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Ranging behaviour in the Malayan Peacock Pheasant *Polyplectron malacense* in Peninsular Malaysia

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The Malayan Peacock Pheasant *Polyplectron malacense* is an inhabitant of lowland dipterocarp rainforest in Peninsular Malaysia and it possibly also still survives in southern Thailand (Fuller and Garson 2000). It is classified as Vulnerable owing to rapid population declines (BirdLife International 2004). Little is known of its behaviour and ecology in the wild. Davison (1983) recorded striking differences in the level of calling by males from year to year and suggested that calling activity was related to food availability. The highest level of calling occurred in a year when trees of many families flowered and fruited synchronously, resulting in an abundance of fruit and insects. McGowan (1994) reported high levels of calling in only four months out of 24 in the field over four years, although occasional calls were heard in most months (McGowan 1992). Display scrapes were only maintained during such calling periods. It is believed that only the males call, although females do produce clucks that are audible from a few metres away (personal observation). Males often respond to calls given by another male (Davison 1983), and playback of recorded calls elicited replies from nearby males (McGowan 1992). This suggests that males call to defend territories, presumably when breeding. When not calling, Malayan Peacock Pheasants are very difficult to detect, and it is not known if they remain resident in their territories.

The movement patterns of few Malaysian rainforest vertebrates are known in any detail, owing to the difficulty of collecting appropriate data. Dense vegetation makes visual tracking impossible, leaving radio-tracking as the only way of locating marked animals, e.g. rats *Rattus mülleri, R. tiomanicus* and *Leopoldamys tiomanicus* (Sanderson and Sanderson 1964), Asian elephants *Elephas maximus* (Olivier 1978), Malayan tapir *Tapirus indicus* (Williams 1979) and seladang *Bos gaurus hubbacki* (Conry 1980). There are only two radio-tracking studies of forest birds in Malaysia. Davison (1981) radio-tagged two male Great Argus *Argusianus argus* for five months, and Lambert (1989) tracked six fruit-eating birds of the three canopy-dwelling species for up to seven days each to determine daily ranges and roost locations. Here I describe the ranging behaviour of the Malayan Peacock Pheasant using radio-tracking in tropical rainforest in Peninsular Malaysia.

STUDY AREA AND METHODS

The study was carried out in 2 km^2 of forest adjacent to the Kuala Lompat Ranger Post on the eastern edge of the Krau Wildlife Reserve, Pahang State, Peninsular Malaysia (3°43′N 102°17′E), where up to 11 Malayan Peacock Pheasants had been heard calling in 1980 (Davison 1983). Detailed descriptions of the lowland evergreen dipterocarp forest found at this site are given by Chivers (1980), Bennett (1983) and Lambert (1987). The site is dissected by north–south trails at 150 m intervals, linked by many cross-trails. Fieldwork was conducted during January–August 1988, January–April 1989, November–July 1990 and January–June 1991.

Five Malayan Peacock Pheasants were radio-tracked from May 1988 to February 1989 (juvenile male 1), late February and March 1989 (adult female 1 and adult male 1), December 1989 to July 1990 (adult female 2), and January to July 1990 (adult male 2). Juvenile male 1 was nearly fully grown, although the fully adult plumage had not yet developed. Birds were trapped with leg snares and equipped with single stage transmitters manufactured by Biotrack, Wareham, U.K. The transmitters were attached to the birds with cord necklaces (Kenward 1987, Marcstrom *et. al* 1989), and weighed l0 g, which is less than 3% of the estimated minimum body weight (the maximum proportional weight recommended by Kenward 1987). Signals were detected using a Mariner 57 portable receiver and a 3-element Yagi antenna. Field-testing showed the range of the transmitters to be up to 230 m, with a life span of up to 10 months.

Table 1. Estimates of the area used by each individual in each two-month sampling period.

