

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

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

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

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

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

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

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Family FRINGILLIDAE Old World finches

A large and morphologically fairly diverse family of small to medium-small passerines, usually with short, robust and often conical bills. As defined here (see below), the family comprises c. 140 species in 20–21 genera, widely distributed through Eurasia, including Indian subcontinent, Philippines and Greater Sundas, Middle East, Africa (except Madagascar), islands of n. and e. Atlantic Ocean, and N., central and S. America. Do not occur naturally in the Lesser Sundas, Moluccas or A'asia, but some species introduced to Aust., NZ and islands of s. Pacific Ocean (Sibley & Monroe 1990; Monroe & Sibley 1993; Peters). In HANZAB region, four species in two genera (*Fringilla*, *Carduelis*), all introduced (Christidis & Boles 1994; NZCL); another seven species were unsuccessfully introduced to HANZAB region (see Table 1).

The taxonomy of the family is complex, and evolutionary relationships between various genera of nine-primaried oscines of Old World and New World have been the subject of much debate. Sibley & Ahlquist (1990) present a detailed discussion of taxonomic changes in the Fringillidae, which are summarized here. Sharpe (1888) divided the Fringillidae into three subfamilies, all of which have 'nine primaries, the first of which is fully developed and usually very long': Coccothraustinae (some cardueline finches, some tanagers, grosbeaks and various other species); Fringillinae (other cardueline finches, chaffinches, Old World sparrows); and Emberizinae (emberizids, including buntings and some tanagers); Sharpe considered the family closely allied to the Tanagridae (tanagers). Ridgeway (1901) largely followed Sharpe's (1888) treatment, but added a number of New World genera of tanagers that had previously (Sclater 1886) been placed in Tanagridae. Opinions vary concerning relationships between Old World finches (fringillids, carduelines) and emberizids (buntings, New World sparrows and allies). Several authors consider *Fringilla* and the cardueline finches closely related, based on similar cranial characteristics and jaw musculature (Beecher 1953), palate and bill structure (Ziswiler 1965), colour of plumage and markings (Harrison 1966), gut morphology (Ziswiler 1967), egg-white proteins (Sibley 1970), limb musculature (Raikow 1978) and tongue skeleto-musculature (Bock & Morony 1978). However, Tordoff (1954) considered *Fringilla* to be more closely related to emberizids than carduelines based on his examination of cranial features, and he combined them in the Fringillidae and placed cardueline finches in the family Ploceidae (including Old World sparrows, weaverbirds and estrildid finches). Some authors (Stresemann 1927–34; Cracraft 1981) consider the family Fringillidae to comprise two subfamilies, Fringillinae (*Fringilla*, cardueline finches, Hawaiian honeycreepers) and Emberizinae (buntings, tanagers and allies). Sibley & Ahlquist 1990 and Monroe & Sibley (1993) also included a monotypic family, Peucedraminae (see below) in Fringillidae. Others (Bock & Morony 1978; Christidis & Boles 1994; Peters; BWP; DAB) split them into two families, Fringillidae (Old World finches) and Emberizidae (see that introduction for further discussion on taxonomy), which we follow here.

Genetic studies have provided a greater insight into (and in some cases complicated) our understanding of evolutionary relationships between the nine-primaried oscine lineages. Marten & Johnson (1986) used allozyme electrophoresis to investigate relationships between various genera of cardueline finches. Their data provides strong support for recognition of separate Fringillidae (cardueline finches) and Emberizidae (emberizids, including New World sparrows) families. DNA–DNA hybridization distances suggest *Fringilla* and the cardueline finches represent a sister group to the New World nine-primaried oscines (Bledsoe 1988); see introduction to Emberizidae for further discussion on results of this and other studies. Other studies based on DNA–DNA hybridization distances (Sibley & Ahlquist 1990; Sibley & Monroe 1990; Monroe & Sibley 1993) examined evolutionary relationships, and the

Table 1. Unsuccessful introductions of Fringillidae to HANZAB region. Figures in parentheses indicate, where known, the number of birds released; where years (and numbers) within square brackets, birds not certainly known to have been released (e.g. imported but no indication of fate). All from Thomson (1922) and Long (1981), which see for some further details (and other sources).

	AUSTRALIA	NEW ZEALAND
Canary <i>Serinus canarius</i>	Vic., c. 1856–72 (18 birds)	[?]
European Siskin <i>Carduelis spinus</i>	[1860s]; Vic.: [1864 (40 birds)], 1866 (20), [1872 (20)]	1876 (2), 1879 (several birds)
Twite <i>Acanthis flavirostris</i>	–	1862 (2 birds), 1871 (38)
Linnett <i>Acanthis cannabina</i>	Vic.: [1856–58], 1860s (7–8 birds), 1865 (19); SA: c. 1879–80; NSW: 1880	1862–75 (50 birds)
Brambling <i>Fringilla montifringilla</i>	SA: c. 1879–80 (78 birds)	1868 (2 birds), 1871 (6), 1874 (3), 1877 (1)
Hawfinch <i>Coccothraustes coccothraustes</i>	[1860s]	–
Eurasian Bullfinch <i>Pyrrhula pyrrhula</i>	[c. 1860s]; Vic.: [1856 (?)]; SA: c. 1879–80 (14 birds)	<1870, 1875

data supports recognition of an expanded Fringillidae comprising the following three subfamilies: (1) Peucedraminae (one species; Olive Warbler *Peucedramus taeniatus*); (2) Fringillinae (169 species in 39 genera, in three tribes: Fringillini [*Fringilla* finches], Carduelini [cardueline finches] and Drepanidini [Hawaiian honeycreepers]); and (3) Emberizinae (823 species in 200 genera, and separable to five tribes: Emberizini [buntings, New World sparrows, towhees and allies], Parulini [wood-warblers], Thraupini [tanagers, seedeaters, tanager-finches and allies], Cardinalini [cardinals], and Icterini [troupials, grackles, meadowlarks and allies]). A number of recent studies of mitochondrial and nuclear DNA-sequences (Burns 1997; Klicka *et al.* 2000; Lovette & Bermingham 2002) indicate some of these subfamilies and tribes (e.g. Parulini) are not monophyletic, and many taxa of New World nine-primaried oscines have uncertain affinities. Here, we follow the combined works of Christidis & Boles (1994) and Peters and accept four families: Fringillidae, Emberizidae, Parulidae and Icteridae. Family Fringillidae, as defined here, comprises the following two subfamilies (excluding Hawaiian honeycreepers, which often placed in subfamily Drepanidinae [Christidis & Boles 1994]): FRINGILLINAE (CHAFFINCHES), with single genus *Fringilla*, comprising three species, one of which, Common Chaffinch *F. coelebs*, introduced to HANZAB region; and CARDUELINAE (CARDUELINE FINCHES, INCLUDING CANARIES, SEED-EATERS, ROSEFINCHES, GROSBEAKS), with c. 137 species in c. 20 genera; three species, in single genus *Carduelis*, successfully introduced to HANZAB region: European Greenfinch *C. chloris*, European Goldfinch *C. carduelis* and Common Redpoll *C. flammea*.

Size varies from small (e.g. Yellow-throated Seedeater *Serinus flavigula*: total length 10–11.5 cm; Lesser Goldfinch *Carduelis psaltria*: total length 11.5 cm; weight 9.5 g) to medium-small (e.g. Great Rosefinch *Carpodacus rubicilla*: total length 20–21 cm, weight 46 g). Little variation in HANZAB region: largest is Common Chaffinch (total length c. 14.5 cm, weight 17–25 g), and smallest Common Redpoll (total length c. 12 cm, weight 8–16 g). The following morphological and osteological characteristics are shared by the family (summarized mainly from Beecher 1953, BWP and DAB): Wings rather short to moderately long, with slightly rounded to slightly pointed tips. Nine well-developed primaries, with vestigial or very short outermost (p10); one species, Przewalski's Rosefinch *Urocynchramus pylzowi* (from w. China), has well-developed p10, and while usually placed in Fringillidae (Clement *et al.* 1993; Peters), Sibley & Monroe (1990) and Monroe & Sibley (1993) place it with the buntings and allies in the Emberizidae. Nine secondaries, including three tertials. Tail fairly short to moderately long, usually rather square with slight to moderate notch at tip; 12 rectrices. Bill usually rather short, robust and often conical; lack obvious notching to tomia, but some species have faint notch or teeth at base of upper mandible; considerable variation in structure of bill between species (see BWP), but always designed for husking seeds in combination with action of blood-stiffened tongue and powerful jaw musculature; tips of upper and lower mandibles crossed in some species (e.g. *Loxia*). Nostrils oval, and partly or largely concealed by feathers. Rictal bristles present. See Ziswiler (1964, 1965, 1979) for discussion of bill anatomy and functional morphology. Legs and feet rather short to moderately long, slender; tarsus ridged at rear (acutiplantar); tarsal scaling laminiplantar. Musculature of jaw distinctive, with particularly massive medial slip of mandibular adductor *M. pseudotemporalis superficialis*. Single slot-like ectethmoid foramen. Lachrymal fused. Palatine processes unfused in *Fringilla* and lacking in cardueline finches (Bock 1960). Tongue cylindrical with horny sheath nearly meeting at dorsal mid-line. Preglossale and muscle *M. hg. anterior* absent (Bock & Morony 1978). Palate extensively ossified with short ridges between central and lateral ridges. Humerus with double pneumatic fossa (Bock 1962). Crop present in Carduelinae, but not in Fringillinae (Clement *et al.* 1993). Stomach and gizzard heavily muscled.

Following summarized from Clement *et al.* (1993) and BWP. Plumage varies greatly. *Fringilla* mostly have brown, blackish, greyish or bluish-grey upperparts, usually with contrasting pale wing-bars, and pinkish, buff, greyish or whitish underparts. Species of Carduelinae usually have brown, grey or olive upperparts, often with white, red or yellow rump, contrasting black or red cap or facial area, and white or yellow wing-bars or wing-panel; and reddish, whitish or yellowish underparts, often with dark streaking. Remiges and rectrices often fringed or tipped white, reddish or yellow. Juveniles usually lack bright coloration to head and body, and often have dark-brown streaking to underparts. Bill, blackish, greyish or yellowish. Only slight seasonal variation in plumage, typically through wear. Sexes usually differ, with males much brighter and more richly coloured than females, but alike or very similar in some species (e.g. European Goldfinch). Nestlings hatch with down, which is usually rather dense. Nestlings lack markings to mouth or tongue. Most species undergo a partial post-juvenile (first pre-basic) moult 1–2 months after fledging, usually not involving remiges or rectrices, to adult female-like first immature (first basic) plumage; some species (e.g. some *Carduelis* in s. part of range) undergo a complete or near complete post-juvenile moult, and acquire adult plumage or strongly adult-like first immature plumage. In most species, males do not acquire adult plumage till first immature post-breeding (second pre-basic) moult, when 1–2 years old. Adults undergo one complete post-breeding (pre-basic) moult annually; occasionally (e.g. in a few Evening Grosbeak *Hesperiphona vespertina*) some birds undergo a partial pre-breeding (pre-alternate) moult to breeding plumage that differs very little from non-breeding plumage. Primaries moult outward.

