

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	pratincoles, 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 (Fjelds  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. Gréy 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 ruficapillus Red-capped Plover

COLOUR PLATE FACING PAGE 800

Charadrius ruficapillus Temminck, 1822, *Pl. col. Oiseaux*, 1: Pl. 47, Fig. 2 — Oceania = New South Wales, *apud* Mathews.

The Latin *ruficapillus* (red-capped) refers to the chestnut crown and nape of the species, brightest and largest in male.

OTHER ENGLISH NAMES Red-capped Dotterel or Dottrel, Red-necked Plover, Sand-Lark.

MONOTYPIC

FIELD IDENTIFICATION Length: 14–16 cm; wingspan: 27–34 cm; weight: 35–40 g. Small, compact, grey-brown and white plover; larger than Red-necked Stint *Calidris ruficollis*; noticeably smaller and slimmer than Double-banded Plover *Charadrius bicinctus*, with shorter rear-end giving more compact appearance, shorter and finer bill, and proportionately longer legs. Sexes differ; female duller. Negligible seasonal variation (see Plumages). Juvenile separable. First immature sometimes separable.

Description Adult male Forehead and narrow supercilium, white, bordered above by black frontal band; supercilium and black band taper to point just behind eye. Crown, nape, rear ear-coverts, hindneck and base of lateral breast-patches, bright rufous, often with varying brown patch in centre of hindcrown. Narrow even black loral stripe (sometimes with some rufous feathering), continues behind eye to ear-coverts, down sides of neck, curving forward and broadening onto sides of breast; lores and ear-coverts occasionally joined by black under eye. Chin, throat, cheeks and rest of underbody, white. Mantle, back, scapulars, tertials, rump and inner wing-coverts, pale grey-brown, scalloped pale rufous when fresh. In flight, blackish-brown remiges and primary coverts contrast with paler upperparts, with narrow white wing-bar across

tips of greater secondary coverts and bases of inner primaries; darker-brown central rectrices and upper tail-coverts contrast with broad white sides of rump, upper tail-coverts and tail. Underwing, white. Bill, black. Iris, brown. Legs and feet, dark greyish-black. **Adult female** Always differ from adult male by: loral stripe, light rufous to grey-brown (never black), broader, usually extending below eye and continuous with ear-coverts; ear-coverts, as lores or slightly paler; frontal band, dark-brown, narrower (sometimes absent), less clear-cut, petering out in front of eye; supercilium, shorter, and poorly defined. Rufous of head and neck, paler, with centre of crown and sometimes nape, pale grey-brown, as mantle; patches at sides of breast, light rufous to greyish brown; little or no dark border to rufous cap and patches at sides of breast. Usually much less rufous on head than in males but extent of rufous of brightest females overlaps with dullest males. Bare parts as male. Rarely, some individuals show faint rufous wash across breast, broadest in centre (see Plumages, Moults). **Juvenile** Sexes alike. Similar to dullest adult females but generally duller, without any black or rufous. Feathers of crown, tipped buffish; ear-coverts and sometimes hindneck and rear of supercilium tinged brownish; narrow buff and blackish scaling on upperparts and wing-coverts when fresh; patches at sides of breast, brown,

with feathers finely fringed buffish when fresh. Legs and feet, dark greyish-black with slight greenish tinge. **First immature** Very similar to dullest adult females, and difficult to distinguish unless a few retained juvenile inner wing-coverts can be seen.

Similar species Small size, fine bill, rather pale upperparts and much white on sides of tail distinguish from all resident and migrant plovers; bright rufous cap and small black patches at sides of breast of brightest birds, diagnostic. First immatures and juveniles could be confused with non-breeding and juvenile **Double-banded Plover**, which is larger, with longer bill, proportionately shorter legs, weaker wing-bar, less white on sides of tail, and darker and browner above; head and neck often buffy, with longer, more prominent pale supercilium; darker and more prominent double patches at sides of breast; do not have brilliant white forehead and underparts of Red-capped. Same ages also possibly confused with juvenile and non-breeding **Mongolian Plover** *Charadrius mongolus*, which is larger, with thicker stubbier bill; slightly darker and browner upperparts; less white on sides of tail; longer, more prominent pale supercilium; and larger, diffuse brown patches at sides of breast. **Kentish Plover** *Charadrius alexandrinus* similar but slightly larger and with longer bill, often with paler brownish or yellowish tinge to legs and feet; easily distinguished in all plumages by complete white collar and larger dark patches at sides of breast.

Gregarious and very active. Usually in small parties though sometimes singly, in pairs or, after breeding, in flocks of hundreds. Inhabit variety of coastal habitats, especially shelly or sandy beaches with muddy or sandy flats nearby; also bare areas in and round some coastal and inland wetlands. Generally tame and approachable. Associate freely with other waders. Usually feed on dry substrates in manner typical of plovers, with rapid runs on twinkling legs, interrupted by abrupt pauses; seldom wade. Often bob head when nervous. Flight, fast and jinking, often in tight flocks. Usual flight call, quiet but brisk chip, often repeated rapidly; and buzzing; when flushed, may give sharper disyllable.

HABITAT Littoral, estuarine and terrestrial wetlands, especially in arid areas. Prefer saline and brackish waters (Lane & Jessop 1983) but tolerate varying salinities, from freshwater (Smith 1966; Badman 1979; Badman & May 1983; Gibson 1986) to brackish (Hindwood & Hoskin 1954; Storr 1977; BOAT 1982) to hypersaline (Crawford 1975; Jaensch *et al.* 1988).

Greatest numbers occur inland, in arid districts where saltlakes common (Lane & Jessop 1983). Prefer inland saltlakes, permanent or ephemeral, with wide open bare mudflats with sparse vegetation round margins on drier upper shore (Hobbs 1961, 1972; Badman 1979; Badman & May 1983; Lane & Jessop 1983; Close & McCrie 1986; Gibson 1986; Henle 1989); also on other inland waters, such as rivers, brackish and freshwater lakes, waterholes and dams, springs, and artesian bore drains and associated swamps (Favaloro 1949; Cox & Pedler 1977; Gibson 1977; Badman 1979, 1989; Badman & May 1983; Storr 1985a; Gibson 1986). Sometimes far from water on gibber plains and claypans (Parsons 1921; Hobbs 1961; Cox & Pedler 1977; Badman 1979; Gibson 1986). In coastal areas, prefer saline wetlands behind coast (Lane & Jessop 1983), including saltmarsh, saltpans and saltworks (Hindwood & Hoskin 1954; Green 1956; Smith 1966; Crawford 1975; BOAT 1982; Park 1983; Storr 1984); also in bays, inlets, estuaries, river deltas and lagoons (Smith 1966; Thomas 1968; Morris 1975; Schodde 1976; Gibson 1977; Pegler 1983; Jaensch *et al.* 1988; Chafer 1989; Schulz 1990). Less often on wide flat sandy ocean beaches, mainly those with berms or banks of sand, shell-grit or shingles, and backed by dunes (Belcher 1914; Littlejohns 1931; Hindwood & Hoskin 1954; Thomas 1968;

Bransbury 1985). Sometimes in paddocks with short cropped grass, often near water (Smith 1966; Cooper 1975; BOAT 1982). In Tas., prefer firm substrates; rarely on soft mud or in water (Thomas 1968). In NZ, recorded on margins of tidal harbours and coastal lagoons (Davis 1980; McKenzie 1980; Hughey 1989).

