

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

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

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

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

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

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

REFERENCES

- Christian, P.D., *et al.* 1992. *Aust. J. Zool.* 40: 291–302.
- Fjeldså, J. 1976. *Vidensk. Medd. dansk. Natur. Foren.* 139: 179–243.
- 1977. *Guide to the Young of European Precocial Birds*. Scarv Nature Productions, Tisvildeleje.
- Glenny, F.H. 1955. *Proc. US natn. Mus.* 103 (3346): 525–621.
- Jehl, J.L., Jr. 1968. *Mem. San Diego Soc. nat. Hist.* 3.
- Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496.
- Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–113.
- Olson, S.L., & A. Feduccia. 1981. *Smithson. Contrib. Zool.* 323: 1–24.
- , & D.W. Steadman. 1981. *Smithson. Contrib. Zool.* 337: 1–25.
- Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds of the World*. Yale Univ. Press, New Haven.
- , & B.L. Monroe. 1990. *Distribution and Taxonomy of the Birds of the World*. Yale Univ. Press; New Haven.
- , *et al.* 1988. *Auk* 105: 409–423.
- Strauch, J.G., Jr. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.

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. Moults 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.

REFERENCES

- Alcorn, R. 1988. *Stilt* 12: 7–23.
 Amiet, L. 1957. *Emu* 57: 236–54.
 Burton, P.J.K. 1974. *Feeding and the Feeding Apparatus in Waders*. Br. Mus. Nat. Hist., Lond.
 Byrkjedal, I. 1990. *Ornis scand.* 21: 239–47.
 Carter, M.J., *et al.* 1976. *Aust. Bird Watcher* 6: 173–7.
 Christian, P.D., *et al.* 1992. *Aust. J. Zool.* 40: 291–302.
 Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.
 Colwell, M.A. 1986. *Auk* 103: 611–12.
 —, & L.W. Oring. 1988a. *Behav. Ecol. Sociobiol.* 22: 165–73.
 —, — 1988b. *Wilson Bull.* 100: 567–82.
 Crawford, D.N. 1972. *Emu* 72: 131–48.
 Dittman, D.L., *et al.* 1989. *Auk* 106: 324–6.
 Fjeldså, J. 1977. *Guide to the Young of European Precocial Birds*. Skarv Nature Publs, Strandgården, Tisvildileje.
 Forest, B.S. 1982. *Aust. Bird Watcher* 9: 159.
 Garnett, S.T. 1989. *RAOU Rep.* 58.
 Gerritsen, A.F.C. 1988. Unpubl. PhD thesis, Univ. Liedon.
 —, *et al.* 1983. *Neth. J. Zool.* 33: 485–96.
 Hindwood, K.A., & E.S. Hoskin. 1954. *Emu* 54: 217–55.
 Jehl Jr, J.R. 1968. *Mem. San Diego Soc. Nat. Hist.* 3.
 —, & B.G. Murray. 1986. *Current Orn.* 3: 1–86.
 Johnsgard, P.A. 1981. *The Plovers, Sandpipers and Snipes of the World*. Univ. Nebraska Press, Lincoln.
 Lane, B.A., & A. Jessop. 1985. *Stilt* 6: 2–16.
 —, & D. Parish. 1991. *ICBP Tech. Publ.* 12: 291–312.
 Ligon, J.D. 1993. *Current Orn.* 10: 1–46.
 Loyn, R.H. 1978. *Emu* 78: 11–19.
 McKenzie, H.R. 1967. *Notornis* 14: 154–7.
 Piersma, T. 1994. *Close to the Edge: Energetic Bottlenecks and the Evolution of Migratory Pathways in Knots*. Uitgeverij Het Open Boek, Den Burg, Texel, Netherlands.
 —, *et al.* 1994. Paper 3 In: Piersma 1994.
 Pitelka, F.A., *et al.* 1974. *Am. Zool.* 14: 185–204.
 Prendergast, H.D.V., *et al.* 1985. *Sunbird* 15: 80–3.
 Reynolds, J.D. 1987. *Ibis* 129: 225–42.
 Robertson, H.A., & M.D. Dennison. 1979. *Notornis* 26: 73–88.

28 Gallinagoninae

Roselaar, C.S. 1979. *Watervogels* 4: 202–10.

Rubega, M.A., & B.S. Obst. 1993. *Auk* 110: 169–78.

Saunders, D., & P. de Rebeira. 1985. *The Birdlife of Rottnest Island*.

Authors, Perth.

Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of*

Birds. Yale Univ. Press, New Haven.

—, et al. 1988. *Auk* 105: 409–23.

Sibson, R.B. 1965. *Notornis* 12: 44–6.

Smith, F.T.H. 1985. *Bird Obs.* 643: 81–2.

Starks, J. 1987. *Report on Shorebird Surveys in Thailand*. Interwader
Publ. 25.

Strauch Jr, J.G. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.

Underhill, L.G., et al. 1993. *Ibis* 135: 277–92.

van Heezik, Y.M., et al. 1983. *Neth. J. Sea Res.* 17: 47–56.

Wall, L.E. 1953. *Emu* 53: 80–6.

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.

REFERENCES

- Ahlquist, J.E. 1974. *Discovery* 10: 14–25.
- Burton, P.J.K. 1974. *Feeding and the Feeding Apparatus of Waders*. Br. Mus. Nat. Hist., Lond.
- Christian, P.D., et al. 1992. *Aust. J. Zool.* 40: 291–302.
- Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.
- Fjeldså, J. 1977. *Guide to the Young of European Precocial Birds*. Skarv Nature Publs, Strandgården, Tisvildileje.
- Jehl Jr, J.R. 1968. *Mem. San Diego Soc. nat. Hist.* 3.
- Kozlova, E.V. 1962. *Fauna S.S.S.R.* 2. Acad. Sci. USSR, Moscow–Leningrad, Nov. ser. 81.
- Lowe, P.R. 1915. *Ibis* (10) 3: 609–16.
- 1931. *Ibis* (13) 1: 491–534.
- Strauch Jr, J.G. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.
- Timmerman, G. 1957. *Parasitol. Schriftenreihe* 8.
- Zusi, R.L., & J.R. Jehl Jr. 1970. *Auk* 87: 760–80.

Bartramia longicauda Upland Sandpiper

COLOUR PLATE FACING PAGE 128

Tringa longicauda Bechstein, 1812, *Kurze Uebersicht aller bekantan Vögel*: 453–4, Pl. 42 — North America.

The generic name is in honour of William Bartram, botanist and ornithologist (1739–1823) (from a specific name, *Tringa bartramia* given to this species by Alexander Wilson [1813] *Am. Orn.* 7: 63 in honour of his friend, near whose home he shot a specimen). The specific epithet is Latin for long (*longus*) tail (*cauda*).

The English name refers to its nesting habitat in North America.

OTHER ENGLISH NAMES Upland Plover, Bartram's Sandpiper.

MONOTYPIC

FIELD IDENTIFICATION Length 26–28 cm; wingspan 64–68 cm; weight c. 150 g. Slim, graceful, medium-sized sandpiper, with rather small head; long, slender neck; short, almost straight, bill; and long tail extending well beyond folded wing-tips at rest. Slightly smaller than Little Curlew *Numenius minutus*, with shorter, straight bill and longer tail. Plumage, buff with dark centres to feathers and barring, and contrasting pale median crown-stripe and buff supercilium. Behaviour recalls that of *Pluvialis* plovers, with preference for dry open grassy habitats similar to Little Curlew. Sexes alike. No seasonal variation. Juvenile and immature separable at close range.

Description Adult Pattern of head distinctive, with characteristic open-faced expression: forehead, crown and nape, black, finely streaked buff, with varying narrow buff median crown-stripe; lores, supercilium and rest of sides of head, pale

buff, with fine dark streaking on rear supercilium, cheeks and ear-coverts and varying narrow dusky streak beneath eye to rear of ear-coverts; and large dark eye surrounded by diffuse whitish eye-ring. Chin and throat, white. Hindneck and sides of neck, buff, narrowly streaked black. Feathers of mantle and inner scapulars, dull black with warm buff fringes; outer scapulars and tertials paler, dark olive-grey with cinnamon to pale-buff fringes, contrasting black subterminal bar, and rows of oblique short lateral black bars; pale buff fringes on upperparts sometimes align to form pale braces, one on outer edge of mantle and another on lower scapulars. Innerwing-coverts similar to outer scapulars, but pale-buff fringes broader, and anchor-shaped black subterminal bar combines with black shaft-streak to form T at tip of each feather; viewed at distance, show as broad pale panel on folded wing. Back, rump

