

Order CHARADRIIFORMES

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

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

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

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

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

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

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

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

REFERENCES

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

Order CHARADRIIFORMES

Family SCOLOPACIDAE sandpipers and allies

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

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

Non-breeding plumage mostly dull and cryptic: mottled greys and browns above, and paler or white below, with or without streaks and spots. Breeding plumage generally much brighter (except in curlews, snipes and woodcocks), with more rufous or black. In HANZAB region, adults seen mainly during austral summer in non-breeding plumage, though breeding plumage can be seen on birds just before n. migration or on arrival after s. migration. Sexes usually similar. Bills, legs and feet variously, sometimes brightly, coloured. Adults generally have two moults per cycle: (1) a partial pre-breeding (pre-alternate) moult of most feathers of body, and, often, some tertials and upperwing-coverts; and (2) a complete post-breeding (pre-basic) moult; both usually performed in non-breeding areas or while staging on migration. Primaries moult outwards, usually after s. migration; some subspecies of Dunlin *Calidris alpina* (q.v.), Purple Sandpiper *C. maritima* and Rock Sandpiper *C. ptilocnemis* moult all primaries on or near breeding grounds before s. migration, a strategy rare in *Calidris*; Bristle-thighed Curlew *Numenius tahitiensis* moult remiges rapidly, inducing flightlessness in 50–70% of birds, apparently uniquely among Charadriiformes. Precocial young nidifugous; most feed themselves. Down varies greatly in structure and pattern; pattern mainly of spotted or striped type (Fjeldså 1977). Juvenile plumage usually distinctive; most like that of non-breeding adults, but often a little brighter, especially in Calidridinae. 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 Westport Bay, Vic., in Aug. when daily exposure of intertidal feeding grounds reduced (Loyn 1978; see also Hindwood & Hoskin 1954; Alcorn 1988).

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

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

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

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

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

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

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

REFERENCES

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

28 Gallinagoninae

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

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

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

Authors, Perth.

Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds*. Yale Univ. Press, New Haven.

—, et al. 1988. *Auk* 105: 409–23.

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

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

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

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

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

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

Wall, L.E. 1953. *Emu* 53: 80–6.

Subfamily TRINGINAE godwits, curlews, 'shanks' and allies

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

Table 1

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

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

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

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

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

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

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

REFERENCES

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

Actitis hypoleucos Common Sandpiper

COLOUR PLATE FACING PAGE 224

Tringa hypoleucos Linnaeus, 1758, *Syst. Nat.*, ed. 10 (1): 149 — Europe.

Actitis is from the Greek ἀκτίτης, coast dweller (from ἀκτή, sea coast or headland, and κίτης, inhabitant). *Hypoleucos* combines the Greek for white (λευκός) and beneath (ὑπο). Linnaeus originally used the specific name as a substantive or noun in apposition (i.e. the White-belly), deriving it from *Gallinula hypoleucos*, a name given to the Common Sandpiper by Gesner (1555), *Hist. Anim.*, Lib. III, *Aves*.

OTHER ENGLISH NAMES Summer Snipe, Carrier Sandpiper; Green Sandpiper (in error).

MONOTYPIC

FIELD IDENTIFICATION Length 19–21 cm; wingspan 32–35 cm; weight 38–84 g. Small sandpiper with rather long body, short legs, straight medium-length bill, and rather long tail which, at rest, projects well beyond tips of wings. Similar in size to Wood Sandpiper *Tringa glareola* but with shorter neck, wings and legs; much smaller and slimmer than Terek Sandpiper *Xenus cinereus*. Dark-brown above and white below, with indistinct pale supercilium, prominent white eye-ring, and distinctive white peak between dark breast-patch and folded wing; flight action, persistent teetering and ringing calls also distinctive. Sexes similar. Slight seasonal variation. Juvenile separable when close.

Description Adult breeding Cap, hindneck and mantle, slightly glossy, greenish brown, with fine dark streaks; rest of upperparts and innerwing-coverts as mantle but with well-spaced, irregular dark barring, and narrow buffish-brown tips to feathers when fresh; have indistinct whitish supercilium, prominent white eye-ring, and indistinct dark eye-stripe from bill to rear of ear-coverts; lower face, grey-brown, finely streaked darker. Underbody, mostly white; throat, foreneck and centre of upper breast, finely streaked dark brown, and sides of neck and upper breast, greenish brown, and finely streaked darker, grading to white on centre of breast; distinctive white peak between dark patch at sides of breast and folded wing. In flight, show dark upperparts with bold white wing-bar and narrow white trailing-edge (which join across inner few secondaries), and broad white barring on sides of rump and tail; strongly patterned underwing: lining, white with narrow dark-brown bars running inwards off carpal and along median coverts; remiges, dark brown except for clearly defined white wing-bar and trailing-edge. Bill, dark brown grading to dull greenish or brownish at base. Iris, brown. Legs and feet, greyish olive to dull yellowish-brown; rarely, yellow. **Adult non-breeding** Like breeding but: upperparts slightly duller and more uniform, with only faint dark streaks and barring; innerwing-coverts show bolder dark subterminal bar but only narrow buffish tips when fresh; foreneck and upper breast less distinctly streaked, and sides of head, neck and dark patches on sides of upper breast, more uniform with little streaking; breast-patches also smaller (rarely join in centre of breast). **Juvenile** Like adult non-breeding but: feathers of head, neck, breast, mantle and scapulars have narrow faint buff-spotted fringes that are soon lost with wear; innerwing-coverts more heavily barred, showing distinct double black subterminal bar, and broader, deeper buff tip, which form barred patch that contrasts more with plain upperparts than in adult non-breed-

ing; tertials have buff fringe broken by clear dark submarginal notches.

Similar species Appearance and actions distinctive. At rest, distinguished by almost constant teetering, and by pattern of dark-brown upperparts and patches on sides of upper breast coupled with distinctive white peak on shoulder. In flight, striking wing-bar and white sides to rump and tail recall species of *Calidris*, but readily distinguished by: distinctive flight action, usually low over water, and distinctive ringing, high-pitched call (see below).

