

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;
- ORIOOLIDAE (Old World orioles and figbirds): three species in two genera in Aust., all breeding;
- ARTAMIDAE (woodswallows, butcherbirds and currawongs): 14 species in four genera in HANZAB region, all breeding;
- PARADISAEIDAE (birds of paradise): five breeding species in two genera in Aust.;
- CORVIDAE (crows and jays): six breeding species in single genus in Aust. and NZ, including one introduced to NZ;
- CORCORACIDAE (Aust. mudnesters): two species in two monospecific genera, endemic to Aust.;
- CALLAEIDAE (NZ wattlebirds): three species (one extinct) in three monospecific genera, endemic to NZ;
- LANIIDAE (shrikes): two species in HANZAB region, one accidental to Prince Edward Is, the other accidental to Christmas I.;
- PTILONORHYNCHIDAE (bowerbirds): ten species in seven genera in Aust. (nine species) and NZ (one species), all breeding; Piopio of NZ probably extinct (Heather & Robertson 1997);
- ALAUDIDAE (larks): two breeding species in HANZAB region (including one successfully introduced to Aust. and NZ);
- MOTACILLIDAE (wagtails and pipits): eight species in two genera in HANZAB region, only two breeding (one on South Georgia), the rest non-breeding visitors or accidentals;
- PRUNELLIDAE (accentors): one species successfully introduced to NZ;
- PASSERIDAE (Old World sparrows and A'asian finches): 22 species in nine genera (including four successful introductions) in HANZAB region, all breeding;
- FRINGILLIDAE (Old World finches): seven species in four genera in HANZAB region, all introduced except one naturally occurring vagrant to South Georgia;
- EMBERIZIDAE (buntings, cardinals, tanagers and allies): two successfully introduced species, occurring NZ and Lord Howe I.;
- NECTARINIIDAE (sunbirds and spiderhunters): single breeding species in Aust.;
- DICAEIDAE (flowerpeckers): single breeding species in Aust.;
- HIRUNDINIDAE (swallows and martins): eight species in four genera in HANZAB region, including four breeding species in Aust. and NZ, one non-breeding visitor and three accidentals;
- PYCNONOTIDAE (bulbuls): one successfully introduced species in Aust.;
- SYLVIIDAE (Old World warblers): 13 species in eight genera in HANZAB region, including ten breeding species (one extinct) in Aust. and NZ, and three accidental to region;
- ZOSTEROPIDAE (white-eyes): seven species (one extinct) in single genus in HANZAB region, all breeding;
- MUSCICAPIDAE (Old World flycatchers, thrushes and chats): eight species in six genera in HANZAB region, including five breeding species (two introduced), and four accidentals (including one on Prince Edward Is);
- STURNIDAE (starlings and mynas): five species in four genera, four breeding in HANZAB region (including two species successfully introduced, and one species now extinct), and one accidental.
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The Aust. oscines fall into two distinct clusters, each with at least three major supra-familial lineages (DAB): One cluster is the Passerida, comprising the 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 (Kroodma 1996).

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

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

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

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Family EMBERIZIDAE buntings, cardinals, tanagers and allies

A very large and morphologically highly diverse family of small to medium-sized 'nine-primaried' oscine passerines. As defined here (see below), the family comprises c. 615 species in c. 150 genera, distributed through the Holarctic, Indomalayan, Neotropical and Afrotropical regions, including throughout Eurasia, Middle East, Africa, and N., central and S. America (Sibley & Monroe 1990; Monroe & Sibley 1993; Peters). Do not occur naturally in HANZAB region, with two species, Yellowhammer *Emberiza citrinella* and Cirl Bunting *E. cirius*, successfully introduced to NZ. In addition to the successful introductions, another four species introduced unsuccessfully to HANZAB region (summarized from Thomson 1922 and Long 1981, which see for further details): Ortolan Bunting *E. hortulana*, introduced to Vic., Aust., in 1863 (c. 16 birds released), and NZ in 1885 (three pairs released); Reed Bunting *E. schoeniclus*, introduced to NZ, 1871 (four birds released); Summer Tanager *Piranga rubra*, introduced to NZ, 1868 (two birds released); and Common Cardinal *Cardinalis cardinalis*, probably released in Vic., Aust., in 1860s–1870s.

Taxonomic history is complex (and much is summarized in introduction to the Fringillidae [q.v.]). Some authors combine emberizid finches (buntings, New World sparrows, juncos, towhees and allies) with fringillid finches (Old World finches) as an expanded Fringillidae (Stresemann 1927–34; Cracraft 1981; Sibley & Ahlquist 1990; Monroe & Sibley 1993). Here, we follow other authors (Bock & Morony 1978; Christidis & Boles 1994; Peters; BWP; DAB) in treating Emberizidae separate from Fringillidae (Old World finches). Recent views on species composition of the family differ considerably. Based on DNA–DNA hybridization data, Sibley & Ahlquist (1990) and Monroe & Sibley (1993) recognized a single huge family, Fringillidae, which included all fringillid, cardueline and emberizid finches as well as many other morphologically disparate taxa, such as tanagers, wood-warblers, tanager-finches and troupials (see introduction to Fringillidae for discussion). However, other studies on DNA–DNA hybridization (Bledsoe 1988), allozymic variation (Marten & Johnson 1986) and DNA sequencing (Klicka *et al.* 2000; Lovette & Bermingham 2002) suggest a more complex phylogeny for the nine-primaried oscines than traditional arrangements. Here we recognize the following subfamilies within Emberizidae (from Peters), but acknowledge that other taxonomic arrangements may be superior from an evolutionary point of view:

EMBERIZINAE (buntings, juncos, new world sparrows, towhees, brush-finches and allies): Consisting of c. 157 species in 32 genera; two species in HANZAB region, both successfully introduced to NZ (and another two species introduced unsuccessfully to HANZAB region; see above).

CARDINALINAE (cardinals, cardinal-grosbeaks and allies): Comprising 42 species in 13 genera (with one species introduced unsuccessfully to NZ; see above).

THRAUPINAE (tanagers, tanager-finches and allies): Comprising c. 413 species in c. 105 genera (with one species introduced unsuccessfully to NZ; see above).

Cardinalinae and Thraupinae not considered further below. For morphological diagnosis of these subfamilies, see Beecher (1953), van Tyne & Berger (1976) and BWP; and for summaries of biology and ecology, see sources cited below for Emberizinae.

Size varies from small (e.g. Grasshopper Sparrow *Ammodramus savannarum*: total length 12–13 cm; weight 17 g) to medium-sized (e.g. California Towhee *Pipilo crissalis*: total length 22–23 cm; weight 44 g). Two medium-small species in HANZAB region, Yellowhammer and Cirl Bunting (both total length c. 15–16 cm, weight c. 25 g). Following are morphological and osteological characteristics common to the subfamily Emberizinae (summarized from Beecher 1953; Byers *et al.* 1995; BWP). Wings usually rather short and rounded at tip, but moderately long and slightly pointed at tip in some species. Nine well-developed primaries; outermost (p10) vestigial. Nine secondaries, including three tertials; many species, particularly those in Eurasia, have distinctive pattern to tertials, with outer edge broad near tip and abruptly narrowing basally. Tail rather short to fairly long, rather square or slightly notched at tip; 12 rectrices. Bill rather short, robust and deep, conical, unnotched and semi-operculate, tomlia incurved; designed for husking seeds with aid of slender muscular tongue; palate with parallel anterior and lateral ridges terminating in a posterior boss for occlusion with tomlia of lower mandible. See Ziswiler (1979) for more details on anatomy and functional morphology of bill. Nostrils oval in shape, at base of bill and largely concealed by feathers. Rictal bristles present but minute. Skeleto-musculature of tongue more similar to chaffinches (Fringillinae) than to cardueline finches (Carduelinae), with elongated paraglossale bone; preglossale and muscle *M. hg. anterior* absent (Bock & Morony 1978). Musculature of jaw similar to that of wood-warblers (Parulidae); median slip of *M. pseudotemporalis superficialis* advances to mandible; large *M. pterygoideus ventralis anterior* overlies *M. p. ventralis posterior*. Legs and feet rather short to moderately long; tarsus ridged at rear; tarsal scaling lamini-plantar. Humerus with double pneumatic fossa (Bock 1962). Ectethmoid foramen doubled or constricted. Lachrymals fused. Crop absent. Stomach and gizzard heavily muscled.

