NAT. HIST. BULL. SIAM SOC. 45: 127–141, 1997

A SURVEY OF THE AVIFAUNA IN SIMILAN NATIONAL PARK, THAILAND

Mark Desholm[1] and Anne Margrethe Wegeberg[1]

ABSTRACT

During December 1994 and January 1995 a survey of the birds in Mu Ko Similan National Park was carried out. Two standardized bird census techniques, timed species count (TSC) and spot-mapping, were used to obtain relative and absolute densities, respectively, of the avifauna in Similan National Park. The mean number of birds registered per TSC was 2.34 (SD = 2.28). For the four mapped territory-holding species, absolute densities varied between 0.2 and 2.9 territories/ha. Eighteen species new to the park were recorded.

Comparison of data obtained by the two methods shows no significant difference for any of the five main species recorded, except for the Oliver-backed Sunbird. It is concluded that for common species, the TSCs in a relatively short time can provide results close to those obtained by the more reliable and time consuming spot-mapping technique.

INTRODUCTION

In Thailand there have been relatively few scientific studies of abundance and diversity of birds due to limited manpower. Even simple species inventories are still lacking for some national parks. This is unfortunate, since knowledge of species present and fluctuation in bird densities through time, is a necessary basis for developing conservation guidelines. Monitoring is essential for the study of the impact of fragmentation and logging of forest.

During December 1994 and January 1995 we made a survey of the birds in Mu Ko Similan National Park, Phang-nga Province, Thailand. This was carried out in agreement with the Marine National Parks Division of the Royal Forest Department, Bangkok.

Besides making a list of all the bird species encountered (Table 1), we used two standardized bird census techniques to estimate bird density. Timed species counts (TSCs), a modified version of point counts, were used to measure relative abundance, whereas the spot-mapping technique was used to estimate the absolute density of birds showing territorial behaviour.

Our aim in presenting our data is to enable comparison with censuses from other areas or with subsequent surveys on the Similan Islands. The latter would make it possible to elucidate changes in bird population densities. Finally we evaluate and compare the two census methods which until now have had very little exposure in tropical moist forest.

[1] Department of Marine Ecology, Institute of Biological Sciences, University of Aarhus, Finlandsgade 14, DK-8200 Aarhus N, Denmark.
Received December 1996; accepted 7 July 1997.

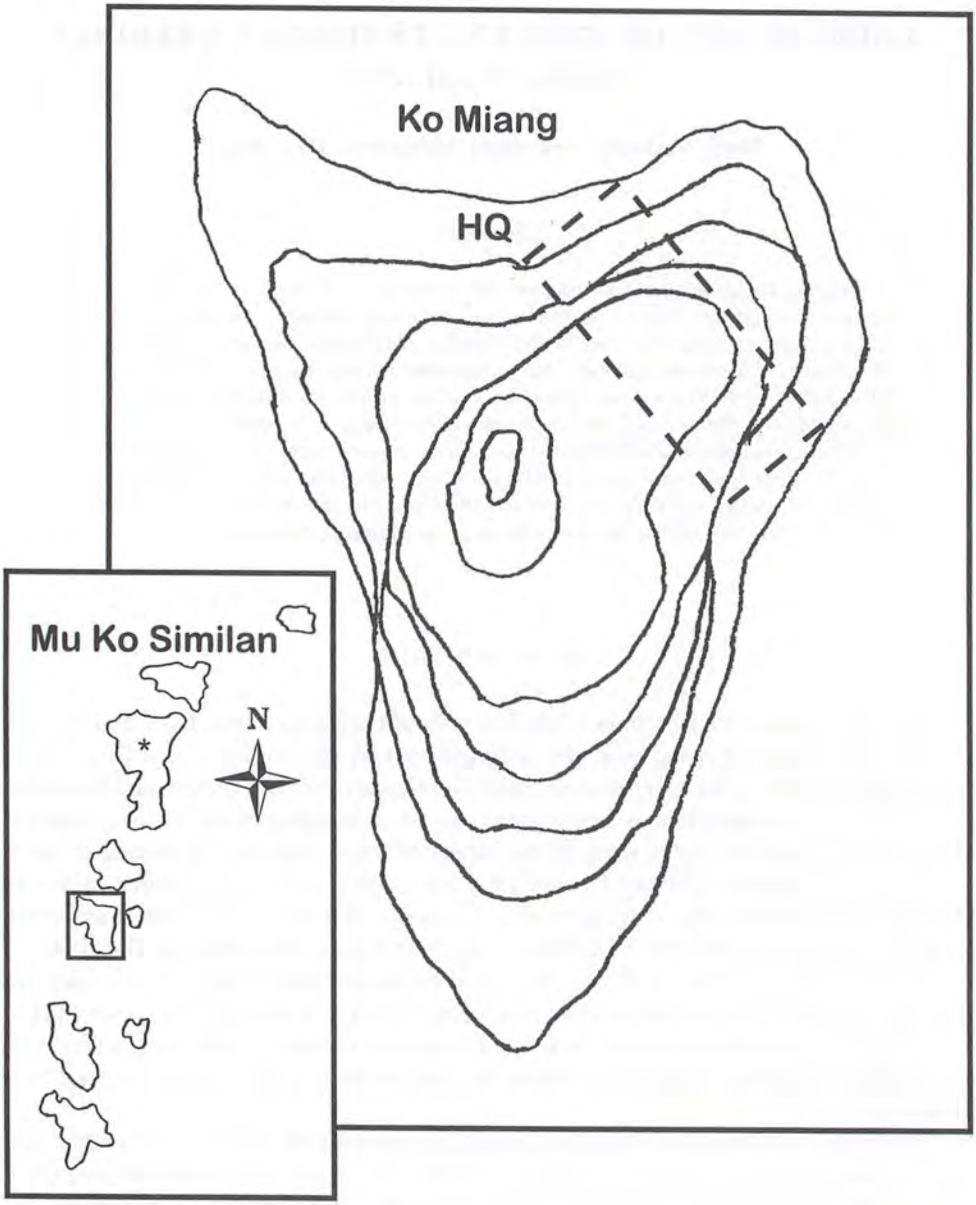

Figure 1. The small map to the left is somewhat inaccurate but shows the nine islands in the Similan National Park (1:320,000). The island marked with a rectangle is "Ko Miang" which has been enlarged on the map to the right. HQ = headquarters. The dotted rectangle indicates the spotmapping area. Asterisk denotes Ko Similan.

