

The status of Gurney's Pitta *Pitta gurneyi*, 1987–1989

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Summary

Fieldwork aimed at censusing Gurney's Pitta *Pitta gurneyi* in Peninsular Thailand was carried out over three field seasons. Fourteen sites were surveyed, at four of which the species was found. The main site (where it had been rediscovered in 1986) held 24–34 pairs, 12–18 of which were in the 500 ha study area. A second site held 3–6 pairs (but it is thought unlikely that this population still exists today), whilst the other two sites held only two pairs each and were thought to have negligible chances of survival. All territories were in semi-evergreen rainforest, below 150 m altitude. The current population is probably some 20–30 pairs, with territories still being lost annually to deforestation. This is currently the total known world population; it is possible that the species may survive in southern Burma, but no recent surveys have been undertaken there. Furthermore, massive deforestation caused by Thai timber companies has been reported from Burma during 1988–1993. The interpretation of census results are discussed, particularly with reference to social organization and calling seasonality. The determined protection of the one remaining site supporting a viable population will be essential if the species is to survive into the next century.

Introduction

Gurney's Pitta *Pitta gurneyi* is the only bird species with a range restricted to southern Thailand and possibly adjacent parts of Burma. Having been encountered regularly up to the 1920s it was only recorded twice thereafter, in 1936 and 1952, until it was rediscovered in 1986 at Khao Nor Chuchi, a surviving area of lowland forest in Krabi province, Thailand. The history of Gurney's Pitta and the story of its rediscovery are detailed in Collar *et al.* (1986) and Round and Treesucon (1986) respectively. As well as having such a restricted distribution, Gurney's Pitta also appears to have very specific habitat requirements, with almost all records coming from semi-evergreen rainforest below 150 m altitude. Since this is the most easily accessible forest type to man, it has suffered widespread clearance, with less than 4.7% of the estimated original area remaining in Peninsular Thailand (Round 1988). The discovery of a single breeding pair in June 1986 generated considerable interest and publicity (e.g. Round 1987), and led to plans for further surveys of the species, which are reported here.

This paper describes the results of censuses during the breeding season in the three years following the rediscovery. These efforts were coordinated by the then Center for Wildlife Research, Mahidol University, Bangkok (CWR) and

the then International Council for Bird Preservation (ICBP). The aim of these surveys was to establish how many Gurney's Pittas survived at the site of rediscovery and whether the species was still present at other sites in southern Thailand. Since the surveys were carried out with limited funds, often by volunteer fieldworkers, the level of coverage varied from year to year. A major CWR/ICBP project to conserve Gurney's Pitta and the lowland forest on which it depends began in March 1990 and is due to continue until at least March 1994. Where relevant, information on the number of Gurney's Pittas from this period is given, but no attempt is made to describe the project in detail. Political constraints unfortunately prevented any assessment of the status of the species in Burma. Observations of the species's breeding biology and habitat requirements will be presented elsewhere (Gretton in prep., Lansdown and Pankhurst in prep.).

Methods

In both 1987 and 1988 efforts were divided between carrying out detailed surveys at Khao Nor Chuchi and checking other lowland forest areas where it was thought Gurney's Pitta might still survive (Figure 1). In 1989 work was restricted to Khao Nor Chuchi. The main study area at Khao Nor Chuchi, near the village of Bang Tiew, has been described by Round and Treesucon (1986) and will be described in more detail elsewhere (Gretton in prep., Lansdown and Pankhurst in prep.). The site was gazetted as Khao Pra-Bang Khram Non-Hunting Area in October 1987, and will be referred to as such hereafter. Other sites worthy of survey were identified by considering the historical distribution of the species (as detailed by Collar *et al.* 1986) and the present distribution of lowland forest in Peninsular Thailand (data from P. D. Round verbally and Round 1988). The level of observer effort involved in these surveys is summarized in Table 1, whilst the individual observers are listed in the acknowledgements.

Very few species of pitta have been studied in detail, and in 1987 very little had been published on pitta survey methods. Pittas, ground-dwelling forest birds, are mostly extremely wary and are more often heard than seen. A tape-recording was available of Gurney's two most frequent vocalizations, to familiarize observers with these calls. The survey technique used was to move slowly along forest trails, listening for any Gurney's Pitta calls, or for any disturbance of the leaf-litter. In sites where the species was not known to be present, playback tapes were used, but their use was generally avoided within the study area at Khao Pra-Bang Khram. If a pitta was heard a full record was made of the location, time and type of call, and an effort was made to see the bird. This was often difficult, as calling birds would usually fall silent if approached to within 20–30 m. If a bird was sighted it would be followed for as long as possible and full details recorded of its behaviour and movements. On five occasions in 1987 individuals were followed for over two hours, but observations were usually of much shorter duration. All contacts were plotted on 1:5,000 scale maps.

Nests were located by searching in areas where the activity of adult birds was concentrated or in apparently suitable habitats. Occasionally nests were reported by local people, and these accounts were then followed up. Once nests were confirmed as belonging to Gurney's Pitta, measurements were taken of

