

Order PASSERIFORMES

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

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

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

The Passeriformes divide into two main groups:

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

SUBORDER PASSERI (OSCINES OR SONGBIRDS): Cosmopolitan in distribution. Within the HANZAB region there are 36 families of Passeri. The Australo-Papuan Passeri can be subdivided into several supra-familial groups, but those recognized differ between authors (for further information, see Sibley & Ahlquist 1985, 1990; DAB). Oscines are

characterized by acromyodian syrinx, with three or four pairs of intrinsic syringeal muscles (van Tyne & Berger 1976; Campbell & Lack 1985; Sibley & Ahlquist 1990; DAB).

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

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- MENURIDAE (lyrebirds): two species in one genus; endemic to Aust.;
- ATRICHORNITHIDAE (scrub-birds): two species in one genus; endemic to Aust.;
- CLIMACTERIDAE (A'asian treecreepers): six species in two genera breeding in Aust.;
- MALURIDAE (Australopapuan fairy-wrens, emu-wrens and grasswrens): 22 breeding species in three genera in Aust.;
- MELIPHAGIDAE (honeyeaters and Aust. chats): 76 species in 26 genera in Aust. and NZ, all breeding;
- PARDALOTIDAE (pardalotes, scrubwrens, thornbills and allies): 51 species (one extinct) in 15 genera in HANZAB region, all breeding;
- PETROICIDAE (A'asian robins): 23 species in eight genera in HANZAB region, all breeding;
- ORTHONYCHIDAE (logrunners): two breeding species in one genus in Aust.;
- POMATOSTOMIDAE (A'asian babblers): four breeding species in single genus in Aust.;
- CINCLOSOMATIDAE (whipbirds, wedgebills, quail-thrushes and jewel-babblers): eight breeding species in two genera in Aust.;
- NEOSITTIDAE (sitellas): single species breeding in Aust.;
- PACHYCEPHALIDAE (whistlers, shrike-thrushes and allies): 17 species in seven genera in HANZAB region, all breeding;
- DICRURIDAE (monarchs, flycatchers, fantails and drongos): 19 species in seven genera in HANZAB region, all breeding;
- CAMPEPHAGIDAE (cuckoo-shrikes, trillers and minivets): eight species (one extinct) in two genera in HANZAB region, all breeding;
- ORIOOLIDAE (Old World orioles and figbirds): three species in two genera in Aust., all breeding;
- ARTAMIDAE (woodswallows, butcherbirds and currawongs): 14 species in four genera in HANZAB region, all breeding;
- PARADISAEIDAE (birds of paradise): five breeding species in two genera in Aust.;
- CORVIDAE (crows and jays): six breeding species in single genus in Aust. and NZ, including one introduced to NZ;
- CORCORACIDAE (Aust. mudnesters): two species in two monospecific genera, endemic to Aust.;
- CALLAEIDAE (NZ wattlebirds): three species (one extinct) in three monospecific genera, endemic to NZ;
- LANIIDAE (shrikes): two species in HANZAB region, one accidental to Prince Edward Is, the other accidental to Christmas I.;
- PTILONORHYNCHIDAE (bowerbirds): ten species in seven genera in Aust. (nine species) and NZ (one species), all breeding; Piopio of NZ probably extinct (Heather & Robertson 1997);
- ALAUDIDAE (larks): two breeding species in HANZAB region (including one successfully introduced to Aust. and NZ);
- MOTACILLIDAE (wagtails and pipits): eight species in two genera in HANZAB region, only two breeding (one on South Georgia), the rest non-breeding visitors or accidentals;
- PRUNELLIDAE (accentors): one species successfully introduced to NZ;
- PASSERIDAE (Old World sparrows and A'asian finches): 22 species in nine genera (including four successful introductions) in HANZAB region, all breeding;
- FRINGILLIDAE (Old World finches): seven species in four genera in HANZAB region, all introduced except one naturally occurring vagrant to South Georgia;
- EMBERIZIDAE (buntings, cardinals, tanagers and allies): two successfully introduced species, occurring NZ and Lord Howe I.;
- NECTARINIIDAE (sunbirds and spiderhunters): single breeding species in Aust.;
- DICAEIDAE (flowerpeckers): single breeding species in Aust.;
- HIRUNDINIDAE (swallows and martins): eight species in four genera in HANZAB region, including four breeding species in Aust. and NZ, one non-breeding visitor and three accidentals;
- PYCNONOTIDAE (bulbuls): one successfully introduced species in Aust.;
- SYLVIIDAE (Old World warblers): 13 species in eight genera in HANZAB region, including ten breeding species (one extinct) in Aust. and NZ, and three accidental to region;
- ZOSTEROPIDAE (white-eyes): seven species (one extinct) in single genus in HANZAB region, all breeding;
- MUSCICAPIDAE (Old World flycatchers, thrushes and chats): eight species in six genera in HANZAB region, including five breeding species (two introduced), and four accidentals (including one on Prince Edward Is);
- STURNIDAE (starlings and mynas): five species in four genera, four breeding in HANZAB region (including two species successfully introduced, and one species now extinct), and one accidental.
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The Aust. oscines fall into two distinct clusters, each with at least three major supra-familial lineages (DAB): One cluster is the Passerida, comprising the Muscicapoida (including true thrushes and allies), Sylvioidea (true warblers and babblers, and swallows, and others), and Passeroidea (including larks, pipits, sunbirds, flowerpeckers and all finches and their allies). The other cluster is the Corvida, which is centred on the Australo-Papuan region (though its origins are not certain) and which also comprises three main lineages: Menuroidea (lyrebirds, scrub-birds, treecreepers and bowerbirds), Meliphagoidea (A'asian wrens, pardalotes, acanthizid warblers, and honeyeaters), and Corvoidea (A'asian robins, logrunners, A'asian babblers, whipbirds and quail-thrushes, sitellas, whistlers, fantails and monarchs, birds of paradise, butcherbirds and woodswallows, cuckoo-shrikes, Old World orioles, crows and mudnesters).

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

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

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

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

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

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

Arboreal or terrestrial or both; some strictly arboreal (e.g. Hirundinidae), others strictly terrestrial (e.g. Menuridae, Pittidae); most combine both arboreal and terrestrial foraging to varying degrees, but usually with one predominating. Feed on almost all known food, from plant material to vertebrate animals, but most show some specialization for certain food, such as feeding on nectar (Nectariniidae), seeds (Passeridae), fruit (Zosteropidae), small vertebrates (Artamidae) and, commonly, insects (e.g. Maluridae, Pardalotidae, Petroicidae and others). Mostly feed by gleaning

and probing, including probing flowers for nectar; and other substrates for invertebrates; also feed by sallying, including various sallying techniques (sally-hovering, sally-striking and sally-pouncing), each suited for one group of prey, particularly moving animals.

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

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

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

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

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

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

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

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

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Family 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 tomlia, 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 megalpaga* (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 coelebs Common Chaffinch

COLOUR PLATE FACING PAGE 1273

Fringilla coelebs Linnaeus, 1758, *Syst. Nat.* 10(1): 179 — Europa = Sweden.

Genus is Latin *fringilla*, a small bird mentioned by Terentius Varro, Valerius Martialis, and Pompeius Festus, and identified by some authors with the Chaffinch. According to Linnaeus (1758), only the female Chaffinches migrate from Sweden in winter, leaving the cock birds to lead a bachelor existence (Latin *caelebs*, single).

OTHER ENGLISH NAMES Beech Finch, Chaffinch, Scobby, Shell-apple.

POLYTYPIC Subspecies *gengleri* Kleinschmidt, 1909, introduced and established throughout NI, SI and Stewart I., NZ (Niethammer 1971), also Chatham, Snares, Auckland and Campbell Is, indigenous to British Isles.

Extralimitally, up to 18 further subspecies in three main groups from Europe to Caucasus, Middle East, n. Africa and Azores, Madeira and Canary Is.

