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 ARDEIDAE bitterns, herons

Medium-sized to large or very large wading birds with long necks and long legs. Variously placed in 61–69 species in 10–17 genera (Bock 1956; Curry-Lindahl 1971; Payne & Risley 1976; Hancock & Elliott 1978; Peters) according to choice between many, mainly monotypic genera and a few large genera. Treated here in few large genera, particularly merging *Egretta* into *Ardea* because there is no clear distinction between the two (Mock 1977; van Tets 1977). Two sub-families: Ardeinae (herons) and Botaurinae (bitterns). In our region, 19 species in four genera; all breeding except three accidentals.

Body, slim; neck, long with kink at sixth vertebra. Male larger than female. Wings, long and broad. Flight strong with regular wing-beats, neck retracted. Eleven primaries: p7–p10 longest, p11 minute. Fifteen to twenty secondaries; diastataxic. Tail, short, square or slightly rounded; 8–12 feathers. Under tail-coverts, nearly as long as tail-feathers. Bill, long, straight and sharply pointed, except in *Cochlearius*; often serrated with notch near tip. Nostrils, long slits. Lores, bare. Legs, long; lower part of tibia, bare. Toes, long; small web between middle and outer. Hind and inner toes, broadened at base; claw of middle, pectinate. Stance upright, neck retracted when at rest; gait striding. Perch in trees adeptly (herons) and climb about expertly in reeds (bitterns). Oil-gland small, often with short tuft (longer in night herons *Nycticorax*). Aftershaft well developed. Plumage, loose; feather tracts, narrow; down confined to apteria. Two to four pairs of powder-down patches; down soft and friable, producing fine particles used in care of plumage. Ornamental plumes on head, back or chest in many species; usually more highly developed in breeding season. Bare parts, yellow, brown or black; usually more colourful in season of display and pair-formation. Seasonal differences in plumage, small. Moults, poorly known; mostly two per cycle, but pre-breeding moult often restricted. Moult of primaries irregular or outwards. Young, semi-altricial and nidicolous; single coat of sparse down, white, grey or pale brown. Clamber out of nests when large but unable to fly. Except in *Nycticorax* and *Ixobrychus*, juveniles like adult or duller. Reach adult plumage when 2–4 years old.

Cosmopolitan, with main area of adaptive radiation in Tropics. Absent from Arctic and Antarctic areas; rare vagrants to subarctic and subantarctic regions. Adapted to catch medium-sized prey in shallow water and damp places with short grass, thus rather restricted in habitat. Avoid areas far from marine and inland waters. Otherwise widely distributed from temperate latitudes through Subtropics and Tropics wherever suitable feeding habitat occurs, including forest, mountain and agricultural areas. Usually found at water's edge, especially where gentle slopes and unobstructed bottom makes fishing easy, but some taller, longer-legged species may feed in deeper water. Some smaller species, however, largely arboreal: Cattle Egret *Ardea ibis* now mainly a commensal of large herbivores. Some species (e.g. reef herons *A. sacra* and *A. gularis*) adapted to littoral habitats; others (notably bitterns *Botaurus* and *Ixobrychus*) habitually haunt tall dense vegetation such as reedbeds.

Main breeding and roosting sites, reedbeds, islands, trees and shrubs along banks of rivers, billabongs and lakes (Fullagar & Davey 1983), from which they forage over wide areas. Formerly plumage trade almost annihil-

ated populations of egrets, which have recovered after protection. In Aust. and NZ mainly dispersive, especially those that depend on freshwater habitats.

Food mostly fish, amphibians and insects and their larvae; also, for some species, molluscs and crustaceans, reptiles, small birds and mammals, and their young. Indigestible material ejected as pellets. Prey grabbed by bill; sometimes speared. Feeding methods: (1) stand and wait for prey; (2) wade or walk slowly while stalking prey; (in both methods strike out with neck and bill when within range); (3) movements serving to uncover or startle prey (e.g. foot-shuffling accompanies method 2, at least in Ardeinae); (4) disturb-and-chase technique, in which bird runs and dashes about in shallow water, flushing prey; (5) swimming in deeper water and surface-diving; (6) hovering above water and plunge-diving; (7) plunge-diving from perch (Meyerriecks 1960). Feeding usually diurnal or crepuscular or both (e.g. *Ardea* spp); or crepuscular or nocturnal or both (e.g. *Nycticorax*). Most species solitary feeders, some territorially; where food plentiful may congregate in feeding flocks. Voice, mostly harsh guttural croaks or grunts, unspecialized. With partial exception of some Botaurinae, monogamous pair-bond typical; usually of seasonal duration and not evident away from nest-site or nearby; birds rarely if ever meeting as mates elsewhere. When breeding, both colonial and solitary species typically defend nest-site only. Most species roost communally, often conspicuously at traditional and protected sites; roosts mainly nocturnal but in some species diurnal.

Comfort-behaviour generally similar to other marsh and waterbirds. Bathe while standing in shallow water. Liberal use made of powder-down and oil-gland while preening, with frequent use of pectinate claw in scratching head, neck and bill. In some species, underwing preened by extending wing at right-angle to body. Heat dissipated by gular-fluttering; characteristic sunning posture with upright stance and wings held, shieldlike, out at sides but not fully spread.