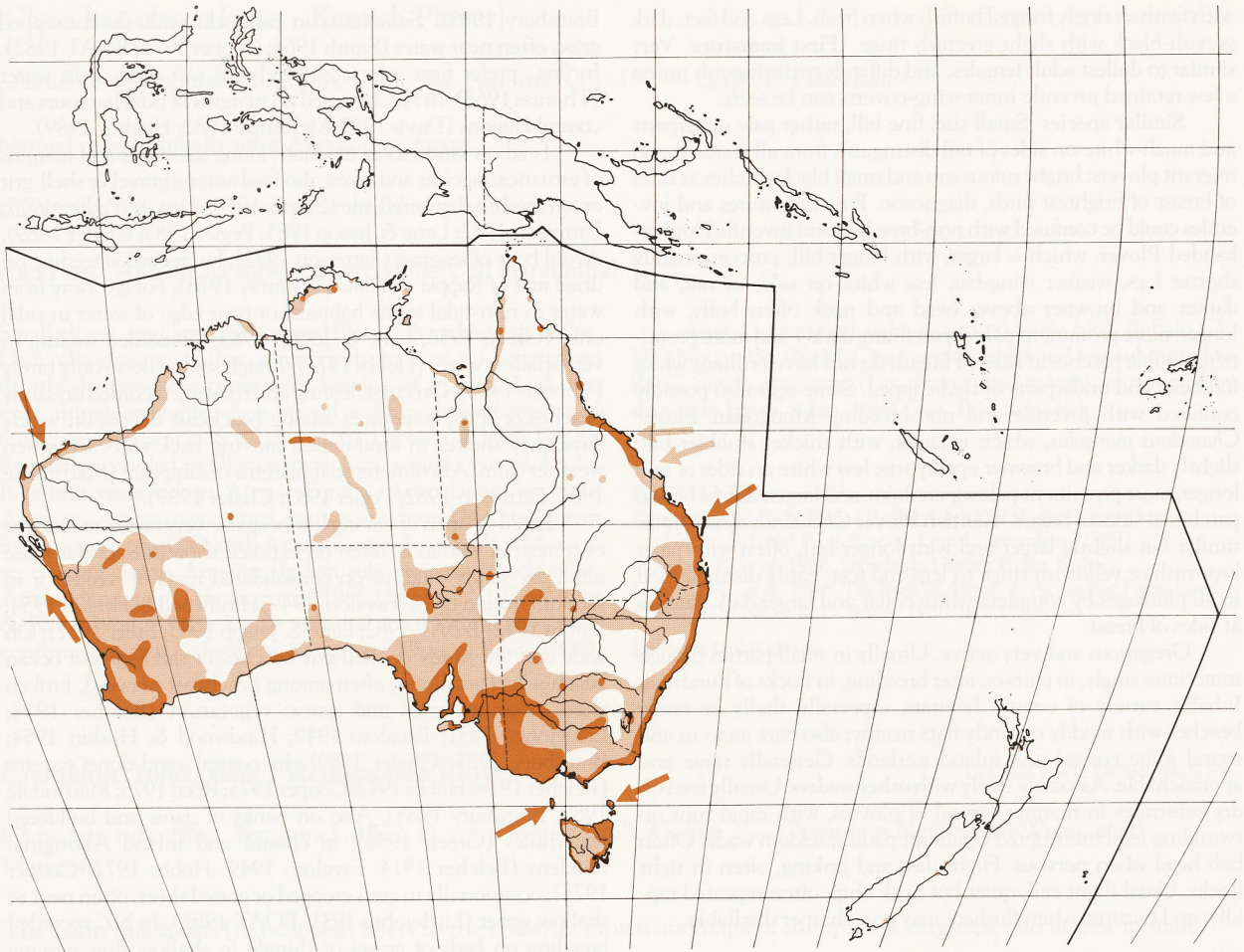
Feed on sandflats or mudflats, along seashores and margins of estuaries, lagoons and lakes; also feed among gravel or shell-grit or on freshly deposited silt (Smith 1966; Cox & Pedler 1977; Patterson 1982; Lane & Jessop 1983; Pegler 1983; Chafer 1989). Avoid beds of seagrass (Patterson 1982), but recorded feeding on dried mat of *Ruppia maritima* (Whinray 1976). Forage away from water in non-tidal saline habitats, or near edge of water in tidal ones (Green 1956; Lane & Jessop 1983). Recorded wading in very shallow water (Hobbs 1972) though said to do so only rarely (Thomas 1986). On coast, loafing and roosting recorded on sandy beaches or spits, sometimes among beachcast debris; on windy days, may shelter in sand-dunes, moving back to beach when weather calm. Also among or at margins of samphire (Martindale 1980; Patterson 1982; Pegler 1983; Chafer 1989).

Breed in open or among low or sparse vegetation at margins of terrestrial wetlands, often on exposed shorelines of flat loose sand, dry sandy mud, or on consolidated mats of weeds, or in sandhills round lakes (Favaloro 1949; Hindwood & Hoskin 1954; Hobbs 1972; BOAT 1982; Lane & Jessop 1983; Storr 1987). On wide and flat sandy or shell-grit beaches or sand-spits of ocean beaches and seashores; often among beachcast seaweed, broken shells, marram grass and sparse vegetation (Belcher 1914; Littlejohns 1931; Favaloro 1949; Hindwood & Hoskin 1954; Bransbury 1985; Chafer 1989). In coastal sand-dune systems (Belcher 1914; Hobbs 1972; Cooper 1975; Reed 1975; Martindale 1980; Bransbury 1985). Also on banks of dams and bulldozed waterholes (Green 1956); in coastal and inland Aboriginal middens (Belcher 1914; Favaloro 1949; Hobbs 1972; Cooper 1975); occasionally in grass cropped or grazed short, often next to shallow water (Littlejohns 1931; BOAT 1982). In NZ, recorded breeding on beds of gravel or shingle in shallow slow-moving rivers, up to 15 km upstream from mouth (Falla 1948; Davis 1980; Hughey 1989; Oliver).

Often recorded round artificial wetlands and watering points (see above), including sewage ponds and saltworks (Smith 1966; Crawford 1975; Storr 1987). Nesting recorded in disturbed areas. In irrigation areas, nests can be destroyed by artificial rise in water-levels caused by discharge of irrigation water (Favaloro 1949). Claimed that coastal habitats threatened by low-density residential development (Newman & Fletcher 1981).

DISTRIBUTION AND POPULATION Widespread in Aust.; mostly in s. half, but scattered records in all districts, especially near coast. Straggler to NZ. Doubtful record from s. New Guinea (Rand & Gilliard 1967).

Aust. Qld Widespread along coastline; sparse inland, in Darling Downs, SW, Central and NW districts (Aust. Atlas). **NSW** Recorded all districts, but least common on Tablelands and W. Slopes (Morris *et al.* 1981; Aust. Atlas). **Vic.** Widespread, mainly in coastal regions and w. half of State; few scattered records in n. and ne. regions (Vic. Atlas). **Tas.** Widespread; mainly in N and E, but recorded all districts; King and Flinders Is (Thomas 1979; White 1985; Tas. Bird Reps.; Aust. Atlas). **SA** Throughout e. half; generally absent W of 135°E except w. Eyre Pen., along coast and e. Nullarbor Plain (Aust. Atlas). **WA** Throughout Nullarbor Plain; mostly in SW and Goldfields districts, W of c. 122°E and S of 26°S. Scattered in Pilbara and sw. and nw. Kimberley Divisions (Aust. Atlas); few records in Great Sandy and Gibson Deserts (Start & Fuller 1983; Jaensch & Vervest



1990; Aust. Atlas). **NT** All coastal regions; scattered inland from Sturt Plain through Tanami Desert to SA border, but not E of Alice Springs (Gibson 1986; Aust. NRS; Aust. Atlas).

NZ Straggler. First recorded 1878; next recorded in 1947 (Falla 1948; Oliver). **NI** Single, specimen, Waikanae, Dec. 1878 (Oliver); single, Miranda, Firth of Thames, 13 Mar. 1966 (McKenzie 1980); several records from Karaka, Manukau Harbour: single, 22 Mar. 1968; two, 13 Jan. 1970; single, 11 Feb. 1975; single, 7 Dec. 1975 (McKenzie 1980; CSN 23). **SI** First recorded at Ashley R., N. Canterbury, single female paired with Double-banded Plover, 1947–50 (Falla 1948; Oliver). Repeated sightings on Ashley, Waipara and Leader Rs, where small population occurred between 1955 and 1980; maximum number of birds seen at any one time, eight (Davis 1980); last reported breeding attempt, 1979–80 (Davis 1980; O'Donnell & Moore 1983; Hughey 1989; CSN 7); none recorded since, despite intense searches in lower Ashley R. in 1986–87 (Hughey 1989). Singles also recorded at L. Tuakitoto, South Otago, 2 Feb. 1963 (McKenzie 1980); L. Ellesmere, 24 Jan. 1981, which is last NZ record (CSN 29).

Breeding Aust. Possibly throughout range. Recorded on most of coastline. Inland records scattered in w. Qld, w. and s. NSW, w. and n. Vic., se. and ne. SA, Nullarbor Plain, area W of line between Arch. of the Recherche, L. Violet and Shark Bay, mid-e. WA, Gibson, Great Sandy and Tanami Deserts (Storr 1985b, 1986; Gibson 1986; Aust. NRS; Aust. Atlas). **NZ** Known only from three rivers in N. Canterbury (Hughey 1989).

Population Aust. population c. 95,000 (D. Watkins). Sites of significance and maximum numbers from summer and winter counts round Aust., 1981–85, were: Eighty Mile Beach, WA, 9600; nw. lakes, NSW, 6800; The Coorong, SA, 5700; se. corner of Gulf of Carpentaria, Qld, 3620; St Vincent Gulf, SA, 3590; Roebuck Bay, WA, 3300 (Lane 1987). Numbers from summer and winter counts, 1986–89, at selected sites round Aust. are summarized in Table 1 (Hewish 1986, 1987a,b, 1988, 1989a,b, 1990a,b). Summer and winter counts on Derwent R. region, Tas., 1980–90 are summarized in Table 2 (Patterson 1984, 1985, 1986; Bulman & Patterson 1987; Bulman 1988, 1989, 1990). Along Discovery Bay, Vic., Oct. 1988, c. 0.6 birds/km of beach (Hewish 1989c). On Flinders I., average 1.1 birds/km of beach (up to 3.2/km in some sections); on King I., average 3.3 birds/km (up to 16.9/km in some sections) (Schulz 1990). Congregation of 5295 at Yantara L., NSW, Feb. 1985 (NSW Bird Rep. 1985).