Following summary of plumage and patterns of moult of Emberizinae from Byers *et al.* (1995) and BWP (for

summary of plumages and moult in Cardinalinae and Thraupinae, see BWP). Plumages rather varying, usually consisting of a mixture of contrasting black, white, brown, buff, yellow or rufous, often with dark streaking, particularly on underparts; many species also have pale wing-bars or white markings on outer rectrices or both. Many species of *Emberiza* have distinct pattern to tertials, with pale outer edges that are broad at tips and abruptly narrow basally (matching structure of these feathers [see above]); and some species have pale edges protruding as a wedge into dark centres. Sexes usually differ, with adult males brighter than females. Juveniles usually similar to adult female in appearance. Many species show distinct seasonal variation, particularly in adult males, with different breeding and non-breeding plumages. Nestlings lack markings of mouth or tongue. Hatch with down, often rather dense. Fledge in juvenile plumage. Usually undergo a partial post-juvenile (first pre-basic) moult to adult female-like first immature non-breeding (first basic) plumage; in a few species (e.g. Corn Bunting *Miliaria calandra*), some or all individuals undergo a complete post-juvenile moult directly to adult (definitive basic) plumage. Most species acquire adult plumage in complete first immature post-breeding (second pre-basic) moult when c. 1 year old. Adults undergo a complete post-breeding (pre-basic) moult annually, and some species also undergo a partial adult pre-breeding moult (pre-alternate) to a breeding plumage; in some species, extent of pre-breeding moult less in female than in male. Primaries moult outward.

Extralimitally, commonly in open habitats or in wooded habitats adjacent to open country, and often at edges of forest or woodland and other such ecotones, though habitats vary widely. Recorded from coasts and lowlands to high altitudes (to >4000 m asl in Andes [e.g. Bright-rumped Yellow-Finch *Sicalis uropygialis*, which recorded up to 4800 m asl]), including alpine and subalpine regions; and recorded in all main climatic zones: arctic continental, temperate, subtropical and tropical zones, and arid and semi-arid zones. Inhabit forests, including coniferous, boreal, deciduous, broadleaf and mixed forests, and stunted forms of same, at edges or in clearings, rainforest and secondary forest, woodlands, especially in Nearctic (including semi-arid woodland), shrubland (including arid, semi-arid, mediterranean, tundra, shrub steppe, temperate and low alpine shrublands) and heathland, dry savannas, dry, moist and wet grasslands (including tussock grasslands), wetlands (including swamps, bogs, marshes, fens, and peatlands), and unwooded habitats, such as coastal beaches and dunes, rocky areas and other bare and barren terrain. Commonly in modified habitats, such as farmlands, gardens, plantations. A few species have restricted habitats, such as the critically endangered Mangrove Finch *Camarhynchus heliobates*, which is restricted to dense mangrove swamps of the Galapagos, and Temminck's Seedeater *Sporophila falcirostris*, which is a bamboo specialist of secondary or disturbed Atlantic forest and forest edges. However, many individual species occupy a wide range of habitats; and migratory species may occupy different habitats in breeding and wintering grounds, e.g. Chestnut Bunting *Emberiza rutila* breeds in open forest with dense understorey of grass or herbs, but occurs on mountain slopes and lake shores on passage, and inhabits rice stubbles and shrublands during winter. In NZ, Cirl Bunting and Yellowhammer commonly in modified open grassy habitats, especially pasture, as well as in parks and gardens, and exotic pine plantations (King *et al.* 1978; Mackworth-Præd & Grant 1980; Maclean 1993; AOU 1998; Orn. Soc. Japan 2000; Robson 2002; BWP; BirdLife International Species Factsheets, available at <http://www.birdlife.org/datazone/species/index.html> [accessed Sept. 2005]; and see species accounts).

Range from sedentary to migratory. Most species breeding n. temperate latitudes partly or wholly migratory, over medium to long distances; those breeding farther S tend to be short-distance migrants, resident or sedentary. Holarctic breeding species almost all migratory, ranging from total long-distance migrants (e.g. Ortolan Bunting *Emberiza hortulana* in Palaearctic, Smith's Longspur *Calcarius pictus* in Nearctic) to partial short-range migrants with breeding and wintering ranges largely overlapping (e.g. Yellowhammer, Field Sparrow *Spizella pusilla*). However, Cirl Bunting, which breeds in Palaearctic, S of 50°N, essentially sedentary, though some leave colder n. parts of range in winter. African breeding species generally resident, though some partly migratory, mainly within overall breeding range of the species (e.g. Cape Bunting *Emberiza capensis*); some species irruptive (e.g. Lark-like Bunting *E. impetuani*). Also largely resident or sedentary in central and S. America; though some species n. migrants from southernmost latitudes of S. America, e.g. Grassland Yellow-finch *Sicalis luteola* resident in Mexico, and central and n. S. America, but at least partly migratory in extreme S of range in Chile and central Argentina, moving N in non-breeding season (AOU 1998; Fry & Keith 2004; BWP).

Emberizinae primarily granivorous, feeding mainly on seeds, especially of grasses, often supplemented with insects and other small invertebrates, and fruit. Proportion of invertebrate food in diet typically increases during breeding season, but in some species invertebrates are major item in diet throughout year. Primarily terrestrial, gleaning food from ground or sometimes by reaching up to take seeds from standing seed-heads; also jump up and drag seed-heads to ground to extract seeds; sometimes forage among grass or herbs, taking food while perched on stems, and occasionally forage in shrubs or trees. Some species take food in flight by sally-striking or sally-hovering. Bills strong and deep, adapted for dehusking seeds (see above). Many species forage in mixed-species flocks, often with other species of Emberizidae. Diet and behaviour vary between subfamilies (Ridgely & Tudor 1989; Byers *et al.* 1995; Fry & Keith 2004; BWP).

Usually seen singly or in pairs during breeding season, and normally gregarious at other times of year (Byers *et al.* 1995; BWP). Most species monogamous, with occasional records of polygamy. However, some species or populations

more commonly polygamous: e.g. some populations of Reed Bunting and Corn Bunting show high incidence of polygyny; polyandry recorded in Corn Bunting; and Smith's Longspur is polygynandrous (i.e. both males and females have multiple mates). Only female incubates, but both parents feed nestlings and fledgelings. Usually nest solitarily, and most are territorial. Usually avoid physical contact with conspecifics, and none known to allopreen. In many species, males perform elaborate displays during breeding season, such as song-flights, dancing round female with wings spread or fluttering, or flashing markings on wings or tail. Courtship feeding recorded in a few species (e.g. Snow Bunting) (Ehrlich *et al.* 1988; Briskie 1992; Byers *et al.* 1995; Fry & Keith 2004; BWP).

Most have complex repertoire of quite loud calls. Songs of males typically used for advertising, and quite varied; some have short and simple songs consisting of a simple note linked together, others have more complex and melodious songs; in some, song high-pitched, insect-like buzzing (Campbell & Lack 1985; Fry & Keith 2004; BWP).

Nest solitarily; and most species monogamous, though polygamy also recorded (see above). In Holarctic species, breeding season timed to coincide with boreal summer; in African buntings and Neotropical sparrows, breeding generally timed to rainy season; in areas of lighter or less predictable rainfall, such as s. USA, Mexico, sub-Saharan Africa and other arid regions of Africa or Asia, breeding closely tied to seasonal rainfall, generally coinciding with onset of rains. Breeding seasons in tropical species often protracted compared with those in species of temperate and arctic zone (Byers *et al.* 1995). Nests usually built on ground, often in depression and in shelter of vegetation (e.g. grass tussock, shrub) or rock; or in fork or among twigs of shrub or tree, often close to ground; sometimes in other sites such as creepers, grasses or herbs, crevices in rock, or artificial structures. Build open, cup-shaped nests, made of grass, plant stems, roots and leaves, and sometimes with twigs or other material, such as moss or bark; usually lined with fine grass and hair, and often with rootlets or feathers; some nests may be unlined. Nest usually built by female only; rarely assisted by male. Eggs sub-elliptical, sometimes ovate; smooth, generally slightly glossy. Ground-colour typically pale, often pure white or shades of white, green, blue or grey, occasionally buff, pink, purple or brown; often marked with spots and blotches (and sometimes lines, streaks or scrawls) of black, brown, grey or purple, with markings often concentrated at large end, and sometimes forming a ring; eggs very rarely unmarked. Clutch-size typically 2–4 in tropical species and 3–6 in temperate species. Eggs laid on successive days. Incubation usually by female only; in some species, male may take short stints, especially near hatching. Incubation period between 11–12 and 16 days in most species. Nestlings brooded by female. Nestlings usually fed by both sexes; sometimes by female only, with food provided by male. Fledging period in most species between 8–9 and 19 days; young often leave nest before capable of flight. Fledgelings fed by both parents, usually for some 1–3 weeks after fledging. Often rear 2–3 broods per season (Byers *et al.* 1995; Fry & Keith 2004; BWP).

