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Order **PASSERIFORMES**

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

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

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

The Passeriformes divide into two main groups:

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

SUBORDER PASSERI (OSCINES OR SONGBIRDS): Cosmopolitan in distribution. Within the HANZAB region there are 36 families of Passeri. The Australo-Papuan Passeri can be subdivided into several supra-familial groups, but those recognized differ between authors (for further information, see Sibley & Ahlquist 1985, 1990; DAB). Oscines are characterized by acromyodian syrinx, with three or four pairs of intrinsic syringeal muscles (van Tyne & Berger 1976; Campbell & Lack 1985; Sibley& Ahlquist 1990; DAB).

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

MENURIDAE (lyrebirds): two species in one genus; endemic to Aust.;
ATRICHORNITHIDAE (scrub-birds): two species in one genus; endemic to Aust.;
CLIMACTERIDAE (A'asian treecreepers): six species in two genera breeding in Aust.;
MALURIDAE (Australopapuan fairy-wrens, emu-wrens and grasswrens): 22 breeding species in three genera in Aust.;
MELIPHAGIDAE (honeyeaters and Aust. chats): 76 species in 26 genera in Aust. and NZ, all breeding;
PARDALOTIDAE (pardalotes, scrubwrens, thornbills and allies): 51 species (one extinct) in 15 genera in HANZAB region, all breeding;
PETROICIDAE (A'asian robins): 23 species in eight genera in HANZAB region, all breeding;
ORTHONYCHIDAE (logrunners): two breeding species in one genus in Aust.;
POMATOSTOMIDAE (A'asian babblers): four breeding species in single genus in Aust.;
CINCLOSOMATIDAE (whipbirds, wedgebills, quail-thrushes and jewel-babblers): eight breeding species in two genera in Aust.;
NEOSITTIDAE (sitellas): single species breeding in Aust.;
PACHYCEPHALIDAE (whistlers, shrike-thrushes and allies): 17 species in seven genera in HANZAB region, all breeding;
DICRURIDAE (monarchs, flycatchers, fantails and drongos): 19 species in seven genera in HANZAB region, all breeding;
CAMPEPHAGIDAE (cuckoo-shrikes, trillers and minivets): eight species (one extinct) in two genera in HANZAB region, all breeding;
ORIOLIDAE (Old World orioles and figbirds): three species in two genera in Aust., all breeding;
ARTAMIDAE (woodswallows, butcherbirds and currawongs): 14 species in four genera in HANZAB region, all breeding;
PARADISAEIDAE (birds of paradise): five breeding species in two genera in Aust.;
CORVIDAE (crows and jays): six breeding species in single genus in Aust. and NZ, including one introduced to NZ;
CORCORACIDAE (Aust. mudnesters): two species in two monospecific genera, endemic to Aust.;
CALLAEIDAE (NZ wattlebirds): three species (one extinct) in three monospecific genera, endemic to NZ;
LANIIDAE (shrikes): two species in HANZAB region, one accidental to Prince Edward Is, the other accidental to Christmas I.;
PTILONORHYNCHIDAE (bowerbirds): ten species in seven genera in Aust. (nine species) and NZ (one species), all breeding; Piopio of NZ probably extinct (Heather & Robertson 1997);
ALAUDIDAE (larks): two breeding species in HANZAB region (including one successfully introduced to Aust. and NZ);
MOTACILLIDAE (wagtails and pipits): eight species in two genera in HANZAB region, only two breeding (one on South Georgia), the rest non-breeding visitors or accidentals;
PRUNELLIDAE (accentors): one species successfully introduced to NZ;
PASSERIDAE (Old World sparrows and A'asian finches): 22 species in nine genera (including four successful introductions) in HANZAB region, all breeding;
FRINGILLIDAE (Old World finches): seven species in four genera in HANZAB region, all introduced except one naturally occurring vagrant to South Georgia;
EMBERIZIDAE (buntings, cardinals, tanagers and allies): two successfully introduced species, occurring NZ and Lord Howe I.;
NECTARINIIDAE (sunbirds and spiderhunters): single breeding species in Aust.;
DICAEIDAE (flowerpeckers): single breeding species in Aust.;
HIRUNDINIDAE (swallows and martins): eight species in four genera in HANZAB region, including four breeding species in Aust. and NZ, one non-breeding visitor and three accidentals;
PYCNONOTIDAE (bulbuls): one successfully introduced species in Aust.;
SYLVIIDAE (Old World warblers): 13 species in eight genera in HANZAB region, including ten breeding species (one extinct) in Aust. and NZ, and three accidental to region;
ZOSTEROPIDAE (white-eyes): seven species (one extinct) in single genus in HANZAB region, all breeding;
MUSCICAPIDAE (Old World flycatchers, thrushes and chats): eight species in six genera in HANZAB region, including five breeding species (two introduced), and four accidentals (including one on Prince Edward Is);
STURNIDAE (starlings and mynas): five species in four genera, four breeding in HANZAB region (including two species successfully introduced, and one species now extinct), and one accidental.

The Aust. oscines fall into two distinct clusters, each with at least three major supra-familial lineages (DAB): One cluster is the Passerida, comprising the Muscicapoidea (including true thrushes and allies), Sylvioidea (true warblers and babblers, and swallows, and others), and Passeroidea (including larks, pipits, sunbirds, flowerpeckers and all finches and their allies). The other cluster is the Corvida, which is centred on the Australo-Papuan region (though its origins are not certain) and which also comprises three main lineages: Menuroidea (lyrebirds, scrub-birds, treecreepers and bowerbirds), Meliphagoidea (A'asian wrens, pardalotes, acanthizid warblers, and honeyeaters), and Corvoidea (A'asian robins, logrunners, A'asian babblers, whipbirds and quail-thrushes, sitellas, whistlers, fantails and monarchs, birds of paradise, butcherbirds and woodswallows, cuckoo-shrikes, Old World orioles, crows and mudnesters).

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

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

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

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

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

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

Arboreal or terrestrial or both; some strictly arboreal (e.g. Hirundinidae), others strictly terrestrial (e.g. Menuridae, Pittidae); most combine both arboreal and terrestrial foraging to varying degrees, but usually with one predominating. Feed on almost all known food, from plant material to vertebrate animals, but most show some specialization for certain food, such as feeding on nectar (Nectariniidae), seeds (Passeridae), fruit (Zosteropidae), small vertebrates (Artamidae) and, commonly, insects (e.g. Maluridae, Pardalotidae, Petroicidae and others). Mostly feed by gleaning and probing, including probing flowers for nectar; and other substrates for invertebrates; also feed by sallying, including various sallying techniques (sally-hovering, sally-striking and sally-pouncing), each suited for one group of prey, particularly moving animals.

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

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

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

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

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

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

Extended tracheae are found in the genus *Manucodia* (Paradisaeidae), the calls of which are deep, loud or far-carrying (Frith 1994). In the only species occurring in our area, the Trumpet Manucode *M. keraudrenii*, the trachea forms a flat coil between the skin and the pectoral muscles, sometimes extending over the abdominal muscles as well, and may be up to 828 mm in length, compared with body-length, from bill to pygostyle, of *c.* 150 mm (Ames 1971; Clench 1978).

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Family **PRUNELLIDAE** accentors

A small, morphologically homogeneous family of sparrow-like passerines with rather compact bodies, short necks, rather short to moderately long wings with fairly rounded or slightly pointed tips, distinctive short, slender and pointed bills with laterally swollen appearance, rather short legs, and brownish or greyish plumage, usually with dark streaking on upperparts (Sibley & Ahlquist 1981; BWP). The family comprises 12–13 species in a single genus *Prunella*, distributed across Europe, nw. Africa, Middle East, mountainous regions of sw. and central Asia, and Japan (Marien 1951; Sibley & Monroe 1990; Monroe & Sibley 1993; Peters; BWP). One species in HANZAB region, Dunnock *P. modularis*, introduced to NZ.

