

NOTES ON THE DISTRIBUTION, ECOLOGY AND TAXONOMY
OF THE PARTRIDGE PIGEON (*GEOPHAPS SMITHII*) AND
SPINIFEX PIGEON (*GEOPHAPS PLUMIFERA*)
IN WESTERN AUSTRALIA

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ABSTRACT

Data on distribution, abundance, habitat, food, breeding and colour of soft parts are given for the Partridge Pigeon and Spinifex Pigeon in Western Australia. Geographic variation in both species is analysed. Two subspecies are recognised in the Partridge Pigeon, *G. s. smithii* of Northern Territory (and formerly eastern Kimberley) and *G. s. blaauwi* of northwest Kimberley, Western Australia. No subspecies are recognised in the Spinifex Pigeon; the complex distribution and variation within this species make it difficult and artificial to recognise subspecies and I treat most of the variation as clinal. In morphology and behaviour the Spinifex Pigeon is close enough to the Partridge and Squatter Pigeons (*Geophaps*) not to require a genus of its own (*Lophophaps*).

INTRODUCTION

The Partridge Pigeon was once widespread in the Northern Territory and Western Australia, but since the early nineteen-hundreds it has steadily declined in both States. Prior to 1960 little was known about the Partridge Pigeon in the Kimberley. It was first recorded in Kimberley near the Isdell River in 1901 by F.M. House who was the medical officer, naturalist and botanist on the Brockman Expedition. In 1902 Tunney collected a male and female at Cockatoo Springs, and at the same place in 1904 Kilgour saw great numbers of them and found a nest with eggs; these records are the last for east Kimberley. Rogers collected three males from the Townsend River in 1902, and Hill collected four males and four females around Napier Broome Bay from August 1909 to July 1910. In 1960 Mees collected a specimen at Kalumburu and in 1968 drew attention to the fact that Mathews' Kimberley subspecies *blaauwi* was distinct. Between 1970 and 1978 the Department of Ornithology and Herpetology of the Western Australian Museum, often in conjunction with the Department of Fisheries and Wildlife, carried out extensive fieldwork in the Kimberley, and much of the data presented here resulted from these surveys.

The Spinifex Pigeon is widespread in arid and semiarid regions of Australia (except sandy deserts), but its distribution, especially in Western Australia, is fragmented. Western Australia is the only State in which both the white-

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bellied ('*plumifera*') and red-bellied ('*ferruginea*') forms occur. Many previous writers have treated these forms as species or subspecies. Recent collections from problematical areas help solve the taxonomic status of western birds and show that most of the variation within "*plumifera*" is clinal. The Spinifex Pigeon has been variously placed by recent authors in *Lophophaps*, *Geophaps* and *Petrophassa*.

MATERIALS AND METHODS

I examined 130 Partridge Pigeons and 119 Spinifex Pigeons held in the Western Australian Museum, Australian National Wildlife Collection (Canberra), Australian Museum (Sydney), American Museum of Natural History and Queensland Museum. Measurements were taken as follows: length of chord of flattened wing, length of tail to outside base of central rectrix, length of tarsus and length of entire culmen. A series of standards were chosen in the Spinifex Pigeon to represent the full range of variation in colour (these are figured); a scale of one to six scored the amount of white and the amount and intensity of reddish brown on the belly.

PARTRIDGE PIGEON (*Geophaps smithii*)

Distribution

Storr (1980) gives the distribution in Kimberley, Western Australia, as northwestern subhumid zone from Napier Broome Bay southwest to the Yampi Peninsula, inland to the lower Drysdale, Mitchell Plateau, Wulumara Creek, the middle Charnley and the lower Isdell. Formerly occurring in the Keep River drainage in far northeast of Kimberley Division but now extinct in this area (see Fig. 1). The present and former distribution in the Northern Territory is outlined in Fig. 1 and by Storr (1977).

Status

Locally common but generally scarce or uncommon, usually occurring in pairs or small flocks of up to twenty.

Ecology

In Kimberley this pigeon favours the ecotone between the rugged King Leopold Sandstones and alluvial flats. The vegetation in these areas is mainly low woodland, tall shrubland and tall open shrubland. The trees and shrubs include *Eucalyptus miniata*, *E. apodophylla*, *E. latifolia*, *E. bigalerita*, *E. polycarpa*, bloodwoods (*Eucalyptus* spp.), *Acacia* spp. (including *A. holosericea* and *A. kelleri*), *Terminalia fitzgeraldii* and *Adansonia gregorii*. The ground cover is