Individual	Months	No. of radio-locations	Home range (MCP; ha)	Core area (90%PNC; ha)
Adult Female 1	February–March 1989	25	12.9	4.5
Adult Female 2	December 1989–January 1990	18	10.7	3.8
	February–March 1990	60	25.8	9.8
	April–May 1990	51	17.0	9.1
	June–July 1990	12	7.3	6.5
Total		141	30.7	19.0
Mean		15.2±4.1	7.3±1.4	
Juvenile Male 1	April–May 1988	33	10.8	5.6
	June–July 1988	61	15.9	8.6
	April–May 1988	59	15.9	5.2
	October–November 1988	29	14.9	5.4
	December 1988–January 1989	58	28.7	13.1
	February–March 1989	28	17.7	5.9
Total		268	49.8	21.4
Mean		17.3±2.5	7.3±1.3	
Adult Male 1	February–March 1989	28	25.4	11.1
Adult Male 2	December 1989–January 1990	52	37.3	10.6
	February–March 1990	60	42.3	22.6
	April–May 1990	51	37.7	16.5
	June–July 1990	12	32.9	5.9
Total		175	58.3	30.1
Mean		37.5±1.9	13.9±3.6	
Females		14.1±1.1	5.9±1.4	
Males		26.7±5.9	10.8±1.9	
All individuals		21.7±4.5	8.8±1.7	

Each radio-location was obtained by triangulation from at least three mapped positions (Kenward 1987, Mech 1983). The reliability of the triangulation was assessed by determining the convergence of bearings taken. 'Error polygons' (triangles of possible locations of the transmitter; Mech 1983) derived from 72 triangulations between April and August 1988 revealed the longest diagonal (i.e. side of a triangle) to be 52 m, with a mean of 20.8 m. Therefore, the mean maximum error was 10.4 m, based on the assumption that the centre of the error triangle is the best estimate of the bird's real position.

Radio-locations were made during an intensive tracking period each month, during which up to 30 fixes were obtained. The number recorded each month varied between months and so two-month sampling periods were used to estimate home range sizes. Analyses were carried out using the software package RANGES IV (Kenward 1990). The total area used during each two-month period was given by Minimum Convex Polygons (MCP: the total area defined by the outermost fixes). Core areas were calculated using the 90% outline defined by the contouring technique of Polynuclear Clusters (PNC; Harris *et al.* 1990, Kenward 1987, 1992). Means are presented±1 S.E.

RESULTS

There was considerable variation within and between the five birds in their ranging behaviour (Table 1; Fig. 1). The mean home range within a two-month sampling period was 21.7±4.5 ha (range: 7.3–42.3 ha), averaging 14.1±1.1 for females and 26.7±5.9 for males. The mean core area was 8.8±1.7 ha. The data suggest that males may have larger ranges than females, but the sample size precludes any test for statistical significance.

Three birds tracked for more than one sampling period offered the opportunity to examine longer-term ranging behaviour. The mean home range overlap between successive sampling periods was 51% (range: 11–89%, n=6 periods) for juvenile male 1, 61% (11–89%, n=4) for adult female 2, and 77% (66–91%, n=4) for adult male 2. However, the total area used by each individual was largely a function of the number of months for which individuals were tracked, because they continued to use new areas in successive sampling periods.

Only two individuals made use of the same areas of forest at the same time: the home range of adult male 2 was overlapped by 99–100% of the home range of adult female 2 during December 1989–May 1990, but the overlap fell to 28.3% in June–July 1990.

DISCUSSION

The five Malaysian Peacock Pheasants were largely sedentary, although home ranges shifted slightly over time. This indicates that they remain within their territories even when not calling, and therefore, when presumed not to be breeding. Other estimates of home range size for pheasants in their native habitats are

1.1–6.2 ha for two male Great Argus (Davison 1981) and 3.7–23.3 ha for three Cabot's Tragopan *Tragopan caboti* (Young *et. al* 1991). Both of these estimates are smaller that those presented here for Malayan Peacock Pheasant.

