

Text and images extracted from

Marchant, S. & Higgins, P.J. (co-ordinating editors) 1990. Handbook of Australian, New Zealand & Antarctic Birds. Volume 1, Ratites to ducks; Part B, Australian pelican to ducks. Melbourne, Oxford University Press. Pages 953-954, 1045-1046.

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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 ARDEIDAE bitterns, herons

Medium-sized to large or very large wading birds with long necks and long legs. Various 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. Moults 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 asynchronous. 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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Ixobrychus novaehollandiae New Zealand Little Bittern

Ardeola Novae Zelandiae Potts, 1871, *Trans. NZ Inst.* 3: 99 — Westland, South Island, New Zealand.

MONOTYPIC

EXTINCT Length 53 cm (skins, NMNZ; O'Donnell & Dilks 1988). Small bittern. Known from few specimens. Few accurate descriptions; two plumages in collections described by Oliver as adult male and female but more likely adult and juvenile. Adult similar to Little Bittern *I. minutus*, but considerably larger; buff patch on upperwing darker and streaked with rufous-brown; black upperparts streaked with light brown; and underparts streaked dark brown and rufous-buff. If specimens represent both sexes, there is no marked sexual dimorphism unlike Little Bittern (Falla 1964), but descriptions of male and female plumages published since 1955 were based on Oliver's description and therefore unreliable.

Restricted to SI, NZ. No definite records for over a century; reasons for extinction unknown. Known from records and specimens from w. SI, mainly in Westland; Oliver defines distribution as L. Brunner, Hokitika, Kanieri R., Okarito, L. Wakatipu, Jackson Bay and Westport. Possibly formerly resident along Okuru and Turnbull Rs (McKenzie 1972). NI records now discounted; birds at Meremere and Kopuku (Howard 1963) probably misidentified Australasian Bitterns *Botaurus poiciloptilus*; record from Tauranga based on specimen without information on when and by whom it was identified, and now untraceable (Falla 1964).

Recorded from wooded margins of saline lagoons and banks of creeks (Oliver). Observed standing motionless for long periods with head bent forward over water, probably watching for prey. No information on food of wild birds; captive bird ate mudfish and worms given in water (Oliver).

Secretive and solitary. Alarm Call described as 'a peculiar snapping cry'; also gave 'a cry not unlike that of a kingfisher, though not so loud' (Buller 1888). No information on movements, social organization, behaviour or breeding.

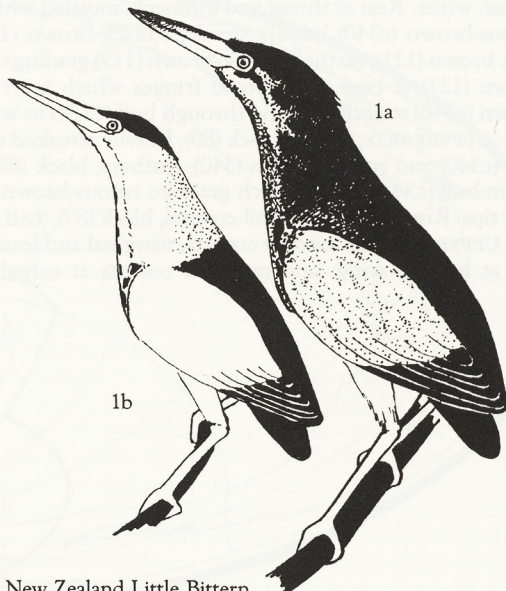


Fig. 1a New Zealand Little Bittern
1b Little Bittern, subspecies *dubia*

PLUMAGES Little information; nine specimens extant (J.A. Bartle) though Oliver says 13; all unsexed and few with dates of collection. Two plumages represented; Oliver assumed these to be adult male and female but, by analogy with other species of *Ixobrychus* bitterns, they are more likely adult (sex unknown) and juvenile; female skin in Carnegie Museum of Natural History has similar plumage to that of Oliver's 'male' (J.A. Bartle).

