Order CHARADRIIFORMES

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

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

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

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

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

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

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

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

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Family CHARADRIIDAE plovers and lapwings

Small to medium-sized, mostly terrestrial, waders of open habitats. About 65 species, placed in varying number of genera. Evidently monophyletic by behaviour and structural characters. Distributed worldwide and separable into two distinct sub-families: Charadriinae (plovers) and Vanellinae (lapwings), both of which are represented in HANZAB region and are discussed in more detail below. Most closely related to Recurvirostridae, Haematopodidae and possibly Burhinidae (Sibley & Ahlquist 1990; Christian *et al.* 1992).

Bodies, compact. Size differences between sexes negligible; sometimes males and sometimes females slightly larger. Necks, short and thick; 15 cervical vertebrae. Wings, long and usually pointed but rounded in some lapwings; 11 primaries, p11 minute; 14–19 secondaries. Tails, short to medium-long, square or rounded; 12 feathers. Bill, short, somewhat swollen at tip and narrower centrally; no sensitive nerve-endings at tip and prey located by sight rather than touch. Nostrils, holorhinal, impervious, slit-like. Head, rounded; forehead steep and broad. Legs, fairly short or medium in length; bare part of tibia short; tarsi, reticulated, rarely with some transverse scutes. Usually three, rather short toes, slightly webbed at base in some plovers; no hind toe in most plovers and in some lapwings; hallux, short and vestigial if retained. No crop. Caeca present. Eyes large. Supraorbital salt-glands, often large; size related to salinity of habitat and influences structure of skull and appearance of head. Plane of *foramen magnum* of occiput nearly horizontal.

Plumages generally boldly patterned in brown, olive-grey, black and white; markings often have cryptic disruptive effect. Bill, bicoloured in some species, especially plovers. Stance erect with head held high. Fast runners for good distances but often proceed in short bursts with halts, especially when feeding. Post-breeding moult complete; primaries outwards; pre-breeding moult varies considerably. Young, precocial, nidifugous and always feed themselves; down of pebbly-pattern type (Fjeldså 1977).

See accounts of sub-families (below) for additional details.

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Sub-family CHARADRIINAE plovers

Generally small birds, usually smaller than lapwings (Vanellinae). Apparently a monophyletic assemblage. About 40 species in five (Voous 1973; Strauch 1978; BWP) to 10 genera (Sibley & Ahlquist 1990; Sibley & Monroe 1990; Christian *et al.* 1992), with most species in two genera, *Pluvialis* and *Charadrius*, and varying number of genera composed of only one or a few species (e.g. *Anarhynchus*, *Phegornis*, *Thinornis*, *Elseyornis*). The affinities of *Phegornis* (Diademed Sandpiper-plover of South America) have not been resolved (Sibley & Monroe 1990). Recent studies of allozymes of Aust. plovers and lapwings (Christian *et al.* 1992) indicate that Red-kneed Dotterel *Erythrogonys cinctus* is a lapwing (Vanellinae; q.v.).

We recognize the following genera within the Charadriinae in HANZAB region:

Pluvialis. Two regular non-breeding migrants (*fulva*, *squatarola*), two doubtfully recorded (*dominica*, *apricaria*). We follow Connors *et al.* (1983, 1993) and treat *fulva* and *dominica* as full species.

Charadrius. Four breeding species (*obscurus*, *ruficapillus*, *bicinctus*, *australis*), six non-breeding migrants (*hiaticula*, *dubius*, *mongolus*, *leschenaultii*, *asiaticus*, *veredus*), one accidental (*tricollaris*); one doubtfully recorded (*alexandrinus*). Inland Dotterel *C. australis* is a typical *Charadrius* plover (Maclean 1976; Christian *et al.* 1992 *contra* Jehl 1968); we follow NZCL in placing New Zealand Dotterel in *Charadrius*.

Thinornis. Two endemic species: *novaeseelandiae* and *rubricollis*.

Allozymes of *rubricollis* form a cluster (with *Elseyornis melanops*) well separated from those of typical *Charadrius*; placed in *Thinornis* on basis of similarities in morphology (Christian *et al.* 1992) and behaviour (Phillips 1980).

Elseyornis. Single species *melanops*, endemic to Aust. Allozymes, with those of *Thinornis rubricollis*, well separated from *Charadrius* (Christian *et al.* 1992).

Anarhynchus. Single species *frontalis*, endemic to NZ.

Thus, in HANZAB region, eight breeding species, eight non-breeding migrants, and four accidental or not acceptably recorded.

General features of the sub-family are outlined under Charadriidae. The plumages of *Pluvialis* are spangled in white or gold and black above, black below when breeding, and never with white band across nape; plumages of *Charadrius* and other genera in general plain brownish above and white below, boldly marked with black on face and head, at least when breeding;

usually with one or two black or chestnut bands across breast and often with white band across nape. Two moults per cycle: complete post-breeding moult, primaries outwards; and partial pre-breeding moult, which often brings in much brighter breeding plumage; supplemental plumage occurs in at least one species (Eurasian Golden Plover *Pluvialis apricaria*). Down of pebbled pattern (Jehl 1968; Fjeldså 1977, 1988; BWP). Juvenile plumage duller than adults in most species, with pale dorsal scalloping. Adult plumage attained at 1–2 years. Most probably first breed at 1–2 years, maturity perhaps delayed further in some migratory species (e.g. Grey Plover *Pluvialis squatarola*).

Inhabit open places; when not breeding, many are typically birds of ocean beaches, coastal mudflats and estuaries; others use rivers and freshwater wetlands, often ephemeral; still others characteristic of dry habitats, including gibber plains, grasslands and steppes. Breeding may occur in any of these habitats, or in tundra or high-altitude moorlands. Most species probably migrate to some extent; about 15 species are long-distance transequatorial migrants. Diet consists of terrestrial and coastal invertebrates. When foraging, tend to spread out and feed separately over wide area, rather than feeding in flocks as do many scolopacids. In general, gregarious but less so than many scolopacids. Roost communally. Usually territorial when breeding; some species may defend feeding territories in wintering areas. Various mating systems recorded in different species: monogamy, polyandry (associated with sexual reversals), polygyny and polygamy. While breeding, generally rather aggressive, defending and advertising territories with displays on the ground and in the air, often with butterfly-like flights and song (long melodious trills). Courtship and mating behaviour often complex or stereotyped. Anti-predator strategies, injury-feigning and distraction displays generally elaborate and well developed. Most vocal during breeding season with variety of peeps, trills and mellow or liquid whistles.

Breed seasonally. Nest, a simple scrape on the ground, sparsely lined with plant stems, grasses and other objects; in open, often unvegetated places. Several scrapes may be prepared by male and one then selected by female. Eggs, oval, short oval or even somewhat pyriform; smooth, not glossy; ground-colour, buff, brown or grey, heavily blotched and spotted dark, well camouflaged. Clutch-size, 2–4, often consistently of one size in a species (e.g. two in *C. ruficapillus*). Laying at intervals of 24–60 h. Replacement laying, up to several times. Incubation by both sexes in monogamous species but share varies and is by male alone in Eurasian Dotterel *Eudromias morinellus*, the only plover in which female more brightly coloured than male. Incubation period, 24–31 days. Young hatched in natal down; precocial, nidifugous. Usually tended by both parents but feed themselves from hatching. Fledge in 3 (smaller species) to 5 (larger species) weeks.

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Pluvialis fulva Pacific Golden Plover

COLOUR PLATE FACING PAGE 777

Charadrius fulva Gmelin, 1789, *Syst. Nat. ed.* 13 1(2): 687 — Tahiti, based on Fulvous Plover of Latham, 1785, *Syn.* 3: 211.

Pluvialis is the adjectival form of the Latin *pluvia* (rain). Why it was given to this genus of waders is not known, but suggestions are that it refers to the plumage, dappled as if after rain; to the migratory habits to avoid rain; or to its wet habitats. *Fulva* in Latin means 'tawny' or 'yellowish brown', describing the general appearance.

OTHER ENGLISH NAMES Eastern, Lesser, Asiatic, and Least Golden Plover.

MONOTYPIC

FIELD IDENTIFICATION Length: 23–26 cm; wingspan: 60–72 cm; weight: 120–175 g. Medium-sized plover, with rounded head, slim neck, short fine bill, rather long legs and generally upright stance; noticeably smaller and slimmer than Grey Plover *Pluvialis squatarola*; very similar to American Golden Plover *Pluvialis dominica*. Much individual variation in plumages, all typically with golden-buff tone. Sexes similar; female may be separable in full breeding plumage (see Plumages). Juveniles and first-year birds separable.