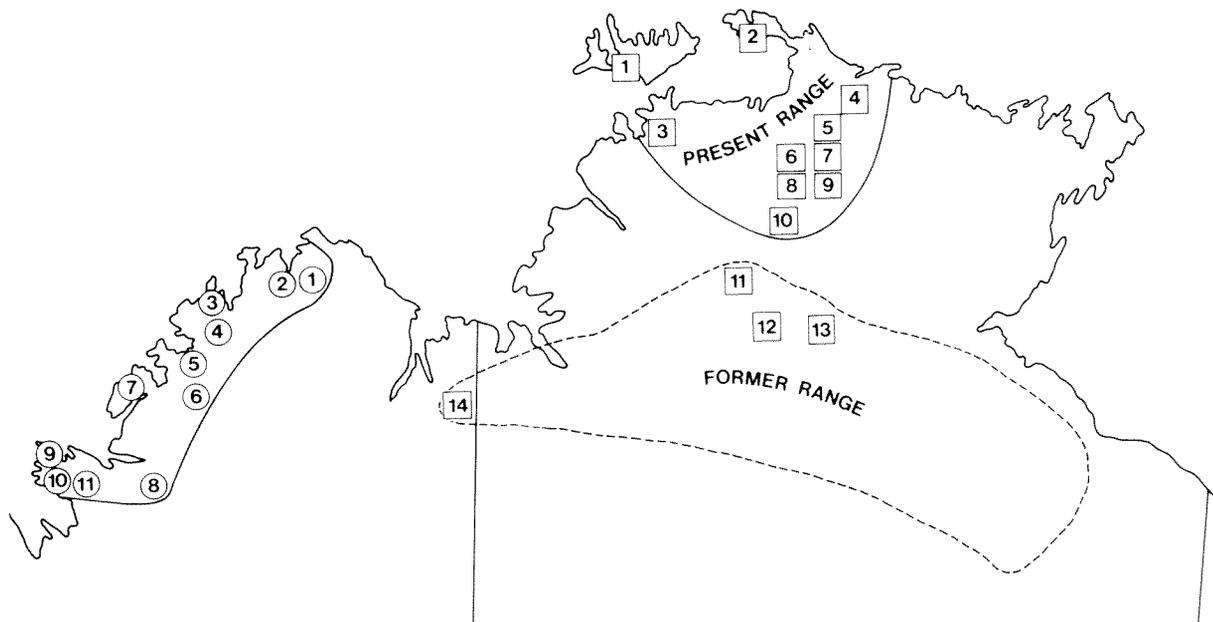


Fig. 1: Map of Northern Territory and Kimberley, Western Australia, showing distribution of *Geophaps s. smithii* (squares) and *G. s. blaaui* (circles). *G. s. smithii*: 1 Melville Island, 2 Cobourg Peninsula, 3 Darwin, 4 Oenpelli, 5-9 East and South Alligator River drainages, 10 El Sherana, 11 Katherine River, 12 King River, 13 Roper River, 14 Cockatoo Springs. *G. s. blaaui*: 1 Mumbo Jumbo, 2 Napier Broome Bay, 3 Crystal Head, 4 Mitchell Plateau, 5 lower Roe River, 6 Prince Regent River, 7 Kunmunya, 8 lower Isdell River, 9 Wotjulum, 10 Kimbolton, 11 Townsend River.

mostly a tall dense layer of grasses (*Sorghum* and *Eriachne* spp.). Pigeons are often seen feeding in grassland along creeks, especially in areas regenerating after fire. During the wet season on Mitchell Plateau many birds (mostly in pairs) feed on the roads and grid lines through a woodland of *Eucalyptus tetrodonta* and *E. miniata* with scattered *E. nesophila* and *E. latifolia* and a dense lower storey of *Livistona eastonii*. Grasses in this area include *Sorghum plumosum*, *Themeda australis*, *Chrysopogon latifolius* and *Plectrachne pungens*.

When approached this species will often squat or freeze like a quail, taking flight only when the observer is very close. The flight is similar to that of the Spinifex Pigeon, with a noisy flap then a glide on stiff wings. When flushed they often perch in trees. The call is a soft 'woop woo'. The bowing or courtship display is similar to that of the Spinifex Pigeon: the head and breast are lowered, the partly open wings are stiffly extended nearly to the ground, the tail is erect and fanned, and the bird coos rapidly. If the male is not close enough to the female to mount her immediately he walks to her with a limping gait. During some courtship displays and occasionally when perched, Partridge Pigeons will raise the lengthened nape feathers to form a short rounded crest.

Breeding

Kilgour found a nest with two eggs at Cockatoo Springs on 14 April 1904 (he wrongly ascribed them to *Petrophassa*). Hill observed young at Napier Broome Bay at the end of March and took eggs from 7 May to 28 June. P. Bindon (pers. comm.) found two nests on a grassy creekside flat on the northeast side of Yampi Peninsula on 7 and 8 July 1977, each with one pin-feathered nestling.

Soft Parts and Weights

The northwest Kimberley subspecies *Geophaps smithii blaauwi* has the iris brown to dark brown (in nine specimens), whitish grey (3) or cream (1), the last an immature. The facial skin is bright yellow (see **Fig. 2**), the bill black and the legs usually purplish brown (sometimes light greenish grey). Weights of seven males ranged from 160 to 217 g (mean 195 g) and five females 188 to 200 g (mean 194 g).