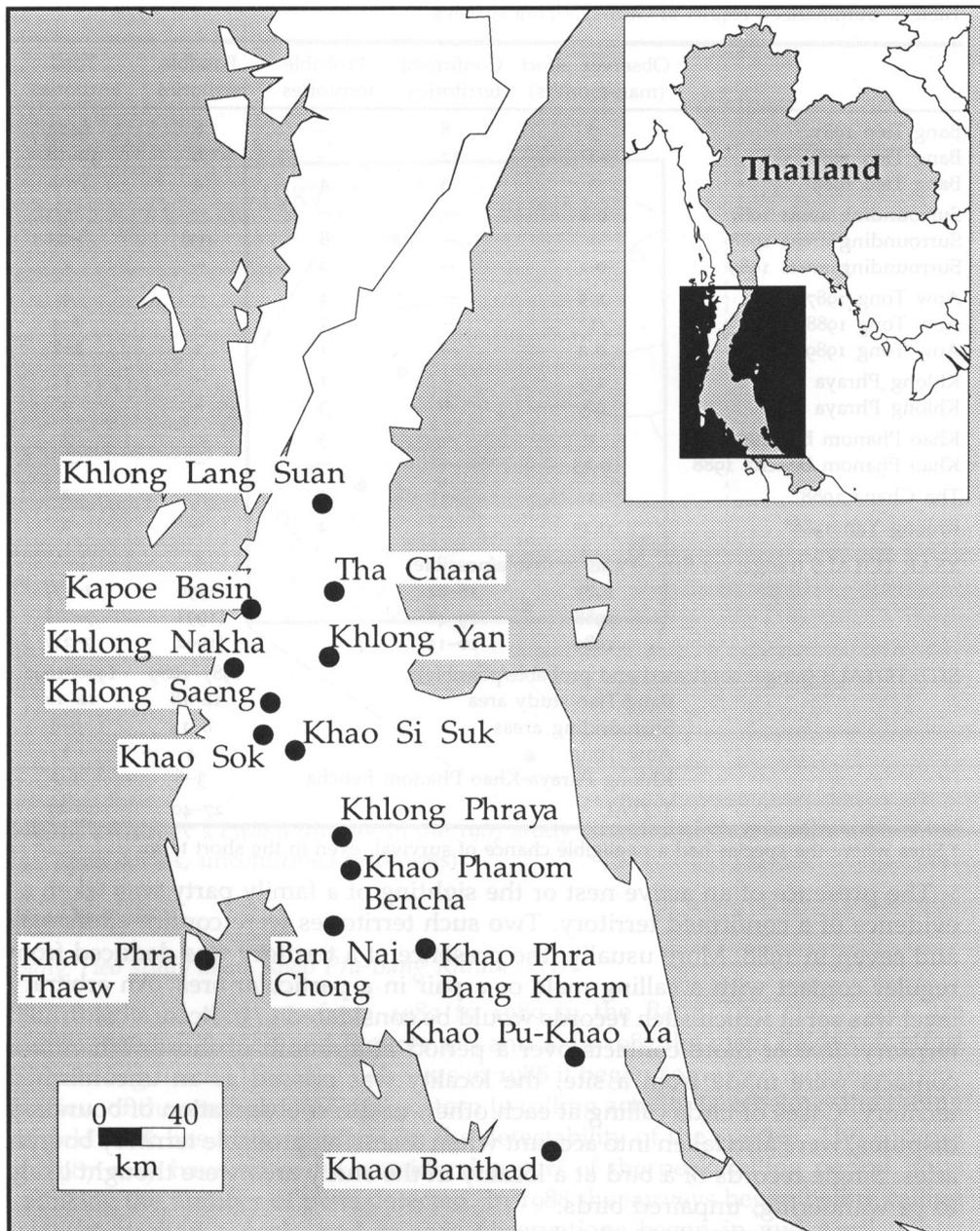


Figure 1. Sites surveyed for Gurney's Pitta.

each and its height above ground and aspect; details of the surrounding areas were also recorded. In 1987 two nests were observed for extended periods, providing a large amount of information on breeding biology (Gretton in prep.). Such observations were not carried out in the following two years, when the emphasis was placed on wider surveys and detailed habitat assessment.

Table 1. Summarized results of Gurney's Pitta surveys

	Observer effort (man-months)	Confirmed territories	Probable territories	Possible territories	Total territories
Bang Tiew 1987	7	8	—	6	8–14
Bang Tiew 1988	11	12	—	6	12–18
Bang Tiew 1989	3	3	4	4	7–11
Surrounding areas 1987	0.2	—	—	—	—
Surrounding areas 1988	1	—	8	4(7)	8–12
Surrounding areas 1989	0.2	—	2	—	2
Aow Tong 1987	1.5	—	4	—	4
Aow Tong 1988	1	—	2	2	2–4
Aow Tong 1989	0.2	—	1	1	1–2
Khlong Phraya 1987	1.5	—	1	—	1
Khlong Phraya 1988	0.5	—	3	—	3
Khao Phanom Bencha 1987	1	—	3	—	3
Khao Phanom Bencha 1988	0.25	—	—	—	—
Tha Chana 1988*	1	—	2	—	2
Khlong Yan 1988*	0.25	—	2	—	2
YEAR TOTALS (range: confirmed and probable/possible)					
	1987	16–22		(1990	13–17)
	1988	29–41		(1991	7–11)
	1989	10–15		(1992	7–21)
SITE TOTALS (range: confirmed and probable/possible)				1987–1989	1990–1992
	Bang Tiew study area			12–18	12–16
	Surrounding areas			8–12	6–8
	Aow Tong			4	1
	Khlong Phraya-Khao Phanom Bencha			3–6	1–2
	TOTAL			27–40	20–27

* Sites where the species had a negligible chance of survival, even in the short term.

The presence of an active nest or the sighting of a family party was taken as evidence of a confirmed territory. Two such territories were confirmed in 1987 and seven in 1988. More usually, the presence of a territory was deduced from regular contact with a calling male or a pair in a particular area. An arbitrary level was set at which such records would be considered to indicate a confirmed territory: five or more contacts over a period of a month or more. Where 2–4 contacts were made from a site, the locality was classed as an unconfirmed territory. Cases of birds calling at each other, or direct observation of boundary disputes, were also taken into account when assessing probable territory boundaries. Single records of a bird at a locality in the study area were thought likely to be wandering, unpaired birds.