Extralimitally, some 35 species of Emberizinae (buntings and allies) threatened (five critically endangered, 11 endangered, 19 vulnerable); 21 species of Thraupinae (tanagers and allies) also threatened (two critically endangered, six endangered, 13 vulnerable), but no Cardinalinae currently listed as threatened. In addition, a total of 47 species of Emberizidae considered near threatened (Stattersfield & Capper 2000; BirdLife International Species Factsheets, available at <http://www.birdlife.org/datazone/species/index.html> [accessed Sept. 2005]).

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Emberiza citrinella **Yellowhammer**

COLOUR PLATE FACING PAGE 1368

Emberiza citrinella Linnaeus, 1758, *Syst. Nat.* 10(1): 177 — Europa = Sweden.

The generic name is from an Old German name 'embritz' for a bunting. The specific epithet is from the Italian name 'citrinella' for some small yellow bird (diminutive from Latin *citrinus*, citrine).

OTHER ENGLISH NAMES Yellow Bunting, Yellow-hammer, Yellow Yorling; Scribbling Lark; Snakebird; Devil's Bird, Goldie, Skite.

POLYTYPIC Subspecies *caliginosa* Clancey, 1914, introduced and established on NI, SI and Stewart I., NZ, spreading to Chatham and Kermadec Is and straying to Lord Howe, Campbell and Snares Is; indigenous to n. and w. British Isles. Extralimitally, nominate *citrinella* from w. Europe to w. Russia, w. Balkans and Greece, wintering in n. Africa; *erythrogegnys* Brehm, 1855, e. Balkans, Ukraine and e. European Russia to Trans-Baikalia, wintering in sw. and w.-central Asia and Mongolia.

FIELD IDENTIFICATION Length 16–16.5 cm, including 6.5–7.5 tail; wingspan 23–29.5 cm; weight 25 (18–30) g; male slightly larger than female. Introduced to NZ. Rather large bunting with noticeably attenuated rear-end and rather long tail (c. 40% total length) with forked tip, rather short wings with slightly pointed tips and broad bases, and strong and conical bill. Similar to introduced Cirl Bunting *Emberiza cirlus*, with which it can be confused in some plumages, but Yellowhammer slightly larger; obviously larger than introduced Goldfinch *Carduelis carduelis* and Common Redpoll *C. flammea*, slightly larger than House Sparrow *Passer domesticus*. Sexes differ at all ages. Adult male distinctive, but vary considerably in appearance seasonally, due to plumage wear (not moult); in worn plumage have bright-yellow head, warm-brown upperparts with prominent blackish streaking, diagnostic long rufous-chestnut rump-patch, white panels in sides of tail and yellow underparts with streaked chest; at any distance, most obvious features are bright-yellow head and clouded breast, and, from behind and particularly when wings lowered, long rufous rump-patch; in fresh plumage, adult male has duller and less extensive yellow coloration, particularly on head and neck. Adult female throughout year rather similar to adult male in fresh plumage. Juvenile male and female rather similar to adult female, but with bolder dark streaking on body. Immature far less distinctive, with less yellow and more obvious streaks on underparts, but some indistinguishable in field from adult female. Slight clinal variation in n. hemisphere; subspecies *caliginosa* probably introduced to NZ and described below. **Adult male FRESH PLUMAGE (AUTUMN TO EARLY WINTER):** Head and neck marked yellow with prominent and complex dark markings. Top of head, from forehead to nape, upper hindneck and most of sides of neck, yellow with fine dark olive-brown or greenish-olive streaks to centre of crown, and blackish-olive streaks on nape. On each side of head, narrow blackish-olive or dark olive-brown lateral crown-stripe extends from lower forehead, back to, and broadening on, sides of nape, where often merge and continue as small patch onto centre of upper hindneck. Rather diffuse olive-grey band extends from sides of hindneck around rear sides of neck, sometimes merging with more olive-toned upper breast. Central ear-coverts, greenish olive or yellowish olive; rearmost ear-coverts, yellow, forming small yellow patch. Upper ear-coverts, blackish olive or olive-brown, forming rather broad rear eye-stripe which extends from behind eye towards sides of hindneck. Lores, greyish yellow. Eye-ring, narrow and unbroken, yellow. Narrow, blackish-olive moustachial stripe often merges with broad concolorous crescent extending round lower and rear edge of ear-coverts. Malar area, yellow, forming distinct yellow submoustachial stripe which separated from yellow chin and throat by narrow to fairly wide dusky-olive or rufous malar stripe. Mantle and

scapulars, rufous-brown with bold blackish stripes and narrow yellow-olive streaks (feathers, rufous-brown with broad blackish centres and yellow-olive fringes); merge into rufous-cinnamon back, rump and uppertail-coverts which form large rufous rump-patch; feathers of rump faintly scaled grey at tips. Uppertail, blackish brown, with narrow yellowish outer edges; when tail spread, bold white area visible on corners of outer rectrices (formed by wedge of white on distal halves of outer two pairs of rectrices). Folded wing, greyish-black, with: broad rufous-cinnamon fringes to tips of median secondary coverts, and rufous-cinnamon outer edges and tips of greater secondary coverts, tips aligning to form indistinct rufous-cinnamon median and greater wing-bars; broad rufous-yellow outer edges to tertials and secondaries, forming broad rufous-yellow panel along innerwing, usually broken by dark centres to tertials; and distinct narrow yellow to greenish-yellow outer edges of primaries, greater primary coverts and alula, those on primaries forming yellowish panel along edge of folded wing. Underbody largely lemon-yellow, with: greyish-olive upper breast, streaked darker olive, and sometimes continuous with olive-grey band extending over shoulder to sides of neck and hindneck (see above); grading into dull-rufous lower breast and upper flanks with bolder dark-brown streaking; rest of underbody, lemon-yellow with bold dull-black streaks on sides of belly and flanks which align to form longitudinal stripes, and with fine light-brown streaking to undertail-coverts. Undertail, dark greyish with conspicuous white panels on distal halves of outer two pairs of feathers. Underwing, pale yellow with broad greyish trailing edge formed by remiges. Bill: upper mandible bluish horn, with dusky culmen; lower mandible paler, lead-blue. Iris, dark brown. Legs and feet, pale flesh-brown. **Adult male WORN PLUMAGE (SPRING TO SUMMER):** Breed in worn plumage. Head and neck become brighter and more extensively yellow as dark markings reduced or lost with wear; when worn, dark markings reduced to remnants of streaking on rear of crown, and thinner and sometimes broken lateral crown-stripes (still continuing to sides of nape), rear eye-stripe, moustachial stripe and crescent round ear-coverts, and malar stripe. Back, rump and uppertail-coverts become uniform rufous-chestnut. Pale outer edges to tail bleach to off-white but also wear and sometimes largely worn off. On upperwing, edges and tips to tertials and greater coverts become pale grey; and outer edges to primaries, greater primary coverts and alula bleach to pale green-yellow or grey-yellow; upperwing becomes less rufous with wear. Underparts more extensively and brighter yellow, with: upper breast-band fairly uniform greenish olive; rest of breast and upper flanks, yellow with narrow rufous-cinnamon streaks; and lower flanks more sharply streaked rufous and black. **Adult female** General patterning somewhat similar to that of male in fresh plumage, but facial markings less prominent, ground-colour of upperparts

duller, and underbody paler yellow. Plumage quite variable, particularly in extent of facial yellow. Differences from adult male in fresh plumage: Crown extensively streaked blackish or dark olive-brown, usually much less extensively yellow and often only obvious as spot on centre of crown. Other areas of head and neck which yellow on fresh adult male, particularly sides of neck, supercilium, submoustachial stripe, chin and throat, tend duller and less uniform, and finely mottled or streaked olive-brown or greyish olive. Rear eye-stripe, moustachial stripe and crescent bordering ear-coverts, narrower and diffuse. Underbody, paler yellow, with slightly darker greyish-black streaking on sides of breast, flanks and undertail-coverts. With wear, plumage becomes slightly brighter and more extensively yellow, more so on head and neck, and more clearly streaked on underparts. Bare parts as adult male. **Juvenile** Plumage similar to adult female, and probably difficult to distinguish in field, but tends paler and duller, particularly yellow tones on head and neck, and more broadly streaked blackish on upperbody and underbody. Supercilium indistinct, pale yellowish-buff with blackish flecking or streaking. Eye-ring, pale buff or whitish. Pale yellowish-buff tips to median and greater coverts forming bright double wing-bar. Sexes similar or alike, but males tend more yellow on crown, chin, throat and belly than females. Bill paler and less bluish than adult; some birds, probably recently fledged, have indistinct yellow gape. Legs and feet, light pink-flesh. **First immature male** Like adult female, but tend brighter and more extensively yellow on head and neck, particularly on crown; rarely as prominent as fresh adult male and never like worn adult male; identical in plumage colour and markings to some brighter adult females. Juvenile tail, remiges and greater primary coverts retained and more worn than those of adult at same time of year (difference possibly visible in close view and apparent in autumn–early winter). Tips of tail-feathers often distinctly pointed. **First immature female** Similar to first immature male, but usually have less extensive, paler yellow on head, neck and underbody. Also tend paler and less extensively yellow than adult female, with buffier breast and clearer dark-brown streaking on underbody.