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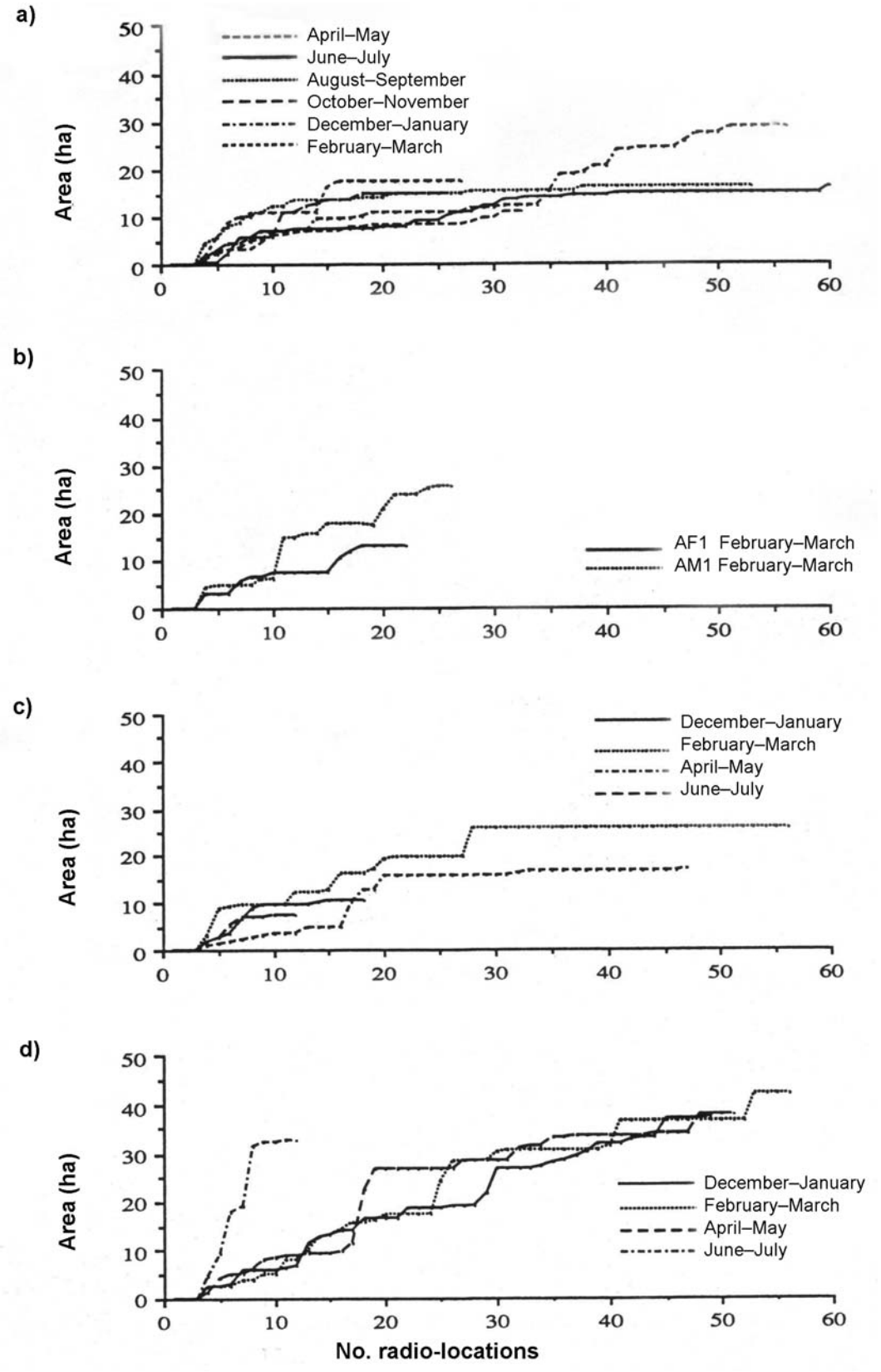

Figure 1. Cumulative range sizes calculated for each two-month sampling period for: (a) juvenile male 1; (b) adult female 1 (AF1) and adult male 1 (AM1); (c) adult female 2; (d) adult male 2.

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First record of Red-throated Diver *Gavia stellata* for Nepal

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We describe a winter-plumaged Red-throated Diver *Gavia stellata* (use of 'Diver' rather than 'Loon' follows author's preference) that was present on Koshi Barrage, Nepal on at least 15–25 February 2002. This sighting, which has been accepted by the Nepal Rare Birds Committee, constitutes the first record of the species for Nepal and only the second for the Indian subcontinent.

The Koshi Barrage (26°20′N 86°46′E, 65 m) is well known as an important site for wintering waterbirds in Nepal (Inskipp and Inskipp 1991). Unfortunately it is presently facing increasing disturbance from the expanding human population, and threats from overfishing and hunting are growing (Inskipp and Inskipp 2001). Nevertheless, it remains a fixed point on the itineraries of most birdwatching groups that visit Nepal and its avifauna is correspondingly well documented. Over 460 species of bird have been recorded from the area (Baral 2000).

In February 2002, SA was with a group of British birdwatchers visiting Nepal, with DG as a local guide. The group spent the afternoon of 15 February on the embankment north of the Barrage on the east side of the Koshi river. The weather was hot and cloudless and there was no noticeable wind. The visibility was good: the embankment is well raised (water levels were comparatively low in the winter of 2001–2002) and so there was relatively little haze despite the heat. Many