Away from the study area, where observer coverage was at a much lower level, rather different criteria had to be used. In cases where observers were only present at a site for one or two days, a single record of a calling male would be assumed to indicate the presence of a probable territory. Whilst it is possible that some very quiet territories may have been missed in the study area (or classed as "unconfirmed"), it is clear that some level does have to be set for territory designation. Whatever the precise point this level is set at, it is essential that the results are comparable from year to year, in order to assess whether any population changes are occurring.

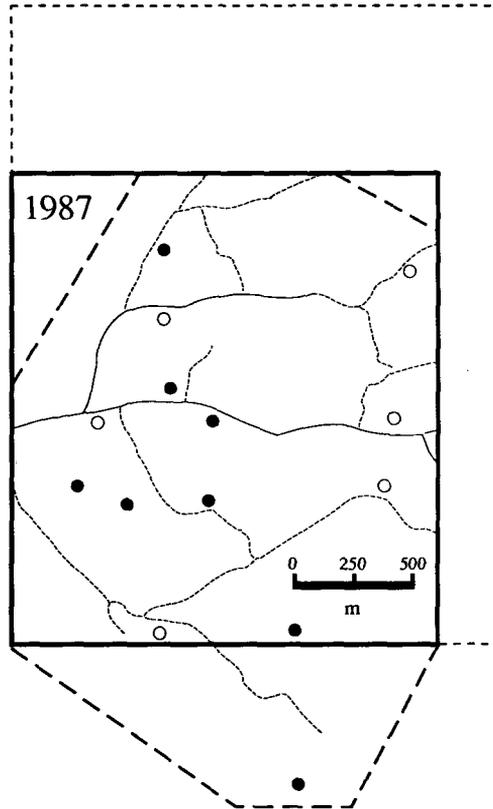


Figure 2. Gurney's Pitta territories in the 1987 study area (full circles, confirmed territories; open circles, unconfirmed territories).

Results

Bang Tiew study area, Khao Pra-Bang Khram NHA

The results of censuses from 1987 to 1989 in the Bang Tiew study area are summarized in Table 1 and Figures 2, 3 and 4. In 1987 the main fieldwork effort did not begin until late May, whereas in 1988 it began some two months earlier. In view of the strongly seasonal pattern to calling activity (see below) the timing of fieldwork has a strong effect on the detectability of the species. The surveys in 1987 may have missed a considerable part of the peak calling period, thus reducing the number of pairs detected. In 1988 the surveys began before calling activity reached a peak, and in 1989 observations began in mid-April, when peak calling would be expected. Census effort was also affected by commitment to other project activities, notably intensive nest-watching in 1987 (from mid-July) and habitat assessment in 1988.

The study area in 1987 was 300 ha, but was enlarged the following year to 500 ha. A core study area of 250 ha was covered in both years, allowing direct comparisons between these two seasons (Figures 2 and 3). In this core area there were seven confirmed territories in 1987 and nine in 1988. In both these years there were six unconfirmed territories in the core area (only two of which

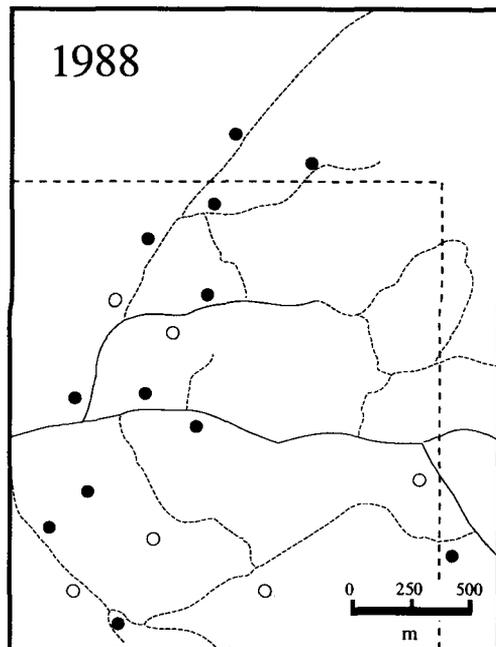


Figure 3. Gurney's Pitta territories in the 1988 study area (full circles, confirmed territories; open circles, unconfirmed territories).

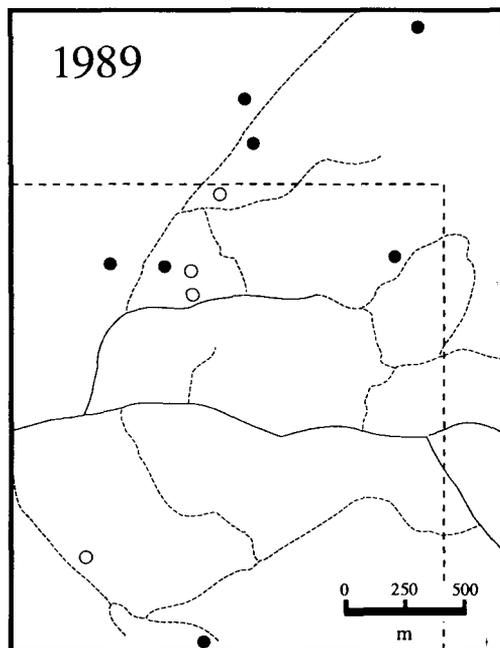


Figure 4. Gurney's Pitta territories in the 1989 study area (full circles, confirmed territories; open circles, unconfirmed territories).

remained the same between the two years). In 1987 there was one further confirmed territory outside the 250 ha core area, giving a total of 8–14 territories. There were three further confirmed territories (outside the 250 ha core) in 1988, taking the total for the 500 ha study area to 12–18 territories.

