

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.
Jacanidae	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, Jacanidae) 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 Jacanidae. 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 leschenaultii Lesson, 1826, *Dict. Sci. Nat.* éd. Levrault, 42: 36 — Pondicherry, India.

Named after J.B.L.C.T. Leschenault de la Tour (1773–1826), French botanist and collector in Aust. 1801–1802, Java 1803–1806 and India 1816–22.

OTHER ENGLISH NAMES Great, Large or Large-billed Dotterel or Sand-Dotterel; Greater Sandplover, Geoffroy's Plover.

POLYTYPIC Nominate *leschenaultii* breeds n. Gobi Desert of Mongolia and nw. China, winters in A'sian region; *columbinus* Wagler, 1829, breeds Middle East, s. Afghanistan and Azerbaijan; winters on Red Sea and Gulf of Aden; *crassirostris* (Severtzov, 1873), breeds from Transcaspia, E to se. Kazakhstan.

FIELD IDENTIFICATION Length: 22–25 cm; wingspan: 53–60 cm; weight: 75–100 g. Medium-sized brown and white plover; usually distinctly larger than very similar Mongolian Plover *Charadrius mongolus*, with larger, broader and more angular head, longer, heavier and more pointed bill, longer legs, and generally standing taller with more horizontal stance; slightly smaller and more compact than Oriental Plover *C. veredus*. At rest, wings fall level with or only slightly beyond tip of tail. Sexes differ. Marked seasonal variation. Juvenile and immatures separable.

Description **Adult male breeding** Lower forehead, white, with thin black vertical line in centre. Black stripe from bill, across lores, broadens into black mask round eye and ear-coverts, and joining narrow black frontal band across upper forehead. Crown and nape, grey-brown, washed pale chestnut; narrow whitish stripe above and behind black mask. Hindneck, chestnut. Rest of upperparts and inner wing-coverts, pale uniform grey-brown, with rufous edges to feathers of mantle, scapulars and tertials; when fresh, median and exposed lesser wing-coverts have narrow pale fringes, appearing slightly paler than rest of upperparts; with wear and fading, diffuse pale panel below scapulars on folded wing. In flight from above, primary coverts and remiges, mostly blackish with narrow white trailing-edge to innerwing and prominent white wing-bar across tips of greater coverts and bases of inner five primaries. Central rump and upper tail-coverts, grey-brown; white at sides. Tail, grey-brown with blackish-brown subterminal band, narrow white tip and sides. Chin, throat and foreneck, white, bordered by chestnut on sides of neck and

narrow even chestnut breast-band, which extends slightly onto anterior flanks; some have narrow dark band on upper border of band. Rest of underbody, white. Underwing, white, with narrow dusky trailing-edge. Bill, black. Iris, dark brown. Legs and feet, generally pale greenish-grey, often with darker toes and joints. **Adult female breeding** Similar to male except: facial mask and frontal band, dark grey-brown; no thin dark stripe through centre of forehead; less chestnut on crown, nape, hindneck and sides of breast-band; and no black upper border of breast-band. **Adult non-breeding** Like adult breeding but lose all black and chestnut. Crown, nape, hindneck, sides of neck, lores and facial mask, grey-brown; some have faint narrow collar. Forehead, whitish, continuing over and behind eye as poorly defined, pale supercilium. Rest of upperparts, grey-brown, with diffuse pale fringes; median and lesser-coverts similar but with dull-white fringes when fresh, forming paler panel below scapulars on folded wing, which becomes much paler and more contrasting when worn and faded. Underparts, white, with large grey-brown patches on sides of breast, sometimes joining in thin line across centre of upper breast. **Juvenile** Usually distinct only for a few months after fledging. Similar to non-breeding except: feathers of upperparts and inner wing-coverts have narrow buffish fringes and indistinct dark streaks and subterminal bands; when fresh, buff wash to face and poorly defined supercilium; patches at sides of breast, buff with grey-brown centres to feathers, with buff wash across breast in some. **First immature** Difficult to distinguish from adult non-breeding though some juvenile inner wing-coverts can be re-

tained, which look contrastingly worn, with pale fringes. **Second immature** Like adult non-breeding or adult female breeding but many retain juvenile primaries; or primaries in active or suspended moult, showing contrast between fresh inner and worn outer primaries.

Similar species Difficult to separate from **Mongolian Plover** (q.v.). **Oriental Plover** similar, differing by: more rakish appearance: smaller head; longer neck; longer wings, projecting well beyond tip of tail at rest; finer bill; stand taller on longer legs; in all plumages: uniformly dark-brown underwing, no clear wing-bar, and less white at sides of rump and tail. Juvenile, non-breeding and duller breeding plumages differ also by bolder supercilium; paler lores; and broader, poorly defined buff or brownish breast-band. Adult breeding male Oriental differs from adult breeding male Large Sand Plover by broader chestnut breast-band bordered below (not above) by black; much paler whitish hindneck and sides of neck; and forehead and sides of head and, sometimes, whole of head, whitish. Juveniles and non-breeding birds could be confused with some of **Double-banded Plover** *Charadrius bicinctus*, which are smaller, with finer bill, shorter legs, more upright stance; darker above; double breast-band or double lateral breast-patches; face and sides of neck, usually buff-brown; and clear, incisive flight call without trill. Non-breeding Large Sand Plover could be confused with non-breeding **New Zealand Dotterel** *Charadrius obscurus*, which is larger and bulkier, with shorter legs; paler above; broad brown band across lores; breast, brown, never completely white in centre, with brown smudging on flanks.

