

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]):

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| Thinocoridae | seed-snipes; 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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Order CHARADRIIFORMES

Family SCOLOPACIDAE sandpipers and allies

Small to large shorebirds (12–66 cm) with long bills and legs. Largest family of suborder Charadrii, with some 88 species in c. 24 genera; most species only breed in higher latitudes of Holarctic, but migrate long distances and occur almost worldwide in non-breeding period. In HANZAB area, 51 species in 18 genera: two breeding species, 27 regular non-breeding migrants, 19 accidentals and three doubtfully recorded. All are transequatorial migrants except for the two species of *Coenocorypha* that breed NZ, which are sedentary. The family is usually split into six subfamilies (e.g. Jehl 1968; BWP): Scolopacinae, Gallinagoninae, Tringinae, Arenariinae, Calidridinae and Phalaropodinae; we place the dowitchers *Limnodromus* in a separate subfamily, Limnodrominae (q.v. for details). All except Scolopacinae (woodcocks) represented in HANZAB region. Though they are convenient groupings, these subfamilies may not be wholly monophyletic (e.g. Strauch 1978; Dittman *et al.* 1989; Sibley & Ahlquist 1990; BWP); until phylogeny within the Family is understood, sequence of genera and species followed by different authors is likely to remain unsettled. Sequence and taxonomy used here follows Christidis & Boles (1994). Studies of allozymes (Christian *et al.* 1992), DNA hybridization (Sibley *et al.* 1988; Sibley & Ahlquist 1990), osteology (Strauch 1978) and patterns of downy young (Jehl 1968) generally agree in treating Scolopacidae as monophyletic, with distant links to Jacanidae, Rostratulidae, Thinocoridae and Pedionomidae.

Body-form diverse, from slender to stocky. Females slightly to considerably larger than males, though in a few species males are larger (Jehl & Murray 1986). Wings, long and pointed; p10 longest; 15–22 secondaries, including elongate tertials, which, with scapulars, cover back and rump when at rest. Tail, short; 12 feathers except in *Gallinago*, which have 14–28, and *Coenocorypha*, which have 14. Neck, long. Shape of bill varies considerably, though generally long and slender; usually straight to decurved, but recurved in a few Tringinae; tip of bill, fine or only slightly swollen (cf. Charadriidae) with sensory pits. Compared to Charadriidae, eyes small and head narrow. Unlike Charadriidae, have numerous fine pores in premaxillary bone to accommodate Herbst's corpuscles, which are assumed to be associated with more tactile, less visual, methods of foraging; some species have been shown to be capable of sensing buried prey, either through chemoreception (van Heezik *et al.* 1983) or mechanical detection of vibrations or self-induced pressure signals (Gerritsen *et al.* 1983; Gerritsen 1988; Piersma *et al.* 1994). Skeleton and musculature of jaw distinctive (Burton 1974). In most species, rynchokinesis of skull highly developed, enabling flexible upper mandible to be opened or retracted at tip only (to grasp prey while probing). Tarsi and tibiae, short to long, with transverse scales (except in *Numenius*). Four toes in all species except Sanderling *Calidris alba*; toes fairly long with lateral membrane (webbed in some); hindtoe, small and raised (except in Arenariinae). No crop. Caeca present. Apparently no other waders have spiral sperm cells (similar to those of Passeriformes).

Non-breeding plumage mostly dull and cryptic: mottled greys and browns above, and paler or white below, with or without streaks and spots. Breeding plumage generally much brighter (except in curlews, snipes and woodcocks), with more rufous or black. In HANZAB region, adults seen mainly during austral summer in non-breeding plumage, though breeding plumage can be seen on birds just before n. migration or on arrival after s. migration. Sexes usually similar. Bills, legs and feet variously, sometimes brightly, coloured. Adults generally have two moults per cycle: (1) a partial pre-breeding (pre-alternate) moult of most feathers of body, and, often, some tertials and upperwing-coverts; and (2) a complete post-breeding (pre-basic) moult; both usually performed in non-breeding areas or while staging on migration. Primaries moult outwards, usually after s. migration; some subspecies of Dunlin *Calidris alpina* (q.v.), Purple Sandpiper *C. maritima* and Rock Sandpiper *C. ptilocnemis* moult all primaries on or near breeding grounds before s. migration, a strategy rare in *Calidris*; Bristle-thighed Curlew *Numenius tahitiensis* moult remiges rapidly, inducing flightlessness in 50–70% of birds, apparently uniquely among Charadriiformes. Precocial young nidifugous; most feed themselves. Down varies greatly in structure and pattern; pattern mainly of spotted or striped type (Fjeldså 1977). Juvenile plumage usually distinctive; most like that of non-breeding adults, but often a little brighter, especially in Calidridinae. Moult-strategies of subadults complex and vary considerably with species, route of migration and age of first breeding. Adult plumage attained when 3–21 months old; most scolopacids of our region (except snipes) first attain adult plumage through partial first pre-alternate moult when c. 8–11 months old, or through complete second pre-basic moult when c. 12–16 months old (see discussion of Moults in General Introduction). Swift runners; wade expertly and some species swim habitually (Phalaropodinae). Stance often upright. Flight, fast and direct, often in tight flocks.

When breeding, most scolopacids (except some snipes and woodcocks) are birds of open habitats, including tundra. At other times, use a variety of habitats, including forests (woodcocks) and open sea (phalaropes), though most prefer shallow, fresh, brackish or intertidal wetlands. Greatest concentrations occur on intertidal mudflats,

especially estuaries. Feed mainly by touch, and the mandibular skeleton has distinctive features associated with tactile methods of foraging. When feeding, most probe into soft, moist substrata to catch invertebrates; some (e.g. Arenariinae) forage on rocky shores; surface-tension mechanism for feeding on plankton, recently described for Red-necked Phalaropes *Phalaropus lobatus* (Rubega & Obst 1993), may prove to be widespread among scolopacids with fine bills. Mixed-species foraging flocks common.

Migration the most striking feature of scolopacids. All but some Gallinagoninae, Scolopacinae and two aberrant Tringinae migrate (though some Tringinae partly resident in Europe), usually from breeding grounds in higher latitudes of n. hemisphere to lower latitudes of n. or s. hemispheres; many undertake extremely long migration steps, with non-stop flights of several thousand kilometres preceded by dramatic increase in weight. Scolopacids of HANZAB region breed mainly in e. Russia, Mongolia, n. China and Alaska; Latham's Snipe *Gallinago hardwickii* breeds Japan and in small numbers in e. Russia.

Migratory routes vary dramatically depending on the relationship between breeding and non-breeding ranges, and the ability to undertake long-distance non-stop flights. Some species migrate overland, some via coastal routes and others cross oceans; many species use a combination of these routes. Some species return to breeding grounds by the same route used in s. migration while others return by different routes, and make a loop migration (e.g. Curlew Sandpiper *Calidris ferruginea*). Timing of departure from breeding grounds often varies between sexes (e.g. Bar-tailed Godwit *Limosa lapponica*) and between ages; juveniles often leave at slightly different time (e.g. Bar-tailed Godwit *Limosa lapponica*) or migrate via a different route (e.g. Sharp-tailed Sandpiper *Calidris acuminata*). Most regular non-breeding migrants to Aust. migrate via East-Asian–Australasian Flyway; others to Aust. and, especially NZ, cross Pacific Ocean. Generally, in Aust. and NZ, s. migration Aug.–Nov. and n. migration, Feb.–May. Individuals of most species display a high degree of site-fidelity at breeding, non-breeding and even staging areas; others have little fidelity to breeding site and populations mix much (e.g. Curlew Sandpipers; P.S. Tomkovich). In HANZAB region, displays sometimes seen before migration, e.g. Red Knots in tight single-species flocks in nw. Aust. before migration (Lane & Jessop 1985). Pre-migratory flighting observed during Mar. in NZ (McKenzie 1967).

