

Order CHARADRIIFORMES

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

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

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

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

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

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

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

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

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Family GLAREOLIDAE coursers and pratincoles

Moderately sized (18–30 cm long) short-billed waders, confined to Old World, where mostly found in arid regions; centre of diversity in Africa. Divided into two subfamilies: Cursoriinae (coursers), comprising seven species in 1–3 genera, distributed in Africa and s. Asia and not recorded in HANZAB region; and Glareolinae (pratincoles), comprising seven species in two genera, also distributed in Africa and s. Asia. Two species of pratincoles in Aust.: Australian Pratincole *Stiltia isabella* endemic; Oriental Pratincole *Glareola maldivarum* regular non-breeding migrant. *Stiltia* intermediate in structure and behaviour between coursers and pratincoles. Family probably monophyletic, except that affinities of Egyptian Plover *Pluvianus aegyptius* are uncertain and it is currently considered an aberrant coursers. Reviews based on osteology (Strauch 1978) and downy young (Jehl 1968) have put Glareolidae close to the Charadriidae, but DNA hybridization (Sibley & Ahlquist 1990) and protein electrophoresis (Christian *et al.* 1992) suggest closer relationship with gulls and allies. Sibley & Ahlquist (1990) also found Crab Plover *Dromas ardeola* (Dromadidae) to be related and combined it with Glareolidae, Laridae and Alcidae in a superfamily Laroidea. Note, Inland Dotterel *Charadrius australis* (Charadriinae) has often been placed in Glareolidae (Lowe 1931; Jehl 1968; Mathews) but is now recognized as a plover (Bock 1964; Maclean 1973, 1976; see HANZAB 2).

Sexes alike; similar in size. Neck, short; 15 cervical vertebrae. Wings, long and pointed; 11 primaries, p10 longest, p11 minute; 14–16 secondaries. Twelve rectrices. Bill, short (especially in pratincoles); strongly arched, tapering. Nostrils, impervious; schizorhinal except holorhinal in *Pluvianus*. Legs, fairly long; tarsus, transversely scutellate in front and behind (except in *Pluvianus*); middle toe pectinate except in *Stiltia* and *Pluvianus*. No crop. Caeca present. Supraorbital salt-glands poorly developed.

Coursers (subfamily Cursoriinae) are ground-dwelling birds, expert runners; flight, fast and direct; usually cryptic and many are active at night; differ from pratincoles by: short square-tipped tails, rather long tarsus, and three rather short toes with no hallux; Cursoriinae not considered further here; see Campbell & Lack (1985), Urban *et al.* 1986 and BWP for further details.

Pratincoles (subfamily Glareolinae) mostly highly aerial, with rapid, graceful, agile flight and resembling terns (Sterninae) or large swallows (Hirundinidae); run fast but spend much time feeding on the wing, though *Stiltia* also forages much on ground; wings and bodies longer than in coursers; tail, rather long and forked (strongly so in most species); bills, short (less than half length of head) with broad gape to allow aerial capture of prey; tarsus, rather short (except in *Stiltia*) with four toes including well-developed but raised hallux; slight webbing round base of rather elongate middle toe. Adults, rather uniform, grey-brown, sandy brown or grey above, with white rump and sides of tail; most have pale-coloured bib, often outlined in black; red at base of bill and gape; red or brown legs; black or chestnut underwing. Post-breeding moult complete; primaries usually moult outwards (some suspend moult); most, perhaps all, have distinct breeding plumage. Hatch in short pale-buff or brownish-grey down, varyingly stippled or marked black. Juveniles duller than adults, with less clear-cut patterning of head and throat; scalloped buff above. Attain adult plumage and probably breed at c. 1 year old.

Inhabit open areas, even deserts, but *Glareola* always near water, such as large rivers, swamps and rice paddies; *Stiltia* less dependent on water. Entirely insectivorous. *Glareola* highly gregarious at all times, *Stiltia* less so. Generally migratory but details not known for most species. Pair-bond, monogamous, perhaps only for each season. Nesting territories within colonies defended vigorously with varied displays. Also much ritual display associated with sexual activity, courtship, greeting and the like; also aerial displays, often by flocks, significance of which poorly understood. Well-developed anti-predator reaction, injury-feigning and distraction displays. Particularly vocal in flight; great variety of high-pitched trilling or twittering, or piping whistles; alarm calls, harsher; generally silent when resting in flocks.

Breed in colonies, seasonally. Nests on ground in open; shallow scrape or natural depression with little or no lining. Eggs, oval or sub-elliptical; smooth, not glossy; cream to buff ground-colour, blotched, spotted and streaked black or dark brown. Clutch-size, 1–4, usually 2–3. Incubation by both sexes. Incubation period, probably 17–21 days. Young precocial, semi-nidifugous; at first fed directly by parents. Fledging period, 25–30 days.

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Glareola maldivarum Oriental Pratincole

COLOUR PLATE FACING PAGE 384

Glareola (Pratincola) Maldivarum J.R. Forster, 1795, *Faunula Indica*, ed. 2: 11 — open sea in latitude of Maldive Islands; based on Maldivian Pratincole of Latham, 1785, *Gen. Syn.* 5: 224.

Glareola is the diminutive of the Latin *glarea* (gravel) after the supposed habitat of the Collared Pratincole *G. pratincola*; *maldivarum* is neo-Latin, meaning 'of the Maldive Islands'.

OTHER ENGLISH NAMES Eastern Collared Pratincole, Grasshopperbird, (Little) Stormbird, Swallow-plover, Swarmer.

Oriental is simpler than **Eastern Collared** and is reasonably appropriate. If the species were to be merged with *pratincola*, the English name would simply be **Collared**.

MONOTYPIC

FIELD IDENTIFICATION Length 23–24 cm; wingspan 54–57 cm; weight 75 g. Medium-sized tern-like wader with long pointed wings, forked tail, short legs and short decurved bill, combination unique to genus among Charadrii. Slightly larger and plumper than Australian Pratincole *Siltia isabella*, with shorter legs and longer tail; when perched, tip of tail falls roughly half-way between tips of tertials and primaries. General character distinctive, with plover-like walks and runs. At all ages, black underwing with mostly chestnut lining, diagnostic. Sexes alike (but see Plumages, Moults). Distinct seasonal variation. Juvenile distinct.