Similar species Worn adult males not likely to be confused with any other species. Juveniles, first immatures, adult females and some fresh-plumaged males potentially confused with juvenile, first immature and adult female **Cirl Bunting**, which also introduced to NZ (see that account for differences). With poor views, possibly confused with similar-sized **European Greenfinch** *Carduelis chloris* (also see that account). Unlikely to be mistaken for juvenile, immature or female **Common Redpoll**, which are obviously smaller, have shorter, more pointed bill, lack any yellow tones, show red wash on forehead and prominent white of buff greater wing-bar on folded upperwing. Juvenile and female **House Sparrow** similar size or slightly smaller than Yellowhammer but unlikely to be confused; Sparrow has more compact, shorter body and tail, deeper, more robust bill, and lacks yellow tones, complex facial markings and prominent dark streaking on underbody.

Flight recalls Common Chaffinch *Fringilla coelebs*, but action rather stronger, with often quicker bursts of wing-beats on take-off giving marked acceleration and rather shorter wing-closures producing at times remarkably direct progress and always less marked and less regular undulations. Length of tail produces characteristic attenuated silhouette in full flight. Landing is an untidy collapse due to length of tail. Escape flight often markedly long and steep, taking bird straight to top of shrub or tree. Gait a hop. Stance variable; often markedly upright on perch, with long forked tail below level of body but noticeably horizontal on ground. Raise head in alarm but usually looks short-necked (especially pale-headed male). Flick tail gently, particularly when uneasy (BWP). Ground feeder, favouring more open habitats such as grasslands

and particularly modified habitats such as farmland; uncommon in shrubland, though select such sites for breeding. Territorial in breeding season, gregarious in winter, when can join mixed-species flocks. Call distinctive; not likely to be confused with other species in HANZAB region. Song usually delivered from conspicuous perch: rapid, repeated short notes and a different ending *sre-sre-sre-sre-sre-sre-sre-sre-sre-sre* ('a little bit of bread and no cheese'). Commonest call a clipped, rather monosyllable *zit* or *chip*. Alarm call a high-pitched *see* or *eee*. In flight, a single *twick* or *zik*, and in flocks a characteristic liquid *twitup*, *tsirrup* or *trrp*.

HABITAT Mostly occur in open country, especially modified habitats such as farmland, and parks and gardens in settled areas. Common in coastal habitats, especially on beaches and nearby lagoons. Often inhabit tussock grassland, though seldom in alpine areas; and seldom recorded in forests, except along roads (see below). Mostly occur from sea-level up to 600 m asl, and occasionally up to 1600 m asl (Sibson 1958; Falla *et al.* 1981; NZRD).

Often occur in farmland (Hodgkins 1949; Edgar *et al.* 1965; Innes 1982; McLeod *et al.* 2005a,b,c; CSN 33, 42), especially hedgerows and ditches (McLeod 2005b), open pasture with thickets of shrubs and trees, such as willows *Salix*, Flax *Phormium tenax* or Tall Fescue *Festuca arundinacea* (Blackburn 1967; Pierce 1980); and crops, including stubble (CSN 3, 35, 37, 40, 48) or those infested with weeds (Blundell & McKenzie 1963); and very occasionally occur in vineyards (CSN 39). Also often recorded in open grassy areas in settlements (Innes 1982), such as parks and gardens (Falla *et al.* 1981; Guest & Guest 1987, 1993; Gill 1989; CSN 3, 4), and other grassy areas, e.g. playing fields or school grounds (CSN 35, 36, 41), or anywhere with newly sown grass (Jackson 1976; CSN 9, 35, 36, 41). Often inhabit tussock grassland, especially where interspersed with thickets of Manuka (Crockett 1954; Challies 1962, 1966), though seldom occur in subalpine tussock grasslands (Challies 1962; Child 1975). In subalpine areas, recorded in open shrubland, e.g. dominated by Boxleaf Hebe *Hebe odora* and *Olearia moschata* with patches of Alpine Totara *Podocarpus nivalis*, *Dracophyllum uniflorum*, *D. menziesii*, Turpentine Scrub *D. longifolium* and stunted Mountain Lacebark *Hoheria lyallii*, and ground-cover of alpine herbs, such as Mountain Daisy *Celmisia coriacea* and Mt Cook Lily *Ranunculus lyallii*, and patches of tall Broad-leaved Snow Tussock *Chionochloa flavescens* and *Aciphylla horrida* (Challies 1962; Child 1975, 1978). Occasionally in shrubland, including thickets of gorse *Ulex*, in other areas (Grant 1967). In coastal areas, often occur on beaches (Sagar 1976; Falla *et al.* 1981; Sibson 1983; CSN 5, 24), and in low vegetation, such as tidal *Sarcocornia* saltmarsh, or exposed mudflats at margins of inlets and lagoons (Pierce 1980; Owen & Sell 1985; J.M. Peter); occasionally also recorded in or at edge of mangroves (Beauchamp & Parrish 1999; CSN 31). Sometimes also occur round other wetlands, such as sewage ponds (Beauchamp & Parrish 1999) and on braided river beds (Merton & Veitch 1986). Occasionally recorded in and round plantations of exotic pines (Weeks 1949; Owen & Sell 1985; J.M. Peter), but seldom occur in native forests, such as beech *Nothofagus* forest (Dawson *et al.* 1978; Pierce *et al.* 1993; Gibb 1996), except at edge of forest (Secker 1958) or where bisected by roads, with areas of bare ground, introduced grasses and seeding herbaceous plants (Onley 1980). Elsewhere, often inhabit grassy roadsides (Edgar 1949; Hodgkins 1949; Innes 1982; J.M. Peter).

DISTRIBUTION AND POPULATION Widespread in Eurasia, from n. Iberian Pen. and British Isles E to L. Baikal and associated headwaters of Lena and Angara Rs; and from c. 70°N in Scandinavia and c. 65°N in Russia, S to n. shores of Mediterranean Sea (though only as far S as Douro R. and

middle and lower reaches of Ebro R. in n. Spain) and absent from offshore Mediterranean islands; in Middle East, occur S to Tigris R. in Iraq and n. Iran, and farther E, in Russia, occur S to upper reaches of Ural R., middle reaches of Irtysh R., and upper reaches of Ob, Yenisey and Angara Rs in w. and central Siberia, and very occasionally occur in Mongolia and Tien Shan Mts in nw. China; also occur in Kazakhstan, between Syrdar and Amudar Rs (de Schauensee 1984; Flint *et al.* 1984; BWP). Successfully introduced to NZ, and unsuccessfully introduced to Aust. and USA (Long 1981).

NZ Introduced; widespread. **NI:** Occur in all districts, though slightly more scattered in some parts of area from e. Bay of Plenty and adjacent areas of East Coast to n. Hawkes Bay (generally areas W of e. slopes of Raukumara, Huiarau and n. Ruahine Ras), and thence W through parts of Volcanic Plain, n. Manawatu and n. Wanganui (NZ Atlas; CSN). Also occur on numerous offshore islands, from Three Kings Is (historically) S to N. Brother I. in Cook Str. (Turbott & Buddle 1948; Gaston & Scofield 1995; Oliver; NZ Atlas; CSN). **SI:** Inhabit all districts (including offshore islands, from Stephens I. S to Stewart I. and associated islets), though occur at scattered sites in some areas: in Marlborough, recorded at scattered sites in area between Richmond Ra. and Seaward Kaikoura Ra.; in w. Canterbury, sparsely scattered or absent from parts of S. Alps; in Otago, scattered in area from Lammermoor and Lammerlaw Ras W to Umbrella Mts; and recorded at very sparsely scattered sites in Fiordland and s. West Coast, S of Cascade Pt; and at a few scattered sites in Kahurangi NP in n. West Coast and Nelson; widespread elsewhere (NZ Atlas; CSN).

