

## 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 cirrus* **Cirl Bunting**

COLOUR PLATE FACING PAGE 1368

*Emberiza cirrus* Linnaeus, 1766, *Syst. Nat.* 12(1): 311 — southern Europe.

The specific name is from local Bolognese (Italian) name 'cirlo' for some sort of bunting.

OTHER ENGLISH NAMES None.

MONOTYPIC

**FIELD IDENTIFICATION** Length 15.0–16.5 cm; wingspan 22–25.5 cm; weight 21–29 g. Introduced to NZ. Medium-sized bunting, recalling Yellowhammer *Emberiza citrinella* but with rather smaller, slighter and more compact form; often in flatter-headed, more hunched appearance; plumage also recalls Yellowhammer but at all times has dull greyish-olive to greyish-brown rump. Male unmistakable, with black throat and eye-stripe and broad olive-green breast band. Female and first immature very like Yellowhammer but with distinctly striped face, reflecting pattern of male (see below). Both sexes distinguished by: olive-tinged grey-brown and streaked rump, greater contrast on side of head between dark markings and ground colour; reddish-brown shoulders, crown wholly streaked greenish grey-brown (no hint of paler crown centre). Typical song and commonest calls differ from Yellowhammer. Sexes differ. Adults show seasonal variation in plumage, but this due to wear, not moult. Juvenile separable at close range. **Adult male FRESH PLUMAGE (AUTUMN TO EARLY WINTER IN NZ):** Top of head from forehead to nape, hindneck and sides of neck, olive-green to greyish olive, rather finely streaked black, densely so on sides of crown, faintly so on nape and sides of neck. Rather prominent yellow or pale-yellow supercilium extends from sides of lower forehead, above eye, to above ear-coverts, narrowest above eye. Blackish-olive or dark olive-grey eye-stripe extends over lores, merging with dark greyish eye-ring, and continues behind eye across upper ear-coverts, stripe finely flecked yellow. Most birds have prominent, broad, yellow or pale-yellow stripe extending from near base of upper mandible, below eye and broadening across lower ear-coverts; some birds have this area dark olive-grey, flecked pale yellow. Rearmost ear-coverts, yellow, forming small yellow spot below rear edge of dark eye-stripe. Malar area, chin and throat, black with fine pale-yellow flecking formed by tips to feathers; combine to form dark bib which, in some birds, continues narrowly below and behind ear-coverts and merges with dark eye-stripe. Mantle and scapulars, chestnut, with terminal black streaks which boldest on mantle, indistinct on scapulars, and with yellowish edges to feathers forming fine streaks. Rest of upperbody, yellow-green or greenish-grey, often tinged chestnut, with fine blackish or dark-greyish streaks, more prominent on longest uppertail-coverts. Uppertail, dark brown or blackish brown, with narrow greenish to whitish outer edges to rectrices, outer pair with broader edges forming white sides to outertail; outer two feathers also have large white wedge on distal part of inner webs, largest on outermost feather, and visible as white corners to tip of tail in flight. Upperwing, mostly rufous-brown broken by dark-greyish centres to remiges and secondary coverts, and mostly greyish-black greater primary coverts and alula; median secondary coverts have pale-grey or whitish fringes to tips which combine to form narrow pale wing-bar; primaries and secondaries have greenish to whitish outer edges, those on primaries combining to form diffuse pale panel on outerwing. Underbody, mostly yellow or pale yellow, with following diagnostic markings: (1) narrow yellow band or crescent below black bib, extends from sides of neck (where narrowest) across uppermost breast; and contrasts sharply with (2) broad olive or greyish-olive central breast-band; (3) chestnut patch on each side of lower breast, often overlain by darker rufous or

