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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 **CALIDRIDINAE** arctic sandpipers and allies

Small to medium-sized (15–29 cm) migratory shorebirds. Twenty-four species in seven genera (see Table 1); six genera monotypic; *Calidris* comprises remaining 18 species (though these were once placed in several different genera). In HANZAB region, 19 species recorded: ten regular non-breeding migrants, eight accidental, one doubtfully recorded (and one problematic hybrid). *Calidris* may contain 2–3 species-groups (BWP): (1) knots (two species), which have much in common with Surfbird *Aphriza virgata*, especially Great Knot C. *tenuirostris* (Jehl 1968a); (2) sandpipers with partially webbed feet ('*Ereunetes*' group: C. *pusilla* and C. *semipalmatus*); and (3) other sandpipers ('*Erolia*' group). Groups (2) and (3) do not differ greatly, and may be more closely related to *Micropalama*, *Limicola*, *Eurynorhynchus*, *Tryngites* and *Philomachus* than they are to knots and Surfbirds (Jehl 1968a; BWP). Patterns of downy young suggest possible affinities of Calidridinae to Gallinagoninae, Limnodrominae and, possibly, Arenariinae (Jehl 1968a,b; Fjeldså 1977) but precise relationships not clear; allozyme and DNA research so far (e.g. Dittman *et al*. 1989; Dittman & Zink 1991; Christian *et al*. 1992) have not included comparison with all other subfamilies of Scolopacidae.

Table 1

GENUS	NUMBER OF SPECIES	NUMBER OF SPECIES IN HANZAB REGION[1]
Aphriza	1 (Surfbird)	0
Calidris	18	8 NB, 6A, 1D
Eurynorhynchus	1 (Spoon-billed Sandpiper)	0
Micropalama	1 (Stilt Sandpiper)	1 NA
Tryngites	1 (Buff-breasted Sandpiper)	1 NA
Limicola	1 (Broad-billed Sandpiper)	1 NB
Philomachus	1 (Ruff)	1 NB

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

Females generally slightly larger than males, but male is larger in polygynous species: Pectoral C. *melanotus*, Sharp-tailed C. *acuminata*, and Buff-breasted T. *subruficollis* Sandpipers, and Ruff P. *pugnax* (Jehl & Murray 1986). Bill, short and finely pointed in most species, but superficially plover-like in *Tryngites* and broad and flattened in *Eurynorhynchus*. Nostrils in a depression extending anteriorly as a groove that nearly reaches tip of upper mandible. Highly rhynchokinetic except in *Aphriza*; upper jaw typically lightly built and tip of bill sensitive, with many Herbst's corpuscles (associated with tactile foraging). Muscles of jaw and tongue hypertrophied in *Limicola* and *Tryngites*; latter also has hypertrophied salivary glands, in these respects resembling plovers. Internal feeding apparatus of *Calidris* and *Micropalama* very similar (Burton 1974) and further research needed on whether *Micropalama* merits generic recognition. Legs, moderately long and tarsus scutellate. Hindtoe small and raised in most; uniquely among Scolopacidae, it is absent in Sanderling C. *alba*. Anterior toes usually unwebbed but *Calidris* of '*Ereunetes*' group have small basal web between front toes.

Adult breeding plumage finely patterned in rufous, black, grey and buff; white or rufous below, usually with dark spotting, streaking or suffusion on breast. Sexes alike or nearly so, except for strong sexual dimorphism in Ruff, which is also unusual in attaining breeding plumage in pre-supplemental (rather than pre-alternate) moult. Adult non-breeding usually much plainer, grey to brown above and mostly white below; in *Tryngites*, little seasonal change in appearance. Juvenile plumage distinctive, usually with upperparts superficially like that of adult breeding and underparts more like adult non-breeding. All species replace most of juvenile body-plumage early in first pre-basic moult (attaining plumage like non-breeding), typically when in late stages of s. migration or after arrival in non-breeding areas. Thereafter, moult-strategies of subadults complex, but can be separated into three broad categories: (1) Undergo complete moult of all juvenile feathers in first pre-basic when c. 6–8 months old, developing adult breeding plumage in first pre-alternate moult just before first n. migration when c. 9–10 months old (e.g. most Little Stints C. *minuta*, Least C. *minutilla* and Sharp-tailed C. *acuminata* Sandpipers). (2) Retain juvenile remiges, and often much of tail and wing-coverts, through first pre-basic; may replace some outer primaries in partial first pre-supplemental moult; attain plumage very similar to that of adult breeding in first pre-alternate moult before undertaking first n. migration when c. 9–10 months old (e.g. Dunlin C. *alpina* and Purple Sandpiper C. *maritima*). (3) Like second strategy, but first pre-alternate moult produces dull plumage, mostly like non-breeding but often with varying number of feathers like breeding plumage (colours of these feathers often duller than adult breeding); such birds typically delay first n. migration until at least 2 years old, first attaining adult non-breeding plumage in complete second pre-basic moult when c. 12–15 months old (e.g. Red-necked Stint C. *ruficollis*, Curlew Sandpiper C. *ferruginea* and Great Knot C. *tenuirostris*). Down of precocial young, long and loose, especially on nape. Mainly ochraceous to rich brown above, with complex patterns of black blotches and bands, including characteristic marking shaped like hour-glass on centre of back; white below, often with brown wash on foreneck and breast. As in Gallinagoninae and Limnodrominae, spotted dorsal pattern formed by white powder-puffs attached to tips of black down. In most species, white barbules at each feather-tip densely packed and interlock with those of other feathers as large closely knit puffs (resembling scattering of large snow-flakes). In knots and *Aphriza*, powder-puffs have looser microstructure and do not entangle much, so some areas (especially in older chicks) may appear to have diffuse white mottling rather than distinct spots. Some other variation in colour and pattern of downy young attributed to breeding habitat rather than taxonomy (see Jehl 1968b; Fjeldså 1977; BWP).

Most species breed in tundra, a few in other open habitats S to Temperate regions of n. hemisphere. Highly migratory; those breeding high Arctic breed faster and migrate farther than most other species of waders. In non-breeding season, inhabit wide range of shallow wetlands. Some species almost exclusively coastal (e.g. Red C. *canutus* and Great C. *tenuirostris* Knots and Sanderling C. *alba*); some typically occur on inland wetlands (e.g. Long-toed Stint C. *subminuta*); others rather catholic in choice of habitat. Feeding behaviour varies; include probing and stitching (a rapid series of shallow probes made close to one another). Usually forage by touch and several species known to detect prey by chemoreception or detection of vibrations (e.g. van Heezik *et al.* 1983; Gerritsen 1988).

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Calidris minuta Little Stint

COLOUR PLATE FACING PAGE 289

Tringa minuta Leisler, 1812, *Nachträge zu Bechsteins Naturgeschichte Deutschlands* I: 74 — Hanau am Main, Germany.

The specific epithet is Latin (*minutus*) for little.

OTHER ENGLISH NAMES Sparrow-shorebird.

