

# THE AVIFAUNAL COMPLEX OF AN OPEN-BILLED STORK COLONY (*ANASTOMUS OSCITANS*) IN THAILAND\*

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## ABSTRACT

A two year study was made of the avifauna of the bird sanctuary at Wat Phai Lom, Phathumtani, Thailand. The bionomics of an Open-billed Stork colony are reviewed and related to those of nearly a hundred species of birds, involving their incidence of parasitism both with ectoparasites and haematozoa. Annual cycles of abundance both for birds and their parasites are given.

## INTRODUCTION

Bordering the Chao Phya River about 25 miles (40 km) north of Bangkok, in Pathumthani Province, lies the 40 rai (18 A, 7 hectare) Stork Colony known as Wat Phai Lom. It includes the grounds around a Wat or Buddhist temple and monastery of that name and has been designated a wildlife sanctuary since 1970. The colony, under the protection of the monks has been present for many years and the temple has a history of several hundred years. The area lies at approximately 13.55° N. latitude and 100.25° E. longitude, and is at sea level, as tides affect the river at this distance from the sea.

Observations of the avifauna were begun in December 1968 and continued through December 1970. Objectives of the study were to follow the annual cycle of the Open-billed Stork colony and its effect

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upon the resident non-migratory birds of the area, the seasonal fluctuations of all species, the effects of stork parasites on other organisms in the colony and the development and intensity of avian parasite populations and haematozoa.

### METHODS

The colony was visited once each week. A field team of two or three people moved in on Monday and set up 30 to 35 mist nets at designated sites. The senior author and two assistants arrived on Tuesday and ringed birds. Immediately upon arrival, about 0930, the senior author made bird population counts along a standard route which ran through the colony into the unprotected thickets to the north for about  $\frac{1}{4}$  mile (400 meters). The junior author examined cloth bands or belts which had been placed about the trunks of trees heavily loaded with stork nests, collecting examples of the arthropods for identification that were hiding behind these bands. When stork nestlings were two to three weeks old those that could be reached in low nests were ringed.

Ectoparasites were collected from netted birds by dusting the hosts with Dri-die 67, a silicon-dioxide powder, and blood films were made from drops of peripheral blood obtained by clipping a toenail.

Japanese mist nets of silk or nylon were used, standard sizes were 4 paneled 12 meters long by 2.4 meters high, with 36 mm or 61 mm mesh. Each net site was numbered and used every week. As there was considerable theft of nets not all sites were always in operation. Nets were left unfurled all night and those birds caught on Monday afternoon or evening were identified and banded by the field team. All other identifications were made by the senior author.

Arthropods collected from the birds, nests or trees were sent to taxonomists or to the U.S. National Museum for identification. Blood films were stained with Giemsa and examined by laboratory technicians at the MAPS headquarters for the presence of haematozoa.

The reader is referred to the only other comprehensive study of this type in Thailand made by Dr. Joe T. Marshall and his associates for comparisons of species, population densities, weights, etc. in another man



disturbed habitat (Bang Phra) about 70 miles SE of Wat Phai Lom. (Nat. Hist. Bull., Siam Soc. 23 : 133-83, 1969)

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### DESCRIPTION OF THE AREA

The sanctuary was unfenced and of irregular shape, Map 1, bordered on the west by the Chao Phya River, south by farm yards, east by rice fields and north by another temple with surrounding thickets. It was roughly divided equally by the monks quarters and temple surrounded by open areas with a few trees. The south half was heavily grown with clumps of bamboo and the north half was about equally divided between an area of bamboo (*Bambusa arundinacea*) and an area of large trees (*Cassia*, *Samanea*, *Tamarindus*, and others). To the north of the next temple was an area of thickets of (*Bambusa arundinacea*, *Capparis siamensis*, *Streblus asper*, *Wrightia religiosa*) and four farmhouses and yards which bordered the river. The most abundant trees were the clumps of *Bambusa* while the other tree species were in about the numerical relationships as indicated by the list of numbered trees in Table 1. (From LAUHACHINDA, 1969 unpublished thesis, Katsetsart University, Bangkok)

Large teak trees had been killed by the annual accumulation of urates from the stork colony and most trees were defoliated by contamination during the dry season. Annual floods during October and November flushed the soil preventing the death of other species.

### RUSUMÉ OF THE STORK COLONY

LAUHACHINDA followed the Open-billed Stork nesting cycle from January 1968 through April 1969 and his thesis is reviewed here. A low level population of a few hundred birds is resident, feeding in rice fields up to fifty miles away during the day and returning each sundown to roost. The migrant flocks begin arriving in October and by the end of November the bulk of the breeders are in.

There is much courtship and territorial fighting with nest building beginning in November. During this initial period the preferred trees are Sugar Palms (*Borassus flabellifera*) which are the scenes of constant battle between wings and bills and of noisy bickering. First nests were built among the fronds. Later with the influx of new pairs and the urgency for nesting, sites were selected among all trees. Bamboo eventually supported one third of all of the nests. Table 1.

Thirty-three species of trees supported nests with 57% of all nests reported by LAUHACHINDA being built in *Bambusa*, *Borassus*, *Samanea* and *Streblus*. There was an average of 400 nests built per tree species, and 69 per individual tree. Some individual trees with spreading limbs and numerous small forked branches were in great demand. These included one each of *Feronia limonia*, *Lagerstroemia calyculata*, *Pithecellobium dulce*, *Sterculia foetida* and *Terminalia bellerica* which supported 979 nests, 386 of which were in the *S. foetida*.

Table 1 also lists the number of active nests per month. Peak activity was in February at which time 90% of the nests had young. The nest is built by the female (?) of twigs brought to her by the male and it is decorated with branches of green leaves which are added to it during the whole cycle or until the young are well grown. A normal clutch includes four eggs laid at about two day intervals. Hatching is at 27 to 29 days. Nestling mortality is high and usually only two young survive. During years without wind storms the survival is higher. Young develop slowly and are under parental care for nearly two months. They can fly by forty days but remain in the colony begging for another two weeks. The food is the meat of the large operculate snail, *Pila pesmei* (Morelet, 1889) which is regurgitated into the nest for the nestlings to pick up. This results in much spillage which is later gleaned by both adults and fledglings searching the ground beneath the colony.

Young begin leaving the nests in January and join adults flying northwest each morning to the feeding grounds. Gradually all young join them and the colony begins depletion in April and May. By June and July nearly all migrants have moved north and only a remnant remains.



The season of nesting is during the hot dry monsoon when temperatures reach 100 degrees or more Fahrenheit (38°C.) in the sun, trees defoliate, rice fields and marshes dry up, and the nests and occupants are subject to severe exposure. Both eggs and young must be shaded by the adults, the young until they are protected by feathers. This apparently illadvised nesting season is related to food supply. It takes nearly a pound of snails per nestling and snails are required by the ton daily during February, March and April. At this time the snail which is aquatic is exposed by receding waters and available to the storks. The inhospitable weather is off set by the availability of food.

### FOOD CHAINS INVOLVING STORKS

There was a small complex of animals involved with the storks which led into more complicated food chains. This little zoocoenosis is illustrated in Fig. 1. There were three groups of organisms involved with eggs, nestlings and adults respectively. Since this is a large bird it is relatively free of predators. No animal other than man was seen to attack them. Poachers in the colony at night with slingshots accounted for several hundred adults in 1970 and almost broke up the colony. While nesting the adults were attacked by *Argas* ticks, *Ornithonyssus* mites and hippoboscids flies (*Icosta mcclurei* Maa). They were nearly free of these parasites at other seasons.

The eggs were attacked on the nest by the Large-billed Crow, *Corvus macrorhynchus*, which probably accounted for less than 1% of the annual loss. The crows in turn were parasitized by the Koel, *Eudynamis scolopacea*. Heavy wind preceding squalls destroyed many nests each year. The fallen eggs were eaten by lizards, *Varanus* spp., dogs and snakes.

The young were involved in a larger cycle. On the nest they were attacked by *Argas robertsi* ticks, hippoboscids flies and *Ornithonyssus bursa* mites. These in turn had their own predators and parasites. When storms knocked young from the nests or they fell from them they were eaten by *Varanus* spp. and dogs. Dead birds were attacked by many necrophilous forms. The loss from storms each year was variable, some years with few storms and with a high young survival as in 1972 and others such as 1968 with several storms and many young down.

The food, mainly snails, dropped by the nestlings was a source of protein to many forms. These included dogs, other storks, Crested Myna, *Sturnus javanicus*, Black-collared Myna, *Sturnus nigricollis*, Common Myna, *Sturnus tristis*, Pied Myna, *Sturnus contra* and others.

### SEASONALITY IN THE COMMUNITY

Although not all of the major vertebrates and invertebrates were followed closely, the community had a marked seasonality. Fig. 2 illustrates this for selected species. The dry season appeared to be the period for nesting in spite of the adverse weather conditions of drought and heat. Juvenile dispersal came at the beginning of the rainy season. Most vertebrates showed a decline by the end of the rainy season except the fruit bats, *Cynopterus brachyotis*. Infection rates of the haematozoa were highest toward the end of the rains.

### AVIAN POPULATION COUNTS

There was a complex of nearly a hundred species of birds which used the area regularly. These showed seasonality related to weather in the community as well as to the presence or absence of northern visitors. Three seasonal groups were in evidence; permanent residents, with a population peak in May; rainy season residents, with a peak in June; and winter or dry season residents, with a peak in October. The overall population density as indicated by birds per observation was: Jan. 32.2, Feb. 22.2, Mar. 43.9, Apr. 55.8, May 77.1, Jun. 69.3, Jul. 53.7, Aug. 54.6, Sep. 48.5, Oct. 72.4, Nov. 37.1, Dec. 31.0, an average of 62.1. The two highest months were May with the influx of juveniles and October with the arrival of winter visitors.

There were 28 species which were found regularly nearly every month of the year, i.e. permanent residents and these made up 77% of the total. They averaged 37.7 birds per observation and the population was above this average (49 birds) for the seven months from April through October, while it was 25.6 for the remaining months. Table 2 lists these data.

Only 15 species were more abundant during the rains. These made up 9.8% of the annual total. For the period April through July, which



is that of the rains which may extend into September, there were nine times as many of these species present as during the remainder of the year, 12.6 as to 1.4. Peak month of the year for this group was June. Table 3.

The 55 species found predominately during the dry season, which included northern migrants, made up only 13.1% of the annual population. For the period January through April the population averaged 6.2 birds. Low season was during the monsoon with an average of 1.3 birds. Peak months were October through December, 13.9, more than double the average, Table 4.

### BIRDS RINGED

The data concerning the number of birds caught and ringed during the 25 month study are presented in Table 5. Seventy species and 2843 individuals, 1432 of which were Open-billed Storks, were banded. Four species other than the storks made up 50.2% of the birds captured; *Pycnonotus blanfordi*, 18.5%, *Copsychus saularis* 9.6%, *Orthotomus sutorius* 10% and *Rhipidura javanica* 12.5%.

Sedentary species were readily recaptured and these made up 29.2% of the total, i.e. 547 of 1877. These recaptured birds indicated trends in age composition of the populations present. Since many nets were stolen it is not possible to determine the validity of these figures since any bird captured by other than the research team would have been removed from the population; eaten or sold at a pet shop. The appearance of new birds in the catch is illustrated in Fig. 3, which shows the influx of juveniles during May and June. The monthly proportions of the populations made up of old birds, or birds previously handled are illustrated in Fig. 4. At peak nesting in March the population is relatively static and 44% of the population in the vicinity of the net lanes was wearing rings. With appearance of juveniles and during their period of dispersal the percentage of ringed birds present dropped to 22. After the birds either left the area or settled down into vacated territories the percentage of repeats again increased, to 36% by August. The decrease following this, shown in Table 6, may have been the result of further competition for territories, mortality among the marked birds, further dispersion, or the arrival of winter visitors.