Widespread, and occur in great diversity of habitats, from forest, woodland and open woodland to shrublands, savanna and grasslands, in all climatic zones and landforms, including open arid country, rocky ground and tundra. Many species (perhaps most) occupy mountainous regions, but recorded from sea coasts (e.g. White-throated

Canary *Serinus albogularis*) to >4000 m asl (e.g. Andean Siskin *Carduelis spinescens*). Eurasian and American species most commonly in woodlands and forests, often coniferous, as well as occupying forest edge, farmlands and other modified habitats. In Aust. and NZ, most commonly in modified habitats (Heinzel 1977; King *et al.* 1978; Mackworth-Praed & Grant 1980; Long 1981; AOU 1983, 1998; Sibley & Monroe 1990; Maclean 1993; Orn. Soc. Japan 2000; BWP; see species accounts).

In HANZAB region, mainly resident or sedentary, with some local movements between habitats (e.g. European Goldfinch, Common Redpoll), and possible local altitudinal migration (Common Chaffinch, and to a lesser extent, European Greenfinch). Readily cross large stretches of water (e.g. to outlying islands of NZ). Palearctic species generally mobile, with complex patterns of movements, ranging from sedentary (e.g. Desert Finch *Rhodospiza obsoleta*) to migratory (e.g. Scarlet Rosefinch *Carpodacus erythrinus*), with many species containing sedentary, resident and migratory populations (e.g. Serin *Serinus serinus*), and altitudinal migration common (e.g. Citril Finch *Serinus citrinella*); some species show erratic or dispersive movements, and some irruptive (especially crossbills, e.g. Common Crossbill *Loxia curvirostra*). African and s. Asian breeding species generally resident or sedentary (e.g. Dark-rumped Rosefinch *Cardopacus edwardsii*), though several species make local (e.g. White-throated Canary *Serinus albogularis*) or local altitudinal movements (e.g. Cape Canary *Serinus canicollis*). American species vary from partly migratory in N, with wintering range generally overlapping extensively with breeding range (e.g. Pine Siskin *Carduelis pinus*), to mainly resident in central and S. America (e.g. Yellow-bellied Siskin *Carduelis xanthogastra*) (AOU 1983, 1998; Grimmett *et al.* 1999; Robson 2000; Fry & Keith 2004; BWP).

Omnivorous, but feed mainly on seeds, supplemented with other plant materials, including fruit, flowers, nectar and buds; insects and other invertebrates, such as spiders, snails and worms, prominent in diets of Fringillinae, but such items taken only occasionally in Carduelinae. Terrestrial and arboreal. Forage mostly on ground and in herbs, shrubs or trees, taking items directly from seed-heads, flowers, foliage, cones and bark of branches and trunks. Forage mainly by gleaning; some species also jump from ground to take seeds from seed-heads, and some take insects by sallying. In contrast to Fringillinae, Carduelinae adept at hanging from vegetation to feed, and often use feet when foraging, e.g. to hold food items against perch, or to pin bent-over stems against ground to feed from seed-heads. Species of Fringillidae reported to engage in kleptoparasitism of Carduelinae. Bills adapted for extracting and husking seeds. Diet varies seasonally, with insects and other invertebrates taken mostly in breeding season; young of Fringillinae reared almost entirely on invertebrates, but young of Carduelinae fed mixture of seeds and invertebrates. Forage in flocks outside of breeding season; some species (especially bullfinches and grosbeaks) also forage in flocks during breeding season, though most species solitary and territorial at this time. Sometimes forage with other seed-eating species, including other Fringillidae (Fry & Keith 2004; BWP).

Most species gregarious outside the breeding season, foraging and roosting in flocks, with maximum size of flocks varying greatly between species, from, for example, small flocks of up to c. 12 birds (e.g. Papyrus Canary *Serinus koliensis*), to large flocks of up to several thousand (e.g. European Greenfinch). Many Carduelinae also gregarious during breeding season, at least while foraging or drinking, but most Fringillinae and some Carduelinae usually seen singly or in pairs during breeding season. Typically monogamous, with strong pair-bonds. In most species, pair-bonds usually last only for duration of breeding season, but sometimes same birds renew pair-bond in subsequent years. However, Pine Grosbeaks *Pinicola enucleator* and bullfinches *Pyrrhula* maintain pair-bonds throughout the year. Usually only female incubates (see below), but both sexes feed nestlings and fledgelings. Usually nest solitary, though many Carduelinae nest in loose colonies; typically territorial, at least in breeding season, with Fringillinae defending large territories, but colonial Carduelinae defending only small territories. Scratch head indirectly. All species are essentially non-contact birds, never allopreening and seldom recorded huddling. Defend territories by singing. Carduelinae species sing while perched and in song-flights, but Fringillinae sing only from perches. Male courtship-feeds female in Carduelinae, but not in Fringillinae (Fry & Keith 2004; BWP; DAB).

Utter large variety of often complex vocalizations that can include clear whistles, trills, warbling, chirps, rattles and squeaks, among others. Often highly vocal while flocking, with many of Carduelinae uttering twittering calls that are not given by Fringillinae. Song of Fringillinae usually short, loud, clear and highly stereotyped, but those of Carduelinae often quite protracted and varied (Fry & Keith 2004; BWP).

Monogamous, and mostly solitary, but some species loosely colonial. Most species usually build nest in horizontal or vertical forks, often among or screened by foliage, in shrubs and trees, but some exceptions, e.g. *Rhodopechys*, *Bucanetes* and *Pseudochloroptila*, nest on ground, in holes or crevices, or beneath boulders or vegetation such as tussocks; Papyrus Canary nests in Papyrus *Cyperus papyrus* heads; and Lemon-breasted Canary *Serinus citrinipectus* in fronds of Ilala Palm *Hyphaene natalensis*. Build cup-shaped nests which, in *Pinicola*, *Pyrrhula*, *Eophona*, *Coccothraustes* and *Hesperiphona*, consist of two distinct layers. Nests usually made of grass, rootlets, bark, fine twigs and plant stems, and sometimes moss, leaves or other plant fibres (e.g. Papyrus Canary builds nests entirely of Papyrus heads), bound together with silk (mostly spider web); and lined with soft material, such as plant down, hair, wool, feathers, rootlets and fine grass (unlined in Papyrus Canary); in some species, outside decorated with lichen, moss, cocoons or the like. Building by female only in Fringillinae and most Carduelinae; in Carduelinae, male usually attends female, and in some species may help with collection of material or construction of nest. Eggs vary

in shape, but usually subelliptical; and usually smooth and slightly glossy. Ground-colour typically pale, from various shades of white (e.g. pure or creamy white, bluish, greenish, or greyish white) to light shades of blue or green, or occasionally grey, brown, cream or buff. Eggs unmarked, or with sparse spots and sometimes blotches, streaks or lines of brown, black, purple, red or grey, often concentrated at broad end. Clutch-size usually two to 4–5, but up to eight, and only 1–2 in Blue Chaffinch *Fringilla teydea* and little known Papyrus Canary. Eggs usually laid on consecutive days. Incubation usually by female only, though claimed that male assists in a few species (e.g. Thick-billed Seedeater *Serinus albogularis*, African Citril *S. citrinelloides*). Incubating female fed by male in Carduelinae, only sometimes so in Fringillinae (e.g. Brambling). Incubation period usually 11–12 to 14–15 days, occasionally 1–2 days shorter or longer (e.g. as few as 9 days in European Goldfinch and Hawfinch; up to 17 days in Brimstone Canary *Serinus sulphuratus* and Cape Siskin *Pseudochloroptila totta*). Nestlings brooded by female; fed by both sexes in Fringillinae; in Carduelinae, fed by male during brooding period (male, at least in some species such as African Citril, passing food to female who in turn feeds young) and by both sexes thereafter. Fledging period typically 10–20 days, but can exceed 20 days in some species (e.g. up to 24 days in Yellow-fronted Canary and up to 28 days in Common Crossbill). Where known, fledgelings fed by both parents. Juveniles independent some 1–4 weeks after fledging (Fry & Keith 2004; BWP).

Twelve species considered globally threatened: Bonin Grosbeak *Chaunoproctus ferreorostris* of Bonin Is, Japan, extinct; São Tomé Grosbeak *Neospiza concolor* and Azores Bullfinch *Pyrrhula murina* critically endangered; and Hispaniolan Crossbill *Loxia megaplagia* (of Haiti and the Dominican Republic), Warsangli Linnet *Carduelis johannis* (n. Somalia), Red Siskin *Carduelis cucullata* (n. S. America) and Yellow-throated Seedeater *Serinus flavigula* (Ethiopia) endangered. A further five species are vulnerable: Syrian Serin *Serinus syriacus*, Salvadori's Serin *S. xantholaemus*, Ankober Serin *S. ankoberensis*, Yellow-faced Siskin *Carduelis yarrellii* and Saffron Siskin *C. siemiradzki*. Threatened species are concentrated in n. Africa and central and S. America, and associated islands; and major threats are from grazing, conversion of forest and native grassland to seeded pasture, and in some cases trapping for cagebird trade (e.g. Yellow-faced Siskin). Four species also considered near threatened (Stattersfield & Capper 2000; BirdLife International 2005).

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Fringilla flammea Linnaeus, 1758, *Syst. Nat.* 10(1): 182 — Europa = Norrland, Sweden.

As the substantive name implies, the male Common Redpoll shares a red forecrown with other species of redpoll (Latin *flammeus*, fiery, flame-coloured).

OTHER ENGLISH NAMES Redpoll or Lesser or Mealy Redpoll; Lesser Red-headed Linnet.

POLYTYPIC Subspecies *cabaret* (P.L.S. Müller, 1776), birds probably of this subspecies introduced to NI and SI, and now established throughout NI, SI and Stewart I, NZ, also on Macquarie, Lord Howe, Kermadec, Chatham, Snares, Antipodes, Auckland and Campbell Is, indigenous from central and nw. Europe to British Isles, wintering in w. and s. Europe. Extralimittally, nominate *flammea*, n. Europe, Siberia, n. America, wintering in s. Europe, central and e. Asia and mid-N. America; *rostrata* (Coues, 1862), e. Canada, Greenland and Iceland, wintering in ne. USA and nw. Europe. Identity of subspecies in HANZAB region contentious (DAB).

