

SOME BIONOMICS OF THE BIRDS OF KHAO YAI NATIONAL PARK, THAILAND

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ABSTRACT

The avi-fauna of Khao Yai National Park was under study during 140 days distributed among all months of the year from 1968-1974. More than 200 species were recorded. Seasonal population status of these is given. Seasonal vocalization of 55 species, evidence of nesting of 39 species, flocking and interspecific associations of 69 species and other bionomic information are reported.

Khao Yai National Park with an area of 2085 sq. km. lies between 14.05° — 14.15° N. and 101.05° — 101.50° E. in central Thailand about 200 km. N.E. of Bangkok. It was established as a National Park in 1965 including forested and mountainous sections of the provinces of Nakhon Ratchasima, Saraburi and Prachinburi.

Except for low undulating lands to the east, the Park is mountainous, part of the Phanom Dongruk range with contours of from 250 to 1400 m. above sea level. These hills and their forests provide watershed for two river systems, the Lam Takhrong which flows northeast to join the Chao Phya water system and the Nakhon Nayok which flows south. There are several waterfalls as these river systems flow through and from the Park. Three high ridges peak the Park, Khao Laem in the northeast, 1400 m.; Khao Khieo in the southeast, 1300 m.; and Khao Sam Yot in the west, 1200 m. Rainfall averages about 400 cm. and the temperature ranges between 6° and 30° C. Rainy season is from the S.W. monsoon during May — Oct. and the dry season during the remainder of the year. The substratum is of ancient origin with Permian and Jurassic limestone

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massifs and Jurassic sandstone. There are lava or conglomerate dikes from earlier volcanic action.

VEGETATION

Because of the area of the Park, mountains, and varied soils, the vegetation is varied with 5 distinct types in evidence. SMITINAND (1968) defines these as: 1. Dry mixed deciduous forest along the northern slope between 400 – 600 m. 2. Dry evergreen forest along the eastern border from 100 – 200 m. 3. Tropical rain forest including the majority of the Park forest from 400 to 1000 m. 4. Hill evergreen forest, above 1000 m. on the peaks. 5. Grassland and secondary growth which has become established in old fields and where lumbering was heavy. There has been some exploitation in most areas so that the forest crown is more open than would be expected in unexploited forest. SMITINAND lists 125 species of major trees and shrubs but the total will be much higher than this when a floral survey is complete.

Extensive lallang or brushy grassland areas ranging from a few to many acres are scattered through the Park, remnants of the fields and villages that were present before the region was declared a park. These are burned regularly and illicitly by animal poachers so as to attract big game to the newly sprouting grass. Where a field remains unburned for a few years there is a rapid invasion of woody shrubs and the succession toward forest begins. The borders around the fields and the invasion of trees and shrubs into them creates a much greater forest edge and diversity of habitats than would have been there before man's disturbance. This results in an abundance of food plants, fruits, and their associated insect residents which supports a large fauna of birds and mammals. At least 60 species of mammals live in the Park and more than 200 species of birds.

This is an account of some of the birds and their bionomics, information resulting from six years of observations during 1967 through 1973.

STUDY SITES

Because of the extensive area of the Park it was necessary to make studies at locations easy of access, but which were thought to be repre-

tative of the habitats present. Admittedly several of the faunas were not observed, mainly those of the lowlands and slopes surrounding the park, those of the mountain peaks, and those of the dry dipterocarp forest to the east. The studies were made on the plateau north of Khao Khieo at about 600 to 700 m. in disturbed tropical rain forest and its associated habitats.

BIRDS SPECIES AT KHAO YAI

Table 1 lists the species recorded from Khao Yai. Most of these have been seen between the entrance gate and Hew Suwat Waterfall. This list presents the actual number of individuals tallied regardless of time or place, which will give some idea of the population densities involved. The months when the species was known to be present are also given and a comment upon its residency. Most of these data are based upon direct observations by the author. Additional information has been drawn from DICKINSON 1963, 1964, and 1967.

The avian fauna of the Park can be drawn up under three main categories; Permanent Residents, Winter Residents, Migrants or Vagrants. Permanent residents remain in the park the year round and breed there. There are very few nest records at present, but these will be augmented by further study. Winter residents arrive in September to November and remain until April. In the third category are those species about which there is less information. They include; 1) Northern migrants that pass through the Park going south or north but which do not remain long; 2) Species that nest in other habitats and which appear here as stragglers or as dispersing juveniles, soon to move on or to fail to establish in the Park; 3) Those species about which there is so little information we can not ascribe a period of residency to them. At present permanent residents appear to include 90 species, winter residents 30 species and species of uncertain residency about 100.

Population density is low for most species. Totaling all of the tallies for five years indicates the following abundance:

Population Range	Species Recorded	
1 to 10 Birds	88	41.5 %
11 - 20	18	78.3 %
21 - 40	28	
41 - 60	17	
61 - 80	12	
18 - 100	3	
101 - 125	5	16.5 %
126 - 150	3	
151 - 200	3	
201 - 250	5	
251 - 300	4	
301 - 500	9	
501 - 1000	6	5.1 %
1000 +	11	

Nearly half the species were seen in numbers of ten or less even though observations were made on 140 days. Over three quarters of the species were seen in numbers less than one hundred. And only eleven species totalled more than a thousand. This means a diversified population in which the observer may make repeated tallies before duplicating a previous record.

During 1970 intensive studies were made monthly along a one mile route traversing disturbed tropical rain forest and at other locations north of Mt. Khao Khieo. Each period of study covered three days and the total number of species tallied for the year was 165 with an observational average of 77. More than 25,500 birds were counted, an average of 155 per species for the year. By month, the average was 28 individuals per species; as low as 8 in February and high as 59 in April.

Tallies were made both by voice and sight of the bird. Vocalization varied by species, some calling every month and others having specific seasons for calling. For example, the Green-legged Tree Partridge (*Arborophila charltoni*) was heard every month, averaging 15 birds per observational period yet not one bird was seen during the whole year.

The Golden-headed Flycatcher-Warbler, *Cisticola exilis*, called from April into July but was seen in the fields every month. Generally speaking there was a direct relationship between calling and movement or activity, for calling birds were apt to be moving about as well. These data are summarized in Table 2 the last line of which shows that peak activity for the year, both by movement and voice, fell in March and April.

VOCALIZATION

Vocalization by birds is related to their breeding cycles, territoriality and to weather. During 1970 55 species were heard calling in early morning along the census route (Elephant Walk). Twenty-six species called regularly and the records for 38 species are shown in Table 3. The total calling birds is listed and the monthly call rate is given as a ratio related to the month of maximum calling (shown as 100).

There is a "Morning chorus" each morning, but a second period of calling occurs just before sundown as well. Fewer species, 36, were heard at sundown than at sunrise, 55; however, peak calling was in March-April in both. Calling was definitely a pre-rainy season event. That there was vocalization throughout the year is illustrated in Fig. 1. The actual number of birds heard calling was greatest in March and April but there was always some calling. Individual species reached maximum vocalization during different months as related to their nesting cycles and physiology. But, as would be expected, the greatest number of species calling coincided with the maximum number of individuals actively singing.

As in other parts of the world maximum vocalization was at dawn and in the early morning. Many species such as the barbets, babblers, and partridges could be heard calling at any hour of daylight and the Pygmy Owlet (*Glaucidium brodiei*) for the entire 24 hour period.

Weather had some effect upon this calling, i.e. calling was actually less during rain or it was more difficult for the observer to hear the birds. Table 4 relates the amount of calling to weather. Basically this relationship was a reciprocal of the number of hours of such weather. Clear and partly cloudy weather made up the bulk of the sky condition in the morning and 73% of the bird calls were heard under these conditions.

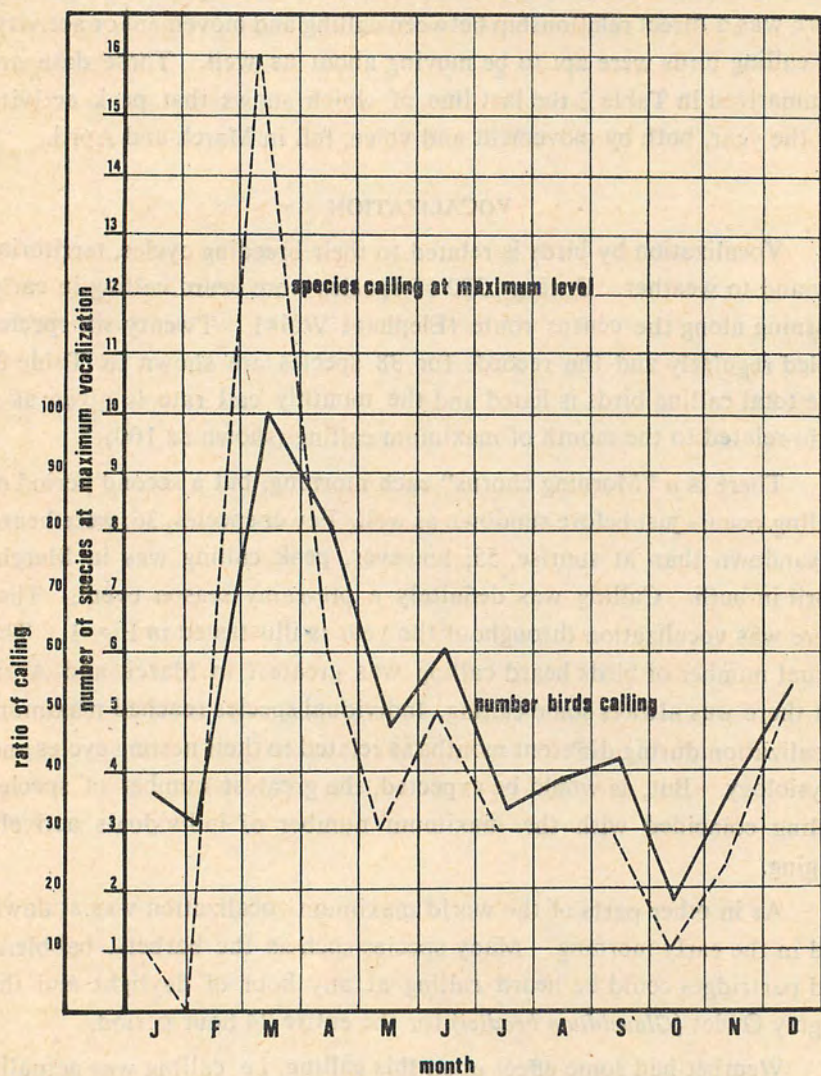


Fig. 1. The seasonality of bird calls at Khao Yai National Park.

Twenty-four percent of all birds were heard calling during clear weather with peak activity in Jan., Feb., Oct. and Dec. Almost clear skies with only a scattering of cirrus yielded peak calling in April and Sept. Partly cloudy skies with alto-cumulus were periods of calling in March and May. Partly cloudy with heavy cumulus gave high counts in Nov. Mostly cloudy skies occluded with cumulus were prevalent in July with peak calling under those conditions. August is the month of rains and peak calling came during light rain. Items in Table 4 are arranged as couplets to be compared in this way: in January 76% of the birds were calling in clear weather and these birds made up 22% of all birds heard calling during clear weather. In February 100% of the birds were heard calling in clear weather, but these made up 19% of birds heard calling in clear weather during the year. To carry this further only 7% of the birds of the year were heard calling in Jan. and 5% in Feb. The number of birds heard calling per day per species respectively these months was 9.2 and 11.3.

The number of birds seen was also related to weather but this may have been an artifact since they are active in the morning because of the necessity to feed and early mornings were usually clear or partly cloudy. Table 5 presents the information about weather and birds seen, again by couplets. January is usually clear to partly cloudy and 81% of the birds seen were in clear to partly cloudy weather. The February counts were low but again they were made in clear weather. March is a month of beautiful skies of broken cumulus. Sixty-eight percent were tallied in this weather. April was a month of fair weather with cirrus overcasts, partly cloudy cumulus, and with some light rain. Tallies under these conditions were respectively 34%, 36%, and 23%. May begins the rainy season with occasional squalls and more days of increasing cloudiness. Forty percent of the birds were seen under partly cloudy conditions and 18% when it was overcast. June brings more rain and clouded sky and 75% of the birds were noted with cirrus or broken cumulus. During July were heavy squalls but rarely a day of rain. During this month 45% of the birds were seen under partly cloudy skies, 21% during heavy overcast, and 10% during light rain. August brought heavy rain and for the first time an appreciable number of birds were seen moving under

such conditions. As an increasing number of the daylight hours were taken up by heavy rains the birds would eventually have to forsake shelter to get sufficient food. September brought clearing skies and tallies showed 16% under cirrus conditions while still 36% of the birds were noted under heavy cumulo-nimbus. Open skies in October brought tallies of 20% seen in clear weather and 56% during partly cloudy. November was again a month of beautiful skies and 80% of the birds seen under partly cloudy, cumulus. Finally December continued the fine weather and 29% were tallied during clear, 31% during partly cloudy conditions.

Thirty-four species were counted in numbers greater than a hundred. None of these was a strictly fair weather species, but several were tallied most often in fair weather; including *Merops leschenaulti* 71.2%, *Merops philippinus* 55.6%, *Hirundo daurica* 63.7%, *Hemipus picatus* 50%, *Pericrocotus flammeus* 50%, *Dicrurus hottentottus* 65.1%, *Garrulax leucolophus* 54.8%, *Pycnonotus melanicterus* 56%, *Gracula religiosas* 55.7%, *Arachnothera longirostra* 84.8%

Wind was a much greater deterrent for activity. An anemometer was relatively useless for ground level air movement was always slight within the forest. When wind reached proportions that the canopy swayed heavily birds ceased to fly and came lower into the forest and thereby less conspicuous and songs, if uttered, could not be heard above the noise of the canopy movement.

The relationships between birds seen and those heard are shown in Table 6.

None of the above fits the popular concept of seasonality as expressed in the temperate zone. The rainy season closes in October as winter residents arrive. Streams have passed flood stage and are rapidly receding. The hours of sunshine increase as the clouds follow the sun south below the equator. The daily temperature rises until it peaks in March and April when the sun has returned and is directly overhead in cloudless skies. Trees have lost their leaves either to become bare or to be more sparsely foliated. The forest floor is dry and brittle with crackling leaves. Leeches practically disappear except from swampy areas. Insect

life has moved to the greener streamside. Many species of trees burst into bloom. There is a period of heavy insect emergence during March, April and May, especially Lepidoptera and Coleoptera. Although studies have not been made this is probably related to the impending new plant growth that will come. These insects undoubtedly breed and lay eggs preparatory to the burst of plant growth as the first storms sweep in.

THE USE OF FLOWERS OR FRUITS

Flowering and fruiting of all species of trees and shrubs in the Park have an effect upon the movement and densities of the vertebrate populations dependent upon the abundance and palatability of the fruit or nectar. Flowers and fruit also attract insects which in turn attract the insectivores. WYCHERLY (1973) reviews the effects of climatic and diurnal changes in weather upon plants in the humid tropics. McCURE 1966 and MEDWAY 1972 have made studies of flowering and fruiting of forest trees in Malaya, but no such study has as yet been made at Khao Yai where the temporal relationships throughout the year would be quite different from those of forests in Malaya.

As a preliminary effort, following are some of the flowering or fruiting species and the animals that make use of them.

Caesalpiniaceae: *Acrocarpus fraxinifolia*: A fairly large tree with lacy foliage that is found on well drained slopes. In December or January it bears purple flowers which resemble "Bottle brushes" and which have a quantity of nectar. The positions of these trees in the forest have an important effect upon the distribution of *Dicrurus hottentottus* which gather in flocks of 15-20 and remain in the vicinity of the flowering trees. They feed on the nectar and also on insects attracted to the blossoms. *Garrulax leucolophus*, *G. chinensis*, *Gracula religiosa* and *Dicrurus paradiseus* also feed on the nectar.

Papilionaceae: *Erythrina subumbrans*: The coral tree, distinguished by spiny or lumpy limbs and trunks, which blooms in December or January. This is more commonly a forest edge species. It is not as heavily used as *Acrocarpus* but nectar is sought by *Gracula religiosa* and *Dicrurus hottentottus*.

Bombacaceae: *Bombax insigne*: Another type of "Coral" tree in which the leaves are lost before the blossoms appear. Usually forest edge and blooms in January or February. Nectar commonly fed upon by *Dicrurus hottentottus*, *Pycnonotus jocosus* and occasionally by *Aplonis panayensis*, *Corvus macrorhynchus* and *Pycnonotus madagascariensis*.

Euphorbiaceae: *Macaranga deticulata*. A small roadside or forest edge tree with large leaves. The small panicles of fruit appear from May into July or August. This is a very important food species fed upon by bulbuls and many other groups: *Criniger pallidus*, *Hypsipetes propinquus*, *Pycnonotus melanicterus*, *P. atriceps*, *Chalcophaps indica*, *Loriculus vernalis*, *Ducula badia*, *Irena puella*, *Garrulax monilegerus*, *G. chinensis*, *G. leucolophus*, *Zosterops palpebrosa*, *Chloropsis cochinchinensis*, *Pomatorhinus schisticeps*, *Dicrurus hottentottus*, and Pig-tailed Macaques as well (*Macaca nemestrina*)

Melastomaceae: *Memecylon ovalifolia*. A small dense tree which produces purple berries in April. Fruit eaten by *Irena puella*, *Pycnonotus melanicterus*, *Hypsipetes propinquus*, *Criniger pallidus*, *Megalaima faios-stricta*, *M. incognita*.

Ulmaceae: *Trema australis*: A small roadside and forest edge tree with leaves slightly larger than the following species. Produces a small greenish berry from May into August much favored by birds: *Criniger pallidus*, *Hypsipetes propinquus*, *Chalcophaps indica*, *Megalaima incognita*, *M. faios-stricta*, *Pycnonotus melanicterus*, *P. jocosus*, *Coracina melachista*, *Eurylaimus javanicus*, *Zosterops palpebrosa*, *Phylloscopus* spp., *Yuhina xantholeuca*.

Trema angustifolia: A small roadside tree, conspecific with the foregoing one and growing in mixed colonies. The small greenish fruit also, produced from May into August are, fed upon by the same birds as the above.

Myrtaceae: *Eugenia cumini*: Large trees scattered in the forest. Small red fruit in May or June. A tree near brushy lalang was heavily fed upon by *Pycnonotus jocosus* coming from the lalang and *Dicaeum agile* coming from nearby forests. Also *Irena puella*, *Phoenicophaeus tristis* and *Megalaima faios-stricta*.

Urticaceae: Many species of figs occur in the forest but those which strangle a host and grow into massive trees have small fruit which are important sources of food to a host of animals. These trees do not have synchronized fruiting so that the animals using them move from place to place following the availability of food. Although the trees may be large with a very heavy fruit load they will be quickly harvested and serve the animals only a short period at each fruiting. This is lengthened to several weeks since the figs ripen progressively. Figs with large fruits do not seem to be as palatable as the smaller ones.

Ficus altissima: Large strangling figs which fruit regularly, but not in synchrony, have been noted fruiting in Jan., March, April, May, Aug., Nov., Dec. They are fed upon by birds in flocks and by mammals. Birds; *Buceros bicornis*, *Anthracoceros albirostris*, *Rhyticeros undulatus*, *Dryocopus javanensis*, *Gracula religiosa*, *Treron curvirostra*, *Ducula badia*, *Irena puella*, *Chloropsis cochinchinensis*, *Megalaima incognita*, *M. faiostricta*, *M. australis*, *Loriculus vernalis*, *Hypsipetes propinquus*, *Criniger pallidus*, *Pycnonotus melanicterus*, *Mulleripicus pulverulentus*; Mammals; *Callosciurus finlaysoni*, *Hylobates lar*, *H. pileatus*, *Viverra zibetha*, *Arctictis binturong*, *Macaca nemestrina*.

A typical count includes 200 animals of 8 or 10 species feeding at the same time. The distribution of numbers will often be as follows: Great Hornbill 5, Wreathed Hornbill 3, Pied Hornbill 5, Lesser Thickbilled Green Pigeons 80, Fairy Bluebirds 50, Hill Mynas 20, Humes Barbet 10, Green-eared Barbet 10, Little Barbet 3, Imperial Pigeons 5, Hanging Parakeets 10, White-handed Gibbon 4, etc. This overlooks the flower-peckers, sunbirds and other small species not readily visible in the large dense crowns of these immense trees.

Ficus annulata: Large tree. Fruiting not followed. When in fruit it was noted feeding *Treron curvirostra* and *Gracula religiosa*.