### POPULATION COMPOSITION IN THE AREA

Thirty net sites were selected in six minor habitats as shown in Map 1 to sample the bird population and a few nets were occasionally placed at random in the open areas of the colony, area G. The success in capturing birds at these sites is given in Tables 7 and 8. The anticipated population curve as indicated by the number of individuals caught is apparently not affected by the presence of the thousands of active stork nests. As the breeding season for other species closed in March and April the influx of birds during May and June coincided with the departure of the juvenile storks and the reduction of noise and filth in the environment. The October-November low in net take was the result of annual floods preventing effective netting in the sanctuary. Greatest catches were in bamboo Area B at the edge of the colony facing ricelands. Catch to the north of the colony, Areas E and F, was within the range of that within the colony. Peak catches varied between May and August from area to area. The take was highest within the protected areas of the sanctuary in spite of the presence of the storks.

### INVERTEBRATES

Invertebrates were noted on the trunks of the trees supporting stork nests. Parasitic invertebrates were found on nearly every avian species. These included many species and families the commonest of which were feather mites. Twenty-seven species were identified in the collections as well as undescribed species from 19 genera. These were from 37 host species. Seventeen host species were captured in abundance great enough to determine whether the rate of infestation with these parasites was uniform or seasonal. Table 9 summarizes the gross information by months.

Heaviest parasitism appeared to be in April when 70% of the hosts were infested. The six month period, February through July, was a period of infestation, 56% of the hosts, which relates fairly well with the presence of the breeding colony. The remaining six months, August through January, was low season for parasites, 35% of hosts infested.



Feather mite infestation was most prevalent and the annual cycle is summarized for 13 avian hosts in Table 10. Some species as the Black-collared Myna and the Pied Fantail Flycatcher seemed always to have heavy infestations while others, as the Black-throated Tailorbird, are rarely infested. At first glance it appears that the larger and heavier birds are more heavily infested, but the five species with a 75% infestation rate averaged 65 grams and the eight species with a 15% infestation rate averaged 50 grams in weight, not a significant difference.

Mallophaga were not abundant on the hosts and were not collected in numbers great enough to indicate other than host specificity.

There were two parasites that went through conspicuous annual cycles; the soft tick *Argas robertsi* and the mite *Ornithonyssus bursa*. Both were intermittent feeders and nest occupants.

Following the October flooding of the sanctuary; to a depth of a meter or more and for a period of three weeks to a month of continuous high water, the tick population was very low. Undoubtedly those hiding beneath debris on the soil surface would drown unless they could escape by climbing up the trees. At this point careful searching would reveal a few adults beneath loose bark on tree trunks.

During December and January as stork nesting increased these remaining adults fed at night on the incubating birds and produced young so rapidly that the population had increased a thousand fold by May. Table 11 illustrates this for some selected trees. A few ticks were present in bark crevices and in the nests into March. This was followed by a population explosion reaching a peak in May and remaining abundant into July. Fig. 5

During this period each evening just after sundown, between 1900 and 2000, the ticks could be seen crawling by the hundreds up every tree toward the nestlings. Within an hour of dawn equal thousands were crawling down the trees to daytime hiding places. How often an individual fed was not determined. During this peak of activity with millions of hungry ticks in the colony they attacked humans, were found on *Otus bakkamoena* and probably attacked other species as well. Young storks on the ground were often found covered with ticks even in the daytime. When banding nestlings during the day it was noted that they



were usually free of ticks, so the heavily infested birds on the ground may have picked up these ticks from the thousands of hungry ones unable to locate a nest and meal during the night. Fig. 6

There was a recedence of the population during June, July and August. In August an ant *Pheidologeton diversus* (Jerdon) made its appearance, climbing the trees, searching every crevice and carrying off the ticks by the thousands. This resulted in a sharp reduction in the tick population to be further reduced by flooding in October. This ant was again seen carrying ticks in October.

*Ornithonyssus bursa* is a common nest parasite found widely over Asia and known to parasitize at least 20 species of birds. At Wat Phai Lom it was collected from the following: *Anastomus oscitans*, *Accipiter virgatus*, *Otus bakkamoena*, *Pelargopsis capensis*, *Dicrurus annectans*, *Dicrurus paradiseus*, *Copsychus saularis*, *Sturnus contra*, *Sturnus javanicus*, *Sturnus nigricollis*, *Sturnus tristis*.

As a nest parasite it feeds intermittently upon nestlings and brooding adults and lays its eggs in the nest debris or drops to the ground to do so. Larvae and nymphs also attack the birds. The life history of this species in this area has not been worked out so some of the following is conjectural. It is assumed that because of their small size or possibly they are resting as eggs or adults, they are very difficult to find until about February. Then a few will make their appearance in the nests, or walking on tree trunks. From this point on into March and early April the population increase is tremendous and the numbers reach millions. They blow from the trees in the wind, at night drifting down to penetrate mosquito nets in open buildings to bite or disturb the sleepers. They crawl over the soil, sidewalks, up monuments and upon any visitors, whom they bite beneath tight clothing. As the above list indicates they crawl onto birds other than the Storks as well.

As the sun moves north the wet monsoon season usually enters Thailand during April or early in May with an occasional heavy shower or thunderstorm. When this first tropical storm of the season strikes Wat Phai Lom the mite population collapses. Whether this is loss by the physical force of the rain or by the resurgence of some disease or fungus has not been determined. The mite is no longer in evidence until the next stork breeding season and next February.



### HAEMATOZOA INFECTIONS

Peripheral blood films were made from drops of blood oozing from toenail clipping of 62 species of birds, 842 individuals, to determine if the presence of haematozoa showed relationship with the presence or absence of the stork colony and possible reactions to stresses brought on during the breeding season. Haematozoa infections were evident in 19 species and seven of these were sampled every month.

*Haemoproteus* spp. were the most prevalent parasites and the incidence among these 19 hosts is shown in Table 12. It was as high as 50% among the resident *Copsychus saularis* and winter visitor *Muscicapa parva* (72 and 18 samples respectively) and as low as less than 10% among the resident *Rhipidura javanica* and *Otus bakkamoena* (109 and 29 samples respectively).

Among the seven host species sampled regularly (*Pycnonotus blanfordi*, *Rhipidura javanica*, *Copsychus saularis*, *Sturnus nigricollis*, *Orthomus sutorius*, *Otus bakkamoena* and *Pelargopsis capensis*), the infection rate was 19.6% during February, March, April, May; 10.4% during June, July; 26.5% during August, September and 6.6% during October, November, December, January. This suggests that the infection rate is lowered by the influx of juveniles into the population during June and July and that it builds up again as vectors have a chance to infect the new individuals. The low infection rate of the latter months of the year remains unexplained.

### WEIGHTS AND MEASUREMENTS OF THE BIRDS

Weights and measurements were taken from 67 species; 665 birds measured, 918 weighed. These are listed in Table 13.

### BATS

The most abundant vertebrates encountered other than birds were bats and the commonest species was the Dog-faced Fruit Bat, *Cynopterus brachyotis*; the numbers of which that were netted are shown in Table 6. At the beginning of the study a few were ringed, but ring damage to the wings was causing mortality so no more were marked. There was also some mortality among those that remained in the nets too long. Both of these factors would have affected the population numbers as indicated

by the numbers netted. Very few were taken during March, April, May and June which suggested that the bats had flown to some other area where there was a food supply. MARSHALL from the studies at Bang Phra suggests that breeding is scattered during the year, but that more young appeared to be born in February and June.

#### ANNOTATED LIST OF BIRDS OF WAT PHAI LOM

1. **Pond Heron, *Ardeola ralliodes*.** A marsh and rice land resident which invaded this thicket habitat only when it was flooded. Eleven, including two juveniles, were taken in October. All blood films taken were negative. (Further reference to negative or positive refers to the presence of haematozoa in the blood films).

2. **Black Bittern, *Dupetor flavicollis*.** A resident forest bittern rarely seen here. One captured in November, negative.

3. **Little Green Heron, *Butorides striatus*.** A palearctic bittern, winter resident of Thailand in small numbers. Usually along rivers and streams. One taken in October, negative.

4. **Shikra, *Accipiter badius*.** A winter resident hawk in forest edge and woodlands. One of two birds taken in December was positive with an infection of *Plasmodium* prob. *vaughani*. This bird was recaptured a year later still with a peripheral infection of this parasite.

5. **Sparrow Hawk, *Accipiter virgatus*.** A resident hawk with a low level population augmented by winter residents from the north. One bird taken in June, and two in December one of which was infected with *Haemoproteus*.

6. **Red-thighed Falconet, *Microhierax coeruleus*.** A tiny falconet resident of open woodlands. One taken in July, negative.

7. **Plaintive Cuckoo, *Cacomantis merulinus*.** A brushland cuckoo parasitic on small birds and wide spread in South-East Asia. Two juveniles taken in this thicket in September, negative.

8. **Greater Green-billed Malkoha, *Phaenicophaeus tristis*.** A resident cuckoo of forests and brushlands, non-parasitic. Adult birds taken in February and September and a juvenile in June. The September bird had an infection of *Plasmodium* prob. *vaughani*.



9. **Crested Red-winged Cuckoo, *Clamator coromandus*.** This beautiful cuckoo was a winter resident in the brushlands. One bird taken in February, two in March. One of the March birds had a *Microfilaria* infection.

10. **Greater Coucal, *Centropus toulou*.** Another free-living cuckoo, resident of grasslands and secondary brush. Two taken in August, negative.

11. **Koel, *Eudynamys scolopacea*.** This noisy permanent resident parasitic cuckoo of the crows was present in the Wat area all year round, but very difficult to catch. One taken in January was negative.

12. **Drongo Cuckoo, *Surniculus lugubris*.** A parasitic cuckoo, black like a drongo, parasitizing many birds including drongos and wide spread over many habitats. One was taken in March, negative.

13. **Barn Owl, *Tyto alba*.** A pandemic owl which lives about man's habitations. They roosted in the temple. Two were captured in October, negative.

14. **Spotted Owlet, *Athene brama*.** A small, noisy nearly diurnal owl which lived in the dense thickets. Four were taken in April, June, July, and October. Blood films were made of the June and October birds and the latter had a *Haemoproteus* infection.

15. **Collared Scops Owl, *Otus bakkamoena*.** The common resident scops owl in most wooded habitats up to 5000 feet. This species is easily caught by night netting and twelve individuals remained negative when recaptured at 8, 23, 12, 15, 1, 8, 2, 2, 17, 7, 2, and 2 months, an average period of 8 months. One bird was known to remain infected with *Haemoproteus* for five months. Thirteen individuals were captured an average of 2.5 times and these probably made up the resident population. A total of 29 birds were captured including six juveniles from April into September. Only one bird was positive, 3.4%.

16. **White-breasted Kingfisher, *Halcyon smyrnensis*.** A common kingfisher found in cultivated fields away from streams and rivers. They were most abundant in the thickets during June into August when 20 of the total of 25 were taken. Half of these were juveniles indicating that this was a dispersing population and not a resident one in the immediate



area. Ten of the birds were recaptured within one or two months before moving on, three were retaken at four months and one at six months. All were negative.

17. **Black-capped Kingfisher, *Halcyon pileata*.** A common winter resident of lowland farmyards, streamsides and secondary forests. Twenty-one birds were taken, ten of which were recaptured (2.7 captures per bird) and four of which were infected with *Haemoproteus*. One bird had a multiple infection of *Haemoproteus* and *Plasmodium* prob. *polare*. None of the recaptured birds had converted to positive. One of the positives was recaptured 13 months later, still with *Haemoproteus*. Half of the recaptured birds were retaken in less than a month and were probably transient migrants. The others were probably winter residents about the Wat. The monthly take totaled: October 2, November 4, December 1, January 0, February 7, March 10, April 13, for the two years. Greatest number of recaptures was in April as migrants moved north.