brownish streaking; and (4) dark brown or dark rufous-brown streaking on flanks, upper belly and longest undertail-coverts. Undertail, greyish with broad white outer edges on distal half of tail. Underwing mostly greyish, with white tips to secondary coverts and narrow yellowish leading edge round bend of wing. Bill: upper mandible, grey-black; lower mandible, pale bluish-grey with grey-black tip. Iris, brown. Legs, pinkish brown. **WORN PLUMAGE (SPRING–SUMMER):** With wear, facial pattern bolder and plumage markings more sharply demarcated. Forehead and crown, greyer with clearer blackish streaking. Yellow of supercilium, stripe below eye and band across upper breast, brighter and more prominent; facial bib, blacker as yellow tips to feathers worn off. Yellow fringes to feathers of mantle and scapulars wear off. Underbody, darker with richer olive-green central breast-band and richer chestnut patch on sides of breast. **Adult female** Plumage individually variable. Mostly buff-brown and grey-brown, lacking strong yellow or chestnut tones. Head and neck rather similar to fresh-plumaged adult male but facial markings less prominent; forehead and crown, greenish olive with fine blackish streaking. Top of head similar to adult male. Supercilium, buff or dull yellow, narrower and more diffuse than adult male. Lack prominent dark eye-stripe, instead having brownish-yellow lores and dark olive-brown or dark olive-grey rear eye-stripe (across upper ear-coverts). Small pale-yellow patch abuts lower edge of rear eye-stripe, usually more diffuse than in adult male. Lack yellow stripe below eye, but have narrow grey-brown or dark olive-brown moustachial stripe extending from gape to below ear-coverts. Diffuse, pale yellow submoustachial stripe, often finely mottled or streaked brown, extends from near base of lower mandible towards sides of neck, bordered below by narrow and diffuse brown or olive-brown malar stripe. Lack blackish bib; instead chin and throat pale yellow, usually with blackish-brown mottling or narrow streaks on lower throat. Upperbody, greyish brown or greyish buff on mantle, chestnut on scapulars (often forming distinct chestnut scapular panels), both areas boldly streaked black-brown, grading to olive-brown or greyish brown on back, rump and uppertail-coverts, with fainter blackish-brown streaking which sometimes absent on rump and uppertail-coverts. Tail as male. Wings as adult male but tend duller, with fringes to tertials and greater secondary coverts duller rufous-brown. Underbody less markedly patterned than adult male, with greyish-buff or olive-grey breast, grading to pale chestnut on sides of lower breast, and dull yellow or pale yellow on flanks, belly, vent and undertail-coverts, with bold, but rather fine, blackish or dark-brown streaking to all except centre of belly. Bare parts as adult male. With wear (in spring–summer), upperbody grades deeper chestnut with darker and bolder blackish streaking, and underparts grade paler yellowish with bolder blackish streaking as edges and fringes to feathers worn away. **Juvenile** Very similar to adult female in fresh plumage, but yellow tones tend paler and less prominent, and streaking to upperbody, chin, throat and underbody, slightly broader and less clear-cut. Recently fledged birds have soft, loosely textured rump-feathers, sometimes with traces of down present. Upperwing as adult female, but median and greater secondary coverts have broader buff-brown fringes. Bare parts as adult but lower mandible has pinkish tinge at base and cutting edges

to bill are paler, greyish yellow; legs and feet, paler flesh-pink. **First immature** Both sexes resemble adult female. Rectrices have more pointed tips than in adult, but this only visible in very close view. Bare parts as adult.

**Similar species** Slightly slimmer and smaller than **Yellowhammer**, with slightly shorter tail and more robust and drooping bill; may appear slightly shorter-necked with slightly hunched appearance (BWP); differences in size and shape probably only obvious when two species seen in direct comparison. Female, immature and juvenile Cirl Bunting most likely to be confused with female, immature and juvenile Yellowhammer. Best distinguished from Yellowhammer by: olive-brown or grey-brown rump with rather faint blackish streaking (unstreaked and dull rufous-brown in Yellowhammer); generally buffy or grey-brown appearance, lacking yellow tones on top of head (Yellowhammer typically with some yellow on top of head, particularly on centre of crown when worn); strong contrast between dark and pale markings on sides of head (tend more diffuse in Yellowhammer); largely chestnut scapulars contrast with duller and more greyish mantle to form chestnut scapular panel (in Yellowhammer, scapulars not obviously contrasting with mantle). Calls diagnostic. Juvenile may superficially resemble female House Sparrow *Passer domesticus* from above, but House Sparrow lacks streaks on crown and has totally unstreaked underparts.

Most of following based on information from n. hemisphere (BWP): Flight lighter and more regular, and body appears less robust than Yellowhammer; over longer distances, has shallower undulations and weaker wing-beats. Stance less upright than Yellowhammer; often have hunched appearance and often sit down on one or both tarsi. Wings often more dropped than Yellowhammer, said not to flick wings or tail, or bob head. Hop, usually slowly, along ground, though sometimes fast and sprightly. Rather furtive and skulking, often keeping to tree and shrub cover, but male sometimes sits in open when singing. Can form flocks in winter, often on open ground; in UK, usually stay within 30 m of cover, unlike Yellowhammer. Usually in singles or twos, though vagrants may join mixed flocks of other buntings and finches. In NZ, sometimes join flocks of House Sparrows, European Greenfinches *Carduelis chloris*, European Goldfinches *C. carduelis* or Yellowhammers when feeding; regularly seen flocking with Yellowhammers in winter. Voice distinctive. Song a brief, rapid trill *tirrr*, rather rattling and metallic; sometimes shifts between two pitches. Commonest call, used in contact by birds on ground, by paired males and females, and occasionally in flight, a thin *zit*, *sit* or *see*; also a soft, downslurred *tsyu*; noticeably less metallic than common call of Yellowhammer.