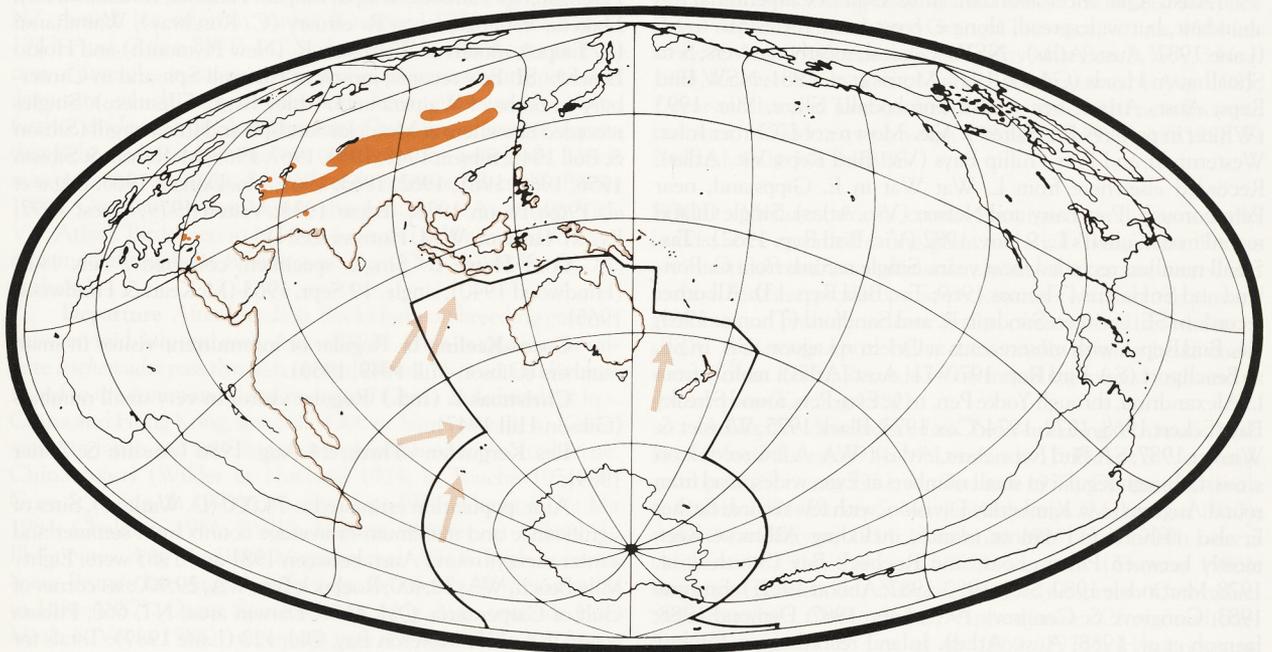
Gregarious and coastal in non-breeding season, foraging on sandy beaches and intertidal mudflats; freely join other waders when feeding or roosting, often forming mixed flocks with Mongolian Plover. Feed in typical stop-start fashion of plovers. Flight and gait typical of genus. Jizz distinctive: head rounded or rather flat-crowned and angular with sloping forehead; bill typically long and heavy, often with pronounced gonys, and nails tapering smoothly; bill usually distinctly longer than distance between base of bill and rear edge of eye; length of bill and size appear excessive for general size, making bird look front-heavy; when relaxed, adopt more horizontal stance; altogether, Large Sand

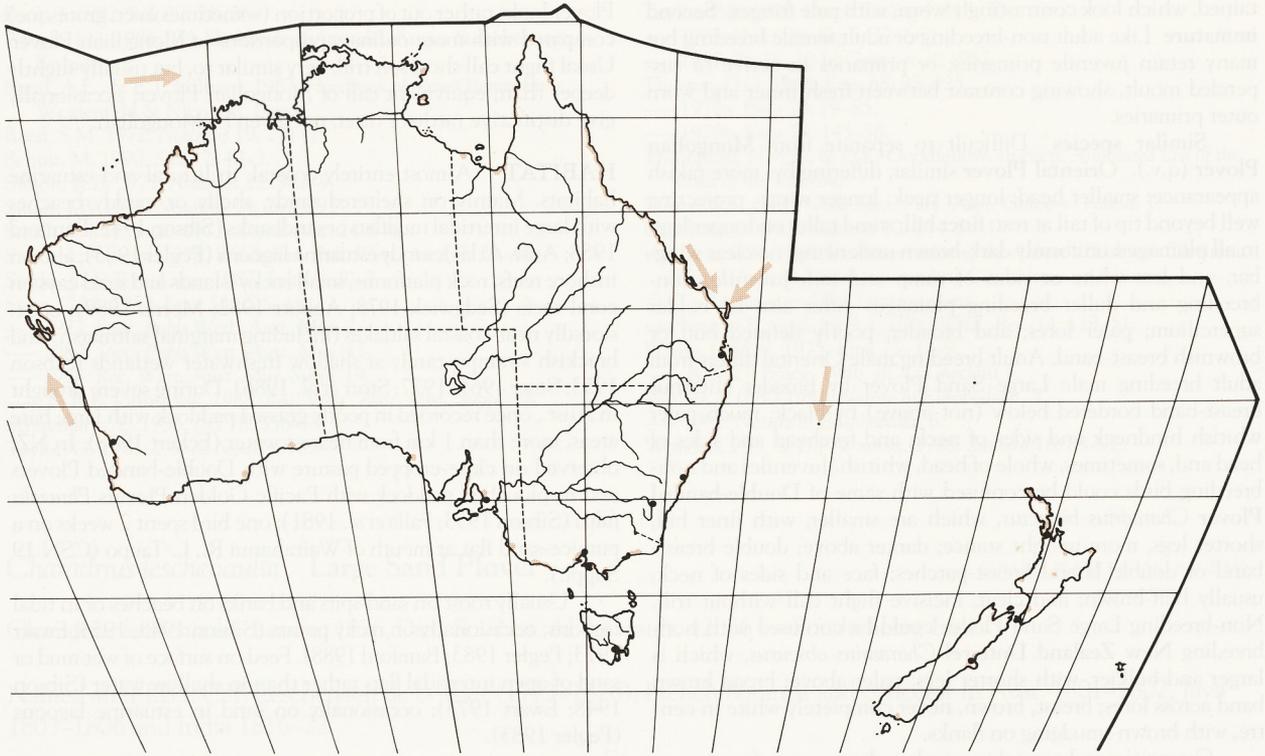
Plover looks rather out of proportion (sometimes even grotesque) compared with more ordinary proportions of Mongolian Plover. Usual flight call short soft trill; very similar to, but usually slightly deeper than, equivalent call of Mongolian Plover; occasionally give distinctive rattle or titter, not given by Mongolian.

HABITAT Almost entirely coastal, in littoral and estuarine habitats. Mainly on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks (Sibson 1948; Bamford 1988; Aust. Atlas); sandy estuarine lagoons (Pegler 1983); also on inshore reefs, rock platforms, small rocky islands and sand cays on coral reefs (Sedgwick 1978; Abbott 1982; Morris 1989); occasionally near-coastal saltlakes (including marginal saltmarsh) and brackish swamps; rarely at shallow freshwater wetlands (Sibson 1953; Storr 1965, 1977; Storr *et al.* 1986). During severe drought in Aust., once recorded in poorly grassed paddock with large bare areas, more than 1 km from nearest water (Eckert 1968). In NZ, observed on close-cropped pasture with Double-banded Plovers and in ploughed paddock with Pacific Golden Plovers *Pluvialis fulva* (Sibson 1953; Falla *et al.* 1981); one bird spent 2 weeks on a pumice-sand flat at mouth of Waitahanui R., L. Taupo (CSN 19 Suppl.).