18. **Stork-billed Kingfisher, *Pelargopsis capensis*.** A resident non-migratory kingfisher of larger rivers and ponds. Twenty birds were tested, only one of which became infected with *Haemoproteus*, the infection being evident when the bird was recaptured 12 months later. One bird had left the area and was shot seven months later about 10 miles away. Five other birds were residents and repeated at an average of 6.5 months. The population was highest in the post rainy season, September, October, November.

19. **Bamboo Green Woodpecker, *Picus vittatus*.** A common woodpecker of coastal mangroves, coconut groves and lowland secondary forests. Three birds were permanent residents and were captured nine times. They remained negative during the entire study.

20. **Ashy Drongo, *Dicrurus leucophaeus*.** A resident drongo of coastal and upland forests. Has seasonal movements which may be related to juvenile dispersal. One bird captured in February, negative.

21. **Hair-crested Drongo, *Dicrurus hottentottus*.** This is a common drongo of upland forests which appears to have seasonal movements related to the flowering of food plants. Two negative birds were taken



in February which may have been juvenile dispersal, and a bird taken in November was infected with *Plasmodium* prob. *cathemerium*.

22. **Crow-billed Drongo, *Dicrurus annectens*.** A migrant drongo captured in the thicket in April, negative.

23. **Bronze Drongo, *Dicrurus aeneus*.** A small drongo, resident near streams and in secondary growth. Three captured in May, June, negative.

24. **Black Drongo, *Dicrurus adsimilis*.** A common drongo, resident of open fields and farmyards which has two populations, a small resident one which seeks isolated woods during the breeding season, and a large migrant one which winters in the rice lands. The migrant birds did not enter the thicket, but the resident subspecies moved in May and June when the juveniles were rapidly dispersing. During these months 15 of 28 birds (54%) were in juvenile plumage. Of 33 birds handled only one was infected, with *Haemoproteus*. This infected bird was recaptured two weeks later, still positive.

25. **Large Racquet-tailed Drongo, *Dicrurus paradiseus*.** A permanent resident of most forests up to three thousand feet. It has penetrated farmyards and cities where there are sufficient trees. Nine of fifteen birds were captured an average of 3.4 times. One bird negative in March, showed a *Plasmodium* prob. *rouxi* infection eight days later and was again negative when recaptured 6 months later. Recognizable juveniles were taken in May and July. Peak period of activity in the thickets was between March and July.

26. **Ashy Minivet, *Pericrocotus divaricatus*.** A winter resident of lowland forests up to 2000 feet. Probably this population is from China. One negative specimen taken in April.

27. **Brown Shrike, *Lanius cristatus*.** A common winter resident shrike from north China and Siberia. Abundant in brushlands and cities of lowlands. Was not well represented in this thicket and one negative was taken in September.

28. **Blanford's Bulbul, *Pycnonotus blanfordi*.** The common bulbul of man disturbed lowlands. 263 birds were ringed, 58 of which were captured again, 22.4%. This is an unstable population in that juveniles



appear to wander, probably in search of vacant territories. 22% of the birds were positive when first caught, and 23% remained positive at subsequent dates. Between March and September 134 new birds were taken with a total of 27 recognizable juveniles (20%) distributed among these months. The bulbuls apparently moved out of the thickets from October until February for only 7.6% were taken then. Nearly 40% of the birds were infected with *Haemoproteus* in March when the population had not been diluted by juveniles which were 89% negative. The infection rate again reached 41% in September as juveniles became infected. Totaling new birds with repeats the percent of infections was: January 11, February 0, March 30, April 46, May 15, June 21, July 7, August 18, September 40, October 33, November 50, December 0. 21 individuals remained negative from 1 to 20 months, average 8. Seven positive birds became negative in from one to 15 months, average 8.6. One negative bird had developed an infection of *Plasmodium* sp. 9 months later. Four birds with *Haemoproteus* remained positive from 5 to 13 months, average 8.2. Two birds that were apparently negative when first captured had *Haemoproteus* in the peripheral blood 8 and 14 days later. One bird was negative when captured, had a *Haemoproteus* infection 4 months later and this was inapparent 3 and 12 months following. One bird was negative when captured, again negative 3 months later, six months after that it had *Haemoproteus*, which was inapparent two months later, again apparent at six weeks and four months.

29. **Abbott's Brown Babbler, *Trichastoma abbotti*.** A common forest edge babbler up to 3000 feet. One bird was first taken in December and was recaptured twice in the next two months, remaining negative.

30. **Striped Tit-Babier, *Macronus gularis*.** A common shrub babbler of the forest edge in forests up to 3000 feet. A resident of thickets but uncommon at the Wat so individuals were not taken all through the year. Seven of eight birds were taken from February to June, of which three must have been residents and were recaptured an average of 3.3 times each. All birds were negative and remained negative at least three months.



31. **Magpie Robin, *Copsychus saularis*.** The common resident thrush of cities and farmyards. Fifty of 72 birds were recaptured 105 times or an average of 3.1 captures per bird. At first capture 44% of the birds were infected with *Haemoproteus*. Recaptured birds were 52% infected. The number of blood films taken each month including those from recaptured birds was January 14, February 6, March 16, April 33, May 28, June 27, July 9, August 8, September 7, October 8, November 0, December 21. Peak activity of new birds was from December into June with juvenile birds making up 15 of the 34 taken in April, May, June. A third of these juveniles were infected when captured. At first capture 84% of the birds that were infected had *Haemoproteus* and 16% *Plasmodium* prob. *rouxi*. Later in recaptured resident birds *Haemoproteus* made up 93% of the infections and *Plasmodium* 7%. *Haemoproteus* was actively proliferating in the habitat with a good vector.

During the two year study some birds remained for 15 to 20 months. This was in spite of the fact that many nets were stolen and used to catch such birds which brought a high price in the local markets. Nearly half of the new birds in the area remained less than three months, were captured for sale, or were unable to find an unoccupied territory. The average time of recapture was 5.1 months after first capture. No rings were reported.

The epidemiological data was as follows. One bird sustained a multiple infection of *P. prob. rouxi* and *Microfilaria*. One other had a multiple infection of *Haemoproteus* and *P. prob. relictum*. Fourteen birds, 28%, remained negative up to 15 months. Twelve birds, 24%, had *Haemoproteus* infections which became inapparent in one week to 10 months. Thirteen birds, 26%, listed as negative developed *Haemoproteus* infections in one week to six months. Eleven birds, 22%, were infected with *Haemoproteus* when first captured and remained so from one week to 18 months. The *Plasmodium* infections of two birds became inapparent in two months.

32. **Siberian Blue Robin, *Erithacus cyane*.** A small migrant ground thrush from Siberia. Found wintering in forest edge and brushlands. Three birds taken in October and December, one of which repeated in four months, all negative.



33. **Orange-headed Thrush**, *Zoothera citrina*. A winter resident of forests of Borneo and Malaya, and sparingly through Thai forests. A ground thrush from South China. One negative taken in December.

34. **Grey-headed Flycatcher**, *Culicicapa ceylonensis*. A resident streamside or valley forest flycatcher. Two wanderers taken in December, negative.

35. **Black-naped Blue Flycatcher**, *Hypothymis azurea*. A resident flycatcher of primary forests, but appeared to be a winter resident at this altitude in these thickets. Population status not well understood. One bird taken in November, six in December and 4 in January, all negative.

36. **Tri-colored Flycatcher**, *Muscicapa zanthopygia*. A winter resident of forest edge and woodlands, but the five captured here were all dispersing or transient juveniles in September, negative.

37. **Red-breasted Flycatcher**, *Muscicapa parva*. The common overwintering flycatcher of this type of brushland and thicket. Also occurred in forests up to 3000 feet. Eighteen of 31 individuals were tested, taken in every month from October into April. Fifty percent of the birds had infections of *Haemoproteus* when first captured. Six birds were captured an average of 2.7 times. A negative bird was infected when taken a year later. Two had infections which had become inapparent twelve months later. Four birds remained negative up to four months.

38. **Blue flycatchers**, *Muscicapa rubeculoides/banyumas*. This complex of flycatchers is very difficult to separate in winter plumage, even in the hand. They are winter residents of lowland brush habitats. Eight birds were taken from October into March. Two of them repeated including a female which was infected with *Haemoproteus* and retained this infection when recaptured 21 days later.

39. **Brown Flycatcher**, *Muscicapa latirostris*. A palearctic flycatcher which winters in the forests of S.E. Asia. One negative taken in February.

40. **Blue-breasted Flycatcher**, *Muscicapa hainana*. A winter resident of lowland forests of S.E. Asia. One bird taken in October negative.

41. **Pied Fantail Flycatcher**, *Rhipidura javanica*. A common scrub flycatcher of farmyards and cities throughout S.E. Asia. A permanent



and abundant resident of the thickets. 109 birds were caught, 51 of which were recaptured, with a capture rate of 2.8. The average interval was 3.3 months. Peak activity was between April and August when juveniles were actively dispersing. Juveniles made up 50% of the take in April, 82% in May, 75% in June, 94% in July and 61% in August. Seven of the eight infections of *Haemoproteus* were in juveniles, and one of the two *Plasmodium* infections. Thirty-three birds remained negative from one week to 16 months. Five birds converted to *Haemoproteus* in from two weeks to three months. One bird infected with *Haemoproteus* was still infected two months later. When first captured 8% of the birds were infected. Juveniles showed an infection rate of 10%. Recaptured birds, i.e. those remaining in the area for some time also had a 10% infection rate.

42. **Paradise Flycatcher, *Terpsiphone paradisii*.** A resident of lowland and mountain forests. One bird taken in May, negative.

43. **Golden Spectacled Flycatcher-Warbler, *Seicercus burkii*.** A migrant flycatcher-warbler infrequently seen in the forest edge and secondary forests. One taken in October, negative.

44. **Indian Great Reed Warbler, *Acrocephalus stentoreus*.** A pale-arctic reed warbler which winters in southern Asia. One taken in April, negative.

45. **Thick-billed Reed Warbler, *Phragmaticola aedon*.** A resident warbler of lowland marshes. One negative taken in March.

46. **Black-throated Tailorbird, *Orthotomus atrogularis*.** A resident tailorbird of farms and lowlands and up into secondary forests at 3000 feet. This was a common resident of the thickets. They were taken every month and were uniformly negative. Seventeen original captures and seven repeat blood films were all negative. They had a capture rate of 3.3 and the average interval of recaptures was 8.6 months.

47. **Common Tailorbird, *Orthotomus sutorius*.** This species was in residency with *atrogularis* and was the more abundant. Only two of 34 birds tested were infected with *Haemoproteus*, 6%. Activity was nearly equal from month to month. The capture rate of repeats was 2.6 times; interval between captures averaged 5 months.



48. **Willow Warbler Complex**, *Phylloscopus borealis/trochiloides*. Winter resident forest and forest edge warblers from the palearctic. There were 24 negative blood films from 32 birds and four from recaptures. The residency was between September and May.

49. **Inornate Willow Warbler**, *Phylloscopus inornatus*. A winter resident warbler of shrubs and low forests. Six negative birds were taken from December into February.

50. **Crowned Willow Warbler**, *Phylloscopus coronatus*. A winter resident warbler of secondary forests and brushlands seen in the thickets only during southward migration, September and October. One of nine birds was infected with *Haemoproteus*.

51. **Thick-billed Willow Warbler**, *Phylloscopus schwarzi*. A winter resident from the palearctic, found in secondary forests. Three birds taken in November, January, and March, negative.

52. **Dusky Willow Warbler**, *Phylloscopus fuscatus*. A palearctic warbler fairly common as a winter resident in lowland secondary forests. Ten birds taken from December into April, eight of these during the spring flight north (March, April), all negative.

53. **Pale-legged Willow Warbler**, *Phylloscopus tenellipes*. The most abundant overwintering willow warbler of the thickets. Also common in towns and lowland forests. Four of 19 birds passing through the Wat must have been resident and averaged 3.8 captures. Three birds returned the following year, 15.7%. Thirty blood films from these 19 birds were negative.

