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THE STUDY ON FORAGE UTILIZATION OF SELADANG IN ULU LEPAR, PAHANG

EBIL BIN YUSOF

ABSTRACT

A forage utilization study of seladang (*Bos gaurus hubbacki*) was carried out Block B, Pahang Oil Palm Estate, in Ulu Lepar, Maran, Pahang. Forty five sample plots of 0.004 ha circular size along transects (compass lines) at 20 m paced intervals were determined by referring of a random number table. From the study, it was found that, there was highly significant statistical evidence that the rate of browsing of seladang under 5 categories of vegetation, namely Rumput Chengkenit (D1) (*Paspalum conjugatum*), Lalang (D2) (*Imperata cylindrica*), Selaput tunggul (D3) (*Centrocima pubscens*), shrubs (D4), and seedlings (D5) were not all equally different ($P< 0.0076$). The forage utilization of seladang in Block B, Ulu Lepar, Pahang also different among vegetation categories of which seedlings was highest in term of browsing rate (80%) compared to *Paspalum conjugatum* (48 %). In addition, the pairs of D5-D4, D5-D3, D4-D3 and D3-D1 variables were found not significantly different. But the pairs of D5-D1, D5-D2, D4-D1, D4-D2 and D3-D2 variables were found significantly different in term of browsing rate.

ABSTRAK

Satu kajian mengenai keupayaan ragutan oleh seladang (*Bos gaurus hubbackki*) telah dijalankan di Blok B, Estate Pahang Oil Palm, dekat Ulu Lepar, Maran, Pahang. Sebanyak 45 sampel plot yang mempunyai keluasan 0.004 ha berbentuk bulat di sepanjang garisan transect (garisan kompas) dengan jarak 20 m di antara satu sama lain, telah dipilih dengan menggunakan jadual nombor rambang. Daripada kajian yang dijalankan, di dapati bahawa kaedah yang digunakan telah menghasilkan satu kenyataan yang amat berguna dari segi statistik yang kadar ragutan seladang daripada 5 kategori tumbuhan-tumbuhan, iaitu Rumput Chengkenit (D1) (*Paspalum conjugatum*), Lalang (D2) (*Imperata cylindrica*), Selaput Tunggul (D3) (*Centrocima pubscens*), shrubs (D4) dan seedlings (D5) adalah tidak sama di antara satu sama lain ($P<0.0076$). Tambahan lagi, beberapa pasangan variable seperti D5-D4, D5-D3, D4-D3 dan D4-D2 tidak menampakkan perbezaan yang ketara. Tetapi, beberapa pasangan variable lain seperti D5-D1, D5-D2, D4-D1, D4-D2 dan D3-D2 adalah nyata ada menunjukkan perbezaan dari segi kadar ragutan.

INTRODUCTION

The usual feeding habit of a seladang normally starts at 5.00 am. It would walk through 100 meters of secondary forest to the nearest agriculture scheme. Shrubs, legumes, seedlings, grasses were found abundance throughout the agriculture schemes (Yusof 1982).

Allen *et. al.* (1986) stated that many researchers used the subject food habits, forage selection, preference and utilization interchangeably in their papers. Thus, they were bounded to state erroneous conclusion of their studies.

Conner and Dickson (1980) mentioned that forage utilization could be defined into two ways. First, forage utilization refers to *the amount* of vegetation (or food supply) removed by foraging animals from a defined area of land during a defined period or seasons of the year. Thus, it became attributes of the land, vegetation or food supply not of an animal. Second, forage utilization was expressed as *the percentage* (or rate of browsing) of plants or twigs that were grazed or browsed by animals. This second definition of forage utilization was considered attribute of an animal not of the land, vegetation of food supply. In this paper, the second definition described by Conner and Dickson (1980) will be used.

Yusof (1982) classified the level of food preference into two classes. The Class I and Class II which consisted of grass species and shrubs + trees species respectively. He recorded the frequencies of browsing on each plant species. Thus, these levels of food preference became attributes of a seladang. But, he never quantified both the **food supply, food habits** and **forage utilization** for determining a **forage preference** of seladang.

The primary objective of this study is only to investigate and quantified the forage utilization of seladang. This study would to some extent attempt to initiate future research on forage preference of seladang. In addition, some comparisons on all pairs of variables tested will be determined.