In non-breeding areas, most species undertake regular local movements between feeding and roosting sites or between different feeding sites. Most local movements are in response to tides, which affect exposure of feeding grounds (e.g. Hindwood & Hoskin 1954; Carter *et al.* 1976; Saunders & de Rebeira 1985; Smith 1985; Lane). Some roosting and feeding sites are close together, birds gradually dispersing from or returning to roosting sites as tides fall and rise (e.g. Robertson & Dennison 1979). At other sites, roosting and feeding sites farther apart, with birds even flying between islands or between islands and mainland (Saunders & de Rebeira 1985); in Capricorn Grp, Qld, Ruddy Turnstones and Grey-tailed Tattlers *Heteroscelus brevipes* fly at least 4 km from Tyron I., where roost at high tide, to North West Reef, where thought to feed (Prendergast *et al.* 1985); at Cairns, Qld, Whimbrels *Numenius phaeopus* move to mouth of Barron R. every evening (Amiet 1957) and can travel up to c. 20 km between roosting and feeding sites (McKenzie 1967; Garnett 1989). In poor weather, such as days of high winds or in storms, may move to sheltered areas other than normal roosting sites, such as near-coastal wetlands or pools in dunes (e.g. Crawford 1972; Forest 1982; Aust. Atlas). Some species dispersive, either locally or over longer distances (see accounts), sometimes in response to availability of food or availability of suitable wetland habitat. In NZ, Common Greenshanks *Tringa nebularia* tend to move round within harbours rather than returning to roosting site each day (Sibson 1965) and, in Tas., Common Greenshanks appear to move between coastal sites (Wall 1953); Curlew Sandpipers apparently move from Westport Bay, Vic., in Aug. when daily exposure of intertidal feeding grounds reduced (Loyn 1978; see also Hindwood & Hoskin 1954; Alcorn 1988).

Mainly feed and roost in single-species flocks. All species are strong fliers and those that form flocks often perform spectacular and complex aerial movements, which are performed with remarkable precision. Many species territorial during breeding season, but others lack specific territorial boundaries and are semi-colonial. Courtship displays, elaborate, including spectacular song-flights, often associated with formation of pairs. Distraction displays include repetitive display-flights, rodent-runs, and feigning injury.

Mating systems extraordinarily diverse, including monogamy (some species pair for life), polygyny (in some species, males display on leks, mating with females that visit their territories; in others, males maintain simultaneous pair-bonds with more than one female but provide no parental care) and polyandry (including double-clutching monogamy, where female lays two successive clutches, each of which is incubated by single adult; and classical polyandry, where female maintains pair-bonds with more than one male). Reasons for diversity of mating systems not clear but short breeding seasons and ability of single parent to incubate clutch and brood and raise chicks probably involved; possibly also related to phylogenetic history. For reviews of mating systems, see Ligon (1993) and Pitelka *et al.* (1974).

In CALIDRIDINAE, mating systems remarkably varied, including monogamy, polygyny, polyandry; most species monogamous (e.g. Pitelka *et al.* 1974). Role of sexes in parental care as diverse as mating systems. Apparently solely by female in the four polygynous species; roughly equally shared in some (e.g. Dunlin *C. alpina*), though female tends to leave chicks earlier; in others, male undertakes more of work and females leave before chick-rearing (or even

incubation) complete. Behaviour more complex in successive polyandrous species, with males raising first brood while females may lay and raise another clutch. In GALLINAGONINAE, mating systems poorly known but several species monogamous; Great Snipe *Gallinago media* promiscuous, mating at leks, and apparently unique among snipe in performing courtship display on ground; others have crepuscular or nocturnal display-flights accompanied by distinctive calls and non-vocal sounds (see Gallinagoninae). Mass flights of displaying snipes have been said to be aerial leks in several species, but confirmation needed (could be result of unsettled territorial boundaries early in breeding season) (Byrkjedal 1990). In TRINGINAE, most species monogamous but successive polyandry can occur in Spotted Redshank *Tringa erythropus* and Spotted Sandpiper *Actitis macularia*. Parental care shared about equally or females leave breeding grounds early while males undertake or finish rearing chicks. ARENARIINAE are monogamous; Ruddy Turnstone territorial and aggressive. LIMNODROMINAE, poorly known; apparently monogamous; territorial but *L. semipalmatus* nests in small colonies. Both sexes incubate; males undertake most of chick-rearing. In PHALAROPODINAE, many sex roles reversed when breeding; females almost unique among Scolopacidae in undertaking courtship behaviour, contesting access to mates in 'scramble displays' (Reynolds 1987; Colwell & Oring 1988a). Phalaropes usually monogamous, though polyandry recorded in all three species; incidence of polyandry may vary between populations but reasons not yet clear (e.g. Colwell & Oring 1988b). Males undertake virtually all incubation and raise chicks alone (see Colwell 1986; Colwell & Oring 1988a,b).

Most scolopacids breed first at 2 years old, though some species can breed in their first year and maturity may be delayed for more than 2 years in some large long-distance migrants. Usually nest on ground, often concealed in herbage. The scrape, often made during a scraping ceremony by the male in the presence of female, is often lined, usually after laying the first egg and more lining is added during incubation. Unusually, Solitary *Tringa solitaria*, Green *Tringa ochropus* and some Wood *Tringa glareola* Sandpipers recorded nesting in trees, usually in nests of other birds (see BWP). Usually four eggs per clutch, in some cases two or three. Eggs usually pyriform, with dark-brown and black markings, over paler ground-colour; all are cryptically coloured. Incubation normally starts with laying of last egg and chicks hatch almost simultaneously. Both sexes usually share incubation, though one bird often takes greater share. Downy young leave nest within 1 day of hatching and generally accompanied by brooding adult till able to fly. Social organization, social behaviour and breeding not discussed further in subfamily accounts.

In East-Asian–Australasian Flyway, hunting and destruction of wetland habitats major threats to shorebirds; this Flyway said to be probably the most threatened migration system in world (Lane & Parish 1991). Outside Aust. and NZ, hunting widespread, mainly for food, but little information available on impact on populations (Lane & Parish 1991). For example, in Thailand and n. Vietnam, both Great Knot and Red-necked Stint on passage or overwintering are eaten, and captive birds are kept to act as decoys to catch other waders; band-recoveries of Red-necked Stints in n. Vietnam have come from birds taken for food (Starks 1987; J.R. Starks). Many wetlands destroyed by reclamation for agriculture, aquaculture, salt-production, and urban or industrial development, including wetland habitats in Aust. and NZ (Lane & Parish 1991). Aust. is signatory to the Ramsar Convention and to bilateral treaties with Japan (JAMBA) and China (CAMBA) to protect migratory birds.

In many n. hemisphere breeding areas, breeding success cyclical and thought to be linked to population cycles of lemmings, which in turn influence levels of predation of breeding birds (Underhill *et al.* 1993). For example, in breeding areas of Curlew Sandpipers, decreased populations of lemmings *Lemmus sibiricus* and *Dicrostonyx torquatus*, the regular prey of Arctic Foxes *Alopex lagopus*, results in increased predation of eggs and young of Curlew Sandpipers (Roselaar 1979). Reproductive success in n. hemisphere in preceding breeding season reflected in numbers and proportion of juveniles and immatures in populations in non-breeding areas, such as Aust. and NZ.

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28 Gallinagoninae

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Subfamily TRINGINAE godwits, curlews, 'shanks' and allies

Diverse and widespread assemblage of shorebirds, varying markedly in size and shape; include small species (*Actitis*, 19 cm) and largest waders (*Numenius*, up to 66 cm in *madagascariensis*). Mostly migratory, breeding from low Arctic to Temperate regions of n. hemisphere. About 30 species, in three tribes (see Table 1) (Jehl 1968; Zusi & Jehl 1970); Prosobiniini restricted to islands of Pacific Ocean. In HANZAB region, 22 species in seven genera recorded: 13 regular non-breeding migrants, seven accidentals, and two doubtfully recorded.

Table 1

| TRIBE | GENUS | NUMBER OF SPECIES (NUMBER RECORDED HANZAB REGION ¹) |
|--------------|---|---|
| Numenini | <i>Limosa</i> (godwits) | 4 (2NB, 1A) |
| | <i>Numenius</i> (curlews and whimbrels) | 8 (3NB, 1A, 1D) |
| | <i>Bartramia</i> | 1 (1A) |
| Tringini | <i>Tringa</i> ('shanks') | 10 (4NB, 4A, 1D) |
| | <i>Xenus</i> | 1 (1NB) |
| | <i>Actitis</i> | 2 (1NB) |
| | <i>Heteroscelus</i> (tattlers) | 2 (2NB) |
| | <i>Catoptrophorus</i> | 1 (0) |
| Prosobiniini | <i>Prosobonia</i> | 2, including 1 recently extinct (0) |

1 NB = regular non-breeding migrant; A = accidental; D = unacceptably claimed.

Monophyly of Subfamily not established. Phalaropes and dowitchers sometimes included, though treated separately here (see Phalaropodinae and Limnodrominae). Other unresolved taxonomic problems include: (1) various features of anatomy, biochemistry and mallophagan parasites (Timmerman 1957; Ahlquist 1974; Strauch 1978) suggest relationship of *Limosa* and *Xenus* to dowitchers; (2) anatomical studies suggest that curlews, godwits and some allies might be better placed in separate subfamily (Lowe 1931; Kozlova 1962) (Numeninae not Limosinae; Jehl 1968), which agrees with phylogenies constructed from allozyme data (Christian *et al.* 1992); (3) affinities of *Prosobonia* are not clear; anatomy supports inclusion in Tringinae (Jehl 1968; Zusi & Jehl 1970) but some features of muscles of jaw and tongue resemble Calidridinae (Burton 1974); there are no studies of downy young, biochemistry or DNA of *Prosobonia*; (4) there is little agreement about whether *Actitis*, *Heteroscelus* and *Xenus* (recognized here after Christidis & Boles 1994) should be included in *Tringa*.