Description Adult breeding Crown, upperparts and tertials, black, boldly spotted and notched golden, with some buff-white

Plate 63

Kentish Plover *Charadrius alexandrinus* (page 836)
1 Adult male breeding; **2** Adult female breeding; **3** Adult non-breeding; **4** Juvenile; **5, 6** Adult non-breeding

Red-capped Plover *Charadrius ruficapillus* (page 836)
7 Adult male breeding; **8** Adult female; **9** Downy young; **10** Juvenile, in fresh plumage; **11** First immature (first basic); **12, 13** Adult male

spotting. Tail, dark brown with golden-buff bars. Most secondary coverts, like upperparts but spots mostly whitish, usually contrasting with more golden mantle and scapulars; usually retain some old grey-brown non-breeding feathers among secondary coverts, and sometimes on scapulars and tertials. In flight from above, remiges, greater coverts and leading-edge of inner wing dark brown, contrasting with spotted upperparts, with thin inconspicuous pale wing-bar across tips of greater-coverts. Narrow frontal band, lores, sides of head, chin, throat, foreneck and most of underparts, black, bordered by white band, curving behind ear-coverts and down sides of neck, joining white patch on sides of breast; typically, broad white line, varyingly barred with black, continues along flanks; under tail-coverts, black centrally, white at sides, barred and spotted black; some show only sparse white mottling along flanks and a few wholly black flanks and under tail-coverts. Axillaries and underwing, appear uniform brownish-grey. Bill, black. Iris, dark brown. Legs and feet, greyish black. **Adult non-breeding** Crown, dark brown, streaked golden-buff or yellow; slightly paler on nape and hindneck. Upperparts and most inner wing-coverts, dark brown, heavily spotted bright golden-buff and usually appearing more scaly than in breeding plumage; secondary coverts mostly spotted white, contrasting with golden-spotted mantle and scapulars. Forehead, lores, supercilium, chin, throat and sides of head, typically golden-buff to creamy buff; paler, whitish round base of bill; pale area round eye between dusky loral streak and spot on lower ear-coverts. Foreneck and breast, typically golden-buff when fresh, streaked grey-brown on foreneck and barred and finely streaked grey-brown on breast, streaks continuing on flanks; belly, flanks, vent and undertail, white with buff tinge, contrasting with breast; when worn, buff tones reduced, and foreneck and breast appear duller, more uniform greyish buff. Rest of plumage and bare parts as breeding. **Juvenile** Very similar to fresh adult non-breeding but with neater, bolder, more even patterning to feathers; underparts more distinctly patterned, with streaking on foreneck and barring or marbling on breast and down flanks. Typically, upperparts evenly coloured and heavily spotted bright golden-buff, often with wing-coverts spotted white and contrasting with mantle and scapulars; supercilium, face, neck and breast, golden buff; contrast between yellowish breast and white belly, or yellowish extends farther down belly. A few have duller, or white, spotting on upperparts and head, and dull whitish face, neck and breast, with little or no yellow tones; appear much duller greyish, recalling juvenile and non-breeding Grey Plover and, especially, American Golden Plover. Wear and fading reduces golden tones and can produce similar greyish appearance or, when very worn, even black-and-white appearance (these individuals often mistaken for juvenile American Golden Plover): mantle and scapulars, very dark, almost blackish; clear whitish supercilium and, sometimes, paler nape and hindneck contrasting with very dark mantle, and emphasizing dark cap; breast, streaked darker, rather sharply demarcated from white belly. After Nov., juvenile plumage difficult to distinguish. **First immature** Distinguished from adult non-breeding only by retained juvenile wing-coverts and tertials, contrasting with fresh scapulars with golden-buff spots or fringes; on tertials, pale notches of retained juvenile tertials often largely worn away, leaving sawtooth indentations along edge of feather; some retain trace of juvenile barring on sides of breast and belly. **Second immature** Some like first immature; many gain varying amount of blackish feathering like that of breeding plumage, such as scattered black mottling on belly; probably most do not attain fully blackish underparts.

Similar species Most likely to be confused with juvenile and non-breeding **Grey Plover**, which is larger and bulkier, with plumper, more hunched outline and more horizontal stance; bigger head, larger eye and shorter legs; and heavier bill, with more obviously swollen tip; tertials relatively shorter, falling well short of tip of tail (on Pacific, longest tertial falls level with or only slightly short of tip); actions more lethargic. In flight, Grey separated by bold white rump, stronger white wing-bar, and black axillaries contrasting with otherwise white underwing; and usual flight call clearly different. In all plumages, greyer, without obvious golden tones. In breeding plumage, upperparts coarsely spotted white; cap and hindneck, much paler whitish, extending into larger bulging white patches at sides of breast; flanks, black, sometimes with scattered white patches; and mostly white lower belly, vent and undertail. Confusion more likely between duller and greyer-toned juveniles and non-breeding Pacific Golden and Grey, which best distinguished by differences in size and structure (above); less capped appearance; less well-defined supercilium; tend to show continuous diffuse dark patch through eye to rear ear-coverts; non-breeding plumage paler and greyer, with more diffuse white spotting above; fresh-plumaged juvenile has foreneck, breast and flanks more clearly streaked (less barred).

American Golden Plover very similar in all plumages; individual variation in both species results in almost complete overlap in all plumages, with some inseparable on plumage (see Recognition). Identification depends on assesment of slight differences in structure, most important of which are projection of primaries and relative positions of tips of wing, tail and longest tertial. On American, primary projection beyond tip of tail usually much longer than that of Pacific, with typically four (even 5–6) primary-tips visible beyond tip of longest tertial; exposed primaries about equal in length to tertials, tips of which fall well short of tip of tail. Pacific has slightly shorter wings, with usually three (2–4) closely spaced primary-tips visible beyond tip of longest tertial; tip of longest tertial falls level with or slightly short of tip of tail, thus exposed primaries only about quarter to half length of overlying tertials; tips of longest two primaries fall very close together on Pacific and may not be discernible. These differences apply only to birds that are not moulting. American appears slightly larger and fuller-bodied, with proportionately slightly shorter, heavier bill and slightly shorter legs; and more attenuated rear-end. In American, toes often do not project beyond tip of tail in flight (normally do so on Pacific). In **adult breeding** plumage, typical American Golden Plover differs by: upperparts and wing-coverts, darker, more finely spangled, with no contrast between coverts and upperparts; black frontal band thicker; white patches at sides of breast, larger, more bulging; and flanks, belly, vent and under tail-coverts, black. In **juvenile and non-breeding plumages**, typically appear colder and greyer; ground-colour of upperparts, grey-brown (non-breeding) or blackish (juvenile), with less distinct buff-white spotting, though often with pale-yellow tones on wing-coverts, rump and upper tail-coverts; strikingly grey-faced, with heavy dark streaking on crown, giving strongly capped appearance, which contrasts with much paler and plainer nape and hindneck and broad whitish supercilium; dark loral smudge more prominent and continues behind eye as

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Plate 64

Double-banded Plover *Charadrius bicinctus* (page 847)
1 Adult breeding male; **2** Adult breeding female; **3** Adult non-breeding; **4** Downy young; **5** Juvenile; **6, 7** Adult non-breeding

Wrybill *Anarhychus frontalis* (page 919)
8 Adult male breeding; **9** Adult female breeding; **10** Adult non-breeding; **11** Downy young; **12** Juvenile; **13, 14** Adult female breeding

prominent narrow dark stripe joining dark patch on ear-coverts, these markings giving more contrasting facial pattern and accentuating supercilium; ground-colour of foreneck, breast and flanks, brownish grey (non-breeding) or white (juvenile), not tinged golden; more delicate grey barring on underparts of juvenile, extending down flanks and onto upper belly. Some fresh juveniles have brighter yellowish-buff spangling above but usually lack strong yellowish tone to supercilium, face, neck and breast. Usual flight calls of American also said to differ; see Alström (1990).

Seen singly, though more usually in small parties or large loose flocks. Mainly coastal, occurring on estuaries, intertidal mudflats, rocky reefs, beaches and saltmarshes; occasionally far inland. Form large communal roosts, often beside but separate from other waders. Shy and wary. Feed in typical stop-start fashion of plovers. Stance generally upright. Flight, strong and swift, more agile than Grey Plover. Normal flight call disyllabic whistling note; sometimes more drawn-out, with stress very clearly on second syllable, recalling Grey-tailed Tattler *Heteroscelus brevipes*.

