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Notes on Australian Whistlers (Aves, *Pachycephala*)

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In view of the great interest in the genus *Pachycephala* for speciation studies, it seemed worth while to review the Australian species, for which no up-to-date revision is available. The "Official checklist of the birds of Australia" (1926) recognizes 10 species. However, of these 10, *robusta* and *melanura* are clearly conspecific with *pectoralis*, and *griseiceps* is conspecific with *simplex*, so that we are left with seven good species.

I wish to express my great appreciation to Mrs. Kate Jennings who measured the wings and tails of all the Australian *Pachycephala* in our collection. The dimensions recorded in this paper are all based on her measurements.

Full bibliographic details of the various synonyms of the recognized forms have been published so often (as in Mathews, 1930) that they are not here repeated, except in a few special cases.

Pachycephala olivacea

There are only two subspecies in this species.

Pachycephala olivacea olivacea Vigors and Horsfield

Pachycephala olivacea VIGORS AND HORSFIELD, 1827, Trans. Linnean Soc. London, vol. 15, p. 241. Tasmania.

The adult female is similar to the adult male and has broad tail-feathers; it differs by having the back duller, the crown less contrasting with the back, more dusky ash gray, not slate gray; the bill, particularly the lower mandible, is horn colored, not black; the gray breast band, separating the white throat from the ocher of the abdomen, is ill defined or missing; the size averages much smaller.

Wing: Males, 96–101; females, 94–100. Tail: males, 87–94; females, 89–92.

Immature birds differ by the narrow and pointed tail-feathers, by the soft and usually rufous edgings of greater upper wing-coverts and secondaries, and by the paler color of crown and bill. A remarkably high percentage of the examined specimens is in this first year plumage.

RANGE: Victoria and Tasmania. Occasional in South Australia (Ey, 1940, *South Australian Ornith.*, vol. 15, p. 67).

Four adult males from Tasmania do not differ from 10 adult males from Victoria either in coloration (above and below) or in measurements. Mathews' *tregellasi* (Victoria) is a straight synonym of *olivacea*.

Pachycephala olivacea macphersoniana White

Pachycephala olivacea macphersonianus H. L. WHITE, 1920, *Emu*, vol. 19, p. 273. Macpherson Range, New South Wales-Queensland border.

I have not seen a specimen of this race, but according to the original description it differs from the nominate form "in being much lighter colored, especially its dull grayish head, which more approaches slate gray, while the outer edgings of the tail feathers are more decidedly yellow . . . wing 101, tarsus 26, bill 22."

RANGE: Macpherson Range. The recorded range of this subspecies appears to be separated from that of the nominate race by a broad gap, but Mr. Allen Keast has informed me that the species occurs in the beech forests in the mountains of New South Wales at Dorrigo, Barrington Tops (west of Port Stephens), and Mt. Wilson (Blue Mountains west of Sydney).

Pachycephala inornata

Pachycephala inornata inornata Gould

Pachycephala inornata GOULD, 1841, *Proc. Zool. Soc. London*, 1840, p. 164. South Australia.

ADULT MALE: Only throat rufous; forehead gray, lores blackish, rufous area on abdomen reduced; edges of primaries greenish gray.

ADULT FEMALE: All gray except under wing-coverts and axillaries pale cinnamon, breast darker, abdomen and crissum whitish; back olive-fuscous, contrasting with pure ash gray rump. A few specimens with rufous on throat or abdomen may be immature males.

Wing: Males, 98-105; females, 97-101. Tail: males, 83-89; females, 84-89.

RANGE: From the Gawler Ranges and the Eyre Peninsula to the Victorian mallee and western New South Wales (Cowra).

The plumages in this species are not yet fully understood. Young birds are apparently striped underneath, and only the under wing-coverts

are rufous cinnamon. The best available information on this species is to be found in Parsons and McGilp (1935).

Pachycephala inornata gilberti Gould

Pachycephala gilbertii GOULD, 1844, Proc. Zool. Soc. London, p. 107. York District, Western Australia.

ADULT MALE: Darker and more richly colored; lores black, rufous of under parts richer and more extensive; abdomen, flanks, and crissum cinnamonaceous; crown and tail deeper slate gray; back also darker gray and with less of a greenish tint,

ADULT FEMALE: Darker, particularly on throat, breast, and flanks, shaft streaks more pronounced; under wing-coverts richer cinnamon; abdomen, flanks, and crissum sometimes washed with cinnamon.

Wing: Males, 98-104; females, 97-101. Tail, males, 84-88; females, 83-84.

RANGE: In the lightly timbered and mallee areas of southwest Australia east to the Nullarbor Plains. It is not well understood whether or not there is a break in the range between *inornata* and *gilberti*. The fairly pronounced difference between the two subspecies indicates an existing or former isolation in the region of the Nullarbor Plains.

Pachycephala rufogularis Gould

Pachycephala rufogularis GOULD, 1841, Proc. Zool. Soc. London, for 1840, p. 164. Adelaide, South Australia.

ADULT MALE: Characterized by having not only the throat, but also the region between bill and eyes (lores) and a narrow line across the forehead rufous. Rufous area on abdomen more extensive; edges of primaries greenish.

ADULT FEMALE: Similar to male except slightly less of the cinnamon coloring on lores, throat, breast, and abdomen.

Size large. Wing: Males, 111, 112, 112, 115. Tail: Males, 83, 83, 86, 87.

RANGE: Mallee of Victoria and South Australia.

A very good description of this species and of the Gilbert Whistler (*P. inornata*) with excellent color plates was published by Parsons and McGilp (1935) who cleared up the question of plumages in this species and other matters of its biology. The name *zanda* Mathews, 1916 (Victoria), is a synonym.