Ficus microcarpus: Small forest tree. Fruiting in May. Fed upon by *Irena puella* and *Megalaima incognita*.

Anacardiaceae: *Choerospondias axillaris*: A small tree by roadside. Fruited in August. Fed upon by *Treron curvirostra* and *Gracula religiosa*.

Elaeocarpaceae: *Slonea kerrii*: A large forest tree. Fruited in December and the nectar was being eaten by *Dicrurus hottentottus* and *Criniger pallidus*.

NESTING AT KHAO YAI

Finding nests in a tropical rain forest is very difficult. Usually it is by fortuitous circumstance that one is discovered. Evidence of nesting at Khao Yai has been based upon observing adults carrying nesting material, feeding fledglings or accompanied by recently fledged juveniles. In this way records have been accumulated concerning the breeding cycles of 39 species. These are listed in Table 7.

From these data it appears that most nesting has been completed by the end of June. Among these species 87% were nesting during Jan., Feb. March and April into May. This was the hottest time of the year and it would seem that food gathering would be at its worse. Fifty percent of the species nested in other months as well. When we understand the cycles of fruit production by the figs and the emergence of insects this discrepancy may not be as evident. At present it would seem that the parents must work hard to feed their broods, but they have them off the nest at the beginning of the best time for nutritious young insects and fruits or fresh growth of plants. Other factors, such as the possibility that insects are more easily found during the dry season when there is less foliage, and the emergence of adults before the rains, may also be involved.

LALLANG (*IMPERATA*) FIELD POPULATIONS

Sundown observations at the Lookout area (Nong Pug Chee) revealed a succession of populations throughout the year. Following is a brief diary of events.

Eleven species made up 94% of the total birds tallied. Although 79 species were recorded the remaining 68 included only 6% of the total. The monthly distribution was such that one or two species characterized

the evening flights, especially during periods of migration. In general when a species was numerically abundant and developed a peak population for the year this coincided with its peak relationship to the over all population as well.

January: *Hirundo daurica* most abundant and conspicuous, followed by *Merops philippinus* and *Gracula religiosa* both of which were at peak abundance in their individual populations.

February: All populations reduced so that they made up less than 1% of the year's totals. *Cypsiurus parvus* and *Gallinula chloropus* were conspicuous, but their individual population peaks came in November and March respectively.

March: *Gallinula chloropus* migrants were arriving from the south and it reached peak populations. Many species were present with increases in numbers evident.

April: March and April were dominated by flocks of *Emberiza aureola* coming at 1800 to roost in the tall grass. April was also the month of greatest populations seen but there was slightly less than average numbers of species present.

May: The total population was down and only *Gracula religiosa* was conspicuous.

June: The population remained low with no single species conspicuous.

July: The July population was about that of June, but *Pycnonotus jocosus* reached peak abundance in its population and in conspicuousness. It had been increasing during May and June.

August: The population rose a little with the appearance of *Hirundo rustica* from the north and the roosting concentrations of *Rhyticeros undulatus*, both being conspicuous and in peak numbers.

September: Again the population dropped, but flocks of *Motacilla flava* from the north began moving into evening roosts in the lallang.

October: *Motacilla flava* reached peak numbers in the evening roost.

November: Bird numbers reduced, but *Buceros bicornis* conspicuous and reached its own peak for the year. The same was true of *Cypsiurus parvus*.

December: Overall populations remained low but *Merops philippinus* was conspicuous and reached its annual peak.

MIXED SPECIES FEEDING FLOCKS

Many of the small insectivorous species in Khao Yai feed in mixed species flocks (Bird waves). These include mainly Campephagidae, Aegithinidae, Zosteropidae, Sylviidae and Nectariniidae. Bulbuls are both fructivorous and insectivorous and commonly feed in mixed species flocks involving mainly bulbuls. However they often join the flocks of smaller insectivores and feed upon insects with them.

These mixed species feeding flocks are not to be confused with assemblages that are found in a fruit bearing tree. Diverse species will seek a fruiting tree as indicated by those that go to feed in figs. The main difference lies in the fact that the "Bird Wave" moves constantly, usually in a definite direction, and remains loosely as a group. Flocks of individual species may compete for food in a tree full of fruit, but each species remains aloof, moving into and out of the tree unrelated to the movements of other species.

In the Khao Yai study areas 36 species have been noted regularly involved in "Bird Waves", while an additional 35 species have been noted with Waves, but probably only incidentally, or caught up in a Wave as it swept by. Forty Waves have been tallied with a total of 1432 birds, 35.8 per Wave. The average number of individuals per species per Wave has been 4.1. Table 8 summarizes the flock data by month. Over two-thirds of the flocks were seen in the latter half of the year. The number of birds per flock was greatest in the third quarter and lowest in the first, 42 and 16 respectively. The average number of species per Wave was fairly consistent, 10 for the first three quarters, 8 for the fourth quarter. It is evident that "Bird Waves" were most numerous following the rainy season and before the maximum heat and drouth. Some species were more often seen in association with "Bird Waves" than alone. These included *Hemipus picatus*, *Yuhina zantholeuca*, *Chloropsis cochinchinensis*, *Hypothymis azurea*, *Melanochlora sultanea*, *Pericrocotus flammeus*, and *Zosterops palpebrosa*. Table 9 lists species commonly seen in such mixed flocks.

The phenomenon of birds feeding together in flocks of mixed species has been reported from most tropical forests and from many temperate ones. It is apparently prevalent in most forest habitats and is almost universal among small insectivorous species in these habitats. Many observers (MOYNIHAN 1962, DIAMOND and TERBORGH 1967, TERBORGH and DIAMOND 1970) myself included (MCCLURE 1967) have attempted to analyze these flocks and to ascribe organization, peck-order, species rank, etc. within them. I am now not convinced that these relationships are as binding or prevalent as have been reported. It is true that such flocks have feeding territories within which they usually remain. It is also true that in any feeding flock, mono- or poly-specific, the birds rush ahead to get a chance at the choice morsels. This flowing motion is evident in all flocks and among tropical mixed species groups it is the small excitable species that move ahead most rapidly. Within a given species there would be peck order with aggressive individuals foraging further ahead. The position of the species within a flock probably relates more to the temperament of that species than to any inter-specific affinities. For example, White-eyes are exceedingly nervous and active and they rush ahead fanning out in a broad front. The Bar-winged Flycatcher-Shrikes are apt to be right with them as they too are excitable. The Yuhinas are less active so will usually be behind the White-eyes. Lethargic and slow moving trogons and malkohas are almost invariably behind and bringing up the rear.

All of the species feeding in a poly-specific flock benefit from it, for the activity and numbers breaks the cover or camouflage of prey and more food is ferreted out. Since camouflage has been so highly perfected in the tropics this mass searching breaks the prey cover more often than would the searching by an individual. The fact that identifiable individuals join a flock and feed with it for a while only to drop out as the flock moves on supports this. Both in Thailand and Australia I have seen ringed individuals in a flock feed with it for a while and then return in the direction from which they came as the flock moved on. There may be individuals that remain with the flock during its entire feeding circuit or it may be that the flock composition constantly changes. If so, the evidence of a flock feeding territory may be only an artifact arising from the movements of the individuals within it, or possibly from the land contour or the position of food supplies. When the opportunity presents itself

some student will mark entire flocks and then the movements of individuals as well as the flock will be understood.

ANNOTATED LIST BY SPECIES

Following are discussions of those species about which some pertinent information has accumulated. If a species has been seen only once or twice and not significantly it is not mentioned, but it will be listed in Table 1.

DARTER OR SNAKEBIRD, *ANHINGA MELANOGASTER*

Early in 1969 a small earth dam was thrown up across a stream at the Lookout Area (Nong Phak Chee). This flooded a small valley and created a permanent pond which then provided a habitat for aquatic species not usually found in the Park. Soon after the pond filled an *Anhinga* made its appearance. The pond quickly became stocked with fish that migrated into it. Since 1969 this Darter (probably the same bird) has followed the pattern of appearance in March and remaining into August. It rests on dead snags about the pond and swims under water in search of food. Occasionally it flies to the pond at the TOT bungalow area but this pond offers less food,

Deer wade thru the Nong Phak Chee pond, large Monitor lizards (*Varanus salvator*) and Pythons (*Python reticulatus*) occasionally swim and fish in the pond. During one observation the monitor lizard was swimming and the Darter fished around it unconcernedly.

Why the Darter does not remain during other months of the year is probably related to its breeding season. It must go somewhere else to breed.

CHINESE POND HERON, *ARDEOLA RALLOIDES*

Pond Herons are usually seen from December into May feeding in the edges of the ponds at TOT and the Lookout. Why they have not been present during other months may be only on accident in observation or may be related to their breeding. There has been no evidence of nesting within the Park. The birds seen here may be juveniles on dispersal

flights. That they fly across the forest from rice growing areas to the North and South is evidenced by the fact that during February or March they will be seen roosting on the tops of dead snags within the forest. There is also some movement along streams in the forest where individuals have been seen feeding at pools.

LITTLE GREEN HERON, *BUTORIDES STRIATUS*

The Little Green Heron is a winter resident of the Park. It appears as individuals along the streams in September or October and remains into April. During these months the density is about one bird per mile of stream. Although this species nests in both the tropic and temperate zones there has been no evidence of them nesting in the Park.

CHESTNUT BITTERN, *IXOBRYCHUS CINNAMOMEUS*

The presence of the ponds at Nong Phak Chee and the TOT has probably stimulated the presence of this bittern which is commonly a lowland form in conjunction with rice farming. Since it is a skulker and remains close to aquatic vegetation it may be present about the ponds more often than noted.

SPARROW HAWKS, *ACCIPITER* spp.

The three *Accipiters*, *virgatus*, *badius* and *trivirgatus*, occur in the Park and are a source of confusion. They have been seen during every month but July, which is probably only an omission. Occasionally one is seen perched and close enough for positive identification. More often they are in flight above or through the forest. Variations in sizes of males and females make the use of size ineffective for identification and they have many plumages. Occasionally the identifying crest of *trivirgatus* is evident. Although present all months, there was no evidence of nesting in the Park. The population density is low and, except during migration, rarely are more than one individual seen in a day. This density apparently has little effect upon the bird populations of the forest although the *Accipiters* are disliked. *Trivirgatus* was seen being chased by *Buceros bicornis*, *Irena puella* and *Criniger pallidus* on separate occasions. *Virgatus* was noted being attacked by *Dicrurus hottentottus*.

HARRIER'S, *CIRCUS* spp.

Both the Marsh Harrier, *Circus aeruginosus*, and the Pied Harrier, *C. melanoleucos*, have been seen scudding over the lallang areas during winter months. They are winter residents or migrants in Thailand and occasionally penetrate the forests of the Park to search the isolated grasslands. They would have to pass over the forests to find these areas so probably locate them only during migration.

BLACK-WINGED KITE, *ELANUS CAERULEUS*

This beautiful hawk is a lowland resident which completes its nesting by the end of April. It is most often seen at Khao Yai over the lallang fields from May or June on. This is probably related to the dispersal of juveniles from the lowlands. These exploring birds are few as only eight have been tallied. In hunting they hover over the fields on beating wings, a habit shared by the Kestrel as well (*Falco tinnunculus*).

FISHING EAGLES, *ICHTHYOPHAGA* sp.

The rivers of Khao Yai are rather small but occasionally these large hawks are found upon them. Fishing Eagles are more often found along larger jungle streams of the lowlands where they establish territories for fishing. Those seen in Khao Yai have probably been the Grey-headed Fishing Eagle, *I. ichthyaetus*.

BLACK EAGLE, *ICTINAETUS MALAYENSIS*

This large dark hawk has been seen often enough over the forest to suggest that it may be resident. It may reside in the more remote and mountainous parts to occasionally fly out over the forest where it can be seen.

SERPENT EAGLE, *SPILORNIS CHEELA*

The common resident hawk of the Park is the beautiful Serpent Eagle. In the area under study there is probably one pair, but the nest has not been found. These birds are often seen singly or as a pair wheeling and calling above the forest. Calling appeared to be most often during the dry season, Jan. into May. This may have been related to

courting and nesting. Although the diet may include other animals, the birds have been seen carrying serpents. It is a raptor unfeared by the birds of the forest which tolerate it when it is resting on a limb or flying through the forest.

OSPREY, *PANDION HALIETUS*

The Osprey is a winter resident to Thailand. After the establishment of the ponds at TOT and Nong Phak Chee an occasional bird would sight this water and explore it. One individual remained during Oct. and Nov. of 1970 and was noted taking a large fish, which must have weighed several pounds, from the TOT pond. The food supply was not adequate to support Ospreys each year.

ORIENTAL HOBBY, *FALCO SEVERUS*

This is a resident falcon which breeds in Thailand. It may possibly nest in Khao Yai but it has seldom been observed so may nest only in some remote area. Most of the sightings have been during winter months. On two successive days in April 1970 a bird was seen hunting for *Emberiza aureola* which was roosting in flocks at Nong Phak Chee. It was foraging at sundown as these birds came in and was stooping upon them but no strike was seen.

KESTREL, *FALCO TINNUNCULUS*

The Kestrel nests in the Palearctic and is a winter resident in Thailand. An occasional bird was seen hovering over the lallang fields in search for small prey. In November 1970 one remained in the vicinity of TOT for several days. It roosted in a clump of large trees by the pond and played a game with several *Corvus macrorhynchus* that also roosted there. Repeatedly each day the falcon would chase the crows or the crows would chase the falcon in a circuit around the pond. With the abundance of *Pycnonotus jocosus* and other birds supported by the lallang fields it is surprising that Kestrels do not remain in residency for the winter.

GREEN-LEGGED TREE PARTRIDGE, *ARBOROPHILA CHARLTONI*

Like all of the forest pheasants this species is very difficult to track down and see. These tree partridges have the most spectacular

call of any bird in the Park, and they can be heard at any time during the day. Only in December, January or February (Table 3) is calling less. October is a month of reduced vocalizing for many species and *arborophila* is seldom heard. The call is a long series of single loud notes followed by a crescendo of notes. Because of this pattern it is unmistakable. The only other Thai bird with such a call is the Helmeted Hornbill of Malaya and Southern Thailand, and the two calls are similar in pattern only, quite different in tone and cadence. In five years of tramping forest trails I have seen this bird once, but a glimpse, so I know nothing of its habits. Its calling is probably territorial designation, for one bird will be heard all day in a restricted area. How calling relates to the breeding cycle remains to be learned. It is a bird of the dense forest and does not come to the forest edge.

FRANCOLIN, *FRANCOLINUS PINTADEANUS*

The Francolin is a partridge of the dry dipterocarp or deciduous forest of the eastern part of the Park. It is common there and can be heard calling vigorously from March into May. Males answer each other and the calling indicates the boundaries of their territories. They do this crowing from tree limbs at about 20 ft. and drop quickly to the ground to disappear in the undergrowth when disturbed. I have not had opportunity to study them further. *Salim Ali* (1969) reports that they call all year round and that nesting is between March and September in Burma. Nest is a hollow lined with grass beneath some dense shrub.

JUNGLE FOWL, *GALLUS GALLUS*

Wild Chickens or the Red Jungle Fowl are very common in the Park in all of the habitats, (forest edge, primary forest, disturbed forest, etc.) It is primarily a bird of secondary or disturbed forests so is probably more abundant in the Park than before settlers opened and cleared parts of it. The cocks crow during most of the year except July and August. Peak crowing is during the months just before the rain season (Feb, Mar, Apr, May). This is probably the breeding season for *Salim Ali* (1969) indicates that it is March through May in Indian forests. Occasionally pairs will cross roads and trails and juveniles may be seen

later on in the year. They are non-gregarious and cocks are usually seen with only one hen. As they nest on the ground, it is amazing that they are so successful considering the number of small predators active in the Park (wild cats, civets, wild dogs, monitor lizards, etc.).

KALIG, SILVER AND SIAMESE FIRE-BACKED PHEASANTS

LOPHURA LEUCOMELANA, *L. NYCTHEMERA* AND *L. DIARDI*.

These pheasants may occur in the Park in some numbers. They do not crow, or if so, are rarely heard. The Kalig has been seen in primary forest and several feathers attributable to Silver Pheasant have been picked up. The Siamese Fire-back has been seen crossing the road. Quiet stalking or waiting in the deep forest would reveal more about these birds.

BARRED BUTTON QUAIL, *TURNIX SUSCITATOR*

A fairly dense population of Button Quails must be sustained in the lallang fields in spite of the yearly burning that they are subject to. This is a grassland and forest edge species. All that have been tallied to date have either been seen crossing trails, feeding in trails or have been flushed from the grass. At the time the lallang is burned, usually in Jan, Feb, or March, they probably repair to the surrounding forest edge until new grass sprouts again. The ground nest, at the base of a clump of grass or beneath a shrub, usually contains 4 eggs. Nesting at Khao Yai may be extended over several months for young were seen with adults in May, 1/2 grown ones with parents in June, and two tiny black bumble-bee sized chicks were scurrying after a hen in August. This species may usually be recognized by the general dark color and the black bib of the female. *T. tanki* also occurs in the Park for they have been reported and one was struck down on the highway in April.

WHITE-BREASTED WATERHEN, *AMAUROORNIS PHOENICURUS*

In common with most rails this bird is a skulker, creeping among the grass and reeds of damp, swampy or seepage areas. They are resident in the Park and can usually be seen at Nong Phak Chee. They call during most of the year, most heavily in May. The call is a low double note as

from a bamboo flute. On several occasions they have been seen feeding beneath the feet of or around Sambar Deer feeding or resting in small marshes. They were catching insects stirred up by the deer.

MOORHEN, *GALLINULA CHLOROPUS*

The Moorhen is a winter resident, arriving in October and leaving in May. They were probably not present in the Park until the creation of the permanent pond with its food supplies at Nong Phak Chee. The pond at the TOT is probably too disturbed to be attractive to Moorhens. Food includes vegetation, insects, and fish for which they dive in a duck-like fashion. It is possible that these birds originate in and return to China.

SANDPIPERS, SCOLOPACIDAE

At least six species of sandpipers have been seen in the Park. They are all stragglers, mostly migrants arriving during winter months and none seem to remain long. Sandpipers of the genus *Tringa* are often seen at Nong Phak Chee, and occasionally Snipes, *Capella*, are flushed from the grass.

EMERALD DOVE, *CHALCOPHAPS INDICA*

This is one of the most interesting of the forest pigeons. It is a permanent resident at Khao Yai, a ground dove rarely seen in trees. The Emerald Dove is the only granivorous pigeon of the forest and it is commonly seen feeding along the roadside where grass is growing or weeds that have seeds. When *Trema* (along the roads and forest edge) is in fruit Emerald Doves will climb among the twigs eating the dry berries. They also come to *Macaranga* trees for berries.

These doves are low flying and characteristically pass you in the forest at head height and at great speed. They have remarkable ability to fly among the dense foliage without striking limbs or twigs.

The call is a deep note or monotone which forms a background sound of the forest. Once you become aware of it you will find that it fills the forest. Calling is generally from March through August. The birds are most commonly seen in the dry season when seeds of roadside plants mature, but most commonly heard during April, May and July.

Nesting may extend over a long period but the only nest observed was in January. It was at seven feet height in dense rotan by a stream, at the center of the plant and could not be approached. Had the female not flushed it would have remained unseen. By her actions it probably contained eggs. Juveniles are rarely recognized since they quickly reach the size and coloration of the female.

MOUNTAIN IMPERIAL PIGEON, *DUCULA BADIA*

This is a large spectacular dove with a deep booming double noted coo heard every month of the year. Peak calling was in March but they can be heard almost any morning and during the day. Imperial pigeons are strong fliers and like to fly high above the forest. They seem to do this most often from February into June. Like most doves they have a courting or flight performance which they do before the female. It consists of a steep climbing flight from a perch, with deep wing strokes that strike above and below the body in loud slapping blows. At the peak of the flight the bird banks to the right or the left and circles back to a perch near the mate. Like the domestic pigeon he bows and coos before her and will preen her feathers.

As big and conspicuous as this bird is it becomes very secretive when nesting. No nest has been discovered, but in March a male was seen carrying twigs through the forest to some unseen nest.

These are fruit pigeons which commonly feed on the fruits of figs, *Trema* and *Macaranga*. They have a wide selection in Khao Yai and probably eat most non-poisonous fruits small enough to swallow. Although usually seen singly or in pairs, they will gather at a fruiting fig until 15 or 20 may be present. Such groups are not permanent flocks and will break up as the birds disperse when fully fed.