STUDY AREA

All data were collected from Block B, Pahang Oil Palm Estate, in Ulu Lepar, Pahang. The study area is located around grid reference 295285. Figure 1 shows the general location of the study area, its drainage system, adjacent boundaries and developments, and figure 2 shows the study area. The study area covers an approximately 3000 ha. It comprises three components of seladang habitat, namely Primary forest, Secondary forest and Agriculture scheme. The altitude of the study area ranges from approximately 50 m up to 300 m asl.

The climate of this site is moist throughout the year. The daily temperature ranges between minimum of 20 °C - 23 °C to maximum of 28 °C - 36 °C.

MATERIALS AND METHODS

1. Field Method

A series of 0.004 ha circular plot along transects (compass lines) at 20 m paced intervals. The locations of the circular plots along the transects were determined by

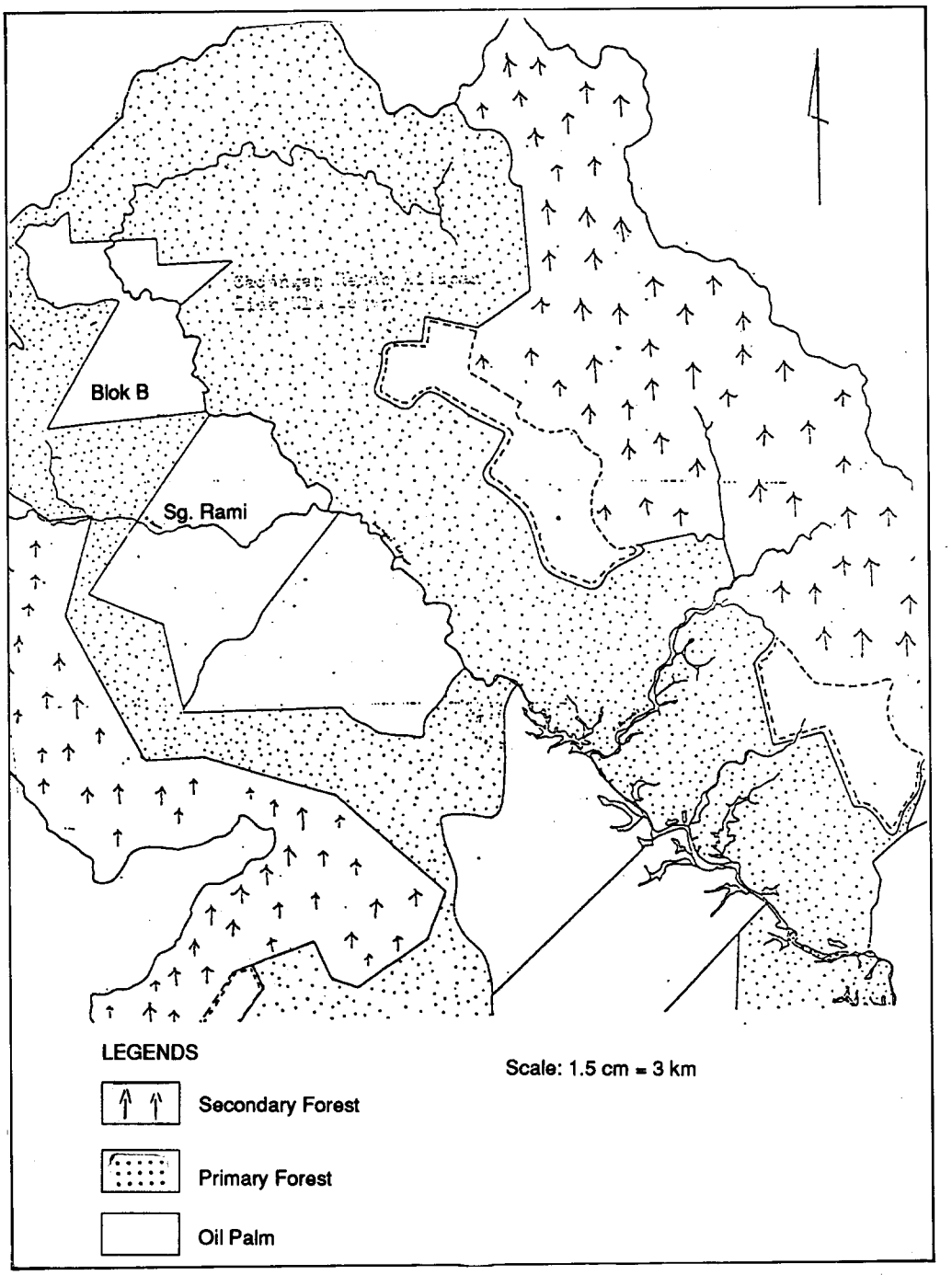


FIGURE 1: A general location of the study area.

