

Order CHARADRIIFORMES

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

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

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

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

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

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

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

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

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Order CHARADRIIFORMES

Family SCOLOPACIDAE sandpipers and allies

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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28 Gallinagoninae

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Subfamily TRINGINAE godwits, curlews, 'shanks' and allies

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

Table 1

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

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

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

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

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

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

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

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Limosa haemastica Hudsonian Godwit

COLOUR PLATE FACING PAGE 96

Scolopax haemastica Linnaeus, 1758, *Syst. Nat.*, ed. 10 (1): 147 — North America = Hudson Bay ex Edwards, pl. 138.

The specific epithet is a mis-spelling by Linnaeus of the Greek αἱματικός for blood, bloody from αἷμα, blood referring to breeding plumage.

The English name refers to Hudson Bay, where it breeds.

OTHER ENGLISH NAMES American Black-tailed Godwit.

MONOTYPIC

FIELD IDENTIFICATION Length 37–42 cm; wingspan 66 cm; weight: male c. 220 g, female c. 290 g. Large wader with long neck, long slightly upturned bill, and long blackish legs. Similar in size to Black-tailed Godwit *Limosa limosa*, but with shorter neck and legs, steeper forehead and more rounded crown, and slightly upturned and more pointed bill; shape and proportions closer to Bar-tailed Godwit *Limosa lapponica*. Feet project beyond tip of tail in flight. In all plumages, dark compared with congeners, with striking black-and-white pattern to upperparts in flight, like that of Black-tailed Godwit, and diagnostic underwing-pattern. Sexes similar but female slightly larger, with longer bill, and different pattern to underparts. Marked seasonal variation. Juvenile distinct. Immatures separable.

Description Adult male breeding Forehead and crown, black with fine whitish streaks; long white supercilium, finely streaked darker behind eye; narrow dark stripe through lores, continuing faintly behind eye; sides of face and chin, off-white with fine dark streaking; rest of head and neck, grey with heavy dark streaking. Mantle, scapulars and tertials, black, with pale chestnut and whitish notches and tips, which soon fade to white. Back and rump, dark grey-brown. Uppertail-coverts and base of outer rectrices, white, forming white band above black tail with narrow white tip. Upperwing: black, with uniform dark grey-brown innerwing-coverts, sometimes with a few bright feathers, as scapulars; short, narrow white wing-bar on bases of inner primaries and outer secondaries. Most of underbody, dark chestnut with heavy black barring, finer on centre of breast and belly; some also have fine pale barring when fresh; vent and undertail-coverts, white. Pattern of underwing, diagnostic: axillaries and most of lining (lesser and median coverts), black; rest of underwing paler, grey, with bold whitish stripe across bases of remiges. Bill: distal half, black; rest, pink. Iris, dark brown. Legs and feet, grey. **Adult female breeding** Like male but underparts usually paler, less chestnut, and blotched with white, so contrasting less with paler head and neck, vent and undertail. Some retain some plain grey-brown non-breeding feathers among scapulars and tertials. **Adult non-breeding** Head, grey-brown, sometimes paler greyish-white on lower face, grading to white on chin and throat, and with short bulging white supercilium (contrasting with narrow dark loral stripe), prominent in front of eye and narrower and faint behind. Upperparts and secondary coverts, dark grey-brown with narrow white fringes to coverts when fresh. Foreneck, breast and flanks, grey-brown, slightly paler than upperparts; rest of underbody, white, with straight

sharp demarcation from breast, though often have dark smudgy central stripe from breast to upper belly. Rest of plumage as breeding. **Juvenile** Like adult non-breeding but plumage neater and more buff. Mainly differ by: forehead and crown, brownish grey streaked black, forming faint cap, which is emphasized by whitish supercilium; rest of head and neck, rather plain, brownish-grey with buff tinge, with dark loral stripe and whitish chin and throat. Mantle, scapulars and tertials, brownish-grey, with blackish shafts and anchor-shaped subterminal bars and narrow whitish or buff fringes or notches to feathers. Innerwing-coverts rather plain, brownish-grey with dark shafts and narrow whitish or buff fringes. Foreneck, breast and fore-flanks brownish-grey with buff tinge; rest of flanks to lateral undertail-coverts, white with short indistinct brownish-grey bars; rest of underbody, white. With wear and moult, plumage difficult to distinguish from adult. **First immature non-breeding** Distinguished from adult non-breeding only by a few retained worn juvenile innerwing-coverts and tertials; primaries fresh to slightly worn in first calendar year (cf. moulting in adults). **First immature breeding** Some attain full breeding plumage like that of adult breeding; most, including those wintering in HANZAB area, gain only a little breeding plumage; some remain in full non-breeding plumage.

