

Order CHARADRIIFORMES

A large, diverse assemblage of small to medium-large (12–75 cm long) limicoline, pratincoline, aquatic or terrestrial birds. Cosmopolitan from Arctic to Antarctic regions; in all sorts of maritime, freshwater and open terrestrial habitats (including deserts) with a few (woodcocks and snipes) even using dense forests. Once known as Limicolae or Laro-limicolae (e.g. Mayr & Amadon 1951); colloquially, the assemblage (excluding alcids, skuas, gulls, terns and skimmers) is often referred to as waders (especially in Britain) or shorebirds (especially in North America).

About 350 species in 19 families, though taxonomic treatments vary. Following families recognized (mostly based on recent reviews of Order [Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990]):

Thinocoridae	seedsnipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painted snipes; two species, s. America and Old World.
Jacaniidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; c. 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratinoles, coursers, and Egyptian Plover; c. 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; c. 47 species, cosmopolitan.
Sternidae	terns; c. 42 species, cosmopolitan.
Alcidae	auks; c. 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA–DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA–DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacaniidae) and charadriids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidiorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to charadriids (e.g. Sibley & Ahlquist 1990). Further relationships within the Order discussed in introductions to families.

Because the Order comprises so many species and adaptations are so diverse, few characters shared by all species; those that are shared are mostly anatomical features of the skull, e.g. most or all have schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacaniidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

breeding and partial pre-breeding; some jacanas and alcids have flightless periods when moulting remiges. Young, downy, usually with intricate cryptic patterns on upperparts of three chief types: pebbly, spotted and striped, matching characters of habitat (Fjeldså 1976, 1977): precocial, nidifugous usually, self-feeding or not depending greatly on parents.

Thirteen families recorded in HANZAB region, with 54 species breeding, 41 occurring as regular non-breeding migrants and c. 38 as accidentals or probable accidentals. Scolopacidae, Stercorariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Family CHARADRIIDAE plovers and lapwings

Small to medium-sized, mostly terrestrial, waders of open habitats. About 65 species, placed in varying number of genera. Evidently monophyletic by behaviour and structural characters. Distributed worldwide and separable into two distinct sub-families: Charadriinae (plovers) and Vanellinae (lapwings), both of which are represented in HANZAB region and are discussed in more detail below. Most closely related to Recurvirostridae, Haematopodidae and possibly Burhinidae (Sibley & Ahlquist 1990; Christian *et al.* 1992).

Bodies, compact. Size differences between sexes negligible; sometimes males and sometimes females slightly larger. Necks, short and thick; 15 cervical vertebrae. Wings, long and usually pointed but rounded in some lapwings; 11 primaries, p11 minute; 14–19 secondaries. Tails, short to medium-long, square or rounded; 12 feathers. Bill, short, somewhat swollen at tip and narrower centrally; no sensitive nerve-endings at tip and prey located by sight rather than touch. Nostrils, holorrhinal, impervious, slit-like. Head, rounded; forehead steep and broad. Legs, fairly short or medium in length; bare part of tibia short; tarsi, reticulated, rarely with some transverse scutes. Usually three, rather short toes, slightly webbed at base in some plovers; no hind toe in most plovers and in some lapwings; hallux, short and vestigial if retained. No crop. Caeca present. Eyes large. Supraorbital salt-glands, often large; size related to salinity of habitat and influences structure of skull and appearance of head. Plane of *foramen magnum* of occiput nearly horizontal.

Plumages generally boldly patterned in brown, olive-grey, black and white; markings often have cryptic disruptive effect. Bill, bicoloured in some species, especially plovers. Stance erect with head held high. Fast runners for good distances but often proceed in short bursts with halts, especially when feeding. Post-breeding moult complete; primaries outwards; pre-breeding moult varies considerably. Young, precocial, nidifugous and always feed themselves; down of pebbly-pattern type (Fjeldså 1977).

See accounts of sub-families (below) for additional details.

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Sub-family CHARADRIINAE plovers

Generally small birds, usually smaller than lapwings (Vanellinae). Apparently a monophyletic assemblage. About 40 species in five (Voous 1973; Strauch 1978; BWP) to 10 genera (Sibley & Ahlquist 1990; Sibley & Monroe 1990; Christian *et al.* 1992), with most species in two genera, *Pluvialis* and *Charadrius*, and varying number of genera composed of only one or a few species (e.g. *Anarhynchus*, *Phegornis*, *Thinornis*, *Elsayornis*). The affinities of *Phegornis* (Diademed Sandpiper-plover of South America) have not been resolved (Sibley & Monroe 1990). Recent studies of allozymes of Aust. plovers and lapwings (Christian *et al.* 1992) indicate that Red-kneed Dotterel *Erythrogonys cinctus* is a lapwing (Vanellinae; q.v.).

We recognize the following genera within the Charadriinae in HANZAB region:

Pluvialis. Two regular non-breeding migrants (*fulva*, *squatarola*), two doubtfully recorded (*dominica*, *apricaria*). We follow Connors *et al.* (1983, 1993) and treat *fulva* and *dominica* as full species.

Charadrius. Four breeding species (*obscurus*, *ruficapillus*, *bicinctus*, *australis*), six non-breeding migrants (*hiaticula*, *dubius*, *mongolus*, *leschenaultii*, *asiaticus*, *veredus*), one accidental (*tricoloris*); one doubtfully recorded (*alexandrinus*). Inland Dotterel *C. australis* is a typical *Charadrius* plover (Maclean 1976; Christian *et al.* 1992 *contra* Jehl 1968); we follow NZCL in placing New Zealand Dotterel in *Charadrius*.

Thinornis. Two endemic species: *novaeseelandiae* and *rubricollis*.

Allozymes of *rubricollis* form a cluster (with *Elsayornis melanops*) well separated from those of typical *Charadrius*; placed in *Thinornis* on basis of similarities in morphology (Christian *et al.* 1992) and behaviour (Phillips 1980).

Elsayornis. Single species *melanops*, endemic to Aust. Allozymes, with those of *Thinornis rubricollis*, well separated from *Charadrius* (Christian *et al.* 1992).

Anarhynchus. Single species *frontalis*, endemic to NZ.

Thus, in HANZAB region, eight breeding species, eight non-breeding migrants, and four accidental or not acceptably recorded.

General features of the sub-family are outlined under Charadriidae. The plumages of *Pluvialis* are spangled in white or gold and black above, black below when breeding, and never with white band across nape; plumages of *Charadrius* and other genera in general plain brownish above and white below, boldly marked with black on face and head, at least when breeding;

usually with one or two black or chestnut bands across breast and often with white band across nape. Two moults per cycle: complete post-breeding moult, primaries outwards; and partial pre-breeding moult, which often brings in much brighter breeding plumage; supplemental plumage occurs in at least one species (Eurasian Golden Plover *Pluvialis apricaria*). Down of pebbled pattern (Jehl 1968; Fjeldså 1977, 1988; BWP). Juvenile plumage duller than adults in most species, with pale dorsal scalloping. Adult plumage attained at 1–2 years. Most probably first breed at 1–2 years, maturity perhaps delayed further in some migratory species (e.g. Grey Plover *Pluvialis squatarola*).

Inhabit open places; when not breeding, many are typically birds of ocean beaches, coastal mudflats and estuaries; others use rivers and freshwater wetlands, often ephemeral; still others characteristic of dry habitats, including gibber plains, grasslands and steppes. Breeding may occur in any of these habitats, or in tundra or high-altitude moorlands. Most species probably migrate to some extent; about 15 species are long-distance transequatorial migrants. Diet consists of terrestrial and coastal invertebrates. When foraging, tend to spread out and feed separately over wide area, rather than feeding in flocks as do many scolopacids. In general, gregarious but less so than many scolopacids. Roost communally. Usually territorial when breeding; some species may defend feeding territories in wintering areas. Various mating systems recorded in different species: monogamy, polyandry (associated with sexual reversals), polygyny and polygamy. While breeding, generally rather aggressive, defending and advertising territories with displays on the ground and in the air, often with butterfly-like flights and song (long melodious trills). Courtship and mating behaviour often complex or stereotyped. Anti-predator strategies, injury-feigning and distraction displays generally elaborate and well developed. Most vocal during breeding season with variety of peeps, trills and mellow or liquid whistles.