Pachycephala rufiventris

The Rufous Whistler occurs throughout all Australia. It is found in every state, and, although it avoids heavily forested areas, it enters

far into the desert country. The species is widespread in the island region north of Australia, where it occurs in many, often strikingly different, forms from the Sula Islands and the Moluccas in the west to the Louisiades (Rossel) and New Caledonia in the east (Stresemann, 1924, Jour. f. Ornith., vol. 72, pp. 540-542). *Pachycephala rufiventris*, in comparison to its diversity among the tropical islands, is very uniform in Australia, and there are good reasons to believe that it invaded Australia comparatively recently, coming from the Tenimber group or the South West Islands. In fact its distribution pattern much resembles that of species like *Coracina novaehollandiae* (Ripley, 1941, Auk, vol. 58, pp. 383-387) and *Halcyon australasia* (Mayr, 1949, Ornith. Biol. Wiss., pp. 55-60). New Caledonia (*xanthethraea*), in turn, was colonized from Australia.

Geographic variation within Australia is continuous and on the whole slight. Two major clines are evident: one of decreasing size from the south to the north; a second, more complex cline, from the arid interior to the more humid periphery, leads from pallid to saturated coloration. The most richly colored populations are found in the southeast (coastal New South Wales, Victoria, and South Australia) and in the north-west (Melville Island). The palest populations are found in central Australia (Finke River, Everard Range, Birdsville [Queensland]) and particularly at the head of the Gulf of Carpentaria (Normanton).

The study of this species is made difficult by the excessive wear to which it is exposed over most of its rather arid habitat. Worn birds become darker on the upper parts (the fresh gray wears to fuscous) and paler on the under parts (the rufous wears to a pale ocher). Consequently, when specimens from different regions are studied, only birds in equivalent plumage condition can be compared.

Pachycephala rufiventris falcata Gould

Pachycephala falcata GOULD, 1843, Proc. Zool. Soc. London, for 1842, p. 134. Port Essington, Coburg Peninsula, Northern Territory.

Pachycephala rufiventris minor ZIETZ, 1914, South Australian Ornith., vol. 1, p. 15. Melville Island, Northern Territory.

MALES: As deeply rufous underneath as the darkest New South Wales birds, but smaller and with the ear-coverts never as deep jet black, lores and forehead sooty or slate gray.

FEMALES: Of a deep rufous ocher underneath (except whitish upper throat), even under tail-coverts rufous.

Wing: Males, 85-89; females, 85-89.

RANGE: Melville Island and opposite part of Northern Territory. I

have not seen any specimens from the Coburg Peninsula, but a freshly collected specimen from the Alligator River (Arnhemland) is fairly deep in coloration. Five of nine adult males from Melville Island have the ear-coverts blackish. Birds from Northern Territory farther distant from Melville Island are paler and are better included with *colletti*.

Pachycephala rufiventris colletti Mathews

Pachycephala rufiventris colletti MATHEWS, 1912, Austral Avian Rec., vol. 1, p. 41. Parry's Creek, East Kimberley, north Western Australia.

Intermediate between *falcata* and *pallida* in the color of the abdomen, width of breast band of males, and color of ear-coverts and upper parts. Nine of 32 adult males have blackish ear-coverts.

West Kimberley: Males, 84-94; females, 83-91. East Kimberley: Males, 84-91; females, 84-92. Northern Territory: Males, 86-93; females, 85-92.

RANGE: Northwestern Australia (West and East Kimberley Districts) and the interior of Northern Territory. Intergrades with *falcata* in the northern part of Northern Territory and with *pallida* at the Gulf of Carpentaria.

Pachycephala rufiventris pallida Ramsay

Pachycephala pallida RAMSAY, 1878, Proc. Linnean Soc. New South Wales, vol. 2, p. 224. Gulf of Carpentaria, Queensland.

The palest race of the species. Males pale pearly gray above, with pale edges of the wing-feathers; abdomen ochraceous, under tail-coverts pale; black breast band narrow; ear-coverts gray or sooty; lores gray. In adult females the streaking of the under parts is reduced.

Wing: Males, 85-89; females, 82-90.

RANGE: Definitely known only from Normanton. Specimens from Alexandria, eastern Northern Territory, are definitely darker and better referred to *colletti*.

Pachycephala rufiventris maudeae White is not only larger but darker and has a broader breast band. It is, in color, closer to *colletti* than to *pallida*.

Pachycephala rufiventris dulcior Mathews

Lewinornis rufiventris dulcior MATHEWS, 1920, The birds of Australia, vol. 8, p. 244. Watson River, western shore of Cape York, Queensland.

Similar to nominate *rufiventris*, but not quite so richly colored underneath, averaging smaller, and ear-coverts usually gray.

Wing: Males, 86-96; females, 84-94.

RANGE: North Queensland, from Townsville to Cape York.

The type locality is not far from Normanton, which is in the 35-inch rainfall zone, while Watson River is in the 55-inch zone. *Pachycephala rufiventris dulcior* is somewhat intermediate between *rufiventris* and *pallida*.

Pachycephala rufiventris rufiventris Latham

Sylvia rufiventris LATHAM, 1801, Index ornithologicus, suppl., p. 55. Sydney, New South Wales.

Lewinornis rufiventris didimus MATHEWS, 1918, Austral Avian Rec., vol. 3, p. 159. "South West Australia."

Lewinornis rufiventris gawlerensis MATHEWS, 1920, The birds of Australia, vol. 8, p. 244. Wataker, Gawler Ranges, South Australia.

Lewinornis rufiventris waddelli MATHEWS, 1920, The birds of Australia, vol. 8, p. 244. Warunda Creek, Eyre Peninsula.

ADULT MALE: Size large, abdomen (in fresh plumage) deep tawny, upper parts rather dark gray, breast band broad, lores and ear-coverts black, rather narrow and rather dark gray edges to wing feathers.

Wing: New South Wales, males, 92–99.5; females, 91–98. Victoria, males, 90–98; females, 90–97.

RANGE: Southern Australia, northward in the west to midwestern Australia, in the east to the Cairns District; leaves Victoria and most of New South Wales in winter.