In many, specially in colonial species, onset of breeding protracted. Seasonal breeders in coastal and temperate areas but prolonged in inland Aust. if wet conditions prevail. Nest in dense vegetation or in trees. Colonial, often with other Ciconiiformes and Pelecaniformes, or solitary. Displays when forming pairs use long neck and large bill in various distinct ways resembling those of long-necked Pelecaniformes, and birds bob up and down, bending and straightening long legs (Daanje 1950; Meyerriecks 1960). Nest, piles of available vegetation, in tree-nesting species of interlocked twigs; built wholly or mainly by female with material brought by male. Eggs blunt oval, light blue or green, smooth. Clutches 3–5 (1–10). Normally single brood. Replacements laid after loss of eggs or even young. Eggs laid at intervals of 1–3 days. Incubation, 22–30 days; typically by both sexes in roughly equal spells. Single median brood-patch. Incubation starts with first or second egg, so hatching asynchronic. Eggshells removed from nest. Young cared for and fed typically by both parents, by complete and partial regurgitation. Brooded continuously when small; then and later, sheltered from strong sun or rain by parents spreading wings. Older young often guarded by parents in turn. May leave nest before fledging, though often return to be fed. Nestling period 30–55 days; young may become independent soon after, but prolonged periods of post-fledging semi-dependence probably more typical, especially in larger species. Age of first breeding usually 1 or 2 years, occurring in some species before adult plumage attained.

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Ardea garzetta Little Egret

COLOUR PLATE FACING PAGE 981

Ardea garzetta Linnaeus, 1766, *Syst. Nat.*, ed. 12, 91: 237—*in Oriente*; restricted to Malalbergo, River Reno, S of Ferrara, north-eastern Italy, by Grant & Mackworth-Praed 1933, *Bull. Br. Orn. Club* 53: 194.

Garzetta is a modern Latinization meaning *little heron*.

OTHER ENGLISH NAMES Lesser or Spotless Egret.

POLYTYPIC Nominate *garzetta* in s. Europe, Africa, Asia, Japan and Philippines; *nigripes* Temminck, 1840, in Indonesia, New Guinea, Solomon Is, Aust. and NZ.

FIELD IDENTIFICATION Length 55–65 cm, of which body about half; wingspan *c.* 90 cm; weight *c.* 300 g. Small to medium-sized all-white egret with black bill and legs. Similar size to White-faced Heron *A. novaehollandiae*; much smaller than Intermediate *A. intermedia* and Great *A. alba* Egrets. Sexes similar. Plumes on nape, breast and back when breeding. Juveniles like non-breeding adults.

DESCRIPTION ADULT BREEDING. Wholly white with sleek appearance under normal roosting, feeding and flying conditions. Two fine plumes, 15–16 cm long, on crown, hanging down hindneck. Numerous fine filamentous plumes from upper breast, mantle and scapulars, those from scapulars extend just beyond tail. Plumes erected in agonistic and greeting displays giving triangular profile with head as narrow apex. When courting, bill, dark grey; base of lower mandible, buff. Lores, orange-yellow; pink or red during courtship (M.N. Maddock). Iris, red for brief period at courtship, fading to buff, cream or yellow. Legs and feet, dark grey; soles, yellow. ADULT NON-BREEDING. Like breeding but without plumes or few only. Bare parts like breeding but lores, yellow. NESTLING. Wholly white down. Colour of bill varies; yellow most common; variegated yellow and black or wholly black; lores generally as colour of bill but birds with wholly black bills may have black or yellowish lores; legs, green; soles of feet, yellow to grey. JUVENILE. Like non-breeding adult. Legs, olive-green with or without black anteriorly.

SIMILAR SPECIES Four other species of all-white egrets in our region may be confused. **Great Egret**, much larger and easily recognized by size alone; also, head and neck about 1.5 times length of body (shorter in Little). **Intermediate Egret**, larger and usually with yellow bill but, when with dark bill, without long lanceolate nuchal plumes; does not have yellow on feet. **Cattle Egret** *A. ibis*, smaller, stockier, with shorter thicker neck; bill, yellow or at least not black; legs, dark grey, or greyish, or anyway not black; in nuptial plumage has orange-buff on crown, lower throat and mantle. White morph of **Eastern Reef Egret** *A. sacra* has shorter thicker bill, greenish yellow in colour, with dusky tip, and dark greenish legs and feet. Nestling Little Egret distinguished from these species by small size; slender lines; long slender bill with length/depth ratio of 3.45; yellow hard palate; pink tongue and lining of lower mandible; and absence of loral notch at gape (Maddock 1989).

Seen singly or in mixed flocks of egrets and ibises in tidal estuaries, mangroves, mudflats, saltmarshes, margins of shallow wetlands and rivers, sewage farms or on pasture among grazing stock. When foraging, active high-stepping gait with jerky dashes after prey, often with wings raised and fluttering. Usually fly sedately with steady flapping, interrupted by glides; wings appear somewhat rounded; head drawn back and legs trailing, exposing yellow soles. Croaking *kark* in flight; bubbling calls at nest.

