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Order GRUIFORMES

Diverse assemblage of small to very large wading and terrestrial birds. Morphologically diverse, with few unifying characters within the Order. Anatomical details are summarized by Sibley & Ahlquist (1990). Possibly polyphyletic, though DNA comparisons indicate that the Order is monophyletic, composed of highly divergent groups that are more closely related to one another than to members of any other order (Sibley & Ahlquist 1990). The boundaries of the Order and relationships with other Orders and between families in this Order are uncertain (Sibley 1960; Sibley & Ahlquist 1972, 1990; Cracraft 1973; G.F. van Tets).

Peters, Wetmore (1960) and Storer (1971) recognized 12 families: Eurypygidae (monotypic Sun-bittern of tropical America); Otididae (bustards); Gruidae (cranes); Heliornithidae (finfoots of tropical Old and New World; three monotypic species); Aramididae (monotypic Limpkin of tropical and subtropical America); Psophiidae (trumpeters of tropical America; three species in single genus); Cariamidae (seriemas of central S. America; two monotypic genera); Rhynochetidae (monotypic Kagu of New Caledonia); Rallidae (crakes and rails); Mesitornithidae (mesites of Madagascar; three species in two genera); Pedionomidae (monotypic Plains-wanderer of Aust.); and Turnicidae (button-quails).

The Plains-wanderer is now recognized as being a charadriiform on evidence of morphology (Olson & Steadman 1981) and DNA-DNA hybridization (Sibley *et al.* 1988). Sibley *et al.* (1988) and Sibley & Ahlquist (1990) placed the Turnicidae in a separate Order, the Turniciformes *incertae sedis* (which we follow here; q.v.) and included Aramididae within the Heliornithidae but otherwise retained a similar arrangement of families. The Mesitornithidae, Rhynochetidae and Otididae have also been regarded as separate Orders.

Only Gruidae, Rallidae and Otididae occur in our region; other families are not considered further here.

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Family RALLIDAE rails, crakes and gallinules

A group of small to medium-sized (12–65 cm long), generally slender, terrestrial birds, usually of wetlands, often very secretive and skulking. Almost cosmopolitan, not occurring in polar regions and waterless deserts. In our region, 17 breeding species in 11 genera, five accidentals (one doubtful) and three extinct. Relation to other Gruiformes not fully resolved; skeletal morphology suggests close alliance to Psophiidae (trumpeters) and Heliornithidae (sungrebes) (Cracraft 1973); Aramididae, Eurypygididae and Cariamididae of S. America, and Rhynochetidae of New Caledonia and the extinct Aptornithidae of NZ also closely related; some or all of these families could be included as sub-families in Rallidae (G.F. van Tets). DNA–DNA hybridization evidence shows Rallidae form a distinct cluster separate from cranes and their allies (Sibley & Ahlquist 1990). Olson (1973b) recognized two sub-families: the monotypic Himantornithinae and the Rallinae, with Himantornithinae intermediate between Rallinae and Psophiidae. The Jacanidae (Charadriiformes; q.v.) may be derived as aquatic specialists from *Gallinula*-like stock and more appropriately placed within the Rallidae (G.F. van Tets).

Arrangements within the Rallidae have varied: Peters recognized 52 genera; Thomson (1964), 45; Olson (1973b), 35; Ripley (1977) 17; BWP, 32–39; Campbell & Lack (1985), 18; and Sibley & Ahlquist (1990) 34 (142 species). Rallidae vary anatomically in relation to diet and habitat. Olson (1973b) suggested they evolved from terrestrial to aquatic but admits evolution may have occurred several times. For practical purposes, broad division often made into (1) rails, crakes and wood-rails, most of which are terrestrial (in HANZAB region: *Rallina*, *Gallirallus*, *Dryolimnas*, *Porzana*, *Eulabeornis*, *Crex*); and (2) coots and gallinules (including swamphens, native-hens and waterhens), which tend to be more aquatic (in HANZAB region: *Amauromis*, *Gallinula*, *Porphyrio*, *Fulica*, *Gallicrex*). The affinities of the genera and, in brackets, the number of volant and flightless species recorded in HANZAB region given below. *Rallina* (2, 0): one species occurring Aust. and New Guinea and another vagrant to Aust.; close relatives are *Canirallus* and *Sarothrura* of Africa, *Mentocrex* of Madagascar and *Rallacula* of New Guinea (Olson 1973b). *Gallirallus* (1, 4): widespread in Indo-Pacific region; one or more species of volant *Gallirallus* are thought to be ancestral to several insular species in the sw. Pacific, including *lafresnayanus* of New Caledonia and *sylvestris* of Lord Howe I. (Olson 1973b; Fullagar & Disney 1981; Schodde & de Naurois 1982; Diamond 1991). *Dryolimnas* (1, 0): one species (*pectoralis*) occurring Aust. and Auckland Is; closely related to *Gallirallus* and *Rallus*; *pectoralis* often placed in *Rallus*. *Amauromis* (1, 0): one species occurring Aust., New Guinea, Philippines and Moluccas. *Porzana* (5, 0): worldwide, with four species native to our region and one vagrant; we follow Mees (1982) by including *Poliolimnas* in *Porzana*; Olson (1973b) thought *Porzana* may have evolved from *Amauromis*. *Eulabeornis* (1, 0) endemic to n. Aust. and Aru Is, and according to Olson (1973b), an allopatric close relative of *Habroptila* (1, 1) of Wallacea and New Guinea. *Crex* (1, 0) breeds in Eurasia and migrates S, mainly to Africa; vagrant to Aust. and, doubtfully, to NZ. *Gallicrex* (1, 0): vagrant from se. Asia to Christmas I. (Ind.); may also have derived from *Amauromis*. *Gallinula* (2, 1) worldwide distribution, with three species in our area; also an *Amauromis* derivative; sub-genus *Tribonyx* is endemic to Aust. with a fossil record going back to Pliocene (Olson 1975); differ from *Gallinula* in broad bill, long tail and short toes. *Porphyrio* (2, 2) appears to be a *Gallinula* derivative, with sub-genus *Porphyryla* intermediate in shape and plumage between *Gallinula* and nominate *Porphyrio* of Africa, Asia and Aust.; the sub-genus *Notornis* of Lord Howe I. and NZ consists of obvious derivatives of the nominate, but are terrestrial with an exceptionally deep bill and short toes. *Fulica* (1, 0): worldwide distribution, with one species in our region, and two flightless extinct species in NZ; probably derived from *Gallinula*-like stock (Olson 1973b).

Bodies, short, often laterally compressed for ease of movement in dense vegetation. Neck, short or moderately long; 14–15 cervical vertebrae. Males, often slightly larger than females. Wings, short, broad, rounded; in volant species, flight appears low, weak and generally not sustained though some species capable of long-distance movements, occurring on or colonizing oceanic islands (e.g. Purple Gallinule *Porphyrio martinica*, Watercock *Gallicrex cinerea* in HANZAB region). Some island species are flightless, yet many others migrate or disperse over long distances. In HANZAB region, all species have 11 primaries (p11 minute) and 10–12 secondaries; in Family, 10–20 secondaries, smaller species have ten and some flightless species have fewer primaries (BWP); diastataxic. Short sharp curved claw on alula. Tail, short, square to rounded, soft; often raised or flicked up to signal colours of under tail-coverts; normally 12 (6–16) rectrices. Bill varies: often rather slender, straight and slightly longer than head, and in some species, slightly decurved; or quite short and laterally compressed (crakes, most gallinules, coots); or massive and laterally compressed (some species of *Porphyrio*). Gallinules and coots have smooth, plate-like horny frontal shield (continuous with ramphotheca) on forehead. Nostrils usually in large depression (not in *Porphyrio*), pervious and perforate in some species. Sense of smell said to be well developed (Ripley 1977). Legs, well developed, usually strong, long to quite short, often laterally compressed. Toes, long and slender but may be rather short and heavy; hind toe, large, slightly raised. In most gallinules (not native-hens *Gallinula*, Takahē *Porphyrio mantelli* and White Gallinule *P. alba*) and some crakes, toes greatly elongated and legs modified for walking on floating vegetation; in coots, toes have enlarged lateral lobes to aid swimming, and pelvis and legs modified for diving. All species can swim; dive easily and can sink, using wings under water if necessary. Many species climb easily among thick vegetation; downy young of some (and

possibly adults) use wing-claw to assist climbing. Oil-gland bi-lobed, feathered in most species. Caeca, long. Syrinx, simple; tracho-bronchial. Feathers, fairly loose and soft, frayed and even hair-like in some; small after-feather usual.

Plumage, generally sombre browns, chestnut, black, or greys; iridescent purplish-blue and green in *Porphyrio*. Barring on flanks common. Vent and under tail-coverts may contrast with rest of plumage. Upperparts, spotted, barred, streaked, or plain. Bare parts often brightly coloured and forehead shield conspicuous. Sexes usually similar or nearly so (except in *Sarothrura* and *Gallixrex*). Pre-breeding moults restricted or absent, with no seasonal changes in appearance (except in *Gallixrex*) but colours of bare parts change in some species, coinciding with moults. Post-breeding moult, complete. Remiges may be moulted irregularly, or simultaneously, with consequent flightless period. Post-juvenile moult partial; can be followed by partial pre-alternate moult or by complete second pre-basic. Young, downy, and unlike other precocial birds, black (sometimes iridescent) or dark brown, which may be an adaptation for hiding in dense vegetation; evidently a derived condition (Olson 1973b). In some species, downy young have brightly coloured bills or skin on head or both, which may function for signalling (Fjeldså 1977). Downy young of *Gallinula*, *Porphyrio* and *Fulica* also have white or yellow terminal bristles on down. Post-natal development slower than in some other precocial birds, such as Galliformes and Turniciformes, with initial emphasis on development of legs and feet and not wings; flight-feathers develop last. Juveniles generally similar to but duller than adults.

Numerous flightless forms; incidence of flightlessness perhaps greater than in any other group except ratites and penguins. Flightlessness has evolved many times within the Rallidae, often and repeatedly on islands without predators and probably independently each time; appears to evolve rapidly and so probably of little phylogenetic significance above the level of species (Olson 1973a). Selection reduces flight-muscle and pectoral girdle, possibly through neoteny (Olson 1973a); usually corresponding increase in development of leg muscles. Frequency of flightlessness suggests that rails are predisposed to it; they are certainly pre-adapted for coping with some of the restrictions it imposes: many volant species are behaviourally flightless, e.g. avoiding predators by running away; many are temporarily flightless during wing-moult (a feature shared with several other groups containing flightless forms), when secretive and elusive; and post-natal development of flight is slow. In many species, populations of insular flightless species exterminated by introduced predators (e.g. Chatham Island Rail *Gallirallus modestus*, Dieffenbach's Rail *Gallirallus dieffenbachi*). Subfossils from our region have been reviewed (Olson 1977) and include flightless and often large species of coot, waterhen, rail and wood-rail and the distinctive snipe-rail *Capellirallus*. For discussion of biogeography of *Gallirallus* see Olson (1973b), Fullagar *et al.* (1982), Schodde & de Naurois (1982), and Diamond (1991).

