32.1; 7–8 days, 24.1–34.8 (M.A. Weston).

Fledging to independence FLEDGING PERIOD: In NZ, mean, c. 27 days (20–30; no N) (Counsilman 1974b); 20–32 days, usually c. 25 days (Heather & Robertson 2000). Extraliminally, 22–24 days (Ali & Ripley 1972). Young fledging at c. 3 weeks old are unable to fly, and parents remain with them during day; parents with flying young move to nearby trees, and arrive at communal roosts at night (Counsilman 1974b). In NZ, fledgelings of first broods remain with parents for 1–2 weeks before being chased away; in Mar. and Apr., re-nesting unlikely and parents with fledgelings remain together for 3–4 weeks (Counsilman 1974b). Continue to be fed by parents for c. 3 weeks after leaving nest (Heather & Robertson 2000); one fledgeling fed by parents for nearly 1 month (NRS).

Success From NRS, in 12 nests where clutch-size and outcome known, of 39 eggs, 14 (35.9%) hatched, and 14 (35.9%) young fledged; in 16 nests where clutch-size and hatching success known, but outcome not always known: of 57 eggs, 29 (50.9%) hatched; in 28 nests where outcome known, 11 (39.3%) were successful and 17 failed; of the 17 nests that failed, 14 were at egg-stage, including six clutches destroyed by observer, six abandoned, and two disappeared; three nests failed at nestling stage, including one brood destroyed by observer, one dead in nest, and one dead on ground near nest, possibly removed by person (NRS). In ACT, from nest-boxes, mean number of young fledged per clutch, 2.0 (1.49; 39) (Pell & Tidemann 1997a). In Auckland, of 67 nests with eggs, 52 (77.6%) hatched and 34 (50.7%) produced fledgelings; three nests in drains flooded after rain; one nest in roof destroyed when house demolished; two nests in air vents abandoned, possibly due to difficulty in gaining access to nest (Counsilman 1974b). In Hawkes Bay, from 339 eggs laid in area where pesticide used often, 170 (50.1%) hatched, and 85 (25.1%) fledged; from 410 eggs in area where little pesticide used, 267 (65.1%) hatched, and 163 (39.8%) fledged (Wilson 1980). Also in Hawkes Bay, some nestlings heavily infested with mites (Counsilman 1974b). Most nest-failures due to disturbance during incubation and starvation (Counsilman 1974b). One pair, after clutch completed, did not begin full incubation and eventually abandoned nest (Perkins 2000b). One pair occupying a hollow (unknown whether eggs laid) apparently abandoned it after Tawny Frogmouths occupied top of hollow (Fitzsimons 2001). One nestling taken by Pied Currawong (Rose 1999); and nest destroyed by Swamp Harrier (CSN 19); and incubating bird possibly taken on nest by Southern Boobook (Bryant 1941).

PLUMAGES Prepared by J.S. Matthew. Following summarized from BWP and Brooke (1976). Naked at hatching (M.A. Weston); age when nestling acquires down not known. Fledge in juvenile plumage. Undergo complete post-juvenile moult to adult plumage; moult of tail starts c. 2 weeks after fledging, but this apparently not part of main post-juvenile moult which, extraliminally, in S. Africa, occurs at end of breeding season (Brooke 1976); some birds said to retain a few juvenile remiges, these instead acquire an adult-like first immature (first basic) plumage (BWP). Once adult plumage attained, complete post-breeding (pre-basic) moult each cycle produces successive adult (basic) plumages with little or no change in appearance (see Plumages and Moults). Sexes similar. Two subspecies; nominate *tristis* introduced to HANZAB region. For descriptions of Plumages and Bare Parts of nominate *tristis*, see Ali & Ripley (1972), Feare & Craig (1998), BWP and Field Identification, above.

MOULTS Based on examination of 11 adult and four juvenile skins from Vic. (MV), nine adult skins from NI (NMNZ), and other information as cited. **Adult post-breeding** (Second or third and subsequent pre-basic). Complete. Primaries moult outward. Little information on moult in HANZAB region. From skins (Aust. and NZ combined): active moult of primaries recorded in Apr. (1 of 2; PMS 36), May (2 of 2; PMS 32, 36) and June (1 of 5; PMS 49; from NZ); rest from Apr.–June, and two of three in July, with all primaries worn; other one in July and eight from Aug.–Jan. with all primaries worn, heavily so in Jan. One from Vic. in May with unconventional primary-moult pattern: N⁵4¹N¹2¹O²; this bird possibly had moult starting at two nodes in primary-tract; same bird had unconventional pattern of secondary moult. These limited data suggest moult of primaries in HANZAB region occurs late summer to late autumn or early winter. Extraliminally, much overlap between timing of breeding and moult (BWP). Moult of tail probably centrifugal; one in Vic. in May with t1–t4 new and t5–t6 nearly fully grown; another from Vic. in Apr. about halfway through moult of primaries and finished moult of tail. Little information on moult of body in HANZAB region; two birds from Vic. in Apr.–May about halfway through moult of primaries and nearly finished moult of body. **Post-juvenile** (First pre-basic). Complete (Brooke 1976; BWP). Usually acquire adult plumage in this moult, but some said to retain a few juvenile remiges and acquire adult-like first immature plumage (BWP); presumably these birds which undergo partial post-juvenile moult acquire adult plumage in second pre-basic moult, when c. 1 year old. In Natal, S. Africa, moult of tail (all retrices) occurs c. 2 weeks after fledging, and again, along with rest of plumage at end of breeding season, from Jan.–June (Brooke 1976); this most unusual in passerines and not known if first moult of tail is part of first pre-basic moult or supplemental moult. Four juveniles collected in Vic., Dec.–Jan., not yet started moult.

