

- Low, R. 1980. *Parrots. Their Care and Breeding*. Blandford Press, Poole, England.
- Lowe, V.T., & T.G. Lowe. 1976. *Aust. Bird Watcher* 6: 252-4.
- MacGillivray, W. 1910a. *Emu* 10: 16-34.
- 1910b. *Emu* 10: 88-102.
- Mack, K.J. 1970. *S. Aust. Orn.* 25: 126-41.
- Masters, J.R., & A.L. Milhinch. 1974. *Emu* 74: 228-44.
- Matheson, W.E. 1976. *S. Aust. Orn.* 27: 125-30.
- McGilp, J.N. 1923. *Emu* 22: 274-87.
- 1935. *Emu* 34: 163-76.
- 1949. *S. Aust. Orn.* 19: 42-50.
- McLennan, C.H. 1907. *Emu* 6: 131-2.
- Moriarty, T.K. 1972. *Emu* 72: 1-7.
- Morris, A.K., et al. 1981. *Handlist of Birds In New South Wales*. NSW Field Orn. Club, Sydney.
- Parsons, F.E. 1917. *S. Aust. Orn.* 3: 113-16.
- Paton, D.C., & H.A. Ford. 1977. *Emu* 77: 73-85.
- , et al. 1994. *S. Aust. Orn.* 31: 151-93.
- Pizzey, G. 1980. *A Field Guide to the Birds of Australia*. Collins, Sydney.
- Rix, C.E. 1937. *S. Aust. Orn.* 14: 86-91.
- 1943. *S. Aust. Orn.* 16: 57-78.
- 1970. *S. Aust. Orn.* 25: 147-91.
- Robinson, L. 1970. *Australian Parrots in Colour*. Rigby, Adelaide.
- Ross, J.A. 1926. *Emu* 25: 179-83.
- Saunders, D., & J. Ingram. 1995. *Birds of Southwestern Australia*. Surrey Beatty, Sydney.
- Schmidt, B.L. 1978. *Aust. Birds* 12: 61-86.
- Schmidt, M. 1985. *Bird Keep. Aust.* 28: 149-51.
- Schodde, R., & I.J. Mason. 1997. *Zoological Catalogue of Australia*. 37.2. Aves. CSIRO Publ., Melbourne.
- Sedgwick, E.H. 1952. *Emu* 52: 285-96.
- Sharp, A., & S. Sewell. 1995. *Sunbird* 25: 49-59.
- Shephard, M. 1989. *Aviculture in Australia*. Black Cockatoo Press, Melbourne.
- Sindel, S., & J. Gill. 1996. *Australian Grass Parakeets*. Singil Press, Austral, NSW.
- Smith, D. 1991. *Aust. Avicult.* 34: 120-4.
- Smith, G.T., & L.A. Moore. 1992. *Aust. Bird Watcher* 14: 155-8.
- Souter, T.G. 1930. *S. Aust. Orn.* 10: 176-7.
- 1942. *S. Aust. Orn.* 16: 27-30.
- Stove, K. 1994. *S. Aust. Orn.* 31: 195-265.
- Sullivan, C. 1927a. *S. Aust. Orn.* 9: 106-8.
- 1927b. *S. Aust. Orn.* 9: 141-5.
- Sutton, J. 1929. *S. Aust. Orn.* 10: 22-45.
- Tavistock, Marquis of. 1925. *Avicult. Mag.* 3: 272-4.
- Taylor, P.W. 1987. *S. Aust. Orn.* 30: 62-73.
- Trounson, D., & M. Trounson. 1987. *Australia, Land of Birds*. William Collins, Sydney.
- White, S.A. 1913. *Emu* 13: 16-32.
- Whitlock, F.L. 1937. *Emu* 37: 106-13.
- Wilson, M. 1974. *Emu* 74: 169-76.

Sponsors: Mr BR and Mrs AM Fleming

Psephotus chrysopterygius Golden-shouldered Parrot

COLOUR PLATE FACING PAGE 448

Psephotus chrysopterygius Gould, 1858, *Proc. Zool. Soc. Lond.* 1857: 220 — near Normanton, Queensland.

Specific name from Greek χρῦσοπτερυγός, golden-winged (from χρῦσός, gold, and πτέρυξ, wing).

OTHER ENGLISH NAMES Antbed, Anthill, Chestnut-crowned or Golden-winged Parrot; Chestnut-crowned or Golden-winged Parakeet.

MONOTYPIC

FIELD IDENTIFICATION Length 23-28 cm; wingspan c. 35 cm; weight c. 55g. Medium-sized, rather slender parrot; noticeably smaller, slimmer and longer-tailed than Pale-headed Rosella *Platycercus adscitus*. Unmistakable within limited range; adult male striking, with black cap, diagnostic yellow shoulder-patch, and salmon-pink lower belly to undertail-coverts; adult female and juveniles much duller and greener, with conspicuous pale underwing-bar. Sexes differ markedly. No seasonal variation. Juvenile distinct. Immature male separable. **Adult male** Head, neck and much of body, turquoise, with: pale-yellow frontal band and neat black cap that tapers onto nape and joins narrow grey-brown line down centre of hindneck; varying blue-green suffusion on cheeks, throat and ear-coverts; grey-brown saddle, which becomes darker and browner with wear; and salmon-pink lower belly, vent, thighs and undertail-coverts, conspicuously scaled off-white. Uppertail: when folded, blue-black grading to olive-green basally; when spread, shows light-green sides that grade to light blue distally and to white tip at sides. Folded wing mostly grey-brown, as saddle, with conspicuous and diagnostic bright-yellow shoulder-band and inconspicuous narrow dark-blue leading edge extending round

carpal joint; folded primaries, blackish, edged with dark blue basally and cream distally. In flight, secondary coverts of upperwing mostly grey-brown, with prominent diagonal yellow band extending inwards from carpal joint; secondaries and outerwing contrastingly blackish. Undertail: light blue, with white tip near centre and black tip in centre. Underwing: greater coverts and remiges, brownish black; rest of coverts, blue. Bill, light blue-grey. Cere, dark grey. Iris, grey-black. Legs and feet, pale pink. **Adult female** Much duller and greener than male, differing by: Frontal band, indistinct, pale yellow, and contrasts less with fainter cap, which is olive to dark olive; cap grades to yellow-green of hindneck and sides of neck; throat, cheeks and ear-coverts, greenish yellow to pale yellow. Saddle, yellow-green, contrasting little with rest of upperbody. Folded wing, mostly yellow-green, as upperparts, with narrow dark-blue leading edge extending round carpal joint; in flight, upperwing as male except secondary coverts uniform yellow-green. Underbody varies: some mostly yellow-green, with centre of belly, paler off-white; in others, whole belly, vent and undertail-coverts, off-white, sharply demarcated from yellow-green breast; all have varying amounts of dull-orange mottling

on thighs and centre of belly. Underwing: as male but with broad cream underwing-bar through centre of all but outer few primaries, prominent in flight. **Juvenile male** Similar to adult female and best distinguished by bright-orange to yellow-orange bill and cere at fledging, changing to greyish horn within 2–4 months. Usually differ from adult female by: (1) darker-olive crown and nape, which gives more capped appearance; (2) pale frontal band tinged pale green at first; (3) cheeks and ear-coverts brighter, green or blue-green; and (4) usually have some red on centre of belly, always more than female. **Juvenile female** Very similar to adult female and best distinguished by colour of bill and cere as in juvenile male. **Immature male** Poorly known. Often rather scruffy mixture of juvenile and adult male plumage on body and secondary coverts (some showing partial yellow shoulder-patch); also retained pale underwing-bar of juvenile. **Immature female** Inseparable from adult female.