Description **Adult breeding** Top of head, rest of upperparts from mantle to upper rump, and secondary coverts, uniform dark olive-brown; paler olive-buff on hindneck and sides of neck; lower rump, uppertail-coverts and tail, white, with narrow black terminal tail-band. Secondary coverts contrast with darker brownish-black secondaries and outerwing. Lores, blackish (possibly paler brownish in females). White line under eye, tapering to point behind eye. Black line from under eye encircles creamy-buff chin and throat. Foreneck and upper breast, olive-buff (as hindneck and sides of neck), grading into brighter orange-buff lower breast, belly and fore-flanks; rest of underbody, white. Axillaries and most underwing-coverts, chestnut, with rest of underwing and narrow leading-edge, black. Bill, black, with red gape and base of lower mandible. Iris, dark brown. Legs and feet, brownish black. **Adult non-breeding** Generally similar to breeding, differing by: upperparts, foreneck, breast and fore-flanks, uniform dark brownish-olive, without buffish tinge to neck and chest; foreneck and breast, darker, contrast more with mostly whitish belly, which has only slight orange-buff wash; lores, paler, buffish with fine dark mottling; chin and throat, paler creamy bordered by short dark streaks, not solid line. Bill, black, with duller brownish-pink gape and base. **Juvenile** Similar to adult non-breeding but crown, nape, hindneck and sides of neck, finely mottled and streaked dark brown; white eye-ring complete and more obvious; feathers of upperparts and innerwing-coverts have broad buffish-white tips and black subterminal bands; fine pale trailing-edge when fresh; chin and throat, whitish, with indistinct border of dark streaks; olive-brown band across foreneck and upper breast generally narrower and less uniform, overlaid with fine pale fringes of feathers and dark-brown streaks and blotches; buffish wash on underbody paler and restricted to sides of lower breast and fore-flanks.

Bill, black; gape, duller red or pinkish grey. Birds in full juvenile plumage not seen Aust.; for short period after arrival, some in moult may be separable from adult non-breeding by distinctive pattern of as yet unmoulted juvenile secondary coverts or scapulars; after moult complete, first non-breeding plumage generally indistinguishable from adult non-breeding.

Similar species None; long pointed wings, forked tail, short legs, short decurved bill, plover-like gait and graceful, swallow-like flight immediately identifies as pratincole. All ages of **Australian Pratincole** differ by: smaller and slimmer appearance, with longer legs, shorter square tail falling well short of tips of folded wings, and finer wing-points, which combine with generally more upright stance to give more elegant, rakish appearance. In flight, distinguished by: much shorter squarish tail, with clearly projecting feet; paler upperparts with contrast between pale innerwing and black outerwing from above; mainly black underwing, with silvery panel formed by secondaries and inner primaries and with chestnut restricted to narrow band along leading-edge of innerwing; less graceful flight, with stiffer wing-beats more like those of smaller *Sterna* tern than swallow-like actions of Oriental.

Gregarious, in small to large flocks (sometimes 1000s) on open plains, bare ground round margins of wetlands, and on mudflats, airfields and saltworks of n. Aust.; singly or in small flocks in s. Aust. and NZ. Gait on land recalls *Charadrius* plovers, with quick tripping action of short legs and body held horizontally; bob head when nervous; when feeding on ground, run or lunge forward after flying or grounded insects. Huge flocks ascend in columns of rising hot air in characteristic double spirals, half flock spiralling clockwise and the other half anticlockwise. Sluggish during heat of day, adopting rather tern-like posture when relaxed, with head drawn in, short legs placed well forward under horizontal body, and long, gently upcurved primaries extending well beyond tip of tail. Often assume upright posture, with head held high on stretched neck, appearing to stand on tiptoe. When disturbed, often fly high (Campbell 1920). Feed mainly on insects, hawking in graceful rapid swallow-like flight, particularly at dawn and dusk and often in large flocks. Give sharp, tern-like calls, particularly in flight; also loud churring and plover-like soft rising *tweet*.

HABITAT Open country, often near water; usually in

lowlands, but found on Atherton Tableland and in PNG to 1700 m asl; usually away from coasts in n. Aust. (Bravery 1970; Mackay & Martin 1976; Campbell 1981).

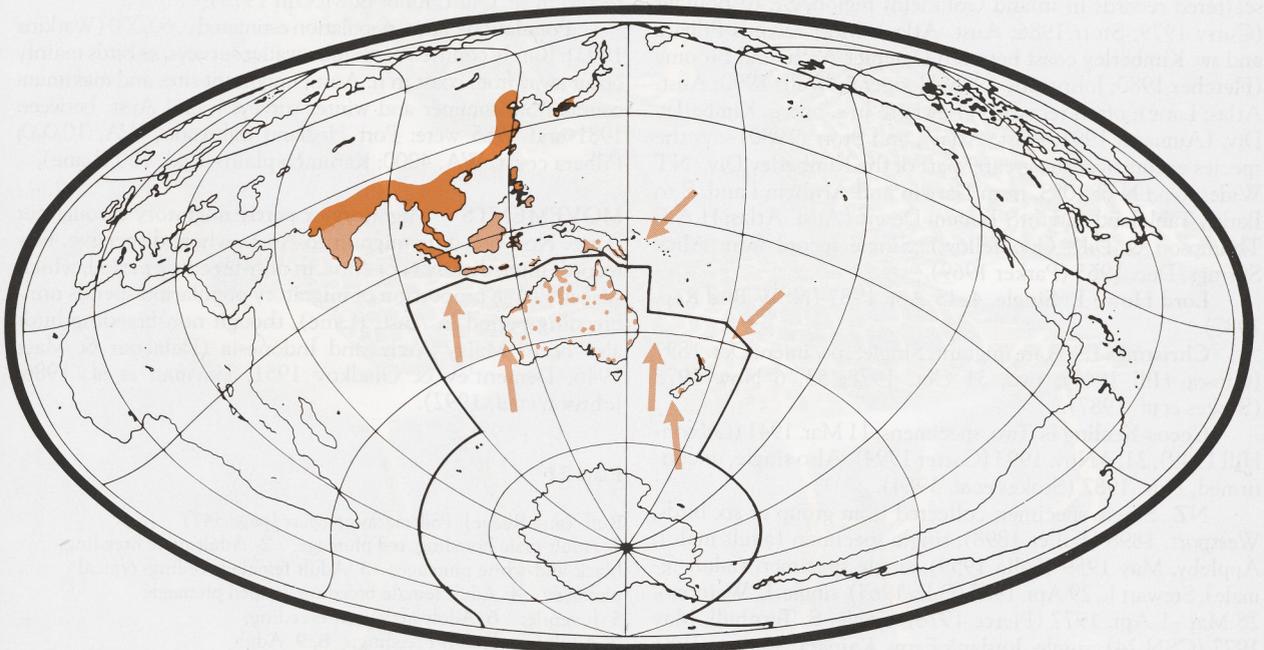
Usually occur on plains, floodplains or grassland with little or no emergent vegetation; on grassy flats and mudflats; use agricultural land such as maize fields (Carruthers 1968; Bravery 1970; Klapste 1977). Occur near terrestrial wetlands formed by rainfall (floodwaters, ditches and puddles), on margins or near billabongs, lakes, creeks and sometimes in small numbers at lagoons, beaches, mudflats and islands (Carruthers 1968; Corben 1972; Hobbs & McGill 1973; Finch & Cox 1974; Opie 1974; Falla *et al.* 1975; Klapste 1977; Garstone 1978; Loyn 1978; Boekel 1980; Stokes 1988; Hutton 1990). Artificial wetlands include reservoirs, saltworks and sewage farms (Smith 1963; Jaensch 1985; Lloyd & Lloyd 1991).