FIELD IDENTIFICATION Length 14.5 cm; wingspan 25–29 cm; weight 17.5–24.5 g. Introduced. Small finch with small, slightly peaked, head, long, sharp bill, long, broad wings and long tail with slight notch to centre of tip. Similar in size and shape to sparrow *Passer*, but bill longer and shallower; shape also similar to Yellowhammer *Emberiza citrinella* or Cirl Bunting *E. cirrus*, though longer-billed. Sexes differ: males delicately coloured, mainly pinkish or rufous brown with blue-grey on head and neck, black wings with bold white stripes, and white edges to dark tail; females and juveniles plainer, mainly grey-brown with bold patterning of wings. Subspecies *gengleri* described below. Slight seasonal variation, due to wear of plumage. **Adult male fresh plumage** Fresh plumage attained late summer or autumn. Forehead dark grey, grading to bluish grey on crown, nape, hindneck and sides of neck, with brownish wash. Lores, supercilium, ear-coverts and malar area, dull rufous with brown, buff or grey tinge formed by fringes to feathers. Mantle and scapulars, rufous-brown, forming saddle, with diffuse grey-green or buff-brown mottling. Back, rump and all but longest uppertail-coverts, yellowish green; longest uppertail-coverts, bluish grey with olive fringes to tips. Tail, blackish with broad white edging. Folded wing: upper marginal secondary coverts, blue-grey with rufous-brown fringes, forming small bluish-grey patch on leading edge of innerwing above carpal joint; lower marginal secondary coverts and all median secondary coverts, white, forming prominent white 'shoulder' continuing as broad white bar extending towards scapulars; greater secondary coverts, black with broad cream or pale-yellow tips which form second, narrower pale bar across centre of wing; rest of wing, black, with: broad buff or brown fringes to tertials (visible as narrow lines); narrower cream or pale greenish-yellow outer edges to secondaries and, very narrowly, on primaries (those on secondaries combining to form diffuse pale panel on innerwing); bases of primaries white, forming small white patch below black greater primary coverts. In flight, upperwing mostly blackish and patterned with: blue-grey leading edge to innerwing; broad white band from carpal towards scapulars; and narrow cream or yellowish bar that merges with white bases of primaries to form distinct, long and narrow pale bar across centre of wing. Chin and throat, pale rufous with buff fringes, sometimes appearing pinkish; slightly paler than face. Breast and upper flanks, pale pinkish-rufous, grading paler on centre of belly, which whitish with pinkish or buff tinge; vent and undertail-coverts, white; lower flanks and thighs, bluish grey. Undertail, mostly white with dark-grey stripe through centre. Underwing appears white on leading edge, with broad dark trailing edge; underwing-coverts mostly white, grading greyer on leading edge of outerwing; remiges, dark grey with pale-grey edges. Bill mostly blue-grey with black tip, dark-grey cutting edges and broad pinkish or yellowish tinge at base. Iris, blackish brown; orbital ring dark grey. Legs, grey, often with strong brown or reddish tinge. **Adult male worn plumage** In spring and early summer, duller tips to feathers wear off, making plumage appear darker and brighter. Forehead, black, grading to light blue-grey on crown, nape, hindneck and sides of neck. Face, brighter pinkish-rufous than fresh plumage. Mantle and scapulars, uniform pinkish brown, tinged slightly redder than fresh plumage; back, rump and uppertail-coverts, olive-green, much brighter than fresh plumage. Upperwing as in fresh plumage, but tips and edges to feathers, white with less

cream, buff or greenish tinge, and bar across tips of greater coverts tends purer white. Chin, throat, breast and upper flanks, brighter, more pinkish, merging into only slightly paler belly, vent and undertail-coverts. Bare parts, largely as per birds in fresh plumage, but bill lacks pinkish or yellowish tinge. In very worn birds, in late summer to autumn, top of head becomes ash-grey as pale fringes to tertials wear off. **Adult female** Dull version of male; plumage appears more sparrow-like. Plumage changes only slightly with wear. Forehead, crown and hindneck, brown to grey-brown; some birds have diffuse grey line extending from sides of nape to sides of neck, forming indistinct grey partial collar, but this sometimes obscure or lacking. Face, plain grey, sometimes broken by narrow, diffuse buff or grey-brown eye-stripe, from anterior lores to top of, and sometimes behind, ear-coverts; at some angles, eye-stripe gives impression of faint grey-brown supercilium; partial eye-ring, comprising arcs above and below eye, buff, cream or whitish. Mantle and scapulars, slightly darker brown than hindneck; back and rump, olive-brown; uppertail-coverts, darker olive-brown. Tail as adult male. Upperwing like adult male, but ground-colour tends blackish brown; upper marginal secondary coverts, grey-brown; usually have less extensive white 'shoulder'; pale-yellowish edging to secondaries and primaries, not as pale or bright, less contrasting. Chin and throat, pale greyish-brown; breast and upper flanks, greyish brown, grading paler along flanks and onto belly, which off-white in centre; vent and undertail-coverts, white. Rest of plumage as adult male. Bare parts as adult male, but bill always as per males in fresh plumage, usually with brownish tinge to base. In worn plumage, appear slightly darker and more brownish. **Juvenile male** Much like adult female, but feathers of wing and tail fresh when adults are in heavy moult. Top of head, grey, with grey-brown stripe either side; centre of nape has pale-grey patch, forming diffuse nuchal patch (not present on adult female). Mantle and scapulars, brown with olive tinge. Rectrices, narrower and more pointed than in adult; central feathers, grey, with greenish-brown tip (cf. black in adult); ground-colour to rest of rectrices, blackish brown (blackish in adult). Underparts, nearly all off-white (slightly paler than adult female) with brownish sides to breast and upper flanks. Bill paler than adult in fresh plumage, basal area more flesh-pink with slight grey tone, paler still at base of lower mandible; legs more pinkish grey. **Juvenile female** Very like juvenile male, but mantle and scapulars more greyish brown. Central tail-feathers, more brownish, not as grey as in juvenile male. White 'shoulder'-patch tends smaller than in other plumages. **Immature** As respective sexes of adults, but retain some juvenile plumage: (1) tail lacks black spot on tips of central rectrices, and feathers narrower and more pointed than in adult; (2) remiges and primary coverts more brownish than in adult; and (3) varying number of outermost greater secondary coverts retained, contrasting with fresher black adult-like coverts, retained coverts tend much greyer.

Similar species Adult male readily distinguished by distinctive blue-grey and pinkish-brown plumage. Dull females and juveniles easily distinguished from all other NZ finches, sparrows and buntings by combination of unstreaked body and pair of white wing-bars on blackish upperwing.

Often occur singly or in twos (presumably pairs), and sometimes in large flocks outside breeding season; such flocks often segregated into different sexes. Often forage with other

finches and buntings. Flight similar to pipits and buntings, rather than to other finches; when flushed, fly quickly with rapid wing-beats, directly to nearest cover (usually trees); longer flights more leisurely and undulating, with quick burst of wing-beats interspersed with gliding on closed wings; white wing-bars and outer tail-feathers emphasize undulating and turning movements. On ground, mostly hop, interspersed with a tripping walk, with short, quick steps and head nodding slightly. Perch upright, with tail drooped; stance more horizontal when on ground. Often flick of tail nervously while feeding on ground. Male sings with head held upward. Male and females have different Songs (that of female is simpler than that of male); also give Subsong, and at least seven different calls (see Voice).

HABITAT Often inhabit farmland, parks and gardens, and pine plantations; also common in forests and shrublands, and, near coasts, on mudflats and beaches. In some areas, occur in forest in breeding season, and move to nearby pasture in non-breeding season (Dean 1990). Occur from sea level to elevations of >1600 m asl (Falla *et al.* 1981; CSN 19 Suppl.).

In rural areas, often occur in farmland, especially pasture (Hodgkins 1949; Sibson 1949, 1983; Blackburn 1967; Dean 1990; CSN 1, 37), and occasionally in orchards and vineyards (Baker 1980; CSN 2, 33). Sometimes recorded in vegetable fields and weed-infested crops, and other weedy areas (Blundell & McKenzie 1963; Sibson 1983; Beauchamp & Parrish 1999), e.g. recorded on scoria and pumice flats among self-sown hawthorn *Crataegus* (Innes *et al.* 1982; CSN 4). In urban areas, often occur in parks and gardens (Turbot 1947; Hodgkins 1949; Sibson 1949; Dawson 1950; Guest & Guest 1987, 1993; Gill 1989; Day 1995; CSN 1, 2, 37), and occasionally on golf courses (Sibson 1983). Elsewhere, sometimes also inhabit other grassy habitats, such as tussock grassland (Innes *et al.* 1982) or scattered tussocks among rocks in glacial valley (J.M. Peter). On Lord Howe I., most records on verges of airstrip (Fraser 2004). In coastal areas, recorded on intertidal mudflats and beaches (Wodzicki 1946; Sibson 1983; Beauchamp & Parrish 1999; CSN); also occur at edges of coastal lagoons and inlets, sometimes among saltmarsh (Sagar 1976; Sibson 1983; Owen & Sell 1985; CSN 41), occasionally among mangroves (CSN 31), and often on vegetated dunes (Dell 1950; Sibson 1983; CSN 35), e.g. at Waikanāe R. estuary, occur on vegetated dunes, in shrubland dominated by Tree Lupin *Lupinus arboreus* with Tauhinu *Cassinia leptophylla* and Tall Toetoe *Arundo conspicua*, or among Kanuka and Coastal Tree Daisy *Olearia solandri*, with a few scattered Cabbage Tree *Cordyline australis* and brambles (Wodzicki 1946). Elsewhere, often recorded in Manuka or Kanuka shrubland (Challies 1966), and occasionally in stunted subalpine shrubland (Child 1975; Innes *et al.* 1982), e.g. in Ruahine Ras, in low shrubland dominated by Leatherwood *Olearia colensoi*, with *Senecio elaeagnifolius* (Challis 1966), in L. Harris Basin, in shrubland with *Olearia moschata* and *Hebe odora* co-dominant, with various other scattered shrubs (Child 1978), or near Arthurs Pass, in stunted alpine community comprising Mountain Flax *Phormium cookianum*, Turpentine Scrub *Dracophyllum longifolium*, Taramea *Aciphylla scott-thomsonii*, Mountain Daisies *Celmisia coriacea*, Mt Cook Lily *Ranunculus lyallii* and sub-alpine cushion plants (J.M. Peter). Also often inhabit native forests, especially those with canopy dominated by beech *Nothofagus* (e.g. Secker 1958; Sibson 1958, 1983; Wilkinson & Guest 1977; Dawson *et al.* 1978; Onley 1983), mixed beech-podocarp forests (Challis 1962), or sometimes broad-leaved forests dominated by Kamahi *Weinmannia racemosa* or Broadleaf *Griselinia littoralis*, podocarp forests, or mixed forests, e.g. of rata, podocarps and hardwood (Sibson 1958; Wilkinson & Guest 1977; Onley 1980; Wilson *et al.* 1988; Fitzgerald *et al.* 1989), often with tall, emergent trees such as podocarps, Rimu