Within the vast range of this subspecies, there is a considerable amount of slight local variation. The diagnosis above applies strictly only to New South Wales specimens. In a series from south Queensland (Warwick, Bunya Mountains) the abdomen is lighter, on the average, and tends to have more gray below the black collar. Victoria birds appear to be virtually indistinguishable from New South Wales specimens, although they are perhaps a shade lighter underneath. A single specimen from Mt. Barker (Mt. Lofty Range), South Australia, has the crown very blackish. Of two males from Eyre Peninsula, one (type of *waddelli*) has the abdomen very deep rufous, the other less so. Both have an unusual amount of gray on the sides of the breast below the black collar. A bird from the Flinders Range is indistinguishable from Victoria specimens.

West and north of Eyre Peninsula and the Flinders Range the birds tend to be somewhat paler and more frequently to have gray ear-coverts. The type of *gawlerensis* is a male in a somewhat aberrant retarded plumage. The black collar is very narrow, and there are shaft streaks on breast and flanks; the ear-coverts are gray and the abdomen is pale.

The population in Western Australia is not "darker above and below,"

as claimed by Mathews in his description of *didimus*, but indistinguishable above and if anything paler below (but not so pale as *maudeae*). The size is rather large (wing, males, 95–101). The difference is not great enough to justify subspecific separation.

Females of this species are subject to great individual variation. The back may be pure gray, or more or less suffused with greenish as in the immatures; the streaking of throat, breast, and flanks may be stronger or weaker; the bill may be black or more or less brownish or yellowish; the under parts more or less suffused with rufous ochre. There is sometimes the indication of a breast band, and the ear-coverts are sometimes blackish gray rather than brownish. The variation in all these characters ranges from a plumage more or less like that of the juvenal to one approaching the adult male.

Superimposed on this true individual variation are the effects of wear and bleaching which lead to a loss of the ochraceous tints of the under parts and to a loss of the soft gray colors of the upper parts.

There is an indication of very slight geographical variation in the eastern populations, with birds of south Queensland, for instance, appearing to be particularly heavily streaked underneath. Birds from New South Wales, Victoria, and the Adelaide district of South Australia in fresh plumage are strongly tinted on the under parts with rich ochraceous. A few specimens from Birdsville (interior of Queensland), Musgrave Range (South Australia), and Western Australia are distinctly paler, even in fresh plumage. Birds from Western Australia in worn plumage are even more bleached than worn birds from Victoria and New South Wales.

Pachycephala rufiventris maudeae S. A. White

Lewinornis rufiventris maudeae WHITE, 1915, Trans. Proc. Roy. Soc. South Australia, vol. 39, p. 794. Everard Ranges, South Australia.

Differs from *rufiventris* only by being paler.

Wing: Seven males, 91–95.5 (93.4); six females, 91–94.5 (92.7).

RANGE: Central Australia.

Three males collected by White (September, 1913) southeast of Alice Springs (Love's Creek, Deep Well, Bitter Springs) are fairly worn and definitely somewhat paler than *rufiventris* from New South Wales in equally worn plumage. The ear-coverts are black or blackish slate; they are a little darker than in two specimens from the Everard Ranges.

This subspecies is not sharply separated from *rufiventris* and is connected with it by intermediate populations. It is worth recognizing only as the end of a cline of paling coloration. Further collecting between the

ranges of *maudeae* and *pallida* will show whether there is indication of a yet existing or former connection between these subspecies or the paler coloration was acquired twice, independently.

Pachycephala lanioides

An excellent series of this species collected by Ken Buller in mid-western Australia not only turns out to be an undescribed subspecies but helps to show that *P. l. carnavoni* Mathews is valid, although the race was synonymized by the author himself (1930). Mathews apparently had of this race only two specimens. Owing to the kindness of Mr. L. Glauert I have been able to examine three additional specimens from the collections of the Western Australia Museum.

Pachycephala lanioides bulleri, new subspecies

TYPE: A.M.N.H. No. 702488; adult female; De Grey River, Western Australia; July 5, 1947; Ken Buller.

ADULT MALE: Indistinguishable from that of *lanioides*, in color or in measurements of wing and tail.

ADULT FEMALE: Differs from that of *lanioides* by being paler below and with the ochraceous buff wash much reduced; shaft streaks on under parts more pronounced and extending farther down on breast and flanks; upper parts similar, but lighter and purer gray and with a slight greenish rather than brownish tint.

Wing: Male adults, 99–104 (101.1); female adults, 100–102 (100.9). Tail: Male adults, 78–80; female adults, 76–79.5.

RANGE: Estuary of the De Grey River in the mangroves. Some specimens labeled Port Hedland. This ecologically specialized bird is undoubtedly confined to isolated pockets of mangrove.

Nine adult males, six adult females, and two juvenals examined.

Pachycephala lanioides carnavoni Mathews

Alisterornis lanioides carnavoni MATHEWS, 1913, Austral Avian Rec., vol. 2, p. 75. Carnavon, midwestern Australia.

ADULT FEMALE: Similar to that of *bulleri*, but more richly colored underneath; breast, abdomen, and flanks washed with golden ochraceous; ear-coverts browner; upper parts with a greenish olive wash, strongest on rump and upper tail-coverts; crown and upper back washed with ochraceous, not pure gray. Differs from *lanioides* by the greenish buff, not slaty, upper parts, by the brighter, more yellowish buff, not rufous buff color of the under parts and by the more extensive streaking of the under parts.

Wing, 95–99 (96.1); tail, 74–78 (75.8).

RANGE: Known only from Carnavon, Shark Bay.

Three adult and two subadult females examined.

Pachycephala lanioides lanioides Gould

Pachycephala lanioides GOULD, 1840, Proc. Zool. Soc. London, for 1839, p. 142. Derby.

Wing: Male adult, 99–102; female adult, 99–100.

Immature birds are usually distinguishable by the brown edgings of the wing feathers, particularly the secondaries, by the pointed tail feathers, and the horn-colored lower mandible.