Most inhabit all sorts of terrestrial, estuarine and littoral wetlands, from sea-level to mountain highlands. Some genera found in lowland and montane forests; others in wet grasslands; still others, e.g. Takahe *Porphyrio mantelli*, *Crex*, tussock grasslands, hay-fields and similar places, not necessarily with wet areas. Some species migratory; many dispersive; others apparently sedentary. Patterns of movements in HANZAB region generally not known, perhaps because they appear to take place at night and perhaps because the birds are so secretive and silent when not breeding that absences may be more supposed than real. Gallinules and coots appear to be more sedentary than crakes and rails, though at least the Black-tailed Native-hen *Gallinula ventralis* is notably irruptive, in response to floods and droughts of inland Aust.

Omnivorous, or in some species mostly vegetarian. Species with long thin bills probe for invertebrates in soft ground and litter. Eat all sorts of plants and submerged vegetation, insects, molluscs, crustaceans, eggs and young of other birds, small fish and carrion. Some gallinules graze, e.g. Tasmanian Native-hen *Gallinula mortierii* and coots. Only *Fulica* dives for food; they and *Gallinula* will up-end. Often wash food in water.

Mostly solitary or in small groups, though densities can be very high in some wetlands; *Gallinula* (e.g. Black-tailed Native-hen *Gallinula ventralis*) and *Fulica* form large flocks, especially in winter; after onset of inland droughts, irruptions may involve thousands of birds. Roost solitarily except in species that flock; generally at night on ground in cover; occasionally in bushes and trees. Some species nocturnal or crepuscular. Most species nest solitarily; some strongly territorial, advertising territories with loud persistent calling and chasing of intruders. Dense vegetation and apparently secretive habits make it hard to study social organization and behaviour in most species. Agonistic and sexual behaviour often conspicuous with wing-spreading, tail-flicking, fighting with use of bill and feet and other ritualized features of display. Pair-bond usually monogamous and only for one season but may be sustained. Polygyny known in captivity and suspected in wild, e.g. in *C. crex*; polyandry occurs in Tasmanian Native-hen *Gallinula mortierii* and possibly Weka *Gallirallus australis*. Co-operative breeding in some gallinules, e.g. Dusky Moorhen *Gallinula tenebrosa*. Pair-formation and courtship little known except in some gallinules and coots, in which a variety of chasing, bowing, nibbling, mock-preening and feeding, and courtship feeding takes place; no elaborate ceremonies at time of nest-relief. Copulation and other activities take place out of water or on specially built platforms. Most species very vocal, with screams, trills, whistles, booms, rattles, trumpets, grunts or barks; can be ventriloquial; mostly silent when not breeding but social species have loud rallying cries. Stand at rest (sometimes on one leg) in hunched posture with head sunk on shoulders, or lie down; sleep with head on back and bill among feathers. Bathe in shallow water, alternately ducking head in water and flipping water over back or by beating half-open wings in water; coots may bathe while swimming. Leave water to oil and preen after bathing. Sun themselves after preening. Allopeening common. Scratch head directly. Some species (e.g. *Porphyrio porphyrio*, *P. alba*, *P. mantelli*) recorded manipulating and grasping food in foot or holding down large items with feet.

Breed seasonally and protractedly. Nest fairly deep and cup-shaped; in some rails, domed; in wetlands, often with ramps up to nests. In thick vegetation, often near or on surface of water but some species nest high in trees; use old nests of other birds or nest on ground far from water; materials from any available plants; built by both sexes. Horned Coot *F. cornuta* of S. America builds islands of small stones. Some build nests that float or are attached to aquatic vegetation; nests on water may be built up rapidly if water-level rises. Non-functional nests often found in gallinules and *Gallinula*, which also build nursery nests after young hatch. Eggs, blunt oval; smooth and fairly glossy; dull white to tan ground-colour, blotched and spotted red-brown to black; unspotted in *Rallina*. Clutch-size, 5–10 (1–18) but dump-laying or laying by more than one female in same nest may complicate estimation of size of clutch laid by an individual. Usually one or two broods and replacement layings up to three times. Lay at intervals of 24 or 48 h. Incubation usually by both sexes but in some by female alone or with only small share by male. Incubation period, 14–24 days per egg; start of incubation varies from first to last egg and so hatching synchronic or asynchronic. Egg-shells left in nest or removed. Generally have two large lateral and one small median brood-patches. Young hatch in down, precocial, nidifugous; at first fed bill to bill, becoming self-feeding within few days or not until 8 weeks old. Normally tended by both parents and, in a few species, offspring of previous broods may help to feed young, e.g. *Gallinula*, occasionally *Porphyrio*. Fledging period, 30–60 days (20–70) and then independent except in co-operative breeders. First breeding usually when 1 year old or less.

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Rallus philippensis Linnaeus, 1766, *Syst. Nat.*, ed. 12, 1: 263 ex Brisson, 1760, *Ornithologie* 5: 63 pl. 14, fig. 1—Philippines.

Gallirallus combines the Latin *gallus* (farmyard cock) and *rallus* (rail). *Rallus* is mediæval Latin for a rail, usually said to be derived from *rallus*, meaning 'thin', and thus applicable to the laterally compressed bodies of rails; however, Latin also has a word *rallum*, meaning a sort of scraper, and it has been suggested that this is the origin of *Rallus* and 'rail', a bird that makes a noise like the scraper when cleaning a ploughshare (Potter & Sargent 1973: 103 *Pedigree Words from Nature*, New Nat. Series). Specifically named after the type-locality.

OTHER ENGLISH NAMES Painted, Striped or Pectoral Rail or Landrail, Corncrake (incorrectly), Landrail, Little Tarlerbird (Norfolk I.).

NZ Banded Rail.

POLYTYPIC Nominate *philippensis* and at least ten other subspecies have been described extralimally in Philippines, Indonesia, New Guinea, New Britain, New Caledonia, New Hebrides and Polynesia; *mellori* (Mathews, 1912), Aust. and Tas.; *tounelieri* Schodde & de Naurois, 1982, Coral Sea and Great Barrier Reef; *assimilis* (G.R. Gray, 1843), NI and SI, NZ, Stewart and Auckland Is; *macquariensis* (Hutton, 1879), Macquarie I.; *andrewsi* (Mathews, 1911), Cocos-Keeling Is.

FIELD IDENTIFICATION Length: 30–33 cm; wingspan: 40–52 cm; weight: 130–230 g. Medium-sized rail with stout body, small rounded head, long tail, short to medium legs and short wedge-shaped bill; larger than *Porzana* crakes or Lewin's Rail *Dryolimnas pectoralis*, with longer tail and shorter stouter bill than latter; smaller than Weka *Gallirallus australis*. More strikingly marked than other secretive rails, with diagnostic buff breast-band. Sexes similar; female slightly smaller. No seasonal variation. Juvenile separable. Slight geographical variation.

Description Adult Pattern of head, diagnostic: forehead, crown, nape and upper hindneck, dull chestnut finely streaked blackish; broad chestnut stripe from bill through eye to sides of neck and round lower hindneck, contrasting with white chin and greyish-white lower cheeks and throat and set off by narrow white supercilium; thin white arc round bottom of eye. Mantle, back, scapulars and tertials, brownish olive with broad blackish centres to feathers and heavily spotted with white; rump and upper tail-coverts similar with a few small white spots. Tail, brownish olive with blackish feather-centres. Inner wing-coverts, rather uniform brownish olive in contrast to heavily streaked and spotted saddle. Primary coverts and outer two primaries, black with white barring; rest of remiges, brownish rufous barred blackish. Chin, white, grading to light-grey foreneck. Sides of lower neck, breast and flanks closely barred black-and-white; diagnostic rich buff band of varying width across upper breast; belly and vent, white; under tail-coverts, pale buff. Under wing-coverts barred black-and-white, with narrow white leading-edge; underside of remiges

as above. Bill, dark pink with varying dusky culmen and tip. Iris, deep red. Legs and feet, dull grey to pinkish-grey. **Juvenile** Differ from adult: ground-colour of forehead, crown, nape and upper hindneck duller brown, lacking chestnut tones; dark stripe from bill through eye to sides of neck and round lower hindneck, duller chestnut or brown and much less distinct; upperparts duller and less heavily spotted with white; foreneck with fine dark barring, buff breast-band marked with rows of dark spots, and dark barring on flanks duller and browner in some; bill, shorter and darker brown; iris, darker, brown.

Similar species Pattern of head and buff breast-band, diagnostic. Might be confused with **Lewin's Rail**, q.v.

Singly, in pairs or, occasionally, loose groups in dense vegetation in or bordering many types of wetlands, estuaries and beaches; also crops and rank pastures and forest and scrub on some offshore islands. Secretive and wary but not shy; most often seen in early morning or late afternoon foraging in open on muddy verges near dense cover, to which quickly retreat when disturbed. Feed by picking items off ground or surface of vegetation, but some prey also secured from under water. Gait on land a slow walk with hunched posture, tail raised and flicked incessantly; often pause to stand erect with neck outstretched to look about, sometimes from rise in ground; run rapidly with neck extended, head lowered and tail cocked; head bobbed rapidly when walking or running. Possibility of recognizing footprints in mud as indication of occurrence (Elliott 1989). Seldom seen to fly, preferring to dash into cover when disturbed; when flushed, fly weakly for short

distance just above vegetation on short rounded wings with neck outstretched, legs dangled or trailing. Voice distinctive; best means of detection in breeding season commonest call a loud creaky squeak, most often heard in morning and evening.

HABITAT Permanent and ephemeral, fresh and saline, terrestrial, estuarine and littoral wetlands: swamps, marshes, lakes, coastal lagoons, billabongs, rivers and creeks, pools, temporarily inundated depressions, saltmarsh, tidal mudflats and artificial wetlands, such as sewage farms, farm dams, channels and ditches. In NZ, found in saltmarshes only with regular supply of fresh water (Elliott 1989), but elsewhere, may occur away from obvious fresh water (Deignan 1964; Dunlop 1970; Aust. NRS; G.P. Elliott). In coastal areas may also occur on beaches, reef flats and sandbanks. Also damp grasslands, heathland, woodlands and forests; coral cays and other islands, especially off coast of Qld. Usually among dense vegetation including overgrown grass, rushes, reeds, sedges and other rank vegetation; occasionally in mangroves. In NZ, prefer vegetation that provides cover but allows movement (Elliott 1983, 1987), and rarely found in saltmarsh dominated by glasswort *Salicornia* or in unmodified stands of raupo (Elliott 1989). Also regularly occur in non-wetland habitats, especially in grasslands and other grassed areas; pasture; crops; occasionally in heathland, woodland, forests and remnants of rainforests. Recorded in pockets of burnt vegetation on plains (Deignan 1964).

Often breed round wetlands or in pasture or crops among dense clumps of grass, rushes, sedges, samphire or shrubs like *Melaleuca*. On islands, may nest in trees and hollows, under logs and rocks, on sand or among grass (MacGillivray 1917, 1928; Gilbert 1936; O'Grady 1963; Masters & Milhinch 1974; Jaensch 1984; Stokes *et al.* 1984; Owen & Sell 1985; Aust. NRS.)