**HABITAT** Often inhabit farmland, especially open pasture interspersed with scattered trees and hedgerows (Taylor 1978; CSN 20, 22, 37, 38, 42); also recorded in rough grassland, with scattered shrubs or thickets of Gorse *Ulex europaeus*, briar or Matagouri *Discaria toumatou* (Heather & Robertson 2000; C.F.J. O'Donnell). In coastal and near-coastal areas, occasionally occur in low saltmarsh dominated by *Sarcocornia* (Heather & Robertson 2000; CSN 33, 36, 37, 38), and occasionally coastal grasslands or sand-dunes (Heather & Robertson 2000; CSN 37). Frequently in willow-fringed wetlands in Canterbury (C.F.J. O'Donnell). Also recorded in low, open shrubland, dominated by Manuka *Leptospermum scoparium* and Monoao *Dracophyllum subulatum*, 0.9–2.4 m tall (Fordham 1961), or denser shrubby habitats in gullies (Taylor 1978), remnants of indigenous shrubland, and edges of remnant native forest on Banks Pen., Canterbury (C.F.J. O'Donnell). Occasionally occur in settled areas, including towns and gardens (CSN 22, 28, 37, 47), and grassy areas, such as sports fields, golf courses and race tracks (CSN 34, 36, 37, 42, 43). Also sometimes recorded in plantations of exotic

pinus (CSN 19 Suppl., 37). Occur from sea level up to elevations of 750 m asl (Taylor 1978; NZCL).

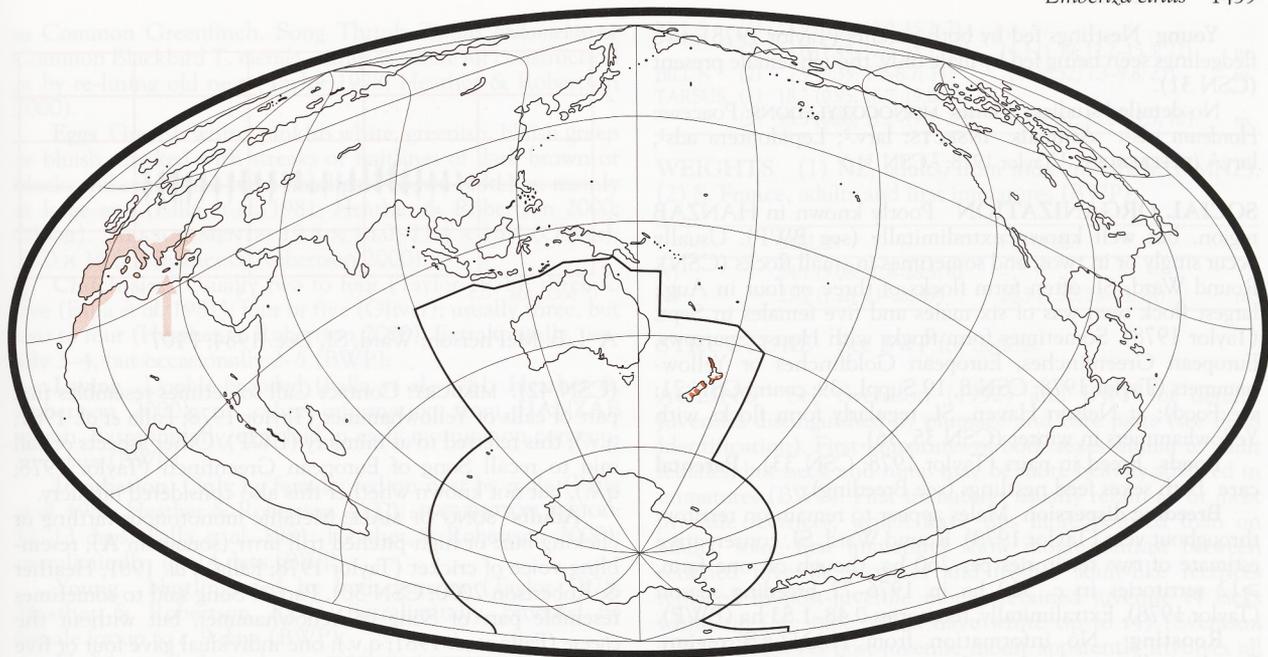
**DISTRIBUTION AND POPULATION** Occur in s. and sw. Europe, from Atlantic coasts of Morocco, Iberian Pen. and France E to s. shores of Black Sea, and S of line joining s. England, n. France, Switzerland, n. Italy, the former Yugoslavia, Bulgaria and n. Turkey, mainly extending S to n. shores of Mediterranean Sea, including various offshore islands, but also occur in coastal and near-coastal n. Africa, from nw. Tunisia, through n. Algeria, to Morocco (BWP). Successfully introduced to NZ (Long 1981).