Seen singly or in small parties on muddy or rocky edges of rivers and streams and other wetlands and rocky or sandy beaches. Gait a brisk walk or run; very agile when climbing over stones or other obstacles. Stance rather horizontal but often erect when moving among rocks; overall length of body and tail emphasized by almost constant wagging of rear of body and tail (teetering). Can swim. Flight action distinctive: level and usually low to water, with spasmodic wing-beats (pause after each downstroke or every few strokes) and short glides on strongly down-bowed wings between bursts of flickering shallow wing-beats; landing usually preceded by long glide and sudden turn before final flutter; teeter vigorously on landing. Flight over long distance, at height or in flock more like that of small *Tringa* or *Calidris*, though still incorporating occasional flutter of wings. Feeding actions slow and deliberate, combining picking and stabbing (as in *Calidris*) with stalking and dashes (as in *Tringa*). Busy and obvious when feeding; often quiet and inconspicuous when not. Habitually perch on water-side objects like rocks, trees, mangrove roots, posts, boats and jetties. Single birds often rather quiet in non-breeding areas; most common call, given in flight, consists of penetrating thin piping notes *tsee-wee-wee*.

HABITAT Wide range of coastal or inland wetlands, with varying levels of salinity. Mainly muddy margins or rocky shores of wetlands; often round estuaries and deltas of streams, as well as on banks farther upstream; also round lakes, pools, billabongs, reservoirs, dams and claypans. Muddy margins often narrow, and may be steep; often associated with mangroves, and sometimes in areas of mud littered with rocks or snags. Large coastal mudflats not favoured (Smith 1966; Loyn 1975; Noske 1975; Longmore 1978; Roberts 1979; Garnett & Bredl 1985; Bamford 1988; Garnett 1989). In some areas, strong preference for rocky areas, such as rocky or coral beaches or shores, inshore reefs and breakwaters in harbours (Smith 1964, 1966; McKean & Hindwood 1965; Noske 1975; Serventy

& Whittell 1976; Sedgwick 1978; Congreve & Congreve 1985). Occasionally occur on ocean beaches (Serventy & Whittell 1976), where may frequent piles of seaweed or wave-washed rocks (Kitchener *et al.* 1975; Martindale 1980).

Generally forage in shallow water and on bare soft mud at edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots (Smith 1964, 1966; Loyn 1975; Noske 1975; Longmore 1978; Bamford 1988; Lane). Foraging birds sometimes venture into grassy areas adjoining wetlands (Smith 1964; Townsend 1978). In NZ, recorded feeding round edges of shallow pools and runnels on coastal shell bank (Edgar 1969). On Lord Howe I., observed foraging on exposed beach and among rocks and coral exposed at low tide (McKean & Hindwood 1965). Once seen feeding on concrete causeway covered by floodwater (Johnson 1990), and round rocky edge of artificial pond (Smith 1966).

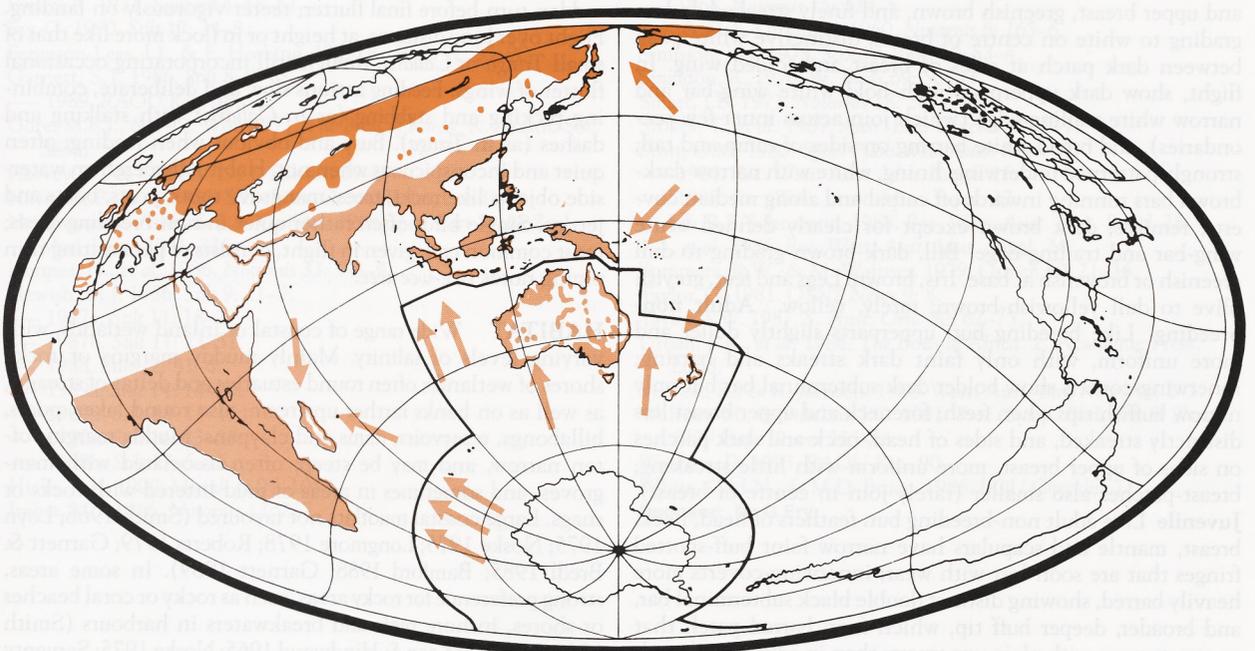
Almost always roost or loaf on rocks or in roots or branches of vegetation, especially mangroves (Garnett 1989; Lane); sometimes rest on mud (Noske 1975). Often perch on posts, jetties, moored boats and other artificial structures (Smith 1966; Loyn 1975; Serventy & Whittell 1976; Dann *et al.* 1994). Edgar (1969) recorded one roosting with other waders on shell bank in a harbour.

Use artificial wetlands, including sewage ponds and saltworks, ponds, irrigation channels, bore and storm-water overflows, stock troughs, flooded gutters, roads, causeways and ditches (Carruthers 1966; Smith 1966; Haselgrove 1975; Loyn 1975; Noske 1975; Schodde 1976; Connor 1981; Badman & May 1983; Crawford 1972; Storr 1984; Johnson 1990; Lane; Vic. Bird Reps; J.M. Peter).