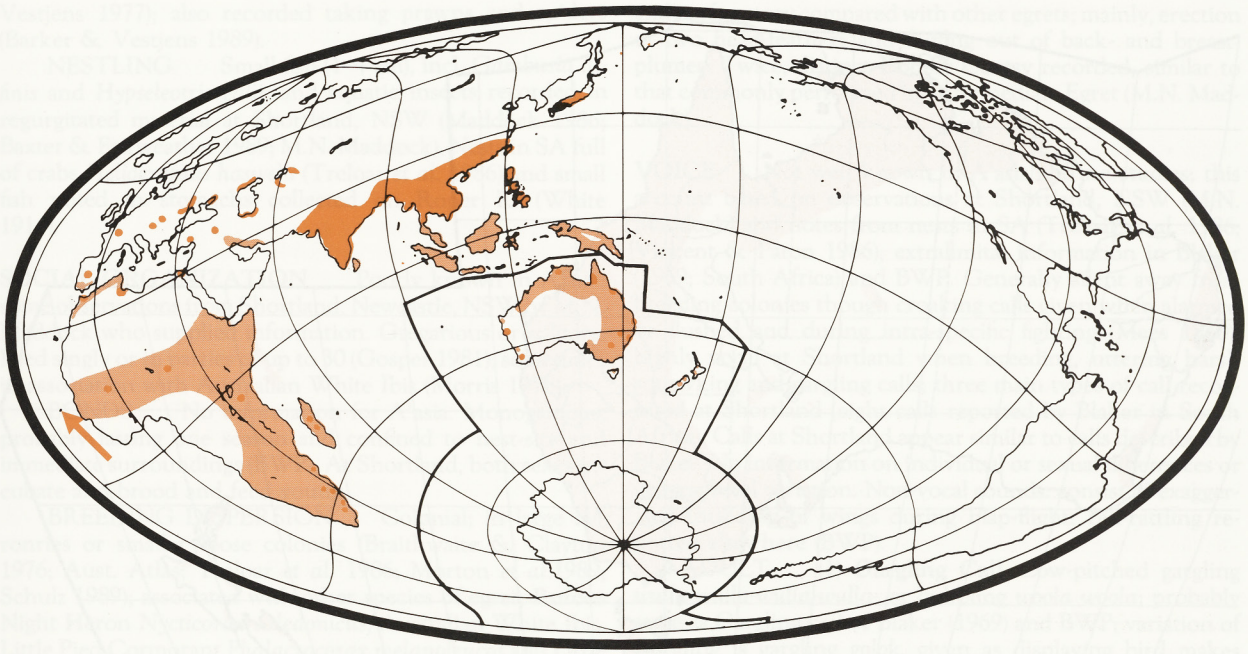
HABITAT In terrestrial wetlands and estuarine and littoral habitats. Forage mainly in shallow open water (0.1–0.15 m deep); also on shores or exposed flats or banks; particularly in areas with soft substrate, abundant aquatic vegetation and little or no emergent vegetation (Recher & Holmes 1982); able to use deep water, where flying birds take fish from surface (Mackay 1967). Saline wetlands much used in Aust. and NZ; prefer intertidal mudflats, mangrove-lined estuaries and tidal reaches of watercourses, saltpans and saltmarsh. Also use shallow coastal lagoons and salt lakes; beaches; and saltfields (Crawford 1972, 1975; Corrick & Norman 1980; Gosper 1981; Corrick 1982; Jaensch *et al.* 1988; Schulz 1989). Rarely occur inland in NZ, but in Aust. prefer watercourses, pools, billabongs and floodwaters with low vegetation of grasses or sedges on floodplains. Also use shallow open areas in freshwater swamps with short or tall emergent vegetation (e.g. *Typha*, *Eleocharis*, *Phragmites*, *Scirpus*); open lakes and reservoirs; shrubby or wooded lakes and swamps (e.g. *Melaleuca*, *Eucalyptus*, *Muehlenbeckia*); wet meadows; seepage from springs; flooded depressions; and sewage farms (Boekel 1976; Vestjens 1977; Corrick & Norman 1980; Gosper 1981; Fjeldså 1985; Schulz 1989). In NT, seasonal variation in use of habitat; in wet season, mainly use tidal waters; in dry season, wider range of habitats including floodplains (Schulz 1989).

Breed in fresh, brackish or saline wetlands vegetated with trees, in which nests are built; along coast, regularly in mangrove forest; inland, in freshwater swamps or lakes (Seton 1971; Braithwaite & Clayton 1976; Treloar *et al.* 1986; Jaensch *et al.* 1988).

Roost in trees, on banks, or occasionally on artificial structures (Wieneke 1988; Schulz 1989). In tidal habitats, roosting determined by tidal cycle (Schulz 1989).

Aust. range has expanded since 1901 (Aust. Atlas); wide use of saline habitats for feeding and breeding may reduce impact of destruction and modification of natural freshwater wetlands, although some breeding sites may have been affected. Reclamation of tidal land may affect local breeding populations in mangroves; colony along navigable channel in Price, SA, abandoned after pruning of mangroves used for nesting (Treloar *et al.* 1986). Mangroves remaining near urban areas used for breeding (Adelaide, SA; Vincent & Paton 1986).

DISTRIBUTION AND POPULATION Africa, Eu-



rope to Japan and New Guinea, Aust., with small numbers in NZ. Accidental ne. North America and e. West Indies.

AUST. Widespread, mostly peripherally from nw. Aust. through n., e. and s. regions to Spencer Gulf, SA. Throughout Kimberleys, and Top End, NT, N of about 18°S, and E to area of Mt Isa. Thence, NE, E and S of line roughly to Winton, Longreach and Barcaldine, to Cunnamulla, Qld, and Bourke, NSW; then down Darling R. to about Menindee, NSW, and W across to Pt Augusta, SA (Aust. Atlas). Rare and irregular visitor farther inland and centrally but, in WA, coastal populations in district of Perth, S of 30°S, in district of Shark Bay and Gascoyne R., and from about Dampier to Port Hedland. Scarce but regular visitor to Tas. (Green 1977).