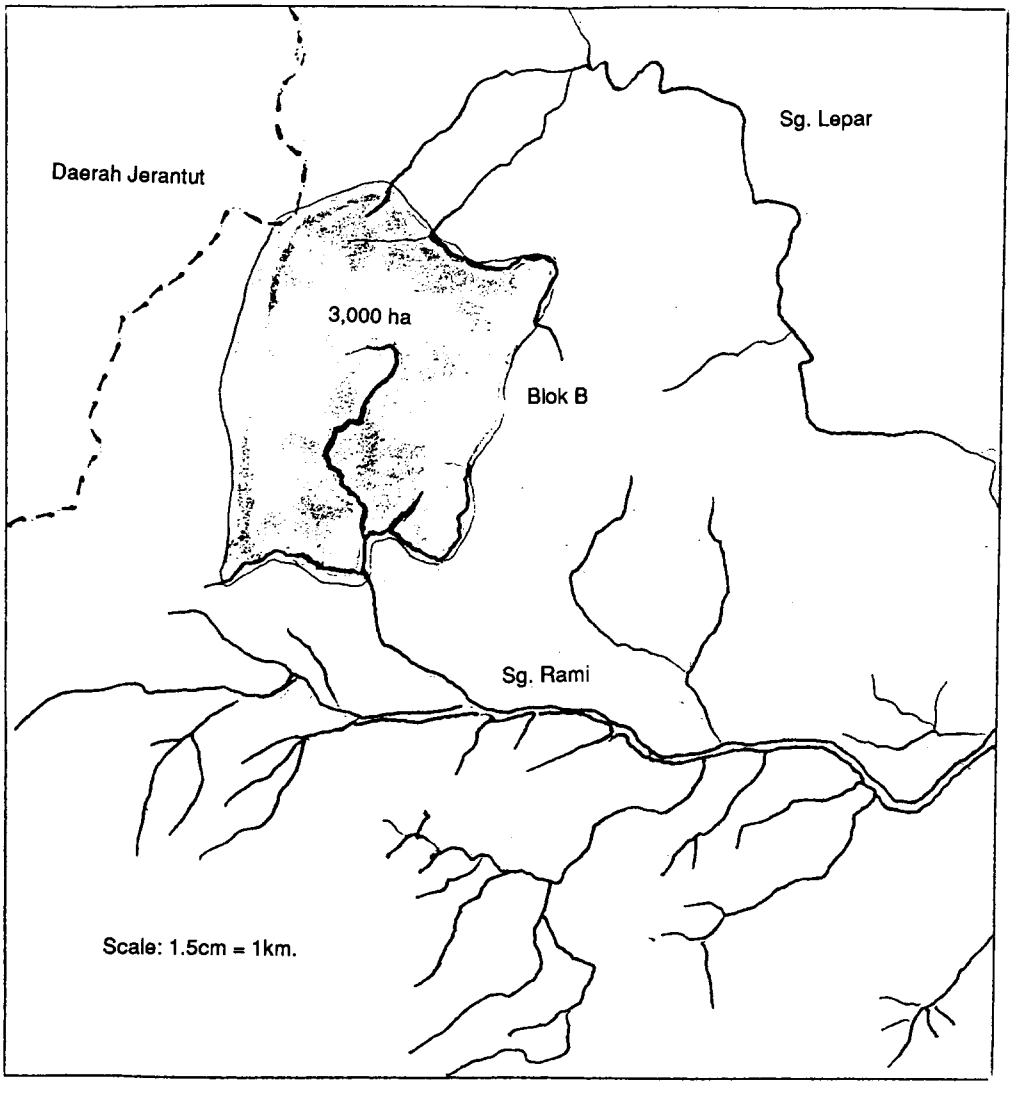


Figure 2: The study area

referring of a random number table. Each plot was measured 3.58 m radius. The sample plot represented only 0.006% of the total study area. On each plot, an ocular estimation of browsing which were covered by a vertical and horizontal projections of the aerial parts of Rumput Chengkenit (*Paspalum conjugatum*), Lalang (*Imperata cylindrica*), Selaput Tunggul (*Centrocima pubscens*), Shrub species and Seedling species were made.

An assumption was made during the utilization measurements that all species and seedling species had equal food preferences for seladang. This assumption had to be made because there were too many shrubs and seedling species that are highly preferable by seladang.