54. **Streaked-breasted Willow Warbler**, *Phylloscopus armandi*. An uncommon winter resident of lowland secondary forests. One negative bird taken in April.

55. **Common Myna**, *Sturnus tristis*. A very common farmyard and city dweller, but difficult to capture. Present at the Wat most of the time, but only three birds taken. One infected with *Microfilaria* and one with *Plasmodium* prob. *relictum*

56. **Crested Myna**, *Sturnus javanicus*. A farmyard species which each year moved into the colony area to glean food spilled by the storks. Twenty birds including seven juveniles were taken in May and June, none infected. One adult taken in March was infected with *Haemoproteus*.



57. **Pied Myna, *Sturnus contra*.** A common farmyard starling that moved into the colony to glean spilled food. Ten birds were taken from April into July, all negative, and two recaptured birds were still negative 18 months later.

58. **Black-collared Myna, *Sturnus nigricollis*.** A common farmyard starling in both lowlands and uplands. Movement into this habitat was related to juvenile dispersal. Twenty-eight of 42 birds taken from April into July were juveniles. As with other starlings these birds came to the colony to glean food from the storks. All juveniles were negative, some remaining so when recaptured one to two months later. Among the adults there was one infection of *Plasmodium prob. rouxi*, one of *P. prob. relictum*, one of *P. prob. vaughani*, one multiple infection of *Microfilaria* and *Haemoproteus*, and 9 other *Haemoproteus* infections. One adult remained negative four months later, and the bird with the *P. prob. relictum* infection was inapparent five months later. The rate of infection was 24.5% and dropped when the population was diluted by juveniles. A total of 53 birds were captured, five of which repeated within four months. Most were extremely dirty and heavily infested with *Ornithonyssus bursa* and at least ten genera of feather mites.

59. **Forest Wagtail, *Dendronanthus indicus*.** A winter resident wagtail from the north palearctic forests. Two of 18 birds were infected with *Haemoproteus*. Only one bird was recaptured and was negative when retaken three months later.

60. **Scarlet-backed Flowerpecker, *Dicaeum cruentatum*.** A permanent resident flowerpecker of lowland disturbed brushy habitats, secondary forests and cities. Six were captured, all negative, one of which was still negative when recaptured 4 months later.

61. **Brown-throated Sunbird, *Anthreptes malacensis*.** A farmland and palm resident in this area. Appeared to be a regular inhabitant of the thicket. Six adults captured, all negative.

62. **Yellow-breasted Sunbird, *Nectarinia jugularis*.** A common resident sunbird of farm and coastal woodlands. Juveniles were taken



in May. Nine birds were tested, three of which were infected with *Haemoproteus*. None was recaptured.

63. **Little Spiderhunter**, *Arachnothera longirostris*. A brushland and forest edge spiderhunter preferring banana thickets. One bird taken in June, negative.

64. **Baya Weaver**, *Ploceus philippinus*. A permanent resident of cane fields and marshy grasslands. Only one bird was taken in the thickets, in May and infected with *Haemoproteus*.

65. **Pegu House Sparrow**, *Passer flaveolus*. A farmland sparrow of the lowlands. This species appears to be nomadic and moves about the countryside. They disperse as the young leave the nests. At the thickets they were present from February into July and absent other months. Juveniles were in the flocks in May and June and made up nearly 50% of those captured. This species has a high incidence of *Haemoproteus*, 80% of 53 birds. Four infected individuals were still positive when recaptured 10 to 12 months later. Two infected birds appeared to be negative a year later. When first caught the incidence was 80%, but among ten recaptured birds it was 90%. Seven of the 53 birds were present in the area the following year suggesting a regular dispersal and return pattern.

66. **Spotted Munia**, *Lonchura punctulata*. A grassland and open country resident munia only occasionally seen in the thickets. Blood films were taken from two of six birds captured and both were infected with *Haemoproteus*.

67. **Sharptailed Munia**, *Lonchura striata*. A forest and brushland resident munia. Not uncommon in the thickets. Only three of eleven birds captured were tested, all negative.

68. **Tree Sparrow**, *Passer montanus*. The city and farmyard sparrow of eastern Asia. They were not common about the Wat. Only nine were trapped but none were tested.



### SUMMARY

Dr. Marshall in his summary concerning the study at Bang Phra comments on the enormous population of vertebrates present at or making use of the Serum Farm habitats. The same is true of Wat Phai Lom. Both areas are completely man-dominated artificial habitats but they support large and diverse populations of vertebrates and invertebrates.

The biotic complex at Wat Phai Lom is highly involved including more than a hundred species of birds, several species of bats, an undisclosed number of lizards, snakes and amphibians, and a host of parasites that interrelate many of these species.

The environment is dominated for seven months of the year by the Open-billed Stork Colony which local avian residents appear to accept, ignore, or take advantage of, and the presence of the storks promotes massive infestations of parasites that in turn attack the other vertebrate residents.

The biotic events in the habitats are related to the monsoon climate with cyclic fluctuations attuned to it and to the rhythms brought on by the appearance and disappearance of palearctic migrants.







Table 1. Use of trees at Wat Phai Lom by Open-billed Storks.

Species	Number Trees	% Trees	NUMBES OF NESTS						Total Nests	Nests Per Tree	% of Nests
			N	D	J	F	M	A			
<i>Albizzia lebbekoides</i>	9	4.7	26	40	169	203	158	49	645	71	4.5
<i>Bambusa arundinacea</i>	26	13.6	0	0	1099	1647	1213	306	4265	164	30.0
<i>Borassus flabellifera</i>	26	13.6	8	43	287	300	216	100	954	37	6.7
<i>Dipterocarpus alatus</i>	14	7.3	2	0	186	253	192	102	740	53	5.2
<i>Erythriua suberosa</i>	14	7.3	0	0	241	187	177	72	677	48	4.7
<i>Hopea odorata</i>	9	4.7	48	44	95	138	106	56	487	54	3.4
<i>Mangifera indica</i>	14	7.3	5	6	129	186	114	62	502	36	3.5
<i>Nauclea orientalis</i>	7	3.6	6	3	89	103	81	31	313	45	2.2
<i>Samanea saman</i>	11	5.7	15	18	347	460	301	121	1262	115	8.8
<i>Streblus asper</i>	16	8.4	37	57	200	343	268	120	1025	64	7.2
Total	146	76.8	147	211	2842	3820	2826	1019	10870		
<i>Feronia limonia</i>	1		5	0	35	35	31	16	122		
<i>Lagerstremia calyculata</i>	1		8	0	25	36	29	12	110		
<i>Pithecollobium dulce</i>	1		0	0	23	44	38	16	121		
<i>Sterculia foetida</i>	1		0	0	30	156	124	76	386		
<i>Terminalia bellerica</i>	1		0	0	61	71	77	31	240		
5 Tree Total	5	2.6	13	0	174	342	299	151	979	196	6.8
Total	151	79.4	160	211	3016	4162	3125	1170	11849		
Remaining Trees (18 Species)	39	20.5	65	32	600	851	568	249	2350	60	16.5
Grand Total	190	100	225	243	3616	5013	3693	1419	14199	74	100



Table 2. Permanent resident bird species at Wat Phai Lom present nearly all months.

Species	MONTHS												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
<i>Number Observations</i>	8	8	9	9	8	9	9	8	9	9	10	14	110
<i>Anastomus oscitans</i>	10000	10000	1357	1099	530	501	350	550	105	433	1300	22000	48225
<i>Haliastur indus</i>	2		1	3	3	2	9	15	15	20	8	15	93
<i>Accipiter virgatus/badius</i>	1	1	1	1		1		1		11	4	9	30
<i>Streptopelia chinensis</i>	1			1	2	1	8	10	6		1	1	31
<i>Eudynamys scolopacea</i>	15	8	15	5	3	1	3	5	6	17	17	26	121
<i>Phaenicophaeus tristis</i>		2	2	1	2	1	5	2	3	1	2	1	22
<i>Centropus sinensis</i>	8	2	12	14	10	8	13	13	8	9	11	17	125
<i>Outs bakkamoena</i>	4	4	3	8	7	5	8	4	3	2	2	8	58
<i>Athena brama</i>	1			6		1	4	2	4	1	2	1	22
<i>Cypsiurus parvus</i>	13	2	14	19	5	5	14	44	27	80	29		252
<i>Pelargopsis capensis</i>	1	2	5	1	7	10	17	19	23	30	18	8	141
<i>Halcyon smyrnensis</i>	1		2		2	9	16	16	10	2	1	1	60
<i>Coracias benghalensis</i>			5	13	13	13	14	14	13	18	10	8	121
<i>Megalaima haemacephala</i>	8		3	7	4	4	5	5	1	9	4	8	58
<i>Picus vittatus</i>	2	2	1		5	1	1			1	1		14
<i>Pycnonotus blanfordi</i>	31	12	60	52	79	91	65	71	62	28	15	24	590
<i>Dicrurus paradiseus</i>	7	1	15	5	11	5	8	7	8	10	6	9	92
<i>Corvus macrorhynchus</i>	20	4	23	18	16	13	16	17	20	25	21	34	227
<i>Copsychus saularis</i>	31	29	44	73	55	52	31	20	20	28	14	54	451
<i>Orthotomus sutorius</i>	12	17	19	28	20	27	30	27	36	22	14	21	273
<i>Orthotomus atrogularis</i>	15	7	13	27	25	7	28	25	10	2	6	7	172
<i>Rhipidura javanica</i>	19	8	18	36	46	60	53	37	25	11	16	16	345
<i>Sturnus nigricollis</i>		9	22	50	99	90	53	23	65	68	24	4	507
<i>Sturnus tristis</i>	2	2	17	26	18	12	21	30	15	28	8	8	187
<i>Anthreptes malacensis</i>		1	1	5	3	1	3	3	4	6	2	1	30
<i>Nectarinia jugularis</i>	3	3	4	2	3		1	2	2			1	21
<i>Dicaeum cruentatum</i>	4	8	9	3	4	2	10	7	6	7	2	5	67
<i>Passer montanus</i>		2	5	5	3	2		3	1				21
Total Species	23	22	26	26	26	27	26	27	26	25	26	25	28
Total birds (w/o Storks)	201	126	314	409	445	424	436	422	393	449	238	288	4131
Ave. birds per species	9.1	6.0	12.6	16.4	17.8	16.3	17.4	16.2	15.7	18.0	9.5	11.5	13.9
Ave. birds per obs.	25.1	15.7	34.9	45.4	55.6	47.1	48.4	52.7	43.7	49.9	23.8	20.6	37.7



Table 3. Species tallied at Wat Phai Lom mainly during the summer or rainy season.

Species	MONTHS												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
<i>Number Observations</i>	8	8	9	9	8	9	9	8	9	9	10	14	110
<i>Anhinga melanogaster</i>	2				19	33	8			3	1		66
<i>Elanus caeruleus</i>							1	1		1			3
<i>Microhierax caeruleus</i>							2						2
<i>Streptopelia tranquebarica</i>							2	3					5
<i>Dinopium javanense</i>				2		3	1						6
<i>Aegithina tiphia</i>					2								2
<i>Dicrurus adsimilis</i>					16	40	12	7	6	22	6	2	111
<i>Dicrurus aeneus</i>					2	1							3
<i>Terpsiphone paradisi</i>					1								1
<i>Sturnus contra</i>		2	1	6	1	3	2	1	2	5			23
<i>Sturnus javanicus</i>			10	18	61	71	11	1	5		2		179
<i>Arachnothera longirostris</i>						1							1
<i>Passer flaveolus</i>	4	4	10	14	57	40	2						131
<i>Ploceus philippinus</i>					1								1
<i>Lonchura striata</i>	1				1								2
Total Species	3	2	3	4	10	8	9	5	3	4	3	1	15
Total Birds	7	6	21	40	161	192	41	13	13	31	9	2	531
Ave. birds per species	2.3	3.0	7.0	10.0	16.1	24.0	4.5	2.6	4.3	8.0	3.0	2.0	7.2
Ave. birds per Obs.	.9	.8	2.3	4.4	20.1	21.3	4.5	1.6	1.4	3.4	.9	.2	4.8



Table 4. Avian species present at Wat Phai Lom during non-summer (Winter Visitors) or the dry season.

