Order **CHARADRIIFORMES**

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

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

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

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariformes, 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 charadrids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidorhyncidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorcariidae, 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 charadrids (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, Stercorcariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Order CHARADRIIFORMES
Family SCOLOPACIDAE sandpipers and allies

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

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

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

When breeding, most scolopacids (except some snipes and woodcocks) are birds of open habitats, including tundra. At other times, use a variety of habitats, including forests (woodcocks) and open sea (phalaropes), though most prefer shallow, fresh, brackish or intertidal wetlands. Greatest concentrations occur on intertidal mudflats, especially estuaries. Feed mainly by touch, and the mandibular skeleton has distinctive features associated with tactile methods of foraging. When feeding, most probe into soft, moist substrata to catch invertebrates; some (e.g. Arenariinae) forage on rocky shores; surface-tension mechanism for feeding on plankton, recently described for Red-necked Phalaropes *Phalaropus lobatus* (Rubega & Obst 1993), may prove to be widespread among scolopacids with fine bills. Mixed-species foraging flocks common.

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

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

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

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

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

In CALIDRIDINAE, mating systems remarkably varied, including monogamy, polygyny, polyandry; most species monogamous (e.g. Pitelka *et al.* 1974). Role of sexes in parental care as diverse as mating systems. Apparently solely by female in the four polygynous species; roughly equally shared in some (e.g. Dunlin *C. alpina*), though female tends to leave chicks earlier; in others, male undertakes more of work and females leave before chick-rearing (or even incubation) complete. Behaviour more complex in successive polyandrous species, with males raising first brood while females may lay and raise another clutch. In GALLINAGONINAE, mating systems poorly known but several species monogamous; Great Snipe *Gallinago media* promiscuous, mating at leks, and apparently unique among snipe in performing courtship display on ground; others have crepuscular or nocturnal display-flights accompanied by distinctive calls and non-vocal sounds (see Gallinagoninae). Mass flights of displaying snipes have been said to be aerial leks in several species, but confirmation needed (could be result of unsettled territorial boundaries early in breeding season) (Byrkjedal 1990). In TRINGINAE, most species monogamous but successive polyandry can occur in Spotted Redshank *Tringa erythropus* and Spotted Sandpiper *Actitis macularia*. Parental care shared about equally or females leave breeding grounds early while males undertake or finish rearing chicks. ARENARIINAE are monogamous; Ruddy Turnstone territorial and aggressive. LIMNODROMINAE, poorly known; apparently monogamous; territorial but *L. semipalmatus* nests in small colonies. Both sexes incubate; males undertake most of chick-rearing. In PHALAROPODINAE, many sex roles reversed when breeding; females almost unique among Scolopacidae in undertaking courtship behaviour, contesting access to mates in 'scramble displays' (Reynolds 1987; Colwell & Oring 1988a). Phalaropes usually monogamous, though polyandry recorded in all three species; incidence of polyandry may vary between populations but reasons not yet clear (e.g. Colwell & Oring 1988b). Males undertake virtually all incubation and raise chicks alone (see Colwell 1986; Colwell & Oring 1988a,b).

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

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

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

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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	*Limosa* (godwits)	4 (2NB, 1A)
	Numenius (curlews and whimbrels)	8 (3NB, 1A, 1D)
	Bartramia	1 (1A)
Tringini	*Tringa* ('shanks')	10 (4NB, 4A, 1D)
	Xenus	1 (1NB)
	Actitis	2 (1NB)
	Heteroscelus (tattlers)	2 (2NB)
	Catoptrophorus	1 (0)
Prosobiniini	*Prosobonia*	2, including 1 recently extinct (0)

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

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

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

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

Inhabit wide range of wetland habitats, including intertidal mudflats, reefs and atolls, damp grasslands and (especially in Tringini) shallow, brackish or freshwater pools; except in high Arctic, Tringinae at almost all sites where waders congregate. Feeding behaviours diverse; feed at night and during day, using sight and touch; in general, visual foraging more important than in Calidridinae. Probe for prey or pick small invertebrates from surface of water or mud; *Limosa* and some *Numenius* specialized to probe mud deeply for large invertebrate prey; Tringini recorded using 'mowing' action, though few observations in HANZAB region.

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Heteroscelus brevipes Grey-tailed Tattler

COLOUR PLATE FACING PAGE 225

Totanus brevipes Vieillot, 1816, *Nouv. Dict. Hist. Nat.* 6: 410 — Timor.

Heteroscelus is from the Greek ἑτεροσκελή, with uneven legs, referring to the hexagonal scutellation of the tibia and rear of the tarsus. *Brevipes* combines the Latin for short (*brevis*) and foot (*pes*) and refers to the short yellow legs.

OTHER ENGLISH NAMES Grey or Grey-rumped Sandpiper, Ashen Tringine Sandpiper.

MONOTYPIC

FIELD IDENTIFICATION Length 25 cm; wingspan 51 cm; weight c. 125 g. Medium-sized wader with rather long wings and tail (giving attenuated rear end), medium-length straight bill, and rather short yellow legs; slightly smaller, slimmer and shorter-winged than very similar Wandering Tattler *Heteroscelus incanus*; tips of folded primaries usually level with or just beyond tip of tail. In all plumages, plain grey above, with white supercilium and dark loral stripe, slate-grey underwing and yellow legs. Sexes alike. Marked seasonal variation. Juvenile and immatures separable.

