

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.
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.

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.

Heteroscelus incanus Wandering Tattler

COLOUR PLATE FACING PAGE 225

Scolopax incana Gmelin, 1789, *Syst. Nat.*, ed. 10 (1): 658, for Ash-coloured Snipe of Latham, 1781–1801, *Gen. Syn. Bds* 3 (1): 154 — Moorea Island, Society Group and Palmerston Island, Pacific Ocean.

The specific epithet is Latin (*incanus*) for grey or hoary, based on the name 'Ash-coloured Snipe' of Latham.

OTHER ENGLISH NAMES American Ashen Tringine Sandpiper.

MONOTYPIC

FIELD IDENTIFICATION Length 27 cm; wingspan 54 cm; weight c. 110 g. Medium-sized wader with long wings and tail, giving attenuated rear-end; straight medium-length bill; and short yellow legs. Very similar in size and shape, though slightly bigger than, Grey-tailed Tattler *Heteroscelus brevipes*; tips of folded primaries normally extend well beyond tip of tail at rest. In all plumages, slate-grey above, with clear white fore-supercilium and dark loreal stripe, slate-grey underwing, and yellow legs. Normally on rocky coasts or reefs; rarely on mudflats. Sexes alike. Marked seasonal variation. Juvenile and immatures separable.

Description Upperparts, slate-grey; slightly darker on primary coverts and outer primaries, and with narrow white tips to outer greater secondary coverts and inner primary coverts (not forming obvious wing-bar), and with very fine white tips to upterminal-coverts, when fresh. On head: narrow white supercilium do not join on forehead and become indistinct behind eye (where finely streaked grey); dark loreal stripe; narrower, less distinct dark stripe behind eye; and narrow white eye-ring. Ear-coverts, cheeks, chin and throat, foreneck and sides of neck, white, coarsely streaked grey. Rest of underbody, except small area of white on central belly and vent, strongly marked with V-shaped dark-grey bars, broadest along flanks; feathers on sides of breast and fore-flanks show more grey than white. Underwing, slate-grey, with feathers of lining slightly darker than remiges and narrowly tipped off-white. Bill, black, with yellowish wash to basal third or more of lower mandible. Iris, dark brown. Legs and feet, bright yellow or yellow-ochre. **Adult non-breeding** As breeding, except no streaking on head and neck and no barring on underbody; cheeks, ear-coverts, foreneck and sides of neck, breast and flanks become plain slate-grey, grading to whitish on chin and throat; belly, vent and undertail-coverts, white. Whitish supercilium and dark loreal stripe remain prominent in front of eye, but behind eye, supercilium reduced to a faint narrow streak or lacking, and dark eye-stripe beneath eye is narrow and indistinct. **Juvenile** Similar to adult non-breeding but: scapulars and tertials have narrow alternating dark and whitish (initially buff) spots along edges; innerwing-coverts similar but with narrow dark subterminal bar bordering pale tip; appear delicately pale-spotted above, but prominence of pale markings varies (some almost unmarked) and quickly reduced by wear. Breast and flanks smudged and finely barred with grey and appear mottled or vermiculated rather than smoothly grey like adult non-breeding. **First immature (non-breeding and breeding)** First non-breeding distinguished from adult non-breeding only by retained juvenile innerwing-coverts and tertials. During May–Sept. of second calendar year, separable from adult by contrast between worn inner and fresh outer

primaries (cf. rather fresh and evenly worn in adults, from about Mar.) or by more worn primaries. A few cannot be distinguished from adult. Most first-year birds that winter in HANZAB area stay in full non-breeding plumage, but some attain partial first breeding plumage: in poorly marked individuals, plumage as non-breeding but grey of breast and flanks often faintly vermiculated like juvenile; more boldly marked birds develop a little adult-like barring on breast and flanks.

Similar species Distinguished from all waders except Grey-tailed Tattler by combination of lighter plain slate-grey upperparts (including entire wings and tail), clear white fore-supercilium and loreal stripe, slate-grey underwing, and yellow legs. For differences from Grey-tailed Tattler, see that account.

Coastal in HANZAB region: on rocky coasts and reefs, coral cays and, occasionally, nearby sandy or stony beaches; rarely on estuarine mudflats. Solitary or in small groups when feeding, but will roost communally, sometimes in association with Grey-tailed Tattlers and other waders; often roost on rock stacks, jetties, partly submerged stakes, driftwood. Generally wary and nervous, but will often allow close approach; may crouch rather than fly in response to threat. When feeding, bob and teeter almost continuously, like Common Sandpiper *Tringa hypoleucos*, while picking and probing among seaweed and barnacles on wave-washed rocks and reefs. Flight, fast and effortless, usually low and direct, with flicking beats of long wings. Usual flight call plaintive, whistled, rippling trill of 6–10 accelerating notes *wee-we-we-we* or *pew-tu-tu-tu*, all on same pitch but decreasing in volume; like flight call of Whimbrel *Numenius phaeopus*, and unlike usual plover-like disyllabic upslurred whistle of Grey-tailed Tattler.

HABITAT Essentially rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds; occasionally on coral reefs or beaches (McKenzie 1949; Hindwood & Hoskin 1954; Morris 1975; Gibson 1977; Roberts 1979; Storr 1984; Lane). Avoid mudflats (Lane). Forage among rocks or shingle, or in shallow pools at edges of reef or beach, mainly along tideline (McKenzie 1949; Hindwood & Hoskin 1954; Bingham 1977; Doyle *et al.* 1985). Once recorded foraging in sandy mud next to shingle-ridges (McKenzie 1949). Have been recorded roosting or perching on top of boulders surrounded by water (Hindwood & Hoskin 1954) or 1–2 m from edge of water (Doyle *et al.* 1985). Sometimes on artificial rocky habitats such as piers and breakwaters (Morris 1975).