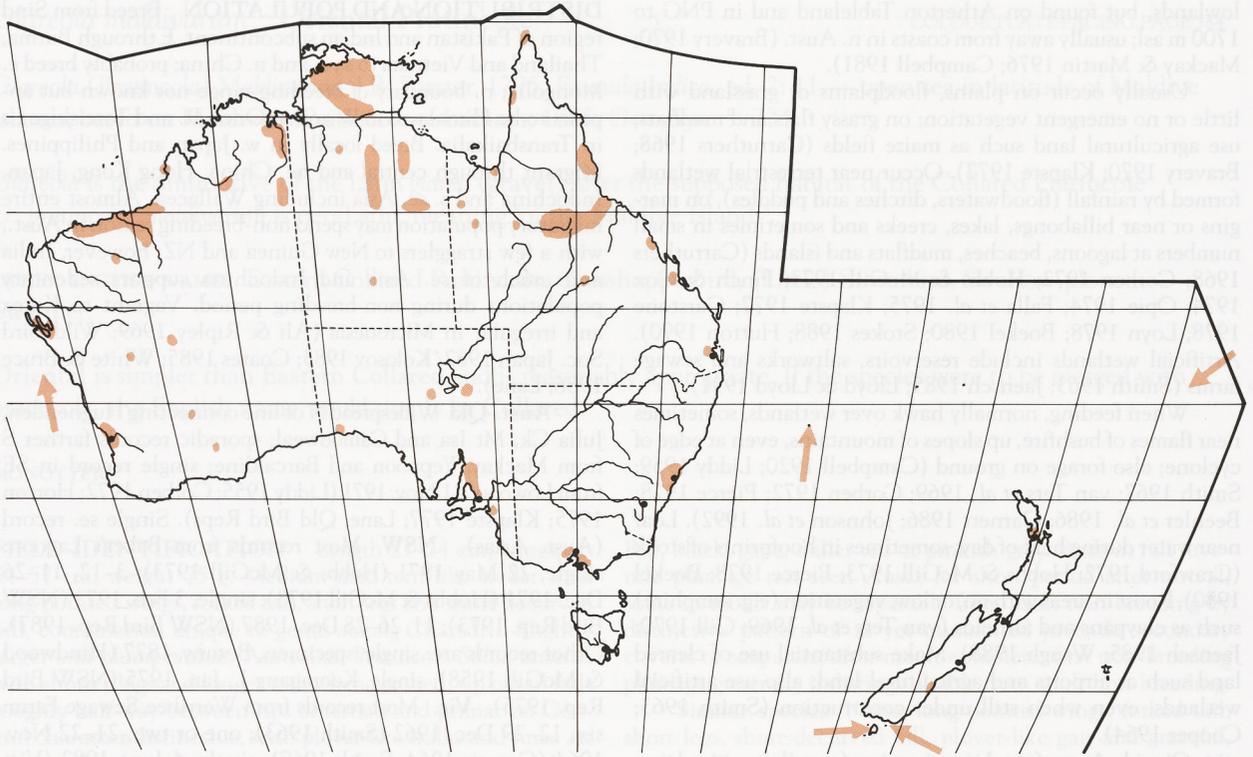
When feeding, normally hawk over wetlands, sometimes near flames of bushfire, up slopes of mountains, even at edge of cyclone; also forage on ground (Campbell 1920; Liddy 1959; Smith 1967; van Tets *et al.* 1969; Corben 1972; Pierce 1978; Beehler *et al.* 1986; Garnett 1986; Johnson *et al.* 1992). Loaf near water during heat of day; sometimes in hoofprints of stock (Crawford 1972; Hobbs & McGill 1973; Pierce 1978; Boekel 1980). Roost in areas with no, or low, vegetation (e.g. samphire) such as claypans and airfields (van Tets *et al.* 1969; Gill 1970; Jaensch 1985; Waugh 1988). Make substantial use of cleared land such as airports and agricultural land; also use artificial wetlands, even when still under construction (Smith 1963; Cooper 1964).

Outside Aust., found in open areas (e.g. plains, meadows, airports, playing fields and pastures), sandbars, river banks, embankments, saltpans, fish ponds, rice fields; breed on hard baked mud of marshes, rivers and lakes (Dement'ev & Gladkov 1951; Ali & Ripley 1969; Orn. Soc. Japan 1974; Smythies 1981; de Schauensee 1984; Chalmers 1986; Lekagul & Round 1991). Recorded loafing on roads, where vulnerable to being run over by motor vehicles (Klapste 1977); and on airfields in n. Aust., where struck in large numbers by aircraft (van Tets *et al.* 1977).