FIELD IDENTIFICATION Length 12 cm (11–13); wingspan 20 cm (19–22); weight 12 (8.5–15.5) g. Introduced. Small finch with small head, small, pointed bill, short neck and rotund body and strongly forked tail. In flight, wings long and narrow, with rounded tips, and tail fairly long with flayed-out sides and strong fork at tip. Much smaller than House Sparrow *Passer domesticus* or European Greenfinch *Carduelis chloris*; roughly same size or slightly smaller than European Goldfinch *Carduelis carduelis*; tail longer than Goldfinch but shorter than Sparrow. Female duller than male; juveniles paler than adults, lacking any red in plumage (see below); immatures mainly differ from adults by retention of juvenile wing- and tail-feathers. Subspecies in HANZAB region thought to be *cabaret*. **Adult male in fresh plumage** Occur in fresh plumage in autumn, after breeding season. Lower forehead mostly dark brown; upper forehead and forecrown, red, forming small cap; hindcrown and nape, light brown, with diffuse blackish streaking. Broad, diffuse supercilium, extending from lores to above ear-coverts, pale grey with rose tinge and faint dark-brown streaking. Faint partial eye-ring, light grey with rose tinge; broken in front and behind by indistinct darker brown eye-stripe extending from lores to upper edge of ear-coverts. Malar area and ear-coverts, pale grey with strong rosy tinge and dark-brown streaking. Hindneck, sides of neck, mantle, scapulars and back, light brown, with diffuse blackish streaking, concolorous with hindcrown and nape, but streaking

on mantle, scapulars and back slightly stronger; rump and uppertail-coverts, paler, grey-brown, with diffuse brown streaking and rose suffusion. Tail blackish brown to dark grey, with narrow whitish edges and fringes, sometimes appearing white-edged. Upperwing, mainly black with distinct, but narrow pair of buff wing-bars, one across tips of median secondary coverts, the other on tips of greater secondary coverts; remiges fringed and edged pale grey to buff, fringes complete and broad on tertials, narrower on secondaries and narrower still on primaries; on folded wing, edging forms pale striping on black background; in flight, mainly black with indistinct pair of pale wing-bars, edging barely noticeable. Chin, black; throat, whitish with strong rose suffusion. Breast and upper belly mostly pinkish-rose, grading to light brown with diffuse dark-brown streaking on sides of breast and flanks; lower belly, vent and undertail-coverts, white, with dark-brown streaking on undertail-coverts. Undertail, dark grey with narrow whitish outer edge. Underwing-coverts, pale grey; remiges, dark grey with broad white bases of remiges, diffuse on primaries, broad at bases of secondaries. Bill mostly yellow with black along top of upper mandible. Iris blackish brown; orbital ring, dark grey. Legs and feet, dark grey to almost black. **Adult male in worn plumage** Wear gives quite different appearance to some aspects of plumage. Differs from fresh plumage by: Lower forehead, lores and feathers round base of bill, black; upper forehead and forecrown, darker red; hindcrown and nape, brown

with strong blackish streaking; supercilium less prominent; malar area and ear-coverts, brown with dark-brown streaking and strong rose tinge, paler than top of head, contrasting with eye-ring. Most of upperbody, darker brown with broad blackish-brown streaking; rump and uppertail-coverts, slightly paler brown, with slight rosy tinge. Tail entirely blackish brown; pale edges and fringes worn off. Upperwing mostly as in fresh plumage, but wing-bars and edging and fringing to remiges reduced and become narrower and more whitish; unless seen closely, folded wing appears blackish. Chin, black, concolorous with feathering of lower forehead, lores and feathers round base of bill. Throat, centre of breast and upper belly, rich rose-red; sides of breast and flanks, mottled rose-red and white, with clear-cut dark-brown streaking; lower belly, vent and undertail-coverts, dirty white. In very worn plumage, entire head and upperbody nearly black, with red upper forehead and forecrown and whitish partial eye-ring. Upperwing, dirty brownish-black, lacking any trace of paler wing-bars, fringing or edging to feathers. Sides of breast and flanks, brownish black, with white streaking and weak rose suffusion; centre of breast, upper belly and sides of belly, more strongly rose-red, forming breast-patch. Rest, including bare parts as described above.

Adult female As adult male in respective fresh and worn plumage, but lack rose tinge to sides of face and underbody. Differ by: Malar area and ear-coverts, pale grey with dark-brown streaking, and lacking rosy tinge; lack rose suffusion on rump and uppertail-coverts; in fresh plumage, breast, flanks, upper belly and sides of belly, pale brown, with faint brown streaking on sides of breast and flanks, and sometimes centre of breast; in worn plumage, breast, upper belly and sides of belly, dull white with dark-brown streaking. Rest of plumage, as adult male. Bare parts, as adult male. **Juvenile** Much as adult, but lack red in plumage. Top of head, dark brown to blackish brown, with bold white streaking; faint hint of pale supercilium; malar area and ear-coverts, mottled dull blackish-brown and buff or white; hindneck, sides of neck, mantle, scapulars, back and rump, dark brown to blackish brown, concolorous with top of head, with bold white streaking that grades to rufous streaks on scapulars. Tail as adult, but feathers acutely pointed and edged rufous-brown, not whitish as adult. Upperwing, as adult, but wing-bars and fringing and edging to remiges (especially tertials) slightly broader, with brown or pale-rufous suffusion (at same time of year, adults have either narrow or bleached whitish wing-bars, edging and fringing). Chin, dark grey; rest of underparts as adult female, but breast and flanks tend warmer light-brown with buff tinge. At fledging, bill, lime-green with slightly greyer top of upper mandible and tip, but bill quickly becomes yellow as post-juvenile moult begins; legs and feet, pink, but darken as post-juvenile moult begins. **Immature** Both sexes as adult female, but male immature tends to have rosy tinge on sides of face. Mostly differs by retention of some wing-feathers and tail: (1) Tail-feathers more pointed than in adult, and lack whitish edging and fringing (these brown if not worn off); (2) if innermost greater secondary coverts replaced, they tend darker and show moult-contrast. Bare parts as in adult.

Similar species Adults distinctive; red forehead and forecrown, and rosy sides of face and underparts in male, diagnostic in adults. Brownish juveniles more difficult to distinguish from females or juveniles of other introduced finches. May briefly be confused with female or juvenile **House Sparrow**, but differs by: heavy streaking on crown (plain on House Sparrow); tail deeply forked (slightly notched on Sparrow); small bill (more robust in Sparrow); and size (Sparrow larger). Distinguished from juvenile **European Goldfinch** by: upperwing largely black, with pair of narrow buff wing-bars (largely black on Goldfinch with prominent, broad yellow bar). Distinguished from juvenile **European Greenfinch** by: small bill (larger, more robust in Greenfinch); upperwing largely

black, with pair of narrow buff wing-bars (upperwing olive on Greenfinch, with yellow leading edge to wing); plumage generally light brown (olive-grey tones on Greenfinch); and size (Greenfinch much larger). Distinguished from juvenile **Common Chaffinch** *Fringilla coelebs* by: streaked plumage (Chaffinch plain); narrow wing-bars (broad whitish wing-bars on Chaffinch); and size and proportions (Chaffinch much larger and proportionately more elongated).

Occur in pairs or small flocks at any time of year, and seldom seen singly; outside breeding season, often form large flocks, often mixing freely with other finches. Mainly forage in shrubs and trees, usually taking small seeds, and sometimes invertebrates. Extraliminally, usually shy when breeding, when mostly keep to tree-tops where more often heard than seen; more gregarious and confiding outside breeding season, calling and moving constantly. Flight steeply undulating, very light and buoyant; rise with series of wing-beats, then glide downward sharply; undulation repeated in longer flight. When flushed, fly quickly to nearest cover, flitting downward, but then often circle back to food source. Hop when on ground, moving quickly over and through low herbage; quite agile when among twigs and leaves of trees and shrubs, sometimes hanging upside-down. Song flight looping and circling, wings beaten more slowly than is typical and outstretched more in glides. Vocalizations include Song, uttered by male, and six calls heard in HANZAB region, of which Chatter Call most common; extraliminally, also give a further three Songs and at least three other calls (see Voice).

HABITAT Mostly inhabit open areas, such as tussock grasslands, farmland and parks and gardens in settled areas; also occur in dense shrubland and forests, though usually in clearings (see below). Occur from coast to altitudes of up to 1500 m asl (Sibson 1958; Wilson *et al.* 1988).

Often inhabit grasslands and the like, including in subalpine areas (Sorenson 1964; Challies 1966; Lambert 1970; Child 1975; Innes *et al.* 1982), e.g. on Heaphy Track, SI, occur in tussock grassland of Narrow-leaved Snow Tussock *Chionochloa rigida* with scattered shrubs (Dawson 1964). In coastal areas, often recorded among grasses, such as Marram Grass *Ammophila arenaria* or Townsend's Cord-grass *Spartina townsendii*, sedges, rushes and low *Sarcocornia* saltmarsh round estuaries, coastal lagoons or inlets or on sand-dunes (Skegg 1963; Sagar 1976; Pierce 1980; Falla *et al.* 1981; Owen & Sell 1985; Oliver; CSN 3, 20; Ann. Locality Rep. 9). Also often occur in farmland, including rough, tussocky pasture, crops, stubble, orchards and vineyards (Hawkins & Bull 1962; Blundell & McKenzie 1963; Blackburn 1967; Pierce 1980; Fennell *et al.* 1985; Freeman 1994; CSN; J.M. Peter); or grassy roadsides surrounded by farmland (CSN 39; J.M. Peter). Sometimes also recorded in parks and gardens in settled areas (Phillipps & Lindsay 1948; East 1967; Guest & Guest 1987, 1993; CSN); and golf courses (Phillipps & Lindsay 1948; CSN 21). On Snares Is, recorded in open grassy areas (Warham 1967; Horning & Horning 1974) or where grass interspersed with Kokomuka *Hebe elliptica* (Miskelly *et al.* 2001; CSN 24). Often inhabit shrublands, from coasts to subalpine areas, especially those dominated by Manuka, sometimes also with bracken and Matagouri *Discaria toumatou* (Sibson 1958; Challies 1962, 1966; Lambert 1970; Child 1975; CSN 7, 19 Suppl., 20, 37); and also in stunted subalpine shrubland, e.g. of Boxleaf Hebe *Hebe odora* and *Olearia moschata* with ground-cover of herbs, interspersed with tall tussocks (Child 1978). Often recorded in native forests, such as those dominated by beech *Nothofagus* (Dawson 1964; MacDonald 1966; Innes *et al.* 1982; CSN 7, 24, 37, 41), e.g. in forest of Hard Beech *Nothofagus truncata* on ridges, with subcanopy of Kamahi *Weinmannia racemosa*, Quintinia *Quintinia acutifolia* and Totara *Podocarpus totara*, and sparse shrub-layer (Dawson *et al.*

1978); in open stunted forest dominated by Kanuka, with no regular understorey, small shrubs and patches of ferns (Gill 1980); or, on Solander I., in forest dominated by Snares Tree-daisy *Olearia lyallii*, up to 6 m, with *Senecio stewartiae*, with understorey of tall ferns and extensive clumps of Large-leaved Punui *Stilbocarpa lyallii* (Cooper *et al.* 1986). Often occur at edges of forests or in clearings, e.g. in fire-breaks and planted areas that have failed (Ryder 1948; Weeks 1949). Sometimes occur in logged forests, in recently logged areas, and among regrowth up to at least 9 years after logging (Onley 1983), e.g. among dense shrubby regrowth below sparsely scattered remnant Rimu *Dacrydium cupressinum*, with a few Kahikatea *Dacrycarpus dacrydioides* and Miro *Podocarpus ferruginea* (Onley 1980), or second-growth hardwood forest, dominated by Mahoe *Meliclytus ramiflorus*, Kanuka and Kotukutuku *Fuchsia excortica*, with a few surviving podocarps (Freeman 1999). Also sometimes occur in plantations of exotic pines (Secker 1951; Owen & Sell 1985; Oliver; CSN 20, 24, 38).

DISTRIBUTION AND POPULATION Widespread in Eurasia and N. America. Widespread throughout much of Eurasia, from British Isles and France E to Chokotsky and Kamchatka Pens in e. Siberia, e. China, Korean Pen. and Japan; occur from n. Scandinavian and Russian coasts S to 40–45°N in Europe, 45–50°N in Kazakhstan and 50–55°N in s. Siberia, n. China and Mongolia, though also occur farther S on Sakhalin and in Japan and e. China, where recorded S to Kiangsu Province, and occasionally still farther S in Fukien. In N. America, occur from Alaska, E across n. Canada to n. Quebec and Newfoundland, and S to line from n. California to S. Carolina, and very occasionally farther S. Also occur in Greenland and Iceland (AOU 1983; de Schauensee 1984; Flint *et al.* 1984; Lee *et al.* 2000; Orn. Soc. Japan 2000; BWP). Successfully introduced to NZ, from whence it has colonized various outlying islands (see below), and was likely origin of vagrant on Vanuatu (Bregulla 1992).