Mu Ko Similan National Park is located 40 km off the west coast of Thailand in Tambol Koh Pratong, Kuraburi District, Phang-nga Province. The park covers 128 km^2 of which 14 km^2 comprise nine islands covered mainly by evergreen forest (Fig. 1).

The Similan Islands have received only minimal human impact, until a few decades ago when dynamite fishermen, and later tourists, invaded the islands (GRAY ET AL., 1994). The growing number of tourists seems to constitute the main threat to the wildlife. Most parts of the islands Ko Miang (Ko 4) and Ko Similan (Ko 7), where the survey took place, are only accessed with difficulty. For this reason we were not able to penetrate large parts of the forest on Ko Similan. Most of the islands consist of steep rocky hills which hinder exploration.

The spot-mapping area was situated on Ko Miang where access was the least difficult. A tourist tent-camp and a few park buildings were located in the northern part of this area. The spot-mapping plot was marked with natural materials, pieces of string tied to the vegetation, and small walking paths made by sweeping the leaves off the forest floor. A master map (1 : 1835) was made where details such as tree trunks, rocks, paths, buildings, big roots etc. were mapped.

METHODS

Equipment.—Observations were made with binoculars (10 x 40), and telescope (20 x 60). For measuring the spot-mapping grid we used a hand compass, a 50-meter long rope, and a map of Ko Miang (Fig. 1).

Timed Species Counts.—Timed Species Count (TSC) is a type of point count adapted to the facts that: (a) steepness and dense undergrowth often make it impossible to quietly follow a continuous route, and (b) the detectability of many forest birds drops sharply at 30–50 meters distance (FJELDSÅ & RABØL, 1995). Records of birds are taken during a 10–minute period per predefined 50 x 50 m plot. Some movements by the observer are allowed where possible to inspect hidden areas or to follow up detected but yet unidentified birds. Sometimes, however, the terrain is so difficult that the observer stays mainly at a good vantage point.

To cover a large area the TSCs were randomly spaced. The boundaries of each count site were determined from a distance, so that they were not biased by the presence of birds in the area.

To avoid double registrations we kept a minimum distance of 100 m between the plots. We found space for only 25 counts on Ko Miang, therefore we placed 25 plots on each of the two islands and visited each plot two times, adding up to 100 TSCs in total. Data from these counts provide relative densities of the most common species. Extending the time limit would significantly improve the number of birds registered but not the number of species.

This method of point counts, which is almost identical to a procedure developed for South African forest by KOEN (1988), has been used also by FJELDSÅ (1993) in a wide range of tropical habitats. Since bird identification in dense forest is difficult, good identification skills including knowledge of songs and calls are essential.

We carried out 50 of the TSCs in the forest on Ko Miang (9–26 December 1994), and 50 on Ko Similan (26–31 December 1994).

Spot-mapping.—The method of spot-mapping is based on territorial behaviour and aims to map the territories of birds in a census area. The location and behaviour of all birds observed in the census area are marked on a detailed map. This procedure is followed during several visits to the same census area. The registrations of birds should fall into clusters approximately coinciding with their territories. For gregarious species such as pigeons (LEKAGUL & ROUND, 1991; GOODWIN, 1967) group clusters are drawn. All birds are mapped but densities of species with territories larger than the defined plot and non-territorial species cannot be included in the final evaluation. The size of the census area on Ko Miang was 10 ha (200 x 500 m), which was suitable for coverage in a single visit of about 3 hours (BIBBY ET AL., 1992).

The census area was not completely homogeneous. In the southern corner of the plot, there was some growth of bamboo in the otherwise evergreen forest. The western corner of the plot included an area sometimes used as a camp-ground for tourists, which caused some disturbance. Here the vegetation was partly cleared and hence less dense (DESHOLM & WEGEBERG, 1995). The plot was bordered by the beach to the north-west and south-east (Fig. 1).

From the spot-observations it is possible to estimate the number of territories in a large homogeneous area. Extrapolation of bird densities from the spot-mapping plot to the same type of forest habitat on Ko Miang and to some extent to the entire group of islands is associated with uncertainty due to the lack of detailed maps on habitat and vegetation cover. Furthermore there might be differences in the species composition between the islands, of which we were unaware, since we only surveyed two islands. We were therefore not in a position to carry out the extrapolation safely.

The spot-mapping method gives a precise estimate of absolute bird densities in the census area, as well as the distribution of territories. Radio tracking, nest finding, and banding of birds would have been a good way of supporting the spot-mapping, but none of these methods are preconditions for the spot-mapping technique (BIBBY ET AL., 1992) and for various reasons they could not be applied. Care must be taken when dealing with wide-ranging nectarivores/frugivores where different birds can make serial visits to a common food source, especially when individual birds cannot be marked as in our study. Applying the rules for interpretation of spot-mapping observations (BIBBY ET AL., 1992; KOSKIMIES & VÄISÄNEN, 1990; DESHOLM & WEGEBERG, 1995) minimizes this kind of bias.

Fieldwork.—We did 10 consecutive days of spot-mapping, from 13 to 22 December, 1994. Normally the detectability of the birds has an early morning peak (DESHOLM & WEGEBERG, 1995), but some species (e.g., thrushes) are easier to detect in the late afternoon. We decided to make eight early morning visits and two visits in the late afternoon. Each census lasted about two hours and was initiated at 6:30 a.m. or 3:30 p.m.

Each day we started our route in different spots. This was to make sure that the period of peak detectability was evenly distributed in the different parts of the census area during the 10 days of mapping.

Observations were made up to 50 m outside the study plot to enable us to interpret edge territories correctly. Only if more than half of the observations occurred within the plot boundary, was the edge territory included in the density estimate (marked with a "+" in Fig. 2).