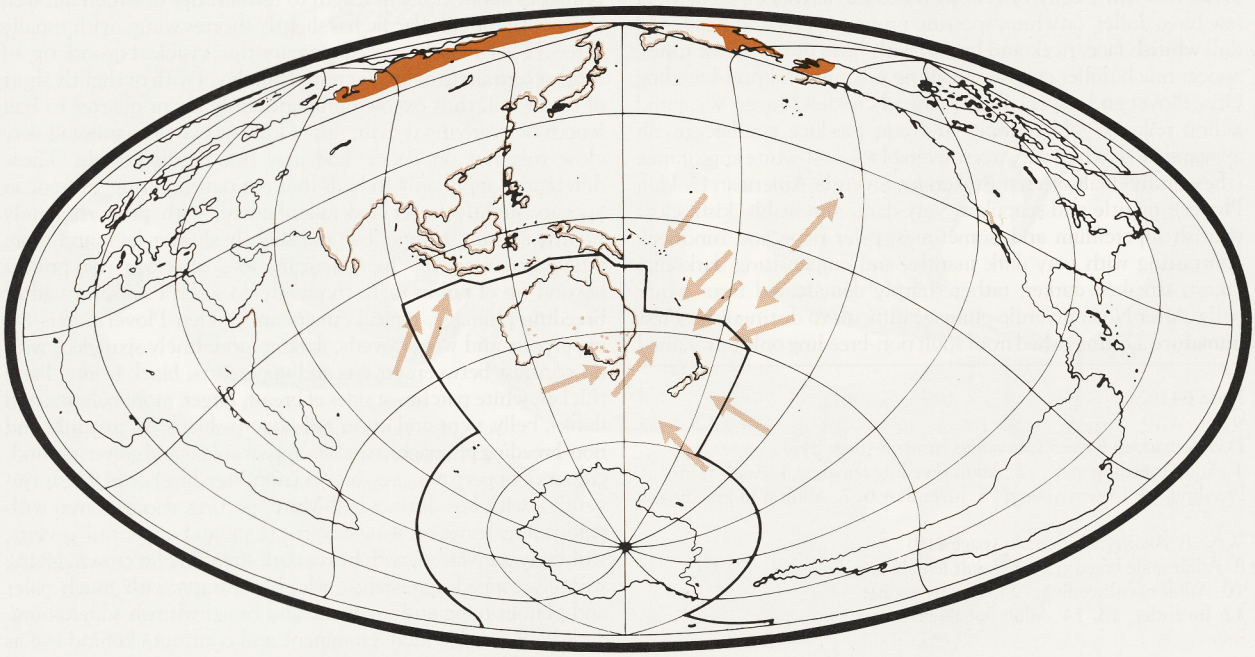
HABITAT Sandy, muddy or rocky shores, estuaries and lagoons, reefs, saltmarsh, and short grass in paddocks and crops. Usually coastal, including offshore islands; rarely far inland.

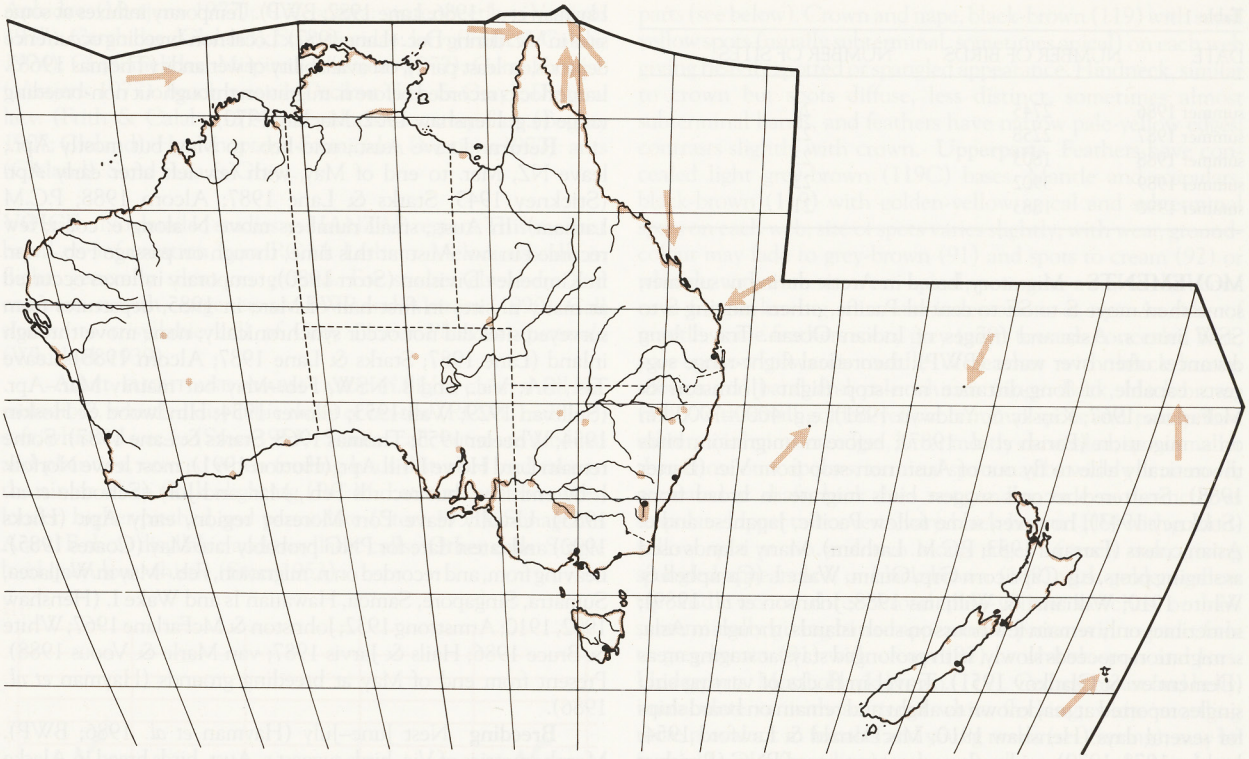
Often on beaches and mudflats, sandflats and occasionally rock shelves, or where these substrates intermingle; harbours, estuaries and lagoons (Thomas 1968; Pegler 1980, 1983; Patterson 1982; Park 1983; Chafer 1989;); islands, including sand and coral cays, and artificial islands; exposed reefs, wave-cut platforms and exposed rocks; rocky points, islets (Hogan 1925; Hindwood & Hoskin 1954; Merton 1970; Domm & Recher 1973; Bransbury 1985; Morris 1989; Vic. Bird Rep. 1987); among mangroves or on seagrass beds (Glover 1954; Ewart 1973; Bamford 1988). Terrestrial subcoastal wetlands such as fresh, brackish or saline lakes, billabongs, pools and swamps, usually with muddy margins and often with submerged vegetation or short emergent grass; margins of reservoirs; wet claypans. Also on saltmarsh, usually with low or sparse growth of *Sarcocornia*; saltworks (Storr 1965; Smith 1966b; Thomas 1968; Robertson & Dennison 1979; Wakefield 1984; Storr & Johnstone 1988). Rarely inland wetlands (Sibson 1946; Storr 1965; Bravery 1970; Gibson 1977; Robertson & Dennison 1979; Boekel 1980; Wakefield 1984; Leach & Hines 1987; Bamford 1988; Jaensch *et al.* 1988; Storr & Johnstone 1988). Grasslands, such as paddocks, grazed pastures, and crops (green or cereal), sometimes with high grass, but more often short sparse growth; sometimes ploughed or recently burnt; may be well away from water; grassy areas of airstrips (Sibson 1946; Hindwood & Hoskin 1954; Edgar *et al.* 1965; Smith 1966a,b; McKenzie 1967; Bravery 1970; Merton 1970; Forshaw & Muller 1978; Robertson & Dennison 1979; Park 1983).

Roost near feeding areas, on sandy beaches and spits, and rocky points, islets and exposed reefs; sometimes under shrubs and trees at top of beach; among vegetation in backing dunes; among beachcast seaweed; on levees and edges of small islands in saltworks; also on low saltmarsh up to 1.6 km from coast and on top of low mangroves (Smith 1966b; Thomas 1968; Ewart 1973; Evans 1975; Robertson & Dennison 1979; Pegler 1980, 1983; Patterson 1982; Bransbury 1985; Prendergast 1985; M.J. Hewish; R.H. Loyn).

Use many artificial or modified habitats for feeding and roosting. Said to have benefited from conversion of swampy areas next to feeding sites to paddocks (McKenzie 1967). Low-density residential development has destroyed some roosting and feeding sites (Newman & Fletcher 1981; Chafer 1989).

DISTRIBUTION AND POPULATION Breed w. Alaska, from C. Prince of Wales, S to Kuskowim R., including St Lawrence and Nanivak Is, and in n. Siberia from Chukotsky Pen. and Gulf of Anadyr, W to Yamal Pen. Breed N to 76°N, on Taimyr Pen. and O. Vrangelya, and S to 68–70°N, though as far as 55°N in E along w. coast of Kamchatka Pen. (P. Tomkovich). During non-breeding season, occur in ne. Africa and Red Sea, and over most of Asia, from Indian subcontinent, E through Burma and SE Asia to China, Korean Pen., Japan and Mongolia; also Indonesia, New Guinea, Aust., NZ and islands of Pacific Ocean. Regular in small numbers in s. California; accidental to inland w. USA, Chile, Greenland, n. and w. Europe and Mediterranean coasts and C. Verde Is (Dement'ev & Gladkov 1951; AOU 1983; Connors 1983; Knox 1987; BWP).