DISTRIBUTION AND POPULATION Breed Siberia, Alaska and nw. Canada. On s. slopes of Anadyr Ra. and Chukotskiy Pen. in Russia; in w., central and s.-coastal Alaska, roughly bounded by Yukon R.; also in central and s. Yukon

Territory, and nw. British Columbia, W of Cassiar Mts. Non-breeding range: round Pacific rim, along coasts of North, Central and South America, from s. California, S to Ecuador, including Galapagos Is; single record from Punta Salinas, Peru. Widespread throughout tropical Pacific, from Hawaii, S to Polynesia, Kermadec Is and NZ, and to e. Aust., New Guinea and e. Micronesia. No published records from w. Micronesia or Philippines; vagrants recorded Japan and Taiwan, and apparently recorded on passage in Korea (Dement'ev & Gladkov 1951; Blake 1977; AOU 1983; Pratt *et al.* 1987; Lane).

Aust. Generally uncommon. Difficult to distinguish from Grey-tailed Tattler, and may often be overlooked (Aust. Atlas). **NT** Status not known; it may be a regular wet-season visitor in small numbers (H.A.F. Thompson & D.K. Goodfellow). Records, all singles, round Darwin, include: Fanny Bay, 21 Oct. 1966; Lee Pt, 17 Dec. 1978, Feb. 1982; Cameron's Beach, 1 Apr. 1979; Sanderson Sewage Farm, 1979, 1981; East Pt, Apr. 1985, early Nov. 1992; Fort Hill Wharf, Nov. 1988 (Storr 1977; Thompson 1977; McKean & Hertog 1980; Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). Crawford (1972) and Aust. CL wrongly listed species as common round Darwin, but this arose from Crawford's treatment of both Wandering and Grey-tailed Tattlers as one species, and his use of '*T. incana*' to refer to Grey-tailed Tattler (Thompson 1977). **Qld, NSW** Passage migrant on at least eight islands in Torres Str. (Draffan *et al.* 1983). Sparsely scattered along e. coast, often on offshore or nearshore islands and reefs. Mostly recorded between Mossman and Innisfail, between Yeppoon and Gladstone, from Bundaberg and Fraser I., Qld, to n. rivers region of NSW, and round Long Reef (Amiet 1957; Barry & Vernon 1976; Sutton 1990; Qld Bird Reps; NSW Bird Reps; Aust. Atlas; J. Thompson). Recorded S to Windang, and once to Moruya (Doyle *et al.* 1985; NSW Bird Rep. 1983, 1984). Occasional records elsewhere along coast (e.g. round Bowen, Boat Harbour) (Morris 1989; Qld Bird Reps; Aust. Atlas).

NZ Regular visitor in small numbers; on mainland, most often recorded round Kaikoura Pen. First recorded Portland I., NI, 1883, where two specimens taken (Oliver). **NI** Scattered

records of single birds from Parengarenga Harbour, S to Miranda, including Karikari, Kauri Mt Beach, Karaka, Omaha, Cuvier I., Waikawau Bay, Kawakawa Bay and Weymouth (McKenzie 1949, 1955; CSN). Elsewhere on NI, singles recorded from Muriwai, Gisborne, 14 Mar., 2 Apr. 1967 (CSN 19 Suppl.); Black Reef, Hawke's Bay, 10 Nov. 1962 (Bell & Blackburn 1963); Rahotu, 26 Feb. 1977 (CSN 24). **SI** Three records from round Farewell Spit (including Whanganui Inlet); up to two birds recorded round Kaikoura Pen. six times between 1977 and 1989 (Bell 1966; CSN). Single records also from Flaxborne R., 18 Jan. 1980 (CSN 28), mouth of Ashley R., 3 Dec. 1973 (CSN 21) and Avon-Heathcote Estuary, where a single bird recorded between 17 Dec. 1989 and July 1990 (CSN 38, 39).

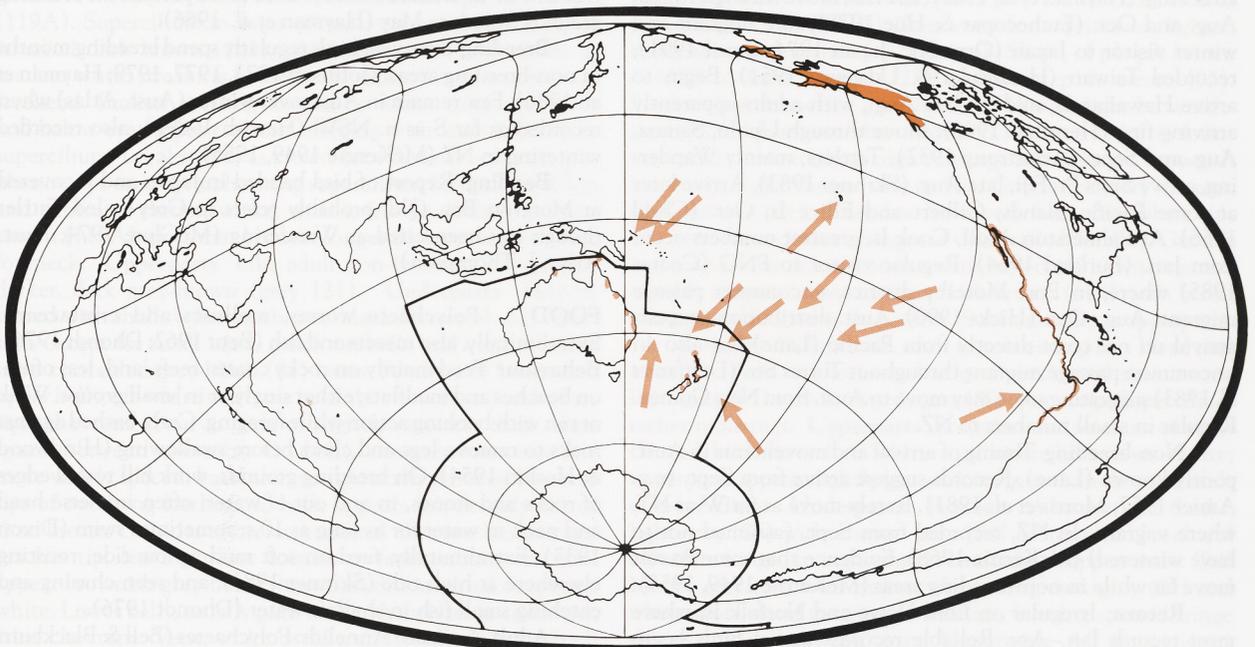
Lord Howe I. Irregular visitor (all singles): specimen, 19 Mar. 1914 (Hindwood 1940); Feb.-Mar. 1971 (NSW Bird Rep. 1971); 7, 14 Apr. 1975 (NSW Bird Rep. 1975).