Similar species Distinguished in all plumages from **Black-tailed** (q.v.) and **Bar-tailed Godwits** by diagnostic black axillaries and underwing-coverts. In all plumages, Bar-tailed differs from Hudsonian in flight by: (1) barred uppertail-coverts and tail; (2) more uniform upperwing, with no wing-bar; (3) streaked and barred axillaries and underwing-coverts; (4) slightly shorter tail; and (5) feet do not project so far beyond tip of tail and rear-end appears more truncated. On ground, breeding male Bar-tailed differs from same of Hudsonian by: chestnut from chin to vent paler and unbarred; and head and neck, chestnut. Breeding female Bar-tailed has much duller pinkish-buff foreneck and breast and white or narrowly dark-barred underbody. Non-breeding Bar-tailed differs from non-breeding Hudsonian by paler grey-brown upperparts with diffuse dark centres and pale fringes to feathers, giving more streaked and variegated appearance above; and by usually longer, bolder white supercilium extending well behind eye (though there is overlap). Juvenile Bar-tailed differs from juvenile Hudsonian by: more heavily dark-streaked cap, darker eye-stripe, and longer, bolder white supercilium forming more contrasting head-pattern; heavier buff fringes and notching on upperparts and innerwing-coverts, giving a coarser, curlew-like

pattern above; and finely dark-streaked lower face, neck and breast.

Gregarious, but in HANZAB area, solitary vagrants. Coastal; prefer muddy estuaries but also on sandy beaches; habitat much as Bar-tailed Godwit. Associate with other waders, especially godwits. General habits, gait, feeding behaviour and flight-actions similar to Black-tailed Godwit. Flight-silhouette closer to Bar-tailed Godwit, with heavier chest and shorter projection of feet beyond tip of tail than Black-tailed. Often hold wings aloft on landing or when roosting, exposing diagnostic pattern of underwing. Silent outside breeding season; normal flight call clear, high-pitched doubled *weet-weet*.

HABITAT In Aust., recorded in coastal lagoons, estuaries, shallow freshwater lakes and saltworks (Cox 1990; Morris 1991; Tas. Bird Rep. 21). In NZ, mostly on sheltered coastal wetlands, including estuaries, lagoons, harbours and bays, with large tidal mudflats, sandflats, shell banks or spits (Sibson 1950, 1952, 1959; Oliver); also recorded on brackish and freshwater lakes and ponds (G. Taylor), and edges of artificial freshwater lake (Medway 1988).