Surprisingly few breeding localities recorded; assumed to breed more widely but perhaps irregularly throughout main range. **WA** : Australind Egret Swamp, near Bunbury; Nicol Bay Swamp, near Carnarvon; Kununurra district. **NT** : East and South Alligator Rs; Roper and lower Adelaide Rs. **Qld**.: Gilbert, Nassau and Mitchell Rs, N of Karumba, w. C. York Pen.; Barrata Ck, Ayr district. **NSW** : Lismore district; Shortland, Newcastle district; Macquarie Marshes; Chittaway Pt, Tuggerah Ls. **Vic**.: Gunbower I., Murray R., near Echuca. **SA** : recently (1983–84) at Price and Torrens I.; only one earlier report, solitary breeding at L. Alexandrina, Nov. 1967 (Bonnin & Rix 1972; Treloar *et al.* 1986; Vincent & Paton 1986; Jaensch *et al.* 1988; Morris 1990; Aust. Atlas; Aust. NRS).

Range has evidently expanded this century. Breeding first recorded on Murray R. in 1939 (Jones 1940) and still regarded as summer visitor in sw. NSW in 1950s (Hobbs 1961). In SA, no definite records before 1952 (Parker *et al.* 1979). In Tas. first record in 1957 (Bolger & Wall 1959). In WA, first record in 1965 (Ford 1966). Spread has been unspectacular and largely unrecorded.

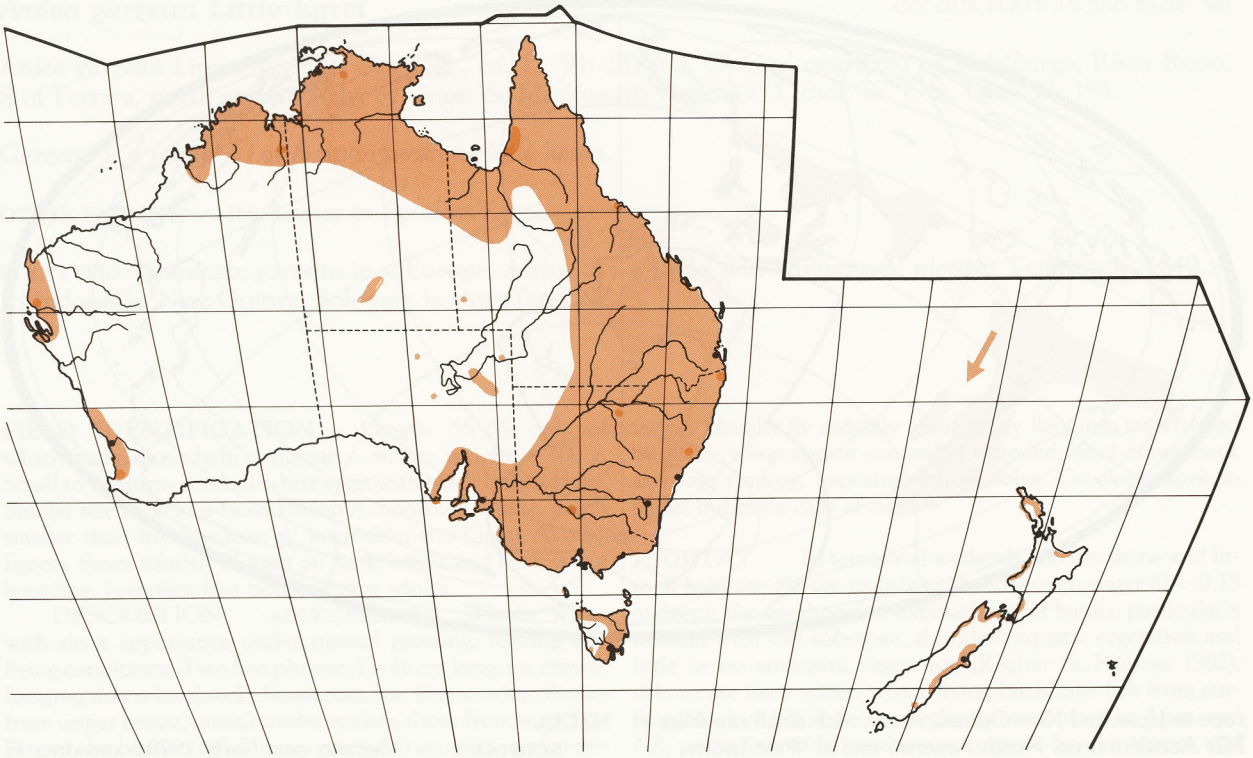
NZ Scattered records throughout, since 1951; rare inland; movements indicate breeding, but banding results indicate trans-Tasman wintering movements (Falla *et al.* 1981; NZCL).

NORFOLK I. Vagrant; one, 'early 1970s' and one, 17 Mar.–15 May but without giving year (Hermes *et al.* 1986). Schodde *et al.* (1983) state recorded once in 1973 and cite de Ravin (1975); however, he only gives 'casual visitor, previously recorded'.