or Northern Rata *Metrosideros robusta*, smaller trees in sub-canopy, shrubby understorey, often comprising fruit-bearing shrubs such as Horopito *Pseudowintera colorata*, Rohutu *Myrtus pedunculata* or Weeping Mapou *Myrsine divaricata*, and diverse ground-cover (Wilkinson & Guest 1977; Dawson *et al.* 1978; Onley 1980, 1983); in dense forests, often occur in clearings or where forest canopy is broken, with areas of bare ground, introduced grasses and herbs (Challies 1966; Onley 1980; J.M. Peter). Also recorded in tall or stunted, dense or open, Kanuka forest (Gill 1980; Dean 1990), and second-growth hardwood forest, dominated by Mahoe *Melicococcus ramiflorus*, Kanuka and Kotukutuku *Fuchsia excortica* (Freeman 1999). On some offshore islands, occur in forests dominated by Pohutukawa *Metrosideros excelsa*, ragwort *Senecio* and daisy-bush *Olearia* (Sagar 1977; Wodzicki 1978; Cunningham & Moors 1985; Miskelly *et al.* 2001); and on Chatham Is, in low forest of Chatham Islands Karamu *Coprosma chathamica*, Chatham Island Lancewood *Pseudopanax chathamicus*, *Hymenanchera chathamica* and Tarahinau *Dracophyllum arboreum* (West 1988). Often occur in plantations or shelter-belts of exotic pines or Monterey Cypress *Cupressus macrocarpa* (Moncrieff 1929; Weeks 1949; Secker 1952; Crockett 1954; Sedgwick 1955; Sibson 1983; Owen & Sell 1985); on Lord Howe I., recorded in plantations of Bunya, Hoop and Norfolk Island Pines (Fraser 2004).

DISTRIBUTION AND POPULATION Widespread in Europe, n. Africa and w. and central Russia. Breed from Canary Is, Morocco, Iberian Pen. and British Isles, and occasionally Iceland, E nearly to L. Baikal; in W, occur from n. Norway S to s. Mediterranean coast, especially in Morocco and Algeria, but also at scattered sites farther E to Nile R. Delta, Israel and Jordan, and farther E, in e. Iraq and w. and n. Iran; E of Urals, n. extent of range occurs from c. 63°N on ne. slopes of Urals to Angara R. near Irkutsk, with s. boundary at c. 50°N in n. Khazakstan and s. Russia (s. Siberia). During non-breeding period, occur in s. half of this range, as well as in Pakistan, n. India and Nepal; possible vagrants on e. coast of N. America (AOU 1983; Flint *et al.* 1984; Inskipp & Inskipp 1985; Sibley & Monroe 1990; Roberts 1992; Grimmett *et al.* 1999; BWP). Successfully introduced to NZ, from whence it has colonized outlying islands; unsuccessfully introduced to mainland Aust., vagrant to Norfolk and Macquarie Is, and said to have visited Lord Howe I., presumably having originated from NZ. Successfully introduced to S. Africa and unsuccessfully to USA in New York, California and Oregon (Long 1981).

NZ Introduced. Widespread throughout NI and SI, as well as most offshore islands (Heather & Robertson 2000; NZ Atlas; NZCL; CSN).

Kermadec Is Vagrant; single female, Macauley I., Nov. 1970 (Merton & Veitch 1986).

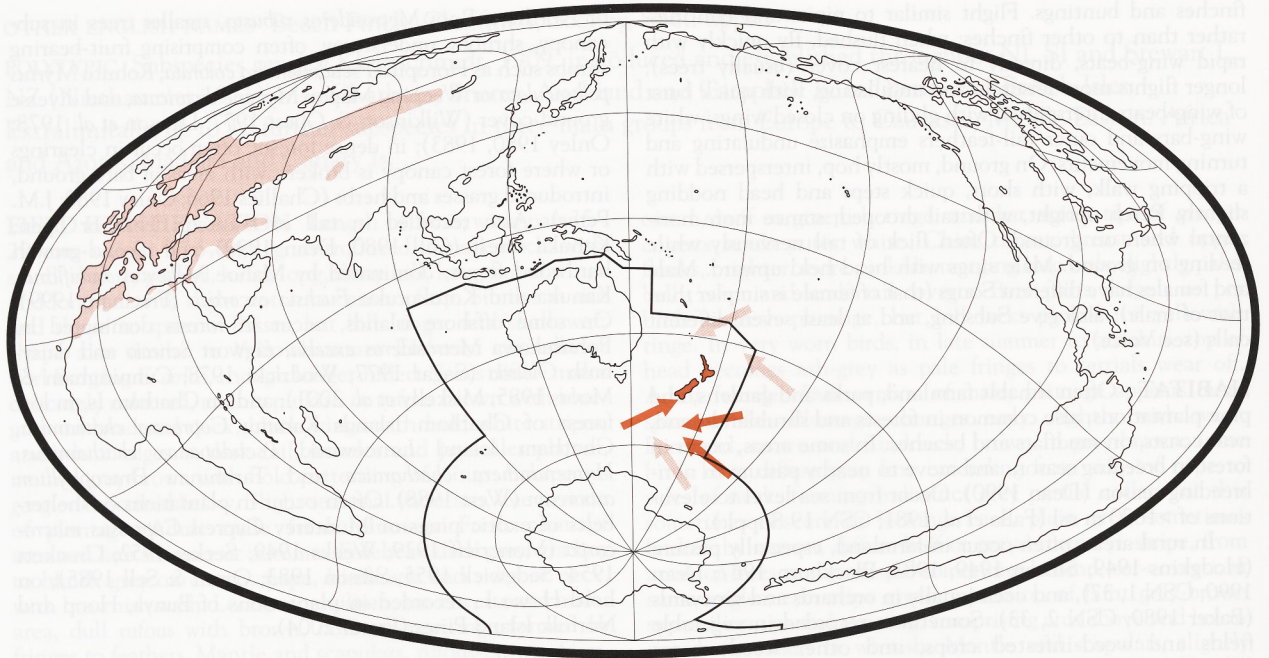
Chatham Is Widespread on Chatham I., occasionally recorded on Pitt I. and very occasionally on Mangere and South East I. (Freeman 1994; CSN 28, 36). First recorded in 1953, when already present throughout main island, and also recorded on Pitt and South East Is (Bell 1955); presumably arrived between 1939 and 1953 (as not listed in report from visit in 1939; Fleming 1939).

Snares Is Present in small numbers (Miskelly *et al.* 2001; CSN 24, 48). First recorded in 1948 (Fleming 1948; Stead 1948; Oliver 1949).

Antipodes Is Vagrant; single female, 3 Dec. 1989 (Tennyson *et al.* 2002).

Auckland Is Though recorded since c. 1940s (Marples 1946), little published information.

Campbell I. First recorded during World War II, though present before then, as Bailey & Sorensen (1962) noted that in 1942 it was 'more common than ... first thought'.



Norfolk I. Vagrant; single male, Phillip I., 4–5 May 2001 (Clarke & Stephenson 2002) (accepted by BARC [Sub. 314]).

Lord Howe I. Vagrant; all singles: 21 Sept.–Dec. 1980; 1 Sept. 1981; 6 Oct. to mid-Dec. 1982; winter 1983 (Fraser 2004). Also reported in 1990s (McAllan *et al.* 2004).

Macquarie I. Vagrant; single, 5 Nov. 2002 (Stafford 2003) (accepted by BARC [Sub. 378]).