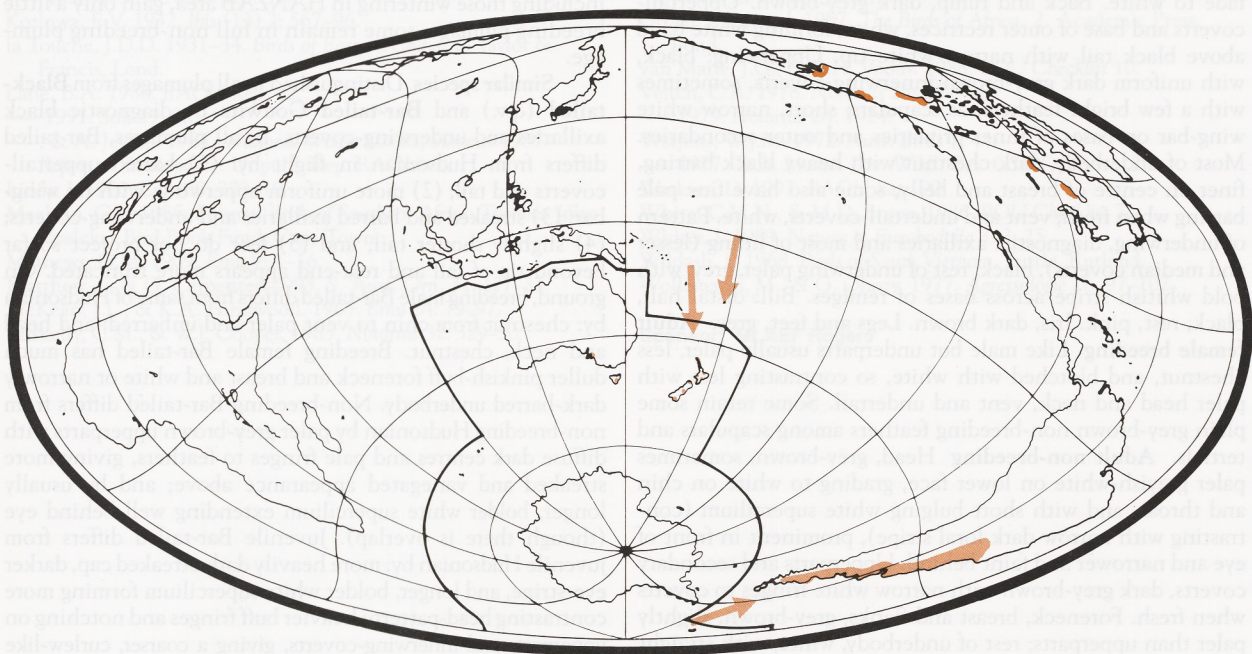
Forage on exposed intertidal mudflats and tidal pools; also at edges of near-coastal freshwater lakes (Medway 1988; Cox 1990), and on sandy beaches (CSN; G. Taylor). Roost or loaf on spits and banks of sand or shells in estuaries (Sibson 1959; Imber 1960b; Barlow 1965; Morris 1991); islets in shallow salt lagoons (Cox 1990); in paddocks of short grass (Sibson 1943, 1947; Gleeson *et al.* 1967); tidal pools fringed with samphire behind mangroves (Cox 1990). Once on mat of waterweed in deep lake (Medway 1988). Often roost at edges of flocks of other species of godwit; sometimes with Black-winged Stilts *Himantopus himantopus* (G. Taylor).

DISTRIBUTION Breed North America: s. coastal and, probably, w. Alaska; and Canada, in n. Mackenzie (Fort Anderson and mouth of Mackenzie R.), nw. British Columbia (Chilcat Pass), and n. Hudson Bay (ne. Manitoba and nw. Ontario). Spend non-breeding period in South America, from

Paraguay, se. Brazil and Uruguay, S through e. Argentina to Tierra del Fuego and Straits of Magellan; sporadic elsewhere in Chile, N to Isla Chiloe; also Falkland Is (Johnson 1965; Blake 1977; AOU 1983). Vagrant to w. Palaearctic and South Africa (Rogers *et al.* 1983; Grieve 1987; Martin & Martin 1987, 1988; Wright 1987). Once recorded Fiji (Skinner & Langham 1981).

Aust. Vagrant, all singles; only three records submitted to and accepted by RAC: Dry Ck Saltfields, SA, 20 Sept. 1986–17 Apr. 1987; 20 Sept. 1987–15 Apr. 1988 (Cox 1990); Lauderdale–Orielson Lagoon, Tas., 21 July 1991 to at least Feb. 1992 (Patterson *et al.* 1994; Tas. Bird Rep. 21); Kooragang I., NSW, 26 Dec. 1982–Dec. 1983 (Morris 1991). Several unverified reports on Kooragang I. not submitted to RAC: 21 Jan.–7 Apr. 1984; 11 Nov. 1984–7 Apr. 1985 (NSW Bird Reps 1984, 1985); 15 Oct. 1988 (NSW Bird Rep. 1988).