Similar species None.

Gregarious; usually in pairs or family parties; occasionally in small flocks. Inhabit open woodlands, native grasslands and scrublands where termite mounds abundant. Quiet and unobtrusive and generally allow close approach; feed mainly on ground, flying to trees if disturbed. Flight swift, direct and slightly undulating; generally keep low, but birds travelling long distances fly above tree-tops. Usual contact call a disyllabic whistled *fweep-fweep*, repeated and sometimes prolonged to *few-weep few-weep*; perched birds utter sharp *weet* repeated two or three times, and mellow *fee-oo fee-oo*.

HABITAT Inhabit open, wet or dry tropical savanna woodlands with canopy dominated by *Melaleuca* or *Eucalyptus* and ground storey dominated by *Schizachyrium*, *Thaumastachloa*, *Sorghum plumosum* and *Eriachne burkittii*. During dry season inhabit woodland dominated by Darwin Stringybark *Eucalyptus tetradonta*, Cullen's Ironbark *E. cullenii*, *E. clarksoniana*, *E. hylandii*, Ghost Gum *E. papuana*, Ironwood *Erythrophleum chlorostachys* and *Grevillea glauca*, with understorey of annual grasses *Schizachyrium fragile* and *S. pachyarthron*. After first rains of wet season, move to low open woodlands dominated by Broad-leaved Tea-tree *Melaleuca viridiflora* and *Petalostigma banksii*, with Fern-leaved *Grevillea pteridifolia*, and understorey of fire grass *Schizachyrium*, *Planichloa nervilemma* and *Hyptis suaveolens* (White 1922; Thomson 1935; Weaver 1982; Garnett & Crowley 1994, 1995). Once recorded in mangroves (MacGillivray 1918).

Nest in termite mounds (see Breeding). Mostly in mounds of *Amitermes scopulus* in ecotone between grassy flats of impeded drainage lines and interfluvial sand-ridges, or on metamorphic boundary between sandstone and granite in low hills. Sometimes also in mounds of *Amitermes laurensis* on grassy flats or *Nasutitermes triodiae* on sandy ridges (Weaver 1982; Garnett & Crowley 1995).

Mainly forage on ground, preferring recently burnt grassland. In dry season, eat fallen seed, mainly from floor of *Eucalyptus* woodland; during wet season, mainly feed in understorey in *Melaleuca* and Fern-leaved *Grevillea* woodland, particularly on and along edges of drainage flats, taking seed directly from stems. Also forage in trees, on leaves and flowers, and on ground beside roads (Garnett & Crowley 1995).

Usually roost in broad-leaved trees, such as Carbeen Gum *Eucalyptus confertiflora*, and Broad-leaved Tea-tree. During day, loaf in shady trees along watercourses or in patches of dry rainforest (Garnett & Crowley 1995; S.T. Garnett & G.M. Crowley).

Threatened by changes to structure of vegetation as a result of changes in fire-regimes (Garnett & Crowley 1995).

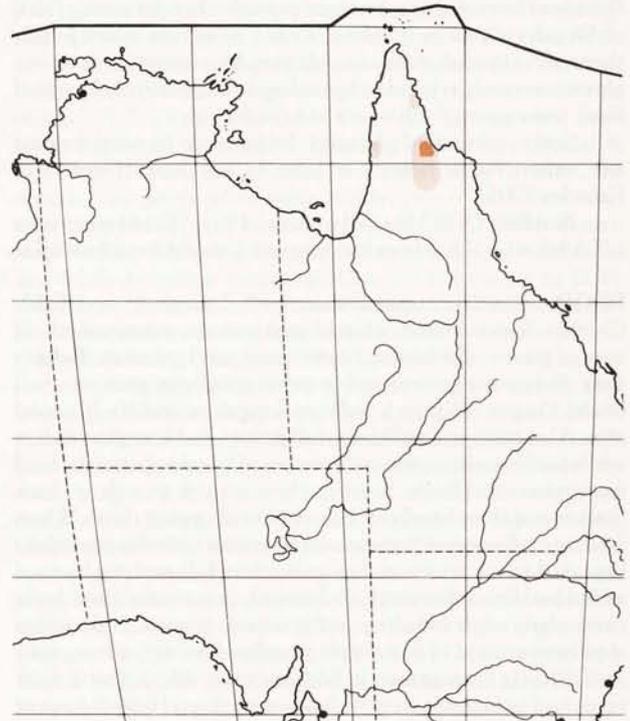
DISTRIBUTION AND POPULATION Endemic to Qld, Aust. Eight records in Aust. Atlas. Restricted to central and s. C. York Pen., in area centred on Artemis and Dixie Stns and upper catchment of Morehead R. in N; and in small area W of Chillagoe in S (Weaver 1982; Chapman 1990; Garnett & Crowley 1994, 1995; Forshaw; Aust. Atlas; Qld Bird Repts 1986, 1988, 1990). Also recorded from upper reaches of Olive R. and 15 km N of Weipa (Weaver 1982; Forshaw); near junction of Kennedy and Normanby Rs (Weaver 1982); and at mouth of Chapman R. (Garnett & Bredl 1985; Aust. Atlas). Reports farther W, e.g. near Darwin, NT, and Carnarvon, WA (Hall 1900; Le Souëf 1902), incorrect.

Breeding Probably throughout range. Nests recorded Artemis and Dixie Stns (Weaver 1982, 1987; Garnett & Crowley 1995; Aust. Atlas) and W of Chillagoe (Garnett & Crowley 1995). In late 1970s, unconfirmed reports from E of Normanby R. and E of Peninsula Development Rd, between Hann and Kennedy Rs (Weaver 1982). First breeding record, in Apr. 1922, was c. 22.5 km N of Coen (White 1922).

Change in range Range has contracted and is still slowly contracting, probably as result of altered fire-regimes (Garnett & Crowley 1994, 1995; Crowley & Garnett 1998). Formerly abundant N of Coen and at Silver Plains (White 1922) and at Violetvale Stn, E of Musgrave Stn (Thomson 1935), but by 1970s mainly confined to area S and W of Musgrave Stn (Weaver 1982) and W of Chillagoe (Garnett & Crowley 1995).

Status Endangered (Garnett 1993). **Populations** Maximum population in N, 1100 pairs; in S, 500 pairs (Garnett & Crowley 1995).

During 1960s, much trapping in Musgrave area (Gellibrand 1964; Weaver 1982) but has been little trapping since 1970s and not now considered major threat or reason for continued decline (Garnett & Crowley 1995; *contra* Gellibrand 1964).



MOVEMENTS Based on contribution by S.T. Garnett and G.M. Crowley unless stated. Sedentary. No large-scale seasonal movements; and no evidence for claims of long-distance post-breeding movement away from nesting areas, toward coast or through open woodland (see Lendon 1973; Garnett 1993; Forshaw).

Breed late wet season through to mid-dry season (Mar.–Aug.), when usually in pairs, sometimes with male auxiliary; few or no unpaired females, and most unmated males associated with breeding pairs, though some follow flocks of woodswallows (see below). After fledging (as early as May through to about early Aug.), most juveniles stay within 2–3 km of nest for c. 2 months; then disperse, some up to at least 12 km, and form dry-season flocks, with any unmated immature males; dry-season flocks remain sedentary within 1 km of water till end of dry season (Oct.–Nov.); there may be some exchange of individuals between dry-season flocks. Sites used traditionally, but duration of stay at any site depends on availability of water and, possibly, fire history of surrounding area (birds preferring to forage on burnt ground). Adults appear to stay near nesting sites, occasionally feeding at edges of dry-season flocks.