Forage round vegetated margins of wetlands on mud among or next to tall grass, reeds, rushes and samphire; also on grassy banks or flats next to wetlands; among other concealing vegetation such as bushes and willows; mudflats (Hodgkins 1948; Sharland 1958; Sawyer 1968; Mason & Wolfe 1975; Mason 1980; Elliott 1987; Vic. Atlas); among mangroves at low tide (Dunlop 1970); among stranded or rotting seagrass in coastal lagoons (Stokes *et al.* 1984; Wood 1985); reef-flats (Crawford 1972); on

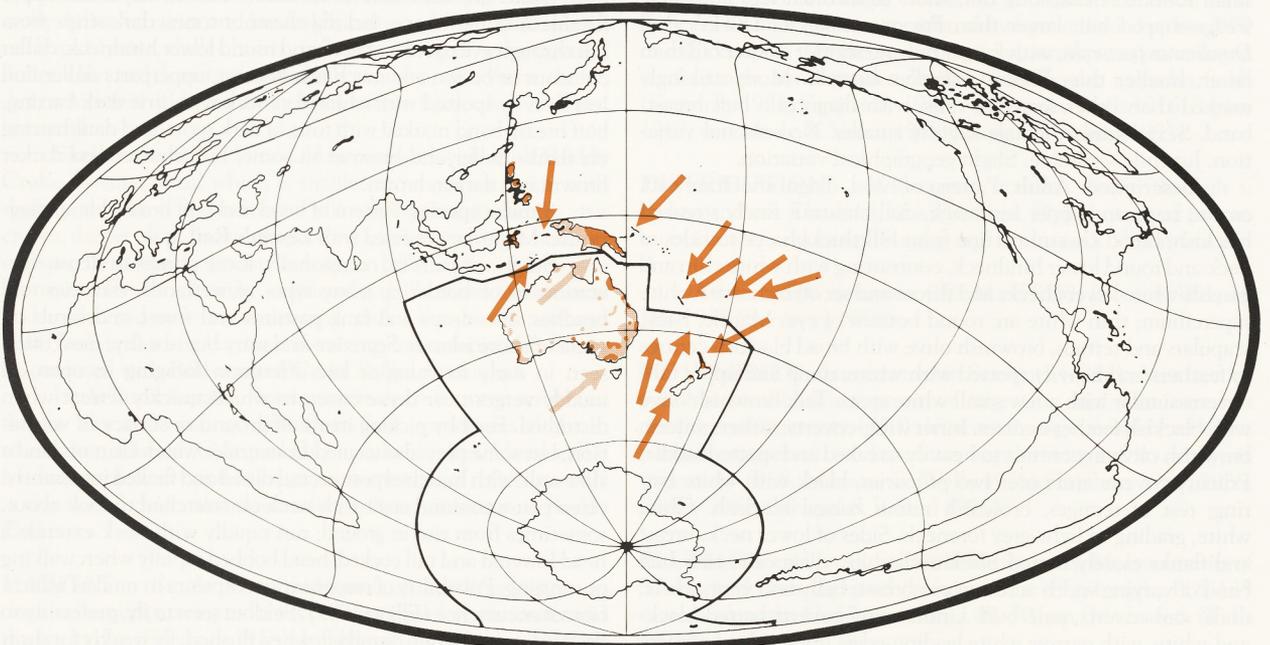
lawns and pathways in gardens (Bonser 1985; Wall 1986); heathland, especially where intersected by creeks (Sharland 1958); air strip (Stokes *et al.* 1984); rubbish tip (CSN 22).

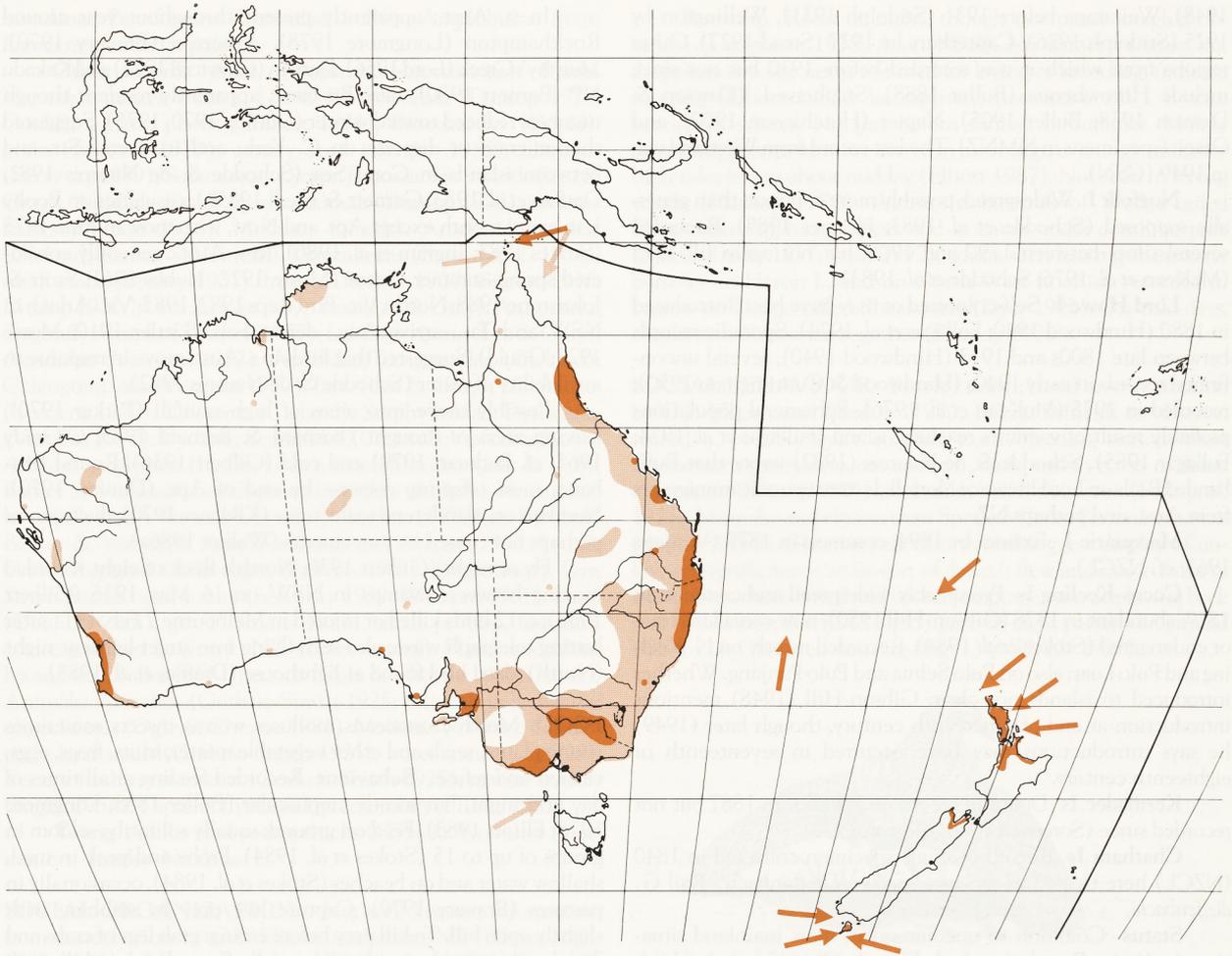
Roost, loaf or shelter among thick, tall clumps of concealing vegetation such as grass, reeds, rushes or shrubs (e.g. *Sesbania*) (Gilbert 1936; Hodgkins 1948; Mason & Wolfe 1975; Elliott 1987, 1989). On Raine I., recorded sheltering in petrel burrows and under coralline rocks during the heat of the day (MacGillivray 1917).

Available habitat reduced by reclamation of wetlands for urban, agricultural or industrial development (Gilbert 1936; Stokes *et al.* 1984; Owen & Sell 1985); stock may trample or eat cover round wetlands (Elliott 1989). This is offset by widespread use of artificial wetlands, such as sewage ponds, irrigation or drainage channels; even recorded using bird-baths and containers of water (Hindwood & Cunningham 1950; Hobbs 1961; Dunlop 1970; Elliott 1989; Jaensch 1989; Vic. Atlas; Vic. Bird Rep. 1985); artificial grassy areas, including lawns, parks and gardens round habitation, pasture, golf courses and airstrips (O'Grady 1963; McEvey 1965; Sawyer 1968; Bravery 1970; Stokes *et al.* 1984; Bonser 1985); along hedges (Thomas & Wheeler 1983); crops (Thomas & Wheeler 1983; Jaensch 1984; Vic. Atlas); disturbed areas such as rubbish tips and mine-heaps (McEvey 1965; CSN 22). One bird observed picking up crumbs inside human habitation (Serventy 1959; Bingham 1977).

DISTRIBUTION AND POPULATION Widespread in se. Asia (Philippines to Indonesia), New Guinea, Aust., NZ, Norfolk, Lord Howe, and Cocos Keeling Is and many islands of sw. Pacific (Solomon Is, Vanuatu, New Caledonia, Fiji, Tonga, Samoa). Extinct on Macquarie and Chatham Is. NZ data from contribution by G.P. Elliott.

Aust. Widespread in coastal, subcoastal and riverine regions and on many offshore islands; a few records far inland (Parker 1970; Cox & Pedler 1977; Badman 1979). **Qld** From e. Gulf of Carpentaria, at Karumba and Edward R. (Garnett & Bredl 1985; Qld Bird Rep. 1985; Aust. Atlas; Aust. NRS) to islands of Torres Str., and along e. coast, including many offshore islands (Draffan *et al.* 1983; Aust. Atlas). Occasional records in W, to





Longreach (Qld Bird Rep. 1986) and Eulo (Qld Bird Rep. 1984). **NSW** Recorded all regions except Upper Western (Morris *et al.* 1981). Mainly E of line between Moree and Willandra, in coastal districts and on w. slopes of Great Dividing Ra.; farther W in Riverina and SW (Hobbs 1961; Aust. Atlas). Dead bird found near continental shelf off Coff's Harbour (NSW Bird Rep. 1985). **Vic.** Scattered records in most districts; mostly S of 36°S (Vic. Atlas; Vic. Bird Reps 1981–85). Small influx recorded in 1982 (Vic. Bird Rep. 1982). **Tas.** Vagrant to mainland; four records this century: near Wynyard, 1927 (Sharland 1981); Eaglehawk Neck, 1935–38 (Fletcher 1939); Cable Stn, Stanley, Aug. 1985 (Wall 1986; Tas. Bird Rep. 15); between Colebrook and Rhyndaston, Dec. 1985 (Wall 1986; Tas. Bird Rep. 15). Five listed on Accession Registers of Tas. Mus. between 1871 and 1873, but specimens missing (Wall 1986). Very occasionally recorded on e. coast of King I. and nearby Councillor I. (Green & McGarvie 1971; McGarvie & Templeton 1974; Green 1989). Also recorded Hogan I. (no date; Morton & Braithwaite 1976). **SA** In E, generally S of 32°S, from SE, N to mid-Murray and W to Streaky Bay, w. Eyre Pen.; also recorded near New Kalamurina, 5 Aug. 1975 (Cox & Pedler 1977); Nunn's Bore, nine, 10 Sept. 1977 (Badman 1979); and 45 km NW of Coward Springs, L. Eyre drainage basin, Aug.–Oct. 1980 (Aust. Atlas). **WA** Recorded Eyre Bird Observatory. In SW, recorded from Shark L. NR to Carnarvon (Jaensch *et al.* 1988; Aust. Atlas); in Pilbara, round Wittenoom and Dampier (Aust. Atlas). Storr (1980) indicates distribution

throughout most of Kimberley Division, S to Fitzroy Crossing; Aust. Atlas lists records from Derby and Kununurra–Wyndham; also from Parry Floodplain, and S to Hall's Ck (Jaensch 1989); probably patchily continuous to NT border (Ford 1978). **NT** Mainly in Top End; occurs S to Katherine (Parker 1969; Storr 1977; Aust. Atlas); also recorded to SW at Keep R. NP (McKean 1985) and to SE at Borroloola (Parker 1970). Apparently absent from Gove Pen. and Groote Eylandt (Thompson & Goodfellow in prep.). Occasionally recorded in S, round Alice Springs and at Tempe Downs HS (Parker 1969, 1970; Aust. Atlas; P.J. Higgins).