MEASUREMENTS **NOMINATE TRISTIS:** (1–2) Vic., skins (MV): (1) Adults; (2) Juveniles. (3) NZ, adults, skins (NMNZ). (4–5) India, China, Caucasus, Réunion, Mauritius, Andaman Is and Hawaii, skins (BWP): (4) Adults; (5) Juveniles. (6) Auckland, NZ, adults, skins (Councilman 1974b).

	MALES	FEMALES	
WING	(1) 135.3 (4.56; 130–141; 6)	134.5 (6.35; 125–138; 4)	ns
	(2) 115, 122, 128	125	
	(3) 141.1 (2.91; 136–145; 11)	–	
	(4) 145.5 (4.40; 138–152; 20)	138.8 (3.88; 134–147; 14)	**
	(5) 133.8 (4.07; 129–140; 5)	130.2 (1.89; 128–132; 3)	
	(6) 140.7 (3.5; 32)	133.7 (3.1; 33)	**
TAIL	(1) 84.3 (1.75; 82–87; 6)	82.5 (4.12; 78–88; 4)	ns

	(2) 65, 71, 71	76	
	(3) 86.5 (3.86; 81–94; 11)	–	
	(4) 85.3 (3.71; 79–92; 21)	80.6 (3.12; 75–85; 14)	**
	(5) 69.6 (1.65; 68–72; 4)	66.7 (2.89; 65–70; 3)	
	(6) 86.3 (3.5; 32)	80.7 (3.7; 33)	**
BILL S	(1) 25.6 (0.93; 24.1–26.4; 7)	24.8 (2.61; 21.1–27.2; 4)	ns
	(2) 22.9, 23.9, 26.5	25.0	
	(3) 26.0 (1.07; 24.2–27.5; 11)	–	
	(4) 26.9 (0.85; 25.1–28.4; 22)	27.1 (1.27; 25.8–28.7; 13)	ns
TARSUS	(1) 38.5 (2.20; 34.7–41.4; 7)	37.8 (2.47; 34.4–40.0; 4)	ns
	(2) 33.1, 37.2, 39.8	35.5	
	(3) 38.9 (1.69; 36.8–41.9; 11)	–	
	(4) 39.9 (1.66; 37.0–42.2; 24)	38.8 (1.61; 36.0–41.6; 17)	ns
	(6) 37.8 (3.2; 32)	35.5 (2.0; 33)	**

See Brooke (1976) for more data on extralimital populations in India, China and S. Africa.

WEIGHTS **NOMINATE TRISTIS:** (1–2) Vic., from museum labels (MV): (1) Adults; (2) Juveniles. (3) NZ, from museum labels (NMNZ). (4) Kazakhstan, ages not given (BWP). (5) Auckland, NZ, adults (Councilman 1974b).

	MALES	FEMALES
(1)	126.0 (13.41; 115–145; 5)	126, 140
(2)	80, 90	88
(3)	139.9 (12.61; 119.2–159.0; 11)	–
(4)	127.5 (123–130.5; 7)	121.2 (111–143; 7)
(5)	130.5 (8.2; 32)	115.0 (6.8; 33)

STRUCTURE See BWP for details.