Description **Adult breeding** Upperparts, slate-grey, slightly darker on primary coverts and outer primaries; tips to outer greater secondary coverts and adjacent inner primary coverts, white, but not forming obvious wing-bar; faint white barring at base of tail; in very fresh plumage, feathers of mantle, scapulars, tertials and innerwing-coverts finely fringed white. Bold white supercilia almost join across forehead and extend well behind eye; prominent dark loral stripe continues narrowly behind eye; narrow white eye-ring. Rear of supercilium, ear-coverts, cheeks, foreneck and sides of neck, white, coarsely streaked grey. Rest of underbody, white, with dense narrow V-shaped grey bars on breast and flanks, and on some, a few on lateral undertail-coverts. Underwing, slate-grey, with remiges slightly paler than lining. Bill, black, with yellow tinge to basal third of lower mandible. Iris, dark brown. Legs and feet, bright yellow. **Adult non-breeding** Similar to adult breeding but without streaking on head and neck, nor barring on underbody. Supercilia usually join above bill, and extend over and behind eye to end above rear ear-coverts; rear half of supercilium varies from off-white to pale grey, though normally still distinct behind eye. Sides of neck and breast (often whole breast), slate-grey, paler grey or greyish white on cheeks; rest of underbody, white. **Juvenile** Similar to adult non-breeding, differing by: scapulars and tertials have narrow alternating dark and pale spots on edge; innerwing-coverts similar, but with narrow dark submarginal bar bordering pale tip, appearing finely pale-spotted above (prominence of spots much affected by wear). Edges of rectrices spotted off-white towards tip (clearest on central feathers). Breast and flanks smudged and finely barred grey and appear mottled or finely vermiculated, rather than evenly washed grey. **First immature (non-breeding and breeding)** First immature non-breeding distinguished from adult non-breeding only if a few retained juvenile innerwing-coverts and tertials can be seen. May–Sept., separable from adult by contrast between worn inner and fresh outer primaries (cf. evenly worn, rather fresh primaries in adults, from about Mar.). A few inseparable from adult non-breeding. Some first-year birds that winter in HANZAB area remain in non-breeding plumage while others attain partial breeding plumage: in poorly marked individuals, plumage as non-breeding but grey of breast and flanks faintly vermiculated like juvenile; more boldly marked birds develop small amount of adult-like barring on breast and flanks.

Similar species Combination of plain grey upperparts, clear white supercilium and dark loral stripe, slate-grey underwing, and yellow legs distinguish from all except **Wandering Tattler**, which is very similar to all plumages of Grey-tailed Tattler. Individual variation in plumage and subjective nature of many characters makes separation difficult. Most reliably separated on call: usual flight call of Wandering Tattler a rippling trill of 6–10 accelerating notes *whee-we-we-we...*, at same pitch but decreasing in volume; usual call of Grey-tailed plover-like upslurred whistle with two or three notes: *tu-whip*, *troo-eet* or *troo-eet-eet*; Grey-tailed occasionally give alarm calls similar to those of Wandering, but usual calls are distinct (see Voice). When together, Wandering appears slightly bulkier and generally shows longer primary projection, typically well beyond tip of tail at rest (primaries usually level with or only just beyond tip of tail in Grey-tailed, though some have longer projection, overlapping with that of Wandering). Differences in length of nasal groove not useful in field (see Plumages). In ALL PLUMAGES: Wandering Tattler slightly darker and greyer above (distinctly darker than non-breeding Red Knot, whereas Grey-tailed about same shade as Knot) and, in fresh plumage, uppertail-coverts are only narrowly fringed white (Grey-tailed shows broader white fringing, sometimes visible in close views as faint whitish barring at base of tail); also bill tends to be darker. Best separated in ADULT BREEDING plumage: in Wandering, grey bars on underbody, broader and cover almost entire underbody, leaving only small clear white area on centre of belly and vent (Grey-tailed shows much larger white area on belly, vent and undertail-coverts, with barring restricted to flanks and sides of vent and undertail-coverts); moulting Wandering Tattlers may show larger area of white on belly but can be identified by broader barring along sides and, if present, strong barring on central feathers of belly or undertail-coverts. In NON-BREEDING plumages, Wandering best distinguished by pattern of head, especially shape and extent of pale supercilium: supercilium broadest and prominent in front of eye but absent or at best only a faint narrow streak behind eye (on Grey-tailed, supercilium slightly broader, of roughly constant width and continues over and behind eye to end above rear ear-coverts; always gives impression of broader pale supercilium behind eye; this impression heightened by usually more prominent dark eye-stripe beneath). Appears slightly darker grey above, on head, breast and flanks, with more grey on flanks, but these differences are of little use except in direct comparison. Other, less reliable points of distinction are: Wandering typically has dark of crown extending narrowly through centre of forehead to meet base of bill, separating supercilia (typically join broadly over bill in Grey-tailed, though sometimes separated by thin grey line or mottling through centre of forehead, especially in moulting birds); dark loral stripe contrasts less with somewhat darker head, with only faint dark stripe behind eye (usually obvious on Grey-tailed). **JUVENILE** Wandering differs from juvenile Grey-tailed as described for non-breeding plumages; also differ by: scapulars, coverts and tertials, generally less obviously pale-spotted, and uppertail-coverts only finely fringed white (though pale markings of Grey-tailed vary, and these differences of little value when plumage worn); and uppertail uniformly grey (Grey-tailed shows white lateral spotting toward tip). While there is much overlap, Wandering uses narrower range of habitats, normally occurring only on rocky coasts and reefs, and occasionally on adjacent sandy or stony beaches; unlike Grey-tailed, rarely on estuarine mudflats.

Seen singly but more usually in small flocks; in wide variety of coastal habitats and waterways. Usually feed singly or in loose groups; freely associate with other waders and form communal (often monospecific) roosts at high tide, when often perch in mangroves, on snags and rocks. Wary and nervous, but will allow close approach; sometimes crouch rather than fly when threatened. Active and alert when foraging; walk with bobbing and teetering movements like those of Common Sandpiper *Tringa hypoleucos*. Flight fast and effortless, usually low and direct, with flicking beats of long wings. Usual call, a disyllabic, upslurred clear whistle (see above); also give sharp monosyllable in alarm, more scratchy *peep*, *peepeepeep* or strident *klee-klee*, *tooee tooee*.

