

GEOGRAPHICAL VARIATION IN THE AUSTRALIAN ROCK PIGEONS

F.H.J. CROME*

and

R.E. JOHNSTONE†

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ABSTRACT

Specimens of White-quilled and Chestnut-quilled Rock Pigeons from forty and eight localities respectively were measured and scored for colour and extent of the wing patch. There was clinal variation in most characters in White-quilled Rock Pigeons: large dark birds in the west Kimberley to small red birds further east. The extent of the wing patch showed no such variation but a sharp transition from presence of a large patch to virtual absence. The populations are grouped in three taxa — *Petrophassa rufipennis*, *P. albipennis albipennis* and *P. a. boothi*.

INTRODUCTION

The Australian White-quilled and Chestnut-quilled Rock Pigeons (*Petrophassa* sens. strict.) are restricted to sandstone escarpments from the Kimberley to Arnhem Land. The first specimens of White-quilled Rock Pigeons were obtained by Lort Stokes in 'north western Australia' and named *P. albipennis* by Gould before the Zoological Society on 8 December 1840 (published 1841). In 1898 Collett described *P. rufipennis* from specimens collected by Knut Dahl in 1895 (Dahl, 1895; Whittell, 1954). Mathews (1912) designated Wyndham as the type locality of Gould's *albipennis* and erected *P. albipennis alisteri* for a form from Napier Broome Bay on the basis of its being 'dark uniform brown above, altogether lacking the rufous brown of typical birds'.

* Division of Wildlife Research, C.S.I.R.O., P.O. Box 84, Lyneham A.C.T. 2602.

† Western Australian Museum, Francis Street, Perth W.A. 6000.

Another subspecific name — *boothi* — was given to specimens of White-quilled Rock Pigeons from the Victoria River that lacked the wing patch to varying degrees (Goodwin, 1969). In the 1975 Checklist only one species of Rock Pigeon was recognised and treated as a polytypic species with three subspecies *P. albipennis albipennis*, *P. a. rufipennis* and *P. a. boothi*; *alisteri* was suppressed under the nominate *albipennis*.

As a result of extensive surveys in the Kimberley and Northern Territory by the Western Australian Museum and C.S.I.R.O. enough material is now available for a more detailed analysis of geographic variation in the Australian Rock Pigeons.

MATERIALS AND METHODS

Specimens of White-quilled Rock Pigeons from forty localities and Chestnut-quilled Rock Pigeons from eight localities, held in the collections of the Western Australian Museum, British Museum (Natural History), American Museum of Natural History and the Australian National Wildlife Collection were examined. Localities with fewer than three specimens were, unless more than 100 km away from, or obviously different in colour from, the nearest group, combined with nearby localities for statistical purposes. The original localities were thus reduced to sixteen (White-quilled) and four (Chestnut-quilled) groups, five localities remaining ungrouped and not subject to statistical analysis (Table 1 and Fig. 1).

Each specimen was measured as follows:

- 1 length of the culmen from the tip to its insertion in skull
- 2 length of the chord of the flattened wing
- 3 length of the tarsus
- 4 weight (from collector's labels)

Specimens of White-quilled Rock Pigeons were scored for colour of the back and belly and the size of the wing patch as follows:

Colour

Back

The mantle and rump vary from red-brown to a dark brownish black. The individual feathers are tricoloured with a greyish or pale brownish central area, a coloured area around this (which was scored for back colour), and a pale fringe. The overall colour of the back was scored on a scale of 1 (blackest) to 6 (reddest) by comparison with a standard series of birds chosen to represent the full range of variation. The series used is given in Table 2.