NZ NI Mostly N of line between Kawhia and Opotiki. Generally coastal, though regularly reported at inland sites in King Country and Northland (NZ Atlas); occasional records (probably vagrants) from Taupo, Rotorua, Manawatu and inland of Gisborne (Lavers 1971; G.P. Elliott; CSN). Also on Great I. in Three Kings Grp (Ramsay & Watt 1971), Tawhiti Rahi in Poor Knights Grp (McCallum 1981) and Great Barrier I. (Ogle 1981). **SI** Two separate populations in n. SI: in Golden Bay and w. Tasman Bay; and in Marlborough Sounds (Owen & Sell 1985; Elliott 1989; NZ Atlas). Also on Big, Kaimohu, Tamaitemioko, and Pohowaitai Is, SW of Stewart I. (Blackburn 1965), and Little Solander I. in Foveaux Str. (Cooper *et al.* 1986). Occasionally reported from Stewart I. (G.P. Elliott).

In NZ, formerly common throughout NI and SI, but by 1930s had disappeared from many regions. Disappeared from Parongahau many years before 1948 (Cunningham & Wodzicki

1948), Wairarapa before 1931 (Stidolph 1931), Wellington by 1925 (Stidolph 1926), Canterbury by 1927 (Stead 1927). Other regions from which it was recorded before 1930 but not since include Horowhenua (Buller 1888), Stephens I. (Dawson & Dawson 1958; Buller 1905), Napier (Hutchinson 1900), and Otago (specimens in NMNZ). The last record from Westland was in 1949 (CSN).

Norfolk I. Widespread; possibly more common than generally supposed (Schodde *et al.* 1983; Hermes 1985). Recorded several times between 1790 and 1908, but not again till 1975 (McKean *et al.* 1976; Schodde *et al.* 1983).

Lord Howe I. Self-colonized or may have been introduced in 1880 (Hindwood 1940; Fullagar *et al.* 1974). Sporadic records between late 1800s and 1913 (Hindwood 1940); several unconfirmed records in early 1940s (Hindwood & Cunningham 1950); recorded in 1975 (McKean *et al.* 1976). Ephemeral populations probably result of vagrants reaching island (Fullagar *et al.* 1974; Fullagar 1985). Schodde & de Naurois (1982) wrote that Buff-banded Rails on Lord Howe or Norfolk Is were episodic immigrants from Aust. and perhaps NZ.

Macquarie I. Extinct by 1894; common in 1879 (Vestjens 1963; cf. NZCL).

Cocos-Keeling Is Presumably widespread and common in 1829; abundant in 1878 (Gibson-Hill 1950); now considered rare or endangered (Stokes *et al.* 1984). Recorded mostly on N. Keeling and Pulo Luar; also on Pulo Selma and Pulo Panjang. Whether introduced to islands not clear: Gibson-Hill (1948) mentions introduction at end of nineteenth century, though later (1949) he says introductions may have occurred in seventeenth or eighteenth century.

Kermadec Is Doubtful record on Raoul I. in 1887 but not recorded since (Sorensen 1964; Merton 1970).

Chatham Is Record of single specimen collected in 1840 (NZCL) here treated as separate species, Dieffenbach's Rail *G. dieffenbachii*.

Status Common to uncommon in most mainland situations in A'asia. **Population** Lady Elliot I., Qld (35 ha), 4–8 birds (Walker 1986a); Swan–Canning Estuary, WA, 10–99 (Jaensch 1987); Little Solander I., NZ (c. 8 ha), 3–4 pairs (Cooper *et al.* 1986). Numbers on Great Barrier I. increased when annual burning of swamp vegetation ceased (Bell & Brathwaite 1964). May have declined in Kimberley Division where swamps overgrazed by stock (Storr 1980). Introduced cats, rats and Wekas have reduced (e.g. Lord Howe, Cocos-Keeling Is) or eliminated (e.g. Macquarie I., probably Solander I.) populations on several islands and may prevent colonization of some islands (Hindwood 1940; Vestjens 1963; Blackburn 1965; McKenzie 1979; Stokes *et al.* 1984; Cooper *et al.* 1986; Walker 1986a). Main reason for decline in NZ is probably loss of wetland habitat, and some predation (G.P. Elliott).

Birds often seen at roadsides, sometimes eating carrion from road-kills (NSW Bird Rep. 1971); occasionally struck by vehicles (Vic. Bird Rep. 1985; NSW Bird Reps 1983, 1985; SA Bird Reps 1977–81; CSN 33). Recorded feeding at rubbish tips (NZRD).

MOVEMENTS Not well known; resident and dispersive; possibly migratory. Conspicuousness probably varies during year, affecting reporting rates; may be less conspicuous during winter when not breeding (Aust. Atlas); however, breed all year in tropical Aust. (Gill 1970) and so may be observed more regularly (G.P. Elliott). In Aust., except in parts of SA (where no records winter and autumn), reported at all times of year though reporting rate drops in winter (Aust. Atlas). In NZ, of 155 sightings (in *Notornis* 1939–82) most in summer, none in July (G.P. Elliott).

In n. Aust.: apparently present throughout year around Rockhampton (Longmore 1978), Atherton (Bravery 1970), Murphy's Creek (Lord 1956), Darwin (Crawford 1972) and Kakadu NP (Barnett 1980); near Brisbane, apparently resident though numbers reduced toward winter (Dunlop 1970, 1975). Suggested that migrate or disperse on C. York, and in Torres Str. and between islands in Coral Sea (Schodde & de Naurois 1982; Draffan *et al.* 1983; Garnett & Bredl 1985b); casualties on Booby I. in every month except Apr. and Nov., with most in June 1975 (Stokes 1983; Ingram *et al.* 1986). In s. Aust.: generally considered spring–summer visitor (Morse 1922; Hobbs 1961; Storr & Johnstone 1988; North; Vic. Bird Reps 1982, 1985; Vic. Atlas); in NSW and Tas., arrive Aug., depart Feb. (Littler 1910; Morse 1922; Gould). Suggested that birds in s. Aust. move in response to availability of water (Schodde & de Naurois 1982).

Possibly move into areas of high rainfall (Parker 1970), leaving areas of drought (Barnard & Barnard 1925; O'Grady 1963; cf. Badman 1979) and cold (Gilbert 1936). Round Brisbane, most offspring disperse by end of Apr. (Dunlop 1970). Numbers on islands tend to fluctuate (Kikkawa 1970); fluctuations perhaps not caused by movements (Walker 1986a).

Fly at night (Gilbert 1936; North); flock of eight recorded moving between swamps in NSW on 16 Mar. 1936 (Gilbert 1936); c. 12 birds killed or injured in Melbourne 7 Feb. 1911 after hitting telegraph wires; also seen flying into street lights at night (North); dead bird found at lighthouse (Draffan *et al.* 1983).

FOOD Mostly crustaceans, molluscs, worms, insects, sometimes young plants, seeds and other vegetable matter, fruits, frogs, eggs, carrion and refuse. **Behaviour** Recorded feeding at all times of day and night, but mostly crepuscular (Buller 1888; Longmore 1978; Elliott 1983). Feed on ground; usually solitarily; seldom in groups of up to 15 (Stokes *et al.* 1984). Probe and peck in mud, shallow water and on beaches (Stokes *et al.* 1984), occasionally in pastures (Bravery 1970). Capture live prey by stabbing with slightly open bill. To kill prey before eating: grab legs of crabs and flick head from side to side till legs fall off; crush fish in bill; peck snail shell until broken; small snails swallowed whole. Some variation in diet according to season and site (for further details see Elliott 1983). Glean for seeds (Coates 1985) and scavenge strand-line (Stokes *et al.* 1984). Peck at animals encrusting mangrove trunks (NZRD). Availability of food claimed to control populations on some islands (Walker 1986b). Once recorded hoarding food (Aust. Atlas). Carry large items into shelter to eat; spear eggs with bill (Serventy 1959); swallow with extended neck (CSN 20). Forage at rubbish dumps in Northland, NZ (CSN 22). Recorded taking chicken-feed (CSN 29) and bread and grain (Bravery 1970; Goodwin 1981; Bonser 1985; P. Scofield). Drink fresh water, sometimes from foliage (Elliott 1983, 1989).

Adult NZ Nelson, Marlborough and Hokianga Harbour (230 faecal samples; Elliott 1983): Plants: lvs 50% freq., 1% vol.; sds 10, 1; rushes 30, 1. Animals: Molluscs: snails: *Potamopyrgus estuarinus* 65, 30; *Amphibola crenata* 25, 5; *Ophicardelus costellaris* 50, 20. Polychaetes: *Nicon aestuariensis* 5, 1. Arthropods 5, 1. Crustaceans: amphipods 1, 1; isopods 1, 1; crabs: *Helice crassa* 85, 50. Arachnids: spiders 10, 1. Insects 25, 1: Coleoptera: ads 10, 1; Curculionidae: 1, 1. **In captivity** (Elliott 1983): Annelids: earthworms. Molluscs: *Ophicardelus costellaris*; *Amphibola crenata*; *Helix aspersa*. Crustaceans: *Helice crassa*; *Palaemon affinis*. Insects: Dermaptera: earwig larv.; Hemiptera: Cicadellidae; Cicadidae; Corixidae; Notonectidae: *Anisops*; Coleoptera: ads, larv.; Lepidoptera: moths; Diptera: Calliphoridae: *Calliphora*. Fish: Salmoniformes: Retropinnidae: *Retropinna*; Galaxiidae: *Galaxias*

maculatus; Perciformes: Eleotridae: bullies. Amphibians: frogs: *Litoria raniformis* tadpoles.

Other records Aust. (crops and observations): **Plants** Vegetable matter (North; Lea & Gray); seeds (Dunlop 1970; Gould), aquatic plants (Gilbert 1936); Poaceae: lvs (Gould), grain (Bravery 1970); canary seed (Bonser 1985); *Citrullus* (Serventy 1959); Solanaceae: *Lycium ferocissimum* fru., sds (Lea & Gray). **Animals** Small aquatic animals (Dunlop 1970); invertebrates (Gilbert 1936). Molluscs (North). Arachnids: spiders (Cleland; Barker & Vestjens). Crustaceans (Stokes *et al.* 1984): small crabs (Berney 1907). Insects (Berney 1907; Gilbert 1936; Dunlop 1970; North; Lea & Gray): larv. (Lea & Gray); Anisoptera: dragonfly nymphs (Vestjens 1977); *Labidum riparia* (Lea & Gray); Acrididae (Vestjens 1977); Acrididae/Tettigoniidae (Cleland); Coleoptera: ads (Vestjens 1977), larv. (Lea & Gray); Carabidae: (Vestjens 1977); *Calosoma* (Cleland); Staphylinidae, Dytiscidae (Vestjens 1977); *Dytiscus*; Scarabidae (Cleland); *Aphodius lividus*, *Adelium neophytum* (Lea & Gray); Curculionidae (Lea & Gray; Barker & Vestjens); Lepidoptera: larv. (Lea & Gray); Noctuidae: larv. (Cleland); Formicidae: ad. (Vestjens 1977; Lea & Gray; Barker & Vestjens). Amphibians: frogs (Vestjens 1977; Lea & Gray). Reptiles: turtle eggs (Warham 1961). Birds: Sooty Tern *Sterna fuscata* eggs, young (Serventy 1959; Warham 1961). Sand (Gould; North), grit (Vestjens 1977), small pebbles, fine dirt, coarse grit (Lea & Gray). **NZ** (observations): **Plants**: succulent lvs and sds (Buller 1888); fru., sds (Ogle & Cheyne 1981; Oliver). **Animals**: Annelids (Guthrie-Smith 1925; Oliver): polychaetes; oligochaetes (Ogle & Cheyne 1981). Molluscs (Oliver): Gastropods: land snails (Guthrie-Smith 1925); water snails (CSN 20). Insects: freshwater insects (Guthrie-Smith 1925); marine insects (Fagan 1954); Diptera: fly; Lepidoptera: moth (Elliott 1983).