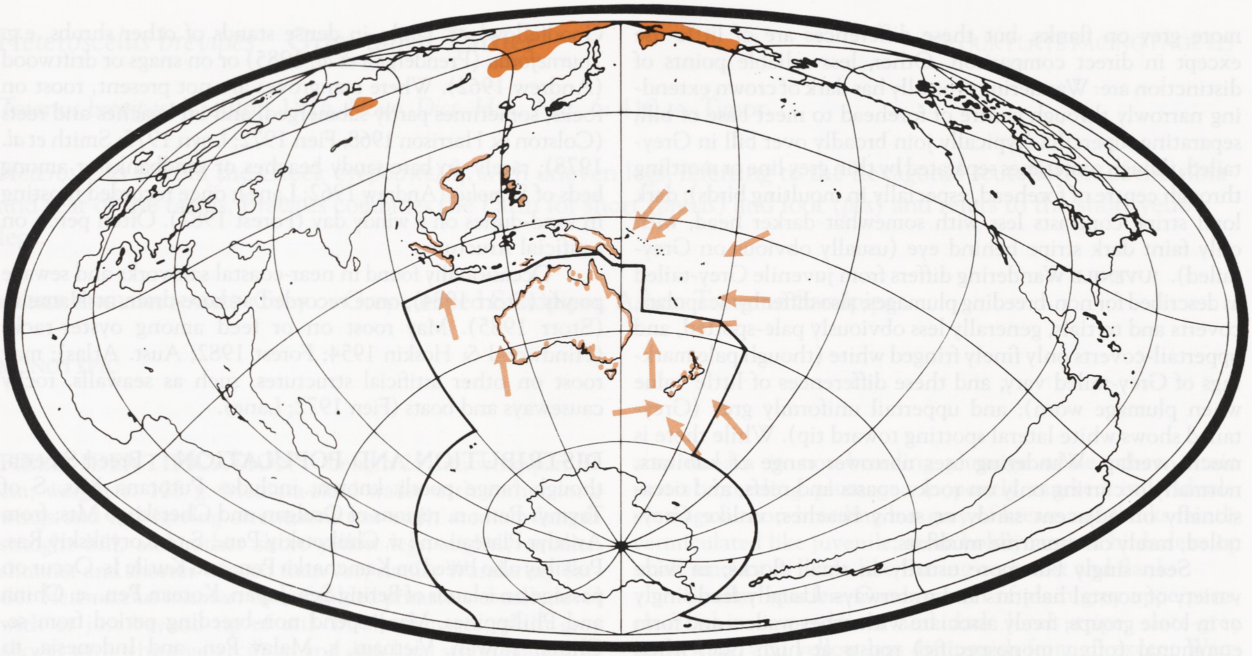
HABITAT Sheltered coasts with reefs and rock platforms or with intertidal mudflats. Intertidal rocky, coral or stony reefs, platforms and islets that are exposed at low tide; also shores of rock, shingle, gravel or shells. Also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves. In Moreton Bay, Qld, most abundant in areas with dense beds of seagrass (Thompson 1992); in Tas., also abundant in areas with seagrass beds; numbers fell when seagrass died off, but birds returned when seagrass beds recovered (J. Thompson; B.A. Lane). Less often on open flat sandy beaches or sandbanks, especially round accumulated seaweed or isolated clumps of dead coral (Andrew 1962; Evans 1975; Schodde 1976; Bransbury 1985; Storr 1987; Garnett 1989; Thompson 1992). Occasionally round near-coastal wetlands, such as lagoons and lakes and ponds in sewage farms and saltworks (Andrew 1962; Storr 1984, 1987; Storr & Johnstone 1988). Rare inland record, on river bank and edges of rock pool (Roberts 1977).

Usually forage in shallow (*c*. 2 cm deep) water, on hard intertidal substrates, such as reefs and rock platforms, in rock pools and among rocks and coral rubble, over which water may surge (Hindwood & Hoskin 1954; Domm & Recher 1973; Prendergast *et al*. 1985; Lane). Also on exposed intertidal mudflats, especially with mangroves and possibly seagrass nearby (Hindwood & Hoskin 1954; Andrew 1962; Loyn 1975; Pegler 1980; Forest 1982). Occasionally on intertidal sandflats, round banks of seaweed or protruding rocks or lumps of coral (Evans 1975; Kitchener *et al*. 1975; Bransbury 1985). Usually roost in branches of mangroves (Colston & Harrison 1968; Loyn 1975, 1978; Forest 1982; Garnett 1989; H.A.F. Thompson & D.K. Goodfellow) or, rarely, in dense stands of other shrubs, e.g. *Tournefortia* (Prendergast *et al*. 1985) or on snags or driftwood (Andrew 1962). Where mangroves are not present, roost on rocks, sometimes partly submerged, and on beaches and reefs (Colston & Harrison 1968; Fien 1972; Loyn 1975; Smith *et al*. 1978); rarely on bare sandy beaches or sandbanks or among beds of *Samolus* (Andrew 1962; Lane); once recorded roosting in sand-dunes on a windy day (Forest 1982). Often perch on artificial structures.

Occasionally found in near-coastal saltworks and sewage ponds (Storr 1984); once recorded at bore-drain at Hamelin (Storr 1985). May roost on or feed among oyster-racks (Hindwood & Hoskin 1954; Forest 1982; Aust. Atlas); may roost on other artificial structures, such as seawalls, rocky causeways and boats (Fien 1972; Lane).

DISTRIBUTION AND POPULATION Breed Siberia, though range poorly known; includes Putorana Mts, S of Taymyr Pen.; n. regions of Orulgan and Cherskogo Mts; from Anadyr Plateau and w. Chukotskiy Pen., S to Koryakskiy Ras. Possibly also breed on Kamchatka Pen. and Kurile Is. Occur on passage on islands of Bering Sea, Japan, Korean Pen., e. China and Philippines. Many spend non-breeding period from se. China, Taiwan, Vietnam, s. Malay Pen. and Indonesia, to A'asia, including New Guinea, Micronesia, Fiji and Tuvalu; straggler to nw. Hawaiian Is; (Orn. Soc. Japan 1974; AOU 1983; de Schauensee 1984; Flint *et al*. 1984; Pratt *et al*. 1987; AWB 1993; Lane); a few birds recorded near hot springs on Kamchatka Pen., Russia, during boreal winter (Neufeldt *et al*. 1961).

Aust. Qld Entire coast and offshore islands, including small numbers in Gulf of Carpentaria (cf. Lane); widespread Torres Str. and e. coast (Ingram 1976; Draffan *et al*. 1983; Garnett 1989; Aust. Atlas). No gap in distribution on e. C. York Pen. (Domm 1977; Cornelius 1987, 1988; Smith 1987 *contra* Aust. Atlas). Inland record, Burdekin Weir, Charters Towers, 8 Oct. 1985 (Qld Bird Rep. 1985); unidentified tattler recorded Mt Isa in mid-1950s (Liddy 1960; Thomas 1970; Horton 1975). **NSW** Along most of coast, S to Tilba L., but more often N of Sydney (Whiter 1992; Aust. Atlas). **Vic.** Rarely recorded: in Gippsland, E of McLaughlans Beach: Barton I., 4 Feb. 1981 (Aust. Atlas); Sperm Whale Head, 1 Sept. 1982 (Vic. Bird Rep. 1982). Mostly Corner Inlet, W (including Venus Bay) to Westernport and Port Phillip Bays. Occasionally on w. coast round Killarney, Port Fairy and Discovery Bay (Vic. Bird Reps; Vic. Atlas). **Tas.** Recorded King I. and Furneaux Grp (Thomas 1979; Milledge 1983; Tas. Bird Reps; Aust. Atlas). Mostly on n. coast, from Robbins I. to C. Portland; on e. coast, recorded at Anson's Bay, Lisdillon and between Triabunna and Marion Bay; Hobart region; in S, recorded on s. Great Bruny I. and at Recherche Bay; on w. coast, at Pieman R., Four Mile Beach and round Ann Bay (Thomas 1979; Schulz 1993; Tas. Bird Reps). **SA** Uncommonly recorded along coasts between Port MacDonnell and Denial Bay, W of Streaky Bay (Eckert 1974; Bransbury 1985; Stove 1994; SA Bird Reps; Aust. Atlas). First confirmed records were Sept.–Oct. 1964 at Outer Harbour and ICI Saltfields respectively (Cooper 1964); unconfirmed inland record, tentatively identified as Grey-tailed Tattler, at Muloorina HS, 1963 (Badman & May 1983; SA Bird Rep. 1963). **WA** Few, scattered records on s. coast, round Eyre Bird Observatory, Pt Malcolm, Rossiter Bay, Shark L. NR, swamps S of L. Gore, Grasmere L. NR, Albany wetlands and Balijup (Kitchener *et al*. 1975; Anon. 1984a,b, 1986, 1989; Jaensch *et al*. 1988;