MONOTYPIC

FIELD IDENTIFICATION Length 12–14 cm; wingspan 28–31 cm; weight 25 g. Very small, compact sandpiper with small rounded head; rounded dumpy body; medium-length legs; and short, straight or faintly decurved and fine bill. At rest, folded primaries level with or extend slightly beyond tip of tail; primary projection short in adults, moderate in juveniles. Very similar to Red-necked Stint *Calidris ruficollis* in size, shape and plumage; Little is slightly smaller, with proportionately smaller, more rounded head (also looking narrower across crown); slightly shorter wings and less elongated rear-end and a more compact dumpier shape accentuated by longer legs and more upright stance; bill slightly longer and finer. In flight, all plumages show clear white wing-bar, and white sides to black-centred rump and uppertail-coverts typical of stints. Sexes similar. Juvenile distinct. Immatures separable.

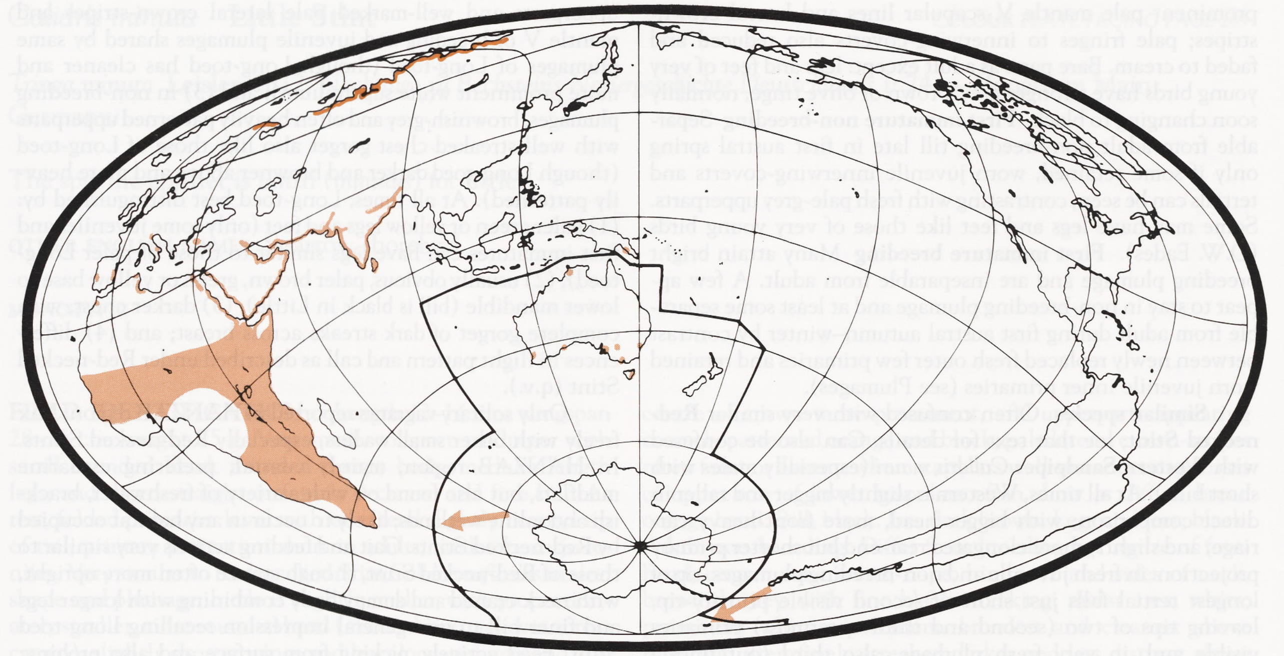
Description **Adult breeding** Centre of forehead and crown, orange-rufous, coarsely streaked black, forming dark central ridge; sides of crown and ear-coverts, orange-rufous, finely streaked darker; in fresh plumage, forehead and crown appear dusted with white. White supercilium, clearest above lores and behind eye (where finely streaked darker and often washed rufous), usually broken by diffuse area of orange-rufous over and in front of eye; narrow pale-orange, buff or white lateral crown-stripes often meet supercilium to create split supercilium. Varying diffuse dusky stripe on anterior lores. Malar area, white, finely streaked darker; chin and throat, white. Nape, hindneck and sides of neck, pale orange-rufous, coarsely streaked dark brown. Feathers of mantle, black, with orange-rufous fringes and white or buff tips to outer feathers, forming broad pale lines that almost meet over rear scapulars to form V. Scapulars, tertials and innerwing-coverts, black, with broad orange-rufous fringes and broad greyish-white to whitish tips, which can, on lower row of upper scapulars, align to form pale scapular line. Underbody, white, with pale orange-rufous wash on sides of foreneck and breast, overlain with dark-brown or blackish streaks and spots, which fade toward centre of chest and form diffuse gorget. Some have a few fine dark streaks on sides to mid-flanks. In flight from above, show: black and rufous innerwing-coverts contrasting with slightly darker uniform blackish primary coverts and remiges; clear narrow white wing-bar along tips of greater coverts; white sides to black centre of rump and uppertail-coverts; and black centre to pale-grey tail. Underwing, white, with narrow band of dark mottling along leading-edge, pale-grey greater primary coverts and diffuse dark-grey trailing-edge. With wear, pale tips to feathers of upperparts and underbody lost and orange-rufous areas fade: nape, hindneck, sides of neck, breast and face, more uniform and brighter orange-rufous, still streaked and spotted darker, with dark centre of crown more prominent, and upperparts appearing coarsely patterned orange and black; pale lateral crown-stripes often faint or absent; when scapulars well spread, orange bases of upper row of lower scapulars often show as diffuse broad orange band. Bill, black. Iris, dark brown. Legs and feet, black. **Adult non-breeding** Differ from breeding by: centre of forehead, crown, ear-coverts, nape, hindneck and sides of neck, brownish grey, with fine black streaking; malar area, white; prominent white supercilium, broadest and cleanest above lores but often finely streaked darker and less distinct above and behind eye; narrow dusky loral stripe, typically broadening into smudge in front of eye, sometimes combining with brownish-grey ear-coverts to form subdued dark eye-stripe. Rest of upperparts and innerwing-coverts, brownish grey, with fine dark streaks; narrowly fringed white when fresh. Underbody, white, with brownish-grey patches at side of breast overlain with fine dark streaking; in some, form complete (sometimes finely streaked) gorget like that of non-breeding Long-toed Stint *Calidris subminuta*. With wear, upperparts appear slightly darker and browner as white fringes lost and dark centres to feathers more prominent. **Juvenile** Differ from adult breeding by: centre of forehead and crown, chestnut, coarsely streaked black (darkest in centre), forming dark ridge accentuated by well-marked narrow off-white lateral crown-stripes; nape, hindneck and sides of neck pale grey, finely streaked darker; white supercilium, broadest and cleanest in front of eye and often meeting lateral crown-stripes to form split supercilium; narrow dusky loral stripe, which often broadens into smudge in front of eye; rear ear-coverts, grey or chestnut-brown, finely streaked darker; rest of ear-coverts paler; and malar area, white, very finely streaked darker, grading to white on chin and throat. Feathers of mantle and upper scapulars, black with chestnut fringes; white tips to outermost feathers of mantle form narrow V (usually joining just above rear scapulars) and white tips to lowermost row of upper scapulars form narrow scapular lines. Lower scapulars, tertials and inner greater coverts, black, with narrow chestnut fringes and white tips; other innerwing-coverts, dark grey, with dark shafts, chestnut fringes and white tips; similar to rest of upperparts. Underbody, white, with orange-rufous wash on sides of breast, overlain with a few black streaks; in fresh plumage, wash can extend faintly across upper breast. A few birds lack strong chestnut tones, are duller and greyer above and on breast, and may have smaller dark subterminal markings on lower scapulars (like pattern of Red-necked Stint); but tertials and inner greater coverts always mostly black and rest of plumage as described above. With wear and fading, chestnut and white fringes and tips on upperparts reduced and mantle and scapulars appear darker and more uniform, black, with less prominent pale mantle V, scapular lines and lateral crown-stripes; pale fringes to innerwing-coverts also reduced and faded to cream. Bare parts as adult except: legs and feet of very young birds have stronger grey, brown or olive tinge, normally soon changing to black. **First immature non-breeding** Separable from adult non-breeding till late in first austral spring only if some retained, worn juvenile innerwing-coverts and tertials can be seen, contrasting with fresh pale-grey upperparts. Some may have legs and feet like those of very young birds (D.W. Eades). **First immature breeding** Many attain bright breeding plumage and are inseparable from adult. A few appear to stay in non-breeding plumage and at least some separable from adult during first austral autumn–winter by contrast between newly replaced fresh outer few primaries and retained worn juvenile inner primaries (see Plumages).