DISTRIBUTION AND POPULATION Breed Europe and Asia: widespread British Isles and w. and central continental Europe; widespread throughout Scandinavia, Baltic countries, Poland (E of Warta R.) and Ukraine, and S round n. and e. shores of Black Sea to w. Iran; s. boundary extends E round s. Caspian Sea in n. Iran, E to headwaters of Amudar'ya, Syrdar'ya and Indus Rs, then NE to w. Sinkiang (including

Tien Shan Mts), Transbaikalia, E to n. coasts of Sea of Japan; in E, throughout Ussuriland and n. Japan, N through Sakhalin and Kurile Is to Kamchatka and Chukotskiy Territory (round tributaries to Anadyr R.); n. boundary mainly 67–69°N from upper Anadyr R. to s. Kanin Pen. and through Kola Pen. Within this distribution, absent from arid lowlands round Caspian Sea, and from there E to L. Balkash, N along Irtysh R. to round Omsk district and W to nw. Kazakhstan. Also recorded breeding at scattered localities in North Korea and central China, in Heilungkiang, Kirin, Kansu, Szechwan, s. Tsinghai, w. Sinkiang and possibly in s. Tibet; aberrant breeding also recorded Uganda and Kenya. A few spend non-breeding period in scattered localities throughout Europe; most occur in Africa or Asia. In Africa, some occur in n. regions and along valley of Nile R., but mainly S of line from s. Mauritania to Somalia. In Asia, occur round coasts of Arabian Pen., Persian Gulf and n. Arabian Sea, to Indian subcontinent, Indomalaya, SE Asia, Indochina, Philippines, and China, S of Yangtse Kiang, and w. Micronesia. In A'asia, visit New Guinea and Aust. regularly, NZ less often. Vagrant or casual visitor to Iceland, Faeroes, Aleutian Is, Samoa and Kiribati (Dement'ev & Gladkov 1951; van Someren 1973; Benson & Irwin 1974; AOU 1983; de Schauensee 1984; Urban *et al.* 1986; Pratt *et al.* 1987; BWP).

Aust. Mostly in N and W. **Qld** Widespread from se. Gulf of Carpentaria, including Mornington I., N to Torres Str., and E of Great Divide. W of Great Divide, sparsely scattered in central, s., sw. and w. Qld, in area from Mt Isa, S to Birdsville, SW to Dynevor Downs, E to St George and N to Longreach (Carruthers 1966; Corben 1972; Horton 1975; Garnett & Bredl 1985; Qld Bird Reps; Aust. Atlas). **NSW** Widespread E of Great Divide. Widely scattered records in Western and Plains regions, but few on w. slopes of Great Divide (e.g. Gunnedah, Jingellic) (Noske 1975; NSW Bird Reps; Aust. Atlas). **Vic.** A few scattered records along coast of Gippsland. Mostly round Westernport and Port Phillip Bays, extending along most of w. coast. Sparsely scattered records in all districts inland (Vic. Bird Reps; Vic. Atlas). **Tas.** Uncommon but





regular visitor, mainly in SE and NW, but occasionally recorded elsewhere (Wall 1965, 1969; Anon. 1968; Tas. Bird Reps). Three records from King I. (McGarvie & Templeton 1974; Tas. Bird Rep. 8). **SA** Most records in area bounded by line between Pt Sinclair (32 km S of Penong), Echo Camp Waterhole and Picaninny Ponds. Also recorded L. Eyre drainage Basin and elsewhere in N. Westernmost records from near Amata in N, and Twin Rocks, e. Nullarbor Plain, in S (Badman & May 1983; Jaensch & Jaensch 1987; SA Bird Reps; Aust. Atlas). **WA** Generally absent from Western Deserts region, though regular records from s. Nullarbor Plain, especially coast (e.g. Congreve & Congreve 1985). Round s. coast and throughout SW; widespread in Gascoyne and Pilbara regions, inland to headwaters of main rivers; also scattered records between Yalgoo, L. Violet and Erlistoun; widespread in Kimberley Div., including inland along major rivers; some records in ne. Great Sandy Desert (Curry 1979; Start & Fuller 1983; Storr 1986; Aust. Atals). **NT** Widespread in coastal regions from Joseph Bonaparte Gulf to McArthur R. Inland, widely scattered throughout most of n. half, S to Devil's Marbles and Frew R.; single record from Merrina Waterhole, Winnecke Ck, but generally absent from Tanami Desert and Barkly Tableland. In s. NT, mainly scattered S of 23°S; W to Uluru, and generally absent from Simpson Desert, but recorded at Jervois Mine Dam (Schodde 1976; Gibson 1986; Aust. Atlas).

NZ First recorded at Paritutu, New Plymouth, 24–25 Oct. 1964 (Pangelly *et al.* 1965). All records of singles unless otherwise stated. **NI** Single, Pananehe I., Spirits Bay, 26 Jan. 1993 (CSN 41; accepted RBC); one or two, Pirini Ck, Rangaunu Harbour, 12–19 Jan. 1982 (Bellingham & Davis 1982); Kerikeri Inlet, 20 Mar. 1969 (Edgar 1969); Whangarai Harbour, summer–early autumn 1992 (Anon. 1992b); estuary of Ruakaka R., Dec. 1979 (CSN 28); estuary of Waipu R., 3 Jan. 1984 (CSN 32); Port Albert, Kaipara Harbour, 23 Feb.

1974 (Brown 1974); Mangere Sewage Ponds, Manukau Harbour, 23 Nov. 1980 (Sibson 1982), 1 Feb. 1981 (CSN 29); Awhitu Pen., Karioitahi, Manukau Harbour, 13 Apr. 1980 (CSN 28); Tararata Ck, Manukau Harbour, 13 Nov. 1977 (Sibson & Jenkins 1978); mouth of Waiau R., 9 Nov. 1983–14 Mar. 1984 (CSN 32); Kairakau Bay, 26 Dec. 1988 (CSN 37); Waikanae R., 24 Nov. 1972 (Fleming 1973); Longburn (Manawatu R.), 26 Aug.–6 Sept. 1981 (CSN 32); New Plymouth, 24–25 Oct. 1964 (Pangelly *et al.* 1965), 13 Feb.–9 Apr. 1972 (Medway 1974). **SI** Whanganui Inlet–Wairoa R., 12–13 Mar., 21 Nov. 1981 (Bell 1981; CSN 30); L. Wainono, 1980 (NZCL).

Norfolk I. Single, 8 Feb.–24 Mar. 1983 (Hermes *et al.* 1986).

Lord Howe I. Singles: Nov.–Dec. 1959, Feb. 1960, 23 Nov. 1962 (McKean & Hindwood 1965); 27–29 Nov. 1971 (NSW Bird Rep. 1971); 29 Nov. 1973 (NSW Bird Rep. 1973).

Christmas I. Common and regular visitor (van Tets 1983; Stokes 1988).

Cocos-Keeling Is First recorded 4 Mar. 1941 and said to be regular visitor in small numbers (Gibson-Hill 1949, 1950). Up to ten recorded in Jan. 1982 (Stokes *et al.* 1984).