RANGE: West Kimberley District.

Specimens from Derby, Broome, and Point Torment were examined.

Pachycephala lanioides fretorum De Vis

Pachycephala fretorum DE VIS, 1889, Proc. Roy. Soc. Queensland, vol. 6, p. 237. Cambridge Gulf [near Wyndham, Eastern Kimberley District] and "Kimberley" [? = Karumba], Gulf of Carpentaria (near Normanton).

Pachycephala lanioides buchanani MATHEWS, 1912, Austral Avian Rec., vol. 1, p. 77. Buchanan Inlet, Melville Island, Northern Territory.

CHARACTERS (BASED ON A SERIES FROM MELVILLE ISLAND): Much smaller than nominate *lanioides*. Males very similar to those of *lanioides* in color; width of breast band identical; brown parts of breast band perhaps a little darker brown, more walnut, less chestnut. Females darker above, more slate gray, most specimens without olive or brownish tint; lighter underneath with less ochraceous wash; streaking slight, normally confined to throat and upper breast.

Wing: Males, 93–98 (95.0); females, 91–95 (93.4).

RANGE: From Melville Island at least to the Roper River.

The above synonymy is tentative, since De Vis' description is the usual combination of fact and fancy and hard to interpret. Dr. G. Mack, Director of the Queensland Museum at Brisbane, has kindly informed me that the only type of *fretorum* extant in the Queensland Museum is the female on which De Vis based part of his description. According to De Vis he also had before him, in addition to an immature female from Cambridge Gulf "an adult female previously procured at Kimberley on the Gulf of Carpentaria in company with two males." There is now no place with the name of Kimberley in the Gulf of Carpentaria, but Dr. Mack has kindly informed me that Karumba, near Normanton, was referred to as Kimberley in the last century. However, in view of De Vis' notorious disregard of accuracy in locality designations, "it is even possible that De Vis' specimens came from the Kimberley District of North-western Australia" (Mack, 1933, Emu, 33, p. 1). There is no recent

record east of the Roper River. The male is described as being "above ash gray washed with olive green," which is not true for any race of *P. lanioides*, unless it be an endemic one at the Gulf of Carpentaria. The description of the female applies to any race, although the note, "all the feathers from the chin to the lower abdomen with a dark shaft streak," applies better to nominate *lanioides* than to the Northern Territory race. The size (wing, males, 93, 96; female, 92; tail, males, 76, 86; female, 79), however, agrees with the north Australian race. In spite of all the contradictions and discrepancies in De Vis' description it would seem proper to accept the name *fretorum* for the north Australian form. It remains to be seen whether or not the species really occurs all along the Gulf of Carpentaria and what the characters of East Kimberley birds are (Cambridge Gulf). All the specimens of nominate *lanioides* in the Mathews Collection are from West Kimberley (Derby and surroundings). Buchanan Inlet (or Islet, the handwriting is not clear), where the type of *buchanani* was collected, is near Melville Island.

GEOGRAPHIC VARIATION IN *Pachycephala lanioides*

The total range of *P. lanioides* extends from Shark Bay in Western Australia to the Gulf of Carpentaria in the north. There are no major discontinuities in this range, although the patches of mangrove where this species occurs are restricted to favored localities, such as estuaries and protected bays. In the Gulf of Carpentaria region and in Northern Territory there are many such locations, and there is presumably little isolation between populations. From the Kimberley districts to Shark Bay, however, there are much fewer mangroves, and the discontinuities between populations are much more pronounced. The De Grey River population (*bulleri*) and the Shark Bay population (*carnavoni*) are probably true isolates, and the West Kimberley population is possibly isolated from that of the East Kimberley District.

Pachycephala simplex

The Australian races of this species are merely advance guards of a widespread Papuan species, formerly known under the name *griseiceps* (Gray, 1858). However, the name *simplex* (Gould, 1843) has 15 years' priority. Only two subspecies occur in Australia: one in Northern Territory (*simplex*), one in north Queensland (*peninsulae*).

Pachycephala simplex simplex Gould

Pachycephala simplex GOULD, 1843, Proc. Zool. Soc. London, for 1842, p. 135. Port Essington, Northern Territory.

Pachycephala grisola riordani MATHEWS, 1912, Austral Avian Rec., vol. 1, p. 41. Melville Island, Northern Territory.

Differs from *peninsulae* chiefly by loss of the yellow pigment and somewhat smaller size. There is no evidence for any difference between specimens from Melville Island and those of the mainland of Northern Territory. Mathews himself (1930) synonymized *riordani* with *simplex*.

RANGE: Coburg Peninsula and Melville Island; also Port Keats, Northern Territory (*vide* A. Keast).

Pachycephala simplex peninsulae Hartert

Eopsaltria (?) *inornata* RAMSAY, 1875, Proc. Zool. Soc. London, for 1874, p. 604. Cardwell, Rockingham Bay, north Queensland. Preoccupied by *Pachycephala inornata* Gould, 1841.

Pachycephala peninsulae HARTERT, 1899, Bull. Brit. Ornith. Club, vol. 8, p. 33. [Near Princess Charlotte Bay], Cape York Peninsula, Queensland.

Pachycephala enidiae MATHEWS, 1912, Novitates Zool., vol. 18, p. 317. New name for *inornata* Ramsay *nec* Gould.

There is no difference in size and virtually no difference in coloration between birds from Cape York and those from the Cairns District. There is perhaps a tendency among Cape York birds towards having a slightly stronger ochraceous (less grayish) wash of the breast band, but the difference is insignificant. Males and females are indistinguishable in coloration, but males average larger [wing, males, 74–81 (78.0); females, 72–77 (74.9)]. Immatures differ by the pale horn-colored (not black) bill, the rufous edges on upper wing-coverts and secondaries, and the pointed tail feathers.