NZ Regular visitor in small numbers; maximum of nine in any year (1990); maximum group size, two (several sites). First recorded 1902 (Stead 1923) with c. 84 individuals to 1992 (G.A. Taylor). Recorded at 33 sites (singles unless stated): **NI** Widespread, most records N of Kawhia and Ohope. **FAR NORTH:** 4, Parengarenga Harbour, 1969–91; Rangaunu Harbour, 1990; L. Ohia, 1991. **NORTHLAND:** 4, Whangarei Harbour, 1972–89; Ruakaka R. estuary, 1951; 2, Waipu R. estuary, 1977. **AUCKLAND, s.** AUCKLAND: Mangawhai Harbour, 1940; 2, Kaipara Harbour, 1967–86; 14, Manukau Harbour, 1946–89; 2, Waikato R. mouth, 1940–90; 4, Firth of Thames, 1946–70; Whitianga Harbour, 1974–75. **BAY OF PLENTY:** Tauranga Harbour, 1987; Matata, 1990; Ohope Spit, 1982. Other NI localities: Kawhia Harbour, 1987; Mamaku L., New Plymouth, 1987; 2, Westshore, Ahuriri estuary, 1981–90; Porangahau R. estuary, 1988; Wanganui R. estuary, 1968; 7, Manawatu R. estuary, 1959–90; L. Wairarapa, 1991. **SI NELSON:** 2, Farewell Spit, 1988–89. **CANTERBURY:** Brooklands Lagoon, 1989–90; 6, Avon–Heathcote estuary, 1960–91; 11, L. Ellesmere, 1902–90. **OTAGO, SOUTHLAND:** Aramoana, 1990; 2, Inchclutha, 1985; Cabbage Pt, Catlins, 1988; Catlins L., 1988; Waikawa, 1969; 4, Invercargill estuary, 1963–68; 2, Awarua Bay, 1969





(Stead 1923; Sibson 1943, 1947, 1950, 1952, 1953, 1959; Imber 1960a,b; Barlow 1965; Gleeson *et al.* 1967; Taylor 1983; Oliver; CSN).

Recorded Tasman Sea (Anon. 1971).

Norfolk I. Single, 5–17 Nov. 1980 (Moore 1981).

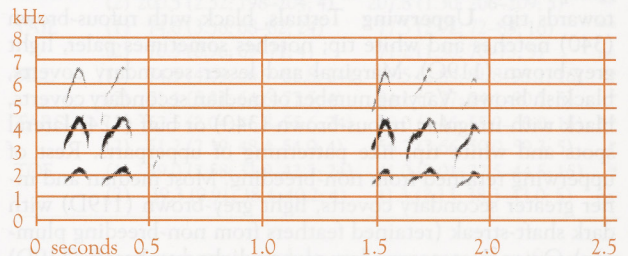
Campbell I. Unconfirmed; single, 1 Sept. 1943 (Bailey & Sorensen 1962).

MOVEMENTS Migratory. Breed Alaska and Canada, moving S for boreal winter (AOU 1983). **Departure** Adults, July–Aug.; juveniles, mid-Sept. to early Oct. Most move SE across Canada, to Hudson and James Bays, then S over w. Atlantic Ocean; occasionally recorded on Pacific coast of North America (AOU 1983; Hayman *et al.* 1986). A few stray W to Pacific islands (Galapagos Is, Oahu I. and Fiji) (Pratt *et al.* 1987). **Non-breeding** S. South America. In NZ, Sept.–May (Sibson 1947; Oliver) with some winter records. Sometimes recorded at one site for months (CSN 37, 39), even for duration of non-breeding period. **Return** Extraliminally, mainly late Apr.–May (Hayman *et al.* 1986). Record from Fiji, Apr., assumed to be on n. migration (Skinner & Langham 1981; Skinner 1983). Most appear to move N through interior of North America; rarely on Pacific coast of Guatemala and Costa Rica (AOU 1983). **Breeding** In Pacific Ocean, single record from Fiji, May–Aug. (Skinner 1983). In Aust., one sighting June (Morris 1991) and single July–Aug. (Tas. Bird Rep. 1992). Several winter records from both islands of NZ (Sibson 1947; Imber 1960a; Oliver; CSN).

FOOD Virtually unknown. Probably worms, molluscs, crustaceans (Bent 1962). **Behaviour** Said to forage by wading in water 10–15 cm deep (Johnsgard 1981), usually in muddy estuaries, coastal pools, flooded grasslands and ricefields (Hayman *et al.* 1986). In HANZAB region, seen feeding among

mats of water-weed on freshwater lake and in tidal pools, in association with Black-winged Stilts, Bar-tailed Godwit or Black-tailed Godwit (Falla *et al.* 1981; Medway 1988; Cox 1990).