Prince Edward Is Marion I. (singles unless stated): 5 Feb. 1975, 1 Dec. 1977, 5 Nov. 1978 (Burger *et al.* 1980); two, 2 Oct. 1979, 28 Jan. 1980, 27–30 Dec. 1980 (Berruti & Schramm 1981); 13–14 Sept. 1984 (Gartshore 1987).

Iles Crozet Singles, Ile de la Possession: 11 Dec. 1980–5 Feb. 1981, 28 Dec. 1982 (Stahl *et al.* 1984).

Iles Kerguelen Single, Presqu'île Jeanne d'Arc, 10 Oct. 1978 (Thomas 1983).

Population Aust. Estimated at 3000 (Watkins 1993). Totals for summer counts, 1986–91, summarized in Hewish (1986, 1987b, 1988, 1990), Anon. (1992a) and Naismith (1992). Areas of national importance and maximum counts

(Watkins 1993) include: se. Gulf of Carpentaria, Qld, 235; Darwin area, NT, 52; Nuytsland NR, WA, 52; Cairns Fore-shore, Qld, 42; Roebuck Bay, WA, 40. In surveys of 197 wetlands in sw. WA between 1981 and 1985, recorded at 29 sites (Jaensch *et al.* 1988).

MOVEMENTS Migratory; breed Eurasia. Move S for boreal winter, with most w. breeding populations wintering in Africa, and e. breeding populations wintering in s. Asia to Melanesia and Aust. (see BWP). Migrate along coasts and overland on broad fronts, generally following rivers. S. passage said to be mostly diurnal, whereas n. passage mainly occurs by night (see Dement'ev & Gladkov 1951; BWP).

Departure Leave breeding grounds: central Yakutia, mid-July to early Sept.; Baikal and Transbaikalia, till mid-Sept.; s. Ussuriland, till early Oct.; Kamchatka Pen., between end Aug. and beginning of Sept.; in Ussuriland, flocking and probably migration starts early July (Dement'ev & Gladkov 1951; P.S. Tomkovich). Common throughout e. and s. Asia on migration (Lane) including Korea, Japan (where more numerous on s. than n. migration) and e. China (where also said to be resident in parts) (la Touche 1931–34; Gore & Won 1971; AWB 1993); first records Jiangsu Province, late Aug. 1991 (Hui 1992). Apparently pass through Hong Kong, Sept. and Oct. (Melville 1980). Common Burma, arriving early Aug. (Smythies 1986); and Thailand, arriving Pattani Bay, Aug.–Nov. 1990 (Lekagul & Round 1991; AWB 1993); arrive Pen. Malaysia about Aug. (Edgar 1969). Pass through Singapore (Hails & Jarvis 1987) and Borneo (Smythies 1981), with numbers increasing in sw. Brunei, Aug.–Nov. (Harvey & Elkin 1991). Common Sumatra, where earliest dated record 3 Aug. (van Marle & Voous 1988). Common passage migrant Wallacea, where dated records from July (White & Bruce 1986). Common Philippines (Delacour & Mayr 1946). Common visitor to w. islands of tropical Pacific, but only occasional straggler farther E to Samoa and Phoenix Is (Pratt *et al.* 1987). Abundant passage migrant New Guinea, arriving mid-July then gradually increasing in number (Beehler *et al.* 1986; Coates 1985; Hicks 1990). In Aust., recorded from July in Kimberley, nw. WA (Storr 1980); regularly arrive Darwin, NT, mid-July (Crawford 1972) and apparently later in Qld, where recorded from Aug. (Amiet 1957; Gill 1970; Storr 1984) with at least some passing through Torres Str. (Draffan *et al.* 1983). Vagrant Norfolk and Lord Howe Is and NZ, where recorded Aug.–Apr. All records from islands S of Aust. and NZ are from non-breeding period.

Non-breeding Movements within Aust. poorly known; some move through near-coastal areas (e.g. Townsville region, Qld; Garnett & Cox 1983) and inland records suggest some migrate across continent (Lane). Apparently arrive NSW from Aug. to Dec. or early Jan. In Gulf St Vincent, SA, some arrived July, well before main influx which began late Aug. (Close & McCrie 1986). Several records, both extralimital and from HANZAB region, of small flocks flying along water-courses at dusk (Edgar 1969; Gill 1970; Smythies 1981).

Return Leave Gulf St Vincent, SA, between Feb. and May (Close & McCrie 1986); NSW, Mar.–Apr. (Noske 1975). Some records suggest pre-migratory concentrations during Mar. and Apr. (e.g. Crawford 1972; Alcorn 1987). Extralimital, leave New Guinea, by early May (Beehler *et al.* 1986). No dated records after May in Wallacea (White & Bruce 1986) or Sumatra (van Marle & Voous 1988). Evidence of passage in sw. Brunei, Borneo, Mar. and Apr. (Harvey & Elkin 1991). At Jurong, Singapore, greater numbers during n. than s. migration

(Medway & Wells 1976). Leave and pass through Pen. Malaysia, Mar.–May (Edgar 1969; AWB 1993); leave Burma, early May (Smythies 1986) and small numbers passed Red R. Delta, Vietnam, Mar. 1989 (AWB 1993). Pass through Hong Kong probably late Apr. and May (Melville 1980). Pass Beidaihe, China, mainly mid-May (AWB 1993). Common passage migrant Korea (Gore & Won 1971). Pass through Japan, Apr., and through Ussuriland, mid-Apr. to end May. Arrive Sakhalin, through May till early June; Kamchatka Pen., Upper Kolyma R., Transbaikalia, and Yakutia, in second half of May till at least early June in some areas (Dement'ev & Gladkov 1951; P.S. Tomkovich).

Breeding In Aust., often winter in N (e.g. Hewish 1987a, 1989); S of 26°S, reporting rate in winter 0.3%, cf. 2.2% in summer (Aust. Atlas). Rarely winter in NSW (Noske 1975) or Vic. (Vic. Atlas). In Tas., two birds seen at Swansea from 10 Feb. to 18 Oct. 1987 (Anon. 1988). No records in winter in NZ. Extralimital, considerable numbers stay in se. Asia during breeding months (McClure 1974), though not recorded from all areas of non-breeding range during this period (e.g. Wallacea; White & Bruce 1986).