BARRED CUCKOO-DOVE, *MACROPYGIA UNCHALL*

This is a smaller and more graceful dove than the Imperial Pigeon and probably more abundant. Cuckoo-doves are strong fliers and spend much time flying at considerable height above the forest. These flights are mainly in early morning and early evening and may be related to courting. They are most conspicuous from February into July. Cooing

is in a somewhat higher register than that of the Imperial Pigeon and is made up of several notes given more rapidly. Calling is greatest during May, June and July which, like the flying, is probably related to the breeding season.

Nest building was at a fever pitch the last week of July 1970 when four nests were found. All were in forest edge and three of them in *Macaranga*. The nest consisted of a mass of twigs piled against the stem of the tree. The trees were small, two to four inches in diameter and the nests placed at seven to fifteen feet. One nest was under construction, the male bringing twigs to the female, and the other three females were incubating, probably on eggs. Success of these nests was not determined since it was a month before the next observation.

This is a slender dove which flies like a cuckoo, from which it derives its name, and moves through the forest canopy at great speed. Its flight is higher in the forest crown than that of the Emerald Dove.

It feeds on small fruit and may sometimes be seen on the ground.

SPOTTED-NECKED DOVE, *STREPTOPELIA CHINENSIS*

This is an open country and farmyard dove which has invaded the Park only where there is lallang. It is most commonly seen about the TOT and Golf Course. This is a weed seed eater that feeds along the roadside or on lawns. The breeding season may be extended, but newly fledged young have been seen in January.

LESSER THICK-BILLED GREEN PIGEON, *TRERON CURVIROSTRA*

This is the most abundant dove in the Park. They travel in flocks of a few birds to fifty or more and are commonly seen feeding in fig trees. They have a peculiar plaintive call which is very un-dove-like and which can usually be heard during the rainy season. They call during May, June and July and during this study period were actively singing in December. The call is so soft that it may have been over-looked during other months.

These fruit pigeons are somewhat lethargic. They spend much time among the foliage of the tree tops preening or remaining quiet. During the morning when feeding they fly as a group to a fig tree where they

climb squirrel-like through the foliage pulling off the fruit. If disturbed they fly to a nearby tree and soon return to feed. Because of their size and coloring they are difficult to see in the top of a giant fig as they move about among the rustling foliage in competition with barbets, bulbuls, leaf-birds, and others. Sated, they leave the tree to rest and return later in the day for other meals.

The nesting season is probably long for juveniles were seen in February and nest building in June. This nest was under construction on top of a limb in a small clump of bryophytes in a large dipterocarp. The nest site was over 100 ft. above the ground, on the north and 30 ft. out from the trunk. The male was busy at 0745 bringing twigs to the female which was assembling the nest, sparsely constructed as that of all doves. He was flying more than 100 meters to the top of an unidentified tree where he broke off small leafless twigs by twisting and jerking them, making six trips in 10 minutes. Often he dropped a twig after freeing it as if it had proved unsatisfactory, and then broke off another. In returning to the nest he made only slight detours. The success of this nesting effort could not be determined, but it was still active on the following day.

INDIAN HANGING PARROT, *LORICULUS VERNALIS*

This tiny gregarious parrot is probably much more abundant in the Park than it would seem. It is virtually invisible in the crown canopy where it lives. In Malaya I had a platform built in the top of a jungle giant where it was possible to watch loriquets approach a fruiting fig in a small flock, gorge themselves and then fly to a nearby tree where they would walk to the tip of some small branch, fall forward and hang up side down. In this position they would preen or sleep. A remarkable protective camouflage.

These loriquets are almost silent, but have a small squeak, flower pecker-like, which is a flock call. Once learned you can identify the presence of the bird even though you can not see it. Nothing was learned of its nesting habits. Once in March one was seen examining a hole in a tree trunk as if considering nesting. It feeds on the nectar of a variety of flowers and upon numerous fruits besides figs.

RENAULD'S GROUND CUCKOO, *CARPOCOCCYX RENAULDI*

This spectacular cuckoo, large as a pheasant, is probably more abundant in the Park than recognized. It has a distinctive human or gibbon-like call and has been heard calling from March into May both at the Viewpoint and in the valleys near Haew Suwat. A pair was seen in March in a valley near the Orchid Falls. The male was calling and courting the female. He strutted before her and gave a low shuddering call with head bowed and tail raised. She responded with the "Human wail." He was so fearless in his performance that he approached me giving his "Shuddering" call. Judging by the widespread calling heard, these cuckoos are well distributed over the north part of the Park.

COMMON COUCAL, *CENTROPUS SINENSIS* AND LESSER COUCAL,
C. TOULOU

These are both permanent residents of the Park. The main difference between the two is in size which is often difficult to distinguish when they walk through tall grass. Their calls are also different, that of *sinensis* being deeper and more "Booming" while *toulou* calls somewhat faster and not so low.

The ecological overlap of the two is very great. Salim Ali (1969) says that in India *sinensis* is widespread in grassland and scrubland and that *toulou* is more specialized preferring grass or marshes near heavy forest. There is a third species in Malaya *C. rectunguis* which is a forest bird and *toulou* may be intermediate between it and *sinensis*. It would be interesting to determine what ecological factors keep these two species separate at Khao Yai.

Calling is heaviest for both species early in the rainy season (May, June). Nesting probably extends during this period, however a juvenile was seen on a roadside in March. This is a non-parasitic cuckoo that builds its own nest, a large round affair in some tangle of weeds, with a side opening.

Apparently both species move in the open lallang feeding or climbing among the grass and weeds. They are fearless of deer and have been seen feeding among them, and also fly close to or walk among the elephants.

GREATER GREEN-BILLED MALKOHA, *PHAENICOPHAEUS TRISTIS*

This is the only Malkoha in the Park. It is large and conspicuous usually going in pairs and often found with feeding flocks of mixed species of small birds. The moving habits of Malkohas are very characteristic. They fly down from one tree in a straight gliding flight, with long tails undulating behind them, to the lower parts of a nearby tree covered densely with vines. Then they walk squirrel-like up through the foliage and out limbs looking for insect prey. Having searched one tree they glide to another and repeat the process.

Most cuckoos are noisy and have loud calls but these are almost voiceless. In five years of observations I have attributed no call to them and have heard only a low grunt which may be given as they feed. A nest was seen under construction in May in a clump of creepers at the top of a small tree trunk, about 15 ft. high at the north eastern edge of the Park.

DRONGO CUCKOO, *SURNICULUS LUGUBRIS*

Like many parasitic cuckoos the Drongo Cuckoo is silent when not breeding, but its 6 or 7 noted ascending calls have been heard from April into July and in December. It is probably a permanent resident of the Park, but DEIGNAN (1945) says that it is a bird of summer months in the north. In Malaya it was heard or seen every month but Sept. and Oct., so its status is uncertain. It resembles a Bronzed Drongo and might be mistaken for a drongo except that it does not have a forked tail. It flies through the foliage like a cuckoo not with the swooping flight of a drongo. In India it is known to parasitize the nests of minivets and drongos. At Khao Yai its hosts are unknown but a *Criniger pallidus* was observed chasing one from its singing perch in March. These cuckoos prefer the highest point in the forest from which to call.

OWLS, STRIGIDAE AND TYTONIDAE

Khao Yai has a large unseen population of owls. Some can be readily indentified by their calls which they give repeatedly night and/or day. Others are rarely heard. Dr. Joe Marshall (personal communication) has recorded the calls of the following: *Otus bakkamoena*, *O. scops*,

O. spilocephalus, *Glaucidium brodiei*, *G. cuculoides*, *Ketupa ketupu* or *zeylonensis*, *Strix leptogrammica*, *Ninox scutulata*, *Athene brama*, *Bubo sumatranus*, *Phodilus badius*.

PYGMY OWLET, *GLAUCIDIUM BRODIEI*

This is probably the most abundant owl in the Park; certainly it is the noisiest. Its call resembles that of the Scimitar Babbler but differs in having an introductory note (— - - —) (low register, slow speed). It calls day or night with heaviest song from February into May, peaking in March. This may also be its breeding season. If quiet before hand it will call in daylight following a rain. This is a forest owl and its calls usually emanate from dense thickets.

BARRED OWLET, *GLAUCIDIUM CUCULOIDES*

This is a forest owl considerably larger than *brodiei*. It is not as vociferous as *brodiei* but has a spectacular involved call difficult to describe. They are probably fairly common in the Park and may usually be heard in March and April. They are not liked by small birds and one was noted being mobbed at mid-day by 18 birds including a Whistling Thrush, Black-crested Yellow Bulbuls, Stripe-throated Bulbul, Grey-eyed Bulbul, Black-headed Bulbul, Ochraceous White-throated Bulbuls, *Phylloscopus* spp, and the Black-breasted Sunbird. On another occasion one was seen attacking a *Phylloscopus*, but unsuccessfully.

COLLARED SCOPS OWL, *OTUS BAKKAMOENA*

A common owl of the lowlands which occurs in the Park as well. It is less secretive than the other small owls and is apt to be the one that you will see. The call is a short plaintive one which is apt to be confused with that of the Brown Hawk Owl. It is probably present all year round but nothing is known of its breeding in the Park.

MOUNTAIN SCOPS OWL, *OTUS SPILOCEPHALUS*

This is the third of the common small owls that can be heard regularly at Khao Yai. Like *brodiei* it calls day and night. Its call is readily identifiable for it is higher than that of *brodiei* and consists of two notes repeated indefinitely. -- -- -- . The remarkable thing about the call is that it begins faintly at first becoming louder and louder. This makes placing the position of the bird very difficult. It may be in a shrub

thicket only a few meters from you but at first will appear to be calling from far away. It is heard during most months. Breeding has not been described in the Park.

LONG-TAILED NIGHTJAR, *CAPRIMULGUS MACRURUS*

This is the smaller of the two nightjars commonly seen in the Park. Calling their monotonous interminably repeated single noted call, they can be heard in almost any month, but most often during the early months of the year. They call usually from sundown until sunup. The nest is upon the ground, no nesting material, just two eggs, pinkish with reddish brown spots, on the bare ground. One nest was seen in February along a roadside within two feet the macadam surface. The parent incubated all day long despite passing vehicles. Its success was not determined.

On several instances this species was seen at dusk following a rain hawking termites in company with bats.

GREAT-EARED NIGHTJAR, *EUROSTOPODUS MACROTIS*

These nightjars are large and easily recognized. They appear at dusk, fluttering over the lallang fields or forest like great dark butterflies. During the day they are very difficult to find since they rest on some limb parallel to it and their mottled coloration makes them nearly invisible. At dusk a bird gives a "Drink-tea-beer" call from its perch which is usually in the forest edge and launches itself out into the air. The high shrill three phrased or three noted call has been paraphrased as "Drink-tea-beer" the first two words quickly and the "Beer" trailed out. Usually the call is preceded with a click or "tack", like one would make with the tongue at the roof of the mouth.

The bird is probably a permanent resident of the Park but its populations vary greatly. During Jan, Feb, Mar into Apr they seem to be very abundant over all fields and forests and hawk insects about the lights at TOT in numbers up to 25 individuals. In other months none at all will be seen over the fields or at the lights.

Following a period of active feeding in early darkness when insects are active they will rest on roads, stumps, or posts in the open. There is another period of active feeding and calling just at dawn after which they drop into the forest to roost.

The one egg is laid on the ground in some open spot from which the bird can rise quickly. None have been seen in the park, but they may breed here.

SPINE-TAILED SWIFTS, *CHAETURA* spp.
(*COCHINCHINENSIS* AND *GIGANTEA*)

Two giant spine-tailed swifts occur in the Park possibly as permanent residents. They are so similar as to be difficult of identification, for their flying speed is the swiftest of all birds and you are usually only awarded a glimpse before they have swept away. Taxonomists do not agree as to their identity as species or subspecies. The curve of abundance indicates that there are greater numbers present from Feb. into July. Each evening before sundown they make their appearance at Nong Phak Chee where they drink from the pond by flying over the surface to scoop up water. The long wings strike a staccato on the water during this maneuver which can be heard from beyond the lake shore.

Both species are known as tree hole nesters, *cochinchinensis* above 5000 ft. in the Himalayas, and *gigantea* at lower-levels. They may nest in Khao Yai but there are no definitive records.

PALM SWIFT, *CYPSIURUS PARVUS*

Single or clumps of tall palms near some open spot or lallang field in the forest are attractive to the Palm Swift. The center of all community activity is about these favored trees. The swifts roost in them, rest, sweep out from them to feed and nest on the fronds. The nest is woven of plant fibers and spider webs and clings to the leaf. As the palm leaves dry they bend down bringing the nest, which is constructed horizontally, into an upright position thereby preventing eggs or young from falling out. The nesting cycle at Khao Yai has not been determined. There are significantly different periods of abundance during the year. Greatest numbers have been seen in the air and about the palm from October into January and in March. This period of abundance may be related to breeding or it may result from movement of the swifts into the Park from areas where food becomes less easily available.

RED-HEADED AND ORANGE-BREASTED TROGONS,
HARPACTES ERYTHROCEPHALUS AND *H. ORESKIOS*

Two of the most striking and beautiful birds of the forest, these trogons live in the same habitats and seem to fill the same niche. No critical study has been made to determine what separates them ecologically. *Erythrocephalus* is more abundant than *oreskios*; but both species have been increasing in abundance during the past five years. What this signifies has not been determined. It could be a normal cyclic phase of their population or it could be resulting from some unrecognizable changes in the forest itself. Both species have a plaintive descending call not unlike that of the Banded Kingfisher but given more slowly and less often. They also have a low grunt which is audible only when you are close by. Possibly it is a warning note. Trogons prefer the climax forests or the groves with almost complete canopies which make the low levels where they live a habitat of nearly perpetual dusk. They rarely fly above head height and move silently through the shrub or low tree levels hawking insects in the quiet corridors of the forest.

Both species habitually follow mixed species feeding flocks of little birds. They do not remain with the busy flock but fly behind it. As a flock passes a trogon soon approaches to wait quietly on a limb until the flock has moved on. Then it will rejoin the flock and wait again. Apparently the activity stirs up insects which the trogon can catch on the wing.

Both species are permanent residents of the Park with very limited territories or daily range. Once you have learned the haunt of a pair you may usually find it by a little patient search or waiting. They do not build an open nest but make use of some abandoned woodpecker or barbet nest hollow. Nesting in Khao Yai has not yet been observed.

COMMON KINGFISHER, *ALCEDO ATTHIS*

This tiny kingfisher is a winter resident from the north. It can usually be found along the shores of ponds and sometimes the streams. It prefers the open light and is less often found in the gloom of streams penetrating the forest. It is never abundant in the Park and usually only one or two will be seen in a day. They arrive in September and leave before May.

DEEP BLUE KINGFISHER, *ALCEDO MENINTING*

Although this is a close relative of *atthis* and easily mistaken for it, *meninting* is a permanent resident of the Park and habitually remains in the forest at jungle streams. It is not abundant.

BLACK-CAPPED KINGFISHER, *HALCYON PILEATA*

This is a migrant, probably from southern China, which makes its appearance in the Park during September and October and again in March. It appears to be a passage migrant that does not over-winter in the Park. When present it is generally found along the roadside rather than in the deep forest.

WHITE-BREASTED KINGFISHER, *HALCYON SMYRNENSIS*

This is an open country kingfisher usually seen resting on wires or fences. It has probably increased in or invaded the Park following timber cutting and is now a permanent resident. A nest burrow was located in April in a road embankment. Length of the nesting season has not been determined.

BANDED KINGFISHER, *LACEDO PULCHELLA*

Although not abundant, the Banded Kingfisher is so exquisite that it is sought for by the bird student as much as are trogons or pittas. It is most often found in deep moist forest not associated with streams or ponds. The call is a rapid plaintive cascade of notes resembling that of the trogons (of much the same tone or quality) or a faint call of the Ruddy Kingfisher. It must breed in the early months of the year for it calls most at that time. Rarely seen above the shrub level these kingfishers apparently hawk insects in the forest corridors. The sexual dimorphism is one of the most striking among the kingfishers.

BLUE-BEARDED BEE-EATER, *NYCTIORNIS ATHERTONI*

The open country bee-eaters of the genus *Merops* pose special problems in distribution and seasonality, but this genus *Nyctiornis* is a sedentary open forest one with two species in S.E. Asia. They are so similar in color and actions that some authorities consider them variations of the same species; one with a blue beard and the other with a red beard. Both give a short barking call, not unlike the bark of a distant dog.

The voice does not carry far so when you hear the bird it is close by and careful scrutiny will reveal it sitting quietly on a limb in or just beneath the upper canopy.

The Blue-bearded Bee-eater is a permanent resident of Khao Yai. Calling can be heard during most months but seems to be most evident during September. Nesting is during the last of the dry season and early rainy season when insects are abundant. A tunnel one and a half to three meters deep is dug into a vertical clay bank such as a stream side or road embankment. The birds dig early in the morning and are very industrious making several holes in a small area, only one of which will contain the nest. They may repair and use previous nests and clean out the hollow at the back which may be cluttered with insect chitin, or there may be unhatched eggs from the previous nesting. Both the nestlings and the adults regurgitate pellets of insect debris (like owl pellets) and these soon partially fill the chamber. The young are helpless at first but as they grow they creep out the tunnel to wait near the entrance for parents bringing food.

BAY-HEADED BEE-EATER, *MEROPS LESCHENAULTI*

The position of the Bay-headed Bee-eater at Khao Yai is very confusing. It may be composed of two populations, one that breeds in the Park, and one that comes as a winter resident. In five years they have not been seen in the study areas during June, July or Aug, yet nests have been found in March and April. Large winter roosts are present in December. During periods of activity they drink and feed at both the pond in TOT and that at Nong Phak Chee.

During December 1968 there was a roost in a small lallang field near Orchid Falls. It was centered around a small tree only 4 meters high and the surrounding tall grass. On two successive morning at dawn more than 200 birds were flushed from this roost. They flew upward and then diverted West and North the first morning and East the second morning. During the bitter cold weather of the last week of Dec. (temperature in the 40°F with a strong NE wind) 1973 a flock of more than 200 tried for five evenings to roost in the crown of a large tree by the TOT pond exposed to the full force of the wind. It was strong enough

to blow birds out of the tree. This flock accumulated for more than an hour previous to dark and left *en masse* before sunup. They came from several directions but flew north upon leaving the roost. Individuals found feeding in lallang about 10 miles northwest of the roost may have been among the flock.

During other months *leschenaulti* may be found drinking at ponds at dusk, or they will be seen hawking insects along the streams. In March 1970 a nest was found in the sand along a major stream 2 Km. west of Orchid Falls. It was in a low cut, only a foot high at the water's level. A bird flew out as the nest was approached. A month later the nest opening was still fresh but no birds were seen. In May the hole had been dug into by some predator.

BROWN-THROATED BEE-EATER, *MEROPS PHILIPPINUS*

This is a winter resident in the Park, from September into March. They are usually seen in late afternoon, feeding and drinking about the man-made ponds. There is no evidence that this species nests at Khao Yai nor in what direction it goes when leaving the Park.

BLUE ROLLER, *CORACIAS BENGHALENSIS*

The Blue Roller is a resident of man-disturbed highlands outside of the Park. It has probably moved into the Park area as the forest was cut or opened up. Habitually it is found on wires along roads traversing the orchard growing uplands. Nesting at Khao Yai has not yet been verified but the bird is present every month. It is rarely seen in the forest, usually in the vicinity of lallang.

BROAD-BILLED ROLLER OR DOLLAR BIRD, *EURYSTOMUS ORIENTALIS*

This is a forest roller which has been seen in the Park every month but November and December. It includes two populations; one that breeds as far north as Japan and Korea and which over winters in southeast Asia. The other probably nests at Khao Yai. The courting flight is an undulating falling leaf type flight from which it gets its name as "Roller." Such flights can be seen from February into August. They like to play about the ponds late afternoons early in the dry season but

disappear by November. Like all bird species in the Park, much needs to be learned about them.

PIED HORNBILL, *ANTHRACOCEROS ALBIROSTRIS*

There are four species of hornbills that may be seen in the Park. Of these the Brown Hornbill, or Tickell's Hornbill, *Ptilolaemus tickelli*, is a straggler from habitats to the north and it has been reported only a few times. The Northern Pied Hornbill is probably the most abundant in the park. It travels in small flocks which may be family groups, moving swiftly and raucously from tree to tree. Not only is it the smallest of the indigenous hornbills but its flight is characteristic, a rapid wing flutter followed by a glide which carries it rapidly across open places into the forest.

Although noisy they are very secretive when nesting and no nest has as yet been reported. By the time the young are fledged they are nearly the same size as the adults so are difficult to recognize.