Usually roost on sand-spits and banks on beaches or in tidal lagoons; occasionally on rocky points (Sibson 1948, 1953; Ewart 1973; Pegler 1983; Bamford 1988). Feed on surface of wet mud or sand of open intertidal flats rather than in shallow water (Sibson 1948; Ewart 1973); occasionally on sand in estuarine lagoons (Pegler 1983).

DISTRIBUTION AND POPULATION Breed from s. Siberia (Altai Mtns, Tuva Republic), Mongolia and nw. China, from S of L. Baikal, n. Gobi Desert (SSW of Ulan Batar) and se. Khangai, in deserts round Tien Shan Mountains; N to 45°N, round Kazakhstan, and W to ne. Aral Sea and e. Caspian Sea round Zaliv-Kara-Bogaz-Gol, Krasnovodsk, and Gasan Kuli, and S to Afghanistan; scattered records from coastal Azerbaijan, W to Turkey and S to Jordan, and single old record from Armenia; breeding suspected in Syria and Iran. Breeding wrongly reported Japan, Taiwan and Hainan by several authors. Non-breeding





birds accidental to Europe and Mediterranean Africa, but mainly recorded from Red Sea, S through e. Africa to s. Africa; also E through Persian Gulf to Indian subcontinent, thence to Burma and SE. Asia, E to Philippines and Micronesia and S through Indonesia, New Guinea and Solomon Is to Aust. and NZ. Transients recorded in e. China, Japan and Taiwan (Mathews 1933; Koslova 1975; Coates 1985; Urban *et al.* 1986; Lane 1987; BWP; Aust. Atlas; P.S. Tomkovich). Single, Ile Amsterdam, Oct. 1987 (Ausilio & Zotier 1989).

Aust. Qld Most abundant in se. Gulf of Carpentaria; less abundant, but widespread, along e. coast from Torres Str. to SE (Lane 1987; Aust. Atlas). **NSW** Coastal; mostly n. rivers; S to Shoalhaven Heads (Gibson 1977; Morris *et al.* 1981; NSW Bird Reps; Aust. Atlas); first record Eurobodalla Shire, Mar. 1993 (Whiter in prep.; A.E. Andrew). **Vic.** Most records Corner Inlet; Westernport and Port Phillip Bays (Vic. Bird Reps; Vic. Atlas). Recorded elsewhere from L. Wat Wat in E. Gippsland, near Peterborough, Port Fairy and Nelson (Vic. Atlas). Single inland record from Cullen's L., 9 Nov. 1982 (Vic. Bird Rep. 1982). **Tas.** Small numbers recorded most years. Single records from C. Portland and St Helens (Thomas 1969; Tas. Bird Rep. 13). All other records in SE, between Sandspit R. and Sandford (Thomas 1969; Tas. Bird Reps), with most records at Orielton Lagoon. **SA** In SE, at Beachport (SA Bird Rep. 1970–71; Aust. Atlas); mainly from L. Alexandrina, through Yorke Pen. to w. Eyre Pen. round Streaky Bay (Eckert 1968, 1972, 1974; Cox 1973; Black 1975; Winslet & Winslet 1987; SA Bird Reps; Aust. Atlas). **WA** A few records on s. coast, though regular in small numbers at Eyre; widespread from round Augusta to w. Kimberley Division, with few records farther E; also offshore and remote islands, including Ashmore Reef; mostly between Pilbara coast and Roebuck Bay (Smith *et al.* 1978; Martindale 1980; Storr 1980, 1987; Abbott 1982; Johnstone 1983; Congreve & Congreve 1985; Lane 1987; Dymond 1988; Jaensch *et al.* 1988; Aust. Atlas). Inland records from Bimbijy

Stn, 2–7 Sept. 1984 (Anon. 1984) and Rowles Lagoon, Credo Stn, 3–4 Sept. 1988 (Jaensch 1989). **NT** Common visitor to coastal Top End between Darwin and e. Arnhem Land, including Groote Eylandt (Deignan 1964; Thompson & Goodfellow in prep.); status W of Darwin to WA border not known.

NZ Straggler; very small numbers most years; maximum in a year, 11 (CSN 32). First recorded 1943 (Sibson & Bull 1946), with c. 130 records since (P.C.M. Latham). **NI** Most records in Manukau Harbour and Firth of Thames. Recorded elsewhere at Parengarenga Harbour, Waipu, Kaipara Harbour, Kawakawa Bay, Maketu, Whangaparaoa R. estuary (C. Runaway), Waitahanui (L. Taupo), mouth of Waingona R. (New Plymouth) and Hokio Beach). **SI** Few records; mostly at Farewell Spit and in Canterbury (mouths of Waipara and Ashley Rs, L. Ellesmere). Singles recorded elsewhere at Motueka Sandspit and Invercargill (Sibson & Bull 1946; Sibson 1948, 1953, 1967, 1968; McKenzie & Sibson 1956, 1960, 1961, 1962, 1963, 1965; MacDonald 1965; Edgar *et al.* 1969; Broun 1970; Edgar 1974; Veitch 1979; Guest 1992; P.C.M. Latham; W.M. Hutton; CSN).

Lord Howe I. Single, specimen, collected 2 Feb. 1914 (Hindwood 1940); single, 19 Sept. 1963 (McKean & Hindwood 1965).

Cocos-Keeling Is Regular or intermittent visitor in small numbers (Gibson-Hill 1949, 1950).

Christmas I. (Ind.) Regular visitor in very small numbers (Gibson-Hill 1947).

Iles Kerguelen Three, 24 Aug. 1986 (Ausilio & Zotier 1989).

Aust. population estimated c. 74,000 (D. Watkins). Sites of significance and maximum or average counts from summer and winter surveys round Aust. between 1981 and 1985 were: Eighty Mile Beach, WA, 30,400; Roebuck Bay, WA, 29,900; se. corner of Gulf of Carpentaria, Qld, 4160; Darwin area, NT, 660; Pilbara coast, WA, 230; Moreton Bay, Qld, 120 (Lane 1987). Totals for

summer and winter counts between 1986 and 1989 in Aust. summarized in Table 1 (Hewish 1986, 1987a,b, 1988, 1989a,b, 1990a,b). Recorded on five of 197 wetlands surveyed in sw. WA, 1981–85 (Jaensch *et al.* 1988).

Table 1.