VOICE No detailed descriptions (see Miller 1992). Generally silent away from breeding areas (Hayman *et al.* 1986). Sonagram A shows alarm call, *weet-weet, weet-weet-weet*, most likely call to be given in HANZAB area. Compared with call of Black-tailed Godwit, it is higher pitched and has energy more evenly spread between at least three prominent harmonics. About 100–150 ms long, with frequency rising and falling smoothly, or ending with higher frequency. Frequency of three main components between 1.5 and 7.0 kHz.



A Cornell LNS; Manitoba; *Western Bird Song*: Peterson Field Guides, CD1: track 24

PLUMAGES Prepared by A.J. van Loon and D.I. Rogers; based on skins in BMNH and RMNH. First migrate S in distinctive juvenile plumage. Partial post-juvenile (first pre-basic) moult brings on non-breeding appearance late in s. migration or on arrival in non-breeding grounds. Many remain

in non-breeding areas for at least first austral winter, developing patches of first-immature breeding plumage in partial first pre-alternate moult; others migrate N and develop more extensive breeding plumage in this moult. Adult non-breeding appearance attained in complete second pre-basic; thereafter moult twice annually, attaining sexually dimorphic breeding plumage in partial pre-alternate moult just before n. migration, and non-breeding plumage in complete pre-basic moult in late stages or immediately after s. migration. Age of first breeding unknown.

Adult male breeding (Second and subsequent alternate). First attained at end of second austral summer. **Head and neck** Off-white, streaked dark brown (219); dark streaking usually broader and heavier on crown and nape. Face and chin contrastingly paler: off-white with dark-brown (219) mottling on ear-coverts and fine dark-brown (219) streaks or flecks on chin. Supercilium, white, most distinct in front of eye; feathers have fine dark shaft-streaks. Lores, dark brown (219); eye-stripe behind eye, indistinct. Lower neck has varying light rufous-brown (139 or 340) wash, grading onto breast, neatly streaked dark brown (219). **Upperparts** Mantle, back and scapulars boldly patterned: dark brown with rufous-brown (340), buff (124) and whitish spots; feathers have dark centres and rufous lateral spots and buff or white tips (bleaching to buff when worn). Spots, tips and edges soon wear off, mantle and back then appearing dark, with few pale spots and narrow edges remaining. Lower back and rump, black. Basal uppertail-coverts, white, some with large black subterminal spot; distal uppertail-coverts, black (as tail), the outermost with narrow white tips. **Underparts** Upper breast, pale brown, streaked dark brown (219) with varying rufous-brown (139–340) wash. Rest of breast and belly, dark rufous-brown (139–340), finely barred dark brown (219) or black-and-white; feathers, rufous-brown with narrow subterminal blackish bar and white tip. Lower belly, flanks, vent and undertail-coverts have similar, but bolder, pattern; feathers, longer, with two broader black bars and broader white tips; vent and undertail-coverts can appear mainly white with black barring. Pattern of underparts depends on amount of moult and wear of white tips and varies from almost pure rufous-brown with fine dark bars to clearly mottled rufous-brown and white. Axillaries, black. **Tail** Black, with white or off-white tips to rectrices; central rectrices have white lateral spots towards tip; outer 2–4 rectrices have white bases, usually concealed by uppertail-coverts but visible when tail spread; on outermost rectrices, white on outer web extends towards tip. **Upperwing** Tertials, black with rufous-brown (340) notches and white tip; notches sometimes paler, light grey-brown (119C). Marginal and lesser secondary coverts, blackish brown. Varying number of median secondary coverts, black with irregular, rufous-brown (340) or buff (124) lateral spots and white tip, like patterning of upperparts. Rest of upperwing retained from non-breeding. Most median and inner greater secondary coverts, light grey-brown (119D) with dark shaft-streak (retained feathers from non-breeding plumage). Outer greater secondary coverts, light grey-brown (119D) with white tips and edges. Alula, black. Greater primary coverts, black with narrow white tips, broader on inner coverts. Median primary coverts, black with broader white tips. Primaries, dark brown (219) to black, with white base to inner primaries. Secondaries, dark brown (219) to black, with whitish bases, especially on outer secondaries. White tips and edges of outer greater coverts combine with white bases of inner primaries and secondaries to form narrow white wing-bar. **Underwing** Remiges, somewhat reflective, pale grey (c86)

with silvery-white bases. Lesser and median secondary coverts, subhumeral and axillaries, black. Outer greater secondary coverts, white, grading to pale grey (c86) on inner coverts. Marginal coverts and lesser primary coverts, black, with broad white, or buff (124) and rufous-brown (340) tips. Greater primary coverts, grey (84). Pale bases of remiges and white greater coverts combine to form pale central wing-bar.