Similar species Often confused with very similar **Red-necked Stint**; see that text for details. Can also be confused with **Western Sandpiper** *Calidris mauri* (especially males with short bills). At all times, Western is slightly bigger and taller in direct comparison; with bigger head, more front-heavy carriage, and slightly more elongated rear-end but shorter primary projection: in fresh juvenile and non-breeding plumages, tip of longest tertial falls just short of second visible primary-tip, leaving tips of two (second and third outermost) primaries visible and, in very fresh plumage, also third (outermost) primary-tip (which is normally hidden by tip of second outermost) (in Little, three primary-tips visible beyond longest tertial [and fourth tip of outermost in very fresh plumage]). Legs appear noticeably longer and tips of toes normally project a short distance beyond tip of tail in flight. Bill longer and more decurved, with even short-billed males having proportionately longer, more decurved bills. In close views, partially webbed toes distinctive. In breeding plumage, distinguished by bright-rufous (less orange) on sides of crown, nape, ear-coverts and scapulars; scapulars contrast with plain grey innerwing-coverts and, often, tertials (in Little, scapulars, innerwing-coverts and tertials, black and rufous as rest of upperparts); narrower, less prominent pale lines along sides of mantle and no pale scapular lines and lateral crown-stripes; and different and more black streaking and arrowheads on underbody. In non-breeding plumage, best distinguished by differences in size, structure and call; differ subtly in plumage: (1) upperparts paler and greyer, with black shafts (cf. more brownish grey, often with broader dark shaft-streaks in Little); (2) crisper black streaking on sides of breast which, unlike Little, normally extends as distinctive necklace of very fine dark streaks across white upper breast (some Little have complete gorget of dark streaks across breast, but these overlie greyish wash, giving such birds a darker-chested appearance). Juvenile differs by: (1) marked contrast between rufous-fringed upper scapulars and paler and greyer lower scapulars, which are distinctly more pointed, with clear black shafts and distinctive black subterminal marks (cf. large, solid black centres on Little); (2) much finer and less prominent pale mantle and scapular lines; (3) head and neck often much paler and greyer, without prominent dark ridge on crown or pale lateral crown-stripes; (4) sides of breast usually paler and greyer, with more and finer dark streaking. Flight calls also differ: thin, rather sharp and high-pitched *jeet* or *cheet*, more drawn out than short incisive notes of Little. Can also be confused with **Long-toed Stint**, which differs in much the same way as described for Red-necked Stint (q.v.). However: (1) dumpy build and generally erect stance of Little much closer to jizz of Long-toed than that of Red-necked Stint; (2) orange-rufous tone of upperparts and well-marked pale lateral crown-stripes and mantle V of breeding and juvenile plumages shared by same plumages of Long-toed (though Long-toed has cleaner and more prominent white supercilium); and (3) in non-breeding plumages, brownish-grey and often heavily patterned upperparts with well-streaked chest gorget also like those of Long-toed (though Long-toed darker and browner above and more heavily patterned). At all times, Long-toed best distinguished by: (1) paler green or yellow legs and feet (only some juveniles and first immatures can have legs similar to those of paler Long-toed); (2) usually obvious, paler brown, green or yellow base to lower mandible (bill is black in Little); (3) darker chest, with complete gorget of dark streaks across breast; and (4) differences in flight pattern and call as described under Red-necked Stint (q.v.).

Only solitary vagrants reported in HANZAB region. Mix freely with other small waders, especially Red-necked Stints. In HANZAB region, mainly coastal, prefering estuarine mudflats, but also found on wide variety of freshwater, brackish and saline wetlands; likely to occur in any habitat occupied by Red-necked Stints. Gait and feeding actions very similar to those of Red-necked Stint, though stance often more upright, with neck craned and dumpy body combining with longer legs and finer bill to give general impression recalling Long-toed Stint. Feed actively, picking from surface and also probing; occasionally wade. When alarmed, may adopt upright stance or crouch in manner of Long-toed Stint. Flight-actions identical to those of Red-necked Stint. Usual flight call short clear incisive *pit* or *stit*, quite different from lower-pitched, more rolled and disyllabic calls of Red-necked Stint; however, also utter some calls very similar to that species, including *chit*, *see-seet* and short trill.

HABITAT In Aust., recorded on mudflats, and occasionally sandflats or islets, of sheltered coastal estuaries, islets and embayments; round mudflats of near-coastal terrestrial wetlands, including open shallow freshwater lakes, lagoons and shallow pools and puddles; also sewage farms and saltponds. Forage on mudflats, in wet mud near edge of water, in shallow water or round shallow pools or channels; also on sandy margins and islets. Recorded roosting on muddy shore (Fletcher *et al.* 1981; Newman 1982; Curry *et al.* 1983; Cox 1988; Jaensch *et al.* 1988; Chafer 1989).

DISTRIBUTION Breed n. Scandinavia and Russia: n. Norway, Finnmark, inland (E) from s. Altafjord, and from e. shores of Porsangen, E to Jakobselv and Pasvikelv Rs; sporadically in Lappland, n. Sweden. In Russia, breed on nw. Kola Pen. E to Bering Str.; also Koluyev and Vaigach Is and s. Novaya Zemlya and New Siberian Is; breed in high densities between Pechora and Indigirka Rs; sparsely scattered in e. Siberia, along coasts of Arctic Sea. During non-breeding season, a few round Mediterranean coasts and valley of Nile R.; mainly in Africa, S of line from sw. Mauritania to junction of Blue and White Nile Rs, and E to coasts of Red Sea, Arabian Pen., Persian Gulf, to Indian subcontinent, sometimes E to Bangladesh and Burma; rarely farther E. Vagrants recorded Iceland, Spitsbergen, Faeroes, Bear I., and C. Verde Is, North America, Saipan (Mariana Is), and nw. Hawaii (Dement'ev & Gladkov 1951; Myers & Greenberg 1978; Ali & Ripley 1980; Morrison 1980; AOU 1983; Flint *et al.* 1984; Pratt *et al.* 1987; Urban *et al.* 1987; BWP; P.S. Tomkovich). Rare vagrant to New Guinea (Finch 1980, 1983); probably regular visitor to Aust. in small numbers.