Table 1

DATE	NUMBER OF BIRDS	NUMBER OF SITES
summer 1986	4556	23
winter 1986	2725	23
summer 1987	3018	22
winter 1987	2056	23
summer 1988	3219	23
winter 1988	2136	23
summer 1989	5354	22
winter 1989	1397	21

Table 2

DATE	NUMBER OF BIRDS	
	SUMMER	WINTER
1980	38	112
1981	178	240
1982	185	189
1983	55	265
1984	155	251
1985	91	150
1986	103	111
1987	88	94
1988	93	113
1989	54	234
1990	133	159

Susceptible to disturbance while breeding: incubating birds leave nest when approached by people or dogs, leaving eggs vulnerable to predation (Reid 1968; Lane 1987). A fence erected round Little Tern colony at Ls Entrance provided protection from interference (Vincent 1983). Breeding may be inhibited by disturbance from trail-bikes (Winslet & Winslet 1987), but nests recorded on edge of airstrip and within 35 m of working bulldozer (Amiet 1957). Recorded nesting successfully in pea crop (Tas. Bird Rep. 12), but harvesting operations may disrupt breeding. Adult bird killed by collision with overhead power lines (Anon. 1965).

MOVEMENTS Poorly known. Move between coast and inland wetlands; also between inland wetlands (Lane 1987). Movement to, from or between inland wetlands apparently in response to availability of suitable wetlands; move to recently filled or drying ephemeral wetlands and flooded areas, and move from completely dry wetlands and apparently from regions affected by drought (Sedgwick 1940; Favaloro 1949; Green 1956; Hobbs 1961, 1972; Thomas 1968; Close & McCrie 1986). Also, may move in response to availability of food, e.g. birds disappeared from part of saltlake when food supply diminished (Abensperg-Traun & Dickman 1989). At Eyre, WA, numbers on coast fluctuate according to state of tide and prevailing weather, sheltering in dunes on windy days and moving back to beach when weather calm (Congreve & Congreve 1982; Aust. Atlas).

Recorded flying in flocks (Hobbs 1972). Said to move by night; when moving through inland, apparently spend daylight at wetlands, with departures and arrivals of flocks occurring at night. Before departure, said to gather into compact flocks of 8–50 birds and engage in short flights (Favaloro 1949; Thomas & Wall 1966). Regularly move between coast and nearby islands, e.g. Rottneest I., WA (Saunders & de Rebeira 1986). Capable of long-distance flights over water, as shown by occurrence in NZ.

No large-scale seasonal patterns apparent (Aust. Atlas); recorded most or all of year in some places (e.g. L. George, NSW, Lamm 1964; Innisfail, Qld., Gill 1970), though seasonality in numbers apparent in many areas (e.g. Rockingham district, WA, Sedgwick 1940; Laverton, Vic., Wheeler 1955). Changes in numbers can be explained by seasonality in rainfall. Regular counts 1986–89 show high numbers normally occur at coastal sites in summer when little surface water inland, though extent and timing of movement affected by unseasonal rainfall. At lakes and marshes generally summer–autumn peak with low numbers in winter–spring (Lane 1987; Alcorn 1990). Other seasonal patterns can be explained by local rainfall, e.g. in Darwin district found inland during dry, and on beach during wet, season because during wet season inland wetlands flood; at Eighty Mile Beach,

WA, more occur in dry than wet season, possibly because lower regional rainfall (cf. Darwin) renders inland wetlands suitable only during wet season (Crawford 1972; Lane 1987). Differences in rainfall between years can explain variation in extent of movement to coast, e.g. decrease in numbers in coastal Aust. with wet conditions in inland e. Aust., e.g. 1988–89 (Alcorn 1990); influx into sw. NSW noted after 1956 floods (Hobbs 1961).

Movements between non-breeding and breeding areas in Aust. unknown. On coast, breeding is seasonal, birds dispersing to breed Aug.–Jan.; generally form non-breeding flocks summer, autumn and winter (Belcher 1914; Hindwood & McGill 1958; Thomas 1968; McGarvie & Templeton 1974; Lane 1987). Inland breeding apparently occurs in response to unpredictable rainfall and flooding (Favaloro 1949; Hobbs 1961, 1972) and thus inland breeding and flocking can occur any time of year (Lane 1987). Before breeding, some birds may disperse from coast to wetlands farther inland (e.g. Smith 1966; Thomas 1968, 1970). Fidelity to non-breeding site unknown; bird with aberrant plumage sighted in two consecutive summers (possibly same bird) at L. Connewarre, Vic. (Smith 1992). NZ birds seen at North Canterbury, SI, from late winter till Dec. where breeding occurred; apparently moved N to Auckland region, NI, where sighted Dec.–Mar. (Hughey 1989).

Banding Of 158 banded at Eyre to 1983, 26% have been sighted nearby; of 63 banded 1981–83, 20 were seen more than 1 month after banding, with longest interval between banding and sighting 2 years 65 days for bird banded as pullus; two banded birds seen 20 km E of banding site, 11 and 13 months after banding (Congreve & Congreve 1985). One banded L. George 21 Aug. 1964 found dead at Broken Hill, NSW, c. 830 km WNW, 4 weeks later (Anon. 1965).

FOOD Annelids, molluscs, small crustaceans, and some vegetation. **Behaviour** Forage on intertidal mudflats, sandy beaches, lakesides, stream banks, saltmarshes, pasture and gibber plain. Feed in stop-run-peck manner typical of *Charadrius*, locating prey by sight. Seldom wade and not reported foot-trembling or washing food.

Adult No detailed studies (stomachs unless stated). Plants: vegetable matter (Hall 1974); sds (Thomas 1986); *Ruppia* sds (Lane 1987). Animals: Annelids (obs., Cooper 1947). Molluscs (Frith & Calaby 1974; North): gastropods (Thomas 1986; Barker & Vestjens); *Coxiella striatula* (Poore *et al.* 1979). Crustaceans (obs., Cooper 1947): ostracods (Thomas 1986); isopods: *Asellus* (Frith & Calaby 1974); amphipods: *Parhyalella* (Poore *et al.* 1979); small crabs (obs., Mathews). Insects (Thomson 1935; obs., Cooper 1947; Gould; Mathews): ad. (Thomas 1986); marine insects (North); larv. (Thomas 1986); Coleoptera (Hall 1974; Cleland; Lea & Gray): larv. (Cleland; Lea & Gray); Anthicidae: *Anthicus* (Lea & Gray); Carabidae (Frith & Calaby 1974; Poore *et al.* 1979; Barker & Vestjens); Dytiscidae (Barker & Vestjens); Staphylinidae (Poore *et al.* 1979); Scarabaeidae (Poore *et al.* 1979); Melonithinae (Barker & Vestjens); Curculionidae (Poore *et al.* 1979; Cleland; Lea & Gray; Barker & Vestjens); Neuroptera: larv.; Diptera (Lea & Gray): larv. (Poore *et al.* 1979); Chironomidae: ads, larv. (Barker & Vestjens); *Ephydrella* brine flies (Lane & Jessop 1983); Coelopidae: kelp fly maggots (Jenkins 1969); Tipulidae: larv. (Poore *et al.* 1979); Hymenoptera: Formicidae (Frith & Calaby 1974); *Rhytidoponeura* (Barker & Vestjens). Small fish (obs., Mathews). Grit (Hall 1974); shell-grit (Lea & Gray).

Young, Intake No data.

SOCIAL ORGANIZATION Poorly known. Usually solitary or in pairs (Green 1956; Lane 1987; North) but also in flocks;

during breeding season, seen in families (Hobbs 1972). Flocking may occur when feeding or resting (Saunders & de Rebeira 1986). In s. and se. Aust., flocking usually occurs in non-breeding months in late summer, autumn and winter (Favaloro 1949; Wheeler 1955; Storr 1965b; Smith 1966; Thomas 1968; Morris 1975; Loyn 1978; Lane & Jessop 1983; Newman & Patterson 1986; Lane 1987), though inland, groups numbering hundreds can occur any time (Lane 1987; Aust. NRS). In Gulf of St Vincent, unusually large flocks of 1000–2000 recorded, often after breeding mostly finished but also at other times (Close & McCrie 1986). During breeding season, flocks and congregations occasionally near nesting sites, particularly inland (e.g. Hobbs 1972), of up to 200 birds (Green 1956), but also on coast (Legge 1929); may contain breeding and non-breeding birds (Green 1956). Various other reports relate to size of flocks: in coastal se. Aust., including Tas., 3–35 (Legge 1929; Newman & Patterson 1986; Field & Field 1989); in sw. NSW, generally in flocks of 6–8 (North) but up to 200 not uncommon (Hobbs 1961); in nw. Vic., 8–50 gather when moving to and from inland waters (Favaloro 1949); at L. Buloke, Vic., 3500 in July (Lane 1987); in sw. WA, gather in large numbers on shores of lakes (Sedgwick 1940); on Rottneest I., WA, up to 150 (Saunders & de Rebeira 1986). Associate with other species of waders, e.g. Double-banded Plovers *Charadrius bicinctus* (Favaloro 1949; Wheeler 1955; Smith 1966; NZRD), Black-fronted Plovers *Elseya melanops* (Jones 1938), Hooded Plovers *Thinornis rubricollis* (Legge 1929; Hewish 1989c; Campbell), Australian Pratincoles *Siltia isabella* (Favaloro 1949), Red-necked Stints *Calidris ruficollis* (Sedgwick 1940; Wheeler 1955), Curlew Sandpipers *C. ferruginea* (Wheeler 1955), Sharp-tailed Sandpipers *C. acuminata* (Favaloro 1949).

