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## Order CICONIIFORMES

Medium-sized to huge, long-legged wading birds with well developed hallux or hind toe, and large bill. Variations in shape of bill used for recognition of sub-families. Despite long legs, walk rather than run and escape by flying. Five families of which three (Ardeidae, Ciconiidae, Threskiornithidae) represented in our region; others — Balaenicipitidae (Shoe-billed Stork) and Scopidae (Hammerhead) — monotypic and exclusively Ethiopian. Related to Phoenicopteriformes, which sometimes considered as belonging to same order, and, more distantly, to Anseriformes. Behavioural similarities suggest affinities also to Pelecaniformes (van Tets 1965; Meyerriecks 1966), but close relationship not supported by studies of egg-white proteins (Sibley & Ahlquist 1972). Suggested also, mainly on osteological and other anatomical characters, that Ardeidae should be placed in separate order from Ciconiidae and that Cathartidae (New World vultures) should be placed in same order as latter (Ligon 1967).

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## Family PLATALEIDAE ibises, spoonbills

Medium-sized to large wading and terrestrial birds. About 30 species in about 15 genera, divided into two sub-families: ibises (*Threskiornithinae*) and spoonbills (*Plataleinae*); five species in three genera breeding in our region. Body elongated, neck long. Male larger and with longer bill than female. Wings rather long and broad; 11 primaries; p8 and p9 longest, p11 minute. About 20 secondaries; diastataxic. Fly with strong wing-beats, often soaring; neck and legs extended. Tail short, square or slightly rounded; 12 feathers. Bill long: decurved in ibises, straight with flattened end in spoonbills; nostrils slit-like. Varying extent of bare skin on head and in *Threskiornis* on head and neck. Legs rather long, lower half of tibia bare; toes of medium length, with small webs basally, hind toe or hallux slightly elevated, middle toe pectinate only in *Plegadis*. Carriage of body upright, gait striding. Oil-gland, feathered. Feathers with aftershaft. Down on feather-tracts and apteria; no powder-down patches. Plumage, white, red, red-brown or black; dark colours often glossy. Sexes alike. In some species, notably *Threskiornis* and *Platalea*, breeding plumage differs from non-breeding by occurrence of ornamental feathers. Bare parts, especially of face, coloured black, brown, red or yellow; colour may intensify during pair-formation, such as red patches under wing in *Threskiornis molucca*. Two moults per cycle; pre-breeding moult may involve only small part of plumage. Moult of primaries in staffelmauser (outwards). Young semi-altricial, nidicolous. Two downs: white, grey or black; first sparse, growing from follicles of later contour-feathers and soon overgrown by dense second down, growing from follicles of later down. Juveniles, similar to adults, but often darker with bare areas of head smaller.

Cosmopolitan in tropical, subtropical and temperate areas. Marine intertidal and inland aquatic birds of warm and temperate continental climates, preferring standing or slow-flowing fresh water, marshes, floodlands and tidal flats. Ibises feed also in drier habitats. In our region species nomadic, with wide post-fledging and post-breeding dispersal. Move diurnally; usually roost in trees and bushes over water at night; fly in formation; often soar. Eat many sorts of invertebrates, especially insects and their larvae, molluscs and crustaceans, and small vertebrates, particularly fish, reptiles and amphibians. Feed mostly in shallow wet areas where typically probe in soft mud (ibises) or sweep bill from side to side in water (spoonbills). Some ibises feed much on insects in dry habitats, often probing in cracks in soil, and on insects flushed from pastures by irrigation; scavenge at garbage tips, poultry farms and in public parks. Gregarious when foraging and when roosting at night. Typically colonial breeders, pairs defending only nest-territory. Spoonbills may nest in small groups or singly. Monogamous pair-bond, of seasonal duration so far as known. Pair-formation appears to be as in other Ciconiiformes but not widely studied; displays include similar essential elements such as Twig-grasping and Stick-passing. Voice, mainly harsh, guttural, wheezing or grunting, with some bill-snapping sounds. Vocalization most apparent during pair-formation, nest-building and nest-occupation. Away from colony or roost, generally silent except when flocks alarmed. Nestlings more vocal than adults, with shriller sound. Comfort-behaviour similar to that of other waterbirds; stand in shallow water, often rapidly beating wings; crouch on nest or roost with wings outstretched and bare patches exposed in hot weather. Heat dissipated by gaping and gular fluttering, adults and unfledged young often stand with one wing lowered; eggs and nestlings sheltered by drooping wings of adult.

Annual, seasonal breeders in temperate parts of range, with local variation influenced by rainfall and flooding. Nest in trees or dense vegetation, almost invariably over water; occasionally stumps or small islands in marshes. Colonies of ibises and spoonbills often mixed, occasionally with cormorants. Nests large, interwoven from available vegetation, usually of sticks and rushes. Built largely by female with material brought by male. Eggs oval, white and smooth, except *Plegadis* (deep greenish-blue and slightly rough). Clutch-size 2-5 (1-5). One brood. Replacement clutches after loss. Eggs laid at intervals of 1-2 days. Incubation period 21-29 days. Incubation starts with first egg; hatching asynchronous. Both sexes incubate, changing over at least once in 24 hours. Single median brood patch. Eggshells discarded over side of nest. Young cared for by both sexes; nestlings brooded continuously when small. Fed mainly by partial regurgitation. May leave nest site at 2-3 weeks, often forming crèches but returning to nest to be fed. Nestling period 4-7 weeks, young becoming independent 1-4 weeks later. Age at maturity unknown, but breeding may occur in *Threskiornis* at 18 months-2 years.