Species	MONTHS												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
Number Observations	8	8	9	9	8	9	9	8	9	9	10	14	110
<i>Pelecanus philippensis</i>	4	1									6	16	27
<i>Phalacrocorax pygmeus</i>										21			21
<i>Ardeola ralloides</i>	1	2	2	1					2	40	7	1	56
<i>Bubulcus ibis</i>								1			1		2
<i>Egretta garzetta</i>							1		1		6	1400	1408
<i>Egretta alba</i>												10	10
<i>Butorides striatus</i>										1			1
<i>Dupetor flavicollis</i>				1							1		2
<i>Nycticorax nycticorax</i>												1	1
<i>Ibis leucocephala</i>												2	2
<i>Milvus migrans</i>							2			19	35	3	59
<i>Butastur liventer</i>											1		1
<i>Amaurornis phoenicurus</i>										1	1	3	5
<i>Larus brunneicephalus</i>											3	18	21
<i>Clamator coromandus</i>	2	1											3
<i>Cacomantis merulinus</i>									1				1
<i>Centropus toulou</i>							1		2	2	2		7
<i>Tyto alba</i>	1									7			8
<i>Chaetura gigantea</i>										1			1
<i>Apus pacificus</i>										3			3
<i>Alcedo atthis</i>											1		1
<i>Halcyon pileata</i>	4	3	18	15	1					19	24	7	91
<i>Merops philippensis</i>		2		4						6	2	2	16
<i>Merops leschenaulti</i>										4			4
<i>Hirundo rustica</i>				5			2	1			8	8	24
<i>Pericrocotus divaricatus</i>				1									1
<i>Dicrurus leucophaeus</i>		1	1							5	1		8
<i>Dicrurus annectens</i>				1									1
<i>Dicrurus hottentottus</i>		2									1		3
<i>Oriolus chinensis</i>			2										2
<i>Trichastoma abbotti</i>	2											2	4
<i>Macronous gularis</i>	1	3	5	3	4	7						1	24
<i>Erithacus cyane</i>			1							3		1	5
<i>Copsychus malabaricus</i>											1		1
<i>Monticola solitarius</i>										3			3
<i>Zoothera citrina</i>												1	1
<i>Seicercus burkii</i>										1			1
<i>Phylloscopus fuscatus</i>	3	1	3	12	1							2	22
<i>Phylloscopus schwarzi</i>	1		3	1							1		6
<i>Phylloscopus inornatus</i>	2	1										3	6
<i>Phylloscopus borealis/rochiloides</i>	8	7	4		5				2	9	7	8	50
<i>Phylloscopus tenellipes</i>	5	2	3	1						1	3	16	31
<i>Phylloscopus coronatus</i>									1	5			6
<i>Acrocephalus stentoreus</i>				1									1
<i>Muscicapa latirostris</i>		1	3	1									5
<i>Muscicapa rubeculoides/banyumas</i>	3	2	2							1	1	5	14
<i>Muscicapa parva</i>	7	9	9	3						2	7	11	48
<i>Muscicapa hainana</i>										1			1
<i>Muscicapa zanthopygia</i>									4				4
<i>Culicicapa ceylonensis</i>												2	2
<i>Hypothymis azurea</i>	3	1									1	7	12
<i>Dendronanthus indicus</i>	6	2	1	2					1	5	1	7	25
<i>Artamus fuscus</i>									14	12			26
<i>Lanius cristatus</i>									3		2		5
<i>Lonchura punctulata</i>		4	2	1		1						7	15
Number species	15	19	16	16	4	2	4	2	10	24	25	27	156
Total Birds	51	46	60	53	11	8	6	2	31	172	124	144	708
Average Birds Per Obser.	6.4	5.7	6.7	5.9	1.4	.9	.6	.3	3.4	19.1	12.4	10.3	



Table 5. Birds banded at Wat Phai Lom, Phatumthani, Thailand.

	1968					1969					1970												Grand					
	D	J	F	M	A	M	J	J	A	S	O	N	D	Total	J	F	M	A	M	J	J	A	S	O	N	D	Total	Total
<i>Ardeola ralloides</i>											3			3										7			7	10
<i>Butorides striatus</i>											1			1														1
<i>Dupetor flavicollis</i>												1		1														1
<i>Anastomus oscitans</i>				522	99	30	1							652		169	140	466	2	3							780	1432
<i>Accipiter badius</i>	2													2														2
<i>Accipiter virgatus</i>	1				1		1							3											1	1	4	
<i>Cacomantis merulinus</i>										1				1									1			1	2	
<i>Centropus sinensis</i>									2					2														2
<i>Clamator coromandus</i>			1	1										2			1										1	3
<i>Eudynamys scolopacea</i>															1												1	1
<i>Phaenicophaeus tristis</i>			2				1							3									1				1	4
<i>Surniculus lugubris</i>				1										1														1
<i>Tyto alba</i>												2		2														2
<i>Athene brama</i>							1				1			2				1			1						2	4
<i>Otus bakkamoena</i>	3	2		1	4	2	1	3		1		2		19	1			1	5	2	1		1		2	13	32	
<i>Halcyon pileata</i>			1	5	3									9		1	6	2						1	3	1	14	23
<i>Halcyon smyrnensis</i>				1		1	5	6	3	1			1	18			1				6	3	2				12	30
<i>Pelargopsis capensis</i>			1	1		2	1			1	3			9		1		1	1			1	4	1	4		13	22
<i>Picus vittatus</i>		1										1		2					1								1	3
<i>Pericrocotus divaricatus</i>					1									1														1
<i>Dicrurus adsimilis</i>						1	11						1	13					9	7	1	2	1		1	21	34	
<i>Dicrurus aeneus</i>						2	1							3														3
<i>Dicrurus annectens</i>																		1										1
<i>Dicrurus hottentottus</i>																2									1		3	3
<i>Dicrurus leucophaeus</i>																1											1	1
<i>Dicrurus paradiseus</i>			1	3	2	1		2		1				10					1		4						5	15
<i>Macronus gularis</i>		1	1	1	1	1	2							7					1	2					1	4	11	
<i>Trichastoma abbotti</i>	2													2														2
<i>Pycnonotus blanfordi</i>	4	6	4	15	13	26	29	16	19	15	6	3	8	164	3	1	7	5	30	16	10	12	11	2		1	98	262
<i>Copsychus malabaricus</i>												1		1														1
<i>Copsychus saularis</i>	16	5	5	5	6	8	3	1	4	1	6	3	5	68	5	7	5	13	9	15	2	4	2	1		5	68	136
<i>Erithacus cyane</i>	2													2										2			2	4
<i>Zoothera citrina</i>																									1	1	1	1
<i>Phragmaticola aedon</i>				1										1														1
<i>Phylloscopus armandi</i>																		1									1	1
<i>Phylloscopus borealis </i> <i>trochiloides</i>	6	6	3	2		2					2	3		24		1			2				1	2			6	30
<i>Phylloscopus coronatus</i>										3	5			8									1				1	9
<i>Phylloscopus fuscatus</i>	1	1		4	7	1							1	15	1		1	1									3	18



Table 5. (cond.)

	1968					1969										1970										Grand		
	D	J	F	M	A	M	J	J	A	S	O	N	D	Total	J	F	M	A	M	J	J	A	S	O	N	D	Total	Total
<i>Phylloscopus inornatus</i>	1	2											1	4		1										1	2	6
<i>Phylloscopus schwarzi</i>												1		1	1		1										2	3
<i>Phylloscopus tenellipes</i>												2	3	5	4	1	2	1							1	7	16	21
<i>Seicercus burkii</i>																							1				1	1
<i>Orthotomus atrogularis</i>	2	4	2	4	5	11	2	4	7	1		1	1	44		2	2	2	4	2		4	2				18	62
<i>Orthotomus sutorius</i>	1	1		1	7	7	6	9	5	9	8	6	7	67	5	9	2	5	8	6	13	10	9	2		5	74	141
<i>Culicicapa ceylonensis</i>													2	2														2
<i>Hypothymis azurea</i>		3										1	6	10	1												1	11
<i>Muscicapa banyumas/</i> <i>rubeculoides</i>	2	2		1							1	1		7	1											1	2	9
<i>Muscicapa hainana</i>											1			1														1
<i>Muscicapa latirostris</i>				1										1		1											1	2
<i>Muscicapa narcissina</i>										1				1														1
<i>Muscicapa parva</i>	1	4	5	4	1						1	1	3	20	3	2	1							1	1	3	11	31
<i>Muscicapa zanthopygia</i>																						4					4	4
<i>Rhipidura javanica</i>	6	3		3	11	10	14	10	8	2	3	5	2	77	4	5	5	10	15	21	16	13	9	2			100	177
<i>Terpsiphone paradisi</i>																		1									1	1
<i>Dendronanthus indicus</i>	3	5	2		1						2		2	15	1			1					1	1		1	5	20
<i>Lanius cristatus</i>																							1				1	1
<i>Sturnus contra</i>					4	1	3							8							2						2	10
<i>Sturnus javanicus</i>				1		6	14							21					3	1							4	25
<i>Sturnus nigricollis</i>			1	3	9	13	3		2		1		1	33			1		3	8	4		5	1	1	1	23	56
<i>Sturnus tristis</i>					1	1								2				1				1					2	4
<i>Anthreptes malacensis</i>				2	3	1								6		1	1		2								4	10
<i>Arachnothera longirostris</i>								1						1														1
<i>Nectarinia jugularis</i>			1	1		1		1						4	2	1			2			1	1				7	11
<i>Dicaeum cruentatum</i>				1				1	2				1	5		2			2		1	1				1	7	12
<i>Lonchura punctulata</i>													3	3		1		1		1							3	6
<i>Lonchura striata</i>	4		3	2										9	1				1								2	11
<i>Passer flaveolus</i>			1	5	2	21	24							53		2		3	14	7							26	79
<i>Passer montanus</i>	1		2	3		1								7	1								1				2	9
<i>Ploceus philippinus</i>						1								1														1
Total Species	18	15	17	28	20	24	20	10	9	12	16	15	17	59	16	20	15	19	21	13	12	11	19	13	6	15	52	70
Total Birds	58	46	36	595	181	151	124	53	52	37	46	32	48	1459	35	211	176	517	116	91	61	52	58	24	11	32	1384	2843
Total birds other than storks	58	46	36	73	82	121	123	53	52	37	46	32	48	827	35	42	36	51	114	88	61	52	58	24	11	32	604	1411



Table 6. Summary of the monthly catches of birds and bats at Wat Phai Lom.

Month	Number Trapping Days	Ave. No. Species Taken	Total New Birds	Total Recaptures	Total Catch	Percent Repeats	Total Fruit Bats
<i>January</i>	8	7.5	76	29	105	27.6	47
<i>February</i>	7	9.5	80	27	107	25.2	27
<i>March</i>	9	11.1	87	70	157	44.5	4
<i>April</i>	7	11.0	117	51	168	30.3	4
<i>May</i>	8	11.5	238	65	303	21.4	7
<i>June</i>	9	9.1	217	79	296	26.6	0
<i>July</i>	9	7.6	110	58	168	34.5	39
<i>August</i>	8	7.5	101	58	159	36.4	28
<i>September</i>	9	7.7	102	44	144	30.5	51
<i>October</i>	8	7.4	75	20	95	21.0	68
<i>November</i>	7	5.6	45	16	61	26.2	25
<i>December</i>	13	7.5	82	30	112	26.7	50
<i>Total</i>	102	70	1330	547	1877		350
<i>Average</i>	8.5	8.5	114	46	156	29.2	29.1



Table 7. The distribution of birds captured by Area and month at Wat Phai Lom.