Aust. Qld Widespread along entire coastline (Storr 1984; Aust. Atlas); scarce inland, e.g. Charters Towers, Mt Isa, L. Muncoonie (Horton 1975; Qld Bird Reps 1985–88; Aust. Atlas). **NSW** Widespread in coastal regions. Sporadic records W of Great Dividing Ra., from Western Slopes, Riverina, SW, and Upper Western region (Hobbs 1961; Schmidt 1978; Morris *et al.* 1981; NSW Bird Reps; Aust. Atlas). **Vic.** Scattered records between Gabo I. and Ls Entrance; mostly between Jack Smith L. and Port Phillip Bay, including Westernport Bay; few records on w. coast, except for congregation between Warrnambool and Port Fairy. Occasional inland records from lakes in W. District; recorded in n. and Mallee regions at Toolamba, L. Tutchewop and near Mildura (Sonter *et al.* 1984; Vic. Bird Reps; Vic. Atlas). **Tas.** Mainly in E, E of line between Moorlands Pt, through central lakes, to Bruny I. (Thomas 1979; Tas. Bird Reps). Scattered records W of this line, from Flowerdale, round Stanley and Kangaroo I. (Thomas 1979; Tas. Bird Reps 9, 20); on w. coast, recorded round Strahan and Queenstown (Thomas 1979; Tas. Bird Rep. 2). Occasionally recorded on King and Flinders Is (McGarvie & Templeton 1974; Sedgwick 1976; Green & McGarvie 1979; Milledge 1983; Newman *et al.* 1984; Schulz 1990). **SA** Many records between SE and Streaky Bay, including Adelaide plains and Yorke Pen.; several records in Riverland district. Vagrant inland at Algebuckina (*c.* 60 km S of Oodnadatta), L. Everard Stn and L. Goyder (Boehm 1964; Eckert 1974; Badman & May 1983; Joseph & Black 1983; Sonter *et al.* 1984; SA Bird Reps; Aust. Atlas). **WA** Rarely, between Eyre and Esperance (Storr 1987); widespread but patchily distributed from Albany to nw. Kimberley Division; rarely E to Ord R. (Aust. Atlas). Occasional inland records, e.g. L. Violet, Malcolm Dam (Curry 1979; Aust. Atlas). Considered uncommon but possibly regular visitor to Rottnest I. during 1950s; rare in 1980s (Storr 1965; Saunders & de Rebeira 1986). **NT** Regular visitor to coastal Top End between Darwin and Borroloola (Storr 1977; Thompson & Goodfellow in prep.). Few inland records, including Tennant Ck, Larrimah, Racecourse Billabong, Mataranka and Ngukurr (Whitbourn 1963; Boekel 1980; Aust. Atlas).

NZ Widespread, mainly near coasts (information from P.C.M. Latham and B.D. Heather). **NI** Regular at many coastal localities, especially Parengarenga, Houhora, Rangaunu, Whangarei, Kaipara and Manukau Harbours, Firth of Thames, Tauranga Harbour, Maketu–Little Waihi, Ohiwa Harbour, Muriwai Lagoon (Gisborne), Wairoa, Ahuriri Estuary (Napier), L. Wairarapa, Manawatu R. estuary. Recorded inland at L. Rerewhakaeitu. **SI** Regular at scattered coastal sites; mostly recorded Farewell Spit, L. Ellesmere, estuary of Mataura R., Waituna Lagoon, Awarua Bay, estuary of Oreti R.

Lord Howe I. Most common shorebird (Hutton 1991).

Norfolk I. Common; most widespread migratory wader (Schodde *et al.* 1983).

Christmas I. (Ind.) Regular migrant (van Tets 1983; Stokes 1988).

Cocos-Keeling Is Regular visitor in small numbers (Gibson-Hill 1949, 1950; Stokes *et al.* 1984).

Kermadec Is Regularly recorded Raoul I.; also Meyer and Macauley Is (Sorensen 1964; Edgar *et al.* 1965; Merton 1970; Morrison 1979; Oliver).

Chatham Is Unknown number, Jan. 1975 (CSN 22); two, Nov. 1978 (CSN 28).

Auckland Is Straggler (NZCL; Oliver).

Population Aust. Estimated *c.* 9000 (D. Watkins). Sites of significance and maximum or average counts from summer and winter surveys round Aust. between 1981 and 1985 were: se. corner of Gulf of Carpentaria, Qld, 1370; Eighty Mile Beach, WA, 440; Hunter R. estuary, NSW, 410; N. coast, NSW, 390; Moreton Bay, Qld, 360; The Coorong, SA, 290; Port Phillip Bay, Vic., 220; Botany Bay, NSW, 210; se. coast, SA, 200 (Lane 1987). Totals for summer counts between 1986 and 1990 in Aust. summarized in Table 1 (Hewish 1986, 1987, 1989a, 1990; Anon. 1992b). **Norfolk I.** Estimated at 1000 in Feb. 1973 (de Ravin 1975).

Table 1

DATE	NUMBER OF BIRDS	NUMBER OF SITES
summer 1986	2745	23
summer 1987	2258	22
summer 1988	1803	23
summer 1989	3902	22
summer 1990	1883	21

MOVEMENTS Migratory; breed in Arctic during n. summer; some then move S to SE to central Pacific, others moving S to SSW into s. Asia and fringes of Indian Ocean. Travel long distances often over water (BWP); theoretical flight-range suggests capable of long-distance non-stop flight (Johnston & McFarlane 1967; Kinsky & Yaldwyn 1981), e.g. 4000–7000 km on s. migration (Parish *et al.* 1987); before n. migration, birds theoretically able to fly out of Aust. non-stop from Vic. (Barter 1988). Scattered records suggest birds migrate in broad front (Stickney 1943); however, some follow Pacific, Japanese and e. Asian coasts (Farrand 1983; P.C.M. Latham). Many islands used as staging posts, e.g. Capricorn Grp, Guam, Wake I. (Campbell & White 1910; Williams & Williams 1988; Johnson *et al.* 1989); sometimes only remain few hours on such islands, though in Asia, s. migration proceeds slowly, with prolonged stays at staging areas (Dement'ev & Gladkov 1951). Travel in flocks of varying size; singles reported at sea; known to alight and remain on board ships for several days (Henshaw 1910; MacDonald & Lawford 1954; Jenkins 1978, 1979); said to fly over mountains of PNG (Parish *et al.* 1987) though little hard evidence (Heron 1978).

Departure Non-breeders, mid-July; breeding adults, Aug.; juveniles, Sept. (Kinsky & Yaldwyn 1981; BWP). On Pribilof Is: adults leave Aug., juveniles in Sept. (BWP). Adults arrive Hawaiian Is and Guam, mid-Aug. to mid-Sept. and juveniles from end Sept. but mostly Oct. (Henshaw 1910; Williams & Williams 1988; Johnson *et al.* 1989); birds move through Wake I., late July–Aug. (Johnston & McFarlane 1967). On s. migration, generally recorded Aug.–Nov. in Korea, Mongolia, Japan, coastal and inland China, Taiwan, Burma, Philippines, Singapore, Borneo and Sumatra (la Touche 1931–34; Gore & Won 1971; Smythies 1981; Hails & Jarvis 1987; van Marle & Voous 1988; also see Dement'ev & Gladkov 1951). Numerous records Dec. onwards in Wallacea (White & Bruce 1986). Arrive Port Moresby, early Aug. (Hicks 1990); earliest date for PNG probably late July (Coates 1985). In Aust., generally move S along e. coast, Sept.–Nov. (Lane 1987), some using inland routes (Aust. Atlas). Arrive on e. coast (from Torres Str., S at least as far as Mackay) in late Aug., Sept. and Oct. and arrive in s. NSW and Lord Howe I., Vic. and Tas. in Sept. (Wall 1953; Wheeler 1955; Hindwood & Hoskin 1954; Hindwood & McGill 1958; Thomas 1968; Lane 1987; Alcorn 1988; Hutton 1991) and in se. SA in Oct. and Nov. (Lane 1987). In WA, on passage in Kimberley, Oct. (Storr 1980). Apparently on passage Cocos-Keeling Is, Oct.–Nov. (Gibson-Hill 1949). In NZ, early records on Kermadec Is and mainland in Aug.; first arrivals usually Sept., with main influx Oct. and early Nov.; in far N, numbers often decrease sharply in late Nov. to Dec., increasing in Jan., but unknown whether these birds moving within NZ or arriving from Pacific Is (P.C.M. Latham); apparently move S through NZ till Dec., when numbers in S stabilize (B.D. Heather).

Non-breeding Japan, s. China, Taiwan, Vietnam, Thailand, Philippines, Malay Pens., Borneo, Indonesia, PNG, Pacific Is, Micronesia, Melanesia, Polynesia, NZ and Aust., though some cross Asia to India, Sri Lanka, sw. Asia and e. and s. Africa (see Hayman *et al.* 1986; Lane 1987; BWP). Temporary influxes at some sites in Vic. during Dec. (Lane 1987). Local non-breeding occurrence depends, at least partly, on availability of wetlands (Thomas 1968). Large flocks recorded before n. migration throughout non-breeding range (e.g. Henshaw 1902; Mackay 1970).