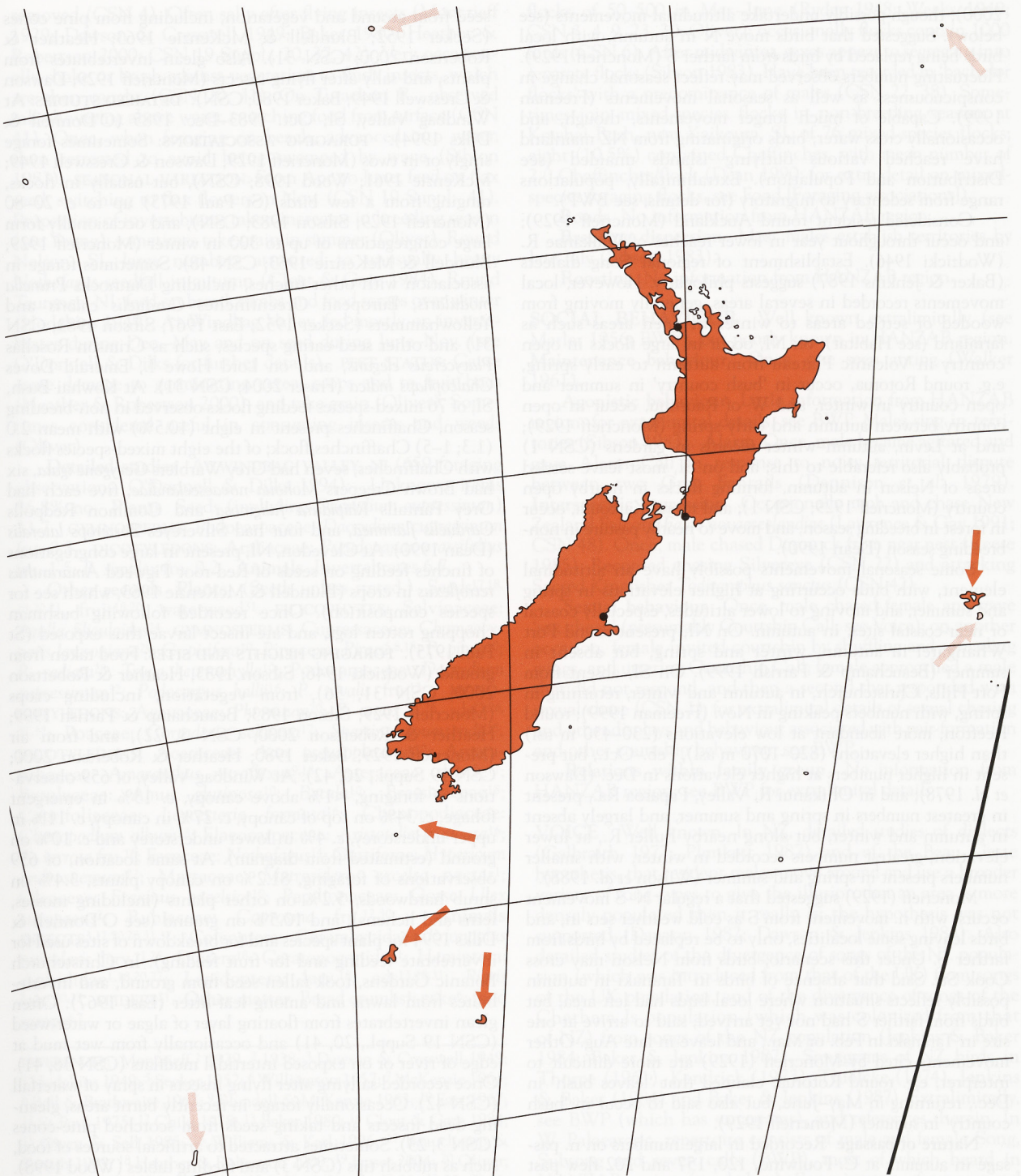
Breeding Throughout NZ and many offshore islands (CSN; NRS). Also recorded on outlying islands: Chatham, Snares, Auckland and Campbell Is (Williams 1953; Sagar 1977; Heather & Robertson 2000).

Introductions Aust. All introductions unsuccessful. NSW: Unknown number imported into Sydney in c. 1856, but probably not released, as it was proposed to send the birds to Melbourne, though whether this happened is unrecorded (Balmford 1978). VIC.: Said to have been first imported in 1857 (Hardy 1928). At least three batches released, presumably round Melbourne: 50 released in 1863, another 40 in 1864, and 40 more in 1872 (Ryan 1906); in addition, Jenkins (1977) claimed that 40 were released at Royal Park in 1866. The numbers released, cited in Long (1981), are much greater: 220 in 1864 and 235 in 1872. Said that 'few, if any' survived till early 20th century (Ryan 1906). SA: Of 16 purchased in Aug. 1879, 14 died; after another was procured, the three birds were released in 1879–80, presumably round Adelaide (Sutton 1935). None survived. WA: Occasionally recorded 'in the free state' near Perth in mid-1930s (Serventy 1937), but unclear whether these 'odd specimens' were escapes or had been released. NZ Records of introductions by acclimatization societies summarized from Thomson (1922), but probably many additional undocumented releases round main regional centres (Thomson 1922; Oliver). NI AUCKLAND: Several released in 1864, 45 more in 1867, another 68 in 1868 and 'a considerable number' in 1869. WELLINGTON: 70 released in 1874, another 36 in 1876, 20 more in 1877 and 'a few more in subsequent years'. SI NELSON: 23 released between 1862 and 1864. CANTERBURY: 11 released in 1867, another five in 1868 and unknown number in 1871. OTAGO: 27 were released in 1868, six in 1869 and another 66 in 1871. SOUTHLAND: Unsuccessfully introduced to Stewart I. in 1879, when 70 released (Thomson 1922).

Change in range, populations NZ Said to have been

widespread in NI and SI by 1900 (Drummond 1906), and abundant in some parts, especially areas N of Taupo, by early 1920s (Thomson 1922; Moncrieff 1929). Now one of the most common and widespread species in NZ (NZCL; CSN). NI: Said to have become established round Auckland by 1868 (Thomson 1922). Said that range expanded from Auckland to Hawkes Bay mainly via the coast, but also inland across mountains along Motu R. Valley (Oliver). Population round Masterton, in Wairarapa, appears to have declined since 1940s: recorded on 229 days in 1942–43, but only on 126 days in 1971–72 (Stidolph 1977). Population round W. Hutt, Wellington, said to have declined between 1981–82 and 1992–93, with mean number recorded in 10-min counts steadily declining from 0.75 to 0.14 birds/count in that period (Gibb 2000). SI: Said to have become established in Canterbury by 1871 (Thomson 1922). First recorded round Invercargill in 1910, but already common elsewhere in Southland by then, e.g. Titiroa, Waiau and Longwood (Thompson 1922). After being released onto Stewart I. in 1879, the species died out well before 1916 (Thomson 1922), but recorded again by 1930 (Oliver) with birds from the mainland presumably having colonized the island in the intervening 14 years; now recorded at scattered sites throughout the island (NZ Atlas).

Populations Total population on Snares Is estimated at 20–30 pairs (Miskelly *et al.* 2001); total population on Mangere I., Chatham Is, ≤ 30 birds, Aug. 1968 (Freeman 1994). RECORDED DENSITIES: 0.1 birds/ha, s. Chatham I. (Freeman 1994; CSN 37). NUMBERS RECORDED IN 5-MINUTE COUNTS: 0.26–0.7 birds/count in 1979 and 0.1–0.62 birds/count in 1993 at six sites in Northland (Pierce *et al.* 1993); 0.49 birds/count, Auckland Domain (Gill 1989); 0.03 birds/count (before rat poison distributed) and 0.27 birds/count (after poison dropped), Red Mercury I. (Robertson *et al.* 1993); 0.09 birds/count (0.36; 333 counts), Kaitoke Wetland, Great Barrier I. (Anderson & Ogdin 2003); 0.35–0.66 birds/count, Kowhai Bush, near Kaikoura, Marlborough (Gill 1980); 0.42 birds/count, Kennedys Bush Scenic Reserve, near Christchurch, Canterbury (Freeman 1999); 0.3–3.5 birds/count, W. Paparoa Ra., near Reefton, W. Coast (Onley 1980); 0.57 birds/count, Fletcher Ck, near Reefton (Dawson *et al.* 1978); 0.33 birds/count, Reefton Saddle, near Reefton (Dawson *et al.* 1978); 0.59 birds/count,



Te Wharau, near Reefton (Dawson *et al.* 1978); 0.39 birds/count, Rahu Saddle, near Reefton (Dawson *et al.* 1978); 0.43–2.14 birds/count, near Karamea (Onley 1983); 0.63 birds/count, Camp Bush, near Nelson (Clout & Gaze 1984); 1.77 birds/count, Chatham I. (West 1988). **NUMBERS RECORDED IN 10-MINUTE COUNTS:** 0.14–0.81 birds/count, W. Hutt, Wellington (Gibb 2000).