Kermadec Is Resident and widespread on Raoul I. (Sorensen 1964; Edgar *et al.* 1965; Merton 1970; Merton & Veitch 1986; Veitch *et al.* 2004), where fifth most common species of passerine (Merton & Veitch 1986). First recorded in 1944 (Sorensen 1964). Two recorded on Curtis I., 15 Sept. 1988; and two on L'Esperance Rock, 14 Sept. 1988 (Tennyson & Taylor 1989; Veitch *et al.* 2004).

Chatham Is Uncommon resident (Heather & Robertson 2000). First recorded in 1910 (Thomson 1922). Records since 1957 include: single Pitt I., 1 Mar. 1957 (Lindsay *et al.* 1959); single South East I., 1961 (Freeman 1994); six, Mangere,

16–22 Aug. 1968 (Freeman 1994); two, Chatham I., Dec. 1978 (Freeman 1994; CSN 26); single South East I., 27 Dec. 1986 (Nilsson *et al.* 1994); two, Chatham I., 17 Oct. 1987 (Freeman 1994; CSN 36).

Snares Is Vagrant; records from Miskelly *et al.* (2001) unless stated. Mummified remains of single male, 14 Feb. 1969 (Warham & Keeley 1969); two, 13–29 Nov. 1976 (Sagar 1977; CSN 24); dried remains of single male, Dec. 1982; single, 5, 8 Nov. 1985; two, 29 Oct.–22 Nov. 1986; single, 8 Nov. 1987; single, 29–30 Apr. 1999; single 2, 7 May 1999.

Campbell I. Vagrant. Single specimen, 27 Apr.–2 May 1943 (Bailey & Sorensen 1962). Possibly occurred in 1907, when 'linnet' observed (Waite 1909).

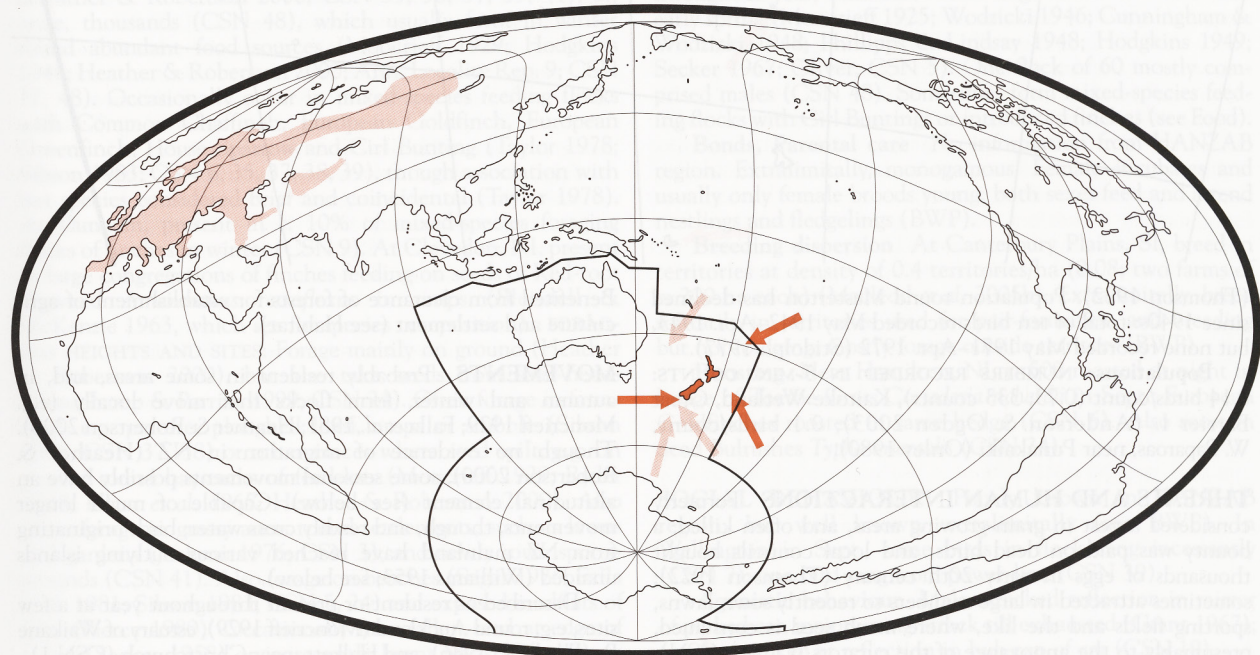
Lord Howe I. Vagrant. Single male, 18 Aug. 1949 (Hindwood & Cunningham 1950). Unconfirmed report of several birds, possibly this species, in late 1949 (Hindwood & Cunningham 1950).

Macquarie I. Unconfirmed report of single male, 5 July 2001 (not accepted by BARC [Sub. 324]).

Breeding Probably throughout range on NI and SI. Also recorded on Kermadec and Chatham Is (Williams 1953).

Introductions NZ Records of introductions by acclimatization societies summarized from Thomson (1922). **NI:** Eight released round Auckland in 1865, another four in 1867, five more in 1868, unknown number in 1869, another 16 in 1870 and 312 more in 1871. **SI:** Three released in Nelson in 1862, but no subsequent records. Single bird released in Canterbury in 1867 and another 34 in 1871. In Otago, eight released in 1868 and 31 more in 1871. In 1879, 32 were unsuccessfully released onto Stewart I. **Aust.** In Vic., 15 released at Royal Park, near Melbourne, in 1863, and 15 more the next year; failed to become established (Ryan 1906; Balmford 1978). In NSW, unknown number unsuccessfully released at various sites including Liverpool Plain, Bathurst, Inverell, Mudgee and Blue Mts in 1880 (Jenkins 1977). **USA** Unsuccessfully released round Cincinnati, Ohio, 1872–74 (Long 1981).

Change in range, populations Range quickly expanded soon after introduction, and by early 20th century occurred throughout NZ (Thomson 1922). Said to have been 'not uncommon' in Southland in early 1890s, with numbers subsequently declining, but a recovery was reported by 1918





(Thomson 1922). Population round Masterton has declined since 1940s: total of ten birds recorded May 1942–Apr. 1943, but none recorded May 1971–Apr. 1972 (Stidolph 1977).

Populations NUMBERS RECORDED IN 5-MIN. COUNTS: 0.14 birds/count (0.73; 333 counts), Kaitoke Wetland, Great Barrier I. (Anderson & Ogden 2003); 0.1 birds/count, W. Paparoas, near Punakaiki (Onley 1980).

THREATS AND HUMAN INTERACTIONS Formerly considered a pest in grain-growing areas, and often killed; a bounty was paid on dead birds, and local councils bought thousands of eggs in early 20th century (Thomson 1922); sometimes attracted in large numbers to recently sown lawns, sporting fields and the like, where much seed is consumed, presumably to the annoyance of the curators (Oliver; CSN).

Benefited from clearance of forests for establishment of agriculture and settlement (see Habitat).

MOVEMENTS Probably resident in some areas, and, in autumn and winter, form flocks that move locally (e.g. Moncrieff 1929; Falla *et al.* 1981; Heather & Robertson 2000). Though no evidence of migration in NZ (Heather & Robertson 2000), some seasonal movements possibly have an altitudinal element (see below). Capable of much longer movements, though, and readily cross water; birds originating from NZ mainland have reached various outlying islands unaided (Williams 1953; see below).

Described as resident or present throughout year at a few sites, e.g. round Auckland (Moncrieff 1929), estuary of Waikane R. (Wodzicki 1946), and Halkett, near Christchurch (CSN 1).

Some seasonal trends detected, as recorded in winter in many areas; unclear whether birds more conspicuous in winter, having formed flocks or made local movements into different habitats in winter; local populations possibly augmented in winter; or perhaps occur as winter visitors. In many areas on NI, considered a winter visitor. Mainly winter visitor to Port Whangarei (Beauchamp & Parrish 1999; CSN 48); present throughout winter at Manukau, with some still present in late Oct. (Ann. Locality Rep. 9); and winter visitor to Firth of Thames (Ann. Locality Rep. 9). Said to arrive at Taumararui in mid- to late autumn and leave in Aug.–Sept. (Moncrieff 1929). Winter visitor to Palmerston N (Guest & Guest 1993); and regular influx into Wellington and Upper Hutt in autumn, remaining in Wellington till Oct. and Upper Hutt till Nov. (Secker 1967). Many of these areas are either coastal or near-coastal, or in valleys, and thus possible that some movements may have an altitudinal aspect. This supported by observations in L. Harris Basin, 1070–1340 m asl, in nw. Otago, where only present in spring–summer, leaving in Feb.; area usually covered with deep snow in winter (Child 1978).