The taxonomy of accentors has been the subject of considerable debate. Sharpe (1883), with reservation, placed accentors in a huge heterogeneous family Timaliidae, which included the Old World babblers, but noted that the very small outermost primary suggested no close relationship with babblers; he also combined Aust. chats *Epthianura* with the accentors. Hartert (1910) placed accentors in the family Accentoridae, between the typical thrushes Turdidae and wrens Troglodytidae, but also noted similarities in behaviour and morphology between accentors and the true finches Fringillidae. This treatment was followed by Witherby *et al.* (1940), who also stated that a close relationship to warblers and thrushes was doubtful. Stresemann (1927–34) placed the family between the vireos (Vireonidae) and New World nine-primaried oscines, including fringillids and ploceids. Mayr & Amadon (1951) placed the family Prunellidae between dippers (Cinclidae) and Motacillidae; this was also followed by Berndt & Meise (1960), who also noted morphological similarities with emberizid finches, such as presence of muscular crop and operculate nostrils. Beecher (1953) placed accentors in a tribe, Prunellini, in the subfamily Saxicolinae of the Turdidae, based on their distinct jaw musculature, which also shows some similarities with that of emberizine finches. Major works such as Peters and BWP place accentors in a distinct family, Prunellidae, between mockingbirds (Mimidae) and typical chats and thrushes (subfamily Turdinae). The links with thrushes were brought into question through studies on egg-white proteins (Sibley 1970) and syringeal musculature, notably the absence of the 'turdine thumb' (Ames 1975). Based on DNA–DNA hybridization studies, Sibley & Ahlquist (1981) concluded that accentors are most closely related to ploceine weaverbirds (ΔT_{50} 7.3), followed by wagtails and pipits (ΔT_{50} 8.5), and are slightly more distantly related to Old World sparrows *Passer* (ΔT_{50} 8.9) and true finches Fringillidae (ΔT_{50} 9.2). This led Sibley & Ahlquist (1990), Sibley & Monroe (1990) and Monroe & Sibley (1993) to treat accentors as a subfamily Prunellinae within an expanded family Passeridae, after the Old World sparrows (Passerinae) and wagtails and pipits (Motacillinae), and before the weaverbirds (Ploceinae) and estrildid finches (Estrildinae). Here we follow recent works (Christidis & Boles 1994; DAB) in maintaining the family Prunellidae which, along with the Motacillidae, splits the Passeridae from the other passeroid families Estrildidae and Fringillidae.

Species of *Prunella* share the following morphological and osteological characteristics (summarized from Marien [1951], Sibley & Ahlquist [1981] and BWP): Small size (length 13–18 cm, weight 13–40 g). Wing rather short to moderately long, with slightly rounded or slightly pointed tip; outermost primary (p10) short, but not vestigial. Nine secondaries, including three tertials. Tail fairly short to moderately long, rather square or slightly notched at tip when folded; 12 rectrices. Bill rather short and slender, tapering rather evenly to a point, with wide base and laterally swollen appearance; culmen rounded in cross-section and slightly depressed. Nostrils operculate. Rictal bristles present but indistinct. Legs rather short and slender; toes strong. Tarsal scaling laminiplantar. Crop and muscular gizzard present and finch-like. Jaw musculature distinctive; trifid M. *pseudotemporalis superficialis* is apparently unique to this family (Beecher 1953). Illustrations showing details of cranial osteology in Moreno (1986: Fig. 4), including *processus dorsanarialis* on culmen (Moreno 1986: Fig. 4c), which is distinct in this family. Humerus with double fossa (Bock 1962).

Following summarized from Marien (1951) and BWP. Plumages generally shades of brown, buff or grey, some species with yellow or rufous tones, and usually with dark streaking on upperparts and rufous edges to remiges; also often have one or more of: dark streaking on flanks, contrasting throat-patch, or pale supercilium. Sexes alike. Nestlings develop dark down and have brightly coloured mouths with contrasting dark spots. Juvenile plumage superficially similar to that of adult. Undergo a partial post-juvenile (first pre-basic) moult to adult-like first immature (first basic) plumage. Attain adult plumage in complete first immature post-breeding (second pre-basic) moult when *c.* 1 year old. Adults undergo a single complete post-breeding (pre-basic) moult annually, with no change in appearance. Primaries moult outward, starting at p1. Moult of tail usually centrifugal. Moult of tail and body starts during early stage of moult of primaries.

Accentors commonly inhabit forest and forest edge (including coniferous forest) and coniferous scrub and woodlands (including mixed spruce–birch woodlands), but also occur in open rocky areas, often with grasses and low shrubs and herbs, sometimes in heaths and alpine meadows, and in modified habitats such as parks, gardens, hedgerows and farmland; several montane species occur in open habitats such as stony slopes and plateaux (e.g. Radde's Accentor *P. ocularis*) or alpine grasslands (Alpine Accentor *P. collaris*), such species often moving in winter to lower altitudes and modified habitats, such as mountain villages and fallow fields (e.g. Brown Accentor *P. fulvescens*). In NZ, Dunnock usually occurs in dense low vegetation, from coast to subalpine regions; commonly in shrublands or understorey of taller vegetation associations, in rural and urban gardens and in orchards, and in exotic pine plantations; occasionally in native forests, especially at edges or clearing such as roads or other disturbed areas with dense regrowth or dense shrub-layer (Heinzel *et al.* 1977; King *et al.* 1978; Long 1981; AOU 1998; Grimmett *et al.* 1999; Orn. Soc. Japan 2000; BWP).

Movements vary. Some species wholly migratory (e.g. Siberian Accentor *P. montanella*), while others partial altitudinal migrants, with resident populations at lower elevations augmented by winter visitors (e.g. Radde's, Black-throated *P. atrogularis*, Alpine and Brown Accentors). In NZ region, Dunnock sedentary or resident, with no evidence of long-distance movement, though birds have successfully colonized offshore and subantarctic islands up to 800 km from main islands of NZ. Extralimitally, movements of Dunnock vary: sedentary in Ireland and w. Scotland, partly migratory in rest of w. Europe, and total migrant in n. and central Europe (Williams 1953; Sibley & Monroe 1990; Grimmett *et al.* 1999; Heather & Robertson 2000; BWP).

Omnivorous. In summer, mainly eat invertebrates, especially insects, but also some snails, worms and spiders; in winter eat much seed and some fruit. Mainly forage singly or in twos, on ground and in low vegetation, usually in or close to cover; sometimes forage in small flocks. When foraging, usual gait on ground a shuffling walk or series of hops, and birds constantly flick wings and tail. Glean invertebrates and seeds from ground; some also probe for worms, in manner of thrushes *Turdus*, and some species (e.g. Dunnock) occasionally sally-strike fallen seed from ground (Keith *et al.* 1992; Grimmett *et al.* 1999; BWP; see species account).

Mainly occur singly or in pairs, but some gregarious in winter, e.g. Alpine Accentor sometimes forages in large flocks of 80 or more. Most species are monogamous, but some species sometimes polygamous, e.g. Dunnock. In most species, bonds probably do not persist outside breeding season. Co-operative breeding reported in only one species (Alpine Accentor). Usually nest solitarily, and territorial at least in breeding season. Scratch head indirectly. Sunning and dust-bathing recorded. Display in breeding season with aerial chases and by singing, usually from exposed perches, but some species perform display flights. Songs rather complex with rapid modulated notes and trills, while most calls are high-pitched and rather simple (Dyrcz 1977; Campbell & Lack 1985; Keith *et al.* 1992; BWP).

Mostly solitary and monogamous, but some species (e.g. Dunnock) sometimes polygynous, and co-operative breeding recorded in Alpine Accentor. Nests usually built close to ground, in branches of shrubs and small trees; some species also nest on ground, or in hollows in banks or under tussocks; and Alpine Accentor habitually nests in rocky environments (e.g. in crevices in cliffs or between rocks, beneath boulders, on rock ledges). Build cup-shaped nests, made of grass, moss, twigs and leaves, and lined with finer material, including hair, wool, moss and feathers. Eggs sub-elliptical, smooth and glossy; blue or blue-green, usually unmarked, though those of Dunnock very occasionally sparsely spotted reddish; generally 17–23 × 13–16 mm, but sometimes slightly larger in Alpine Accentor. Clutch-size 1–7, but usually 3–5 in most species. Eggs laid on successive days. Species for which data are available usually rear two broods per season, but some (e.g. Altai Accentor *P. himalayana*) are single-brooded and others (e.g. Dunnock) can produce up to three broods in a season. Incubation either by female only (e.g. Dunnock, Black-throated Accentor) or by both sexes (e.g. Alpine and Rufous-breasted *P. strophiata* Accentors); incubation period, 10–11 to 15 days. Both parents attend to and feed young. Based on few data available, fledging period 11 to c. 16 days or more; and fledgelings dependent on adults for another 1–2 weeks or more after fledging (Ali & Ripley 1973; Robson 2000; BWP).