and uppertail-coverts, black. Tail, olive-grey centrally, grading to orange-buff on sides, with narrow white outer edge and irregular narrow black barring throughout. In flight, from above show: black upperwing with contrasting white shaft of outermost primary and pale panel on central innerwing-coverts, and pale barring on secondaries and inner primaries; very dark, uniformly black back to uppertail-coverts, with some white showing at sides of rump; and dark-centred and narrowly dark-banded tail showing some orange-buff on sides and narrow white outer edge when tail spread. Foreneck, breast and upper belly, pale buff; rest of underbody, white, with bold black streaking on foreneck and upper breast, and black chevrons on lower breast, upper belly, and flanks. Axillaries and underwing, white, heavily barred black. Bill, yellow or yellow-brown, with tip and culmen, dark brown. Iris, dark brown. Legs and feet, dull yellow, often tinged brown or green. **Juvenile** Very similar to adult, differing mostly in pattern of upperparts and innerwing-coverts: mantle and scapulars dull grey, with contrasting narrow black submarginal lines and narrower buff fringes giving neat scaly appearance; tertials also grey, with rows of black dots at sides interrupting narrow buff fringe (all feathers of upperparts lack black barring seen in adult); innerwing-coverts (except black coverts on leading-edge), buff grading to grey at base, with clear narrow black submarginal U (broken into lateral spots on larger feathers), and crisp narrow buff fringes. With wear, scaly pattern of upperparts lost, though dark submarginal lines and U-marks can still be seen sometimes. **Immature** Separable from adult only if some retained worn juvenile innerwing-coverts or tertials can be seen. Immatures in second calendar year separable only by moderately worn, not fresh, primaries.

Similar species Size; short, straight, mostly yellow bill; curlew-like plumage, with large dark eye set in plain face; long tail protruding well beyond folded wing-tips at rest; yellow legs; and rather *Pluvialis*-like behaviour unique among waders in HANZAB region. **Little Curlew** (q.v.) superficially similar.

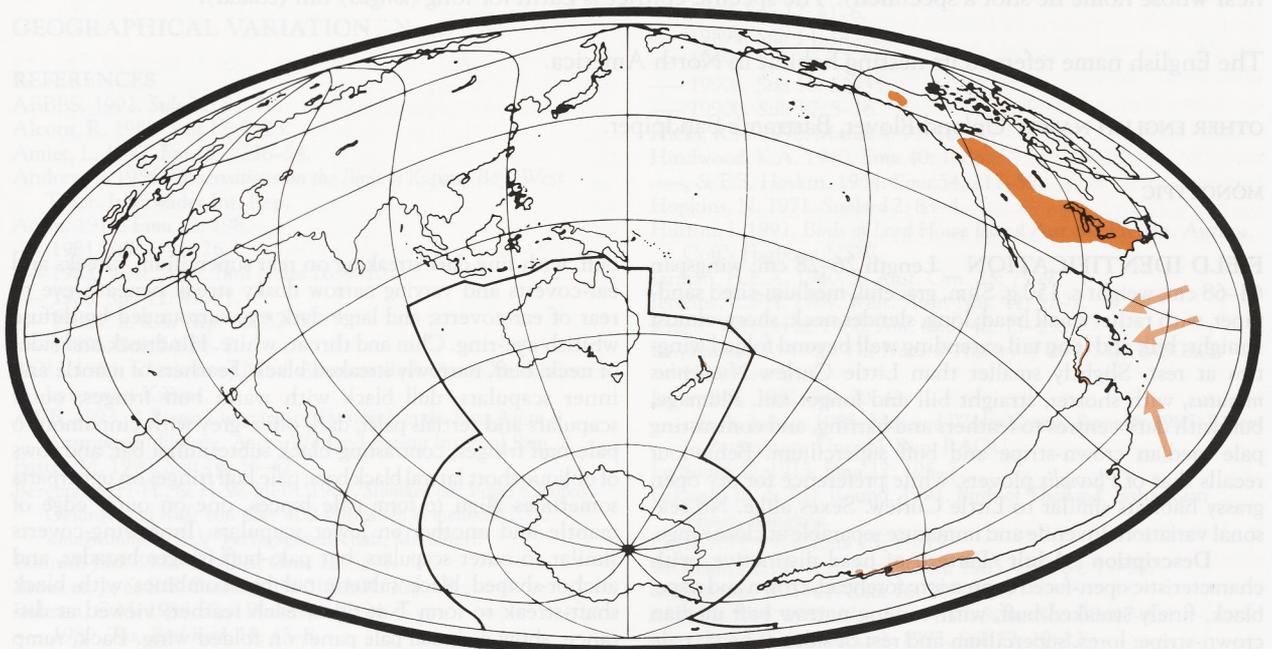
Usually singly or in small groups, away from other waders, in wide variety of open grassy habitats. Often tame and