Young Adults feed young chicks (CSN 2). No other information. **Intake** No data.

SOCIAL ORGANIZATION Not well known; information from contribution by G.P. Elliott; studied in NZ (Elliott 1983, 1987, 1989), and near Brisbane, Qld (Dunlop 1970). Generally found singly, in pairs, or family groups; in winter, singly or in groups (Gilbert 1936; Dunlop 1970). Size of recorded groups vary from two to five (Crawford 1972), though two adults accompanying six chicks recorded (Dunlop 1970). Unpaired birds usually forage solitarily (G.P. Elliott).

Bonds Unknown, probably sustained monogamous; members of one pair remained together when feeding (Dunlop 1970, 1975). One pair drove intruding male away, who later bonded with female of pair; and together drove former male partner away (Dunlop 1970). **Parental care** Both parents incubate (Falla *et al.* 1975) and care for young (Dunlop 1970). Share of incubation possibly equal; both parents feed chicks (Dunlop 1970, 1975; Elliott 1983), one parent seems to undertake greater share of caring for young (Dunlop 1970); male normally near nest but not observed brooding young (Smith 1915). Chicks leave nest soon after hatching; one adult assumed to incubate while other accompanies young (Elliott 1983). Chicks forage independently after first week (Dunlop 1970); young evicted from territory when 5–6 weeks old (Dunlop 1970; NZRD).

Breeding dispersion Solitary nesting in territories (Dunlop 1970; Elliott 1983). Nest-sites not re-used though, during one season, replacement and second nests may be close to first site. Breeding territories of pairs or single birds at Nelson, NZ, in rush covered saltmarsh averaged 1.5 ha (0.73; 15) (Elliott 1989 *contra* Elliott 1983). In Hokianga Harbour, six pairs in mangroves, saltmarsh and rough grass occupied average 1.4 ha (0.7–3.4) (M. Bellingham and A.M. Davis).

Roosting Roost at night, though nocturnal foraging observed (Longmore 1978; Aust. NRS). No details of sites, but droppings at some nests, not used for laying or brooding, indicate roosting (Elliott 1983). In captivity, not active till 1 h after sunrise in winter, but just before sunrise in summer. Mainly diurnal; appear to be more active in mornings, evenings, and after high tide; less so about midday (Elliott 1987). Not seen in strong winds (Dunlop 1970); shelter in burrows of Wedge-tailed Shearwater *Puffinus pacificus* and in caves under coralline rock (MacGillivray 1917; Dyer 1992); adults seen leaving shearwater burrows on Heron I., and on North West I., chick recorded in burrow of Wedge-tailed Shearwater (Dyer 1992). On cold days, chicks stand hunched together (Dunlop 1970).

SOCIAL BEHAVIOUR Poorly known; based on contribution by G.P. Elliott, and Dunlop (1970, 1975). Difficult to observe; secretive, possibly more so after main breeding season; most interactions probably occur at dawn, dusk, and in cover of dense vegetation (Elliott 1989); more often heard than seen (Falla *et al.* 1975). More shy and elusive than Spotless Crake *Porzana tabuensis* (Buddle 1946). Observations of one bird suggest display of unknown significance: 'some sort of dance'; flew and ran in front of mangroves, then darted and dived, jumping in air, displaying back and both wings; described rapid figure-of-eight pattern on ground (CSN 21). Observed sunning (Fig. 1) (NPIAW 1985).

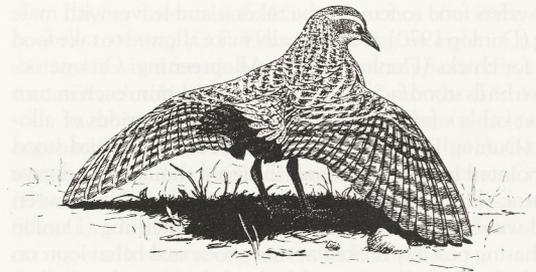


Fig. 1 Sunning

Agonistic behaviour Often described as quarrelsome (Hogan 1925). Non-breeding birds skirmish over use of feeding areas. When caring for young, apparently only one parent responsible for repelling intruders (Dunlop 1970). If two birds placed in aviary, both birds aggressive toward each other (North). Young often charge at other birds; by Mar., many encounters between adults and offspring; birds often dash suddenly into groups scattering members without actually making physical contact. Call to advertise territory (Dunlop 1970); claimed to develop into choruses if breeding population dense (Aust. RD). **Threat** Two birds stand a few centimetres apart, facing each other, and stare at one another for 15–20 s before one bird withdraws (Dunlop 1970). In another display, bird lowers head, points bill at ground, half spreads wings, and makes quiet grunting calls (G.P. Elliott). Most agonistic interactions involve Chasing, with Fighting less frequent. **CHASING**: run with neck extended, head lowered and tail cocked up; new birds to an area Chased for c. 1 week (Coates 1985). Dunlop (1970) noticed some similarity between Chasing sequences in winter between unmated birds: pursued bird runs 5–6 m, turns suddenly, runs <1 m, then stops; pursuer continues straight ahead for c. 2 m, then stops, stares in all directions, and dashes off; pursued bird feeds before sequence repeated. Sometimes fly to pursue rival, skimming over tops of scrub or grass; longest such flight seen, c. 55 m over open area (Dunlop 1970). **Fighting** Mostly pecking, mainly to head; often birds face one another, rise together, and strike with beaks and claws; between bouts birds

coo; noisy, usually brief, seldom more than few seconds (Dunlop 1970; G.P. Elliott). **Escape** After Fighting, squeal in retreat (Dunlop 1970). Some birds avoid confrontation; if a bird chased at same time every day, it may change its foraging times (Dunlop 1970). Rigid hierarchy shown by Chases (Dunlop 1970). Known to kill other species of rail with single peck (Serventy 1959). Feed amiably near other species, then attack or displace them without apparent reason. Species attacked include Masked Lapwing *Vanellus miles* (Coates 1985), Peaceful Dove *Geopelia placida*, honeyeaters, Australian Magpie *Gymnorhina tibicen* and bandicoots (Dunlop 1970). Attacked by nesting Bridled Terns *Sterna anaethetus* (Hulsmann & Langham 1985). **Alarm** Individuals respond differently to disturbance (Davis 1923; Hogan 1925; Serventy 1959); when watching, stretch to full height (Dunlop 1970); stand erect, often on rise, with neck extended, and flick tail (Gilbert 1936; Coates 1985); usually run into cover rather than fly (Berney 1907; Gilbert 1936; McKean *et al.* 1976; Elliott 1987), may call (Dunlop 1970); observed zigzagging when chased by cat (Parker & Parker 1986); fly skimming over scrub or grass then pitch into cover (Dunlop 1970). One bird observed running down beach into water where it joined party of Silver Gulls *Larus novaehollandiae*, later flying back to cover (Warham 1961).

Sexual behaviour Members of one pair rarely more than 0.5 m apart, usually feeding shoulder to shoulder; later (presumably when breeding) foraged alternately (Dunlop 1975). **Courtship** Includes Courtship feeding and Allopreening. **Courtship feeding** Male offers food to female, she takes it and leaves with male following (Dunlop 1970). Occasionally mate allowed to take food intended for chicks (Dunlop 1970). **Allopreening** On one occasion, two birds stood facing each other for c. 1 min, each in turn nibbling at other's face; interspersed with short periods of allopreening (Dunlop 1970). Possible mating behaviour: bird stood on toes, pointed bill skywards, and shrugged shoulders and gave sharp squeak (Fig. 2); repeated at intervals of 15–20 s; between calls, bird wandered round as if looking for something (Dunlop 1970). Chasing possibly related at times to sexual behaviour: on one occasion male feeding near female pecked her, then called, and she ran 1 m; he ran, stopping in front of her, then she ran, passing and pecking him, into grass and he followed; later these birds paired. In mating period, record of male chasing female in tight circles (Dunlop 1970). **Greeting** If call given by parent with young, partner approaches (Dunlop 1970). **Copulation** Appears to occur with no display (G.P. Elliott). May occur while feeding or when female prospecting for nest-site. Female does not crouch but bends forward, until bill almost touches ground, to counter weight of male; maintains stiff legs. Male steps on back of female, flapping wings vigorously; does not grip with feet. After 5–6 s male dismounts, pair often quickly shake, and then resume

feeding. Several instances of females avoiding copulation. Once female slipped out from under male, turned, nibbled male's throat and left. Another time, female was sitting in hollow, and male rushed at her, grabbing her by back of neck; female jumped clear and ran (Dunlop 1970).

Relations within family group During change-over, eggs not left untended for more than few minutes at a time (Elliott 1983); change-over more frequent during hatching. Chicks stand within 5 h of hatching (Dunlop 1970, 1975; Elliott 1983); known to leave nest within 2–3 h (Oliver). Adult observed leading chicks across open, then returning to retrieve a straggler (CSN 1974); each parent may shepherd part of brood (Dunlop 1970). Chicks fed on nest within 1 h of hatching. When feeding young, adult picks up food, calling softly as chick reaches up to take it; when being fed, chicks favour position between adult's legs; sometimes if chicks do not take offering immediately, other adult takes food (Dunlop 1970). Chicks forage independently after first week (Dunlop 1970); at 5 days old (G.P. Elliott). Parents sometimes aggressive to young, usually if they are sick or less developed (Dunlop 1970; Coates 1985). Parent approaches and pecks 2–3 times at back of chick's head; later Chases. Occasionally chick adopts feeding position between adult's legs, gets fed, then pecked; one chick ran and hid under other young (Dunlop 1970). Unfledged chicks Chase adults; adult may flee or peck chick, sometimes knocking it over; on one occasion, adult charged young, which stood its ground, got on adult's back, and pecked back of adult's head; this occurred second time with adult on top. Young will also Chase honeyeaters and Peaceful Doves (Dunlop 1970). Contact call between young and adults (Gilbert 1936). **Parental anti-predator strategies** If disturbed, parents may move eggs (see Breeding); leave nest when approached (Aust. NRS) or remain till vegetation above nest parted (Gilbert 1936). When nest approached, parent gives DISTRACTION DISPLAY: dashes out of cover; drags wings on ground; may imitate being snared (Reithmüller 1931; Dunlop 1975). May threaten intruder by charging repeatedly with head lowered, and feathers of back erect (Smith 1915). **Anti-predator responses of young** Lower head to ground and peer upwards (Dunlop 1970); hide under rocks (Buddle 1946). Young are also fast runners (Reithmüller 1931). Alarm call given when chicks and young run to cover (Gilbert 1936).