CHRISTMAS I. Vagrant: two seen and one collected from fringing reef near Norris Pt in Apr. 1940 (Gibson-Hill 1947); occasionally observed in 1980s (Stokes 1988).

COCOS-KEELING IS Vagrant; one, Pulau Panjang, W of main atoll, in 1879 (Forbes 1885); based on a specimen record, though thought to breed by Forbes by confusion with white-phase Reef Egrets (Gibson-Hill 1949).

MOVEMENTS Poorly understood, probably most movements over short distances but dispersive when necessary with banded immatures from se. Aust. recovered in NZ and New Guinea. Populations in most of n. Aust. apparently move short distances between wet-season breeding sites and dry-season refuges or coast: no seasonal variation noted at Darwin (Crawford 1972), Atherton Tableland (Bravery 1970), Innisfail (Gill 1970), Hunter R. (Gosper 1981) and movements apparently local in district of Alligator Rs, NT (Morton *et al.* 1989). Similarly, reporting rates in Vic. suggest no long-distance seasonal movements (Vic. Atlas). However dry-season visitor to Torres Str. (Draffan *et al.* 1983) where flocks seen moving N in Apr., S in Nov.–Dec., probably in response to drying of swamps on coastal Gulf of Carpentaria (S.T. Garnett). Also absent from Richmond R., Jan.–Apr. during exceptionally wet years 1974 and 1976, which suggests movement inland (Gosper 1981) and in se. Qld numbers during Oct. counts negatively correlated with local winter rainfall (Woodall 1985). Birds wing-tagged at Shortland Wetlands Centre, e. NSW, sighted live at Forster, Tea Gardens, Shoalhaven R. (NSW) and Joskeleigh (Qld) in first-year of life; one at Warrnambool, Vic., in first or second year (M.N. Maddock). Unusually large numbers of Little Egrets reached NZ,



1957–58 (Falla 1958; Andrew 1963), when dry spell followed widespread flooding in inland NSW, and may now visit there regularly in winter, where several birds banded in Aust. have been recovered. In early 1970s, absent in some years from L. Cowal, May–July (Vestjens 1977) but now occurs s. NSW all year (Aust. Atlas). In SA disperses from breeding sites on Torrens I. and e. side Gulf St Vincent to Adelaide Plains in non-breeding season (Treloar *et al.* 1986; Vincent & Paton 1986).

BANDING Returns from Red Bank Weir, sw. NSW (ABBBS) summarized Fig.1.
Other records (all ABBBS)
32S151E 11 P U 2 108 044
32S151E 11 U U 8 1056 354
37S140E 12 P U 5 1078 066

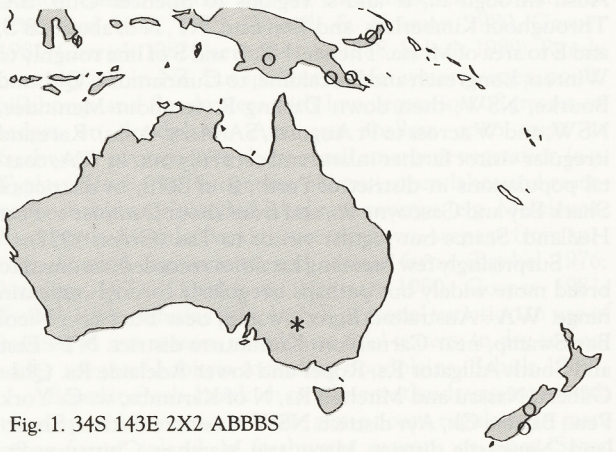


Fig. 1. 34S 143E 2X2 ABBBS

FOOD Aquatic animals, principally fish but also frogs and insects. BEHAVIOUR. Active feeder with perhaps most diverse methods known in ardeids: standing and waiting for prey, crouching and waiting, walking slowly or quickly, running, wing-flicking, foot-stirring (Recher & Holmes 1982; Recher *et al.* 1983). Most common behaviour is to stand erect searching for prey, then walk quickly or run in pursuit, sometimes aided by wings. Wing-flicking rarely observed on vegetated flood plains but may be more frequent on open expanses of water (Recher & Holmes 1982). Foot-stirring used to dislodge prey from beneath debris or vegetation, yellow soles of feet possibly acting to attract fish (Garnett & Cox 1983). Has also been seen to plunge for fish from air (Mackay 1967), and hover (Demey 1986). At Kakadu, NT, 59.8% of time spent standing still, mostly scanning for food; when moving, travelled mean distance of 5.8 m at 0.8 ± 0.03 steps/s, averaging 2.2 attacks/min with 54.5% success (117 observations, 117 min; Recher & Holmes 1982). Defend feeding territories over successive days and, when loose congregations form at concentrations of prey, agonistic behaviour can disrupt foraging (Recher & Holmes 1982). Sometimes follow foraging cormorants *Phalacrocorax* spp, taking fish driven into shallows by them (Recher & Holmes 1982). Also recorded feeding in association with spoonbills *Platalea* (Vestjens 1975; Hobbs 1980, 1981) and Australian White Ibis *Threskiornis molucca* (Morris 1978).

ADULT At Kakadu, NT, fish <2 cm long most often recorded. Fish caught and eaten successfully, *Neosilurus* 10–15 cm caught but lost (Recher & Holmes 1982); at L. Cowal contained freshwater crayfish 33% freq., shrimps 33, damselflies 67, crickets 33, water-boatmen 67, waterbugs 33, water beetles 100, fish *Gambusia affinis* 100 (three stomachs;

Vestjens 1977); also recorded taking prawns and spiders (Barker & Vestjens 1989).