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Area A Nets; 1, 2, 3, 4, 5, 21, 22, 23 Among Bamboo Thickets	29	14	50	53	66	68	39	31	24	4	20	39	347
Area B Nets; 6, 7, 8 Open Bamboo	23	33	24	44	73	81	32	33	19	3	11	47	423
Area C Nets; 9, 10, 11, 12 Dense Bamboo Thickets	17	22	29	20	34	32	31	34	26	2	7	25	279
Area D Nets; 13, 14, 15, 28, 29 Beneath large trees	10	8	19	14	14	13	17	38	20	0	4	12	169
Area E Nets; 16, 17, 18, 19, 24, 25 Dense broad leaved Thickets, outside colony	11	9	24	38	46	49	19	10	9	3	5	17	240
Area F Nets; 20, 26, 27 Open Bamboo, outside colony	13	6	18	16	54	38	22	13	13	3	2	12	210
Area G Nets; 5 not numbered Random Sampling in Open	1	2	4	1	2	4	7	4	22	31	14	7	99
Total Percent by Month	104 5.6	94 5.0	168 9.0	186 10.0	289 15.5	285 15.3	167 8.9	163 8.7	133 7.1	46 2.4	63 3.3	159 8.5	1857 8.3



Table 8. The 13 most commonly netted birds and bats at Wat Phai Lom and the percentage of the total captured in each Area.

Item	AREA							Total
	A	B	C	D	E	F	G	
<i>Otus bakkamoena</i>	3%	1%	3%	8%	1%	1%	3%	2.6%
<i>Halcyon pileata</i>	4	1	2	4	0	1	10	2.4
<i>Halcyon smyrnensis</i>	3	2	2	3	3	1	3	2.4
<i>Dicrurus paradiseus</i>	1	1	2	1	5	1	1	1.8
<i>Pycnonotus blanfordi</i>	14	20	13	27	19	26	15	18.7
<i>Copsychus saularis</i>	16	9	17	15	14	14	5	13.4
<i>Orthotomus atrogularis</i>	6	5	6	2	5	1	0	4.5
<i>Orthotomus sutorius</i>	7	9	14	5	5	6	11	8.2
<i>Muscicapa parva</i>	2	2	2	1	1	2	4	2.1
<i>Rhipidura javanica</i>	13	13	19	8	20	17	3	14.2
<i>Sturnus nigricollis</i>	6	0	0	10	1	1	8	3.1
<i>Sturnus javanicus</i>	5	1	1	3	1	0	0	1.8
<i>Passer flaveolus</i>	1	15	1	0	6	3	0	4.8
13 Species Total	369	341	230	179	208	153	63	1543
13 Species Percent of Total	82	80	82	90	81	74	64	81
Number remaining Species	27	25	23	15	17	18	10	
<i>Cynopterus brachyotis</i>	97	37	67	45	5	4	70	325
Total Bats	103	37	67	48	5	4	72	336
Total Birds	447	425	281	199	257	206	98	1913
Total Birds and Bats	550	462	348	247	262	210	170	2249
Number Nets	8	3	4	5	6	3	5	34
Ave. Catch per net	69	154	87	50	44	70	34	66



Table 9. The distribution of avian ectoparasites throughout the year, from 17 species of hosts.

	MONTHS												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
No. with evident Parasitism	27	10	56	43	91	62	49	78	51	29	23	25	544
Ratio	30	11	61	47	100	68	54	86	56	32	25	27	
Hosts with Feather Mites	18	13	51	94	99	65	51	22	30	6	4	38	491
Ratio	18	13	51	94	100	65	51	22	30	6	4	38	
Hosts with Mallophaga	0	0	16	20	17	11	7	7	7	4	4	9	102
Ratio	0	0	18	100	85	55	35	35	35	20	20	45	
Number Birds Examined	45	23	118	142	191	129	101	101	81	37	30	64	1062
Percent Non-parasitized	60	43	47	30	48	48	48	77	63	78	77	39	







Table 11. Estimates of numbers of *Argas* ticks on selected tree trunks at Wat Phai Lom, based on two year averages.

MONTHS											
J	F	M	A	M	J	J	A	S	O	N	D
1	0	0	435	<i>Albizzia lebbekoides</i> 84	0	4	14	0	0	1	0
1	3	5	6	<i>Cassia siamea</i> 39	47	28	5	0	0	6	2
1	0	1	1	<i>Dipterocarpus alatus</i> 10	3	1	1	0	0	1	0
2	1	8	1059	<i>Feronia limonia</i> 4668	4643	2743	901	220	23	41	7
0	0	1	312	<i>Mangifera indica</i> 376	1380	290	85	3	0	3	1
0	1	2	22	7	1	0	1	2	1	8	3
2	1	15	490	365	127	7	14	6	0	4	2
2	9	91	4530	<i>Sterculia foetida</i> 4825	1990	587	39	24	3	5	1
10	14	125	7167	Two Year Average Total		4884	1459	388	37	88	18
.7	1.1	9.8	563.4	Ratio per 1000 ticks in May		383.9	114.7	30.5	29	6.9	1.4



Table 12. The incidence of Haemoproteus infections among birds at Wat Phai Lom

No. Birds	Percent Positive by Month												No. Pos.	Percent
	J	F	M	A	M	J	J	A	S	O	N	D		
145	11	0	30	46	15	20	7	15	30	0	50	0	34	25.3
109	0	0	12	0	0	4	9	22	21	0	0	25	11	10.0
72	14	16	69	50	43	44	44	62	43	50	—	38	38	52.7
53	—	100	100	84	70	86	100	—	—	—	—	—	43	81.1
53	—	—	50	33	0	0	25	66	40	0	0	0	10	18.8
32	0	0	0	0	0	0	0	0	28	0	0	0	2	6.2
29	0	0	0	14	0	0	0	25	0	0	0	0	1	3.4
21	—	0	27	33	—	—	—	—	—	0	0	0	4	19.0
21	—	—	100	—	0	0	—	—	—	—	—	—	1	4.7
20	—	0	0	0	0	0	0	0	20	0	0	0	1	5.0
18	16	0	0	50	—	—	—	—	—	0	—	0	2	11.1
18	80	0	50	0	—	—	—	—	—	50	0	43	10	55.5
9	0	100	—	—	0	—	100	—	0	—	—	—	3	33.3
9	—	—	—	—	—	—	—	—	0	20	—	—	1	11.1
8	0	100	0	—	—	—	—	—	—	0	0	0	1	12.5
3	—	—	—	—	—	0	—	—	—	—	—	50	1	33.3
2	—	—	—	100	—	100	—	—	—	—	—	—	2	100.0
2	—	—	—	—	—	0	—	—	—	100	—	—	1	50.0
1	—	—	—	—	100	—	—	—	—	—	—	—	1	100.0
19	4	4	8	8	4	5	6	5	6	4	1	4		26.7
30.6	19.0	17.3	28.5	34.7	17.3	25.0	40.0	38.4	35.2	18.1	5.5	16.0		
	30.2	79.0	54.7	51.2	57.0	51.0	47.5	38.0	30.3	55.0	50.0	39.0		
	3.4	16.6	23.0	20.4	18.3	9.7	12.1	27.1	26.0	7.1	7.1	9.0		



Table 13. Some Measurements and Weights of Birds Netted at Wat Phai Lom, Phathumtani, Thailand (in Millimeters).