Adult female breeding (Second and subsequent alternate plumages). Differs most obviously from breeding male in paler underparts: pale brown of foreneck extends farther onto breast than in male, and feathers of underparts have less rufous-brown (139–340, often paler and more cinnamon than in male); feathers also have broader white tips, and larger white bases (usually partly exposed); females thus look white to pale brown below, with varying blotches or wash of rufous-brown on breast and belly; unlike male, rufous-brown tinges seldom strongly marked on uppermost breast, rear flanks and vent; underparts at least as strongly barred dark brown as adult male. Usually retain more grey-brown non-breeding scapulars and tertials than males.

Adult non-breeding (Second and subsequent basic). First attained at end of first austral winter. **Head and neck** Forehead and crown, grey-brown (119C), finely streaked darker; grades to rather uniform, light grey-brown (119C–119D) nape and neck. Chin and sometimes malar region and lower ear-coverts, white, grading to mostly light grey-brown (c119C–119D) face; prominent clean white supercilium, broad above lores but barely extending behind eye, contrasts with narrow dark-brown loreal stripe. **Upperparts** All of mantle, back and scapulars, brown or grey-brown (119B–119D), darkest on back and mantle (119B); feathers have darker shaft-streaks. Sometimes much darker brown (between 119A and 119B) on mantle. Rest of upperparts as adult breeding. **Underparts** Lower neck and breast, light grey-brown (119C–119D), contrasting with chin and white belly, vent and undertail-coverts. Flanks, grey-brown (119C). **Tail** As adult breeding. **Upperwing** Like adult breeding, but all greater and median coverts, grey-brown (119B) with dark shaft-streaks. Marginal coverts, very dark brown (c219), contrasting with other coverts. **Underwing** As adult breeding. Marginal coverts and lesser primary coverts, black with white (not rufous-brown) tips.

Juvenile Head and neck Forehead and crown streaked black and buffish (c124) (dark feathers with pale edges), forming distinct cap, contrasting with supercilium. Supercilium, white, especially distinct in front of eye. Loreal stripe, dark brown (219). Nape and rest of neck, grey-brown (c119C), extending towards upperbreast and contrasting with whitish chin and upper throat. Ear-coverts, white, mottled grey-brown (119C). **Upperparts** Mantle, upper back and scapulars, grey-brown (c119B–119C) with dark-brown (219) shaft-streaks and subterminal bars to feathers, forming bold anchor-shaped markings on scapulars and giving overall dark appearance to mantle; when fresh, neatly scalloped by buff (124) fringes to feathers. Longer scapulars may have second subterminal bar. Rest of upperparts, like adult. **Underparts** Upper breast and fore-flanks, grey-brown (119C) with dark shaft-streaks to feathers of sides of breast and flanks; grade to paler grey-brown (119D) with distinct buff cast on rear flanks. Belly, vent and undertail-coverts, off-white with a few small dark streaks on sides of vent. **Tail** Black with white base and poorly demarcated buff (124) tip; on outer rectrices, white extends farther, about half-way along feather, especially on outer web. **Upperwing** Remiges, most primary coverts, and alula, black or dark brown (119–219); secondaries and p1 to p5 or p6 have

white bases, extending farthest on outer web; inner greater primary coverts tipped white. Greater secondary coverts, grey-brown (c119C) with paler whitish tips and outer edges, joining wing-bar at base of primaries. Median and lesser secondary coverts, grey-brown (119C), neatly fringed off-white. Marginal coverts, dark brown (219), fringed buff (124) (as mantle). Lesser primary coverts, black with narrow white fringes. Tertials, dark brown (219) with large buff (124) lateral spots near tips, sometimes joining to form irregular bars. White bases of secondaries and inner primaries combine with white on inner primary coverts to form pale wing-bar. **Underwing** Like adult.