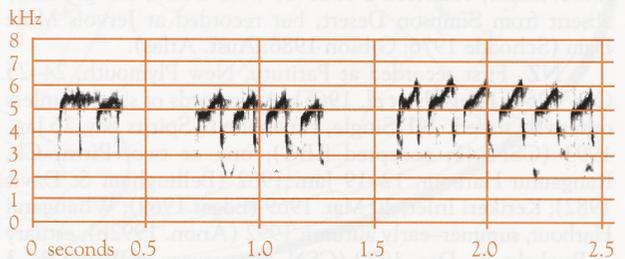
Banding No relevant recoveries. In s. Asia, tend to return to same non-breeding site year after year (McClure 1974).

FOOD Carnivorous. Molluscs, crustaceans and insects; extralimital, algae and seeds, worms, spiders, fish, frogs and tadpoles. **Behaviour** Diurnal (diurnal and nocturnal on breeding grounds). Adopt low creeping posture to snatch low-flying insects (Smith 1964); may dart forward to secure sitting prey (Reed 1952). Outside area, observed to locate prey visually on ground (especially among stones and cracks), low vegetation or in faeces of mammals; rarely probe, though may push bill sideways under debris on beaches; sometimes wash prey before eating. Associate with large animals to take disturbed prey and may take ectoparasites (BWP).

Adult No detailed studies. Animals: Molluscs (Gould): bivalves (FAB); Crustaceans: amphipods (Lea & Gray); crabs (McLennan 1917; Lea & Gray); Insects (Smith 1966; Gould): Orthoptera: Gryllidae; Neuroptera: Myrmeleontidae (FAB); Coleoptera: Staphylinidae: *Cafius*; *Dicax* (Lea & Gray); Scarabaeidae; Tenebrionidae; Chrysomelidae (FAB); Curculionidae: *Timareta* (Lea & Gray); Diptera: Coelopidae (Smith 1964); Tabanidae (Reed 1952); Hymenoptera: Formicidae: *Camponotus*; *Iridomyrmex* (FAB).

VOICE Calls well described. Sonagrams in Bergmann & Helb (1982); BWP; Glutz von Blotzheim *et al.* (1977) and Nethersole-Thompson & Nethersole-Thompson (1986). Generally a very noisy wader when disturbed, with distinctive call.

Adult Distinctive flight call a penetrating but thin piping *tsee-wee-wee* or *sweet-wee-wee* (Hayman *et al.* 1986;



A F. van Gessel; Darwin, NT, Jan. 1986; P36

BWP). Also described as ringing, high pitched and either extended or condensed in alarm (BWP). Examples (sonagram A) show range of combinations, and distinctive but subtle drop in pitch with each succeeding syllable. Main energy within the syllables rises from 5 to 6 kHz.

PLUMAGES Prepared by A.M. Dunn. Finish complete, or almost complete, post-juvenile moult in non-breeding areas; moult body (first pre-basic), Aug.–Dec., and remiges (first pre-supplemental), Jan.–Mar. Undergo partial first pre-alternate moult Jan. to early Apr., resulting in breeding plumage similar to adult breeding but slightly duller; then migrate N. Adult non-breeding plumage attained in second pre-basic moult that starts after s. migration. Thereafter moult twice annually: a partial (pre-alternate) moult to adult breeding starts Feb., before n. migration; and complete pre-basic moult starts after s. migration. Probably first breed in second year.

Adult breeding (Second and subsequent alternate). **Head and neck** Feathers of forehead, crown, nape and hindneck, brown (119B) to grey-brown (91), with dark brown (121) shaft-streaks. Indistinct white supercilium extends from above lores to just behind eye. Lores and area behind eye, slightly darker than forehead and crown, forming indistinct eye-stripe. Prominent eye-ring, white. Feathers of chin and throat, white to brownish grey (80), with narrow brown (28) shaft-streaks. Feathers of cheeks and side of neck, brown (28), narrowly fringed off-white, giving streaked appearance. **Upperparts** Mantle, upper back and smaller scapulars, grey-brown (91) to brown (119B), with black-brown (119) shaft-streak and central bar on feathers forming a cross or arrow on centre of each feather. Larger scapulars, brown (119B), with black-brown (119) shaft-streak and widely spaced black-brown (119) bars. Lower back, rump and central uppertail-coverts, grey-brown (91), with fine dark-brown (121) shaft-streak, narrow dark-brown (121) subterminal bar, and narrow buff (123D) fringe to tips of feathers; lateral uppertail-coverts, brown (119B) near base, and barred dark brown (121) and white. **Underparts** Mostly white with contrasting dark breast. Centre of breast, white, with narrow brown (28) shaft-streaks to feathers. Feathers of sides of breast, light grey-brown (119C) to grey-brown (91), with narrow brown (28) shaft-streaks. Rest, white, with concealed grey-black (82) bases to feathers. **Tail** T1, grey-brown (91) with dark-brown (219) subterminal bar, and dark-brown spots along margins; sometimes finely tipped white. T2, as T1 but with broad white tips. Outer rectrices, gradually paler to T6, which is mostly off-white, barred dark brown (219), and broadly tipped white. **Upperwing** Lesser secondary coverts, olive-brown (29) with dark-brown (121) shaft-streak and wavy subterminal bar. Median secondary coverts, olive-brown (29) with 2–3 wavy dark-brown (121) bars, and thin dark-brown (121) shaft-streak. Greater secondary coverts, olive-brown (29) with 1–2 thick, faint dark-brown (121) bars and narrow white tips. Feathers of alula, black-brown (119), with white outer edges and tips. Lesser and median primary coverts, olive-brown (29), finely fringed off-white. Greater primary coverts, black-brown (119), finely tipped white. Primaries, black-brown (119), with fine white tip on p1–p7 and partly concealed white patch half-way down edge of inner web. Outer secondaries, mostly black-brown (119), with thin white tips and broad white bases. Toward innerwing, secondaries have less black-brown as white tips and bases become broader; s9, mostly white with 1–2 black-brown (119) spots c. 1 cm from tip; s10, black-brown (119), broadly fringed white. Bases of secondaries and patches on primaries form white wing-bar on open

wing, broken across primaries. Inner secondaries conspicuously tipped white. Tertiaries, olive-brown (29) with dark-brown (121) shaft-streak, and jagged dark-brown (121) barring along length of feather. **Underwing** Lesser secondary coverts, white. Lesser primary coverts, dark brown (219), narrowly tipped white. Median secondary coverts, dark brown (219), broadly tipped white. Median primary coverts, white with dark-brown (219) base. Dark-brown areas of lesser and median primary coverts and median secondary coverts form narrow dark wing-bar. Greater primary coverts, dark brownish-grey (brownish 83), white tips broadening toward innerwing. Greater secondary coverts, white with dark brownish-grey (brownish 83) bases, which become smaller toward innerwing; innermost feathers, white. Dark-brown areas of greater primary and secondary coverts form second dark wing-bar. Axillaries, white. Outermost primary (p10), dark grey (c83), with white shaft-streak; other primaries, dark grey (c83), with white patch half-way down edge of inner web, which overlaps to form broad white wing-bar. Outer secondaries, mostly dark grey (c83), with thin white tips and broad white bases. Area of dark grey reduced towards innerwing as white tips and bases become larger; s9 white with 1–2 dark-grey (c83) spots, about 1 cm below tip of feather; s10 dark grey (c83), with broad white fringe.