*Plegadis falcinellus* Glossy Ibis

*Tantalus Falcinellus* Linnaeus, 1766, *Syst. Nat.*, ed 12, 1: 241; based on *Numenius rostro arenato* of W.H. Kramer, 1758, *Elench. Veg. Anim. Austr. infer. Observ.*: 350 and *Le Courly verd* of Brisson, 1760, *Orn.* 5: 326, Fig. 2 (immature); Austria, Italia; Neusiedler See, Lower Austria (ex Kramer) suggested by Hellmayr & Conover, 1948, *Publ. Fld Mus. nat. Hist. zool. Ser.* 13: 264.

The generic name comes from Greek *πλεγάς, -αδης* (a sickle) and the specific from *falcinella*, Latin for a small scythe, both referring to the curved beak.

OTHER ENGLISH NAME Black Curlew.

MONOTYPIC

**FIELD IDENTIFICATION** Length 55–65 cm; wingspan 80–95 cm; weight 500 g. Entirely dark-brown, medium-small slender ibis with decurved bill and glossy green and purple iridescence in some lights; appears blackish at distance. On ground, appearance superficially like curlews *Numenius* spp; in flight, resembles small cormorant. Sexes similar; seasonal changes in plumages. Juvenile separable.

**DESCRIPTION** **ADULT BREEDING.** Head, neck and upperparts, dark chestnut brown with iridescent green and purple gloss, depending on light; chestnut brown of head and face bordered by pale line, forming white stripe extending from forehead, behind eye, then forward below eye to chin at base of lower mandible. Upperwing appears dark with contrast between dark chestnut-brown coverts of innerwing (with purple iridescence) and dark olive-green remiges, primary coverts and alula (with bright-green iridescence). Underparts, dark red-brown with strong green or purple iridescence in some lights. Underwing appears all dark; remiges, dark olive-green (with iridescence in some lights) contrasting with slightly darker green under wing-coverts, also with iridescence in some lights. Bill, long, thin and decurved, pink- to green-brown, somewhat darker at base. Bare skin of lores, at base of lower mandible and round eyes, cobalt-blue during courtship; dark grey to black at other times. Bare facial skin and lores bordered with conspicuous white to pale-blue line at edge of feathering of head. Iris, dark brown. Legs and feet, yellow-green to brown or grey. **ADULT NON-BREEDING.** Head and neck, dark brown heavily streaked with white, particularly below eye. Mantle and upper back appear dark brown; rest of upperparts as breeding with entire upperparts showing stronger purple iridescence. Underparts, dark brown sometimes with faint red-brown tinge with strong purple iridescence. White line bordering facial skin and lores, less conspicuous. **JUVENILE.** Like adult non-breeding but head and neck browner with faint white mottling on face and varying white patches on throat and hindneck. Bill, at first shorter and striped with pink. Upperparts, dark olive with little iridescence, green when seen. Underparts, dark olive-brown. Upperwing, duller than adults; underwing, as adult. **IMMATURE.** Gradually attains plumage of non-breeding adult, first on head and neck.

**SIMILAR SPECIES** Unlikely to be confused with other ibises or spoonbills: slender decurved bill ought to distinguish Glossy Ibis from all other waterbirds except Australian White *Threskiornis molucca* and Straw-necked *T. spinicollis* Ibises and curlews *Numenius* spp. All-dark plumage, with glossy green and purple iridescence distinguishes

Glossy from predominantly white Australian White and slate-grey-and-white Straw-necked Ibises. Dark glossy plumage, more upright stance with longer legs and heron-like gait also distinguishes Glossy Ibis from curlews.

Walk and wade slowly and sedately, like other ibises and spoonbills. Probe for food mainly in shallows and on land. Gregarious, though often seen singly; sometimes with Straw-necked or Australian White Ibis. In flight, silhouette rakish, with neck and legs extended, head held somewhat below horizontal, slender body and rounded wings. Flocks fly in sinuous lines and chevrons, constantly changing form. Combination of attenuated profile, blackish colouring and rapid wing-beats, alternating with glides, makes distant flying flock resemble Little Black Cormorants *Phalacrocorax sulcirostris*. Frequent many sorts of wetland, such as fresh or brackish swamps and lakes, irrigated agriculture, tidal flats and mangroves (mainly in n. Aust.). Roost in trees and shrubs, sometimes far from water. Mainly silent but give corvid-like croaking call when flushed; flocks sometimes utter chattering notes.