One species, Yemen Accentor *Prunella fagani*, considered near threatened, with breeding recorded from only six localities in densely settled and heavily cultivated w. mountains, but with no declines in population known or suspected (Stattersfield & Capper 2000).

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Prunella modularis Dunnock

COLOUR PLATE FACING PAGE 1112

Motacilla modularis Linnaeus, 1758, *Syst. Nat.*, ed. 10 (1): 184 — Europa = Sweden.

Genus based on the German name 'braunelle' for this small brown bird (diminutive from Mediaeval Latin *prunus*, brown). The specific name is from Latin *modulari*, to sing.

OTHER ENGLISH NAMES Hedge Accentor or Hedge Sparrow; British or English Hedge Sparrow.

POLYTYPIC Subspecies *occidentalis* (Hartert, 1910), indigenous to Scotland (except Hebrides), England and w. France; introduced and established throughout NZ, including Stewart I., and several outlying island groups (see below). Extralimitally, five to seven subspecies from Ireland and Hebrides (Scotland), and Europe E through Ukraine to n. Middle East and n. Iran; nominate *modularis* migrates from n. and central Europe to s. Europe and n. Africa, and others to s. Middle East.

FIELD IDENTIFICATION Length 13–14.5 cm; wingspan 19–21 cm; weight 21.5 g. Small, rather nondescript sparrow-like bird with slender pointed bill, rounded head, and sleek but rather plump body, with full chest and belly. When perched, tips of folded wings extend just past uppertail-coverts; in flight, wings broad with rounded tips and tail moderately long with rather square or slightly notched tip. Similar to House Sparrow *Passer domesticus* in length but appear slightly more slender, with smaller and more rounded head, slimmer rear-end and longer tail, and with very different bill. Adults mostly brown above boldly streaked darker, with largely dull blue-grey head, neck and breast, boldly streaked brown on top of head and neck, and with brownish lores and ear-patch; and rest of underbody, off-white with greyish-brown flanks and reddish-brown streaking to undertail-coverts. Sexes very similar, often indistinguishable in field. No seasonal variation. Juvenile browner and more heavily streaked than adult, especially on underbody. Immatures very similar to adults, differing by heavier mottling and streaking to head and hindneck, slightly duller underbody, and retained juvenile plumage of wing and tail. **Adult male** In fresh plumage, top of head and hindneck, dull olive-grey, with fine dark-brown streaks to top of head merging to heavier blackish-brown streaking on hindneck. Broad but diffuse dull-grey supercilium (sometimes tinged bluish) merges with dull blue-grey sides of neck, which in turn continuous with blue-grey malar area, chin and throat, with fine white mottling to malar area, chin and upper throat; blue-grey encloses dark brownish-grey lores and ear-coverts (often tinged reddish brown on rear coverts) with fine white speckling or mottling on lores and narrow white streaking on ear-coverts. Dark feather-bases at sides of chin form narrow, indistinct and diffuse dark malar stripe. Narrow and inconspicuous eye-ring mottled dark grey and white. With wear, head and neck appear largely dull blue-grey, tinged olive-grey on top of head and ear-coverts, and with fine white speckling or mottling on lores and below and behind eyes. Mantle, scapulars and back, reddish brown, broadly streaked brownish black and with some narrow, diffuse light-brown streaking or mottling; rump and uppertail-coverts warm grey-brown and contrastingly unstreaked. Uppertail, grey-brown to blackish brown. Folded wing largely dark olive-brown, with: dull rufous-brown outer edges to median and greater secondary coverts, and with buff or off-white spots at tips of greater secondary coverts which align to form narrow broken wing-bar in fresh plumage (lost with wear); remiges mostly dark grey-brown with dull rufous-brown edges, grading to paler buff or cream fringes to tips of feathers, conspicuous on tertials. Breast, dull blue-grey with faint olive tinge and fine whitish fringes to feathers when fresh; grades to greyish-brown on sides of breast and flanks, which diffusely streaked reddish-brown and black-brown, and into cream to greyish white on belly, vent and undertail-coverts; coverts also marked with reddish-brown chevrons and streaks. Undertail, grey-brown, slightly paler than uppertail. Underwing mostly grey: coverts; grey with white mottling on leading edge of wing; and remiges, darker, grey-brown, with narrow cream inner edges. Bill: in breeding season wholly brownish black to black; in non-breeding period, bluish-black with pink-brown base of upper mandible and most of lower mandible. Iris, brownish red to dark red or bright red. Orbital ring, dark grey. Legs, red-brown to pinkish brown or pale straw-brown. **Adult female** Very similar to adult male and doubtfully distinguishable in field, with differences very subjective; some duller females may be separable from males by combination of: Duller grey head and breast, with less bluish and more brownish tone; heavier white mottling to chin; slightly stronger olive-brown tinge to breast, and broader off-white fringes to feathers of lower breast in fresh plumage and which often present even in worn plumage; and belly tends to be whiter than in adult male. Some females have iris light brown to brown. **Juvenile** Browner and more heavily streaked than adult, differing by: (1) Top of head darker, brownish grey, and more broadly streaked dark brown; (2) grey of head and neck, duller and mottled or tinged olive-brown, with supercilium barely contrasting with ear-coverts and crown; (3) mantle, scapulars and back have buff tinge and lack reddish-brown tone, and dark streaking narrower; and rump and uppertail-coverts also have buff tinge; (4) more distinct white wing-bar across greater secondary coverts formed by larger pale spot at tips of coverts; (5) chin and throat, off-white, mottled brownish grey; (6) breast and flanks, buff to buff-brown, grading to off-white on belly and rest of underbody, and with all but belly heavily marked with long blackish streaks; and (7) tail-feathers narrower and more pointed at tips. At fledging: bill, flesh-pink with blackish-brown tip; iris, dark grey, grey-brown or greyish olive; and legs and feet, pale greyish-pink or pale brownish-pink. Not known if colours of bare parts change before moult to immature plumage. **Immature male** Like adult male but usually have broader olive or blackish tips to feathers of crown, nape and hindneck (which also appear less uniformly dull grey in worn plumage); and underbody, especially breast, tends to be duller, like that of dull adult females, though chin usually greyer than adult female. Also retains juvenile remiges and rectrices and, usually, all primary coverts and greater secondary coverts of upperwing, but more prominent whitish tips to juvenile greater secondary coverts often difficult to see owing to wear and abrasion of these feathers. However, some birds show moult-contrast between new adult-like inner greater secondary coverts and retained and worn juvenile outer coverts, which usually show more prominent pale tips. Bill, brownish black, with yellowish-brown base, most extensive on lower mandible. Iris, greyish olive, olive-brown or reddish brown, becoming more reddish with age. Legs and feet, light yellow-brown. Attains adult coloration of bare parts by first spring. **Immature female** Very similar to immature male, but said to have: chin and throat more strongly mottled off-white or pale buff; breast, brownish rather than grey, with pale-buff scalloping; and lower breast, off-white, as belly.

Similar species Distinctive and should not be mistaken for any other species. In brief views, possibly confused with female **House Sparrow**, but easily distinguished by: narrow pointed bill (broader and more finch-like in Sparrow); largely dull bluish-grey sides of head and neck and chin, throat and breast (head and neck largely brown in Sparrow); and skulking habits (Sparrows often bold, and commonly in open areas and close to human activity). Should not be confused with juvenile **Yellowhammer** *Emberiza citrinella* or **Cirl Bunting** *E. cirlus*: these larger and plumper; with thicker, conical sparrow-like bills; and paler plumage, with olive-tinge to upperparts, pale-yellow wash and fine black streaking to underparts and distinct white outer edges and corners to tail (lacking extensive rufous or deep-grey tones); also, as House Sparrow, far less shy and skulking than Dunnock.

Small ground-dwelling passerine, usually seen singly or in pairs, occasionally in small flocks. Normally active and restless, constantly twitching wings somewhat nervously, but usually unobtrusive, staying in or near dense cover, and sometimes considered rather shy and furtive. Mainly forage on ground, mainly on invertebrates. Flight usually low and fast on rounded, whirring wings, with birds typically dashing into dense cover when flushed. Where migratory, flight on passage less whirring and slightly undulating. On ground, move actively by hopping in rather upright posture while flicking wings and jerking tail up and down; also move about in distinctive crouching mouse-like shuffle or creeping action, making small hops and mincing walks, with legs nearly hidden beneath body, and with head and tail often held above level of body. Stance also rather upright when perched, especially when singing. Both males and females utter high-pitched warbling Song; also utter sharp, shrill *tseep*, especially in non-breeding period, and several other calls. (Above summary based on BWP, and information cited below.)