GEOGRAPHICAL VARIATION Two subspecies usually recognized: nominate *tristis* occurs naturally across much of central and s. Asia, from se. Iran, E through India, Pakistan and Himalayas, to s. China, Burma and mainland se. Asia; introduced to tropical islands in Pacific, Atlantic and Indian Oceans, S. Africa, Hong Kong, Singapore, NZ and Aust. (Vaurie 1959; Ali & Ripley 1972; Long 1981; Feare & Craig 1998; Peters; BWP; DAB); and subspecies *melanosternus* from Sri Lanka. Adults of subspecies *melanosternus* are smaller and have darker plumage than nominate *tristis*; adult *melanosternus* have: chin, throat and breast, blackish, continuing as blackish strip down mid-line to mid-belly; darker upperparts, flanks and thighs; less extensive white at base of primaries, barely extending past tips of greater primary upperwing-coverts; greater primary coverts, white with black markings, varying from black tips to almost entirely black on outer coverts of some birds (cf. coverts entirely white in adult nominate); birds from s. India (e.g. Kerala) probably intergradient between nominate and *melanosternus* (Vaurie 1959; Ali & Ripley 1972). Brooke (1976) proposed a third subspecies, *tristoides*, occurring naturally in higher-rainfall areas of Burma and Nepal; this subspecies recognized in BWP but not by Feare & Craig (1998). See BWP for discussion on variation on Indian subcontinent, including intergradation between nominate and *melanosternus* in s. India.

Based on examination of 18 skins from Aust., DAB stated that populations in Aust. are nominate *tristis*. Many birds released in Melbourne and Sydney in 19th century (see Distribution and Population: Introductions); birds released in Vic. apparently came from India or Afghanistan (Hall 1907; Cunningham 1948), but the origin of birds introduced to Sydney unknown (Hone 1978). Populations introduced to NZ from Aust. in 1870s, but generally only remain now on NI (see Distribution and Populations). Electrophoretic analysis of allozymes for 39 presumptive gene loci reveals genetic differences between ancestral and introduced populations (Baker & Moeed 1987): birds from Melbourne, Sydney, five sites on NI, various sites elsewhere across introduced range, and seven sites in India were sampled: (1) percentage of polymorphic loci is lower in introduced populations, including Aust. and

NZ, than endemic population in India; (2) mean number of alleles per locus is lower in introduced populations, including those from Aust. and NZ, than endemic populations in India; (3) introduced populations have fewer alleles per locus (mean 1.30 alleles/locus in Aust.; 1.24 in NZ) than those in India (1.43); (4) levels of genetic differentiation apparently higher among introduced populations, with NZ and Aust. populations having higher heterogeneity in allele frequency, than populations in India, which show rather homogeneous allele frequencies; (5) c. 18% of alleles present in endemic populations in India are not present in introduced populations; all of these alleles occur at low frequency in India and have subsequently been eliminated during process of colonization; (6) all alleles present in Aust. populations are also present in NZ populations, and vice versa; (7) populations in NZ are genetically closer to those from Melbourne than those from Sydney; (8) populations in Sydney and Melbourne are genetically divergent, possibly due to random genetic drift in geographically separated populations; alternatively, this may be due to different origins of founder stocks. In summary, Baker & Moeed (1987) indicated level of genetic divergence between native and introduced populations is consistent with genetic divergence between avian subspecies. DAB indicated birds from Canberra and Sydney have longer bill (Bill F 19.5–21.5, sexes combined) than those in Melbourne (19.0–20.0), possibly indicating morphological divergence within se. Aust.

Present study indicates adult males from Vic. (n=6) have shorter Wing ($P < 0.01$) than adult males from NZ (n=11). Analysis of 27 osteological characters (lengths and widths of various bones) and weight of 307 adults from eight sites in NI reveals general N to S pattern of morphological differentiation (Baker & Moeed 1979): (1) general N–S pattern in morphological variation in both sexes, those characters showing significant inter-locality differentiation tending to have higher means at n. latitudes; (2) significant variation occurs for more characters in males (18 characters) than in females (13 characters); (3) in males, 64.3% of general body-size variation is explained by temperature parameters, but there is no significant association between body-size and temperature parameters in females; (4) skeletal shape shows significant association with precipitation parameters in both males and females; (5) skeletal shape shows significant association with altitude in females, but not males; (6) inter-locality variation is positively correlated with intra-locality variation in females only; and (7) populations in s. NI show greater morphometric differentiation than those in N, probably because some n. populations were not established till 1960s (cf. s. populations in 19th century and central populations on Volcanic Plateau in 1940s). The diversity of founder populations introduced to NZ probably affected by two bottlenecks, one when birds were first introduced from Asia to Aust., the other when introduced to NI from Aust.

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Sponsor: Dr X Dennett



Volume 7 (Part A), Plate 24

Brown Shrike *Lanius cristatus* (page 818)

NOMINATE CRISTATUS: 1 Adult male breeding; 2 Adult female breeding; 3 Adult non-breeding; 4 Immature; 5 Adult male breeding
 SUBSPECIES SUPERCILIOSUS: 6 Adult male breeding

Red-whiskered Bulbul *Pycnonotus jocosus* (page 1589 [Part B])

NOMINATE JOCOSUS: 7 Adult; 8 Juvenile; 9, 10 Adult

Common Myna *Acridotheres tristis* (page 1937 [Part B])

NOMINATE TRISTIS: 11 Adult; 12 Juvenile; 13, 14 Adult