Aust. Few records submitted to RAC or State bird reports and most published without details and unacceptable; early records of 'Little Stint' refer to C. *ruficollis*. First accepted record, Werribee Sewage Farm, Vic., 15 Jan. 1977 (RAC). Following records singles unless stated. **NSW** Comerong I., 7 Apr. 1984 (Chafer 1989). Unconfirmed reports: Tullakool Saltworks, 24 Nov. 1987–17 Jan. 1988; Kooragang I., 2 Nov. 1991. **Vic.** Most records from Werribee Sewage Farm, where individuals reported regularly, including captures, e.g. 15 and 22 Jan. 1977, 17 Nov. 1979, 18 Jan. 1992, 29 Dec. 1993; (RAC; VWSG); reported elsewhere in w. Port Phillip Bay: Laverton, 15–18 Feb., 6 Nov. 1984 (Vic. Bird Rep. 1984); L. Connewarre (w. Bellarine Pen.), 8 Jan. 1984 (Vic. Bird Rep. 1984). Also reported L. Tutchewop, 18 Oct. 1980, 14 Jan. 1981, 20 Oct 1982, 30 Oct. 1983, 1 Jan. 1984 (Lowe 1981; Vic. Bird Reps 1981–84); and L. Kelly, 13, 20 Mar. 1983 (Vic. Bird Rep. 1983). Unverified report, Avalon, 23 Jan. 1989. **Tas.** First record Moulting Lagoon, 25 Oct. 1980 (Fletcher *et al.* 1981). Most reports round Hobart: Lauderdale, Pipeclay Lagoon, Clear Lagoon, 20 Dec. 1980–Mar. 1981, 31 Oct.–1 Nov. 1981, 1–7 Dec. 1981, 22 Oct. 1983 (Newman 1982; Tas. Bird Rep. 13); Orielton Lagoon, Nov.–Dec. 1981, 21 Nov. 1987, 4 Dec. 1988, 26 Nov. 1989, 8 Feb. 1992 (Newman 1982; Tas. Bird Reps 17–19, 22); Barilla Bay, 7 Feb. 1988 (Tas. Bird Rep. 18). Captured, West Bay, S. Arm Neck, 15 Nov. 1981 (Newman 1982; ABBBS). **SA** Port Gawler, specimens, 10–11 Mar., 25 Nov.–7 Dec. 1979 (Cox 1988). Most records from ICI Saltworks (St Kilda) and Buckland Park: 11 Mar. 1979, 7 Dec. 1979 (specimens, SAM), 6–18 Feb. 1980, 6 Feb. 1986, 13 Dec. 1986, 14 Dec. 1986–8 Feb. 1987, 26 Dec 1987–Mar. 1988, 19–27 Nov. 1988 (specimen, ANWC), 10 Mar. 1991 (Cox 1988). Also Price Saltfields, 17–18, 23 Oct. 1983 (Cox 1988). **WA** L. Forrestdale, 1–2, 9–12 Apr. 1982 (Curry *et al.* 1983); Eyre Bird Observatory, 18 Sept. 1984 (Dymond 1988); L. Forrestdale, 16 Feb. 1985 (Anon. 1985). Unconfirmed reports: Rottnest I. (1980), Alfred Cove (1988) (Curry *et al.* 1983; Anon. 1988) and Port Hedland (3 Apr. 1992). **NT** All reports round Darwin: Lee Pt, Jan. 1980; Mungena Waterhole, Oct. 1980; Darwin Sewage Farm: Sept. 1981; two, Jan. 1983; Jan. 1984; Aug. 1987; Leanyer, Oct. 1981; Palmerston Sewage Farm, Dec. 1983–Jan. 1984 (McKean & Hertog 1980; H.A.F. Thompson & D.K. Goodfellow). Unconfirmed report near Sanderson Sewage Farm, 1979 (McKean & Hertog 1980; Aust. Atlas).

NZ Unverified reports of singles: Firth of Thames, Nov.–Dec. 1986 (Sagar 1987); L. Ellesmere, Nov. 1992 to 26 Mar. 1993 (Petch 1993).

S. Georgia Single, specimen, Bird I., 28 Dec. 1977 (Prince & Croxall 1983).

Prince Edward Is Marion I.: single, 17 Jan. 1979; unconfirmed report of single, 26 Nov. 1976 (Burger *et al.* 1980).

MOVEMENTS Migratory. Breed n. Europe and n. Russia; depart breeding grounds, July to mid-Aug. (P.S. Tomkovich). Move S to SW, between July and Nov., occurring between w. Europe and Siberia, as far E as Mongolia, on passage (Dement'ev & Gladkov 1951; AWB 1993; BWP; P.S. Tomkovich). Some occur E of main migration route: e. Siberia (Dement'ev & Gladkov 1951), Japan (AWB 1993) and n. North America (AOU 1983); small numbers said to migrate along e. Asian coasts. Non-breeding areas mainly Africa, round Indian Ocean and coasts of Indian subcontinent (Dement'ev & Gladkov 1951; AWB 1993; BWP). Some apparently move to areas E of main non-breeding range: Bangladesh (Rashid 1988), Burma (Smythies 1986), Vietnam and Malaysia (AWB 1993). Also pass through Hong Kong and Philippines, and rare in tropical Pacific Ocean (Pratt *et al.* 1987; AWB 1993); vagrant PNG (Finch 1980; Hicks 1990). Return passage Mar.–June (Dement'ev & Gladkov 1951). Bird banded India recovered Gydan Pen., w. Siberia. No records from HANZAB region during breeding season.

PLUMAGES Prepared by D.I. Rogers. Juvenile plumage usually retained till arrival in non-breeding areas. Undergo usually complete post-juvenile moult after arrival in non-breeding areas. Replace primaries late in first pre-basic, or

perhaps as a first pre-supplemental moult. Also undergo partial first pre-alternate moult of body-feathers in non-breeding areas, generally bringing on breeding appearance before n. migration (immatures migrate N with adults). Thereafter, complete pre-basic and partial pre-alternate moults each year into non-breeding and breeding plumage respectively; moult occurs mainly in non-breeding areas. Strategies of moult vary geographically and, in some tropical populations, adults also have pre-supplemental moult of outer primaries. In most plumages, easily confused with Red-necked Stint.