The census was walked at a relaxed pace on the paths made for that purpose allowing time to obtain simultaneous observations of birds in different territories, and to record species difficult to detect, as well as the sex and age of the birds. However, if the travel speed is too low the risk of recording a bird twice increases.

Observation was difficult because the forest was tall and rather dense. Furthermore, the Common Koel was very shy, and most of the other species stayed in the canopy. Therefore, most of our observations were based on birds heard rather than seen.

When mapping our observations, we used the notation described by BIBBY ET AL. (1992) and KOSKIMIES & VÄISÄNEN (1990).

Statistical analysis.—The statistical methods used follow FOWLER ET AL. (1985). To investigate associations between variables the chi-square (χ^2) test was used. The variability within samples is described by the standard deviation (SD).

RESULTS

Species List

A total of 40 species of birds were recorded for the park from December 8, 1994, to January 2, 1995. Eighteen of these were new records for Similan National Park (Table 1). The list of species includes records from general bird watching, TSCs, and spot-mapping. All birds on the list were identified by observation. One of the least common species was Black Baza *Aviceda leuphotes* observed December 30 sitting in a tree in the forest on Ko Similan. Japanese Sparrowhawk *Accipiter gularis* was observed several times between December 9 and December 27 on Ko Miang. Three birds identified as Oriental Hobby *Falco severus,* showing rufous underparts and underwing coverts, were hunting insects above the forest on Ko Similan on December 26 and 27. According to MEDWAY & WELLS (1976) there are no other records of this species on islands. At the edge of the water reservoir December 11 on Ko Miang, a female or non-breeding Watercock *Gallicrex cinerea* was observed. One immature male Siberian Thrush *Zoothera sibirica* was observed on December 14 and several observations of an adult male were made between December 16 and December 25 in the forest on Ko Miang.

Timed Species Count

The mean number of birds registered per TSC was 2.34 (SD = 2.28). The total number of birds counted was 234 for the 100 TSCs. Of these, 17 were unidentified. Those identified are listed in Table 1. Forty % of all the species observed on the islands were recorded during the TSCs (Table 1).

Table 1. The list of the 40 species encountered in the Similan National Park, December 1994. Numbers in brackets denote the number of records during the 100 TSCs. A total of 217 birds were identified during the TSCs. Asterisk denotes the eighteen species new to Similan National Park recorded during the survey.

Chinese Pond-Heron *Ardeola bacchus* (2)	Nicobar Pigeon *Caloenas nicobarica* (13)
Pacific Reef-Egret *Egretta sacra*	Common Koel *Eudynamys scolopacea* (85)
Little Heron *Butorides striatus**	Black-capped Kingfisher *Halcyon pileata*
Cinnamon Bittern *Ixobrychus cinnamomeus*	Collared Kingfisher *Halcyon chloris*
Osprey *Pandion haliaetus*	Dollarbird *Eurystomus orientalis* (1)
Brahminy Kite *Haliastur indus*	Greater Flameback *Chrysocolaptes lucidus**
Black Baza *Aviceda leuphotes* (1)*	Pacific Swift *Apus pacificus**
Crested Goshawk *Accipiter trivirgatus**	Barn Swallow *Hirundo rustica**
Japanese Sparrowhawk *Accipiter gularis* (2)	Red-rumped Swallow *Hirundo daurica**
White-bellied Sea-Eagle *Haliaeetus leucogaster* (4)	Grey Wagtail *Motacilla cinerea*
Oriental Hobby *Falco severus**	Arctic Warbler *Phylloscopus borealis* (7)
Peregrine Falcon *Falco peregrinus*	Lanceolated Warbler *Locustella lanceolata**
Red-legged Crake *Rallina fasciata**	White-rumped Shama *Copsychus malabaricus* (1)*
Ruddy-breasted Crake *Porzana fusca* (1)*	Blue Rock-Thrush *Monticola solitarius**
White-breasted Waterhen *Amaurornis Phoenicurus* (9)	Orange-headed Thrush *Zoothera citrina**
Watercock *Gallicrex cinerea**	Siberian Thrush *Zoothera sibirica**
Little Ringed Plover *Charadrius dubius**	Eyebrowed Thrush *Turdus obscurus* (3)*
Green Imperial Pigeon *Ducula aenea* (27)	Asian Brown Flycatcher *Muscicapa dauurica* (1)
Pied Imperial Pigeon *Ducula bicolor*	Hill Myna *Gracula religiosa* (30)
Emerald Dove *Chalcophaps indica*	Olive-backed Sunbird *Nectarinia jugularis* (30)

Spot-Mapping

The species showing colonial or territorial behaviour are given below. Territories are either breeding or feeding territories.

Common Koel *Eudynamys scolopacea*.—The map for the Common Koel (Fig. 2) shows 29 apparent territories in 10 ha. The population was most dense in the centre of the plot away from the two beaches. In the western corner no territories were observed and only a few territories were found around the south-eastern edge of the plot. In the former area, the forest was partially cleared for tenting, and in the latter area there was a clearing towards the beach. The Common Koel seemed to prefer more dense forest. The density of Common Koel in the 10-ha plot was 2.9 territories/ha.

Nicobar Pigeon *Caloenas nicobarica*.—On Ko Miang Nicobar Pigeons were gregarious but no physical or vocal aggressive behaviour between individuals from different groups