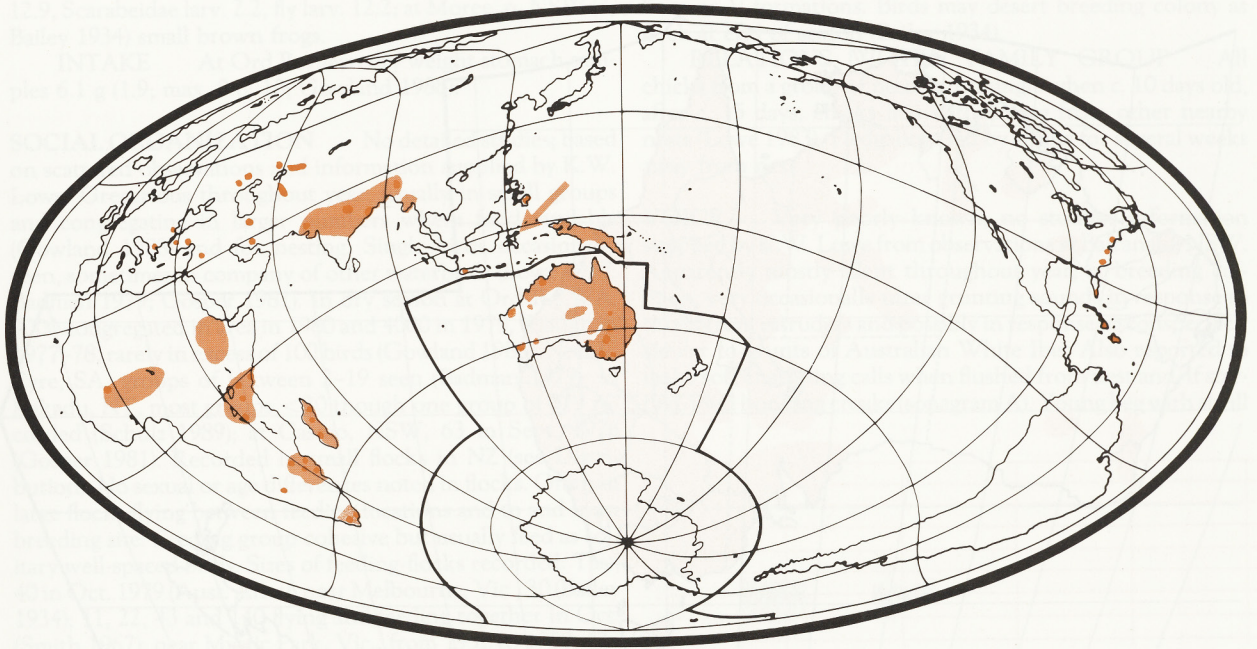
**HABITAT** Terrestrial wetlands, and occasionally wet grasslands and sheltered marine habitats. Forage in shallow water over soft substrate or on grassy or muddy verges of wetlands, preferring those providing variety of water depths (Morton *et al.* 1989); avoid dry ground. Prefer freshwater wetlands inland; in particular, permanent or ephemeral waterbodies on floodplains (watercourses, billabongs, pools) and shallow swamps with abundant aquatic flora. Also on shores and shallow margins of large lakes or deeper swamps, in open water or among tall emergent vegetation (*Phragmites*, *Scirpus*, *Typha*, *Eleocharis*), shrubs (*Muehlenbeckia*) or woodland (*Eucalyptus*, *Melaleuca*); flooded pasture and agricultural land; wet meadows; and sewage-ponds. Uncommon on coast, but occasionally on estuaries and tidal reaches of watercourses (Wilson 1954; Lowe 1957; Vestjens 1977; Corrick & Norman 1980; Gosper 1981; Corrick 1982; Fjeldså 1985; Jaensch *et al.* 1988; Morton *et al.* 1989; Schulz 1989). Unusual on artificial impoundments (Braithwaite *et al.* 1985a).

Breeding usually in fresh or brackish wetlands (swamps, lakes, watercourses, floodwaters) vegetated with reeds, rush, shrubs or trees, in which nests are built (Bailey 1934; Vestjens 1977; Cowling & Lowe 1981; Close *et al.* 1982; Jaensch & Auricht 1985); less often in permanent saline wetlands (Corrick 1982).

Fly at any height, often high, in formation. Roost in dead or living trees standing in or near water.

Many natural freshwater wetlands used for feeding and





breeding have been destroyed or modified by drainage, clearing, grazing, burning, increased salinity, groundwater extraction and invasion by introduced plants (Riggert 1966; Goodrick 1970; Corrick & Norman 1980; Corrick 1981, 1982; Jaensch *et al.* 1988; Morton *et al.* 1989; Schulz 1989). Rarely on artificial wetlands, although occasionally found on irrigated or flooded agricultural land; in Ord River region, rice-fields favoured (K.W. Lowe). In Balranald, NSW, breeding birds were killed by foxes after water extraction allowed access to colony (Lowe 1983).

**DISTRIBUTION AND POPULATION** Widespread from e. North America and Caribbean to w. Palearctic, central Asia, Africa S of Sahara, Pakistan, India, se. Asia, Philippines, Indonesia, PNG and Aust.

**AUST.** Regularly reported throughout Qld, NSW, Vic., se. SA, ne. WA and NT, NE of line roughly from Kimberley Div., WA, to Spencer Gulf, SA; in large numbers in N of range (Morton *et al.* 1989), smaller numbers and flocks in S; scattered records occasionally reported in desert areas (Gibson 1986; Gibson & Cole 1988). Vagrant to Tas.; reported near Cressy before 1945 and probably other records before then; one, near St Helens, 12 Jan. 1945; Longford, 30 Oct. 1965; Lauderdale, 1 Dec. 1965; five, Woolnorth, 22 Nov. 1972; Sandford, 10 Apr. 1975; two, South Arm, 20 Apr.-late Sept. 1975; one, Oyster Cove, 7 May 1975; c. 40, near Burnie, mid-Oct. 1979; two, C. Portland, 5 Apr. 1987 (Sharland 1946; Wall 1968; Green 1989; Tas. Bird Reps 2,5,9,17).

**NZ** Vagrant as individuals and small parties; single, Washdyke Lagoon, Timaru 1902; Makikihi, Rangitikei, Woodville, Foxton, Ohau R., Blenheim, Whangamoa, Harihari, Washdyke Lagoon (Oliver); 14-16, Dillons Pt, Blenheim 13 Nov. 1953 to 8 Jan. 1954 (Wilson 1954), scattered records 1957-58 (Falla 1958; Andrew 1963). Recorded annually in small numbers (up to eight) from NI and SI since 1970, with flock of 16 in autumn 1975 (NZ Atlas; Falla *et al.* 1981; CSN).

**BREEDING** Known Aust. localities with year of

record and size of colony, if recorded (from Aust. NRS and Aust. Atlas, unless otherwise referenced).