Breed seasonally. Nest, a simple scrape on the ground, sparsely lined with plant stems, grasses and other objects; in open, often unvegetated places. Several scrapes may be prepared by male and one then selected by female. Eggs, oval, short oval or even somewhat pyriform; smooth, not glossy; ground-colour, buff, brown or grey, heavily blotched and spotted dark, well camouflaged. Clutch-size, 2–4, often consistently of one size in a species (e.g. two in *C. ruficapillus*). Laying at intervals of 24–60 h. Replacement laying, up to several times. Incubation by both sexes in monogamous species but share varies and is by male alone in Eurasian Dotterel *Eudromias morinellus*, the only plover in which female more brightly coloured than male. Incubation period, 24–31 days. Young hatched in natal down; precocial, nidifugous. Usually tended by both parents but feed themselves from hatching. Fledge in 3 (smaller species) to 5 (larger species) weeks.

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Charadrius mongolus Mongolian Plover

COLOUR PLATE FACING PAGE 840

Charadrius mongolus Pallas, 1776, *Reise versch. Prov. Russ. Reichs* 3: 700 — salt lakes towards Mongolian border = Kulussutai, probably on Onon River, Siberia, *vide* Ridgway.

Named after the type-locality, Mongolia.

OTHER ENGLISH NAMES Mongolian Dotterel or Sand-Dotterel; Mongolian or Lesser Sand-Plover.

Mongolian Plover is the simplest name and has been widely used internationally; **Lesser Sand Plover**, which may now be coming more into fashion, is probably better because it is close to the Large Sand Plover *C. leschenaultii* and draws attention to the similarity between the two species.

POLYTYPIC Nominate *mongolus*, e. Siberia, Mongolia; *atrifrons* Wagler, 1829, Kirghiz Steppes, Ladakh, Tibet; *pamirensis* Richmond, 1896, Pamirs, Karakoram; *stegmanni* Portenko, 1939, Kamchatka area; *schaeferi* de Schaunsee, 1938, w. China and s. Mongolia.

FIELD IDENTIFICATION Length: 18–21 cm; wingspan: 45–58 cm; weight: 56–71 g. Small to medium grey-brown and white plover; similar to Large Sand Plover *C. leschenaultii* but usually smaller, with generally more upright stance and more compact appearance, with proportions more typical of a small plover; slightly larger than Double-banded Plover *C. bicinctus*; much smaller than New Zealand Dotterel *C. obscurus*. Sexes differ in breeding plumage. Marked seasonal variation. Juveniles and immatures separable. Two subspecies groups that differ only in adult male breeding plumage in field (see Plumages, Moults).

Description Adult male breeding Black stripe extends from bill, across lores, to broaden into black mask through eye to rear of ear-coverts. Lower forehead, white, bisected by thin black vertical line, which joins narrow black frontal band across upper forehead to black facial patch (*mongolus* group) or forehead, all-black, sometimes with tiny white patches (*atrifrons* group). Crown and nape, grey-brown, washed pale chestnut; paler band on forecrown continues along upper border of black mask as narrow pale supercilium. Hindneck, chestnut. Rest of upperparts and inner wing-coverts, grey-brown, sometimes with rufous scaling on mantle and scapulars; median and exposed lesser coverts appear slightly paler than rest of upperparts and, with wear and fading, form contrasting pale panel below scapulars. In flight from above, primary coverts and remiges, blackish with thin white trailing-edge to secondaries and prominent narrow even white wing-bar across tips of greater coverts, bases of secondaries and inner primaries. Rump and upper tail-coverts, grey-brown centrally, with white sides; tail rather uniform grey-brown, with faintly darker subterminal band, narrow white tip and sides. Chin, throat and foreneck, white, sharply demarcated from chestnut neck and breast-band, which extends broadly onto flanks and merges into white of belly (lower border of band less sharply demarcated from white than upper border); in *mongolus* group, narrow blackish upper border to breast-band (not in *atrifrons* group). Rest of underbody and underwing, white except for narrow dusky trailing-edge to wing. Bill, black. Iris, dark brown. Legs and feet, typically dark grey but may be tinged greenish. **Adult female breeding** Similar to male except: facial mask and frontal band, dark grey-brown or rufous; no dark vertical stripe through centre of forehead; less chestnut on crown, nape, hindneck and sides of neck and breast-band; and lack dark upper border to breast-band. **Adult non-breeding** As adult breeding but lose all black and chestnut. Crown, nape, hindneck and sides of neck, lores and facial mask,

uniform grey-brown, though facial mask often appears slightly darker; some show very faint narrow pale collar on hindneck. Forehead, whitish, continuing over and behind eye as diffuse pale supercilium. Rest of upperparts, grey-brown with paler fringes, and narrow white edges to longer scapulars and tertials (soon lost with wear); median and exposed lesser coverts, similar, forming slightly paler panel below scapulars, which becomes much paler when worn and faded. Underparts, white, with large grey-brown patches at sides of breast sometimes joining in thin line across centre of upper breast. **Juvenile** Distinct in field for only a few months after fledging. Similar to adult non-breeding except: feathers of upperparts and inner wing-coverts have narrow buffish fringes and indistinct dark streaks and bands, which are usually lost quickly, upperparts then appearing very similar to adult non-breeding; when fresh, face and poorly defined supercilium washed buff; and patches at sides of breast, buff mottled grey-brown; buff tones soon lost. **First immature** Difficult to distinguish from adult non-breeding unless bird has retained a few juvenile inner wing-coverts, which would be contrastingly worn and pale-fringed. **Second immature** Like non-breeding adult or adult female breeding, but retain worn juvenile primaries, or primaries in active moult.

Similar species Very similar to **Large Sand Plover** and best separated by differences in shape and proportions of bill, head and body; also on length and colour of legs, extent of white in wings and on tail, calls and size. Shape of bill important; that of Large Sand Plover longer and heavier, distinctly longer than distance between base of bill and rear edge of eye (shorter than or about equal to that distance in Mongolian), and swollen nail generally longer; in profile, end of bill slightly swollen, mandibles tapering to pointed tip (in Mongolian, end usually more swollen, and tip appears blunter and bill stubbier). Large Sand Plover slightly larger and taller; head slightly larger and broader, rounded to more angular and flat-crowned, with less abruptly sloping forehead; stance more horizontal and balanced; legs, longer, especially above knee, and toes project beyond tip of tail in flight (level with or barely beyond tip of tail on Mongolian); Large Sand Plover generally looks rather out of proportion, even grotesque, Mongolian has more ordinary shape and proportions. Upperparts of Large Sand Plover slightly paler; wing-bar generally slightly narrower on innerwing and broader on outerwing, with bulging rear edge (more even in Mongolian); often more white at sides and tip of tail, especially on upper tail-coverts, and contrastingly

darker subterminal bar (central tail uniformly dark on Mongolian); legs, usually paler grey with greenish or yellowish tinge. In adult breeding males, Large Sand Plover, paler chestnut, with more orange tone (cf. darker brick-red colour in Mongolian); narrower, more parallel-edged breast-band, with lower edge more sharply demarcated from white lower breast, and with less colour extending onto fore-flanks (similar to moulting Mongolian, which may show narrower, not yet fully developed breast-band); in fresh plumage, feathers of mantle and scapulars (and sometimes also tertials) often strongly edged rufous (rarely in Mongolian). Non-breeding and juvenile plumages of Mongolian and Large Sand Plovers very similar and best distinguished by structural differences (see above). Distinguishable on call: Large Sand Plover does not give hard disyllabic note of Mongolian and occasionally gives distinctive rattle, apparently never matched by Mongolian. For distinction from non-breeding and juvenile **Double-banded Plover**, see that text.