Bonds No studies. Age of first breeding, unknown; one sitting bird appeared immature, but nest unsuccessful (Hobbs 1972). **Parental care** Incubation by both sexes (e.g. Reid 1968), though apparently more by female (Hobbs 1972; Aust. NRS); in two cases, apparently by male only (Hobbs 1972). Both sexes tend young (e.g. Storr 1965b; Hobbs 1972).

Breeding dispersion On coast, usually as territorial pairs (Smith 1966; Aust. NRS), though not always (Legge 1929); inland, as solitary pairs or loose colonies (Green 1956; Hobbs 1972). Details of size and density of colonies: in sw. NSW, loose colony of 43 nests along stretch 800 m long and 180 m wide (perimeter of suitable nesting shoreline, 10 km), usually 70–100 m apart, closest 28 m (Hobbs 1972); at Long Point, Tas., six nests within one area (size uncertain), one being a few metres from another (Legge 1929); at Grimes Lagoon, Tas., c. 200 birds, almost all of which seemed to be breeding (no indication of nesting dispersion) (Green 1956); in Tas., 4–10 nests in 1 ha (Lane 1987). Sometimes nest with other waders and terns (see Breeding). **Territories** In breeding season, agonistic interactions between conspecifics seen (Abensperg-Traun & Dickman 1989); one pair recorded excluded Black-fronted Plovers from nesting territory (Jones 1938).

Roosting On Rottneest I., sometimes roost in flocks of up to 150 on mown grass (Saunders & de Rebeira 1986). On one inland lake, flock rested away from water and nests between c. 10:00 and 16:30 or longer in extreme heat; often in hoofprints or other depressions, exposed to full sun; flew back to water as one flock (Hobbs 1972). During incubation, male rests c. 20 m from nest, probably in regular spot (Hobbs 1972).

SOCIAL BEHAVIOUR Some details, particularly Hobbs (1972) but not well known. Tolerably fearless (Sedgwick 1940); when nesting, appear to accept presence of people nearby (Jones 1938; Amiet 1957; North). **Flock behaviour** When observer

approached loose breeding colony, whole flock uneasy, and flew round; small parties landed near observer and ran about, calling (Legge 1929). During day, small flocks, which form when moving to and from inland waters, gave short spectacular flights resembling those of Sharp-tailed Sandpipers; when disturbed, flew over water, calling often and performing synchronized turns, then landed near site of take-off (Favaloro 1949).

Agonistic behaviour At one nest, trespassing by Black-fronted Plovers that were nesting nearby resulted in fights; both species suffered broken feathers; Red-capped gave Distraction Display several times, fluttering round Black-fronted, but interaction generally ended in fight (Jones 1938). **Alarm** When approached by people, typically take flight when intruder c. 15 m away (Abensperg-Traun & Dickman 1989); bob heads (Sedgwick 1940). Also see Parental anti-predator strategies.

Sexual behaviour Aerial chasing frequent, involving 2–4 birds flying low over breeding area, calling excitedly and continuously; possibly courtship displays (Hobbs 1972). **Copulation** Observed several times by Hobbs (1972): always near nest-scape but never after nest-scraping. Male adopted high-stepping gait, standing erect and displaying white underparts; began by performing in front of, and then behind, female; high-stepped for 3–4 min before mounting female from behind; when high-stepping on ground for only a short time, male continued to high-step on back of female. Actual copulation brief and unusual: male threw himself on back, dragging female on top of him by gripping her neck feathers with bill. No special post-copulatory display; male may stand for a few moments after rising and one or both birds may preen for short time; then both fly away. Similar observations by Davis & Reid (1964) and Campbell (1984), but one copulation lasted much longer (125 s) (Campbell 1984).

Relations within family groups Male often makes scrapes while squatting with tail held high and breast on ground; female nearly always nearby; male often stops scraping to chase her on foot (Hobbs 1972). If eggs accidentally broken, female may scatter remains away from nest; as far as 90 m (Hobbs 1972). During hatching, female broods first chick till dry; then, while female continues to incubate, male leads it up to 20 m from nest and broods (Hobbs 1972); at another nest, parents <1 m from nest when chick hatched, but did not visit it (Littlejohns 1931). Male may shelter chick from sun (Littlejohns 1931). Though family with two chicks moves together, each parent appears to take care of one chick (Hobbs 1972). One pair of adults constantly removed ants from chick. Chick returns to call of parent (Littlejohns 1931). **Anti-predator behaviour of young** Squat beside seaweed, clump of mud, etc., and remain motionless even if touched (Littlejohns 1931; Sedgwick 1942; North); run off with wings spread (Green 1956). One sheltered under wings of adult male (Patterson 1990). **Parental anti-predator strategies** Individuals behave differently, but usually consistently (Hobbs 1972); reactions also vary with proximity to nest (Reid 1968), stage of

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

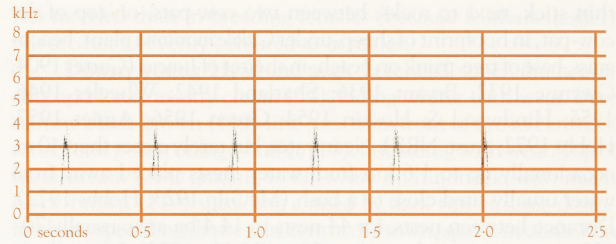
Mongolian Plover *Charadrius mongolus* (nominate *mongolus*) (page 860)

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

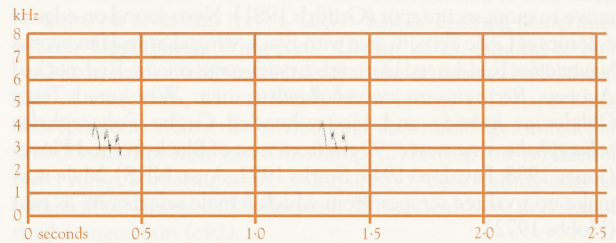
incubation (Gwynne 1932), and whether on eggs or with young (Littlejohns 1931; Hobbs 1972; North). **Distraction displays:** feign injury (Hall 1902; Jones 1938) or give Broken-wing Display (Saunders & de Rebeira 1985): bird noisy as it raises one wing and waves it in air or spreads both wings, dragging them on ground (Hobbs 1972); lies on side fluttering wings and squeaking (Legge 1929); performed on land and in water (Wheeler 1959). May perform rodent-run type display, zigzagging away from nest with back hunched, and tail depressed and dragging on ground (Reid 1968; Hobbs 1972). When on eggs, responses by sitting male and female same (Reid 1968). Reactions include flying or running from nest, rodent-runs, and excited injury-feigning (e.g. Jones 1938; Reid 1968; Saunders & de Rebeira 1985; North). When approached to within 100 m, sitting bird, usually female, **CROUCH-RUNS** erratically, with head low; then performs **ERECT RETURN**, running back towards observer, usually with mate, holding body erect, showing conspicuous white front, and continuously uttering clicking note (Hobbs 1972). When fox near nest, one sitting bird ran and performed Crouch-run mixed with Erect Return c. 20 m from fox (Hobbs 1972). When Australian Ravens *Corvus coronoides* and Little Crows *C. bennetti* overhead, bird on exposed nest runs rapidly away for c. 50 m and stands motionless; when Australian Kestrels *Falco cenchroides* overhead, flatten on nest until danger passes (Hobbs 1972). Also seen to chase Richard's Pipit *Anthus novaeseelandiae* (Gwynne 1932). If observer very close to nest or handling eggs, bird will spread wings over nest or peck hand, and call (Reid 1968; Hobbs 1972). When returning to nest, look from side to side and run in short bursts (Gwynne 1932); if female reluctant to resume incubation, male precedes her to nest or drives her back by repeatedly rushing at her on foot (Hobbs 1972). When with young, Distraction Displays more frequent (Littlejohns 1931; Sedgwick 1942; Hobbs 1972). Members of one pair also seen running and jumping over one another in zigzagging leap-frog; one bird then picked up white object and laid it on ground in front of companion (Sedgwick 1942).