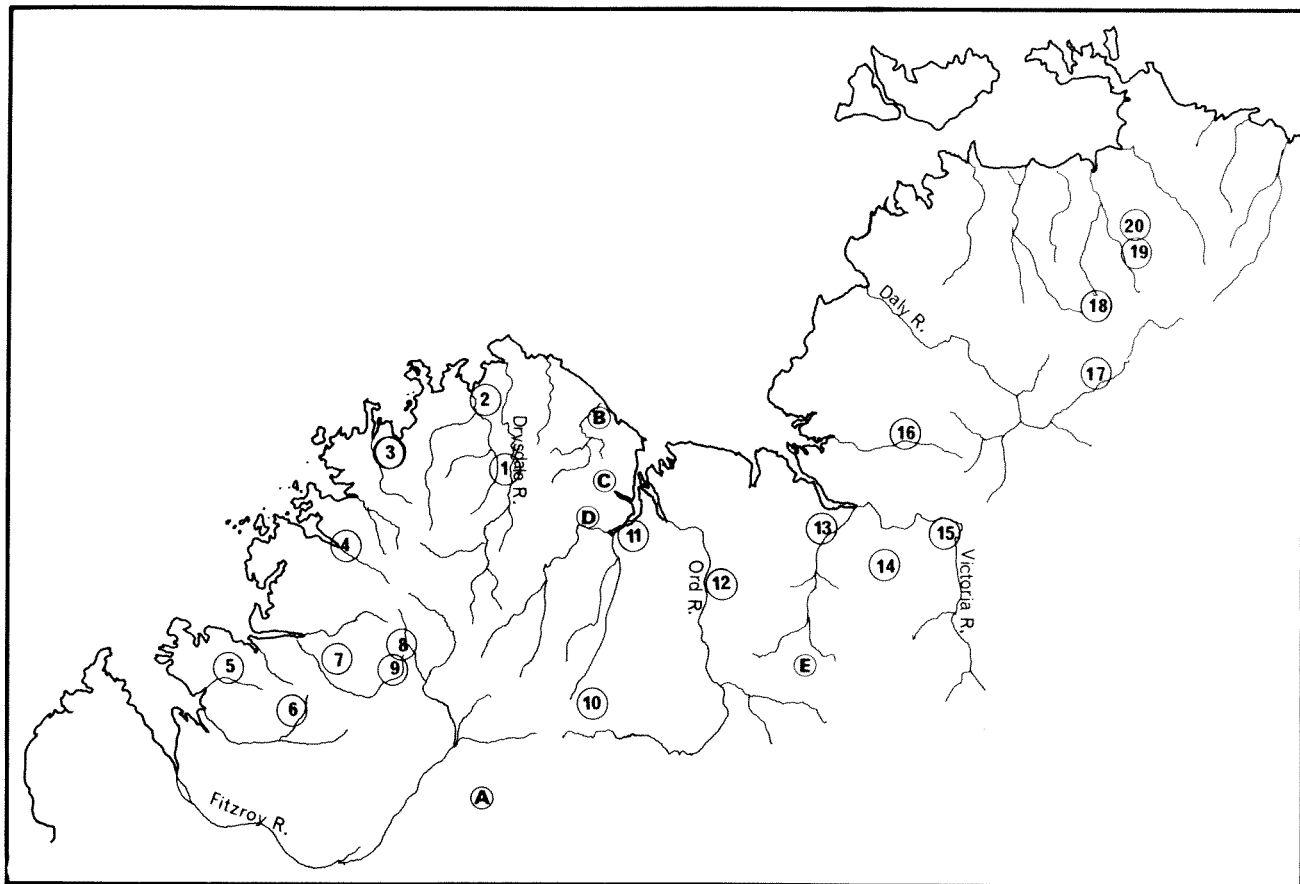


Fig. 1: Localities from which Rock Pigeons were examined. Numbers refer to groups in Table 1.

TABLE 1

Localities from which Rock Pigeons were examined

| Localities | Co-ordinates | Groups |
|----------------------------|-----------------------------|----------------------|
| White-quilled | | |
| Theda Station | 14° 48' S 126° 30' E | 1 Theda |
| Drysdale River | 14° 14' 127° 00' | |
| Kalumburu | 14° 17' 126° 38' | 2 Kalumburu |
| Mitchell Plateau | 14° 40' 125° 44' | 3 Mitchell Plateau |
| Mitchell Falls | 14° 52' 125° 50' | |
| Wollaston Island | 14° 31' 124° 27' | |
| Prince Regent River (1) | 15° 07' 125° 33' | 4 Prince Regent |
| (2) | 15° 34' 125° 25' | |
| (3) | 15° 47' 125° 20' | |
| Wotjulm | 16° 11' 123° 40' | 5 Yampi Peninsula |
| Kimbolton Spring | 16° 38' 123° 43' | |
| Oobagooma | 16° 46' 123° 58' | |
| Napier Downs | 17° 17' 124° 55' | 6 Napier Downs |
| Mt Bell | 17° 10' 125° 19' | 7 King Leopold Range |
| Mt Vincent | 17° 09' 125° 19' | |
| Mt Hart | 17° 08' 125° 14' | |
| Beverley Springs | 16° 39' 125° 30' | 8 Joint Hill |
| Joint Hill | 16° 27' 125° 56' | |
| Mt Barnett | 16° 43' 125° 56' | 9 Mt Barnett |
| Tableland Station | 17° 20' 127° 05' | 10 Durack Range |
| Teronis Gorge | 17° 19' 127° 18' | |
| Mt King | 17° 19' 127° 25' | |
| Mt Bedford | 17° 27' 127° 20' | |
| Bedford Downs | 17° 26' 127° 37' | |
| Fossil Downs | 17° 45' 126° 08' | A Not grouped |
| Chamberlain River | 16° 01' 127° 56' | 11 Wyndham |
| Moochalabra Dam | 15° 38' 128° 08' | |
| Parry Creek | 15° 30' 128° 15' | |
| Berkeley River | 14° 30' 127° 35' | B Not grouped |
| Forrest River | ca. 15° 10' 127° 50' | C Not grouped |
| Durack River | ca. 15° 30-35' 127° 30-128° | D Not grouped |
| Kununurra | 15° 39' 128° 42' | 12 Kununurra |
| Ord River Main Dam | 16° 00' 128° 47' | |
| Spencer Range | 15° 38' 129° 40' | 13 Spencer Range |
| Jasper Gorge | 16° 03' 130° 42' | 14 Jasper Gorge |
| Bridge over Victoria River | 15° 36' 131° 06' | 15 V.R.D. |
| Waterloo Station | 16° 55' 129° 35' | E Not grouped |
| Dee River | 14° 39' 130° 56' | 16 Dee River |

TABLE 1 (continued)

| Localities | Co-ordinates | Groups |
|-------------------------|----------------|--------------------|
| Chestnut-Quilled | | |
| Katherine Gorge | 14°20' 132°25' | 17 Katherine Gorge |
| UDP Falls | 13°26' 132°25' | 18 UDP Falls |
| El Sherana | 13°31' 132°31' | |
| Koolpin Creek | 13°29' 132°36' | |
| Nourlangie | 12°51' 132°46' | 19 Nourlangie |
| Sawtooth Gorge | 12°54' 132°57' | |
| Noranda | 12°53' 132°48' | |
| Mt Brockman | 12°44' 132°55' | 20 Mt Brockman |

TABLE 2

Colour standards used in scoring back and belly in White-quilled Rock Pigeons

| Score | Reg. no. of specimen | Colour of feathers* | |
|--------------|----------------------|---------------------------|---------------|
| Back | | Main coloured area | Fringe |
| 1 | ANWC 13662 | Blackish-fuscous | Drab to clay |
| 2 | ANWC 12482 | Umber-fuscous | Drab to clay |
| 3 | ANWC 12470 | Blackish burnt umber | Drab |
| 4 | ANWC 12497 | Raw umber | Clay |
| 5 | ANWC 12135 | Dark cinnamon-brown | Cinnamon |
| 6 | ANWC 12907 | Reddish antique brown | Cinnamon |
| Belly | | General colour | |
| 1 | ANWC 14698 | Dusky brown | |
| 2 | ANWC 12468 | Dark greyish brown | |
| 3 | ANWC 12500 | Dark fuscous | |
| 4 | ANWC 12907 | Fuscous | |

* The colours are the nearest match in Smithe (1974) and are approximate matches only.