Norfolk I. Rare or irregular visitor (singles unless stated). Three, 20-23 Jan. 1968 (Moore 1985); unknown number, Feb. 1969 (Schodde *et al.* 1983); Feb. 1973 (de Ravin 1975); 10 Mar. 1974 (Moore 1985); two, 9 Oct. 1977 (Moore 1981); unknown number, Dec. 1978 (Schodde *et al.* 1983); 15 Nov. 1980 (Moore 1981); 15 Dec. 1984 (Moore 1985).

Kermadec Is Most records from Raoul I.; first recorded 1913, single specimen (Oliver). Subsequently recorded on Raoul I., Macauley I., N. and S. Meyer Is and Milne Islets during expeditions in Nov. 1966-Jan. 1967, Nov. 1970 and Oct. 1974 (Merton 1970; CSN 19 Suppl., CSN 22). Mostly singles, but seven observed Raoul I., 18 Oct. 1974 (CSN 22) and two on Macauley I., Aug. 1966 (Merton 1970).

Chatham Is Singles: Okawa Pt, 1961; C. Pattison, 1 Dec. 1985; Seal Rocks, Round I., 8 Dec. 1985; Otawae Pt, 29 Nov. 1987 (Freeman 1994). South-East I.: one present for 3 years in early 1970s; two, 1970s (Nilsson *et al.* 1994).

In summer and winter wader surveys at 21 to 23 selected sites in Aust., 1986-91, a total of five Wandering Tattlers was recorded (Hewish 1986, 1987a,b, 1988, 1989a,b, 1990a,b; Anon. 1992; Naismith 1992).





MOVEMENTS Migratory; breed Siberia, Alaska and nw. Canada. Move S for boreal winter. Cross Pacific Ocean to Pacific islands, ne. Aust. and NZ. Also move down Pacific coast of America (Hayman *et al.* 1986; Lane). Distribution and status in Asia and Aust. poorly known partly because of confusion with Grey-tailed Tattler (Bryant 1933; Lane). Flocks noted on some Pacific islands during s. migration (e.g. w. Samoa; Child 1979) but not recorded in HANZAB region.

Departure Said not to be present on breeding grounds after Aug. (Hayman *et al.* 1986). In Asia, move through Korea, Aug. and Oct. (Etchecopar & Hüe 1978); rare migrant and winter visitor to Japan (Orn. Soc. Japan 1974; Brazil 1991); recorded Taiwan (Hachisuka & Udagawa 1951). Begin to arrive Hawaiian Is, mid- to late Aug., with adults apparently arriving first (Henshaw 1902). Move through Upolu, Samoa, Aug. and Sept. (Armstrong 1932). Tattlers, mainly Wandering, arrive Suva Pt, Fiji, late Aug. (Skinner 1983). Arrive later at some Pacific islands; Gilbert and Ellice Is, Oct. (Child 1956). At Palmerston Atoll, Cook Is, greatest numbers occur from Jan. (Burland 1964). Regular visitor to PNG (Coates 1985) where, in Port Moresby district, uncommon passage migrant, Aug.–Oct. (Hicks 1990). Aust. distribution suggests arrival on ne. coast directly from Pacific (Lane) but also an uncommon passage migrant throughout Torres Str. (Draffan *et al.* 1983) suggesting some may move to Aust. from New Guinea. Regular in small numbers to NZ.

Non-breeding Timing of arrival and movements in Aust. poorly known (Lane). Records suggest arrive from Sept. (e.g. Amiet 1957; Morris *et al.* 1981). Rarely move as far W as NT, where vagrant. In NZ, recorded from Sept. (assumed not to have wintered) (McKenzie 1968). Evidence that some do not move far while in non-breeding areas (McKenzie 1949, 1955).

Return Irregular on Lord Howe and Norfolk Is, where most records Jan.–Apr. Reliable records suggest birds begin

leaving Aust., Apr.–May (Hindwood & Hoskin 1954; Amiet 1957; Morris *et al.* 1981). Extralimittally, pass through Port Moresby district, PNG, Mar.–June (Hicks 1990); not usually recorded PNG after early May (Coates 1985). In Pacific, leave Suva Pt, Fiji, Upolu in Samoa, Palmerston Atoll in Cook Is, Gilbert and Ellice Is and Hawaiian Is, Apr. or May (Henshaw 1902; Armstrong 1932; Child 1956; Burland 1964; Skinner 1983). In Asia, pass through Korea, in May (Etchecopar & Hüe 1978) and recorded from Kurile Is, May and June (see Dement'ev & Gladkov 1951). Said to be present on breeding grounds from late May (Hayman *et al.* 1986).