In 1989 there was lower observer coverage and the rainfall in April had been unusually low, perhaps delaying the start of the breeding season. This resulted in only three territories being fully confirmed, from the same (500 ha) study area as 1988, but there were four additional probable territories (taking into account the lower survey effort in 1989). A further four possible territories were also recorded, giving a maximum total of 11 territories (Figure 4 and Table 1). Considering the lower observer coverage in this year, the results are not inconsistent with the situation in the preceding two years. With the exception of one of the unconfirmed 1987 territories (confirmed in 1989), which was at an altitude of 130 m, and the northernmost 1989 territory at *c.* 150 m, all territories in the study area were below the 100 m contour.

The surroundings of the Bang Tiew study area

Surveys in the surroundings of the study area were greatly influenced by the level of observer coverage in each year, with little such survey work being carried out in 1987 or 1989. In each of these years reports of Gurney's Pitta near the village of Bang Tiew were followed up. No records resulted in 1987, but in 1989 (30 May–1 June) contact was made with at least two calling males and probably one female in an area west of the village. In 1988, however, the higher number of observers present allowed more widespread surveys, resulting in greater numbers of records (Figure 5). Calling males were heard at a total of 15 locations in the surroundings of the study area in 1988. Five of these sites were in or close to the village of Bang Tiew, whilst the remaining ten sites were to the south and east of the study area (Figure 5). Four of these sites were a little above the 100 m contour, and two others were on or close to it.

The interpretation of the 1988 results is problematic. Because of the large area involved, it was often not feasible to carry out repeat visits to the sites where calling males were heard, and thus several of these records are based on the presence of a calling male on a single occasion. Whilst in some cases a territory-holding pair may have been present, in others it is possible that the calling was by single, wandering males, or even a single territory-holding male, perhaps ranging some way from the core of its territory. Surveyors were not able to follow up these records in 1989, and therefore the exact status of Gurney's Pitta around the Bang Tiew study area remained unclear.

Some useful comparisons can be made, however, with surveys carried out in March and April 1992 by Y. Meekeow and J.P. for the ICBP/Center for Conservation Biology Lowland Forest Project (map on file at the BirdLife International Secretariat). These surveys located Gurney's Pitta at eight separate sites to the south and west of the study area (at seven of which females were seen). Three of these locations corresponded to 1988 sites, whilst four were in areas not surveyed in 1988. Thus in both 1988 and 1992 a significant number of territories were located away from the study area, some in very degraded and fragmented forest.

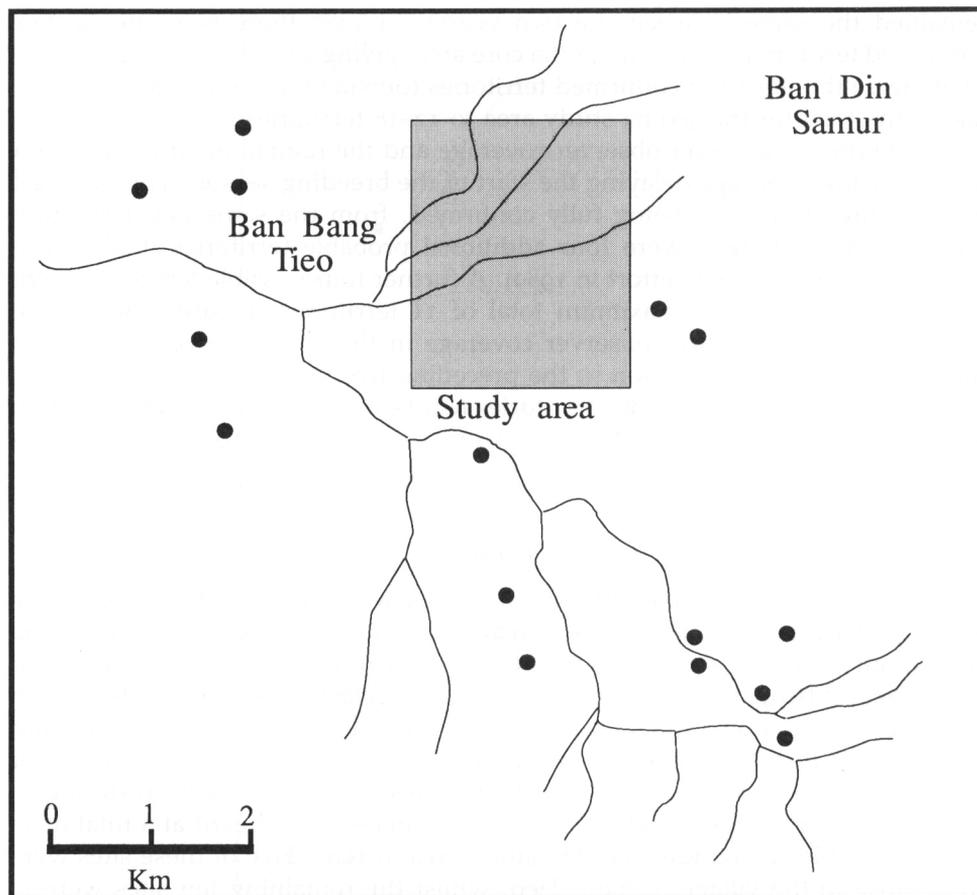


Figure 5. Location of Gurney's Pitta territories in the surroundings of the Bang Tiao study area.

At the most pessimistic, all the 1988 records (around the Bang Tiao study area) could have come from some five pairs plus wandering males, whilst at the other extreme it is conceivable that each calling male represented a breeding pair. In reality the situation is likely to lie between these two, with perhaps 8–12 pairs holding territories around the study area. Even at the lower end of this range the importance of these areas is confirmed; in 1988 they supported over 25% of all known Gurney's Pittas, with at least eight pairs out of a total of at least 29 pairs (Table 1). Several of these sites, particularly those close to the village, are however highly vulnerable to development.