DATE	NUMBER OF BIRDS	NUMBER OF SITES
summer 1986	425	23
winter 1986	34	23
summer 1987	723	22
winter 1987	102	23
summer 1988	156	23
winter 1988	8	23
summer 1989	149	22
winter 1989	209	21

MOVEMENTS Migratory; most migrate S from breeding grounds during n. winter to Asian and Indian Ocean shores although some CIS birds resident in s. Turkmenia (Dement'ev & Gladkov 1951; BWP). Relation between breeding and non-breeding quarters poorly known. Only nominate *leschenaultii* known to occur in Aust., probably moving from breeding grounds through s. China, Philippines and Borneo to nw. Aust. and PNG; probably return via similar route (Lane 1987; BWP). Extraliminally, rarely seen inland except on migration (Hayman *et al.* 1986). Apparently move overland across s. and sw. Asia on broad front; lack of inland sightings suggests non-stop flights between breeding and wintering areas; some follow coasts (BWP). Paucity of inland records in Aust. suggests movements rarely take birds far from coast (see Distribution). Extraliminally, large flocks seen on passage (Dement'ev & Gladkov 1951; Smythies 1981), often with Mongolian Plover (e.g. Draffan *et al.* 1983). Theoretical flight-range: birds weighing 110 g capable of flying non-stop to Chinese coast; in nw. Aust. 5% of birds in late Mar. and 28% mid-Apr. weigh >110 g (Barter & Barter 1988).

Breeding Mar. onwards in W of range, June onwards in central Asia (Hayman *et al.* 1986). Some remain in wintering areas during breeding season; recorded all months in Aust. and NZ, though less often in winter (Crawford 1972; Draffan *et al.* 1983; Aust. Atlas; BWP; P.C.M. Latham). In nw. Aust., proportion of juveniles in cannon-net catches increases during period of departure, which suggests that birds leaving are mostly adults; further, evidence from development of breeding plumage suggests that light adults in mid-Apr. are mostly second-year birds, which may remain in nw. Aust. during breeding season (Barter & Barter 1988). Occasionally seen during this period in s. Aust. (e.g. Vic., Vic. Atlas). Birds seen in NZ late June and July assumed to have remained throughout breeding season (CSN 30,34,35; P.C.M. Latham).

Departure After breeding, flocks form on breeding grounds between mid-July and early Aug. (BWP). On s. migration, nominate *leschenaultii* pass through central China, Taiwan and Ryukyu Is and so are common inland in central China and abundant in s. China and Hong Kong, late July–Oct. or Nov.; vagrant to Korea, scarce in Japan and ne. China (though commonly reported on ne. China coast) (Wildner & Hubbard 1924; la Touche 1931–34; Gore & Pyong-oh 1971; Orn. Soc. Jap. 1974; Cheng 1976; Ma 1984; Chalmers 1986; BWP). Highest numbers at Olango I., Philippines, Aug. (in 1989; Magsalay *et al.* 1990). High numbers occur Brunei, late Aug. to early Sept. (Vowles & Vowles unpubl. in Lane 1987). Occur Sumatra from early Aug. onwards (van Marle & Voous 1988); in general, pass through Wallacea, Aug.–

Sept., with some till Dec. (White 1975; White & Bruce 1986). Usually arrive Port Moresby, PNG, mid-Aug. (Hicks 1990). Small numbers move through Torres Str. (Draffan *et al.* 1983). Arrive Darwin and nw. coast of Aust., mid-Aug. to Sept.; some leave nw. Aust. by Oct. and Nov., and temporary influx occurs at Darwin in Oct. Small numbers migrate S down e. coast and along central s. coast, Sept. to Nov. (Lane 1987; Barter & Barter 1988). At Eyre, WA, birds sometimes occur during spring passage (Congreve & Congreve 1982). In nw. Aust., adults and immatures arrive first half of Aug.; juveniles arrive late Aug. (Barter & Barter 1988). Arrive NZ, Aug. or Sept. (P.C.M. Latham). Occur on Cocos-Keeling Is from Oct. onwards; small numbers regularly on Christmas I. (Ind.) during n. and s. migration, Sept.–Nov. and Mar.–May (Gibson-Hill 1949).

Non-breeding Nominate *leschenaultii* generally winters S of Thailand and Philippines, though uncommon Micronesia (Lane 1987; Pratt *et al.* 1987). In Aust., most found in N, particularly nw. Aust. (Lane 1987; Barter & Barter 1988); small numbers regularly in s. Aust., e.g. Port Phillip Bay (Vic. Atlas). Rare but regular in NZ, late Sept. to mid-Apr. (Falla *et al.* 1981; P.C.M. Latham). Some remain for months at one place, probably same birds (e.g. Edgar *et al.* 1969; Thomas 1969, 1970).

Return Migrate N along e. and central s. coasts of Aust. in Mar. and Apr., with influx at most sites in Qld in third week of Mar. Migrate N through Darwin, Mar. and Apr., though in 1985 influx occurred late Feb. to early Mar. and another in late Apr., which suggests two waves of migration. Most have left nw. Aust. by early or mid-Apr., and leave sites in Qld by end of Mar.; in 1985, all birds had left by end of Apr. (Deignan 1964; Lane 1987; Starks & Lane 1987; Barter & Barter 1988). Usually leave PNG, early May (Hicks 1990). Abundant in s. China, Apr. and May, and on passage late Mar. to late May in Hong Kong (la Touche 1931–34; Chalmers 1986). At least some arrive in Orok-nor and Kyzyl-Kum Desert, CIS, May (Dement'ev & Gladkov 1951).

Banding In nw. Aust., apparent strong fidelity to non-breeding sites; of 86 birds recaptured 1981–85, all were near banding site (Barter & Barter 1988); recoveries from Asia also suggest tendency to remain or re-occur at same non-breeding site (McClure 1974). Long-distance recoveries: one banded Roebuck Bay, 2 Sept. 1981, recovered Grangxi Province, China, 4604 km away, 12 Aug. 1982; one, banded Eighty Mile Beach, WA, 3 Nov. 1983, recovered Kwang-Si, China, 4702 km away, 4 Aug. 1985; 1-year-old, banded Taiwan, 2 Sept. 1989, recovered near Broome, nw. Aust., 4673 km away, 8 Apr. 1990 (Pook 1992). 18S122E 09 2+ U 11 4604 341 ABBBS

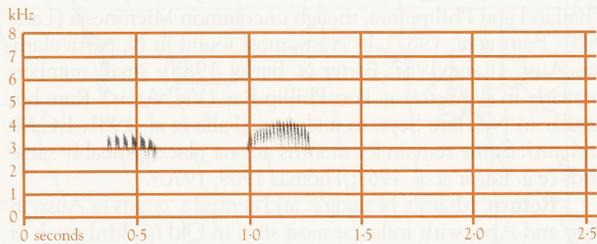
FOOD Molluscs, worms, crustaceans, insects and, occasionally, lizards; once recorded eating plant material. **Behaviour** Forage on intertidal mudflats, saltmarsh, shores of lakes and rivers, and pasture. Feed in typical stop-run-peck manner of *Charadrius* plovers, gleaning and probing in loose flocks, often with other waders or singly. Will wade up to belly, occasionally putting head under water (Glutz 1975). Recorded foot-trembling in mud and sand to disturb prey (Keeling 1982).