VOICE Not well known; anecdotal information only. Calls described below. Excited and continuous calling in flight during courtship (Hobbs 1972), but mating display and copulation silent (Davis & Read 1964). When disturbed, birds with eggs seldom call; call persistently if there are young (Littlejohns 1931). *Pit* call (see below) sweeter and lighter than in Double-banded Plover (Davis 1980).

Adult CONTACT CALL: faint *wit-wit-wit* (Falla 1948) (sonagram A); probably *drit-drit*, often uttered in flight (Lane 1987) and *pit-pit-pit*, calling up mate (Davis 1980). **ALARM CALL:** feeble plaintive high-pitched *twink* (Sharland 1945; Condon & McGill 1952; NZRD), rather shrill (Frith 1969). **CHIRRING:** frantic, during apparent distraction display (Hobbs 1972). Calling in similar circumstances described as squeaking (Legge 1929), squawking (Reid 1968) and flute-like *poo-eet* (NZRD). Sonagram B shows



A F. van Gessel; Kooragang I., NSW, Jan. 1988; P104



B F. van Gessel; Kooragang I., NSW, Jan. 1988; P104

two *poo-eet* calls. **TICKING NOTE:** uttered continuously by bird returning to nest after disturbance (Hobbs 1972). **PARENTAL CALL:** summons young to parent; not described (Littlejohns 1931). **Other calls** Softer notes; trilling with rising cadence (Frith 1969).

Young Squeaking heard 1 day before hatching, audible to 1 m (Littlejohns 1931). Faint *chip* from recently hatched young (North).

BREEDING Fairly well known; studied by Hobbs (1972); 521 records in Aust. NRS up to Sept. 1992. Breed in simple pairs, singly or occasionally in groups of up to 44 pairs (Hobbs 1972). One record of hybridization with Double-banded Plover (Falla 1948; NZCL).

Season Largely seasonal in s. Aust., laying starting in July or Aug. and continuing till Jan., occasionally into Feb. and Mar. but may breed in almost any month. In n. Aust., breeding recorded all months but mostly Mar.–May and Aug.–Nov. **N. Qld** May–Oct. (Amiet 1957), July–Jan., Mar. (Aust. Atlas); laying, Mar.–Apr., Aug.–Nov. (Lavery 1986); eggs, late Aug. to mid-Oct. and mid-Jan. (Aust. NRS). **NSW** Eggs, early July to late Jan., also early Mar. and late June (Aust. NRS); laying, late June to late Sept. or later, occasionally in May. **Vic.** Laying, mid-Aug. to as late as early Apr. (Wheeler 1955); eggs, late July–late Jan. (Aust. NRS). **Tas.** Eggs, late Oct. to mid-Nov. (Green 1956), mid-Aug. to early Jan., plus young in late July (Aust. NRS). **SA** Aug.–Feb. (Aust. NRS); eggs, late Apr. (Aust. Atlas). **S. WA** In all months except May, mostly Aug.–Jan.; first clutches, Aug.–Sept., second, Nov.–Jan. (Halse & Jaensch 1989). **N. WA:** Apr. and June–Sept. (Aust. Atlas); eggs, early May and early Aug. (Carter 1904; Aust. NRS). **NT** Apr., May and July (Aust. Atlas); eggs, late Mar. and early Sept. (Aust. NRS).

NZ Eggs recorded early Aug., small young in late Oct. (Falla 1948; Davis 1980).

Site On ground in sand, shell-grit, mud or stony areas, on beaches, dunes, sand-spits, sandflats along foreshore of rivers, gibber plains, on islands in samphire, brackish or freshwater lagoons, canegrass swamps, levee banks, bank of dam, edge of sewage pond, salt pans, middens, dry or drying mud, dredge-spoil, slag, levelled dump of building rubble, edge of airstrip; on grassy ridge, side of sand hummock, in tuft of grass, samphire, on thin mat of weed on dry mud, among driftwood, seaweed next to long

Plate 66

Oriental Plover *Charadrius veredus* (page 877)

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

Inland Dotterel *Charadrius australis* (page 884)

7 Adult male; 8 Adult female; 9 Downy young
10 Juvenile; 11, 12 Adult male

thin stick, next to rocks, between two cow-pats, on top of dry cow-pat, in hoofprint of sheep, under *Cakile maritima* plant, beach-grass, base of tree-trunk on beach, in shelter of *Juncus* (Carter 1904; Gwynne 1932; Bryant 1936; Sharland 1942; Wheeler 1946, 1955; Hindwood & Hoskin 1954; Green 1956; Amiet 1957; Hobbs 1972; Aust. NRS). Near water, but rarely closer than 40 m, occasionally up to 1.6 km from water; nests placed away from water usually sited close to a bush (McGilp 1923; Hobbs 1972). Distance between nests, for 44 nests in 14.4 ha area: usually 70–100 m apart, never closer than 28 m (Hobbs 1972). Lay replacement clutches near previous site but if continually unsuccessful, move to more secure spot (Griffith 1981). Nests found on edge of colonies of Little Tern; in area with Black-winged Stilts *Himantopus himantopus*, Red-kneed Dotterels *Erythrogonys cinctus*, Red-necked Avocets *Recurvirostra novaehollandiae*; near Whiskered Terns *Chlidonias hybrida* and Hoary-headed Grebe *Poliiocephalus poliocephalus*; one nest c. 90 cm from nest of Black-fronted Plover (Jones 1938; Falvaloro 1949; Starks 1992; Aust. NRS). Male may make up to three scrapes, from which female selects one as nest (Hobbs 1972).

Nest, Materials Usually small depression in ground, unlined or lined with a few small flat shells, stones, bits of grass, saltbush, seaweed, waterweed, feathers, even sheep dung (Gwynne 1932; Wheeler 1946; Green 1956; Hobbs 1972); lining material often white (Aust. NRS). Nests on damp mud made of substantial cones of waterweed (Hobbs 1972). Male often makes scrape while squatting, with tail held high and breast on ground (Hobbs 1972). Stone chips may be collected from up to 100 m away (Hobbs 1972). May encircle depression with small shells or stone chips, which are sometimes added during incubation; vegetation added to one nest during incubation (Jones 1938; Aust. NRS). **MEASUREMENTS:** one nest 10 cm in diameter, 1.3 deep (Storr 1965a); thickness of lining of nest on dry mud, c. 6 mm thick; on wet mud, 25 mm (Hobbs 1972).

Eggs Short to elongate oval and pyriform; close-grained, smooth, slightly lustrous; light yellowish-stone to pale-brown and yellowish-brown ground-colour, occasionally tinged green, with irregularly shaped freckles, spots, small blotches and short streaks of black or blackish brown, with similar but fewer underlying markings of ashy grey. Markings may be fairly evenly distributed or larger and predominate on thicker end where sometimes form cap or zone (North). **MEASUREMENTS:** 30.8 (1.57; 29.2–33.3; 8) x 22.6 (0.67, 21.6–23.4) (North).

Clutch-size Almost invariably two eggs per clutch; two records of nests with one egg incubated by male only; rarely, three eggs, one nest with four eggs (Wheeler 1955; Hobbs 1972; Aust. NRS). A nest with four eggs contained one pair distinctly different from other, no doubt a result of two females laying in same nest (Littlejohns 1931).

Laying Laying interval often 1 day, but second egg sometimes laid 2–3 days after first (Aust. NRS). Will re-lay after failure; said to re-lay up to five times; one interval between failure and re-laying, 2 weeks (Griffith 1981).

Incubation Female does almost all incubation but male may incubate during or just after laying (Hobbs 1972; Aust. NRS). Hatch synchronically (Gwynne 1932). **INCUBATION PERIOD:** 30 days (n=1; Aust. NRS); 31 days (Gwynne 1932). Eggshells removed from nest; broken eggs and dead embryos removed by female and deposited in different places away from nest (Hobbs 1972).

Young Precocial, nidifugous. No other information. **Parental care, Role of sexes** At three nests during or just after hatching of an egg: female brooded newly hatched young for about 1 h until dry, then male led chick away, up to 20 m from nest, while female

continued to incubate unhatched egg; after both eggs hatch, adults and young move away as family unit (Hobbs 1972). Perform Broken-wing Display to distract intruder (Jones 1938).

Success From 79 eggs, 15 hatched (Hobbs 1972); 87 eggs, 27 hatched (n=46; Aust. NRS). Eggs washed away by floods, trampled by sheep, people, probably taken by ravens *Corvus* and foxes (Littlejohns 1931; Gill 1970; Hobbs 1972; Aust. NRS).