Return Leave Aust., mid-Feb. to May, but mostly Apr.; leave NZ, Mar. to end of May, with few left after early Apr. (Stickney 1943; Starks & Lane 1987; Alcorn 1988; P.C.M Latham). In Aust., small numbers move N along e. coast; few recorded in nw. Aust. at this time, though on passage Feb.–Mar. in Kimberley Division (Storr 1980); temporary influxes occurred at many n. sites in first half of Mar.; in 1985, departures from surveyed sites did not occur synchronically; none move through inland (Lane 1987; Starks & Lane 1987; Alcorn 1988). Leave Tas., SA, Vic., and s. NSW, Feb.–May but mainly Mar.–Apr. (Sullivan 1929; Wall 1953; Glover 1954; Hindwood & Hoskin 1954; Wheeler 1955; Thomas 1968; Starks & Lane 1987). Some remain Lord Howe I. till Apr. (Hutton 1991); most leave Norfolk I. by end Dec. but records Feb., Mar. and July (Schodde *et al.* 1983). Usually leave Port Moresby region, early Apr. (Hicks 1990) and latest date for PNG probably late May (Coates 1985). Leaving from, and recorded on n. migration, Feb.–May in Wallacea, Sumatra, Singapore, Samoa, Hawaiian Is and Wake I. (Henshaw 1902, 1910; Armstrong 1932; Johnston & McFarlane 1967; White & Bruce 1986; Hails & Jarvis 1987; van Marle & Voous 1988). Present from end of May at breeding grounds (Hayman *et al.* 1986).

Breeding Nest June–July (Hayman *et al.* 1986; BWP). Morphometrics of Vic. birds suggest s. Aust. birds breed in Alaska (Barter 1988, 1989). Small numbers of birds remain in non-breeding range throughout s. winter, apparently leaving extreme S. At 23 surveyed sites in Aust., ≤4% of summer population remained over winter, which suggests that most first-year birds leave Aust. for s. winter. In s. States (Tas., Vic., SA, WA, and NSW), 0–2% remained over winter; in Qld, 5–41% remained over winter. Of those remaining along e. coast of Aust., most N of 30°S (Hewish 1988, but see Hewish 1989b, 1990); numbers fairly stable at individual sites during winter (Alcorn 1988). Very few in NZ in s. winter (P.C.M. Latham).

Banding One adult banded 21 Dec. 1984 at Kooragang I., NSW, recaptured at same site more than 6 years later (Anon. 1992a); one banded as adult at Werribee, Vic., 7 Jan. 1984, recovered Bundaberg, Qld, more than 32 months later (Lowe 1987). Banding study in Hawaii found high fidelity to non-breeding site between successive years (Johnson *et al.* 1981; Johnson & Johnson 1983). Bird banded Pribilof Is, Bering Sea, and recovered NSW; recorded as *P. dominica* before *P. fulva* was generally accepted as a full species (Wyndham 1977; Anon. 1987); see American Golden Plover.

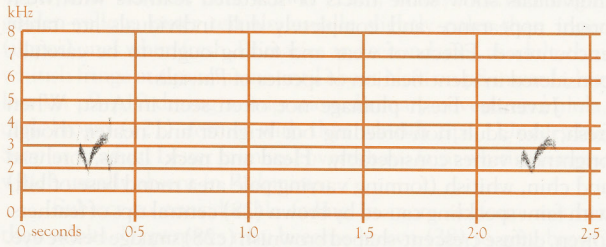
FOOD Molluscs, worms, insects, crustaceans, spiders and occasionally seeds, leaves, lizards, bird's eggs and small fish. **Behaviour** Diurnal and nocturnal. Glean and probe for prey on mudflats, saltmarsh, in wave-wash, among tide-wrack on beaches and in pasture. Feed alone or in flocks of up to 100 or more. Run, take short pauses, then peck (Evans 1975).

Adult Non-breeding Plants: lvs (Cleland). Animals: Annelids (S. Lauder): polychaetes (P.C.M. Latham). Molluscs: gastropods (Domm & Recher 1973; Evans 1975; Cleland): freshwater snails (Vestjens 1977); Acmaeidae; Neritidae; Turbinidae (Frith & Calaby 1974). Crustaceans: small crustaceans and crabs (Domm & Recher 1973); crabs: *Helice crassa* (P.C.M. Latham). Arachnids: spiders (stomach, Vestjens 1977). Insects (stomachs: Thomson 1935; Cleland): grubs (Berney 1907); Hemiptera:

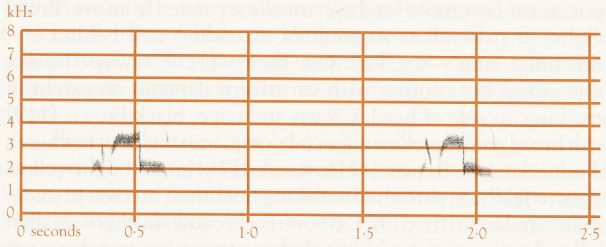
Aphidae (Vestjens 1977); Coleoptera: water-beetles (Vestjens 1977); Carabidae (Cleland); Scarabaeidae: larv. (Frith & Calaby 1974); Chysomelidae: Mispinae (Vestjens 1977); Curculionidae (Vestjens 1977): beach weevils *Decilaus* (Lea & Gray); Diptera: larv. (Frith & Calaby 1974); Lepidoptera: caterpillars (Berney 1907; Cleland); Hymenoptera: Formicidae (Vestjens 1977): ants (Cleland). Sand (Lea & Gray).

VOICE No detailed studies in HANZAB region. This account based on information from P.C.M. Latham. Melodious calls in flight, generally silent on ground. For studies elsewhere and comparison with congeners see BWP and Alström (1990). Call similar to trisyllabic call of Grey Plover *Pluvialis squatarola* (Whitlock 1939).

Adult FLIGHT AND ALARM CALLS: in flight, clear, shrill but melodious, whistled disyllabic *tlu-ee* or *tee-tew* (P.C.M. Latham); soft, whistled *wee-ee* (Storr 1953). Similar call, but more subdued and plaintive, uttered when feeding birds disturbed and take to the air, or when flock alighting (P.C.M. Latham). Alarm notes, louder, higher-pitched and parrot-like (Storr 1953). Sonagrams A and B show disyllabic and trisyllabic calls. **Other calls** Single loud querulous whistle (Storr 1953).



A R. Swaby; Lord Howe I., Dec. 1973; P36



B F. van Gessel; Kooragang I., NSW, Feb. 1988; P104

PLUMAGES Prepared by D.J.James. Juvenile plumage replaced by first immature plumage in partial post-juvenile moult soon after arrival in winter quarters; partial pre-breeding moult introduces second immature plumage during s. autumn. Thereafter, complete post-breeding and partial pre-breeding moults each cycle produce alternating non-breeding and breeding plumages with seasonal change in appearance. Sexes generally similar. Age at first breeding unknown. Moderate individual variation; slow and sometimes incomplete moult of body-feathers and tendency for fading produce much variation in appearance.