Adult No detailed studies. **Non-breeding** Animals: Molluscs (MacGillivray 1914; McLennan 1917; Barker & Vestjens): gastropods (Serventy 1952; van Tets *et al.* 1977). Crustaceans (Frith & Calaby 1974; Barker & Vestjens): shrimps (McLennan 1917); crabs (MacGillivray 1914; McLennan 1917; Hall 1974). Insects (McLennan 1917; Serventy 1952): ads, larv. (Thomas 1986); Isoptera: Termitidae: *Nasutitermes*; Coleoptera: Carabidae; Scarabaeidae: *Onthophagus*; Aphodiinae; Chrysomelidae; Curculionidae (van Tets *et al.* 1969, 1977); Hymenoptera:

Formicidae (Barker & Vestjens): *Iridomyrmex* (Frith & Calaby 1974). Shell and grit (Hall 1974). **Young, Intake** No data.

VOICE No detailed studies and almost no details from HANZAB area. Best summary of few available descriptions in BWP and Colston & Burton (1988). Soft calls common from feeding birds and as flight call. No sexual differences reported.

Adult TRILLING: in HANZAB area, typical call is short rippling trill, described as *treep* or *trrrt* or *dririt* (sonagram A) with longer *drri-drii-drii-drii* or rattling *trriiii-ou*; longer and louder from disputing birds (Colston & Burton 1988). Sometimes almost rattling or loud tittering. Trills very like those given by Mongolian Plover but said to be louder and longer than in that species but difficult to distinguish.



A. E. Slater & P.J. Fullagar; Broome, WA, Oct. 1992; X150

PLUMAGES Prepared by D.I.Rogers. Nominate *leschenaultii*. Succession of plumages similar to Mongolian Plover. All plumages similar to corresponding plumages of Mongolian Plover and only differences from Aust. Mongolian Plover described below.

Adult male breeding Second and subsequent alternate plumages; first attained at end of second Aust. summer. **Head and neck** Lower forehead, white, often bisected by varying vertical black (89) stripe meeting top of culmen. Narrow black (89) loreal stripe meets upper mandible and gape; broadens to black (89) mask (broader below eye), encompassing ear-coverts. Black (89) band runs across upper forehead from front of eyes (narrower in general than frontal band of *Aust. mongolus*), and scalloped by white tips to feathers when fresh. Crown and nape, grey-brown (c119B) with strong rufous (c38–c136) wash at sides and border of frontal band (rufous area generally much broader than in *Aust. mongolus*). Short narrow white stripe, sometimes washed pale rufous (c39), begins above eye and runs back above black mask. Hindneck and sides of neck, rufous (c136, c38), becoming paler (c38, c39) when worn; sometimes sharply separated from white chin and throat by narrow blackish (119) line (which is seldom absent in breeding plumage of *Aust. mongolus*). Feathers of sides of neck may be narrowly tipped white when fresh. **Upperparts** Rufous of hindneck can encroach slightly on upper mantle. Rest of mantle, back and scapulars, grey-brown (c119B); feathers have very narrow white tips when fresh, that become pale grey-brown (c45) and broader with wear; these inconspicuous at all times and grey-brown of upperparts looks rather uniform. Some have narrow rufous (c38) edges to feathers of mantle and sometimes to shorter scapulars and outer scapulars (these always absent in *Aust. mongolus*). Rump and upper tail-coverts, grey-brown (119B–119C), slightly paler than back; lateral upper tail-coverts, tipped white; rump has white sides (slightly broader than in *Aust. mongolus*). **Underparts** Upper breast, rufous (c136–c38), becoming paler (c38) when worn; breast-band sharply demarcated from white chin and throat, often by narrow blackish (119) line (latter almost never absent in *Aust. mongolus* in breeding plumage).

Breast-band generally narrower than in breeding *Aust. mongolus*, with parallel edges (breast-band narrows considerably in centre of breast of *Aust. mongolus*); sometimes encroaches on anterior flanks. When breeding plumage fresh, as is usual in our region, breast-band and hindneck generally lighter and more orange in Large Sand Plover, darker and more brick-red in *Aust. mongolus*; this distinction lost when plumage worn. Feathers of breast, tipped white when fresh; rest of underparts, white. **Tail** Grey-brown (similar to back) with darker-brown subterminal band, and broad white sides and tip (broader than in *Aust. mongolus*). Central four pairs of rectrices, grey-brown (c119B), grading to dark brown (121) or blackish brown (c119) at distal end, with white tips 3–4 mm wide when fresh. Outer web of t5, grey-brown (c119B) with broad white tip and narrow white edge; inner web white with broad grey-brown (c119B) subterminal band; t6 wholly white. **Upperwing** Marginal, lesser and median secondary coverts, grey-brown (c119B); as scapulars but can look paler when worn, with only occasional inconspicuous rufous (c38) tips. Greater secondary coverts slightly darker greyish-brown (c119A) with white tips (c. 2–3 mm wide when fresh), which meet narrower white inner edge. Primary coverts and alula, blackish brown (119), grading to dark-brown (c119A) inner edges; inner greater primary coverts, narrowly tipped white. Tertiaries, grey-brown (c119B) to dark grey-brown (c119A), occasionally with narrow rufous (c38) outer edges. 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 inner edges of inner feathers. Inner 4–5 primaries have white bases to outer webs occupying basal 40–60% of feathers; these pale patches can be tinged pale brown (c223D) on p4 and p5. White bases of primaries and white tips of greater secondary coverts meet to form narrow white wing-bar, broader (sometimes markedly so) over primaries (wing-bar of *mongolus* usually more even in width). **Underwing** Remiges, light glossy grey (c80) (slightly darker at tips of primaries) grading to white bases, larger on inner webs. Greater secondary coverts, similar; other coverts, white with greyish (c80) bases (these more concealed than in *Aust. mongolus* but can still be slightly exposed toward leading-edge). Basal halves of greater primary coverts, greyish (c80), usually concealed (unlike in *Aust. mongolus*).