The Northern Territory subspecies *Geophaps smithii smithii* has the iris white or silvery white (79), greenish (3), yellow (2), mauve (1) and brown (1). The few birds that varied in iris colour may have been looked at some time after death. The facial skin in *G. s. smithii* is bright red (see **Fig. 2**), the bill black and the legs purplish grey, purplish brown or purple mauve. Weights of 59 males ranged from 167 to 230 g (mean 195 g) and 48 females 150 to 210 g (mean 180 g).

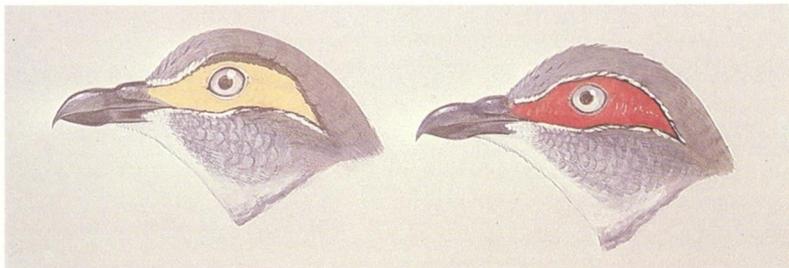


Fig. 2: Head pattern of *G. s. blaauwi* (left) and *G. s. smithii*.

Geographic Variation and Nomenclature

The Partridge Pigeon can be divided into two distinct subspecies, *Geophaps smithii smithii* (Jardine & Selby) of the Northern Territory and *Geophaps smithii blaauwi* Mathews from northwest Kimberley, Western Australia. Mathews (1912) described *blaauwi* from Napier Broome Bay on the basis of the naked eye-space or orbital skin being yellow rather than scarlet. Mathews' subspecies however has not been generally accepted. Peters (1937) regarded it as very doubtfully distinct. Deignan (1964) rejected it, suspecting that Mathews was misled by the red orbital skin rapidly becoming yellow in the dried skin. Condon (1975) listed it as a synonym of *G. s. smithii*, despite the fact that Mees (1968) had collected a specimen and observed many individuals around the type locality of *blaauwi* all with the orbital skin ochre-yellow. I have also collected many specimens and observed numerous individuals in Kimberley, all with bright yellow orbital skin.

Another good character is the lack in *blaauwi* of a white supercilium. In *G. s. smithii* the white supercilium (white line above the black line) extends the full length of the orbital or facial skin and meets the white suborbital line

behind the ear (Fig. 2). In *G. s. blaaui* the white line above the lore extends at most to the front of the eye; it then becomes a broad all-black supercilium that meets the white suborbital line behind the ear (Fig. 2).

Hartert (1905), writing on Tunney's collection, listed a male and a female from Cockatoo Springs (near Kununurra, east Kimberley) collected on 20 June 1902. Tunney did not record the orbital skin colour of his specimens and, as the Partridge Pigeon is now extinct in east Kimberley (not recorded here since 1904), their subspecific identity was unknown. The easternmost population of *blaaui* (at Mumbo Jumbo on the lower Drysdale River) is about 300 km to the northwest of Cockatoo Springs (Fig. 1). Only one of Tunney's specimens has been located, the male (no. 616113 in the American Museum of Natural History). This specimen has the complete white supercilium of the nominate race. Tunney labelled the iris colour of this bird as silvery grey, which is the same as in most Northern Territory birds (in *G. s. blaaui* it is usually dark).

Table 1 gives the measurements of the two races. It will be seen that *G. s. blaaui* has a slightly longer wing and bill than *G. s. smithii*.

TABLE 1

		Wing	Tail	Tarsus	Culmen
<i>G. s. smithii</i>	N.T.	♂ 127-140 (133, N64)	76-101 (89, N65)	26-32 (28, N65)	18.0-23.5 (22.0, N62)
		♀ 124-135 (130, N50)	75-97 (87, N50)	25-31 (28, N50)	19.5-24.0 (21.5, N50)
	W.A.	♂ 132	90	30	21.5
<i>G. s. blaaui</i>	W.A.	♂ 132-143 (137, N9)	85-95 (90, N9)	24-29 (27, N9)	21.0-25.0 (22.8, N9)
		♀ 131-138 (135, N6)	82-89 (85, N6)	25-27 (26, N6)	21.0-23.0 (21.8, N6)

Table 1: Measurements (mm) of *Geophaps smithii* with means and sample size in parentheses.