Adult breeding (Second and subsequent alternate). First attained in second austral autumn (when about 19 months old). **Head and neck** Feathers of crown and nape, rufous-brown (c136) with black-brown (119) centres and white fringes at tips when fresh; appear coarsely streaked (especially when worn) and faintly scalloped paler when plumage fresh; in some, rufous-brown (c136) edges of feathers form narrow lateral crown-stripe; edges and stripes, buff (c39) when worn. Forehead, white; area of white broadens above lores to form varying white spot; sometimes meets whitish streak behind eye, to create broad diffuse pale supercilium; occasionally appear to have split supercilium when narrow buffish (c39) lateral crown-stripes meet spot above lores. Usually, any supercilium much obscured and broken by rufous-brown (136) to light-brown (39) patch round eye and on ear-coverts; patch faintly streaked by dark-brown (121) shaft-streaks where it meets white chin and throat; rufous of lores usually contrasts with small dark-brown (121) to black-brown (119) spot in front of eyes. Hindneck and sides of neck, rufous-brown (136) (duller brown [c139–c123A] when worn), finely and evenly streaked by dark-brown (121) shaft-streaks. Foreneck has varying light rufous-brown (38–39) wash, often restricted to sides of foreneck, and diffuse gorget of dark-brown (121–119) spots or short streaks. When fresh, markings on throat obscured by narrow white tips to feathers. (Red-necked Stint differs most obviously in even brick-red face and throat; also has less orange on crown and nape and no lateral crown-stripes.) **Upperparts** Feathers of mantle, back and scapulars, rufous-brown (136) (lighter, rufous-brown [39] to brown when worn) with broad contrasting black-brown (119) centres, square at tips but tapering slightly at shaft; bases of feathers, mostly concealed, dark brown (121); tips, pale grey (86) and of varying width, broader when fresh and perhaps broader in females; longest feathers broadly edged buff (121D), forming distinct V on mantle. Most of rump and uppertail-coverts, dark brown (121) with rufous-brown (136) fringes; lateral uppertail-coverts and sides of rump, white. Some non-breeding feathers can be retained on rump and uppertail-coverts. (Red-necked Stint has less distinct mantle V, and feathers of mantle and scapulars have broader grey tips and more brick-red [less orange] tinge to edges [edges less conspicuous on mantle].) **Underparts** Mostly white. Diffuse gorget of foreneck continues onto upper breast: small dark-brown (121) spots or short shaft-streaks over varying light rufous-brown (38–39) wash, strongest on sides and often fading toward centre. Rufous-brown wash of gorget varies individually and with wear; can be partly obscured by white tips of feathers in fresh plumage, and bleached to white when worn. **Tail** T1, black-brown (119), grading to dark brown (119A) at (concealed) base and broadly fringed rufous-brown (136) (cf. Red-necked Stint); other feathers often retained from non-breeding and similar to that plumage even if replaced in pre-breeding moult. **Upperwing** Primaries, secondaries, primary coverts, alula and greater secondary coverts retained from non-breeding (and very similar to Red-necked Stint). Tertials, black-brown (119), very broadly fringed rufous-brown (136–340), especially at tips, and narrowly tipped white when fresh; occasionally retain a few non-breeding tertials; some have 1–2 rather dull breeding tertials (those grown first; Veit & Jonsson 1984; Pearson 1984) with dark-brown (119A) centres and narrower, paler (39) fringes. Tertial coverts, dark grey-brown (c121), fringed white, longest feathers edged rufous (c38). Breeding median and lesser secondary coverts have slightly tapering black-brown (119) centres and broad rufous-brown (136) edges, and look similar to scapulars when wings folded. Usually only a few (outer) or no median and lesser secondary coverts retained from non-breeding plumage; marginal coverts retained more often. (Red-necked Stint retains nearly all non-breeding coverts and often some tertials; breeding tertials are slightly darker with narrower rufous edges.) **Underwing** Retained from non-breeding plumage (as Red-necked Stint).

Adult non-breeding (Second and subsequent basic). First attained in second austral spring (when 14–15 months old). Very similar to adult non-breeding Red-necked Stint (q.v.) and not reliably separable on plumages; Little differs from Red-necked by: **Head and neck, Upperparts** Dark centres to feathers of crown, nape, mantle, back and scapulars usually slightly broader, appearing almost spotted; ground-colour may be slightly darker. **Underparts** Often appear to have faint gorget across junction of foreneck and uppermost breast, formed by light-grey (85) wash overlain with small dark-brown (c121) shaft-streaks to feathers; gorget often broken in centre of foreneck (Red-necked Stint has clean white foreneck and breast, though grey of sides of neck can extend slightly onto sides of foreneck). **Upperwing** Ground-colour of tertials, slightly blacker (119) but much overlap in colour in worn birds; white fringe of p11 not usually as strongly assymetrical (in Red-necked, outer web usually has broader white tip than inner) but overlap occurs.

Juvenile Similar to adult breeding; care needed to distinguish from aberrant adults with reversed moult-cycles, which can have fresh breeding plumage Sept.–Dec. when only juveniles might be expected to be brightly coloured. Very similar to juvenile Red-necked Stint (some of which may not be separable) and extralimital Semipalmated Sandpiper C. *pusilla* (which is not discussed here); for discussion of individual and wear-related variation in juveniles of these three species, see Alstrom & Olsson (1989) and references therein. **Head and neck** Feathers of crown, dark brown (121) to black-brown (119) with cinnamon-rufous (c40–38) edges, narrowest in centre of crown, giving streaked appearance; in some (especially worn birds), edges of feathers, paler rufous-brown (c39), and centres, dark brown (121–119A) (generally duller than most adults, which also differ in having narrow white tips to feathers of crown when fresh). White of forehead usually meets broad square-tipped white supercilium, and narrow white lateral crown-stripes, which combine to give appearance of split supercilium in side view; from above, crown-stripes tend to confine dark of crown to distinct strip. Hindneck and sides of neck, pale grey-brown (c119D), indistinctly streaked by darker-brown (119A–119B) shaft-streaks (usually only very worn breeding adults show similar contrast between pale hindneck and dark cap). Face whiter than typical adult breeding, with dusky patch on ear-coverts formed by broad indistinct dark-brown (119A) shaft-streaks, and usually separated from rear of eye by small white patch; rear of ear-coverts tinged cinnamon-rufous (c40–39) but never have large rufous-brown facial patch of breeding adult; lores have narrow dark-brown (119A) central strip broadening towards eye. Foreneck, as upper breast (q.v.). (Head of Red-necked can be very similar, but, typically duller overall, accentuating contrast of dark loral stripe and white sides of forehead; seldom has obviously split supercilium; and dusky patch on ear-coverts slightly bolder and generally extends to rear of eye.) **Upperparts** Most of mantle and scapulars appear neatly scalloped; feathers have dark-brown (121) to black-brown (119) centres, with broad cinnamon-rufous (c40, c38) fringes; dark centres more smoothly rounded at tip than in adult breeding and usually contrast less strongly. White tips to longest feathers of mantle and outermost row of upper scapulars form broad bold mantle V and narrower, less distinct V on scapulars. Lower (outermost) scapulars also have white tips and cinnamon-rufous (c40, c38) edges but have grey-brown (c91) centres that meet black-brown (119–121) subterminal spot; this spot usually large and well defined (grey-brown centres to feathers can be largely concealed) but much individual variation; spots are smaller in a few birds and may have 'anchor'-shape (similar to that of juvenile Red-necked Stint). Rump and uppertail-coverts, mostly blackish brown (119–121), feathers narrowly fringed light brown (c239) at tip (unlike bold fringes of adult breeding); lateral uppertail-coverts and sides of rump, white. (Red-necked Stint generally less rufous above, with less obvious mantle V and smaller, less contrasting dark centres to feathers, especially on lower scapulars. However, both species vary, and dull Little and bright Red-necked overlap in general appearance; also, a few very dull and worn Little ['grey phase' in some literature] have very little rufous fringing on upperparts and are superficially similar to typical Red-necked.) **Underparts** Mostly white. Light orange-rufous (c39) wash at sides of breast, paler than in adult breeding; when fresh, wash can extend across upper breast as diffuse buff (124–c118) gorget; in worn birds, centre of breast, fades to off-white, and sides of breast have light greyish-brown (c119C) tinge to ground-colour as feather-bases partially exposed; some have greyish-brown tinge even when plumage fresh. Dark-brown (119A–121) shaft-streaks of gorget at sides of breast, broader and more diffuse than in adult breeding, never extending fully across breast but often forming quite well-defined half-collar at sides of upper breast and where it joins foreneck. (Red-necked Stint generally has darker and greyer ground-colour to breast, though brightest have as strong an orange-tinge as dull Little Stint, and streaking on sides of breast usually finer, fainter and more diffuse, and can be missing.) **Tail** Similar to adult breeding but t1 has narrower buff (124) fringes, grading to cinnamon-rufous (39–40) at tip; fringes broaden toward tip of feather, so tip of dark feather-centre looks pointed rather than rounded (cf. Red-necked Stint). **Upperwing** Primaries, primary coverts, alula and outer greater secondary coverts, as adult. Inner greater secondary coverts and tertials, dark brown (c121) to black-brown (119) with neat rufous-brown (c38–c40) fringes, which are narrower than in adult and often have whitish tinge to bases and extreme tips. Median and lesser secondary coverts usually have dark-brown (c121) to black-brown (119) centres (more neatly rounded at tips than in adult breeding), contrasting with cinnamon-rufous (c40–c38) edges, which often grade to white at tips; in some, rufous fringing on median and lesser secondary coverts indistinct and ground-colour grades to greyish brown (c119A) away from shaft, especially on median coverts, and appears similar to brightest Red-necked Stints. (In Red-necked Stint, tertials usually have paler centres, so black shaft-streaks usually contrast more with centres than in Little Stint, and only rarely have sharply defined and extensively rufous fringes; median and lesser secondary coverts usually paler in centres, with only a little rufous coloration on tips and grading to buff on edges. Paler centres to tertials, with pattern of breast, probably best character separating juveniles of the two; Alström & Olsson 1989.) **Underwing** As adult.