VOICE Not studied; no detailed descriptions. Information from G.P. Elliott, except where stated. Best known call a harsh squeak mostly heard in morning and evening, specially in breeding season (P.J. Fullagar). Call mostly after sunset (Gilbert 1936; Sibson 1959). Otherwise apparently silent but variety of soft calls rarely heard; not heard by Berney (1907) and not initially by Dunlop (1970). No information on differences between sexes or between individuals. Regional variation not known.

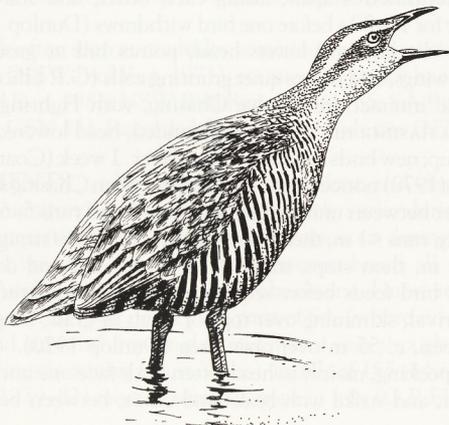
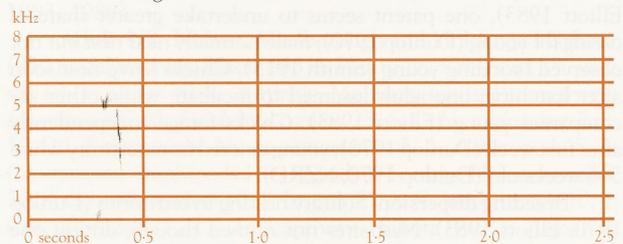


Fig. 2



A. P.J. Fullagar; Montagu I., NSW, Oct. 1985; X098

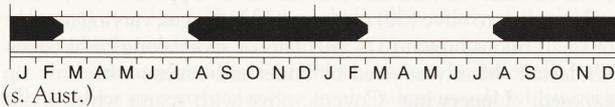
Adult SQUEAK (sonagram A): harsh and creaky *preep*, usually repeated 4–5 times with intervals of 15–20 s between squeaks. Loudest call; perhaps has territorial function; carries up to 250 m (Sibson 1959). Other birds often call in response (Sibson 1959);

G.P. Elliott). Given when surprised by other bird (Dunlop 1970). Probably the *clack* of Smith (1915) and *tick* of Fletcher (1939). **LOW-PITCHED GROWL**: probably the sometimes angry *coo* of Dunlop (1970). **GRUNT**: quiet; given in series. Perhaps the *kuk* of Dunlop (1970). Low grunts used to call chicks (Smith 1915). Compton (1905) and Bryant (1951) also noted grunts. **HISSES**: explosive, made with deep growling notes, when chicks chased by a person (Sawyer 1968); also made with grunting notes when eggs collected (MacGillivray 1917).

Young Downy chicks make *peeping* calls typical of young rails. Soft high-pitched squeaks when pursued (Sawyer 1968).

BREEDING Poorly known. No major studies in Aust.; studied in NZ by Elliott (1983). Aust. data based on Dunlop (1970) and general references; 25 records in Aust. NRS; NZ data based on contribution by G.P. Elliott. Breed in simple pairs; may breed up to three times per year (Dunlop 1970).

Season Aust. Laying begins Aug. or Sept. in s. Aust.; may raise up to three broods per year; laying recorded Sept.–Feb. (Hyem 1936; Dunlop 1970; North; Aust. Atlas; Aust. NRS); in n. Aust., lay Sept.–Mar. (Lavery *et al.* 1968; Parker 1970; Storr 1980); Apr., hatching in June (Serventy 1959); eggs and young in all months (Gill 1970). Cocos-Keeling Is: laying Jan., May and June, normally ends, Aug.–Oct. (Gibson-Hill 1950; Stokes *et al.* 1984). Norfolk I.: one nest with eggs found 5 Dec. (Basset-Hull 1909). **NZ** Sept.–Dec. (Elliott 1983); one record of eggs, early Mar. (Fagan 1954); young in Mar. and Apr. (CSN 23).



Site Long grass, grass tussocks, reeds, thick sedge, rushes in saltmarshes (Gilbert 1936; Dunlop 1970; Elliott 1983; North; Aust. NRS), oat crop, lucerne paddock (Hyem 1936; Masters & Milhinch 1974; North); on ground in slight depression; above ground, occasionally above water; on raised hummock, island of grass in small creek, bank of rice paddy; in sheltered position under tussock of grass, lignum bush, logs, coral rocks, banana leaf, corner of building, in hollow base of tree (MacGillivray 1917, 1928; Hogan 1925; Dunlop 1970; Aust. NRS), in small shrubs (Jaensch *et al.* 1988; Aust. NRS); usually near water but may be found up to c. 60 m away (North). One nest with eggs found among pile of boxes (Hogan 1925). Nests not re-used; may build trial nests before laying (Elliott 1983; G.P. Elliott). Construct flimsy brood-nests, which are probably used for only one night (Elliott 1983). **MEASUREMENTS** (cm): from Aust. NRS: height above ground, 0–15 (n=6); above water, 11 (5–30; 6); depth below top of vegetation, 49 (20–112; 10). If nest disturbed, may move eggs to hastily constructed nest nearby, lifting them one by one (Fig. 3) (Hall 1922); also, see Reithmüller (1931).

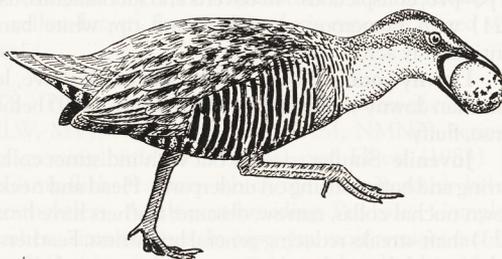


Fig. 3 Carrying egg

Nest, Materials Cup-shaped nest of short dry lengths of grass stems and herbage (Bryant 1951; North) bent over and interwoven rush stalks (Aust. NRS); roughly woven platform of grasses or rushes or both with slight depression on top; unlined; sometimes with flimsy bower of rushes or grasses pulled down over nest (G.P. Elliott). Female will pull stalks of grass round nest during incubation (Dunlop 1970). **MEASUREMENTS** (cm): diameter, 10–23 (n=5); depth of platform 17 (n=1); depth of egg cavity, 2.5–6.5 (n=3); diameter of cavity, 10 (n=1); height from ground 20 cm (n=1).

Eggs Oval to rounded oval; close-grained, smooth, glossy; creamy buff to faint buffy-white, dotted and blotched red, purplish red with underlying markings of different shades of violet-grey. Markings may be even or irregular, predominantly on thicker end, where a few irregular wavy streaks or lines may be found (North). **MEASUREMENTS**: Aust.: 35.0 (1.03; 33.0–36.6; 11) x 27.6 (0.93; 25.6–28.7) (North); 36.6 (0.97; 35.1–37.8; 7) x 27.5 (0.69; 26.2–28.2) (Campbell). **NZ**: 40.4 (1.4; 35.9–43.5; 27) x 28.9 (0.6; 27.7–29.8; 28) (Elliott 1983). **WEIGHT**: 16 (1.4; 13–19; 26) (Elliott 1983).

Clutch-size Usually 5–8 (Gilbert 1936; Aust. NRS; North), 4–5 during drought (Gilbert 1936); smaller clutches of three (Dunlop 1975; Storr 1980) and two (Aust. NRS) recorded; larger clutches of 11 (North) and 12 (Campbell) probably result from two females laying in one nest. In NZ, average 4.7: C/3 x 1, C/4 x 2, C/5 x 5, C/6 x 6 (G.P. Elliott).

Laying Intervals of 24 h, except once after 2 days; at night or early morning (G.P. Elliott); last egg of eight in a nest laid during day when female visited nest for only 5 min (Bryant 1951); successive clutches laid at intervals of 2 months (Dunlop 1970).

Incubation By both sexes; starts when clutch complete; eggs hatch within 24 h (Dunlop 1975; G.P. Elliott). **INCUBATION PERIOD**: 18–19 days (n=1, Gilbert 1936); estimate of c. 2 weeks (Dunlop 1970) probably wrong. In NZ, 19–22 days (n=3) (G.P. Elliott), c. 25 days at one nest (Moon 1967). Adults sometimes eat egg-shells after young hatch (G.P. Elliott).

Young Precocial, nidifugous. Hatch in black down with grey eye-stripe or cheek-patch; legs and bill, black; iris, brown; down changes to brownish black by 7–10 days old (Dunlop 1970; North; G.P. Elliott). For two hand-reared chicks in NZ (G.P. Elliott): weight at hatching, 12–13 g; remiges appear at 5 days, rest of feathers at c. 7 days; egg-tooth lost, 5–8 days; facial markings appear, 11–13 days; start losing down, 16 days; adult weight attained at c. 3 weeks. **Parental care, Role of sexes** Fed on nest soon after hatching and leave nest within 24 h (Gilbert 1936; G.P. Elliott), both parents accompany young until almost fully grown; brood may divide evenly when pair together (Dunlop 1970). Young usually feed themselves but female may occasionally feed young, picking up food item, cooing softly, with chick taking food from female's bill; after first week, young forage alone for long periods (Dunlop 1970). Female feigns injury in distraction display if disturbed during incubation (Reithmüller 1931; Dunlop 1975); at sign of danger, adults give an alarm call and young scurry for cover (Gilbert 1936).

Fledging to maturity Young fully grown and able to fly at 2 months (Dunlop 1970; G.P. Elliott); attain adult eye-colour at 65–70 days; pre-juvenile moult completed in 2 months and immediately begin post-juvenile moult (G.P. Elliott). Probably breed at 1 year (Dunlop 1970).

Success Aust.: nine eggs laid, seven hatched (two clutches) (Dunlop 1975; Aust. NRS); **NZ**: 38 eggs laid, 13 young hatched and left nest (eight clutches) (Elliott 1983); 1.6 young hatched per nest. Of unhatched eggs: three infertile, eight lost when tide flooded nests, nine lost when adults taken by predators (cat,

Swamp Harrier *Circus approximans*), four remaining young abandoned after Stoat *Mustela erminea* took newly hatched chick from nest (G.P. Elliott). Nests in lucerne paddocks often destroyed during mowing (Hyem 1936); some nests inundated by high spring-tides (Gilbert 1936); eggs trampled by cattle (Aust. NRS). Predators of young and adults include feral and domestic cats (Berney 1907; Parker & Parker 1986; Walker 1986b), dogs (North), Weasels *Mustela nivalis* (Oliver), Stoats, Black *Rattus rattus* and Brown *R. norvegicus* Rats, possibly Kiore *R. exulans* (Elliott 1983), foxes (Lord 1956), probably Swamp Harriers (Elliott 1983) and Wekas (Vestjens 1963).

PLUMAGES Prepared by D.J. James. Sexes similar throughout life. Hatch in natal down; pre-juvenile moult begins in a few days, producing distinct juvenile plumage; post-juvenile moult, partial, producing first immature non-breeding plumage, which is quite similar to adult; partial immature pre-breeding moult produces immature breeding plumage, which is similar to immature non-breeding; thereafter complete post-breeding and partial pre-breeding moults give alternating, though indistinguishable, non-breeding and breeding plumages each cycle. Sometimes breed as early as 11 months (Dunlop 1970) when presumably in immature breeding plumage.