All three hornbills are omnivorous, feeding on fruit, habituating fig trees, and catching any small animal or invertebrate that they can overpower. They beat and scrape such prey on limbs until broken up for easy swallowing.

GREAT HORNBILL, *BUCEROS BICORNIS*

The Great Hornbill is probably the most spectacular bird of Khao Yai with the Wreathed Hornbill a close second. They are common residents of the Park but select their nest sites so effectively that they remain unseen. These sites are probably away from the paths of man and while nesting this great bird is very quiet. Judging by the number of young brought from nearby forests to the Bangkok "Sunday" Market for sale the breeding season is from January into May. During these months fewer birds are seen with only about two per observation (pairs?). When the young and the female have left the nest cavity the family moves from feeding tree to feeding tree as a group. These groups gradually coalesce into small flocks that seek communal roosts from August into January. Such roosts may be a favored tree near the forest edge or one deep in the forest. Criteria for a roost tree are not clear.

In spite of this use of communal roosts the adults appear to be territorial and dawn calling in regular study areas indicated that the sleeping habits were fairly regular. In other words, individuals seem to sleep in specific trees each night and to open the morning calling from the night roost. One or more birds may be in the sleeping tree and will call alternately or they may be in separate trees. After an initial preening and calling they will fly off together, noisily squawking, to seek their breakfast. This morning chorus reaches its peak in April (Table 3). Table 10 compares the numbers seen with the numbers heard. In April most birds are calling but only one-eighth as many are seen as in August when many are seen but only one-fourth as many heard.

Great Hornbills are omnivores eating all kinds of fruit and any animal that they can catch. They probably function as a raptor in the bionomics of the forest more than has been recognized. Figs are a favored fruit and the movements of the hornbills are related to the fruiting of figs. Without proper tagging it has not been possible to determine the range of a family nor how many fig trees are required for one territory. Other fruits may be incidental and seasonal in their diet. As a predator they take insects, reptiles, birds, and small mammals. Meat and the other products of animal foods are necessary for the birds to maintain good plumage and health.

Hornbills do not drink water except in the rain, when they will open the mouth and let water flow into the throat. They do not bathe in open water, but bathe in the rain. During the dry season they may have to remain bathless for as long as a month. Food, especially sweet fruits, tends to sully the bill and to clog the inside since the tongue is atrophied to a small stub capable only of assisting in swallowing food thrown back into the gullet. The birds cleanse the bill by rubbing it inside and out on sharp stubs. The deutrum grows constantly and must be worn off and polished by hammering on wood or polishing on sharp stubs. Captive birds like to chew or scrape projecting nails for this purpose.

In the Great Hornbill the oil gland has been modified as a paint brush. Secretions from it are bright yellow and are used by both sexes to paint the bill and the white stripe of the wings. Males perform this

riktual more often than females and the brilliant yellow wing stripe seen in a flying bird is the result of this painting. In being modified for this purpose the oil gland has ceased of function as an oil producer. Therefore the feathers remain dry and harsh and can not shed water. With no water proofing in their feathers the birds become quickly soaked to the skin during a rain. An evening rain sees them sitting miserably cold for the night. However, they do not seem susceptible to pneumonia from this exposure. During a heavy rain both the Great and the Wreathed will be seen huddled with feathers drawn close and bill turned upward. Water runs the length of the bird to drip in a stream from the tail tip. An interesting sacrifice of comfort for the sake of beauty.

Great Hornbills are weak fliers. They are heavy, more than seven pounds (over 3000 grams), and the wings are not massive enough for sustained flight. In moving from tree to tree or across open lallang the flight pattern is three or four slow deep strokes of the wings, a glide, more strokes, a glide (i.e. flap, flap, flap, flap, glide, flap, flap, flap, flap, glide, etc.). During these strokes the harsh primaries cut the wind in a loud hoarse whistle that can be heard long before the birds can be seen.

WREATHED HORNBILL, *RHYTICEROS UNDULATUS*

Whereas the Great Hornbill is the most spectacular bird in Khao Yai, the Wreathed Hornbill is the one seen in the greatest numbers. It is a strong flier with a loud wing roar which heralds its approach before the birds can be seen. Great and Pied Hornbills stay within the forest canopy making only short trips across openings. The Wreathed flies above the forest with steady wing beats that carry it for miles. They have been noted leaving mountain top forests and heading out over farm lands toward other mountains and forests many miles away. The cultivated fields are like open water to them, offering no food, and the occasional tree for a resting place is but a trap because of the prevalence of guns.

All three hornbills will sleep in communal roosts, but the Wreathed because of its stronger flight capability will gather at a favored roost from miles around. One tree may have 200 hornbills in it, like giant fruit. One such roost was in sight of the lookout at Nong Phak Chee in 1968-69 and the bulk of the birds came from beyond the horizon to the north-east, how far could not be determined.

Table 11 illustrates the seasonality of the Wreathed in Khao Yai. From January into May very few birds are seen. They have forsaken their communal roosts and are scattered over the Park nesting. Small non-nesting groups may sleep together but these roosts are scattered. Like the great Hornbill they gather at fig trees to feed, but here too the numbers are fewer. Less than two birds per observation have been tallied during these months. The Great and Pied are raucous and noisy, but the Wreathed is silent. It has a faint call which it occasionally gives, and is capable of a sustained roar but this has not been heard in the wild and I do not know in what way the bird uses this loud vocalization. So except for the wing whistle of an approaching bird you are not aware that they are around you.

Like the other hornbills, large hollows in great trees are used as nests. Most young are out of the nests by June and the flock sizes begin to increase. The male has a yellow throat pouch, the female a blue one, and the juvenile a sort of dirty blue. The casque of the juvenile is smaller and sloping. As these family groups move about the forest their flight arrangement usually includes the female as leader, followed by the male and then the juveniles. It is a matriarchal society for the female is usually in the lead whether juveniles are present or not. From July into November the communal roosts are reestablished and evening flights to them become conspicuous. Peak numbers seen have been in August and October. A communal roost near Nong Phak Chee broke up in 1970 and the spectacular flights of 50 to 100 birds toward it ceased. A replacement roost has not yet been discovered although there has been a smaller one near the Viewpoint. Flock size during the non-breeding months was: Aug. 38 birds, Sept. 17, Oct. 31, Nov. 12, Dec. 14.

LITTLE BARBET, *MEGALAIMA AUSTRALIS*

Four species of barbets are fairly common in the Park; the Lineated, *M. zeylanica*, which is at the lowland borders and in the drier forests of the eastern part, and the other three in the wetter and higher forests. These three call throughout the year and during peak periods of activity the forest is never quiet during daylight hours. Because of their color-

tion none are easy to see, but Hume's and the Green-eared Barbets are less secretive than the Little and may be seen more often.

Little Barbets have a short trill or buzzing call which vibrates the throat very rapidly. They repeat this call over and over as they sit among the leaves in some tree top, for this is a high canopy form. Only under very favorable conditions can you see the bird, for it turns its head as it calls throwing the voice in all directions and giving a ventriloquial quality to it. Peak calling appears to be in April which is in mid-breeding season. Adults have been seen feeding newly fledged young in May. The nest is a hollow in a dead limb or snag, either dug by the barbet itself or an old woodpecker hole is remodeled. Barbets sleep in such holes as well, so one has to be careful ascribing nesting activities to the use of tree hollows.

Courtship feeding is part of the courting ceremony of these birds. A male will seek a ripe fig and bring it to the female. He offers it to her and if she accepts it he may have to bring such a gift repeatedly before she permits copulation. It is amusing to watch his rise in excitement as he seeks fruit after fruit to win his award.

GREEN-EARED BARBET, *MEGALAIMA FAIOSTRICTA*

The two most abundant barbets are the Green-eared and Hume's, of nearly equal population density. They share the habitat, using high canopy, feed in the same fig trees, call at the same time, etc. During any morning chorus from November into May or June both species will be heard almost continuously. The Green-eared reaches peak calling in March and may almost cease during September, October, November. Calling of Hume's remains high from November into June with peak activity in November or March. The calls of the two are similar except that the Green-eared is somewhat slower and lower than that of Hume's. Only when you see the birds calling can you be sure that you have learned to distinguish the song.

In May a piccolo tree (a stub or trunk with many barbet and woodpecker holes) was in use as a nest site on two consecutive years. The Green-eared barbet was seen entering a burrow repeatedly and removing

bits of wood. In March and June adults were also seen feeding young. In one case the parent was carrying berries to the hole hidden high in a living tree and in another the fledgling remained on a twig while parents brought berries to it. The number of eggs is usually two, but only individual fledglings have been seen with the parents.

HUME'S BARBET, *MEGALAIMA INCOGNITA*

Because it is so noisy Hume's Barbet appears to be the most abundant barbet in the Park. This may be true for it calls abundantly for at least nine months of the year. This species seems to be less secretive than the others, or possibly because it is large enough to be seen, but it is often observed feeding in figs, *Macaranga*, *Trema* and other fruiting trees.

The interpretation is that the birds are totally fructivorous, but this is not correct. In eating figs they get protein from the fig insects present and also they eat other insects. One was noted to capture and devour a large walking stick, Phasmatidae. Another hopped along a limb and disturbed a large long-horned beetle, Cerambycidae, which it captured and beat into insensibility. Then it took it to a fledgling (in March) and proceeded to feed it to the bird in chunks.

The piccolo tree used by the Green-eared Barbet was also a nesting site for Hume's. In January 1970 one was working in a hole at 35 ft. on the east side of the stub. In March 1970 another hole at 40 ft. on the east was in use. Digging in the wood was noticed on two consecutive days. In May 1969 a hole was under construction at 45 ft. on the north. Again in May of 1970 one of these holes was in use. Since observations were made only at monthly intervals it could not be determined if these cavities were actually used as nests or were also sleeping quarters.

In March 1970 adults were noted carrying figs to young in a nest high in a tree. A fledgling was also being fed berries in April. In May 1973 young were being fed fruit in a hollow at 80 ft. on the south of a large tree. From these observations it appears that the breeding season extends from January into June, or through the dry season,

WOODPECKERS, PICIDAE

At least 10 species of woodpeckers are resident in the Park. They have calls difficult to recognize and because of their crown-hopping they are difficult to see and identify. Much work remains to be done with this group.

Apparently both species of the Yellow-naped Woodpeckers, *Picus chlorolophus* and *P. flavinucha* occur there, but their population densities need to be clarified.

Both species of Golden-backed Woodpecker, *Chrysocolaptes lucidus* and *Dinopium javanense* have been reported and again much needs to be learned concerning their niches in the Park.

The White-bellied Black Woodpecker, *Dryocopus javanensis* is either rare in the Park or a straggler from some other habitat. The great Slaty Woodpecker, *Mulleripicus pulverulentus* is a resident, but a wanderer in the Park. They had a territory for two years in the vicinity of Haew Suwat Water fall but changed it to the area near Klong Etao. This is such a noisy spectacular species that its presence is readily known.

Two tiny woodpeckers, Heart Spotted, *Hemicircus canente* and Black-and-Buff Woodpecker, *Meiglyptes jugularis* may be confused. The Heart-spotted is much fewer than the Black-and-Buff. Probably both nest in the Park, but that of the Black-and-Buff was seen in May. It was in the side of a dead snag, at 15 ft. and the opening was facing west. Eggs were being incubated as the female approached at 0800 and exchanged with the male which flew away to feed. Parents were seen feeding 3 fledglings in April.

Both of these species associate with feeding flocks or "Waves," the Black-and-Buff more often seen in this capacity than the Heart-spotted. Both search the low trees and shrubs with these groups, hitching up and down the limbs as the other birds search the leaves.

The Rufus Woodpecker, *Micropternus brachyurus*, sometimes fills this capacity as well. Large woodpeckers may occasionally be with feeding flocks, but these are probably accidental. These three small species are of the same size range as birds of the flocks and of equal nervous activity so they can stay with them as the flock moves through the forest,

LONG-TAILED BROADBILL, *PSARISOMUS DALHAUSIAE*

Among the more colorful birds of Khao Yai are the broadbills, only one of which is common enough to be seen regularly. This is the spectacular Long-tailed Broadbill, large with a long pointed tail and colored in various shades of green, yellow, and blue.

This is a gregarious form usually seen in small flocks up to 10 or 20 birds except during the breeding season when they become territorial and are present in pairs. The call is a single shrill whistle given by the male and heard as a territorial call or as a flock assembly call. The nest is the usual large bulky affair of broadbills, appearing as a cluster of debris caught up at the end of a limb. It is pendulous but not as much so as that of the Banded or the Black-and-Red Broadbills. Entrance to the nest cavity is from the side. One nest was active in April and May, at the end of a long horizontal branch about 100 ft. above the forest floor in a heavily wooded ravine. The female was incubating while the male remained nearby. This pair made use of this valley for at least a year. Another pair was seen feeding nestlings in April.

These broadbills are insectivorous and occasionally will join feeding flocks or waves. A flock of 20 Long-tails was seen feeding in August with a large "Wave" making up over 100 birds of nine species. The Broadbills broke away from the "Wave" as it departed indicating only a temporary association.

JEWEL THRUSHES, PITTIDAE

Because the Jewel Thrushes or Pittas are so secretive as to be rarely seen they are sought after by the ardent bird student. The Lesser Blue Pitta, *Pitta cyanea* is a resident of deep primary forest and may be seen feeding like a partridge or quail along the paths or corridors of the forest. It runs from the observer rather than flies and hides behind fallen logs to peep over or around them. Other species may occur in the Park as Thailand has seven species in its fauna. Nothing is known of the habits of the Blue Pitta in Khao Yai, but others of the genus build bulky nests looking like piles of debris at the bases of trees or clumps of palms. The nest is a hollow within and there is a side entrance. The female incubates with her head at the doorway so that the striped head

pattern matches the tangle of twigs, giving the appearance of nothing but a pile of debris.

HOUSE MARTIN, *DELICHON URBICA*

This small swallow is a winter resident or a passage migrant. They are occasionally seen riding air currents above the Park. A study of the limestone bluffs in and near the Park might reveal that they remain near them for the winter months.

RED-RUMPED SWALLOW, *HIRUNDO DAURICA*

The Red-rumped Swallow is a northern migrant which arrives at Khao Yai in September and remains until May. It is commonly seen resting on wires at the TOT or drinking at the pond there. Each afternoon flights pass over Nong Phak Chee where they pause to feed, bathe or drink at the pool. They are usually enroute to some roost. This may be in the vicinity of some cliff but was not discovered during the study. The birds that winter here probably nest from Laos on north into China. Several were captured and ringed but there have been no recoveries.

HOUSE SWALLOW, *HIRUNDO RUSTICA*

This swallow is also a winter resident, but with quite a different population pattern from that of *daurica*. Migrants leave Thailand (and the Park) during April. Usually none are seen at Khao Yai during May and June. In July several hundred will make their appearance and they will remain near the TOT or Lookout areas. We have not learned if these are non-breeders which went north to China and returned without nesting or if they are those that left Thailand early in March, raised one brood in China and returned. Adults and juveniles are both present so the problem is not clear cut. Not only have these birds made an early appearance but they are limited to the highlands. It would be interesting to learn if this phenomenon is widespread over the country. In September or October these flocks at Khao Yai dwindle and have moved to lowland feeding and roosting areas. From then on until they depart the population at Khao Yai is a low and tenuous one. When present they may

mingle with *daurica* on remain aloof and will be seen drinking and bathing at the ponds in late afternoon before going to roost.

THE CAMPEPHAGIDS, CAMPEPHAGIDAE

Six species of this interesting family are resident in the Park, both permanently or seasonally. This is a peculiar group of insectivores some of which resemble shrikes. Because of their affinities they have no definitive name being called wood-shrikes, caterpillar-shrikes, flycatcher-shrikes, or minivets. The minivets are colorful high canopy forms, the remainder drab and found in the lower levels of the forest. Their migratory status is uncertain, except that the Ashy Minivet is a winter resident that nests far to the north in China, Korea, and Japan. As seen in Table 1 several of the species are of uncertain population status.

BAR-WINGED FLYCATCHER-SHRIKE, *HEMIPUS PICATUS*

In southern Thailand and Malaya this species is in association with the Black-winged Flycatcher-shrike, *H. hirundinaceous* with which it seems to share a niche in the forest. At Khao Yai only *picatus* is present. This is a small black bird, unmistakable because of its white wing bar, that is almost invariably seen in association with bird "Waves" or feeding flocks. Ninety percent or more of these birds that you will see will be in these flocks. They are almost silent and nothing has been learned of their nesting in the Park.

During the study 218 individuals were seen in 62 groups or an average flock size of 3.5. This is small enough to suggest that these are families that join the "Bird Waves."

The distribution of the population was as follows:

Month	J	F	M	A	M	J	J	A	S	O	N	D	T
No. Observations	4	3	7	4	2	5	2	8	3	13	3	8	62
Number Birds	17	3	19	18	7	10	6	43	10	47	8	30	218
Ave. per flock	4.2	1.0	2.7	4.5	3.5	2.0	3.0	5.4	3.3	3.6	2.6	3.7	3.5

These data suggest that the *picatus* may be nesting in February, March, June and July when fewer are seen. After juveniles are fledged the flock size goes up in August and remains high, or above average. From August more birds are seen with the "Waves."

ASHY MINIVET, *PERICROCOTUS DIVARICATUS*

The Ashy Minivet is a winter resident that nests in the upland forests of Japan, Korea and northern China, up to 4,000 ft. They arrive in Khao Yai in October and remain until April. The population level is low although they will usually be seen with bird "Waves" or in association with other campephagids. The fact that none have been recorded in January and February may be significant or it may mean simply that they have been overlooked. The winter flocks include five or six birds which feed in the high canopy.

SCARLET MINIVET, *PERICROCOTUS FLAMMEUS*

Other species may be spectacular in size and color, but the male Scarlet Minivet elicits an exclamation of surprise and unbelief from every newcomer to the Park interested enough to observe the life around him. The male is a startling combination of scarlet and black which is altered to yellow and black in the female. They travel in small groups of four to a dozen birds and are almost never seen singly. Even during the nesting season the groups do not entirely break up and both sexes are always present. They have a high thin flocking call that precedes where ever they go. They are sun loving so this faint call will be heard and then the flash of flame appears at the tree top level. Courting and calling are greatest in February and March which is probably the peak of the nesting season. The males defend territories adjacent to the nest with a wild abandon, chasing intruders with shrill squeaks and flashing color.

Scarlet Minivets are among the usual components of Bird "Waves." In association with other campephagids, White-eyes, leafbirds, and warblers they move through the forest in a rapidly flowing flock. They are the top of such flocks as the trogons are the bottom, i.e. the minivets remain in the canopy and the trogons remain in the shrubs. They are mainly insectivorous but have been observed feeding on nectar and eating figs, small berries of *Macaranga* and *Trema* as well as other unidentified fruits.

DRONGOS, DICRURIDAE

The drongos make up a very homogeneous group. They look alike, act alike, and even have similar calls. The six species at Khao Yai range from the small Bronzed Drongo, which is almost silent, to the Greater Racquet-tailed Drongo, active noisy and an excellent mimic. They are all resident in the Park except the Black Drongo which is a winter visitor from southern China. All species exhibit peculiar gaps in their populations and residency which are not understood. These may be related to available food supply or to breeding.

The Black Drongo, *Dicrurus adsimilis*, is a lowland species which prefers the vicinity of rice or marshes. The Thai sub-species *cathoecus* is a resident while other subspecies, mainly *albirictus*, flock in from the north during the winter. It is during this time of population pressure that Black Drongos make their appearance in the lallang fields and about the ponds at Khao Yai.

BRONZED DRONGO, *DICRURUS AENEUS*

This is the smallest of the black drongos at Khao Yai and it tends to be more quiet than the others. Found along streams, near ponds, or along the edges of the lallang, it is usually considered as a lowland form and may be a resident of Khao Yai, but is apparently absent during April and May. This may be an oversight on the part of the observers or it may relate to the breeding cycle of the bird.

ASHY DRONGO, *DICRURUS LEUCOPHAEUS*

Although this species is not black it is of such a dark shade of grey that it looks black under many light conditions. It is a quiet species calling only occasionally and usually rests near the base of the upper canopy. From here it can watch the corridors of the forest beneath it and sweep down to catch insects that fly from the foliage. They also commonly hawk above streams and forest canopied roads. It is probably a permanent resident of the Park but has been absent in July, August and September from its usual haunts. This is a solitary species rarely seen in numbers greater than pairs.

The density in the Park is shown by the following :

Month	J	F	M	A	M	J	J	A	S	O	N	D	T
Number Times Seen	7	2	5	1	1	2	0	0	0	31	18	43	110

This makes it appear as a winter resident with stragglers present during other months.