Breeding First-year birds regularly spend breeding months in non-breeding areas. (Johnson 1973, 1977, 1979; Hayman *et al.* 1986). Few remain in Aust. over winter (Aust. Atlas) when recorded as far S as n. NSW (Hewish 1989b); also recorded wintering in NZ (McKenzie 1949, 1955).

Banding Report of bird banded in Japan and recovered at Moreton Bay, Qld, probably refers to Grey-tailed Tattler though has been cited as Wandering (McClure 1974; Aust. Atlas; J. Thompson).

FOOD Polychaete worms, molluscs and crustaceans. Extralimittally, also insects and fish (Bent 1962; Dhondt 1976).

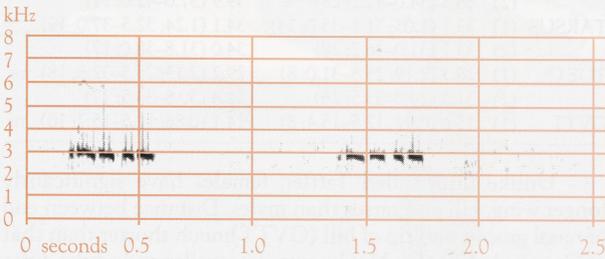
Behaviour Feed mainly on rocky coasts, reefs, and, less often, on beaches and mudflats; either singly or in small groups. Walk or run with bobbing action while foraging. Crabs bashed against rocks to remove legs and claws before swallowing (Hindwood & Hoskin 1954). On breeding grounds, work bill round edges of rocks and stones, in and out of water; often immerse head and neck in water for as long as 10 s; sometimes swim (Dixon 1933). Extralimittally, feed on soft mud at low tide, roosting elsewhere at high tide (Skinner 1983), and seen chasing and catching small fish in shallow water (Dhondt 1976).

Adult Animals: Annelids: Polychaetes (Bell & Blackburn

1963); Molluscs (Aust. RD); Crustaceans (Sclater 1881); Crabs (Hindwood & Hoskin 1954; Bell & Blackburn 1963).

VOICE No detailed studies or published sonagrams.

Adult Most distinctive call (cf. Grey-tailed Tattler), a plaintive, whistled, rippling trill (Hayman *et al.* 1986); pitched at c. 3 kHz; usually 5–10 syllables per call (sonagram A).



A Cornell LNS; Washington; *Western Bird Songs: Peterson Field Guides*, CD #1: track 28

PLUMAGES Prepared by A.M. Dunn and D.J. James. Undergo post-juvenile (first pre-basic) moult to immature non-breeding plumage, starting after s. migration. Immatures moult outer primaries in first pre-supplemental moult, beginning about Mar. First pre-breeding (first pre-alternate) moult varies: some attain partial adult-like breeding plumage but most retain worn first immature non-breeding plumage and stay in non-breeding areas. First attain adult non-breeding plumage in second post-breeding (pre-basic) moult (which may start earlier than post-breeding moult of returning adults). Thereafter moult twice annually: a partial pre-breeding (pre-alternate) moult to adult breeding plumage, starting Feb. and finished before n. migration; and a complete post-breeding (pre-basic) moult to non-breeding plumage, after s. migration. Probably first breed in third cycle.

Adult breeding (Second and subsequent alternate). **Head and neck** Forehead, crown, nape and hindneck, dark grey-brown (grey 121). Malar area, cheeks, ear-coverts and side of neck and throat, off-white densely streaked dark greyish-brown (119A). Supercilium in front of and over eye, white, heavily streaked dark brown (121); continues to varying extent as unclear white streaking behind eye; supercilia do not join on forehead. Broken eye-ring formed by white crescents above and below eye, upper crescent merging with and obscured by supercilium. Loral stripe, as crown (not darker), extending as obscure eye-stripe, emphasizing supercilium behind eye. Chin and centre of throat, white, with a few small dark greyish-brown (119A) spots that become longer dark streaks on white foreneck. **Upperparts** Like adult non-breeding but slightly darker, dark grey-brown (grey 121). **Underparts** Heavily barred with shallow brownish grey-black (brownish 82) chevrons except for small white patch on belly and vent; feathers have concealed grey-black (82) bases. Feathers of breast and upper belly, off-white with two bold chevrons (bars) and white tips; chevrons about as wide or slightly narrower than white spaces between chevrons. On belly, chevrons narrower and more widely spaced; basal chevron generally covered by white tips of overlying feathers, so belly appears less densely barred than breast. On sides of breast, terminal chevron broader and reaches tip, leaving white corners to feather; area can thus appear brownish grey-black (brownish 82), mottled or spotted white. Lower belly, usually pure white, though sometimes with faint chevrons. Vent, white or like undertail-coverts, which

are white with about three narrow, widely spaced chevrons across feathers, forming bold barring; shorter central coverts sometimes white or with less barring. Thighs, like breast but chevrons broader, so area appears a little darker overall. Flanks, barred like breast, with about four chevrons on each feather, the distal two normally visible. Axillaries, uniform dark brownish-grey (brownish 83), some with thin white spots or half-bars along inner and outer edges of innermost feathers. **Tail, Upperwing, Underwing** As adult non-breeding (see below).