Gregarious and coastal in non-breeding season; forage on mudflats, sandy beaches, estuaries, and tidal areas in mangroves; occasionally on airfields; rarely inland. Seen singly, in small parties, and large flocks (numbering hundreds). Freely join other waders when feeding or roosting, often forming mixed flocks with Large Sand Plover though generally segregated from latter when roosting; in NZ, usually flock with Double-banded Plover *C. binctus*. Feed in stop-start manner typical of plovers. Flight and gait typical of plovers. When settled, rather upright stance, with legs appearing to be set well back, rounded head, with steep forehead and rather short stubby bill, give shape and proportions rather typical of small plover. Usual call short hard disyllabic note, often likened to call of Ruddy Turnstone *Arenaria interpres*.

HABITAT Usually coastal, in littoral and estuarine environments; rarely inland round terrestrial wetlands.

Beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally sandy ocean beaches; coral reefs, wave-cut rock platforms and rocky outcrops; sometimes in short saltmarsh or mangroves (McGill & Keast 1945; Hindwood & Hoskin 1954; Thomas 1968; Evans 1975; Pegler 1983; Storr & Johnstone 1988; Morris 1989; P.C.M. Latham).

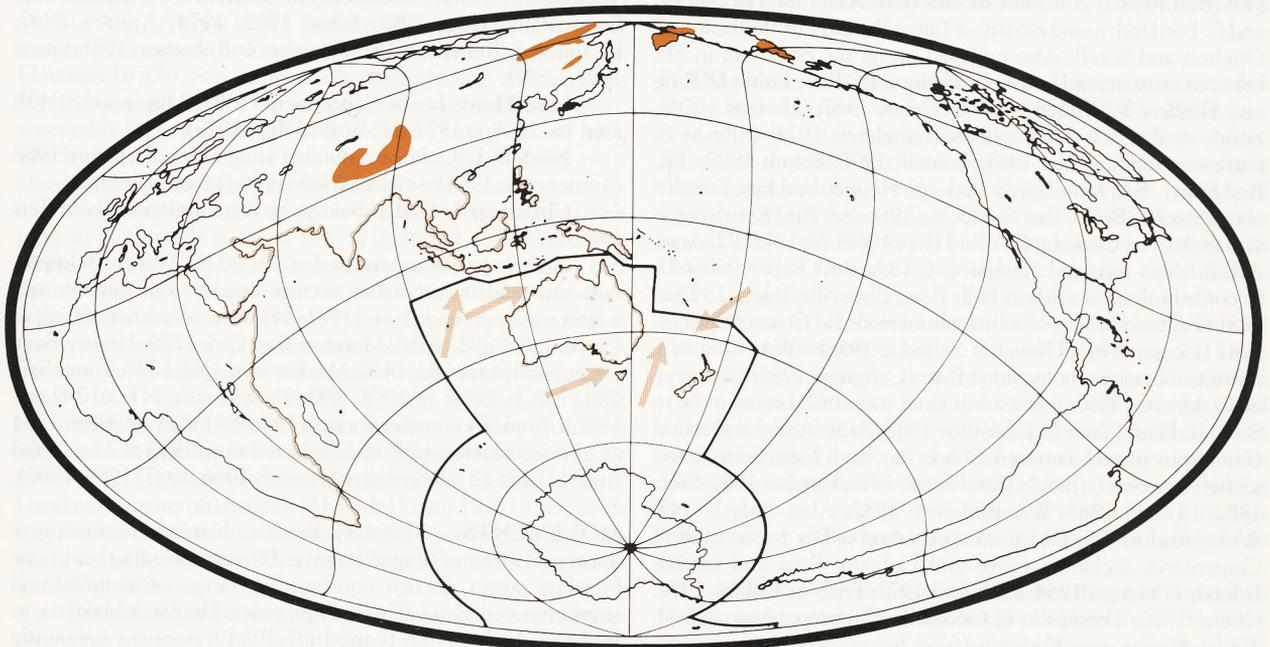
Near-coastal salt pans, brackish swamps and sandy or silty islands in river beds (Storr 1977; Taylor 1981; Schulz 1990). Rarely recorded inland: at margins of lakes, soaks and swamps round artesian bores (McGill & Keast 1945; Badman & May 1983; Henle 1989). Also on airfields (van Tets *et al.* 1969).

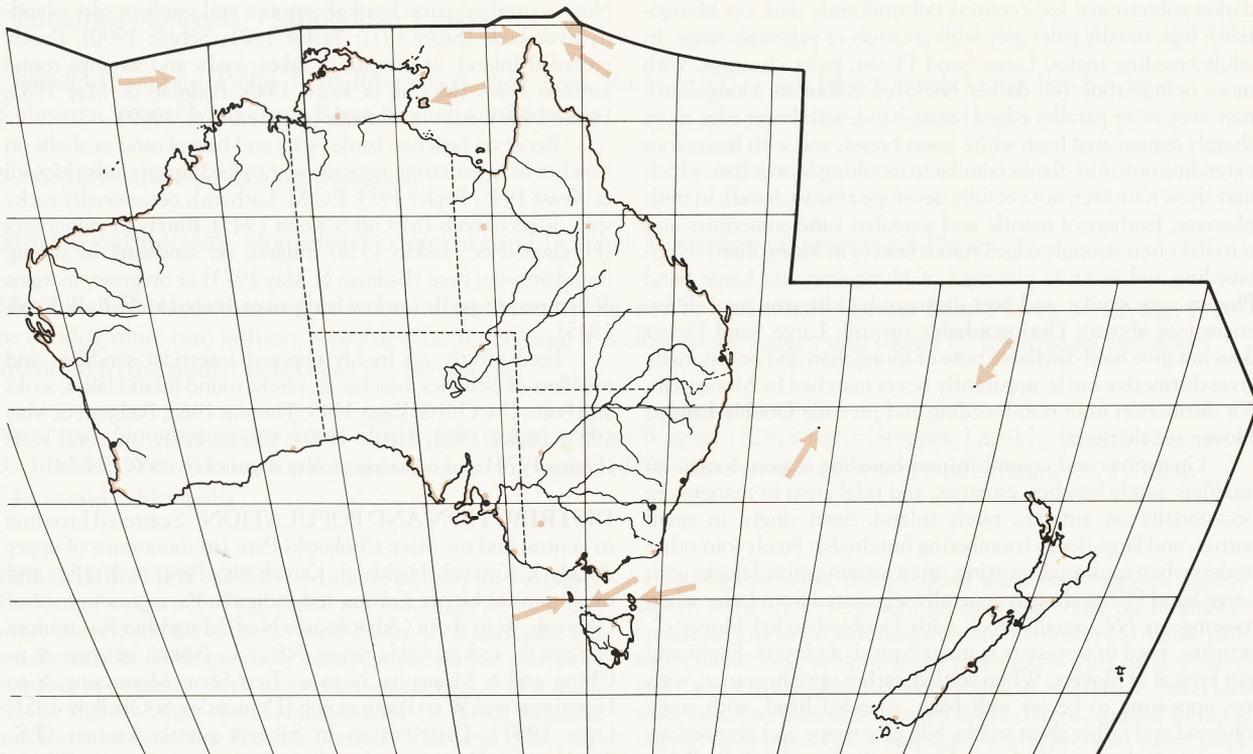
Roost on beaches, banks, spits and bars of sand or shells on beaches or in estuarine lagoons next to feeding grounds (McGill & Keast 1945; Pegler 1983; P.C.M. Latham); occasionally rocky spits, islets or reefs (McGill & Keast 1945). Rarely in mangroves (Hindwood & Hoskin 1954). Inland, on sandbank in swamp round artesian bore (Badman & May 1973) or on grassy margins of temporary pools on low-lying river islets (McGill & Keast 1945).

Feed mostly on freshly exposed intertidal sandflats and mudflats of estuaries, beaches or, rarely, round inland lakes, soaks and bores (McGill & Keast 1945; Thomas 1968; Badman & May 1983; Pegler 1983; Henle 1989). Occasionally on coral reefs (Evans 1975) and on sandy or silty edges of rivers (CSN 29).