HABITAT Mainly occur in dense vegetation, often <2 m tall, in shrublands or understorey of taller vegetation associations; also occur in orchards, exotic pine plantations and gardens; in native forests, usually in disturbed areas with dense regrowth or dense shrub-layer (Mauersberger 1977; see below). In mixed Rata–podocarp–hardwood forest, with canopy 6–20 m tall, mostly captured in mist-nets 1.5–3.5 m above ground, corresponding with dense subcanopy and shrub layer (Fitzgerald *et al.* 1989). Occur from coasts to subalpine regions, to elevations of nearly 1500 m asl on Mt Ruapehu, and common at 1000–1200 m asl on Mt Egmont (Sibson 1958).

Mainly inhabit dense shrublands and thickets (Riney *et al.* 1959; Nilsson *et al.* 1994), e.g. small patches of low subalpine scrub surrounded by tussock grasses and alpine herbs, and, at lower elevations, in continuous Manuka *Leptospermum scoparium*–Kanuka *Kunzea ericoides* scrub, or thickets of boxthorn on coastal sand-dunes (Wodzicki 1946; Sibson 1958; Riney *et al.* 1959; Challies 1962; Child 1975, 1978; Innes *et al.* 1982; Elliott & Ogle 1985; Cooper *et al.* 1986; CSN 2, 30, 34, 37, 41). In native forests, mainly recorded in disturbed areas with dense regrowth, e.g. along roads through forests, in clearings or at edges of forest (Riney *et al.* 1959; Onley 1980; Elliott & Ogle 1985), and especially in native forests where logging or clearing has encouraged dense regrowth of shrubs and saplings (Dawson *et al.* 1978; McKenzie 1979; Onley 1983; Elliott & Ogle 1985; Nilsson *et al.* 1994; Freeman 1999), e.g. forests of Rimu *Dacrydium cupressinum* and Mountain Beech *Nothofagus solandri* logged 7–9 years previously, with dense shrub layer up to 3 m tall of *Coprosma*, Wineberry *Aristotelia serrata*, and Cutty Grass *Carex coriacea*, and various saplings; less often in 3–4-year-old regrowth (Onley 1983). Only occasionally in unlogged or undisturbed forests (e.g. Fitzgerald *et al.* 1989; *contra* Riney *et al.* 1959; CSN 34), e.g. in Beech forests comprising combinations of Mountain, Red *Nothofagus fusca* and Silver *N. menziesii* Beech or Rimu–Mountain Beech forest (Dawson *et al.* 1978; Freeman 1999). Often inhabit hedges, shrubberies and other dense vegetation in parks and gardens, and in farmland (Graham 1948; Dawson & Cresswell 1949; Hodgkins 1949; Sibson 1949; CSN). Also occur in orchards (Sibson 1949; Baker 1980; CSN 41); and plantations of exotic pines, e.g. Monterey Pine, especially in young or thinned areas with dense understorey of bracken or the like (Clout & Gaze 1984; Owen & Sell 1985; CSN 23, 30; J.M. Peter). At Hokitika, common among lupins growing along foreshore (CSN 32). At Port Whangarei, recorded in mangroves (Beauchamp & Parrish 1999).

DISTRIBUTION AND POPULATION Widespread in w. Palaearctic, from British Isles and Iberian Pen. E to Ural Mts and n. Iran, and from N of Arctic Circle in Scandinavia S to n. coast of Mediterranean Sea. Vagrants recorded n. Africa, Iceland and Faeroes (BWP). Unsuccessfully introduced to USA, round Cincinnati, between 1872 and 1874 (Long 1981); and successfully introduced to NZ, where now widespread.

NZ Introduced to various districts between 1867 and 1882 (see Introductions below). **NI** Widespread, though patchily scattered in some parts of East Coast, Volcanic Plain, Manawatu and Wanganui. Also occur on many offshore islands. **SI** Widespread, including on Stewart I. and associated islets (Mauersberger 1977; NZ Atlas; CSN).

Chatham Is Widespread on Chatham I., and present on most smaller islets, including Pitt, South East, Mangere, Little Mangere and Star Keys (Freeman 1994; Nilsson *et al.* 1994; Aikman & Miskelly 2004; CSN).

Antipodes I. Widespread on main island, and also present on Bollons I. (Warham & Bell 1979; Tennyson *et al.* 2002).

Snares Is Few records (singles unless stated): 19 Nov.–21 Dec. 1947 (Stead 1948); 19 and 21 Nov. 1968 (Warham & Keeley 1969); 26 Sept. 1985, 8–17 Jan. 1986, 17 Feb. 1987, 12 Oct.–25 Nov. 1987, 24–28 July 1994, and one or two, 14–16 Apr. 2000 (Miskelly *et al.* 2001); and 14 Apr. 2005 (C.M. Miskelly).

Auckland Is Abundant and widespread; occur on Auckland, Rose and Enderby Is (Taylor 1971; Bartle & Paulin 1986; Turbott 2002).

Campbell I. Widespread and common (Westerskov 1960; Bailey & Sorensen 1962).

Aust. Unacceptably claimed to have been 'both seen and heard' near Mintaro, SA, in c. 1880 (Sutton 1935). There are no records of introductions to Aust. (Long 1981) and no other claimed records of the species.

Breeding Probably throughout NZ range, with published records from scattered sites in most regions (CSN). Also breed Chatham, Antipodes, Auckland and Campbell Is (Williams 1953; Heather & Robertson 2000).

Introductions, and increase in range, in NZ Considered a 'hardy colonizer' (Skegg 1963), and 'colonization of outlying islands is a marked propensity of this little deportee' (Falla 1948). Widespread throughout NZ by 1920s (Thomson 1922; Oliver). NI: In Auckland, doubtfully said to have been imported in 1859; one was introduced in 1867, two in 1868, seven in 1872, 19 (of 80 imported) in 1874 and 18 in 1875; in Hawkes Bay, unknown number released in 1867; and in Wellington, four introduced in 1880, 26 in 1881 and 20 in 1882 (Thomson 1922). First recorded at Parengarenga Harbour, Far N, in late 1930s (Watt 1947), and said to have spread throughout N. Auckland District in c. 1930s and early 1940s (Turbott 1947). Expansion of range, especially onto offshore islands, continued till at least 1940s, e.g. first recorded on Hen & Chickens Is in 1947 (Sibson 1949), and more widespread and common there by early to mid-1960s (Skegg 1964). Also increased on Little Barrier I. and round Minginui, Rotorua and Kaingaroa Forest in 1940s to early 1950s (Phillipps & Lindsay 1948; Weeks 1949; McKenzie 1950; CSN 4). SI: In Canterbury, nine introduced in 1868, 41 in 1871, and unknown number released in gardens round Christchurch in 1875; and in Otago, 18 released in 1868 and 80 in 1871 (Thomson 1922). Regarded as rare in Nelson in early 1920s, but rather widespread 10 years later; first recorded at Tutaki, c. 96 km S of Nelson, in 1922–23 (Moncrieff 1931).

Change in range, populations Some populations have declined since introduction and expansion of range. NI: In Far N, recorded in Puketi and Russell Forests in 1979, but not recorded in comparable surveys in 1993 (Pierce *et al.* 1993). Round Auckland, populations declined in mid- to late 1970s (CSN 25) and not recorded round Clevedon since about early 1970s (CSN 24), and at Papakura none recorded since 1973 (CSN 21). Population on Great Barrier I. has possibly declined: in 1960, recorded as being as common as on mainland (Bell & Brathwaite 1964) but seldom or not recorded in

1972–73 (Reed 1972; Bell 1976) and not plentiful in 1975 (Bell 1976). Formerly common at Te Puke, but absent by late 1990s (CSN 47). Farther S, at Masterton, population declined between 1942 and 1972 (Stidolph 1977). **SI** Population in Takahe Valley declined between 1949 and 1969 (Reid 1970).