PLUMAGES Prepared by D.I. Rogers. Hatch in natal down, replaced by juvenile plumage. Partial post-juvenile moult (first pre-basic), usually not including remiges and always excluding most coverts of upperwing, begins shortly after fledging and results in dull-coloured first immature plumage; sexes similar to this stage. A partial (first pre-alternate) moult at end of first winter produces second immature plumage, rather similar to adult plumage and the first in which sexes differ. Adult plumage attained with complete second pre-basic moult when c. 12 months old. Adults replace all plumage in post-breeding moults and most feathers of body in pre-breeding (pre-alternate) moults, but seasonal changes in appearance negligible. Age of first breeding unknown.

Adult male breeding Second and subsequent alternate plumages; first attained late in second winter. **Head and neck** White forehead meets short white supercilium, which tapers abruptly behind eye. Forehead neatly outlined by uniformly narrow black (89) loreal stripe from eye to base of upper mandible, and by black (89) frontal band above forehead, c. 3–5 mm wide, tapering posteriorly, which runs back above rear of eye and may extend to rear of supercilium. Crown, nape, hindneck and sides of lower neck, rufous (c340), fading paler (38, 39) when worn; feathers have concealed grey (84) bases. In centre of hindcrown, feathers, greyish brown (c79 or browner) with rufous (38) to cinnamon (39) tips and grey (84–85) bases. Hindcrown usually looks duller than crown, even when fresh; when worn, always brownish spot on hindcrown of varying size. Upper auriculars vary from rufous (continuous with nape) to black-brown, continuous with rest of auriculars and occasionally joined to loreal stripe by narrow blackish line below eye; more often white of lower face meets underside of eye. Lower auriculars, black-brown (119); this marking often joins narrow black-brown continuation of loreal stripe (eye-stripe) behind eye. Chin and throat, white; always separated from rufous of hindneck by narrow black-brown (119) line. **Upperparts** Rufous of hindneck sometimes extends onto upper mantle. Rest of mantle, back and scapulars, grey-brown; when fresh, scalloped by light rufous-brown (39) tips c. 1 mm wide. With wear, tips fade to creamy white (c92) and become narrow; they can be totally lost. Most subscapulars have narrow white fringes, broadest on outer webs; longest has narrow, cream (c92) to pale-rufous (39) fringe. Central rump and upper tail-coverts, dark brown (121), with narrow cinnamon-brown (39) tips, which are lost with wear; lateral rump and upper tail-coverts, white. **Underparts** Mostly white. Small black-brown (119) crescent at sides of upper breast continuous with narrow dark line down sides of neck and can form slightly collared appearance. Crescent sometimes has olive-brown (c28) rear-boundary. **Tail** Blackish, with white sides; t1–t3, dark brown (121); t2 and t3 narrowly fringed white; t4–t6, white; t4 usually has brown (119B) subterminal band or spot near tip. **Upperwing** Tertial coverts, median and lesser secondary coverts, as scapulars. Tertials, dark grey-brown, with narrow cinnamon (39) to cream (92) fringes. Marginal coverts, dark brown (c121). Greater secondary coverts, black-brown (119) grading to dark brown (c121) on inner feathers; all have broad white tips, c. 2–3 mm wide. Ground-colour of alula, primary coverts, primaries and secondaries, black-brown (119); secondaries, inner primaries and primary coverts, narrowly

tipped white. Outer webs of p1–p5 have white bases; these combine with white tips of greater coverts to form long white wing-bar, broadening on primaries. **Underwing** Remiges mostly grey (c84), grading to grey-white lores; outer primaries grade to blackish (c82) tips. Secondaries and inner primaries, narrowly tipped white. Most coverts, white. Greater primary coverts, light grey (85), with broad white tips. Light-grey (c85) bases of median and lesser primary coverts and outermost greater secondary coverts also partially exposed.

Adult female breeding Second and subsequent alternate plumages. Differences from adult male. **Head and neck** Loral stripe, never black; usually greyish brown (c119B) to dark greyish-brown (c119A), with scattering of rufous (38–340) feathers; in a few, almost all loral stripe, rufous. Loral stripe wider than in males and usually broadens at eye; often extends below eye as grey-brown line continuous with ear-coverts; in a few, white of lower face meets underside of eye. Ear-coverts, greyish brown (c119A–c119B), washed pale rufous (c39) posteriorly. Frontal band, dark brown (119A) to black-brown (119), never black as in males; narrower (maximum width 2–3 mm) and can be absent; never extends back as far as top of eye. Supercilium generally shorter than in male, sometimes only reaching top of eye; rear of supercilium sometimes washed pale rufous (c39) (especially behind eye) and thus poorly defined (always pure white and sharply demarcated in adult males). Rufous on top of head generally paler and less extensive than in adult males, ranging from rufous (c38) to light rufous-brown (c39). Rear of frontal band and extreme sides of crown and neck always, and hindneck generally, rufous. Size of these areas varies, shade of rufous tending to be darkest in those individuals with largest rufous areas, which can perhaps overlap slightly with adult males. Usually, brown patch of hindcrown much larger and extends onto nape and central crown; feathers in latter area, usually fringed rufous (c38) to light rufous-brown (c39) and look browner when worn. These feathers darker brown (c119A) in centre, lighter brown (c119B, fading to c119C when worn) at sides; with wear, dark centres exposed; top of head can look mottled when worn, recalling juvenile; this never happens in adult males. **Upperparts** Black-brown shafts of feathers generally more conspicuous than in males; tips of feathers similar to those of males but extend slightly onto edges of feathers. Also, fewer feathers of upperparts replaced during pre-alternate moult less evenly coloured or more mottled in females. **Underparts** White. Dark crescent on sides of upper breast generally smaller than in males and can be absent; usually greyish brown (c119B) varying mottled by light rufous-brown (c38–39) tips; centres of feathers can be darker brown (c119A) but seldom exposed. **Upperwing** As with mantle, back and scapulars, a tendency for median and lesser secondary coverts to look more mottled than in males; effect less striking than on upperparts because both sexes retain wing-coverts during pre-alternate moult. **Tail, Underwing** As male.

Adult male non-breeding Second and subsequent basic plumages; first attained in second summer, c. 15 months after fledging. Very similar to adult male breeding. Brown spot of hindcrown usually larger but, as in male breeding, entire cap can be rufous. Occasionally, some rufous (c38) feathers in loral stripe, though borders of stripe always black; two of 17 examined had neat narrow rufous line running through centre of loral stripe, and two others had a few rufous feathers scattered in this area.

Adult female non-breeding Very similar to adult female breeding. Rufous feathering in loral stripe perhaps less common; of six examined, three had a few rufous feathers on lores, three had none. Top of head, mantle, back and scapulars tend to look

less mottled than in breeding females (because feathers fresher) but are not as evenly coloured as in males.

Downy young Head and neck Forehead, supercilium, eye-ring and lores, mostly cream (54), fading whiter with wear. Very narrow black-brown (119) line runs from front of eye to centre of lores; loral point, orange-buff (c118), not fading with wear. Top of head, cream (c54) grading to off-white on hindneck, with much black-brown (119) speckling caused by dark tips of some down-feathers; speckling densest in centre of crown, sparse or absent on hindneck. Speckling also heavy behind eye and may form narrow broken blackish post-orbital line. Ear-coverts, cream (54), grading to white on chin and throat. Lower half of eye-ring sometimes white. **Upperparts, Wing-pads** Cream (c92), grading to buff (c124) on base of wing-pads and off-white on sides of back; distal half of wing-pads, white. Much black-brown (119) speckling above, in some areas so dense that large dark markings formed: (1) mid-dorsal stripe from mantle to rump; (2) broken line on sides of lower rump, bordering white underparts; (3) dark trailing-edge to basal half of wing-pad. **Underparts** White, with vent and rear of thighs tinged buff (c92).

Juvenile Sexes similar. Post-juvenile moult occurs in first summer or autumn. **Head and neck** Forehead and short supercilium, cream (c92) to creamy white. Crown and nape, mottled brown, with obvious pale scalloping; feathers, light brown (119C), grading to brown (c119B) subterminal fringes, with buff (124–92) fringes. Loral stripe, light brown (223D), flecked or mottled by black-brown (c119) shaft-streaks; stripe broadens near eye and merges to cinnamon (39) ear-coverts and sides of neck; cinnamon tinge can encroach on hindneck and rear of supercilium. Feathers of hindneck rather downy in texture; light brown (119C) with pale-grey (86) bases that are often exposed, and narrow cinnamon (39) tips that impart generally cinnamon tinge. Chin and throat, white. **Upperparts** Ground-colour similar to that of adults but mantle, back and scapulars, neatly scalloped by pale-buff (c92) fringes 1–2 mm wide, and much narrower dark-brown (119A) subterminal fringes. Central rump and upper tail-coverts, tipped orange-buff (c118). **Underparts** White; crescents at sides of breast about same size as those of adult female. Feathers, dark brown (119A), grading to brown (119A) centres; buff (124) fringes form heavily scaled pattern. **Tail** Similar to adult but t1 to t3 fringed cream (92) when fresh. **Upperwing** Median and lesser secondary coverts and tertials, as scapulars. Rest similar to adults, but tips of remiges slightly narrower and more pointed. **Underwing** As adult.