Tambon Aow Tong, Khao Pra-Bang Khram NHA

Survey work was carried out in this area (some 12 km south-east of the Bang Tiao study area) in each of the three years covered by this paper. One pair had been located here in December 1986 by P. D. Round and colleagues. A further three territories were located in 1987 (Figure 6), and four other forest areas were

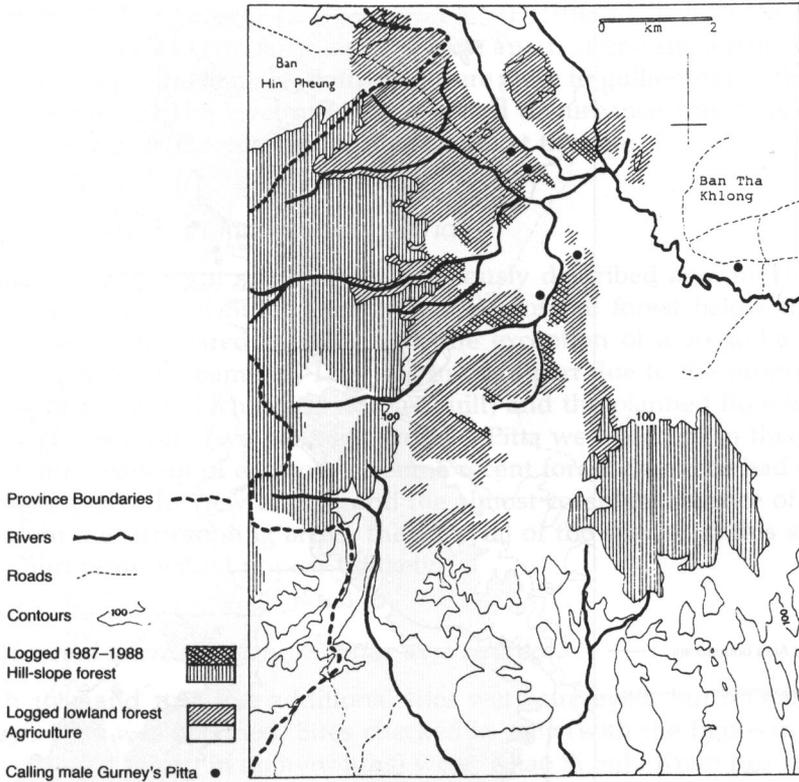


Figure 6. Location of Gurney's Pitta territories at Aow Tong, 1987 and 1988.

identified which appeared suitable for Gurney's Pitta. In 1988 the species was recorded at one of the 1987 sites, plus a new site near to the new Royal Forest Department substation. There were also reports (from local people) of calling males at (or adjacent to) two of the previously known sites. The remaining site from 1987 had been destroyed by clear-felling, along with some 150 ha of forest in this area. In both these years therefore, four territories were thought to be present. In 1989 survey coverage was lower, and the presence of a pair was confirmed at just one site, with another calling male also recorded. A local guide was, however, certain that there were other occupied territories. A single bird was heard calling on 9 June 1991, but no surveys were carried out in 1990 or 1992 (Round and Treesucon 1990–1992).

Khlong Phraya Wildlife Sanctuary and Khao Phanom Bencha National Park

These two areas are best considered together as they are almost contiguous. They were surveyed in 1987 and 1988 (Figure 7), but not in 1989. In 1987 the species was observed at four locations: one just outside the south-east boundary of Khlong Phraya Wildlife Sanctuary, two between the two protected areas, and one just north-east of Khao Phanom Bencha National Park. These four sites were revisited in 1988, but no contact with Gurney's Pitta was made, although forest remained in the areas. It is not known if birds were still present but were

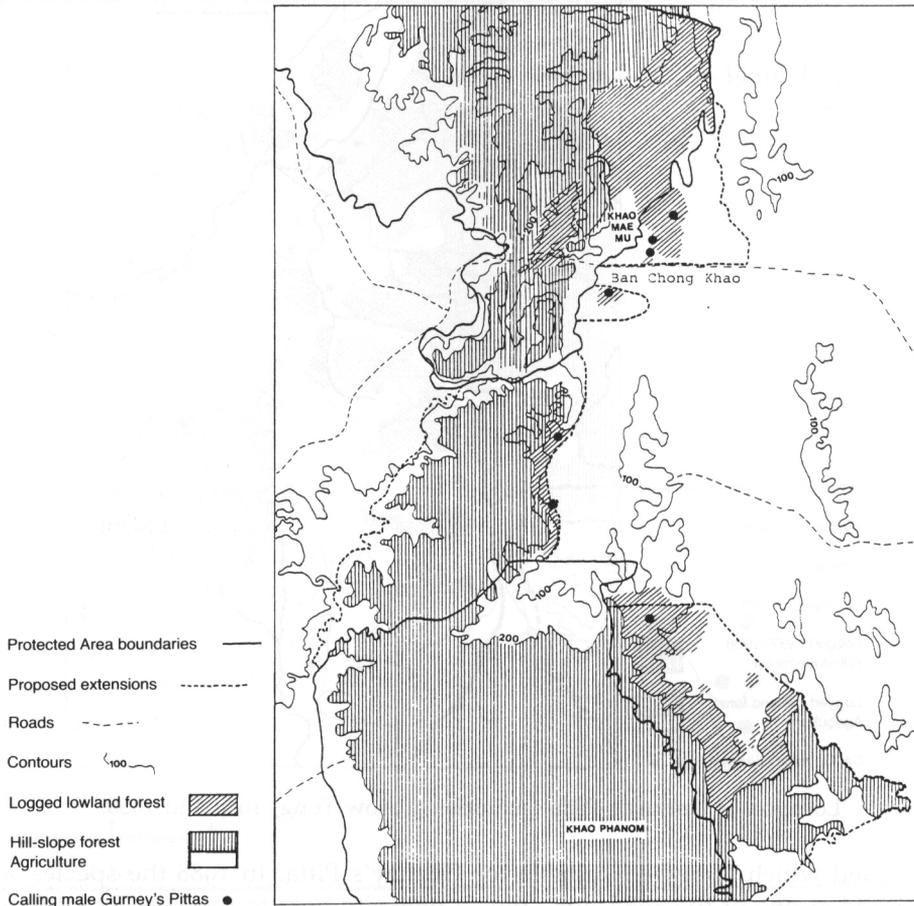


Figure 7. Location of Gurney's Pitta territories at Khlong Phraya/Khao Phanom Bencha, 1987 and 1988.