First immature non-breeding (First basic). Attained in first austral spring–summer. Like adult non-breeding, but retain juvenile primaries and secondaries (moderately worn when adults undergoing complete moult) and some juvenile tertials and innerwing-coverts. Juvenile crown (dark cap) and feathers of mantle retained till late in post-juvenile moult (at least Oct.–Nov.).

First adult breeding (First alternate). Not known to breed in this plumage. Varies greatly, appearance depending on amount of body-plumage and wing-coverts moulted in first pre-alternate. Some may attain full breeding plumage (Prater *et al.* 1977) but most recognizable by retained juvenile primaries (very worn in first austral winter) and inner median upperwing-coverts. Those remaining in HANZAB region through austral winter only develop a little breeding plumage and may resemble adult non-breeding.

BARE PARTS Mostly from photos (e.g. Farrand 1983; Pringle 1987; Moon 1988; Chandler 1989; Paulson 1993; Patterson *et al.* 1994). **All plumages** Iris, black-brown (119); 'hazel' reported on some labels (BMNH, RMNH). Bill, bicoloured; in HANZAB region, basal 30–50% mostly dull pink (5), pink (c7) or pink-red (c108C), often with dark-grey (83) to grey-black (82) lines along culmen and upper tomion; these usually meet dark-grey (83) to grey-black (82) tip (distal 50–70%). When breeding, pale base of bill tends to become larger, occupying basal 50–60% of bill; dark stripes of culmen and upper tomia may fade to pale brown (119C–119D) or be lost. In breeding males only, base of bill brightens to orange (c17) during courtship, rapidly resuming normal coloration afterwards (Sutton 1968). Legs, toes and nails, dark grey (83) to grey-black (82).

MOULTS Based on skins (BMNH, RMNH), photos (as Bare Parts), and descriptions (Bent 1962; Prater *et al.* 1977).

Adult post-breeding (Second and subsequent pre-basic). Complete; primaries outwards. Moult of body probably begins on breeding grounds, in July (Bent 1962) and is in progress (often advanced) in migrants on North American shores in Aug. and Sept. (Bent 1962; Paulson 1993; BMNH). Completed first on head and neck; breeding plumage retained longest on belly, rear-flanks and undertail-coverts, along with scattered feathers on mantle, and scattered scapulars and tertials. Traces of breeding plumage can be retained till arrival in non-breeding areas (Cox 1990); non-breeding appearance usually attained c. Oct. (Cox 1990; Paulson 1993) but individual photographed in USA in Nov. (Chandler 1989) still had much breeding plumage. Moult of primaries delayed until arrival in non-breeding areas; timing not well known. Prater *et al.* (1977) gave completion date as Nov.–Dec. but only data available from our region is an individual collected NZ with (unusually late?) primary-moult of N⁴I²1¹O⁵ on 31 Dec.

(CM). A female and a male on 12 July in Argentina had mixed plumage, with only few breeding feathers (some feathers of underparts and mantle, and some worn tertials); these birds possibly in second pre-basic, or older birds that had not migrated to breeding grounds and had started pre-basic moult early (though the possibility that pre-alternate moult had been incomplete cannot be excluded). **Adult pre-breeding** (Second and subsequent pre-alternate). Partial, involving most or all feathers of body and tertials. Occurs in non-breeding areas and on migration to breeding grounds in austral summer and autumn, starting late Feb. or early Mar. (earliest record, 13 Feb.; Cox 1990); can develop breeding appearance before leaving our region (e.g. Cox 1990; Patterson *et al.* 1994). At least sometimes rapid; individual in SA appeared in full plumage 22 days after first traces of moult were seen (Cox 1990). Most birds appear in breeding plumage (but may still be moulting) in May on migration in USA. **Post-juvenile** (First pre-basic). Partial, beginning Oct. during migration to non-breeding areas (Bent 1962) and probably finishing there; involves feathers of body and most wing-coverts. Some juvenile upperwing-coverts (especially inner median coverts), tertials and many feathers of mantle and scapulars retained. **First post-breeding** (First pre-alternate). Does not follow a breeding attempt. Poorly known. Timing not known; assumed to be in first austral autumn (resultant plumage observed May–July). Partial; may develop as much breeding plumage as adults (Prater *et al.* 1977) but individuals remaining in non-breeding areas in first austral winter generally look like adult non-breeding, some developing varying patches of breeding plumage; such traces recorded on flanks, belly, sides of breast, scapulars and tertials of (unaged) birds in non-breeding areas in May (BMNH; photos in Patterson *et al.* [1994] and Pringle [1987]). Not known if any body-moult occurs producing feathers like non-breeding, or if any primaries may be moulted before second pre-basic.