First immature First basic. Attained rather soon after fledging; moulted in first winter. Sexes similar, both rather like adult female. **Head and neck** Forehead, white. Loral stripe, grey-brown, often extending below eye and continuing to ear-coverts; perhaps generally broader in females (see Sexing). Demarcation between white forehead and dark crown sharp, but there is no frontal bar. Top of head and hindneck, uniform grey-brown (c119B, as adults), sometimes with narrow light rufous-brown (c39) tips to all feathers (though seldom on hindcrown); tips broadest on hindneck and on sides of crown and neck behind eye; these areas can look wholly dull rufous (c38) but are generally conspicuously less brightly coloured than in adult females. **Upperparts** Ground-colour, as adults. Feathers of mantle, back and scapulars have pale fringes of uniform width; these are 1–2 mm wide and buff (124) when fresh, narrower and cream (92) when worn. Unlike juveniles, no dark-brown subterminal fringes to first-basic feathers. Many retain juvenile feathers on rump and upper tail-coverts. **Underparts** Crescents at sides of breast, similar to adult female but often with white fringes to feathers. **Tail** Often all rectrices retained from juvenile plumage, in which case cream fringes of t1–t3 are

helpful ageing character. Some replace at least some inner feathers. **Upperwing** Nearly all retained from juvenile plumage, except for marginal coverts; smaller lesser coverts and sometimes outer median secondary coverts. Coverts can become too worn for tips and subterminal fringes of juvenile coverts to be used in ageing; these markings persist longest on innermost median and greater coverts, which are usually concealed by scapulars. **Underwing** As juvenile.

Second immature First alternate; attained in first winter. First plumage in which sexes can be distinguished readily; closely similar to adults of respective sexes. **Males** Brown patch of hindcrown generally larger than in older birds and in this character overlap slightly with brightest adult females. Frontal band, black (89) to black-brown (119), darker than female and shaped like that of adult male; loreal band like that of adult males and reliable sexing character. All juvenile upper wing-coverts have lost distinctive pale tips and dark subterminal bands, appearing extremely frayed compared with upperparts. **Females** Like adult females except for slightly larger brown patch on hindcrown, and worn upper wing-coverts retained from juvenile plumage.

Aberrant plumages Smith (1992) recently published record of an unusual individual at L. Connewarre, Vic. in summers of 1990–91 and 1991–92. Sexed (by Smith) as a male on basis of orange-rufous crown and upper nape, it was similar to ordinary Red-capped in structure but had a broad deep-rufous band across breast. This band was narrowest at sides where it met rufous lateral breast-crescents; upper boundary was sharply defined and ran straight across junction of foreneck and upper breast. Lower boundary extended closest to belly in midline of body and hence looked U-shaped; rufous suffusion ran from lower breast onto belly. Some characters of this bird seem more characteristic of females: grey-black (not black) loreal stripe broadening considerably below eye to meet reddish-brown ear-coverts; short white supercilium only just reaching eye. If it was female, aberrant coloration must also have affected crown and nape. Two records of somewhat similar birds from Avalon and Jack Smith's L., Vic., from Feb. and Mar. 1991 (D.W. Eades; T. Reid). These were adult females with solid rufous loreal lines broadening below eye to meet rufous ear-coverts. They had large rufous patches at sides of breast that broadened towards centre of breast but did not form complete band. Pale rufous (almost buff) wash across whole central breast, formed by rufous feather-tips, contrasted with clean white of throat and belly; combined, patches at sides of breast and pale rufous wash covered the same area as U-shaped breast-band of the L. Connewarre individual. Much rufous on hindneck and nape. Avalon bird had small rufous patch on anterior flanks, largest on right side.

Hybrids Hybridization with Double-banded Plover has been reported once in NZ (Falla 1948; Oliver). Offspring resulting from male *bicinctus* and female *ruficapillus* parents, said to be 1 year old, was rather similar to adult female Red-capped but with narrow chocolate band across upper breast and no rufous marking on sides of neck (Oliver).

BARE PARTS From photos (Simpson 1972; Pringle 1987; Aust. RD; NZRD; unpubl.: J.N. Davies, R. Davies, D.W. Eades). **Adults, Immatures** Bill, black (82–89). Iris, black-brown (119). Tibia, tarsus and toes, black (89) or grey-black (82) to dark grey (83). Curry (1981) saw two in s. WA with bright carmine-red legs. **Downy young** Bill, grey-black (82) with dark-grey (83) base; small white egg-tooth at hatching. Iris, black-brown (119). Tarsus and toes, dark grey (83) at hatching with grey-white soles; while still small, legs become light blue-grey (88). **Juvenile** Legs, dark grey (83) in only photo available.

MOULTS Based on skins of 95 adults and 30 younger birds, except where stated. **Adult post-breeding** Second and subsequent pre-basic moults; complete. Primaries moult outwards; inner feathers shed rapidly and 3–4 of them may grow concurrently. Outer primaries replaced less quickly and usually only one or two of outer five primaries grow concurrently. Sequences of moult of secondaries and tail unknown. Moult of body-feathers begins shortly before moult of primaries; most of body looks fresh by time primary moult-score reaches 30, but slower body-moult continues until all primaries have been replaced. In s. Aust., moult during summer; in Vic. and Tas., Jessop (1990) found males moulted primaries between Jan. and late Mar., females between Nov. and mid-Mar. Skins show a similar story except that several males have been recorded with moult in Nov. (including one with primary moult-score 27 on 28 Nov.); several birds of each sex had not begun moult by Dec.; one female skin had completed moult by mid-Jan. Primary-moult usually complete by Apr. but, in some, moult probably continues until May or June, e.g. male with primary moult-score of 16 in last week of Mar., female with moult-score of 21 in first week of Mar. These data suggest timing varies but not known if variation is individual or from year to year. Few data (19 records) available from s. WA but these also suggest varying timing; earliest records of active primary-moult from 20 Oct. (primary moult-score 20), earliest completed moult by 30 Dec.; some have yet to begin primary-moult in first week of Dec. and latest record of active-moult (primary moult-score 41) from first week of Apr. Timing apparently differs in n. WA, adults moulting earlier (Jessop 1990). Moult already under way when first n. WA samples (from n. coast between Port Hedland and Broome) were banded in Aug., and most birds had primary moult-score of over 35 when last samples were banded in Nov. Bamford (1983) also recorded rather early moult at Shark Bay, WA, in late Sept. 1981 when two of 11 had completed primary-moult and five were in primary-moult. **Adult pre-breeding** Second and subsequent pre-alternate moults. Partial, never including primaries, secondaries or tail. Active moult has been recorded in se. Aust. in July and Aug. Males usually moult all feathers of head and body but can retain some scapulars and tertials; retain all primary coverts, greater and median secondary coverts and longest lesser coverts. Females have more restricted moult; usually retain patch of basic feathers from hind- or mid-crown to nape. Also retain good deal of upperparts; basic feathers usually scattered throughout but more numerous towards tail. Some females replace up to c. 70% of feathering of upperparts. Extent of moult of underparts of females varies; often complete but basic feathers can be retained on breast and belly. Small amount of moult in upperwing similar to males but some females retain marginal and smaller lesser coverts and more tertials. **Post-juvenile** First pre-basic. Partial; retain most juvenile upper wing-coverts and usually retain primaries and secondaries. Timing and duration of moult not well known; 12 records available of active moult scattered between early Dec. and late May. Large range of dates may reflect varying timing rather than extended duration. All feathers of head and body can be moulted but many retain juvenile rump and upper tail-coverts; a few retain juvenile feathers on crown. Marginal and smaller lesser coverts and sometimes inner rectrices and outer median secondary coverts moulted. A few, perhaps individuals that fledged early, moult some or all primaries (in outwards sequence, starting at p1) during first summer or autumn but retain juvenile coverts of upperwing. Four such individuals examined, collected Dec.–Feb.; three had primary moult-scores of 49 but had completed first pre-basic moult of feathers of head and body. Confirmation that this primary-moult coincides with first pre-basic moult of body lacking; it may be that this primary-moult is

separate event or an early stage of first pre-alternate. **First immature pre-breeding** First pre-alternate. Partial; active moult has been recorded late Sept. and early Oct. but some have completed moult by this time. Similar to pre-alternate moults of adults, but males can retain a few first basic feathers in upperparts and occasionally in forecrown. If not replaced in first pre-basic, rump and upper tail-coverts are moulted in first pre-alternate. As with subsequent pre-alternate moults, females moult fewer body-feathers than males. Moult certainly involves underparts but not known if all feathers of underparts replaced.