NZ Introduced. Widespread; the source of all records on outlying islands, including Aust. possessions of Lord Howe and Macquarie Is. **NI** Widespread, but much more sparsely scattered than in SI (see below). Though occur in all regions (including on several offshore islands) from C. Reinga S to C. Palliser, and from near East C. W to near C. Egmont,

recorded at rather sparsely scattered sites in e. Waikato, Bay of Plenty, East Coast and parts of Taranaki (NZ Atlas; CSN). **SI** Widespread, including offshore islands (NZ Atlas; CSN).

Kermadec Is Only recorded on Raoul I. (Merton & Veitch 1986; Veitch *et al.* 2004). First recorded (as 'linnets') in 1885, and said to have been common by 1909, with a specimen collected the following year (Sorensen 1964; Merton & Veitch 1986). Since then, only recorded in small numbers, with flock of 20+ seen in Oct. 1972 (Veitch *et al.* 2004).

Chatham Is Common and widespread (Freeman 1994; CSN).

Snares Is Present in small numbers (Miskelly *et al.* 2001). First recorded in 1907 (as 'linnets') (Williams 1953).

Antipodes Is Present in small numbers (Tennyson *et al.* 2002); the most common of the 'self-introduced passerines' (Warham & Bell 1979).

Auckland Is Little published information. Recorded by mid-1950s (Williams 1953), and present on Adams I. in 1966 (CSN 19 Suppl.).

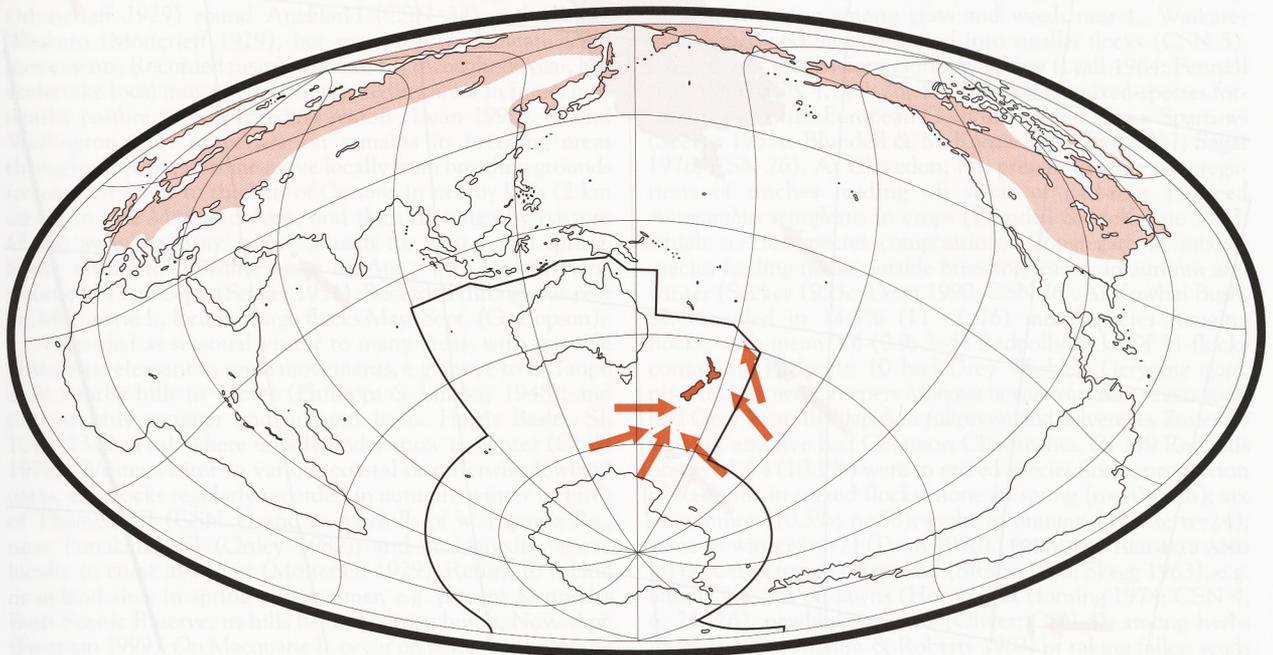
Campbell I. Common; first recorded (as 'linnets') in 1907 (Williams 1953; Bailey & Sorensen 1962); 'established' by early 1930s (Stidolph 1933) and numerous by 1942 (Bailey & Sorensen 1962).

Lord Howe I. Vagrant; 15 specimens collected (and other birds present), 26–28 Aug. 1913 (Hindwood 1940); flock of five, Blackburn I., 9 June 1983 (Ingram & Roberts 1983). A small flock of finches, possibly this species, was reported between Sept. 1941 and 5 Feb. 1942 (Hindwood & Cunningham 1950).

Macquarie I. Common and widespread (Warham 1969; Anon. 1987; G. Copson). First recorded on 8 Feb. 1912, when flock of seven (from which three specimens collected) recorded, and others present (Falla 1937).

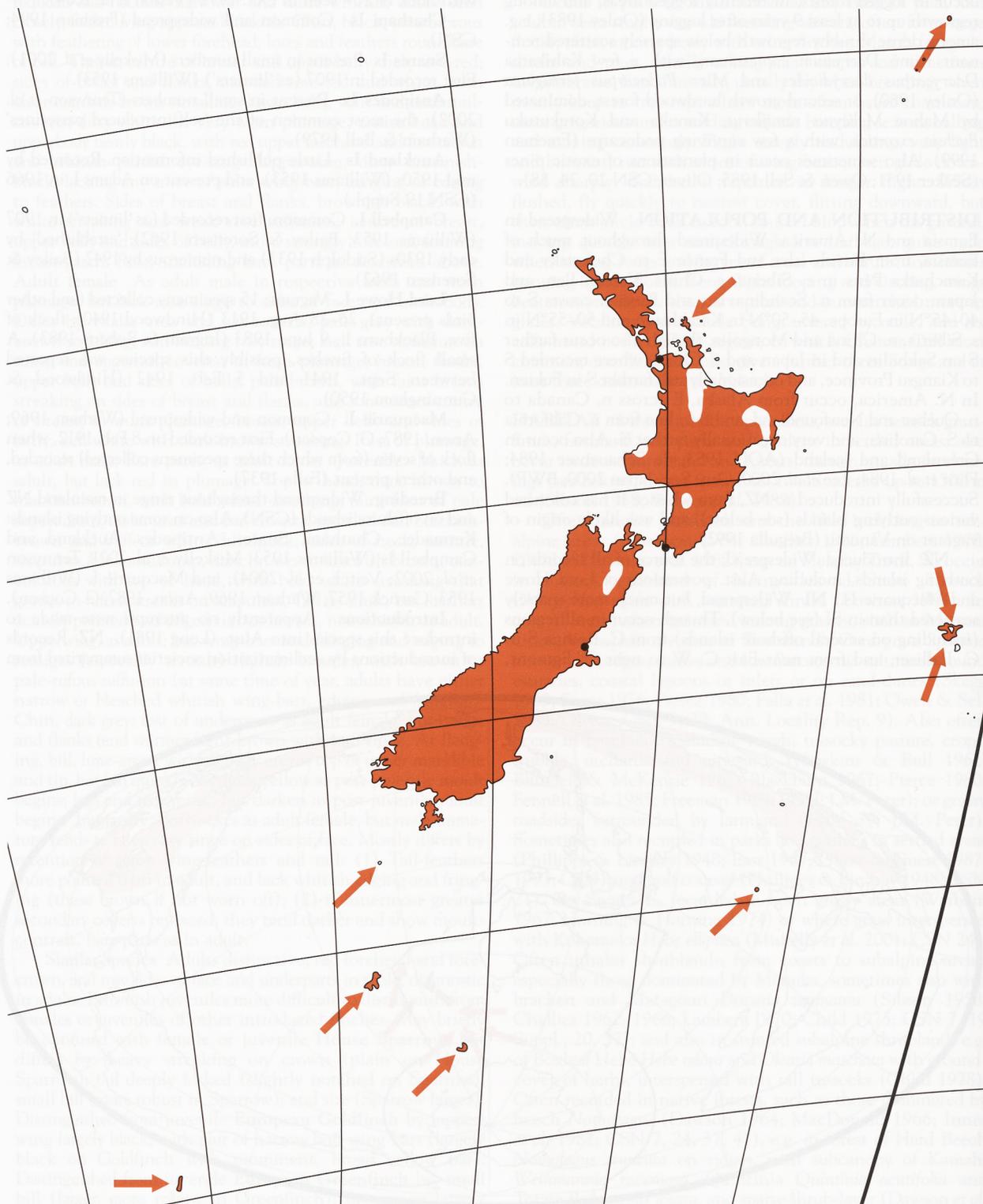
Breeding Widespread throughout range in mainland NZ and on offshore islands (CSN). Also on some outlying islands: Kermadec, Chatham, Snares, Antipodes, Auckland and Campbell Is (Williams 1953; Miskelly *et al.* 2001; Tennyson *et al.* 2002; Veitch *et al.* 2004); and Macquarie I. (Williams 1953; Carrick 1957; Warham 1969; Anon. 1987; G. Copson).

Introductions Apparently no attempts were made to introduce this species into Aust. (Long 1981). **NZ** Records of introductions by acclimatization societies summarized from



Thomson (1922). NI: Single bird released near Auckland in 1871, and a further 209 released S of Auckland in following year. Two released round Wellington in 1875. SI: Unknown number imported into Nelson in 1862, but only two survived the voyage; their subsequent fate is unrecorded. In 1868, 14 released in Canterbury, probably round Christchurch; a further 120 in 1871; and unknown number released c. 1875. In Otago, ten liberated near Dunedin in 1868, and another 71 in 1871.

Change in range, populations Range expanded dramatically from centres of introduction, and populations increased. Widespread by 1900 (Heather & Robertson 2000; *contra* Hutton & Drummond 1904). First recorded at Invercargill, in Southland, in 1909, and common in some parts of Southland by 1911, with up to 500 able to be caught in a single day (Thomson 1922). By 1911 populations round Christchurch and Dunedin were very large, with some people able to capture



'70 with one pull of the net', and catch a thousand within a fortnight (Thompson 1922). Populations said to have been increasing in parts of Northland in 1940s (Weeks 1949), on Volcanic Plateau in mid-1950s (CSN 6), and round Havelock N, Hawkes Bay, in late 1980s and early 1990s (CSN 37). Conversely, numbers round Masterton declined: total of 96 birds recorded May 1942–Apr. 1943, but none recorded May 1971–Apr. 1972 (Stidolph 1977). Formerly more common on Raoul I. (Merton & Veitch 1986).

Populations Total population on Snares Is estimated at <100 pairs (Miskelly *et al.* 2001). **RECORDED DENSITIES:** 0.05 birds/ha, s. Chatham I. (Freeman 1994; CSN 37). **NUMBERS RECORDED IN 5-MINUTE COUNTS:** 0.19–1.84 birds/count, Kowhai Bush, near Kaikoura (Gill 1980); 0.58 birds/count, Kennedys Bush Scenic Reserve, near Christchurch (Freeman 1999); 0.09 birds/count, Fletcher Ck, near Reefton (Dawson *et al.* 1978); 0.28 birds/count, Reefton Saddle, near Reefton (Dawson *et al.* 1978); 0.03 birds/count, Te Wharau, near Reefton (Dawson *et al.* 1978); 0.03 birds/count, Rahu Saddle, near Reefton (Dawson *et al.* 1978); 0.4 birds/count, W. Paparoa Ra. (Onley 1980); 0.53–1.08 birds/count, Chatham Is (West 1988).