#### Qld

Alice Downs: 1981

L. Bullawarra: 1974, c. 500 pairs

Cunnamulla: 1907, 3-4 nests (Bailey 1934)

#### NSW

Murwillumbah: 1980

Moree area: Dec. 1921, 17 nests; Feb. 1922, c. 5000 nests (Bailey 1934)

Macquarie Marshes: 1978, 400-500 pairs (NSW Bird Rep. 1978); 1981

Old Dromana Stn: 1983, 1000 (NSW Bird Rep. 1983)

Narran L.: 1978; 1980

Lachlan area: 1899, 3 nests

Booligal: 1984, 4000 pairs (NSW Bird Rep. 1984)

Gunbar: 1984, 900 pairs (NSW Bird Rep. 1984)

Balranald: 1977; 1981, 1000 birds (Lowe 1983); 1984, 2000+ pairs (NSW Bird Rep. 1984)

Barham: 1981, 38 nests

#### Vic.

Heart Morass: 1986 (R. Chatto)

Reedy L. (Geelong): 1988 (G. Suckling)

Tragowel Swamp: 1968, mixed colony of Glossy, Straw-necked and Australian White Ibis, 1000 nests (Cowling & Lowe 1981)

Kerang district: 1968, 250-300 pairs

Hird Swamp: 1973, 9 nests in mixed colony of 100 nests, with Straw-necked and Australian White Ibis (Cowling & Lowe 1981); 1973, 1500

Lough Calvert: 1980, 14 pairs

#### SA

L. Merreti: 1981

Keith: 1981, 8 nests (Jaensch & Auricht 1985)

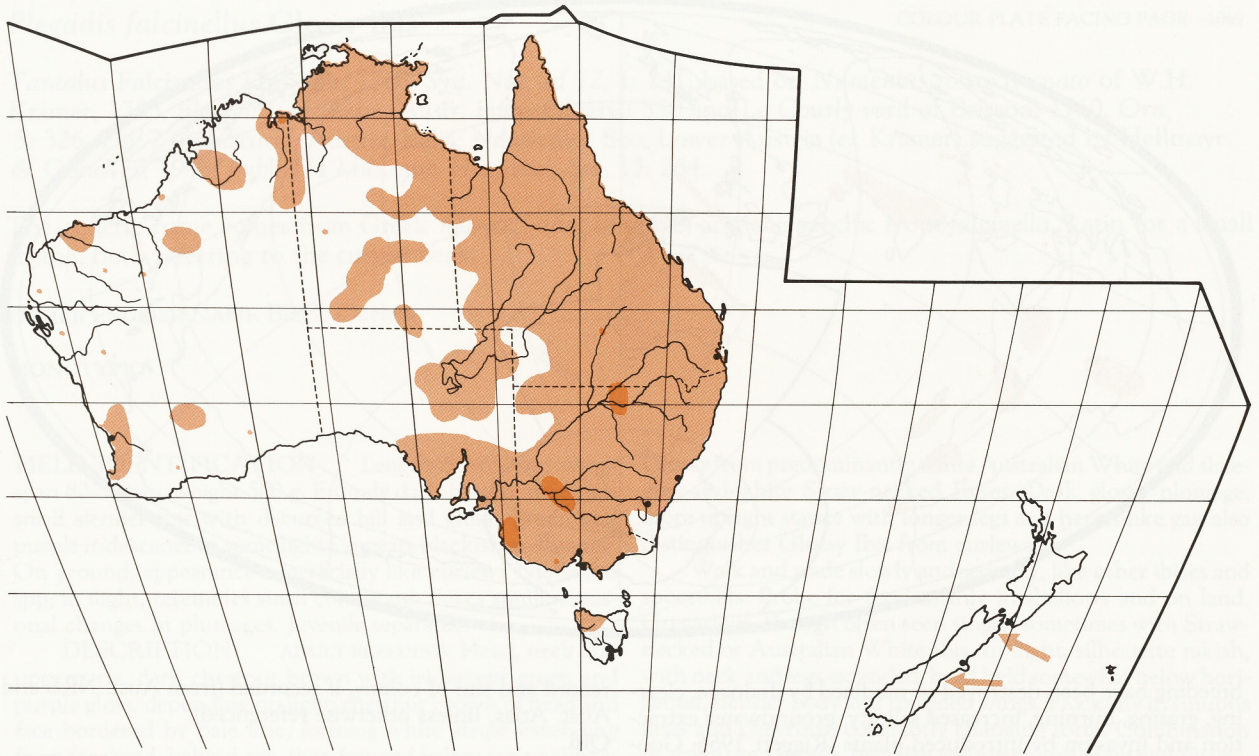
Bool Lagoon: 1980-81

Monster Mt: 1981

L. Alexandrina: 1964, 200 nests

Salt Lagoons: Oct. 1962, 250-330 nests; Nov. 1963, 0; 1964, 12





pairs; Oct. 1965, 400 nests; Nov. 1966, 270 nests (Close *et al.* 1982)

#### WA

Chandala: 1983, 2 nests (Jaensch *et al.* 1988)

Kununurra: 1977

Annual indices of abundance from aerial surveys (transect counts) of wetlands in about 12% of land area of e. Aust. from 1983–88 were 7926; 17,156; 4290; 3039; 2362; 855 respectively (Braithwaite *et al.* 1985a,b, 1986, 1987; Kingsford *et al.* 1988, 1989).