DISTRIBUTION AND POPULATION Scattered breeding in central and ne. Asia: Chukotski Pen. (in mountains of upper Anadyr); Koreyak Highland, Kamchatka Pen., n. Kuriles and mountains of Upper Kolyma and Indigirka Rs; n. coast of sea of Okhotsk, W to about Okhotsk; area N of Dzhugdzhur Ra., sources of Zeya R. and probably ranges NE of L. Baikal; in areas of w. China and s. Mongolia, N to e. Tien Shan Mountains, S to Himalayas and W to Pamir region (Dement'ev & Gladkov 1951; Lane 1987). Distribution in Siberia poorly known (P.S. Tomkovich). During non-breeding season, occur from se. Siberia and Japan, e. and s. China, through Indochina and Philippines to Indonesia, New Guinea, Aust. and islands in sw. Pacific. Rare but regular visitor to NZ; also round Indian Ocean, from s. and e. Africa, NE to Arabian Sea and Indian subcontinent, and S through Malay Pen. and Indonesian Arch. Vagrant to Europe and Middle East (BWP).

Aust. Qld Widespread from se. Gulf of Carpentaria, N to Torres Str., and along entire e. coast (Amiet 1957; Draffan *et al.* 1983; Storr 1984; Garnett & Bredl 1985; Lane 1987; Woodall & Watson 1988; Aust. Atlas). Rare inland records from Mt Isa, Jan.





1967 and Feb. 1968 (Thomas 1970a; Horton 1975) and Toomba L. (c. 70 km W of Charters Towers), 22 Dec. 1985 (Qld Bird Rep. 1985). **NSW** Most common on n. coast, becoming less common farther S (Lane 1987; Aust. Atlas). Rare on s. coast (Whiter 1991, 1992). Recorded inland, L. Menindee, May 1987 (Henle 1989). **Vic.** Regularly in Corner Inlet, Westernport Bay and Port Phillip Bay; casual elsewhere on coast. Inland record from L. Hindmarsh (Vic. Atlas). **Tas.** Scarce but regular summer visitor (Tas. Bird Reps 1, 20). Most records from NW, round Robbins I. and C. Portland; round estuary of Tamar R.; and Pitt Water, round Orielton and Sorell. Also recorded on far ne. coast and in SE, between estuaries of Derwent and Huon Rs. Rare visitor to King and Flinders Is (Milledge 1966; Green 1967; Thomas 1970a; Smith *et al.* 1971; McGarvie & Templeton 1974; Bulman & Patterson 1987; Ashby 1987; Bulman 1990; Schulz 1990; Tas. Bird Reps). **SA** Mainly in S, between Fleurieu and Eyre Pens, to about Streaky Bay (Close & McCrie 1986; SA Bird Reps); occasionally in The Coorong (SA Bird Reps 1969–70, 1971–72; Aust. Atlas). Also recorded Kangaroo I. (SA Bird Rep. 1966–67). Recorded inland at Clifton Hills Bore, Birdsville Track, 28 Dec. 1981 (Badman & May 1983); doubtful record at Coward Springs, 1941 (Cooper 1941; Glover & Schodde 1958). **WA** Rare in s. districts: occasionally recorded Eyre (Congreve 1982; Congreve & Congreve 1985); few records from round C. Leeuwin, N to Swan R. Plain (Storr & Johnstone 1988; Aust. Atlas) and round Geraldton; mostly between Shark Bay and King Sound; few scattered records farther N (Smith *et al.* 1978; Fletcher 1980; Storr 1980; Howard 1983; WA Bird Rep. 1982; Aust. Atlas). **NT** Widespread in Top End from about Anson Bay to sw. Gulf of Carpentaria, including Gove and Cobourg Pens and Groote Eylandt (Deignan 1964; Crawford 1972; Frith & Calaby 1974; Officer 1976; Thompson & Goodfellow in prep.; Aust. Atlas). Tindal Airport, near Katherine (van Tets *et al.* 1969).

NZ Rare but regular summer visitor, usually singles; largest group, four; maximum in a year, seven (NZCL; B.D. Heather). **NI** Most records from Manukau Harbour and Firth of Thames; other records from Parengarenga and Kaipara Harbours, Kerikeri Inlet, Maketu, Porangahau estuary and Hokio Beach (McKenzie & Sibson 1963; Urquhart 1963; Reed 1972; Sibson 1975; Brown 1979; McKenzie 1980; CSNs; B. Chudleigh). **SI** Most records at Farewell Spit; other records Motueka, Whanganui Inlet, Waimakariri R., L. Ellesmere, L. Wainono, Aramoana and Invercargill (Hogg 1961; Edgar 1962, 1974; Andrew 1967; Dennison & Robertson 1979; Heather & Robertson 1981; Guest 1991; CSN).

Lord Howe I. Two, specimens, 1887 (Hindwood 1940); four, 18–20 Apr. 1977 (NSW Bird Rep. 1977).

Norfolk I. Unknown number (single record), before 1968 (Turner *et al.* 1968); single, 12 July 1976 (Moore 1981).

Christmas I. (Ind.) Said to be regular migrant (van Tets 1983).

Aust. population estimated at 20,000 (D. Watkins). Important sites and maximum or average counts from summer and winter surveys round Aust. (1981–85) were: se. corner of Gulf of Carpentaria, Qld, 4050; Moreton Bay, Qld, 1770; Hervey Bay–Great Sandy Str., Qld, 1430; Mackay area, Qld, 1090; Torres Str., Qld, 700; n. coast of NSW 690; Darwin area, NT, 610 (Lane 1987). Totals for summer counts (1986–89) in Aust. were: 1584 at 23 selected sites; 1289 at 22 selected sites; 1973 at 23 selected sites; 1254 at 22 selected sites (Hewish 1986, 1987, 1989, 1990).

MOVEMENTS Migratory. Breed n. hemisphere, moving S during n. winter. Subspecies have different breeding and non-breeding ranges, though non-breeding ranges of *mongolus* and *stegmanni* overlap in s. China, Philippines, Thailand, Malaysia, w. Indonesia and n. Aust. (Lane 1987; BWP); *mongolus* apparently

more common; records of *stegmanni* in n. and possibly e. Aust. In NZ, subspecies probably *mongolus*, but *stegmanni* also suggested. Subspecies *schaeferi* may occur nw. Aust. Theoretical flight-range: adults probably able to reach Gulf of Carpentaria from Vic. (2600 km), with heaviest birds capable of reaching Irian Jaya (4400 km), if flight-speed of 75 km/h assumed (Barter 1991).

Departure Subspecies *mongolus*: timing of breeding and departure from breeding grounds, not known, though probably similar to *stegmanni*; common during migration on Chinese coast, e.g. Jiangsu Province, Aug.–Sept. 1991; vagrant Korea and Japan; common on migration in Philippines (la Touche 1931–34; Orn. Soc. Jap. 1974; Hui 1992); status in e. Indonesia not known, though listed for Sulawesi (Stresemann 1936); common PNG, usually arriving Port Moresby district, mid-Aug. (Rand & Gilliard 1967; Heron 1978; Hicks 1990); occasionally reported in South Pacific (Smart 1971; Lane 1987). Subspecies *stegmanni* generally leaves breeding grounds by end Sept.; females begin to leave late July, mainly Aug. to early Sept.; juveniles leave in first two-thirds of Sept.; fly along coast of Sea of Okhotsk, through Sakhalin and through Maritime Territory of CIS; common during migration in Korea (mostly Sept.–Oct.) and Japan (where large numbers recorded on S migration); occur in Taiwan and Philippines (Dement'ev & Gladkov 1951; Gore & Pyong-oh 1971; Orn. Soc. Jap. 1974; de Schauensee 1984; BWP).

Large numbers of e. Siberian birds also pass overland through Transbaykalya (CIS) and Manchuria (BWP). In Hong Kong, mostly June–Nov. (Chalmers 1986); at Olangi I. in Philippines, Aug.–Oct. (1989) (Magsalay 1990); arrive Bali, Aug. (Ash 1984); occur Wallacea, Aug.–Nov. (White 1975).