The food is mainly insects caught on the wing. Bee-eaters hold a large insect in the bill and beat it to death upon some object (limb, wire, stump). This drongo was noted catching a large cicada which it then grasped in its feed like a hawk and flew to a perch. Here it held the insect between its feet and tore it to bits as would a shrike. They also approach lights at dawn to carry away the large sphinx moths attracted there.

HAIR-CRESTED DRONGO, *DICRURUS HOTTENTOTTUS*

Hottentottus is a permanent resident of the Park with widely varying populations. It is nomadic, following the appearance of nectar bearing flowers (*Bombax*, *Erithrina*, *Slonea*, *Acrocarpus*, and others) at which times the bird becomes very abundant. It feeds on these same flowers across S.E. Asia into India, therefore it must cross wide stretches of cultivated and deforested areas to follow the flowering of its favored plants. Like the other drongos it hawks insects in the forest corridors. It sustains a low-level population until trees bloom and the nomads move in. The above genera of trees, unlike the figs, are very seasonal, so the bird must go for long periods without this nectar. It may fill in the gaps by seeking the flowers of other species. The following illustrates this wide variance in population density.

Month	J	F	M	A	M	J	J	A	S	O	N	D	T
Number of Times Birds seen	26	10	23	3	5	3	4	8	5	17	18	64	186
Total Birds Counted	141	18	119	5	14	11	7	18	14	34	56	508	945

Nesting occurs during April, May, June when the birds are very quiet and inconspicuous. Apparently two young are raised at a setting since this is the usual number of fledglings being fed. Previous to nesting they are noisy and have almost as many calls as *paradiseus*.

LARGE RACQUET-TAILED DRONGO, *DICRURUS PARADISEUS*

Paradiseus is a permanent resident of the Park. It was recorded singing nearly every month with peak activity in March. During this time they join in the morning chorus being one of the first birds to greet dawn. They will begin calling while it is still too dark to see them. The repertoire of calls that they use is the most involved of any species in the Park. Whether these are mimic calls or just part of its own is a matter of interpretation. During the day the call will be the usual rather ringing phrases, but at dawn they sound like shamas, wood-peckers and others, so that newcomer is completely baffled by what appears to be a host of singers.

This drongo is apparently an insect feeder, taking but little nectar. Their usual method is to hawk insects in the forest corridors. It rarely flocks in groups greater than family size. The population distribution throughout the year was as follows:

Months	J	F	M	A	M	J	J	A	S	O	N	D	T
Number of times seen	4	4	10	7	9	9	6	9	9	14	4	12	97
Number of birds seen	6	5	17	7	13	14	12	20	10	24	4	25	157
Birds per observation	1.5	1.2	1.7	1.0	1.4	1.6	2.0	2.2	1.1	1.7	1.0	2.0	1.6

From the above it is apparent that there is almost no population seasonality.

The nest is a flimsy platform hurriedly built, usually high in some jungle giant. It is near the end of a limb and usually has access from several sides. Nesting activity has been seen both in May and December so it may be distributed through the year,

Racquet-tailed drongos are nervous and excitable and rarely still. They defend their territories vigorously and have a special dislike for the Great Hornbill. In several instances they have been seen attacking flying hornbills from the rear causing them to dip and dive to escape the pecking of the drongo. They also give chase to Serpent Eagles that enter their territories. They are occasionally seen in the company of other birds, bulbuls, fairy bluebirds, or broadbills, but these may be just accidental or temporary associations.

LESSER RACQUET-TAILED DRONGO, *DICRURUS REMIFER*

The Lesser Racquet-tailed Drongo also occurs in the Park. It has not been reported every month and may be from higher altitudes than usually under study. Its range does not overlap much with that of *paradiseus* which occurs from lowlands up to 4000 ft. and *remifer* about 3000 ft.

GREEN HUNTING CROW, *CISSA CHINENSIS*

This is one of the exciting birds of the Park. It is larger than a jay, bright green, with a long pointed tail, and with brick red beneath the wings. It has a sharp clear whistle which it gives while hunting and it moves rapidly through the forest in the canopy just above that of shrubs, i.e. just below the upper canopy. It is usually solitary, only once or twice have I seen two birds hunting together. It undoubtedly nests in the Park but none has been reported.

The food is whatever it can catch, insects, small birds, etc., but it itself occasionally falls prey to the larger predators for a pile of feathers found in January indicated that a hawk had made a successful strike.

LARGE-BILLED CROW, *CORVUS MACRORHYNCHUS*

The other crow of the Park is the Large-billed Crow. It probably increased when settlers and villagers were present. Now it is nearly restricted to the TOT area but will occasionally be seen over or in the forest. Crows may not nest in the Park, although they were seen feeding fledglings in December. They are most actively cawing in April. The numbers seen in the Park are greatly reduced from February into September which may be related to a seasonal movement. Flocking didn't become evident until October. Monthly tallies were as follows :

Month	J	F	M	A	M	J	J	A	S	O	N	D	T
Number of times seen	9	3	8	4	8	1	1	4	5	11	10	20	84
Total birds tallied	60	4	20	13	18	1	2	8	9	69	79	123	406
Number crows per tally	6.6	1.3	2.5	3.2	2.2	1.0	2.0	2.0	1.8	6.3	7.9	6.1	4.8

Crows are disliked by other species. They have been seen under attack by *Artamus*, *Irena*, and *Falco tinnunculus*. In the case of the *Falco* it was reciprocal, they chased each other.

SULTAN TIT, *MELANOCHLORA SULTANEA*

The only representative of the Paridae seen in the Park has been the Sultan Tit. This beautiful black and yellow bird, larger than most tits, is rarely seen other than in association with a feeding flock. There is a low level population in the Park which is probably permanently resident. In August a family was seen, male, female and two well grown fledglings. Although nearly self-sufficient they still begged from the parents.

BABBLERS, TIMALIIDAE

The babblers make up the largest family of birds in the Asian tropics. There are seventy species listed for Thailand and at least eight species occur in Khao Yai. More may be reported when studies include the foothills and the forests to the east. Babblers are a non-descript group that are so heterogeneous that they are difficult to describe. Most have strong feet, strong bills, hop instead of walk, are non-migratory, build bulky nests open to the top or side, and are weak fliers. Some are beautiful singers, others almost voiceless. None of these characteristics help one in identifying a babbler in the field. They are found from the ground to the tree crowns, most prefer shrubs and the lower part of the forest, but they fill many niches. You just have to learn babblers as they come. Most are drab colored.

BLACK-THROATED LAUGHING THRUSH, *GARRULAX CHINENSIS*

The laughing thrushes make up one of the large genera of babblers and four species occur at Khao Yai. This is the most beautiful singer of these four and its clear liquid and at times melancholy tones are delightful. The male is strongly territorial and by using a tape recorder you can call him to you and get him to perform his whole repertoire. Singing reaches its peak in April at the peak of nesting but has been recorded most months. Juveniles and fledglings have been seen with the parents in April, but nests have not been reported to us. *Chinensis*, though commonly heard, is difficult to see. Tallies reflect this, for the birds are recorded only when responding to a call or crossing a trail.

All four *Garrulax* travel in mixed flocks among which *leucolophus* is the most abundant and makes up the dominant species, *Monilegerus*, *chinensis* and *pectoralis* join these flocks occasionally or when they pass through their territories. *Chinensis* will be seen with such flocks, but as they move on *chinensis* will drop behind to remain in its territory. This relationship may break down during the post-nuptial period but our records are inadequate to describe this.

All of these laughing thrushes feed on the ground. Probably the effect of flocking and noisily throwing leaves aside helps to stir out insects and small lizards. They are general feeders, eating berries and seeds as well.

The nest is a compact cup secluded in some dense shrub and both sexes incubate. The courting performance of all is somewhat similar. It is a lateral display, the male, with crest raised (most spectacular in *leucolophus*) mouth open and inner wing drooping hops, or walks around the female stopping every few seconds to look about and call.

WHITE-HEADED LAUGHING THRUSH, *GARRULAX LEUCOLOPHUS*

You will make acquaintance of this bird by voice long before you will see it. As large and colorful and noisy as it is it can melt into the forest without a trace at the least sign of danger. The best way to observe them is to sit quietly when you hear a flock approaching and they will come around you. As quickly as they discover you they will screech, disperse, hop from shrub to shrub, glide into the mosaic background of

foliage. In a few minutes they will be laughing and shouting again at a distance from you.

Leucolophus calls all year round with peak activity from March into June. They never seem to break up their flocks, even for breeding. It is the flock that has territory. The relationship between the flock territory and that of a pair has not been described, nor are we aware of the relationships within a flock, i.e. are they all related as siblings or uncles and aunts, or is there significant gene interchange between flocks.

Leucolophus makes up the dominant numbers in flock and the other three species just seem to join them to benefit by the food and protection. As is so often true of bird flocks these flow through the forest and over the forest floor, the hindmost birds hopping and gliding ahead of the foremost. When they reach a clearing or road they do not cross it *en masse* but continue this individual gliding so that it may take moments for the flock to pass.

The nest is an untidy bundle of grass and twigs hidden in a dense shrub at about shoulder height. Usually so noisy, they approach and leave the nest with such stealth that you may pass it unnoticed repeatedly.

Whereas the other three species have beautiful calls *leucolophus* seems to be mainly raucous. Since the others travel with *leucolophus* all calls will seem to emanate from the same species. *Leucolophus* has a typical chortling and rasping call barely audible at a distance which is the flock call. They talk to each other with this all of the time that they are feeding or moving through the forest. An individual bird or pair may take up this flock call, enlarge upon it and burst into shouts followed by the whole band of 15 or 20 into a bedlam of sound. And as suddenly they will desist. They call at any time of the day. The loud voices of the White-headed Laughing Thrush, the Red-legged Tree Partridge, and the White-handed Gibbon lend color and identity to the forests of Khao Yai.

LESSER NECKLACED LAUGHING THRUSH, *GARRULAX MONILEGERUS*

Monilegerus and *pectoralis* are both beautiful singers during the breeding season. They associate with the *leucolophus* bands and are difficult to see. *Pectoralis* probably occurs in the Park but has not been

positively reported. Both species appear to share the same niche. They apparently drop from the *leucolophus* band and establish territories for nesting.

Monilegerus was seen carrying nesting material in May but the location of the nest was not found.

YELLOW-BREASTED TIT BABBLER, *MACRONUS GULARIS*

All over South-east Asia there is a noisy obscure little babbler that lives in the brush of the forest edge and sometimes invades farms and cities. The call is a monotonous undertone repeated indefinitely. The bird is a skulker that hides in the shrubbery or vines as it searches the leaves for insects. It calls every month of the year with lowest point in July and peak calling in March. Twice as many birds were reported calling as were seen and usually the only month when they are readily seen is December. Even with heaviest calling in March only three fourths as many birds were seen then as in December. This December movement is related to the feeding flocks or "Bird Waves" as *Macronus* joins them and can then be tallied. These relationships are seen in the following where the peak activity for the year is considered as 100 and other months compared with it:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Number of birds calling	41	22	100	37	44	33	5	34	16	53	23	75
Number of birds seen	10	13	13	17	23	18	27	43	25	20	70	100
The above two combined	34	22	79	34	43	32	16	44	23	47	49	100

RED-CAPPED BABBLER, *PELLORNEUM RUFICEPS*

This is another shrub and forest edge babbler heard much more often than seen. During the period of study it was not heard in January or February, and although 93 birds were heard only nine were seen (10%). It secludes itself in the dense shrubbery and feeds there upon insects hidden among the leaves. Peak song was in March which was probably related to its breeding season. No nests were reported.

CHESTNUT-NAPED OR YELLOW-BILLED SCIMITAR BABBLER,
POMATORHINUS SCHISTICEPS

The scimitar babblers are large babblers, almost as large as the laughing thrushes, and they are so named for their long down-curved (scimitar) bills. Like the others they are secretive and make their presence known by their voices. *Schisticeps* calls through most of the year and its call resembles that of Pygmy Owlet. The owlet has an introductory note which the call of the scimitar babbler lacks. Although *schisticeps* prefers the forest edge or secondary forest it will also be heard in the primary forest. It remains generally at the shrub level, rarely mounting higher in the trees. It is a permanent resident of the Park but its nest was not recorded.

ABBOTTS JUNGLE BABBLER, *TRICHASTOMA ABBOTTI*

This is the least distinctive of the brush or shrub babblers in the Park. It is dull colored throughout with only a slight warmth of chestnut on the back and wings. It has relatively long legs and when seen is usually creeping through vegetation on the ground or climbing among shrubs and vines. Like the previous three species its voice is its most distinctive character. Three times as many individuals were heard as were seen and peak calling fell in August. They are heard every month of the year and this calling seems to be related to feeding as much as to territoriality; the bird calling as it searches for insects in dense shrubbery. It is a permanent resident but nothing was learned of its nesting.

WHITE-BELLIED YUHINA, *YUHINA ZANTHOLEUCA*

With this Yuhina we leave the babblers that are noteworthy for their calls and encounter a quiet one which can be seen readily. This species is an important component of the "Bird Waves." It moves with these feeding flocks in the lower canopy of the forest and when not with such flocks it is rarely found. They were most conspicuous in the flocks in April, May, and June, and in December. The nest is a delicate affair usually placed below six feet and in shrubbery. None were reported from the Park, but this is a permanent resident and they should be found during and latter part of the dry season.

THE BULBULS, PYCNONOTIDAE

This is another very large family, including 32 species in Thailand, of which at least nine occur in Khao Yai. As with the babblers this figure will increase when the lower reaches of the Park have been studied. Bulbuls are more homogeneous than babblers. They are almost all tree or lower canopy inhabitants and have a similar body structure. The feet are strong for perching but not for walking. They are of uniform size, there being no giants or dwarfs among them, most being about 15 to 20 cm. long and weighing around 30 grams. Their colors and patterns are varied from the black of *Hypsipetes madagascariensis* to the clear yellows of *Pycnonotus melanicterus*.

SWINHOE'S WHITE-THROATED BULBUL, *CRINIGER PALLIDUS*

This is a very difficult species to distinguish from *C. ochraceus* which occurs south of the Park. Specimens from Khao Yai were sent to the American Museum of Natural History for positive identification. This is a noisy garrulous bulbul traveling in small flocks with somewhat the habits of laughing thrushes. They travel noisily only to become quiet and slip away when you try to see them. Since they do much feeding in the forest edge they can be seen there. They are basically a forest species being equally at home in primary forest as in the forest edge. They are insect and fruit feeders and move through the lower canopy at young tree level, calling and scolding as they go. They are often found in mixed bulbul flocks (not to be confused with "Bird Waves") and are almost always in the company of the Grey-eyed Bulbul *Hypsipetes propinquus*. What these two species gain by this association is not self-evident. *Criniger* is larger and more aggressive and this may be of value to *propinquus*. Occasionally both species will join insectivorous feeding flocks and search for insects as well. When *Trema* or *Macaranga* fruit are ripe they join other bulbuls in feeding on them and may be up in the tops of fruiting figs as well.

Nest building was seen in March. The birds were industriously carrying bits of grass and twigs to a nest site beyond vision in the forest. Although calling was greatest during the breeding season with peak in

April, the birds were most conspicuous in October and December. These flocks probably included more than one family. If it is multibrooded as are other bulbuls then, the flock could include young from previous nestings.

ASHY BULBUL, *HYPSIPETES FLAVALA*

The Ashy Bulbul is probably a permanent resident of the Park but its population is low and it may not be seen for several months at a time. It is very secretive and only occasionally joins other flocks of bulbuls. It has a beautiful un-bulbul-like song, a clear melodious whistle which is occasionally heard. I have recorded it calling in March.

GREY-EYED BULBUL, *HYPSIPETES PROPINQUUS*

Within the forest this bulbul probably runs a close second to *C. pallidus* as the most abundant bulbul. It associates so closely with *pallidus* that the two species are rarely seen separately. *Pallidus* is the dominate species in this team and the much smaller *propinquus* seems to remain with it as a "Small admiring boy." Both species are fruit and insect eaters and they may join other bulbuls in fruiting trees or bird waves to glean insects. The relationship between the two is a puzzling one. Nests of neither have been found nor indications of courting or territorialism while nesting. The *pallidus* has a loud raucous rasping call usually used as a flocking call and they appear to be "Nagging" at each other. *Propinquus* gives a plaintive cat's cry so that we have dubbed it the "Cat-bird". This also appears to be a flock call. Other calls for either species have not been noted. Peak calling activity occurs for both species in March and April which probably coincides with the breeding season.

BLACK BULBUL, *HYPSIPETES MADAGASCARIENSIS*

This spectacular black bulbul with a white head and orange beak is a winter straggler in Khao Yai. It was first seen as a flock of five in Jan. 1970 feeding on nectar in *Bombax* flowers. Again in Dec. 1973 a few were noted and a large flock of fifty or more were feeding in *Erithrina* in Feb. 1974. It nests in the Himalaya Mountains to the north and is probably driven so far south into Thailand by severe winter weather as

well as attracted by the flowering of *Bomdax* and *Erithrina*. Their presence in a tree is made known by a squeaking flock call. Otherwise they are not noisy at the time they are present. When flying from tree to tree they stream out in irregular groups, not leaving as a flock.

BLACK-HEADED BULBUL, *PYCNONOTUS ATRICEPS*

The genus *Pycnonotus* is well represented in the Park with at least five species. More may be discovered. The Black-headed Bulbul is a forest edge species which is less common. It is present all year and is usually in company with *P. melanicterus* with which it may be confused if you do not see *melanicterus*' yellow eyes and crest or *atriceps*' yellow tail tips. *Aatriceps* is also somewhat smaller than *melanicterus*. The association between these two species is not as close as that between *pallidus* and *propinquus*. It appears that *propinquus* and *pallidus* may derive mutual benefits from their relationship, but *atriceps* and *melanicterus* may only be together when feeding. They commonly join "Bird waves" and may be integral parts of them. *Aatriceps* rarely calls, being one of the quietest bulbuls in the Park.

BLACK-CRESTED YELLOW BULBUL, *PYCNONOTUS MELANICTERUS*

This bulbul is abundant all year in the Park, but it is nearly restricted to roadsides, cut forest, stream sides, or the edge of lallang fields. This makes it seem more abundant as it is readily seen. It has a nondescript call which resembles that of other forest edge species and reaches peak vocalization in March. The breeding season extends from February into May. Two young is the usual brood for these bulbuls and *melanicterus* was seen feeding a pair of fledglings in March and also in May.

Black-crested Yellow Bulbuls are integral components of many "Bird Waves." They were noted attending nearly half of the waves that were recorded, searching the trees along with leafbirds, *Yuhina* and others. They also like *Trema* and *Macaranga* berries and join other bulbuls feeding on them.

STRIPE-THROATED BULBUL, *PYCNONOTUS FINLAYSONI*

This is a permanent resident of the Park and it is even more limited to forest edge than the other *Pycnonotus*. This habit is widespread and wherever roads are built into the forest *finlaysoni* will disperse along them. When the forest is removed this species disappears or moves to patches where there is edge. It has a pleasant call which it sings from the depths of shrub foliage along the edge. Peak calling in Khao Yai was in March and another period of song was in July, August and September.

RED-WHISKERED BULBUL, *PYCNONOTUS JOCOSUS*

This is a brushland bulbul, a permanent resident of the Park with a peculiar population pattern. It prefers brushy lallang. Where the fields have been burned often enough to prevent woody plants from becoming established this bulbul is less often seen. Where weeds and woody plants encroach upon the grass *jocosus* is abundant. Population counts made at the Lookout (Nong Phak Chee) were as follows:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Birds seen	15	24	40	27	44	88	157	28	70	38	10	7
Birds calling												
(Ratio)	—	75	100	87	5	75	12	37	—	—	37	—
Nesting					*	*						
<i>Eugenia cumini</i> in fruit						*						

They practically leave the lallang from November into March, but calling is heaviest in February, March and April. Fledged young were seen in May and June. Flocks gathered in the vicinity of fruiting *Eugenia* each June and peak numbers were seen roosting in the brushy lallang in July. This can be explained in the following manner. During November and December the birds disperse to nesting territories, even penetrating a little ways into the forest or along streams. Nesting continues from January into May which accounts for the calling. The more or less gradual build up of numbers into July reflects the influx of juveniles into the population and the return to the brushy lallang to feed and to roost. Fruiting *Eugenia* in the study area was attractive to the bulbuls and increased the numbers seen and tallied. During the non-breeding season

the birds feed in loose bands and are especially vociferous as they enter roosts.