Subspecies *mellori* **Adult breeding and non-breeding** (Definitive alternate and basic). First attained about beginning of second year. **Head and neck** Forehead, crown and nape, brown, densely streaked black-brown; feathers, black-brown (119) with varying, usually narrow, rufous-brown (37) to brown (123) fringes; on darkest birds, brown restricted to edges, giving dark crown. Narrow light-grey (85) to pale-grey (86) supercilium from base of upper mandible just below culmen, narrowest and palest anteriorly (where almost white in some), broadening slightly and extending well behind eye to side of nape. Bordered below by broad chestnut stripe from lores (originating at base of upper mandible from gape to just below culmen) through and under (not over) eye to side of hindneck where joins chestnut nuchal collar; feathers, red-brown (32) with varying, usually thin, dark-brown (121) centres; width of stripe varies slightly between individuals though usually widest on lores and through eye. Thin, partial white eye-ring round bottom third or so of eye. Hindneck, rufous-brown (340) to red-brown (32) forming broad chestnut nuchal patch that extends down hindneck in solid U-shape; feathers sometimes have varying olive-brown (29) centres and tips that are usually inconspicuous, but when broadest can partially obscure collar (possibly age-related; see Immature). Chin, throat, foreneck and sides of neck from below facial stripe, grey: grades from darkest posteriorly and dorsally (grey-brown [79] on lower side of neck) to palest anteriorly and ventrally (white on chin); darkness varies slightly between individuals, some having large pale chin, throat and malar. Black-and-white barring of chest reaches onto base of neck at sides (see Underparts). **Upperparts** Feathers have grey-brown (79) bases. Mantle, mostly olive with black mottling and fine white spots though gross appearance quite varying and prominence of spots greatly reduced by wear; feathers, olive (48 to light 48) at tip with black centres; usually two small white spots at edge of each web though these occasionally elongated and joining at shaft to form two fine bars; feathers towards centre of mantle more likely to show barred pattern than those at sides. Scapulars, black with broad olive (50) to brown (123) rosethorns and two sharp but irregular white spots on each edge, which are mostly concealed by tips of overlying feathers; appear olive, varying mottled blackish with sparse white spots. Subscapulars, black with broad olive (50) to brown (123) fringes (appear broadly streaked) with mostly concealed white spots (often washed brown [123]) along edges on

basal two-thirds of feathers. Back and rump, similar to subscapulars but with spots diminishing towards rear and often absent. Upper tail-coverts, olive (c50) at tips irregularly separated from black base, with prominent to weak, olive (c52) to brown (123) spots along basal edges. **Underparts** Top of upper breast, uniform grey-brown (80) like foreneck. Rest of upper breast, boldly and finely barred black-and-white; feathers have four white bars (including tip) separated by four grey-black (82) bars (including most basal one) of equal width; bases, grey-brown (79). Varying buff (123B) to light-brown (123A) band across middle of breast, 0–30 mm wide, (Schodde & de Naurois 1982); feathers of band like those of upper breast except that tips washed buff, generally obscuring distal bars to varying extent (basal bars concealed); on birds without bands, feathers rarely as upper breast but usually faintly washed buff on distal white bands. Lower breast, belly and flanks, similar to upper breast; lower breast has only three white bars on each feather and posterior flanks 2–4 per feather; barring slightly bolder on belly than on breast; on some, black bars narrow or missing in thin line along centre of belly. Vent, white with 1–2 grey-black (82) bars at base, usually concealed or showing as mottling. Thighs as vent but mostly covered by feathers of flanks. Under tail-coverts, grey-black (82) on basal three-quarters with two broad widely spaced white bars from edge to shaft on each web, and with buff tip grading to narrow band of white next to black base; pattern can be symmetrical or asymmetrical: in former, base and tip cut off in straight line across feathers and bars align at shafts; in latter, tip cut off in sigmoid line across feather with black wider on outer web, and bars offset at shafts. **Uppertail** Grey-black (82) grading to olive (50) or brown (123) fringes; varying number of small rufous-brown (37–340) bars or spots along basal edges. **Undertail** Mostly covered by under tail-coverts with only tip exposed. **Upperwing** Coverts, olive with sparse white spots; remiges, dark-brown barred rufous-brown. Outer three primaries, dark brown (121) with thin widely spaced white bars that are usually lightly washed rufous-brown (38). Rest of primaries and secondaries, black-brown (119) to dark-brown (121) with 4–5 broad, evenly spaced rufous-brown (38) bars (normally equal to or slightly broader than dark-brown ones) and thin subterminal bar that is white lightly washed rufous and broken at shaft; bars can be square-cut or rounded; if rounded, form less regular pattern; on inner web, bars often narrower, elongate and fading to white in centre. In some, bars of adjacent feathers align as continuous bars along remiges while in others bars completely offset forming chequered pattern. Median and greater primary coverts, dark brown (121) with olive (50) to brown (123) tips and about three rufous-brown (38) bars along edges. Median and greater secondary coverts, similar with black-brown (119) bases and about three short white bars or small spots along edges. Alula, dark brown (121) with white bars along edges and narrow olive (50) to brown (123) fringe. Lesser coverts, olive (50) to brown (123), sometimes irregularly, finely spotted white. Marginal coverts, white, forming thin white leading-edge. **Underwing** Remiges, barred dark brown (121) and light rufous-brown (pale 139). Very narrow white bars on p8–p10, conspicuous. All coverts and subhumeral, dark brown (121) with numerous white bars and tip; white bars aligned continuously across wing-lining.

Downy young Black (89) or sooty black above, less iridescent than downy young crakes; black-brown (119) below. Down, dense, fluffy.

Juvenile Similar to adult but with indistinct collar, fainter barring and buff mottling on underparts. **Head and neck** Rufous-brown nuchal collar, narrow, obscure; feathers have broad brown (223) shaft-streaks reducing general brightness. Feathers of throat and foreneck have olive-buff tips that give mottled look. Varia-

tion in amount of white on throat appears to be same as for adults. **Upperparts** Feathers of mantle have less clearly defined and browner (black-brown [119], not black) centres and smaller spots, which are usually not white but olive-buff with little contrast, with olive (50) to brown (123) edges; thus appear obscurely pale-spotted, not distinctly white-spotted. **Underparts** Breast, belly and flanks, barred as adult, but barring grey (84), not grey-black (82) and tips of feathers have faint buff wash; in general, pattern much paler and less distinct. Width of breast-band varies as in adult; Dunlop (1970) reported that young developed breast-band in juvenile plumage in some clutches but later in others. Feathers in breast-band, grey (84) at base and buff at tips, completely lacking black-and-white barring; some have olive-grey tips to feathers giving untidy, dirty look to band. **Tail, Wing** Pattern similar to adult. Rectrices and tertials usually have pointed and frayed (loosely knit) tips; often rachides of natal down still evident clinging to tip. Degree to which this evident varies greatly.

First and second immature (First alternate and basic). Very similar to adult. Juvenile flight-feathers retained and, in the hand, combination of adult-like body-plumage and pointed frayed tips to tertials and rectrices, diagnostic. However, in some individuals it is not possible to recognize juvenile flight-feathers, especially when feathers worn, so proportion of immatures that can be recognized probably decreases with age. All skins aged as immatures on above criteria had very narrow nuchal collars that were often obscured by brown (223) tips to feathers. Some skins not aged as immatures showed same pattern; some of these are probably cryptic immatures but not known if adults (i.e. in definitive plumage) ever have obscured nuchal collar. Study of marked or captive birds needed to evaluate use in ageing.

Aberrant plumages Partial leucism seen occasionally; usually evident as scattered white feathers but mostly white birds occur (Oliver; Mathews; skins).

BARE PARTS Based on photos (NPLAW 1985; Trounson & Trounson 1989; Lindsey 1992; Aust. RD; unpubl.: J.N. Davies; R. Davies; G.P. Elliott; D.J. James), banding records (K. Rogers; A. Rogers) and museum labels. **Adult** Bill, dirty pink (c3) to pink-red (c10) on basal quarter to two-thirds, grading to grey (c84) or brownish-grey (c79) culmen and tip. Iris, bright red (c12); dark red, dark orange; inner ring sometimes dark blue or brown; perhaps some seasonal change. Legs, grey or brownish grey (c79) with pink, reddish, buff or olive tinge. Claws, dark grey to grey-black (83–82). **Downy young** Bill: at first, grey (83–84), with grey-black (82) saddle and small white egg-tooth; as chick grows, size of dark saddle increases; at 6 days old, bill mostly black; small grey area at base of bill (with weak pink tinge) recedes, restricted to small patch under nares at c. 12 days old; grey tip of lower mandible and tip of upper tomia also tinged pink, which remains until c. 12 days old. Orbital ring, dark. Iris, dark brown. Feet, dark grey (82–83), with faint pink tinge, especially on front of tarsus. Claws, grey-black (82). **Juvenile** Bill, mostly grey-black with pinkish tinge, especially at base. Iris, dark brown to brown. Legs, dark grey with pink tinge. **First immature** As adult, except iris probably yellow-brown. In transition, iris reported as red with yellow flecks.

MOULTS Poorly known. Based on examination of c. 80 skins (AM, HLW, MV), c. 90 data sheets (AM, NMNZ), series of photos of growing birds (G.P. Elliott), and Elliott (1983). No skins moulting flight-feathers, which indicates secretive behaviour when flightless. **Adult post-breeding** Pre-basic. Complete. Flight-feathers, simultaneous. In captivity, most remiges moulted in 1 day and all within 5 days; regrowth completed within 35 days;

flight regained only a few days before remiges fully grown (Elliott 1983). Timing probably varies: in se. Aust.: eight skins in moult, Oct.–Jan.; 16 not moulting, June–Jan. In Coral Sea, moulting feathers of head and body: Sept. (two skins), Oct. (one), Dec. (one); not in moult: May (one), Dec. (two). Of 21 birds trapped in Nelson, NZ, between Jan. and Apr., six were moulting; also, in captivity, moult from early Jan. to early Apr. (Elliott 1983). Skins from NZ (MV; NMNZ data), moulting feathers of head and body: Nov. (one), Jan. (one), Feb. (two), Apr. (five), May (two); one skin moulting wing, in Mar. In NZ, not known to moult while breeding (Elliott 1983); no data from Aust. Moulting male with enlarged testes collected New Guinea (Mayr & Gilliard 1954); moulting and breeding may occur year round in Samoa (Banks 1984). **Adult pre-breeding** Pre-alternate. Partial, head and body. Six skins from se. Aust and two from NZ moulting feathers of head and body, June–July, probably pre-breeding but could be post-breeding. **Pre-juvenile** Feathers of face (ear-spot and supercilium) and breast begin appearing about Week 2; by Day 20, scapulars and most of underparts well developed; central breast and belly develop quite late, leaving conspicuous dark stripe of down. Flight-feathers and under wing-coverts develop last. When moulting, often appear hairy with clinging down, especially round thighs and upper tail-coverts. Mostly finished at 2 months (Dunlop 1970). **Post-juvenile** First pre-basic. Partial. All or most feathers of head and body replaced. Remiges and rectrices, retained. Wing-coverts, unknown. One skin from e. NSW, in moult on neck, mantle and breast in Jan. **Immature pre-breeding** Partial. Details, unknown; probably restricted to some feathers of head and body. **Immature post-breeding** Second pre-basic. First complete moult. Similar to adult post-breeding. Probably at beginning of second year; when adults moult or slightly earlier. Details, unknown.