DISTRIBUTION AND POPULATION Breed from Sind region of Pakistan and Indian subcontinent, E through Burma, Thailand and Vietnam to s., e. and n. China; probably breed e. Mongolia; n. boundary of breeding range not known but appears to be Himalayas in W and at Onon R. and Toreiskige Ls in Transbaikalia. Breed locally in w. Japan and Philippines. Migrant through central and ne. China, Hong Kong, Japan, Indochina and s. se. Asia including Wallacea. Almost entire migratory population may spend non-breeding season in Aust., with a few stragglers to New Guinea and NZ; however, India and much of se. Asia and Indochina support sedentary populations during non-breeding period. Vagrant to Korea and irregular in Micronesia (Ali & Ripley 1969; Wild Bird Soc. Japan 1982; Kolosov 1983; Coates 1985; White & Bruce 1986; Lane).

Aust. Qld Widespread N of line connecting Hughenden, Julia Ck, Mt Isa and Camooweal; sporadic records farther S from Mackay, Yeppoon and Barcaldine; single record in SE from Lowood, 21 Nov. 1971 (Liddy 1955; Corben 1972; Horton 1975; Klapste 1977; Lane; Qld Bird Reps). Single se. record (Aust. Atlas). **NSW** Most records from Baker's Lagoon: single, 22 May 1971 (Hobbs & McGill 1973); 3–12, 11–26 Dec. 1971 (Hobbs & McGill 1973); single, 3 Feb. 1973 (NSW Bird Rep. 1973); 11, 26–28 Dec. 1987 (NSW Bird Rep. 1987). Other records are: single, specimen, Botany, 1877 (Hindwood & McGill 1958); single, Kooragang I., Jan. 1975 (NSW Bird Rep. 1975). **Vic.** Most records from Werribee Sewage Farm: six, 12–29 Dec. 1962 (Smith 1963); one or two, 21–22 Nov. 1964 (Cooper 1964; Smith 1967); single, 6 June 1982 (Vic. Bird Rep. 1982); single, 11 May 1985 (Vic. Bird Rep. 1985); unverified report, single, 25 Apr.–17 May 1992. Other records are: single, Yallock Ck, 19 Jan. 1974 (Loyn 1978); unknown number, Laverton, 1975–76 (Aston & Balmford 1978). **Tas.** Single, unconfirmed, Marion Bay, 7 Apr. 1987 (Tas. Bird Rep. 17). **SA** Single, Milang (or Meningie), 1905 (Anon. 1905); single, unconfirmed, between Clayton and Dulkaninna, Sept. 1955 (Glover 1957); single, Mosquito Pt, L. Alexandrina, 22 Dec. 1973 (Finch & Cox 1974); single, 32 km W of Nullarbor





Stn, 27 May 1974 (Opie 1974); single, Porter's Lagoon, 15 km S of Burra, 23 Nov. 1975 (Pedler 1976); single Billa Kalina, 1 and 3 Dec. 1980 (Badman & May 1983); single, Dry Ck Saltfields 27 Feb. 1988 (Lloyd & Lloyd 1991). **WA** Scarce visitor on Swan R. plains (Serventy 1967; Anon. 1982, 1983, 1985; Jaensch 1987, 1989; Jaensch & Vervest 1987; Jaensch *et al.* 1988; Storr & Johnstone 1988; Vervest & Burbidge 1992; Aust. Atlas; Lane). Recorded on Houtman Abrolhos (Garstone 1978), and round Shark Bay (Ford 1966; Aust. Atlas). Few scattered records in inland Goldfields region, SE to Boulder (Curry 1979; Storr 1986; Aust. Atlas). Most records Pilbara and sw. Kimberley coast between Dampier Arch. and Broome (Fletcher 1980; Johnstone 1983; Hooper & Wells 1990; Aust. Atlas; Lane); often recorded elsewhere in s. and e. Kimberley Div. (Aumann 1991; Aust. Atlas), and Storr (1980) says the species occurs over the greater part of the Kimberley Div. **NT** Widespread N of 20°S, from Darwin and Arnhem Land, S to Barkly Tableland and into Tanami Desert (Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). Single record from Alice Springs, Dec. 1965 (Parker 1969).

Lord Howe I. Single, 4–15 Apr. 1987 (NSW Bird Rep. 1987).

Christmas I. Rare migrant. Single, specimen, Oct. 1897 (Gibson-Hill 1949); two, 31 Oct. 1978; 53, 6 Nov. 1978 (Stokes *et al.* 1987).

Cocos-Keeling Is Two, specimens, 11 Mar. 1941 (Gibson-Hill 1949); 21, 4 Nov. 1993 (Carter 1994). Also single, unconfirmed, Nov. 1982 (Stokes *et al.* 1984).

NZ Single specimen collected from group of six birds, Westport, 1898 (Buller 1898); single specimen (adult male), Appleby, May 1959 (Falla 1959); single specimen (adult female), Stewart I., 29 Apr. 1963 (Falla 1963); single, L. Wainono, 28 Mar.–1 Apr. 1977 (Pierce 1978); single, S. Turnbull, May 1977 (CSN 24); single, Jordan's Farm, Kaipara, 30 Nov. 1985

(CSN 34); single, Ruapuke I., 10–11 Feb. 1988 (CSN 36).

Kermadec Is Single, Raoul I., 28–31 May 1976 (CSN 25).

In n. Aust., may suddenly appear in thousands, coinciding with arrival of thundery cyclonic storms that may cause number of insects, main component of diet, to increase dramatically; influx of thousands round Mt Isa disappeared abruptly after a storm (Carruthers 1968; Hobbs & McGill 1973; Horton 1975; Storr 1977, 1984; Boekel 1980; Fletcher 1980; Howard 1986; Lane). Occurrence in NSW in 1971 coincided with first record in se. Qld (Hobbs & McGill 1973).

Populations Aust. population estimated c. 60,000 (Watkins 1993). Rarely counted on regular wader surveys, as birds mainly occur away from coast in n. Aust.; important sites and maximum counts from summer and winter surveys round Aust. between 1981 and 1985 were: Port Hedland Saltworks, WA, 10,000; Pilbara coast, WA, 4000; Karumba plains, Qld, 700 (Lane).