The geographically nearest subspecies in New Guinea (*perneglecta*) has the breast more conspicuously streaked and is brighter above and below.

RANGE: Cape York Peninsula, south to Cairns District, north Queensland.

The two Australian subspecies parallel precisely the geographic variation of the species in New Guinea, where some subspecies (*griseiceps* group) are yellow and olive, and others (*dubia* group) lack the yellow lipochromes.

Pachycephala pectoralis

Parts of this richest of all species of birds in number of races have been revised by me in earlier papers. Discussion of the Australian races in the present article is brief, because Mr. Galbraith of Oxford University has completed a manuscript on character geography and speciation in *Pachycephala pectoralis* which he has kindly placed at my disposal and which will soon be published.

I begin the discussion of the Australian races in the southwest, with

occidentalis, and continue counterclockwise around the entire periphery of Australia until the circle is nearly closed in Western Australia (*bynoiei*). The only island form included in the discussion is *glauca* from Tasmania.

The 12 subspecies here recognized as valid have 11 synonyms, not including five old synonyms of the nominate race. Mathews is the author of six of these synonyms.

Pachycephala pectoralis occidentalis Ramsay

Pachycephala occidentalis RAMSAY, 1878, Proc. Linnean Soc. New South Wales, vol. 2, p. 212. Albany, Western Australia.

ADULT MALE: Of large size and with a small bill; base of tail gray; base of feathers of throat black.

ADULT FEMALE: Throat whitish, finely barred with gray; abdomen rufous buff; upper wing-coverts and edges of wing-coverts more or less tinted with greenish olive; back ash gray like crown, sometimes slightly tinted with greenish or brown.

Wing: Male adults, 93–100; females, 91–96. Tail: Male adults, 72–79; females, 73–77.

RANGE: Southwest Australia, north to Geraldton, east to Esperance Bay.

Mathews described a form *interjecta* from the Stirling Range (1920, vol. 8, p. 222) with the description: "the females noticeably paler below, but still with a reddish shade, and the upper coloration paler grey. The males vary in the depth of the black band on the tail, in some specimens it almost disappears and the grey is a pale shade." These differences are imaginary. The Stirling Mountain females are very worn, and their paler color is due to bleaching. The tail color of males is not different from that of other birds from southwest Australia. Since Mathews apparently fixed no type of this subspecies, the entire series must be considered cotypes.

Pachycephala pectoralis fuliginosa Vigors and Horsfield

Pachycephala fuliginosa VIGORS AND HORSFIELD, 1827, Trans. Linnean Soc. London, vol. 15, p. 241. Port Lincoln, Eyre Peninsula, South Australia.

Synonyms are *meridionalis* North, 1904 (Adelaide); *halmaturina* Campbell, 1906 (Kangaroo Island); *myponga* Mathews, 1920 (Fleurieu Peninsula); and *bettingtoni* Mathews, 1920 (Bellbird Bore, Victorian Mallee).

MALES: Very similar to those of *occidentalis*, but back with a richer, deeper citrine olive, yellow collar more pronounced; black zone on tip of

tail more extensive; under parts richer yellow; black breast band perhaps wider.

FEMALES: Similar to those of *occidentalis* but considerably darker underneath, ruddy ochraceous rather than rufous buff; back brownish olive, conspicuously contrasting with the slate gray crown.

Wing: Males, 95–99; females, 92–96. Tail: Males, 73–78; females, 71–76.

RANGE: South Australia (Eyre Peninsula, Fleurieu Peninsula, and Kangaroo Island) and Victorian mallee.

No differences between birds from the different parts of South Australia have been pointed out, and Condon (1951) is quite right in considering *meridionalis*, *myponga*, and *halmaturina* as synonyms of *fuliginosa*. Males from Kangaroo Island are indistinguishable from mainland birds, but I have not seen females.

Males from western Victoria (*bettingtoni* Mathews) cannot be separated subspecifically from South Australian specimens. The amount of gray at the base of the tail is variable, but on the average it is not distinctly reduced. Females are as a series more grayish on the back (not so olive brown), with less contrast between back and crown. The under parts are of a paler clay color (not so deep ochre). These are evidently signs of intergradation with adjacent *youngi*.

Wing: Males, 94, 97, 97, 98, 98; females, 90.5–97. Tail: Males, 73–78; females, 70–79.

Victoria specimens of *fuliginosa* from Bell Bird Bore, Lingerandye, and Kow Plains were examined.

It would seem unwise to recognize this slightly intergrading population of the Victorian mallee subspecifically. Condon (1951, p. 40) came to the same conclusion.

Pachycephala pectoralis glaucura Gould

Pachycephala glaucura GOULD, 1845, The birds of Australia, pt. 18. Tasmania.

ADULT MALE: Differs from that of *youngi* and of *fuliginosa* by having the tail all gray, the back slightly duller green, the yellow nuchal collar less conspicuous, the abdomen paler lemon yellow, and the edges of the secondaries grayish rather than olivaceous; the bill is very small.

ADULT FEMALE: Darker above than that of *youngi* and more brownish, without any greenish wash; under parts similar, but also with a brownish wash. Bill shorter; wing and tail longer.

Wing: Males, 99–104 (101.3); females, 96–103 (100.3). Tail, males, 79–83; females, 75–83.

RANGE: Tasmania and adjacent islands.

There are no apparent differences between specimens from King Island and those from Flinders Island or Tasmania.

Pachycephala pectoralis youngi Mathews

Pachycephala gutturalis youngi MATHEWS, 1912, Novitates Zool., vol. 18, p. 313. Lallal, Victoria (about 50 miles west of Melbourne, 14 miles southeast of Ballarat).

ADULT MALE: Differs from that of *fuliginosa* by averaging less gray at the base of the tail, usually only one-third of tail being gray. Differs from that of *pectoralis* by having the base of the tail pure gray, not olive.

ADULT FEMALE: Indistinct from that of *pectoralis*.

Wing: Males, 98–102; females, 92–98. Tail: Males, 73–80; females, 70–75.