Belly

The darkness of the belly was scored on a scale of 1 (darkest) to 4 (lightest), see Table 2.

These scores were converted to standard deviates (Table XX, Fisher & Yates, 1970) prior to calculation of means and standard deviations.

Wing patch

The specimens in the ANWC had been prepared with one wing detached and spread. The total length of, and the length of the white area on, each

primary was measured. The purity of the white area was then scored as being pure white or with a few brown flecks only (A), or with brown flecks occupying at least 50% of the total white area (B). For each specimen two indices of the size of the white patch were calculated as follows:

$$I_1 = 100 \left(\frac{\sum_{i=1}^{10} W_{Ai}}{\sum_{i=1}^{10} L_i} \right)$$

$$I_2 = 100 \left(\frac{\sum_{i=1}^{10} W_{Bi}}{\sum_{i=1}^{10} L_i} \right)$$

where I = index

W_{Ai} = length of pure white area on a primary

W_{Bi} = length of brown/white area on a primary

L_i = length of primary

Where specimens had broken or growing primaries, as long as there were not more than two feathers unmeasurable, the means for the population to which the specimen belonged were used as replacements for these missing values (e.g. specimen ANWC 19242 from Dee River was growing primary 2. The value of 100 mm was used as the length of this feather, this being the mean length of primary 2 in the Dee River population). If within the one sample 25% or more of the specimens had the same primary broken they were not used in the analysis.

RESULTS

Measurements of size, colour and wing patch are given in the appendix and in Fig. 2.

Variation in size

Chestnut-quilled

There are no significant differences in the length of the culmen, wing and tarsus or the weight between the four groups.

White-quilled

Culmen

The length of the culmen decreases from the north-western and central Kimberley to the V.R.D. The population with the largest average culmen

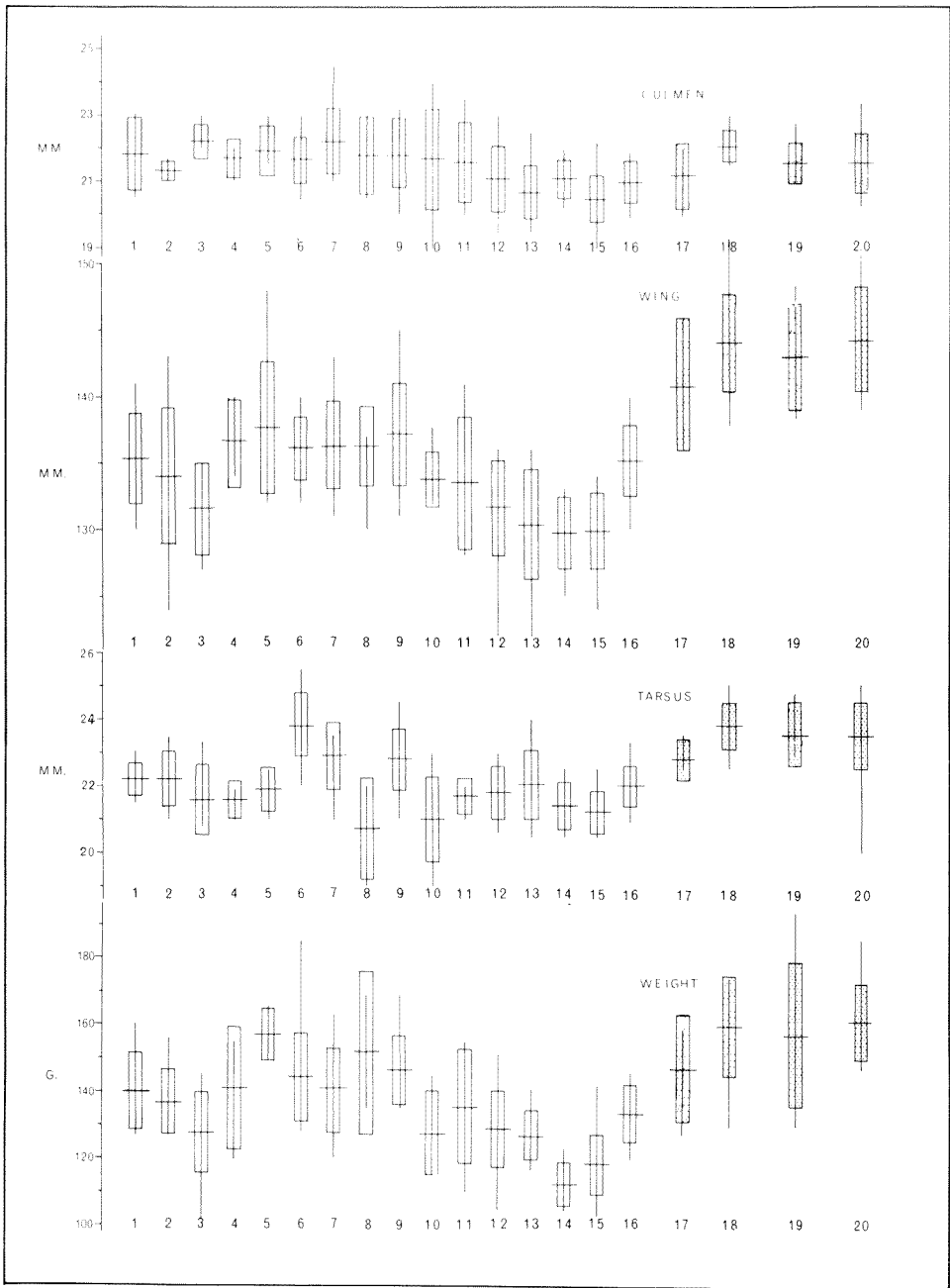


Fig. 2: Measurements (means, ranges and standard deviations) of Rock Pigeons. Numbers refer to groups in Table 1. Open figures — White-quilled Rock Pigeons, shaded figures — Chestnut-quilled Rock Pigeons.

is from King Leopold Range, that with the smallest from the V.R.D. The trend is a shortening from west to east.