Females larger than males, especially in Numenini. Great diversity in structure of bill: in Numenini, long and highly rhynchokinetic, decurved to straight or slightly upturned; in most Tringini, shorter and straighter, and only moderately rhynchokinetic in many; difference in bills associated with variety of methods of feeding. Differ from Calidridinae in cranial structure (Lowe 1915) and musculature of jaw (Burton 1974). Body-form diverse; typically have narrow, deeply keeled sternum (associated with powerful flight) and upright stance associated with oblique plane of *foramen magnum* of occiput. Twelve rectrices. Tarsus, long, not greatly compressed; in Tringini, scutellate in front and usually behind; in Numenini, reticulate behind and scutellate or reticulate in front. Hallux, small and raised; small to minute webs between bases of anterior toes; most species can swim.

Most species undergo marked seasonal change in appearance of plumage; *Numenius*, *Bartramia* and *Prosobonia* do not. Sexes usually alike in breeding plumage, except in *Limosa*, in which males brighter. In general, plumages typical of Scolopacidae and sequences of moult resemble those of Calidridinae. Down of precocial young, soft and ramose; at least three patterns (Jehl 1968; Fjeldså 1977; BWP): (1) In most Numenini, down buff to cinnamon, with partially exposed grey bases, marked above by discontinuous dark-brown blotches and bands; in mid-dorsal region bands and blotches arranged in elongate (*Limosa*) or compact (*Numenius*) diamond-shape. (2) In most Tringini, pattern includes three prominent dark bands along length of back, as well as prominent dark blotches on wing-pad, thigh, lower leg and crown and cap; underparts off-white. (3) In *Heteroscelus*, *Actitis* and *Xenus*, dorsal pattern, pebbly, superficially like that of Charadriidae but with bold black mid-dorsal line; underparts off-white. *Bartramia* has unusual stiff down with densely mottled pattern like adult; downy young of *Prosobonia* apparently undescribed.

Inhabit wide range of wetland habitats, including intertidal mudflats, reefs and atolls, damp grasslands and (especially in Tringini) shallow, brackish or freshwater pools; except in high Arctic, Tringinae at almost all sites

where waders congregate. Feeding behaviours diverse; feed at night and during day, using sight and touch; in general, visual foraging more important than in Calidridinae. Probe for prey or pick small invertebrates from surface of water or mud; *Limosa* and some *Numenius* specialized to probe mud deeply for large invertebrate prey; Tringini recorded using 'mowing' action, though few observations in HANZAB region.

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Numenius minutus **Little Curlew**

COLOUR PLATE FACING PAGE 128

Numenius minutus Gould, 1841, *Proc. Zool. Soc. Lond.* 1840: 176 — Maitland on the Upper Hunter River.

Numenius is from the Greek νομήνιος, an unknown bird mentioned by Hesychius, Diogenes Laertius, and Suidas, but long associated with the Eurasian Curlew *Numenius arquatus* by reason of its long, crescent-shaped bill (νεομηνία, new moon). The specific epithet is Latin (*minutus*) for little.

OTHER ENGLISH NAMES Little Whimbrel (NZ); Pygmy Curlew, Siberian Baby Curlew.

MONOTYPIC

FIELD IDENTIFICATION Length 28–31 cm; wingspan 68–71 cm; weight 175 g. Smallest curlew. Medium-sized wader with small head; long slender neck; longish wings and tail giving attenuated rear-end at rest; short slender bill, decurved toward tip; and medium-length legs. Like Whimbrel *Numenius phaeopus* but much smaller, with proportionately shorter, thinner and straighter bill; similar in size to Pacific Golden Plover *Pluvialis fulva* but slightly slimmer and longer-legged. Boldly striped head and general pattern of plumage similar to that of Whimbrel but overall tone warmer buffish-brown, and with more lightly patterned underbody, incomplete dark loreal stripe giving more open-faced expression, and dark-brown back,

rump and uppertail-coverts concolorous with rest of upperparts in flight. Trisyllabic call distinctive. Sexes alike, but females slightly larger. No seasonal variation. Juvenile and immature separable when close.

Description Adult Head strongly patterned: crown, blackish brown, with narrow pale-buff median crown-stripe broadening toward nape; broad pale-buff supercilium; and blackish-brown eye-stripe formed by small dusky triangular patch in front of eye and narrow dark line starting below eye and curving up to rear ear-coverts; often show separate thin short dark streak on lower ear-coverts. Rest of sides of head, pale buff, finely streaked darker and grading to off-white on chin and

throat; anterior lores, pale buff, combining with broad buffy fore-supercilium to give open-faced expression; large dark eye surrounded by narrow whitish eye-ring. Hindneck and sides of neck, pale buffish-brown with narrow dark streaking, latter concentrating in diffuse narrow dark stripe running down centre of hindneck to mantle. Mantle, scapulars and central innerwing-coverts, blackish brown, fringed and broadly notched cinnamon-buff. Tertials, paler, grey, with narrow blackish bars interrupting broad, notched, cinnamon buff edges. Back, rump and upperpart-coverts, blackish brown with small buff or cinnamon-buff notches, often joining on tail-coverts to form narrow bars. Tail, grey-brown with narrow dark barring and narrow buff tip. In flight: upperparts dark; remiges, primary coverts and leading-edge of innerwing, blackish brown, contrasting with paler panel on central innerwing formed by buff-fringed greater, median and hindmost rows of lesser coverts; shaft of outermost primary, white. Foreneck and breast, buff, finely streaked dark brown and with some fine dark-brown barring on sides of breast, sharply separated from unmarked creamy-white belly, centre of vent and undertail-coverts; flanks, and sides of vent and undertail-coverts, buff, with some irregular dark barring along flanks. Underwing-coverts and axillaries, buff, narrowly barred dark brown, contrasting with uniformly dark remiges and whitish belly. In worn plumage, crown and upperparts appear mostly dull black, with buff and cinnamon fringes abraded and notches bleached to off-white and partly worn away (often completely from tertials, leaving indented edges). Bill, blackish brown, with basal half of lower mandible fleshy pink to bright pink. Iris, dark brown. Legs and feet, bluish grey. **Juvenile** Like adult; differs by: more buff plumage, with feathers of upperparts showing smaller and paler buff notches, which give more finely pale-spotted appearance to upperparts when fresh; tertials darker blackish-brown, bordered by rows of alternating short black bars and pale-buff notches; dark streaking on foreneck and breast and, especially, dark barring on sides of breast and along flanks paler and less pronounced. Pale spotting on upperparts soon fades to off-white and reduced with wear, upperparts then appearing darker blackish; dark streaking and barring on underparts becomes more prominent with wear. **Immatures** Difficult to distinguish from adult unless a few retained juvenile innerwing-coverts or tertials can be seen. In second calendar year, separable from adult only by heavily worn retained juvenile primaries (fresh in adults); some birds replace a few outer primaries and are separable by contrast between worn inner and fresh outer primaries (uniformly aged and fresh in adults); a few inseparable from adult when moult complete.

Similar species Small size and short bill normally sufficient to rule out confusion with larger congeners, though may be confused with **Whimbrel** (q.v.). Superficially similar to **Upland Sandpiper** *Bartramia longicauda*, which is: slightly smaller; with shorter, nearly straight bill, with mainly yellowish lower mandible; relatively longer tail extending beyond wing-tips at rest; plainer face (no dark eye-stripe); much more heavily marked underbody, especially flanks, which show strong brown bars and chevrons; shorter, yellow legs. In flight, back to uppertail-coverts darker uniform black, often with some white at sides of rump; pale barring on remiges (particularly below) and off-white (not buff) ground to heavily barred axillaries and underwing-coverts; tips of feet do not trail beyond tip of tail in flight.