With first rains of early wet season, juveniles and immature and second-year males from dry-season flocks move to sites where Black-faced Woodswallows *Artamus cinereus* traditionally breed (and thus confined to small home-ranges) and where wet-season food abundant. With first rains, adults at first return to near breeding sites and display but, as rains continue and food depleted, also move to Woodswallow breeding sites or move more widely searching for food; several pairs seen up to 7 km from where they later nested. Parrots stay and feed in area till Woodswallows finish breeding and disperse in mid-wet season (Jan.–Feb.); Parrots then also disperse. At this time, no female Parrot is without a mate and most second-year males have obtained a mate. Some pairs appear to move back to nesting sites, where food again available; others, perhaps newly formed pairs without attachment to a nesting site, move much farther. Till as late as May, some immature males follow Woodswallows, feeding for short periods, then following flock of Woodswallows as it moves. Other immature males attach themselves to adult pairs as auxiliaries. Movements at this time almost certainly related to spatial and temporal patchiness of food; some young birds move at least 30 km.

Some, particularly females, breed close to natal nesting site, others found nesting at least 12 km away (Garnett & Crowley 1995).

Banding Of 613 banded in Aust., 1953–96, 144 recoveries (23.5%): all <10 km from banding site. Longest lived 8 months.

FOOD Based on contribution by S.T. Garnett and G.M. Crowley unless stated. Mostly granivorous; mainly seeds of annual grasses; also leaves, flowers, and, rarely, insects. **Behaviour** Forage on ground and in trees; usually in pairs or small flocks. On ground, mostly walk, pecking at ground 30–70 times/min. Also grasp and pull down tall grasses, holding grass in feet while feeding; also perch on branches of low shrubs to take seed from grasses and herbs. In trees, chew on new growth or pluck flowers and chew briefly on bases before dropping them. When feeding on flowers of Fern-leaved Grevillea *Grevillea pteridifolia* appeared to use tongue to lap up nectar while probing bases of individual flower bracts (L. Robinson). Sometimes chew bark, particularly while breeding. In dry season, primarily take fallen seed from ground in *Eucalyptus* woodland; in wet season, take seed directly from grasses in *Melaleuca* woodland. Drink from pools and farm dams, from hollows in trees, and from foliage of

trees wet with rain or dew, especially bases of leaves of *Pandanus* (Garnett & Crowley 1995).

Adults, Immatures Feeding on ground, wet and dry seasons, CENTRAL C. YORK PEN. (% of 4.2 million bird × s, 443-h obs.): **Plants** (Seeds unless stated.) **MONOCOTYLEDONS:** Commelinaceae: *Aneilema siliculosa* 0% in wet season, 3.1% in dry season; *Cartonema spicatum* 0, 0.4; Cyperaceae: *Fimbristylis* 0, 2.1; *Scleria novaehollandiae* or *S. rugosa* 5.2, 2.3; *S. tricuspidata* 0, 0.1; Poaceae: *Alloteropsis cimicina* 0, 1.4; *A. semialata* 0, 8.0; *Chrysopogon latifolius* 0, 0.4; *Dactyloctenium* 0, 0.8; *Digitaria ciliaris* 0, 11.3; *D. leucostachya* 0, 3.1; *Echinochloa colona* 0, 6.0; *Eliurus citreus* 0, 0.8; *Eragrostis cumingii* 0, 0.02; *Eriachne burkittii* 0.04, 0; *E. obtusa* 0, 1.4; *E. stipacea* 0, 1.2; *Heteropogon triticeus* 0, 0.1; *Ischaemum fragile* 3.4, 0.6; *Mnesithea formosa* 3.0, 0; *Paspalum scrobiculatum* 0, 4.1; *Planichloa nervilemma* 12.9, 0.4; *Rottboellia cochinchinensis* 0.02, 0; *Schizachyrium fragile* or *S. pachyarthron* or *S. pseudoelalia* 58.5, 15.4; *Setaria apiculata* 0, 1.2; *Sorghum angustum* 0, 2.1; *S. plumosum* 0, 1.2; *Thaumatococcus brassii* or *T. major* or *T. pubescens* or *T. rariflora* 2.0, 0; *T. monilifera* 3.0, 4.5; *Urochloa holosericea* 0, 0.6; *U. subquadrifida* 0, 4.7; Haemadoraceae: *Haemadorum brevicaulis* 0, 3.3. **DICOTYLEDONS:** Acanthaceae: *Brunoniella acaulis* 0, 0.1; Asteraceae: *Allopterigeron filifolius* 0, 0.1; Boraginaceae: *Heliotropium* 0, 0.1; Convolvulaceae: *Ipomoea polymorpha* 0, 0.1; Euphorbiaceae: *Phyllanthus hebecarpa* 0, 8.2; *P. virgatus* 0, 1.6; Fabaceae: *Desmodium* 0, 7.6; *Stylosanthes hamata* 0, 1.8; *Tephrosia varians* 0, 0.02; Lamiaceae: *Hyptis suaveolens* 12.1, 0.4; Violaceae: *Hybanthus enneaspermus* 0, 0.1.

Feeding in trees, wet season, C. YORK PEN. (% of 398,000 bird × s): **Plants** **MONOCOTYLEDONS:** Orchidaceae: *Dendrobium johannis* fl. 0.03%. **DICOTYLEDONS:** Anacardiaceae: *Buchanania arborescens* fru. 0.02; Chrysobalanaceae: *Parinari nondi* fl. 1.9; Combretaceae: *Terminalia platyptera* sh. 0.08; Erythroxylaceae: *Erythroxylum ellipticum* sh. 0.1; Fabaceae: *Dendrolobium* sh. 1.9, fl. 10.9, galls 0.1; Myrtaceae: *Astromyrtus glomulifera* fl. 0.4, *Eucalyptus clarksoniana* sh. 1.1, fr. 0.02; *E. confertiflora* sh. 9.3, buds 1.5; *E. melanophloia* sh. 0.02; *E. papuana* fl. 0.5; *E. tetradonta* fru. 0.2; *Melaleuca citrolens* sh. 0.1; *M. foliolosa* sh. 9.3, buds 1.5; *M. nervosa* fl. 2.6, buds 0.5; *M. stenostachya* sh. 2.1, fl. 1.1; *M. viridiflora* sh. 9.3, fl. 20.6, buds 0.6, galls 0.01; *Thryptomena* sh. 7.1, fl. 0.08; Saesalpinaceae: *Erythrophleum chlorostachys* sh. 42.8, fl. 1.9; Sterculiaceae: *Brachychiton gallowayi* sh. 0.03, fl. 0.1; *Sterculia quadrifida* fl. 7.8.

Other records **Plants** **MONOCOTYLEDONS:** Poaceae: Unident. grass seeds (Thomson 1935); *Eragrostis cumingii* (Weaver 1982); *Panicum mindanaense* (Weaver 1982); *Setaria* (Weaver 1982). **DICOTYLEDONS:** Myrtaceae: *Melaleuca* fl. (Hutchins & Lovell 1985); *M. viridiflora* bark (Weaver 1982); Proteaceae: *Grevillea pteridifolia* fl. (Weaver 1982; L. Robinson). Also observed eating rain-softened termite mound (S.T. Garnett & G.M. Crowley) and fragments of rough bark from bloodwood *Eucalyptus* (L. Robinson).