First immature non-breeding (First basic). Very similar to adult non-breeding. Ageing on moult characters difficult because undergo usually complete moult of primaries in non-breeding areas (unlike Red-necked Stint). Separable by retained juvenile median and lesser secondary coverts until these feathers replaced late in moult, about Dec.–Apr. of first year. However, rufous fringes of these feathers can be lost through wear (even on innermost feathers) well before they are moulted, coverts then only differing from those of adults by being slightly smaller and more worn.

First immature breeding (First alternate). Often indistinguishable from adult breeding. Unlike many waders, can rarely, if ever, be aged by retained juvenile wing-coverts. Said to be duller than adult breeding, especially on ear-coverts and breast (Prater *et al.* 1977) and some apparently very similar to adult non-breeding plumage (Veit & Jonsson 1984), though none such observed in study in Kenya (Pearson 1974, 1984). However, it may be possible to determine age of some birds in breeding plumage; in Kenya, a few birds moulted only outer primaries (may be typical in immatures wintering in more n. non-breeding areas; see Moults), and may be distinguished from adult breeding by contrast between fresh outer primaries and worn juvenile inner primaries; also, these birds usually moulted only t1 and t2 instead of all tail.

BARE PARTS From photos (Veit & Jonsson 1984; Grant 1986; Pringle 1987; Delin & Svensson 1988; Chandler 1989; Paulson 1993; D.W. Eades).

Adults, Immatures Bill, grey-black (82) to black (89). Iris, black-brown (119). Legs and feet, grey-black (82) to black (89); BWP reported various brown to grey colours on dark legs. **Juvenile** Like adult, but stronger dark-olive, dark-brown (119A) or grey (79) tinge on legs of very young birds; aberrant individual photographed in Grant (1986) had strong pink (c7) tinge on sides of tarsus.