THREATS AND HUMAN INTERACTIONS Sometimes regarded as a pest, eating grain in summer (Oliver); bounties were paid in S. Canterbury, and probably elsewhere,

for the destruction of the species in early 20th century (Thomson 1922). Some populations probably reduced after eating poisoned grain intended to kill rabbits, and populations increased after this method superseded by other rabbit-control measures (Thomson 1922). Sometimes attracted to artificial feeding sites, such as kitchen scraps placed in garden (McKenzie 1961).

MOVEMENTS Probably resident in HANZAB region, with some local seasonal movement (see below). No evidence of regular long-distance migration (Heather & Robertson

2000), though possibly undertake altitudinal movements (see below). Suggested that birds move N in autumn, with local birds being replaced by birds from farther S (Moncrieff 1929). Fluctuating numbers observed may reflect seasonal change in conspicuousness as well as seasonal movements (Freeman 1999). Capable of much longer movements, though, and occasionally cross water; birds originating from NZ mainland have reached various outlying islands unaided (see Distribution and Population). Extralimitally, populations range from sedentary to migratory (for details, see BWP).

Considered resident round Auckland (Moncrieff 1929); and occur throughout year in lower reaches of Waikanae R. (Wodzicki 1946). Establishment of regional Song dialects (Baker & Jenkins 1987) suggests philopatry. However, local movements recorded in several areas, generally moving from wooded or settled areas to winter in open areas such as farmland (see Habitat): on NI, occur in large flocks in open country in Volcanic Plateau from autumn to early spring, e.g. round Rotorua, occur in 'bush country' in summer and open country in winter, and W of Raurimu, occur in open country between autumn and early spring (Moncrieff 1929); and at Levin, autumn-winter records in gardens (CSN 1) probably also referable to this; and on SI, most leave settled areas of Nelson in autumn, forming flocks in nearby open country (Moncrieff 1929; CSN 1); and round Kaikoura, occur in forest in breeding season, and move to nearby pasture in non-breeding season (Dean 1990).

Some seasonal movements possibly have an altitudinal element, with birds occurring at higher elevations in spring and summer, and moving to lower altitudes, especially coastal or near-coastal sites, in autumn. On NI, present round Port Whangarei in autumn, winter and spring, but absent in summer (Beauchamp & Parrish 1999). On SI, absent from Port Hills, Christchurch, in autumn and winter, returning in spring, with numbers peaking in Nov. (Freeman 1999); round Reefton, more abundant at low elevations (230–430 m asl) than higher elevations (820–1070 m asl), Feb.–Oct., but present in higher numbers at higher elevations in Dec. (Dawson *et al.* 1978); and in Ohikanui R. Valley, Paparoa Ra., present in greatest numbers in spring and summer, and largely absent in autumn and winter, but along nearby Buller R., at lower elevation, greatest numbers recorded in winter, with smaller numbers present in spring and summer (Wilson *et al.* 1988).

Moncrieff (1929) suggested that a regular N–S movement occurs, with n. movement from S as cold weather sets in, and birds leaving some localities, only to be replaced by birds from farther S. Under this scenario, birds from Nelson may cross Cook Str. Said that absence of birds in Taranaki in autumn possibly reflects situation where local birds had left area, but birds from farther S had not yet arrived; said to arrive at one site in Taranaki in Feb. or Mar., and leave in late Aug. Other movements cited by Moncrieff (1929) are more difficult to interpret, e.g. round Rotorua, claimed that 'leaves bush' in Dec., returning in May–June, but also said to occur in 'bush country' in summer (Moncrieff 1929).

Nature of passage Recorded in large numbers on n. passage in autumn: at C. Foulwind, 120, 157 and 202 flew past daily on 3 days, 28 Apr.–3 May, though not stated whether in flocks of this size (CSN 35); and 58 flew past Millerton, 12 Apr. (CSN 35). Suggested that some move past Cook Str. (Moncrieff 1929).

Banding Of 3281 banded in NZ, 1950–96, 30 recoveries, 1988–93; no information on recoveries at other times (Cossee 1989, 1992, 1993, 1995, 1997, 1998a,b; Cossee & Wakelin 1991). **LONGEVITY:** Adult male banded near Christchurch May 1991, recovered near banding site 7 years 7 months later (P.M. Sagar).

FOOD Seeds and invertebrates; some fruit. **Behaviour** Forage mainly on ground (Heather & Robertson 2000), taking

seed from ground and vegetation, including from pine cones (Secker 1952; Blundell & McKenzie 1963; Heather & Robertson 2000; CSN 31). Also glean invertebrates from plants, and sally after flying insects (Moncrieff 1929; Dawson & Cresswell 1949; Baker 1980; CSN). **DETAILED STUDIES:** At Windbag Valley, SI, Oct. 1983–Dec. 1985 (O'Donnell & Dilks 1994). **FORAGING ASSOCIATIONS:** Sometimes forage singly or in twos (Moncrieff 1929; Dawson & Cresswell 1949; McKenzie 1961; Wood 1998; CSN), but usually in flocks, ranging from a few birds (St Paul 1975) up to c. 20–80 (Moncrieff 1929; Sibson 1983; CSN), and occasionally form large congregations of up to 300 in winter (Moncrieff 1929; Blundell & McKenzie 1963; CSN 48). Sometimes forage in association with other finches, including Dunnocks *Prunella modularis*, European Greenfinches *Carduelis chloris* and Yellowhammers (Secker 1952; East 1967; Sibson 1983; CSN 31) and other seed-eating species, such as Crimson Rosellas *Platycercus elegans*, and, on Lord Howe I., Emerald Doves *Chalcophaps indica* (Fraser 2004; CSN 31). At Kowhai Bush, SI, of 76 mixed-species feeding flocks observed in non-breeding season, Chaffinches present in eight (10.5%) with mean 2.0 (1.3; 1–5) Chaffinches/flock; of the eight mixed-species flocks with Chaffinches, seven had Grey Warblers *Gerygone igata*, six had Brown Creepers *Mohoua novaeseelandiae*, five each had Grey Fantails *Rhipidura fuliginosa* and Common Redpolls *Carduelis flammea*, and four had Silvereyes *Zosterops lateralis* (Dean 1990). 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). Once recorded following bushman chopping rotten logs, and ate insect larvae thus exposed (St Paul 1975). **FORAGING HEIGHTS AND SITES:** Food taken from ground (Wodzicki 1946; Sibson 1983; Heather & Robertson 2000; CSN 31, 36), from vegetation, including crops (Moncrieff 1929; Sibson 1983; Beauchamp & Parrish 1999; Heather & Robertson 2000; CSN 3, 22), and from air (Moncrieff 1929; Baker 1980; Heather & Robertson 2000; CSN 19 Suppl., 20, 42). At Windbag Valley, of 659 observations of foraging, <1% above canopy, c. 13% in emergent foliage, c. 34% on top of canopy, c. 27% in canopy, c. 11% in upper understorey, c. 4% in lower understorey and c. 10% on ground (estimated from diagram). At same location, of 659 observations of foraging, 81.2% on canopy plants, 3.4% on shrub hardwoods, 5.2% on other plants (including mosses, ferns and lichens), and 10.5% on ground (see O'Donnell & Dilks 1994 for plant species and for breakdown of sites used for invertebrate feeding and for fruit feeding). In Christchurch Botanic Gardens, took fallen seed from ground, and invertebrates from lawns and among leaf-litter (East 1967). Often glean invertebrates from floating layer of algae or water-weed (CSN 19 Suppl., 20, 41) and occasionally from wet mud at edge of river or on exposed intertidal mudflats (CSN 36, 41). Once recorded sallying after flying insects in spray of waterfall (CSN 42). Occasionally forage in recently burnt areas, gleaning dead insects and taking seeds from scorched pine-cones (CSN 3, 23). Sometimes attracted to artificial sources of food, such as rubbish tips (CSN 3) and feeding tables (Wood 1998). Once recorded foraging on fourth floor of city car park (CSN 37). **FORAGING METHODS:** Forage mainly by gleaning and sallying. At Windbag Valley, foraged mainly (>80% of 659 observations of foraging) by gleaning, and occasionally by probing, tearing or by scanning from a perch. Glean fallen seed from ground (East 1967; Heather & Robertson 2000; CSN 31), and glean insects from plants (Moncrieff 1929; CSN 3, 22). Seeds are extracted from pine-cones by probing, grasping seed-wing in bill and pulling till seed removed (Secker 1952). Pods of Tutsan *Hypericum androsaemum* are broken open to get at seeds (CSN 3, 20); and seeds of flax *Phormium* are grasped in bill and shaken till seed-wings

removed (CSN 4). Often sally after flying insects (Moncrieff 1929; Dawson & Cresswell 1949; Baker 1980; Heather & Robertson 2000; CSN 19 Suppl., 20, 37, 42). Very occasionally shake or brush against vegetation to flush insects, which are then caught (CSN 20, 41). On Tutaekuri R., observed sally-hovering above water, snatching food from surface (CSN 41). Once, when foraging on beach, advanced into water, then retreated to avoid being swamped by wave (Sibson 1983). **SEASONAL VARIATION:** From Apr. to June, feed on flax seed, switching to flax flowers in Nov. (CSN 19 Suppl., 41). Proportion of invertebrates taken increases in breeding season (see Young); sometimes take grain in summer (Oliver). Round Nelson, SI, large numbers attracted to unusually heavy *Nothofagus* seedfall in autumn (Clout & Gaze 1984). Round Tauranga, NI, feed on breadcrumbs and food scraps over winter (Hodgkins 1949). At Windbag Valley, fed mostly on invertebrates during Dec.–May and on seed during June–Nov. (see O'Donnell & Dilks for further details). **PEST STATUS:** Cause some damage to germinating cereal crops and to fruit buds (Heather & Robertson 2000), and take grain (Oliver). Sometimes considered useful in consuming insects and weeds (Oliver).