**NZ** Introduced. Range rather restricted. **NI** Recorded at a few sparsely scattered sites; most records S of 38°S. **NORTHLAND:** A few records at Mt Tiger, near Kerikeri and Whangamumu, round Bay of Islands (CSN 20, 39, 44). **AUCKLAND:** Recorded at Ahuroa, N of Auckland (NZCL). **EAST COAST:** Only other record from N of 38°S was at East C. Farther S, recorded at a few sites round Gisborne, e.g. Tuahine Pt, Makauri, Kaiti Hill and Muriwai, and also at Wairoa. **HAWKES BAY:** Published records from Napier, Clive and Mangakuri. **WAIRARAPA, WELLINGTON AND MANAWATU:** Occur at scattered sites from round Whangamoana and s. Rimutaka Ra. N to Aokutere and Palmerston N (NZ Atlas; NZCL; CSN). **SI** Occur at scattered sites E of S. Alps. **NELSON:** Recorded at several sites on Farewell Spit, but mostly in coastal and near-coastal localities round Tasman Bay, from Abel Tasman NP S to Waimea Plains, and thence NE to Wakapuaka. **MARLBOROUGH:** Recorded at scattered sites: Stephens I. and various sites in Marlborough Sounds, S to Kanae Bay; between Blenheim and Ward; and between Kaikoura and Oaro. **CANTERBURY:** Recorded at a few sites in NE, e.g. Waiiau, Cheviot and Gore Bay; more widespread farther S, from mouth of Waipara R. S to sw. L. Ellesmere, and E to sites on Banks Pen., and inland to Summerhill (Rangiora) and Dunsandel; farther S and W, recorded at sparsely scattered sites from L. Coleridge S to St Andrews and L. Aviemore, and W to L. Ohau. **OTAGO:** Widespread in parts, especially in N and E: widespread between Otematata and Duntroon in N, and in coastal and near-coastal areas from mouth of Waitaki R., S to Waihola. Elsewhere, recorded at Middlemarch, and at widespread but scattered sites on e. slopes of S. Alps, from Alexandra and Queenstown N to L. Hawea and Lindis Pass (Taylor 1978; Heather & Robertson 2000; NZ Atlas; CSN). **SOUTHLAND:** Historical record from Resolution I. in Fiordland, Mar. 1949 (CSN 4). **WEST COAST:** Single recent record at Anderson Glen, a tributary of Jackson, R., Cascade SF, c. 50 km S of Haast, 18 June 1983 (O'Donnell & Dilks 1983).

**Breeding** Few published records; presumably at scattered sites throughout much of range.

**Introductions** Few documented releases, referring to only a few birds, though other releases were possibly not recorded (NZCL). **NI** Four birds released in Wellington in 1880 (Oliver). **SI** Seven birds released in Otago in c. 1868 (Hutton & Drummond 1904) or 1871 (Thomson 1922). Another 18 were unsuccessfully released on Stewart I., Southland, in 1879 (Thomson 1922).