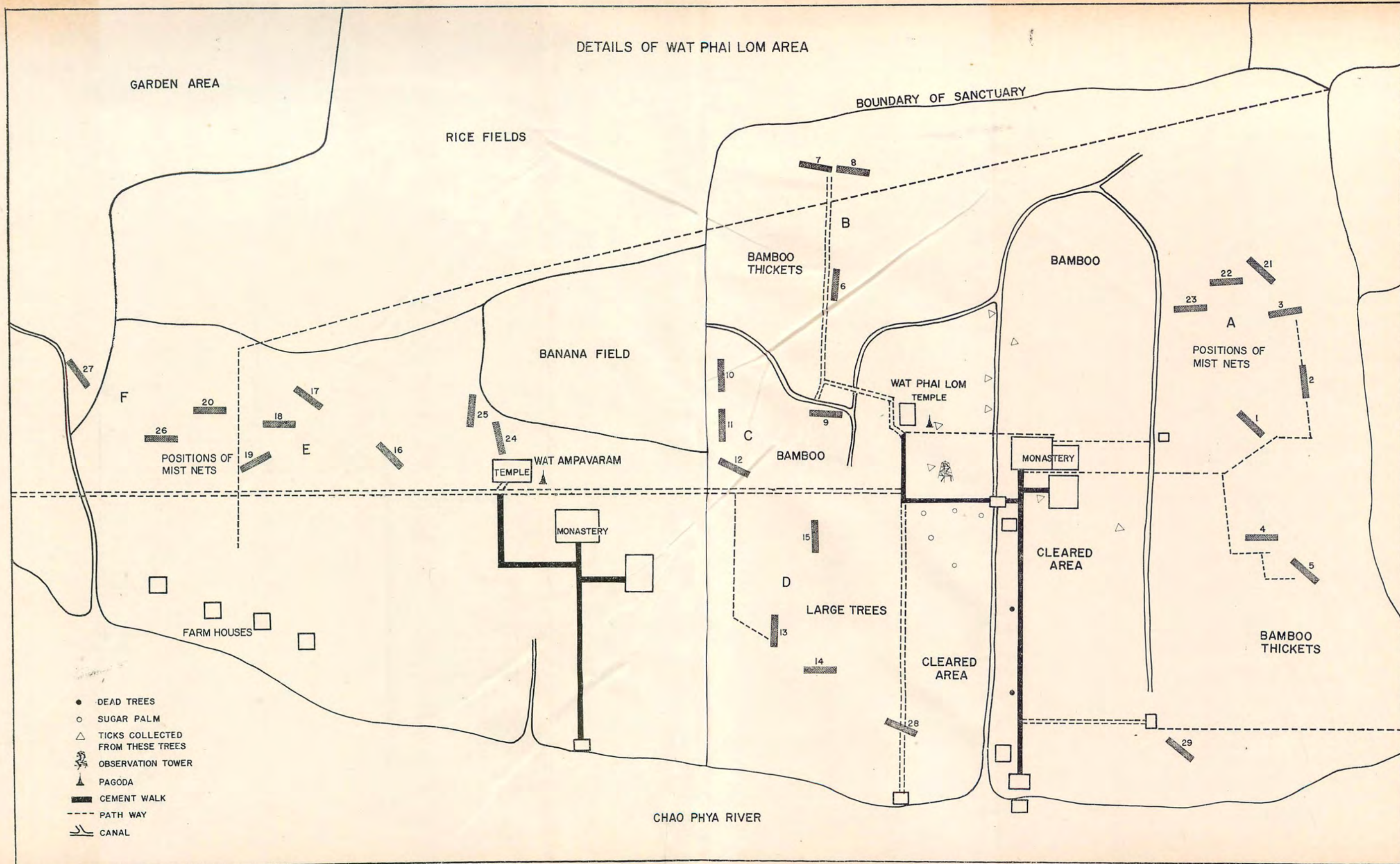
Species	Number	Length		Wing		Tail		Tarsal Diameter		Tarsal Length		Gape		Weight, grammes	
		Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Range	Number weighed
<i>Ardeola ralloides</i>	9	438	420-480	212	200-230	88	70-100	7.8	7-8	56	51-62	80	72-86	265	192-314
<i>Butorides striatus</i>	1	370		165		60		7.0		46		88		164	
<i>Dupetor flavicollis</i>	1	470		190		80		8.0		66		102		278	
<i>Accipiter virgatus</i>	3	325	310-340	210		173	160-180	11.7	11.5-12	48	48-50	24	23-24	209	198-220
<i>Cacomantis merulinus</i>	2	212	210-215	112	110-115	117	115-120	2.3	2.2-2.5	17.5	17-18	22.5	22-23	28.2	26.5-30.0
<i>Clamator coromandus</i>	2	368	345-390	150	145-155	235	210-260	4.0	3.5-4.5	23		32	29-35	81	77-85
<i>Microhierax coeruleus</i>	1	160		110		75		4.0		20		11		46.5	
<i>Eudynamys scolopacea</i>	1	360		195		210		8.0		28		41		309	
<i>Phoenicophaeus tristis</i>	1	570		150		380		5.0		37		38		114	
<i>Surniculus lugubris</i>	1	225		130		125		3.0		14		27		37	
<i>Tyto alba</i>	2	327	325-330	307	305-310	145		9.0		67	65-68	41.5	41-42	466	460-472
<i>Athene brama</i>	4	182	175-190	142	135-150	71	70-75	5.0	4.5-5.5	24	23-25	20	18-21	103.5	90-114
<i>Otus bakkamoena</i>	22	205	160-220	155	130-165	88	75-95	5.6	5-7	30	27-33	22	19-25	127	110-156
<i>Halcyon pileata</i>	18	268	240-280	125	120-130	86	75-100	4.5	4-5	13	11-14	73	70-58	88	82-108
<i>Halcyon smyrnensis</i>	17	248	230-265	111	150-120	82	75-90	4.1	3.5-4.5	13	12-17	64	58-71	66.9	52-93
<i>Pelargopsis capensis</i>	18	344	320-370	146	140-155	107	100-120	5.8	5-7	14	11-16	94	90-105	181.1	152-209.5
<i>Picus vittatus</i>	2	290	280-300	132	130-135	120	120	4.2	4-4.5	24	23-26	37	36-38	128	124-132
<i>Pitta moluccensis</i>	1	180		120		40		4.0		36		32		76	
<i>Pericrocotus divaricatus</i>	1	190		95		95		2.0		13		21		19.5	
<i>Dicrurus adsimilis</i>															
<i>To fork in tail</i>	18	214	210-220			109	100-115								
<i>Including whole tail</i>	33	261	235-290			144	130-180	3.1	3-4	18	17-22	25	23-27	40.2	35-46
<i>Dicrurus aeneus</i>	2	230	210-250	125	120-135	125	110-140	3.2	3-3.5	17.5	17-18	25.5	25-26	40.3	36-46
<i>Dicrurus annectans</i>	1	240		135		135		3.0		20		26		43	
<i>Dicrurus hottentottus</i>	3	278	260-290	157	150-160	140	130-145	3.6	3.5-3.7	23	22-24	38	36-40	77	75-78
<i>Dicrurus leucophaeus</i>	1	255		135		150		3.0		17		28		47.5	
<i>Dicrurus paradiseus</i>															
<i>With racquet</i>	13	402	320-510			270	195-380								
<i>Without racquet</i>		278	260-290	145	135-155	154	140-185	3.6	3.5-4.0	23	22-26	34	30-36	67	57-86
<i>Macronus gularis</i>	5	116	110-120	56	55-60	53	50-55	2.2	2.0-2.3	16	15-18	16	15-17	12.1	11-13
<i>Trichastoma abbotti</i>	1	145		70		50		2.0		25		21		25	
<i>Pycnonotus blanfordi</i>	86	177	160-201	80	75-90	85	77-95	3.1	2.5-4.8	19.7	17-27	20	17-24	32.7	24-40
<i>Copsychus saularis</i>	42	185	150-210	90	80-100	88	70-100	2.9	2.5-3.5	25	20-28	23	21-27	35.8	30-44
<i>Erithacus cyane</i>	1	125		70		50		1.8		22		17		16	
<i>Zoothera citrina</i>	1	200		110		75		3.0		29		28		56	
<i>Acrocephalus stentoreus</i>	1	170		80		75		2.3		28		23		27	
<i>Phragmaticola aedon</i>	1	185		75		90		2.5		25		22		23	
<i>Phylloscopus armandi</i>	1	120		57		57		1.8		22		13		9	
<i>Phylloscopus borealis/</i> <i>trochiloides</i>	21	113	110-125	64	58-75	51	45-60	1.5	1.4-1.8	17	16-19	15	13-18	9	8-11
<i>Phylloscopus coronatus</i>	3	125	105-150	66	60-75	53	50-60	1.5	1.5	16	15-17	14.7	14-15	9.5	9-10.5
<i>Phylloscopus fuscatus</i>	7	111	105-120	58	55-62	51	45-55	1.5	1.5-1.6	20	18-23	14	12-15	9.1	8-10
<i>Phylloscopus inornatus</i>	3	95	90-100	57	55-60	41	37-45	1.2	1.2-1.5	16	15-17	12	11-13	5.8	5-7
<i>Phylloscopus schwarzi</i>	2	115	110-120	59	55-63	53	50-60	1.7	1.5-2.0	19.5	19-20	14.5	14-15	10	7.5-12
<i>Phylloscopus tenellipes</i>	16	110	105-112	62	57-70	50	47-53	1.5	1.3-1.7	17	15-18	14	13-16	8.4	7.5-11.0
<i>Seicercus burkii</i>	1	95		50		45		1.3		17		12		6.0	



Table 13 (cond.)

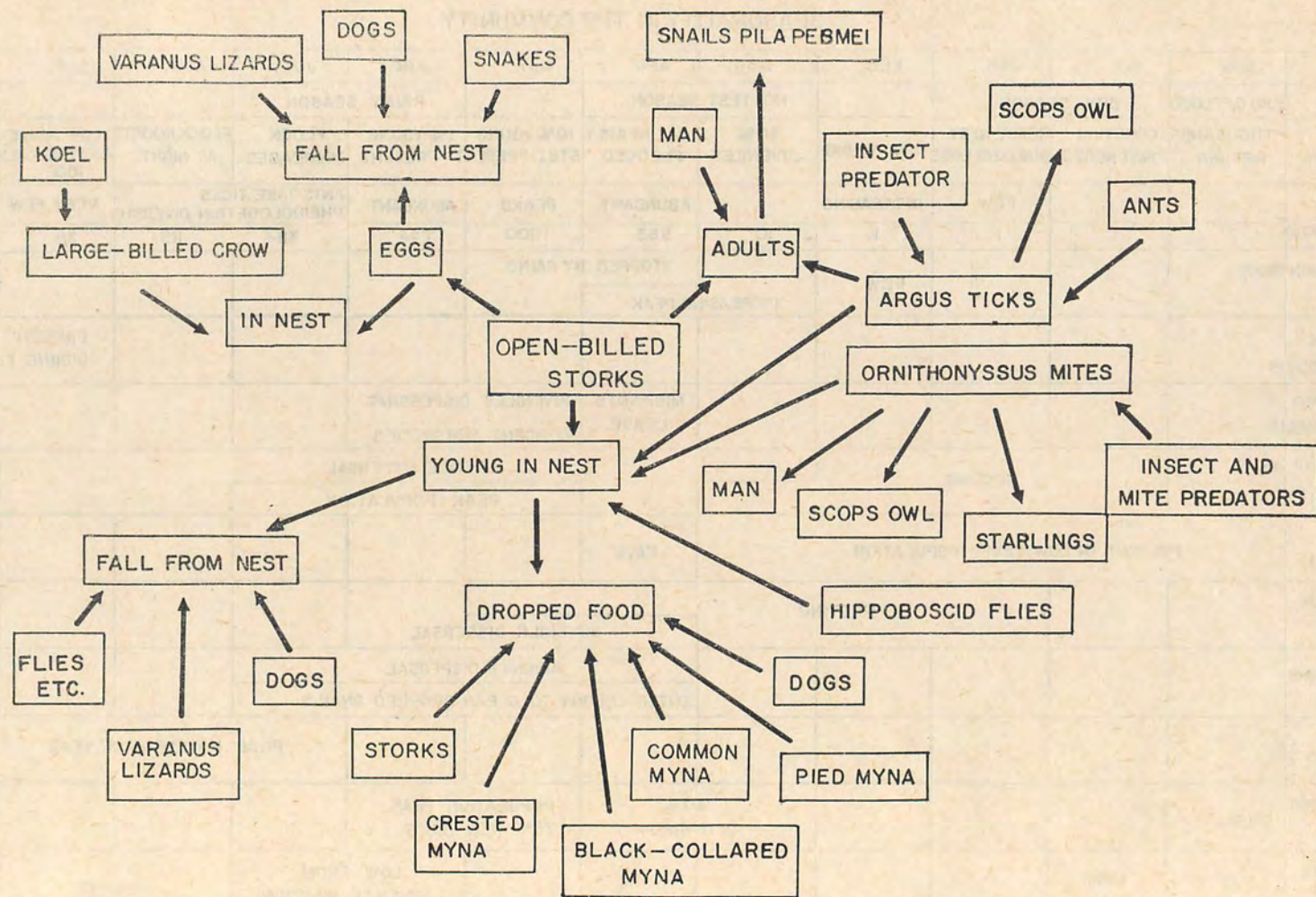
Species	Number	Length		Wing		Tail		Tarsal Diameter		Tarsal Length		Gape		Weight, grammes		
		Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range	Number weighed
<i>Orthotomus atrogularis</i>	24	95	80-118	43	40-45	39	35-45	1.5	1.2-1.8	17	14-22	17	14-18	7.0	5-8.5	37
<i>Orthotomus sutorius</i>	52	97	85-120	41	35-55	42	30-60	1.6	1.3-2.0	17	15-20	16	14-18	6.8	5-8.5	70
<i>Culicicapa ceylonensis</i>	1	110		57		50		1.3		11		13		7.0		1
<i>Hypothymis azurea</i>	7	146	140-154	70	65-70	76	65-80	1.6	1.5-1.8	14	12-16	16	10-19	11.1	10.5-11.5	8
<i>Muscicapa rubeculoides</i>	4	132	125-140	72	67-80	60	55-65	1.8	1.7-2.0	15	14-16	17	15-19	14.6	12.5-18.5	6
<i>Muscicapa hainana</i>	1	130		65		65		1.7		15		18		14.5		1
<i>Muscicapa latirostris</i>	1	115		70		60		1.6	1.5-1.8	12.5	12-13	14.5	14-15	9		1
<i>Muscicapa narcissina</i>	4	118	115-124	67	65-70	52	47-60	1.6	1.5-1.8	17	15-18	16	15-17	12.4	11-13.5	4
<i>Muscicapa parva</i>	13	118	110-125	70	65-78	55	50-60	1.5	1.4-1.8	16	14-17	14	13-16	10.0	8.5-11	14
<i>Rhipidura javanica</i>	80	165	150-180	71	63-82	91	80-100	1.9	1.6-2.3	18	17-23	17.5	15-20	12.3	9-16	110
<i>Terpsiphone paradisi</i>	1	170		85		90		2.0		13		21		16.0		1
<i>Dendronanthus indicus</i>	11	147	140-155	78	75-82	71	65-75	1.8	1.5-2.0	20	18-25	18	17-19	16.6	10-18	17
<i>Lanius cristatus</i>	1			87						25		24				
<i>Sturnus contra</i>	8	202	180-215	117	110-128	70	60-75	4.2	4.0-4.5	29	27-32	36	35-38	78	66-92	8
<i>Sturnus javanicus</i>	15	210	195-230	126	115-130	78	70-90	4.7	4.0-5.0	34	30-38	31	28-37	98.8	80-126	24
<i>Sturnus nigricollis</i>	48	244	215-285	144	125-160	90	75-110	5.0	4.5-6.0	37	33-46	37	33-40	{ 126 Juv	105-147	29
<i>Sturnus tristis</i>	4	199	165-220	120	110-130	70	55-80	4.5	4.3-5	34	32-35	30	29-30	{ 132 Ad	102-160	21
<i>Anthreptes malaccensis</i>	9	112	105-120	64	60-67	45	35-55	1.9	1.7-2.0	14	13-15	19	18-21	90	78.5-106	4
<i>Arachnothera longirostris</i>														10	7.5-13.0	9
<i>Nectarinia jugularis</i>	9	95	90-100	50	48-50	35	34-40	1.5	1.4-1.8	12.5	12-14	18	17-20	13		1
<i>Dicaeum cruentatum</i>	9	78	75-80	46	40-54	26	16-30	1.5	1.2-2.0	10.5	9-11	12	11-12	6.6	6-7.5	9
<i>Lonchura punctulata</i>	2	107	105-110	50		42.5	40-45	2.1	2.0-2.3	13		10		5.8	5-6.5	11
<i>Lonchura striata</i>	2	102	100-105	47	45-50	45		1.7	1.7-1.8	11.5	11-12	9.5	9-10	12.7	12.5-13	2
<i>Passer flaveolus</i>	29	128	125-135	69	60-70	56	50-60	2.2	2.0-2.5	16	14-18	13	11-18	11.0		2
<i>Ploceus manyar</i>	1	130		65		48		2.2		19		16		19.3	16-21	59
<i>Ploceus philippinus</i>	6	134	130-140	68	65-70	50	45-53	2.5	2.3-2.8	19	17-21	17	16-18	19		1
														23.2	21.5-25	6





Map 1. Wat Phai Lom Open-billed Stork Sanctuary, Phathumtani, Thailand





FOOD CHAINS INVOLVING OPEN-BILLED STORKS

Fig. 1.