Birds originating on NZ mainland have colonized some outlying islands (Kermadec and Chatham Is; see Distribution and Population); colonization of Kermadec Is said to have been aided by prevailing sw. winds (Merton & Veitch 1986). Vagrants also recorded on various other outlying islands, from Snares Is, W to Lord Howe I. and S to Campbell I. and possibly Macquarie I. (see Distribution and Population), all presumably having come from mainland NZ (Williams 1953).

Banding Of 1188 banded 1950–96, none recovered 1988–93, and no information on recoveries at other times (Cossee 1989, 1992, 1993, 1995, 1997, 1998a,b; Cossee & Wakelin 1991).

FOOD Seeds and invertebrates. **Behaviour** Largely granivorous, though also occasionally take invertebrates; mostly forage on ground in small feeding flocks, sometimes with other species (see below). **DETAILED STUDIES:** At Christchurch International Airport, July–Sept. 1968 (Moeed 1975). **FORAGING ASSOCIATIONS:** Occasionally forage singly or in twos (Sagar 1977; CSN 6, 24), but usually in flocks of 12–45 birds (Phillipps & Lindsay 1948; Owen & Sell 1985; CSN 3, 5, 24, 33), and occasionally in large congregations of up to 500 birds (Heather & Robertson 2000; CSN 35, 36, 37, 39, 41), or, once, thousands (CSN 48), which usually form in winter round abundant food sources (Moncrieff 1929; Hodgkins 1949; Heather & Robertson 2000; Ann. Locality Rep. 9; CSN 37, 48). Occasionally occur in mixed-species feeding flocks with Common Chaffinch, European Goldfinch, European Greenfinch, House Sparrow and Cirl Bunting (Taylor 1978; Sibson 1983; CSN 6, 35, 37, 38, 39), though association with last species considered brief and coincidental (Taylor 1978). At Dunedin, present in c. 10% of mixed-species foraging flocks of finches in winter (CSN 9). At Clevedon, NI, present in large congregations of finches feeding on seeds of Red-root Pigweed *Amaranthus retroflexus* in crops (Blundell & McKenzie 1963, which see for species composition). **FORAGING HEIGHTS AND SITES:** Forage mainly on ground (Heather & Robertson 2000), but also take seeds from seed-heads (Beauchamp & Parrish 1999; CSN 24). Often forage in farmland, e.g. pasture, ploughed land, crops or stubble (Sibson 1966; CSN 37, 38) or other places where seed spilt, e.g. on ground round haystacks of feed-lots (Moncrieff 1929; Ryder 1948; Edgar *et al.* 1965; Heather & Robertson 2000). Also often forage in grassy areas round settlements, such as lawns and gardens (Jackson 1976; CSN 3), and newly sown sports-grounds (CSN 41). Also forage on beaches (Sagar 1976; Falla *et al.* 1981; Sibson 1983; CSN 5, 24) and exposed mudflats of lake (Pierce 1980). Occasionally take fallen seed at edge of forest (Secker 1958) or in recently burnt areas (Oliver); on

roads (Beauchamp & Parrish 1999; CSN 6, 33). Occasionally visit feeding tables (CSN 6). **FORAGING METHODS:** Hop when foraging on bare ground or among short grass (Heather & Robertson 2000). Once seen pecking at seaweed (CSN 24). **INTERSPECIFIC COMPARISONS:** At Christchurch International Airport, occupied similar foraging niche and may have competed with European Greenfinches and House Sparrows for food, but took more insects than European Goldfinches, European Greenfinches or House Sparrows. **PEST STATUS:** Seldom cause serious damage, feeding on grain and newly sown seeds, and damaging crops and haystacks, and considered a minor nuisance, though formerly regarded as a major pest (Dawson & Cresswell 1949; Heather & Robertson 2000; Oliver).

At CHRISTCHURCH INTERNATIONAL AIRPORT (n=204 food items from crop contents of two birds; Moeed 1975): **Plants** (All seeds.) **MONOCOTYLEDONS:** Poaceae: *Lolium* 85.8% no., 100% freq.; *Stipa* 4.9, 50; *Vulpia* 3.9, 50. **DICOTYLEDONS:** Geraniaceae: *Erodium* 1.0, 50; Oxalidaceae: *Oxalis* 0.5, 50. **Animals** **INSECTS:** Coleoptera: ad. 1.0, 50; Lepidoptera: larv. 2.9, 100.

Other records **Plants** (All seeds.) Seeds^{1,7,9,11,12,14}, chaff³; waterweed¹⁶. **MONOCOTYLEDONS:** Poaceae^{2,7,10,11,12}; *Poa annua*^{6,15}; *P. astonii*^{6,15}; *Spartina townsendii*⁸. **DICOTYLEDONS:** Amaranthaceae: *Amaranthus retroflexus*⁵; Asteraceae: thistle⁹; Fagaceae: *Nothofagus*⁴; Papilionaceae: *Trifolium*¹⁰. **Animals** Unident. animal matter¹⁵. **SPIDERS**¹⁰. **INSECTS**¹¹: Coleoptera¹⁰; Diptera¹⁰; Hemiptera¹⁰; Lepidoptera: larv.^{10,13}.

REFERENCES: ¹ Moncrieff 1929; ² Phillipps & Lindsay 1948; ³ Ryder 1948; ⁴ Secker 1958; ⁵ Blundell & McKenzie 1963; ⁶ Sagar 1977; ⁷ Child 1978; ⁸ Owen & Sell 1985; ⁹ Beauchamp & Parrish 1999; ¹⁰ Heather & Robertson 2000; ¹¹ Oliver; CSN ¹² 3, ¹³ 4 14 9, ¹⁵ 24, ¹⁶ 39.

Young Fed by both parents (see Breeding). Nestling diet mainly invertebrates; on Canterbury farmland, Lepidoptera and Arachnida were preferred prey fed to nestlings (McLeod *et al.* 2005a).

SOCIAL ORGANIZATION Poorly known in HANZAB region, but well known extralimitally (see BWP and references therein). In NZ, seen singly, in twos or small flocks throughout year; sometimes form large flocks in winter and early spring (Moncrieff 1925; Wodzicki 1946; Cunningham & Wodzicki 1948; Phillipps & Lindsay 1948; Hodgkins 1949; Secker 1967; Oliver; CSN 5). One flock of 60 mostly comprised males (CSN 48). Sometimes form mixed-species feeding flocks with Cirl Buntings or introduced finches (see Food).

Bonds, Parental care No information from HANZAB region. Extralimitally, monogamous. Female incubates and usually only female broods young; both sexes feed and attend nestlings and fledgelings (BWP).

Breeding dispersion At Canterbury Plains, SI, breed in territories at density of 0.4 territories/ha (0.08; two farms of c. 200 ha each) (Macleod *et al.* 2005b). Extralimitally, breed solitarily in territories used for pair-formation and breeding but not foraging; mostly forage outside territory (BWP).

Roosting Near Hamilton, NI, c. 500 roosted at night in hedge of Toetoe Grass *Cortaderia richardii* in Sept.; European Goldfinches roosted in same hedge (CSN 6). Also roost in dead Bulrushes *Typha orientalis* (CSN 34).

SOCIAL BEHAVIOUR Poorly known in HANZAB region, but well known extralimitally (see BWP). In Wellington in Sept., some birds in flock sang incessantly (CSN 7); one bird sang from power-line (CSN 39).

Agonistic behaviour Male attacked reflection in mirror of parked car, maintaining attack till exhausted (Grant 1967); another pecked at reflection in hub cap of car (CSN 19).

Sexual behaviour Courtship display seen in Dec., followed by mating (CSN 41); no other information from HANZAB region. For details of courtship display extraliminally, see BWP.

Relations within family group, Anti-predator responses of young No information from HANZAB region. **Parental anti-predator strategies** At nest with a nestling and two eggs, female performed distraction display when person approached to within 2 m of nest; female feigned injury, fluttering into grass with wings spread, and paused when c. 1–2 m from nest; resumed fluttering till c. 7 m from nest, then flew to nearby tree (Hadden 1991).