NESTLING Small fish (1–4 cm), incl. *Gambusia affinis* and *Hypseleotris galii*, and aquatic insects recorded in regurgitated material at Shortland, NSW (Maddock 1986; Baxter & Fairweather 1989; M.N. Maddock). Nests in SA full of crabs *Heliograpsus haswelli* (Treloar *et al.* 1986) and small fish noted in stomachs collected on Roper R. (White 1916).

SOCIAL ORGANIZATION Poorly known in A'asia; some observations from Shortland, Newcastle, NSW by M.N. Maddock who supplied information. Gregarious or solitary. Feed singly or in parties of up to 30 (Gosper 1981); sometimes in association with Australian White Ibis (Morris 1978).

BONDS No information for A'asia. Monogamous; probably lasting one season and confined to nest-site and immediate surroundings (BWP). At Shortland, both sexes incubate and brood and feed young.

BREEDING DISPERSION Colonial; in large heronries or smaller loose colonies (Braithwaite & Clayton 1976; Aust. Atlas; Treloar *et al.* 1986; Morton *et al.*1989; Schulz 1989); associated with other species of egret, Rufous Night Heron *Nycticorax caledonicus*, Australian White Ibis, Little Pied Cormorant *Phalacrocorax melanoleucos* and Little Black Cormorant *P. sulcirostris* (Seton 1971; Braithwaite & Clayton 1976; Vincent & Paton 1986; M.N. Maddock).

ROOSTING Either singly or in groups (sometimes large). In NZ, communally at traditional sites in trees. In tidal areas, can be regulated by tidal cycle. At high tide in Kakadu NP, NT, some individuals roost in mangroves; others in small groups on mud banks together with such species as Pied Heron *Ardea picata*, sometimes in large concentrations, e.g. 161 individuals (Schulz 1989). Do not appear to move large distances to reach communal roost-sites; in Kakadu NP, Schulz (1989) found birds do not fly into or out of areas at night; presumably remain near feeding area throughout night.

SOCIAL BEHAVIOUR Poorly known in A'asia; some observations from Shortland, Newcastle, NSW by M.N. Maddock who supplied information. Some information outside A'asian region in Blaker (1969) and BWP.

AGONISTIC BEHAVIOUR Head- and body-plumes raised to different degrees, depending on closeness and intensity of perceived threat, creating typical triangular profile. Neck held extended forward toward opponent or flicked in typical forward action (M.N. Maddock).

SEXUAL BEHAVIOUR Complex displays both before and after pair-formation, including cracking of wings in flight and fanning of nuptial plumes. COURTSHIP. **Forward Display** similar to that described for Little Egret in Africa (Blaker 1969); bird thrusts head and neck toward mate and quickly withdraws; accompanies by gargling sound (M.N. Maddock). **Flap Flight** and **Circle Flight** displays observed as described by Blaker (1969); flies with neck extended above horizontal plane, and flaps wings slowly and noisily. On take-off, gives Gargling Call (see Voice). Flap Flight is short, to nearby tree; Circle Flight is round colony returning to same or nearby perch (M.N. Maddock). Other typical heron displays reported but not described: Stretch, Twig Shake, Wing Preen and Body Shake. Birds also observed to stab head and neck rapidly and repeatedly upwards, making *golok* call with each stab; function unknown (M.N. Maddock). GREETING. Brief and perfunctory compared with other egrets; mainly, erection of two head-feathers and fluffing out of back- and breast-plumes. Twice, distinct **Bob** or **Curtsy** recorded, similar to that commonly performed by Intermediate Egret (M.N. Maddock).

VOICE Not well known in A'asia and no studies; this account based on observations at Shortland, NSW (M.N. Maddock) and notes from nests in SA (Treloar *et al.* 1986; Vincent & Paton 1986); extralimital information in Blaker (1969; South Africa) and BWP. Generally silent away from breeding colonies though croaking calls given when alarmed or flushed and during intra-specific fighting (Mees 1950); highly vocal at Shortland when breeding, uttering harsh squawking and gargling calls; three main types of call recognized at Shortland (eight calls reported by Blaker in South Africa). Calls at Shortland appear similar to calls described by Blaker. No information on individual or sexual differences or geographical variation. Non-vocal sounds: consist of exaggerated thudding of wings during Flap-flight; Bill-rattling reported elsewhere (BWP).

ADULT (1) **Gargling Call**. Low-pitched gargling *wulla-wulla-wulla-wulla-* or bubbling *woola woola*; probably same as Gargling-call of Blaker (1969) and BWP; variation of Gargling is gargling *golok*, given as displaying bird makes upward stabbing movement with head; usually repeated several times. Gargling Calls heard only when courting and building; noted between members of pair courting and when birds take-off on Flap-flights. (2) Brief hollow-sounding single note, probably equivalent to Blaker's *dow*; at Shortland, only heard during courting period, given after series of Gargling Calls. (3) **Harsh Calls**. Harsh, medium- to high-pitched squawking *kiaw* or drawn-out *kaaa*. When being followed round colony by fledgelings, bird utters harsh notes sounding like *kurik kurik kurik* followed by *kak kak kak kak* or *kiaw* as it approaches nest. Heard throughout breeding season. **Other calls**: Blaker (1969) describes several other calls: long grating *aaaah* at take-off (Aaah-call); loud *da-WAH* (Da-wah call); descending series of 5–9 hollow *po. . .* notes (Po-call); brief nasal chattering (Chatter-call) and a brief gulping *ow* (Ow-call); see also BWP.