Adult non-breeding (Second and subsequent basic). Differences from adult breeding: **Head and neck** Crown, nape, cheeks and sides of neck less obviously streaked, and supercilium and eye-stripe more pronounced. **Upperparts** Feathers of mantle, upper back and small scapulars, olive-brown (29), with faint dark-brown shaft-streak; when fresh, may have faint dark-brown (219) subterminal bar and thin off-white to pale buff (c123D) terminal fringe. Scapulars, brown (28) with dark-brown (219) subterminal bar and thin off-white to pale buff (c123D) terminal fringe, with faint pairs of dark-brown (219) spots or partial bars along margins of feathers. **Underparts** Little or no streaking on breast; streaks much paler (c119D) than in adult breeding. **Upperwing** Median secondary coverts, olive-brown (30) with broad dark-brown (121) bar, bordered buff (123D) to cream (92); sometimes indistinctly barred dark-brown (121) basally. Tertiaries, brown (28) to olive-brown (29), narrowly fringed cream (92), with very thin dark-brown (121) shaft-streak and broad dark-brown (121) spots or half bars along margins of feathers.

Juvenile Very similar to adult non-breeding, differing by: **Head and neck** Feathers of crown and nape may be finely fringed off-white to buff (123D) when fresh. Supercilium speckled light grey-brown (119D) and may be less distinct. White eye-ring distinct. **Upperparts** On all feathers, dark-brown (219) subterminal bar, and buff (123D) to orange-buff (118) fringe on tips, brighter and more sharply defined. **Underparts** Light grey-brown (119C) feathers on side of breast fringed white. **Upperwing** Bars on lesser and median coverts, narrower and more sharply defined, mostly with two complete bars instead of one. Buff (123D) to orange-buff (118) tips of feathers and barred borders, more distinct. Tertiaries, olive-brown (29) with very small alternating buff (123D) and dark-brown (219) spots along margins of feathers.

First immature non-breeding (First basic). As adult non-breeding but some juvenile inner upperwing-coverts and feathers of back and rump occasionally retained. Primaries and old coverts usually show considerable wear.

First immature breeding (First alternate). Most probably indistinguishable from adult. Generally duller than adult breeding, with greyer upperparts. Dark markings on scapulars,

tertiaries and mantle lighter than adult. Often retain juvenile primaries in innerwing, and worn non-breeding rectrices.

BARE PARTS Based on photos (Farrand 1983; Pringle 1987; Chandler 1989) and descriptions (BWP). **Adult** Iris, dark brown (219). Bill, grey-brown (91) near base, grading to black-brown (119) near tip. Legs, olive-grey (42), often tinged yellow or pink. **Juvenile** Like adult, but with pale base to bill and paler pinkish legs.

MOULTS Based on data collected in n. hemisphere (Dement'ev & Gladkov 1951; Pearson 1975, 1977; BWP), and 28 Aust. skins (HLW, MV). Data from Aust. agrees with that gathered overseas. **Adult post-breeding** (Second and subsequent pre-basic). Complete; primaries outwards. Begins mostly in non-breeding areas, but a few feathers of mantle, sides of breast, scapulars, tertials and tail often moulted on breeding grounds, late June–July; some moult 2–6 inner primaries, suspend moult on s. migration and continue moult in non-breeding areas. Moult of primaries occurs from Sept.–Oct. to late Jan.–Feb. Moult of body active Oct. and Nov. Secondaries replaced inwards from outermost feather. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial. Involves most feathers of body and wing-coverts, but may retain some non-breeding lesser and median coverts and some feathers on back and rump. Active, Feb.–May. **Post-juvenile** (First pre-basic). Complete or almost so. Replace wing-coverts, tail, tertials and plumage of body, Aug.–Dec. **Post-juvenile moult of primaries** (First pre-supplemental). Moult of primaries outwards from p4 or p5 and, in many birds, inner primaries are replaced at same time, possibly in inward sequence; Jan.–Mar. Moult of secondaries proceeds very rapidly, Feb.–Mar., and in random sequence (birds have been seen with seven secondaries missing or only partly grown on each wing). In some locations, a few birds retain inner primaries and a few secondaries. Pearson (1977) considered pattern of juvenile wing-moult intermediate between a normal pre-basic moult (e.g. as in Little Stint *Calidris minuta*) and moult of outer primaries only (e.g. as in Wood Sandpiper *Tringa glareola*). **Immature pre-breeding** (First pre-alternate). Partial. Involves tertials, tail, alula, most wing-coverts and body plumage. Occurs Jan. to early Apr., overlapping with replacement of remiges in post-juvenile moult. Immature and adult pre-breeding moults occur to same extent but differ slightly in timing.

MEASUREMENTS (1) Aust., adult, skins (HLW, MV, QM, SAM, WAM).

	MALES	FEMALES	
WING	(1) 108.8 (3.17; 103–115; 13)	109.2 (3.30; 104–114; 12)	ns
TAIL	(1) 53.2 (2.62; 48–57; 12)	54.8 (2.40; 50–58; 15)	ns
BILL	(1) 25.0 (0.85; 23.9–26.7; 13)	25.2 (0.84; 23.5–26.5; 15)	ns
TARSUS	(1) 24.6 (0.68; 23.8–26.2; 13)	24.6 (0.83; 23.0–25.8; 15)	ns
TOE C	(1) 23.3 (0.90; 21.5–24.9; 12)	23.5 (0.77; 22.2–25.4; 14)	ns

WEIGHTS (1) Aust., adults, label data (QM, SAM, WAM).

	MALES	FEMALES	
(1)	37, 43, 50	43.2 (3.77; 39–48; 4)	ns

(2) Aust., adults, live (ABBBS; principle contributors K.R. Mills & T. Hertog).