MOVEMENTS Migratory or partly migratory throughout range. Non-breeding migrant to Aust., where dispersive. Few records immediately N of Aust. in non-breeding period, which suggests large proportion of migratory population spends non-breeding period in Aust. (Lane), though non-breeding birds also occur Malay Arch. and Indonesia (Delacour & Mayr 1946; Dement'ev & Gladkov 1951; Hayman *et al.* 1986; Johnson *et al.* 1992).

Plate 21

Ruff (and Reeve) *Philomachus pugnax* (page 341)

- 1 Adult male breeding, red plumage;
- 2 Adult male breeding, black-and-white plumage;
- 3 Adult female breeding, typical plumage;
- 4 Adult female breeding, striped plumage;
- 5 Juvenile;
- 6 Adult male non-breeding;
- 7 Adult female non-breeding;
- 8, 9 Adult

Departure Passage migrants, Hong Kong, early Oct. to early Nov., with maximum numbers in Oct. (Chalmers 1986); flocks in passage, Singapore, Oct.–Nov. (Hails & Jarvis 1987); in Kelabit uplands of Borneo, passage migrants scarce but regular Sept. to Nov. (Smythies 1981); in w. Java, maximum numbers on migration occurs Oct.–Nov.; Cilacap, on s. coast, may be final staging area before departure for Aust.; juveniles recorded w. Java, Oct.–Nov. and some may remain for non-breeding period (Johnson *et al.* 1992). On Moa I., Torres Str., flocks seen flying from N on evening of 3 Dec. 1919 and numerous by next day (Campbell 1920).

Non-breeding Arrive n. Aust. later than most migratory shorebirds (Lane). Large numbers recorded in N during wet season from late Oct. to Apr. (Kilgour 1904; Storr 1980), when birds also occur as far S as s. WA, s. SA, s. Vic. and Tas.; occasionally occur in NZ (see Distribution; Serventy & Whittell 1976; Curry 1981; Storr 1985; Waugh 1988). In n. Qld, birds arrived early Nov. 1903–4, early Jan. 1902–3 (Berney 1904). In higher-rainfall zones of Kimberley, occur Nov.–Dec.; in semi-arid and arid zones, Jan.–Mar. (Storr 1980); large numbers may spend short periods in nw. Qld, moving on after rainfall (Carruthers 1968). Occasionally occur in NZ (Falla *et al.* 1975). Some birds spend non-breeding period N of Aust., e.g. round Port Moresby, usually occur Oct.–Mar. (Hicks 1990); elsewhere in PNG, Oct. to late Mar. or Apr. but once recorded June (Beehler *et al.* 1986; Coates 1985); in Sumatra, 6 Oct.–July (van Marle & Voous 1988); in Japan, singles, spring–autumn (Orn. Soc. Japan 1974). During this period also present in Indian subcontinent, Burma, Thailand, Indochina, Philippines and s. Taiwan (see Lane).

Arrival possibly dictated by weather, birds arriving in Aust. with first rains of wet season, with thunderstorms, or just before first cyclonic front of wet (Storr 1977; Boekel 1980 *contra* Kilgour 1904). Apparently dispersive; birds remain in localities for varying lengths of time (Parker 1969; Crawford 1972; Lloyd & Lloyd 1991); move toward areas of recent rainfall (Crawford 1972; Klapste 1977), or move into areas before rain falls, leaving soon after (Carter 1904); also move in response to cyclones or local storms (Horton 1975; Fletcher 1980; Aust. Atlas); may search locally for abundant invertebrates, some of which hatch in large numbers before rain (Kilgour 1904; Lane). Possibly move to coastal areas during dry periods (Dawson *et al.* 1987; Murlis *et al.* 1988) or from flooded wetlands where margins inundated (Hobbs & McGill 1973; Pierce 1978). In se. Gulf of Carpentaria, birds observed flying from plains to wetland (probably to drink) throughout day (Garnett 1986).

Return Leave Darwin and nw. Aust. by first week of Apr. (Crawford 1972; Lane). Apparently leave NT at onset of heavy continuous rain during wet season, in late Dec. or early Jan. and seldom recorded after mid-Jan. (Storr 1977; Boekel

1980); in 1987, large numbers left Port Hedland Saltworks in 10 days before 24 Mar. when only 1000 remained; about this time 12,000 seen on Eighty Mile Beach, which may have been passage migrants from Saltworks (Dawson *et al.* 1987). Over 1000 left se. Gulf of Carpentaria by Jan. (Garnett 1986). Some years in Richmond district, n. Qld, birds seen on s. migration but not seen on n. movement (Berney 1907). Occur Singapore, Feb.–Mar. (Hails & Jarvis 1987); appeared Brunei, 14 Feb. to end Mar. 1988 (Harvey & Elkin 1991); in Hong Kong, most returning passage migrants occur from early Mar. to mid-June with peak in Apr. (Chalmers 1986).

Breeding In India and Pakistan, Apr.–June (Ali & Ripley 1969). Few records of birds spending breeding period in Aust.: one each in NSW for July and May (Hobbs & McGill 1973); one record near Nullarbor Stn, SA, 27 May 1974 (Opie 1974).

Banding In w. Java, few recaptures and few sightings of colour-flagged birds, Oct.–Nov., which indicated that birds passed through rapidly (Johnson *et al.* 1992).

FOOD Insectivorous. **Behaviour** Hawk for swarming insects; flight highly manoeuvrable; to c. 10 m at Werribee, Vic.; 10–20 m above ground when feeding on chironomids at Wainono, NZ; also up to considerable heights such as c. 60 m asl in w. Java (observed circling at c. 300 m asl) (Campbell 1920; Liddy 1959; Smith 1967; van Tets *et al.* 1969; Corben 1972; Pierce 1978; Beehler *et al.* 1986; Garnett 1986; Johnson *et al.* 1992). Travel in flocks searching for swarms of locusts (Kilgour 1904). Flocks of thousands of birds ascend in thermals near cyclonic storms to feed on insects and other prey sucked up by thermals (van Tets *et al.* 1977). Glean on ground, especially in morning (Pierce 1978). Also scratch in soil (Ali & Ripley 1969).