Wing

There is again a clinal decrease of wing length from west to east but it is more complex than that of culmen length. Wing length is greatest in south-west Kimberley (Yampi Peninsula to Mt Barnett) then decreases through Durack Range, Wyndham and Kununurra to the V.R.D. Birds from the Dee River, north of the V.R.D., however have longer wings than the V.R.D./Spencer Range populations, and the length is not significantly different from that of the south-west Kimberley birds. Populations in north Kimberley, particularly the eight birds from Mitchell Plateau have shorter wings than the south-western birds.

Tarsus

The trends in tarsus length are not as marked as those in wing length, tarsus, like bill, not being as sharply correlated with size within similar populations as wing length. Joint Hill and Durack Range birds have the shortest and Napier Downs the longest tarsi.

Weight

The changes in weight show a pattern, as one would expect, similar to that of wing length with a diminution (clinal) from the west Kimberley to the V.R.D., and with birds from the Dee River being heavier than those from the V.R.D., while those from the north Kimberley are lighter than those from the south-west Kimberley.

Variation in colour

Chestnut-quilled Rock Pigeons

There is no measurable variation in back and belly colour of the specimens.

White-quilled Rock Pigeons (Fig. 3)

Birds from the north Kimberley (Theda, Kalumburu, Mitchell Plateau) are darkest of all, being blackish brown above and below. The colour lightens in the Prince Regent area and from Yampi Peninsula to King Leopold Range. From Mt Hart the trend of lightening and reddening continues eastward but there are anomalous breaks in an otherwise smooth cline. Birds from Joint Hill and Mt Barnett are darker than those from King Leopold Range to the west. Spencer Range and Dee River birds are also darker than the populations to the east and south of them (Wyndham to V.R.D.). The reddest birds of all are from Jasper Gorge. The ungrouped birds support the general picture. The Fossil Downs bird is like those from Durack Range, and that from Waterloo Station like Jasper Gorge and V.R.D. birds. The Forrest

River and Durack River birds are like those from Wyndham. The two birds from Berkeley River (AMNH 615853 and 615852) are darker and greyer than Wyndham birds and more like those from south-west Kimberley (King Leopold Range).

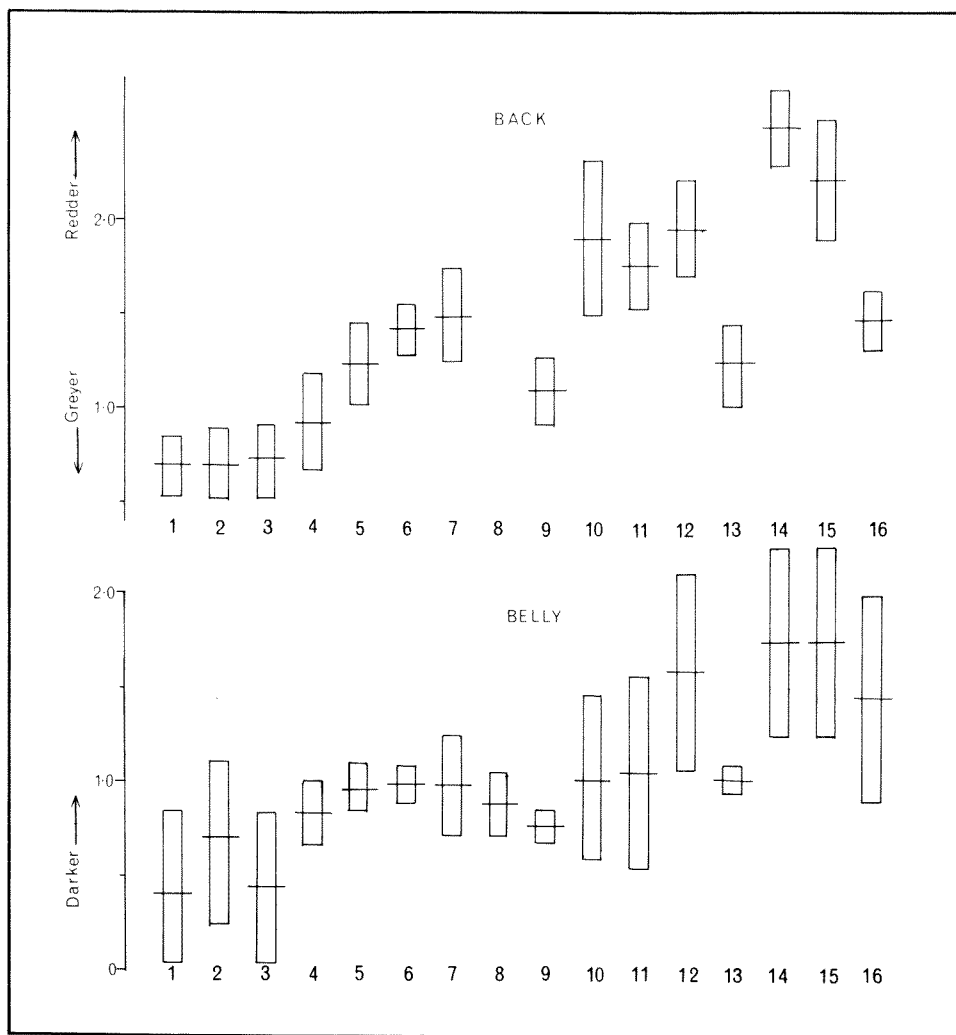


Fig. 3: Scores (mean and standard deviations) for colours of White-quilled Rock Pigeons. Numbers refer to groups in Table 1.