**MOVEMENTS** Migratory in at least part of range but local movements erratic. In e. Aust. apparently marked N-S movement with birds breeding in S during summer and moving N in winter. Reporting rate in se. Aust. during Aust. Atlas was lower in winter than summer and in Vic., considered partial migrants with most records Sept.–Apr. (Vic. Atlas). In district of Alligator Rs, NT, population peaks at about 60 000, Sept.–Oct. but virtually absent in wet season (Morton *et al.* 1989); similar pattern at Ord R., nw. Aust. (Gowland 1988) and at Aurukun, C. York Pen. (A. Taplin). Records from NZ, Mar. (Tunncliffe 1966), May (Scarlett 1966), Sept.–Oct. (Tunncliffe 1966), Nov. (Anon. 1954) correspond with times when birds moving either N or S although unusually large numbers reached NZ, 1953–54 and 1957–58 (Falla 1958; Andrew 1963; see Distribution) when dry spell followed wide flooding in inland NSW. Not all birds participate in N-S migration. Though few breeding records from n. Aust., species much more common there than in S. Recorded all months in Darwin though uncommon Dec.–May (Crawford 1972), but at Atherton Tablelands (Bravery 1970), Innisfail (Gill 1970) and Townsville (Garnett & Cox 1983) more abundant Aug.–May. In nw. Aust., where breeding recorded, present in large numbers all year, particularly Dec.–Apr. (Aust. Atlas). Local

movements probably determined by rainfall. Presence in se. Qld corresponds with influx of waterbirds from inland (Woodall 1985) and most breeding sites in Riverina used irregularly (K.W. Lowe) although some birds may return to same feeding place in successive years (Lowe 1957).

**FOOD** Mostly aquatic invertebrates and insects. **BEHAVIOUR.** Food taken in tip of curved bill while probing soft sediments, or taken from surface or from seed panicles of standing grass (Gowland 1988). Peck and probe rapidly when feeding (Sanson 1954); in flocks ( $\leq 500$ ); birds often feed close together, sometimes abreast in shallow water or on soft substrate (Gowland 1988). Occasionally run after prey (K.W. Lowe). In mild weather feed all day, in hot weather most feeding confined to morning or evening (Gowland 1988).

**ADULT** At Ord R. Irrigation Area, nw. Aust. (ten stomachs; Gowland 1988) seeds of commercial rice 94.8% vol., 90% freq.; insects bugs Notonectidae 1.2, 10, *Pseudaletia separata* 2.3, 30, other lepidopterans 0.5, 10, unident. 1.2, 20. At L. Cowal (seven stomachs; Vestjens 1977) freshwater snails 29% freq., freshwater mussels 14, freshwater crayfish 14, aquatic mites 14, spiders 43, crickets 14, short-horned grasshoppers 28, long-horned grasshoppers 14, water boatmen 57, water bugs 14, water beetle ads. 86, larv. 57, ground beetles 14, chafers 28, weevils 28, fly larv. 28, frogs 43.

Also shellfish (Mathews 1910), spiders (McGill 1923), insects (McGill 1923; Ellis 1940) incl. beetles (Mathews 1910), Hydrophilidae (Barker & Vestjens 1989), cane beetle larv., pupae (North); fish (Mathews 1910).

In NZ, take fish, small eels, frogs, tadpoles and insects and earthworms from pastures.

**NESTLING** At Balranald, s. NSW (139 items, one stomach; Lowe 1983) snails *Lymnaea* 0.7% no., insects odonatan larv. 68.3, beetles *Berosus* larv. 2.9, unident. ad. 0.7, larv.



12.9, Scarabeidae larv. 2.2, fly larv. 12.2; at Moree, n. NSW (3; Bailey 1934) small brown frogs.

**INTAKE** At Ord R. mean dry weight stomach samples 6.1 g (1.9; max. 9.6; 10; Gowland 1988).

**SOCIAL ORGANIZATION** No detailed studies; based on scattered observations and information supplied by K.W. Lowe. Gregarious throughout year; usually in small groups and congregating in larger numbers where food available (Gowland 1988) and for nesting. Single birds occasionally seen, sometimes in company of other waterbirds (Lowe 1957; Badman 1979; Gosper 1981). In dry season at Ord R., WA, 9000 congregated in area in 1980 and 4000 in 1979, though in 1977–78, rarely in excess of 100 birds (Gowland 1988). Near L. Eyre, SA, groups of between 2–19 seen (Badman 1979); in Kakadu, NT, most groups <20 though one group of 379 recorded (Schulz 1989); at Casino, NSW, 63 in Sept. 1978 (Gosper 1981). Recorded in small flocks in NZ (see Distribution). No sexual or age differences noted in flocks. Often in large flocks flying between feeding locations and to and from breeding site. Feeding group cohesive but usually feed as solitary well-spaced birds. Sizes of feeding-flocks recorded: Tas., 40 in Oct. 1979 (Aust. Atlas); near Melbourne, Vic., 30 (Bailey 1934); 11, 22, 43 and 140 flying and feeding together in Oct. (Smith 1967); near Mystic Park, Vic., from 1952 to 1957, 12–27 in winter; seven in Feb.; 45–50 in Jan.; at this time noted flocks never remain intact for longer than few hours, birds tending to break up into groups (Lowe 1957). Alligator Rs, NT, up to c. 200 in dry season (Morton *et al.* 1989); Ord R. area, WA, 20–50 although occasionally >500 birds (Gowland 1988). At Kakadu, numbers of birds flying at dusk varied between one and 82 (Schulz 1989).

**BONDS** Presumably monogamous but no information from marked birds. Both parents tend young, continuing for a while after fledging.

**BREEDING DISPERSION** Nest colonially, often in association with other species of ibis, cormorants, herons and spoonbills (Bailey 1934; Lowe 1983; Jaensch & Auricht 1985). Generally do not use breeding sites regularly (Lowe 1983). Nest in dense colonies. Bailey (1934) records five nests in one tree and Jaensch & Auricht (1985), 11 nests in five trees, trees being spaced at most 5 m apart; at Balranald, up to 5 nests/m<sup>2</sup> (K.W. Lowe). When breeding, defend only area close to nest from just before laying. Share feeding with conspecifics but, when breeding may exclude other species from feeding area (Bailey 1934).