Young Crops of chicks contained mostly grass seed, particularly *Schizachyrium*, but always included seeds of legumes, mainly *Desmodium* (G.M. Crowley & S.T. Garnett).

SOCIAL ORGANIZATION Account based on contribution by S.T. Garnett and G.M. Crowley from studies on Artemis and Dixie Stns, unless otherwise stated. Usually in pairs or family groups; sometimes congregate in flocks at food or water (Chapman 1990; Forshaw). When breeding (late wet season to mid-dry season, Mar.–Aug.), usually seen in pairs, sometimes with young male auxiliary; auxiliary associates with adult pair when feeding, and calls near nest, but does not assist in raising

of young; some immature males follow flocks of Black-faced Woodswallows. After juveniles independent, form loose dry-season flocks with second-year males; flocks usually of 15–30 birds (e.g. Garnett & Bredl 1985) but occasionally larger and, once, 110 birds. Flocks feed, drink and roost together. Adults usually remain near nesting sites till early in wet season. In early to mid-wet season, most juveniles and immatures at breeding sites of Black-faced Woodswallows, which adults also join in mid-wet season. For further details of patterns of movements and social organization of various age-groups, see Movements.

Bonds Monogamous; apparently lifelong. If male disappears during breeding season, female obtains new mate within days, but new male does not assist with rearing young. Both sexes can breed in first year, but most males do not breed till at least second year. Males form bonds with first-year females in non-breeding flocks. Of 17 marked immature males, only one paired by end of first dry season, and another two by next breeding season (late wet to early dry season). Of ten marked immature females, seven paired with males in adult plumage and three, unmated by end of first dry season, paired with unmarked immature males by following breeding season (late wet season to early dry season). **Parental care** Female does most excavation of chamber (see Breeding). Female incubates and broods; both sexes feed nestlings and fledgelings. In both wild (Bohner 1994) and captivity (Hutchins & Lovell 1985), male often feeds female before she feeds nestlings. Adults feed young for c. 8 weeks after fledging. In captivity, independent in 2–3 weeks (Shephard 1989; Sindel & Gill 1996) but parents can continue feeding them for much longer (Hutchins & Lovell 1985). Some siblings stay in same flock through late dry season and move in same flock to Woodswallow breeding sites at start of wet season (see Movements). If one member of pair dies, either sex can raise up to five chicks alone (S.T. Garnett & G.M. Crowley).

Breeding dispersion Nests as close as 100 m but never in sight of each other and mostly more dispersed (Lendon 1973; S.T. Garnett & G.M. Crowley). At Artemis and Dixie Stns, 67 active nests in 120 km² in one breeding season. Defend termite mounds in which nesting against other pairs, but breeding adults sometimes feed together (S.T. Garnett & G.M. Crowley); one male seen chasing off immature male (Chapman 1990). For movements of juveniles and adults after breeding, see Movements.

Roosting Roost in flocks or pairs in outer foliage of trees. During middle of day, loaf below canopy in shady trees, with as many as 30 in one tree; usually congregate at same place each day (Bohner 1994; Garnett & Crowley 1995; Forshaw; S.T. Garnett & G.M. Crowley).

SOCIAL BEHAVIOUR Account based on contribution by S.T. Garnett and G.M. Crowley from study on Artemis and Dixie Stns, unless otherwise stated. Quiet, inconspicuous, and generally easily approached, especially when roosting during day (Chapman 1990; L. Robinson; but see Alarm). Displays generally similar to those of Hooded Parrot *Psephotus dissimilis*.

Flock behaviour Feeding birds fly to ground in small groups but then forage more or less independently; some move together, but individuals and small groups often become separated. When alarmed, all take flight simultaneously. Flight from perches rarely synchronous; small parties tend to follow each other through canopy. Usually descend to water in small parties, with individuals acting independently (S.T. Garnett & G.M. Crowley). Said to be wary when drinking; alight in tree-tops and move slowly to water, sometimes taking nearly 1 h; after drinking, leave immediately (Eastman & Hunt 1966) or usually

remain for several minutes before and after drinking (Sindel & Gill 1996). **Comfort behaviour** Bathe in water or in wet foliage of trees. When preening, stretch wing, tail and legs of one side; once, bird repeatedly chewed on leaves of *Melaleuca stenostachya* then preened tail and wings. Rarely, spread wings in sun.

Agonistic behaviour Males very aggressive in captivity (Hutchins & Lovell 1985; Sindel & Gill 1996; S.T. Garnett & G.M. Crowley). **Threat** **THREAT DISPLAY:** Male stands erect and raises feathers of crown; if perched, usually calls loudly and vibrates tail from side to side; chase follows if on ground. Most Threat Displays occur between males but, just before breeding, occasionally between male and female or between females. In early wet season, many immature males chase each other round termite mounds. **Fighting** In period before breeding, Threat Displays sometimes lead to fighting between males on termite mounds; at other times, Displays can lead to fights between males over widowed female. **Alarm** When alarmed while feeding, raise head and freeze, poised to take flight; when in trees, give soft call and sometimes start walking along branches. When loafing and feeding, easily flushed in middle of wet season but will allow closer approach during dry season (S.T. Garnett & G.M. Crowley). When flushed, usually fly to nearby tree, returning to ground to feed after danger has passed (Forshaw; L. Robinson), but if threatened fly well away (L. Robinson).

Sexual behaviour **COURTSHIP DISPLAY:** Usually male first flies around in jerky manner while giving Contact Calls, then sweeps upwards to land on perch beside female and displays, in manner resembling Threat Display: strutting toward female, occasionally wiping bill on perch, while calling (Contact Call) and with feathers of crown raised, plumage fluffed, chest thrust forward and up, shoulders thrust up and out, and closed tail vibrating laterally; female sometimes responds with similar but less intense display (Eastman & Hunt 1966; Hutchins & Lovell 1985; Sindel & Gill 1996; Forshaw; S.T. Garnett & G.M. Crowley; L. Robinson). Tail is closed, not fanned as in *Playcerus*, *Barnardius* or *Northiella* (L. Robinson). Most Courtship Displaying is by immature males in early wet season (pre-breeding) through to early dry season (early in breeding season), when can continue uninterrupted for several hours after morning feeding has finished; also given by breeding males near nesting mound (S.T. Garnett & G.M. Crowley). In captivity, male starts displaying to female as breeding approaches (Sindel & Gill 1996); once nest selected, if female ready to mate, she remains on perch while male displays then feeds her, after which copulation may occur (Hutchins & Lovell 1985). **Courtship feeding** Male feeds female before and during incubation and while brooding young nestlings (S.T. Garnett & G.M. Crowley; L. Robinson). Females fed away from nest and males do not enter nests to feed females (Hutchins & Lovell 1985; S.T. Garnett & G.M. Crowley; L. Robinson). Male comes to nest and calls to female, either from entrance to nest or nearby tree, whereupon female emerges and flies with male to trees 20–50 m away where feeding occurs; male then accompanies female back to nest and perches either on nesting mound or in nearby tree for up to 1 h or more, but more usually for only a few minutes (L. Robinson). Male feeds female by regurgitation, directly into bill of female; male stands erect over female, who lowers body forward so that breast almost touches branch, and turns head sideways and upwards so that bill points vertically upwards; bills of male and female interlock at right angles (S.T. Garnett & G.M. Crowley; L. Robinson). Male often feeds female before she feeds nestlings (Hutchins & Lovell 1985; Bohner 1994). **Allopreening** Not recorded in 443 h of

observation. **Copulation** In captivity, copulation preceded by male hopping around or over female with chest fluffed and thrust forward, wings half-raised, feathers of crown raised and some lateral wagging of closed tail; female responded with similar posture (Hutchins & Lovell 1985; Sindel & Gill 1996; L. Robinson). Copulation observed once in wild: initiated by female sidling up to perched male, raising tail, fluffing feathers of rump and dropping wings; after several approaches male raised feathers of crown, strutted past female, inspected her rump and mounted for 48 s; copulation took place 3 weeks before first egg laid; copulation noted again just after chick fledged.