Jaensch 1989; Aust. Atlas). In SW, between Augusta and Cervantes. Widespread from Houtman Abrolhos and adjacent mainland to Kimberley Div., including offshore islands (Garstone 1978; Smith *et al.* 1978; Storr *et al.* 1986; Aust. Atlas). Inland records from L. Argyle (Storr 1980; Jaensch & Vervest 1990). NT Widespread round coasts from border of WA, N to Melville I., and E at least to S. Goulburn I.; from round Gove Pen. and Groote Eylandt to Sir Edward Pellew Is and mouth of McArthur R. (Boekel 1976; Schodde 1976; Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). Several inland records round Hermannsburg (Thomas 1970; Roberts 1977).

NZ Regular visitor in small numbers. NI Records most widespread in harbours and islets in N, from Spirits Bay, S to Kawhia Harbour in the W and Maketu, Bay of Plenty, in the E. A few scattered records elsewhere: Muriwai Lagoon, Westshore and Ngaruroro R. estuary in E; Wellington; estuaries of Waikanae and Manawatu Rs and Waiongana Stream on w.

coast (Andrew 1962; Edgar *et al*. 1969; Edgar 1971, 1978; CSNs). **SI** Most records from Farewell Spit, but also occasionally Tasman Bay, round Motueka, Waimea Inlet and Nelson Haven. Recorded at scattered sites in coastal Canterbury, Otago and Southland, including Kaikoura area, estuary of Ashley R., Avon–Heathcote Estuary, mouth of Ashburton R., Otago Pen., Catlins area, Southlands lagoons, including Awarua Bay and Invercargill Estuary. Recorded on w. coast, at Okarito Lagoon (Hamel 1968; Owen & Sell 1985; CSN). A record from Tasman R., near Mt Cook, remains unconfirmed (CSN 19).

Christmas I. First collected Sept. 1898 (Gibson-Hill 1947). Probably a regular, rather than rare, migrant (Stokes 1988 *contra* Gibson-Hill 1947; van Tets 1974). Recent records include singles, 9 Dec. 1977 and 30 Sept. 1978 (Stokes *et al*. 1987).

Norfolk I. Uncommon but regular visitor (singles unless stated): Sept. 1971; two, 1–13 Nov. 1971; Feb. 1973; 10 Mar. 1974; Mar. 1976; 1–2, 11–12 July 1976; three, 16 Sept. 1978; unknown number, Dec. 1978; 1–6, 15–23 Nov. 1979; 1–3, 6–18 Nov. 1980; 1–15 Nov. 1981; 2–24 Dec. 1984 (de Ravin 1975; Moore 1981, 1985; Schodde *et al*. 1983).

Lord Howe I. Two, specimens, Nov.–Dec. 1887 (Hindwood 1940); two, 27–29 Feb. 1960; single, 25 Nov. 1962; four, 5 Sept. 1963 (McKean & Hindwood 1965), single, 6 and 13 Apr. 1975 (NSW Bird Rep. 1975).

Chatham Is Singles, Chatham I.: Te Whanga Lagoon, 12 Apr. 1967; C. Pattison, 23 Nov. 1978 (Freeman 1994; CSN 26). Single unidentified tattler, C. Young, 4 Dec. 1987 (Freeman 1994).

Snares Is Unconfirmed report, single, 9 Dec. 1968 (Warham & Keeley 1969; NZCL).

Auckland Is Single unidentified tattler, Derry Castle Reef, 8 Dec. 1976 (Penniket *et al*. 1986); three, Enderby I., Apr. 1980 (Pierce 1980).

Population Aust. Estimated at 36,000 (Watkins 1993). Sites of significance and maximum or average counts for summer and winter surveys round Aust., 1981–85, were: Eighty Mile Beach, WA, 8500; Moreton Bay, Qld, 3190 (see below); Roebuck Bay, WA, 3180; se. Gulf of Carpentaria, Qld, 985; n. coast of NSW, 380; Hunter R. estuary, NSW, 100 (Lane). Other sites of international importance and maximum counts (Watkins 1993) include: Great Sandy Str., Qld, 7680 (Driscoll 1990); n. Great Barrier Reef, Qld, 1842 (Cornelius 1987). Totals for summer and winter counts, 1986–91, summarized in Table 1 (Hewish 1986, 1987a,b, 1988, 1989a,b, 1990a,b; Anon. 1992; Naismith 1992). At Moreton Bay, Qld, maximum estimate of 22,052, recorded during n. migration, 1989, far exceeds previous highest estimate of 8500 at Eighty Mile Beach, WA (Thompson 1993).

Table 1

Year	Summer Total	No. Sites	Winter Total	No. Sites
1986	498	23	167	23
1987	724	22	322	23
1988	479	23	162	23
1989	749	22	293	21
1990	879	21	118	21
1991	90	21	–	–

MOVEMENTS Migratory; breed Siberia (Orn. Soc. Japan 1974; AOU 1983; Lane). Move S for boreal winter, mainly along e. coast of Asia but also across sw. Pacific Ocean (Neufeldt *et al*. 1961; Pratt *et al*. 1987; Lane). Non-breeding range generally farther W than that of Wandering Tattler (q.v.), though there is some overlap where status of each not well known because identification in field is difficult (e.g. Fiji; Skinner 1983). Migration mainly coastal, but sometimes occur on inland wetlands (la Touche 1931–34; Dement'ev & Gladkov 1951; Coates 1985).