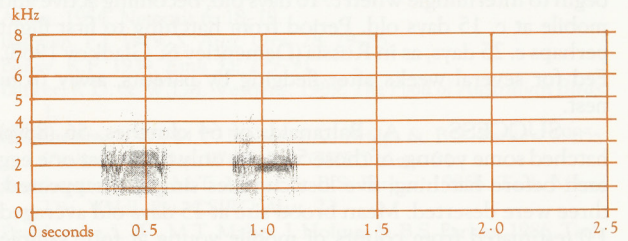
**ROOSTING** Communal. At night, in trees, often dead, over water or bordering swamps (Bailey 1934). Sometimes fly long distances (>10 km) from feeding site to roost (K.W. Lowe). In Ord R. area, roosts recorded adjacent to wetlands near feeding grounds such as L. Kununurra swamps, shallow sandbar margins of Ord R., irrigation and drainage channels, flooded rice bays, farm dams and flooded pastures; in 1979–81, flocks grouped together to form one large main roost (Gowland 1988). May fly to roost after dusk in failing light. In Ord R. area, departure from roosts not rigidly defined and varied from pre-sunrise to 3–4 h later; during day, two-way movement between feeding area and roost observed; flew out again from roost 3–4 h before last light. Flocks sometimes roost in trees during day (Morton *et al.* 1989); often near feeding site (K.W. Lowe).

**SOCIAL BEHAVIOUR** No detailed studies in Aust. See BWP for some extralimital observations. Flocks fly in

lines or V-formations. Birds may desert breeding colony as flock at end of season (Bailey 1934).

**RELATIONS WITHIN FAMILY GROUP** All chicks from a group of nests intermingle when c. 10 days old, after c. 15 days, chicks mix with young from other nearby nests (Lowe 1983). Fledgelings fed by adults for several weeks away from nest.

**VOICE** Very poorly known; no studies. Information supplied by K.W. Lowe from observations at Balranald, NSW. Apparently mostly silent throughout year; at breeding colonies, very occasionally utter grunting sounds in response to threat from intruders and possibly in response to conspecifics; similar to grunts of Australian White Ibis. Also reported to make soft chattering calls when flushed from nest and, if startled, loud honking croaks (sonagram A). Young beg with shrill



A R. Buckingham; captive, Melbourne, Vic., Jan. 1981; P35

call similar to that of other ibises; call pulsates as head is bobbed; only given in presence of adult, sometimes after juveniles have left nest. No further information for Aust. Extralimital, little information: low harsh *graa graa graaa* sometimes given by birds in flight; at nest, utter grunting sounds followed by one or more notes like bleating of young calf and guttural cooing contact call between mates and parents and young (BWP).

**BREEDING** Based on work at Balranald, NSW, by K.W. Lowe (1983). Breed in simple pairs, colonially, usually with other ibises, spoonbills, herons, egrets.

**SEASON** At Balranald, laying from 10 Oct. to 6 Nov. in one season with 87% of clutches started between 17 and 31 Oct. At L. Cowal, NSW: Oct.–Feb. (Vestjens 1977). Probably varies according to flood and drought conditions.

**SITE** On top of flattened lignum bushes; some under overhanging lignum (inside lignum bushes [Vestjens 1977]) and in lignum at base of eucalypt trees; in small trees (NSW, Qld; North); 10–50 cm above water level, which varies (drops) during nesting period; on periphery of groups of nests of Straw-necked Ibis or roughly *vice versa*. Said to use old nests of herons, spoonbills in Qld (North).

**NEST, MATERIALS** Compact pile of interwoven small sticks, occasionally lined with eucalyptus leaves; bunches of leafy twigs, unlined (North). No measurements or details of building. Usually disappears before start of next season; probably demolished by other species of ibis that start breeding before Glossy.

**EGGS** Elongated oval, sometimes pointed at smaller end, even pyriform (North); chalky or somewhat coarse-grained surface, very slightly glossy (Campbell); deep greenish blue or black, fading in sunlight to light blue.

**MEASUREMENTS:** at Balranald, 52.3 (2.7; 47.5–57.6; 51) x 35.7 (1.5; 31.5–38.2). At L. Cowal, 52x35 (n=13; Vestjens 1977).



53.6 (49.3–56.1; 6) x 35.0 (33.8–37.6) (North).

**CLUTCH-SIZE** At Balranald: 2–6 eggs recorded in nests; sample of 50 nests had 3xC/2, 41xC/3, 6xC/4 (av. 3.06±0.42) but not established as completed clutches. L. Cowal, three eggs (n=126; Vestjens 1977). Single brood in one season. Replacement laying not recorded.

**LAYING** No Aust. information; in Russia, daily (Dementiev & Gladkov 1968).

**INCUBATION** Probably by both sexes, starting before clutch complete because hatching asynchronous. No further information. **INCUBATION PERIOD.** Not determined; in Russia, 21 days (Dementiev & Gladkov 1968).

**YOUNG** Semi-altricial, nidicolous. Fed by both parents by incomplete regurgitation. Young usually defaecate out of nest. No further information on parental care, growth of young. **NESTLING PERIOD.** Young from neighbouring nests begin to intermingle when c. 10 days old, becoming active and mobile at c. 15 days old. Period from hatching to first flight perhaps c. 25 days, as in Russia (Dementiev & Gladkov 1968). Fed for several weeks after fledging by parents, away from nest.