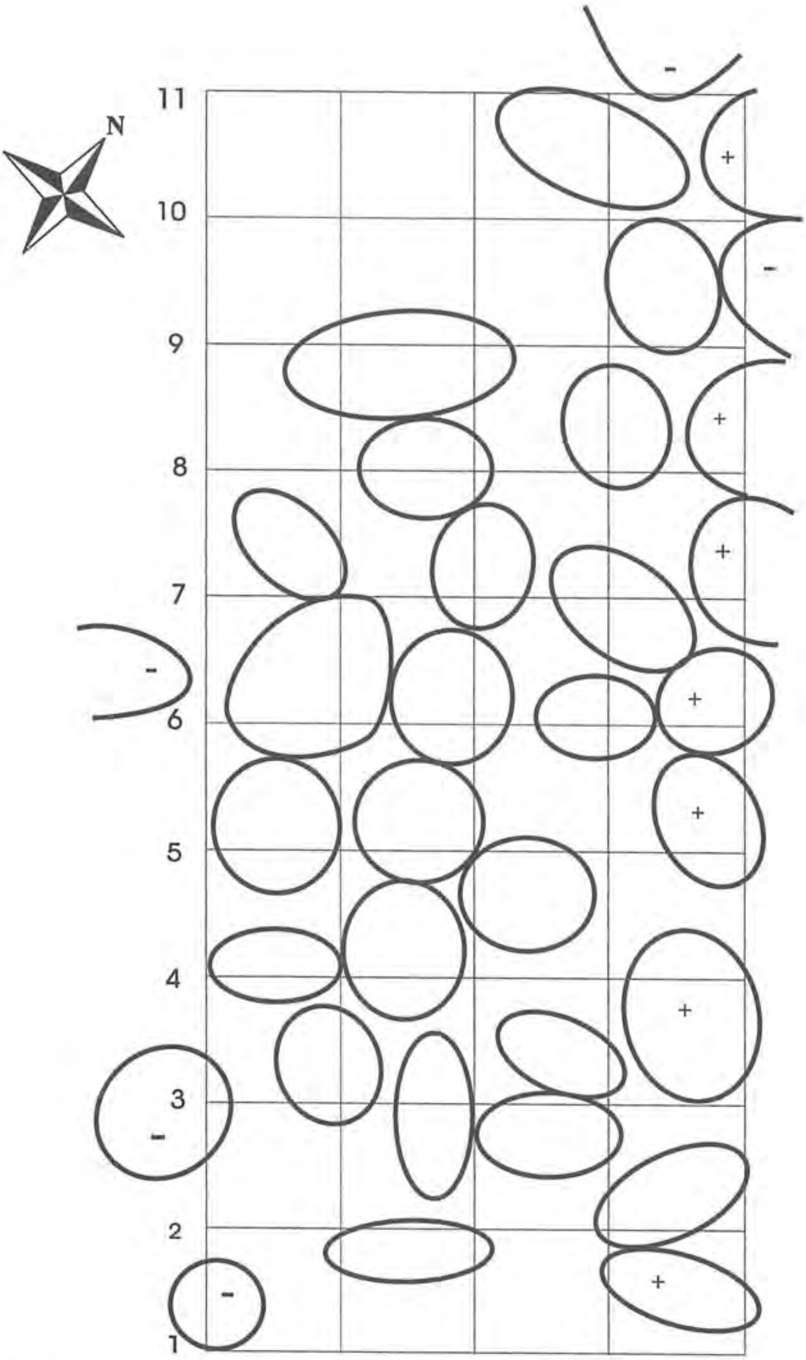

Figure 2. The Common Koel held 29 territories in the spot-mapping plot. One circle represents one territory but not the exact territory boundaries. Plus and minus indicate whether or not the territory is considered to be inside the plot. Each square in the figure measures 50 x 50 m.

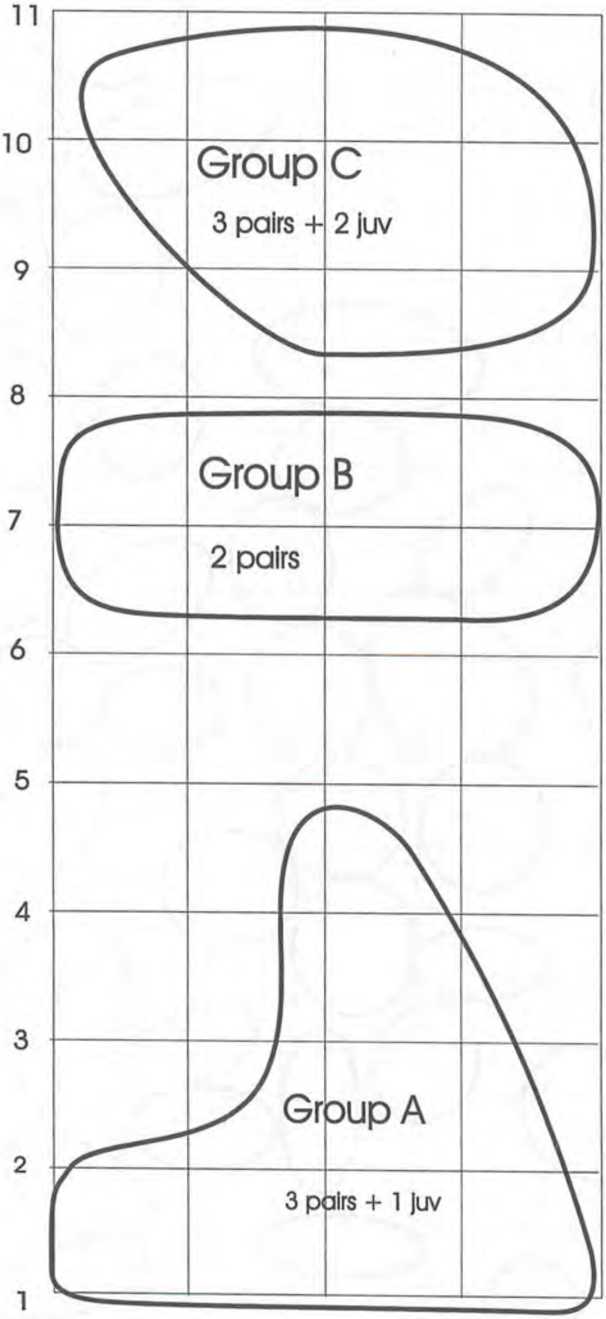

Figure 3. The Nicobar Pigeon held 3 apparent group territories denoted A, B, and C in the spot-mapping plot. One circle represents the territory of a group of Nicobar Pigeons but not the exact territory boundaries. The number of pairs in each group is written inside the territory circle. Each square in the figure measures 50 x 50 m.