Adult breeding (Definitive alternate). **Head and neck** Ear-coverts, lores, narrow band over base of bill, chin, throat and foreneck, black-brown (119); sometimes slight white speckling in these areas from exposed white bases of feathers. Band over bill c. 1.4 mm thick (Connors 1983). White frontal band (c. 7.3 mm thick, but varying; Connors 1983) across upper forehead and forecrown, continuous with broad white supercilium extending to side of nape and curving sharply down side of neck onto underparts (see below). Crown and nape, black-brown (119) with small yellow spots (usually subterminal, sometimes apical) on each web giving heavily spotted or spangled appearance. Hindneck, similar to crown but spots diffuse, less distinct, sometimes almost subterminal bands, and feathers have narrow pale-yellow edges; contrasts slightly with crown. **Upperparts** Feathers have concealed light grey-brown (119C) bases. Mantle and scapulars, black-brown (119) with golden-yellow apical and subterminal spots on each web; size of spots varies slightly; with wear, groundcolour may fade to grey-brown (91) and spots to cream (92) or whitish; with extreme wear, apical spots wear away to thin concave fringes leaving structural indentations at tips. At sides of mantle, some feathers sooty grey (c79) towards concealed base, pale yellow towards middle of feather with black-brown subterminal band and pale whitish fringe. Back, black-brown (119) with small golden-yellow terminal spots and pale-yellow subterminal spots on edges, latter mostly concealed; spots smaller than those on scapulars; terminal spots may be widely or narrowly separated at shaft; back does not tend to fade as distinctly as scapulars. Upper tail-coverts, vary: black-brown (119) with golden-yellow spot at tip and two along edges of each web, giving spangled appearance; or black-brown (119) with golden-yellow tip and two or three broad pale-yellow notches or bars subterminally, giving barred appearance; patterns intergrade; fade to grey-brown (91) with cream (92) or whitish spots and bars. **Underparts** Mostly black-brown (119). Central breast and belly, immaculate or with scattered white flecking; white mottling more prevalent in females and young males (see Sexing); may be formed by new (breeding) feathers that have exposed white bases or white outer webs, but especially in females may be retained non-breeding feathers. White stripe continues from side of neck to side of breast and varyingly down flank; expanded slightly into prominent patch at side of breast (sometimes with a few small blackish blotches enclosed); patches probably always widely separated by broad zone of black-brown (119) on central breast; usually continues as narrow white line along flank, which is varyingly mottled black; flank-line may be almost as wide as patches at side of breast or very narrow and inconspicuous, but typically narrower, sometimes just a thin line or series of small white blotches or rarely not visible below closed wing on standing bird; when present, always at least slightly and sometimes heavily mottled black, though in general the wider the line the less it is mottled. Under tail-coverts usually, and vent sometimes, mottled with white feather-tips and edges; most have black central coverts and mottled lateral coverts but >10% (probably older males), essentially all black (Golley & Stoddart 1991). **Tail** Rectrices retained from non-breeding plumage (see below); worn and faded; yellow tones fade to cream (92) and wear of spots along edges causes structural notches to form; tip often worn down. **Upperwing** Feathers tend mostly to be retained from adult non-breeding, slightly to heavily worn and faded; brownish coverts with whitish spots or fringes contrast with black-and-gold spangled upperparts. Leading lesser secondary coverts, grey-brown (119B) with thin whitish fringes. Median and rear lesser secondary coverts, dark brown (c121) with whitish spot near tips of feathers (which become worn to concave fringes leaving structural indentations) and one pair of concealed whitish subterminal spots along edges; sometimes almost fringed rather than spotted along edges; scattered new feathers with pattern like scapulars may be intermingled. Greater secondary coverts, brown (28) to grey-brown (91), with thin cream fringes forming very narrow wing-bar. Secondaries, brown (28) to dark brown (121) on tip and outer web, grading to pale grey-brown (119D) at base of inner web. Inner primaries when worn tend to be uniform grey-brown (119B). Outer prima-

ries, dark-brown (121) distally and on outer web, grading to light grey-brown (119C) on base of inner web; shafts, white for most of middle portion, forming faint indistinct wing-bar. Alula and primary coverts, brown (28) to dark brown (121) with pale grey-brown (119D) fringes at tips usually worn off. Tertials, usually new, black-brown (119) with five or six bold golden-yellow spots or notches along edges reaching about half-way toward shaft; some retain outer tertials from non-breeding, faded to brown (28) with cream (92) notches. **Underwing** Primaries, silvery grey at base, with dark-brown (121) ill-defined tips and faint brown (28) speckling along inner webs. Secondaries and greater coverts, brownish grey (c80). Median and lesser coverts, light grey-brown (119C) with thin inconspicuous whitish fringes. Subhumerals, light grey-brown, as axillaries.

Adult supplementary Jukema & Piersma (1987) described a partial supplementary moult of feathers of underparts for both sexes of Eurasian Golden Plover *P. apricaria* in which some blackish feathers of breast replaced by mottled feathers during incubation; they suggested that similar moult may occur in other species of *Pluvialis*. This has not been fully examined for *P. fulva*, though possible supplementary feathers with black tips and edges and whitish centres can be seen in some skins from late breeding season (Aug., Sept.). Stresemann & Stresemann (1966), Kinsky & Yaldwin (1981) and Johnson & Johnson (1983) all concluded that moult out of breeding plumage begins in underparts during incubation. Dunn *et al.* (1987) reported some breeding females have mainly white underparts with black mostly confined to belly; these observations might be explained by a supplementary moult.

Adult non-breeding (Definitive basic). **Head and neck** Crown, black-brown with neat golden-yellow fringes giving scaled appearance; with wear, yellow fades and tip lost so appearance becomes streaked. Hindneck, dark brown streaked pale yellow, slightly paler than crown; feathers have dark-brown (121) central streak and pale-yellow edges; with wear, edges may fade to cream. Supercilium, whitish but speckled dull brown (c28), long and broad extending well behind eye; prominence and width vary slightly though usually most prominent before eye. Forehead, lores, ear-coverts, chin and throat, varyingly washed buff (124) with varying dark-brown (121) streaking concentrated round side of face. Irregular horizontal dark-brown (c121) patch on ear-coverts behind eye; may meet back of eye, though usually separate. **Upperparts** Mantle and scapulars, black-brown with neat golden-yellow fringes, which are mostly continuous round edge of feathers, though often with constricted points, or nearly continuous, so appearing more scaled than spangled; may fade to dark brown (121) or brown (28) with cream fringes. Back, rump and upper tail-coverts, black-brown (119) to dark brown (219) with golden-yellow tips (wider at corners of feather than shaft) and subterminal yellow spot along each edge; fading usually only pronounced on tail-coverts; tips tend to be joined rather than separated at shaft compared with breeding plumage but varies. **Underparts** Generally rather pale. Breast, washed pale buff (bright when fresh but fades rapidly) and mottled pale grey-brown (119D); feathers, off-white at base with indistinct pale grey-brown (119D) triangular spot distally and with buff or yellowish (c153) wash at corners. Grades indistinctly to unmarked off-white belly, vent and under tail-coverts. Flanks, vary: grey-brown (91) with yellow tips to feathers; or brown (119B) with cream (92) to yellow-buff (153) tips, with slightly barred appearance; fade to pale grey-brown (119D), with pale-yellow to off-white tips. Axillaries, as breeding plumage. **Uppertail** Rectrices, black-brown (119) to dark brown (121), notched or barred light grey-brown (119C–119D) and with golden-yellow tip; bars or notches may be weakly to strongly tinged yellow distally and toward edges of feathers; barring most prominent and usually clear on central feathers; with wear, yellow tones fade to cream (92) and wear along edges causes structural notches to form. Colours tend to be paler and pattern less distinct on outer feathers but barring usually present (cf. Juvenile; see Sexing). **Undertail** Usually only narrow pale tip and single dark subterminal band visible beyond under tail-coverts. **Upperwing** Remiges, as Adult breeding but with very narrow whitish fringes (except on outer few primaries) when fresh. Tertials, dark brown (121) with bold whitish notches; wear and fade to brown (28), with cream notches much reduced. Coverts, not always all renewed. Median and lesser secondary coverts, brown (28) with golden-yellow fringes, broad and almost even or broken series of spots along edges; wear faster than upperparts, to light grey-brown (119C) with cream (92) fringes. Greater secondary coverts, grey-brown (91) to light grey-brown (119C) with cream (92) fringe, broad at tip, narrow along edges. Alula, dark brown (121). Greater primary coverts, dark brown (121) to brown (28) with thin white fringes. Lesser primary coverts, brown (28) with broad whitish fringes. **Underwing** As Adult breeding.

Though plumage subject to considerable fading, feathers of body rarely replaced rapidly or completely, so even most faded individuals show some tracts or scattered feathers with fresh bright appearance and completely dull individuals are rarely encountered. Effects of wear and fading ought to be carefully considered in identification of species of *Pluvialis*.

Juvenile Fresh plumage not often seen in Aust. When fresh, like adult non-breeding but brighter and neater, though brightness varies considerably. **Head and neck** Lores, forehead and chin, whitish (forming varying pale area round base of bill) with faint speckling caused by brown (28) central tips of feathers. Often, diffuse crescent-shaped brownish (c28) smudge before eye. Ear-coverts, side and front of neck, washed yellow-buff, with fine dark-brown (121) or brown (28) streaking. Dark-brown (121) spot on ear-coverts, behind eye, usually separated from eye. Broad bright- or pale-yellow supercilium extending well behind eye, sometimes faintly streaked dark brown (121); always distinct from crown but contrast with ear-coverts depends on extent of streaking on side of head. Crown and nape, black-brown (119) with broad golden-yellow edges (about quarter width of feathers). Hindneck, dark brown (121), streaked by broad bright-yellow edges to feathers; pattern of streaking finer than on crown, sometimes similar to that on ear-coverts, because feathers smaller; duller than crown, producing slight contrast but not distinctly capped appearance. By late s. spring, wear and fading may reduce yellow and buff tones to cream (c92) or whitish and dark brown to dull brown (c28) or grey-brown (c91). Note that it is uncommon but not exceptional for supercilium to become whitish. **Upperparts** When fresh, similar to adult breeding, but even more distinctly spangled in appearance; differs also in single generation of feathers showing uniform wear (often some mixture of generations present in adults). Mantle and scapulars, dark brown (219) to black-brown (119) with bright golden-yellow spots at tips (corners) of feathers and subterminal spot along each edge; size of spots varies individually. Subscapulars, notched bright golden-yellow, notches about quarter width of feathers. Back and rump, dark brown (121) with bright golden-yellow tips to feathers, narrowly bisected by shaft, and slightly paler subterminal spot on each edge; have spotted appearance. Upper tail-coverts, similar to rump but duller: brown (28) with pale-yellow spots at edges of tip. With wear, may fade to brown (c28) with cream or whitish markings particularly in exposed areas (mantle and scapulars), but tinge of yellow usually present at least until post-juvenile body-moult under way. **Underparts** Breast, varyingly but usually