**SUCCESS** At Balranald: of 64 clutches, 56 (88%) hatched some young; of those 56 nests only three lost one egg each before hatching; five lost clutches simply disappeared; three were deserted. Mean brood size at 15 days old averaged 1.0 (estimated from counts of mobile young at four sample areas). Foxes *Vulpes vulpes* and wild pigs suspected of causing losses of chicks; starvation probably important cause of mortality.

## PLUMAGES

**ADULT BREEDING** Definitive alternate. In w. Palaearctic, assumed in third year. Age of first breeding unknown. **HEAD AND NECK.** Crown and forehead, dark chestnut-brown with purple (c1) iridescence. Feathers have chestnut (32) bases and broad chestnut (32) shaft-streaks extending to feather tip; rest of feather, dark brown (c119) showing purple (c1) iridescence in most direct lights. Chin and feathered border of bare facial area appear dark chestnut-brown; feathers, small, dark brown (119) with broad chestnut (32) shaft-streak and tips. Rest of head and neck, deep chestnut (132); feathers of neck, long and narrow. **UPPERPARTS.** Mantle, deep chestnut (132) with slight purple gloss. Upper back and shorter scapulars have patchwork of chestnut (132) areas with purple (1) gloss and of dark-brown areas with green iridescence. Feathers, chestnut (132), with purple (1) gloss in some lights; some feathers have large smudges of dark brown with green gloss. Rest of upperparts, dark brown with strong iridescence, which is purple (1) in most lights and green (c146) in some. **TAIL,** dark brown with strong purple (1) or green (c146) gloss depending on incidence of light. **UPPERWING.** Marginal coverts, deep chestnut (132) with purple (c1) iridescence. Upper row of lesser coverts as marginal coverts, but with sharply defined dark-brown tips showing strong purple and green iridescence. Outer secondaries, dark olive with light-green iridescence. Primaries, primary coverts and alula, dark olive with bright green (162A) iridescence. Other feathers as back and rump; median coverts, tertiaries and inner secondaries show only purple iridescence. **UNDERPARTS.** Axillaries and under tail-coverts, dark brown with strong iridescence, which is purple (1) in most lights and green (c146) in some. Rest, red-brown (132); feathers have concealed grey-brown (brownish 83) bases. **UNDERWING.** Remiges as upperwing; primaries have glossy blackish (89) tegmen. Under

wing-coverts, iridescent; olive in dull light, green (162A) in direct light; greater coverts have purple (c1) gloss in some lights.

**ADULT NON-BREEDING** Definitive basic. **HEAD AND NECK,** dark brown streaked white; feathers, dark brown (c20) with short white edges, broadest below eye, giving this area appearance of heavier white streaking. **UPPERPARTS.** Mantle and upperback, dark brown (c20) with glossy patches at ends of feathers which show purple (c1) in most lights. Rest of upperparts as adult breeding, possibly showing more purple iridescence. **UNDERPARTS,** dark brown; under tail-coverts and vent have strong purple (c1) iridescence. In some, feathers of belly and flanks varyingly tipped red-brown, giving faint rufous tinge to underparts; thighs usually red brown. **WING AND TAIL,** as breeding adult.

**DOWNY YOUNG** Protoptile grows in pteryllae; sparse, dark grey (83) to blackish (82) with varying white patches in mid-throat and hindcrown. In whitest birds, white band runs across hindcrown from eye to eye; some birds have no white. On head and neck, juvenile feathers below white protoptile also white; below dark protoptile, tips dark greyish brown (121). White patterning of small downy young thus retained after juvenile plumage has developed. Mesoptile grows in apteria; short and thick, greyish (c79).

**JUVENILE HEAD AND NECK,** mostly dark grey-brown; feathers, brown-olive (29) with broad, sharply defined, open pennaceous dark grey-brown (121) fringes. Face has faint white mottling; hindcrown and mid-throat have varying white patches (as downy young). **UPPERPARTS, TAIL,** dark olive in dull light, dull green in direct light. **UPPERWING,** as upperparts, including marginal and lesser coverts. **UNDERPARTS,** dark olive-brown. **UNDERWING,** as breeding adults.

**FIRST IMMATURE** First basic. **HEAD AND NECK.** As non-breeding adult. Rest of plumage, as juvenile; upperparts and underparts gradually acquire feathers as non-breeding adult.

**SECOND IMMATURE** First alternate. Reported in w. Palaearctic (BWP); unknown if this plumage occurs in Aust. **HEAD AND NECK** appear mottled or streaked rufous; feathers have chestnut tips (-), brown (-) bases and varying off-white margins. **UPPERPARTS,** as non-breeding, but feathers of mantle and scapulars varyingly tinged chestnut.

**BARE PARTS** Based on label data at SAM, ANWC and photos from Aust. RD, Pringle (1985) and unpublished (J.N. Davies, T. Lowe).

**ADULT BREEDING** Iris, dark hazel (c32). Bill, horn (c92) to pale pinkish brown (c219C), tending to be darker at base; green-grey and greenish brown also reported (ANWC). Bare skin of lores, rictus, base of lower mandible and round eye, dark brown-grey (c21) to blackish (82); cobalt-blue (-) when courting. Bordered by narrow white to pale-blue (168D) line along feathering of forehead and cheeks. Line tends to be wider when pale blue than when white; colour perhaps under voluntary control. Feet and legs, vary from olive buff (c124) to dark grey (83) or blackish (82).

**ADULT NON-BREEDING, IMMATURE** Narrow line along feathering of forehead and cheeks, white. Otherwise as breeding adults.