missed or if the birds had left these sites. In 1988 however, three further territories were located close to each other, to the east of Khao Mae Mu, just outside the south-east border of Khlong Phraya Wildlife Sanctuary. Seven separate Gurney's Pitta sites in total have therefore been identified in this area. In December 1988 during a visit by Wildlife Conservation Division staff, one of the 1987 territories was found to have been destroyed. At least two calling males were present at the south end of Khlong Phraya in 1990 and a single male was seen on 14 June 1992 by P. D. Round and U. Treesucon. Owing to continued large-scale forest clearance the population of Gurney's Pitta in this area is thought to be "probably no more" (P. D. Round *in litt.*).

Tha Chana district

The area surveyed is in the northern part of Surat Thani province (Figure 1). Considerable deforestation had occurred here, leaving isolated patches of forest, rarely larger than 30 ha. A single Gurney's Pitta had been heard here in January

1987 by P. D. Round and U. Treesucon (P. D. Round *in litt.*). In 1988 the species was located at two sites, some 1.5 km apart; at one site a pair was seen, and in the other a single male. Both sites were close to gullies and within 150 m of the forest edge. The level of forest loss and disturbance was considered so high as to preclude the survival of the species at this site.

Khlong Yan valley, Khiri Ratthanikhom district

This site is some 30 km south of the previously described area in Tha Chana district, to the west of Surat Thani town. Almost all forest below the 200 m contour had been cleared in 1988, with the exception of a 20–30 ha patch of forest, dominated by bamboo. This was in large part due to the proposed construction of a dam (which is still not yet built) and the planned flooding of the valley for a reservoir. Two pairs of Gurney's Pitta were located in this patch of forest, within earshot of each other. Some recent forest clearance had occurred within this patch. In view of this, and the almost complete absence of lowland forest from the surrounding areas, the survival of the species at this site, even in the short term, would appear unlikely.

Areas surveyed where no Gurney's Pittas were recorded

In both 1987 and 1988 five additional sites were surveyed, but no evidence of Gurney's Pitta was obtained. Sites checked in 1987 (with the figure in brackets giving observer effort, in man-months) were: Khao Si Suk, Krabi province (0.5); Khao Pu-Khao Ya National Park, Phattalung and Trang provinces (1); Khao Sok National Park, Surat Thani province (0.25); Khao Phra Thaew Non-Hunting Area, Phuket Island (0.1); and Ban Nai Chong, Krabi province (0.1). Very little lowland forest remained at any of these sites, but some areas retained a rich avifauna. In 8.5 days of survey at Khao Si Suk 160 bird species were recorded, including 14 which are considered to be lowland forest specialists. However, the presence of Gurney's Pitta at any of these sites was considered highly unlikely.

In 1988 five further sites were surveyed, following recommendations by P. D. Round (the numbers in brackets give observer effort in man-months, as above): Khlong Nakha Wildlife Sanctuary, Ranong province (0.25); Khlong Saeng Wildlife Sanctuary, Surat Thani province (0.1); Kapoe Basin, Ranong province (0.2); Khao Bantad Wildlife Sanctuary, Trang province (0.4); and the Khlong Lang-suan Floodplain, Chumphon province (0.1). Very little lowland forest remained at any site, although six lowland forest specialist bird species were recorded at Khlong Nakha.

Discussion

Interpretation of results

With such an elusive and poorly known species, the interpretation of our survey data is not straightforward. No species of pitta has been studied in detail; indeed by the end of the 1987 season, Gurney's – although by far the rarest and most threatened of the family – was considered to be the best-known species (D. R.

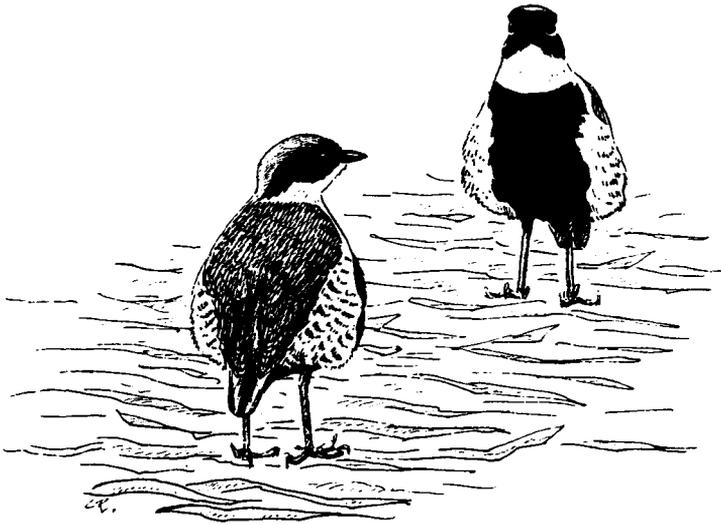


Figure 8. Two male Gurney's Pittas at a territory boundary (Craig Robson).

Wells verbally) and still appears so today. Two principal factors influence the interpretation of the data: the social organization of the species (where many considerations about monogamy and territoriality are involved) and the seasonality of calling (since most records were of calling birds). Other factors related to the population dynamics of the species could also have an effect (e.g. the level of breeding success in different areas and the resulting dispersal of young birds), but will remain unclear until more detailed studies are undertaken.