Populations RECORDED DENSITY: 0.02 birds/ha, Chatham I. (CSN 37). Recorded at rate of *c.* 5 birds/km along *c.* 1.6 km transect near Geraldine (Graham 1948). 5-MIN COUNTS: 0.02 birds/count (0.18; 333 counts), Kaitoke Wetland, Great Barrier I. (Anderson & Ogden 2003); 0.06 birds/count, Kennedys Bush Scenic Reserve, near Christchurch, Canterbury (Freeman 1999); 0.5 birds/count, W. Paparoa Ra., near Reefton, W. Coast (Onley 1980); 0.004 birds/count, Fletcher Ck, near Reefton (Dawson *et al.* 1978); 0.01 birds/count, Reefton Saddle, near Reefton (Dawson *et al.* 1978); 0.02 birds/count, Te Wharau, near Reefton (Dawson *et al.* 1978); and 0.14 birds/count, near Karamea (Onley 1983).

THREATS AND HUMAN INTERACTIONS Has benefited from clearance of native forests, and often inhabit dense regrowth vegetation in logged areas (see Habitat). Sometimes killed by Cats (Phillipps & Lindsay 1948; Cunningham 1952; Kinsky 1957); and contents of nests taken by introduced predators, including European Wasps *Vespula germanica* (see Breeding: Success). Two birds once accompanied bushman chopping logs, feeding on exposed grubs; and sometimes scavenge for crumbs, even entering houses (see Food).

MOVEMENTS Apparently sedentary in NZ, defending territories for all or most of year (see Social Organization, and below), though usually described as resident or present throughout year; possibly undertake local movements in some areas (see below). However, seasonal changes in conspicuousness (especially singing [see Voice]) may incorrectly suggest seasonal movements. No evidence for long-distance movement within NZ (Heather & Robertson 2000), though successful colonization of offshore islands, up to 800 km across open water (see below), show ability to move long distances. In w. Palaearctic, some populations resident, others partly migratory, and some migratory (BWP).

Widely described as resident or present throughout year, e.g. lower reaches of Waikanae R., NI (Wodzicki 1946); Papakura, NI (CSN 34, 36); on N Brother I. in Cook Str. (Gaston & Scofield 1995); round Christchurch (Freeman 1999); Herbert, SI (Anderson 1947); and round Reefton, SI (Dawson *et al.* 1978). May undertake some local movements: in survey of garden birds at Te Kuiti, NI, 1980–85, seldom seen Dec.–Feb., though recorded elsewhere nearby, with change thought not to be result of change in conspicuousness (Guest & Guest 1987). In subalpine L. Harris Basin, SI, present throughout year, but numbers lowest in winter (Child 1978). Some longer movements apparent. Colonized Chatham, Campbell, Auckland, and Antipodes Is; vagrants to Snares Is result of long-distance dispersal from populations in mainland NZ, presumably assisted by prevailing winds (Williams 1953; Mauersberger 1977; Warham & Bell 1979).

Banding Of 2485 banded in NZ, 1950–96, six recoveries 1950–57, and 34 1988–93, with no information on recoveries for other periods (Kinsky 1957; Cossee 1989, 1992, 1993, 1995, 1997, 1998a,b; Cossee & Wakelin 1991). LONGEVITY: In NZ, oldest known bird 6 years 3 months (Niethammer 1970; Heather & Robertson 2000).

FOOD Invertebrates, mainly insects; some fruit and seeds. **Behaviour** Forage mainly on ground, less often in low vegetation (Gravatt 1971; Falla *et al.* 1981; Chambers 1989; Heather & Robertson 2000; CSN 3, 9; see below). DETAILED STUDIES: In Orongorongo Valley, near Wellington, NI, Oct. 1973–Aug. 1976 (Moeed & Fitzgerald 1982). FORAGING ASSOCIATIONS: Usually forage singly or in twos (Baker 1980). Seen foraging with Common Chaffinches *Fringilla coelebs* (Secker 1952). FORAGING HEIGHTS AND SITES: Mainly forage on ground, usually in or close to cover (Riney *et al.* 1959; Kikkawa 1966; East 1967; Gravatt 1971; Moeed & Fitzgerald 1982; Chambers 1989; Heather & Robertson 2000; CSN 3), such as on lawns, among leaf-litter and on paths in gardens (Hodgkins 1949; Secker 1952; East 1967; CSN 9, 22, 31) and from forest floor, peaty ground at edges of forests and beneath and around shrubs (Kikkawa 1966); seen foraging among boulders on Solander I. (Cooper *et al.* 1986). At Christchurch Botanic Gardens, SI, of 346 observations of foraging: *c.* 50% on lawn, *c.* 40% on leaf-litter, *c.* 7% on paths, *c.* 3% on bare soil and *c.* 1% feeding on artificial food (East 1967). Also forage in low vegetation (Chambers 1989); in subalpine areas in winter, take invertebrates from shrubs protruding above snow (Child 1978); and seen probing pine-cones for seeds (Secker 1952). At Levin, NI, foraged round bases of apple trees in orchard (Baker 1980); and said to have eradicated aphids from orchards in Central Otago (Oliver). FORAGING METHODS: When foraging on ground, slowly shuffle or hop along in crouched posture, gleaning items from substrate (Falla *et al.* 1981; Heather & Robertson 2000); leaf-litter tossed aside with bill (East 1967). Pull earthworms from lawns in manner of thrushes *Turdus* (CSN 31, 36). Glean invertebrates from emergent shrubs in snow (Child 1978). Seen probing pine-cones for seeds (Secker 1952). Two accompanied bushman chopping rotten logs, feeding on Huhu *Prionoplus reticularis* larvae thus exposed (St Paul 1975); and seen to enter houses to scavenge crumbs (CSN 5). SEASONAL VARIATION: In Orongorongo Valley, invertebrates eaten in all seasons sampled (summer, winter and spring) but fruit, seeds and other plant material recorded only in winter (Moeed & Fitzgerald 1982, which see for further details). At Dunedin, ate invertebrates and seeds throughout year (Kikkawa 1966, which see for further details). Pattern similar extralimitally, eating insects for most of year with significant proportion of seeds in winter (BWP).

Detailed studies In ORONGORONGO VALLEY (13 faecal samples from mist-netted birds; Moeed & Fitzgerald 1982): **Plants** Unident. plant material 30.8% freq. MONOCOTYLEDONS: Pandanaceae: *Freycinetia baueriana* sds 15.4. DICOTYLEDONS: Araliaceae: *Schefflera digitata* sds 7.7; Loganiaceae: *Geniostoma ligustrifolium* sds 15.4. **Animals** OPILIONES 15.4. MITES AND TICKS 15.4. SPIDERS 61.5. INSECTS: Blattodea 7.7; Coleoptera: beetles ads 76.9; Curculionidae ads 23.1; Diptera ads 23.1; Hymenoptera: wasps 7.7; Formicidae: ants 46.2; *Huberia striata* 7.7; Lepidoptera larv. 7.7.

Other records **Plants** Fruit[7,8], seeds[2,3,8,10], grass tips[12]. GYMNOSPERMS: *Pinus* sds[2]. MONOCOTYLEDONS: Poaceae: sds[3]; *Poa annua* sds[12]. **Animals** ANNELIDS: Oligochaetes[3,8,13]. SPIDERS[8]. SPRINGTAILS[3]. INSECTS[1,3,4,6,9,13]: Coleoptera[3,8]: Cerambycidae: *Prionoplus reticularis* larv.[5]; Diptera[3,8]; Hemiptera[3]: Aphididae[8,9]; Hymenoptera[3]: Formicidae[8]; Lepidoptera[3]. **Other matter** Crumbs[11]; porridge[14,15]; bread[2,16].

REFERENCES: [1] Chisholm 1926; [2] Secker 1952; [3] Kikkawa 1966; [4] East 1967; [5] St Paul 1975; [6] Child 1978; [7] Moeed & Fitzgerald 1982; [8] Heather & Robertson 2000; [9] Oliver; [10] NZRD; CSN [11] 5, [12] 22; [13] 31, [14] 32, [15] 33; [16] 48.

Young Fed by both parents (see Breeding). Fed mainly insects (Moeed & Fitzgerald 1982; CSN 3); in Orongorongo Valley, an adult returning to its young was captured carrying two beetles (Dascillidae), two flies (one Asilidae, one unknown), a bug (Cixiidae), three ants *Huberia striata*, a cockroach *Parellipsidion conjunctum*, 17 spiders (6 Ctenidae, 11 Lycosidae) and an earthworm (Moeed & Fitzgerald 1982).