LEAFBIRDS, AEGITHINIDAE

The leafbirds appear to be represented by only four species although *Aegithina tiphia* may appear in the disturbed lower levels of the Park. The Great Iora, *A. lafresnayei* may be a permanent resident, but has a low level population and is uncommonly seen. If present it is usually in the company of a "Bird Wave." The Golden-fronted Leafbird, *Chloropsis aurifrons* seems to be just entering the Park for it is occasionally seen along roads or in brushy lallang.

YELLOW-HEADED GREEN LEAFBIRD, *CHLOROPSIS COCHINCHINENSIS*

The commonest green leaf bird in the Park, this species is most often seen in the company of "Bird Waves." It is a permanent resident. It usually travels in family sized flocks; a male with a female or two. Juveniles are difficult to distinguish from females. Courting was observed in April. Nests are built in dense thickets of vines or epiphytes on the trees and can only be found if parents are seen building, or carrying food to nestlings. This can be said for most of the tropical forest species since nest predation is high. The male has a lovely song and often mimics other species but, we have insufficient records to indicate seasonality in singing.

FAIRY BLUEBIRD, *IRENA PUELLA*

This large leaf bird is so divergent from other species in the family that it is often considered as another family, Irenidae. It is a permanent resident of the Park, flocks when not breeding, and moves about the Park seeking food trees. It is omnivorous, but probably takes more fruit than do other species of the family. It is noisy and vociferous and sings all year with peak vocalization in March, but also actively singing in January, April, and August. The population appears to change rapidly as the flocks follow food or disperse for breeding. The average numbers seen in one study plot varied at monthly observations as follows:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Ave. Birds seen	9	3	85	29	18	16	7	17	15	8	34	20

When the birds were absent from this area they were often found in another.

Nest building was noted in March. The male was carrying material made up of stiff twigs which he brought to the female building in a rotan palm thicket. The nest was about 30 ft. high and barely visible as the birds worked upon it. Juveniles were seen being fed in July so the breeding period probably extends over half a year.

Usually the flocks include both male and female but at times they are segregated. They often join "Bird Waves" to feed with them, or with bulbuls in a fruit tree. Large flocks of fifty or more will sometimes spend all day in the vicinity of a fruiting fig and they have been seen joining drongos in flowering *Erithrina* or *Bombax*.

THRUSHES, TURDIDAE

Thrushes are well represented in the Park by at least 12 species. Since many species that enter Thailand (43) are migratory others will probably be noted as more observers work in the area. Of these twelve only the Common Shama could be considered abundant. Others have low level populations or are present only during parts of the year. Winter residents include: *Erithacus calliope*, rare or with a low level population, limited to deep forest. *Erithacus cyane*, fairly common, most often seen walking along jungle trails, both primary and secondary forest. *Monticola solitaria*, an open country bird usually seen about buildings (at TOT) or along the roads in the forest. *Saxicola torquata*, very common in the lallang where it is seen perched on grass or shrubs, or resting on nearby wires. *Turdus obscurus*, not abundant, but often seen feeding on rocky areas of nearly dry stream beds.

COMMON SHAMA, *COPSYCHUS MALABARICUS*

The commonest permanent resident thrush in the Park. This is a forest species, but seems to prefer disturbed forest. It is secretive in habits, fitting through the low shubbery, but has one of the loveliest songs of the forest. The full tones of the Shama and the *G. chinensis* are

especially pleasing. The Shama sings from January into June, during the breeding season, with peak vocalization in May. It is solitary, rarely ever seen in numbers greater than pairs and it does not join in with other flocks of feeding birds.

SLATY-BACKED FORKTAIL, *ENICURUS SCHISTACEUS*

Both *schistaceus* and the White-crowned Forktail, *E. leschenaulti* occur at Khao Yai but *schistaceus* is much more common. They have similar habits, both preferring rocky streams. They are solitary, rarely seen even in family groups, occasionally as pairs. The streams are parceled among them so that one bird is flushed and flies ahead until it reaches the limit of its territory. Then it turns back. The call is a sharp whistle given as the bird takes wing. The violent bobbing up and down of the tail is probably a signaling device since the sounds of the water rushing over rocks would drowned out calls. Nests are built up the small rocky tributary streams beneath a rock overhanging the water. Nesting is during the dry season when such places are exposed and many insects are attracted to shallow pools.

BLUE-WHISTLING THRUSH, *MYOPHONEUS COERULEUS*

The other river or waterfall thrush is this large deep blue bird with a yellow bill. It has a characteristic warning whistle. They are almost confined to the rocky waterfall areas, usually only one bird or a pair. Nests are built in rock hollows, even in caves, but they have not yet been described from Khao Yai. The only time that one has been seen in association with other species was when one was noted joining small birds that were mobbing a Barred Owlet (*Glaucidium cuculoides*).

STONE-CHAT, *SAXICOLA TORQUATA*

Late in September or early in October Stonechats arrive from the north. This is a common field bird over most of Eurasia and Africa (south of Sahara) but it does not breed at Khao Yai. Common in all of the lallang fields from October into April.

THE WARBLERS, SYLVIIDE

Only five members of this family are regular residents of the Park, but during winter months several species of *Phylloscopus* flood the forest and join the "Bird Waves." These are difficult to identify, but nine or ten species may be recognized. These are forest dwellers and the remaining species are nearly all forest edge or open country species.

RUFIOUS-HEADED FANTAIL WARBLER, *CISTICOLA EXILIS*

This beautiful acrobatic little warbler lives in lallang fields and sings on the wing. It appears to nest during the rainy season for nests, young, and fledglings have been seen in May, June and August. The nests are woven cups deep in the lallang grass or attached to twigs of shrubs. Peak aerial performance is from April into July (June most active) when the males mount above their territories and sing and dive like miniature Skylarks. Their flight is not so erratic as that of the Streaked Fantail Warbler, *C. juncidis*, nor the call so insect-like. During other months they are inconspicuous in the grass.

BLACK-NECKED TIALORBIRD, *ORTHOTOMUS ATROGULARIS*

This is a forest edge species that penetrates the forest along roads, streams, and in cut or thinned areas. Probably other tailorbirds inhabit the edges of the Park. It is so small as to be easily over-looked although it has several calls. It is often seen in company with *Macronus gularis* and sometimes in "Bird Waves." Nests have not been reported, but have probably been overlooked since they are built within large leaves curled and sewed together in a manner which gives the genus its name. Nesting is usually during the dry season.

WREN-WARBLERS, *PRINIA*

There are three species of Wren-Warblers which reside in lallang and brushy lallang, *P. flaviventris*, *rufescens* and *subflava*. Of these *subflava* is probably the most abundant. *Flaviventris* was seen with newly fledged young in August. All *Prinia* were most evident during the dry season. Much needs to be learned concerning the interrelationships of these three species so closely conspecific.

FLYCATCHERS, MUSCICAPIDAE

The flycatchers of the Park are mainly a winter population. At least eleven species occur and eight of these are migrants, remaining only for short periods of residency. Most arrive in October and leave by mid-April. None of the winter residents are abundant, but have restricted populations with restricted territories. For example, *Muscicapa latirostris* will usually be found all winter within a few meters of its favorite hunting perch. Table 1. lists the species with short term residency.

GREY-HEADED FLYCATCHER, *CULICICAPA CEYLONENSIS*

When present this is a very common flycatcher. It may be a winter resident in the Park for the average numbers recorded in the census area was as follows:

Months	J	F	M	A	M	J	J	A	S	O	N	D
Ave. No. Birds	4.0	4.0	1.7	1.0						1.4	6.6	10.3

At the same altitude near Kuala Lumpur, Malaya, they are permanent residents and nest in vegetation hanging above the streams. No such nests have been observed at Kao Yai. This is a noisy flycatcher singing while it feeds and peak calling was in December. At that time they were also seen in small flocks of as many as six birds. Those in Malaya were never noted flocking. In both areas they commonly join "Bird Waves" but usually only as the wave passed through their territories. When birds were being ringed at Khao Yai *Culicicapa* was caught only during winter months.

BLACK-NAPED BLUE FLYCATCHER, *HYPOTHYMIS AZUREA*

This is the commonest of the forest resident flycatchers. It is usually seen as individuals or pairs in company of "Bird Waves." It does not call conspicuously and no nests have been reported.

RICHARDS PIPIT, *ANTHUS NOVAZEELANDIAE*

Richard's Pipit is a permanent resident of the Park and is usually found on the lawns around the TOT Cabins. They nest in the grass of these lawns as well and nestlings were noted being fed in June. This is a

species with both migratory and non-migratory populations, therefore the winter population at Khao Yai is augmented by birds from the north.

THE WAGTAILS, *MOTACILLA*

Four species of wagtails are winter residents at Khao Yai, including the beautiful Forest Wagtail, *Dendronanthus indica*, which is usually seen along animal trails of the forest, and the three *Motacillas*, *caspicus*, *alba*, and *flava* which are birds of the open. Both *caspicus* and *flava* prefer the vicinity of water, *caspicus* usually along the streams in the forest and *flava* by the ponds in the lallang. In non-breeding plumages *caspicus* and *flava* are very difficult to tell apart. *Caspica* is less gregarious and is usually seen singly or in pairs. *Flava* arrives in flocks and uses the brushy lallang fields as roosts early in the dry season. Apparently these flocks remain a few weeks and then move on. Those that were tallied came to the brushy lallang of Nong Phak Chee arriving at sundown. They flew in high from the east or west depending upon where they had been feeding during the day. From an altitude of several hundred feet they would dive directly into the lallang. Tallies were as follows:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Ave. No. Birds												
Tallied	1.6	1.0	1.0					7.1	137.0	97.3	16.0	7.8

Dendronanthus also mingled with these early winter flocks. Apparently those seen during the day in the forest were not those that came to roost in the lallang. These flew in high with the other wagtails.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Ave. No. Birds												
Tallied				1.5	1.0				1.0	11.0		40.0

Alba was usually seen along the roadsides at TOT or on trails through the lallang. Rarely more than two or three were together, however in the severe weather of Dec. 1973 many were forced south from China and Laos and their numbers increased to flocks of as many as 8 or 10. These dispersed as soon as the weather became mild again. All of these wagtails are surface feeders catching insects on the soil or among surface debris.

ASHY WOOD SWALLOW, *ARTAMUS FUSCUS*

This is the only representative of this Australasian family (Artamidae) in the Park. A small flock is usually present around the pond at TOT. Here they nested in March 1972 and in April 1974 in the top of a lone tree by the pond. These are very gregarious birds, perching close together on some limb or twig so that they are touching each other. They retained this togetherness while nesting as well. The flock included four individuals and while one bird incubated the other three attacked Crows (*Corvus macrorhynchos*) or Sparrow Hawks (*Accipiter virgatus*) that happened to be passing by. This flock had increased to six individuals by mid-1973. They feed on the wing like swallows and remain near the water.

BROWN SHRIKE, *LANIUS CRISTATUS*

Among the three or four shrikes that might be seen in the Park the Brown Shrike is the most abundant and it is a winter resident arriving late in September and remaining into April or May. They are a forest edge species, usually seen in brushy lallang or along the roads penetrating the forest. They prefer to sit on wires or a prominent plant from which they can watch for insects. Their flight is direct and rapid and they catch their prey by overtaking them. These shrikes are territorial in their winter habitats as well as in their northern breeding habitats. When they arrive there is much calling as they establish these territories and defend them, usually the same one they used last year. They become quiet during winter months and call again before returning north in April.

THE STARLINGS, STURNIDAE

Most of the starlings are weed species which follow man as he opens and destroys the forest. At least eight of them will eventually be recorded in and around the Park. The beautiful Gold-crested Myna, *Ampeliceps coronatus* occasionally enters the Park from drier habitats to the north or east and joins the flocks of Hill Mynas.

HILL MYNA, GRACKLE, *GRACULA RELIGIOSA*

The only resident starling of the Park is the Hill Myna. This is a gregarious species which travels about the forest crown in flocks of from a few birds to more than fifty. They are noisy but do not mimic other species as often as would be expected. They have many calls and are heard "conversing" in flocking and feeding notes when together. Their call is a characteristic loud "Tiong" which gives them an onomatopoeic name by many peoples. They vocalize all year but peak calling comes in December before the nesting season. Nests and young have been seen from January into July. The nest is in any tree hollow, old woodpecker hole, rotting limb, barbet burrow, etc. When nest site hunting the whole flock joins in with much chatter and examination of prospective holes by all members. Once a pair decides on a location it becomes their territory. While the incubating bird is on the nest its mate perches nearby giving warning calls. When not at the nest the individual or pair will join the flock. When young are present the parents also join the flock searching for food and then return to the nest. They are omnivorous and join other birds at fig trees or other fruits, but catch insects as well. Since they are protected from nest destruction in the Park their very interesting habits of preening and courting and flock association can be watched. Outside the Park almost every nest is destroyed or robbed since the young have high sale value in the local and world markets.

Because of flock movements there was considerable variation in the average numbers tallied at the census area from month to month.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Ave. No. Birds												
Tallied	102	16	9	7	11	12	20	44	6	9	73	40

THE SUNBIRDS, NECTARINIIDAE

This and the following family, the Dicaeidae, are poorly represented in the records from Khao Yai. Both groups are tiny canopy-top species which are difficult to see, difficult to identify, and difficult to study. At least six species of sunbirds and one spiderhunter are resident in the Park for various periods. They may all be permanent residents. Occasion-

ally the sunbirds may be seen individually or in family groups but usually they are in association with "Bird Waves." Little can be said about their seasonality and population fluctuations and nothing about their nesting in the Park. All are nectar and insect feeders which follow the flowering of canopy trees and their creepers. None are good vocalists so we know nothing of their singing habits.

LITTLE SPIDERHUNTER, *ARACHNOTHERA LONGIROSTRIS*

The Little Spiderhunter is a forest edge species commonly found where wild banana has invaded cutover or open patches. They follow the roadsides into the forest and also are along streams. It has an identifiable call, a somewhat monotonous whistle. Nests are built as bulky mats of grass and fibers beneath low banana or palm leaves. Spiderhunters are insect and nectar feeders and do catch spiders as their name signifies. They pluck spiders from their webs while hovering in front of them.

THE FLOWERPECKER, DICAETIDAE

At least four species of flowerpeckers occur in the Park. These are all small high canopy inhabitants and are rarely seen clearly. Almost any leaf will hide them. They have a small shrill buzz which identifies them as a group, but it is difficult to locate the author of the buzz. Little has been recorded about them in the Park.

At one time, in June, *Dicaeum agile* was seen leaving the forest to fly out over the lallang to a fruiting *Eugenia cummini* where they fed on the berries. All day long there was this trek of *agile* from and back to the forest, numbers never before seen in such evidence.

ORIENTAL WHITE-EYE, *ZOSTEROPS PALPEBROSA*

White-eyes are high canopy residents that travel in flocks numbering as many as fifty individuals. They are both insectivorous and fructivorous, joining "Birds Waves" in search of insects, or flocks of bulbuls at fruiting figs or *Macaranga*. Their flock call is the same as that heard from caged birds, making their presence known before they can be discerned in the foliage. Part of the population is resident in the Park and this is augmented in winter months by flocks from the north. Whether with a "Bird Wave" or feeding alone, white-eye flocks flow rapidly

through the canopy in what appears as a never ending stream, and they disappear as quickly as they appear.

YELLOW-BREASTED BUNTING, *EMBERIZA AUREOLA*

Of the great palearctic family of finches (Fringillidae) only this one reaches Khao Yai. They arrive in October and remain into April, but they appear not to be resident in the Park during the day. This is a granivorous species which flies outside of the Park to feed and returns to it of evening to roost in brushy lallang. How far they go from the Park to feed has not been determined. Largest roosting flocks are present in March as they gather for the trek north. At this time, at sundown each evening (approximately at 1800) they arrive high in the air and dive precipitously into the lallang. Outside of the Park commercial trapping of this species is very heavy at all known roosts, so those that use the Park survive to fly back north.

SHARP-TAILED MUNIA, *LONCHURA STRIATA*

Several species of Munias may occur in the Park but *striata* is the commonest permanent resident. This is the most arboreal of the *Lonchura*. They nest in trees and shrubs of the forest edge and may go some distance into the forest for a suitable site. They are usually found about isolated clumps of trees in the lallang fields. Nest building has been seen as early as March and as late as August. As these are seed eaters they stay near the lallang and its weeds for food.

SUMMARY

Khao Yai National Park in Thailand covers an area of more than 2000 sq. km. and is clothed with several forest and non-forest associations. Observations from 1968 into 1974 in the north-west section indicated more than 200 species of birds present with periods of residency related to species and habitat. Nesting, seasonal vocalization, and flocking habits of some species are discussed. Observations of some of the bionomics of the commoner species are reported in an annotated list.

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TABLE 1. Birds reported at Khao Yai National Park, Thailand × seen in this study, reported by other observers

English Name	Scientific Name	Months known to be present													Remarks
		Number Tallied	J	F	M	A	M	J	J	A	S	O	N	D	
Darter	<i>ANHINGIDAE</i> <i>Anhinga melanogaster</i>	21			×	×	×	×	×	×					Resident of some other place.
Chinese Pond Heron	<i>ARDEIDAE</i> <i>Ardeola ralloides</i>	25	×	×	×	×	×							×	Vagrant from ricelands.
Cattle Egret	<i>Bubulcus ibis</i>	2										×			Vagrant.
Little Green Heron	<i>Butorides striatus</i>	10	×	×	×	×	×				×	×	×	×	Winter resident, streams.
Little Egret	<i>Egretta garzetta</i>	3			×							×			Vagrant from ricelands.
Chestnut Bittern	<i>Ixobrychus cinnamomeus</i>	8		×		×	×							×	Vagrant, at ponds.
Cotton Teal	<i>ANATIDAE</i> <i>Nettapus coromandelianus</i>	3	×					×							Vagrant.
Shikra Goshawk	<i>ACCIPITRIDAE</i> <i>Accipiter badius</i>	15	×	×		×	×			×		×		×	Uncommon forest resident.
Crested Goshawk	<i>Accipiter trivirgatus</i>	14	×	×	×	×	×				×	×	×	×	Forest resident.
Asiatic Sparrow Hawk	<i>Accipiter virgatus</i>	37			×	×	×	×			×	×	×	×	Maybe a winter resident.
Black-crested Baza	<i>Aviceda leuphotes</i>	2										×			Vagrant.
Cinnamon-winged Buzzard	<i>Butastur liventer</i>	1	—		×		—			—				—	Uncommon forest bird
Marsh Harrier	<i>Circus aeruginosus</i>	1										×			Migrant.
Pied Harrier	<i>Circus melanoleucos</i>	2			×	—	—					×			Migrant.
Black-winged Kite	<i>Elanus caeruleus</i>	8	—				×	×	×	×	—	×	—	—	Lowland resident.
Gray-headed Fishing Eagle	<i>Ichthyophaga ichthyaetus</i>	—												—	Status unknown.
Black Eagle	<i>Ictinaetus malayensis</i>	5	—	—			—		—	—		×	—	×	Rare resident?
Serpeant Eagle	<i>Spilornis cheela</i>	48	×	×	×	×	×	×	×	×	×	×	×	×	Common forest hawk.
Honey Buzzard	<i>Pernis ptilorhynchus</i>	—		—		—	—					—	—	—	Migrant.

[illegible]

* Heard only ‡ Heard and seen

[illegible]

Indian Hanging parrot Mustache Parakeet	<i>PSITTACIDAE</i>															
	<i>Loriculus vernalis</i>	253	×	×	×	×	×	×	×	×	×	×	×	×	×	Forest resident.
	<i>Psittacula alexandri</i>	27			×	—	×				—	—	×	—		Occasional in forest Common in lowland.
Plaintive Cuckoo Renauld's Ground Cuckoo	<i>CUCULIDAE</i>															
	<i>Cacomantis merulinus</i>	1*			×											Vagrant.
Common Coucal	<i>Carpococcyx renauldi</i>	6#			×	×	×									Probably resident.
	<i>Centropus sinensis</i>	8#	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident, brushy lal- lang.
Lesser Coucal	<i>Centropus toulou</i>	54#	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident, brushy lal- lang.
Red-winged Crested Cuckoo	<i>Clamator coromanda</i>	1			×											Migrant.
Greater Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	108	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident, forest, lower canopy.
Drongo Cuckoo	<i>Surniculus lugubris</i>	8#			×	×	×								×	Probably a winter resident.
Spotted Owlet	<i>STRIGIDAE</i>															
	<i>Athene brama</i>	1								—					×	Straggler from other habitats.
Pigmy Owlet	<i>Glaucidium brodiei</i>	247*	×	×	×	×	×	×	×	×	×	×	×	×	×	Common forest owl, heard daily.
Barred Owlet	<i>Glaucidium cuculoides</i>	8#			×					—		—	—			Probably resident.
Ceylon Fish Owl	<i>Ketupa zeylonensis</i>	—				—						—	—			Status unknown.
Brown Hawk Owl	<i>Ninox scutulata</i>	—	—									—			—	Winter resident.
Collared Scops Owl	<i>Otus bakkamoena</i>	4*		—	×	×					×				—	Resident.
Scops Owl	<i>Otus scops</i>	—	—													Winter visitor.
Mountain Scops Owl	<i>Otus spilocephalus</i>	63*	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident of forest, heard daily.
Savannah Nightjar Migratory Nightjar	<i>CAPRIMULGIDAE</i>															
	<i>Caprimulgus affinis</i>	—					—									Status uncertain.
Long-tailed Nightjar	<i>Caprimulgus indicus</i>	3			×									×		Rare migrant.
Great-eared Nightjar	<i>Caprimulgus macrurus</i>	38#	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident.
	<i>Eurostopodus macrotis</i>	229#	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident, heaviest cal- ling Jan. to April.