VOICE Well known extraliminally (see BWP, and references therein), but little published information from HANZAB region; sonagrams in BWP. In W. Palearctic, repertoire of adults consists of Song, Subsong and eight calls (BWP). Described as a vocal species (Merton & Veitch 1986). Song is most often reported vocalization in HANZAB region (see below). Part of Song similar to that of Cirl Bunting (Taylor 1978; BWP). **SEASONAL PATTERN:** Mostly start singing in Aug. or Sept., but sometimes as late as mid-Nov., and continue till Feb. (Falla *et al.* 1981; Heather & Robertson 2000; CSN), though, in 1926, heard singing in Nelson till late Apr. (Moncrieff 1929). Call at other times of year (Ward 1969; Falla *et al.* 1981; Heather & Robertson 2000). **DIURNAL PATTERN:** Mostly sing in morning and evening, at least till sunset (Cunningham & Moors 1985; CSN 5, 28), though also recorded at noon and in mid-afternoon (15:00) (CSN 1).

Adults SONG: Given in two parts: (1) First part consists of series of repeated short motifs giving chinking or buzzing trill, progressively increasing slightly in pitch; (2) concludes with one or two units, the first shrill and high-pitched, and the second of lower pitch. Sonagram **A** shows both parts of a song, in which the second part comprises two units. Popularly rendered as *little bit of bread and no cheese*, or otherwise as *tintintintintink-sweee* or *chitty-chitty-chitty...swee* (Moncrieff 1925; Falla *et al.* 1981; Heather & Robertson 2000; BWP), but none of these imparts the often disyllabic nature of second part (J.M. Peter), which, extraliminally, is rendered as *zi-teeee* or *tee-sii* (BWP). Song sometimes referred to as 'cheese song' (CSN 32, 34). Second part often omitted from Song early and late in season, when described as 'tentative' singing or 'part song' (Skegg 1963; Falla *et al.* 1981; Heather & Robertson 2000; CSN 1). Extraliminally, Song described as 'trivial and monotonous' (Wolstenholme 1926). Usually sing from conspicuous perch, such as overhead wires (Falla *et al.* 1981; CSN 19 Suppl., 39), though occasionally from concealed perch (DNFC 1949). Males sometimes sing while still in flocks (Falla *et al.* 1981; CSN 7) with individuals temporarily leaving flock to sing tentative Song (Ann. Locality Rep. 9). **SUBSONG:** Extraliminally, twittering Subsong given by adults of both sexes and by young in autumn (BWP), presumably after singing season finished. In HANZAB region, soft, tuneful warbling given by birds in flock (Falla *et al.* 1981; Ann.

Locality Rep. 8) probably refers to Subsong, as may trisyllabic call recorded on Kermadec Grp (Ward 1969). **CONTACT CALL:** Rendered as ringing *zeet*, *tink* or *chip* (Ward 1969; Falla *et al.* 1981; Heather & Robertson 2000). Delivered at measured rate and more or less regular intervals, rather than rapidly repeated (BWP). Said to be similar to Contact Call of Common Blackbird *Turdus merula* (Ward 1969). Most common call, given throughout year (BWP). **FLIGHT CALL:** Single or repeated *twik* given in flight (Falla *et al.* 1981; Heather & Robertson 2000; Bull. Rep. OSNZ 3). Birds in winter flocks sometimes utter similar, but disyllabic and more liquid, *twitup* or *twitic* (Falla *et al.* 1981; Heather & Robertson 2000). **AERIAL PREDATOR WARNING CALL:** Extraliminally, drawn-out *zieh* given as warning of presence of flying predator (BWP); buzz recorded on Kermadec Grp (Ward 1969) possibly refers to this call. **OTHER CALLS:** Six other calls reported extraliminally: Alarm Call, Aggressive Call, Soliciting Call, Chup Call and Z-lit Call (BWP).

Young No information from HANZAB region. Extraliminally, nestlings give soft *zee*, *tsi* or *ssississi* calls; fledgelings give similar *zee* calls when begging or flying after parent, and *tip* call given in bursts when parents approach, or at longer intervals when perched alone, and given by older fledgelings in flight. When 10–11 weeks old, give juvenile Subsong, which bears no resemblance to Subsong of adult (BWP).

BREEDING Poorly known in HANZAB region. Detailed studies at Canterbury Plains, SI, 2001–02 (Macleod *et al.* 2005a,c). Well known extraliminally (see BWP for details)

Season Eggs, Oct. to mid-Feb. (Falla *et al.* 1981; Hadden 1991; Heather & Robertson 2000; Oliver; CSN); nestlings, Dec.–Feb. (Hadden 1991; CSN). Unspecified breeding, including fledgelings, Oct.–Feb. (Falla *et al.* 1981; Heather & Robertson 2000; CSN 1).

Site Usually on ground among long grass, or near ground in dense shrub or occasionally a tree, such as Gorse *Ulex europaeus*, blackberries, bracken or other ferns (e.g. Silver Fern *Cyathea dealbata*), Manuka, Matagouri *Discaria toumatou* or Scotch Thistle *Onopordum acanthum* (DNFC 1949; Pennycook 1949; Child 1978; Falla *et al.* 1981; Heather & Robertson 2000; Oliver; CSN). **MEASUREMENTS (m):** Height of nest, 0.4 (0.47; 0–1.5; 12) (Pennycook 1949; CSN); usually 0.6–0.9, but sometimes 1.5 (Oliver); usually <1 (Heather & Robertson 2000). Height of nest-tree, 1.2 (CSN 4).

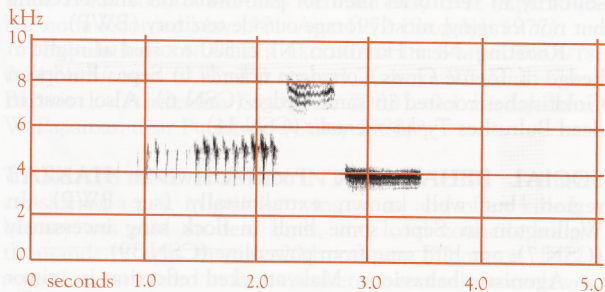
Nest, Materials Rough cup of dry grass, sometimes with small twigs; lined with rootlets, fine grass, hair, moss, wool and feathers (Pennycook 1949; Heather & Robertson 2000; Oliver; CSN 1). Some built in old nests of Song Thrushes *Turdus philomelos* (Heather & Robertson 2000).

Eggs Whitish, whitish pink or pinkish cream; entire surface marked with fine, scribbling, dark-brown lines, and some grey and light-brown spots and lines (Falla *et al.* 1981; Heather & Robertson 2000; Oliver). **MEASUREMENTS:** 21.0 × 17.2, 20.5 × 15.2, 21.5 × 16.0 (Oliver); 21.0 × 16.0 (Heather & Robertson 2000).

Clutch-size Mean clutch-size, 3.06 (0.85; 1–4; 16) (Niethammer 1970). Three to five (Falla *et al.* 1981; Oliver); three to five, usually four (Heather & Robertson 2000). At Canterbury Plains, 3.10 (0.08; 48) (Macleod *et al.* 2005c).

Laying Double-brooded (Falla *et al.* 1981; Heather & Robertson 2000); no other information from HANZAB region. Extraliminally, eggs laid early in morning on consecutive days (BWP).

Incubation By both sexes, but mostly by female (Heather & Robertson 2000). Extraliminally, only incubated by female (BWP). **INCUBATION PERIOD:** 13 days (12–14) (Heather & Robertson 2000); 12–14 days (Falla *et al.* 1981). Two infertile eggs were ejected from a nest after two other eggs in clutch hatched (Pennycook 1949).



A L.B. McPherson; Ward, SI, Jan. 1985; P107

Young Nestlings fed by both parents (Heather & Robertson 2000). Extraliminally, only female broods young (BWP). At nest with a nestling and two eggs, female performed distraction display when approached by person (see Social Behaviour: Relations within family group). For details of nestling growth rates at Canterbury Plains, see Macleod *et al.* (2005a).

Fledging to independence FLEDGING PERIOD: 12–13 days (Falla *et al.* 1981; Heather & Robertson 2000). At Canterbury Plains, 10.2 days (0.96; 41) (Macleod *et al.* 2005a). Extraliminally, fledgelings fed by both parents (BWP).

Success In nest with four eggs, one hatched and fledged (CSN 4). At Canterbury Plains, 88.1% (19.9; 26) of eggs hatched, and 91.7% (18.0; 40) of nestling fledged, with mean 0.87 fledgelings per breeding attempt (Macleod *et al.* 2005c). No other information from HANZAB region.