Detailed studies At WINDBAG VALLEY, NI (659 foraging observations; O'Donnell & Dilks 1994): Unknown items 56.8% no. **Plants** Seeds (including *Dacrydium cupressinum*) 33.7. **GYMNOSPERMS:** Podocarpaceae: *Dacrydium cupressinum* fru. 0.3. **DICOTYLEDONS:** Araliaceae: *Pseudopanax crassifolius* fru. 1.5; *P. simplex* fru. 0.2. **Animals** Invertebrates 6.7.

Other records **Plants** (Seeds unless stated.) Seeds^{17,18,19,20,21}, fruit^{18,20}, waterweed³¹. **FILICOPHYTES:** Salvinaceae: *Azolla filiculoides*²⁴. **GYMNOSPERMS:** Cupressaceae: *Chamaecyparis lawsoniana*²⁹; *C. pisifera*¹⁰; Pinaceae: *Pinus*^{3,8,18}; *P. pinea*¹⁰; *P. radiata*²⁸; *Tsuga heterophylla*¹⁰; Podocarpaceae: *Dacrydium cupressinum*³²; *Podocarpus hallii*¹⁶; *P. nivalis* fru.¹². **MONOCOTYLEDONS:** Agavaceae: *Phormium*²⁰; *P. tenax* fl.²⁶, sds^{23,26,31,32}; Poaceae: *Cortaderia seloana*¹⁷; *Spartina townsendii*¹⁵. **DICOTYLEDONS:** Aceraceae: *Acer pseudoplatanus*¹⁰; Amaranthaceae: *Amaranthus retroflexus*^{9,18}; Asteraceae: thistle¹⁷; Betulaceae: *Alnus glutinosa*¹⁰; *Betula*¹⁰; Brassicaceae¹⁸; Caprifoliaceae: *Leycesteria formosa*¹⁶; Chenopodiaceae: *Chenopodium album*¹⁸; Elaeocarpaceae: *Aristotelia fruticosa*¹⁶; *A. serrata* fru.¹⁶; Fagaceae: *Nothofagus*¹⁴; Guttiferae: *Hypericum androsaemum*²²; Myrtaceae: *Metrosideros excelsa* nectar¹; Oleaceae: *Fraxinus excelsior*¹⁰; Papilionaceae: Gorse *Ulex europaeus*²; Rubiaceae: *Coprosma* fru.^{12,30}. **Animals** **INSECTS**^{3,12,20,26,31,32}: Coleoptera: Cerambycidae: *Prionophorus reticularis* larv.^{11,25}; Diptera¹⁸: Ceratopogonidae¹; Hemiptera: Aphididae^{1,18,20,27}; Lepidoptera: larv.¹⁸, ads^{13,18,31}; *Pieris* larv.^{20,33}. **SPIDERS**²¹. **Other matter** Bread crumbs⁴; cake⁶; food scraps^{4,7}.

REFERENCES: Moncrieff¹ 1929, ² 1938; ³ Dawson & Cresswell 1949; ⁴ Hodgkins 1949; ⁵ Secker 1952; ⁶ Williamson 1957; ⁷ McKenzie 1961; ⁸ Bell & Brathwaite 1963; ⁹ Blundell & McKenzie 1963; ¹⁰ East 1967; ¹¹ St Paul 1975; ¹² Child 1978; ¹³ Baker 1980; ¹⁴ Clout & Gaze 1984; ¹⁵ Owen & Sell 1985; ¹⁶ Williams & Karl 1996; ¹⁷ Beauchamp & Parrish 1999; ¹⁸ Heather & Robertson 2000; ¹⁹ Fraser 2004; ²⁰ Oliver; ²¹ NZRD; CSN 22 3, ²³ 4, ²⁴ 5, ²⁵ 6, ²⁶ 19 Suppl., ²⁷ 22, ²⁸ 23, ²⁹ 31, ³⁰ 33, ³¹ 41, ³² 42, ³³ 49.

Young Usually fed by both parents (see Breeding). Mostly insect larvae, especially caterpillars, and moths and spiders (Moncrieff 1929; Heather & Robertson 2000; Oliver).

SOCIAL ORGANIZATION Well known extraliminally (Marler 1956; BWP, which see for details), but poorly known in HANZAB region. Usually seen in ones or twos (presumably pairs) in breeding season; form flocks in non-breeding season (Sibson 1983; CSN 5) with small flocks in Feb., and form

flocks of 50–500 in Mar.–June (Ryder 1948; Weeks 1949; CSN 3, 4, 9, 23, 30; Oliver); occasionally flocks contain 1000 birds (CSN 6). After midwinter, sexes appear to segregate into separate flocks (Sibson 1983). Have been recorded in 'bachelor flocks' with a predominance of males (CSN 22, 38). Sometimes join mixed-species flocks in non-breeding season; at Kowhai Bush, near Kaikoura, SI, of 76 mixed-species flocks; eight (10.5%) contained Chaffinches, with mean number of 2.0 Chaffinches/flock (Dean 1990; for extra detail on mixed-species foraging flocks, see Food [Foraging associations]).

Bonds No information from HANZAB region.

Breeding dispersion Most males establish territories by late July (Sibson 1983).

Roosting No information from HANZAB region.

SOCIAL BEHAVIOUR Well known extraliminally (see Marler 1956; BWP), but poorly known in HANZAB region.

Maintenance behaviour Once, one seen anting (Walker 1961).

Agonistic behaviour Little information from HANZAB region; for extralimital details, see BWP. Males sing in territories (Sibson 1983). **Alarm** Once, male became agitated and gave Alarm Call in response to noisy territorial dispute between two Grey Fantails (Dennison *et al.* 1979).

Interspecific aggression Occasionally mob and chase New Zealand Falcons *Falco novaeseelandiae* (Lawrence & Gay 1991; CSN 48). Once, male chased Dunnock from near nest (Reese 1985). Recorded chasing Silvereye (CSN 22) and attacking Sacred Kingfisher *Todiramphus sanctus* (CSN 42).

Sexual behaviour Once, male chased female and gave 'sex cheep' (presumably Courtship Call; see Voice); on another occasion, female invited courtship by shuffling and spreading wings, and uttering Courtship Call; female approached a male that did not respond, and then a second that responded with sexual chase (CSN 1); for extralimital details of sexual chasing and other displays and behaviour associated with pair-formation and other courtship behaviour, see BWP.

Relations within family group No information from HANZAB region; see BWP for extralimital details.

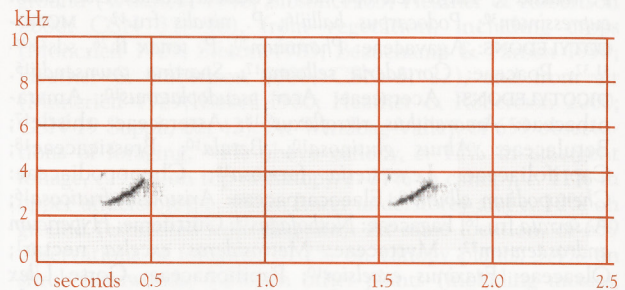
VOICE Well known. In NZ, detailed studies of dialects (Galbraith 1977; Plunkett 1987) and of the Beau Geste hypothesis, that resident males move around and use a broader variety of song-types to give the illusion that an area is more densely populated than it really is; the hypothesis was not supported (Dawson 1982; Dawson & Jenkins 1983). Also detailed studies of the divergence of songs of the NZ population (which was introduced from that of the UK) from songs of the UK population, and of the divergence of songs of the Chatham Is population (which was colonized from that of NZ) from songs of the NZ population (Jenkins & Baker 1984; Baker & Jenkins 1987). Sonagrams of NZ birds in Thorpe (1961), Kendrick (1973), Thielcke (1974), Jenkins & Baker (1984) and Baker & Jenkins (1987). Extraliminally, see BWP (which has sonagrams), and references therein. In W. Palaearctic, repertoire consists of male and female Song, Subsong and seven calls (BWP), most of which heard in HANZAB region (see below). Song is most often reported vocalization in HANZAB region (CSN); described as short but pleasant (Oliver). Up to five birds heard singing together (Chambers *et al.* 1955; Skegg 1964). **SEASONAL PATTERN:** Mostly start singing in July or early Aug., and continue till Dec. or Jan. (Warham 1967; Gill 1989; Freeman 1999; Gibb 2000; Heather & Robertson 2000; Oliver; CSN); singing generally increases in Aug., peaking in either Sept. or Nov., and then declines in Dec., ceasing in Jan. (Freeman 1999; Gibb 2000; CSN 1, 2); see Table 1 for monthly analysis of Song and calls. This pattern often predictably regular, e.g. in Cass R. Delta, singing 'may be expected towards the end of the third