MEASUREMENTS Subspecies *mellori*: Aust. mainland, skins; sexing based on labels (AM, HLW, MV): (1) adults; (2) immatures and fully grown juveniles.

	MALES	FEMALES	
WING	(1) 145.8 (6.19; 130–156; 30) (2) 146.2 (6.85; 136–153; 6)	141.2 (5.38; 132–152; 18) 144.2 (5.70; 138–153; 6)	* ns
STH P	(1) 101.8 (4.11; 90–107; 22)	96.1 (3.72; 90–100; 7)	*
TAIL	(1) 69.3 (4.60; 60–78; 26)	64.8 (4.17; 54–71; 16)	*
BILL F	(1) 31.9 (2.86; 22.7–41.5; 25) (2) 32.4 (2.69; 29.2–35.5; 5)	29.8 (1.37; 27.3–32.5; 17) 29.5 (1.78; 27.5–31.9; 6)	* ns
TARSUS	(1) 40.8 (2.62; 34.5–45.7; 30) (2) 42.5 (1.54; 40.6–44.1; 5)	38.8 (2.17; 35.5–43.2; 18) 39.1 (1.26; 37.0–40.3; 6)	* ns
TOE-C	(1) 34.7 (1.27; 32.4–37.1; 18)	33.3 (1.64; 30.1–35.5; 11)	*

Subspecies *assimilis*: NZ, adult and immature skins: (3) MV; sexing based on labels; (4) Schodde & de Nurois (1982); (5) Elliott (1983) (AWMM, CM, NMNZ); sexing based on labels.

	MALES	FEMALES	
WING	(3) 134.5 (5.97; 128–142; 4) (4) 137.3 (0.6; 3) (5) 140.4 (41)	130, 135 131 (2.5; 3) 134 (30)	* *
STH P	(3) 95 (3.56; 95–100; 4)	92, 94	
TAIL	(3) 64.0 (2.45; 62–67; 4)	64, 66	
BILL F	(3) 35.2 (3.29; 32.3–39.1; 4) (4) 34.9 (5.2; 3) (5) 36.4 (41)	30.5, 33.6 33.2 (2.1; 3) 32.7 (29)	* *
TARSUS	(3) 42.6 (3.31; 38.5–46.0; 4)	38.4, 42.0	

	(4)	41.6 (1.9; 3)	40.9 (4.4; 3)	
	(5)	40.8 (40)	39.2 (31)	*
TOE-C	(3)	34.2 (2.67; 32.0–37.8; 4)	35, 35.7	

Subspecies *tounelieri*: skins, adults and immatures: (6) Coral Sea and Great Barrier Reef; sexing based on labels (AM, MV); (7) Coral Sea and lower Great Barrier Reef (Bunker Grp) (Schodde & de Naurois 1982).

	MALES	FEMALES	
WING	(6) 139.0 (8.46; 130–150; 4)	129.8 (5.97; 124–139; 5)	ns
	(7) 140.3 (8.5; 3)	124.8 (4.6; 6)	
BILL F	(6) 33.6 (1.68; 31.3–34.9; 4)	29.0 (0.58; 28.3–29.8; 5)	*
	(7) 33.4 (1.0; 3)	28.4 (2.3; 6)	
TARSUS	(6) 38.2, 39.1, 40.5	38.6 (1.67; 36.2–40.2; 5)	
	(7) 40.0 (2.7; 3)	36.5 (2.4; 6)	

Subspecies *tounelieri*: (8) Raine I., live; methods unknown (ABBBS: B.R. King).

	UNSEXED
WING	(8) 128.9 (5.89; 114–138; 54)
TAIL	(8) 55.9 (3.00; 48–62; 48)
BILL F	(8) 31.4 (2.45; 27.0–36.8; 56)
TARSUS	(8) 40.2 (4.80; 31.8–54.3; 53)

Males generally larger than females for all measurements and probably in all populations, though samples often too small to show this. Subspecies *assimilis* has shorter wing and longer bill than nominate. Subspecies *tounelieri* has shorter wing than nominate, but other measurements similar and variation greater than others in all measurements. Schodde & de Naurois (1982) present geographical breakdown of measurements from HANZAB area and parts of sw. Pacific.

WEIGHTS Subspecies *mellori*: Aust. mainland, museum labels and data sheets; sexing based on labels (AM, HLW, MV): (1) adults; (2) immatures and fully grown juveniles.

	MALES	FEMALES
(1)	181 (25.1; 144–234; 16)	165.6 (36.5; 123–240; 8)ns
(2)	183, 195, 210	152, 161

Subspecies *assimilis*: (3) NZ, adults and immatures, register cards (NMNZ).

	MALES	FEMALES
(3)	171 (31.3; 126–204; 7)	168 (36.7; 115–218; 8)ns

Subspecies *tounelieri*: (4) Raine I., live birds, (ABBBS: B.R. King).

	UNSEXED
(4)	188 (31.7; 130–290; 52)

Males probably heavier on average though samples too small to demonstrate adequately.

STRUCTURE Subspecies *mellori*. Body, laterally compressed. Wing, short, rounded with curved outer primaries and straight trailing-edge. Short, hooked claw on alula. Eleven primaries; p8 and p9 equal, longest; p10 9–11 mm shorter, p7 1–4, p6 6–9, p5 11–19, p4 18–24, p3 24–30, p2 31–37, p1 39–46, p11 minute. Eleven secondaries including three tertials; longest tertial falls between p4 and p6 on folded wing. Tail, reasonably long for rail, rounded at tip, flimsy; ten rectrices. Bill, moderately long, laterally compressed, deep at base tapering evenly to tip. Culmen, rather straight for basal three-quarters with down-curved tip. Lower mandible slightly arched along base with pronounced gonydeal angle about three-quarters from base. Nostril, horizontal, slit-like, in large nasal groove. Tarsus, strong, laterally compressed. Toes, long; front toes have very narrow lobes; hind toe, laterally compressed. Scales, scutellate on front and rear of tarsus and top of toes, reticulate on side of tarsus, soles and joints. Outer toe 80–87% of middle, inner 73–78%, hind 25–31%. Claws, laterally compressed, thin, sharp.

Subspecies *assimilis*. NZ birds have slightly shorter wing (Schodde & de Naurois 1982). Bill, slightly longer, and thinner (interramal area narrower) and much shallower; gonydeal angle, less pronounced; nostril, narrower.

RECOGNITION For identification of downy young, see Lewin's Rail. On present knowledge, inseparable from downy young Weka or Woodhen *Gallirallus sylvestris*.

GEOGRAPHICAL VARIATION Complex. Widely distributed in A'asia and sw. Pacific. Ripley (1977) recognized 26 subspecies; Schodde & de Naurois (1982) lumped six of these from Aust. and New Guinea into two, cast doubts on several from Bismarck Arch. and described subspecies *tounelieri* from the Coral Sea. *G. dieffenbachii* here treated as distinct species. For discussions of extralimital populations, see Schodde & de Naurois (1982), Ripley (1977), Junge (1953), Parkes (1949), Mayr (1938, 1949) and Mathews.

Aust. mainland and Tas. populations previously divided into three subspecies (Mathews); however Schodde & de Naurois (1982) found no consistent geographical variation and are followed here in recognizing single Aust. subspecies (*mellori* [the earlier name *australis* is pre-occupied in *Gallirallus*]) that also includes birds from Torres Str., s. and w. New Guinea, and Snow Mountains, Irian Jaya (latter formerly subspecies *randi*). Trends in plumage previously thought to be geographical are more probably caused by age and individual variation (see Plumages); size, similar throughout Aust. with no more variation between populations than between individuals of one population when sexual differences taken into account (Schodde & de Naurois 1982). Two skins from Lord Howe I. and one from Norfolk I. (AM) match *mellori*.

Population from Coral Sea and Great Barrier Reef (subspecies *tounelieri*) rather poorly defined and subspecific status doubtful. Measurements support view of Schodde & de Naurois (1982) that wing shorter than *mellori* on average (though varies greatly) but in plumage hardly differs from latter: in ten skins (AM, HLW, MV) four features of plumage cited by Schodde & de Naurois (1982) to distinguish *tounelieri* (facial stripe, nuchal collar, back [= mantle and scapulars], and remiges) not evident when age and wear considered, and fifth feature (pectoral band) though more often reduced in *tounelieri*, varies greatly between individuals. Population, highly mobile and shows slight cline from E to W, which suggests broad hybrid zone with gene flow from subspecies *mellori* in W, *swindellsii* (of New Caledonia) in E, and perhaps *reductus* (from e. New Guinea) in N and *assimilis* in S (cf. Schodde & de Naurois 1982).

Subspecies *assimilis* of NZ differs from *mellori* in plumage (contra Schodde & de Naurois 1982), length of wing and shape of bill. Well-marked but very similar to subspecies *mellori*; differs by: **Adult Head and neck** Top of head, dark brown (219) to black-brown (119) with lighter and broader brown (123) to light brown (39) fringes giving paler and more streaked crown. Nuchal collar, slightly paler, rufous brown (36); distinction slight and affected by wear; possibly slightly narrower on average. **Upperparts** Paler, more uniformly olive. Fringes of feathers on mantle and scapulars, much broader, olive (51–52), with black centres much smaller and inconspicuous. **Underparts** Breast-band, similar but possibly slightly paler (light yellow-brown [123]) on average; distinction slight. **Tail** Slightly paler because of broader olive (51–52) fringes to feathers. **Immature** Only skin examined completely lacked chestnut nuchal collar. Schodde & de Naurois (1982) considered strong individual variation, with some birds that apparently scarcely differ from *mellori*, as evidence of continued gene flow between Aust. and NZ, but confirmation needed. No known geographical variation in main islands of NZ.

Subspecies *andrewsi* of Cocos-Keeling Is poorly known. Mathews' original description suggests highly distinctive form with very dark upperparts almost lacking olive-brown fringes but with numerous white spots more developed than in all other subspecies and extending to rump (but spots do occur on rump of other subspecies). Status requires confirmation.

Subspecies *macquariensis*, extinct since about 1880 (NZCL), known only from three skins and subfossil remains. Bill (28–35 mm) and wing (117–131 mm) both slightly shorter than *assimilis* (Vestjens 1963; Ripley 1977; Oliver); tarsus, heavy (Hutton 1879). Possibly flightless. Following based on descriptions of type specimen, which is probably immature (plumage features; pointed rectrices; brick-red iris): differs from subspecies described above by: indistinct grey supercilium; indistinct rufous wash of nuchal collar (probably sign of immaturity); darker upperparts with few pale spots; much broader rufous-brown breast-band; less pronounced barring on flanks, which are washed olive-brown; olive-brown fringes on secondaries (Hutton 1879; Buller 1888; Ripley 1977; Oliver). Scott (1882) considered *macquariensis* dimorphic with reddish and slightly smaller black forms; this not in accordance with other information. Taxonomic status requires further study.

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Volume 2, Plate 40

Buff-banded Rail *Gallirallus philippensis* (page 495)

1 Adult, subspecies *mellori*; 2 Adult, subspecies *assimilis*; 3 Downy young; 4 Juvenile, subspecies *mellori*; 5, 6 Adult, subspecies *mellori*

Woodhen *Gallirallus sylvestris* (page 520)

7 Adult; 8 Older adult (>c. 7 years old); 9 Adult, sunning; 10 Downy young; 11 Juvenile