In non-breeding season, in dense flocks of several hundred, sometimes thousands, on coastal and inland grasslands and blacksoil plains of n. Aust., near freshwater swamps and

pools or flooded ground. Also on other dry open grassy areas such as pasture, airfields, playing fields and suburban lawns, areas of bare cultivation. Associate with other waders, e.g. Pacific Golden Plover, Australian Pratincole *Stiltia isabella* and Oriental Plover *Charadrius veredus*; in NZ, occasionally with New Zealand Dotterel *Charadrius obscurus* and Black-winged Stilts *Himantopus himantopus*. Not very wary, and often tame and approachable. Active, with nimble tripping gait recalling *Pluvialis* plovers; stance more erect than larger congeners; when alarmed, stand erect or crouch out of sight in long grass. Feed mostly by picking and shallow probing; walk steadily in loose groups, picking as they go. Fly with shallow deliberate yet languid wing-beats giving easier take-off and freer, more manoeuvrable flight than larger congeners, again recalling *Pluvialis* plovers; in flight, size and general shape may suggest large plover, but show same deep chest and medium-length decurved bill as congeners; tips of toes often just project beyond tip of tail. Usual flight call, a soft whistled *tchew-tchew-tchew*, usually of three notes, each rising slightly in pitch, sometimes with emphasis on last note; also give harsh *kweek-ek* in alarm.

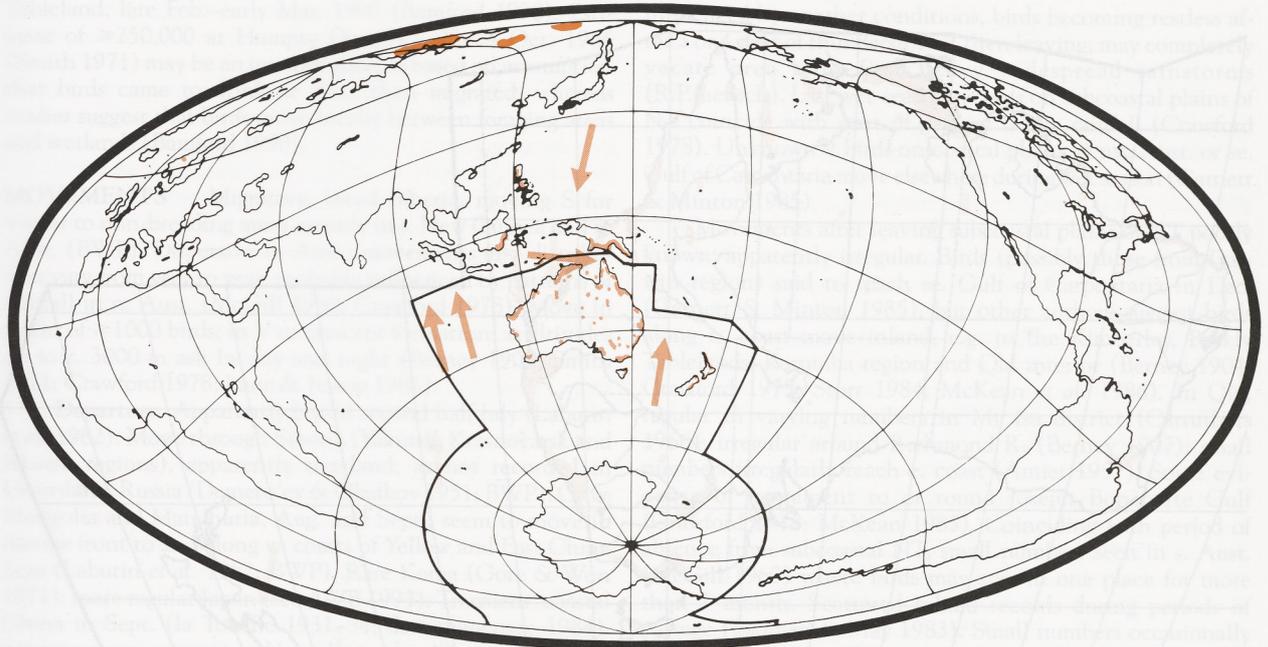
HABITAT Short, dry grasslands and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools; often on artificial short-grassed flats, such as mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips. Occasionally in open woodland with grassy or burnt understorey, and in dry saltmarshes; also coastal swamps and on sheltered coasts on mudflats or sandflats of estuaries or beaches.

Mostly feed in dry grassland or sedgeland, either natural (e.g. dominated by *Eleocharis*, *Hymenachne*, *Ludwigia*, *Pseudoraphis* or *Iseilema*) or artificial (e.g. lawns, football grounds); which may vary in density from bare ground to >90% projected ground cover. Generally in grass <20 cm tall; avoid dense (>75% projected ground-cover) grass >20 cm tall. Often forage in areas that have been recently burnt. Foraging sites usually within 5 km of daytime roosting sites. Sometimes forage in grasslands round pools, river beds and water-filled tidal channels; occasionally in shallow water at edges of billabongs, among emergent grasses or partly submerged *Ipomoea* vine during heat of day, moving to dry grasslands when cooler. Also on flooded claypans and floodplains inundated by spring or king tides, though vacate foraging areas inland when they become flooded. May feed on bare ground, such as blacksoil plains or edges of reservoirs, where soil has been moistened (Liddy 1960; McGill 1960; Lincolne 1970; Smith 1971; Crawford 1978; Boekel 1980; Garnett & Minton 1985; Garnett 1986; McKean *et al.* 1986; Murlis *et al.* 1988; Bamford 1988a,b, 1989, 1990; R.P. Jaensch). Vagrant in Tas., observed foraging among seagrass, then on damp sand after tide had receded (Thomas 1968).

Plate 3

Hudsonian Godwit *Limosa haemastica* (page 77)
 1 Adult female breeding; 2 Adult male breeding;
 3 Adult female non-breeding; 4 Juvenile; 5, 6 Adult

Black-tailed Godwit *Limosa limosa* (subspecies *melanuroides*) (page 68)
 7 Adult male breeding; 8 Adult female breeding;
 9 Adult non-breeding; 10 Juvenile; 11, 12 Adult



Congregate to loaf and roost on exposed margins of shallow (<30 cm deep) freshwater pools in sparsely grassed floodplains during hottest times of day. Prefer pools with bare dry mud and without fringing vegetation; occasionally roost on dry mudbanks in shallow water. Do not use pools if dry or flooded, or shoreline vegetated (Garnett & Minton 1985; Bamford 1988a,b, 1989, 1990; Jaensch 1989), though once recorded using a pool with shoreline and shallows covered in low (15 cm) creeping *Ipomoea* vine (Lincolne 1970; Bamford 1990). Also loaf or roost in shallows of reservoirs (e.g. Fogg Dam) and the sea (near Broome), especially after freshwater pools have dried up (Lincolne 1970; Smith 1971; Garnett & Minton 1985; Murlis *et al.* 1988). Once recorded 'resting' in grassy, open woodland (McKean 1985), and on bare blacksoil plains (Smith 1971). Roost at night in dry or recently burnt grasslands on floodplains, which may be without vegetation for hundreds of metres (Garnett & Minton 1985; Bamford 1988b, 1989, 1990; Jaensch 1989); occasionally on mudflats when nearby grasslands are unburnt and round swamps (Bamford 1990). Garnett (1989) suggested that birds may roost round margins of saltflats.

Often use artificial short-grassed areas in urban areas; also pasture, stubble and germinating crops. Occasionally artificial water-impoundments; sewage ponds and saltworks; once at overflow of artesian bore (Badman & May 1983). In Gulf Country, has benefited from provision of watering points and large area of grassland by pastoralists (Garnett 1989). In Kakadu NP, may have benefited from control of numbers of feral Water

Buffalo *Bubulus bubulis* (Bamford 1988b), though this has, at least in part, resulted in denser covering vegetation on floodplains, leaving less habitat for shorebirds (R.P. Jaensch).