Adult non-breeding (Second and subsequent basic). Differences from adult breeding: **Head and neck** Forehead, crown, nape and hindneck, dark grey (83); ear-coverts, cheeks, and sides of neck, light brownish-grey (brownish 85); chin and throat, off-white. Little contrast in colour of head and neck. Narrow, clear white supercilia extend to or just over eye, but not behind eye; do not reach base of bill or join across forehead (cf. Grey-tailed Tattler). Blackish-brown (c219) loral stripe, contrastingly darker than ear-coverts but little darker than crown (cf. Grey-tailed Tattler). **Upperparts** Uniform dark grey, tinged brown (c83), becoming paler and browner with wear (when fresh, may be darker than Grey-tailed Tattler but little difference in worn plumage) and, on feathers of rump and uppertail-coverts, very thin inconspicuous whitish fringes, which quickly wear off (cf. Grey-tailed Tattler). **Underparts** Breast, sides and flanks, brownish grey (lighter brownish 85), not sharply demarcated from white lower breast, belly, vent and undertail-coverts. Centre of breast may be paler than sides but apparently never white. Feathers have concealed grey-black (82) plumulaceous bases. **Tail** Uniform dark grey with brown tinge (c83), like upperparts; shafts, brown (223A). **Upperwing** Secondary coverts, lesser primary coverts and tertials, uniform dark grey with brown tinge (c83), like upperparts; outer secondary coverts have white fringes at tip and some lesser and median secondary coverts may have narrow off-white fringes. Greater primary coverts and alula, black-brown (119) with narrow white fringes, which narrow on outer coverts and may be absent on outermost coverts. Secondaries, uniform dark greyish-brown (c121) with inconspicuous whitish edges. Outer primaries, black-brown (119) with basal two-thirds of inner web, paler grey-brown (28); fade to duller dark-brown (199A) when worn. Inner primaries, lighter, merging to dark brown (c121) on p1. Shafts of p1–p9, brown (121C) to light brown (123A); shaft of p10, cream (92). **Underwing** Primaries, grey-brown (91) with light brownish-grey (119D) bases and dark-brown (219) tip, the latter forming untidy dark trailing-edge to wing. Secondaries, brownish grey with slight sheen (silvery 80). Greater primary coverts, dark brown (121); inner few have very faint thin white tips (cf. narrow but distinct fringes of Grey-tailed Tattler). Greater and median secondary coverts, dark brown (121) with narrow whitish fringes. Lesser coverts, dark brown (121) with broad white tips that give scaly pattern. Subhumeral, as upperparts.

Juvenile Differs from adult non-breeding by: **Head and neck** Feathers of cheeks and sides of neck, and ear-coverts, light-grey (85) with brownish-grey (80) spot at tip. Supercilium rather indistinct. **Upperparts** Scapulars and feathers of mantle and back have fine white tips, often broken in centre; upperparts appear slightly less uniform grey than those of adult non-breeding. **Underparts** Feathers of breast and flanks, light-grey (85) with uneven grey (84) subterminal band and off-white fringe, giving uneven vermiculated appearance. **Tail** Mostly grey (84) with narrow alternating dark-grey (83) and white spots along margins of feathers, forming spotted fringe that is quickly lost with wear. **Upperwing** All wing-coverts

have fine white terminal fringes. **Underwing** As adult.

First immature non-breeding (First basic). Similar to adult non-breeding but occasionally retain some juvenile feathers on breast; otherwise, distinguished from adult only by wear and moult of remiges (see Ageing).

First immature breeding (First alternate). Most remain in non-breeding areas and do not attain any breeding plumage (moult from worn first immature non-breeding to adult non-breeding plumage in second pre-basic moult) (Johnson 1977; Paulson 1993). However, on Niue I., Aug., immatures observed with varying amounts of adult breeding plumage, from a few barred feathers on underparts to apparently full breeding plumage; more information needed (Kinsky & Yaldwin 1981).

BARE PARTS Based on photos (Farrand 1983; Pringle 1987; Paulson 1993), museum labels (ANWC, NMNZ, MV, QM) and description in Paulson (1993). **Adult breeding** Bill: olive-brown (c30) to grey (84) with grey-black (82) tip; mostly black; or mostly black with greenish to grey base to lower mandible. Iris and orbital ring, dark brown (c121). Legs, greyish yellow-brown (greyish 123C), yellow or greenish yellow. **Adult non-breeding** Bill, black with yellow wash to base of lower mandible (unpubl. photo: D.W. Eades). Legs, straw yellow (57). **Juvenile** Bill, slate-grey with grey-black tip; often more grey at base than in adults (Paulson 1993). Legs, pale yellow.

MOULTS Based on c. 40 skins with dates (ANWC, NMNZ, MV, QM) and information gathered from Pacific region (Johnson 1977; Kinsky & Yaldwin 1981) and other sources (Dement'ev & Gladkov 1951; Prater & Marchant 1975; Miles 1982). **Adult post-breeding** (Second and subsequent pre-basic). Complete; primaries outwards. Moult of primaries begins late Oct.–Nov. after completing migration; up to three inner primaries active at a time; completed Jan. Moult of body probably begins Aug.; non-breeders may begin as early as July; most acquire non-breeding appearance by Nov. Tail usually moults inward from t6, but t3 or t4 occasionally skipped, then replaced last; or sometimes moult outward from about t3 on each side. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial. Involves head and most of upperparts and all underparts; probably begins Feb. and completed in May before arrival on breeding grounds; some birds appear in breeding plumage by about Mar. (McKenzie 1949; skins). **Post-juvenile** (First pre-basic). Partial. Moult feathers of head and body; begins Sept. and finished about Jan. **Post-juvenile moult of primaries** (First pre-supplemental). Moult varying number of outer primaries (4–8); begins about Mar.; very occasionally moult starts in two places in wing. Moult of primaries generally occurs after post-juvenile moult of body complete and can overlap with first pre-breeding moult. **First immature pre-breeding** (First pre-alternate). Partial moult of head and body; varies in extent. Some undergo partial pre-breeding moult in Apr. and attain some adult-like breeding plumage; most remain in basic plumage (Johnson 1977; Paulson 1993). **First immature post-breeding** (Second pre-basic). Complete. Similar in extent to adult but possibly begins earlier; some start moult early Aug. (Kinsky & Yaldwin 1981).