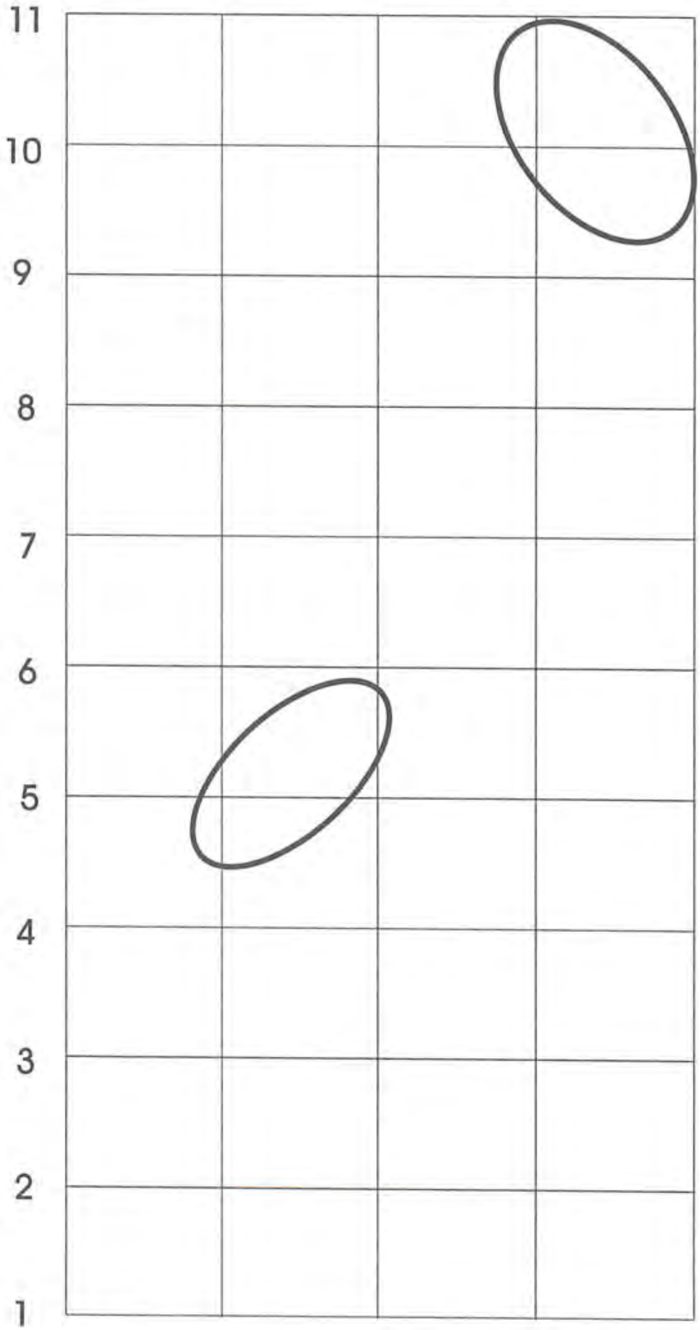

Figure 4. The Olive-backed Sunbird held 2 territories in the spotmapping plot. One circle represents the territory of a pair but not the exact territory boundaries. Each square in the figure measures 50 x 50 m.

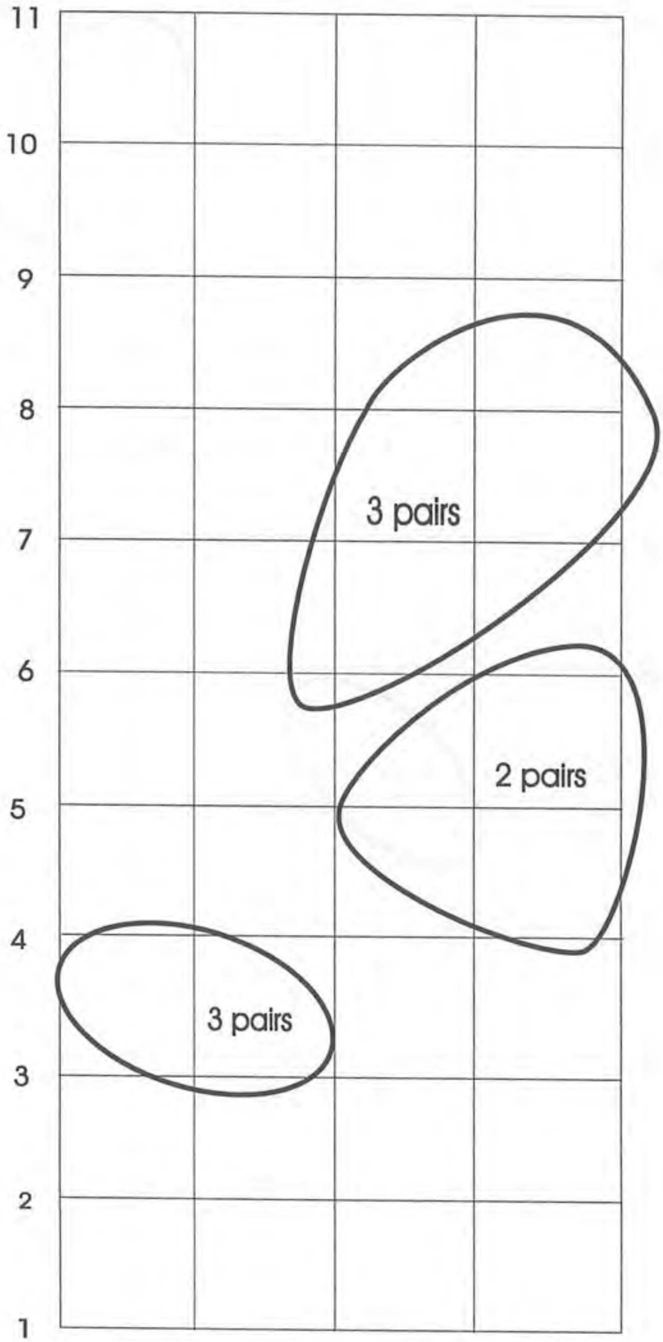

Figure 5. The Green Imperial Pigeon held 3 apparent group territories in the spotmapping area. One circle represents the territory of a group but not the exact territory boundaries. The number of pairs in each group is written inside the territory circle. Each square in the figure measures 50 x 50 m.

was recorded. In the spot-mapping area three clusters were found (Fig. 3): group A (3 pairs + 1 juvenile), group B (2 pairs), and group C (3 pairs + 2 juveniles), which adds up to 16 adults and 3 juveniles. This makes 0.8 adult pairs/ha and 0.3 juveniles/ha in the 10-ha spot-mapping area. Apart from this, a single group D (3 pairs) was observed in the south-western part of Ko Miang outside the spot-mapping area. The largest group seen together was 20 adults foraging around the restaurant area in the northern part of the island. Nicobar Pigeons were registered only on the smaller island, Ko Miang, and none were observed on the largest island, Ko Similan.