Relations within family group While female digging nest, male sits atop termite mound and Chatters (Sindel & Gill 1996). When coming to feed nestlings, pair can arrive together or separately, land atop mound and often call before entering nest (Sindel & Gill 1996). Males always enter nest to feed young and not observed to cling to entrance to nest to feed young, even when young near fledging (L. Robinson). One pair with nestlings would loaf in tree near nest during middle of day, and parents and young would call to each other, unless raptors or crows present, when birds remained silent (Bohner 1994). Adults call from top of mound or from nearby tree to entice young to leave nest (Bohner 1994; Sindel & Gill 1996; L. Robinson). Once, male perched atop nesting mound then, after a couple of minutes, began calling and nestling responded by giving Food-begging Calls; male called for 2–3 min when young suddenly flew from nest; male, and female who was nearby, then flew on each side of young to a nearby tree (Sindel & Gill 1996). Another time, male entered nest and was thought to have fed young; then flew to nearby tree and gave Contact Call several times; nestling then came to entrance of nest and male began to call excitedly; nestling then edged farther out before flying to male, who continued to call excitedly, before both flew off (L. Robinson). Feeding of nestlings, by both parents, the same as courtship feeding of female by male (L. Robinson; see above). **Anti-predator responses of young** Newly fledged young sit still in foliage, relying on camouflage. **Parental anti-predator strategies** Survey surrounds for several minutes from nearby perch before flying to nest (Sindel & Gill 1996). While female feeding nestlings, male stands guard (Chapman 1990) or perches nearby and calls (Bohner 1994). Parents give Alarm Calls when chicks handled. A Black-backed Butcherbird *Cracticus mentalis* diving on chicks at nest chased off by parents and a second pair of Parrots, which dived at Butcherbird.

VOICE No detailed studies. Account based on contribution by S.T. Garnett and G.M. Crowley unless stated. Quiet and unobtrusive, with variety of chirruping calls and soft pleasing whistles (Pizzey 1980; Forshaw; L. Robinson). Most calls moderately loud, with seeming overlap in function; generally used throughout year, though Advertising Calls mostly heard before and during breeding season (see below). Calls like those of Hooded Parrot *Psephotus dissimilis*. Females have distinctive variant of Contact Call given when away from mate. No other information on sexual differences and no information on individual or regional variation. Mimicry not reported. **NON-VOCAL SOUNDS:** Noise of flight said to be audible and distinctive. Calls on P40 not typical of species (L. Robinson).

Adult ADVERTISING CALL: Melodious warbling; often interspersed with Alarm Calls. Given much by immature males in early wet season (pre-breeding) through to early dry season (early in breeding season). Call likened to that of small rosella (Thomson 1935) probably this call. **CONTACT CALL:** Disyllabic,

lilting, musical whistling *fweep-fweep*, and sometimes drawn out to *few-weep ... few-weep* or *feweep-feweep*, repeated two or more times; each note has upwards inflection towards end (Forshaw; L. Robinson). Call also described as pleasant whistling *joe-joe* or *jeeo* (Eastman & Hunt 1966). When perched in trees or when keeping in contact with other birds, utter quiet mellow *fee-oo ... fee-oo* or *fee-you ... fee-you* (Forshaw; L. Robinson; but see Alert Call below). One variation, a descending trisyllabic whistle, given by female when separated from mate. Considered a contact call; also a flight call. **ALERT CALL:** Soft *chirrup*, audible only within 10 m. Usually given just before taking flight when disturbed. **ALARM CALL:** Loud high-pitched whistle. Given when birds alarmed and as part of Threat Display; can also be given with Advertising Call (see above). Sharp and very abrupt *weet-weet* or *weep-weep*, repeated two or three times (Forshaw; L. Robinson) may be this call. **DISTRESS CALL:** Utter loud screeches when held in hand; often attracts conspecifics. **Other calls** **CHATTERING:** *chissick-chissick*; given by male when female excavating nest (Sindel & Gill 1996). *Cluck-cluck* also reported (Eastman & Hunt 1966; Forshaw) given by captive birds when alarmed; it may be same as Alert Call (above).

Young FOOD-BEGGING CALL: Harsh grating screech, repeated at c. 1-s intervals when adult lands on nest or enters hollow. After fledging, Call more drawn out, higher pitched and more musical. **ALARM CALL:** Chicks screech when handled.

BREEDING Account based on contribution by S.T. Garnett and G.M. Crowley unless stated, from studies in wild at Artemis and Dixie Stns, central C. York Pen. Nest in hollows excavated in termite mounds. Only one record in NRS.

Season Breed Mar.–Aug. (dry season); eggs, early Mar. to early June, with peak in early Apr.; median date of laying, 17 Mar. to 8 Apr.; last fledging, mid-Aug. (n=135 nests over 3 years; S.T. Garnett & G.M. Crowley). Eggs, Apr. and May (White 1922); dependent young, late June (NRS). Thomson (1935) claimed that double-brooded, with first clutch May and second brood reared July or Aug., but birds not marked so little evidence to distinguish from re-use of site by other pairs.

Site In tunnel excavated in termite mound; of 148 nests, 96.7% excavated in conical mounds of *Amitermes scopulus*, 2.8% in meridian, or magnetic, mounds of *A. laurensis*, and 0.5% in turret-shaped mounds of *Nasutitermes triodiae*; choice of mound thought to be related to activity cycle of termites (S.T. Garnett & G.M. Crowley). Meridian mounds warmer during day and colder at night than conical mounds: 13.0–41.2 °C (n=9) and 14.8–36.0 °C (n=9) respectively (Weaver 1987). **MEASUREMENTS (cm):** Height of entrance of tunnel in conical mounds, 60.0 (20.8; 46–91.5; 19); in meridian mounds, 80.0 (23.0; 49.0–125; 13) (Weaver 1987). Height of conical mounds, 159 (75–255; 185); girth, 149 (98–279; 172) (S.T. Garnett & G.M. Crowley). Of 196 nests, 181 (93%) newly constructed; rest re-used old chamber. Nest usually colonized by larvae of moth *Trisyntopa scatophaga*, which eat faeces of chicks (Turner 1923; Thomson 1935; S.T. Garnett & G.M. Crowley). Frogs *Litoria caerulea* and blowfly maggots may also occupy nest-chamber. Termites sometimes attack chicks; heads of dead desiccated soldiers found locked onto plumage of chicks, without ill effect.