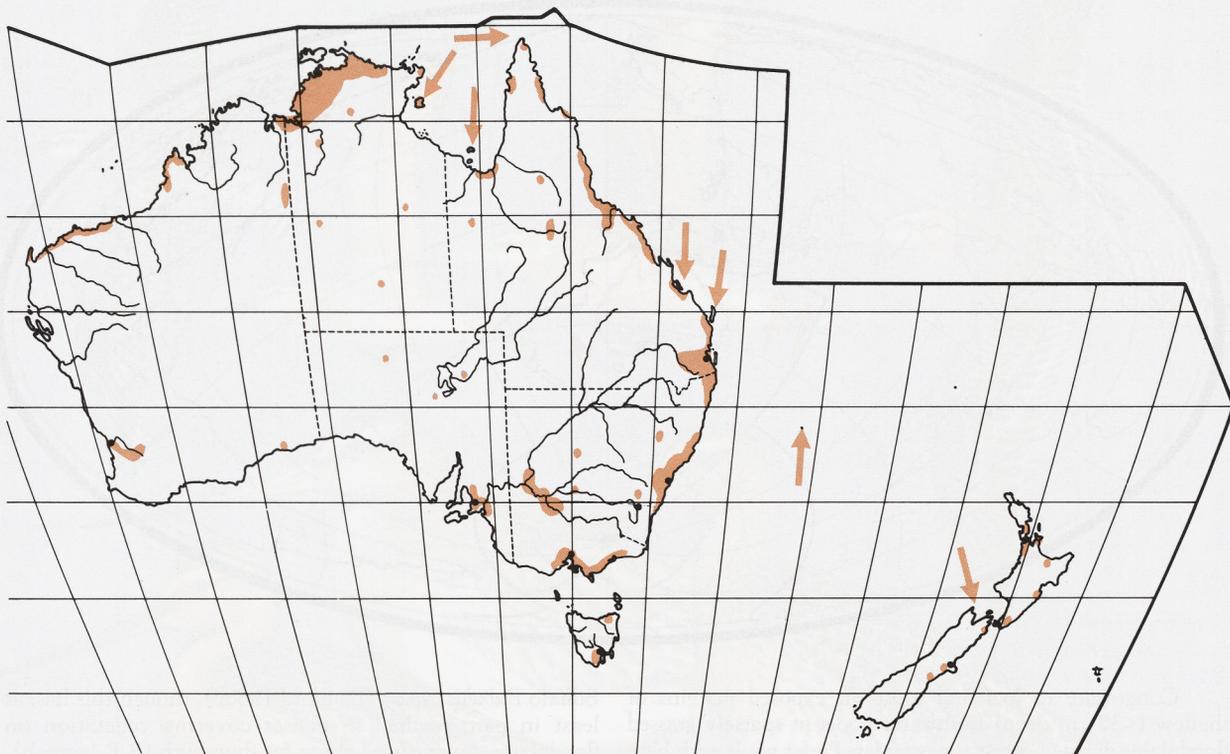
DISTRIBUTION AND POPULATION Breed Siberia, patchily from upper Kochechumo R., N to Lena R., near Kyusyura in foothills of Kharaulakhsy Ra., and SE to upper Indigirka R., near Tyubelyakh (Labutin *et al.* 1982). Transient through Mongolia, China, Japan, Indonesia and New Guinea; few records from Borneo, and straggler to Philippines (Orn. Soc. Japan 1974; Smythies 1981; de Schauensee 1984; Coates 1985). Most winter in n. Aust.; irregular visitor to NZ. Vagrant to Palau and Guam in w. Micronesia (Pratt *et al.* 1987), and Norway (BWP).

Aust. Widespread N of 20–21°S. Scattered records elsewhere inland; widespread but scattered records on e. coast. **Qld** Generally widespread N of 20–21°S, including inland; elsewhere, widespread in coastal regions. In SE, recorded W to Dalby (Qld Bird Rep. 1984). **NSW** Most records scattered E of Great Divide, from Casino, S to Greenwell Pt, and once S to Bermagui R., 1990; W of Great Divide recorded at Griffith; Windouran Swamp (ENE of Moulamein); Fletcher's L., Dareton; Wentworth; Springwood Stn (N of Wentworth); Morrison's L., near Ivanhoe; Eureka Plains; near Marshall's Ponds (Whiter 1991; NSW Bird Reps; Aust. Atlas). **Vic.** E of Wilson's Prom., recorded at L. Tyers, 8 Sept. 1979 (Aust. Atlas); L. Wellington, 2 Feb. 1981 (Vic. Bird Rep. 1981); Shallow Inlet, 5 Mar. 1967 (Wheeler 1967; Cooper 1970). Most records from round Port Phillip Bay; also from lakes in Western Districts, and lakes in region of Mystic Park (Wheeler 1957; Thomas 1970b; Aust. Atlas; Vic. Bird Reps). **Tas.** Single, Ralph's Bay–South Arm, Derwent R. estuary, 23 Jan. 1965 (Milledge 1966); single, Pittwater, 12 Feb. 1966 (Thomas 1970a; Tas. Bird Rep. 1); single, C. Portland, 24 Jan.–6 Feb. 1988 (Tas. Bird Rep. 18). Incorrectly listed in Tas. Bird Rep. 14 (Tas. Bird Rep. 15). Also listed as occurring in Tas., without evidence, by Hall (1924). **SA** Vagrant; first recorded Encounter Bay, Mar. 1902 (Condon 1969). Most records clustered

Plate 4

Bar-tailed Godwit *Limosa lapponica* (page 82)
 1 Adult male breeding; 2 Adult female breeding;
 3 Adult female non-breeding; 4 Juvenile; 5, 6 Adult

Asian Dowitcher *Limnodromus semipalmatus* (page 206)
 7 Adult breeding; 8 Adult breeding;
 9 Adult non-breeding; 10 Juvenile; 11, 12 Adult



between Price, Gawler, Fleurieu Pen. and L. Alexandrina. Other records all N of 30°S: single, L. Killalpaninna, 16 Oct. 1978 (Aust. Atlas); single, Coward Springs, 1–3 Oct. 1978 (Badman & May 1983); three (including specimen), Welcome Bore, 23 Mar. 1981 (Badman & May 1983); about six, Mintabie, 27 Sept. 1990 (Cox 1991). **WA** Rare S of 21°S; s. records include (singles unless stated): three, Arubiddy Stn, 13 Oct. 1984 (Dymond 1984, 1988); mouth Preston R., 9 Feb. 1986 (Anon. 1986); Coolup, late summer 1949 (Serventy & Whittell 1976); two, Coolup, late summer 1953 (Serventy & Whittell 1976); Mandurah, 11 Nov. 1984 (Anon. 1984); Swan R., Dec. 1964 (Serventy & Whittell 1976); two, White Water L., Nonalling L. NR, Nov. 1984 (Jaensch *et al.* 1988). Farther N, recorded from Peron Pen. (Davies & Chapman 1975), Carnarvon (Anon. 1984), McNeill Claypan (Storr 1985) and Pt Cloates–Ningaloo (Storr 1984; Halse & Halse 1988); N of 21°S, widespread, and recorded in n. Pilbara region round Port Hedland, and in sw., n. and e. Kimberley Div. Also in Great Sandy Desert at Sturt Ck HS and Figure 8 Waterhole (Aust. Atlas). **NT** Mainly N of 20°S (R.P. Jaensch). Widespread in Top End, from Keep R. NP, E to Gove Pen. and Groote Eylandt, and S to Kidman Springs. Also recorded at Frewina, Alice Springs, and in the Tanami Desert (Parker 1969; Gibson 1986; Aust. Atlas). Widespread in Barkly Tableland region from L. Woods to Playford R. (Bamford 1990; R.P. Jaensch); 70, Birrindudu floodplain, 8 Apr. 1993 (R.P. Jaensch; B. Wells).