strongly washed pale buff, softly streaked and mottled light grey-brown (119C); feathers have triangular light grey-brown (119C) spots in middle and yellow-buff tips; usually noticeably less streaked than foreneck. Sides of belly and flanks, pale yellow to cream (92) with narrow delicate light grey-brown (119C) barring across feathers; bars often almost chevron-shaped; pattern, neat and distinctive, sometimes almost chequered, though subtly; important feature for ageing. Centre of belly, vent and under tail-coverts, white or faintly washed very pale buff. Axillaries, as adult. **Tail** Similar to adult. Rectrices have less tendency to be completely barred than respective ones of adults, and outer rectrices often lack barring on outer web. Kinsky & Yaldwyn (1981) found that in juveniles, outer rectrices (t6) were distinctly less barred than those of adults and they used the feature to age their specimens; but outer rectrices were not found reliable for ageing in skins examined (D.J. James) or by Johnson & Johnson (1983) because some juveniles show adult-like rectrices and vice versa. **Upperwing** Median and lesser secondary coverts, brown (28) with pale-yellow spots along edges (usually almost joining as fringes), which quickly fade to cream. Greater secondary coverts, grey-brown (91) with narrow pale-yellow or whitish fringe or spots round edges. In general, coverts contrast as paler than upperparts. Tertials, dark brown (121), boldly notched bright golden-yellow; outer tertials, usually slightly paler than inner (upper) ones when fresh. Primaries and secondaries, as adult; thin whitish fringe at tips remains until about Nov. on p8 inwards, but lost on p9–p10 during s. migration. Primary coverts and alula, dark brown (121), former with thin whitish tips. **Underwing** Similar to adult. Lesser primary coverts have faint whitish fringes, which usually absent in *P. dominica*.

Subject to considerable fading in more uniform manner than adults. Upperparts may become brown (28) to grey-brown (91) with cream or whitish spots; wing-coverts, brown (28) to light grey-brown (119C), with worn untidy fringes; underparts, whitish with light grey-brown mottling on breast and barring on flanks and sides of belly; in extreme cases, most, perhaps all, yellow tinge lost. In some birds with small spots on mantle, these may become completely worn away leaving uniformly blackish mantle.

First immature (First basic). Varies somewhat, partly because replacement of body-feathers during post-juvenile moult varies in extent. Similar to adult non-breeding. **Upperparts** Mantle and scapulars, black-brown (119) with golden-yellow spots round edges of feathers; pattern like adult breeding but less bright; some birds have fringes to feathers like adult non-breeding. **Underparts** Breast, like adult non-breeding. Many retain faint trace of juvenile barring on flank and side of belly, until at least Mar. (Prater *et al.* 1977; skins), providing best means of ageing. **Upperwing** Retained from juvenile. Wing-coverts become very faded and contrast greatly with newer upperparts; can aid in ageing (see Ageing).

Second immature (First alternate). Poorly known and literature contradictory (e.g. Witherby *et al.* 1947; Kinsky & Yaldwyn 1981; Pym 1982; Johnson & Johnson 1983; Chandler 1989; Golley & Stoddart 1991; Lewington *et al.* 1992; BWP); varies considerably but most birds probably attain much adult-like breeding plumage. In Hawaii, recorded with underparts varying from completely black (indistinguishable from adult breeding) to completely pale (like non-breeding) (Johnson & Johnson 1983); skins from Niue I., June–Sept. (NMNZ; see Kinsky & Yaldwyn 1981) showed 20–60% breeding plumage on underparts, but activity of moult not checked; possibly some retain appearance of first immature (BWP); may depend on extent of pre-alternate moult (Johnson & Johnson 1983).

Aberrant plumages Apparent hybrids with *P. apricaria* reported (Pym 1982; Vinicombe 1988).

BARE PARTS Based on photos (Pym 1984; Coates 1985; Pringle 1987; Chandler 1989; Stoddart 1990; Golley & Stoddart 1991; *Br. Birds* 84: pll 35, 131; unpubl.: M.A. Barter/Vict. Wader Study Grp; D.J. James). **All plumages** Bill, black, with varying, usually obscure but sometimes extensive pink tinge to base of lower mandible not obviously related to age, sex or season. Iris, dark brown. Legs, grey to dark grey, usually with bluish or olive tinge.

MOULTS From variety of sources (Stresemann & Stresemann 1966; Johnston & McFarlane 1967; Kinsky & Yaldwyn 1981; Johnson & Johnson 1983; Barter 1989; BWP; skins). **Adult post-breeding** (Pre-basic). Complete. Primaries, outwards; up to four at a time in early moult but one or two in late stages. Begins on breeding grounds in July (during incubation) with scattered feathers of face and underbody; arrive in winter quarters from Aug. with varying amount of breeding plumage; underparts usually (*c.* 85% of birds) from scattered black flecks to one-quarter black, but up to three-quarters black; body-moult usually finished by mid-Oct. (duration 2.5–3.5 months) but sometimes delayed; supercilium and neck-stripe often last conspicuous feature of breeding plumage. Sometimes moult of inner primaries begins on breeding grounds and suspended or active during migration; generally, moult of primaries begins on wintering grounds after migration. In Hawaii, onset of primary-moult, early Aug.–early Sept.; in Vic., all adults have begun primaries by late Oct. when median primary-moult scores (MPMS) are *c.* 20; progress of MPMS sigmoidal to 50 in late Jan.–early Feb.; by end of Feb., *c.* 90 % have completed primaries. Duration of primary-moult for individuals, estimated 4–5 months. Tail, centrifugal but often disorderly and slightly asymmetrical; outer rectrices rarely retained, so birds may sometimes have three generations of tail-feathers; sometimes begin on breeding grounds. Secondaries, inwards from several centres. Primaries, secondaries and tail finish at about same time. **Adult pre-breeding** (Pre-alternate). Partial, involving most of head and body, inner tertials, and varying amount (usually scattered) of median and rear lesser secondary coverts; sometimes outer rectrices, rarely all, replaced. Begins before n. migration, usually Feb., occasionally late Jan. First signs are bright new scapulars and crown-feathers and suggestions of supercilium and neck-stripe, soon followed by black flecks in underparts (by mid Feb. in earliest birds). Progression from stage of first flecks to completely black underparts takes *c.* 67 days. Males often attain fully black underparts before migratory departure, whereas females begin slightly later (flecking evident by mid-Mar.) and usually depart with 75% or less black on underparts. In early Mar., breeding plumage averages 10% (0–50; 18). Assumed to be completed on breeding grounds but observations lacking. **Post-juvenile** (First pre-basic). Partial, replacing most of head and body, sometimes other feathers. Inner tertials, replaced. Wing-coverts, usually retained but scattered replacement occurs. Occasionally outer pair or pairs of rectrices replaced. Timing, varies, beginning late Oct. to late Dec., finishing Dec.–Mar. **Immature pre-breeding** (First pre-alternate; immatures unlikely to breed). Partial, involving unknown amount of feathering of head, body and wing-coverts. Apparently varies because some birds attain substantial amount of black in underparts but others attain none. Usually, most head and body probably replaced. Birds remaining on wintering grounds during n. hemisphere summer tend to show less moult than those migrating. Begins before n. migration, about late Feb. In early Mar., breeding plumage averages 5% (0–25; 10). **Immature post-breeding** (Second pre-basic). First complete moult. Similar to adult post-breeding. In Hawaii and

Niue I., moult of primaries of birds remaining on wintering grounds during n. hemisphere summer began earlier than adults, June–July; in Vic., migrants arriving Oct. have similar MPMS to adults. Birds beginning primary-moult on breeding grounds sometimes assumed to be mostly immatures.

MEASUREMENTS Aust, NZ and s. Pacific, skins (ANWC, MV, NMNZ): (1) all ages; (2) adults; (3) juvenile and first immature (fresh juvenile primaries); (4) second immature moulting to adult non-breeding (with very worn juvenile outer primaries).

	MALES	FEMALES	
WING	(1) 165.9 (4.33; 157–177; 27)	168.7 (3.57; 162–175; 23)	ns
	(2) 166.7 (2.34; 163–170; 6)	168.7 (2.68; 166–174; 4)	ns
	(3) 170.5 (4.65; 166–177; 4)	170.6 (3.68; 163–175; 9)	ns
	(4) 164.6 (4.17; 157–173; 17)	166.3 (3.09; 162–172; 7)	ns
TAIL	(1) 61.1 (2.20; 54–65; 26)	60.7 (2.24; 58–65; 24)	ns
BILL F	(1) 24.1 (1.03; 22.3–22.5; 25)	23.5 (1.40; 21.0–26.1; 23)	ns
TARSUS	(1) 43.8 (1.57; 40.5–47.2; 27)	43.6 (1.64; 40.0–46.5; 23)	ns
TOE	(2) 23.7 (0.79; 22.7–24.7; 5)	23.4 (0.21; 23.1–23.6; 4)	ns

Siberia, skins: (5) unaged (BWP); (6) adults (Prater *et al.* 1977); (7) adults; wing flattened (Vaurie 1964).