RANGE: Victoria, east of a line from Heytesburg to Castlemaine.

The tail of males shows a considerable amount of variation. Among specimens from the same locality, one may have the tail largely black, another half gray.

Pachycephala pectoralis pectoralis Latham

Muscicapa pectoralis LATHAM, 1801, Index ornithologicus, suppl., p. 51. Port Jackson, New South Wales.

Synonyms are *gutturalis* Latham, 1801 (preoccupied); *dubia* Shaw and Nodder, 1811; *albicollis* Vieillot, 1817; *lunularis* Stephens, 1826; and *fusca* Vigors and Horsfield, 1827.

ADULT MALE: Tail always largely black, with an olive base.

ADULT FEMALE: Back brownish gray, with or without a greenish tint; upper tail-coverts gray brown or olive green; tail always brown (specimens with a green tail are immature males). Differs from *fuliginosa* and *occidentalis* by the lighter under parts, with only a slight buffy wash or none at all.

Wing: Males, 94–101; females, 92–99. Tail: Males, 70–77; females, 71–77.

RANGE: New South Wales. Location of area of intergradation with *youngi* and *ashbyi* unknown.

Pachycephala pectoralis ashbyi Mathews

Pachycephala gutturalis ashbyi MATHEWS, 1912, Novitates Zool., vol. 18, p. 313. Blackall Range, south Queensland.

ADULT MALE: Very much like that of *pectoralis*, but black on tail encroaching even more on greenish base; yellow edge of upper wing-coverts perhaps more pronounced.

ADULT FEMALE: Very different from that of *pectoralis*. Back of 13 of 15 females strongly washed with greenish or olive; upper tail-coverts and tail green; crissum and under tail-coverts yellow. Under parts variable, but lighter, less grayish and often washed with buff on breast, flanks, and abdomen.

Wing: Males, 89–99; females, 86–93. Tail: Males, 70–78; females, 66–75.

RANGE: Blackall Range, Bunya Mountains, and Warwick, south Queensland.

I have seen only immatures from Mackay, Gracemere, and the Dawson River, but they seem to belong to this race.

Yellow under tail-coverts and a greenish tail are characteristic for immature males of *P. p. pectoralis* but is never found in adult females, while in *ashbyi* it is the most characteristic feature of the adult females.

Pachycephala pectoralis queenslandica Reichenow

Pachycephala queenslandica REICHENOW, 1899, Ornith. Monatsber., vol. 8, p. 8. Bellenden Ker, Cairns District.

A synonym is *mestoni* De Vis, 1905, from Bellenden Ker.

ADULT MALE: Not clearly distinct from that of *ashbyi* but yellow nuchal collar perhaps narrower; tail sometimes black down to the base, pale basal area olive or grayish.

ADULT FEMALE: Much deeper buffy ochraceous below, sometimes almost rufous; the ochraceous color occasionally encroaches even on the throat which is white with indistinct grayish or fuscous barring; crissum and under tail-coverts frequently yellow; upper parts similar to those of *ashbyi* but back and particularly wings usually with a more pronounced brownish wash; crown and sides of head not so clear gray.

Differs from *pectoralis* by the ochraceous breast, belly, and flanks, by the yellow crissum, and by the greenish back and tail. Bill longer and stronger than in *pectoralis* and *ashbyi*.

Wing: Males, 87–95; females, 86–94. Tail: Males, 60–72; females, 61–70.

RANGE: Specimens seen from Barron River, Johnston River, Bartle Frere, Kuranda, and Bellenden Ker, all in the Cairns District.

Pachycephala pectoralis spinicauda Pucheran

Pteruthius spinicaudus PUCHERAN, 1853, Voyage au Pôle Sud, Zoologie, vol. 3, p. 58. Warrior Island, Torres Strait.

ADULT MALE: Differs from *queenslandica* by having the back brighter, more citrine colored; the yellow nuchal collar is broader; the feathers of

the throat are white to the base, the edges of the wing feathers are grayer (even the edges of the secondaries and tertials are more or less grayish); primary coverts black or very narrowly edged with gray; tail black to the base, as in *queenslandica*; under parts very bright golden yellow; bill still longer and stronger.

As far as adult males are concerned I can see no clear-cut difference between birds from Cape York and those from Normanton, McArthur River, Daly River, or Melville Island. The shade of olive on the back (greenish or citrine), the width of the yellow nuchal collar, the yellow of the under parts (more or less golden), and the edging of the tertials (gray or gray green) vary individually and cannot be used for the diagnosis of subspecies.

ADULT FEMALE: Differs from that of *queenslandica* by the whiter throat, with only little fuscous cross barring, by the deeper yellow crissum, and by having the entire abdomen washed with yellow, strongly on the flanks; breast and flanks, however, are still prevailing ochraceous. Upper parts similar to those of *queenslandica* and *ashbyi*, but greens purer, less olivaceous or brownish; rump more extensively green.

Wing: Males, 86, 89, 91; females, 83, 87. Tail: Males, 66, 67, 69; females, 66, 69. Bill: Males, 19, 19.5, 20; females, 19, 20.

The name *spinicauda* given to an immature has 23 years' priority over *robusta* Masters.

Since several races east of the range of *spinicauda* (*collaris*, *misimae*, etc.) agree in the clear yellow under parts of the females better with *violetae* (Northern Territory) than with *spinicauda*, it seems that *spinicauda* owes its characters in part to an admixture of *queenslandica* genes.

Pachycephala pectoralis violetae Mathews

Pachycephala gutturalis violetae MATHEWS, 1912, Austral Avian Rec., vol. 1, p. 76. Daly River, western Northern Territory.

Synonyms are *consobrina* Mathews, 1912 (Melville Island); *longirostris* Zietz, 1914 (Melville Island); *borrooloola* Mathews, 1918 (McArthur River, eastern Northern Territory); and *intercedens* Mathews, 1920 (Normanton, Queensland).