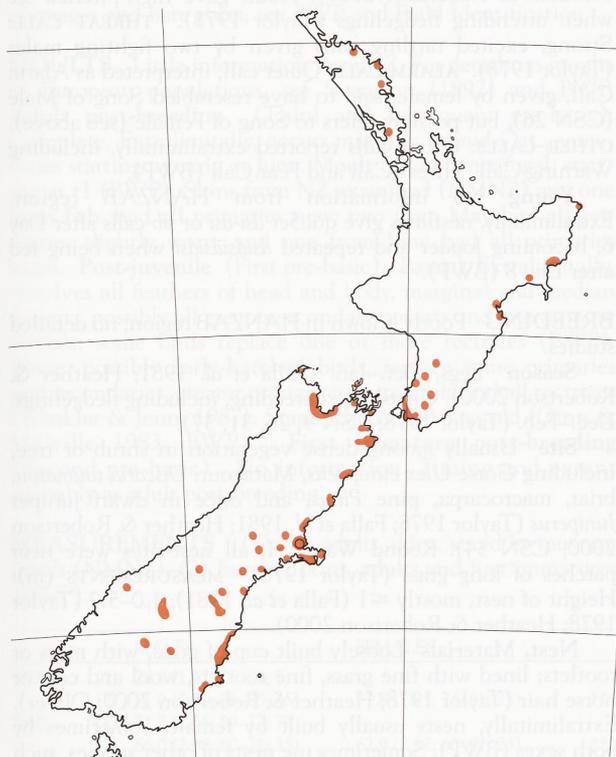
**Change in range, populations** Least successful of the introduced European passerines (NZ Atlas). After release in Otago, said to have been 'not uncommon' round Dunedin by 1878, and, by 1891, range had expanded to include Malvern Hills in Canterbury (Hutton & Drummond 1904). Said to have been common in Taranaki, especially round Hawera, by 1916 (Thomson 1922), but no records from there for decades (NZ Atlas; CSN). Fluctuations of populations round Christchurch and in Otago were reported in late 19th or early 20th centuries, with numbers oscillating between being common and rare (Thomson 1922). A few historical records round



Tauranga, but no published records since 1950s (Stidolph 1950; CSN 4, 19 Suppl.).

**Populations** Total population estimated at 2000–5000 birds (Heather & Robertson 2000). No realistic estimates of densities: at Ward, SI, 0.023 calling males/ha (Taylor 1978).

**THREATS AND HUMAN INTERACTIONS** In Canterbury, adversely affected by loss of habitat through subdivision of shrubland for residential development or establishment of pine plantations (C.F.J. O'Donnell). Occasionally killed by vehicles on roads (CSN 41). Formerly trapped and kept as cagebirds (Thomson 1922).



**MOVEMENTS** Poorly known in HANZAB region. No clear pattern, but probably sedentary (see below). Some males apparently remain on territories throughout year (Taylor 1978). Form small flocks in Feb.–Aug. which move locally, mainly from farmland to coastal grassland and saltmarsh; these local movements sometimes described as nomadic (Falla *et al.* 1981; Long 1981; Heather & Robertson 2000). Extralimittally, sedentary (BWP).

Described as resident (possibly referring to sedentary of HANZAB) at various sites, e.g. Lyttelton Harbour and Halkett, near Christchurch (CSN 1, 37, 39, 43), and at Tarras and Ardgour Valley in central Otago (CSN 38). Probably also resident at Henley, near Dunedin, where recorded Oct.–June (CSN 37). Recorded in both summer and winter at Kakanui (CSN 48) and Oamaru (CSN 43).

**Banding** Of 30 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. **Behaviour** Forage singly or in small parties, taking seeds from seed-heads (Taylor 1978; CSN 42). Sometimes forage in mixed-species flocks, usually with Yellowhammers (Taylor 1978; CSN 43). No detailed studies. **FORAGING ASSOCIATIONS:** Forage singly (Taylor 1978; O'Donnell & Dilks 1983; CSN 37), in twos (CSN 26, 42) and in small flocks of 6–8 (CSN 42, 43). Forage in mixed-species flocks with Yellowhammers (Taylor 1978; CSN 43), House Sparrows (CSN 28) and 'other finches' (CSN 19 Suppl.) or other 'small birds' (Taylor 1978). Round Ward, SI, association with Yellowhammers said to be coincidental and usually short-lived (Taylor 1978). **FORAGING HEIGHTS AND SITES:** Seeds taken from seed-heads of grasses (Taylor 1978; CSN 21). Seen foraging on bare ground and among introduced grasses and Scabweed *Raoulia tenuicaulis* (O'Donnell & Dilks 1983) and on lawns (CSN 28). **FORAGING METHODS:** Round Ward, SI, gleaned (plucked) Barley seeds either directly from seed-head, or by severing seed-head, then removing seeds (Taylor 1978). **FOOD HANDLING:** Dehusk Barley seeds by nipping them several times (Taylor 1978).

No detailed studies. **Plants** Seeds<sup>2</sup>. **MONOCOTYLEDONS:** Poaceae: sds<sup>4,6</sup>; *Hordeum* sds<sup>1,3</sup>. **DICOTYLEDONS:** Chenopodiaceae: *Sarcocornia* sds<sup>5</sup>. (REFERENCES: <sup>1</sup> Taylor 1978; <sup>2</sup> Heather & Robertson 2000; CSN <sup>3</sup> 21, <sup>4</sup> 26, <sup>5</sup> 37, <sup>6</sup> 42.)