Intake Daily intake estimated at 14.62 g/day (Lloyd & McQueen 2000).

SOCIAL ORGANIZATION Poorly known in HANZAB region; well known extralimitally (e.g. Davies 1992; BWP, and references therein). Typically solitary; seen singly or in pairs (e.g. Wodzicki 1946; Hodgkins 1949; Baker 1980; CSN 1, 2, 20, 31), sometimes in threes or small flocks of up to about six (Wodzicki 1946; Hodgkins 1949; CSN 2, 3, 6, 24). In S. Alps of nw. Otago, said not to form flocks in winter (Child 1978). Extralimitally, essentially solitary in non-breeding periods, though local feeding congregations may occur; solitary and territorial when breeding (BWP).

Bonds In NZ, apparently monogamous; and only recorded nesting in simple pairs (Cunningham 1941–42; Wagener 1966; Thoresen 1967; CSN 1). Extralimitally, typically monogamous or polyandrous (trios of female and two males); also regularly polygynous (trios of male and 2–3 females); occasionally in mixed groups of 2–3 males and 2–4 females. Extralimitally, age of first breeding usually 1 year old (BWP). **Parental care** Incubation and brooding by female alone. Nestlings fed by both parents; and no records of feeding by auxiliaries in NZ (see Breeding: Young). Extralimitally, nestlings and fledgelings fed by female alone or by female and one or more males; young fed for up to 17 days after fledging (BWP).

Breeding dispersion No information for NZ; extralimitally solitary and territorial, though dispersion varies with bonds; highest recorded density 640 breeding adults/km^2 (BWP). **Territories** Round Wellington, appear to be territorial for much of year, though permanency of such territories not known: birds seen re-establishing territories in Jan., but with territorial behaviour also seen in autumn–winter (Secker 1952). Extralimitally, occupy largely exclusive home-ranges in non-breeding season, and males begin establishing territories within winter home-ranges in late winter to early spring (BWP).

Roosting No information for NZ. Extralimitally, normally 1–2 m above ground in dense hedge or shrub; usually with two birds together (BWP).

SOCIAL BEHAVIOUR Poorly known in HANZAB region; well known extralimitally (see Davies 1992; BWP and references therein). Though widespread and common, inconspicuous and seldom seen (Moncrieff 1929, 1931; Hodgkins 1949; Warham & Bell 1979; Nilsson *et al.* 1994; Gibb 2000; CSN 1), except when singing in winter–spring (Hodgkins 1949; CSN 37, 41). However, in Wellington, unobtrusive in some places, but less wary in others (CSN 1). Seldom seen when moulting (Gibb 2000). SONG-DISPLAY: Usually sing from prominent vantage point, especially overhead wires, or top of vegetation, such as trees, shrubs, stems of Pampas Grass *Cortaderia argentea* or lupins *Lupinus* (Heather & Robertson 2000; CSN); once heard singing on ground (CSN 3); extralimitally, said to occasionally sing in flight. Sing for much of year, but usually least or not at all between midsummer and early autumn (Heather & Robertson 2000; for further details, see Voice). Song usually by male, but sometimes given by female (BWP; see Voice); used to advertise and defend territory (Heather & Robertson 2000; see Agonistic behaviour below; also see BWP for extralimital details). Sometimes two or more birds sing alternately (CSN 4) with up to six birds heard singing at once (CSN 34). **Maintenance behaviour** Two seen bathing in wet clover on lawn (CSN 9).

Agonistic behaviour In NZ, territorial behaviour includes wing-flicking, full Song and chasing (Tiley 1947; Secker 1952; CSN 4) but no details; for timing of singing, see Voice. Two birds seen fighting and locked together in Feb., even allowing observer to move them from path (CSN 23). Once seen to be aggressive towards House Sparrows, 30 Aug. (CSN 35). For details of behaviour in Europe, see BWP (and references therein).

Sexual behaviour Courtship Extralimitally, courtship commonly begins with prolonged chasing of female by males (BWP). PRE-COPULATORY DISPLAY: Female crouches, quivering her wings and vibrating or raising tail (Secker 1952; CSN 1, 20, 22); male hops round behind female and pecks rhythmically at her cloaca, while rapidly vibrating his wings, accompanied by almost inaudible Subsong (Secker 1952; CSN 1, 20, 22). Once, presumed male, while pecking at cloaca of female, rose with each peck, as though dancing (CSN 1). Male once sang in tree after Pre-copulatory Display on ground (CSN 22). **Copulation** Very brief (Burrows 1948; Secker 1952). A pair seen flying or moving rapidly, half hopping, half running, towards each other and, when almost touching, both reversed, male apparently contacting cloaca of female to copulate (Secker 1952; CSN 1). For details of extralimital behaviour, see BWP and references therein.

Relations within family group Juvenile once seen perched with adult (CSN 9). Two fledgelings, barely able to fly, begged at male House Sparrow (CSN 9). Extralimitally, young skulk in dense vegetation where fed by parents for up to 17 days after fledging. A Dunnock seen repeatedly to feed four 5-day-old Chaffinch nestlings while their parents away from nest after they had fed young; it departed quickly after feeding young, but, on one occasion, male Chaffinch returned sooner than anticipated, and waited in tree; when Dunnock returned, it was chased away by Chaffinch, but when Chaffinch left, Dunnock returned to feed nestlings. When nest visited 4 days later, Dunnock was still feeding nestlings (Reese 1985). At a nest in which nestlings were being attacked by European Wasps *Vespula germanica*, adults swooped back and forth across nest giving Alarm Call (Moller 1990); no other information on anti-predator strategies of adults or of young in NZ. Extralimitally, young will fledge prematurely when alarmed, and female will slip silently off nest when approached (BWP).

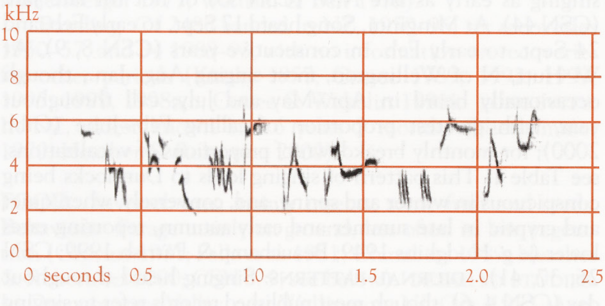
VOICE Well known extralimitally (see BWP, and references therein), but little published information for HANZAB region; sonagrams in BWP. In w. Palaearctic, repertoire consists of male and female Song and three calls (BWP). Often heard but not often seen; Song is most often reported vocalization in HANZAB region and presence often detected by Male Song (Dell 1950; Walker 1953; Warham & Keeley 1969; Hicks *et al.* 1975; Gibb 1996; CSN), e.g. at W. Hutt, only 7% of records were of birds detected by sight, with rest heard first (Gibb 2000). SEASONAL PATTERNS: Vocalize throughout year (Gibb 2000; CSN 44), but proportion of singing and calling varies seasonally (see below). Sing for much of year, but usually least or not at all between midsummer and early autumn (Heather & Robertson 2000): incomplete Song given in Apr.–May, and full Song between June and Aug., with intensity of Song increasing in July and peaking in Aug., before decline in singing till cessation in Dec. to mid-Jan. (Tiley 1947, 1951; Oliver; CSN). However, first Song sometimes given in Mar. (CSN 1, 5, 6, 38) or not till July or very occasionally Aug. (Secker 1952; CSN); and sometimes stop singing as early as late Nov. (CSN 35) or not till late Jan. (CSN 44). At Minginui, Song heard 17 Sept. to early Feb. and 24 Sept. to early Feb. in consecutive years (CSN 8, 9). At W. Hutt, N of Wellington, most singing Aug.–Jan., though occasionally heard in Apr.–May and July; call throughout year, with greatest proportion of calling Feb.–June (Gibb 2000); for monthly breakdown of proportions of vocalizations, see Table 1. This pattern of singing leads to Dunnocks being conspicuous in winter and spring, and, conversely, when quiet and cryptic in late summer and early autumn, reporting rates lower (e.g. Hodgkins 1949; Beauchamp & Parrish 1999; CSN 26, 37, 41). DIURNAL PATTERNS: Singing heard throughout day (CSN 4, 6), though most published records refer to singing in morning (CSN). Sometimes also sing in late afternoon or

Table 1. Monthly proportions (%) of vocalizations at W. Hutt, near Wellington, 1981–92; figures estimated from graph (Gibb 2000).