Variation in the wing patch of White-quilled Rock Pigeons (Fig. 4)

Birds from the V.R.D., Jasper Gorge and the one from Waterloo have no wing patch or it is extremely reduced. Only a few V.R.D. birds had a score

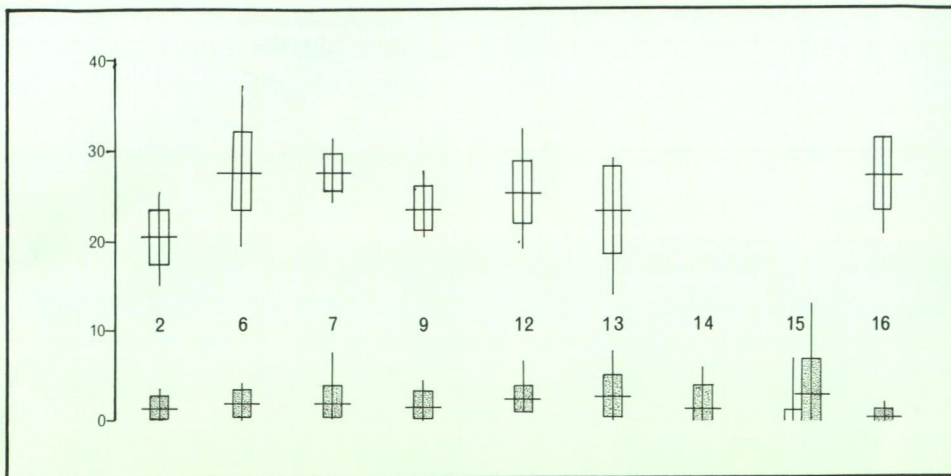


Fig. 4: Size (mean and standard deviation) of the wing patch of White-quilled Rock Pigeons. Open figures — Index I₁, shaded figures — Index I₂.

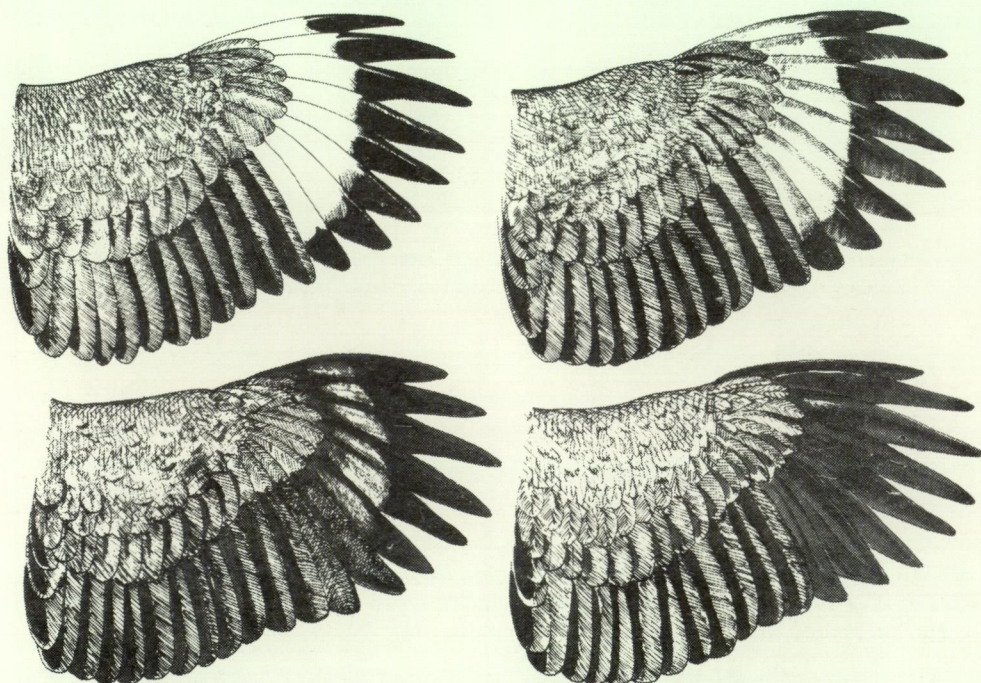


Fig. 5: Wings of selected White-quilled Rock Pigeons showing variation in the white patch. Top left ANWC 19236 Dee River; top right — ANWC 12920 Spencer Range; bottom right — ANWC 12929 Jasper Gorge; bottom left — ANWC 13675 Victoria River.

for Index 1. Eight of the twenty-one V.R.D. birds, six of the ten Jasper Gorge birds and the single Waterloo bird had no white whatsoever in the wing. Amongst the other populations there is a vague tendency for the white patch to diminish from west to east. The smallest average wing patches are on Kalumburu birds and the largest on Dee River birds.

In some birds from the V.R.D. a speckled white patch is obvious and in some birds with large white patches there is some encroachment of brown (Fig. 5); nonetheless the break between a large wing patch and none or a reduced patch is sharp.

DISCUSSION

The trend of variation in White-quilled Rock Pigeons is from large dark birds in north and west Kimberley to small red birds in east Kimberley and Northern Territory. This trend is however made more complex by the presence of large dark populations at the Spencer Range and the Dee River east of the small red population at Kununurra and west and north of the V.R.D. group. This pattern could be associated with differences in rainfall or rock colour (camouflage), the darkest birds coming from wet north-west coastal Kimberley and the reddest from the more inland drier parts (Gloger's rule) or dark birds living on darker sandstone than red birds. We have no quantifiable information to test associations with rock colour but a regression of average colour score on rainfall shows a highly significant relation (the best fit to the data was a power curve: $\text{colour} = 25976.7 (\text{rainfall})^{-1.454}$, $r = .853$ ($df = 14$), $t = 5.686$ ($df = 14$) ($P < .001$).