THREATS AND HUMAN INTERACTIONS In areas where large numbers occur, sometimes considered a pest by farmers (see Food: Pest status). As a result, occasionally shot, poisoned or trapped; in 1961, more than 2500 Redpolls were destroyed on nine orchards in Otago, including 222 poisoned and 72 shot (Hawkins & Bull 1962).

MOVEMENTS Resident or sedentary. No evidence of regular migration, but form flocks that undertake local seasonal movements, mainly in winter, when occupy different habitats, probably reflecting availability of food (e.g. Secker 1951; Blundell & Mackenzie 1963; Heather & Robertson 2000); some movements possibly altitudinal, but others do not fit that pattern. In some areas, movements irregular or erratic. Capable of much longer movements, and occasionally cross water; birds originating from NZ mainland have reached various outlying islands unaided (see Distribution and Population). Extraliminally, migratory over short distances, though capable of longer movements; avoids long sea-crossings (BWP).

Described as resident or recorded throughout year (Moncrieff 1929) round Auckland (CSN 34) and Ohura, Waikato (Moncrieff 1929), but most reports indicate local movements. Recorded near Kaikoura, SI, throughout year, but undertake local movements, from breeding areas in forest into nearby pasture in non-breeding season (Dean 1990). Round Wellington, part of population remains in breeding areas throughout year, but some move locally from breeding grounds in remnant forest to thickets of *Cassinia* in nearby hills (2 km away) in late Mar. and Apr., and then into nearby pasture (5 km away) in May, where remain for winter and spring. Some return to breeding areas in Aug., with most having returned by late Sept. (Secker 1951). Recorded throughout year on Macquarie I., forming large flocks May–Sept. (G. Copson).

Regarded as seasonal visitor to many areas, with possible altitudinal element in some movements, e.g. move to L. Taupo from nearby hills in winter (Phillipps & Lindsay 1948); and present only summer and autumn in L. Harris Basin, SI, 1070–1340 m asl, where usually under snow in winter (Child 1978). Winter visitor to various coastal or otherwise lowland areas, e.g. flocks regularly recorded in autumn–winter in Firth of Thames, NI (CSN 1) and in foothills of w. Paparoa Ra., near Punakaiki, SI (Onley 1980); and at Dunedin, move locally to coast in winter (Moncrieff 1929). Return to inland or upland sites in spring and summer, e.g. present Kennedys Bush Scenic Reserve, in hills behind Christchurch, Nov.–Apr. (Freeman 1999). On Macquarie I., occur on plateau in autumn–

winter, and move to lower altitudes in spring–summer (Warham 1969). In contrast, some birds do not move away from high elevations in winter, e.g. recorded above snowline, at 1280 m, in Tararua Ra., 3 Aug. 1960 (CSN 9; see also below).

Also seasonal visitor elsewhere, but movement does not necessarily reflect altitudinal shift: visit Waerenga, S. Auckland, June–Nov. (CSN 6, 22), Rotorua, NI, July–Sept. (CSN 6), Ruahine Ra., NI, early spring to Dec. (Lyll 1964), and W. Hutt Hills, NI, Mar.–Aug. (Gibb 2000); and spring–summer visitor to Palmerston N, NI (Guest & Guest 1993) and upland areas of Egmont NP, NI (CSN 44), and present Masterton, NI, Aug.–Sept. till Mar. (CSN 41, 44), and Riverton, W of Invercargill, SI, Sept.–Feb. (Moncrieff 1929). Elsewhere, movements described as irregular (Moncrieff 1929; Secker 1951) or erratic (CSN 9). Near Wellington, a few birds seen flying E in mid-winter, then returning in spring (Secker 1951). Said that, at L. Waikaremoana, NI, flocks tend to move N, but timing or nature of such movements not given (CSN 7).

Early in breeding season, females wander 'promiscuously' through established territories, and males also wander widely late Nov.–Dec., when territory boundaries become ill defined (Secker 1951; see Social Organization and Behaviour).

Nature of passage Round Wellington, birds on passage moving along valley said to move in 'excitable but silent flocks of 50 to 70' (Secker 1951).

Banding Of 8146 banded in NZ, 1950–1996, 16 recoveries, 1988–1993; no information on recoveries at other times (Cossee 1989, 1992, 1993, 1995, 1997, 1998a,b; Cossee & Wakelin 1991). In banding study NZ SI, 590 banded at Canterbury Feb.–June 1983 and 237 near Christchurch, June–Aug. 1983; retrap rate Feb.–Mar. was 4.6% of adults, 8.9% of juveniles (Fennell *et al.* 1985).

FOOD Mostly seeds; also insects, and occasionally buds. **Behaviour** Mainly granivorous (East 1967; Dean 1990); forage on ground and among vegetation (Secker 1951; Sibson 1962; Skegg 1963; East 1967). **DETAILED STUDIES:** At Windbag Valley, SI, Oct. 1983–December 1985 (O'Donnell & Dilks 1994). **FORAGING ASSOCIATIONS:** Forage in twos (CSN 6, 23, 37) and in flocks (Sibson 1962; Lyll 1964; Owen & Sell 1985; Freeman 1994; CSN), which vary from <10 birds (Ingram & Roberts 1983; Miskelly *et al.* 2001) up to thousands (Fennell *et al.* 1985; CSN 4, 8, 43); e.g. flock of 4000–5000 recorded foraging among grass and weeds near L. Waikaremoana, NI, and later dispersed into smaller flocks (CSN 5). Large flocks usually form autumn–spring (Lyll 1964; Fennell *et al.* 1985; CSN 4, 5, 9, 26, 43). Often form mixed-species foraging flocks with European Goldfinches and House Sparrows (Secker 1953; Blundell & McKenzie 1963; East 1967; Sagar 1976; CSN 26). 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). Congregate in mixed-species feeding flocks outside breeding season, in autumn and winter (Secker 1953; Dean 1990; CSN 26). At Kowhai Bush, SI, recorded in 14.5% (11 of 76) mixed-species foraging flocks, with mean 3.6 (0.9; 2–5) Redpolls/flock. Of 11 flocks containing Redpolls: 10 had Grey Warblers *Gerygone igata*, nine had Brown Creepers *Mohoua novaeseelandiae*, seven each had Grey Fantails *Rhipidura fuliginosa* and Silvereyes *Zosterops lateralis*, and five had Common Chaffinches. Of 139 Redpolls observed, 14 (10.1%) were in mixed-species flocks; proportion of Redpolls in mixed flocks: none in spring (n=50 birds); six in summer (10.3%; n=58); eight in autumn (33.3%; n=24); none in winter (n=7) (Dean 1990). **FORAGING HEIGHTS AND SITES:** Often forage on ground (Sibson 1962; Skegg 1963), e.g. among grass or on lawns (Horning & Horning 1974; CSN 4, 6, 24, 26), newly sown grass (Oliver; CSN 4), among herbs (Secker 1951; Ingram & Roberts 1983) or taking fallen seeds

on floor of forest (CSN 24). Also often forage in vegetation, perching in rushes, shrubs and trees (Secker 1951, 1953c; Lyall 1964; East 1967; Horning & Horning 1974; Falla *et al.* 1981; Ingram & Roberts 1983). In Christchurch Botanic Gardens, foraged mainly in trees and shrubs, from lower branches and shrubs (0.5–4 m above ground) to the canopy, mostly from twigs (East 1967). At Windbag Valley, of 432 observations of foraging, c. 37% in emergent foliage, c. 31% on top of canopy, c. 29% in canopy, c. 2% in upper understorey (estimated from diagram). On Snares Is, insects taken from leaves of shrubs (Horning & Horning 1974). **FORAGING METHODS:** Forage by gleaning and hanging. At Windbag Valley, foraged almost entirely by gleaning (n=432 observations of foraging). Glean seeds from ground (CSN 24) while perched on seed-heads of rushes (Falla *et al.* 1981) or clinging to vertical stems and hanging from twigs of trees such as birch *Betula* or alder *Alnus* to obtain seeds from catkins (East 1967); also glean seeds from strawberries (Davidson 1950). When feeding on buds in fruit trees, move systematically along branch, pecking protective sheath from each bud (Hawkins & Bull 1962). Also glean and insects from foliage (Horning & Horning 1974) and spiders from webs, sometimes by hanging (CSN 19 Suppl., 29). **INTERSPECIFIC COMPARISONS:** In Christchurch Botanic Gardens, consumed similarly sized seeds to European Goldfinches, smaller than those taken by European Greenfinches and Common Chaffinches. **PEST STATUS:** Where large numbers occur, sometimes considered a pest by farmers, e.g. said to be serious pest by growers of strawberries by eating seeds in fruits (Davidson 1950; CSN 41), by eating buds, blossoms and young fruits, especially in Apricot and Peach orchards (Hawkins & Bull 1962), and by eating grass seed sown in forest clearings (Oliver). This is offset by eating turnip green fly (Oliver).

No detailed studies. **Plants** (Seeds unless stated.) Seeds¹³,^{15,36}, buds^{5,18,20}, fruit⁵. **GYMNOSPERMS:** Cupressaceae: *Chamaecyparis pisifera*⁹; *Juniperus*¹; Pinaceae: *Larix*³¹; *Tsuga heterophylla*⁹. **MONOCOTYLEDONS:** Commelinaceae²⁷; Cyperaceae^{18,20,21}; Scirpous nodulos⁷; Juncaceae: *Juncus*³⁵; Poaceae^{13,18,20,21,23,26}; *Ammophila arenaria*¹²; *Cortaderia fulvida*¹⁷; *C. seloana*^{17,27,35,36}; *Paspalum dilatatum*²⁷; *Poa*²⁹; *P. annual*^{10,11,19,24,28}; *Phleum pratense*⁵; *Spartina townsendii*¹⁶. **DICOTYLEDONS:** Amaranthaceae: *Amaranthus retroflexus*^{6,18}; Apiaceae: *Azorella selago*¹⁰; Asteraceae¹⁸: *Cassinia*^{3,4}; *Celmisia*¹³; *Cosmos*³³; *Cotula*¹⁰; *Olearia moschata*¹³; *Pleurophyllum*¹⁰; Betulaceae: *Alnus*¹⁴; *A. glutinosa*⁹; *Betula*^{9,14}; Brassicaceae²²: *Brassica*^{15,18}; *Brassica napus*¹⁵; Chenopodiaceae: *Chenopodium album*^{5,18,25}; *Sarcocornia*²¹; Cunoniaceae: *Weinmannia racemosa*³⁷; Fabaceae: *Trifolium*^{15,18}; Fagaceae: *Nothofagus*²⁸; Guttiferae: *Hypericum androsaemum*³; Myrtaceae: *Eucalyptus incisa*¹⁷; *Leptospermum scoparium*²⁷; *Metrosideros excelsa*¹⁷; Onagraceae: *Oenothera*^{15,18}; Papaveraceae: *Glaucium flavum*³⁵; Podocarpaceae: *Dacrydium cupressinum*³⁷; Polygonaceae: *Rumex*¹⁸; Rosaceae: *Fragaria virginiana*^{2,18,34}; *Prunus armeniaca* buds^{5,18}; *P. persica* buds¹⁸; Salicaceae: *Salix*⁸; Scrophulariaceae: *Paulownia tomentosa*¹⁷; *Verbascum*³². **Animals** **SPIDERS:** Pisauridae³⁰. **INSECTS**^{11,20}: Diptera²⁰; Hemiptera: Aphididae¹¹. **Other matter** Chaff¹⁵.