Departure Mostly during Aug., but sometimes appear S of breeding range as early as July, and some remain on breeding grounds as late as Sept. or Oct. Move down e. coast of Siberia (Neufeldt *et al*. 1961; Dement'ev & Gladkov 1951). Migrate through w. Aleutian Is, and through Japan (Orn. Soc. Japan 1974; AOU 1983; AWB 1993). Pass through ne. China and Korea between late July and Oct., though generally rare in China; recorded from Mongolia and pass through central China (la Touche 1931–34; Hemmingsen & Guildal 1968; Gore & Won 1971; de Schauensee 1984; AWB 1993). Small numbers move through Hong Kong, mainly mid-Aug. to early Oct. (Chalmers 1986). Rare passage migrant Thailand (Lekagul & Round 1991); regular in small numbers Vietnam (Wildash 1968); scarce Pen. Malaysia, from Sept. (Medway & Wells 1976). Move through and common Philippines (Hachisuka 1931; Delacour & Mayr 1946; AWB 1993). Pass through Borneo and Bali from Sept. (Smythies 1981; Ash 1984; Harvey & Elkin 1991); pass through Wallacea, from Aug. (White & Bruce 1986). Apparently common New Guinea (but see Lane); in PNG, s. migration from mid-Aug. till Nov. or Dec. (Coates 1985; Hicks 1990). Arrive Solomon Is, late Aug. (Bayliss-Smith 1972) with small numbers from other Pacific islands as far E as Fiji and Tuvalu (Pratt *et al*. 1987; Lane). Common passage migrant Torres Str. (Draffan *et al*. 1983). In Aust., adults arrive n. coast, late Aug. and early Sept., with first-year birds apparently arriving about 4 weeks later (Haward & Barter 1991; Lane).

Non-breeding Aust. Mainly in N, though small numbers found annually on s. coast; influxes on e. coast, Sept.–Nov. suggest movement along coast; inland records suggest some move overland from n. coast (Lane). Small groups arrive in central latitudes of e. and w. coasts as early as Aug. (e.g. Forest 1982; Storr *et al*. 1986). Small numbers move along s. coast, Sept.–Nov. (Lane); arrive Tas., Oct.–Nov. (Sharland 1958; Thomas 1970); occur less regularly at other sites (Ashby 1991). **NZ** Rare but regular to NI and SI, especially Parengarenga and Farewell Spit. At least some birds recorded in one locality for months, even for duration of non-breeding period (e.g. Waikanae Estuary) (Andrew 1962; Falla *et al*. 1981). One bird, assumed to be same individual, present Manukau for more than 4 years (Sibson 1967).

Said to gather at particular localities during periods of migration; before n. migration birds in NSW were '...restless and flew and settled as a flock' (Keast 1949).

Return Generally leave Aust. by early or mid-Apr. (Lane) but leave Tas., Mar.–June (Thomas 1968, 1970). Temporary influxes along e. coast, in parts of SA and in Darwin, NT, in Mar. and Apr., suggest birds may migrate across continent as well as along e. coast (Lane). In nw. Aust. in Apr., some birds estimated capable of flying non-stop to Philippines (Haward & Barter 1991) or s. China (Lane & Jessop 1985). One moved from nw. Aust. to Taiwan in 23 days (see Banding).

Extralimitally, apparently leave sw. Pacific islands, Bali, Wallacea, Sabah and Malay Pen., Apr.–May (Bayliss-Smith 1972; Medway & Wells 1976; Smythies 1981; Ash 1984;

White & Bruce 1986; Magsalay *et al.* 1990). Pass through Port Moresby, PNG, Olango I. in Philippines, Hong Kong, e. China and Korea, Apr.–May (la Touche 1931–34; Gore & Won 1971; Chalmers 1986; Hicks 1990). Move along Siberian coast and on breeding grounds from May (Dement'ev & Gladkov 1951; Neufeldt *et al.* 1961; Hayman *et al.* 1986).

Breeding First-year birds often stay S during breeding season, e.g. New Guinea (Beehler *et al.* 1986; Hayman *et al.* 1986). In Aust., reporting rate in winter 0.7% compared with 1.5% in summer (Aust. Atlas). During winter, recorded in N: e.g. Nickol Bay, nw. WA (Colston & Harrison 1968); One Tree I., Qld (Domm & Recher 1973); Torres Str. (Draffan *et al.* 1983); and in S: e.g. Vic. (Vic. Atlas); se. SA (Hewish 1989b) with winter records as far S as Tas. (e.g. Wall 1953; Hewish 1987a). Recorded during winter on Norfolk I. (Moore 1981) and several winter records from NZ (e.g. Andrew 1962), even from SI (Hamel 1968).

Banding, Colour-marking Birds banded nw. Aust. recovered se. China and Hong Kong and Taiwan. Birds banded e. Aust. recovered Japan and e. Siberia. Birds banded Japan recovered e. Qld coast (but also see Banding for Wandering Tattler) and bird banded Taiwan moved to nw. Aust. (ABBBS 1992). Bird colour-marked nw. Aust. in Aug. 1992 sighted Moreton Bay, Qld, Nov. 1992 indicating e. movement across n. Aust. (Minton 1993).

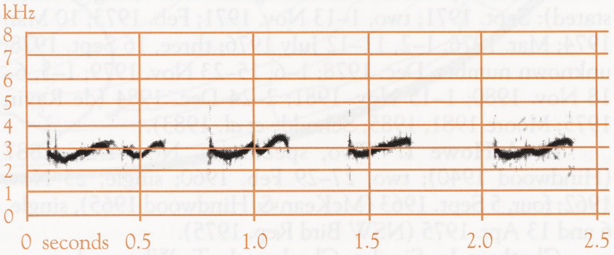
32S151E	04	1+	U	26	10815	11	ABBBS
32S151E	04	1+	M	26	10815	11	ABBBS
32S151E	04	1+	U	26	10785	10	ABBBS
32S151E	04	1+	M	26	10785	10	ABBBS
34S151E	04	1+	U	13	7805	350	ABBBS
34S151E	04	1+	U	13	7805	350	ABBBS
34S151E	04	1+	U	13	7805	350	ABBBS
34S151E	04	1+	U	13	7805	350	ABBBS
32S151E	11	1+	U	93	7660	349	ABBBS
35N139E	08	1+	U	12	7058	166	MAPS
35N140E	05	2+	U	8	6019	172	BMRC
35N139E	09	2+	U	32	5137	177	BMRC
19S121E	11	3+	U	6	4787	342	ABBBS
18S122E	04	2+	U	1	4772	358	ABBBS
18S122E	04	2+	U		4771	358	ABBBS
19S121E	03	2+	U	17	4684	349	ABBBS
18S122E	04	2+	U	16	4673	357	ABBBS
24N120E	08	2+	U	7	4673	177	H
18S122E	04	2+	U	12	4576	336	ABBBS
18S122E	08	2	U	8	4553	343	ABBBS
18S122E	08	1	U	8	4553	343	ABBBS
18S122E	08	2	U	8	4532	342	ABBBS
18S122E	08	1	U	8	4532	342	ABBBS
18S122E	04	2+	U	12	4474	343	ABBBS
18S122E	03	2+	U	29	177	218	ABBBS
19S121E	04	2+	U	24	177	38	ABBBS