	MALES	FEMALES	
WING	(5) 165 (3.8; 159–174; 34)	166 (4.7; 158–173; 17)	
	(6) 163.7 (157–173; 32)	162.1 (152–168 (28)	
	(7) 165.3 (156–174; 17)	165.8 (160–173; 15)	
BILL F	(5) 23.4 (1.3; 21–25; 34)	23.4 (0.9; 22–25; 17)	ns
TARSUS	(5) 43.3 (1.9; 41–47; 34)	43.7 (1.2; 42–26; 17)	

Alaska, skins: (8) adults; wing flattened (Vaurie 1964). Prater *et al.* (1977) also give range of wing for adults as 164–180.

	MALES	FEMALES
WING	(8) 169.5 (164–177; 30)	171.6 (164–180; 16)

Unsexed, Vic., live; THL = total head-length. (Barter 1988): (9) adults; (10) juvenile and first immature (fresh primaries); (11) second immature moulting to adult non-breeding (worn).

	UNSEXED
WING	(9) 173.8 (5.1; 161–183; 35)
	(10) 171.6 (6.5 (166–182; 21)
	(11) 165.2 (4.3; 155–176; 24)
BILL F	(9) 23.7 (1.54; 20.3–26.3; 30)
	(10) 23.4 (0.97; 21.5–25.3; 35)
	(11) 24.0 (0.98; 22.0–25.9; 23)
THL	(9) 57.2 (2.1; 52.9–61.2; 30)

No significant differences between sexes. Birds from Alaska have longer wings than those from Siberia (Vaurie 1964; Prater *et al.* 1977). Barter (1988) showed that wear of juvenile primaries reduces length of wing an average 6 mm; compare (10) and (11). Additional measurements in Kinsky & Yaldwyn (1981) (though their birds re-measured and included in (1) to (4) above), Ridgeway (1919), Johnston & McFarlane (1967), Johnson *et al.* (1989), BWP and references therein.

WEIGHTS No significant differences between sexes (Connors 1983; BWP). Unsexed live birds, Vic., by month (Barter 1988); juvenile and first immature combined.

	ADULT	JUVENILE
OCT.	130.3 (5.1; 119–136; 15)	
NOV.	129.4 (7.1; 118–140; 16)	127.7 (11.5; 110–142; 6)
DEC.	129.1 (6.0; 116–139; 28)	134.9 (11.0; 122–157; 10)
JAN.	126.3 (0.5; 126–127; 4)	120, 132, 144
FEB.	147.9 (12.0; 142–174; 12)	133.2 (8.5; 120–145; 14)
MAR.	158.2 (13.4; 125–178; 19)	153.5 (13.2; 140–175; 10)
APR.	172	

In Vic., gain of weight begins Feb. and maximum weight attained just before migration in late Mar. to early Apr.; first-year birds may begin gaining weight slightly before adults (Barter 1988). Similar data from Hawaii and Marshall Is (Johnston & McFarlane 1967; Johnson *et al.* 1989); see also BWP.

STRUCTURE Medium-sized wader with rounded head. Wing, rather long, narrow, pointed. Eleven primaries; p10 longest; p9 2–5 mm shorter, p8 11–19, p7 25–29, p6 35–40, p5 50–54, p4 60–68, p3 72–80, p2 84–91, p1 91–99, p11 minute. Fourteen secondaries including four tertials; tips of longest tertials fall between p6 and p8 (usually p7 and p8) on folded wing; exposed primaries quarter to half length of overlying tertials; tertials fall approximately level with tip of tail (Dunn *et al.* 1987; Harris *et al.* 1989). Tail, short, slightly rounded to square; 12 rectrices. Bill, short, robust, straight; tip of culmen, somewhat bulbous; slight gonydeal angle. Nostril, horizontally slit-like in long nasal groove. Lower two-thirds or so of tibia, unfeathered. Tarsus, medium-length, slender; scales, reticulate. Toes, slender; no hind-toe. Outer toe 84–90% of middle, inner 67–72%. Claws, laterally compressed, slightly twisted outwards.

AGEING Juveniles can all be aged by barring on underparts, which is retained until at least about Dec. and often until Mar. (Prater *et al.* 1977; skins), and by small neatly patterned scapulars; when these tracts replaced with first immature plumage, reliable ageing possible only in hand. In s. spring, juveniles have uniformly fresh primaries with no moult; adults have worn outer and moulting inner primaries; second immatures moulting to adult non-breeding have very worn outer and moulting inner primaries. After outer primary drops, latter two age-classes cannot be reliably separated. By late summer to autumn, adults have finished moult and have fresh primaries, while first immatures have worn primaries, but in some cases, status ambiguous (Prater *et al.* 1977; Johnson & Johnson 1983; Barter 1988). Unbarred outer rectrices indicative of juveniles though some juveniles have adult-like barred rectrices (Johnson & Johnson 1983; *contra* Kinsky & Yaldwin 1981). Spotted rather than scaled scapulars and contrast between fresh upperparts and rather worn wing-coverts may aid field identification of first immatures.

SEXING Sexes generally similar. In breeding plumage, underparts of males tend to be nearly immaculate black, while those of females usually flecked with white, especially under tail-coverts; however, substantial overlap between sexes (Golley & Stoddart 1991), and matter may be complicated by slight decrease of flecking in successive breeding plumages over first few years (Johnson & Johnson 1983) so method unreliable. Johnston & McFarlane (1967), Kinsky & Yaldwyn (1981) and Johnson & Johnson (1983) found that outer rectrices of adult males usually

clearly barred while those of females often obscurely barred; considered completely reliable for sexing by Kinsky & Yaldwyn (1981), but only 80% reliable by Johnson & Johnson (1983). Rectrices not reliable for sexing juveniles (Johnson & Johnson 1983).

RECOGNITION Very similar to American Golden Plover; field identification has been reviewed in detail (Pym 1982, 1984; Hayman *et al.* 1986; Dunn *et al.* 1987; Chandler 1989; Harris *et al.* 1989; Alström 1990; Golley & Stoddart 1991; Lewington *et al.* 1992); reviews have mostly emphasized structure of rear-end coupled with features of fresh plumage, but views on latter sometimes contradictory; few have adequately considered worn plumages, particularly juveniles (note especially that juvenile, first immature and non-breeding plumages may fade from buff to brownish grey in general appearance when worn). Structure of rear-end not reliable for identification of skins because tertials often drawn forward by preparation. Ratio of wing/tarsus x bill gave best practical separation (but discriminant function was not published); however using all combinations of biometric and plumage variables, Connors (1983) could not identify c. 4% of skins in breeding plumage from areas of allopatry.

GEOGRAPHICAL VARIATION No subspecies currently recognized. Birds breeding Alaska larger than those in Siberia (Vaurie 1964; Prater *et al.* 1977; Connors 1983). Measurements suggest birds wintering in Vic. come from Alaska (Barter 1988, 1989). On measurements, wintering birds in Hawaii and Marshall Is probably from Alaska (Johnson *et al.* 1989), and birds on Wake and Niue Is from Siberia (Johnston & McFarlane 1967; Kinsky & Yaldwyn 1981).

Previously considered conspecific with American Golden Plover *P. dominica*; recently more often treated as separate species (BOURC 1986; NZCL) following recommendations of Connors (1983) who, using discriminant analysis, could find no evidence of intergradation in areas of sympatry greater than that in areas of allopatry (no hybrid zone), different patterns of post-juvenile moult (Johnson 1985), rate of development to maturity, migration, and non-breeding habitats (see Knox 1987). Connors *et al.* (1993) showed clear and consistent differences in breeding vocalizations and nesting habitat and strict assortative mating where both species occur in w. Alaska. Barter (1988, 1989) has suggested that Connors' (1983) data may be incomplete because wing-lengths from Vic. intermediate between *fulva* and *dominica* given by Connors (1983). Difference in strategy of post-juvenile moult (Johnson 1985) dubiously deduced, and no observation of juvenile *dominica* in primary-moult has been published. Differences in rate of development lack convincing support.

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Grey Plover *Pluvialis squatarola* (page 811)
1 Adult breeding; **2** Adult non-breeding; **3** Juvenile; **4, 5** Adults, non-breeding plumage

Pacific Golden Plover *Pluvialis fulva* (page 800)
6 Adult breeding; **7** Adult non-breeding; **8** Juvenile; **9, 10** Adult non-breeding