ADULT (or possibly immature). **HEAD AND NECK.** Forehead, crown and nape, black (89). Narrow supercilium, sides of head and neck, chestnut-brown (c32), grading to mottled black-brown (c119) strip down hindneck. Sides of chin and upper throat, white. Lower throat, foreneck, sides of chin and upper throat, buff (124) heavily streaked rufous-brown (c340) and dark brown (c119); feathers rufous-brown (340) with dark-brown (c119) shaft-streaks and broad buff edges. Feathers of centre of throat lack buff edges, giving appearance of darker midline. Foreneck feathers elongate, obscuring much of upper breast. **UPPERPARTS,** black (89) with light-brown streaks; feathers black (89) with brown (123-123A) edges. **TAIL,** black (89). **UPPERWING.** Primary coverts, alula and remiges, grey-black (82) with small rufous-brown (340) central tips to secondaries, primary coverts, alula and inner primaries. Marginal coverts, black-brown (c119) near carpal joint; all other coverts, olive-buff with rufous-brown (340) centres; secondary coverts have dark-brown (c119) shaft-streaks; wing-patch looks darker and more mottled than in *I. minutus*. **UNDERPARTS,** streaked dark brown and rufous-buff; feathers, dark brown (119A-119) with rufous-buff (118-39) fringes, grading to white edge. Dark-brown streaks are narrower towards vent and under tail-coverts. **UNDERWING.** Remiges, dark grey (83) with white shafts; secondaries and inner primaries have narrow rufous-brown (c340) tips. Most under wing-coverts, buff (124) with dark-brown (121) central wedge, broad near base and tapering to point at tip. Median and primary greater coverts, buff-white with dark-brown (121) shaft-streaks; marginal coverts and bases of lesser coverts, white.

JUVENILE HEAD AND NECK. Forehead, crown and nape, glossy black (89); hindneck, rufous-brown (c340) grading to dark brown (c119). Sides of head and neck and upper throat, white. Rest of throat and foreneck, mottled white and rufous-brown (c340) heavily streaked black-brown (119) or dark brown (121); feathers, black-brown (119) grading to dark brown (121) at base, with broad fringes which are rufous-brown (c340) at ends, grading through buff (c124) to white at base. **UPPERPARTS,** mostly black (89), heavily streaked cream-buff (c340) and rufous-brown (340); feathers, black (89) with cream-buff (c54) fringes, which grade to rufous-brown (c340) near tips. Rump and upper tail-coverts, black (89). **TAIL,** black (89). **UPPERWING.** Secondary coverts, marginal and lesser coverts at base of wing, and marginal coverts at carpal joint,

rufous-brown (c340); secondary coverts have black-brown (119) shaft-streaks. Other marginal and lesser coverts, and median coverts, cream-buff (c54) with black-brown (119) central wedge, broad at base and tapering to point at tip. Remiges, primary coverts and alula, grey-black (c82) with rufous-brown (c340) tips; tips absent on outer 3-4 primaries. **UNDERPARTS,** white, grading to buffish on flanks, with heavy dark-brown streaking; feathers, white with varying amount of buff (c124-c118) near end, and broad dark-brown (121) to black-brown (119) centres.

BARE PARTS

ADULT According to Oliver: iris, yellow; facial skin and bill, yellowish green with black culmen and tip; feet, yellowish green. No other information.

MOULTS No information.

MEASUREMENTS Few available; available skins seem closer in size to Black Bittern *I. flavicollis* than to Little Bittern *I. minutus*. All measurements below of skins. (1) Oliver; methods unknown. (2) O'Donnell & Dilks (1988); methods unknown. (3) Adult (?) female (Carnegie Museum of Natural History, measured by J.A. Bartle).

	(1)	(2)	(3)
WING	152-164	144, 151, 150	153
TAIL	51-60	51, 49	53
BILL	53-56	54, 53, 57	55.8
TARSUS	50-57	49, 48, c.50	48
TOE	57		

WEIGHTS No information.

STRUCTURE Similar to *I. minutus* (see that account); perhaps with slightly shorter bill and wing relative to body size. As in *I. minutus*, p10 shorter than p9-p7; p9 longest. No wing formulae available.

GEOGRAPHICAL VARIATION Once combined with Little Bittern *I. minutus*, but far larger, with distinctive plumage, and treated as full species by NZCL. DIR

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