NZ Based on information supplied by Barrie Heather. Irregular visitor (all singles unless stated): **NI** Parengarenga Harbour, Mar. 1971 (Edgar 1971), 22 Jan. 1976 (CSN 23), 30 Mar. 1986 (CSN 34); two, Whangarei Harbour, 13 Mar. 1977 (CSN 24); Kaipara Harbour, 13–14 Mar. 1982 (CSN 30); Manukau Harbour, 28 Mar. 1964 (Urquhart & McKenzie 1964), 7 Dec. 1975 (CSN 23); Miranda, 13 Oct. 1964

(McKenzie 1965), 4 Jan.–8 Feb. 1966 (McKenzie 1966), 21 Jan. 1988 (CSN 36), unconfirmed, Jan.–May 1994 (B.D. Heather); Kaituna Cut, Maketu, 6 Jan. 1976 (Palliser 1976; CSN 23); Ahuriri Lagoon, 12 July 1952 (Brathwaite 1953a), 26 Oct. 1952, 12 Apr. 1953 (Brathwaite 1953b), three, 17 Jan. 1969, single, 22 Oct. 1972 (Heather & Mackenzie 1973); 28 Jan. 1979 (CSN 26); L. Wairarapa, 31 Jan. 1983 (CSN 31); Wellington w. coast (beachcast), Nov. 1964 (Imber & Boeson 1969); Manawatu R. estuary, 15 Jan.–18 Feb. 1984 (CSN 32). **SI** Farewell Spit, 24 Jan. 1961 (Wiblin & Bell 1961), Mar. 1968 (Edgar 1974); Blenheim, Dec. 1977 (B.D. Heather); L. Ellesmere, two (including specimen), June 1900 specimens, Mar. 1921, 1922, 1925, 1927 (Stead 1923; Brathwaite 1953b; Oliver); two, 6 Feb. 1972 (CSN 19), four, 19 Feb. 1974 (CSN 21), 1–2, 5 Jan.–22 Feb. 1981 (CSN 29), Jan.–Mar. 1986, two Apr. 1986 (CSN 34); L. Wainono, 3 Nov. 1973 (CSN 21).

Lord Howe I. Single, 4 Nov. 1984 (NSW Bird Rep. 1984).

Cocos-Keeling Is Single, 12, 15 Mar. 1983; three, 26 Mar. 1983 (Stokes *et al.* 1984).

Christmas I. Several records (Stokes *et al.* 1987).

Populations Estimated at 180,000 (Watkins 1993). Areas of international importance in Aust. (Watkins 1993), are: Alligator Rs area, NT, 180,000 birds (Morton *et al.* 1989); Roebuck Plains, WA, 50,000 (Minton 1987); Anna Plains, WA, 12,000 (Garnett & Minton 1985; Jaensch 1989); Karumba Plains, Qld, 6390 (Lane); Roebuck Bay, WA, 5000 (Murlis *et al.* 1988); Parry R. floodplain, WA, 3000 (Jaensch 1989); L. Eda, WA, 2000 (Jaensch 1989). Other significant counts include: c. 40,000, Kakadu NP, NT, Oct. 1987 (Bamford 1988a); >10,000, L. Finniss, at edge of Adelaide R. floodplain, Oct. 1993 (R.P. Jaensch); >5000, near Magowra and Inverleigh, Qld, Apr. 1985 (Garnett 1989); 2000–3000, Richmond area, Qld (Berney 1904); ≥1400 in L. Sylvester area of Barkly

Tableland, late Feb.–early Mar. 1990 (Bamford 1990). Estimate of $\geq 250,000$ at Humpty Doo, NT, 22–24 Oct. 1966 (Smith 1971) may be an overestimate, as based on assumption that birds came to drink at dam, then migrated, whereas studies suggest that birds move locally between foraging areas and wetlands (Bamford 1990).

MOVEMENTS Migratory; breed Siberia, moving S for winter to non-breeding areas, mainly in s. New Guinea and n. Aust. (BWP). Dispersive in Aust.; movements and distribution vary from year to year, probably influenced by patterns of rainfall in n. Aust. (McGill 1960; Crawford 1978). Move in flocks of ≥ 1000 birds; in V or crescent formation; at altitudes up to c. 3000 m asl; by day and night (Berney 1907; Smith 1971; Crawford 1978; Lane & Jessop 1985).

Departure Apparently begins second half July (Labutin *et al.* 1982). Move through Siberia (Yakutsk, Krasnoyarsk and Irkutsk regions), apparently overland, as not recorded in Ussuriland, Russia (Dement'ev & Gladkov 1951; BWP). Cross Mongolia and Manchuria, Aug. and Sept.; seem to move in narrow front to and along w. coasts of Yellow and East China Seas (Labutin *et al.* 1982; BWP). Rare Korea (Gore & Won 1971); more regular Japan (see AWB 1993). Transient, coastal China in Sept. (la Touche 1931–34; de Schauensee 1984). Scarce passage migrant in Hong Kong, late Sept. to late Oct. (Chalmers 1986). Route S of China lies E of Borneo; rare in Borneo (Smythies 1981); very rare passage migrant in Thailand (Lekagul & Round 1991); vagrant to Cocos-Keeling Is (Stokes *et al.* 1984). Lack of records between China and non-breeding areas (e.g. from Philippines, Delacour & Mayr 1946; rare in w. Micronesia, Pratt *et al.* 1987), and timing of movements between these areas, suggest long non-stop flight from e. China to s. New Guinea or n. Aust. (c. 5000 km) (Lane; BWP). Passage migrant Wallacea, where most dated records, Oct. (White & Bruce 1986). Uncommon but regular passage migrant in varying numbers in Port Moresby district, PNG; usually arrive PNG, late Sept., mostly in Oct. and Nov.; single specimen from Carstenz Massif, Irian Jaya, suggests at least some may cross central mountain ranges (Schodde *et al.* 1975; Coates 1985; Hicks 1990).

Movements in Aust. poorly understood. Usually first arrive subcoastal plains of NT, mid- to late Sept.; in nw. Aust., in 1992, first arrived mid-Sept., numbers then slowly increasing. Most arrive NT and WA during Oct., either arriving in a broad front or arriving coastal NT then dispersing (Crawford 1972, 1978; Garnett & Minton 1985; McKean *et al.* 1986; Bamford 1990). Uncommon passage migrant Oct. and Nov. through Torres Str. (Draffan *et al.* 1983). Straggler to NZ, mainly Oct.–Apr. (B.D. Heather).

Non-breeding Extraliminally, large numbers occur s. New Guinea, and smaller numbers in Timor, between Oct. and Dec. However, these birds may move S to Aust. during monsoon season (Hoogerwerf 1964; McKean *et al.* 1975, 1986; Coates 1985; Watkins 1993). In Aust., mainly in N.

Movements within Aust. dispersive; move in response to rainfall, subsequent suitability of habitat, and availability of food (Carter 1904; Crawford 1972, 1978; McKean *et al.* 1986), which leads to large-scale movements during non-breeding period; move away from subcoastal plains of NT during wet season. Up to several thousand frequent ovals in Darwin for 4–6 weeks after arrival (R.P. Jaensch); usually leave Darwin region Nov. to mid-Dec., with similar patterns at Kakadu and Borrooloola (Crawford 1978; McKean *et al.* 1986; Bamford 1989). Movement away from subcoastal plains of NT probably

influenced by weather conditions, birds becoming restless after 3 or 4 days of thunderstorms, then leaving; may completely vacate area after first heavy widespread rainstorms (R.P. Jaensch). Last wet-season records on subcoastal plains of NT coincide with start of general heavy rainfall (Crawford 1978). Unknown if birds on coastal plains of nw. Aust. or se. Gulf of Carpentaria move elsewhere during wet season (Garnett & Minton 1985).

Movements after leaving subcoastal plains of NT poorly known; apparently irregular. Birds (possibly those from Darwin region) said to reach se. Gulf of Carpentaria in Dec. (Garnett & Minton 1985), but other authors suggest birds along n. coast move inland, e.g. to the Kimberley, Barkly Tablelands, Karumba region and Qld interior (Berney 1904; Crawford 1978; Storr 1984; McKean *et al.* 1986). In Qld, regular in varying numbers in Mt Isa district (Carruthers 1966); irregular around Richmond R. (Berney 1907); small numbers irregularly reach e. coast (Amiet 1957). Some evidence of movement to or round Joseph Bonaparte Gulf (Crawford 1978; McKean 1985). Coinciding with period of absence from subcoastal NT, small numbers seen in s. Aust. (McGill 1960) where birds may stay in one place for more than 1 month. Scattered inland records during periods of passage (Badman & May 1983). Small numbers occasionally move as far S as sw. WA, Vic. and Tas. (Thomas 1968; Aust. Atlas; Vic. Atlas). In NZ, few stay long in any locality, suggesting movement from, or within, NZ (B.D. Heather). In Aust., some records of unusually high numbers attributable to patterns of rainfall (e.g. in Oct. 1966 when high numbers at Fogg Dam, NT, and heavy rain over much of NT) (Smith 1971; Crawford 1978) (though other congregations appear not to be related to patterns of rainfall, such as occurrence in Darwin area, Apr. 1978 [McKean *et al.* 1986]).

Fly up to at least 10 km to available water; feeding flocks observed moving across plains (Garnett & Minton 1985; see Bamford 1988a, 1989, 1990 for details of local movements in Kakadu).