Adult female breeding Similar to adult male breeding. Only two skins available, so full range of variation unknown. At least some slightly duller than breeding males, with dark grey-brown (c119A) facial mask, only grading to black (89) in centres of feathers in front of and below eye; narrower or no frontal band; no black median stripe on forehead; less rufous on sides of crown, hindneck and breast-band; no rufous edging on upperparts. In subspecies *columbinus*, sexes consistently separable on plumage (BWP) but not known if this is so in *Aust. leschenaultii*. More research needed to determine if females can be distinguished from males that have not completed pre-alternate moult.

Plate 67

Hooded Plover *Thinornis rubricollis* (page 902)

- 1 Adult; 2 Downy young;
- 3 Juvenile in fresh plumage with down remaining on head;
- 4 Juvenile in worn plumage; 5, 6 Adult

Red-kneed Dotterel *Erythrogonys cinctus* (page 928)

- 7, 8 Adult; 9 Downy young; 10 Juvenile in fresh plumage;
- 11 Immature in post-juvenile moult; 12, 13 Adult

Black-fronted Plover *Elseyonis melanops* (page 892)

- 14, 15 Adult; 16 Downy young; 17 Juvenile; 18, 19 Adult

Adult non-breeding Second and subsequent basic plumages; first attained early in second Aust. summer when c. 14 months old. Similar to adult breeding but all black and rufous markings lost. Sexes similar and only pattern of tail and stripe on upperwing differ consistently from Aust. *mongolus*. **Head and neck** Forehead, white; joins white (rarely, off-white) supercilium, often poorly defined, 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. Lorals stripe and facial mask same shape as that of adult, but grey-brown (c119B), occasionally slightly darker than crown. When fresh, lores mottled by narrow white fringes to feathers. **Upperparts** No rufous edges to feathers; otherwise similar. White sides of rump slightly broader than in Aust. *mongolus*. **Underparts** Mostly white. Large grey-brown (c119B) patches at sides of breast sometimes joined by thin line across upper breast (perhaps less commonly than in Aust. *mongolus*). **Tail** As adult breeding. **Upperwing** As adult breeding but lacks all rufous edging on tertials and inner coverts. When worn, inner wing-coverts may look conspicuously paler than upperparts. **Underwing** As adult breeding.

Juvenile Post-juvenile moult begins shortly after arrival or perhaps during s. migration; few individuals in fresh plumage seen in Aust. Differences from adult non-breeding. **Head and neck** When fresh, top of head scalloped pale buff (124) by fringes of feathers; fringes fade to whitish and become narrow with wear; can be lost from all feathers except on forecrown. Lores, forehead and supercilium, buff (92–124) at first, lores varying speckled by grey-brown (119B) shaft-streaks; ground-colour fades to whitish when worn. Ear-coverts, greyish brown (c119B), usually paler than adult non-breeding and, at first, tinged buff (124) by tips to feathers. **Upperparts** Most feathers narrowly fringed buff (124); fringes broader on scapulars, which can also have slightly darker-brown (c119A) subterminal bands. With wear, buff fringes can be lost from all feathers except some longer scapulars. Upper tail-coverts have broad white fringes, tinged buff (124) at tips (apparently differ from juvenile *mongolus*). **Underparts** Patches at sides of breast, grey-brown (c119A), heavily marked by buff (124) fringes broadest towards centre of breast; when fresh, buff (124) wash can extend across entire breast. **Tail** As adult but tips of t1–t4 tinged buff (c124) when fresh. **Upperwing** Tertials have narrow white fringes, tinged buff (c124) at tips. Lesser and median coverts have broad buff (124) fringes retained (at least on innermost feathers) until post-juvenile moult, even when this occurs as late as Apr. White tips of inner greater secondary coverts, tinged buff when fresh. **Underwing** As adult.

First immature non-breeding First basic. Very similar to adult non-breeding but with retained juvenile primaries, secondaries, most of tail, and inner median and lesser secondary upper wing-coverts. Some also retain juvenile plumage on nape and from central mantle to upper tail-coverts; all buff tipping can be lost from these upperpart feathers before moult.

First immature breeding Similar to adult non-breeding; can be aged on primary-moult (see Ageing). Some have varying amounts of breeding plumage on head, neck and breast; this uncommon in birds spending first Aust. winter in our region.

Second non-breeding As adult non-breeding.

First adult breeding Second alternate. Very similar to older adults in breeding plumage; probably not consistently separable in our region. In extralimital *columbinus*, both sexes have less rufous, in females restricted to white-mottled band on breast; males have more restricted black on head (BWP). Not known if this is so in *leschenaultii*, though Barter & Barter (1988) noted that adults remaining in nw. Aust. in mid-Apr. had less developed breeding plumage than adults that had left mid-Mar. to early Apr.; they suggested these late birds could be in second alternate.

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

All plumages Bill, black (89); some have small pinkish-brown (219D) spot at extreme base of lower mandible, or pale-brown tinge in same area. Legs and feet, can be as Mongolian Plover (q.v.) but generally paler; can be pale brown (119D, 219D) or straw-yellow (c56), with brownish-grey (c79), dark-grey (83) or grey-black (82) toes. Claws, black (89).

MOULTS Based on BWP, Barter & Barter (1988) and skins (HLW, MV) except where stated. **Adult post-breeding** Third and subsequent pre-basic moults. Complete; primaries outwards. Moult begins shortly after nesting, when in or near nesting area; most replace good deal of plumage of head and body, central rectrices, and 0–4 inner primaries within 1 month. On arrival in Aust., in mid-Aug., very few retain any bright breeding plumage, though body-moult still active. In cannon-net catches in nw. Aust. between 20 Aug. and 2 Sept., 28% had yet to begin primary-moult, 25% had suspended primary-moult after replacing 1–4 primaries (usually two or three) at staging areas on s. migration; 47% had resumed active primary-moult. Moult of body-feathers and tail continues until at least Oct.; chin and face to breast usually replaced before arrival; feathers of back through to upper tail-coverts are last to be replaced. After resuming moult, primaries replaced fairly quickly; median primary moult-score 32–33 in nw. Aust. in first week of Nov. (Barter & Barter 1988) and most complete moult in Nov.–Dec., a few in Jan. (BWP). **Adult pre-breeding** Second and subsequent pre-alternate moults; partial. Occur in non-breeding grounds in Feb.–Mar., a few continuing moult into Apr. Involves feathers of forehead, chin and throat, sides of head, upper mantle, all underparts and sometimes t1. Varying amount of feathering of upperparts moulted, often including forecrown, sides of neck, lower mantle, scapulars and tertials; feathers of hindneck and rump to upper tail-coverts often retained. Some individuals replace all feathers of head and upperparts, along with inner upper wing-coverts. Moult of females often more restricted than in males. **Post-juvenile** First pre-basic. Partial, involving most feathers of head and body and upper wing-coverts; retain primaries, secondaries, tail and some wing-coverts (including buff-tipped inner median and longest lesser coverts). Often, nape and central mantle to upper tail-coverts also retained. Moult begins late Aug. or early Sept., on arrival at non-breeding grounds; perhaps some begin moult at staging areas on s. migration. Dates of finishing, not well known; some have completed moult by late Nov.; some (perhaps a minority) have retarded moults, not completed until Mar. **First immature pre-breeding** First pre-alternate; partial or complete, involving at least some remiges and some feathers of body. Primaries nearly