UNSEXED			
Aug.–Sept.	(2)	42, 43, 51	
Oct.	(2)	47.1 (6.04; 35–63; 24)	
Nov.–Dec.	(2)	46.2 (3.76; 40–54; 18)	
Jan.–Feb.	(2)	51.3 (6.85; 43–64; 11)	
Mar.–Apr.	(2)	49.4 (8.59; 40–78; 33)	
May	(2)	63, 67	

Range of weights of adults in Aust., Aug.–Sept., similar to that recorded in nw. Africa (44–45); mean weights of adults, recorded Sept.–Jan., similar to those recorded in s. Africa (48.7 [4.2; 44–55; 7]): departure weights recorded in s. Africa, late Mar. to early Apr., 85.2 (10.9; 67–96; 6) were much higher than those of Aust. birds (Dick & Pienkowski 1979; Summers & Waltner 1979).

STRUCTURE Wing, long and pointed. Eleven primaries; p10 longest; p9 1–3 mm shorter, p8 4–8, p7 10–15, p6 18–25, p5 26–31, p4 31–37, p3 37–43, p2 42–48, p1 50–53; p11 minute. Fourteen secondaries, including four tertials; tips of longest tertials fall between p6 and p9 on folded wing. Tail, short and rounded; 12 rectrices; t1 longest, t6 12–15 mm shorter. Bill, straight and slender, about same length as head; slightly laterally compressed; nostril, long and slit-like within long shallow nasal groove about two-thirds length of bill. Tarsus, rather short and slender; scales, scutellate. Tibia, 7–9 mm exposed. Outer toe, 82–86% of middle, inner 73–77%, hind 30–33%.

AGEING Juveniles similar to adult non-breeding but with finer barring on wing-coverts and spotted edges to tertials. Condition of remiges the most obvious guide to age: from Aug. to Dec., juvenile primaries fresh, while primaries of adults worn (Aug.) or in moult (Dec.); from Jan. to Mar., juveniles moulting primaries while adults have new primaries. After moult completed, late Mar.–Apr., immatures similar to adults but plumage slightly duller.

GEOGRAPHICAL VARIATION None.

REFERENCES

- Alcorn, R. 1987. *Stilt* 10: 4–5.
 Amiet, L. 1957. *Emu* 57: 236–54.
 Anon. 1968. *Tasm. Nat.* 12: 3.
 — 1988. *Stilt* 13: 13–14.
 — 1992a. *Stilt* 20: 33–7.
 — 1992b. *Wingspan* 6: 5.
 AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
 AWB. 1993. *A Status Overview of Shorebirds in the East Asian–Australasian Flyway*. Asian Wetland Bureau Internal Rep. 2.
 Badman, F.J., & I.A. May. 1983. *S. Aust. Orn.* 29: 29–39.
 Bamford, M. 1988. *RAOU Rep.* 41.
 Beehler, B.M., et al. 1986. *Birds of New Guinea*. Princeton Univ. Press, Princeton.
 Bell, B.D. 1981. *Notornis* 28: 160.
 Bellingham, M., & A. Davis. 1982. *Notornis* 29: 149.
 Benson, C.W., & M.P.S. Irwin. 1974. *Bull. Br. Orn. Club* 94: 20–1.
 Bergmann, H.-H., & H.-W. Helb. 1982. *Stimmen der Vogel Europas. Gesänge und Rufe von über 400 Vogelarten in mehr als 2000 sonagrammen*. BLV Verlagsgesellschaft, München.
 Berruti, A., & M. Schramm. 1981. *Cormorant* 9: 133–5.