MEASUREMENTS (1) Throughout range, adults, skins (ANWC, BMNH, NMNZ, NMV, QM). (2) Polynesia, skins (Lacan & Mougins 1974).

	MALES	FEMALES	
WING	(1) 169.4 (4.83; 164–178; 13) (2) 163 (147–176; 28)	175.1 (5.91; 167–185; 18) 165 (142–182; 17)	**
TAIL	(1) 72.4 (4.45; 65–81; 14) (2) 68 (61–78; 28)	74.4 (4.18; 64–83; 19) 69 (62–79; 17)	ns
BILL	(1) 38.1 (1.51; 35.5–40.6; 14) (2) 38.5 (34.0–42.2; 28)	40.4 (2.11; 36.9–45.1; 17) 39.9 (37.0–42.0; 17)	**
TARSUS	(1) 33.1 (1.03; 31.1–35.0; 14) (2) 33.7 (31.0–36.2; 28)	34.1 (1.24; 32.5–37.0; 19) 34.0 (31.8–38.0; 17)	*
TOE C	(1) 28.3 (2.19; 25.5–31.0; 8) (2) 31.3 (29.0–33.5; 28)	29.2 (2.13; 25.5–32.8; 18) 32.4 (30.8–34.5; 17)	ns
GVTT	(1) 13.6 (0.92; 12.5–15.4; 8)	14.1 (0.86; 12.5–15.7; 10)	ns

Unlike Grey-tailed Tattler, females have significantly longer wing, bill and tarsus than males. Distance between end of nasal groove and tip of bill (GVTT) much shorter than that of Grey-tailed Tattler. Not known if juveniles and adults differ in size; only available juvenile skin, a female (BMNH) had wing 174, tail 70.5, bill 38.2, tarsus 29.8, toe 34.4 (A. van Loon).

WEIGHTS (1–2) Aust. and Pacific regions, June–Sept., museum labels (ANWC, NMNZ): (1) Adults; (2) Immatures moulting to or in first breeding plumage. (3) Alaska, probably adults on breeding grounds in boreal summer (Dunning 1993).

	MALES	FEMALES	
(1)	110, 120	122.2 (10.85; 105–135; 5)	ns
(2)	116.8 (5.38; 110–122; 4)	133.5 (11.38; 120–165; 8)	*
(3)	101.0 (87.0–114.0; 13)	116.0 (98.0–130.0; 16)	

In above samples, weights of adults and immatures in non-breeding areas during austral winter do not differ significantly. Only other weights available from HANZAB region are adult female in Feb. weighing 108 g (ANWC), and unsexed adult in Oct. weighing 101 g (QM). Unsexed, non-breeding birds from Enewetak Atoll in July, 96.5, 118.4 and 132.5 (Johnson & Morton 1976). Seasonal changes in weights poorly known; an adult male from Pacific Ocean, May, 213 g (probably having gained weight before migration); an adult and immature female collected May, 125 and 165 g respectively (NMNZ).

STRUCTURE Wing, pointed, narrow. Eleven primaries; p10 longest; p9 3–5 mm shorter, p8 14–19, p7 20–26, p6 31–38, p5 45–52, p4 56–65, p3 67–76, p2 75–86, p1 85–96; p11 minute. Fourteen secondaries including four tertials; tips of longest tertials fall between p5 and p8 on folded wing. Tail, square to gently rounded; 12 rectrices; t1 longest, t6 up to 5 mm shorter. Bill, long, somewhat laterally compressed, moderately deep at base; quite straight though slightly decurved at

Plate 9

Lesser Yellowlegs *Tringa flavipes* (page 153)

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

Marsh Sandpiper *Tringa stagnatilis* (page 136)

6 Adult breeding; 7 Adult non-breeding; 8 Juvenile;
9, 10 Adult

very tip; distinct nasal groove, long, extending from loreal point, and tapering distally; about two-thirds length of bill (see Measurements). Nostril, slit-like, near base of groove, similar to that of Grey-tailed Tattler. Tarsus, moderately long, fairly round; toes, unwebbed, with narrow flanges on soles of toes. Scales, scutellate on front of tarsus and top of toes, often reticulate at top of tarsus; scales on hind tarsus, mostly reticulate (cf. scutellate in Grey-tailed Tattler), but sometimes mixed, with more scutellate texture on lower tarsus (see Fig. 1, Grey-tailed Tattler). Tibia, 10–13 mm exposed. Outer toe 80–87% of middle, inner 71–79%, hind 27–31%. Claws, typical of wader, short, curved, blunt.

AGEING JUVENILES: on arrival in non-breeding areas, distinguished from adults by plumage; also have fresh primaries (those of adults old or moulting). IMMATURES: In Jan.–Feb., first immature non-breeding differ from adult non-breeding by retained worn juvenile primaries (adults have finished moult and primaries are fresh). In Mar., immatures begin moult of outer primaries and then distinguished from adults by contrast between old worn inner primaries and fresh or moulting outer primaries. Between Feb. and May, adults moult into breeding plumage and most migrate N; most immatures remain in non-breeding plumage and do not migrate; a few attain varying amounts of breeding plumage; those with nearly full breeding plumage probably indistinguishable from adults. In Sept.–Oct., adults return from breeding grounds with uniformly old primaries and little remaining breeding plumage; immatures still separable by contrast between very worn inner primaries and less-worn outer primaries. Not separable from adults after primaries replaced in second pre-basic moult.