ADULT MALE: In coloration not clearly distinguishable from that of *spinicauda*.

ADULT FEMALE: Lower breast, abdomen, and flanks a clear bright yellow in fresh plumage, separated by a narrow gray or buff gray gorget from the white throat (slightly mottled with fuscous). Back gray green, more olive in some birds, more grayish in others, particularly in worn specimens; rump always green. Tail blackish, greenish, or a mixture of

the two. Wing feathers edged with gray, inner secondaries and tertials often washed with greenish.

	NORTHERN TERRITORY AND GULF OF CARPENTARIA	MELVILLE ISLAND
Wing		
Males	85-86 (85.4)	81-86 (83.5)
Females	81-85 (82.7)	81-85 (82.7)
Tail		
Males	63-65	60-67
Females	59-64	60-62
Bill	18-19	18

RANGE: From the Daly River in the west through Northern Territory to Normanton on the Gulf of Carpentaria; Melville Island.

The tail of two of the three Normanton females is green with a sub-terminal black bar; that of the third Normanton female and of the McArthur River bird is black with a greenish base. The tail of the Daly River bird is almost entirely black, while among five adult females from Melville Island the tail varies from mostly black to mostly green.

There is no clear-cut difference between the various populations. Females from Melville Island are rather grayish on the back but badly worn. The freshest specimens look greenest and can be matched by birds from the mainland of Northern Territory. The only available female from the Daly River is exceptionally dark and richly colored, with the crown dark gray, the back bright green, and the abdomen very deep yellow. The few other available specimens from Northern Territory agree with birds from the Gulf of Carpentaria. There are no apparent differences in the length or shape of the bill. At present it is not justifiable to separate any of these populations subspecifically.

Pachycephala pectoralis hilli Campbell

Eopsaltria hilli A. J. CAMPBELL, 1910, Emu, vol. 10, p. 168. Hecla Island, northwest Australia.

ADULT MALE: Rather similar to that of *violetae* but secondaries and tertials entirely gray; primary coverts with narrow gray edges, greater upper wing-coverts with grayish edges; tail feathers blackish, edged with olive at lower third. Very similar to that of *melanura*, but apparently differing by narrower gray edges on wing-feathers and wing-coverts.

ADULT FEMALE: Differs from that of *violetae* by the much paler yellow of the abdomen, with the yellow not reaching so far up the breast; back very grayish, with green restricted mainly to rump and upper tail-

coverts; wing very gray; tail blackish, with a liberal wash of greenish, particularly on the central tail-feathers.

Wing: Male, 84; female, 83. Tail: Male, 67; female, 65. Bill; Male, 17.5; female, 17.5.

RANGE: Known only from Napier Broome Bay and Hecla Island (off Cape Bougainville), northwest Australia.

This population is precisely intermediate between *violetae* and *melanura*.

Pachycephala pectoralis melanura Gould

Pachycephala melanura GOULD, 1843, Proc. Zool. Soc. London, for 1842, p. 134. Derby, west Kimberley District, northwest Australia.

ADULT MALE: Similar to that of *violetae*, but smaller; abdomen a paler lemon yellow; yellow nuchal collar averaging narrower; back more greenish, less golden citrine. Tail blackish, outer edges of tail-feathers often olive. Gray edges of wing-feathers broader, edges of tertials rather grayish, gray edges of primary coverts broader, edges of greater upper wing-coverts more gray than green.

ADULT FEMALE: Quite different from that of *violetae*; breast, flanks, and abdomen whitish; crissum and under tail-coverts pale lemon yellow; fuscous mottling on throat reduced, grayish buff gorget inconspicuous. Back gray, sometimes with a slight olive wash, rump greener, tail a pale (grayish) olive; edges of wing-feathers buffy gray.

Wing: Males, 79–85; females, 76–82. Tail: Males, 59–65; females, 58–65. Bill: Males, 18–18.5; females, 17.5–18.

RANGE: Known only from the neighborhood of King Sound (Point Torment, Derby, Fitzroy River, Obagama).

A collection from Broome (Roebuck Bay) is best included with *melanura*. The width of the nuchal collar and the color of back, under parts, and wing of adult males are identical, but on the average there is much more green in the tail. In females the back is virtually pure gray.

Pachycephala pectoralis bynoei Mathews

Pachycephala melanura bynoei MATHEWS, 1918, Austral Avian Rec., vol. 3, p. 136. Port Hedland, midwest Australia.

ADULT MALE: Differs from that of *melanura* by the still paler yellow of the under parts, by the much narrower yellow nuchal collar, by the greener back with some feathers tending towards gray green, and by the increased amount of olive in the tail. Wings similar.

FEMALE: Not yet described.

Wing: Males, 82, 86. Tail: Males, 65, 68, 68. Bill: Males, 18, 18, 19.

RANGE: Three adult males examined from the De Grey River (Ken Buller), Port Hedland (type, Whitlock), North West Cape (T. Carter). As a mangrove bird presumably difficult to collect.

Although *bynoei* is definitely close to *melanura*, it should be emphasized that the differentiating characters all point in the direction of *occidentalis*. However, there is no gray in the tail of any of the three examined specimens of *bynoei*. It would be interesting to know whether the female also indicates an approach towards *occidentalis*.

PATTERNS OF GEOGRAPHIC VARIATION

Study of the geographical variation of *Pachycephala pectoralis* in Australia is greatly facilitated by the fact that the species lives only along the periphery of the continent. It goes slightly inland in the southern half of its range and in the east as far north as Queensland, but is strictly coastal in the north and northwest, often being limited to mangrove swamps and small off-coastal islands. With few exceptions the range is virtually continuous. One gap exists in the west between the Exmouth Gulf (North West Cape; *bynoei*) and the Murchison River (*occidentalis*), and a second one in the south between Esperance Bay (*occidentalis*) and the Eyre Peninsula (*fuliginosa*). There is no evidence for any real gaps on Cape York or in the Kimberley district, although unsuitable areas such as the Eighty Mile Beach are, of course, uninhabited.