YOUNG In SA, ventriloquial trilling given by small white downy young; and persistent harsh hissing or rasping sounds.

BREEDING Studied at Shortland, NSW (M.N. Maddock). Additional information from Aust. NRS. Breed in simple pairs, colonially, with other herons, ibises, spoonbills, cormorants. Proportion of nests in colonies: Shortland, *c.* 5–9% of 350–550 nests; Macquarie Marshes *c.* 18%; one Vic. colony, *c.* 1%; one NT colony, *c.* 15%.

SEASON At Shortland: late Oct.–early Mar., no laying after mid-Jan.; Vic., eggs Nov.–Dec.; NT, eggs and young Jan.–Apr. (Aust. NRS); in WA, five breeding records (laying) were between Oct. and Dec. (Halse & Jaensch 1989); in SA, eggs and young, Nov. and Jan.–Mar., the young in Mar. about one week old on 7 Mar. (Treloar *et al.* 1986; Vincent & Paton 1986).

SITE In forks of trees, on lateral limbs and elsewhere in lower half of trees, often standing in water; 3–7 m above water; usually in one area of, not scattered throughout, colony; $\geq$0.5 m from nests of other egrets but rarely close to those of conspecifics. In SA, NT and Qld, reported nesting in mangroves.

NEST, MATERIALS Shallow platform of loosely woven sticks; one in SA measured *c.* 40 cm diameter, with a shallow depression *c.* 15 cm diameter. Building behaviour not recorded.

EGGS Oval to elliptical; surface minutely pitted, slightly glossy; pale blue-green or sea-green (North). MEASUREMENTS.: 48.0 x 43.0, 45.7 x 39.9, 44.5 x 32.8 (Campbell).

CLUTCH-SIZE No quantified data. Generally said to be 3–4, but 2–6 recorded. Estimated minimum av. from definite broods (18 x C/2, 14 x C/3, 2 x C/4) 2.2 ± 0.82.

LAYING No information.

INCUBATION By both sexes. Hatching asynchronic. No further information. INCUBATION PERIOD. Undetermined; from observations of adults first sitting to young first visible, probably 20–25 days, as elsewhere (Hancock & Elliot 1978; BWP).

YOUNG Semi-altricial, nidicolous. Both parents attend and feed young; by incomplete regurgitation at least when older; young grasp bill of adult to stimulate. No further details. Young scramble out of nest on average at 26.2 days old (21–32; 10) and perch on nearby branches. NESTLING PERIOD. Period from hatching to first flight 36.4 days (32–46; 9) but after leaving nest depend on parents, pursuing them round colony and being fed by incomplete regurgitation away from nest. Length of dependent period not known.

GROWTH No detailed knowledge.

SUCCESS Of 35 nests, 31 (90%) fledged some young: 9 x 1, 12 x 2, 8 x 3, 2 x 4 or 2.1 ± 0.91 chicks reared per successful pair (in dry year av. 1.46 for 15 nests; in wet, 2.59 for 16).

PLUMAGES Subspecies *nigripes*.

ADULT BREEDING Age of first breeding unknown. Entirely white. Two nuchal plumes on nape, loose, narrow and elongate (up to 120 mm). Among scapulars, long filamentous aigrettes extending up to 50 mm beyond the tip of the tail and recurved at tip. Feathers on breast loose and lanceolate (up to 100 mm).

ADULT NON-BREEDING Similar to adult breeding, but without nuchal plumes and lanceolate breast feathers; aigrettes much reduced. Glover & Schodde (1956) observed varying amount of buff in plumage, but no details are given.

NESTLING Down white, slightly cream (54) in colour; hairy and erect on crown.

JUVENILE Similar to adult non-breeding but lacks aigrettes.

BARE PARTS Based on Hindwood *et al.* (1969) and photos in Coates (1985), Pringle (1985), Aust. RD and Slater (1987), except where stated.

ADULT BREEDING Iris, red for brief period at courtship; fading through pink, then white, to become buff (123D), cream (54) or yellow during rest of breeding season. Eye-ring, straw-yellow (57). Bill, grey-black (82); base of lower mandible, buff (53). Loral skin, red or pink for brief period at courtship, becoming orange-buff (118–153) during rest of breeding season. Tarsus and feet, grey-black (82); soles, straw-yellow (57).

ADULT NON-BREEDING Iris, cream (54). Bill, grey-black (82) and at base, dull straw-yellow (57). Loral skin, buff (53). Tarsus and feet, grey-black (82); soles, lime-green (59). Sometimes legs and feet, greenish-yellow (Coates 1985).

NESTLING Iris, white, cream or yellow. Bill, yellow or black, tipped yellow or variegated black and yellow; rictus, black. Tongue, pink or yellow. Palate, predominantly yellow, but may be black or have black marks. Loral skin, yellow or variegated black and yellow or just black (Maddock 1988, 1989). Tarsus, dusky (Aust.RD). Soles, yellowish or yellow. Skin of nestling, generally grey-olive (43). Bare parts of nestlings vary with age (see photos in Pringle 1985).