RECOGNITION See Grey-tailed Tattler.

GEOGRAPHICAL VARIATION None.

REFERENCES

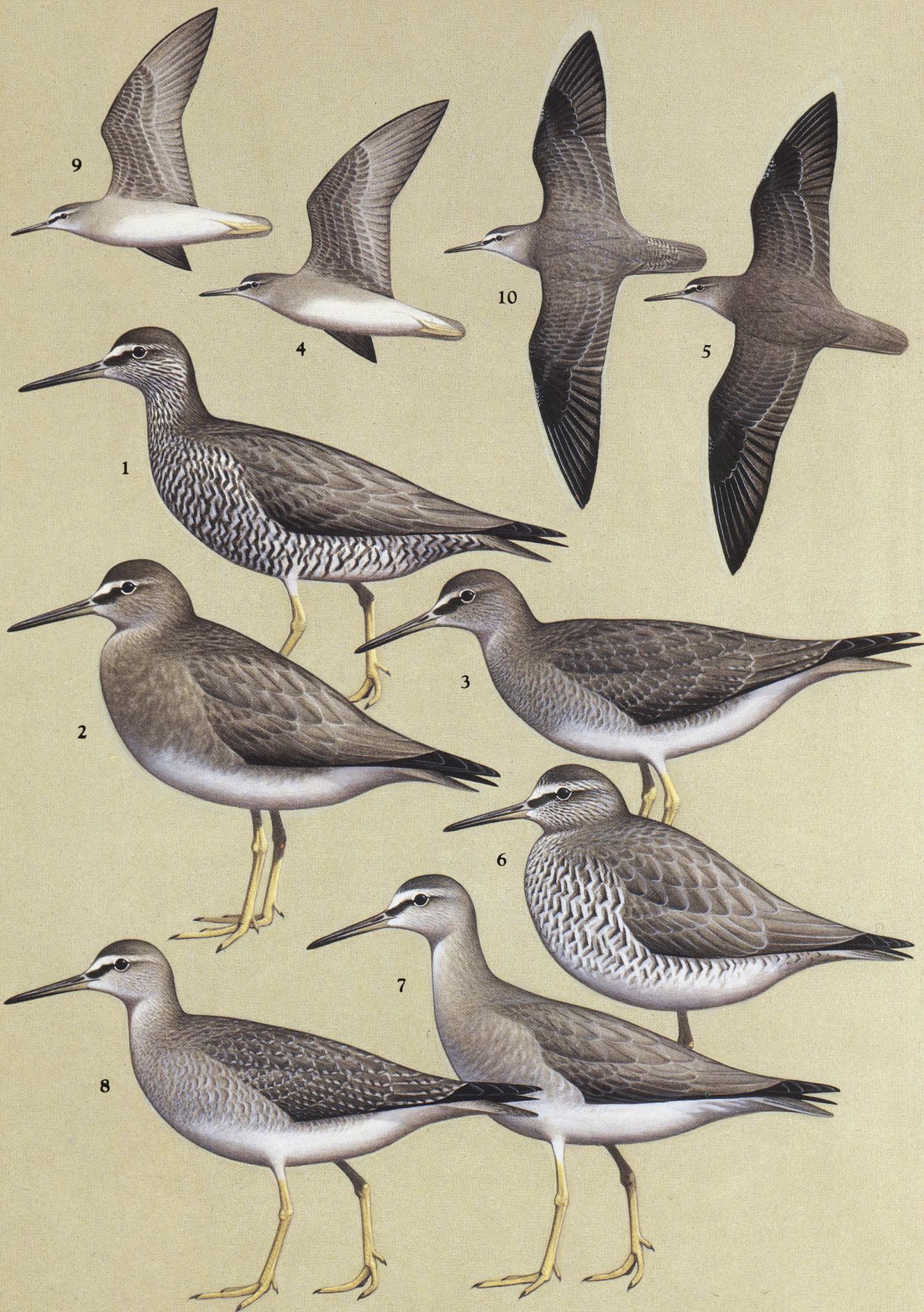
- Amiet, L. 1957. *Emu* 57: 236–54.
 Anon. 1992. *Stilt* 20: 33–7.
 AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
 Armstrong, J.S. 1932. *Birds of Samoa*. Bale & Danielsson, Lond.
 Barry, D.H., & D.P. Vernon. 1976. *Sunbird* 7: 107–11.
 Bell, B.D. 1966. *Notornis* 13: 104–5.
 —, & A. Blackburn. 1963. *Notornis* 10: 188.
 Bent, A.C. 1962. *Life Histories of North American Shore Birds*. Dover, New York.
 Bingham, P. 1977. *Aust. Bird Watcher* 7: 99–100.
 Blake, E.R. 1977. *Manual of Neotropical Birds*. Univ. Chicago Press, Chicago.
 Brazil, M.A. 1991. *The Birds of Japan*. Croom Helm, Lond.
 Bryant, C.E. 1933. *Emu* 32: 294–7.
 Burland, J.C. 1964. *Notornis* 11: 145–54.
 Child, P. 1956. *Birds of the Gilbert and Ellice Islands*. Unpubl. Rep. to Gilbert & Ellice Is Educ. Dept.
 — 1979. *Notornis* 26: 171–9.