DISCUSSION

Storr (1977) gives the status of the Partridge Pigeon in the Northern Territory as 'formerly common in well-watered but well-drained grassy woodlands and open forests, but now either greatly reduced in numbers or extinct in much of former range. Still locally common in rough country about the East and South Alligator and east of Pine Creek; scarce on Cobourg Peninsula; rare in Darwin district. No recent records from the Keep, Victoria, lower Daly, Katherine, King, Roper and McArthur drainages'.

There is little doubt that the great decline in numbers in the Northern Territory and east Kimberley is due to over-grazing by domestic stock. This is not only evident with the Partridge Pigeon but also with its close relative the Squatter Pigeon (*Geophaps scripta scripta*) and other grassland species, such as the Paradise Parrot (*Platycercus pulcherrimus*) and the Black-throated Finch (*Poephila cincta cincta*), in eastern Queensland. All are species which favour woodland savannah especially in broad river valleys; this habitat, often the

first taken up by pastoralists, is vulnerable to degradation by over-grazing. All four species are now extinct over most of their former range, and all declined rapidly between 1860 and 1920.

SPINIFEX PIGEON
(Geophaps plumifera)

Distribution

Storr (1980) gives the distribution in the Kimberley as arid and semiarid zones, north to Beverley Springs, the Phillips Range, the sources of the Durack River, the New York Range, the lower Pentecost, Wyndham and Kununurra; west to Inglis Gap, the Napier Range, Mt Anderson, Grant Range and Logues Springs (Dampier Downs); and south to the Edgar Ranges, Mt Arthur, St George Ranges, Wattle Spring (56 km southeast of Christmas Creek HS), Mt Bannerman and the Gardiner Range (**Fig. 3**).

In the Northwest Division of Western Australia it ranges north to the DeGrey River, east to the Rudall River and Carnarvon Range, and south to Cape Range, the Wooramel River and Meekatharra. There is also an isolated population in the far east of the Eastern Division (Rawlinson Range and Walter James Range).

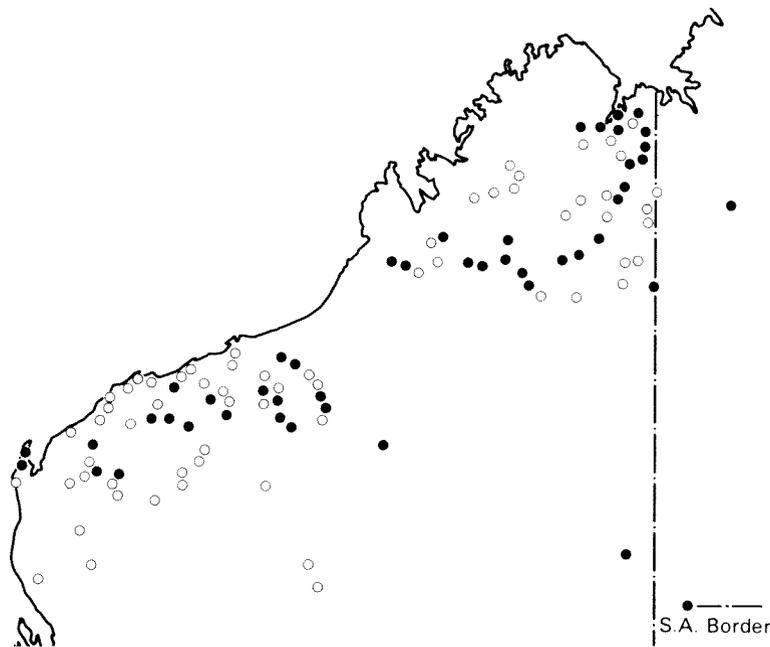


Fig. 3: Map of north Western Australia, showing location of specimens (solid circles) and sight records (hollow circles) of *Geophaps plumifera*.

Status

This pigeon is common throughout most of its range but may be uncommon to moderately common in isolated populations such as those of the Cape Range, Rawlinson Range and Walter James Range. It is usually found in pairs or small parties, occasionally in large flocks of up to 100 at water.

Ecology

The Spinifex Pigeon generally frequents rocky or stony country with permanent water. It is absent from sandy deserts. Although strongly associated with spinifex (*Triodia* and *Plectrachne*), Spinifex Pigeons are not completely dependent on it as a food source, feeding also on the seeds of other grasses and herbs. Water is an important factor in determining their distribution.

The flight is similar to that of the Partridge Pigeon, the birds rising with a clatter of wings then a glide, but when landing they often make a few slow flaps. The Spinifex Pigeon is very agile on the ground, being able to make short jumps from rock to rock and walk and run quickly. The bowing display is similar to that of the Partridge Pigeon (see above). The call is a short 'coo oor'.

Breeding

Twenty-one two-egg clutches have been recorded for Western Australia; eight in Kimberley in the following months, January (1), April (2), May (1), July (3), October (1), and thirteen in the Northwest Division in the following months, January (1), May (2), June (1), August (4), September (2), October (1) and December (2).