approachable. General stance and feeding actions plover-like, alternating short runs with sudden stops followed by quick stab for small invertebrates. When alarmed, bob rear end like Common Sandpiper *Tringa hypoleucos*. Run into take-offs like *Pluvialis* plover; fly swiftly with steady or loose wing-beats recalling small *Numenius* or Ruff *Philomachus pugnax*; distinctive cruciform silhouette in flight, with small head in front of long wings and very long tail (feet not trailing); land gently with noticeable 'parachute' of tail and tremble of outstretched wings; in breeding areas, often perch on fence-posts or telephone poles, sometimes hovering over perch before landing and holding wings aloft before folding them. Usual flight call measured piping *quip-ip-ip-ip*, with last syllable pitched lower than first three; also low and rather liquid *kwee-lip* or *pulip-pulip*; wide variety of whistling songs given on breeding grounds.

HABITAT In North America, generally open grassy areas in rolling or hilly pasture lands or broad flat prairies. Most often recorded in farmland, including pasture, cultivated paddocks and cereal stubble; frequent airfields. Occasionally in grassy clearings in forests. During non-breeding months, occur in savanna, open fields, wet grassland and pampas; sometimes at edge of forested rivers. Similar habitats frequented on passage (Bent 1962; BWP).

In HANZAB region, recorded on semi-marine flats round shell banks in harbour, round muddy shores of moss-fringed lake and near a reservoir (Holdgate 1965; McKenzie 1968; Gould).

DISTRIBUTION Breed North America, in Alaska and Yukon Territory; most of s. Canada E of Rocky Mts, from nw. British Columbia and n. Alberta, through w.-central Saskatchewan to s. regions of Manitoba, Ontario, Quebec and New Brunswick; in USA, N of line between e. Washington, n. Texas and central Virginia. Migrate through central and e. USA, Central America and Caribbean islands to South America. Non-breeding grounds are E of the Andes, mainly in Brazil, Uruguay and Argentina; occasionally recorded Chile



(Bent 1962; AOU 1983). Accidental to w. Europe (BWP). Vagrant to A'asia and s. islands of Atlantic.

Aust. Single specimen, near Sydney, snipe season 1848 (Gould).

NZ Single, Karaka, 28 Feb. 1967 (McKenzie 1968). Unconfirmed record of two others there at same time.

S. Orkney Is Unconfirmed or doubtful record: 1–2, Signy I., 6, 30 Dec. 1962, 26 Jan. 1963 (Holdgate 1965).

S. Shetland Is Single, specimen, Deception I., 9 Feb. 1923 (Dabbene 1923; Bennett 1926).

MOVEMENTS Migratory; breed North America, moving S to South America, mainly between 22°S and 42°S. Leave breeding areas, late Aug. or early Sept. Migrate through central and e. USA (E of Rocky Mts) with most in s. USA by end Sept. Move through Mexico and down e. Central America or across Gulf of Mexico; evidence of some movement across w. Atlantic Ocean. Arrive in non-breeding areas, late Sept. and Oct., sometimes as late as Nov. (Hayman *et al.* 1986; see BWP). Dated records in HANZAB region Dec.–Feb., during non-breeding period. Extralimitally, return passage begins mid-Feb. with n. route reverse of autumn migration except no evidence of movement over Atlantic. Reach s. USA from early Mar. with main passage late Mar. to late Apr.; reach s. breeding grounds by early Apr. (Hayman *et al.* 1986; BWP). Arrive breeding grounds in North Dakota and Minnesota, USA, from late Apr. but usually in first ten days of May; may not arrive at Yukon–Alaskan breeding areas till June (Higgins & Kirsch 1975; see BWP).

PLUMAGES Prepared by A. Rogers. Insufficient material in museums in Aust. or NZ to prepare full account. Following summarizes most important features; see BWP for more details. Partial post-juvenile (first pre-basic) moult begins on breeding grounds and continues after s. migration. Immature pre-breeding (first pre-alternate) little known; apparently moult few feathers, with no change in appearance. Adult non-breeding plumage first attained in complete second pre-basic moult. Perform complete post-breeding (pre-basic) moult annually; some start moult before s. migration but most occurs in non-breeding areas. Age of first breeding not known (Paulson 1993).

MOULTS Based on BWP.