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Song	78	0	0	16	8	0	50	81	92	81	93	91
Call	22	100	100	84	92	100	50	19	8	19	7	9

evening (Tiley 1951; CSN 5). At Dunedin, as rates of singing declined in Jan., birds sang only occasionally in mornings and evenings (Tiley 1951). Very occasionally sing at night (Tiley 1947; CSN 19 Suppl., 39). Sing in calm, warm weather (Child 1978; CSN 36), bright conditions after rain (CSN 5), and when drizzling or raining (Sibson 1947; CSN 5), though Song said to be longer and more spirited during sunny spells (CSN 37). RESPONSE TO PLAYBACK: Respond to playback of calls (CSN 24).

Adult MALE SONG: Hurried warble, lasting for a few seconds (sonagram **A**); rendered as *weeso*, *sissy-weeso*, *sissy-weeso*, *sissy-wee*, repeated several times in rapid succession (Falla *et al.* 1981; Heather & Robertson 2000). Usually sing from exposed perches (see Social Behaviour). At Dunedin, in mid-Sept., 182 Songs heard over whole day, with peak of singing in morning, between 08:30 and 09:00 (CSN 6). Song used to advertise and defend territory (see Social Behaviour; also see BWP for extralimital details); and sometimes two or more birds sing alternately (e.g. CSN 4, 34; see Social Behaviour). Also reported after Pre-copulatory Display (CSN 22), and one bird gave bursts of full Song while foraging on ground (CSN 3). When singing resumed after break of several weeks, often uttered as half-hearted, short, partial or incomplete Song for a few days or even weeks before full Song given (CSN); tinkling (CSN 39) possibly describes partial Song. SUBSONG: Undescribed subsong said to be given by male during Pre-copulatory Display (Secker 1952); and whisper song (Secker 1952; CSN 36) probably also refers to Subsong. Extralimitally, Song sometimes given at low volume when closely escorting female (BWP). FEMALE SONG: Not described in HANZAB region. Extralimitally, similar to Male Song, but shorter and less elaborate (BWP). SEEP CALL: Sharp and insistent, rendered as *tseep* (Falla *et al.* 1981; Heather & Robertson 2000). Most common call outside breeding season (Gibb 2000; Heather & Robertson 2000). Peeping (CSN 37) possibly also refers to this call. Extralimitally, functions to advertise presence in home-range (BWP). TRILL CALL: Not described in HANZAB region. Extralimitally, soft, rapid trilling *ti-ti-ti* of 3–5 notes with downward inflection, giving it a plaintive sound; serves as contact call, often given alternately by male and female (BWP). Said to be distinctive (Child 1978). Given by male and female while hidden in vegetation shortly before dusk, probably just before roosting (Wagener 1966); plaintive notes given by adults after their nest was robbed (Hornby School 1946) probably also this call. ALARM CALL: Not described in HANZAB region, but said to be given when New Zealand Falcon *Falco novaeseelandiae* flew overhead (Porter & Dawson 1968), and by adults when nestlings threatened by swarm of European Wasps *Vespula germanica* (Moller 1990). Extralimitally, a loud, high-pitched single-note call uttered by both sexes (BWP). OTHER CALLS: Single-note and two-note heard in Feb.–Mar. probably refer to one of above calls, but not obviously (CSN 5).



A L.B. McPherson; Christchurch, SI, Aug. 1984; P106

Young No information for HANZAB region. Extralimitally, begging call described as high-pitched and ending abruptly (BWP).

BREEDING Not well known in HANZAB region, and no detailed studies. Better known extralimitally (see BWP).

Season Eggs recorded Aug.–Jan. May raise 2–3 broods in a season (Cunningham 1941–42; Falla *et al.* 1981; Heather & Robertson 2000; Oliver; CSN 1). NI: Eggs recorded Sept.–Dec. (McKenzie 1950; Sibson 1953; CSN 1, 3, 6, 25); and nestlings Oct.–Nov. (Ryder 1948; McKenzie 1950; CSN 1, 19 Suppl., 38). Otherwise, fledgelings and unspecified breeding recorded Sept., Dec. and Feb. (CSN 3, 9, 33). SI: Eggs recorded Sept.–Dec. (CSN 1, 4, 5, 26, 30); and nestlings Oct. and late Feb. (CSN 1). Otherwise, fledgelings and unspecified breeding recorded Sept.–Feb. (Kikkawa 1966; CSN 1, 33). CHATHAM IS: Unspecified breeding recorded Oct.–Dec. (Nilsson *et al.* 1994). ANTIPODES IS: Adults with young seen Feb. (Warham & Bell 1979).

Site Usually well hidden in low shrubs or hedges, usually within 2 m of ground (Ryder 1948; Wilkinson & Wilkinson 1952; Child 1978; Falla *et al.* 1981; Heather & Robertson 2000; Oliver; CSN 1, 5, 38); in wide variety of plants, including macrocarpa *Cupressus* hedges, ferns (including bracken), hawthorn *Crataegus*, jasmine, Taupata *Coprosma repens*, *Cotoneaster*, Rimu *Dacrydium cupressinum*, *Escallonia*, *Olearia*, bush lawyer *Rubus* and Gorse *Ulex europaeus* (Moncrieff 1929; Hornby School 1946; Wilkinson & Wilkinson 1952; Wagener 1966; Moller 1990; CSN 1, 4, 5, 6, 30). On Chatham Is, nest recorded in Matipo *Myrsine chathamica* logs on ground, cavities in tree-trunks and tangles of lignum (Nilsson *et al.* 1994). One was wedged between a large tree-fern and an epiphytic White Rata vine *Metrosideros diffusa* (Moncrieff 1934). Once, two nests found in a macrocarpa hedge (Hornby School 1946). Nests may be re-used to rear multiple broods within a season (CSN 1), though one pair apparently built new nest 7.6 cm above original nest and in same shrub for second clutch of season (Cunningham 1941–42). Pairs may also return to build in same nest-plants in subsequent seasons (CSN 38). One pair used vacated nest of European Goldfinch *Carduelis carduelis* in Apple tree, though many other suitable sites available (CSN 19 Suppl.). MEASUREMENTS: Height of nest, 1.8 m (0.88; 0.9–3.1; 5) (Moncrieff 1934; Cunningham 1941–42; CSN 1), excluding one unusually high nest in tree, 4.6 m above ground (Oliver).

Nest, Materials Build neat, cup-shaped nest of twigs, grass and moss and lined with hair, wool, feathers, tree-fern scales and moss (Heather & Robertson 2000; Oliver). One unusual nest composed mainly of twigs and moss, with some tree-fern scales and plant stems, and lined with dry grass, hair, and fluffy contents of carpet-sweeper; nest-cup was divided into two compartments by a wall of matted fluff from carpet-sweeper, each compartment containing fragments of eggshell (Moncrieff 1934). Built by female, though male can assist a little; completed in c. 5 days (Heather & Robertson 2000). Laying begins c. 4 days after building completed, though interval may be >1 week (Heather & Robertson 2000; CSN 20). One pair appropriated vacated nest of European Goldfinch (see Site, above).

Eggs Ovoid; greenish blue to deep blue (Moncrieff 1934; Falla *et al.* 1981; Heather & Robertson 2000; Oliver). Extralimitally, subelliptical; smooth and glossy; bright blue, rarely, with a few reddish spots (BWP). MEASUREMENTS: 19.4 × 14.8, 20.2 × 15.0 (Oliver); also given as 20 × 14.5 (Heather & Robertson 2000). EXTRALIMITALLY: Subspecies *occidentalis*, 19.8 (18.4–22.5; 100) × 14.7 (14.0–15.5) (BWP).

Clutch-size Two to five, usually four (Falla *et al.* 1981; Heather & Robertson 2000; Oliver), though on Chatham Is, two or three (Nilsson *et al.* 1994). Mean 3.87 (0.65; 2–5; 48) (Niethammer 1970); at Mt Bruce, NI, C/4 × 8 in 1941–42, and C/3 × 10 in 1942–43 (CSN 1). Clutch-size in England and NZ similar, though NZ sample small (Niethammer 1970).