MOULTS Mostly based on studies in Kenya (Pearson 1974, 1984), South Africa (Middlemiss 1961; Dean 1977), India (Balachandran & Hussain 1992) and w. Palaearctic (BWP). **Adult post-breeding** (Second and subsequent pre-basic). Complete; timing and duration vary geographically. Most information from Kenya, with other details from South Africa. Primaries moult outwards; inner primaries replaced faster (up to five growing concurrently) than outer primaries (usually no more than two replaced concurrently). Secondaries moult inwards, beginning at about time of moult of p6 and completed before p10 moulted. Tertials vary; usually in sequence s14–13–12–15–11; begin early in moult of primaries and completed at about the time p5–p6 moulted. Sequence of tail usually t1–2–3–6–4–5; t1 sometimes moults early but others moult when PMS 20–40; tail-coverts moult early in tail-moult. Begin moult of body before primaries, usually Aug., but apparently early July in failed breeders (BWP); most moult of body occurs at non-breeding areas (e.g. Pearson 1984), or at staging sites of birds migrating farthest S; in South Africa, birds in late stages of body-moult on arrival. In Kenya, moult of primaries begins shortly after arrival, mid-Sept. to early Oct.; completed Dec.–Feb. or Mar.; estimated duration of moult of individuals, 130 days; range from *c.* 100 to *c.* 150 days, as some appear to suspend moult briefly. In India, most adults in primary-moult, Aug.–Nov. (Pearson 1984); in some years, moult of primaries suspended through boreal winter and moult resumes and completed in boreal spring (Balachandran & Hussain 1992). Moult may start later at non-breeding areas farther S. In South Africa, moult of primaries begins after arrival; early Nov.–Dec. (Middlemiss 1961), or between late Sept.–Oct. and Dec. (Dean 1977); suspended moults not reported and moult of primaries was complete before departure for breeding grounds. Moult apparently faster in South Africa than in Kenya, with more primaries growing concurrently (further, estimate of duration of moult of primaries in Transvaal of 100–115 days probably too high as immatures were not separated from adults). Duration of moult in most n. non-breeding areas, poorly known. In Morocco (Pienkowski *et al.* 1976), moult of primaries probably begins Aug. and early Sept., and faster than in Kenya, but birds only caught in early and middle stages of moult. Early and rapid moult also characteristic of some birds in Majorca (non-breeding area), which had completed, or nearly completed, moult by late Nov. to mid-Dec. (Garcias & Gargallo 1992). Only four records of adult primary-moult from Aust. (ANWC, SAM, AWSG, ABBBS); three birds from late Nov. to mid-Jan. all in middle to late stages (PMS 29–41) and moult complete in bird collected 11 Mar.; these data consistent with adults from South Africa. Not known if some begin and suspend moult at staging sites; does not occur on some n. staging sites (e.g Waddenzee, Boere 1976; n. Iran, K. Lessels), and no observations of birds arriving in suspended moult in Africa (Middlemiss 1961; Dean 1971; Pearson 1984). In South Africa, aberrant bird reported moulting all remiges simultaneously and thus flightless (Middlemiss 1961). In Aust., birds recorded in reversed moult-cycles (see Adult pre-breeding). **Adult pre-breeding** (Second and subsequent pre-alternate). Partial; generally feathers of body, median and lesser upperwing-coverts, tertials and t1; some moult all rectrices. Often retain non-breeding outermost tertial; sequence of others varies but often in alternate pairs, s12 with s14 and s13 with s15; coverts moult while moult of tertials active (Pearson 1984). In Kenya, moult Feb.–May, most completing moult mid-Apr. to early May before leaving for breeding grounds; begins earliest in those completing pre-basic moult of primaries by mid-Feb., with tertials starting late Jan. to mid-Feb. and body in mid-Feb.; adults with delayed pre-basic moult of primaries began pre-alternate, Mar. to early Apr., with tertials starting while p8–p10 still in pre-basic moult (Pearson 1984). Kenyan study also showed tendency for first-grown breeding feathers to be duller than those grown later, with tertials, t1 and coverts only brightly coloured if grown after end Feb. (Pearson 1984). In South Africa, begin but do not complete pre-alternate moult before n. migration (Middlemiss 1961), presumably suspending moult and completing it on staging grounds. Little data from Aust. suggest moult completed before n. migration; nearly complete in female collected on 11 Mar. in SA (Cox 1988) and seemed complete in indvidual at L. Kelly, Vic., 20 Mar. 1983 (D.W. Eades). Some in Aust. appear to have been in reversed moult-cycles; birds in full breeding plumage with fresh primaries observed Hobart, Tas., 15 Nov. 1981 and at least one observed Werribee, Vic., 17 Nov. 1978 and 12 Nov. 1979; one of the Werribee birds moulted to non-breeding plumage in Apr. (D.W. Eades). Such individuals aberrant. Some other claims of adults with reversed moult-cycles in Aust. may have been incorrectly aged juveniles (Cox 1988). **Adult pre-supplemental** Reported only from tropical non-breeding areas. In se. India, adults undergo a second partial moult of outer primaries in spring, except in those years that they suspend pre-basic moult of primaries through boreal winter (Balachandran & Hussain 1992). In Kenya, birds that finished pre-basic moult of primaries early (Jan.) started to moult some outer primaries again by Apr., usually starting from p7 or p8; often overlapped with pre-alternate moult of body; secondaries were not moulted. This moult of outer primaries could perhaps be regarded as pre-alternate; more information needed. **Post-juvenile** (First pre-basic). Considered complete, though post-juvenile moult of primaries should perhaps be considered first pre-supplemental. Feathers of body usually moulted Oct.–Dec.; Kenyan study found peak of moult, mid-Oct. to early Nov., with active moult rare in Sept. and Dec. Arrive in most wintering areas, including Aust. (Cox 1988), in juvenile plumage; Cox recorded an apparent juvenile in se. SA as late as 13 Dec. but another 7 Dec. (SAM B32522) almost half-way through moult of body. In most populations, all primaries and other remnants of juvenile plumage moulted about Dec.–Apr.; in South Africa, timing apparently similar to that of adults and moult complete, given that studies of moult (Middlemiss 1961; Dean 1977) have failed to distinguish young birds. In Kenya, most started complete moult of primaries in Dec. or Jan. (exceptionally in late Nov.) and finished between Feb. and mid-Apr., with duration for individuals estimated at 70–100 days. About 10% of individuals in Kenya only moulted outer primaries in outwards moult, generally starting between p3 and p6; such individuals usually started late (between Jan. and Mar.) and apparently moulted at similar rates to those in complete moult, finishing between Mar. and early May; usually retained juvenile outer secondaries but moulted as many rectrices, tertials and wing-coverts as adults and immatures performing complete pre-basic moult; a few individuals moulting as late as Apr.–May retained juvenile tertials, wing-coverts and t1 until first pre-alternate. Moult of primaries can also be complete or partial in se. India (Balachandran & Hussain 1992). Suggestions that birds in northernmost non-breeding grounds of n. Africa and Mediterranean only moult outer primaries or none at all (Prater *et al.* 1977) await confirmation but appear consistent with observations from Majorca (Garcias & Gargallo 1992) where juveniles had not begun any moult of primaries by mid-Dec. **Immature pre-breeding** (First pre-alternate). Partial; similar in extent to pre-alternate moults of adults. Only studied in detail in Kenya, where most moult occurs between Feb. and May and timing and extent very like that of adults with delayed moult; completion dates of all pre-alternate moults much more synchronised than starting dates, implying first pre-alternate moult slightly faster than in typical adults. Moult of tail tended to be less extensive, usually only moulting t1 and t2; often began while outer rectrices were still being replaced in first pre-basic. Tertials moulted Mar. to early May, even in individuals that had previously delayed onset of first pre-basic moult of primaries (only moulting outer primaries); such birds only acquired first-basic tertials in Feb. or Mar., yet replaced them with breeding-type feathers between late Mar. and May.

MEASUREMENTS Throughout range, skins (BWP, AM, ANWC, MV, SAM): (1) Adults; (2) Juveniles; (3) Ages combined.

		MALES	FEMALES	
WING	(1)	96.4 (1.90; 93–100; 22)	99.1 (2.87; 94–104; 17)	**
	(2)	96.5 (2.16; 94–101; 12)	100.5 (2.21; 95–103; 11)	**
TAIL	(1)	39.3 (1.79; 35–43; 23)	40.2 (1.72; 37–44; 19)	ns
BILL	(3)	18.1 (0.80; 16.7–19.2; 25)	18.5 (0.76; 17.5–19.9; 19)	ns
TARSUS	(3)	21.1 (0.80; 19.8–23.2; 25)	21.6 (0.86; 19.7–23.6; 19)	ns
TOE	(3)	18.8 (0.95; 17.5–20.8; 19)	19.0 (0.65; 17.5–20.1; 19)	ns

WEIGHTS Extralimitally, weights from non-breeding areas in Africa well known. Ages and sexes combined (thought to be little differences in weights): (1) Kenya (Pearson *et al.* 1970). (2) South Africa (Middlemiss 1961).

	(1) KENYA	(2) SOUTH AFRICA
Aug.–Sept.	24.2 (18–31; 57)	–
Oct.	22.4 (19–27; 73)	23.3 (19.1–30.3; 44)
Nov.	21.9 (18–26; 83)	23.4 (18.2–29.1; 158)
Dec.–Jan.	21.1 (17–27; 248)	22.5 (17.2–27.1; 704)
Feb.–Mar.	22.9 (18–30; 170)	22.7 (17.9–29.1; 630)
Early Apr.	24.0 (18–35; 143)	24.6 (20.8–39.0; 53)
Late Apr.	–	31.9 (23.5–43.5; 28)
May	28.4 (20–38; 57)	–

In Africa, appear to have still some migratory stores on arrival in non-breeding areas (Middlemiss 1961) though high average weights from Kenya in Aug.–Sept. possibly influenced by staging birds. Weights fairly stable through most of non-breeding season, possibly with slight and gradual decline till about Dec. or Jan. (above), but not confirmed and inconsistent with other South African data (Skead 1977). Gain in weight before migration, rapid, possibly delayed till near end of moult (Middlemiss 1961; Pearson *et al.* 1970). For weights in staging, see BWP. In breeding areas, June: adult males 26.6 (24–28; 6), adult females 30.6 (21–40; 4), and unsexed juveniles 23.8 (29–29; 17) (BWP).

Only six weights available from Aust. (ANWC, SAM, ABBBS, AWSG). Most are similar to data from South Africa. Adults and immatures, Oct.–Dec., 24.6 (2.28; 22–27.5; 4); two adults in breeding plumage in mid-Nov. (in reversed plumage cycles and apparently reversed weight-cycles): 32.5 (Hobart, Tas.; ABBBS) and 36 (Werribee, Vic.; AWSG); weights similar to those of adults just before migration.