Return Most leave Aust. during first 2 weeks of Apr. Birds in nw. Aust. probably fly non-stop to Asia; in late Mar. and early Apr. some capable of flying non-stop to s. China. Birds from Gulf of Carpentaria said to stop to feed in NT (Garnett & Minton 1985; Barter 1992), though only occasional records of large concentrations in subcoastal NT, Apr.–May; with no evidence of regular staging around Darwin or Kakadu (McGill 1960; Crawford 1972; Thompson 1978; McKean *et al.* 1986; Bamford 1988a). On subcoastal plains of NT said to be recorded between Mar. and early May only during dry years (Crawford 1978); Top End usually too wet and overgrown during Mar.–Apr. and not suitable for stopover; often none seen in this region during period of n. migration (R.P. Jaensch). However, in years when cyclonic conditions in Gulf of Carpentaria, said to use Kakadu and Darwin floodplains as staging area for n. migration (Bamford 1988a), though, staging in Darwin region recorded in both cyclone and non-cyclone years (McKean *et al.* 1986). Other concentrations before n. migration seen in interior NT and n. Qld, Karumba area, and on Roebuck Plains, WA (McEvey 1967; Storr 1977, 1984; Bamford 1990; Lane).

Extraliminally, rarely recorded from PNG (Coates 1985; Hicks 1990), suggesting birds overfly New Guinea (Beehler *et al.* 1986). Return route apparently reverse route of s. migration (BWP). Scarce passage migrant in Hong Kong between mid-Apr. and early June (Chalmers 1986). Transient coastal China, Apr. and May (la Touche 1931–34; de Schauensee

1984). Often pass Japan (AWB 1993). Arrive on breeding grounds late May (Labutin *et al.* 1982).

Breeding Few winter records from Aust. (Aust. Atlas), e.g. from Pilbara, WA (Fletcher 1980) and NT (Storr 1977). Several have probably stayed in NZ in winter (B.D. Heather).

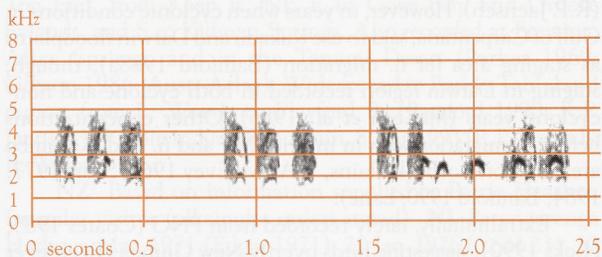
Banding No international recoveries.

FOOD Omnivorous; mainly insects, also seeds and berries.

Behaviour Thrust bill, to base, into soft ground among roots of grass to take small black beetles (Campion 1958; McGill 1960). In Gulf of Carpentaria, forage in flocks of 30–200 that move across dry grass with birds at back of flock continuously flying forward to feed at front of flock (Garnett & Minton 1985). Group seen chasing a small frog (Bamford 1990). In NT, alight on ponds or flutter above water to sip fresh water (Smith 1971; Garnett & Minton 1985).

Adult No detailed studies in HANZAB region. **Plants:** Poaceae: *Oryza* rice husks (Crawford 1978); *Setaria* sds; Fabaceae: *Stylosanthes humilis* sds; Convolvulaceae: sds (van Tets *et al.* 1977). **Animals:** Arachnids: Aranea spiders (van Tets *et al.* 1969, 1977); Insects (Campion 1958; Lincolne 1970; Badman & May 1983); Isoptera: Termitidae (van Tets *et al.* 1969); *Nasutitermes* (van Tets *et al.* 1977); Orthoptera: Acrididae (Campion 1958; Garnett & Minton 1985); Hemiptera: Pentatomidae (van Tets *et al.* 1977); Coleoptera (Campion 1958); Carabidae (van Tets *et al.* 1969, 1977); Scarabaeidae: *Heteronychus sanctaehelenae* (McGill 1960); Diptera: Stratiomyidae: *Odontomyia* larv. (Badman & May 1983); Lepidoptera: larv. (Campion 1958; Crawford 1978); Hymenoptera: Formicidae (van Tets *et al.* 1969): *Rhytidoponera metallica* (van Tets *et al.* 1977).

VOICE Descriptions of calls given by Boswall & Veprintsev (1985); Labutin *et al.* (1982) and Veprintsev & Zablotskaya (1982), all with sonagrams. Flight call usually a series of two or three, occasionally more, sharp whistled notes: *tchew tchew tchew* or *te-te-te*. Call lower and more rasping than any similar call of Greenshank *Tringa nebularia* or Marsh Sandpiper *Tringa stagnatilis*; said to be like calls of Whimbrel, but shorter, slightly more metallic and higher pitched. Examples shown (sonagram A) are calls given by a small group and have two different qualities: (1) strong whistled components with peak energies at c. 2 kHz and c. 4 kHz are superimposed over a soft mushy sound; (2) a much clearer whistled quality with most energy concentrated in one band. This second type is given as a gradually rising series of 4–5 notes, with maximum rise in frequency from c. 2.5 kHz to c. 2.7 kHz. The strong components of both calls are c. 100 ms long, but the rise and fall in pitch of each type differs slightly in detail. A musical *quee-dlee* said to recall Pacific Golden Plover (BWP).



A F. van Gessel; Fogg Dam, NT, Feb. 1984; P36

PLUMAGES Prepared by A.M. Dunn. Begin post-juvenile (first pre-basic) moult on arrival in non-breeding areas. First

pre-supplementary moult of remiges mostly complete in early Apr., but some remiges retained till second pre-basic moult. Partial first pre-breeding (pre-alternate) moult begins Apr. but with no change in appearance. Thereafter, moult twice annually: a complete pre-basic moult, starting on breeding grounds but with most moult taking place after s. migration; and a partial pre-alternate moult to adult breeding plumage (without change in appearance) beginning before n. migration and completed after leaving Aust. Adult non-breeding plumage first attained in second complete pre-basic moult.

Adult (Second and subsequent basic and alternate).

Head and neck Forehead, crown and nape, mostly dark brown (219) with narrow buff (123D) fringes to feathers and often indistinct, buff (123D) to orange-buff (118) median crown-stripe. Broad bold supercilium, from base of culmen to nape, off-white to pale buff (c123D), very lightly streaked dark brown (219). Eye-stripe from centre of lores to ear-coverts, dark brown (219). Anterior lores, chin and throat, off-white to cream (54). Cheeks, sides of neck and hindneck, off-white to pale buff (c123D), densely streaked dark brown (219). Narrow eye-ring, white. **Upperparts** Feathers of mantle, black-brown (119) with brownish-grey (79) bases and orange-buff (118) edges or flattened spots at edges. Scapulars, black-brown (119), notched orange-buff (118) along margins of feathers. Back and rump, black-brown (119) with off-white to buff (123D) lateral spots near tips of feathers. Uppertail-coverts, black-brown (119), notched or barred deep off-white to buff (123D). **Underparts** Feathers of upper breast, pale pink-buff (pale 121D) with dark-brown (219) shaft-streaks, partly concealed dark-brown (219) bars, and concealed dark-grey (83) bases. Lower breast, belly, vent and thighs, white. Flanks, white, barred dark brown (121). Undertail-coverts, white with some thin wavy brown (121) barring. **Tail** Light grey-brown (119C) with widely spaced narrow dark-brown (219) bars and very narrow indistinct off-white fringe. **Upperwing** Primaries, dark brown (121) with off-white fringe near tips of inner primaries; shaft of p1, white. Secondaries, dark brown (121), finely fringed white. Greater primary coverts, dark brown (121) with narrow white fringes at tip. Median primary coverts and alula, dark brown (121). Lesser primary coverts, black-brown (119), very finely tipped off-white to buff (124). Marginal coverts, dark brown (121), narrowly fringed white. Lesser secondary coverts, dark brown (121), finely fringed off-white. Greater and median secondary coverts, dark brown (121) with buff (124) to pink-buff (121D) notches along edges of feather, which quickly fade to white with wear. Tertiaries, dark brown (121) with buff (124) to pink-buff (121D) notched edges and black-brown (119) spots or half-bars inside margins of sides of feathers. **Underwing** Primaries and secondaries, brownish grey (c79); shaft of p10, white. Greater primary coverts, brownish grey (c79) with off-white terminal fringe and subterminal band, and white speckled notches along edges of feathers. Median and lesser primary coverts, light pink-buff (light 121D) with brown (c28) wavy barring. Median and lesser secondary coverts and axillaries, light pink-buff (light 121D) with thin widely spaced wavy brown (28) bars. Greater secondary coverts, off-white, with two grey (c84) subterminal fringes near tips of feather and grey (c84) half-bars along edges of lower half of feathers.