MEASUREMENTS (1) Aust., S of 30°S, adult, skins (HLW, MV, SAM, WAM). (2) As (1) but wings only from birds with fresh p10. (3) As (1) but wings from birds with worn p10. (4) Aust., juvenile and immature, skins (HLW, MV, SAM, WAM).

	MALES	FEMALES	
WING	(2) 105.4 (3.02; 98–113; 24)	105.0 (2.04; 102–108; 13)	ns
	(3) 104.2 (2.92; 98–102; 22)	104.1 (2.40; 100–108; 19)	ns
	(4) 103.9 (2.68; 100–108; 11)	102.9 (2.51; 100–109; 10)	ns
8TH P	(1) 70.1 (1.58; 67–73; 10)	69.1 (1.81; 66–71; 7)	ns
TAIL	(1) 41.5 (2.02; 38–46; 24)	39.7 (2.11; 35–42; 18)	**
	(4) 40.0 (2.18; 37–44; 8)	39.1 (2.38; 36–43; 9)	ns
BILL	(1) 13.8 (0.75; 12.2–15.5; 43)	13.9 (0.68; 12.4–15.4; 34)	ns
	(4) 13.7 (0.52; 13.0–14.8; 13)	13.4 (0.87; 11.7–14.7; 10)	ns
TARSUS	(1) 25.7 (1.08; 23.7–28.8; 43)	25.6 (1.07; 23.3–28.0; 36)	ns
	(4) 25.5 (1.02; 22.6–26.8; 13)	25.0 (0.99; 23.6–26.3; 12)	ns
TOE-C	(1) 18.4 (0.66; 17.3–19.3; 11)	17.7 (0.68; 16.5–18.6; 9)	ns
	(4) 17.5 (0.66; 16.6–18.5; 5)	17.3 (0.55; 16.4–17.9; 4)	ns

Differences in size between sexes negligible. Wing-lengths of adult similar in birds with worn and fresh p10. Juvenile wing may be slightly shorter than in adults; above data suggests this is so (at least for females). Measurements from live birds (Jessop 1990) also suggest this is the case; juveniles and first immatures had wings of 103 (4; 25), 103 (3; 44) and 101 (3; 37) in Vic., Tas., and n. WA respectively. These apparently shorter than wings of adults measured in same study, presented below.

(5–7) Live birds; THL = total head-length (Jessop 1990): (5) Vic., adults; (6) Tas., adults; (7) coastal n. WA between Port Hedland and Broome, adults (may include some second immatures).

	MALES	FEMALES	
WING	(5) 107 (3; 99–113; 215)	106 (3; 97–114; 150)	ns
	(6) 106 (3; 99–113; 143)	105 (3; 97–112; 64)	ns
	(7) 105 (3; 101–107; 69)	104 (3; 100–111; 55)	ns
BILL	(5) 13.7 (0.6; 12.0–15.3; 104)	13.6 (0.7; 10.5–15.2; 87)	ns
	(6) 14.3 (0.5; 13.5–15.0; 15)	14.1 (0.7; 13.0–15.5; 9)	ns
	(7) 14.4 (0.6; 14.0–16.0; 25)	14.4 (0.6; 13.3–16.0; 25)	ns
THL	(5) 39.6 (1.0; 36.9–41.5; 63)	39.1 (0.8; 37.2–41.8; 45)	ns
	(6) 39.3 (1.1; 37.4–46.4; 126)	38.9 (1.0; 33.2–40.7; 82)	ns
	(7) 38.1 (1.5; 34.5–40.3; 34)	38.6 (1.8; 32.5–41.1; 30)	ns

Live samples above show Tas. and Vic. birds to be similar in size; adults from NW have slightly shorter wing and total head-length, but slightly longer bills. Measurements from skins also show little size variation in s. Aust. but possible differences in tropical Aust.

(8–11) Adult, skins (HLW, MV, SAM, WAM): (8) Vic.; (9) se. SA; (10) s. WA; (11) tropical Aust., N of 18°S.

SEXES COMBINED	
WING	(8) 105.4 (2.51; 100–109; 21)
	(9) 104.2 (2.21; 98–108; 26)
	(10) 104.9 (2.94; 98–113; 22)
	(11) 102.6 (2.29; 100–108; 10)
BILL	(8) 13.8 (0.58; 12.4–15.1; 22)
	(9) 13.9 (0.75; 12.4–15.5; 24)
	(10) 13.9 (0.84; 12.2–15.2; 24)
	(11) 13.6 (0.40; 13.1–14.3; 9)
TARSUS	(8) 25.5 (0.92; 23.7–27.1; 22)
	(9) 25.7 (1.08; 23.3–27.5; 27)
	(10) 25.9 (1.19; 24.0–28.8; 21)
	(11) 26.2 (1.13; 24.3–27.7; 10)

WEIGHTS Adults, data from banding studies (Jessop 1990): (1) Tas. (all months); (2) Vic. (all months); (3) se. SA (all Feb.); (4) nw. Aust. coast between Port Hedland and Broome, WA (Aug.–Nov. and Apr.).

	MALES	FEMALES	
(1)	39.1 (2.6; 34–44; 135)	39.9 (3.7; 38–54; 90)	ns
(2)	37.3 (2.3; 33–48; 254)	37.6 (3.8; 32–50; 209)	ns
(3)	35.5 (2.6; 27–40; 69)	36.5 (2.9; 30–43; 70)	ns
(4)	35.3 (2.9; 32–40; 61)	35.3 (4.6; 29–49; 55)	ns

Sexes similar. Jessop (1990) found adults from nw. Aust. significantly lighter than those in Vic. and Tas.; adults from Tas. in Feb. heavier than samples from Vic. and SA in Feb.; and samples males from Tas. in Apr. heavier than males from Vic. in Apr. However, patterns of seasonal variation in weight not understood.

Immatures and juveniles slightly lighter than adults; data from banding studies (Jessop 1990): (5) Tas. (all months); (6) Vic. (all months); (7) se. SA (all Feb.); (8) nw. Aust. coast between Port Hedland and Broome, WA (Aug.–Nov. and Apr.).

SEXES COMBINED	
(5)	36.8 (3.5; 22–52; 97)
(6)	36.1 (3.1; 31–43; 71)
(7)	35.5 (2.2; 30–39; 32)
(8)	34.3 (3.0; 28–40; 68)

STRUCTURE Wing, long, narrow and pointed. Eleven primaries; p10 longest, p9 0–2 shorter, p8 5–7, p7 12–14, p6 19–23, p5 29–32, p4–p2 not measured, p1 51–55; p11 minute. No emarginations. Sixteen secondaries, including five tertials; tips of longest tertials usually lie between tips of p8 and p9 of folded wing. Tail, square to slightly rounded, t1 projecting slightly beyond other rectrices; 12 feathers. Bill, slender, short (c. 35% of total head-length) and straight. Underside of gonys gently upcurved; distal third of upper mandible slightly raised as inconspicuous bill-nail. Nostrils, elongate, set in deep broad nasal groove extending over half length of bill. Tibia and tarsus, slender, moderately long; scaling, reticulate, with largest scales occurring on front of tarsus. Toes, short, with small web between first phalanges of outer and middle toe; outer toe c. 75% length of middle, inner toe c. 67%, no hind toe.

SEXING Adults can be sexed reliably on plumage (see adult female description). Not known if sexes differ in first-basic plum-

age but loral stripe may average broader in females. In the two males examined, white of face met underside of eye; this only applied to one of six females examined. Few sexed juveniles available but variation occurring in lores of juveniles (broader dark shaft-streaks make lores look darker in some individuals) could also be tested as a character to identify sex.

RECOGNITION Downy young readily distinguished from downy young of other Charadriidae in HANZAB region by rather poorly defined whitish collar on hindneck, without broad black border above or below. Downy Red-kneed Dotterel predominantly grey-brown (not buff) above, with coarser black mottling above and dark area under eye. Downy Inland Dotterel *Charadrius australis* has diagnostic dark cheek-patches. In NZ, could be confused with downy Double-banded Plover (gold forms), which have somewhat heavier speckling above, extending in front of eye (only level with eye in Red-capped), and some dark mottling below white eye-ring. Downy Wrybill *Anarhynchus frontalis*, greyer, with sparser and finer black speckling above.

GEOGRAPHICAL VARIATION Slight; no subspecies. Birds in n. WA have slightly shorter wings and total head-lengths than birds in s. Aust., and perhaps have slightly longer bills (see Measurements). Not known if variation clinal from N to S, or whether it is stepped.

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Sponsors: Mr G Samphier, Sir E Woodward



Volume 2, Plate 63

Kentish Plover *Charadrius alexandrinus* (page 836)

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

Red-capped Plover *Charadrius ruficapillus* (page 836)

7 Adult male breeding; 8 Adult female; 9 Downy young; 10 Juvenile, in fresh plumage; 11 First immature (first basic); 12, 13 Adult male