Plate 13

Ruddy Turnstone *Arenaria interpres* (page 194)
1 Adult male breeding; 2 Adult female breeding;
3 Adult non-breeding; 4 Juvenile; 5, 6 Adult

Wilson's Phalarope *Steganopus tricolor* (page 348)
7 Adult male breeding; 8 Adult female breeding;
9 Adult non-breeding; 10 Juvenile; 11, 12 Adult

STRUCTURE Wing, rather long, narrow, slightly less pointed than in Red-necked Stint. Eleven primaries; p10 longest, p9 0–2.5 mm shorter, p8 4–8, p7 11–15, p6 16–23, p5 24–30, p4 30–36, p3 37–41, p2 41–48, p1 46–53; p11 minute, concealed by primary coverts. Rest of structure very similar to that of Red-necked Stint (q.v.), except: bill slightly longer, finer at tip, with faintly drooped tip to lower mandible; legs slightly longer, with 14–19 mm of tibia unfeathered (10–16 mm unfeathered in Red-necked Stint); central rectrices project 2–4 mm beyond t2 (4–7 mm in Red-necked Stint) and t6 slightly longer relative to t3–t5.

RECOGNITION Despite considerable knowledge of field identification of dark-legged stints (Jonsson 1984; Grant & Jonsson 1984; Veit & Jonsson 1984; Hayman *et al.* 1986; Grant 1986; Alström & Olsson 1989; Lewington *et al.* 1991), some worn juvenile and many non-breeding Little Stints cannot be separated from Red-necked Stints on plumages.

In the hand, structural differences (see Structure) often diagnostic; measurements also useful. Aust. banders with much experience of Red-necked Stints have first noticed some Little Stints by smaller 'feel' (M.A. Barter). Ratio of wing to tarsus separates most individuals (Prater *et al.* 1977); 4.6 (0.22; 4.1–5.1; 30) in Little Stint; 5.3 (0.2; 5.0–5.6; 19) in Red-necked Stint (BWP). However, some birds fall into range of overlap and are not separable. Further, in Aust., ratio of wing:tarsus of Red-necked Stints can be lower than indicated above because primaries worn and thus there may be greater overlap with Little Stint, e.g. in Vic. in late Dec., ratio of wing:tarsus of freshly dead adult males: 5.17 (0.23; 4.50–5.74; 64), females: 5.21 (0.29; 4.62–5.69; 49) (D.I. Rogers).

GEOGRAPHICAL VARIATION None.

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Red-necked Stint *Calidris ruficollis* (page 258)
1, 2 Adult

Little Stint *Calidris minuta* (page 250)
3, 4 Adult

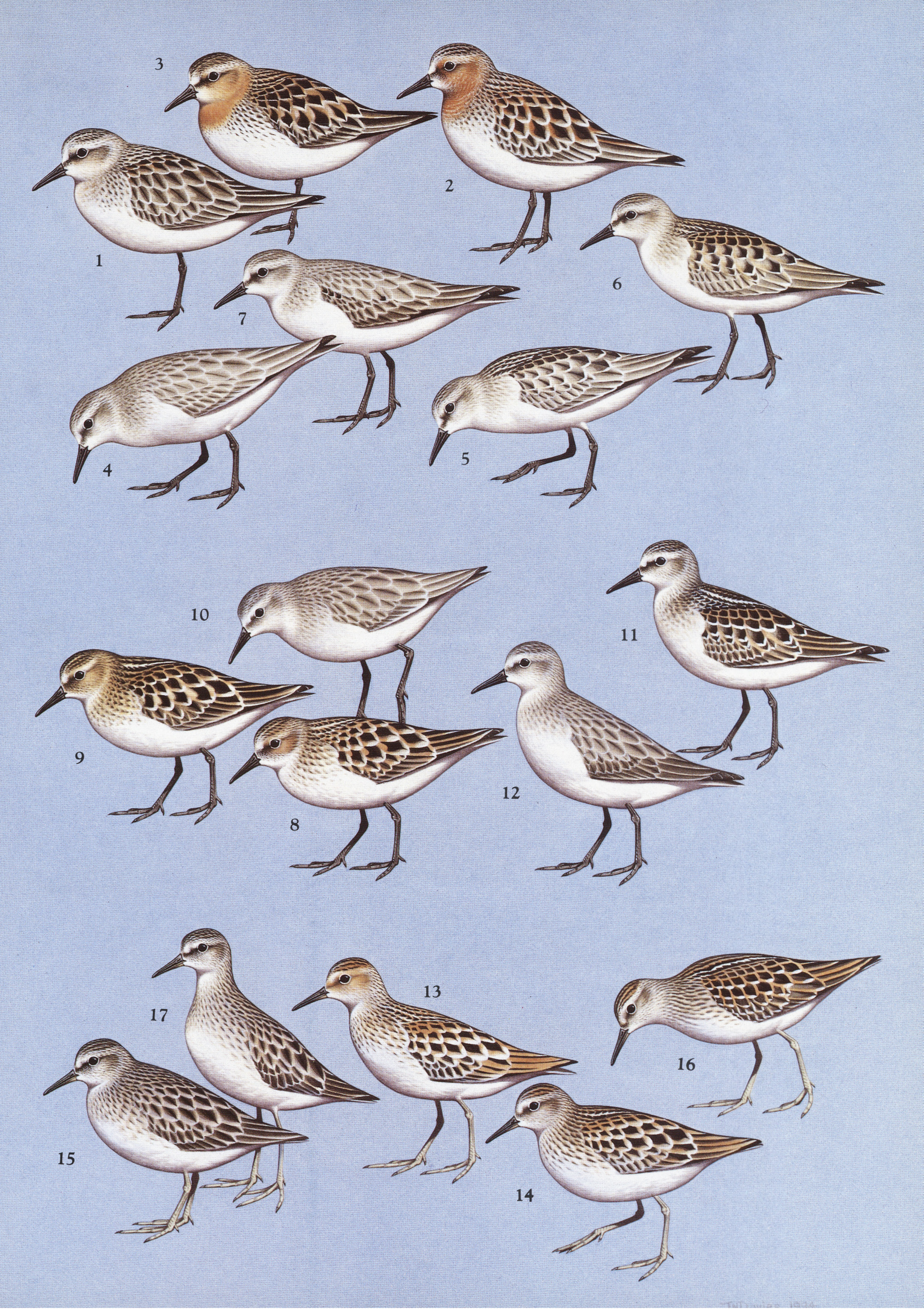
Long-toed Stint *Calidris subminuta* (page 270)
5, 6 Adult

Broad-billed Sandpiper *Limicola falcinellus* (page 333)
7, 8 Adult

Sanderling *Calidris alba* (page 237)
9, 10 Adult

White-rumped Sandpiper *Calidris fuscicollis* (page 279)
11, 12 Adult

Baird's Sandpiper *Calidris bairdii* (page 283)
13, 14 Adult



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Red-necked Stint *Calidris ruficollis* (page 258)
1 Adult breeding, pale bird; **2** Adult breeding, bright bird; **3** Adult breeding, worn plumage; **4** Adult non-breeding; **5** Juvenile, typical; **6** Juvenile, bright plumage; **7** First immature non-breeding

Little Stint *Calidris minuta* (page 250)
8 Adult breeding, fresh plumage; **9** Adult breeding, worn plumage; **10** Adult non-breeding; **11** Juvenile; **12** First immature non-breeding

Long-toed Stint *Calidris subminuta* (page 270)
13 Adult breeding, bright plumage; **14** Adult breeding, typical plumage; **15** Adult non-breeding; **16** Juvenile; **17** First immature non-breeding