**Young** Nestlings fed by both parents (Taylor 1978); two fledgelings seen being fed by male only, though female present (CSN 31).

No detailed studies. **Plants** MONOCOTYLEDONS: Poaceae: *Hordeum* sds<sup>2</sup>. **Animals** INSECTS: larv.<sup>2</sup>; Lepidoptera ads<sup>1</sup>, larv.<sup>1</sup> (REFERENCES: <sup>1</sup>Taylor 1978; <sup>2</sup>CSN 31.)

**SOCIAL ORGANIZATION** Poorly known in HANZAB region, but well known extralimitally (see BWP). Usually occur singly or in twos, and sometimes in small flocks (CSN). Round Ward, SI, often form flocks of three or four in Aug.; largest flock seen was of six males and five females in Sept. (Taylor 1978). Sometimes form flocks with House Sparrows, European Greenfinches, European Goldfinches or Yellowhammers (Taylor 1978; CSN 8, 19 Suppl., 39; *contra* CSN 21; see Food); at Nelson Haven, SI, regularly form flocks with Yellowhammers in winter (CSN 35, 36).

**Bonds** Breed in pairs (Taylor 1978; CSN 33). **Parental care** Both sexes feed nestlings (see Breeding).

**Breeding dispersion** Males appear to remain on territory throughout year (Taylor 1978). Round Ward, SI, conservative estimate of two territories per 260 ha, though on one farm,  $\geq 12$  territories in c. 520 ha in 1976–77 breeding season (Taylor 1978). Extralimitally, territories 0.48–1.83 ha (BWP).

**Roosting** No information from HANZAB region. Extralimitally, roost  $\geq 1$  m above ground, usually in dense vegetation, including hedgerows, and occasionally in leafless shrubs (BWP).

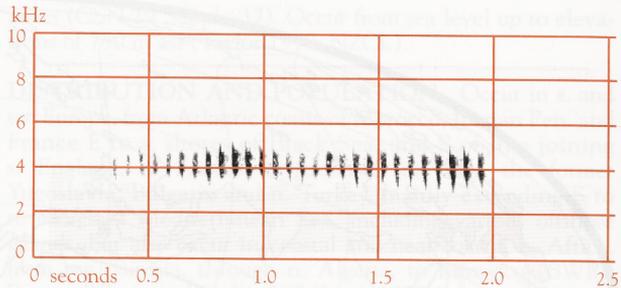
**SOCIAL BEHAVIOUR** Poorly known in HANZAB region, but well known extralimitally (see BWP). Easily approached (O'Donnell & Dilks 1983). Males sing from elevated perches, especially trees, power poles and overhead wires; not recorded singing from ground, though once from shrub <1 m tall (Taylor 1978; Falla *et al.* 1981; Heather & Robertson 2000; CSN 9, 28), probably either to proclaim territory or advertise for mate (Taylor 1978; Heather & Robertson 2000; see Voice).

**Agonistic behaviour** Males seen fighting by facing each other, almost touching, and singing while flying vertically c. 5 m, then descending in different directions (Taylor 1978). **Alarm Call** in alarm (CSN 26; see Voice).

**Sexual behaviour** No information in HANZAB region. For extralimital details, see BWP.

**Relations within family group** When attending fledgelings, adults give high-pitched Contact Call (Taylor 1978; see Voice). **Anti-predator responses of young, Parental anti-predator strategies** No information from HANZAB region.

**VOICE** Well known extralimitally (see BWP, and references therein), but little published information from HANZAB region, mostly in Taylor (1978); sonagrams in BWP. Generally inconspicuous (Taylor 1978). Extralimitally, repertoire includes Song of Male, Song of Female and Subsong, and at least six different calls (BWP). Contact Call most common vocalization (BWP). Song usually given by male (CSN); sometimes several birds sing together, e.g. two males singing on territories (CSN 30, 39), up to eight males singing along 4 km of Taieri R. (CSN 37), and at least 12 males singing in c. 520 ha (Taylor 1978). **SEASONAL PATTERNS:** Contact Call given throughout year, but mostly in breeding season (BWP). Song occasionally given in mid-Aug., with regularity slowly increasing, so that singing regularly by late Oct. (Taylor 1978); recorded Sept.–Feb. (CSN), though suggested that possibly continue after Feb. (Falla *et al.* 1981), and once heard in May (CSN 29). **DIURNAL PATTERNS:** Mostly call early in morning and in late afternoon till dusk (Taylor 1978; Heather & Robertson 2000; CSN 9, 24); captive male sang at night



A L.B. McPherson; Ward, SI, Dec. 1984; P107

(CSN 42). **MIMICRY:** Contact Call sometimes resembles first part of calls of Yellowhammer (Taylor 1978; Falla *et al.* 1981; q.v.); this referred to as mimicry (BWP). Other aspects of call said to recall Song of European Greenfinch (Taylor 1978; q.v.), but not known whether this also considered mimicry.