REFERENCES: ¹ Moncrieff 1929; ² Davidson 1950; Secker ³ 1951, ⁴ 1953c; ⁵ Hawkins & Bull 1962; ⁶ Blundell & McKenzie 1963; ⁷ Skegg 1963; ⁸ Lyall 1964; ⁹ East 1967; ¹⁰ Warham 1969; ¹¹ Horning & Horning 1974; ¹² Sagar 1976; ¹³ Child 1978; ¹⁴ Falla *et al.* 1981; ¹⁵ Fennell *et al.* 1985; ¹⁶ Owen & Sell 1985; ¹⁷ Gibb 2000; ¹⁸ Heather & Robertson 2000; ¹⁹ Miskelly *et al.* 2001; ²⁰ Oliver; ²¹ Ann. Locality Rep. 9; CSN 22 2, 23 4, 24 6, 25 8, 26 9, 27 20, 28 24, 29 26, 30 29, 31 30, 32 33, 33 37, 34 41, 35 44, 36 45; ³⁷ O'Donnell & Dilks 1994.

Young Fed by both parents, for 1–2 weeks after fledging (see Breeding).

SOCIAL ORGANIZATION Poorly known in HANZAB region, but well known extralimally (BWP). Occur singly, in twos (presumably pairs) or small flocks at any time of year, but in non-breeding season (Feb.–Oct.) often form larger flocks, comprising hundreds, or occasionally thousands (Warham 1969; Oliver; CSN; G. Copson). Near Barryville, NI, one flock estimated at >100,000 birds (Hudson 1969). Composition of flocks changes over the year. Females, unpaired or immature males, and juveniles form flocks in early Jan., and joined in late Jan. by males that had bred; these flocks persist till at least May. In June, some small flocks composed entirely of males. In late Sept., flocks start to break down as males move to territories. In Oct., flocks mostly comprise females, but sometimes with a few males (Secker 1951, 1953b). Sometimes in mid-Oct., males form groups with small parties of females nearby, which said to superficially resemble leks (Secker 1951). When moving from breeding to non-breeding areas, form flocks of 50–70 (Secker 1951). Sometimes recorded in mixed-species flocks with Common Chaffinches, European Greenfinches, European Goldfinches and Yellowhammers *Emberiza citrinella* (CSN 2, 21, 43), usually in non-breeding season (Dean 1990). In one such flock, Redpolls were dominant species and numbered thousands (CSN 21). See also Food for details of mixed-species foraging flocks.

Bonds Monogamous, but probably form new pairs each year (Secker 1951). Round Wellington, pair-bond established mid-Nov. (Secker 1951); on Macquarie I., pairs form late Sept. (Warham 1969). Pair-formation appears to take place over several days after female settles in territory; during this time, males from nearby territories continually intrude onto territory (Secker 1951; see also Social Behaviour: Agonistic Behaviour), possibly to attempt extra-pair copulations during fertile period of female (A.M. Dunn). Sometimes non-breeding males of previous season skulk about with female when territory-holding male is silent or absent (Secker 1951). From banding study in Canterbury from Feb.–Aug., sex-ratio 45% males to 55% females. Sex-ratio of catches varied widely; in Feb., 41% female (n=49); in Mar., 63% female (n=108); in May, 66% female (n=39); in June, 29% female (n=48); in July, 50% female (n=86) (Fennell *et al.* 1985). **Parental care** Nestlings fed by both parents (see Breeding).

Breeding dispersion Nest in pairs in territories (Secker 1951). Sometimes semi-colonial, with several pairs nesting in limited area of suitable habitat (Falla *et al.* 1981). Near Wellington, territories spaced with nests 100–250 m apart. Some males set up territories in Aug.; by late Nov.–Dec., when boundaries ill defined, males wander widely, leaving territories in Jan. (Secker 1951).

Roosting No information from HANZAB region.

SOCIAL BEHAVIOUR Poorly known in HANZAB region, but well known extralimally (see BWP). Extralimally, usually shy when breeding, and more confiding outside breeding season (BWP). **Maintenance behaviour** Nestlings gaped when nest in sun (Davidson 1952). **Displacement behaviour** Male performed displacement feeding when female absent from breeding territory for long periods (Secker 1951).

Agonistic behaviour **AGGRESSION WITHIN FLOCKS:** No aggressive behaviour observed within small male-only flocks, but birds seeking to join flock dance around it in swerving flight (Secker 1951). In Oct., when flocks comprise mostly females, bickering occurs (Secker 1951). **Threat displays** Males start singing when setting up territories (Secker 1951), and threat behaviour seen till mid-Feb (Secker 1953a). **BOUNDARY FLIGHTS:** Occur early Oct. to late Jan.; male flies along boundary of territory, calling vociferously. Number of Boundary Flights declines in Nov., then resumes after young fledge, usually in mid-Dec., and peters out after late Jan.

(Secker 1951). Rattle Call possibly used in threat; sometimes given while flying in circles and quivering wings; usually in summer, seldom in winter; once given by both members of pair after aggressive encounter with another Redpoll (Secker 1955). Once, female perched and gave threat calls (probably Rattle Call) while male flew in circles round female with wings rigid; female then flew towards male, then perched and quivered wings, retracted head and protruded breast (Secker 1953a). Chee Call sometimes given, often in conjunction with Rattle Call, by pair when strangers nearby (Secker 1955). As establishment of pair-bond begins, neighbouring males continuously intrude onto territory, resulting in DISPLAY FLIGHTS and bickering between male owner of territory and intruders; Display Flights undescribed, but appear identical to those given in sexual contexts (Secker 1951; see also Social Organization [Bonds], and Sexual Behaviour). Territorial intrusions cease abruptly when nesting begins, and male then perches in prominent place near centre of territory; as incubation progresses, Display Flights and noisy calling of males decline in intensity (Secker 1951). Females persistently evict intruding females from territory (Secker 1951). **Fighting** When two males fighting, sometimes give Strangled Pyaa Call in conjunction with Rattle Call; once also given by several courting males when mobbing a female (Secker 1955). **Interspecific aggression** Early in breeding season, give threatening postures, while in flight, towards Dunnocks *Prunella modularis*, Yellowhammers, Common Starlings *Sturnus vulgaris*, and people (Secker 1953c). Once, in early winter, large flock attacked New Zealand Falcon *Falco novaeseelandiae* (Secker 1953c).

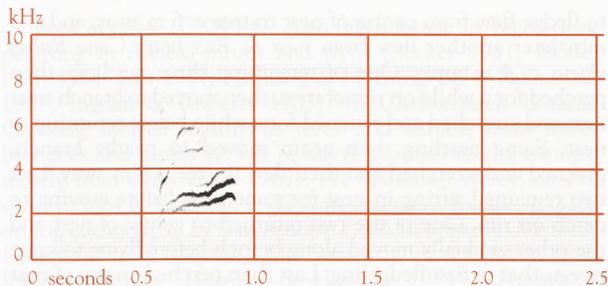
Sexual behaviour **ADVERTISING DISPLAYS:** Once in mid-Oct., single males called loudly while flying over flock; later, females from flock moved off towards males, and several rapid chases seen (Secker 1953b). On Macquarie I., undescribed aerial display flights seen in early Dec. (Warham 1969). In Nov., Boundary Flights replaced by Display Flight; at this time many females wander through territories, which said to provoke several males to leave territories and to congregate in display, though occasionally males give Display Flight from within territory. Such displays initiated by female in Nov., but not in Dec. when nesting started (Secker 1951). Display Flight also used aggressively (see Agonistic Behaviour). Once, male gave Tseet Call when flying, possibly hovering, in front of perched female (Secker 1955); possibly Display Flight. **Courtship and pair formation** Unpaired females wander through territories, and males from nearby territories sometimes leave territory and congregate in display (Secker 1951). In Oct. and Nov., birds seen flying together in small groups, with male and female sometimes separating from group and undertaking twirling sexual chase; this also often seen in non-breeding flocks in late autumn and early winter (Secker 1951). Once, in early Dec., female perched on dead twig and gave high-pitched cries, similar to begging calls, while quivering wings and gaping; male did not respond and the two then flew away; occurred three times 10:00–10:30 (Secker 1951). Once, male approached female by crouching low and 'winding' through grass towards her; male then adopted elongated, upright stance in front of female; thought to have been trying to mate with female (Secker 1953b). **COURTSHIP FEEDING:** Male feeds female on nest during incubation (Heather & Robertson 2000; NZRD). Once, female adopted posture for courtship feeding after giving Chee Call (Secker 1955; see also Agonistic behaviour). **COPULATION:** Sometimes just before copulation, male performs hovering, hesitant flight over female (Secker 1953a). Occasionally males attempt to copulate in Oct., but unsuccessfully (Secker 1951).

Relations within family group In nest with five nestlings, nestlings restless on the two days before fledging, often wriggling, preening and scratching. On day of fledging, first young

to fledge flew from centre of nest to tree c. 6 m away, and c. 3 min later another flew from nest to Raspberry Cane *Rubus idaeus* c. 4 m away. One of remaining three nestlings then perched for a while on rim of nest, then moved to branch near nest and stretched and preened for a while before returning to nest. Same nestling then again moved to nearby branch, preened and stretched and then flew to tree c. 9 m away. Last two remained sitting in nest for some time before moving to perch on rim. One of the two returned to centre of nest and the other gradually moved along branch before flying to same tree as that of first fledgeling. Last then perched on rim of nest for c. 10 min then moved to nearby branch, preened and stretched and then flew to Raspberry Cane c. 3 m from nest. Time between first and last young leaving nest was 75 min (Davidson 1952). **Anti-predator responses of young** No information from HANZAB region; for extralimital details, see BWP. **Parental anti-predator strategies** One brooding female reluctant to flush, but after flushing, did not return to nest, instead perching in nearby tree giving Dsooe Call (CSN 1).

VOICE Well known extralimitaly (see BWP, and references therein), but little published information from HANZAB region, mostly in Secker (1955); sonagrams in BWP and Knox & Lowther (2000). Often quiet, with migrating flocks silent (Secker 1951); seldom sing (Secker 1951) but conspicuous when doing so (Gill 1980), with up to six birds sometimes singing together (CSN 33). Chatter Call (Flight Call) most common vocalization (see below). **SEASONAL PATTERNS:** Sing from late Sept. or early Oct. till Jan. or early or mid-Feb. (Secker 1951; Gill 1980; Heather & Robertson 2000; CSN 1), though once started singing in early Aug. (CSN 2); most conspicuous in summer, due to Song (Gill 1980; CSN 28). Call most vociferously Aug.–Oct. (Secker 1951, 1953b, 1955), though sometimes difficult to distinguish between Song and Calls (BWP). Foraging flocks said to be 'feeble in voice' during winter (Secker 1951). **DIURNAL PATTERNS:** Calls and Songs heard daily (DNFC 1947; CSN 2), but no indication of time of day. Heard during wet and misty weather (Challies 1966). **RESPONSE TO PLAYBACK, ETC.:** Once 'excited by squeak bottle' (CSN 31).