Olive-backed Sunbird ***Nectarinia jugularis.***—Two territories were mapped in the 10-ha plot (Fig. 4), corresponding to 0.2 pairs/ha.

Green Imperial Pigeon ***Ducula aenea.***—During the spot-mapping we found three apparent group territories of Green Imperial Pigeon (Fig. 5). Two of these consisted of three pairs, and one of two pairs (8 pairs in total). All three groups were situated in the centre of the plot away from the beaches. This makes 0.8 pairs/ha in the 10-ha spot-mapping plot.

Hill Myna ***Gracula religiosa.***—The distribution of Hill Myna in the spot-mapping area appeared to be non-clustered, and hence there was no way to evaluate the observations in terms of territories. The mean number of Hill Mynas per spot-mapping census was 20.4 and the maximum record was 36 birds. Since most records were vocal, we were unable to distinguish between juvenile and adult birds, but all visual observations were of adults only. Taking these data into account, we can make a crude estimate of about 30 Hill Mynas in the 10 ha plot, which corresponds to 1.5 pairs/ha.

DISCUSSION

Species List

According to our new list and the already existing species list from "MASS Database for species, habitat and conservation areas", maintained at Center for Conservation Biology, Mahidol University, there is now a total of 65 bird species registered in Similan National Park.

Timed Species Count

As described in "Results," 40% of all the species observed on the islands were recorded during the TSCs. That 60% of the species were not registered during the TSCs was mainly due to the low abundance of these species on the islands. Since the actual time spent on TSCs constituted only 10% of the total time spent on bird watching in the park, the less common birds were unlikely to have been recorded during the TSCs. The mean number of birds per count, 2.34, illustrates the overall density of birds on the islands.

Spot-Mapping

Common Koel.—The observed territorial behaviour of this species is not fully understood, which makes it difficult to interpret the mapping records. Because the Common Koel is a brood parasite and is shy and elusive, it is difficult to determine whether the observed clusters were winter or breeding territories defended with respect to food or the availability of hosts, respectively. The Common Koel on Similan Islands is probably, as described by SMYTHIES (1953, 1960) and GLENISTER (1959), a local migrant with high densities on coasts and islands in winter. We did not find any active nests of potential hosts, and since koels do not build nests, evidence of breeding was difficult to find. Nevertheless, the vocal behaviour of the birds did not fit the description of their half-hearted off-season calls (SMYTHIES, 1953; ALI, 1953; ALI & RIPLEY, 1969; PIZZEY, 1980). ALI (1996) describes the species as "silent in winter, thus often overlooked and recorded as absent". The koels were uttering a call, *ho-y-o,* described as song by BEEHLER ET AL. (1986), early in the morning all together in an enormous choir. They used the same call throughout the day answering each other.

The hosts of Common Koel are not known clearly. The usual host is House Crow *Corvus splendens,* Jungle Crow *Corvus macrorhynchos,* and occasionally orioles (Oriolidae) (ALI & RIPLEY, 1969). Additionally, Black-collared Starling *Sturnus nigricollis* and 5 species of Myna (Sturnidae) are reported as fosters in Malaysia (GLENISTER, 1959). POIANI & ELGAR (1994) mention 32 potential hosts and a size range from 250 to 300 mm of 3 documented species. In Australia 21 host species about half the size of Common Koel are reported (BROOKER & BROOKER, 1989).

The fact that single males may also hold territories should be taken into account, but we have not been able to identify any such bachelors. During our survey females and males were observed occupying the same territory, not showing any aggressive behaviour towards each other as was observed between neighbouring males. Generally, cuckoos defend territories against other cuckoos which parasitize the same hosts (GLENISTER, 1959). It is still unclear whether the Common Koels were wintering or breeding at the time of the survey. The breeding season of Common Koel is everywhere coincident with that of its host (ALI & RIPLEY, 1969; ALI, 1996). If they were actually breeding, then Green Imperial Pigeon and Hill Myna were possible but undocumented hosts.

The extraordinarily high total of 29 territories in the relatively small spot-mapping area (10 ha) seems excessive, but so was the number of Common Koels heard when walking through the forest in the morning. The large number of Common Koels may be an example of density compensation (WIENS, 1989) on the islands. If a particular habitat is able to support a given number of birds, a smaller number of species will permit a larger number of individuals per species. This type of effect has been recorded for certain islands in Sweden (NILSSON, 1977) and in Bermuda (CORWELL, 1962).

Nicobar Pigeon.—GOODWIN'S (1967) description of the Nicobar Pigeon as a colonial species coincides with our observations. On one occasion 20 adults were aggregated sharing the same food source in the restaurant area on Ko Miang. The Nicobar Pigeons in the group D outside the spot-mapping area are not expected to be included in this group since they foraged in a more inaccessible and less disturbed part of the island and were therefore more shy than most of the other pigeons. Group A (Fig. 3) is also not expected to be included since these birds had plenty of open space on the south-eastern part of the island where they could always be found. The Nicobar Pigeons on Ko Miang seemed to prefer to feed in shady but open spaces where the ground was free from leaves, and seeds were easily found. The pigeons in the described groups always flew into nearby trees when approached and this lack of long distance flights minimized the risk of overlapping counts during a census. The observations of groups, together with the data from spot-mapping, enabled us to make a conservative population estimate of 16 pairs of adults (10 pairs from the large flock + 3 pairs from group A + 3 pairs from D) and about 7 juvenile Nicobar Pigeons on Ko Miang.