Adult At Aust. airports (18 stomachs; van Tets *et al.* 1969): Insecta: Odonata: Zygoptera 11.1% freq; Hemiptera: indet. 5.5; Cicadidae 72.2; Cicadellidae 22.2; Pentatomidae 27.8; Notonectidae 22.2; Coleoptera: Carabidae 11.1; Geotrupidae 5.5; Scarabaeidae 11.1; Elatridae 11.1; Cerambycidae 11.1; Chrysomelidae 5.5; Lepidoptera moths 11.1; Hymenoptera: Formicidae 22.2.

Other records Insecta: Isoptera (FAB); Orthoptera: Acrididae: locusts (Kilgour 1904; Boekel 1980), grasshoppers (Mathews 1909, 1910); Diptera: Chironomidae ads; Ephydriidae: *Ephydrella aquaria*; Hymenoptera: bees (Pierce 1978); Ichneumonidae (FAB).

Young, Intake No information.

VOICE Little known. Said to be noisy in flight, uttering hard tern-like *chick-chick* or *kyik*; also soft plover-like *toowheet toowheet* (Pizzey 1980; Hayman *et al.* 1986); five birds circling at c. 100 m heard to call continuously (Liddy 1955). Extralimitally, said to make characteristic *kirri-kirri* constantly in flight (Ali & Ripley 1969); sharp raucous *tar-rak*; call said to be tern-like but less harsh (King & Dickinson 1975).

Calls of flock in Aust. (Buckingham & Jackson 1987) best described as harsh chatter, apparently in couplets or triplets, which are repeated at short intervals, possibly by different birds. Calls similar in structure to some of those described for Collared Pratincole *G. pratincola* and Black-winged Pratincole *G. nordmanni* (see BWP for descriptions); sonagram of Aust. flock (not suitable for publication) shows call resembles that of call of Collared Pratincole (see BWP: sonagram III); takes form of stack of 8–9 harmonics (fundamental c. 700 Hz), each showing a rapidly rising and falling shape at higher frequencies; calls c. 100 ms apart.

Plate 22

Red-necked Phalarope *Phalaropus lobatus* (page 352)

- 1 Adult male breeding; 2 Adult female breeding;
3 Adult non-breeding; 4 Juvenile;
5 First immature non-breeding; 6, 7 Adult

Grey Phalarope *Phalaropus fulicaria* (page 360)

- 8 Adult male breeding; 9 Adult female breeding;
10 Adult non-breeding; 11 Juvenile; 12, 13 Adult

PLUMAGES Prepared by D.J. James. Juveniles not normally seen in HANZAB area, with young birds arriving with post-juvenile moult well advanced. Complete post-juvenile moult to first immature non-breeding plumage followed by partial pre-breeding moult to first immature breeding plumage. Thereafter, complete post-breeding and partial pre-breeding moults each cycle produce alternating non-breeding and breeding plumages with distinct seasonal change in appearance. Juveniles, adults and some immatures can be separated. Sexes, similar. Age at first breeding, unknown.

Adult breeding (Definitive alternate). **Head and neck** Forehead, crown and nape, dark olive-brown (29); feathers on forehead have tiny buff fringes when fresh. Ear-coverts, hindneck and sides of neck, light brown (c123A), paler and brighter than crown. Sharp black stripe on lores, from base of upper mandible to front of eye. Chin, throat and foreneck, yellow-brown (123B), brighter than ear-coverts; encircled by sharply defined narrow black necklace extending from under eye (where it joins loreal stripe), down cheek and sides of neck, looping across base of foreneck; thin inconspicuous white border inside (to corner of gape) and very thin obscure buff (c124) border on neck outside necklace. Necklace and its borders formed mostly by feathers with exposed white bases, black middles and narrow buff tips. Narrow sharp white partial eye-ring round bottom half of eye and extending as very short stripe or point behind eye. From about Jan. to Mar., birds still moulting may have less tidy but still distinct necklace and incomplete loreal stripe. **Upperparts** Mantle and scapulars, dark olive-brown (29); mantle grades indistinctly to paler and brighter hindneck. Back and upper rump, dark brown (221); slightly darker than scapulars but contrasting little. Lower rump and uppertail-coverts, white. **Underparts** Upper breast, light grey-brown (119C), tinged yellow-brown (123B), and slightly duller than throat; feathers, light grey-brown at bases, grading indistinctly to broad yellow-brown fringes. Grades from upper breast to pale yellow-brown lower breast, buff belly, and white vent, thighs and undertail-coverts. Flanks, dark olive-brown (dark 29). Axillaries, rufous-brown (136), like underwing-coverts. Buff tinges reduced with wear, but birds usually on extralimital breeding grounds at this stage. **Uppertail** White basally and dark distally. T1–t3, white for basal third or so, sharply demarcated from dark-brown (221) tip; have indistinct, faintly paler fringe at tip. T4, similar but with slightly broader white base. T5 has even broader white base grading to dark-brown (119A) distal half of outer web and brown (119B) distal half of inner web. T6 grades from white basal two-thirds to brown (119B) middle and dark-brown (221) tip. **Undertail** Appears mostly dark brown (221) with narrow white edges, contrasting sharply with white undertail-coverts. **Upperwing** Secondary coverts and tertials, dark olive-brown (29); if coverts retained from non-breeding (see Moults) then they may become faded and contrast slightly with upperparts by austral autumn. Marginal coverts have thin white fringes. Primary coverts, black-brown (119) on outer web, dark olive-brown (29) on inner web. Alula, black-brown (119). Inner seven primaries, dark brown (121). Outer three primaries, and all secondaries, black-brown (119) on outer web and tip, grading to dark-brown (121) inner web; secondaries have very thin (<1 mm) whitish fringe at tip when fresh. Shafts of primaries dark brown (219), except p10, which is light grey-brown (119C). **Underwing** Remiges and greater and median primary coverts, dark brown with grey tinge (grey 121), slightly darker outwards; appear blackish. Greater and median secondary coverts and hind rows of lesser coverts, rufous-brown (136);

outer greater secondary coverts have dark greyish-brown (grey 121) tips. Leading rows of lesser coverts, dark sooty-brown (sooty 219).