Adults **SONG OF MALE: ADVERTISING SONG:** Short, rippling trill (Falla *et al.* 1981; Heather & Robertson 2000), often vociferous (Secker 1951); often preceded by Chatter Call (Falla *et al.* 1981). Given either from perch (sometimes near nest) or in flight, usually along territorial boundary (Secker 1951; Falla *et al.* 1981; Heather & Robertson 2000; CSN 38). Seldom sing (Secker 1951). **CHATTER CALL:** Metallic twittering or harsh rattling, rendered as *chich-ich-ich-ich* or *chich-chich-chich*, sometimes followed by *bizzzz* (Falla *et al.* 1981; Heather & Robertson 2000). Most common vocalization (Heather & Robertson 2000); usually mentioned without description (e.g. Edgar *et al.* 1965; Challies 1966; Merton 1970), as considered too well known for description to be necessary (Secker 1955). Given as contact call, usually given in flight to integrate flock (often referred to as 'Flight Call'), but also given while feeding, resting, in response to conspecifics flying past, and when taking flight (BWP). **DSOOEE CALL:** Plaintive, nasal *tsooet*, *txwee* or *twee* (Secker 1955; Falla *et al.* 1981; Heather & Robertson 2000; CSN 1), usually given in alarm (Falla *et al.* 1981; Heather & Robertson 2000; BWP), but possibly also used as Contact Call (Secker 1955). See sonagram A. Given by female soon after being flushed from nest (CSN 1), by both sexes when alighting, by female when male chased conspecific, by female when mate postured at another male, and by solitary birds (Secker 1955). **STRANGLED PYAA CALL:** A high-pitched rattle, rendered as *garr*, given by flocks in flight (Secker 1955) possibly refers to this call (BWP). Said to be given when disturbed (BWP). In HANZAB region, also



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

given by courting males when mobbing female, and when fighting (used in conjunction with Rattle Call) (Secker 1955). **RATTLE CALL:** Buzzing or purring rattle (BWP), or low-pitched trill rendered as *tzur*, repeated several times (Secker 1955); sometimes given in association with Chatter Call (Secker 1955). Uttered by both sexes, either when perched or in flight, including flying in circles with quivering wings (Secker 1955). Peculiar churring cry (Moncrieff 1929) possibly also describes this call. Serves as threat call, given after intimidating a conspecific that had entered territory (Secker 1953a, 1955). Possibly also used in advertisement or as expression of excitement (BWP). **TSEET CALL:** Repeated harsh metallic *tzeu-tzeu-tzeu-tzeu* given by male as he flew in front of perched female (Secker 1955) possibly refers to this call (BWP). Sometimes given as soliciting call, usually during nest-building, egg-laying and early in incubation (BWP). **CHEE CALL:** Shrill, high-pitched cry from female, rendered as *tzlee-tzlee-tzlee-tzlee*, similar to that of recently fledged young, given in conjunction with quivering wings and gaping (Secker 1951, 1955); presumably to solicit male (BWP). Incongruously, also said to be given by pairs when stranger present (Secker 1955). **OTHER CALLS:** Weak twittering calls mentioned but not described further (Secker 1955). Extraliminally, other songs (Single Unit, Courtship Song and Subsong) and various calls (e.g. Whistle Call, Tin Call and Pee Call) described, but not recorded in HANZAB region.

Young No information from HANZAB region. Extraliminally, nestlings give series of noisy, low-pitched *che* sounds and higher-pitched *chzip* calls, and *pyuee* when adult approached with food or after losing contact with siblings; give short *err* or *drd* in first few days after fledging, and soft *dee* thereafter (BWP).

BREEDING Poorly known in HANZAB region and no detailed studies; well known extraliminally (BWP).

Season NZ: Eggs, mid-Oct. to early Feb. (DNFC 1949; Secker 1951; Heather & Robertson 2000; CSN 1, 4) or Sept.–Jan. (Falla *et al.* 1981; Oliver); nestlings, Dec.–Feb. (Davidson 1952; Lambert 1970; CSN 1). Unspecified breeding, including fledgelings, Sept.–Feb.; often produce two broods (Moncrieff 1929; Pennycook 1949; Secker 1951; Davidson 1952; Falla *et al.* 1981; Heather & Robertson 2000; CSN 21, 33, 38, 41). **OUTLYING ISLANDS:** On Antipodes Is, fledgelings, Feb. (Warham & Bell 1979). On Snares Is, nestlings Dec.–Feb. (Miskelly *et al.* 2001). On Macquarie I., eggs, mid-Dec. to mid Feb. and nestlings, mid-Dec. to mid-Mar. (Anon. 1987; G. Copson).

Site Usually in fork of low shrub or tree, such as Gorse *Ulex europaeus*, Matagouri *Discaria toumatou*, Kotukutuku *Fuchsia excorticata*, broom bush *Cytisus*, Apple trees or briar (Pennycook 1949; Secker 1951; Davidson 1952; Sibson 1958; Child 1978; Falla *et al.* 1981; Heather & Robertson 2000; Oliver; CSN 1), and once in lupins *Lupinus* (CSN 21). Round Wellington, nest in isolated trees surrounded by shrubland, such as Kotukutuku in gullies of Tauhinu *Cassinia leptophylla*

thicket, or in pine *Pinus* among gorse and broom or thickets of Tauhinu (Secker 1951). On Snares Is, nest in Kokomuka *Hebe elliptica* (Miskelly *et al.* 2001). On Macquarie I., several nests recorded in tall tussock grass clumps, and two in flowerhead of Macquarie Island Cabbage *Stilbocarpa polaris* (Warham 1969; G. Copson). **MEASUREMENTS (m):** Height of nest, 2.0 (0.2–7.0) (Heather & Robertson 2000); seldom >3.5 (Falla *et al.* 1981); up to c. 3 (Oliver); 1.8–2.7 (Davidson 1952; CSN 1, 6). Height of nest-plant, 1.8 (Sibson 1958). On Macquarie I., ≤0.7 in tallest plants on island (G. Copson).

Nest, Materials Small, neat cup of grass, fine twigs, moss, wool and spider webs, lined with feathers, willow catkins, wool or hair (Heather & Robertson 2000; Oliver). Built by female (Heather & Robertson 2000); extraliminally, built by female, accompanied by male (BWP).

Eggs No information on shape in HANZAB region, but extraliminally, sub-elliptical, smooth and slightly, or non-glossy (BWP). Lustreless. Bluish-green, usually spotted and streaked with pale purplish-brown or light brown, with occasional dark reddish-brown markings, often forming a zone (Falla *et al.* 1981; Heather & Robertson 2000; Oliver), though some unmarked (Falla *et al.* 1981). **MEASUREMENTS:** 14.5 × 11.6, 15.2 × 11.6 (Oliver); 15 × 11.5 (Heather & Robertson 2000).

Clutch-size Three to six, usually four (Heather & Robertson 2000); four or five (CSN 1); four to six (Falla *et al.* 1981; Oliver). On Macquarie I., C/3 × 1, C/5 × 2 (G. Copson).

Laying No information from HANZAB region.

Incubation By female; incubating bird fed by mate on nest (Heather & Robertson 2000). **INCUBATION PERIOD:** 11 days (10–15) (Heather & Robertson 2000); 10–12 days (Falla *et al.* 1981); 11 days (Pennycook 1949).

Young Both parents feed nestlings by regurgitation (Heather & Robertson 2000). At one nest, brooded by female (CSN 1).

Fledging to independence **FLEDGING PERIOD:** 13 days (12–15) (Heather & Robertson 2000); 11–14 days (Falla *et al.* 1981); 12 days (Pennycook 1949). At one nest, all five young fledged 11:10–12:15. Three young perched on side of nest, then crawled onto nearby branches before making first flight; one returned to nest before flying. Initial flights 3.0–9.1 m long (Davidson 1952; see Social Behaviour: Relations within family group). Fed by both sexes for 1–2 weeks after fledging (Heather & Robertson 2000).

Success In Kowhai Bush, SI, of five nests where outcome known, only one fledged young successfully; predation of eggs at the other four nests was attributed to mustelids (Moors 1983).

PLUMAGES Prepared by J.S. Matthew. Following summarized from BWP. Nestling has fairly 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, when c. 1 year old. Thereafter, complete post-breeding moult each cycle produces successive adult (basic) plumages with no change in appearance. Sexes differ in adults. Thought that subspecies *cabaret* introduced to HANZAB region (see Geographical Variation for discussion). Descriptions of plumages and bare parts of *cabaret* given in BWP and Field Identification (q.v.). See Fennell *et al.* (1985) and Troy & Brush (1983) for individual variation in breast-colour of adult males.

MOULTS Based on examination of skins of 15 adults from NZ (NMNZ); skin of three adults and eight first immatures from Macquarie I. (MV); and other information as cited. For detailed information on moult in Britain and Europe, see Evans (1966) and Jenni & Winkler (1994). **Adult post-breeding** (Third and subsequent pre-basic). Little information from

HANZAB region. For detailed information on moult in *cabaret* in England, see Evans (1966). Complete. Primaries moult outward; in Europe, some birds suspend moult of primaries due to breeding (Jenni & Winkler 1994). In England, moult of primaries starts late July to late Aug. and finished early Sept. to late Oct.; individual duration of moult of primaries 43–60 days, with some overlap between breeding and start of moult (BWP). In NZ, moult not yet started by late Jan. when plumage is well worn (Niethammer 1971). In skins from NZ examined here: one of one in Apr. and one of one in May had all primaries new; four of four in June had all primaries slightly worn; nine of nine from Aug.–Oct. had all primaries worn. Little information from Macquarie I.; two collected in May had all primaries new, and one from Dec. had all primaries worn. For information on moult of other feather-tracts in n. hemisphere populations, see Jenni & Winkler (1994) and BWP. **Post-juvenile** (First pre-basic). Partial in n. hemisphere, involving all feathers of head and body, all, or most, marginal and median coverts and, in some early-hatched birds, variable number of greater secondary coverts, 1–2 tertials, and rarely some rectrices (Svensson 1992; Jenni & Winkler 1994; BWP). Little information from HANZAB region; eight first immature skins from Macquarie I. from May–Aug. (MV) had all juvenile remiges and rectrices retained; all of these birds have small orange-red or orange-brown patch on forehead (but some of the skins were stored in alcohol, which may have affected feather pigmentation).

MEASUREMENTS SUBSPECIES CABARET: (1) NZ, adults, skins (NMNZ). (2) Christchurch region, SI, live birds, ages combined, sexed by plumage (Fennell *et al.* 1985). (3–5) Live birds and skins combined, sexed by plumage (Fennell & Sagar 1985): (3) Southland, SI; (4) Snares Is; (5) Campbell I. (6–7) NZ, including Campbell I., skins (Westerkov 1953): (6) Adults; (7) Juveniles. (8–9) Skins (Niethammer 1971): (8) NZ; (9) Great Britain. (10) Campbell I., skins, sexed by dissection (Bailey & Sorensen 1962). (11) Snares Is, live adults, sexed by plumage (Miskelly *et al.* 2001). (12) Netherlands, skins, adults and first immatures (BWP). NZ populations thought to be subspecies *cabaret*, but see discussion in Geographical Variation below. **NOMINATE FLAMMEA:** (13) Scandinavia, skins (Niethammer 1971). (14) Fenno-Scandinavia, skins, adults and first immatures (BWP).