Why were no Nicobar Pigeons seen on Ko Similan? The headquarters there was fairly new and the island had been without rangers until a year before the survey was done, so recent hunting or trapping for the Nicobar Pigeon may have reduced the population.

Other species.—Although we have no solid evidence we presume that the Olive-backed Sunbirds were nesting. Maximum two individuals were observed together, indicating territories as opposed to feeding parties in flowering trees. In the latter several individuals would be expected at least on some occasions. Furthermore, breeding individuals were observed several times on the mainland before and after our visit to Similan National Park.

In Thailand, the Green Imperial Pigeon is known as a resident species, so the observed pigeons were most probably breeding on the islands. Since the birds breed in January in Java (MACKINNON, 1990) and from March to April in India (ALI, 1996) the pigeons could be breeding or preparing themselves for breeding at the time of our visit. No signs of breeding were observed since the arboreal behaviour of the species made detection rather difficult. Often these pigeons were only heard. This relatively high density of an otherwise uncommon species may be due to absence of hunting pressure in such remote places like the Similan Islands.

The fact that Hill Myna appeared to be non-territorial does not rule out the possibility that they could be breeding at this time of year. Starlings and Mynas (Sturnidae) often exhibit gregarious behaviour (LEKAGUL & ROUND, 1991; KING ET AL., 1987) and therefore do not show territorial behaviour during their breeding season.

Hill Mynas also suffer from human persecution and are more numerous on remote islands than on the mainland.

CONCLUSIONS

When preparing prospective bird surveys, one should decide whether relative or absolute densities are needed. The spot-mapping technique is the most reliable but also the most time consuming way of estimating bird densities. The advantage of this method is its accuracy and the attainment of absolute density but the technique is restricted to species that are territorial and common. The TSCs give estimates of the relative bird densities and are normally used for large areas.

When comparing the data from the TSCs and the spot-mapping we must restrict ourselves to the four species that showed territorial behaviour during spot-mapping, and to Hill Myna for which a density could crudely be estimated. Likewise, the densities must be compared as relative densities since the TSCs do not provide us with the absolute

Table 2. The distribution of species recorded during the timed species count (TSC) and the spot-mapping (SM) expressed in percentage of the five species together, and results from the chi square tests. The latter shows that the relative densities found by the two different methods do not differ significantly for any of the species except for the Olive-backed Sunbird. For all the chi square tests df = 1. The species recorded during only one of the census methods are excluded. In the calculations for Common Koel and Olive-backed Sunbird it is assumed that there is one pair per mapped territory.

	TSC	SM	χ^2	P
Common Koel	46%	47%	0.00	P>0.95
Hill Myna	16%	24%	1.23	P>0.20
Green Imperial Pigeon	15%	13%	0.04	P>0.80
Olive-backed Sunbird	16%	3%	7.58	P<0.01
Nicobar Pigeon	7%	13%	1.25	P>0.20

densities. From the chi square tests in Table 2, it is evident that the relative densities found by using the two different methods do not differ significantly among species, except for the Olive-backed Sunbird. This difference might result from the behaviour of the Olive-backed Sunbird, which is very active, sometimes flying long distances for food. This behaviour induces a certain risk of counting the same bird twice during the TSCs. The Spot-mapping technique excludes superfluous registrations of birds leaving their territory by taking only clusters of observations into account. When dealing with forest nectarivores care must be taken not to interpret a flowering tree as a territory.

Discrepancies between the two methods can lead to a different outcome for some species, which can make a comparison of densities between the methods problematic. Because of the otherwise high consistency of the two methods (Table 2), however, for common species on Similan we can conclude that the TSCs in a relatively short period of time can provide results close to those obtained by the more time consuming spot-mapping technique. Nevertheless, if TSC is the only method used in a survey, we recommend that also a species list is prepared. If time and resources are available, spot-mapping in addition to the TSCs would be the optimal approach during a survey.

ACKNOWLEDGMENTS

We thank the employees at the Royal Forest Department, Marine National Parks Division for making this project possible, Jon Fjeldså for giving us advice on bird census techniques practicable in tropical forests and Henrik Sell for comments on an earlier draft of this manuscript. Finally thanks to Kim N. Mouritsen, Tina Greve, Kristian Beedholm and Thomas Dam Poulsen for comments on the manuscript.

REFERENCES

ALI, S. 1953. *The birds of Travancore & Cochin.* Oxford University Press, London. 436 pp.

ALI, S. 1996. *The Book of Indian Birds.* Oxford University Press, Mumbai. 354 pp.

ALI, S. AND S.D. RIPLEY. 1969. *Handbook of the Birds of India and Pakistan.* Oxford University Press, London. 2060 pp.

BEEHLER, B.M., T.K. PRATT AND D. ZIMMERMAN. 1986. *Birds of New Guinea.* Princeton University Press. 293 pp.

BIBBY, C.J., N.D. BURGESS AND D.A. HILL. 1992. *Bird Census Techniques.* Academic Press, London. 257 pp.

BROOKER, M.G. AND L.C. BROOKER. 1989. Cuckoo Hosts in Australia. *Australian Zoological Reviews.* 2: 1–67.

CROWELL, K.L. 1962. Reduced interspecific competition among birds of Bermuda. *Ecology.* 43: 79–88.

DESHOLM, M AND A.M. WEGEBERG. 1995. *A Survey of the Avifauna in three National Parks in Thailand.* Unpublished Report, Department of Zoology, Aarhus University, Denmark. 50 pp.

FJELDSÅ, J. 1993. The avifauna of the Polylepis woodlands of the Andean highlands: the efficiency of basing conservation priorities on patterns of endemism. *Bird Conservation International.* 3: 37–55.

FJELDSÅ, J. AND J. RABØL. 1995. Variation in avian communities between isolated units of the Eastern Arc Montane forest, Tanzania. *Le Gerfaut.* 85: 3–18.

FOWLER, J. AND L. COHEN. 1985. *Statistics for Ornithologists.* Loughborough University of Technology, BTO Guide, No. 22. 175 pp.