Nest, Materials Nest an oval chamber in termite mound, connected to outside by narrow tunnel (White 1922; Thomson 1935; Weaver 1982, 1987; S.T. Garnett & G.M. Crowley). No material. Excavation mainly by female, with contribution by male varying individually; use bill to dig and feet to remove

loose dirt; mainly excavate in morning. Often pair digs trial scrape before constructing complete chamber. Chamber takes several days to excavate; first egg laid within 7 days of completion. **MEASUREMENTS** (cm): Length of tunnel in conical mounds, 28.3 (7.8; 20.5–37.5; 19); in meridian mounds, 40.0 (12.1; 20.0–61.5; 13) (Weaver 1987). In conical mounds, height of chamber above ground, 68 (37–110; 182); depth to back of chamber, 32 (19–45; 88); length of tunnel, 12.5 (5.5–22.5; 67); vertical diameter of tunnel, 4.5 (3.8–5.4; 66); horizontal diameter of tunnel, 4.4 (3.5–5.4, 66). Of 192 nest-tunnels, entrances faced E in 16%, N in 31%, S in 29%, and W in 24%.

Eggs Ovate; smooth, lustreless; white. **MEASUREMENTS**: 20.6 (0.84; 18.8–24.0; 80) × 17.8 (0.54; 16.3–18.9) (S.T. Garnett & G.M. Crowley); 21.3 (20.5–22.2; 6) × 18.4 (18.2–18.7) (HLW). **VOLUME**: 27.3 cm³ (21.8–32.6; 80) (S.T. Garnett & G.M. Crowley).

Clutch-size Mean 5.55 (0.65; 4–7; 104), excluding one clutch of 13 eggs, probably laid by more than one female. Clutch-size lower at start and end of breeding season.

Laying Eggs usually laid at intervals of 2 days; sometimes up to 4 days between first and second eggs or before last egg. Nest lost during incubation replaced after 5 weeks. Once, after a female had disappeared, a second female added to abandoned clutch. Said, without good evidence, to rear two broods per year (Thomson 1935).

Incubation By female only, starting after laying of second or third egg (Forshaw; S.T. Garnett & G.M. Crowley). Male feeds female at c. 1-h intervals. **INCUBATION PERIOD**: 19–21 days. Usually hatch over c. 3 days; rarely, 7 days or more.

Young Altricial, nidicolous. Hatch blind and naked; develop pale down within a few days. First feathers in pin at 9 days. Before fledging, slightly heavier than average adult weight; at fledging, wing-length c. 90% that of adult. **Parental care, Role of sexes** Female broods for up to 1 week after hatching. Both parents regurgitate food to young; contribution of each sex varies between pairs. Either sex can raise up to five chicks alone if one member of pair dies.

Fledging to independence Young leave nest at c. 5 weeks. Members of brood sometimes leave over several days, sometimes synchronously; fly directly from nest for at least 100 m. For short periods in morning and evening, fly wildly to and from perches, stooping among foliage and swooping in and out of trees. Young fed by parents for c. 8 weeks after fledging.

Success Of 695 eggs in 148 clutches, 475 (68%) hatched; all eggs hatched in 65 clutches, all failed in 41 clutches. Causes of failure: predation by reptiles (46%), apparent infertility (15%), abandonment (12%), fixture to floor of nest by termites (10%), failed hatching of fertile eggs (8%), disappearance from otherwise successful nests (4%), scraped out of nest (3%), failed hatching of eggs of unknown fertility (2%), egg-bound female (1%). Of 462 chicks from these clutches, 311 (67%) fledged; in 32 nests all eggs hatched and all chicks fledged. Causes of loss of chicks: 44% attributed to predation by reptiles, 21% to predation by birds, 19% to unknown causes, 9% abandoned, 8% disappeared, 3% to premature fledging, 3% to ants (*Camponotus*) and 1% trapped by pupating moths *Trisyntopa scatophaga*. Evidence from banding suggests post-fledging mortality high. One young, just fledged, killed by Green Tree-Ants *Oecophila smagodina*; another free-flying bird killed by Blue-winged Kookaburra *Dacelo leachii*. Trapping for aviculture was prevalent in 1960s (Weaver 1982) but has largely stopped (S.T. Garnett & G.M. Crowley). Adults were killed at 12% of 153 nests, 9% killed away from nests. Females raised young at all five nests where male known to have been killed; of 12 nests where

females killed, males raised young at five, abandoned eggs at two, and, at five, nest contents taken with female.

PLUMAGES Prepared by K. Bartram. Fledge in distinct juvenile plumage at c. 5 weeks old (see Breeding). Probably begin partial post-juvenile (first pre-basic) moult of body and underwing-coverts either soon after leaving nest or at c. 4 months old (see Moults). Then undergo complete first immature post-breeding (second pre-basic) moult to adult plumage, probably starting at c. 1 year old. Thereafter, undergo one complete post-breeding (pre-basic) moult each year with no change in appearance. Sexes differ at all ages.

Adult male (Second and subsequent basic). Bases of feathers of body, grey or light grey (84, 85), except on nape, where bases white (ne). **HEAD AND NECK**: Forehead and lores, dull yellow (between 56 and 157) forming distinct frontal band. Crown, black-brown (19). Nape, dark brown (21) grading to light grey-brown (between 45 and 27) and tapering to stripe on centre of hindneck, extending to mantle; on some, a few feathers in centre of hindneck have green-blue (between 66 and 164) fringes, usually only at sides of stripe, but occasionally in centre. Sides of head and throat, green (between 162D and 63) with bright-green (58) suffusion on tips of feathers, most obvious near eyes and on ear-coverts; with wear, tips lost and appearance greener overall. Feathers of foreneck, sides of hindneck and sides of neck, light green (light 61) with broad light-blue (66) fringes; in fresh plumage, overall colour of foreneck and sides of neck, green-blue, tending greener as feathers wear. **UPPERPARTS**: Mantle and scapulars, grey-brown (light 91–27) with indistinct cream (dull 92) fringes to feathers. Feathers of back and rump, light blue (66) with pale-green (161) area near base. Uppertail-coverts, bright green (58) with light-blue (93–66) fringes. **UNDERPARTS**: Feathers of breast, upper belly and flanks, light greenish-blue (c93) with light-green (61) centres. Axillaries, brownish grey (80) with broad light-blue (dark 66) tips. Feathers of lower belly, vent, thighs and undertail-coverts, mostly dull orange (ne) with dull white (ne) fringes, broadest on undertail-coverts, and narrow white shaft-streaks and concealed area of white near base. **UPPERTAIL**: T1 mostly dark blue to blue-black (between 74 and 90) with olive (150) basal third and grey-black (82) tip c. 1 cm wide. T2 mostly grey-blue (ne) with light-green (61) basal third, dark grey to grey-black (83–82) stripe along inner edge, and white (ne) tip, c. 2 cm wide on outer web and c. 3 cm wide on inner web. T3–t6 mostly light green (61) with broad grey-black (82) transverse band c. 2 cm from base, grey-blue (ne) subterminal patch (broad on t3, small on t6) and white (ne) fringes (broadest on t3). Shafts of all rectrices, red-brown (32), becoming white on white tips to feathers. **UNDERTAIL**: T1, glossy dark grey (83). T2, dull greenish-grey (ne) with dark-grey (83) inner edge, a small grey-black (82) marking on outer web above base of feather and white tip as on uppertail. T3–t6, mostly green (dull 63) with grey (84) bases, broad grey-black (82) transverse band c. 2 cm from base, light blue-grey to grey (88–87) subterminal areas, and white tips as on uppertail. Shafts of all rectrices, cream (54) with narrow grey-black (82) edges, grading to white (ne) at tips. **UPPERWING**: Marginal and inner lesser secondary coverts, brownish grey (79) with green (dull 63) wash on fringes; forms brownish-grey triangle at base of wing; marginal coverts at carpal joint have green-blue (greenish 93) fringes. Rest of lesser and all median secondary coverts, yellow (55), forming distinctive yellow shoulder-patch. Greater secondary coverts, greyish green (ne) with dark-grey (83) bases and inner edges that grade from yellow (55) or light brown-grey