The populations in the V.R.D./Jasper Gorge area to which the name *boothi* has been applied appear in all respects, except wing patch, to be the end of this cline in colour and size. The break between V.R.D./Jasper Gorge and Spencer Range populations in this character is of course abrupt but the character is obviously labile since many V.R.D./Jasper Gorge birds have some traces of white. The V.R.D./Jasper Gorge populations are probably recent isolates. They are separated from the Spencer Range by the unsuitable habitat of the Whirlwind Plains, and a survey in 1976 found no suitable habitat between the V.R.D. and the Dee River population. Further west they are separated from the Kununurra and northern Durack Range populations by the flood plain of the Ord River. In the south-west, however, there could be continuous habitat connecting the Waterloo and Mt Bedford populations. If so there could be a cline in the size of the wing patch through this region. If not the V.R.D./Jasper Gorge populations would be completely isolated and could be unequivocally given subspecific status. Until such time as this information is available we prefer to be conservative and only tentatively retain the name *boothi* for them.

The clinal variation in colour and size of White-quilled Rock Pigeons is the reverse to what one would expect if a geographical connection with Chestnut-quilled Rock Pigeons existed. Although the large brown birds of the Dee River probably extend into the Flora River headwaters there is no suggestion of their being like Chestnut-quilled Rock Pigeons. The two are, of course, closely related. In fact, close examination of the wing patch showed that some individuals from Kununurra, Jasper Gorge and V.R.D. had a slight chestnut suffusion to the subdistal areas of some primaries (19 birds) and primary coverts (28 birds). However the following characters consistently distinguish between White and Chestnut-quilled Rock Pigeons and appear fixed in both forms:

- 1 The chin and centre of the throat is white in Chestnut-quilled Rock Pigeons and spotted black and white in White-quilled Rock Pigeons (feathers black with white centres).
- 2 The head, neck, mantle and upper breast in Chestnut-quilled Rock Pigeons is mottled with sagittate silvery-grey marks (feather centres) while this area in White-quilled Rock Pigeons is more or less concolorous or slightly scalloped grey and brown.

Nomenclature

From the foregoing we consider the populations of Australian Rock Pigeons to consist of two species — the Chestnut-quilled Rock Pigeon and White-quilled Rock Pigeon, the latter with two subspecies. The first subspecies shows clinal variation in size and back colour and extends throughout Kimberley from Oobagooma to Kununurra and into the Northern Territory north of the flood plain of the Baines River and into the ranges of the Fitzmaurice River system east, probably, to the headwaters of the Flora River. Two names have been applied to birds from this population — *albipennis* Gould and *alisteri* Mathews. *Alisteri* must be sunk but there is confusion over the type locality of *albipennis*.

Gould (1841) described the White-quilled Rock Pigeon from a male and female obtained from the 'most rugged and sterile districts of the north-west coast of Australia' by officers of H.M.S. *Beagle* and now in the Academy of Natural Sciences Philadelphia. Mathews (1912) restricted the type locality to Wyndham, and described a new race, *P. a. alisteri* from Napier Broome Bay. Whittell (1954) and Parker (1968) believed that the cotypes of *albipennis* came from the vicinity of King Sound. Meyer de Schauensee (1957) simply gives the type locality as north-west Australia.

The *Beagle*, under the command of John Lort Stokes, made two voyages to northern Australia, the first in 1838 to the King Sound region, Western Australia, and the second in 1839 to the Victoria River in the Northern Territory. White-quilled Rock Pigeons were collected in King Sound, as

Stokes noted in his diary: 'Some rather small pigeons of a dark colour marked with a white patch on the wings, were seen, and some specimens shot. They made a whirring sound in flight, like a partridge, and appeared to haunt the rocks, a habit which all subsequent observation confirmed.'

Nine new birds were collected in the King Sound area in 1838 and were described by Gould in 1839; these included White-breasted Whistler, Silver-crowned Friarbird, Yellow-tinted Honeyeater, Red-headed Honeyeater and Black-ringed Finch. Would Gould have waited until 1841 to describe a new genus of pigeon if specimens were available two years earlier?

In 1839 the *Beagle* sailed up the east coast of Australia to survey the Northern Territory coast west to the Victoria River. On the return journey down the Victoria River on 27 November 1839 Stokes shot some pigeons of a dark brown colour with a white patch on the extremity of the wing similar to the birds he had seen in King Sound and 'which always inhabited rocky districts and making a whirring sound, like a partridge on the wing'. Whittell (1954: 104) wrongly supposed that these birds were specimens of *Petrophassa rufipennis*.

Gould described his specimens as having the crown of the head and neck greyish brown, margined with sandy brown, all the upper surface, chest and tail rufous brown, the centre of each feather inclining to grey (Gould, 1843; pl. 71). Birds from the Spencer Range and the Dee River near the mouth of the Victoria River match this description better than the blackish brown King Sound birds. We have compared three plates of Gould (one of 1843 and two of 1848) with specimens but can find no good match. The most dissimilar are Kalumburu/Prince Regent birds. Dee River birds are the closest but still lack the rich brown portrayed. Dr F.B. Gill of the Academy of Natural Sciences Philadelphia kindly compared the cotypes with specimens from Lake Argyle (Ord River) and the Drysdale River, sent to him. He wrote that they were similar to A14046 (Drysdale River) but 'they are badly faded, paler and more brownish, lacking the intense charcoal coloration of your specimens. However they also lack the bright rusty colour of the eastern race.' Birds from the Dee River and Spencer Range are slightly browner than Drysdale specimens.

We conclude therefore that the most likely source of the types was the mouth of the Victoria River.

The second subspecies is a presumed isolate extending from the Stokes Range to Waterloo Station in the Northern Territory, south-east of the Baines River floodplain but with an unknown range to the south-east and south-west and characterised by no or a reduced wing patch. It was described as *P. albipennis boothi* by Goodwin (1969).

The arrangement we therefore propose is as follows:

Petrophassa rufipennis Collett

Type locality Alligator River, N.T.

Petrophassa albipennis Gould

Petrophassa albipennis albipennis Gould

Type locality presumably mouth of Victoria River, N.T. (syn. *P. a. alisteri* Mathews)

Petrophassa albipennis boothi Goodwin

Type locality Stokes Range, N.T.