Plate 68

Masked Lapwing *Vanellus miles* (page 943)

1 Adult, subspecies *novaehollandiae*; 2 Adult, nominate *miles*
3 Downy young, subspecies *novaehollandiae*; 4 Downy young,
nominate *miles*; 5 Juvenile, subspecies *novaehollandiae*;
6, 7 Adult, subspecies *novaehollandiae*

Banded Lapwing *Vanellus tricolor* (page 935)

8 Adult; 9 Downy young; 10 Juvenile; 11, 12 Adult

always moult outwards but one skin had skipped p3 in right wing, p2 and p4 in left wing. Date at which moult of primaries begins not well known and probably varies. BWP gave starting date as June (occasionally Apr. in extralimital *crassirostris*) but in nw. Aust. at least half of immatures between late Mar. and mid-Apr. in primary-moult (Barter & Barter 1988). Of 226 caught in this period, 48% were in active primary-moult, 40% had undertaken no moult, 3% had completed primary-moult and 9% had interrupted primary-moult after replacing 1–7 (usually three) inner primaries. Some moult feathers on head, mantle, scapulars and underparts, attaining some breeding-type plumage; none examined (n=3) had started primary-moult. BWP said this moult occurs Apr.–May, but it has been recorded in Aust. in late Feb. to Mar. (Rogers *et al.* 1990). It can occur with moult of inner primaries, hence designation of this primary-moult as pre-alternate. In Mar., individuals that have retarded post-juvenile body-moult are still replacing juvenile plumage with feathers of non-breeding character. Some evidence from Aust. skins suggests that these with retarded moult are also replacing some first-basic feathers of breast at this time; confirmation of this is lacking, and it may be that moult in Mar. of those with retarded moult is a continuation of first pre-basic. At end of first Aust. winter, some immatures have very worn outer primaries retained from juvenile plumage, and some have slightly worn outer primaries contrasting with older primaries inside. Latter pattern of wear produced by partial moult of outer primaries; BWP records such a moult as occurring early in Palaearctic summer in those individuals that return to (or near to) breeding areas. Not known if this can occur in immatures remaining in Aust. Further work on immatures in Aust. winter needed to provide details of moult and to investigate relations between movements in first year and moult strategy used. **First immature post-breeding** Second pre-basic. Similar to adult post-breeding but starts earlier; begins June (BWP) and moult-scores in late Aug. and early Sept. higher than in adults (Barter & Barter 1988). According to BWP, primaries may begin moult near nesting grounds before second pre-alternate moult of outer primaries completed; can result in staffelmauser pattern of moult, with p1 and p8 or p3 and p9 growing concurrently. This pattern of moult not yet recorded in Aust. and some of our birds certainly arrest first pre-alternate moult of primaries. Moult of primaries apparently slightly slower than in adults and both ages have similar moult-scores by Oct. After Oct., ageing of second-year birds seldom possible, so completion date of this moult unknown. BWP claims that primaries moult later if a partial moult of outer primaries has occurred in first Palaearctic summer; not known if this is so in Aust.

MEASUREMENTS Nominate *leschenaultii*: (1) Aust., adult skins (HLW, MV). (2) Aust., skins of immatures collected in first Aust. summer (HLW, MV). (3) Aust., skins, ages combined (HLW, MV). (4) Indonesia, skins; wing only measured on adults; BILL D = greatest depth of bill at gonys (BWP).

	MALES	FEMALES	
WING	(1) 141.8 (3.93; 138–147; 6)	142.3 (3.92; 136–147; 12)	ns
	(2) 139.5 (3.16; 135–146; 7)	141.6 (3.14; 138–146; 5)	ns
	(4) 141 (3.35; 136–147; 20)	144 (3.52; 137–149; 32)	**
STH P	(1) 91.8 (1.83; 90–95; 5)	92.3 (2.89; 88–97; 12)	ns
	(2) 90.0 (2.52; 88–95; 6)	91.2 (2.64; 88–94; 5)	ns
TAIL	(1) 53.5 (4.43; 46–60; 6)	51.9 (2.16; 48–56; 13)	ns
	(2) 50.4 (2.31; 46–54; 9)	51.2 (2.93; 46–54; 5)	ns
BILL	(3) 22.6 (0.64; 21.3–23.5; 16)	23.2 (1.26; 19.5–25.2; 18)	ns
	(4) 23.3 (0.88; 21–24; 52)	23.2 (1.10; 21–25; 67)	ns

BILL D	(4) 5.77 (0.28; 5.4–6.2; 19)	5.90 (0.28; 5.6–6.4; 16)	ns
TARSUS	(3) 36.9 (0.78; 35.3–38.4; 16)	36.2 (1.09; 34.9–38.6; 18)	*
	(4) 36.9 (2.78; 35–39; 49)	36.7 (1.38; 34–39; 65)	ns
TOE-C	(3) 23.1, 22.7	22.3 (0.37; 21.6–22.8; 6)	

Size differences between sexes negligible.

(5–7) NW. Aust., live, sexes combined; THL = total head-length; TT = tarsus plus toe, measured from back of tibio-tarsal joint to tip of middle toe-pad (Barter & Barter 1988): (5) adults; (6) immatures in first Aust. summer, Aug.–Nov.; (7) immatures, Mar.–Apr. of first Aust. summer.

UNSEXED	
WING	(5) 143.8 (4.02; 705)
	(6) 142.1 (3.32; 74)
	(7) 136.0 (4.09; 123)
BILL	(5) 23.8 (1.09; 215)
	(6) 23.8 (0.96; 90)
THL	(5) 54.7 (1.16; 423)
TT	(6) 54.4 (1.06; 126)
	(5) 61.5 (1.77; 126)
	(6) 61.5 (1.56; 94)

Length of juvenile wing significantly shorter than in adults; no differences found for length of tail or p8 but samples small. Barter & Barter (1988) also found THL to be significantly shorter in immatures but difference in means very small (0.3 mm).

WEIGHTS NW. Aust., live (Barter & Barter 1988).