*Heard only

Heard and seen

English Name	Scientific Name	Months known to be present													Remarks
		Number Tallied	J	F	M	A	M	J	J	A	S	O	N	D	
House Swift	<i>APODIDAE</i> <i>Apus affinis</i>	4							×						Vagrant. Migrant.
White-rumped Swift	<i>Apus pacificus</i>	16				×	—				×				
White-throated Spine-tail Swift	<i>Chaetura cochinchinensis</i>	98	×		×	×	×	×	×	×					Status uncertain.
Malaysian Spine-tail Swift	<i>Chaetura gigantea</i>	100	×	×	×	×	×	×	×	×	×	×	×	×	Probably breeds at cliffs. Resident.
Palm Swift	<i>Cypsiurus parvus</i>	1333	×	×	×	×	×	×	×	×	×	×	×	×	
Red-headed Trogon	<i>TROGONIDAE</i> <i>Harpactes erythrocephalus</i>	34	×	×	×	×	×	×	×	×	×	×	×	×	Deep forest resident.
Orange-breasted Trogon	<i>Harpactes oreskios</i>	10	×	×	×	×	×	×	×	×	×	×	×	×	Less abundant than above.
Common Kingfisher	<i>ALCEDINIDAE</i> <i>Alcedo atthis</i>	11	×	×	—	—	—			×	×	×	×	×	Winter resident. Probably resident.
Deep Blue Kingfisher	<i>Alcedo meninting</i>	9	×			×	×	×	×	×			—	—	
Black-capped Kingfisher	<i>Halcyon pileata</i>	5			×						×	×			Migrant.
White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	27	—	—	×	—	×	×	×	×	—	×	×	×	Nests in the park. Deep forest resident. Straggler from low-lands.
Banded Kingfisher	<i>Lacedo pulchella</i>	6	×			×	—	×	×	—				×	
Stork-billed Kingfisher	<i>Pelargopsis capensis</i>	9					×	×	×	×		×	×	—	
Bay-headed Bee-eater	<i>MEROPIDAE</i> <i>Merops leschenaulti</i>	394	×	×	×	×	×				—	×	×	×	Winter resident, nests in park.
Brown-throated Bee-eater	<i>Merops philippinus</i>	361	×	×	×						×	×	×	×	Winter resident near ponds.
Blue-throated Bee-eater	<i>Merops viridis</i>	—											—		Vagrant.

Blue-bearded Bee-eater	<i>Nyctiornis athertoni</i>	58#	×	×	×	×	×	×	×	×	×	×	×	×	Resident, nests in road banks.
<i>CORACIIDAE</i>															
Blue Roller	<i>Coracias benghalensis</i>	41	×	×	×	×	×	×	×	×	×	×	×	×	Resident, lallang.
Dollar Bird	<i>Eurystomus orientalis</i>	62	×	×	×	×	×	×	×	×	×	×	×	×	Resident.
<i>BUCEROTIDAE</i>															
Pied Hornbill	<i>Anthraceroceros albirostris</i>	315	×	×	×	×	×	×	×	×	×	×	×	×	Resident, seen in flocks.
Great Hornbill	<i>Buceros bicornis</i>	1207	×	×	×	×	×	×	×	×	×	×	×	×	Resident, seen in flocks.
Wreathed Hornbill	<i>Rhyticeros undulatus</i>	3623	×	×	×	×	×	×	×	×	×	×	×	×	Resident, seen in flocks.
<i>CAPITONIDAE</i>															
Little Barbet	<i>Megalaima australis</i>	186#	×	×	×	×	×	×	×	×	×	×	×	×	Uncommon resident.
Green-eared Barbet	<i>Megalaima faiostricta</i>	314#	×	×	×	×	×	×	×	×	×	×	×	×	Resident, sings most of year.
Humes Barbet	<i>Megalaima incognita</i>	502#	×	×	×	×	×	×	×	×	×	×	×	×	Resident, sings most of year.
Lineated Barbet	<i>Magalaima zeylanica</i>	—	—							—	—	—			Heard at edge of park.
<i>PICIDAE</i>															
Golden-backed 4-toed Woodpecker	<i>Chrysocolaptes lucidus</i>	37	×	×	×	×	×	×	×	×	×	×	×	×	Resident, difficult to separate from 3-toed in the field.
Golden-backed 3-toed Woodpecker	<i>Dinopium javanense</i>	5			×	—	—	—	—	×	×	×	—	—	Resident, difficult to separate from 4-toed in the field.
White-bellied Black Woodpecker	<i>Dryocopus javensis</i>	2			×							×			Status uncertain.
Heart-spotted Woodpecker	<i>Hemicircus canente</i>	13	—		—	×			—	—		×	—		Resident, uncommon.
Black and Buff Woodpecker	<i>Meiglyptes jugularis</i>	25	×	×	×	×	×	×	×	×	×	×	×	×	Resident.
Rufous Woodpecker	<i>Micropternus brachyurus</i>	9	×		×			×	×	×	×				Probably resident.

Heard and seen

English Name	Scientific Name	Months known to be present													Remarks
		Number Tallied	J	F	M	A	M	J	J	A	S	O	N	D	
Great Slaty Woodpecker	<i>Mulleripicus pulverulentus</i>	8	×	—	—		—						—	×	Status uncertain.
Lesser Yellow-naped Woodpecker	<i>Picus chlorolophus</i>	42			×		×	×	×	×	×	×	×	×	Resident } Difficult to separate in the field.
Greater Yellow-naped Woodpecker	<i>Picus flavinucha</i>	8	—							—		×		×	
Bamboo Green Woodpecker	<i>Picus vittatus</i>	14		×		×	×	×	×	×		×	×	×	Resident.
<i>EURYLAIMIDAE</i>															
Green Broadbill	<i>Calyptomena viridis</i>	1												×	Vagrant.
Banded Broadbill	<i>Eurylaimus javanicus</i>	6				×		×						×	Uncommon.
Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>	51	×	×	×	×	×	—		×		×			Resident, deep forest.
Silver-breasted Broadbill	<i>Serilophus lunatus</i>	18	×			—	×					×	×		Uncertain status.
<i>PITTIDAE</i>															
Lesser Blue Pitta	<i>Pitta cyanea</i>	1	—											×	Uncertain status.
<i>HIRUNDINIDAE</i>															
House Martin	<i>Delichon urbica</i>	19	×									×		×	Winter visitor.
Red-rumped Swallow	<i>Hirundo daurica</i>	4469	×	×	×	×	×				×	×	×	×	Winter resident.
House Swallow	<i>Hirundo rustica</i>	2207	×	×	×	×			×	×	×	×	×	×	Winter resident.
<i>CAMPEPHAGIDAE</i>															
Dark Gray Cuckoo-shrike	<i>Coracina melaschista</i>	71	×	×	×	×					×	×	×	×	Winter resident of forest.
Lesser Cuckoo-shrike	<i>Coracina polioptera</i>	5	×									×			Uncertain status.
Bar-winged Flycatcher-shrike	<i>Hemipus picatus</i>	223	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.
Ashy Minivet	<i>Pericrocotus divaricatus</i>	40			×							×	×	×	Winter resident.

Scarlet Minivet	<i>Pericrocotus flammeus</i>	414	×	×	×	×	×	×	×	×	×	×	×	×	×	For est canopy resident
Brown-tailed Wood Shrike	<i>Tephrodronis virgatus</i>	7	—		—	—	—		—	—		—	×	×		Uncertain status.
<i>DICRURIDAE</i>																
Black Drongo	<i>Dicrurus adsimilis</i>	31	×		×		×					×	×	×		Winter visitor.
Bronzed Drongo	<i>Dicrurus aeneus</i>	58	×	×	×	×		×	×	×	×	×	×	×	×	Permanent resident.
Ashy Drongo	<i>Dicrurus leucophaeus</i>	137	×	×	×	×	×	×	×			×	×	×	×	Permanent resident?
Hair-crested Drongo	<i>Dicrurus hottentottus</i>	938	×	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
Large Racquet-tailed Drongo	<i>Dicrurus paradiseus</i>	148	×	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
Lesser Racquet-tailed Drongo	<i>Dicrurus remifer</i>	10	×	×			×	×				×	×	×		Uncertain status.
<i>ORIOOLIDAE</i>																
Oriole	<i>Oriolus</i> spp.	41	×	×	×							×	×	×	×	Uncertain status and species.
<i>CORVIDAE</i>																
Green Hunting Crow	<i>Cissa chinensis</i>	46#	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident.
Large-billed Crow	<i>Corvus macrorhynchus</i>	384	×	×	×	×	×	×	×	×	×	×	×	×	×	Resident of disturbed areas.
Jay	<i>Garrulus glandarius</i>	1											×			Accidental.
<i>PARIDAE</i>																
Sultan tit	<i>Melanochlora sultanea</i>	28			×		×	×		×	×	×			×	Probably permanent resident.
<i>SITTIDAE</i>																
Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	10			—		×	—		—	×	×				Status uncertain.
<i>TIMALIIDAE</i>																
Black-throated Laughing Thrush	<i>Garrulax chinensis</i>	63#	×	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
White-headed Laughing Thrush	<i>Garrulax leucolophus</i>	357#	×	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident, common.
Lesser Necklaced Laughing Thrush	<i>Garrulax monilegerus</i>	58	×	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.

Heard and seen

English Name	Scientific Name	Months known to be present													Remarks
		Number Tallied	J	F	M	A	M	J	J	A	S	O	N	D	
Yellow-breasted Tit Babbler	<i>Macronus gularis</i>	289#	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
Red-capped Babbler	<i>Pellorneum ruficeps</i>	37#	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
Chestnut-naped Scimitar Babbler	<i>Pomatorhinus schisticeps</i>	61#	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
Abbott's Jungle Babbler	<i>Trichastoma abbotti</i>	105#	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
White-bellied Yuhina	<i>Yuhina zantholeuca</i>	180	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident.
<i>PYCNONOTIDAE</i>															
Swinhoe's White-throated Bulbul	<i>Criniger pallidus</i>	880#	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.
Ashy Bulbul	<i>Hypsipetes flavala</i>	32	×	×	×	—	×	×	—			×	×	×	Probably resident.
Grey-eyed Bulbul	<i>Hypsipetes propinquus</i>	424#	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.
Black Bulbul	<i>Hypsipetes madagascariensis</i>	68	×	×										×	Winter Vagrant.
Black-headed Bulbul	<i>Pycnonotus atriceps</i>	68	×	×	×	×	×	×	×	×	×	×	×	×	Forest edge resident.
Black-capped Bulbul	<i>Pycnonotus aurigaster</i>	17							×	×		×			Forest edge Vagrant.
Stripe-throated Bulbul	<i>Pycnonotus finlaysoni</i>	260#	×	×	×	×	×	×	×	×	×	×	×	×	Forest edge resident.
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	3107	×	×	×	×	×	×	×	×	×	×	×	×	Abundant in brushy lallang.
Black-crested Yellow Bulbul	<i>Pycnonotus melanicterus</i>	847	×	×	×	×	×	×	×	×	×	×	×	×	Common forest edge resident.
<i>AEGITHINIDAE</i>															
Great Iora	<i>Aegithina lafresnayei</i>	10	—		—	×	×		×	—	×		×	—	Resident, low level population
Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	12	—		—	—				×	—	×		×	Vagrant, forest edge.
Yellow-headed Green Leafbird	<i>Cloropsis cochinchinensis</i>	205	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.

Fairy Bluebird	<i>Irena puella</i>	1385#	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.
<i>TURDIDAE</i>															
Common Shama	<i>Copsychus malabaricus</i>	28#	×	×	×	×	×	×	×	×	×	×	×	×	Forest resident.
Slaty-backed Forktail	<i>Enicurus schistaceus</i>	25	×	×	×	×	×	×	×	×	×	×	×	×	Streamside resident.
White-crowned Forktail	<i>Enicurus leschenaulti</i>	9	×				×				×		×	×	Resident?, higher streams.
Ruby Throat	<i>Erithacus calliope</i>	2										×		×	Winter vagrant.
Siberian Blue Robin	<i>Erithacus cyane</i>	40	×	×	×							×	×	×	Winter resident of forest.
White-throated Rock Thrush	<i>Monticola gularis</i>	1	—	—										×	Winter vagrant.
Blue Rock Thrush	<i>Monticola solitaria</i>	80	×	×	×						×	×	×	×	Winter resident, open country.
Blue Whistling Thrush	<i>Myophonus coeruleus</i>	13	×	×	×	×	×	×	×	×	×	×	×	×	Resident near falls.
Stone chat	<i>Saxicola torquata</i>	60	×	×	×						×	×	×	×	Winter resident, lallang.
Grey-headed Thrush	<i>Turdus obscurus</i>	10	×	×								×	×	×	Scarce winter resident.
Orange-headed Thrush	<i>Zoothera citrina</i>	1												×	Vagrant.
Long-tailed Ground Thrush	<i>Zoothera dixonii</i>	1												×	Rare vagrant.
<i>SYLVIIDAE</i>															
Rufous-headed Fantail Warbler	<i>Cisticola exilis</i>	80	×	×	×	×	×	×	×	×	×	×	×	×	Resident, lallang.
Black-necked Tailorbird	<i>Orthotomus atrogularis</i>	44	×	×	×	×	×	×	×	×	×	×	×	×	Forest edge resident.
Long-tailed Tailorbird	<i>Orthotomus sutorius</i>	2				—			—	×		—		×	Vagrant from the valley.
Thick-billed Warbler	<i>Phragamaticola aedon</i>	5	—			—								×	Vagrant from the valley.
Leaf Warblers	<i>Phylloscopus coronatus</i>	1		×											Migrants or winter residents.
Leaf Warblers	<i>Phylloscopus fuscatus</i>	2	×									×		×	Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus inornatus</i>	12	×	×		×						×		×	Verified by capturing and ringing, field identification difficult.

English Name	Scientific Name	Months known to be present													Remarks
		Number Tallied	J	F	M	A	M	J	J	A	S	O	N	D	
Leaf Warblers	<i>Phylloscopus reguloides</i>	3				×						×		×	Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus ricketti</i>	5		×										×	Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus schwarzi</i>	2												×	Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus subaffinis</i>	1				×									Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus tenellipes</i>	2												×	Verified by capturing and ringing, field identification difficult.
Leaf Warblers	<i>Phylloscopus trochiloides</i>	28				×	×						×	×	Verified by capturing and ringing, field identification difficult.
Yellow-bellied Wren Warbler	<i>Prinia flaviventris</i>	13				×	×	×	×	×	×			×	Resident of lallang.
Rufescent Wren Warbler	<i>Prinia rufescens</i>	3	—	—	—	—	—	—	—	×	—	—	—	×	Lallang resident.
Brown Wren Warbler	<i>Prinia subflava</i>	42	×	×	×	×	×	×	×	×	×	×	×	×	Lallang resident.
Yellow-eyed Flycatcher Warbler	<i>Seicercus burkii</i>	16	×									×		×	Winter resident in forest.
<i>MUSCICAPIDAE</i>															
Grey-headed Flycatcher	<i>Culicicapa ceylonensis</i>	106	×	×	×	×		×				×	×	×	Status uncertain.

Black-naped Blue Flycatcher	<i>Hypothymis azurea</i>	57	×	×	×	×	×	×	×	×	×	×	×	×	Forest resident.
Hill Blue Flycatcher	<i>Muscicapa banyumas</i>	28	—	×	×	—	—	—	×	×	×	×	—	×	Probably forest resident.
Brown Flycatcher	<i>Muscicapa latirostris</i>	11	×		×		×			×	×	×	×	×	Winter resident.
Orange-breasted Flycatcher	<i>Muscicapa dumetoria</i>	1												×	Vagrant.
Mugimaki Flycatcher	<i>Muscicapa mugimaki</i>	1	×												Vagrant.
Red-breasted Flycatcher	<i>Muscicapa parva</i>	7		×	×							×	×	×	Winter resident.
Verditer Flycatcher	<i>Muscicapa thalassina</i>	39	×	×	×				×			×	×	×	Probably winter resident from higher altitudes.
Little Pied Flycatcher	<i>Muscicapa westermanni</i>	3	×		×									×	Uncertain status.
Tricolored Flycatcher	<i>Muscicapa zanthopygia</i>	3		×						×			×		Migrant.
Paradise Flycatcher	<i>Terpsiphone paradisi</i>	11								—	×	—		×	Uncertain status.
MOTACILLIDAE															
Tree Pipit	<i>Anthus hodgsoni</i>	6	—			—								×	Winter vagrant.
Richard's Pipit	<i>Anthus novaezealandiae</i>	144	×	×	×	×	×	×	×	×	×	×	×	×	Permanent resident of grasslands.
Forest Wagtail	<i>Dendronanthus indicus</i>	47	—	—	×	×					×	×	—	×	Winter resident, Forest.
Pied Wagtail	<i>Motacilla alba</i>	112	×	×	×						×	×	×	×	Roadside winter resident.
Grey Wagtail	<i>Motacilla caspica</i>	33	×	×	×	×					×	×	×	×	Winter resident, streamsides.
Yellow Wagtail	<i>Motacilla flava</i>	1215	×	×	×					×	×	×	×	×	Winter resident, lallang.
ARTAMIDAE															
Ashy Wood Swallow	<i>Artamus fuscus</i>	50	×	×	×	×	×	×		×		×		×	Resident, low level population.
LANIIDAE															
Brown Shrike	<i>Lanius cristatus</i>	61	×	×	×	×	×				×	×	×	×	Winter resident, forest edge.
Black-headed shrike	<i>Lanius nasutus</i>	7	×								×			×	Vagrant from lowlands.
STURNIDAE															
Gold-crested Myna	<i>Ampeliceps coronatus</i>	27	×		×					×		×	×		Vagrant from forests to east.
Hill Myna	<i>Gracula religiosa</i>	2445	×	×	×	×	×	×	×	×	×	×	×	×	Common forest resident.

[illegible]

TABLE 2. Summary of calling and activity based upon studies during 1970.

	Months												TOT.	AVE.
	J	F	M	A	M	J	J	A	S	O	N	D		
No. of species seen	75	75	86	80	78	69	72	59	76	87	82	84	165	77
No. of individuals seen	1907	587	4140	4723	1086	1492	1617	2536	1593	1875	1866	2108	25530	2130
No. birds per day	635	293	1380	1574	362	497	539	845	531	468	622	702	709	709
No. birds seen per species	25	8	48	59	14	22	22	43	21	21	23	25	155	27
No. species heard calling	29	27	37	40	33	36	26	31	29	22	27	34	55	31
No. birds heard calling	278	237	768	635	369	465	259	296	321	139	276	426	4421	368
Ave. birds calling per species	10	9	21	16	11	13	10	10	11	6	10	12	103	11
Birds seen & heard per species	35	17	69	75	25	35	32	53	32	27	33	37	258	39

TABLE 3. Bird calling at Khao Yai. Figures show the ratio of calling by month related to the month of maximum vocalizing (100). Based upon one complete year of observations.