Adult post-breeding (Second and subsequent pre-basic). Complete, primaries outwards. Moult of body (head, mantle, scapulars and chest) often begins from July, on breeding grounds. Most start moult of primaries in non-breeding areas, from mid-Nov.; finish mid-Dec. to early Jan. Some (probably failed or non-breeders) start moult earlier, replacing most feathers of head and body, many wing-coverts, some rectrices and inner 4–6 primaries while still on breeding grounds; moult of primaries suspended during s. migration and completed in non-breeding areas from mid-Nov. **Adult pre-breeding** (Second and subsequent pre-alternate). Moult few feathers. Birds that undergo early pre-basic moult may replace some feathers of head and tail, and wing-coverts. **Post-juvenile** (First pre-basic). Partial. Starts soon after fledging, though timing varies; in late Aug. (on migration) and Sept. (in non-breeding areas) some birds moulting feathers of crown, neck, mantle and sides of breast only; others have much fresh immature (first-basic) plumage, except for juvenile feathers on back and rump, tertials, wing-coverts, much of tail and all remiges. Moult finished between Jan. and early Mar. except for remiges, primary coverts, some greater and lesser coverts and,

sometimes, a few tertials, which are retained until second pre-basic moult.

MEASUREMENTS (1–2) Adults, skins (BWP): (1) W. North America and South America; (2) E. USA, Surinam and ne. Brazil.

	MALES	FEMALES	
WING	(1) 168 (3.28; 165–174; 6)	178 (5.94; 172–190; 10)	**
	(2) 166 (4.87; 156–172; 11)	170 (1.79; 168–173; 7)	ns
TAIL	(1) 78.3 (4.88; 73–85; 6)	85.3 (3.94; 81–89; 10)	ns
	(2) 79.8 (3.86; 73–86; 13)	81.0 (2.40; 78–85; 10)	**
BILL	(1) 28.1 (1.08; 27–30; 6)	30.0 (1.27; 28–32; 10)	ns
TARSUS	(1) 49.0 (0.86; 48–50; 6)	50.3 (1.54; 48–52; 10)	ns
TOEC	(2) 29.4 (1.13; 28–32; 15)	29.8 (0.98; 29–31; 10)	ns

Wing of juvenile slightly shorter than that of adult; tail of juvenile c. 5 mm shorter than that of adult (BWP).

WEIGHTS Adults (BWP): (1) Breeding areas (Yukon and Alaska); (2) Non-breeding areas (mostly Surinam).

	MALES	FEMALES
June	(1) –	153, 157, 182
July–Aug.	(1) 151.2 (135–159; 4)	–
late Aug.–Sept.	(2) –	98
late Sept.–Oct.	(2) 137, 140	133.8 (7.59; 126–144; 4)
Dec. to mid-Feb.	(2) 128, 128	137, 140, 149
mid-Feb. to Mar.	(2) 166	166, 172

Females heavier. In breeding areas in early Sept. (just before s. migration) one female 169 g, others up to 226 g. Juveniles, late Aug.–Sept.: male 118, female 132. In Mar.–early Apr., immature females 144 and 149 g, well below weight of adults before migration, which suggests they do not migrate as far (BWP).

AGEING Juvenile plumage distinct till Nov. (see Field Identification). Immatures (first basic) differ from adult by retained juvenile plumage on back, rump, tertials, wing-coverts, much of tail and remiges; and in wear of primaries: from Aug. to Nov.–Jan., primaries fresh (when adults have suspended or active moult); from Dec. to Aug.–Sept., adults have finished moult but primaries of immatures rather more worn. Like adults after second pre-basic moult.

GEOGRAPHICAL VARIATION Size of females varies: populations in w. America larger than those of e. America (see Measurements). Extent of variation unknown (BWP).

REFERENCES

- AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
- Bennett, A.G. 1926. *Ibis* (12) 2: 306–33.
- Bent, A.C. 1962. *Life Histories of North American Shore Birds*. Dover Pubs, New York.
- Dabbene, R. 1923. *El Hornero* 3: 197.
- Hayman, P., *et al.* 1986. *Shorebirds*. Croom Helm, Lond.
- Higgins, K.F., & L.M. Kirsch. 1975. *Wilson Bull.* 87: 96–102.
- Holdgate, M.W. 1965. *Br. Antarct. Surv. Bull.* 6: 77.
- McKenzie, H.R. 1968. *Notornis* 15: 216–18.
- Paulson, D. 1993. *Shorebirds of the Pacific Northwest*. Univ. Washington Press, Seattle.



© J. Davies 1990

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

© [Jeff Davies](#)