Birds arrive on and move along n., e. and s. coasts of Aust., Aug.–Oct.; continue to move down e. coast, Nov., with maximum numbers at most sites in Dec.; in se. Aust., numbers at sites increase gradually, Aug.–Dec. (Lane 1987; Alcorn 1988). Timing of arrival in Aust. between 1981 and 1987: Darwin region, NT, Sept.–Nov., with peak mid-Oct.; n. Qld, Sept., with another influx mid-Oct.; S of Ross R., Qld, (19°16'S) pattern varies, with arrival at some sites as late as Dec.; S of Finlayson Pt, Qld, (20°53'S), Sept. to early Oct. with maximum numbers, Nov. to early Jan.; influxes on n. coast NSW, Sept.–Dec., with large-scale movements, Dec.–Feb.; Clinton Conserv. Park, SA, large arrivals, late Aug. (Alcorn 1988). At Eyre, WA, small numbers, only in spring (Congreve & Congreve 1982). Arrive Tas., July–Oct. (Thomas 1970b). Some apparently move through inland; numbers increasing at Fitzroy Crossing, WA, during Sept. (Mathews); acceptable inland records from Sept., Dec., Jan., Feb. and May, which suggests some birds may also occur inland during non-breeding period or on n. migration (see Distribution).

Non-breeding In Aust., generally Sept.–Apr. or May with most in N (McGill & Keast 1945; Hindwood & McGill 1958; Starks & Lane 1987); small numbers occur regularly in NZ, mainly late Sept. to mid-Apr. or early May (P.C.M. Latham). Apart from influxes and exoduses before n. migration, numbers at many sites fairly constant from mid-Nov. to late Feb., though fluctuations in numbers in some areas (e.g. most sites in n. Qld) suggest local movements (McGill & Keast 1945; Lane 1987; Alcorn 1988). In NZ, some birds at a locality for only a short time while others (assumed to be same bird) apparently present for months, e.g. Manukau Harbour (Urquhart 1963; P.C.M. Latham). Local movements often dictated by tide (Evans 1975). Pre-migratory display observed in NZ (Brown 1979); pre-migration flocking noted in Sydney area (Hindwood & Hoskin 1954; Hindwood & McGill 1958).

Return At some sites in n. Aust., numbers generally increase Feb.; at most other sites, influxes occur Mar.–Apr., which

suggests short movements along e. and n. coasts before leaving NZ from Mar. to late Apr. In Qld, at sites S of Deception Bay, influx mid-Mar. to late Mar., before leaving late Apr. to early May; at sites farther N, declines began late Mar. to mid-Apr. At sites in s. Aust. between 1981 and 1987, numbers gradually decreased 90–120 days before last birds left in late Apr. to early May. Leave Tas., Apr.; Sydney region, late Apr. (McGill & Keast 1945; Hindwood & Hoskin 1954; Thomas 1970b; Lane 1987; Alcorn 1988). Two waves of departure from n. Aust. noted in 1985, with birds leaving first half Mar. and second smaller departure, early Apr. (Starks & Lane 1987). Generally leave Broome–Port Hedland area, WA, late Apr.; leave n. Qld. coast, mid-Apr. (Storr 1953; Starks & Lane 1987; Lane 1987).

Occur Wallacea, Feb. and Apr.–June (White 1975; White & Bruce 1986). Usually leave Port Moresby district, PNG, mid-May (Hicks 1990). Inner Gulf of Thailand may be important stop-over because high numbers (mainly *schaeferi* and *atrifrons*) recorded Mar.–Apr. (Lane 1987). High numbers Feb.–Apr. in Philippines (Magsalay 1990); pass through Hong Kong late Mar. or early Apr. (mainly *mongolus* subspecies-group) (Chalmers 1986; Howes 1987), mostly *stegmanni* in Korea in May (Gore & Pyong-oh 1971) and common in Japan on n. migration (Orn. Soc. Jap. 1974). Subspecies *stegmanni* arrives breeding grounds, first half of May (McGill & Keast 1945; Dement'ev & Gladkov 1951). Timing of arrival on breeding grounds of *mongolus* unknown (Dement'ev & Gladkov 1951).

Breeding Some birds remain in non-breeding range. In Aust., reporting rates 1.17% in summer and 0.52% in winter (Aust. Atlas); recorded in some areas in all months, e.g. Raby Bay, Qld, Darwin region (Amiet 1957; Crawford 1972); rarely in s. Aust. during this period (Alcorn 1988), though occasionally recorded as far S as Vic., Bass Str. and mainland Tas. (Thomas 1970b; Schulz 1990; Vic. Atlas); more common in n. Aust. at this time (Draffan *et al.* 1983; Alcorn 1988). Three or four records of singles in NZ during n. summer, bird often apparently remaining at one locality for months (P.C.M. Latham); one stayed at Porangahau, Mar. 1986 to Jan. 1988 (B.D. Heather).

Banding Two recoveries: one banded NSW as adult recovered dead in Philippines (6196 km), over 9.25 years later; adult banded in Vic., recovered dead at Shanghai, China (8184 km) (Pook 1992).

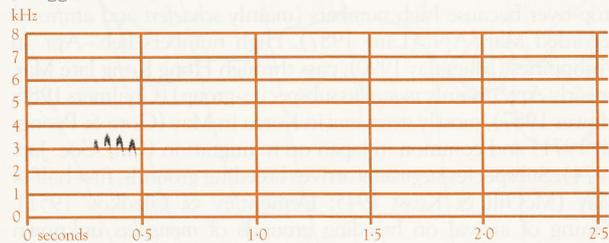
FOOD Molluscs, worms, crustaceans and insects; once recorded eating seeds (Dement'ev & Gladkov 1951; BWP). **Behaviour** Feed solitarily, or in scattered flocks, often with other waders. Forage on intertidal mudflats, saltpans and saltmarsh; rarely, at edge of water (Lane 1987). Typical run-stop-peck manner of *Charadrius* plovers; also stalk worms in holes (BWP). Locate prey by sight (Domm & Recher 1973). One bird observed feeding with Double-banded Plovers *Charadrius bicinctus*, New Zealand Dotterel *C. obscurus* and Ruddy Turnstones *Arenaria interpres* at Maketu Estuary, NZ; behaviour similar to that of Double-banded Plovers, but stood still for longer, followed by swift run and lunge or sometimes a dig in the sand for prey; often adopted horizontal posture before darting or lunging for prey; rarely moved forward without having first seen prey (P.C.M. Latham). Crabs caught in water are carried to dry ground and pounded against ground to dismember before swallowing (Heather 1987). Observed shaking feet in sand and mud to disturb prey (Piersma 1985), though similar behaviour has been interpreted as foot-cleaning (Mathews 1984).

Adult No detailed studies. **Non-breeding** (observations): Molluscs: gastropods (Domm & Recher 1973; Evans 1975). Crustaceans (Domm & Recher 1973); crabs (Domm & Recher 1973);

Heather 1987). Extralimitally, see Dement'ev & Gladkov (1951), BWP. **Young, Intake** No data.

VOICE Little information; no detailed studies. Usual call, soft and melodious trill (Hindwood & Hoskin 1954). Also monosyllabic and disyllabic calls. Some calls similar to those of Double-banded Plover.

Adult TRILLING: soft and melodious trilled *tirrit-tirrit-tirrit* or occasional *tirrit-it* (sonagram A); most common call, generally uttered in flight (Hindwood & Hoskin 1954). Also given in apparent pre-migratory display, with upstretched neck, to group of Double-banded Plovers (Brown 1979). **MONOSYLLABIC CALL:** deeper than that of Double-banded Plover (Heather & Robertson 1981). **DISYLLABIC CALL:** *tik-it*, as bird rose in flight, less incisive and carrying less far than typical note of Double-banded Plover (Hogg 1961).



A F.N. Robinson; Cape Ra. NP, WA, July 1986; P36

PLUMAGES Prepared by D.I. Rogers. Hatch in natal down; replaced by distinctive juvenile plumage. Begin partial moult to first pre-basic plumage about Sept., at end of s. migration. Remain in non-breeding areas for rest of first year, undertaking partial moult to first alternate plumage about Aust. autumn. Adult non-breeding plumage first attained with complete second pre-basic moult in second Aust. spring. Adult breeding plumage first attained with partial second pre-alternate moult late in second Aust. summer, just before n. migration. Thereafter, moult twice a year: a complete pre-basic moult to non-breeding plumage beginning about time of arrival at non-breeding areas, after s. migration; and a partial pre-alternate moult to breeding plumage just before departure on n. migration. Aust. birds from *mongolus* subspecies-group described below; for notes on separation of subspecies, see Geographical Variation.