	MALES	FEMALES	
WING	(1) 69.6 (1.82; 66–73; 16)	–	
	(2) 70.0 (1.70; 65–74; 198)	68.2 (1.70; 63–72; 229)	**
	(3) 70 (66–74; 20)	67 (63–70; 15)	
	(4) 70 (66–71; 10)	68 (64–71; 14)	
	(5) 69 (68–71; 12)	67 (64–69; 11)	
	(6) 69.8 (1.28; 68–72; 13)	66, 68, 69	
	(7) 68.9 (1.51; 67–71; 12)	67.8 (1.50; 66–69; 4)	ns
	(8) 70.2 (2.14; 67–74; 28)	68.3 (1.74; 64–70; 11)	**
	(9) 70.2 (1.36; 67–73; 21)	67.1 (1.61; 65–72; 13)	**
	(10) 68, 70, 71	68, 70	
	(11) 69.6 (2.10; 66–71; 10)	67.6 (2.10; 64–71; 15)	**
	(12) 70.9 (1.56; 68–74; 27)	69.2 (1.92; 66–73; 32)	**
	(13) 74.0 (1.30; 72–78; 11)	(70–72; 3)	
	(14) 75.2 (1.53; 72–78; 14)	73.4 (1.02; 71–75; 7)	**
TAIL	(1) 52.1 (3.13; 47–59; 16)	–	
	(2) 52.1 (2.20; 47–55; 46)	52.5 (2.20; 47–56; 52)	ns
	(3) 53 (50–55; 20)	52 (49–54; 15)	
	(4) 52 (49–56; 10)	52 (49–54; 14)	
	(5) 53 (50–56; 12)	51 (48–53; 11)	
	(8) 51.8 (1.93; 49–56; 29)	50.1 (47.5–52; 11)	
	(9) 51.6 (2.11; 48–57; 21)	50.9 (48–55; 13)	
	(10) 50, 50, 52	50, 53	
	(12) 54.3 (2.34; 51–58; 14)	53.4 (2.26; 50–57; 16)	ns
	BILL S (1) 11.0 (0.75; 9.5–12.2; 16)	–	
	(2) 11.7 (0.39; 11.1–12.2; 22)	11.6 (0.32; 10.9–12.1; 36)	ns
	BILL F (2) 9.1 (0.50; 8.0–10.0; 66)	9.1 (0.50; 8.0–10.4; 63)	ns

	(3) 8.9 (8.1–9.5; 20)	8.6 (8.0–9.5; 15)	
	(4) 9.5 (9.0–9.8; 10)	9.7 (8.7–10.6; 14)	
	(5) 8.9 (8.5–9.2; 12)	8.7 (8.5–9.0; 11)	
	(6) 8.5 (0.25; 8.0–9.0; 13)	8.0, 8.0, 8.0	
	(7) 8.3 (0.33; 8.0–9.0; 12)	8.1 (0.25; 8.0–8.5; 4)	
	(11) 9.5 (0.30; 9.0–9.8; 10)	9.6 (0.70; 8.4–10.6; 15)	ns
BILL N (12)	7.1 (0.41; 6.5–7.6; 21)	7.0 (0.35; 6.6–7.7; 24)	ns
TARSUS	(1) 14.8 (0.50; 14.0–15.7; 14)	–	
	(2) 14.8 (0.80; 13.5–16.5; 49)	15.0 (0.80; 13.1–17.0; 53)	ns
	(4) 15.9 (14.9–16.2; 10)	15.0 (13.1–16.2; 14)	
	(5) 14.5 (13.2–15.5; 12)	14.4 (13.2–15.0; 11)	
	(10) 15, 15, 15	13, 14	
	(11) 15.9 (0.80; 14.9–17.2; 10)	15.0 (0.90; 13.1–16.2; 15)	**
	(12) 14.0 (0.49; 13.3–14.8; 13)	14.1 (0.62; 13.3–15.1; 15)	ns

WEIGHTS SUBSPECIES CABARET: (1) NZ, adults, from museum labels (NMNZ). (2–4) Christchurch region, SI, live birds, ages combined, sexed by plumage (Fennell *et al.* 1985): (2) Feb.–Mar.; (3) June–July; (4) Aug. (5) NZ (Niethammer 1971). (6) Snares Is, adults, sexed by plumage (Miskelly *et al.* 2001). NZ populations thought to be subspecies *cabaret*, but see discussion in Geographical Variation below.

	MALES	FEMALES	
(1)	10.9 (0.98; 8.6–12.3; 18)	–	
(2)	12.0 (0.80; 10.0–15.0; 85)	11.5 (0.80; 10.0–14.0; 129)	**
(3)	13.0 (0.80; 11.5–15.5; 74)	12.5 (0.90; 10.5–14.5; 57)	**
(4)	13.3 (1.10; 11.0–15.5; 47)	12.4 (0.70; 11.0–13.5; 51)	**
(5)	10.9 (8.6–12.5; 18)	11.7 (10.6–13.0; 8)	
(6)	13.3 (0.70; 12.0–14.0; 10)	12.5 (0.90; 11.0–14.0; 15)	*

BWP gives the following monthly mean weights for birds captured in central and s. England (subspecies *cabaret*): Sept. 11.6 (9.0–14.5; 1208); Oct. 11.9 (9.0–16.5; 1343); Nov. 11.9 (9.5–16.5; 389); Dec. 12.3 (10.0–16.5; 73); Jan. 12.6 (11.0–14.5; 145); Feb. 11.7 (10.0–14.5; 104). See Evans (1966) for detailed information on weights of *cabaret* in England. Miskelly *et al.* (2001) gave mean weight of unsexed juveniles from Snares Is as 11.8 (0.80; 10.5–13.5; 20). Adult male captured on Macquarie I. in Sept. weighed 12.5, and female in Aug. weighed 14.7 (G. Copson).

STRUCTURE See BWP for details.

AGEING See Evans (1966), Boddy (1981), Svensson (1992), Jenni & Winkler (1994) and BWP for details on ageing n. hemisphere birds. Following summarizes key ageing criteria. Juveniles distinguished by plumage and, to lesser extent, bare parts (see Field Identification above). First immatures difficult to distinguish from adult females. In n. hemisphere populations in autumn to early winter, first immatures (nominata and *cabaret*) have fresh body-plumage and are distinguishable from adult females by (from Svensson 1992; Jenni & Winkler 1994; BWP): (1) immature males often have rosy-pink tinge to lower ear-coverts and upper breast, more so than adult females and sometimes as intense as adult males; (2) red cap in immature males tends slightly larger (mean length 10.6 mm [5–14]) than adult female (mean 9.9 [7–13]) but slightly smaller than adult male (mean 11.5 [9–14]); red cap in females not different from adult female; (3) usually retain all juvenile rectrices, which are slightly narrower and distinctly more pointed at tips than those of adult; (4) c. 70% of first immatures show moult-contrast within greater secondary upperwing-coverts, retained juvenile coverts (often outer coverts) more worn and having paler-brownish centres to feathers and buffish tips (cf. darker-black centres and brownish-orange tips to adult-like coverts); (5) a few birds show moult-contrast within tertials, retained juvenile tertials with paler feather-centres; (6) retained juvenile primaries and secondaries, which are more worn than those of adult. First immatures much more

difficult to distinguish from adults once plumage, especially rectrices, worn (by spring–summer). These ageing criteria presumably also apply to populations introduced to HANZAB region. Fennell *et al.* (1985) examined breast-colour of males in Christchurch region, and found: 'first year' birds (first immatures) in May have 'slight pink' breasts (4 of 4 birds); in June–July 'slight pink' (19 of 24) or pink (5 of 24); and in Aug. 'slight pink' (10 of 11) or pink (1 of 11); adult males tend richer pink or red on breast than immatures at same time of year; those in May have 'slight pink' (2 of 9), pink (2 of 9) or red (5 of 9) breasts; in June–July 'slight pink' (5 of 68), pink (6 of 68) or red (57 of 68); and in Aug. pink (7 of 31) or red (24 of 31).

SEXING See Evans (1966), Da Prato & Da Prato (1978), Boddy (1981), Svensson (1992) and BWP for details on sexing n. hemisphere birds. Adult male *cabaret* average larger than adult females (see Measurements), but much overlap between sexes. Stenhouse (1962) examined 234 birds captured on SI of NZ; he sexed birds as female if lacking pink on breast, ear-coverts and rump, or males if pink present on these areas; sexing checked by dissection of 13 birds and two birds identified as first immature males (with small amount of pink) were actually females, but all other birds were sexed correctly. Fennell *et al.* (1985) compared colour of forehead and forecrown (poll) in 244 males and 299 females (sample not including juveniles) captured round Christchurch, Feb.–Aug. 1983, and found: 5.7% of females either lacked coloured poll or had yellow to bronze colour (cf. no males); 23.8% of females had orange-red or light-red poll (cf. 9% of males); and 70.3% of females had bright-red or dark-red poll (cf. 91% of males). They also found that females tend to have smaller poll (9.0 mm [6.5–12.0; 55]) than males (10.5 [9.0–13.0; 26]), but no significant difference between sexes in presence or absence of white greater wing-bar.

GEOGRAPHICAL VARIATION Complex in n. hemisphere; number of subspecies recognized either three (BWP), four (Svensson 1992; Peters), five (Williamson 1961) or six (Salomonsen 1928; Witherby *et al.* 1938; Westerkov 1953). For detailed discussion on geographical variation in plumage and morphometrics in n. hemisphere, see Salomonsen (1928), Vaurie (1965) and BWP. Following subspecies accepted by all aforementioned authors: nominate *flammea* occurs naturally in n. Eurasia from Scandinavia, E to e. Siberia, and n. N. America; subspecies *cabaret* occurs in British Isles and through much of central and e. Europe, including Alps and along North Sea coast; and subspecies *rostrata* from Iceland, s. Greenland and Baffin Land (BWP). Subspecies *cabaret* differs from nominate by: (1) smaller size (see Measurements); (2) slightly broader, blacker and more sharply defined streaking on nape, upper-parts and flanks; (3) sides of head, breast and flanks, richer tawny-brown with bolder black streaking, contrasting more strongly with cream belly (paler cream-buff with dark-grey streaks, not contrasting strongly with whitish belly in nominate); (4) fringes to rectrices, tertials and median and greater secondary upperwing-coverts, deeper cinnamon-buff (paler buff or whitish in nominate); and (5) adult males have slightly deeper pink on chin, throat and underparts, extending farther down belly (BWP). Some authors consider populations introduced to NZ, and those that reached Macquarie I. from NZ, as subspecies *cabaret* (Westerkov 1953; Niethammer 1971; DAB). Stenhouse (1962) suggested NZ populations closely resemble *cabaret*, but show some characteristics (such as distinct white greater wing-bar and greater length of wing) of nominate *flammea* from continental Europe; he suggested either some birds introduced to NZ were nominate or there have been subsequent imports of nominate birds to NZ. Regardless of the origin of ancestral stocks, Stenhouse (1962)

suggested NZ populations should not be assigned to a particular subspecies. This largely supported by Fennell *et al.* (1985), who considered NZ birds to closely resemble *cabaret*, but often have white wing-bars similar to those of nominate; the latter study, however, did not take into account the effects of feather-wear (greater wing-bar grades narrower and paler with wear; see Field Identification above). Fennell & Sagar (1985) found that populations on Snares and Campbell Is show less variation in colour of poll than those on mainland NZ, and birds on Campbell I. tend orange (cf. pink or red) on breast, especially males. More data, including genetic analysis, needed to determine extent to which NZ populations have diverged from British (or European) populations.

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Nicolas Day

Volume 7 (Part B), Plate 39

Common Redpoll *Carduelis flammea* (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