Juvenile Differences from adult: **Head and neck** Fringes on feathers of crown, narrower; crown appears mostly black-brown (119) with indistinct median crown-stripe. **Upperparts** Notches on sides of feathers of mantle, scapulars, back and rump, smaller and less buff, soon bleaching to white, and

abrading, giving darker, less spotted, appearance. **Underparts** Dark shaft-streaks on breast, and bars on sides of breast and flanks, narrower and paler than in adult and less extensive; often no barring on flanks. **Tail** Evenly barred light grey-brown (c119C) and black-brown (119); black-brown bars closer together and more numerous than in adult. **Upperwing** Median secondary coverts have broader off-white to pale buff (c123D) edges. Secondaries and inner primaries have slightly wider, pale edges at tip than adult, off-white rather than buff. P6–p8 may show some white tips to feathers, if not too worn. Tertiaries, dark brown (121) with rows of short black-brown (119) bars and small pale-buff triangular indentations along margins of feathers. **Underwing** Similar to adult.

First immature Similar to or indistinguishable from adult. Juvenile feathers often retained on back, rump, outer tail, upperwing-coverts and tertiaries. Some juvenile remiges retained, particularly on innerwing; these worn feathers contrast with newer adult primaries; sometimes all juvenile primaries retained.

BARE PARTS Based on photos (Pringle 1987) and descriptions (Moon 1983; Hayman *et al.* 1986; Paulson 1993; BWP). **Adult, Juvenile** Bill: upper mandible, dark brown (121) to black-brown (19); lower mandible, pink (c108C) to dull pink (5) at base with dark-brown (c121) tip. Iris, dark brown (219). Legs vary: blue-grey, pale green, grey with green or olive tinge, 'straw coloured'.

MOULTS Based on data from 361 live birds in nw. Aust. (Barter 1992; AWSG), 62 Aust. skins (AM, ANWC, HLW, MV, NTM, SAM, WAM), and information from n. hemisphere (BWP).

Adult post-breeding (Second and subsequent pre-basic). Complete; primaries outwards. Moulting of body starts on or near breeding grounds; involves head, mantle, scapulars, often a few tertiaries, and, sometimes, underparts and median upperwing-coverts. Moulting most extensive in failed breeders (Kozlova 1962). Moulting suspended during migration, and completed in non-breeding areas. Moulting of primaries starts Oct.–Nov.; completed Feb.–Mar., before leaving for breeding grounds. Little data on timing of moulting in Aust., as most data collected before start of moulting of primaries or after it is completed. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial; extent varies between individuals. Includes some feathers of head, mantle and scapulars, and often some feathers of breast and flanks. Begins Apr. and may be completed during migration or after arrival on breeding grounds. **Post-juvenile** (First pre-basic). Partial, involving most feathers of body. Mostly completed in non-breeding areas, but some feathers of body may be replaced before migration. Not known when completed. **Post-juvenile moult of primaries** (First pre-supplemental). BWP stated juvenile remiges usually retained until second pre-basic moult. However, data collected at L. Eda near Broome, nw. Aust., from 28 Mar. to 2 Apr. (AWSG), suggest that most juveniles moult primaries; all 346 birds caught had completed, or had nearly completed, moult of primaries. Thus, likely that most Aust. immatures moult primaries before undertaking non-stop flight to e. China (see Movements) (Barter 1992). **First immature breeding** (First pre-alternate). As adult pre-breeding, but more restricted.

MEASUREMENTS Aust., skins (AM, ANWC, HLW, MV, NTM, QM, SAM, WAM): (1) Adults; (2) Juveniles and first immature non-breeding; (3) Ages combined.

| | MALES | FEMALES | |
|--------|--------------------------------|----------------------------|----|
| WING | (1) 181.6 (6.78; 173–191; 9) | 185.8 (4.01; 178–194; 22) | * |
| | (2) 183.6 (2.39; 181–187; 8) | 188.2 (4.27; 179–195; 17) | ** |
| TAIL | (3) 69.8 (3.00; 63–74; 19) | 69.8 (3.35; 64–78; 39) | ns |
| BILL | (3) 41.9 (2.40; 36.9–44.8; 18) | 44.5 (2.32; 32.9–49.0; 38) | ** |
| TARSUS | (3) 48.4 (1.97; 44.7–51.7; 17) | 49.6 (1.71; 46.1–54.7; 39) | * |
| TOE C | (3) 31.7 (1.34; 29.6–34.0; 13) | 31.8 (1.26; 28.6–34.4; 27) | ns |

No significant difference in length of wing of adults and of juveniles and immatures.

(4) NW. Aust., adults, live; TAT = tarsus and toe (Barter 1992). (5–6) Kakadu NP, NT, adults, live (Bamford 1990): (5) Oct.–Nov.; (6) Sept.–Oct.

| | UNSEXED |
|------|---------------------------------|
| WING | (4) 187.5 (5.05; 173–200; 138) |
| TAIL | (4) 74.1 (2.76; 69–81; 39) |
| BILL | (4) 43.9 (2.43; 38.9–49.7; 162) |
| THL | (4) 78.5 (3.00; 72.0–90.0; 163) |
| | (5) 77.9 (2.45; 72.7–82.7; 15) |
| | (6) 79.6 (2.94; 74.7–85.5; 32) |
| TAT | (4) 83.7 (2.75; 79–89; 48) |

WEIGHTS Birds caught Kakadu NP, NT, Sept.–Nov.: 148 (13; 126–175; 13). Birds caught nw. Aust., late Mar. to early Apr.: 173.1 (15.98; 118–221; 338) (Barter 1992); birds were gaining weight before migration but most had not reached estimated 214 g needed for departure (see Davidson [1984] for calculation of flight-ranges). A few other weights in BWP.

STRUCTURE Wing, long, narrow and pointed. Eleven primaries; p10 longest; p9 1–5 mm shorter, p8 8–16, p7 22–31, p6 36–44, p5 51–57, p4 63–70, p3 76–82, p2 86–93, p1 95–103; p11 minute. Eighteen secondaries, including four tertiaries; tips of longest tertiaries fall between p6 and p7 on folded wing; five humerals. Tail, short and slightly rounded; 12 rectrices; t1 longest; t6, 7–11 mm shorter. Bill, about 1 to 1.5 times length of head, slender and slightly decurved; thickest at base and tapering for half length of bill; depth of curve about 3 mm near centre of bill. Nostril, long, slit-like and set in long shallow nasal groove, about three-quarters length of bill. Tarsus, long and slender; scales, scutellate. Tibia, about 30 mm exposed. Outer toe 77–84% of middle, inner 73–81%, hind 29–33%. Small webs between each toe barely reach basal joint.

AGEING After arrival in Aust., juveniles distinguished by more sharply defined lateral spots to feathers of upperparts, upperwing-coverts and tertiaries, which quickly wear leaving jagged notches; upon arrival, adults have old primaries or are just beginning moult of primaries. Immatures that moult all primaries pose ageing problems. One specimen was aged on retained, worn juvenile inner secondaries and some coverts (BWP) but some, or even most, possibly moult these feathers too, and are then indistinguishable from adults. Some birds in second year identified by contrast between new outer primaries and very worn inner primaries and secondaries on arrival in Aust; this contrast probably only present till about Dec., when inner primaries replaced.

RECOGNITION Eskimo Curlew (not reported from HANZAB region) differs from Little by: slightly longer bill

and shorter tarsus; wing-tips project well beyond tip of tail (just reach tip of tail in Little); wing-lining, cinnamon-buff; upperparts more heavily marked, with bold chevrons on breast and flanks; loreal stripe reaches base of bill (Farrand 1983; Gollop *et al.* 1986; Haymen *et al.* 1987; Lewington *et al.* 1991; Paulson 1993).

GEOGRAPHICAL VARIATION None. Forms superspecies with (and has been considered a subspecies of) Eskimo Curlew; see BWP.

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Volume 3, Plate 5

Little Curlew *Numenius minutus* (page 95)
1 Adult; 2 Juvenile; 3, 4 Adult

Upland Sandpiper *Bartramia longicauda* (page 125)
5 Adult; 6 Juvenile; 7, 8 Adult

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