Adult male breeding Alternate plumages from second Aust. summer onwards; first attained when c. 20 months old. **Head and neck** Lower forehead, white, often bisected by varying black (c89) median line, which meets base of culmen. Upper forehead, black (c89), occasionally scalloped by narrow white tips to feathers; this marking forms dark transverse band meeting front of eyes. Narrow black (89) loreal stripe meets upper mandible and gape; broadens posteriorly to broad black (c89) mask encompassing ear-coverts and broader below eye. Crown and nape, grey-brown (c119B), strongly washed pale rufous (c38–c39) at sides and upper margin of dark frontal band. Short narrow whitish stripe, varying washed light rufous (c39), begins above eye and runs back above black mask. Hindneck and sides of neck, rufous (c40, c340), becoming paler (c38) when worn; almost always sharply separated from white chin and throat by narrow blackish (119) line. **Upperparts** Light rufous of hindneck may encroach slightly onto upper mantle. Rest of mantle, back and scapulars, greyish brown (c119B); usually rather uniform but worn birds subtly scalloped by indistinct brownish-grey (c45) tips of feathers. Inner subscapulars usually concealed; slightly paler grey-brown (c119C) than rest of scapulars, with white fringes, narrow on inner webs. Rump and upper tail-coverts, slightly paler grey-brown (119B–

119C) than back; lateral upper tail-coverts tipped white and rump has narrow white sides. **Underparts** Breast, rufous (c40–c340), sharply separated from white chin and throat by narrow blackish (119) line. Lower margin of breast-band not so sharply demarcated and often broken up to form coarse rufous mottling; breast-band narrowest in centre and extends on to anterior flanks to varying extent. Rest of underparts, white. **Tail** Grey-brown (similar to back) with whitish sides and tips, and sometimes with subtly darker subterminal band. T1, grey-brown (c119B), grading to slightly darker greyish-brown (119A) towards tip; has narrow white fringes that can be lost with wear. T2–t5, grey-brown (c119B), grading to light grey-brown (119C) on outer feathers; white tips to feathers 1–2 mm wide, usually retained when worn; subtly darker grey-brown (c119A) subterminal band narrows or tapers out on outer feathers. T6, white with varying pale grey-brown (119C–119D) marking in centre of each web (usually larger on inner web). **Upperwing** Marginal, median and lesser secondary coverts, as scapulars. Greater secondary coverts, slightly darker greyish-brown (c119A), with white tips (2–3 mm wide when fresh and narrowing with wear), which meet narrower white inner edge. Primary coverts and alula, blackish brown (c119), grading to dark-brown (c119A) inner edges; inner greater primary coverts, narrowly tipped white. Tertiaries, grey-brown (119B) to dark grey-brown (c119A). Primaries and secondaries, blackish (c119), grading to largely concealed dark-brown (c119A) centres and inner webs to feathers; secondaries have narrow white tips that broaden and encroach on edges of inner feathers. Inner four or five primaries have white bases to outer webs, broadest at outer edges and extend for 30–50% of length of feather. White bases of primaries and white tips of greater coverts meet to form narrow white wing-bar, often broader over secondaries, and usually with straight (not bulging) rear edge over primaries. **Underwing** Remiges, light glossy-grey (c80) (slightly darker at tips of primaries) grading to white bases, larger on inner webs. Greater coverts, light glossy-grey (c80), with broad white tips and narrow white edges. Other coverts, white, with greyish (c80) bases, mostly concealed but slightly exposed towards leading-edge; coverts on leading-edge outside carpal, dark brown (119A) with broad white fringes.

Adult female breeding No skins available from our region and further work required to determine if females can be distinguished from males moulting into breeding plumage. Sexual dimorphism usually marked in *atrifrons* subspecies-group, with much of black of forehead and facial mask replaced by mixture of dark grey-brown and cinnamon-buff (sometimes nearly uniform buff or off-white) and with less rufous on crown, hindneck and breast-band (BWP). Apparently less marked in *mongolus* subspecies-group, in which sexes similar but females often have brown, rather than black, ear-coverts (BWP).

Adult non-breeding Second and subsequent basic plumages; first attained early in second Aust. summer when c. 15 months old. Similar to adult breeding, but all black and rufous markings lost from head, neck and underparts. Sexes similar. **Head and neck** Forehead, white; joins often poorly defined, white or off-white supercilium that runs over eye and ear-coverts. Crown, nape, hindneck and sides of neck, grey-brown (c119B); forecrown sometimes slightly scalloped by narrow white tips to feathers. Loreal stripe and facial mask shaped like those of adult breeding but grey-brown (c119B) or dark grey-brown (c119A), often slightly darker than crown. When fresh, lores mottled by narrow white fringes to feathers. **Underparts** Mostly white. Large grey-brown (c119B) to dark grey-brown (c121) patches at sides of breast sometimes joined by thin line across centre of upper breast. **Tail, Wings** As adult breeding.

Juvenile Post-juvenile moult usually begins shortly after s. migration and few Aust. birds seen in full fresh juvenile plumage. Differences from adult non-breeding. **Head and neck** When fresh, ground-colour of top of head slightly greyer; feathers, narrowly fringed pale buff (c124), fringes broadest on forecrown. With wear, pale fringes fade to whitish and eventually lost, and ground-colour of top of head becomes browner (c119B), worn birds looking more like adult non-breeding. Loes, buff (124) at first, speckled grey-brown (c119A) by shaft-streaks to feathers; supercilium and sides of forehead buff (124) at first. When worn, ground-colour fades to whitish. Ear-coverts, grey-brown (c119B), usually paler than non-breeding adults. **Upperparts** All feathers narrowly fringed buff (124), markings broadest on scapulars, which also have narrow dark-brown (c12) subterminal bands and shafts. Except on scapulars, buff fringes are lost rapidly with wear, upperparts then looking similar to adult. **Underparts** Patches at sides of breast, grey-brown (c119A) heavily marked by buff (c124) fringes that are broader toward centre of breast; at least some have buff (124) wash right across breast when fresh. Buff areas fade to whitish when worn. **Tail** As adult; pale tips of feathers tinged pale buff (c124) when fresh. **Upperwing** Median and lesser secondary coverts have buff (124) fringes, slightly broader than those on scapulars, and usually have narrow dark-brown (c121) subterminal bands. These markings retained, at least on inner coverts, until feathers moulted. White tips of greater secondary coverts have faint buff (124) tinge at first, fading to pure white when worn. **Underwing** As adult.

First immature First basic; very similar to adult non-breeding but with retained juvenile primaries and secondaries; wear and timing of moult of primaries allows reliable ageing (see Ageing). Some buff-tipped juvenile inner coverts retained on upperwing until at least Dec. and probably until first pre-alternate moult in about Mar. Outer rectrices and back to upper tail-coverts can also be retained until at least mid-summer, but by late Sept. these feathers can lose buff tips through wear, appearing similar to first-basic plumage.

Second immature First alternate. Similar to adult non-breeding but with varying amount of breeding-type plumage on head, neck and breast. In subspecies *pamirensis*, often restricted to sides of breast but sometimes also on parts of head and upper breast (BWP). Similar variation seems to occur in our region but few skins or photos available of this plumage. Can be aged on condition of primaries (see Moults, Ageing).

BARE PARTS Based on notes from six live nw. Aust birds in the hand (AWSG unpubl.), photos (Pringle 1986; Aust. RD; AWSG; unpubl.: J.N. Davies) and museum labels (AM, HLW, MV, SAM, WAM).

