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MEASUREMENTS OF THE NOISY PITTA *Pitta versicolor* IN AUSTRALIA

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Measurements of the wing, tail, tarsus and culmen of the Noisy Pitta *Pitta versicolor* show no sexual dimorphism but significant latitudinal increases, southwards from Cape York Peninsula. This follows Bergmann's Rule. These geographic differences, and the lack of any seasonal differences, suggest that there is no extensive north-south movement of Noisy Pittas in the southern parts of their range.

INTRODUCTION

The Noisy Pitta *Pitta versicolor* is widespread in eastern Australia from Cape York Peninsula to northern New South Wales, with some records as far south as Sydney (Blakers *et al.* 1984). It was initially described from Australasia by Swainson (1825), later restricted to 'New South Wales' although the exact type locality is unknown. Gould (1868) described a smaller subspecies *P. v. simillima* from Cape York Peninsula and Mathews (1912) described a third subspecies, *P. v. intermedia*, intermediate in size between *P. v. versicolor* and *P. v. simillima* from Bellenden Ker, Queensland. More recently Storr (1984) recognized only *P. v. versicolor* and *P. v. simillima*, lumping *P. v. intermedia* with the nominate form, and MacDonald (1973) recognized no subspecies.

The original descriptions gave few measurements of the birds and this study is the first attempt to analyse measurements of the Noisy Pitta for sexual and geographic variation.

METHODS

Specimens of Noisy Pitta were assembled from museums in Australia (see Acknowledgments) and measured using standard procedures (Spencer 1984) and including the length from the rostral margin of the nare to the tip of the bill. Specimens with immature plumage were excluded from the sample and four specimens with damaged bills had to be excluded from the culmen and nare-to-tip measurements (Table 1). No transformations were made to the data. The sex of each bird, as recorded on the museum labels, was noted. The latitude of each specimen was recorded and each was then allocated to one of four regions: **A**: 10°00′ to 14°59′ (Cape York Peninsula); **B**: 15°00′ to 19°59′ (Cooktown to Townsville); **C**: 20°00′ to 24°59′ (Mackay to Bundaberg); **D**: 25°00′ to 29°59′ (Gympie to northern New South Wales). The distribution of specimens along this latitudinal range showed some clumping but was reasonably even with only three of the 21 one degree blocks lacking specimens and these three were in regions **A**, **B** and **C** respectively. The date of collection of each specimen was allocated to two categories: breeding season (October–March, n = 42) and the non-breeding season (April–September, n = 38) (MacDonald 1973; Woodall unpubl. data).

Analysis of the data was initially conducted using Multivariate Analysis of Variance (MANOVA) (with sex, season and region as independent variables, excluding specimens with no sex, date or locality recorded) followed by *post hoc* Newman-Keuls and Scheffe tests on pairs of regions (including unsexed and undated specimens) (Sokal and Rohlf 1981).

RESULTS

The MANOVA showed no significant effect of sex for any measurement ($P > 0.16$) and in most cases the interactions between sex, season and region were not significant ($P > 0.05$), exceptions being interactions between sex and region; and sex, season and region for tarsus length which were just significant ($P = 0.049$ for both).

There were highly significant effects for all measurements caused by region ($P < 0.0001$). When these were plotted it was clear that there was a general increase in size from north to south (Fig. 1). The nature of these differences was not always consistent between variables, thus regions **A** and **B** were significantly different for all measurements except culmen and nare-to-tip; regions **B** and **C** were significantly different for all

TABLE 1

Morphometrics of the Noisy Pitta in Australia.

Variable	Sex		Region				n
	Male	Female	A	B	C	D	
Sample size	53	36	25	24	10	46	
Wing Length	122.4 (5.14)	122.6 (4.91)	116.6 (3.37)	122.4 (2.81)	123.6 (2.63)	126.8 (2.69)	105
	n.s.		***	n.s	**		
Tail Length	45.2 (4.37)	46.9 (4.51)	41.0 (3.17)	44.4 (1.97)	47.5 (3.21)	49.8 (2.60)	105
	n.s		**	*	*		
Tarsus Length	43.9 (2.98)	43.7 (2.52)	41.1 (2.05)	43.4 (2.17)	46.4 (2.22)	45.3 (1.93)	105
	n.s.		**	**	n.s.		
Culmen Length	29.9 (2.21)	29.5 (2.29)	28.3 (1.36)	28.4 (1.29)	31.7 (1.06)	31.0 (1.96)	101
	n.s.		n.s.	***	n.s.		
Nare-Tip Length	18.8 (1.83)	19.1 (1.72)	17.6 (1.39)	17.8 (1.10)	20.0 (1.41)	20.6 (1.23)	101
	n.s.		n.s.	***	n.s.		

Data presented as mean and (standard deviation), sexes combined for regional data. Differences between sexes and regions indicated as: n.s.(not significant) = $P > 0.05$; * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$.