Nomenclature

Gould believed that the Spinifex Pigeon comprised three species, namely *Lophophaps plumifera* (which he described in 1842 with specimens from the Victoria River, Northern Territory), *L. ferruginea* (described in 1865 from Shark Bay, Western Australia) and *L. leucogaster* (described in 1869 from Machrihanish Station, South Australia). Mathews (1912) reduced the number of species to two, a white-bellied *plumifera* and a red-bellied *ferruginea* and named two new Western Australian subspecies: *Lophophaps plumifera pallida* from Parry Creek, and *L. ferruginea mungi* from 13 km southeast of Mt Alexander.

Mayr (1951) went further and treated all forms as a single species and described a new subspecies (*proxima*) from central-south Kimberley, and synonymised *pallida* with *plumifera*. Condon (1975) followed Mayr in treating *ferruginea* as a race of *plumifera* and recognising all five subspecies, but placed *Lophophaps* and *Geophaps* in *Petrophassa*.

The small head and bill, the reduced bronze on wing, the presence of a wing speculum, the barring on nape (and other parts of plumage), the immature

plumages and the absence of a crest link *Petrophassa* more to *Geopelia* than to *Geophaps*. The main similarities between *Lophophaps* and *Geophaps* are the stout bill, shape and extent of orbital and facial skin, iridescent wing patches (on inner secondaries in *Lophophaps* and upper wing coverts in *Geophaps*), colour pattern of breast feathers, and crest (incipient in *Geophaps smithii*). The colour of the flesh also separates *Geophaps* from *Petrophassa*. In the Spinifex and Partridge Pigeons the flesh is pale pinkish white, whereas in the White-quilled Rock Pigeon *Petrophassa albipennis* and presumably the Rufous-quilled Rock Pigeon *P. rufipennis* it is dark reddish brown.

Geographic Variation

This subject is dealt with by comparing the more distinctive populations, beginning with those in the west.

1. Cape Range

The isolated population in the Cape Range is the palest of all red-bellied populations (**Figs 4, 5**). The breast and belly is very pale reddish brown; the breast band is ill-defined with the feathers pale bluish-grey at base, a blackish or dark brown narrow indistinct subterminal bar and a pale reddish brown tip. The forehead is pale bluish grey, the nape pale reddish brown (one specimen greyish brown), the mantle buffy brown, the lower back and tail pale reddish brown, the feathers with indistinct light brown rather than blackish brown bars. The wing coverts have a washed-out appearance, being pale bluish grey, tipped pale reddish brown. The Cape Range birds are separated from the Pilbara population by a broad belt of unsuitable sandy country south and east of Exmouth Gulf.

2. Pilbara ('*ferruginea*')

These are characterised by being a rich reddish brown above and below. The breast is reddish brown; the individual feathers of the dark breast band (as with the feathers on the wing coverts and mantle) are bluish grey except for a blackish subterminal bar and pale tip; the rest of the under parts are reddish brown. The forehead is bluish grey; the crown is dark reddish brown; the mantle feathers are pale grey with an indistinct dark brown subterminal bar and reddish brown tip; the wing coverts are bluish grey with a distinct black subterminal bar and dark reddish brown tip; the lower back, rump and tail are dark reddish brown (**Fig. 4**). The iris is orange-brown or reddish brown. These populations are isolated from the Central Australian (Rawlinson Range etc.) by the Gibson Desert and from the Kimberley populations by the Great Sandy Desert.



Fig. 4: Ventral coloration of *Geophaps plumifera*. Top, left to right: Cape Range W.A., Carawine Pool W.A., Edgar Ranges W.A. and Christmas Creek W.A. Bottom, left to right: Wyndham W.A., Wave Hill N.T., Newcastle Range Qld. and Rawlinson Range W.A.



Fig. 5: Dorsal coloration of *Geophaps plumifera*. Top, left to right: Cape Range W.A., Carawine Pool W.A., Edgar Ranges W.A. and Christmas Creek W.A. Bottom, left to right: Wyndham W.A., Wave Hill N.T., Newcastle Range Qld. and Rawlinson Range W.A.

3. Southwest Kimberley ("*mungi*")

At Mt Anderson, Grant Range, Logues Springs, Edgar Ranges and Mt Arthur occur 'red-bellied' birds which match well with Cape Range specimens. Although the Grant and Edgar Ranges and Mt Arthur are all separated by unsuitable habitat, specimens from these localities are almost identical. It is of interest here to point out that Mayr (1951) unwittingly included specimens from Yardie Creek (Cape Range) with '*mungi*'. He apparently believed that Yardie Creek was near Derby. Cape Range specimens are in fact slightly paler on the belly and back than '*mungi*'. A description of '*mungi*' is as follows: the breast and belly are pale reddish brown (buffy brown); the breast band feathers are basally bluish grey and have a blackish subterminal bar and pale tip. The forehead is bluish grey and the crown reddish brown; the mantle feathers have a pale greyish brown base, a dark brown subterminal bar and a sandy brown tip; the wing coverts are bluish grey, with a black subterminal bar and a broad sandy brown tip; the lower back, rump and tail are pale reddish brown (Figs 4, 5).