FOOD Polychaetes, molluscs, crustaceans, insects and, occasionally, fish. **Behaviour** Diurnal; roost at night. Locate prey by sight or by probing rocky shores, reef crests, areas of reef rubble (Domm & Recher 1973), and along edge of water of beaches and mudflats. Crabs possibly more important food source before migration. Catch crabs in shallow water, often immersing head completely, or, occasionally, in burrows; manipulate and repeatedly drop or throw prey to remove legs and claws, then wash before eating (Andrew 1962; Keast 1949). Three birds took five crabs in 5 min (Keast 1949). Seen chasing and catching small fish in rock pools (Hindwood & Hoskin 1954). Chase amphipods out of water and take some prey ashore to get a better grip (Andrew 1962).

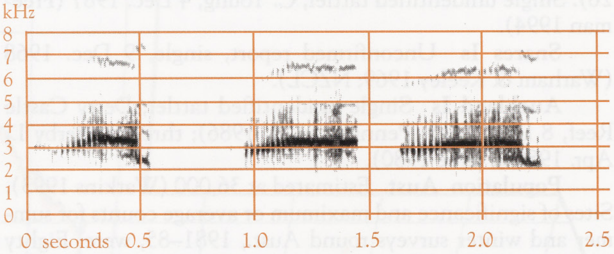
Adult Annelids: polychaetes; Molluscs (Hindwood & Hoskin 1954); Crustaceans: amphipods; isopods; crabs (Andrew 1962; photograph, Pringle 1987): Hymenosomatidae: *Heleocius cordiformis* (Keast 1949); *Parathelphusa transversa* (FAB); Insects (Hindwood & Hoskin 1954); Fish (Hindwood & Hoskin 1954; Andrew 1962).

VOICE No detailed studies or published sonagrams (Miller 1992).

Adult Usual call, upslurred whistle *tu-whip* (Hayman *et al.* 1986) (see sonagram A); easily distinguished from call of Wandering Tattler. After a drop in frequency at start, call rises in pitch 2.5–3.5 kHz, usually with a distinct hesitation at midpoint. Rippling call (sonagram B), given by captive birds, probably close contact sound of flock.



A F. van Gessel; Darwin, NT, Nov. 1983; P36



B E. Slater & P.J. Fullagar; Broome, WA, Oct. 1992; P36

PLUMAGES Prepared by A.M. Dunn. Undergo partial post-juvenile (first pre-basic) moult to immature non-breeding plumage after s. migration. Most immatures then moult outer primaries in first pre-supplemental moult, Mar.–Apr. Undergo varying first pre-breeding (pre-alternate) moult; most, especially those that remain in non-breeding areas, remain in non-breeding plumage; some moult to breeding plumage like adults. Attain adult non-breeding plumage in complete second pre-basic moult. Thereafter moult twice annuallly: a partial pre-breeding (pre-alternate) moult to breeding plumage that begins in non-breeding areas and finished before reaching breeding grounds; and a complete post-breeding (pre-basic) moult to adult non-breeding plumage, mostly in non-breeding areas after s. migration. Probably first breed in second year.

Adult breeding (Second and subsequent alternate). **Head and neck** Forehead, dark brown-grey (82–221), feathers fringed white; mostly white near base of bill. Supercilium, white, speckled or streaked black-brown (119); extends from base of bill to above ear-coverts. White crescents above and below eye form broken eye-ring; crescent above eye joins with, and obscured by, supercilium. Crown, nape and hindneck, dark brown-grey (82–221). Black-brown (119) eye-stripe through lores and ear-coverts. Chin, white. Cheeks, throat and side of neck, white, heavily streaked black-brown (119). **Upperparts** Mantle, back, rump and scapulars, dark brown-grey (82–221), feathers fringed off-white when fresh. Uppertail-coverts, dark grey (83), fringed white, and often with some barring on outer coverts. **Underparts** Breast, flanks and thighs, white, narrowly barred black-brown (119). Belly and vent, white. Undertail-coverts, white, with single thin black-brown (119) bar on some outer feathers. All feathers have concealed grey-black (82) bases. **Tail** Dark-grey (83), feathers finely fringed white when fresh. **Upperwing** Secondary coverts, dark brownish-grey (c83) with white fringes to greater secondary coverts and narrow off-white fringes to median coverts, which are lost with wear. Alula and outer greater primary coverts, black-brown (119). Marginal and lesser primary coverts and inner greater primary coverts, black-brown (119), fringed white. Outer primaries, black-brown (119) merging to dark-brown (c121) inner primaries; outermost primary has white shaft. Secondaries, dark brown (c121). Tertials, dark brownish-grey (c83) with very thin off-white fringes when fresh. **Underwing** Lesser and median primary coverts, brownish grey (c79), fringed white. Greater primary and secondary coverts, grey (84) with white fringes to tips of feathers. Primaries and secondaries, grey (84).

Adult non-breeding (Second and subsequent basic). Differs from adult breeding by: **Head and neck** Forehead, crown, nape and hindneck, grey (84) to brownish grey (79). Distinct white supercilium extends from base of bill to above ear-coverts, though less distinct behind eye. Dark brown (219) eye-stripe from lores to ear-coverts. Chin, throat and foreneck, white. Cheeks and side of neck, brownish grey (c80). **Upperparts** Mantle, back and scapulars, grey (84). Rump and most uppertail-coverts, grey (84), fringed white; outer uppertail-coverts, barred white. **Underparts** Mostly white, with brownish-grey (c80) wash on breast and flanks.