Adults, Immatures Bill, black (89). Iris, dark brown (21, 22) to black-brown (119). Legs, vary; usually dark grey (83), with yellowish tinge often producing brownish-grey (80) or dark-olive (150) appearance; in some, look olive-grey (c42). Three have been recorded with light-brown (19C) legs (AWSG). Toes sometimes grey-black (82); frequency with which this occurs in Aust. not known. In e. Africa, toes and joints not usually darker than legs (Taylor 1982, 1983); perhaps not so in Aust. and NZ, because black (82) toes have been recorded on several labels and all six live nw. Aust. birds examined in the hand. Unfortunately, most available photos do not show toes and on most labels colour of toes not given. Claws, black (89). **Juvenile** No information for our region. In w. populations, similar to adult but more often with greenish tinge to legs (Lewington *et al.* 1991).

MOULTS From BWP, Barter (1991) and skins (AM, ANWC, HLW, MV, SAM, WAM).

Adult post-breeding Third and subsequent pre-basic moults. Complete; primaries outwards. Moult said to begin on arrival in non-breeding grounds (BWP) but two of seven caught in nw. Aust. in Aug.–Sept. had suspended primary-moult (Barter 1991), indicating that moult can begin in staging areas during s. migration. Three of 45 caught in Vic. in early Jan. had also suspended primary-moult. Other individuals begin moult immediately on arrival in Aug.–Sept.; inner 3–5 primaries replaced rapidly before decrease in rate at which primaries shed. Moult of body-feathers, tail and wing-coverts continues to be rapid and, by mid-Oct., most plumage basic; primary-moult continues until at least Dec. Several records of late primary-moult available from Feb. and early Mar. but primary-moult complete by mid-Mar. at latest (BWP). **Adult pre-breeding** Second and subsequent pre-alternate moults; appears to occur first at end of second Aust. summer. Partial, involving head, neck, underparts and, usually, mantle and scapulars; occasionally other body-feathers, central rectrices or a few wing-coverts or tertials also replaced (BWP). Most moult occurs early Jan. to early Apr.; adults have at least 50% breeding plumage on departure from Vic., at least 75% on departure from n. WA; some complete pre-alternate moult before leaving Aust. **Post-juvenile** Partial, first pre-basic. Starts about late Sept. on arrival from s. migration; most individuals undergo fairly rapid body-moult and have assumed first pre-basic plumage by Nov.–Dec., with retained juvenile remiges, some tertials, some upper wing-coverts (but not marginal or shorter lesser coverts) and back to upper tail-coverts. Gradual replacement of these feathers continues until Mar., when only juvenile primaries and secondaries, greater secondary coverts and outer rectrices and a few inner median coverts remain. Not clear whether moult can be interrupted between Dec. and Mar.; if so, replacement of some of above feathers should perhaps be treated as first pre-alternate. **First immature pre-breeding** (Do not breed in first year). First pre-alternate. Some individuals undergo partial primary-moult (perhaps complete in some individuals) during late first Aust. summer or autumn. Time at which this outwards primary-moult begins not well known. In late Mar.–Apr., 12 of 30 immatures caught in nw. Aust. had undergone some primary-moult; five of these had interrupted primary-moult after replacing 2–6 inner primaries. Moult probably continues through first Aust. winter, as four of 18 birds caught in Aug.–Sept. had replaced 5–9 inner primaries. BWP reports that this primary-moult can be complete, continuing until at least July; not confirmed that this is so in Aust. Extent of body-moult occurring in first pre-alternate not known, but in first Aust. summer or winter some develop some breeding-type plumage on breast and head. **First immature post-breeding** (Do not breed in first year). Second pre-basic. Complete; similar to subsequent pre-basic moults but begun earlier (Barter 1991) and appear not to suspend moult of primaries.

MEASUREMENTS (1) Aust., localities combined, adult, skins; length of wing all from birds in which primaries worn but tips not obviously broken; wing longer when primaries fresh (see below); BILL D = depth of bill at base of gonyes, measured vertically (perpendicular to the long axis of the bill) (AM, ANWC, HLW, MV, SAM, WAM). (2) Aust., localities combined, immature collected during first Aust. summer with worn primaries, skins; as (1). (3) Nominate *mongolus*: Amur area during Palaearctic summer and winter, skins (BWP). (4) Subspecies *schaeferi*: L. Kuknor area, China, in Palaearctic summer and Java during Palaearctic winter, skins (BWP). For BWP measurements, wings

at least from adults. (5) Subspecies *stegmanni*: Commander Is, adult, skins (C.S. Roselaar).

	MALES	FEMALES	
WING	(1) 130.5 (2.98; 124–135; 11)	133.4 (2.97; 130–138; 5)	ns
	(2) 131.8 (2.56; 128–135; 5)	130.7 (2.53; 127–135; 9)	ns
	(3) 134 (2.96; 130–138; 13)	136 (2.37; 133–140; 6)	ns
	(4) 130 (2.34; 127–130; 30)	131 (2.70; 126–135; 60)	ns
	(5) 132.5, 136	137.5, 143.5	
TAIL	(1) 51.7 (2.66; 47–56; 16)	52.5 (2.18; 50–56; 12)	ns
	(2) 49.2 (1.17; 48–51; 5)	48.9 (3.53; 44–56; 12)	ns
BILL	(1) 16.6 (0.77; 15.5–18.2; 17)	16.8 (0.63; 15.8–18.2; 12)	ns
	(2) 16.8 (0.91; 15.3–17.6; 5)	16.8 (0.87; 15.4–18.3; 10)	ns
	(3) 16.2 (0.81; 15–17; 11)	15.6 (15–16; 3)	
	(4) 18.6 (1.04; 17–22; 32)	18.6 (0.8; 17–21; 66)	ns
	(5) 15.9, 16.2	15.2, 15.4	
BILL D	(1) 4.5 (0.25; 4.0–5.0; 17)	4.4 (0.26; 4.1–5.0; 10)	ns
	(2) 4.4 (0.26; 4.0–4.8; 5)	4.3 (0.3; 3.6–4.8; 9)	ns
	(5) 4.8, 4.5	4.6, 4.6	
TARSUS	(1) 31.6 (1.42; 28.4–34.9; 17)	32.6 (1.37; 30.3–34.9; 11)	ns
	(2) 30.9 (1.56; 28.4–32.7; 4)	31.6 (1.15; 28.9–33.5; 10)	ns
	(3) 31.0 (0.58; 30–32; 11)	30.8 (29–33; 3)	
	(4) 34.6 (0.91; 33–36; 23)	34.5 (1.44; 32–38; 40)	ns
	(5) 28.9, 28.9	28.9, 29.8	

Differences in size between sexes negligible but females may have slightly longer wings. In samples of subspecies *pamirensis* and *atrifrons* from breeding grounds (BWP), females have longer wings than male but difference small, and less striking than variation caused by wear of primaries.

Sexes combined: (6–7) N. Aust. (between Port Hedland, WA, and Darwin, NT) and e. coast (mostly NSW and s. Qld), adult, skins: (6) birds with worn outer primaries; (7) birds with fresh outer primaries. (8–11) E. coast (Vic.) and n. Aust. (between Port Hedland and Broome, WA), live; THL = total head-length (Barter 1991): (8) adults with fresh p10; (9) adults with worn p10; (10) immatures in first Aust. summer with p10 worn; (11) immatures early in second Aust. summer with p10 very worn.