(44) on inner coverts to narrow blue (168) edges on central and outer coverts. Marginal primary coverts, grey-black (82) with bright-blue (168B) fringes. Rest of primary coverts, black-brown (19), though outermost greater covert and alula have dull-green (dull 63) outer webs, and next two feathers of alula and next three greater coverts have blue (dark 68) outer webs. Tertiaries, brownish grey (light 80 grading to dark 79 at bases and inner edge) with yellowish-green (ne) outer edge; area of darker brownish-grey (dark 79) on each tertial increases outwards. Innermost secondary (s8) like outermost tertial. Rest of secondaries (s9–s12), dark grey (83) with thin light-green (61) outer edges, which become even narrower outwards. P1, brownish grey to dark grey (between 79 and 83). P2–p4, brownish grey to dark grey (between 79 and 83) with thin blue (168) outer edges; p5 similar but blue (168) outer edge subterminal and outer edge cream (54). On p6–p9, outer half of inner web, dark brownish-grey to dark grey (between 79 and 83); rest of inner web and inner half of outer web, dull blue (dull 168); outer halves of outer webs, pale blue-grey (between 88 and 85) with narrow cream (54) outer edge. P10 has green-grey (ne) outer web, and brownish-grey (between 79–83) inner web. **UNDERWING:** Remiges and greater coverts, glossy brownish grey to dark grey (between 79 and 83); a few have faint cream-white (ne) smudge on p6, half-way along edge of inner web; outermost tertial and innermost secondary have cream-white (ne) stripe along inner edge. Rest of coverts, blue (168) with brownish-grey to dark grey (between 79 and 83) bases to feathers, giving mottled appearance.

Adult female (Second basic and subsequent plumages). Much greener and duller than adult male. **HEAD AND NECK:** Lores and forehead, straw-yellow (56), forming indistinct frontal band. Crown and nape vary from blackish olive (c49) to dark olive (46). Sides of head, cheeks and throat, pale greenish-yellow (ne). Neck, lime-green (dull 159). **UPPERPARTS:** Mantle and scapulars, lime-green to light green (between 159 and 61), sometimes with brown (28) fringes to feathers. Back, rump and uppertail-coverts, like those of adult male. **UNDERPARTS:** Breast, flanks and most of belly, yellowish green (ne) to yellow-olive (52) with light-blue (pale 93) fringes to feathers; in some, probably very worn, birds, fringes olive-brown (30). Most of centre of belly, off-white (ne); feathers in very centre of belly and feathers of thighs, dull orange (116) centrally, with broad pale-green (161) fringes, which are suffused with light blue (93). Vent and undertail-coverts, pale green (161) or bright green (58) with light-blue (pale 93) wash near tips of feathers and dull-white (ne) fringes. Axillaries, light grey (85) with light-blue (93) tips. **TAIL:** Like adult male. **UPPERWING:** Marginal and inner lesser secondary coverts, lime-green (159). Rest of lesser secondary coverts and median secondary coverts, bright green (58) with faint bluish-white (ne) fringes, which form indistinct shoulder-patch. Greater secondary coverts, brownish grey to dark grey (between 79 and 83) with bright-green (58) fringes. Primary coverts, like those of adult male, except marginal coverts have dull-white (ne) outer webs. Tertiaries, lime-green (159) with dark-grey bases and inner webs. Secondaries, dark grey (83) with pale-yellow (157) outer edges. All primaries have narrow cream (c54) fringes and dark-brown (221) inner webs; p1–p7 have cream (c54) patches, c. 10 × 10 mm, on inner web, forming broken upperwing-bar when wing spread. Outer webs of p1–p3, dark brown (221); of p4–p9, light greyish-blue (ne) on outer half and dark blue (ne) on inner half; of p10, light greenish-grey (ne). **UNDERWING:** Remiges and greater coverts, brownish grey (79) with large, c. 10 × 10 mm, cream (c54) patches on basal third of outer webs of p1–p7,

which form broad pale underwing-bar. Lesser and median coverts, brownish grey (79) with light blue-grey (88) or light greyish-blue (c93) tips to feathers. Marginal coverts, pale yellow (dull 157).

Downy young Covered in sparse pale-grey (pale 86) down soon after hatching. Down remains fairly sparse till feathers start sprouting at c. 20 days (Sindel & Gill 1996).

Juvenile male Like adult female, but with a few male characteristics. **HEAD AND NECK:** Forehead and lores, pale green (162D) forming indistinct frontal band. Crown and nape, dark olive (49). Ear-coverts and cheeks, bright light-green (c63) with light-blue (93) tips to feathers, brighter than in female. Hindneck, olive-green (between 53 and 159). Rest of head and neck, bright green (58) with light-green (61) fringes. **UPPERPARTS:** Mantle and scapulars slightly darker than in female and more olive-green (between 52 and 159). Back, rump and uppertail-coverts, like adult. **UNDERPARTS:** Like adult female, but breast tends to be more olive-green (between 52 and 159). **TAIL:** Like adult. **UPPERWING:** Like adult female, but marginal and inner lesser secondary coverts more olive-green (between 52 and 159). Rest of lesser and median secondary coverts, yellowish green (ne) with dull yellow-green (ne) fringes, so that shoulder-patch duller than in adult female and only slightly paler than surrounding coverts. Greater secondary coverts, dark brownish-grey (between 79 and 83), as adult female, but edges more yellowish green (between 58 and 157), forming faint bar across tips of greater coverts. Remiges as in adult female but with broader neat cream (pale 54) fringes in fresh plumage. **UNDERWING:** Like adult female.

Juvenile female Much like juvenile male, differing by: **HEAD AND NECK:** Much duller. Forehead and lores, grey-green (ne), forming very indistinct frontal band; sides of head, dull grey-green (ne), lacking bright-green colour of juvenile male. Rest as juvenile male.

Immature male (First basic). Like adult male but differs by: **HEAD AND NECK:** Edges to feathers of upper forehead, green-blue (64), giving mottled appearance to frontal band. **UNDERPARTS:** Centre of belly, thighs and vent, slightly less orange (sides of belly as adult male); feathers, orange (ne) centrally, with broader, white (not dull white) fringes. Undertail-coverts, yellow-green (between 157 and 58), faintly barred orange-yellow (18) with light-blue (93) wash centrally and narrow white shaft-streaks. **UPPERWING:** Retain most coverts from juvenile plumage, so shoulder-patch very dull yellowish-green (ne); also retain juvenile remiges and so broad whitish cream wing-bar and cream (pale 54) fringes to remiges. **UNDERWING:** Replace coverts; new feathers identical to those of adult male. Retain juvenile remiges, so differ from adult male by pale underwing-bar.

Immature female Like adult female and only identified by retained juvenile remiges and rectrices (see Ageing).

BAREPARTS From photos (Forshaw 1969; Robinson 1970; Trounson & Trounson 1987; Lindsey 1992; Flegg & Longmore 1994; Digney 1996; Sindel & Gill 1996; Crome & Shields). **Adult male** Bill, bluish grey (between 88 and 86) with dark-grey (83) tips to both mandibles. Cere, pale grey (86) with slight pink (3) tinge. Iris, grey (84). Orbital ring, light grey to grey (85–84). Legs and feet, salmon (pale 106). **Adult female** Bill, pale grey (86) with slight pink tone. Rest like adult male. **Downy young** Naked body, dull pink (c5). Bill, dull orange (c17). Cere, light brown (25). Area round eye, dark blue-grey (78). Legs, pink (dull 3). **Juvenile** Bill, dull orange-yellow (between 17 and 18); otherwise as adult. Bill changes to adult-

like colour 2–4 months after fledging (S. Sindel); one male moulting into immature plumage (photo in Robinson 1970) had already acquired adult male bill colour.