Species	Total Birds Recorded	Ratio of calling											
		J	F	M	A	M	J	J	A	S	O	N	D
<i>Arborophila charltoni</i>	186	19	42	100	65	65	84	50	61	65	38	76	46
<i>Gallus gallus</i>	123	15	55	100	41	92	7	—	—	33	15	51	37
<i>Amaurornis phoenicurus</i>	53	—	—	67	67	33	100	—	40	—	47	—	—
<i>Chalcophaps indica</i>	37	—	—	10	100	70	30	100	60	—	—	—	—
<i>Ducula badia</i>	191	37	13	100	39	66	71	37	37	13	8	48	37
<i>Macropygia unchall</i>	101	74	—	68	5	89	84	100	47	16	10	37	52
<i>Treron curvirostra</i>	37	—	—	—	9	64	73	36	18	18	—	18	100
<i>Centropus sinensis</i>	13	14	14	—	28	100	14	—	—	—	—	14	—
<i>Centropus toulou</i>	68	—	44	94	56	19	100	56	12	37	—	—	7
<i>Surniculus lugubris</i>	25	33	84	100	84	67	50	—	—	—	—	—	—
<i>Glaucidium brodiei</i>	208	8	58	100	58	47	39	53	25	78	42	39	89
<i>Eurostopodus macrotis</i>	80	45	18	100	54	—	3	—	3	—	—	—	18
<i>Nyctiornis athertoni</i>	31	11	—	44	55	44	—	22	11	100	—	11	44
<i>Anthracoseros albirostris</i>	70	42	37	—	42	25	5	31	100	31	—	10	42
<i>Buceros bicornis</i>	355	25	15	42	100	44	41	44	26	41	25	38	50
<i>Megalaima australis</i>	151	55	10	68	100	29	32	19	3	81	3	39	48
<i>Megalaima incognita</i>	319	85	74	96	64	51	68	8	8	—	25	100	98
<i>Megalaima faiostriata</i>	154	8	8	100	14	54	32	—	38	—	—	—	54
<i>Pericrocotus flammeus</i>	41	—	—	100	48	5	19	—	—	10	5	—	10
<i>Dicrurus paradiseus</i>	69	—	—	100	38	31	68	31	44	62	6	18	31
<i>Cissa chinensis</i>	18	—	—	33	—	67	33	33	100	33	—	—	—
<i>Corvus macrorhynchus</i>	22	22	55	22	100	—	—	—	22	11	—	—	11
<i>Garrulax chinensis</i>	57	13	40	40	100	40	47	52	26	—	13	7	—
<i>Garrulax leucolophus</i>	288	4	30	80	84	38	100	40	30	80	30	20	40
<i>Macronus gularis</i>	280	41	22	100	37	44	33	5	34	16	53	23	75
<i>Pellorneum ruficeps</i>	97	—	—	100	79	63	74	53	53	68	5	5	10
<i>Pomatorhinus schisticeps</i>	54	20	33	33	7	27	—	33	—	7	100	40	60
<i>Trichastoma abbotti</i>	168	56	60	80	64	68	64	60	100	56	36	20	8
<i>Criniger pallidus</i>	188	—	18	100	64	18	27	18	27	20	—	—	49
<i>Hypsipetes propinquus</i>	114	3	15	59	100	26	29	6	26	35	—	—	35
<i>Pycnonotus finlaysoni</i>	92	80	13	100	53	—	66	66	87	60	—	26	60

<i>Pycnonotus jocosus</i>	172	—	75	100	87	5	75	12	37	—	—	37	—
<i>Pycnonotus melanicterus</i>	98	46	15	100	97	6	32	—	—	6	—	—	12
<i>Irena puella</i>	207	65	25	100	67	25	40	50	75	32	2	12	22
<i>Copsychus malabaricus</i>	30	20	10	80	80	100	10	—	—	—	—	—	—
<i>Cisticola exilis</i>	23	—	—	—	8	41	100	41	—	—	—	—	—
<i>Culicicapa ceylonensis</i>	44	69	38	8	8	—	—	—	—	—	53	61	100
<i>Gracula religiosa</i>	203	28	—	47	80	42	42	25	67	31	47	55	100
38 species calling	4300	27	27	34	37	34	34	26	29	26	20	24	29
Ratio		36	31	100	83	48	60	34	38	42	18	36	55

TABLE 4. The relationships between bird calls and weather.

		Months												T
		J	F	M	A	M	J	J	A	S	O	N	D	
Clear	1 2	76 22	100 19	24 15	2 1	2 .5	0 0	3 1	0 0	18 4	65 18	6 1	37 18	24.4
Cirro stratus	1 2	18 8	0 0	5 5	43 34	21 8	27 14	16 6	9 4	30 11	4 2	4 1	8 6	16.5
Stratus	1 2	0 0	0 0	.6 71	0 0	.5 28	0 0	0 0	0 0	0 0	0 0	0 0	0 0	.12
Partly Cloudy	1 2	3 1	0 0	33 18	24 10	56 11	38 10	40 8	38 10	27 5	26 5	89 14	23 8	32.6
Mostly Cloudy	1 2	0 0	0 0	27 26	19 16	12 5	15 8	23 10	15 8	13 5	6 2	1 1	23 18	15.3
Nimbus	1 2	0 0	0 0	2 4	6 11	3 3	13 16	13 12	25 30	12 10	0 0	0 0	8 14	7.0
Light Rain	1 2	0 0	0 0	.8 4	5 20	5 11	7 18	4 9	14 35	1 3	0 0	0 0	.3 1	3.3
Fog	1 2	3 29	0 0	3 68	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	.15 3	.7
Percent of birds heard calling per month		7	5	15	13	7	9	7	8	6	7	5	12	
Average number birds heard calling per species per day per month		9.2	11.3	15.8	17.4	9.3	14.1	7.1	7.1	10.3	8.2	10.4	7.1	10.6

1. The percentage of birds calling related to weather that month. Figures totaled vertically equal 100.

2. The percentage of all birds heard calling in that weather during the year. Figures totaled horizontally equal 100.

TABLE 5. Weather and its relationship to birds seen.

		Months												T
		J	F	M	A	M	J	J	A	S	O	N	D	
Clear	1 2	18 49	100 15	10 11	.7 .8	2 .5	0 0	4 1	0 0	7 3	19 7	0 0	29 13	16.1
Cirrus	1 2	5 3	0 0	11 12	34 40	20 4	36 13	14 4	5 2	16 6	6 2	15 7	17 7	16.8
Stratus	1 2	0 0	0 0	.2 90	0 0	.1 10	0 0	0 0	0 0	0 0	0 0	0 0	0 0	.03
Partly Cloudy	1 2	13 4	0 0	68 33	6 3	40 4	43 7	44 6	28 7	17 3	56 9	80 18	31 6	36.0
Mostly Cloudy	1 2	0 0	0 0	10 12	36 46	19 4	9 3	21 7	10 6	18 8	15 6	5 2	13 0	15.4
Nimbus	1 2	0 0	0 0	.6 1	1 2	18 8	6 5	6 4	34 41	37 31	.2 .2	0 0	7 6	7.5
Light Rain	1 2	0 0	0 0	.2 .4	23 60	0 0	6 5	10 7	23 20	4 3	3 2	0 0	2 7	7.4
Fog	1 2	0 0	0 0	0 10	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	1 90	.1
% Seen per month. Ave. number birds seen per day per month.		11 770	1 188	12 1416	14 1569	3 263	4 487	4 376	15 709	4 501	12 455	6 628	13 573	661

1. The percentage of birds seen related to weather for that month. Figures totaled vertically equal 100.

2. The percentage of all birds seen in that weather during the year. Figures totaled horizontally equal 100.

TABLE 6. Relationship between the number of birds seen (S) and heard (H) along a one mile study route in Khao Yai.
Figures are the totals from the number of observations listed in line one.

Species		Months												T
		J	F	M	A	M	J	J	A	S	O	N	D	
No. Observations		3	2	3	3	3	3	3	3	3	2	2	2	32
<i>Arborophila charltoni</i>	S													0
	H	5	10	15	15	15	15	15	10	15	5	10	7	137
<i>Gallus gallus</i>	S	2					4							6
	H	4	5	15	6	15	2			4	3	6	7	67
<i>Chalcophaps indica</i>	S				3	12	6	7	7		1		1	37
	H				7	1		15	1					24
<i>Ducula badia</i>	S	10	4	16	4	9	15	36	12	11	8	17	16	158
	H	14	10	25	12	16	20	12	9	4	1	12	10	145
<i>Macropygia unchall</i>	S	6	3	8	6	17	26	22	20	7	1	10	4	130
	H	14	5	2	1	15	13	10	9	2	2	7	10	90
<i>Treron curvirostra</i>	S	184	1	10	14	17	10	1	168	11	4	11	77	508
	H				1	2	6	3		2		2	5	21
<i>Surniculus lugubris</i>	S													0
	H	2	5	3	4	4	3							21

<i>Eurostopodus macrotis</i>	S H	5	5 6	2 10			2 1	1	4 1	1	4	1	1 4	21 27
<i>Lacedo puchella</i>	S H	2	2			3	3	2 3		3				2 16
<i>Nyctiornis athertoni</i>	S H	5 1	5	2 4	13 5	1 4		4 3		5 7		1	3 1	34 26
<i>Anthracoceros albirostris</i>	S H	25 4	3 5	6	9 2	3 3	11 1	20 13	11 6	8 4		26 2	19 2	141 42
<i>Buceros bicornis</i>	S H	31 8	1 2	10 16	19 37	4 17	6 12	6 16	2 12	10 10	1	8 12	14 22	111 165
<i>Rhyticeros undulatus</i>	S H	8 1	2	12 4	7 1	2		6	15 2	6 2	2	12 5	10 1	82 16
<i>Megalaima australis</i>	S H	12	1	3 7	71	1	6	1 2	6	7		3 5	2	15 58
<i>Megalaima faiostricta</i>	S H			15 5	2 7	9	5 6	1	5 5				14 20	51 43
<i>Megalaima incognita</i>	S H	5 40	1 30	12 13	9 20	12 9	2 15	2 4	8 2		4	30	12 20	63 187
<i>Chrysocolaptes lucidus</i>	S H	1 1	6 10	8	2 3			4				3		24 14

Species		Months												T
		J	F	M	A	M	J	J	A	S	O	N	D	
<i>Pericrocotus flammeus</i>	S H	15	11	45 21	31 10	31 1	36 4	14	20	14 2	6 1	14	11 2	248 41
<i>Dicrurus paradiseus</i>	S H	4	1	9 10	4 6	6 5	7 11	3 4	4 7	8 16	1	2 3	7 3	55 66
<i>Cissa chinensis</i>	S H			5 2		5 4		13 4	4 4	3 2				30 16
<i>Corvus macrorhynchus</i>	S H	2 2	4 5	3 2	13 9	3			1 2	1 1	2	2	5	36 21
<i>Garrulax chinensis</i>	S H	1 2	1 5	2 4	9 15	4	7	1 4	2	2			4	20 43
<i>Garrulax leucolophus</i>	S H	2	5 5	10	6 15	1 12	4 20	11 10	10	23 25	19		36 5	105 114
<i>Macronus gularis</i>	S H	6 30	2 30	8 45	7 35	6 25	15 17	18	16 6	17 14	5	28 12	15 7	138 226
<i>Pellorneum ruficeps</i>	S H		2	12	15	11	13	15	5	5 13	1	1	7	5 90

<i>Pomatorhinus schisticeps</i>	S H	5	10	11	10	3 17	1 6	12	4	1 17	1	1 12	7	6 112
<i>Trichastoma abbotti</i>	S H	14	20	3 15	1 16	2 15	1 16	30	10	14	4	1 5	1 2	9 161
<i>Criniger pallidus</i>	S H	11	21 20	42 30	57 30	32 10	42 15	48 15	51 10	19 11	17	32	11 20	383 161
<i>Hypsipetes propinquus</i>	S H	1 1	4 10	27 15	17 27	73 7	37 10	29 7	15 2	27 10	13	20	19 2	282 91
<i>Pycnonotus finlaysoni</i>	S H	9 12	6 7	13 10	8 8	4	10 10	18 15	5 8	19 9	4	9	8 9	113 88
<i>Pycnonotus melanicterus</i>	S H	15	12 5	59 31	60 25	48 2	34 10	68	43	47 1	14	14	14 3	428 77
<i>Irena puella</i>	S H	34 16	11 10	241 25	64 26	48 10	34 10	20 25	98 5	40 13	7 1	92	65 2	747 143
<i>Copsychus malabaricus</i>	S H	3 2	1	3 8	1 8	10	1							7 30
<i>Culicicapa ceylonensis</i>	S H	11 9	6		1						2 2	5 7	5 12	23 37
<i>Gracula religiosa</i>	S H	302 5	32	22 5	14 7	28 5	24 11	47 12	114 17	13 6	16 2	131 15	73 7	816

TABLE 7. Evidence of nesting at Khao Yai. Birds seen courting, nest building, or feeding nestlings or fledglings.

Species	Months											
	J	F	M	A	M	J	J	A	S	O	N	D
1. <i>Turnix suscitator</i>					×	×		×				
2. <i>Chalcophaps indica</i>	×							×				
3. <i>Ducula badia</i>			×			×				×	×	×
4. <i>Macropygia unchall</i>							×	×				
5. <i>Streptopelia chinensis</i>	×											
6. <i>Treron curvirostra</i>		×				×						
7. <i>Loriculus vernalis</i>			×									
8. <i>Centropus toulou</i>			×									×
9. <i>Phaenicophaeus tristis</i>					×							
10. <i>Caprimulgus macrurus</i>		×										
11. <i>Halcyon smyrnensis</i>				×								
12. <i>Merops leschenaulti</i>			×	×								
13. <i>Nyctiornis athertoni</i>			×	×								
14. <i>Buceros bicornis</i>	×						×					
15. <i>Rhyticeros undulatus</i>	×		×									
16. <i>Megalaima australis</i>					×							
17. <i>Megalaima faiostricta</i>			×		×	×						
18. <i>Megalaima incognita</i>	×		×	×	×							
19. <i>Meiglyptes jugularis</i>				×	×							
20. <i>Psarisomus dalhousiae</i>				×	×							
21. <i>Pericrocotus flammeus</i>		×	×									
22. <i>Dicrurus hottentottus</i>					×	×						
23. <i>Dicrurus paradiseus</i>					×							×
24. <i>Corvus macrorhynchus</i>												×
25. <i>Melanochlora sultanea</i>								×				
26. <i>Garrulax chinensis</i>				×								
27. <i>Garrulax monileger</i>					×							
28. <i>Criniger pallidus</i>			×									
29. <i>Pycnonotus jocosus</i>				×	×	×						
30. <i>Pycnonotus melanicterus</i>			×		×							
31. <i>Chloropsis cochinchinensis</i>				×								
32. <i>Irena puella</i>			×				×					
33. <i>Enicurus schistaceus</i>				×								
34. <i>Cisticola exilis</i>					×	×		×				
35. <i>Prinia flaviventer</i>								×				
36. <i>Anthus novaezeelandiae</i>						×						
37. <i>Artamus fuscus</i>			×	×								
38. <i>Gracula religiosa</i>	×	×	×	×	×	×	×					

TABLE 8. Feeding flocks or Bird Waves at Khao Yai.

	Months												T
	J	F	M	A	M	J	J	A	S	O	N	D	
No. flocks	2	1	2	2	2	2	2	8	3	4	4	8	40
Total species	8	9	13	20	16	9	13	24	24	16	20	29	69
Ave. species per flock	7.0	9.0	13.0	13.5	7.7	6.5	7.0	11.0	13.7	8.0	8.5	6.3	9.3
Total birds	34	10	40	71	61	45	64	425	124	119	100	339	1432
Ave. birds per flock	17	10	20	35.5	30.5	22.5	32.0	53.1	41.3	30.0	25.0	42.4	35.8
Ave. birds per species per flock	2.5	1.1	2.1	3.2	3.6	3.4	4.6	5.3	4.0	2.3	3.0	6.6	4.1
Ave. Air temperature in Fahrenheit	—	—	70	78	83	77	81	77	78	72	75	76	

**TABLE 9. Species associated with mixed species feeding flocks.
(Birds waves).**

Species	Number Flocks	Number Birds	Birds Per Flock	% of Flocks
<i>Hemipus picatus</i>	23	97	4.2	57.5
<i>Yuhina zantholeuca</i>	22	97	4.4	55.0
<i>Chloropsis cochinchinensis</i>	19	75	3.9	47.5
<i>Hypsipetes propinquus</i>	17	59	3.4	42.5
<i>Pycnonotus melanicterus</i>	17	86	5.0	42.5
<i>Zosterops palpebrosa</i>	16	250	15.6	40.0
<i>Pericrocotus flammeus</i>	15	62	4.1	37.5
<i>Macronus gularis</i>	14	44	3.1	35.0
<i>Irena puella</i>	13	54	4.1	32.5
<i>Criniger pallidus</i>	11	42	3.8	27.5
<i>Culicicapa ceylonensis</i>	10	21	2.1	25.0
<i>Hypothymis azurea</i>	10	15	1.5	25.0
<i>Phylloscopus</i> spp.	8	27	3.3	20.0
<i>Dicrurus hottentottus</i>	5	66	13.2	12.5
<i>Phaenicophaeus tristis</i>	5	7	1.4	12.5
<i>Anthreptes singalensis</i>	5	12	2.4	12.5
<i>Loriculus vernalis</i>	4	14	3.5	10.0
<i>Pericrocotus divaricatus</i>	4	10	2.5	10.0
<i>Aegithina lafresneyei</i>	4	6	1.5	10.0
<i>Muscicapa thalassina</i>	4	5	1.2	10.0
<i>Melanochlora sutanea</i>	4	11	1.7	10.0
<i>Harpactes erythrocephalus</i>	3	6	2.0	7.5
<i>Terpsiphone paradisi</i>	2	6	3.0	5.0
<i>Orthotomus atrogularis</i>	2	5	2.5	5.0
<i>Phylloscopus ricketti</i>	2	5	2.5	5.0
<i>Hypsipetes flavala</i>	2	3	1.5	5.0
<i>Seicercus burkii</i>	2	3	1.5	5.0
<i>Meiglyptes jugularis</i>	2	4	2.0	5.0
<i>Picus flavinucha</i>	2	2	1.0	5.0
<i>Psarisomus dalhousiae</i>	2	21	10.5	5.0
<i>Oriolus chinensis</i>	2	2	1.0	5.0
<i>Phylloscopus coronatus</i>	2	3	1.5	5.0
<i>Pycnonotus atriceps</i>	1	6	6.0	2.5
<i>Sitta frontalis</i>	1	2	2.0	2.5
<i>Aethopyga saturata</i>	1	2	2.0	2.5
<i>Aethopyga siparaja</i>	1	2	2.0	2.5
<i>Harpactes oreskios</i>	1	1	1.0	2.5
<i>Serilophus lunatus</i>	1	4	1.0	2.5
<i>Dicaeum</i> spp.	1	5	5.0	2.5
<i>Muscicapa latirostris</i>	1	1	1.0	2.5
<i>Muscicapa parva</i>	1	1	1.0	2.5
<i>Dicaeum agile</i>	1	1	1.0	2.5
<i>Hippogramma hippogramma</i>	1	2	2.0	2.5
<i>Phylloscopus tenellipes</i>	1	2	2.0	2.5

TABLE 10. Comparison of numbers of *Buceros bicornis* seen and heard.

Month	Total Birds Counted	Total Counts Made	Ave. Birds Per Count	Ave. Birds Per Count Without Flocks Included in Total	Ratio of Times seen	Ratio of Number Birds seen	Ratio of Number Birds Calling
J	60	13	4.6		22	20	25
F	11	6	1.8		10	4	15
M	27	15	1.8		26	9	42
A	37	17	2.1		29	12	100
M	32	8	4.0	2.4	14	11	44
J	39	16	2.4		27	13	41
J	17	8	2.1		14	6	41
A	297	37	8.0	3.3	64	100	26
S	12	7	1.7		12	4	41
O	211	58	3.6	2.5	100	71	25
N	223	43	5.2	3.7	74	75	38
D	211	43	5.0	2.0	74	71	50
T	1177	271	4.3	2.5			

TABLE 11. The seasonality of the local populations of Wreathed Hornbill at Khao Yai.

	Total Birds	Total Counts	Ave. Per Count	Ave. Minus Flocks	Ratio Number Time seen	Ratio Number Birds
J	40	24	1.6		12	2.1
F	4	3	1.3		1	.2
M	51	33	1.5		17	2.7
A	10	6	1.7		3	.5
M	21	16	1.3		8	1.5
J	32	14	2.3		7	1.7
J	63	3	21.0	2.5	1	3.4
A	1202	171	7.0	3.3	87	65.4
S	145	23	6.3	2.5	12	7.8
O	1837	196	9.4	3.8	100	100
N	141	42	3.3	2.7	21	7.6
D	124	42	3.0	2.7	21	6.7
T	3670	573	6.4	2.3		