	AUG. TO NOV.	END MAR. TO MID-APR.
ADULTS	74.8 (4.46; 63–87; 599)	92.6 (11.06; 66–121; 203) **
SECOND YEAR	74.4 (5.05; 58–86; 130)	–
FIRST YEAR	68.6 (5.27; 55–85; 57)	67.6 (4.98; 56–85; 162)

Weight of adults fairly stable from Aug. to Nov.; not known when begin to gain weight before migration. Mean weight of adults peaks in first week of Apr. at 104 (8.9; 82–121; 50). On basis of flight-range equations (Summers & Waltner 1979), critical weight above which adults can migrate estimated to be 110 g (Barter & Barter 1988); 5% exceed this weight in late Mar., 28% in early Apr. and none in mid-Apr. (note that flight-range equations are still being refined, e.g. Castro & Myers 1988; Piersma & Jukema 1990). It has been suggested that birds remaining in mid-Apr. are second-alternate birds either migrating late or remaining in nw. Aust. for second Aust. summer. Immatures significantly lighter than adults for first Aust. summer and autumn but have attained adult weight early in second Aust. summer.

STRUCTURE Wing, long, narrow and pointed. Eleven primaries; p10 longest, p9 1–4 shorter, p8 8–13, p7 18–24, p6 28–36, p5 38–44, (p4–p2 not measured), p1 70–81; p11 minute, concealed by greater primary coverts. No emarginations. Sixteen secondaries, including five tertials. Tail rather square, 12 feathers; t1 longest, t2 shortest and then slight gradual increase in length to t6. Bill, straight and rather long (only slightly shorter than head); tomlia straight. Strong upward inflection between gonys and mandibular rami. Distal half to distal third of upper mandible raised slightly to form slightly arched bill-nail. Nostrils, slit-like and pervious; set in large deep nasal groove extending c. 50% length of bill. Further details on shape of bill in Recognition. Tarsus,

slender, fairly long; reticulate, with largest scales on front. Distal half of tibia, unfeathered. Toes, rather short with small web between base of outer and middle; outer toe c. 82% length of middle, inner c. 72%.

AGEING From Aug. to Oct., after arrival in our region, three age-classes can be identified: (1) adults have worn outer primaries and immediately begin complete moult, or resume a complete moult suspended during migration; (2) juveniles begin body-moult to first-basic plumage but retain primaries grown on breeding grounds; (3) second-year immatures similar to adults but in later stage of primary-moult; outer primaries either retained from juvenile plumage and thus extremely worn, or have been replaced over first Aust. winter by pre-alternate moult, so look fresher than those of adults. After Oct., not all second-year immatures can be distinguished from adults. First-year immatures and adults remain separable until adults depart in Mar.–Apr.; former do not begin any primary-moult until at least Dec., while adults complete moult and most have fresh, fully grown primaries after Dec. Distinction particularly obvious Mar.–Apr., when adults have much breeding plumage; some immatures attain some breeding plumage but many remain dull. From May to July, immatures (hatched 10–12 months before) are probably only age-class in Aust.; not known if some older birds also remain.

RECOGNITION Can be confused with Mongolian Plover, though difficulty of identification has been exaggerated in Aust. literature. In e. Africa and w. coast of Indian Ocean, identification more challenging because long-billed subspecies of Mongolian and short-billed subspecies of Large Sand Plover can occur together (see Taylor 1987); no confirmed records of these subspecies in our region. Nevertheless, long-billed Mongolian subspecies *schaeferi* could occur in Aust. as vagrant, so diagnostic differences in shape of bill described below (mainly from Lewington *et al.* 1991).

Bill of Large Sand Plover usually obviously longer (see Measurements), with distance from base of bill to tip longer than distance from base of bill to rear edge of eye; in Mongolian Plover (and a few Large Sand Plover of extralimital subspecies *columbinus*), bill usually shorter than or equal to that distance. In Large Sand Plover, bill-nail of upper mandible only slightly arched and the end of bill tapers rather smoothly to a point; in Mongolian, bill-nail more strongly arched and edges of mandibles meet at steep angle at tip; net effect is that Mongolian bill looks shorter with blunt or stubby tip. Lewington *et al.* (1991) also stress importance of length of bill-nail; in Large Sand Plover, distance from base of nail to tip generally greater than distance from base of bill-nail to loreal point; in Mongolian, bill-nail usually slightly shorter than that distance. This character should be used with care in Aust. because: (1) the point at which bill-nail meets culmen is not always clear; (2) bill-nail occasionally shorter in Large Sand Plover, especially when young; (3) this character works best on *atrifrons* subspecies-group of Mongolian; in *mongolus* subspecies-group, relative length of bill-nail often overlaps with that of Large Sand Plover. Nail more strongly arched than in *atrifrons* subspecies-group, so stubby-billed appearance should be sufficient for identification of *mongolus* and *stegmanni*.

GEOGRAPHICAL VARIATION Pronounced; three subspecies recognized, differing in proportions of bill and colour of adult breeding and juvenile. Subspecies *leschenaultii* (described above) occurs in Asian region (Barter & Barter 1988), breeds in n. Gobi Desert of Mongolia and nw. China. Following based on BWP. Subspecies *columbinus* breeds Middle East, s. Afghanistan

and Azerbaijan and winters on Red Sea and Gulf of Aden; has shorter, more slender bill than nominate *leschenaultii*; bill-length 22.6 (1.13; 70) and maximum depth of bill at gonys of 5.0 (0.20; 67); gonys runs on with almost no upwards inflection from mandibular rami; nail at tip of upper mandible not strongly arched. Breeding adult *columbinus* has much rufous-cinnamon fringing on feathers of mantle, scapulars, lower breast, flanks and tertials. Juveniles usually have wider and paler fringes on upperparts. Subspecies *crassirostris* breeds from Transcaspiya, E to se. Kazakhstan; largest subspecies, with wing 147 (3.95; 38), bill 24.4 (1.20; 52) and tarsus 37.8 (1.39; 52). Intermediate between *columbinus* and *leschenaultii* for other characters but closer to latter; bill-depth at gonys slightly smaller at 5.8 (0.3; 52). Upperparts of breeding adults mostly grey as in nominate *leschenaultii* but rufous-cinnamon of breast-band and flanks as in *columbinus*. Not readily separated from *leschenaultii* in non-breeding plumage, so non-breeding distribution of these two subspecies not properly known; *leschenaultii* assumed to be most plentiful on e. side of Indian Ocean, *crassirostris* on w. side, but extent of overlap in non-breeding ranges unknown.

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Volume 2, Plate 65

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