- Brown, B. 1974. *Notornis* 21: 267–8.
- Burger, A.E., et al. 1980. *J. Biogeogr.* 2: 305–10.
- Carruthers, R.K. 1966. *Aust. Bird Watcher* 2: 211–14.
- Chandler, R.J. 1989. *The Macmillan Field Guide to North Atlantic Shorebirds*. Macmillan, Lond.
- Close, D.H., & N. McCrie. 1986. *Emu* 86: 145–54.
- Coates, B.J. 1985. *The Birds of Papua New Guinea*. 1. Dove, Alderley, Qld.
- Congreve, D.P., & P. Congreve. 1985. *RAOU Rep.* 9: 20–42.
- Connor, M.A. 1981. *Aust. Bird Watcher* 9: 32.
- Corben, C. 1972. *Sunbird* 3: 80–4.
- Crawford, D.N. 1972. *Emu* 72: 131–48.
- Curry, P.J. 1979. *West. Aust. Nat.* 14: 112.
- Dann, P., et al. 1994. *Aust. Bird Watcher* 15: 331–65.
- de Schauensee, R.M. 1984. *The Birds of China*. OUP, Oxford.
- Delacour, J., & E. Mayr. 1946. *Birds of the Philippines*. Macmillan, New York.
- Dement'ev, G.P., & N.A. Gladkov (Eds) 1951. *Birds of the Soviet Union*. Israel Prog. Scient. Trans., Jerusalem (1969).
- Dick, W.J.A., & M.W. Pienkowski. 1979. *Ornis scand.* 10: 117–23.
- Draffan, R.D.W., et al. 1993. *Emu* 83: 207–33.
- Edgar, A.T. 1969. *Notornis* 16: 202–3.
- Farrand Jr, J. 1983. *The Audubon Society Master Guide to Birding*. 1. Knopf, New York.
- Fleming, C.A. 1973. *Notornis* 20: 78–9.
- Garnett, S. 1989. *RAOU Rep.* 58.
- , & J. Cox. 1983. *Birds of the Townsville Town Common*. Qld NPWS, Townsville.
- , & R. Bredl. 1985. *Sunbird* 15: 6–23.
- Gartshore, N.A. 1987. *Cormorant* 15: 48–58.
- Gibson, D.F. 1986. *Cons. Comm. North. Terr. Tech. Rep.* 30.
- Gibson-Hill, C.A. 1949. *Ibis* 91: 221–43.
- 1950. *Bull. Raffles Mus.* 22: 213–70.
- Gill, H.B. 1970. *Emu* 70: 97–104.
- Glutz von Blotzheim, U.N., et al. (Eds) 1977. *Handbuch der Vögel Mitteleuropas*. 7. Akademische Verlagsgesellschaft, Frankfurt.
- Gore, M.E.J., & P.O. Won. 1971. *Birds of Korea*. Roy. Asiatic Soc., Seoul.
- Hails, C., & F. Jarvis. 1987. *Birds of Singapore*. Times Edns, Singapore.
- Harvey, D., & J. Elkin. 1991. *Stilt* 18: 29–37.
- Haselgrove, P. 1975. *Sunbird* 6: 32–41.
- Hayman, P., et al. 1986. *Shorebirds*. Croom Helm, Lond.
- Hermes, N., et al. 1986. *Notornis* 33: 141–9.
- Hewish, M.J. 1986. *Stilt* 9: 21–9.
- 1987a. *Stilt* 11: 18–22.
- 1987b. *Stilt* 11: 23–31.
- 1988. *Stilt* 14: 14–20.
- 1989. *Stilt* 15: 13–15.
- 1990. *Stilt* 16: 23–35.
- Hicks, R.K. 1990. *Muruk* 4: 91–105.
- Horton, W. 1975. *Sunbird* 6: 49–69.
- Hui, W. 1992. *Stilt* 20: 48–50.
- Jaensch, R.P., & L.A. Jaensch. 1987. *S. Aust. Orn.* 30: 60–1.
- , et al. 1988. *RAOU Rep.* 30.
- Johnson, R. 1990. *Stilt* 17: 74.
- Kitchener, D.J., et al. 1975. *Rec. West. Aust. Mus. Suppl.* 1.
- la Touche, J.D.D. 1931–34. *Birds of Eastern China*. 2. Taylor & Francis, Lond.
- Lekagul, B., & P.D. Round. 1991. *The Birds of Thailand*. Saha Karn Bhaet, Bangkok.
- Longmore, N.W. 1978. *Sunbird* 9: 25–53.
- Loyn, R. 1975. *Report on the Avifauna of Westernport Bay*. Rep. Westernport Environ. Study; Vic. Ministry Conserv., Melbourne.
- Martindale, J. 1980. *RAOU Rep.* 1: 4–40.
- McClure, H.E. 1974. *Migration and Survival of the Birds of Asia*. US Army, Bangkok.
- McGarvie, A.M., & M.T. Templeton. 1974. *Emu* 74: 91–6.
- McKean, J.L., & K.A. Hindwood. 1965. *Emu* 64: 79–97.
- McLennan, W. 1917. *Emu* 16: 205–31.
- Medway, D.G. 1974. *Notornis* 21: 387–9.
- Medway, Lord, & D.R. Wells. 1976. *Birds of the Malay Peninsula*. 5. Witherby & Witherby, Lond.
- Melville, D.S. 1980. *Birds at Kai Tak Airport, Hong Kong*. Agric. and Fish. Dept, Hong Kong.
- Naismith, L. 1992. *Stilt* 21: 6–7.
- Nethersole-Thompson, D., & M. Nethersole-Thompson. 1986. *Waders: Their Breeding, Haunts and Watchers*. Poyser, Calton.
- Noske, R. 1975. *Aust. Birds* 10: 1–9.
- Pangelly, W.J., et al. 1965. *Notornis* 12: 107–8.
- Pearson, D.J. 1975. *Wader Stud. Grp Bull.* 12: 6–14.
- 1977. *Scopus* 1: 89–94.
- Pratt, H.D., et al. 1987. *A Field Guide to the Birds of Hawaii and the Tropical Pacific*. Princeton Univ. Press, Princeton.
- Pringle, J.D. 1987. *Shorebirds of Australia*. Angus & Robertson, Sydney.
- Reed, J. 1952. *Emu* 52: 215–6.
- Roberts, G.J. 1979. *The Birds of South-east Queensland*. Qld Conserv. Council, Brisbane.
- Schodde, R. 1976. *A Survey of the Fauna of the Lower McArthur River Region, Northern Territory*. CSIRO Div. Wildl. Res. for Mimites D'ment, Canberra.
- Sedgwick, E.H. 1978. *West. Aust. Nat.* 14: 55–108.
- Serventy, D.L., & H.M. Whittell. 1976. *Birds of Western Australia*. Univ. West. Aust. Press, Perth.
- Sibson, R.B. 1982. *Notornis* 29: 47–8.
- , & J.A.F. Jenkins. 1978. *Notornis* 25: 253–4.
- Smith, F.T.H. 1964. *Aust. Bird Watcher* 2: 70–84.
- 1966. *Aust. Bird Watcher* 2: 246–66.
- Smythies, B.E. 1981. *The Birds of Borneo*. Sabah Soc. & Malayan Nat. Soc., Sabah & Kuala Lumpur.
- 1986. *The Birds of Burma*. Nimrod Press, England.
- Stahl, J.-C., et al. 1984. *Gerfaut* 74: 39–46.
- Start, A.N., & P.J. Fuller. 1983. *Wildl. Res. Bull. West. Aust.* 12: 94–108.
- Stokes, T. 1988. *Aust. Nat. Parks Wildl. Serv. Occ. Pap.* 16.
- , et al. 1984. *Emu* 84: 23–8.
- Storr, G.M. 1980. *Spec. Pubs West. Aust. Mus.* 11.
- 1984. *Rec. West. Aust. Mus. Suppl.* 16.
- 1986. *Rec. West. Aust. Mus. Suppl.* 26.
- Summers, R.W., & M. Waltner. 1979. *Ostrich* 50: 21–36.
- Thomas, T. 1983. *Oiseau Revue fr. Orn.* 53: 133–44.
- Townsend, S. 1978. *Aust. Bird Watcher* 7: 278–9.
- Urban, E.K., et al. 1986. *The Birds of Africa*. 2. Academic Press, Lond.
- van Marle, J.G., & K.H. Voous. 1988. *BOU Checklist* 10.
- van Someren, G.R.C. 1973. *Bull. Br. Orn. Club* 93: 39–40.
- van Tets, G.F. 1983. In: *Preservation of the Abbott's Booby on Christmas Island, Australia*. Senate Standing Comm. Sci., Tech. & Environ., Canberra.
- Wall, L.E. 1965. *Emu* 64: 151–3.
- 1969. *Tasm. Nat.* 19: 3.
- Watkins, D. 1993. *RAOU Rep.* 90.
- White, C.M.N., & M.D. Bruce. 1986. *BOU Checklist* 7.



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Volume 3, Plate 11

Solitary Sandpiper *Tringa solitaria* (page 157)
 1 Adult breeding; 2 Adult non-breeding; 3 Juvenile; 4, 5 Adult

Wood Sandpiper *Tringa glareola* (page 158)
 6 Adult breeding; 7 Adult non-breeding; 8 Juvenile; 9, 10 Adult

Common Sandpiper *Actitis hypoleucos* (page 173)
 11 Adult breeding; 12 Adult non-breeding; 13 Juvenile; 14, 15 Adult