Juvenile Differs from adult non-breeding by: **Upperparts** Scapulars, grey (84) tinged brown, with alternating dark-brown (121) and white spots along margins of feathers; white spots buffish when fresh (white on all Aust. skins examined). Uppertail-coverts have more white barring. **Underparts** Grey areas of breast and flanks not evenly washed, but have fine white vermiculations giving faintly mottled appearance. **Tail** Brownish grey (c79) with white notches or half bars, bordered dark brown (219), along margins of feathers. **Upperwing** Median and greater secondary coverts, and tertials, have white lateral spots or notches, bordered dark brown (219); white spots buffish when fresh (but white on all Aust. skins examined).

First immature non-breeding (First basic). Like non-breeding adult; may retain some juvenile median coverts and scapulars. Often only distinguishable from adults by very worn primaries, or by partial moult of primaries beginning about Mar.–Apr., which replaces outer 4–5 primaries in outward moult. All primaries in adults rather new at this time.

First immature breeding (First alternate). Similar to first immature non-breeding, but often have some scattered bars on breast and flanks, and fresh feathers on back have thin white fringes. Bars on breast sometimes very faint or incomplete. Obtain barred plumage much later than adults, if at all.

BARE PARTS Based on photos (Pringle 1987), labels (HLW, MV) and descriptions (Witherby *et al.* 1940; AWSG). **Adult** Iris and orbital ring, dark brown (219). Bill, black-brown (119) to dark olive-brown (c129) with olive-brown (29) to pink-buff (c121D) base to lower mandible. Legs, yellow-brown (24–123B) with slightly darker joints. **Juvenile** Iris, dark brown (22). Bill, black-brown (119) with light grey-brown (119C–119D) base. Legs, yellow-brown (24–123C) with slightly darker joints.

MOULTS Based on data collected from live birds in Aust. (Haward & Barter 1991) and n. hemisphere (Dement'ev & Gladkov 1951; Prater & Marchant 1975), and 49 skins from Aust. and NZ (HLW, NMNZ, MV, SAM, WAM). **Adult post-breeding** (Third and subsequent pre-basic). Complete, primaries outward. In nw. Aust., moult of primaries starts on arrival in Aug.–Sept.; finished by early Feb. to mid-Mar. Birds from Vic. moult later than those from nw. Aust. Some had suspended moult during Nov.–Dec. (Prater & Marchant 1975), but this was not found in Aust. adults. Moult of body probably begins during migration or on arrival in Aust.; complete by late Sept. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial, involving all head and neck, underparts, mantle, back, rump, scapulars and tertials; very few wing-coverts replaced but some median secondary upperwing-coverts usually replaced. Begins late Mar. to early Apr. and completed before arrival on breeding grounds in May. **Post-juvenile** (First pre-basic). Partial, involving head and neck, most upperparts and underparts, and some upperwing-coverts. Probably begins Aug.–Sept. after arrival in non-breeding areas. Birds resemble first basic by late Oct. **Post-juvenile moult of primaries** (First pre-supplemental). In nw. Aust., between 80 and 90% of first-year birds moult outer primaries, starting from p5, p6 or p7 in late Mar.–early Apr.; a few birds begin moult from innermost primary and moult is almost complete; three birds caught in Vic., late June, had suspended moult having replaced three, five and seven primaries respectively (Haward & Barter 1991). **First immature pre-breeding** (First pre-alternate). Varies greatly in extent; some undergo partial moult similar to that of adults, most remain mostly in non-breeding plumage. Those that moult, begin Mar.–Apr. **First immature post-breeding** (Second pre-basic). Complete. Similar in extent to adult but, in nw. Aust., began 2 months earlier than adults.

MEASUREMENTS Aust., skins; GVTT = distance from end of nasal groove to tip of bill (HLW, MV, NMNZ, SAM, WAM): (1) Adults; (2) Juveniles and immatures.

		MALES	FEMALES	
WING	(1)	161.5 (4.98; 154–168; 12)	163.3 (3.82; 157–170; 11)	ns
	(2)	159.9 (5.57; 150–167; 10)	157.8 (4.73; 152–166; 12)	ns
TAIL	(1)	66.5 (4.72; 60–74; 13)	64.4 (4.08; 56–70; 12)	ns
	(2)	62.3 (2.46; 58–65; 12)	62.9 (3.25; 57–68; 13)	ns
BILL	(1)	37.3 (1.11; 35.7–39.2; 12)	37.7 (1.35; 35.1–39.9; 11)	ns
	(2)	37.1 (0.86; 36.0–39.1; 12)	37.9 (1.26; 36.4–40.1; 13)	ns
TARSUS	(1)	32.3 (0.83; 31.0–33.8; 13)	32.3 (1.22; 29.6–33.9; 12)	ns
	(2)	32.1 (1.47; 29.6–34.4; 12)	32.3 (1.18; 30.9–34.3; 13)	ns
TOE C	(1)	30.6 (3.10; 28.0–39.7; 11)	29.6 (0.69; 28.3–30.4; 9)	ns
	(2)	29.0 (1.24; 26.8–30.9; 11)	29.2 (1.17; 26.3–30.6; 11)	ns
GVTT	(1)	20.0 (1.16; 17.5–21.5; 12)	20.0 (0.97; 18.8–21.7; 11)	ns
	(2)	19.1 (0.61; 18.4–20.3; 12)	19.4 (0.98; 18.0–21.0; 12)	ns

Juveniles and immatures had significantly shorter wing and tail than adults.

(3) Vic. and nw. Aust., adults, live, unsexed (Haward & Barter 1991).

		VIC.	NW. AUST.	
WING	(3)	165.9 (3.90; 27)	166.8 (4.34; 287)	ns
BILL	(3)	38.1 (1.95; 29)	38.2 (1.62; 150)	ns
THL	(3)	68.3 (1.80; 26)	68.6 (2.12; 157)	ns

WEIGHTS (1) Aust. adults, museum labels (MV, WAM).

	MALES	FEMALES
(1)	117.4 (24.82; 86–145; 5)	130.0 (17.49; 108–150; 4)

(2) NW. Aust., adults, live (Haward & Barter 1991).

		UNSEXED
Late Aug.	(2)	96.4 (6.78; 13)
Early Sept.	(2)	98.7 (9.03; 42)
Oct.–Nov.	(2)	98.7 (6.48; 74)
Late Mar.	(2)	115.1 (11.82; 287)
Early Apr.	(2)	127.1 (10.61; 348)
Mid-Apr.	(2)	122.2 (11.66; 43)

Weight lowest on arrival in Aust., rapidly increasing to c. 98 g, then remaining stable over most of non-breeding period. In Mar., weight gradually increases before migration. In Aust., birds weighing >140 g estimated to be capable of flying non-stop from nw. Aust. to the Philippines, where Tattlers are known to occur during migration (Haward & Barter 1991).