Plate 10

Common Greenshank *Tringa nebularia* (page 144)
 1 Adult breeding; 2 Adult non-breeding; 3 Juvenile;
 4, 5 Adult

Terek Sandpiper *Xenus cinereus* (page 165)
 6 Adult breeding; 7 Adult non-breeding; 8 Juvenile;
 9, 10 Adult

- Coates, B.J. 1985. *The Birds of Papua New Guinea*. 1. Dove, Alderley, Qld.
 Crawford, D.N. 1972. *Emu* 72: 131–48.
 de Ravin, J.A. 1975. *Aust. Bird Watcher* 6: 4–10.
 Dement'ev, G.P., & N.A. Gladkov (Eds) 1951. *Birds of the Soviet Union*. 3. Israel Prog. Scient. Transl., Jerusalem (1969).
 Dhondt, A. 1976. *Notornis* 23: 29–43.
 Dixon, J.S. 1933. *Condor* 35: 173–9.
 Doyle, M., et al. 1985. *Aust. Birds* 19: 39–40.
 Draffan, R.D.W., et al. 1983. *Emu* 83: 207–34.
 Etchecopar, R.D., & F. Hüe. 1978. *Les Oiseaux de Chine, Non Passereaux*. Les Editions du pacifique, Tahiti.
 Farrand Jr, J. 1983. *The Audubon Society Master Guide to Birding*. 1. Knopf, New York.
 Freeman, A.N.D. 1994. *Notornis* 41 Suppl.: 127–41.
 Gibson, J.D. 1977. *Aust. Birds* 11: 41–74.
 Hachisuka, M., & T. Udagawa. 1951. *Q. J. Taiwan Mus.* 1: 4–7.
 Hayman, P., et al. 1986. *Shorebirds*. Croom Helm, Lond.
 Henshaw, H.W. 1902. *Birds of the Hawaiian Islands*. Thrum, Honolulu.
 Hewish, M.J. 1986. *Stilt* 9: 21–9.
 — 1987a. *Stilt* 11: 18–22.
 — 1987b. *Stilt* 11: 23–31.
 — 1988. *Stilt* 12: 41–6.
 — 1989a. *Stilt* 14: 14–20.
 — 1989b. *Stilt* 15: 13–15.
 — 1990a. *Stilt* 16: 23–35.
 — 1990b. *Stilt* 17: 5–16.
 Hicks, R.K. 1990. *Muruk* 4: 91–105.
 Hindwood, K.A. 1940. *Emu* 40: 1–86.
 —, & E.S. Hoskin. 1954. *Emu* 54: 217–55.
 Johnson, O.W. 1973. *Condor* 75: 336–43.
 — 1977. *Auk* 94: 222–30.
 — 1979. *Stud. avian Biol.* 2: 193–205.
 —, & M.L. Morton. 1976. *Condor* 78: 144–5.
 Kinsky, F.C., & J.C. Yaldwin. 1981. *Natn. Mus. NZ Misc. Ser.* 2.
 Lacan, F., & J-L. Mouglin. 1974. *Oiseau Revue fr. Orn.* 44: 191–280.
 McClure, H.E. 1974. *Migration and Survival of the Birds of Asia*. US Army Med. Component (SEATO Med. Proj.), Bangkok.
 McKean, J.L., & A.L. Hertog. 1980. *North. Terr. Nat.* 1(4): 10–12.
 McKenzie, H.R. 1949. *NZ Bird Notes* 3: 178–80.
 — 1955. *Notornis* 6: 110–11.
 — 1968. *Notornis* 15: 38.
 Merton, D.V. 1970. *Notornis* 17: 147–99.
 Miles, J.A.R. 1982. *Notornis* 29: 230–3.
 Moore, J.L. 1981. *Notornis* 28: 50–6.
 — 1985. *Notornis* 32: 311–18.
 Morris, A.K. 1975. *Aust. Birds* 9: 37–76.
 — 1989. *Aust. Birds* 23: 7–21.
 —, et al. 1981. *Birds in New South Wales*. NSW Field Orn. Club, Sydney.
 Naismith, L. 1992. *Stilt* 21: 6–7.
 Nilsson, R.J., et al. 1994. *Notornis* 41 Suppl.: 109–25.
 Orn. Soc. Japan. 1974. *Checklist of Japanese Birds*. Gakken, Tokyo.
 Paulson, D. 1993. *Shorebirds of the Pacific Northwest*. Univ. Washington Press, Seattle.
 Prater, A.J., & J.H. Marchant. 1975. *Bull. Br. Orn. Club* 95: 120–2.
 Pratt, H.D., et al. 1987. *A Field Guide to the Birds of Hawaii and the Tropical Pacific*. Princeton Univ. Press, Princeton.
 Pringle, J.D. 1987. *Shorebirds of Australia*. Angus & Robertson, Sydney.
 Roberts, G.J. 1979. *The Birds of South-east Queensland*. Qld Conserv. Council, Brisbane.
 Schodde, R., et al. 1983. *Aust. Natn. Parks Wildl. Serv. Spec. Publ.* 8.
 Sclater, P.L. 1881. *The Zoology of the Voyage of HMS Challenger*. 8. Report on Birds. HMSO, Lond.
 Skinner, N.J. 1983. *Notornis* 30: 227–32.
 Storr, G.M. 1977. *Spec. Publ. West. Aust. Mus.* 7.
 — 1984. *Rec. West. Aust. Mus. Suppl.* 19.
 Sutton, P. 1990. *Sunbird* 20: 41–57.
 Thompson, H.A.F. 1977. *Sunbird* 8: 83–91.



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Volume 3, Plate 12

Wandering Tattler *Heteroscelus incana* (page 188)
 1 Adult breeding; 2 Adult non-breeding; 3 Juvenile; 4, 5 Adult

Grey-tailed Tattler *Heteroscelus brevipes* (page 180)
 6 Adult breeding; 7 Adult non-breeding; 8 Juvenile; 9, 10 Adult