week of July' (CSN 26), but often some variation: e.g. first Song of season occasionally not given till mid-Sept. at some sites (CSN 35, 43); at Minginui, most records of singing were between early Sept. and mid- to late Feb. (CSN 5, 6, 8, 9); at Nelson, last Song once heard on 4 Apr. (CSN 4); and very occasionally heard singing out of season, Mar.–June, sometimes in bursts (CSN 1, 3, 19 Suppl., 49), e.g. at Dunedin, sang sporadically 8–23 May, but not again till 8 July (CSN 2). This general pattern of singing leads to Chaffinches being conspicuous in late winter and spring, and, conversely, when quiet and cryptic in late summer and early autumn, reporting rates are lower (e.g. Wilson *et al.* 1988; Gill 1989; Miller 1993; Gibb 1996; Freeman 1999; Miskelly *et al.* 2001), though this sometimes attributed to seasonal movements (e.g. Dawson *et al.* 1978; Wilson *et al.* 1988; Freeman 1999; see Movements). Call throughout year (Gibb 2000; see Table 1). **DIURNAL PATTERN:** Sing throughout day (CSN 1, 4, 5, 6). In list of species participating in dawn chorus near Te Teko, NI, on 27 Oct., Chaffinch was first heard singing at 05:59 (23 min before sunrise) (Taylor 1975). Sing as often in light wind as in windy weather (Gibb 2000). **REGIONAL VARIATION:** Songs of NZ population appear to have diverged from those of UK population, and have more elaborate terminal phrases than those of UK birds but with simple trill segments. Songs of the Chatham Is population, however, appear not to have diverged from those of the NZ population (Jenkins & Baker 1984; Baker & Jenkins 1987). Regional dialects have been detected throughout NZ (Heather & Robertson 2000). **RESPONSE TO PLAYBACK OF CALLS:** Attracted to recording of Song (Fraser 2004).

Adults SONG OF MALE: Repeated series of short, rattling notes, ending with a flourish; rendered as *chip chip tell tell cherry-erry-erry tissi cheweeo* (Falla *et al.* 1981; Sibson 1983; Heather & Robertson 2000); described as a chromatic drop of varied interval followed by a pause and a final flourish of varied vocalization, and said usually to comprise a bar of seven notes with a terminal flourish (Oliver). Compared to trilling of canary (CSN 2) or Song of Scarlet Robin *Petroica multicolor* (Wakelin 1968). Often performed from prominent perch to proclaim territory (Heather & Robertson 2000). When singing resumed after break of several weeks, often uttered as broken snatches for a few days before full Song given (Skegg 1963; Falla *et al.* 1981; CSN), e.g. half usual Song (CSN 1), first phrase (CSN 5, 6) or one or two notes (CSN 1); these described as weak, tentative, and not of full volume or repertoire (Secker 1958; CSN 5, 6, 29, 34). **SONG OF FEMALE:** Series of identical units, simpler than Song of Male, lacking flourish at conclusion (BWP). In HANZAB region, lack of final note of Song of Male noted; once given in short bursts in mid-Aug. while feeding on ground (McKenzie 1961). Song 'without the characteristic slur at the end' was attributed to incomplete Song of Male (Cunningham 1943; see above), but probably describes this Song. **SUBSONG:** Extralimitally, low-pitched, quiet chirping, warbling or rattling given by male early in breeding season, before full Song has developed (BWP). Noted without comment in HANZAB region (CSN 6). Sometimes also given quietly by male just before and during copulation (BWP); a 'sex cheep' given by male (CSN 1) possibly refers to this (but see also Courtship Call, below); and so might 'chirping' given by male while chasing either female or immature male (Rep. Bull. OSNZ 3; but see also Rain Call,

below). **CHINK CALL:** Distinctive *chink*; most frequent call; given by either sex in various contexts, with intensity of call dependent on situation (BWP). In HANZAB region, described as metallic *pink* or *chwink-chwink* (Falla *et al.* 1981; Heather & Robertson 2000) or cheery *spink* (Moncrieff 1925). **FLIGHT CALL:** Described as *tupe* or *tsüp*, given by either sex in flight or when just about to take flight, and also when communicating with fledgelings (BWP). In HANZAB region, rendered as a soft *tsip* (Falla *et al.* 1981; Heather & Robertson 2000). **SEEE CALL:** High-pitched, thin *see*, given in alarm (BWP). Given when New Zealand Falcon flew overhead (Porter & Dawson 1968). Once given by male in response to territorial dispute between two Grey Fantails (Dennison *et al.* 1979). Extralimitally, also given during breaks in courtship, after copulation or by injured birds (BWP). **RAIN CALL:** Greatly varied call given by breeding male in various contexts (BWP). See Sonagram A. 'Chirping' given by male while chasing either female or immature male (Rep. Bull. OSNZ 3) possibly this call. **COURTSHIP CALL: MALE:** *Kseep* given early in breeding season, when still likely to attack female (BWP). In HANZAB region, a 'sex cheep' given by male (CSN 1) possibly refers to this. **FEMALE:** *Seep* given when soliciting copulation (BWP). Recorded in HANZAB region as strident *yeet*, given in combination with shuffling and spreading wings (CSN 1; see Social Behaviour). **OTHER CALLS:** Two other calls reported extralimitally: Aggressive Call and another undescribed call (BWP); not recorded in HANZAB region.

Young No information from HANZAB region. Extralimitally, nestlings give short *cheep* or *peep*, increasing in volume, duration and complexity with age (BWP). Fledgelings beg with *chirrup* or *churr*, which is also used in communication and when mobbing; and give *tew* in alarm (BWP).



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BREEDING Poorly known in HANZAB region; no detailed studies. Well known extralimitally (BWP).

Season Eggs, mid-Sept. to late Jan., peaking in Oct.–Nov. (DNFC 1947; McKenzie 1950; Falla *et al.* 1981; Heather & Robertson 2000; CSN 34); nestlings, Oct.–Jan. (DNFC 1947; McKenzie 1950; Cunningham & Moors 1985; Reese 1985; CSN 2). Fledgelings recorded in Nov. (CSN 5). On Snares Is, eggs, Dec. (Sagar 1977) and fledgelings Jan.–Feb. (Miskelly *et al.* 2001). On Chatham Is, breeding recorded Nov.–Dec. (Dennison *et al.* 1979).

Site Usually in fork of branch or crotch of trunk and branch in tree or shrub (Child 1978; Falla *et al.* 1981; Heather & Robertson 2000; Oliver); once found on leaf of Nikau Palm *Rhopalostylis sapida* (Sibson 1947). Often nest in Manuka,

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

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Song	58	0	9	7	0	0	21	61	72	68	77	80
Call	42	100	91	93	100	100	79	39	28	32	23	20

Matagouri *Discaria toumatou*, Gorse *Ulex europaeus*, pines (including Monterey Pine) and willows *Salix* (DNFC 1947; Pennycook 1949; Heather & Robertson 2000), and less often in elderberry *Sambucus*, *Coprosma*, Nikau, ragwort *Senecio* and Ribbonwood *Plagianthus regius* (Sibson 1947; Pennycook 1949; Lambert 1970; Sagar 1977; Reese 1985; Oliver; CSN 24). Also nest in gardens round settlements, and in farmland (Moncrieff 1929; McKenzie 1961; Pierce 1980). **MEASUREMENTS** (m): Nest-height, 3 (1–18) (Heather & Robertson 2000); 0.6–6.1 (Oliver); usually <6 (Falla *et al.* 1981); or 0.8–3 (DNFC 1947; Sagar 1977; Oliver; CSN 24); round Temuka, SI, usually 2.4–3.0 (Pennycook 1949).

Nest, Materials Neat, cup-shaped nest; usually made of grass and moss, and sometimes sticks, wood fibres or rootlets; camouflaged with lichen; and lined with hair, feathers, wool or thistle down (Heather & Robertson 2000; Oliver; CSN 24). Built by female only (Heather & Robertson 2000). Usually built in 1–2 weeks (Heather & Robertson 2000).