Adult non-breeding (Definitive basic). Similar to breeding, differing as follows. **Head and neck** Hindneck and ear-coverts, olive-brown (c29), almost concolorous with crown and mantle, lacking richer light-brown tinge. Throat, cream (c92), lightly streaked dark brown (121) in centre; heavy blackish streaking round outside of throat forms necklace like breeding but heavier and not so sharply defined and tidy. Lores, dark olive-brown (29) with small buff (124) tips. **Underparts** Breast and flanks, grey-brown (91) with narrow indistinct (not scaly) light grey-brown (119C) fringes to feathers; merges into white belly, vent and undertail-coverts. Generally lack warm buffy tones to breast but some have narrow zone on lower breast tinged light brown or orange-brown. Sometimes have scattered dark-brown feathers around tops of thighs.

Juvenile No skins examined. Not likely to be encountered in HANZAB area as body-moult begins on breeding grounds and mostly complete before arrival in non-breeding areas. **Head and neck** Top of head and neck, olive-brown, streaked and mottled dark brown. Chin and throat, cream to whitish, surrounded by dark streaking that merges into neck and breast, not forming distinct black necklace. White eye-ring, complete or nearly so, more prominent than on adult, not extending as point behind eye. **Upperparts** All feathers except uppertail-coverts, olive-brown, with narrow pale-buff to cream fringe at tips and small clear blackish subterminal bar; fringes progressively wider posteriorly. Uppertail-coverts, white. **Underparts** Breast, brown or olive-brown, with pale tips and dark subterminal bars on feathers; can form indistinct gorget. Grades to narrow zone of brownish buff on sides of lower breast and white belly to undertail-coverts. **Tail** Similar to adult. Central rectrices have sharp, narrow (1–2 mm) buff fringes at tip. **Upperwing** Primaries, dark brown with pale-cream fringes at tips, thin but prominent when fresh. Secondaries, dark brown, with prominent buff or pale-buff tip (c. 3 mm wide) bordered by distinct blackish subterminal bar. Median and lesser coverts, similar to upperparts but less boldly marked. Greater coverts, olive-brown with light-brown (c123C) tinge along edges, dark-brown subterminal bar and neat narrow cream fringe at tip. Tertials, olive-brown with dark subterminal bar and streaky buff fringe. **Underwing** Similar to adult; details unknown.

First immature non-breeding (First basic). Very similar to adult and indistinguishable if post-juvenile moult complete, but some birds may retain small number of juvenile feathers: some retain one to several (rarely all) juvenile secondaries (easily recognized in hand by narrow, c. 2–3 mm, cream to whitish tip, emphasized by narrow blackish subterminal band) but many replace all secondaries. Many retain outer few juvenile primaries, distinguished from adult only by being slightly narrower and more worn (cream fringes worn off before arrival in HANZAB area). Some retain a very few scattered juvenile wing-coverts, subscapulars or tertials, which allow ageing in the field; these are dark olive-brown (29) (like adult) with small black-brown (119) subterminal spot or bar but cream tips worn off, except sometimes on tertials. Pattern of head and neck varies: some, as adult non-breeding (skins); others have throat, pale dirty-buff (dirty 124) encircled by necklace of dark streaks from under eye, narrower and more tidy than in adult non-breeding but not sharp like adult breeding; some dark streaks in centre of throat but fewer than in adult non-

breeding; dark spot on lores in front of eye; short dark stripe at gape (skins). Photos from Java, Oct.–Nov. (W. Lawler; see Johnson *et al.* 1991) show birds in post-juvenile wing-moult gaining pattern of head like adult breeding.

First immature breeding (First alternate). Usually identical to adult non-breeding. Some may be recognized by retained juvenile secondaries if post-juvenile moult suspended.

BARE PARTS Based on photos (Coates 1985; Pringle 1987; Aust RD.; unpubl.: D.J. James; W. Lawler) and museum labels (AM, ANWC, MV). **Adult breeding** Bill, black with sharply defined bright-red gape (extending to basal tomium) and small base to lower mandible. Mouth, pale pink. Orbital ring, brown to dark brown, indistinct. Iris, dark brown. Legs, grey-black to brownish black or dark brown-grey. **Adult non-breeding** Bill, black with brownish-pink gape. Mouth, iris, orbital ring and legs, as breeding. **Juvenile** No information. **Immatures** Apparently similar to adult non-breeding; birds with pattern of head like adult breeding have dull-red gape and base to lower mandible.

MOULTS Based on banding study of 449 adults and 156 first-year birds by Johnson *et al.* (1991) in w. Java between mid-Oct. and mid-Nov. 1990, and examination of c. 60 skins (AM, ANWC, HLW, MV, WAM). **Adult post-breeding** (Pre-basic). Complete. Primaries, outwards. Tail, centrifugal. Begins on breeding grounds (about July to Aug.) with inner primaries, and some of head and body; details unknown. Generally primaries slightly ahead of secondaries, which in turn slightly ahead of tail. Moult of remiges and rectrices usually suspended during migration and, if so, resumed with arrival on or near non-breeding areas, early Oct.–Nov. However, do not always suspend moult: 89% of adults in Java had finished primaries though apparently still migrating. Primary-moult finished in c. 80% of skins from Aust. by mid-Nov., but some still moulting in Jan.; a bird banded nw. Aust. had not finished at end of Mar. In Java, 78% had completed moult of secondaries and 2% were in active moult of secondaries; 41% had not begun tail, 2% were active, and 6% were finished. **Adult pre-breeding** (Pre-alternate). Partial; involves probably all of head and body; remiges, rectrices and usually most upperwing-coverts, retained. Undertaken in non-breeding areas. Usually begins immediately after post-breeding moult finished, about Nov. to Feb; can be nearly finished (so birds in full breeding plumage) by Jan.; but apparently sometimes delayed until about Mar., well after post-breeding moult finished, hence mixed flocks of birds in breeding and non-breeding plumage encountered in n. Aust. Begins with throat and spreads to breast then upperparts. **Post-juvenile** (First pre-basic). Complete, or nearly so. Similar to adult post-breeding but begins and finishes slightly later. Remiges and rectrices suspended during migration and resumed in non-breeding areas; some retain a few inner secondaries, outer tertials or outer primaries, but probably most replace all juvenile feathers. Body essentially moulted before arrival in non-breeding areas but some may suspend moult, with scattered scapular and feathers of back retained; rarely, a few juvenile upperparts feathers retained until immature pre-breeding moult. In Java, juveniles not as advanced as adults: 11% had completed primaries, almost all were in second half of moult (PMS >25), and 2% were active; 28% had not begun secondaries and 27% were in second half (SMS >25) but none was finished; 66% had not begun tail, 5% were active and one bird had finished. **Immature pre-breeding** (First pre-alternate). Partial; similar to

adult pre-breeding; may involve fewer feathers and possibly starts later. Probably finished before leaving non-breeding areas.