ACKNOWLEDGEMENTS

We wish to thank Dr H.J. Frith who conceived and started this project many years ago and continued to contribute greatly to it. When he discovered that the Western Australian Museum was similarly active, he and Dr Storr combined resources and suggested we finish and write up the project. We thank Dr F.B. Gill for examining Gould's types for us and the curators of the British Museum (Natural History) and the American Museum of Natural History for the loan of specimens. We also thank T.O. Wolfe and L.A. Smith for help in the field and Drs Frith, Storr and Schodde for comments on the manuscript.

APPENDIX

Measurements of Rock Pigeons from localities in Kimberley and Northern Territory

| Locality | Culmen (mm) | | | | Wing (mm) | | | | Tarsus (mm) | | | | Weight (g) | | | |
|----------------------------|-------------|------|-----------|----|-----------|-----|---------|----|-------------|------|-----------|----|------------|------|---------|----|
| | x | S | Range | N | x | S | Range | N | x | S | Range | N | x | S | Range | N |
| White-quilled | | | | | | | | | | | | | | | | |
| 1 Theda | 21.9 | 1.09 | 20.5-23.0 | 8 | 135 | 3.5 | 130-141 | 8 | 22.2 | 0.51 | 21.5-23.0 | 8 | 140 | 11.7 | 127-160 | 7 |
| 2 Kalumburu | 21.3 | 0.30 | 20.9-21.7 | 10 | 134 | 5.1 | 124-143 | 11 | 22.2 | 0.82 | 21.0-23.5 | 12 | 137 | 9.9 | 127-156 | 11 |
| 3 Mitchell Plateau | 22.2 | 0.45 | 22.0-23.0 | 5 | 132 | 3.4 | 127-135 | 5 | 21.6 | 1.04 | 20.8-23.3 | 5 | 127 | 12.4 | 112-145 | 5 |
| 4 Prince Regent | 21.7 | 0.58 | 21.0-22.0 | 3 | 137 | 3.1 | 134-140 | 3 | 21.6 | 0.55 | 21.0-21.9 | 3 | 141 | 18.5 | 120-155 | 3 |
| 5 Yampi Peninsula | 21.9 | 0.74 | 21.5-23.0 | 5 | 138 | 5.0 | 132-148 | 5 | 21.9 | 0.67 | 21.0-22.5 | 4 | 157 | 7.6 | 150-165 | 3 |
| 6 Napier Downs | 21.7 | 0.72 | 20.5-23.0 | 15 | 136 | 2.3 | 132-140 | 15 | 23.8 | 0.99 | 22.0-25.5 | 16 | 144 | 13.3 | 128-185 | 16 |
| 7 King Leopold Range | 22.2 | 0.99 | 21.0-24.5 | 24 | 136 | 3.3 | 131-143 | 23 | 22.9 | 0.98 | 21.0-23.5 | 24 | 140 | 12.8 | 120-163 | 22 |
| 8 Joint Hill | 21.8 | 1.19 | 20.5-23.0 | 4 | 136 | 2.9 | 130-137 | 4 | 20.7 | 1.53 | 19.0-22.0 | 3 | 152 | 24.0 | 135-169 | 2 |
| 9 Mt Barnett | 21.8 | 0.98 | 20.0-23.2 | 18 | 137 | 3.9 | 131-145 | 18 | 22.8 | 0.94 | 21.0-24.5 | 18 | 146 | 10.1 | 135-169 | 18 |
| 10 Durack Range | 21.7 | 1.56 | 19.0-24.0 | 9 | 134 | 2.1 | 132-137 | 9 | 21.0 | 1.24 | 19.0-23.0 | 9 | 127 | 12.6 | 115-145 | 8 |
| 11 Wyndham | 21.6 | 1.20 | 20.0-23.5 | 6 | 134 | 5.0 | 128-141 | 6 | 21.7 | 0.52 | 21.0-22.0 | 6 | 136 | 16.9 | 110-155 | 5 |
| 12 Kununurra | 21.1 | 0.97 | 19.5-23.0 | 23 | 132 | 3.6 | 122-136 | 25 | 21.8 | 0.79 | 20.6-23.0 | 24 | 129 | 11.5 | 105-151 | 22 |
| 13 Spencer Range | 20.7 | 0.87 | 19.5-22.5 | 13 | 130 | 4.2 | 122-136 | 14 | 22.0 | 1.07 | 20.5-24.0 | 14 | 127 | 7.2 | 117-141 | 14 |
| 14 Jasper Gorge | 21.1 | 0.56 | 20.3-22.0 | 10 | 130 | 2.8 | 125-133 | 10 | 21.4 | 0.69 | 20.5-22.5 | 10 | 113 | 6.8 | 105-123 | 10 |
| 15 Victoria River District | 20.5 | 0.78 | 19.0-22.2 | 21 | 130 | 2.8 | 124-134 | 21 | 21.2 | 0.62 | 20.5-22.5 | 20 | 119 | 9.2 | 103-142 | 20 |
| 16 Dee River | 21.0 | 0.62 | 19.9-21.9 | 13 | 135 | 2.9 | 130-140 | 14 | 22.0 | 0.64 | 20.9-23.3 | 14 | 134 | 8.6 | 120-146 | 14 |
| Chestnut-quilled | | | | | | | | | | | | | | | | |
| 17 Katherine Gorge | 21.2 | 1.06 | 20.0-22.0 | 3 | 141 | 5.0 | 136-146 | 3 | 22.8 | 0.58 | 22.5-23.5 | 3 | 148 | 16.1 | 136-166 | 3 |
| 18 UDP Falls | 22.0 | 0.55 | 21.4-23.0 | 12 | 144 | 4.3 | 137-154 | 14 | 23.7 | 0.70 | 22.5-25.0 | 14 | 160 | 14.0 | 130-174 | 14 |
| 19 Nourlangie | 21.6 | 0.85 | 20.5-23.0 | 11 | 143 | 4.2 | 136-149 | 11 | 23.5 | 0.77 | 22.5-24.5 | 11 | 159 | 18.3 | 130-194 | 11 |
| 20 Mt Brockman | 21.6 | 0.89 | 20.3-23.4 | 28 | 144 | 3.6 | 139-151 | 29 | 23.5 | 1.09 | 20.0-25.0 | 26 | 161 | 11.4 | 137-186 | 29 |