	N. AUST.	E. COAST	
WING	(6) 129.6 (3.85; 124–134; 5)	132.3 (2.61; 129–138; 11)	ns
	(7) 135.8 (3.97; 131–142; 6)	133, 138	
	(8) 138.2 (3.07; 77)	139.3 (2.75; 13)	ns
	(9) 134.2 (4.79; 34)	136.0 (3.04; 45)	ns
	(10)	130.4 (2.62; 21)	–
	(11)	127.8 (4.25; 13)	–
8TH P	(6) 85.2 (2.48; 81–89; 6)	86, 92	
TAIL	(6) 51.2 (2.99; 47–56; 10)	52.5 (2.03; 49–56; 18)	ns
BILL	(6) 16.5 (0.70; 15.5–18.0; 12)	16.8 (0.72; 15.5–18.2; 17)	ns
	(8) 17.0 (0.73; 83)	16.3 (0.84; 52)**	
	(10) 17.2 (0.92; 15)	16.0 (1.00; 3)	
BILL D	(6) 4.59 (0.20; 4.3–4.8; 9)	4.41 (0.25; 4.0–5.0; 18)	ns
	(8) 4.8 (0.29; 51)	5.0 (0.26; 5)	
	(10)	4.6 (0.28; 16)	–
THL	(8) 45.7 (0.86; 72)	45.7 (1.01; 50)ns	
(10)		45.4 (0.67; 15)	–
TARSUS	(6) 31.8 (1.29; 29.6–33.9; 10)	32.1 (1.56; 28.4–34.9; 18)	ns

Bill and tarsus are fully-grown before arrival in Aust. Juvenile wings and tail are significantly shorter, at least in males, than in adults; shorter wings have also been reported in juveniles of *atrifrons* subspecies-group (BWP). Length of wing decreases with wear; in samples above, birds with worn primaries had wing 3–5 mm shorter than those with fresh primaries, though no birds were

measured in which tips of primaries were broken.

WEIGHTS Live, captured (Barter 1991): (1) Vic., adults; (2) nw. Aust., between Port Hedland and Broome, adults.

UNSEXED	
Aug.–Sept.	(2) 61.0 (4.41; 10)
Oct.–Nov.	(2) 61.4 (3.88; 22)
Nov.–Jan.	(1) 64.0 (3.27; 56–71; 46)
3rd week Mar.	(2) 79.0 (9.84; 10)
4th week Mar.	(2) 79.7 (7.68; 29)
1st week Apr.	(2) 82.5 (7.92; 46)
2nd week Apr.	(2) 85.1 (5.84; 32)
3rd week Apr.	(2) 71.8 (6.03; 10)

Weights of adults probably remain fairly stable during most of Aust. summer, though little data on museum labels, e.g. in Dec., males 54, 57 and females 61, 73, 65, 80; in Feb., females 58, 66. In Vic. (above), adults Nov.–Jan. significantly lighter than adults from NW in early summer. Pre-migratory fattening underway by Mar.; Vic. adults appear to become heavier than in nw. Aust., weighing 104 (7.6; 90–110; 7) in Apr.; nw. Aust. adults significantly lighter in the same period (even though catches were made at times of peak departure); heaviest bird caught in nw. Aust., 105 g. In Mar.–Apr., nw. Aust. immatures (in first Aust. summer), 57.7 (4.83; 37); in Aug.–Sept., nw. Aust. immatures at end of first Aust. winter, 64.3 (4.75; 10). These data suggest that weights of immatures remain fairly stable until pre-migratory fattening begins but confirmation needed.

STRUCTURE Similar to Large Sand Plover *C. leschenaultii* in most respects. Eleven primaries; p10 longest, p9 0–3 shorter, p8 6–11, p7 14–23, p6 22–32, p5–p2, not measured, p1 60–75. Bill, straight and slightly shorter than head. Gonys curves slightly upwards, tomlia roughly straight; distal third to distal half of bill is raised as bill-nail, which is fairly steeply decurved towards tip. See recognition section of Large Sand Plover for more information. Tarsus, slender, shorter than in Large Sand Plover (see Measurements).

AGEING Wear and moult of primaries can be used in ageing as for Large Sand Plover (q.v.).

RECOGNITION See Large Sand Plover.

GEOGRAPHICAL VARIATION Complex; five subspecies in two subspecies-groups recognized on basis of differences in breeding plumage and proportions of wing, bill and tarsus; *mongolus* group includes *mongolus* and *stegmanni*; *atrifrons* group includes *pamirensis*, *atrifrons* and *schaeferi*. Following summary based largely on most recent review (1983) by Roselaar in BWP.

Range of variation in *mongolus* subspecies-group described in Plumages and Measurements. Component subspecies not easily distinguished because no information on *stegmanni* and further work needed to establish breeding distribution and diagnostic characters of this subspecies. At present, breeding birds from Commander Is considered typical *stegmanni* (C.S. Roselaar), with range perhaps extending to mainland of far e. Siberia (BWP). From small samples available, *stegmanni* may have shorter tarsus than *mongolus* (see Measurements), with rather short and stout bill; ratio of bill-length to bill-depth averages 3.33 in *stegmanni*, 3.52 in *mongolus*. Breast-band and dark lines on head perhaps broader on average, and rather heavily pigmented; i.e. upperparts brownish rather than greyish, and rufous markings rather dark and large.

Pigmentation varies geographically in both groups of subspecies, with nominate *mongolus* being rather less pigmented, and so greyish above; however, considerable variation (partly through bleaching with wear) restricts its use in identification of subspecies.

Breeding plumage of *atrifrons* group differs from that of *mongolus* group: males have mainly black forehead and lack black border above rufous breast-band. In breeding plumage, sexes differ more (see adult female breeding). Variation in measurements mostly clinal, with *pamirensis* intermediate between the two subspecies-groups; long wing, short tarsus and short and deep bill in *mongolus* group from NE of breeding range; *atrifrons* group from SW of breeding range has relatively short wings, long tarsus and long and slender bill. Subspecies *atrifrons* has shortest wings; in males, wing 124 (2.24; 11), bill 16.7 (0.40; 11) and tarsus 32.8 (1.22; 10). Forehead and mask of males in breeding plumage, black, occasionally with white mottling in front of eye; all breast and flanks rufous. In male *pamirensis*, wing 128 (2.56; 17), bill 16.9 (1.30; 18) and tarsus 33.9 (1.30; 18); males in breeding plumage have black forehead, sometimes with small white spots at sides or with cinnamon or brown tinge on ear-coverts; below breast-band, slight rufous wash on mid-breast and flanks. Subspecies *schaeferi* has longest bill and tarsus (see Measurements), proportions recalling Large Sand Plover; often has white on forehead, and intermediate in this character between *atrifrons* and *mongolus*.

Distribution of subspecies in our region poorly known, though biometrics (Barter 1991) and breeding plumage in nw. Aust. in Mar. and Apr. confirm that at least most are from *mongolus* subspecies-group. Sight records of individuals from *atrifrons* group in Aust. (e.g. Izzard 1985; McBride 1986) not confirmed. BWP recommended use of wing-tarsus ratio (>4.1 in *mongolus* group, <4.1 in *atrifrons* group) and wing-bill ratio (>7.7 in *mongolus* group, <7.7 in *atrifrons* group) for identification to subspecies-group. Using these ratios, Lane (1986) found that eight of 25 adults caught in nw. Aust. in Oct. fell into the *atrifrons* group; of skins measured in this study 12 of 22 adults fell into the *atrifrons* group. These results clearly nonsensical, for breeding plumage in Aust. birds almost always consistent only with *mongolus* group. The common feature of skins and these live birds is that they had worn primaries and 3–5 mm decrease in wing-length in our region with wear obviously affects ratios greatly. Given these problems, it is not easy to assess how many birds from *atrifrons* group occur here; it seems likely that *schaeferi* will turn up some time, because it occurs in Sumatra and Java (Barter & Davies 1991; BWP).

The subspecies of *mongolus* group occurring in Aust. is also unresolved. Barter (1991) found bill/bill-depth ratio to be higher in live birds from nw. Aust. (average 3.54) than in live birds from Vic. (average 3.26). These values are close to average ratios available from skins (BWP) of 3.52 and 3.33 for *mongolus* and *stegmanni* respectively. They perhaps indicate that *mongolus* predominates in nw. Aust. and that more easterly breeding *stegmanni* predominates on e. coast of Aust. (and presumably NZ). However, measurements of tarsus do not differ significantly in skins from these two areas (see Measurements).

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Large Sand Plover *Charadrius leschenaultii* (nominate *leschenaultii*) (page 868)

1 Adult male breeding; 2 Adult female breeding; 3 Adult non-breeding; 4 Juvenile; 5, 6 Adult non-breeding

Mongolian Plover *Charadrius mongolus* (nominate *mongolus*) (page 860)

7 Adult male breeding; 8 Adult female breeding; 9 Adult non-breeding; 10 Juvenile; 11, 12 Adult non-breeding