PLUMAGES Prepared by J.S. Matthew. Following summarized from BWP. Nestling has dense cover of long down. Fledge in juvenile plumage. Partial post-juvenile (first pre-basic) moult results in adult female-like first immature (first basic) plumage. Acquire adult plumage in complete first immature post-breeding (second pre-basic) moult, probably when c. 1 year old. Thereafter, complete post-breeding moult each cycle produces successive adult plumages with no change in appearance. Sexes differ. Three subspecies in n. hemisphere. Subspecies *caliginosa* introduced to NZ. For descriptions of plumage and bare parts of very similar nominate *citrinella*, see BWP. See Field Identification and Geographical Variation for descriptions of plumages of subspecies *caliginosa*.

MOULTS Information from NZ based on examination of skins of 13 adults (NMNZ), and comments in Niethammer (1971). For details on moults in n. hemisphere, see Svensson (1992), Jenni & Winkler (1994) and BWP. **Adult post-breeding** (Third and subsequent pre-basic). Complete (Jenni & Winkler 1994; BWP). Starts at p1; individual duration of moult of primaries c. 54 days, but sometimes >80 days (BWP). Some birds suspend moult of primaries after p1–p4 replaced (Jenni & Winkler 1994). In skins from NZ: all of seven from May–June had all primaries new or slightly worn; all of six from July–Nov. had all primaries worn, less so in July–Aug. Niethammer (1971) indicated birds in NZ have active moult in Jan. and Feb. **Adult pre-breeding** (Pre-alternate). Little known. Jenni & Winkler (1994) stated that some birds in Europe replace some feathers of head and upperparts in spring. Not known if any birds in NZ undergo partial pre-breeding moult. **Post-juvenile** (First pre-basic). Partial; involves all feathers of head and body, marginal and median wing-coverts, and all greater secondary wing-coverts; a few birds replace one or more tertials, and some replace up to three inner rectrices (Jenni & Winkler 1994; BWP). No information on extent or timing of post-juvenile moult in NZ. **First immature post-breeding** (Second pre-basic). No information from NZ, but timing and extent probably similar to adult post-breeding.

MEASUREMENTS SUBSPECIES *CALIGINOSA*: (1) NZ, adults, skins, sexed by plumage and museum labels (NMNZ). (2–3) Adults, skins (Niethammer 1971): (2) NZ; (3) England and Scotland. (4) Ireland, Scotland and w. England, skins, ages not given (BWP). NOMINATE *CITRINELLA*: (5) Germany, adults, skins (Niethammer 1971). NZ birds presumed to be *caliginosa* (but see Geographical Variation for discussion).

	MALES	FEMALES	
WING	(1) 85.2 (2.12; 81–89; 19)	–	
	(2) 87.0 (2.36; 82–90; 48)	82.6 (1.33; 81–85; 13)	**
	(3) 86.1 (2.53; 81–92; 37)	81.3 (2.13; 76–84; 18)	**
	(4) 86.4 (3.35; 80–91; 10)	77, 80, 80	

	(5) 89.7 (2.32; 85.5–95; 90)	84.1 (2.21; 83–89; 25)	**
TAIL	(1) 72.1 (2.88; 67–77; 19)	–	
	(2) 71.2 (2.06; 66–75; 46)	67.8 (2.22; 65–71; 12)	**
	(3) 71.7 (2.75; 66–78; 63)	67.5 (2.56; 62–73; 33)	**
	(4) 67.9 (2.51; 63–72; 10)	60, 61, 62	
	(5) 74.6 (2.97; 68.5–80; 15)	69.3 (1.88; 65–73; 23)	**
BILL S	(1) 13.6 (0.52; 12.7–14.7; 19)	–	
	(4) 13.8 (0.82; 11.9–14.6; 10)	13.4, 13.9, 14.7	
BILL N	(4) 7.9 (0.30; 7.4–8.4; 10)	6.6, 7.5, 8.7	
TARSUS	(1) 19.6 (0.74; 18.3–20.9; 18)	–	
	(4) 19.4 (0.87; 17.9–20.7; 9)	18.0, 18.5, 19.6	

WEIGHTS SUBSPECIES *CALIGINOSA*: (1) NZ, adults, from museum labels (NMNZ). (2) NZ, adults (Niethammer 1971).

	MALES	FEMALES
(1)	24.9 (4.45; 17.5–30.8; 16)	–
(2)	25.7 (23–30; 10)	25.2 (24–27.5; 5)

Browne & Browne (1956) gave the following weights for *caliginosa* (ages not given) from Skokholm I., Wales: 23.1, 23.7, 26.4.

STRUCTURE See BWP for details.

AGEING See Svensson (1992) and Jenni & Winkler (1994) for details; identification of juveniles and first immatures summarized in Field Identification. Juveniles distinguished by plumage and, to a lesser extent, bare parts (see Field Identification). Following summarized from Jenni & Winkler (1994). First immatures very similar to adult female. As post-juvenile moult includes all secondary coverts, there is no obvious moult-contrast in wing of first immatures. However, most birds (c. 70% of individuals in European populations) replace one or more tertials in post-juvenile moult; in autumn, these birds show contrast between worn retained juvenile tertials and fresh replaced tertials. Shape of rectrices useful for distinguishing first immatures from adults; most birds retain all juvenile rectrices, which are narrower and more pointed at tips than those of adult (see illustration in Svensson [1992] for difference in shape of juvenile and adult rectrices); some birds (c. 15% of individuals in European populations) replace one or more of t1–t3 in post-juvenile moult; these similar in shape to those of adult and showing moult-contrast with more worn retained juvenile rectrices. First immatures probably difficult to distinguish from adult females by spring, due to wear of plumage.

SEXING See Svensson (1992), Jenni & Winkler (1994) and BWP for details. Adults plumage- and size-dimorphic (see Field Identification). First immatures more difficult to sex, and some probably not sexable. First immature females have narrow, mostly concealed yellow at base and centre of feathers of forehead and crown (cf. first immature males which have yellow on basal half or less of these feathers); also, first immature females tend paler yellow on underparts than adult females and immature males (BWP). See Svensson (1992) for illustrations of crown-feathers of both sexes of adults and immatures.

GEOGRAPHICAL VARIATION Slight and largely clinal in n. hemisphere, mostly involving colour of plumage (BWP). Most authors recognize three subspecies: nominate *citrinella* from w. Europe, sw. England, E to nw. Russia and nw. Balkans; *caliginosa* from Ireland, Scotland, Isle of Man, and n. and w. England; and paler and more rufous-plumaged *erythrogenys* from e. and se. Europe, S to Ukraine and s. Ural Mts, and E to Iran, Caucasus and central Siberia, wintering S to Iraq, Tien Shan Mts (China) and n. Mongolia; *caliginosa* and nominate said to intergrade in w. England; *erythrogenys* and nominate intergrade in w. Russia, Baltic States, and parts of e. Europe

including Slovakia, w. Belarus and w. Ukraine (Svensson 1992; Peters; BWP). Populations in sw. England and w. continental Europe (w. France, Belgium, Netherlands and w. Germany) sometimes considered as subspecies *nebulosa*, based largely on their duller yellow plumage, less extensive rufous on underparts and more distinct olive band across upper breast (Harrison 1954, 1955a). However, these birds not considered sufficiently different from other w. European populations of nominate to warrant recognition as a subspecies (Peters; BWP).

Birds introduced to NZ probably subspecies *caliginosa*, based on measurements and plumage coloration (Niethammer 1971). Compared with nominate, *caliginosa* slightly darker with slightly bolder streaking on upperparts, warmer rufous mantle and scapulars, and less olive on hindneck and upper breast (Svensson 1992; BWP). However, Harrison (1955b) suggested NZ populations are not derived, at least not entirely, from British *caliginosa*, but instead nominate *citrinellus* from central Europe, which migrate to British Isles in non-breeding season (when ancestral stocks thought to have been trapped). Harrison (1955b) also suggested NZ birds are slightly smaller than birds of central Europe; this supported by measurements above. As provenance of birds introduced to NZ is unknown, the subspecific identity of NZ populations remains uncertain.

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Volume 7 (Part B), Plate 39

Common Redpoll *Carduelis flamma* (page 1345)

SUBSPECIES CABERET: 1 Adult male (fresh plumage); 2 Adult male (worn plumage); 3 Adult female; 4 Juvenile; 5 Immature male; 6 Adult male

Yellowhammer *Emberiza citrinella* (page 1449)

SUBSPECIES CALIGINOSA: 7 Adult male (fresh plumage); 8 Adult male (worn plumage); 9 Adult female; 10 Juvenile; 11 Immature male; 12 Adult male

Cirl Bunting *Emberiza cirlus* (page 1457)

13 Adult male (fresh plumage); 14 Adult male (worn plumage); 15 Adult female; 16 Juvenile; 17 Adult male