Social organization Since no birds were individually marked during this study, and radio telemetry was not used, we have little information on how widely individual birds move. Such techniques were not used, in order to minimize levels of interference to a species with such a small known population. They could, however, yield very valuable information and allow more precise estimates of the surviving population (see below). Evidence of territoriality in the species comes both from the survey observations summarized here, and from the detailed nest observations (Gretton in prep.).

At several sites (often around gully systems) birds would repeatedly be located over a period of several weeks. Typically, calling males were regularly heard (using the "lillip" call, which appears to be the species's usual territorial call: see Round and Treesucon 1986), with the female or the pair together occasionally being seen. In some cases individual males could be recognized by the pattern of barring on their flanks, and these individuals were present at the same site on a number of days. In rarer cases, apparent boundary disputes between males were witnessed (e.g. an observation by C.R. on 29 May 1987, illustrated in Figure 8). Calling was also heard between neighbouring birds some 50–200 m apart. Finally, the majority of territories located in 1987 were still present in 1988 (in some cases in adjacent areas): only one confirmed 1987 territory was not occupied the following year (Figures 2 and 3).

The intensive nest observations carried out at two nests in 1987 (totalling some 230 hours) afforded an excellent opportunity to assess the social organization of the species (Gretton 1988 and in prep.), as did those at the single nest found in 1986 (Round and Treesucon 1986). The male shared incubation and feeding of young almost equally with the female. At no time were any extra-pair birds seen during these observations, although in 1987 calling was regularly heard from a neighbouring territory 100–200 m away (which was often answered, or induced, by the male under observation). The male at the 1987 nests had a distinctive pattern of flank bars, and was present at both the nesting attempts observed (consecutively, in the same territory). The female had no such identifying features, but only one female at a time was seen at either nest. Over such a long period of observation, it is highly unlikely that a second female could have gone unobserved, although it is conceivable that there was a change in females between the nesting attempts; at the second nest the female supplied a much smaller proportion of the food brought to the young, suggesting that a different bird might have been involved. It is possible that the female at the first nest left the territory, accompanying the fledged young. Alternatively, the female may conceivably have continued to feed the fledged young, thus reducing her contribution to the second nest.

Whilst firmer conclusions concerning the social organization of the species will have to await the results of individual marking or telemetry studies (if it is decided that such studies are justified), the balance of evidence at present points to the species being monogamous and territorial. The loud "lillip" call appears to be used as a song to advertise the presence of a territory. Although there have also been more recent records of females giving a truncated version of this call (U. Treesucon verbally 1990 and J.P.), it is readily distinguished from the male's call by an experienced observer (P. D. Round *in litt.*). The use of calling registrations, combined with sightings where possible, therefore appears to be a valid census technique, on the basis of current information.

Calling seasonality Knowledge of the seasonality of calling is crucial for any attempt to census a species by the location of calling individuals. In 1986 one nest was observed (Round and Treesucon 1986), whilst prior to this only one other nest had ever been found (Herbert 1924). The former was discovered in June and the latter in early October, giving rather little information on nesting seasonality. It appeared likely, however, that the species (in common with many in Peninsular Thailand) was a wet-season breeder, with the breeding season thus expected to start in April. One observer was in the field in mid-March 1987 (at Khlong Phraya), but full-time monitoring at Bang Tiew did not start until late May. The number of records of calling birds declined steadily from the time of arrival to mid-June, when it levelled out at a low frequency (Figure 9). It is thought likely that this coincided with the onset of nesting.

In the following year the first observer arrived at Bang Tiew in late March. From this time calling activity rose rapidly to a peak in mid-April, remained at a high level until mid-May, and then fell rapidly to a low level by mid-June (Figure 9). This pattern thus matched that of 1987 very closely. In 1989 observations began in mid-April, but the month was unusually dry and calling activity remained low. Most records of calling birds were from the first half of May.

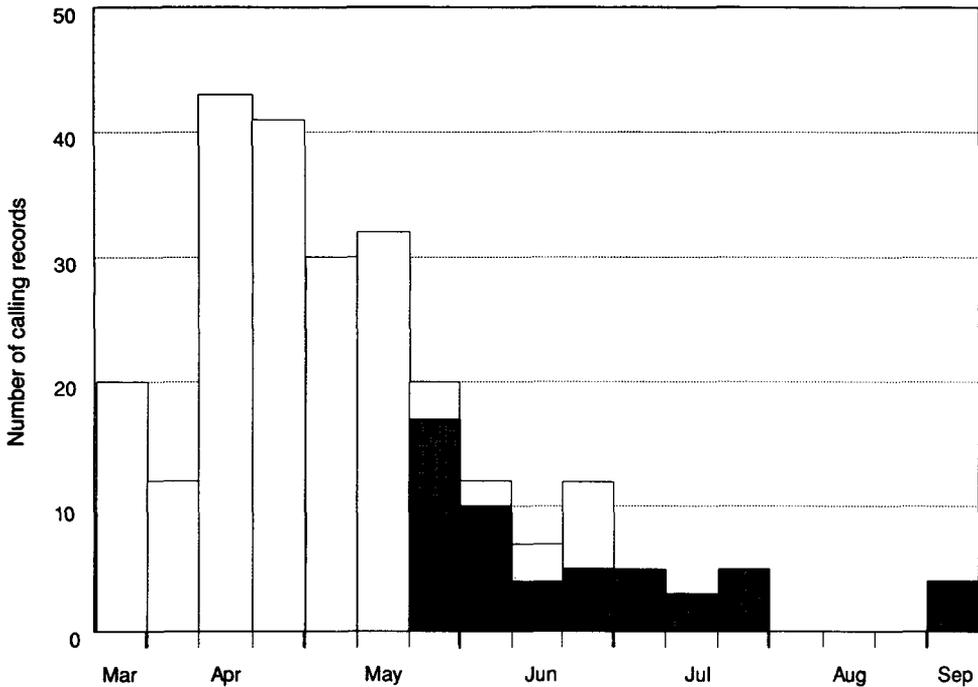


Figure 9. Calling seasonality of Gurney's Pitta (shaded, 1987 records; unshaded, 1988 records).