Laying Eggs laid daily (Heather & Robertson 2000; CSN 1, 5). Claimed that last egg of clutch may be laid more than 1 day after penultimate egg (NZRD), but source of this not known. May raise 2–3 broods in a season (see Season). Once, following successful fledging of a brood on 31 Oct., what was apparently same pair had another nest with eggs on 29 Dec. (Cunningham 1941–42).

Incubation By female only (Falla *et al.* 1981; Heather & Robertson 2000; BWP); extralimitally, begins with last egg or sometimes on morning after (BWP). INCUBATION PERIOD: 12 days (11–14) (Heather & Robertson 2000); *c.* 12 days (Falla *et al.* 1981); extralimitally, 12–13 days (BWP). Eggs may hatch on same day (CSN 19 Suppl.), or over several days (Cunningham 1941–42).

Young Fed by both parents (Heather & Robertson 2000; BWP). No records of feeding by auxiliaries in NZ, but extralimitally nestlings can be fed by other adults, depending on bonds (BWP; see Social Organization). Once, adult fed Common Chaffinch nestlings (Reese 1985; see Social Behaviour: Relations within family group). Adults give Alarm Calls if nestlings threatened (see Social Behaviour: Relations within family group).

Fledging to independence FLEDGING PERIOD: 12 days (10–14) (Heather & Robertson 2000); 11–15 days (Falla *et al.* 1981). Extralimitally, 11–12 days (BWP). Extralimitally, fledgelings fed by both parents, for 14–17 days after fledging (BWP).

Success Of 14 nests where outcome known, five (35.7%) successfully fledged at least one young, and nine (64.3%) failed (Cunningham 1941–42; Hornby School 1946; Warham & Bell 1979; CSN 1, 5, 6, 9, 19 [Suppl.]). Eggs eaten by Swamp Harriers *Circus approximans* (Baker-Gabb 1981); and unidentified nest-contents taken by Little Owls *Athene noctua* (Hornby School 1946) and probably by Stoats and Cats (Thomson 1922), with eggs in one nest appearing to have been pierced by teeth (CSN 1). Suggested that a Common Myna *Acridotheres tristis* possibly killed nestlings at one nest (CSN 19 Suppl.). In one nest, newly hatched nestlings killed and eaten by European Wasps *Vespula germanica* (Moller 1990). Clutches often include an addled egg (CSN 1).

PLUMAGES AND BARE PARTS Prepared by J.S. Matthew. Following summary of plumage development from BWP. Nestling has sparse down. Fledge in juvenile plumage. Undergo partial post-juvenile (first pre-basic) moult to first immature (first basic) plumage. Acquire adult plumage in complete first immature post-breeding (second pre-basic) moult. Thereafter, a complete post-breeding (pre-basic) moult each cycle produces successive adult (basic) plumages with no change in appearance. Sexes similar. Up to eight subspecies. Subspecies *occidentalis* (and possibly also *hebridium*) introduced to NZ, probably from Great Britain (see Geographical Variation; also see Distribution and Population). For detailed descriptions of plumages, bare parts and geographical variation in Europe, see BWP.

MOULTS Based on examination of skins of 13 adult males (NMNZ), and other information as cited. **Adult post-breeding** (Third and subsequent pre-basic). Little information from NZ. In Europe, moult is complete, with primaries moulting outward, starting at p1; estimated individual duration of primary moult, 54–60 days (BWP). In NZ, moult starts late Jan. (Niethammer 1971; Mauersberger 1977) and proceeds through Feb.–Apr. (Mauersberger 1977). No skins from NZ examined with active moult of primaries: one in Apr. has all primaries new; five of six in July have all primaries new or very slightly worn, the other with all primaries worn; and other skins, collected Sept.–Nov., have all primaries worn. **Post-juvenile** (First pre-basic). No information from NZ. In Europe, post-juvenile moult partial, involving feathers of head and body, marginal and median coverts of upperwing, and in late-hatched birds, also tertials, inner greater secondary coverts and all or some rectrices (BWP). **First immature post-breeding** (Second pre-basic). No information from NZ. Timing and extent probably similar to adult post-breeding.

MEASUREMENTS SUBSPECIES NOT CERTAIN, BUT PROBABLY *OCCIDENTALIS*: (1–2) NZ, adult skins: (1) NMNZ; (2) Niethammer (1971). SUBSPECIES *OCCIDENTALIS*: (3–4) Skins: (3) England and s. Scotland, adults and first immatures (BWP); (4) England (Niethammer 1971). SUBSPECIES *OCCIDENTALIS* AND *HEBRIDIUM*: (5) Scotland, adults and first immatures, skins (Niethammer 1971).

		MALES	FEMALES	
WING	(1)	67.9 (1.79; 65–71; 15)	–	
	(2)	68.9 (2.54; 66–74; 11)	67, 72	
	(3)	70.3 (1.61; 68–74; 27)	68.7 (1.40; 66–71; 30)	**
	(4)	69.1 (2.12; 65–74; 31)	67.7 (1.89; 63–71; 26)	**
	(5)	68.9 (1.43; 65–72; 31)	66.9 (1.80; 64–70; 20)	**
TAIL	(1)	60.1 (2.34; 57–65; 15)	–	
	(2)	59.4 (3.23; 55–67; 10)	60, 63	
	(3)	57.9 (2.64; 54–62; 18)	57.5 (2.24; 53–61; 23)	ns
	(4)	59.9 (2.03; 56–65; 31)	58.0 (52–62; 25)	
	(5)	59.6 (2.23; 55–65; 29)	57.5 (55–61; 19)	
BILL S	(1)	14.5 (0.65; 13.3–15.5; 15)	–	
	(3)	14.7 (0.49; 13.9–15.4; 17)	14.6 (0.61; 13.7–15.6; 22)	ns
TARSUS	(1)	21.3 (1.16; 18.8–23.6; 15)	–	
	(3)	21.5 (0.75; 20.3–22.6; 18)	21.5 (0.80; 19.9–22.4; 23)	ns

Two unsexed birds, captured Little Barrier I.: Wing 65, 69; Tail 59, 63; Tarsus 20.8, 22.0 (Gill & Veitch 1990).

WEIGHTS SUBSPECIES *OCCIDENTALIS*: From Britain (live, captured throughout year), 21.7 (17–26; 69) (BWP). NZ: Adult males: 21.5 (3.19; 15.5–27.0; 14) (museum labels [NMNZ]); 20.4, 20.5, 23 (Niethammer 1971). Two unsexed birds, Little Barrier I., 19, 22.5 (Gill & Veitch 1990).

STRUCTURE See BWP for details.

GEOGRAPHICAL VARIATION For details on geographical variation in Great Britain and Europe, see BWP. Populations introduced to NZ thought to be subspecies *occidentalis* (Niethammer 1971; Peters), though precise origins of introduced stocks not known. Niethammer (1971) found no difference in length of Wing or Tail between birds from NZ and England (see Measurements above). Populations from Ireland, w. Scotland and Hebrides considered subspecies *hebridium* (Peters; BWP). Compared with *occidentalis*, subspecies *hebridium* said to have bolder blackish mottling on crown and hindneck, duller brown edges to feathers of mantle, scapulars and tertials (cf. more rufous-brown in *occidentalis*), slightly darker grey underparts, and slightly darker olive-brown sides of breast and flanks with less prominent streaking (BWP). Insufficient skins from Great Britain held in Aust. and NZ museums for satisfactory comparison with skins from NZ; till such comparison is made, subspecific identity of NZ birds remains uncertain and may include *hebridium*, intergrades between *hebridium* and *occidentalis*, and possibly even nominate *modularis* or other subspecies from continental Europe.

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Volume 7 (Part B), Plate 31

Dunnock *Prunella modularis* (page 1059)
SUBSPECIES *OCCIDENTALIS:* **1** Adult male; **2** Juvenile; **3** Adult male

House Sparrow *Passer domesticus* (page 1070)
NOMINATE *DOMESTICUS:* **4** Adult male (fresh plumage); **5** Adult male (worn plumage); **6** Adult female; **7** Juvenile; **8** Adult male

Eurasian Tree Sparrow *Passer montanus* (page 1089)
9 Adult (fresh plumage); **10** Adult (worn plumage); **11** Juvenile; **12** Adult

Java Sparrow *Lonchura oryzivora* (page 1270)
13 Adult; **14** Juvenile