Eggs Oval, though varied; pale blue, greyish blue, greenish blue or pink; blotched and spotted reddish, dark brown, dark purplish-brown or purplish, mostly at large end (Falla *et al.* 1981; Heather & Robertson 2000; Oliver); on some, dark spots located within lighter blotches (Oliver). **MEASUREMENTS**: 19.0 × 14.4, 20.2 × 14.5, 21.4 × 14.0 (Oliver); also 20.0 × 14.0 (Heather & Robertson 2000).

Clutch-size Three to six, usually four (Heather & Robertson 2000); four to six (Falla *et al.* 1981; Oliver). Clutch-size significantly smaller in NZ than in England: in NZ, mean clutch-size 3.64 (0.70; 1–5; 44 clutches); in England, mean clutch-size 4.30 (0.74; 2–6; 1433) (Newton 1964; Niethammer 1970).

Laying No information from HANZAB region. Extraliminally, eggs laid early in morning on consecutive days. Seldom attempt multiple broods, but lay up to three replacement clutches (BWP).

Incubation By female only. **INCUBATION PERIOD**: 13 days (11–15) (Falla *et al.* 1981; Heather & Robertson 2000). Eggs hatch over 1–3 days (Heather & Robertson 2000).

Young Nestlings said to be covered with long, pale smoke-grey down (NZRD). At one nest, nestlings were feathered by c. 9 days old (Reese 1985). Fed by both sexes (Reese 1985; Heather & Robertson 2000) and brooded by female (Heather & Robertson 2000). Claimed, without substantiating evidence, that some broods reared by female only (NZRD). Parents said to eat faeces of nestlings in first 2–3 days after hatching; thereafter, faeces carried from nest (NZRD). Nestlings once fed by a Dunnock (Reese 1985).

Fledging to independence Fledging period 14 days (10–16) (Falla *et al.* 1981; Heather & Robertson 2000). Fed by both parents for c. 3 weeks after leaving nest (Heather & Robertson 2000).

Success Shining Bronze-Cuckoo *Chrysococcyx lucidus* once seen sucking contents from fresh egg (Michie 1948); a young cuckoo fed by female Chaffinch (CSN 30). Thorax and feathers of a juvenile Chaffinch were found at base of power pole used by New Zealand Falcons (Lawrence & Gay 1991).

PLUMAGES Prepared by J.S. Matthew. Following summarized from BWP. Nestling has long down on upperparts, upperwing, thighs and vent. Fledge in juvenile plumage. Undergo partial post-juvenile moult, starting when c. 5 weeks old, to adult-like first immature (first basic) plumage. Acquire adult plumage in complete first immature post-breeding (second pre-basic) moult, probably when c. 1 year old. Thereafter, complete post-breeding (pre-basic) moult each cycle produces successive adult plumages with no change in appearance. Sexes differ. Subspecies *gengleri* introduced to NZ. For descriptions of plumages and bare parts of nominate and *gengleri* see BWP, and Field Identification for descriptions of *gengleri*.

BARE PARTS See BWP and Field Identification for details.

MOULTS Little known in HANZAB region. Following based on information from Britain in BWP, and examination of skins (NMNZ) of 11 adults from NI, NZ. **Adult post-breeding** (Third and subsequent pre-basic). Complete. Primaries moult outward. In Britain, moult of primaries starts mid-June to late July, and finished after c. 70 days in late Aug. to early Oct. In skins from NZ: all of three from Apr. had all primaries new; and all of eight from July–Sept. had all primaries slightly worn. This limited data suggests moult in NZ occurs after breeding season (see Breeding), and finished by mid-autumn, but more data needed to determine precise timing of moult. **Post-juvenile** (First pre-basic). Partial in n. hemisphere and presumably also in NZ. Involves feathers of head and body, marginal and median coverts, and most or all greater secondary coverts; some birds replace 1–3 tertials, and very occasionally central pair of rectrices. Starts when c. 5 weeks old. Individual duration of moult, c. 45 days in n. Russia (nominate *coelebs*). No information on timing in NZ.

MEASUREMENTS **SUBSPECIES GENGLERI**: (1) NI, NZ, adult male skins, sexed by plumage and museum labels (NMNZ). (2–3) Adult skins (Niethammer 1971): (2) NZ; (3) England (England and Scotland for tail-length data).

	MALES	FEMALES	
WING	(1) 85.7 (2.08; 81–90; 19)	–	
	(2) 87.1 (2.33; 83–91; 21)	80.0 (77–83; 7)	
	(3) 85.7 (2.75; 80–95; 100)	80.2 (1.50; 78–83; 9)	**
TAIL	(1) 66.3 (2.92; 61–70; 19)	–	
	(2) 65.2 (2.13; 62–69; 21)	60.6 (58–66; 6)	
	(3) 63.8 (2.52; 57–73.5; 177)	59.3 (2.08; 56–63; 19)	**
BILL S	(1) 14.3 (0.77; 13.0–15.5; 19)	–	
TARSUS	(1) 18.6 (0.75; 17.0–20.0; 19)	–	

See BWP for measurements of *gengleri* from Ireland and Scotland, and measurements of other subspecies.

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

	MALES	FEMALES
(1)	21.3 (2.21; 17.5–24.5; 12)	–
(2)	(20.5–22.0; 3)	18.5

See BWP for weights of *gengleri* from Ireland and Scotland, and other subspecies.

STRUCTURE See BWP for details.

AGEING Juveniles distinguished by plumage and bare parts (see Field Identification and BWP). In n. hemisphere (and presumably also NZ), first immatures similar to respective sexes of adults, but retain juvenile remiges (though some birds replace one or more tertials), greater primary coverts, alula, rectrices (except for t1 in some birds) and sometimes a few outer greater secondary upperwing-coverts. In first immature males, retained juvenile wing-coverts and alula are greyish (becoming brownish with wear) and contrast with less worn blackish adult-like coverts which replaced in post-juvenile moult; also, retained juvenile rectrices narrower and more pointed at tips than adult rectrices. Distinguishing first immature females from adult females more difficult, but immatures still show some moult-contrast between retained juvenile wing-feathers and adult-like feathers replaced in post-juvenile moult. See Field Identification and BWP for details.

SEXING Adults and first immatures obviously plumage-dimorphic. Juveniles less so (see Field Identification and BWP).

GEOGRAPHICAL VARIATION Rather complex in n. hemisphere with three main groups of subspecies, sometimes separated as distinct species, distinguishable by colour of plumage and subtle differences in wing-structure: *COELEBS* group (comprising 9–12 subspecies) occurs in w. Europe and Middle East; *SPODIOGENYS* group (two subspecies) occurs in n. Africa; and *CANARIENSIS* group (four subspecies) on Atlantic islands (BWP). See BWP for detailed discussion of geographical variation between subspecies in n. hemisphere. Subspecies *gengleri*, introduced to NZ from England, belongs to *COELEBS* group; *gengleri* very similar to nominate *coelebs* from mainland w. Europe, but with shorter wing, slightly darker upperparts and darker rufous-cinnamon underparts (BWP). Populations from sw. Scotland and sw. Ireland have been considered as subspecies *scotica* and *hibernicus* respectively, but differences from *gengleri* in rest of Britain and Ireland too slight to warrant their recognition (BWP).

Since the introduction of >400 birds from England in 19th century, there has been only minor genetic and morphometric differentiation between various NZ populations. Baker *et al.* (1990) sampled adult Chaffinches from eight localities in NZ (three from NI, four from SI, one from Chatham I.) and analysed allozymic and morphometric variation (measurements of 12 osteological characters) between these localities. Their findings indicate: (1) very limited genetic and morphometric differentiation between NZ populations; (2) some evidence for population structuring between NI and SI, probably attributed to lack of gene flow across Cook Str.; (3) isolated population on Chatham I. has not diverged significantly, morphologically or genetically, from mainland NZ despite differences in structure of Song found by Baker & Jenkins (1987); (4) no obvious geographical trends in genetic or morphometric variation, such as clines or isolation by distance; and (5) NZ populations are probably in a very early phase of divergence compared with other bird species such as House Sparrow *Passer domesticus* and Common Starling *Sturnus vulgaris*.

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Common Chaffinch *Fringilla coelebs* (page 1305)
 1 Adult male (fresh plumage); 2 Adult male (worn plumage); 3 Adult female; 4 Adult male

European Greenfinch *Carduelis chloris* (page 1315)
 5 Adult male (fresh plumage); 6 Adult male (worn plumage); 7 Adult female; 8 Juvenile male; 9 Immature male; 10 Adult male; 11 Adult female

European Goldfinch *Carduelis carduelis* (page 1328)
 12 Adult male (fresh plumage); 13 Adult male (worn plumage); 14 Adult female; 15 Juvenile; 16 Adult male