MOULTS Very poorly known and few data. Based on examination of seven adult and four juvenile skins and one in moult to second basic plumage (AM, HLW, MV). **Adult post-breeding** (Third and subsequent pre-basic). No information. Probably complete and primaries centrifugal as in other *Psephotus* (q.v.). Available specimens collected Apr.–June and all had worn remiges and rectrices and had not started moult (though one from June had some moult of nape). **Post-juvenile** (First pre-basic). Partial, involving feathers of body (Forshaw) and underwing-coverts and, possibly, some upperwing-coverts (this study). Only four skins from wild, all collected June (which would be soon after fledging; see Breeding); three were moulting head, mantle and breast. Forshaw claims undergo moult at 4 months old. **First immature post-breeding** (Second pre-basic). Probably as adult post-breeding. One skin (May) had not started moult of wings or tail, but had begun moult of ear-coverts, breast, belly and upperwing-coverts. Said to attain complete adult plumage at c 16 months old (Forshaw).

MEASUREMENTS (1–2) Skins (including aviary birds) (AM, HLW, MV, QM, SAM): (1) Adults; (2) Juveniles and immatures with retained juvenile remiges and rectrices.

	MALE	FEMALE	
WING	(1) 117.6 (2.78; 112–122; 9)	113.9 (3.00; 109–118; 8)	*
	(2) 110.6 (3.68; 104–116; 12)	109.5 (1.91; 108–112; 4)	ns
TAIL	(1) 158.2 (4.86; 154–164; 5)	154.6 (5.86; 146–162; 5)	ns
	(2) 140.2 (12.15; 119–148; 5)	133	
BILL	(1) 12.3 (0.59; 11.7–13.3; 9)	12.7 (0.70; 11.8–13.6; 8)	ns
	(2) 11.4 (0.78; 10.2–12.7; 12)	11.7 (0.62; 10.8–12.2; 4)	ns
TARSUS	(1) 14.9 (1.05; 12.4–15.8; 9)	14.8 (0.53; 14.2–15.7; 7)	ns
	(2) 14.4 (0.63; 13.3–15.4; 12)	15.2 (0.39; 14.8–15.7; 4)	*
TOE C	(1) 20.3 (0.71; 19.0–21.1; 6)	19.9 (0.35; 19.6–20.5; 5)	ns
	(2) 20.5 (0.96; 19.0–21.5; 9)	18.6, 21.2	

Juvenile males have significantly shorter Wing ($P < 0.01$), Tail ($P < 0.01$) and Bill ($P < 0.01$) than adult males; samples of females too small for comparison.

WEIGHTS No data for adults from wild. Three nestlings from wild: 13.9, 23.5 and 25.8. From aviaries (AM, MV, QM, SAM): adult male 41.5; adult females 28, 54.3; juvenile males 32, 34.5, 36; juvenile females 35, 36.5, 38.5; nestlings 31.5, 39.

STRUCTURE Wing broad and rounded at tip. Ten primaries: either p9 or p8 longest; p10 4–10 mm shorter, p9 0–2, p8 0–1, p7 1–4, p6 8–13, p5 20–25, p4 27–32, p3 30–37, p2 34–41, p1 36–45. Slight emargination on outer webs of p6–p10 and inner webs of p8–p10. Thirteen secondaries, including seven tertials; longest tertial extends to p3 on folded wing. Tail long

and slender, with squared tip; 12 rectrices; t1 longest: t2 13–16 mm shorter, t3 50–54, t4 73–82, t5 82–92, t6 88–100. Bill, fairly small; adults have slight notch c. 3 mm from tip on cutting edge of upper mandible; no notch in juveniles. Cere, medium-sized; nostrils, small, rounded and set in centre of cere at either side of bill. Tarsus moderately short and rounded; granulate. Toes and claws long and slender; outer front toe longest: inner front 67% of outer front, outer hind 82%, inner hind 47%.

AGEING Juveniles and immatures differ from adults by: p5–p10 narrower, with rounded (not square) tips. Soon after leaving nest, juveniles lack notch in bill, photo of bird moulting to immature (Robinson 1970) showed notch already present.

GEOGRAPHICAL VARIATION None.

REFERENCES

- Bohner, F. 1994. *Aust. Avicult.* 48: 190–1.
 Chapman, P. 1990. *Birds Int.* 2(1): 22–33.
 Crowley, G.M., & S.T. Garnett. 1998. Vegetation change in the grasslands and grassy woodlands of central Cape York Peninsula. *Pacific Cons. Biol.*
 Digney, P. 1996. *Aust. Birdkeeper* 9: 183–6.
 Eastman, W.R., & A.C. Hunt. 1966. *The Parrots of Australia*. Angus & Robertson, Sydney.
 Flegg, J., & N.W. Longmore. 1994. *Reader's Digest Photographic Field Guide to the Birds of Australia*. Reader's Digest, Sydney.
 Forshaw, J.M. 1969. *Australian Parrots*. Lansdowne Press, Melbourne.
 Garnett, S.T. 1993. *RAOU Rep.* 82.
 —, & R. Bredl. 1985. *Sunbird* 15: 6–23.
 —, & G.M. Crowley. 1994. *Wingspan* 16: 21–3.
 —, — 1995. *Recovery Plan for the Golden-shouldered Parrot*. Unpubl. Rep. to Dept. Environ. & Heritage.
 Gellibrand, T.I. 1964. *Emu* 63: 454.
 Hall, R. 1900. *Victorian Nat.* 17: 59–63.
 Hutchins, B.R., & R.H. Lovell. 1985. *Australian Parrots: A Field and Aviary Study*. Avicult. Soc. Aust., Melbourne.
 Le Souëf, D. 1902. *Emu* 2: 85–96.
 Lendon, A.H. 1973. *Neville W. Cayley's Parrots of Australia in Field and Aviary*. Angus & Robertson, Sydney.
 Lindsey, T. 1992. *Encyclopedia of Australian Animals*. Birds. Angus & Robertson, Sydney.
 MacGillivray, W. 1918. *Emu* 17: 180–212.
 Pizzey, G. 1980. *A Field Guide to the Birds of Australia*. Collins, Sydney.
 Robinson, L. 1970. *Australian Parrots in Colour*. Rigby, Adelaide.
 Shephard, M. 1989. *Aviculture in Australia*. Black Cockatoo Press, Melbourne.
 Sindel, S., & J. Gill. 1996. *Australian Grass Parakeets*. Singil Press, Austral. NSW.
 Thomson, D.F. 1935. *Birds of Cape York Peninsula*. H.J. Green, Melbourne.
 Trounson, D., & M. Trounson. 1987. *Australia, Land of Birds*. William Collins, Sydney.
 Turner, A.J. 1923. *Trans. Entomol. Soc. Lond.* 1923: 170–5.
 Weaver, C.M. 1982. *Emu* 82: 2–6.
 — 1987. *Emu* 87: 57–9.
 White, H.L. 1922. *Emu* 22: 98–9.
- Sponsors: Mr S Fairbairn, Mr AC Hunt, Mr P Sipek, and the staff of Birds Australia in recognition of the Golden Wedding anniversary of Norman and Joan Wettenhall**