# SEASONALITY IN THE COMMUNITY

MONTH	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.
WEATHER	END OF FLOOD	DRY SEASON			HOTTEST SEASON			RAINY SEASON			FLOODS	
STORK COLONY	THOUSANDS RETURN	COURTING FIRST NESTS	HEAVY NEST BUILDING, EGGS	NEW YOUNG	30% JUVENILES	ALL NEARLY FLEDGED	10% YOUNG STILL PRESENT	1% YOUNG PRESENT	FLOCK DECREASES	FLOCK ROOSTS AT NIGHT	LOW POINT OF YEAR ONLY 100	FEW BIRDS RETURNING
TICK, ARGAS			FEW	INCREASING		ABUNDANT	PEAKS	ABUNDANT	ANTS TAKE TICKS PHEIDOLETOGETION DIVERSUS		VERY FEW	
ROBERTSI, RATIO	7	1	1	1	10	563	1000	733	384	115	30	3
MITES, ORNITHONYSSUS BURSA				FEW	STOPPED BY RAINS							
					INCREASING PEAK							
POND HERON ARDEOLA BACCHUS											PRESENT ONLY DURING FLOODS	
BLACK DRONGO DICRURUS ADSIMILIS						MIGRANTS LEAVE	JUVENILES DISPERSING					MIGRANTS ARRIVE
							RESIDENT SUBSPECIES					
BLANFORD'S BULBUL PYCNONOTUS BLANFORDI		NESTING			JUVENILE DISPERSAL							
						PEAK POPULATION						
MIGRANTS FROM NORTH	PRESENT IN LOW LEVEL POPULATION					LEAVE						ARRIVE
MAGPIE ROBIN COPSYPCHUS SAULARIS			NESTING			JUVENILE DISPERSAL						
						JUVENILE DISPERSAL						
MYNAS, STURNUS SPP.						ENTER COLONY TO GLEAN DROPPED SNAILS						
FRUIT-BATS CYNOPTERUS SP.									PEAK MOVEMENT OF YEAR			
OTHER PASSERINE SPECIES	LOW				40% OLD BIRDS		POPULATION PEAK 75% NEW BIRDS					LOW
HAEMATOOZA INFECTION	LOW	LOW						LOW FROM JUVENILE DILUTION		HIGHEST		LOW
ECTOPARASITES	LOW			LOW		PEAK INFECTIONS						LOW

Fig. 2. Seasonality in the Community.



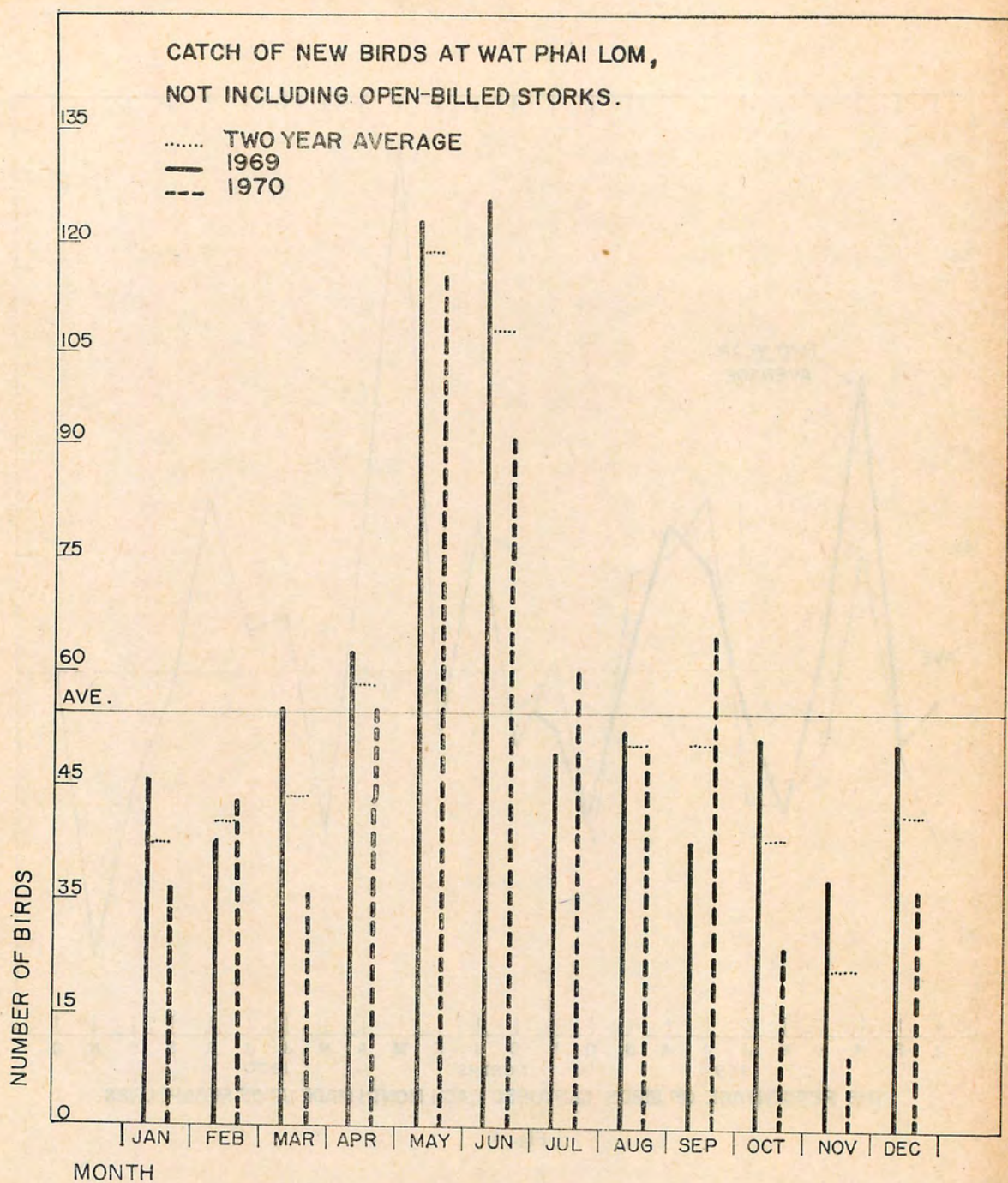
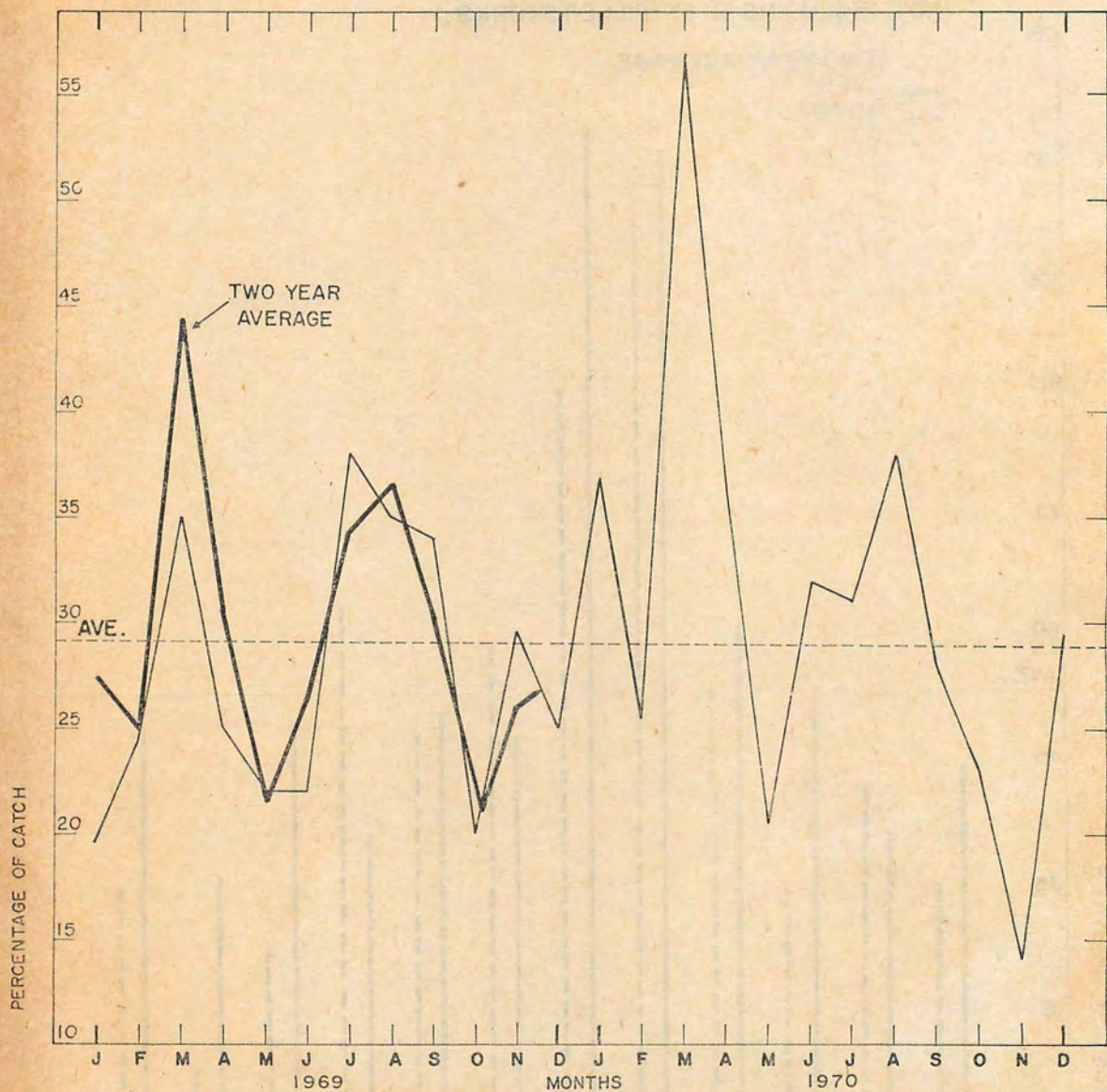


Fig. 3. Catch of New Birds at Wat Phai Lom, not Including Open-billed Storks.





THE PERCENTAGE OF BIRDS CAPTURED EACH MONTH MADE UP OF RECAPTURES.

Fig. 4.





Fig. 5. *Argas robertsi* and other arthropods on the bark of a tree at Wat Phai Lom.



Fig. 6. *Argas robertsi* on a juvenile Open-billed Stork.