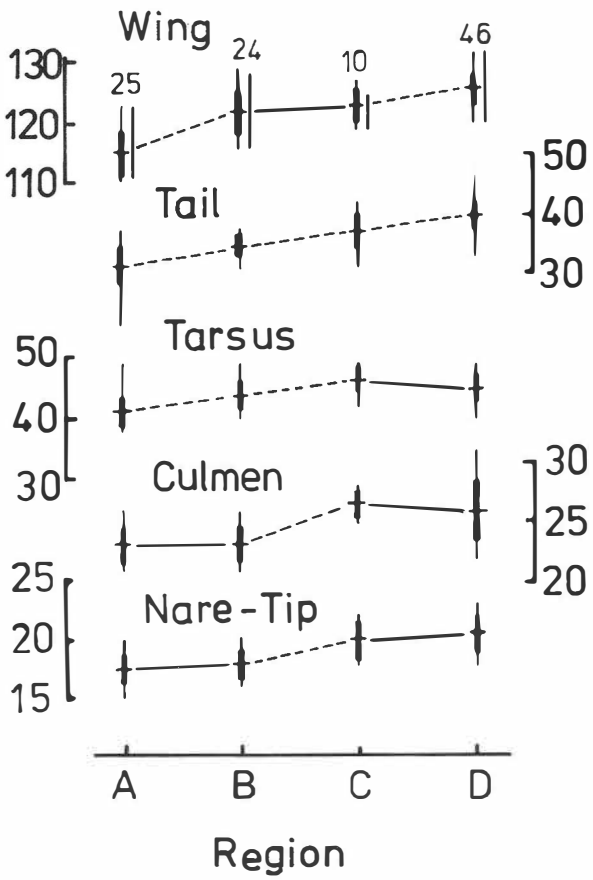

Figure 1. *Geographical variation in measurements of the Noisy Pitta in Australia. The regions, A to D correspond to 5-degree differences of latitude: A (10°00' to 14°59'); B (15°00' to 19°59'); C (20°00' to 24°59'); D (25°00' to 29°59'). Measurements from regions connected by a solid line are not significantly different (P > 0.05) while those connected by a broken line are significantly different (P < 0.05). Horizontal lines indicate the mean, thin vertical lines the range and thick vertical lines ± 1 standard deviation. Superscripts indicate the sample size for each region. For the wing, the range for summer measurements (October-March)is also given.*

measurements except wing length; and regions C and D were significantly different for wing and tail lengths but not for the other variables.

Some measurements showed a wide scatter (e.g. wing length in Region A — Fig. 1) and it was possible that this might be caused by the seasonal movement of birds from other regions. However, the MANOVA showed no significant effects of season for any measurement ($P > 0.05$) nor any significant interaction between region and season.

DISCUSSION

This study has shown that there is no sexual dimorphism in the measurements of the Noisy Pitta but that there are significant differences associated with locality. Generally size increases southward but there is not always a regular change in size between regions for each variable.

This variation is probably best considered as a latitudinal cline but if subspecies are recognized then the three currently described (A = *simillima*, B = *intermedia*, D = *versicolor*) all show significant differences, in at least some variables, between each other. If more specimens were available from region C it is likely that it too would show more significant differences from region D. The initial descriptions were largely based on size: *P. v. simillima* — 'smaller size and having the under surface a deeper buff' (Gould 1868); *P. v. intermedia* — 'intermediate in size between *P. v. versicolor* and *P. v. simillima*, and differing from the preceeding in its lighter undersurface and brighter red on the under tail-coverts and thighs, and the paler cap' (Mathews 1911).

Mathews (1919–20) later wrote "I still consider the three subspecies should be accepted, the differences in size being appreciable though there is little variation in colouring" and MacDonald (1973) recognized no subspecies since the described races "did not seem to be clearly defined; northern birds may be slightly smaller".

Bergmann's Rule states that, in polytypic species, body size tends to be larger in cooler parts of the total range (Campbell and Lack 1985). A study of body size in the Singing Honeyeater *Lichenostomus virescens* (Wooller *et al.* 1985) showed that it conformed to Bergmann's Rule but there has been criticism of the rule (Zink and Remsen 1986; Geist 1987) with the suggestion that humidity should be considered together with temperature (James 1968, 1970). For example, Aldrich and James (1991) found that the smallest American Robins *Turdus migratorius* were in warm, humid areas and the largest in cool dry ones. The results for the Noisy Pitta follow this pattern but it is not possible to separate the effects of temperature and humidity. Allen's Rule that extremities, particularly the bill, are longer in warmer parts of the range (Campbell and Lack 1985) is not supported.

Some Noisy Pittas make seasonal movements, with those in the north probably crossing the Torres Strait to Papua New Guinea (Draffen *et al.* 1983; Coates 1990). Southern birds also seem to have seasonal movements with a peak of reports from non-forest habitats (e.g. residential gardens, creeks, etc.) in April and May (Woodall, unpubl. data). If this also reflected a large-scale northerly migration, one would expect that the morphologial differences between the regions would become diluted and insignificant and that there would be significant seasonal differences in the measurements. The lack of a seasonal component in the variance supports the contrary view that the movement of southern birds is unlikely to extend far up the coast, if at all, and these movements are more likely to be east-west and altitudinal. However, it is acknowledged that limited north-south movements within a region or to adjacent regions may not be detected by this analysis.

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