Galbraith (MS) has divided the Australian populations into two subspecies groups, a southern (*occidentalis* to *queenslandica*) and a northern (*bynoei* to *spinicauda*), both containing additional subspecies outside the Australian continent. The proposed division is a natural one, although it is difficult to find diagnostic characters. The white feathers of the throat of southern males have blackish bases, in the northern males they are all white; the yellow of the under parts in northern birds tends to be deeper golden, the tail more extensively black. Northern females may have the throat whiter and more yellow on the under parts. However, there are two confusing phenomena. There are definite subgroups within the northern and the southern groups, and there are several subspecies (*bynoei*, *ashbyi*, *queenslandica*, and *spinicauda*) that connect the northern and the southern groups. The change from such a typical southern bird as *fuliginosa* (South Australia) to such a typical northern bird as *violetae* (Northern Territory) goes by the following steps:

youngi, Victoria (gray base of tail reduced in male, female without ocher below)

pectoralis, New South Wales (base of tail olive in male)

youngi and *queenslandica*, Queensland (basal tail area in male reduced,

nuchal collar broad, edging of primary coverts narrower, back of female washed with greenish, tail green, crissum yellow, throat whiter)

spinicauda, Cape York (tail virtually all black in male, back in female greener, abdomen washed with yellow)

violetae, Northern Territory (nuchal collar in male very wide, back in female green, breast and abdomen bright yellow, tail blackish)

The three Queensland subspecies thus definitely lead from the southern to the northern group. In the west a special subgroup is formed by small, pale *melanura* which is connected with *violetae* by *hilli*, and perhaps with *occidentalis* by *bynoei*. The loss of black on the tail in *bynoei* suggests at least some influence from *occidentalis*, although it might equally well be the effect of the local selection.

Although the range of *pectoralis* in Australia is now practically continuous, the recognizable subspecies fall into six distinct subgroups. There is a definite indication that each of these groups consists of a former geographical isolate which has secondarily come into contact with neighboring isolates.

ISOLATES	INTERMEDIATE FORMS
Southern group	
1. <i>occidentalis-fuliginosa</i>	" <i>bettingtoni</i> " towards <i>youngi</i>
2. <i>glaucura</i>	Isolated on Tasmania
3. <i>youngi-pectoralis</i>	Intergradation with <i>ashbyi</i> in northern New South Wales not yet described
4. <i>ashbyi-queenslandica</i>	
Northern group	<i>spinicauda</i>
5. <i>violetae</i>	<i>hilli</i>
6. <i>melanura</i>	
Southern group	<i>bynoei</i>
1. <i>occidentalis</i>	

The history of some of these isolates may be rather complex. For instance, *occidentalis* presumably was originally isolated in southwest Australia. During a more humid period it spread into South Australia. This connection became again interrupted, and the differences between *occidentalis* and *fuliginosa* evolved.

The population of *fuliginosa* in western Victoria ("*bettingtoni*") shows definite effects of gene flow from *youngi*, but not enough to justify subspecific recognition. At Cape York *spinicauda* has the characters of *violetae* as affected by gene flow from *queenslandica*. In East Kimberley *hilli* is almost precisely intermediate between *violetae* and *melanura*. *P. p. bynoei* is not yet sufficiently well known to determine whether or not its characters are due to gene flow from *occidentalis*.

PATTERN OF VARIATION AMONG THE AUSTRALIAN
SPECIES OF *Pachycephala*

Some of the Australian species (such as *olivacea*) appear very different. Others are closely related (such as *rufogularis* to *inornata*; *lanioides* to *rufiventris*; and *simplex*, in spite of its hen-feathered plumage, to *pectoralis*). In turn, the *rufiventris* group is not far from *pectoralis*, while the *inornata-rufogularis* group is rather isolated. The history of much of this speciation is far too ancient to be elucidated at this date. It is very probable, however, that *lanioides* is an earlier wave of the same stock of immigrants that later gave rise to *rufiventris*, and that *rufogularis* and *inornata* were originally separated into southwestern and eastern Australia by desert, and that their present overlap is due to a rather recent eastward range expansion by *inornata*.

The study of intraspecific patterns of variation is far easier. The number of subspecies per species recognized for the Australian area fluctuates from one (monotypic *rufogularis*) to 12 (*pectoralis*). Other species have the following number of subspecies: *olivacea*, two; *inornata*, two; *simplex*, two; *lanioides*, four; and *rufiventris*, six.

More interesting is the type of subspecies found in the various species. As pointed out in earlier papers (e.g., Mayr and Jennings, 1952) variation within a species may either be clinal, with each subspecies grading insensibly into the neighboring ones, or consist of more or less well-defined isolates. In *Pachycephala* the variation is clinal in *P. rufiventris* and within certain subspecies groups of *P. pectoralis*. This may mean either that the continent has been colonized so recently that there has been no opportunity for the origin of isolates or that dispersal is too powerful to permit their development.

Isolates have developed in all other species (except the monotypic *rufogularis*). These isolates either are still clearly separated from each other as in *olivacea*, *lanioides*, and *simplex*, or presumably are connected by secondary intergradation as in the case of *inornata* and *pectoralis*. The number of isolates (or ex-isolates) per species is as follows: *olivacea*, two; *inornata*, two; *simplex*, two; *lanioides*, four; and *pectoralis*, six to eight. There is thus opportunity for further speciation even on continental Australia.

The pattern of variation appears to be quite orthodox in most Australian species. Two major trends are evident. The intensity of pigmentation decreases from the more humid periphery towards the more arid interior, and size decreases from the south towards the Equator. Neither trend is without its exceptions, and no definite ruling can be made for isolated populations, such as those of *lanioides*. Nor has any clear-cut

correlation been established between type of coloration in the females of *P. pectoralis* and the respective environment.

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