MEASUREMENTS (1) Aust., adults and immatures combined, skins; sexing based on labels; Fork is difference between central and outer rectrices (t_6-t_1); Bill F = visible part of culmen (feathers cover but do not grow at base of culmen), affected by wear of feathers and preparation; Bill L = from loreal point, a more consistently repeatable measurement (AM, ANWC, HLW, MV, WAM). (2–3) Skins (Prater *et al.* 1977): (2) Adults and immatures; (3) Juveniles.

	MALES	FEMALES	
WING	(1) 185.2 (6.06; 175–195; 18) (2) 190.8 (182–200; 18)	182.9 (5.31; 174–195; 34) 190.0 (185–199; 9)	ns
8TH P	(1) 116.7 (3.81; 110–124; 14)	118.4 (3.52; 112–125; 25)	ns
TAIL	(1) 79.1 (2.39; 74–84; 18)	76.5 (3.35; 72–83; 35)	*
FORK	(1) 24.1 (3.38; 18–31; 14) (2) 26.4 (22–33; 17) (3) 19.8 (14–25; 6)	22.8 (3.97; 18–32; 25) 24.4 (17–30; 9) 14.4 (8–19; 5)	ns
BILL F	(1) 15.1 (1.96; 11.8–17.5; 13)	15.5 (1.82; 12.0–17.8; 32)	ns
BILL L	(1) 12.2 (0.61; 11.4–13.2; 13)	12.1 (0.50; 10.9–13.0; 26)	ns
TARSUS	(1) 33.0 (1.39; 29.9–35.4; 20)	31.3 (1.27; 29.0–34.7; 36)	*
TOE	(1) 18.4 (0.78; 17.0–19.7; 18)	17.7 (1.05; 16.1–19.7; 30)	ns

(4–5) Java, Oct.–Nov., unsexed, live; Wing O = wing with old worn outer primaries (wing-moult not completed, PMS <50; in case of immatures, juvenile outer primaries retained); Wing N = wing with new primaries (wing-moult completed; PMS = 50); THL = total head-length from back of skull to tip of culmen (Johnson *et al.* 1991): (4) Adults; (5) Immatures.

	UNSEXED
WING O	(4) 183.2 (6.11; 169–199; 62) (5) 177.0 (7.23; 159–193; 138)
WING N	(4) 184.6 (5.36; 171–200; 380) (5) 183.9 (4.84; 176–192; 19)
BILL F	(4) 13.9 (0.92; 11.1–16.6; 446) (5) 13.8 (0.36; 11.3–16.1; 157)
THL	(4) 46.1 (1.25; 41.0–49.4; 446) (5) 45.9 (1.21; 43.1–49.1; 155)
TARSUS	(4) 30.9 (1.68; 26.2–39.1; 447) (5) 30.9 (1.91; 25.8–38.4; 156)

Age-groups not significantly different except in length of wing; juvenile wing shorter than that of adult and immature (P < 0.01). Length of wing and tarsus (32–37 mm) for adults given by Prater *et al.* (1977) larger than for Aust. and Java, which suggests there may be undescribed cline in size in this species. Additional measurements in Johnson *et al.* (1991) and Vaurie (1965).

WEIGHTS Aust., adults and immatures combined, skins; sexing based on museum labels (AM, ANWC, HLW, MV, WAM): males, 75.2 (6.92; 65–90; 15); females, 75.8 (5.90; 65–85; 29). Two adult male skins had weights of 118 and 115 from Feb. and Mar. respectively.

(1–2) NW. Aust. in Mar. and Java in Oct.–Nov., live; weighed shortly after capture (Johnson *et al.* 1991): (1) Adults; (2) Immatures.

	NW. AUST.	JAVA
(1)	76.8 (7.39; 61–94; 66)	75.2 (6.64; 59–95; 211)
(2)	74.6 (6.76; 59–84; 17)	73.5 (7.05; 60–94; 69)

In Java, birds held overnight lost 5–6 g (Johnson *et al.* 1991).

STRUCTURE Wing, long, narrow, pointed. Eleven primaries; p10 longest, p9 1–7 mm shorter, p8 11–19, p7 25–32, p6 38–48, p5 52–61, p4 64–72, p3 77–84, p2 88–93, p1 96–104; p11 minute. Sixteen secondaries including four tertials; tips of longest tertials fall between p4 and p6 on folded wing (skins). Tail, deeply forked (see Measurements); 12 rectrices; t1–t3 similar in length and shape (normal width with rounded tip); t4 slightly longer; t5 slightly longer, narrower and pointed, t6 very long, narrow and pointed. Head, large and rather square. Bill, short, very broad at base, triangular with concave sides in plan view; gape, very wide; culmen has sharp high central ridge and hooked tip; lower mandible, small with distinct gonydeal angle; nostril, horizontally elliptical. Tarsus, short, slender. Outer toe 67–76% of middle, inner 53–61%, hind 27–30%. Claws, long, slender, crescentic in cross-section; middle claw, pectinate (i.e. with prominent serrated comb on inner edge).

SEXING Prater *et al.* (1977) and Hayman *et al.* (1986) suggested that, like extralimital Collared Pratincole, lores may differ in breeding plumage: black in males, olive-brown or brownish in females. Has not been confirmed and care needed to distinguish birds mostly in breeding plumage but still moulting lores during austral summer and autumn.

GEOGRAPHICAL VARIATION None. Sometimes considered conspecific with Collared Pratincole; see BWP.

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Oriental Pratincole *Glareola maldivarum* (page 366)
 1 Adult breeding; 2 Adult non-breeding; 3 Juvenile; 4, 5 Adult

Australian Pratincole *Stiltia isabella* (page 373)
 6 Adult; 7 Downy young; 8 Juvenile; 9 First immature non-breeding; 10, 11 Adult