**Adults SONG OF MALE:** Metallic monotonous rattling or clicking buzz or high-pitched trill *tirrrr* (sonagram A), resembling voice of cricket (Taylor 1978; Falla *et al.* 1981; Heather & Robertson 2000; CSN 30). Part of Song said to sometimes resemble part of Song of Yellowhammer, but without the *cheese* (Falla *et al.* 1981; q.v.): one individual gave four or five notes similar to those of Yellowhammer, then continued with rattling or clicking sounds (Taylor 1978); and rattling and clicking parts of Song sometimes considered similar to parts of Song of European Greenfinch (Taylor 1978). Song often rapidly repeated (CSN 28), up to 9 times/min (Taylor 1978). Usually sung from prominent perch (see Social Behaviour). **SONG OF FEMALE:** Vocalization given by female, said to have been similar to that of perched male (CSN 28), possibly refers to this (see also Alarm Call, below). Said to occasionally occur extralimitally (BWP). **CONTACT CALL:** Thin, short, quiet *zit*, *sip*, *see* or *zib*, usually given singly or repeated as *zib-zib*, and occasionally run together when given in flight, a strident or sibilant *sissi-sissi-sip* (Taylor 1978; Falla *et al.* 1981; Heather & Robertson 2000). Adult gave high-pitched *see* when attending fledgelings (Taylor 1978). **THREAT CALL:** Strong, excited rattling calls given by two fighting males (Taylor 1978). **ALARM CALL:** Quiet call, interpreted as Alarm Call, given by female; said to have resembled Song of Male (CSN 26), but possibly refers to Song of Female (see above). **OTHER CALLS:** Other calls reported extralimitally, including Warning Call, Threat Call and Fear Call (BWP).

**Young** No information from HANZAB region. Extralimitally, nestlings give quiet *dsi-dsi* or *sib* calls after Day 6, becoming louder and repeated *dsidsidsidsi* when being fed after Day 8 (BWP).

**BREEDING** Poorly known in HANZAB region; no detailed studies.

**Season** Eggs, Oct.–Jan. (Falla *et al.* 1981; Heather & Robertson 2000). Unspecified breeding, including fledgelings, Dec.–Feb. (Taylor 1978; CSN 9, 26, 31, 37).

**Site** Usually among dense vegetation in shrub or tree, including Gorse *Ulex europaeus*, Matagouri *Discaria toumatou*, briar, macrocarpa, pine *Pinus*, and once in dwarf juniper *Juniperus* (Taylor 1978; Falla *et al.* 1981; Heather & Robertson 2000; CSN 34). Round Ward, SI, all nest-sites were near patches of long grass (Taylor 1978). **MEASUREMENTS (m):** Height of nest, mostly  $\leq 1$  (Falla *et al.* 1981); 1.0–5.0 (Taylor 1978; Heather & Robertson 2000).

**Nest, Materials** Loosely built cup of grass, with moss or rootlets; lined with fine grass, fine rootlets, wool and cow or horse hair (Taylor 1978; Heather & Robertson 2000; Oliver). Extralimitally, nests usually built by female, sometimes by both sexes (BWP). Sometimes use nests of other species, such

as Common Greenfinch, Song Thrush *Turdus philomelos* or Common Blackbird *T. merula*, either as a base for construction or by re-lining old nest (Taylor 1978; Heather & Robertson 2000).

**Eggs** Greyish white, pinkish white, greenish, bluish green or bluish, marked with streaks or hairlines of dark brown or black, and sometimes have small pale-brown blotches, mainly at large end (Falla *et al.* 1981; Heather & Robertson 2000; Oliver). **MEASUREMENTS:** 19.8 × 16.0, 21.4 × 16.4 (Oliver); 21.0 × 16.0 (Heather & Robertson 2000).

**Clutch-size** Usually two to four (Taylor 1978); three to five (Falla *et al.* 1981); four or five (Oliver); usually three, but two to four (Heather & Robertson 2000). Extralimitally, usually 3–4, but occasionally 2–5 (BWP).