JUVENILE Similar to adult non-breeding, but legs and feet, grey-olive (43) or greenish-yellow (Coates 1985). Individuals observed with variegated bill up to 4 months after fledging (M.N. Maddock).

MOULTS Breeding protracted in Aust.; no definite moult period can be ascribed. Based on skins from se. Aust. (MV, SAM).

ADULT POST-BREEDING Complete; primaries irregularly; Feb.–June; begins with loss of nuchal plumes and aigrettes.

ADULT PRE-BREEDING Duration unknown; nuchal plumes and aigrettes appear.

POST-JUVENILE Unknown, presumably partial as in nominate *garzetta* (BWP).

MEASUREMENTS (1) Se. Aust., adults, skins (MV, SAM). (2) Shortland, NSW, adult, live (M.N. Maddock). (3) Shortland, NSW, juveniles, live (M.N. Maddock).

MALES

WING	(1)	265.2 (5.16; 258–272; 8)
8TH P	(1)	174.5 (6.94; 161–182; 6)
TAIL	(1)	90.3 (4.36; 82–95; 6)
BILL	(1)	87.8 (2.83; 83.5–93.2; 7)
TARSUS	(1)	100.3 (5.30; 95–112; 7)
TOE	(1)	70.8 (1.81; 68.4–73.7; 7)

UNSEXED

WING	(2)	260
	(3)	260, 260
BILL	(2)	78.0
	(3)	66.5, 68.2
TARSUS	(2)	91.8
	(3)	84.4, 89.0

Additional measurements in Amadon & Woolfenden (1952).

WEIGHTS Few data. Juvenile male from Vic.: 325; juvenile male from NI, NZ: 254. Shortland, NSW, unsexed adult, live: 310; unsexed juveniles, live: 320, 390 (M.N. Maddock).

STRUCTURE Wing, broad. Eleven primaries; p8 and p9 longest, p10 4-8 mm shorter, p7 0–7, p6 10–19, p5 25–34, p4 39–47, p3 49–60, p2 63–73, p1 76–83, p11 minute. P10-p9 emarginated on inner web; slight on p8. P9-p8 slight on outer web. Fourteen secondaries including four tertials. Tail, square, edge of webs rounded. Twelve rectrices: t1 longest, t6 1–7 mm shorter. Five patches of powder down, one on breast, one on each side of rump and inner thighs. Bill, pointed and slender, with deep nasal groove. Legs, slender; long toes,

lower half of tibia bare. Middle claw, pectinate. Neck, short; crown flat (Cox 1973). Outer toe *c.* 87% of middle, inner *c.* 75%, hind *c.* 48%.

RECOGNITION Confusion possible between nestling egrets. Nestling Little Egrets have post-gape loral notch below pupil of eye; bill long and slender; forehead sloping (Maddock 1988, 1989; see illustration in Maddock 1988, 1989).

GEOGRAPHICAL VARIATION In A'asia, formerly two subspecies *nigripes* and *immaculata* (Amadon & Woolfenden 1952; NZCL; Aust. CL), now placed in synonymy (Peters). Subspecies *immaculata* [= *nigripes*] smaller than nominate *garzetta* (Grant & Mackworth-Praed 1933; Curry-Lindahl 1971). Nominate *garzetta* has yellow feet; *nigripes* black with yellow soles. The subspecific status of A'asian birds still requires further study. Forms superspecies with Snowy Egret *A. thula*, Western Reef Egret *A. gularis* and Dimorphic Egret *A. dimorpha* (Peters). Note, however, that Hancock & Kushlan (1984) consider *A. gularis* and *A. dimorpha* as subspecies of *A. garzetta*.

RMO

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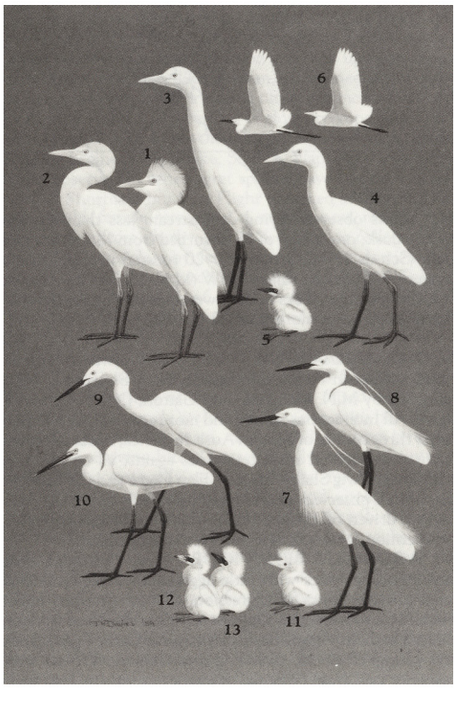

Volume 1 (Part B), Plate 72

Cattle Egret *Ardea ibis*
1. Adult breeding (with courtship flush)
2. Adult breeding (without courtship flush)
3. Adult non-breeding
4. Juvenile
5. Downy young
6. Adult non-breeding

Little Egret *Ardea garzetta*
7. Adult breeding (with courtship flush)
8. Adult breeding (without courtship flush)
9. Adult non-breeding
10. Juvenile
11. Downy young, light form
12. Downy young, intermediate form
13. Downy young, dark form
14. Adult non-breeding