Information on the seasonality of Gurney's Pitta from 1990 to 1993 also corresponds with these observations (Round in press): most records (both visual and aural) came from March to May, with less than 3% of contacts from August to November.

Ideally, therefore, attempts to census the species should cover both April and May. Since this was not done in 1987, it is possible that some pairs may have been missed in that year. The 1988 fieldwork covered the entire peak calling season, with sufficient manpower to undertake widespread surveys. In 1989 dry weather in April, combined with a lower number of observers, resulted in less complete coverage. The 1988 results are thus most likely to reflect the actual population of Gurney's Pitta present in the study area.

Conclusions

How many Gurney's Pittas survive?

Four populations were identified between 1987 and 1989 in Peninsular Thailand, which together represented the total known world population of the species. The probable total number of territories (pairs) at the end of the three-year period detailed above lies between 27 and 40 (Table 1). This assumes that the two remnant populations at Tha Chana and Khlong Yan have been lost. In view of the problems in censusing a species as elusive as a pitta, it is prudent also

to give absolute maximum and minimum population estimates. From the 1987–1989 data, this range is 24–48 territories.

So much forest destruction has occurred at Khlong Phraya–Khao Phanom Bencha (see above) that Gurney's Pitta may already be extinct at this site. It is also known that some territories at Bang Tiew have been lost to deforestation, and some losses continue to be reported annually. Most territories outside the national reserve forest boundary have been cleared (P. D. Round *in litt.*). If all suitable habitat is occupied by the species, it is possible that displaced birds have nowhere to go, so that each territory destroyed results in a corresponding population decline. Table 1 also includes a summary of census information from 1990–1992 (from Round and Treesucon 1990–1992), although precise comparisons are not possible owing to variation in observer effort, weather conditions, etc. In addition, few surveys have been carried out in outlying areas and at Aow Tong. Nevertheless, there appears to be a decline in Gurney's Pitta numbers, with the apparent loss of all birds from Khlong Phraya–Khao Phanom Bencha being particularly serious. The population at the end of 1992 was probably 20–30 pairs, excluding Khlong Phraya–Khao Phanom Bencha, but allowing for up to five further territories in the surrounding areas of Bang Tiew and at Aow Tong (taking into consideration the low survey coverage in these areas).

Prognosis

The 1987–1989 surveys confirmed that Gurney's Pitta is a lowland forest specialist, with most territories located below 100 m, and none above 150 m. This has long been judged the most likely explanation for the current rarity of the species, since level lowland forest, owing to its accessibility, is almost always the first to be logged (Round and Treesucon 1986, Round 1988). In 1987 the entire area of such forest below 100 m remaining in Peninsular Thailand was estimated to be as little as 20–50 km² (P. D. Round verbally, and C.R.). These figures have certainly fallen since then, with recent forest losses noted at several of the areas we surveyed. It is thought that the Khao Pra-Bang Khram NHA supports the most extensive and richest area of lowland forest remaining in Peninsular Thailand; it has had the greatest number of bird species recorded of any site in Peninsular Thailand (Round 1988 and verbally).

There is no truly primary lowland forest remaining in Peninsular Thailand, as a result of pressure by logging companies and settlers; the small remaining area of forest has all been logged to some extent. Several of the Gurney's Pitta territories at Bang Tiew and elsewhere were in very degraded and fragmented forest areas, often close to the forest edge. The site at which most of the nest observations were made consisted of only 2 ha of forest (less than 20 m tall), almost completely surrounded by rice paddy. The species appears to be less flexible in other aspects of its habitat requirements, however, needing lowland forest with gullies, streams and palms present. Since almost all the species's feeding is carried out on the forest floor, its characteristics are likely to be more important than those of the forest as a whole. Factors such as the structure of the understorey vegetation, the humidity and composition of the leaf-litter (including during the dry season), and the availability of earthworms (the main food brought to the nest: Gretton 1988) may thus be of the greatest importance

in determining the distribution of Gurney's Pitta. In the absence of primary lowland forest it is not possible to know whether optimal habitat for Gurney's Pitta is such primary forest and the species has been forced into more degraded areas, or whether it actually selects secondary and edge habitats. Despite this degree of flexibility, there is clearly a limit beyond which the species cannot survive, as shown by its current highly restricted distribution.

It is clear that the future of Gurney's Pitta is inextricably linked to the fate of the tiny remnant of level lowland rainforest which survives in Peninsular Thailand. On the basis of our current knowledge, the species is represented solely by the population at Khao Pra-Bang Khram. Apart from the Aow Tong subpopulation (with only one bird heard from 1990–1992), all territories are in the Khlong Thom basin, around the village of Bang Tieo. This has been the focus for a major BirdLife International–Center for Conservation Biology project, carried out by P. D. Round and U. Treesucon over four years from March 1990, the details of which are outside the scope of this paper. From the outset the project recognized that the survival of Gurney's Pitta would depend on the establishment of an effective protected area, and on the development of an integrated forest conservation project, with every effort being made to involve and interest local people in the conservation of the remaining forest. Many advances have been made, but there have also been formidable problems to overcome. Crucially, the boundary of the Wildlife Sanctuary, recently declared by the Royal Forest Department, excludes most Gurney's Pitta territories. Despite very considerable local interest and support, economic necessities are still often the key factor in land-use decision-making. Without comprehensive legal protection of all remaining forest used by Gurney's Pitta in Thailand, the future of the species appears bleak, the main alternative hope being that it will be rediscovered in Burma.

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