**DOWNY YOUNG** Iris, blackish brown. Bill, black (89) with two broad pink (7) bands; these bands whiter with age. Palate bright pink-violet (-) with large blackish blobs in upper pharynx (SAM). Bare facial skin, black (89); patch shaped as adults. Pink-red (13–10) patches on hindcrown and



mid-throat soon covered by white down. Legs and feet, dark grey (83) to grey-black (82), with grey hind edge to tarsus and pale creamy grey (c86) soles. Claws, light grey (ANWC).

**JUVENILE** Iris, red-brown (132B). Bill, as downy young at fledging, but as adults when moulting into first immature.

**MOULTS** Based on skins (ANWC, MV, HLW) and observations in Melbourne Zoo. For information on moult in w. Palaearctic, see BWP.

**ADULT POST-BREEDING** Pre-basic. Complete, beginning with head and neck. Primaries outwards, about two remiges growing per wing at one time. Recorded in Jan. and Feb.

**ADULT PRE-BREEDING** Pre-alternate. Partial, involving head, neck and probably body, but not wings or tail. Birds completing this moult have been collected in late Sept. and late Oct.; some have completed moult in late Oct.

**POST-JUVENILE** First basic. Feathers of head and neck replaced early in first winter; neck moult recorded in May (HLW). Gradual replacement of body-feathers and probably flight-feathers occurs later; no information on timing. A first immature with primary moult N<sup>505</sup> (ANWC) suggests primary moult can be interrupted.

**MEASUREMENTS** (1) Adult skins (MV, HLW, ANWC). (2) Skins, methods unknown (Amadon & Woolfenden 1952).

	MALES	FEMALES
WING	(1) 275, 287, 294 (2) 286 (4.3; 280-292; 5)	267 (7.02; 256-275; 5) 259.8 (4.5; 254-264; 5)
8TH P	(1) 179, 194, 202	183.2 (4.09; 179-188; 5)
TAIL	(1) 93, 98, 107	98.8 (4.21; 96-106; 5)
BILL	(1) 126.3, 140.0, 140.1	106.2 (5.76; 97.8-112.7; 5)
TARSUS	(1) 96.8, 101.9, 107.7	79.4 (7.27; 67.5-86.7; 5)
TOE	(1) 75.7, 79.2, 83.0	70.8 (2.48; 66.5-72.7; 5)

**WEIGHT** Few data. Adult female, breeding: 485, 545, 570; first immature female: 445, 525; first immature male: 580; unsexed juveniles: 490, 620 (data from MV, ANWC). No information on seasonal changes.

**STRUCTURE** Wing, rather long and broad, slightly rounded. Eleven primaries, p8 usually longest, p10 3-9, p9 1-3, p7 8-13, p6 23-31, p5 41-51, p4 56-71, p3 70-85, p2 81-97, p1 91-107; p11 minute. Eighteen secondaries, four of tertial form. Tail, short, square; 12 feathers, t1-t6 = 5 to -6. Bill, long and slender, higher than broad at base, evenly curved downwards. Upper mandible ridged, lower grooved; tip of bill slightly flattened. Nostrils, small and slit-like. Head and neck feathers, rather pointed and elongate in breeding season, shorter and rounder in other plumages. Legs, long and slender, lower half of tibia bare; small web between middle and outer toe. Claws long, slightly curved, mid-claw slightly incised on inner edge. Outer toe c. 85% middle, inner c. 75%, hind c. 40%.

**GEOGRAPHICAL VARIATION** None in Aust.; no subspecies. Mathews (1912) and others separated Aust. and Indonesian populations as subspecies *peregrinus* from nominate subspecies in Old World, on ground that it is smaller and

has different colour of crown in breeding plumage. Crown colour of adult breeding birds in Aust. seems similar to that of w. Palaearctic birds (described in BWP); measurements now available, including those above (Vaurie 1965; Amadon & Woolfenden 1952) show no significant differences in size. Colour of bill of Aust. adults paler than in w. Palaearctic, where bill dark olive-brown (BWP), or North America, where bill dark-brown (Palmer 1962). Related White-faced Ibis *P. chihi* of w. USA, Mexico and South America sometimes considered conspecific (e.g. Palmer 1962); differs in breeding plumage by rim of white feathers bordering bare reddish facial-skin. DIR

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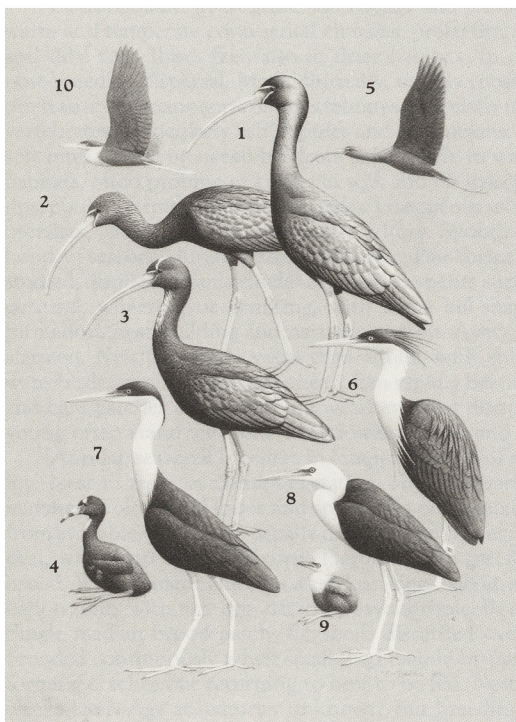
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Glossy Ibis *Plegadis falcinellus*

- 1. Adult breeding
- 2. Adult non-breeding
- 3. Juvenile
- 4. Downy young
- 5. Adult breeding

Pied Heron *Ardea picata*

- 6. Adult breeding
- 7. Adult non-breeding
- 8. Juvenile
- 9. Downy young
- 10. Adult breeding

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