The population '*mungi*' is important for interpreting the variation within the species. *Mungi* is in fact a primary intergrade. There is a slight break of 90 km between red-bellied birds in the Grant Range and white-bellied birds in the St George Ranges. The alluvial flats separating these two populations are unsuitable for Spinifex Pigeons. Although there is now little or no contact between white-bellied and red-bellied birds in this area, there is a definite cline in colour of back and to a lesser extent in belly colour (Figs 4, 5). In iris colour, too, '*mungi*' bridges the gap between white-bellied and red-bellied birds. White-bellied birds have a yellow iris ('chrome yellow' or 'yellowish'), whereas in Pilbara birds (*ferruginea*) it ranges from orange and reddish orange to light brown. Eighteen '*mungi*' from the Grant Range (which are nearest geographically to white-bellied birds) have the iris recorded as yellow, whereas eight '*mungi*' from the Edgar Ranges have the iris recorded as orange (1); reddish orange (5), brick red (1) and reddish brown (1).

4. Central-south Kimberley (*proxima*).

At St George Ranges, Fitzroy Crossing, Go Go, Cherrabun, Christmas Creek and the Margaret River occur white-bellied birds which Mayr (1951) named '*proxima*'. They differ from '*mungi*' in having a white breast band and white belly. A description of these birds is as follows: the breast is dark reddish brown with a well-defined white breast band above the dark band; the bluish grey feathers of the dark breast band are tipped dark reddish brown; the upper belly is mostly white, some feathers with a light reddish brown wash particularly on the flanks; the lower belly is pale sandy brown with some feathers washed or tipped whitish. The upper parts are almost the same as in '*mungi*'.

The entire series seen by Mayr was collected by Tunney in April 1902 from the middle Fitzroy River (320 km upstream) and the Margaret River (420 km

from Derby). Mees (1961), with additional specimens from Moola Bulla, Margaret River and Fitzroy Crossing, agreed that '*proxima*' was distinct, but he wondered if it was desirable to separate it. Contrary to Mayr, however, he placed Margaret River specimens with the nominate race. As the variation here is clinal, no two authors could be expected to agree on where to draw the line between these 'subspecies'.

There is no break in the range of white-bellied birds in Kimberley. Birds from the Margaret River and middle Fitzroy are slightly more reddish brown (less greyish brown) on the upper parts than those from northeast Kimberley; this cline in back colouration ends in the Grant and Edgar Ranges, i.e. it extends through three 'subspecies'. The amount of rufous on the belly also decreases east of Christmas Creek. Most of the 34 specimens from between Christmas Creek and Noonkanbah had decidedly more white than pale reddish brown on the belly. However five specimens have more pale reddish brown than white; they are from Christmas Creek, Cherrabun and Fitzroy Crossing and not, surprisingly, from further west.

Birds from the Gardiner Range match well with Christmas Creek specimens, being more reddish brown on the upper parts than birds from Halls Creek.

5. East Kimberley, north of Northern Territory (*plumifera*) and northwestern interior of Queensland

As mentioned above populations 4 and 5 are continuous. However birds from north of Halls Creek become more greyish brown (less reddish) on the upper parts, especially on the lower back and rump. The breast is reddish brown; the white and dark breast bands are broad, and the rest of the under parts are almost pure white with some reddish brown on the flanks.

Storr (1977) delimits three isolated populations of the Spinifex Pigeon in the Northern Territory; one in the west (Ord and Victoria drainages), a second in the northeastern semiarid zone (Carpentaria drainage), and a third in the hills and ranges of the central and southern arid zone (**Fig. 6**). Specimens from northeastern and northwestern Northern Territory and east Kimberley are similar. A specimen from Wave Hill in the Northern Territory is the most boldly patterned of all Spinifex Pigeons I have seen. It has the breast dark reddish brown with broad white and dark breast bands (the subterminal black bars on the breast feathers are much wider than in Halls Creek specimens). The belly is white with scattered reddish brown feathers, and the lower belly and vent are pale buffy brown. The cap is chestnut (light reddish brown in Halls Creek specimens) and the upper parts are more reddish than Halls Creek birds.

Most birds from the western interior of Queensland match well with birds from the north of the Northern Territory and northeast Kimberley.