MEASUREMENTS Mainly North and South America, and Falkland Is, all year, skins (BMNH, RMNH, ZMA): (1) Adults; (2) Juveniles and immatures with juvenile p10 from austral spring and autumn.

	MALES	FEMALES	
WING	(1) 209.0 (5.42; 198–219; 24) (2) 200.5 (2.52; 198–204; 4)	217.4 (5.52; 208–226; 16) 207.8 (1.30; 206–209; 5)	** **
TAIL	(1) 74.6 (3.38; 68–82; 24) (2) 70.3 (0.96; 69–71; 4)	77.5 (2.92; 72–83; 16) 71.2 (1.30; 70–73; 5)	** ns
BILL	(1) 74.5 (4.09; 66.9–82.8; 24) (2) 71.1 (5.31; 64.6–77.5; 4)	89.5 (2.89; 81.8–93.1; 16) 84.1 (7.27; 74.1–90.7; 5)	** *
TARSUS	(1) 52.5 (2.04; 46.8–55.6; 24) (2) 51.2 (2.39; 48.4–54.0; 4)	58.0 (1.46; 55.9–60.0; 15) 56.2 (3.66; 50.0–59.3; 5)	** *
TOE	(1) 39.0 (2.58; 31.9–42.3; 24) (2) 39.3 (0.91; 38.4–40.2; 4)	41.0 (2.01; 37.5–44.5; 15) 41.3 (2.13; 38.3–43.0; 5)	* ns

Differences between adults and immatures significant for wing and tail in males, and for wing, tail and bill in females. For additional measurements, see Prater *et al.* (1977) and Rynn (1982).

WEIGHTS Few data. Average for males 222.0 g (n=6), females 289.0 g (n=6) (Jehl & Smith 1970). Average weight on breeding grounds said to be 243.1 (Baker 1977); in incubation period, one female weighed 247.9 and one male 221.0 (Williamson & Smith 1964).

STRUCTURE Wing, long, narrow and pointed. Eleven primaries; p10 longest; p9 2–6 mm shorter, p8 10–19, p7 24–32, p6 40–47, p5 54–63, p4 68–82, p3 82–93, p2 92–107, p1 102–119; p11 minute, concealed. About 11 secondaries and five tertials; longest tertials reach to p6–p7 on folded wing. Tail short, square at tip; 12 rectrices. Bill, very long, deep at base, slightly upturned (intermediate between *L. limosa* and *L. lapponica* in general appearance). Upper mandible slightly longer than lower; tip shaped like that of Black-tailed Godwit (q.v.). Nostril a short, narrow slit, set in short, poorly defined nasal groove. Tarsus, long, scutellate. Lower 30–35 mm of tibia unfeathered. Outer toe 78–85% of middle, inner 69–80%, hindtoe much shorter and reduced, 26–35% of middle. Small but clear web between outer and middle toe; web between inner and middle toe very small and hardly visible.

AGEING First alternate (May–July of first year) can usually be distinguished from adult by retained buff-fringed inner median coverts and worn primaries, and often by absence of, or incompletely developed, breeding plumage, though some may attain full breeding plumage (Prater *et al.* 1977); not known if some moult primaries in first year (then being very similar to adults).

GEOGRAPHICAL VARIATION None. Said to form superspecies with Black-tailed Godwit (BWP).

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Volume 3, Plate 3

Hudsonian Godwit *Limosa haemastica* (page 77)

1 Adult female breeding; 2 Adult male breeding; 3 Adult female non-breeding; 4 Juvenile; 5, 6 Adult

Black-tailed Godwit *Limosa limosa* (subspecies *melanuroides*) (page 68)

7 Adult male breeding; 8 Adult female breeding; 9 Adult non-breeding; 10 Juvenile; 11, 12 Adult

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