(Localities combined as in Table 1)

APPENDIX

Body colour and size of the wing patch of White-quilled Rock Pigeons

| Locality | Back Colour | | | | Belly Colour | | | | Index I ₁ | | | | Wing Patch | | | | Index I ₂ | | | |
|----------------------------|----------------|----------------|--------------------|----|----------------|----------------|--------------------|----|----------------------|------|-------------|----|------------|------|-----------|----|----------------------|---|-------|---|
| | x ¹ | S ¹ | Range ² | N | x ¹ | S ¹ | Range ² | N | x | S | Range | N | x | S | Range | N | x | S | Range | N |
| 1 Theda | 0.69 | 0.16 | 2-3 | 8 | 0.40 | 0.44 | 1-3 | 8 | | | | | | | | | | | | |
| 2 Kalumburu | 0.69 | 0.18 | 2-3 | 11 | 0.68 | 0.45 | 1-3 | 11 | 20.44 | 3.04 | 14.93-26.25 | 11 | 1.46 | 1.23 | 0-3.37 | 11 | | | | |
| 3 Mitchell Plateau | 0.72 | 0.20 | 2-3 | 5 | 0.44 | 0.40 | 1-2 | 5 | | | | | | | | | | | | |
| 4 Prince Regent | 0.92 | 0.25 | 2-3 | 3 | 0.83 | 0.17 | 2-3 | 3 | | | | | | | | | | | | |
| 5 Yampi Peninsula | 1.23 | 0.22 | 3-4 | 5 | 0.97 | 0.13 | 2-3 | 5 | | | | | | | | | | | | |
| 6 Napier Downs | 1.42 | 0.14 | 3-4 | 16 | 0.99 | 0.10 | 2-3 | 16 | 27.73 | 4.38 | 19.62-37.29 | 16 | 1.86 | 1.58 | 0-4.02 | 16 | | | | |
| 7 King Leopold Range | 1.49 | 0.24 | 2-5 | 24 | 0.99 | 0.27 | 2-4 | 24 | 27.66 | 2.05 | 24.70-31.11 | 12 | 1.89 | 2.22 | 0-7.42 | 12 | | | | |
| 8 Joint Hill | 1.07 | 0 | 3 | 4 | 0.88 | 0.17 | 2-3 | 4 | | | | | | | | | | | | |
| 9 Mt Barnett | 1.09 | 0.17 | 2-4 | 18 | 0.76 | 0.10 | 2-3 | 18 | 23.71 | 2.42 | 20.41-27.79 | 16 | 1.78 | 1.72 | 0-4.31 | 16 | | | | |
| 10 Durack Range | 1.90 | 0.41 | 4-6 | 9 | 1.01 | 0.42 | 2-4 | 9 | | | | | | | | | | | | |
| 11 Wyndham | 1.76 | 0.23 | 4-5 | 6 | 1.05 | 0.51 | 2-4 | 6 | | | | | | | | | | | | |
| 12 Kununurra | 1.95 | 0.26 | 4-6 | 23 | 1.59 | 0.54 | 3-4 | 23 | 25.40 | 3.64 | 19.20-32.45 | 15 | 2.62 | 1.54 | 1.46-6.74 | 15 | | | | |
| 13 Spencer Range | 1.24 | 0.21 | 3-4 | 14 | 1.01 | 0.08 | 2-3 | 14 | 23.40 | 4.89 | 14.01-29.20 | 13 | 2.82 | 2.44 | 0-7.82 | 13 | | | | |
| 14 Jasper Gorge | 2.48 | 0.20 | 5-6 | 10 | 1.75 | 0.49 | 3-4 | 10 | 0 | 0 | 0 | 10 | 1.55 | 2.35 | 0-6.04 | 10 | | | | |
| 15 Victoria River District | 2.21 | 0.32 | 5-6 | 21 | 1.72 | 0.50 | 3-4 | 21 | 0.33 | 1.53 | 0-6.99 | 21 | 3.04 | 3.95 | 0-12.97 | 21 | | | | |
| 16 Dee River | 1.47 | 0.17 | 3-5 | 14 | 1.45 | 0.55 | 2-4 | 14 | 27.62 | 4.08 | 20.77-32.60 | 9 | 0.45 | 0.70 | 0-2.02 | 9 | | | | |

(Localities combined as in Table 1)

¹ Calculated after conversion of scores to normal deviates.

² Actual scores.

REFERENCES

- DAHL, K. (1926)—*In savage Australia*. London: Phillip Allan.
- FISHER, R.A. & YATES, F. (1970)—*Statistical tables for biological, agricultural and medical research*. 6th ed. Edinburgh: Oliver & Boyd.
- GOODWIN, D. (1969)—A new subspecies of the White-quilled Rock Pigeon. *Bull. Br. orn. Cl.* 89: 131-133.
- GOULD, J. (1841)—New species of Australian birds. *Proc. zool. Soc. Lond.* 1840: 169-178.
- GOULD, J. (1843)—*Birds of Australia*, Vol. 5, pt. 10. London.
- MATHEWS, G.M. (1912)—Additions and corrections to my reference list to the birds of Australia. *Aust. avian Rec.* 1: 28.
- MEYER DE SCHAUENSEE, R. (1957)—On some avian types, principally Gould's, in the collection of the Academy. *Proc. Acad. nat. Sci. Philad.* 109: 123-246.
- PARKER, S.A. (1968)—The type-locality of White-quilled Rock-pigeon *Petrophassa albipennis* Gould. *Bull. Br. Mus. nat. Hist. (Zool.)* 88: 57-58.
- SMITHE, F.B. (1974)—*Naturalist's color guide*. New York: American Museum of Natural History.
- WHITTELL, H.M. (1954)—*The literature of Australian birds*. Perth: Paterson Brokensha.