GLENISTER, A.G. 1959. *The birds of the Malay Peninsula, Singapore and Renang.* Oxford University Press, London. 282 pp.

GOODWIN, D. 1967. *Pigeons and Doves of the World.* The British Museum, London. 446 pp.

GREY, D., C. PIPRELL AND M. GRAHAM. 1994. *National Parks of Thailand.* Communication Resources Ltd. Bangkok, Thailand. 250 pp.

KING, B., M. WOODCOCK AND E.C. DICKINSON. 1987. *A Field Guide to the Birds of South-East Asia.* Collins, Grafton Street, London. 480 pp.

KOEN, J.H. 1988. A census technique for Afromontane forest bird communities. *Suid-Afr. Bosboutydskrif* 145: 39–41.

KOSKIMIES, P. AND R.A. VÄISANEN. 1990. *Monitoring Bird Populations.* Zoological Museum, Finnish Museum of Natural History, University of Helsinki, Finland. 144 pp.

LEKAGUL, B. AND P.D. ROUND. 1991. *Birds of Thailand.* Saha Karn Bhaet Co., Ltd. Bangkok. 457 pp.

MACKINNON, J. 1990. *Field Guide to the Birds of Java and Bali.* Gadjah Mada University Press. 391 pp.

MEDWAY, L. AND D.R. WELLS. 1976. *The Birds of the Malay Peninsula.* Willkerby and University Malaya Press, Kuala Lumpur. 448 pp.

NILSSON, S.G. 1977. Density compensation among birds breeding on small islands in a South Swedish lake. *Oikos.* 28: 170–176.

PIZZEY, G. 1987. *A Field Guide to the Birds of Australia.* William Collins Sons & Co., Ltd. London. 460 pp.

POIANI, A AND M.A. ELGAR. 1994. Cooperative breeding in the Australian avifauna and brood parasitism by cuckoos (Cuculidae). *Animal Behaviour.* 47: 697–706.

SMYTHIES, B.E. 1953. *The Birds of Burma.* Oliver and Boyd, London. 668 pp.

SMYTHIES, B.E. 1960. *The Birds of Borneo.* Oliver and Boyd, London. 562 pp.

WIENS, J.A. 1989. *The Ecology of Bird Communities, Vol 1: Foundations and Patterns.* Cambridge University Press. 539 pp.

REFERENCES

ALI, S. 1953. *The Birds of Travancore & Cochin*. Oxford University Press, [illegible] pp.

ALI, S. 1979. *The Book of Indian Birds*. Natural History Society, Bombay, [illegible] pp.

ALI, S. AND S.D. RIPLEY. 1983. *Handbook of the Birds of India and Pakistan*. Oxford University Press, [illegible] 2000 pp.

BOONSONG, LEKAGUL, T.N. [illegible] AND D. [illegible]. 1990. *Birds of [illegible]*. [illegible] pp.

CODY, M.L., N.D. [illegible] AND D.A. HILL. 1993. *Bird Census Techniques*. [illegible] 257 pp.

[illegible] AND L.C. [illegible]. 1989. [illegible] Australia. [illegible] *Wildlife Research* [illegible]

CROWELL, K.L. 1962. Reduced interspecific competition among birds of Bermuda. *Ecology* 43: 75–88.

[illegible], M. AND A.M. [illegible]. 1992. *A Survey of the Avifauna in [illegible]*. Unpublished Report, Department of Zoology, [illegible] University, [illegible] pp.

[illegible], J. 1975. The avifauna of the "[illegible]" woodlands in the Andean high [illegible] [illegible] Sedentation priorities in patterns of endemism. *Bird Conservation International* [illegible]

[illegible], J. AND J. [illegible]. 1995. Variations in avian communities between [illegible] parts of the [illegible] Montane Forest, [illegible] *Le Gerfaut* [illegible]

[illegible], J. AND J. [illegible]. 1988. *[illegible]*. [illegible] Occas. Sec. [illegible] 195 pp.

[illegible], A.G. 1990. *The Birds of the Malay Peninsula, Singapore and Penang*. [illegible] London. 282 pp.

[illegible], D. 1987. *Pheasants and Doves of the World*. The British Museum [illegible] pp.

[illegible], D. C. [illegible] AND M. [illegible]. 1994. *Lowland Birds of Thailand*. [illegible] Bangkok, Thailand. 250 pp.

KING, B., M. WOODCOCK AND E.C. DICKINSON. 1975. *A Field Guide to the Birds of South-East Asia*. Collins, London. 480 pp.

[illegible], J.H. 1988. A census technique for [illegible] forest bird communities. [illegible] 36–43.

[illegible], P. AND R.A. [illegible]. 1990. *[illegible] Bird [illegible]*. [illegible] of Natural History, University of Helsinki, Finland. [illegible] pp.

[illegible], D. AND P.D. [illegible]. 1991. *Birds of Thailand*. Saha Karn Bhaet Co., Ltd., Bangkok. [illegible] pp.

MACKINNON, J. 1993. *Field Guide to the Birds of Java and Bali*. Gadjah Mada University Press, [illegible]

MEDWAY, L. AND D.R. WELLS. 1976. *The Birds of the Malay Peninsula*. Witherby, London, and Penerbit Universiti Malaya, Kuala Lumpur. 448 pp.

NELSON, S.G. 1977. Density compensation among birds breeding on small islands in the South [illegible] *Oikos* 28: 173–176.

[illegible], G. 1987. *A Field Guide to the Birds of Australia*. William Collins Sons & Co. Ltd., London. [illegible] pp.

[illegible], A. AND M.A. [illegible]. 1991. Cooperative breeding in the Australian avifauna and social [illegible] [illegible] *Animal Behaviour* 42: [illegible]

SMYTHIES, B.E. 1953. *The Birds of Burma*. Oliver and Boyd, London. [illegible] pp.

SMYTHIES, B.E. 1960. *The Birds of Borneo*. Oliver and Boyd, London. [illegible] pp.

WIENS, J.A. 1989. *The Ecology of Bird Communities*. Vol. 1. Foundations and patterns. Cambridge University Press. 539 pp.