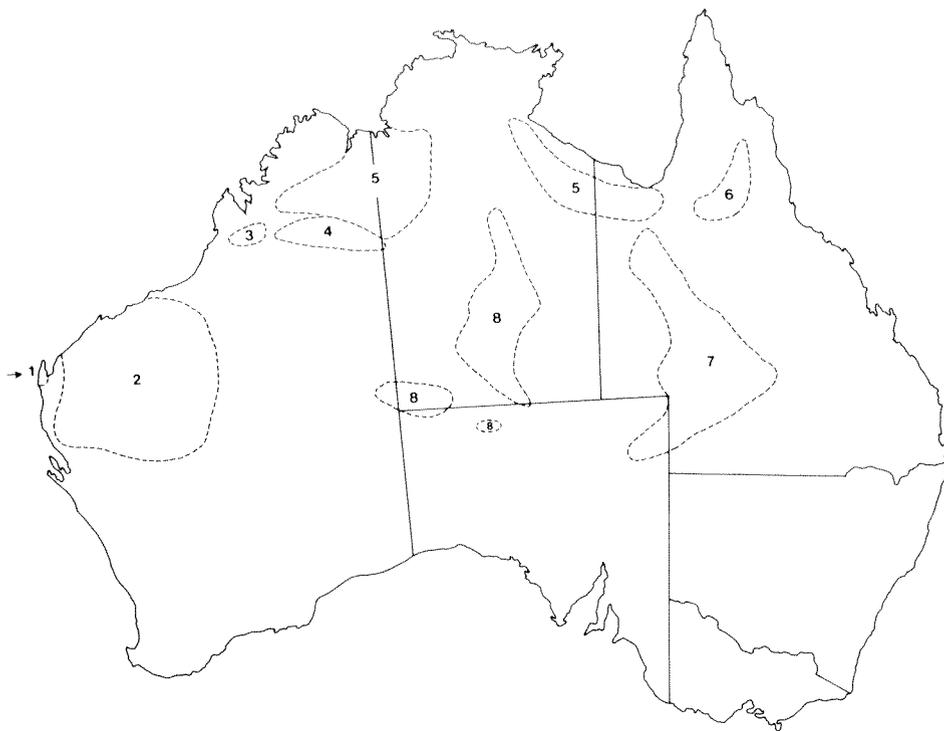


Fig. 6: Map of Australia showing the distribution of *Geophaps plumifera*. Numbers correspond to populations treated in text.

6. Southern interior of Cape York Peninsula

Birds from the Newcastle Range are isolated from those of western Queensland and are quite distinctive. The breast is buffy brown (or pale yellowish brown); the white and dark breast bands are broad and distinct; the belly is pure white, the flanks with a faint buffy wash. The crown is pale buffy brown (becoming almost white on the crest); the mantle feathers are bluish grey with a blackish subterminal bar and buffy brown tip; the back and rump are brownish grey (greyish brown in one specimen); the wing coverts are bluish grey with black subterminal bars and broad pale yellowish brown tips. This dark barring on the wing coverts gives a dark appearance to the upper parts (Figs 4, 5). The breast has a very washed-out appearance. These are the palest of all white-bellied specimens that I have seen.

7. Southwestern interior of Queensland and northeastern South Australia ('leucogaster')

Gould characterised the race '*leucogaster*' from northeastern South Australia as agreeing in colour with '*plumifera*' but having a longer wing. Specimens from Coopers Creek are in fact slightly smaller than the measurements

given by Mayr for '*leucogaster*', being more like the white-bellied populations to the north. Mayr however loosely applied the name '*leucogaster*' to the Central Australian populations rather than to birds from the southwestern interior of Queensland and northeastern South Australia. Birds from southwestern Queensland are slightly paler than white-bellied birds to the north and there is a trend from north to south in reduced white on the belly. Two Coopers Creek birds have only a few white feathers below the dark breast band, and the rest of the belly is pale buffy brown.

8. Central Australia

The most interesting aspect of birds from Central Australia is the reduction in white on the belly. This is most evident in birds from the MacDonnell Ranges, Ayers Rock and Rawlinson and Mann Ranges. In this respect and in back coloration these birds, especially those from the Mann and Rawlinson Ranges, show a tendency towards '*ferruginea*'. The Mann and Rawlinson Range birds have the breast reddish brown, the white breast band narrow, and the belly pale buffy brown. The two specimens from these areas only score 1 out of 6 for white on the belly (Fig. 4). They are also large (Table 2). In back coloration and in reduced white on the belly these specimens are most like the red-bellied populations; however they have some white on the belly and a white breast band.

In the past there may have been a connection between the Central Australian and Pilbara populations. There are many low ranges and hills between the Rawlinson and Carnarvon Ranges, but water is now scarce in this region. The Bowerbird (*Ptilinorhynchus maculatus guttatus*) is similarly disjunct between the Carnarvon Ranges and the Central Australian Highlands and likewise depends on water.