STRUCTURE Wing, long, narrow and pointed. Eleven primaries; p10 longest; p9 3–5 mm shorter, p8 10–13, p7 21–25, p6 32–37, p5 45–51, p4 55–62, p3 65–72, p2 74–81, p1 82–89; p11 minute. Fourteen secondaries, including four tertials; tips of longest tertials fall on folded wing between p6 and p8. Tail, short and square; 12 rectrices. Bill, slightly longer than head; straight, narrow and slightly laterally compressed. Upper mandible, tapering to a point at slightly decurved tip. Lower mandible, straight, often curved upward slightly at tip. Nostril, long and slit-like; set in nasal groove, about half length of bill. Tarsus, short, slender and slightly laterally compressed; scales, mostly scutellate front and rear; some reticulate scales near base of rear tarsus. Tibia, 10–16 mm exposed. Outer toe 81–85% of middle, inner 76–80%, hind 24–30%. Small web between outer and middle toes; little if any webbing between middle and inner toes.

AGEING JUVENILES: on arrival in non-breeding areas, primaries fresh (primaries of adults old or moulting); distinguished on plumage till at least Oct.–Dec. IMMATURES: in Feb.–mid Mar., first immature non-breeding have worn retained juvenile primaries; adults have finished moult and have fresh primaries. In late Mar.–early Apr., most immatures start pre-supplemental moult of outer primaries; those that migrate N separable from adults on return to non-breeding areas by contrast between very worn inner primaries and only slightly worn outer primaries (adult primaries are all old); immatures that remain in non-breeding areas retain non-breeding appearance and start moult of primaries 2 months earlier than returning adults. As adult after second pre-basic moult.

RECOGNITION Very similar in appearance to Wandering Tattler. In Grey-tailed, most scales on rear of tarsus scutellate, whereas in Wandering more often reticulate (see Fig. 1). Nasal groove of Grey-tailed extends about half length of bill; about three-quarters length in Wandering. Wandering significantly larger in length of wing, tail, bill and tarsus and in distance from tip of bill to end of nasal groove: in Grey-tailed, 17–22 mm; in Wandering 12–16 mm.

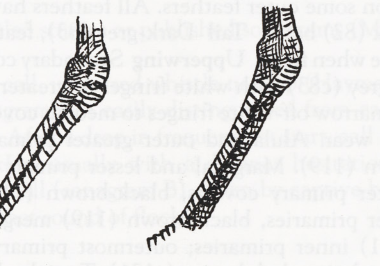


Figure 1 Scaling of tarsi

GEOGRAPHICAL VARIATION None.

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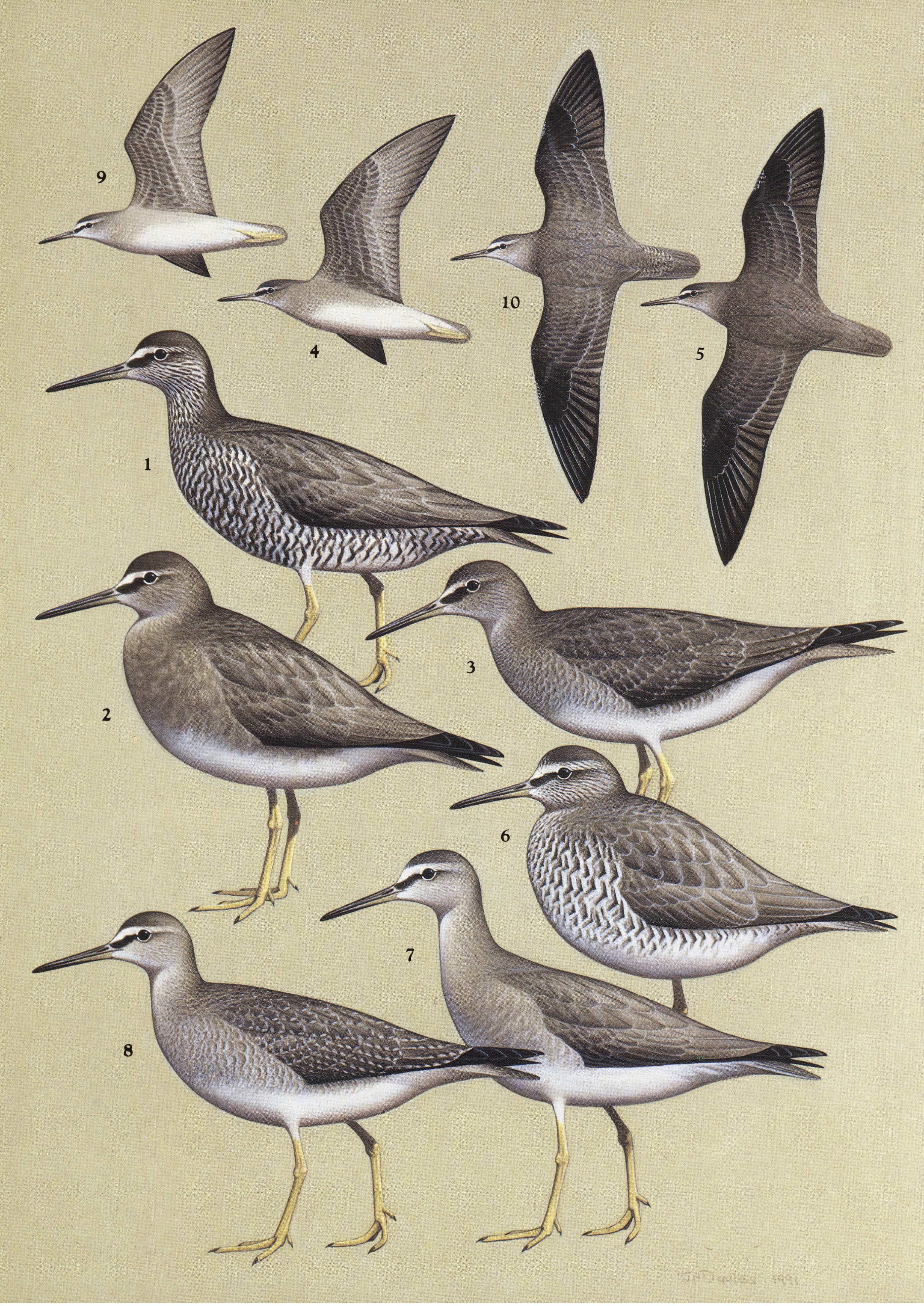

Volume 3, Plate 12

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