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

**Incubation** Only by female; fed on nest by male (Falla *et al.* 1981; Heather & Robertson 2000). **INCUBATION PERIOD:** 11–13 days (Falla *et al.* 1981; Heather & Robertson 2000); extralimitally, 11–14 days (BWP).

**Young** Nestlings fed by both parents (Taylor 1978; Heather & Robertson 2000). Extralimitally, brooded by female for up to c. 9 days (BWP).

**Fledging to independence** **FLEDGING PERIOD:** 11–13 days (Falla *et al.* 1981; Heather & Robertson 2000).

**Success** No information from HANZAB region. Clutches often contain an infertile egg (Taylor 1978).

**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. Monotypic. For descriptions of plumages and bare parts, see BWP and Field Identification.

**MOULTS** Little information from NZ. For details on moults in European populations, see Svensson (1992) and BWP. **Adult post-breeding** (Third and subsequent pre-basic). Complete. Extralimitally, occurs mid-July to mid-Oct., sometimes starting as early as June. Moult of tail centrifugal, starting at t1 (BWP). Skins from NZ examined (NMNZ) are: one from Feb. had all primaries new; two from May had all primaries slightly worn; and one from June had all primaries worn. **Post-juvenile** (First pre-basic). Partial. Extralimitally, involves all feathers of head and body, marginal and median coverts, possibly all greater secondary coverts and one or more tertials; some birds replace one or more rectrices (BWP). Some, possibly early-hatched birds, replace some primaries and secondaries, greater primary coverts, alula and all rectrices (Winkler & Jenni 1987). Starts when c. 30 days old (Ginn & Melville 1983; BWP). **First immature post-breeding** (Second pre-basic). No information. Timing and extent probably as adult post-breeding.

**MEASUREMENTS** (1) NZ, adults, skins, sexed by museum labels (NMNZ). (2) Europe, skins, adults and first immatures (BWP).

	MALES	FEMALES	
WING	(1) 78.6 (1.77; 76–81; 7)	–	
	(2) 81.0 (2.00; 76–86; 45)	77.8 (1.95; 74–81; 25)	**
TAIL	(1) 71.7 (2.56; 69–77; 7)	–	
	(2) 66.0 (2.68; 60–71; 35)	63.9 (2.17; 60–67; 23)	**

BILL S	(1) 13.9 (0.67; 13.0–15.2; 7)	–	
	(2) 14.0 (1.49; 12.5–15.1; 43)	14.3 (1.39; 12.2–15.3; 22)	ns
BILL N	(2) 7.9 (0.35; 7.1–8.7; 34)	8.0 (0.52; 7.3–9.8; 23)	ns
TARSUS	(1) 18.2 (0.95; 16.7–19.8; 7)	–	
	(2) 18.3 (0.68; 17.2–19.7; 28)	18.3 (0.67; 17.6–19.5; 10)	ns

**WEIGHTS** (1) NZ, adults, from museum labels (NMNZ). (2) S. France, adults and first immatures (BWP).

	MALES	FEMALES	
(1)	24.1 (3.08; 20.8–28.5; 6)	–	
(2)	25.7 (1.26; 23–28; 39)	25.5 (1.30; 23–28; 24)	ns

**STRUCTURE** See BWP for details.

**AGEING** See Svensson (1992) and BWP for details. Juveniles distinguished by plumage and bare parts (see Field Identification). First immatures of both sexes similar to adult females, but neck and rump may be more heavily streaked in immatures (BWP). First immatures usually retain all or most juvenile rectrices, which have tips more pointed than on adults; some first immatures show moult-contrast between retained juvenile rectrices and fresher adult-like rectrices replaced in post-juvenile moult; retained juvenile t4 lacks white tip (cf. some adults have white tip to t4) (Svensson 1992; BWP). As post-juvenile moult apparently involves all greater secondary coverts (BWP), first immatures do not show moult contrast within this feather-tract. First immatures likely to have primaries more worn than those of adult at same time of year, and this probably more obvious in autumn–early winter.

**SEXING** See Svensson (1992) and BWP for details. Adults distinctly plumage-dimorphic, though differences less obvious in fresh plumage (late summer to autumn). Adults slightly size-dimorphic, males with longer average length of wing and tail than females. Some first immature males very similar to bright adult females (Svensson 1992), and probably only separable by retained juvenile plumage (see Ageing).

**GEOGRAPHICAL VARIATION** Monotypic. Populations from Sardinia and Corsica slightly more heavily streaked on upperparts (BWP) and sometimes recognized as subspecies *nigrostriata* (Peters). Populations introduced to NZ presumably from British Isles, but provenance of ancestral stocks not known.

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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