TABLE 2

		Wing	Tail	Culmen	Weight
1 Cape Range W.A.	♂	105-114 (N3)	59-70 (N3)	19.5-21.0 (N3)	112
	♀	111	61	19.5	
2 Pilbara W.A.	♂	103-110 (106, N12)	55-69 (64, N12)	19.0-22.5 (20.6, N12)	80-114 (99, N6)
	♀	106-115 (110, N13)	59-67 (63, N13)	18.0-21.0 (19.6, N13)	80-89 (83, N7)
3 Southwest Kimberley W.A.	♂	104-109 (106, N9)	54-69 (63, N9)	18.0-21.0 (19.5, N9)	73-96 (88, N9)
	♀	97-106 (102, N7)	52-64 (58, N7)	17.0-19.5 (18.4, N7)	70-83 (76, N7)
4 Central-south Kimberley	♂	104-112 (108, N18)	61-75 (67, N18)	18.0-22.0 (19.8, N18)	80-104 (91, N18)
	♀	102-108 (105, N15)	62-72 (67, N18)	18.5-20.0 (19.0, N18)	72-96 (81, N14)
5 East Kimberley, north of N.T. and northwestern interior of Qld.	♂	106-112 (109, N12)	63-75 (70, N12)	18.0-20.5 (19.4, N12)	90-128 (102, N9)
	♀	101-114 (106, N15)	65-74 (69, N15)	18.0-21.0 (19.5, N15)	67-96 (85, N9)
6 Southern interior of Cape York Peninsula	♂	106-111 (109, N5)	71, 79 (N2)	20.0-22.0 (21.0, N5)	
	♀	103-108 (105, N5)	67, 73 (N2)	18.5-21.5 (19.2, N5)	
7 Southwestern interior of Qld and northeastern S.A.	♂	103	67	18.0	
	♀	104, 110	69, 73	20.5	
8 Central Australia	♂	113	75	20.5	113
	♀	109	67	20.0	100

Table 2: Measurements (mm) of *Geophaps plumifera* with means and sample size in parentheses.

DISCUSSION

In view of the clinal and discordant variation within the Spinifex Pigeon it becomes artificial to recognise subspecies. Geographic variation within this species can be summarised as follows:

1. The red-bellied '*ferruginea*' appears to be the most distinct in belly, back and iris colour as compared to white-bellied birds; however the Edgar and Grant Range populations ('*mungi*') are intermediate between these forms. Birds of the Cape, Edgar and Grant Range are in back coloration most like '*plumifera*' but in the colour of the underparts most like '*ferruginea*'. One could group these populations as a polytopic subspecies; however the pale coloration of the Cape Range birds must have evolved independantly.

2. No line can be drawn between '*proxima*' and '*plumifera*' or between '*plumifera*' and '*leucogaster*'. I can find little difference between some '*plumifera*' from southeastern Kimberley and some specimens of '*leucogaster*' from southwestern Queensland.

3. The Mann and Rawlinson Range birds are also difficult to place; they have the back and, to some extent, belly colour as in '*ferruginea*' but retain some white on the belly and have a white breast like '*plumifera*' and '*leucogaster*'.

This demonstrates the difficulty in recognising races within this species. If '*ferruginea*' is recognised the Cape Range, Newcastle Range and other populations should also be named.

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REFERENCES

- CONDON, H.T. (1975)—*Checklist of the Birds of Australia, Part 1. Non-passerines*. Melbourne: RAOU.
- DEIGNAN, H.G. (1964)—Birds of the Arnhem Land expedition. *Records of the American-Australian scientific expedition to Arnhem Land* 4, *Zoology*: 345-425.
- HARTERT, E. (1905)—List of Birds collected in North-Western Australia and Arnhem Land by Mr J.T. Tunney. *Novit. zool.* 12: 194-242.
- HILL, G.F. (1911)—Field notes on the birds of Kimberley, north-west Australia. *Emu* 10: 258-290.
- MATHEWS, G.M. (1912a)—A reference-list to the birds of Australia. *Novit. zool.* 18: 171-455.

- MATHEWS, G.M. (1912b)—Additions and corrections to my reference list to the Birds of Australia. *Aust. avian Rec.* 1: 25-52.
- MAYR, E. (1951)—Notes on some pigeons and parrots from Western Australia. *Emu* 51: 137-145.
- MEEES, G.F. (1961)—An annotated catalogue of a collection of bird-skins from west Pilbara, Western Australia. *J. Proc. R. Soc. West. Aust.* 44: 97-143.
- MEEES, G.F. (1968)—Colour of orbital ring in Partridge Pigeon *Geophaps smithii*. *Emu* 67: 294.
- PETERS, J.L. (1937)—*Check-list of birds of the world*. 3. Cambridge, Mass.: Mus. Comp. Zool.
- STORR, G.M. (1973)—List of Queensland Birds. *West Aust. Mus. Spec. Publs.* No. 5.
- STORR, G.M. (1977)—Birds of the Northern Territory. *West. Aust. Mus. Spec. Publs.* No. 7.
- STORR, G.M. (1980)—Birds of the Kimberley Division, Western Australia. *West. Aust. Mus. Spec. Publs.* No. 11.