The maximum height of estimation of 1.36 m suggested by Aldous (1984) was only suitable for herbivores animal namely deer in the Northern America states. For the purpose of this study, I prefer to use 1.82 m for the maximum height of shrub and seedling species and 0.3 m for the maximum height of Rumput Chengkenit, Lalang and Selaput Tunggul. The frequencies of browsing were recorded in the PLOT ANALYSIS FORM and later were converted into the percentages of browsing. The collection of data were carried out everyday from the 1st February 1983 to 31st July 1983.

The variables involved were Rumput Chengkenit (D1), Lalang (D2), Selaput Tunggul (D3), Shrub (D4) dan Seedling (D5). Since, there were too many shrub species and seedling species grazed by seladang (Yusof, per observ.), all shrub species of 1.82 m and below and seedling species of 1 m and below were combined in Shrub and seedling categories respectively. All vegetation species under these groups were assumed to be identical in term of forage preference of seladang.

2. Statistical analysis

The statistical analysis of data was carried out using a SAS computer program with the approval of Virginia Tech, Computer Center, Virginia, U.S.A, on the 24th. April 1989.

One-Way ANOVA statistical analysis of vegetation for seladang in the study area was classified without considering the locations of all sample plots. The first step of this analysis excluded all vegetation species that were less than 1% of browsing rates. The second step, it responded only to the most highest browsing rate of each sample plot. Finally, only forty-five measurements (browsing rates) were selected automatically by the computer program.

The General Linear Regression analysis of data of vegetation was carried in order to determine whether the Null hypotheses is accepted or rejected.

The hypotheses (H) for this analysis is that the rate (%) of browsing or expected rate (%) of browsing of seladang is equal to all vegetation species which are denoted by D1, D2, D3, D4 and D5. While, an alternative hypotheses (H) always includes a

statement of inequality, which is nearly always possible if the test is 1-Sided (1-Way ANOVA).

If the above analysis concludes that the result is not all equally different, a multiple comparison procedure of Tukey's test will be employed to determine which slope(s) or ß are different from each other.

RESULTS

The graph in figure 3, showed that Seedling (D5) attained its maximum browsing rate up to 81% with a mean of 47.8%, Shrubs (D4) was up to 72% with a mean of 39.6%, *Centrocima pubescence* (D3) was up to 66% with a mean of 37.4%, *Imperata cylindrica* (D2) was up to 46% with a mean of 16.4% and *Paspalum conjugatum* (D1) was up 41% with a mean of 19.2%.

To determine whether the Null Hypotheses is accepted or rejected the General Linear Model (GLM) procedure was carried out. The result was very highly significant. Therefore it can be concluded, there was very highly significant evidence that the browsing rates for 5 categories of vegetation were not equally preferred by the seladang ($P<0.0076$).

The data was further refined for T-Test (LSD) on variable Percentile (% of browsing) to check for the Type 1 comparisonwise error rate with alpha= 0.05 and DF=40 (see Table 1).

Table 1: T-Test (LSD) for variable Perct with alpha= 0.05, DF=40, MSE= 412.694, critical value of T= 2.02108 and LSD=19.355

Grouping	Mean	N	Diet
A	47.778	9	D5
A A	39.556	9	D4
A B A	37.444	9	D3
B B C	19.222	9	D1
C	16.444	9	D2

(Means with the same letter are not significantly different)

The pairs of D5-D4, D5-D3, D4-D3 and D3-D1 were not significantly different to each other. While, the pairs of D5-D1, D5-D2, D4-D1, D4-D2 and D3-D2 were significantly different to each other.

De Vos (1969) and Zar (1984) suggested that LSD test should follow by HSD test to see the Type II error and multiple comparison of pairs. Using Tukey's Studentized Range (HSD) test for variable perct (% of browsing) with alpha=0.01 and DF=40 (See Table 2).

Table 2: Tukey's Studentized Range (HSD) Test Alpha=0.01, DF=40, MSE=412.694 Critical value of studentized range=4.931 and Minimum significance difference=33.39

Grouping	Mean	N	Diet
A	47.778	9	D5
A	39.556	9	D4
A	37.444	9	D3
A	19.222	9	D1
A	16.444	9	D2

(Means with the same letter are not significantly different)

The results showed that D1, D2, D3, D4 and D5 variables were not significantly different. Zar (1984) mentioned this test generally had a higher Type II error rate. If the comparisons were more that 6 pairs, T-Test (LSD) results would be more accurate for making our conclusion in the study.

DISCUSSIONS

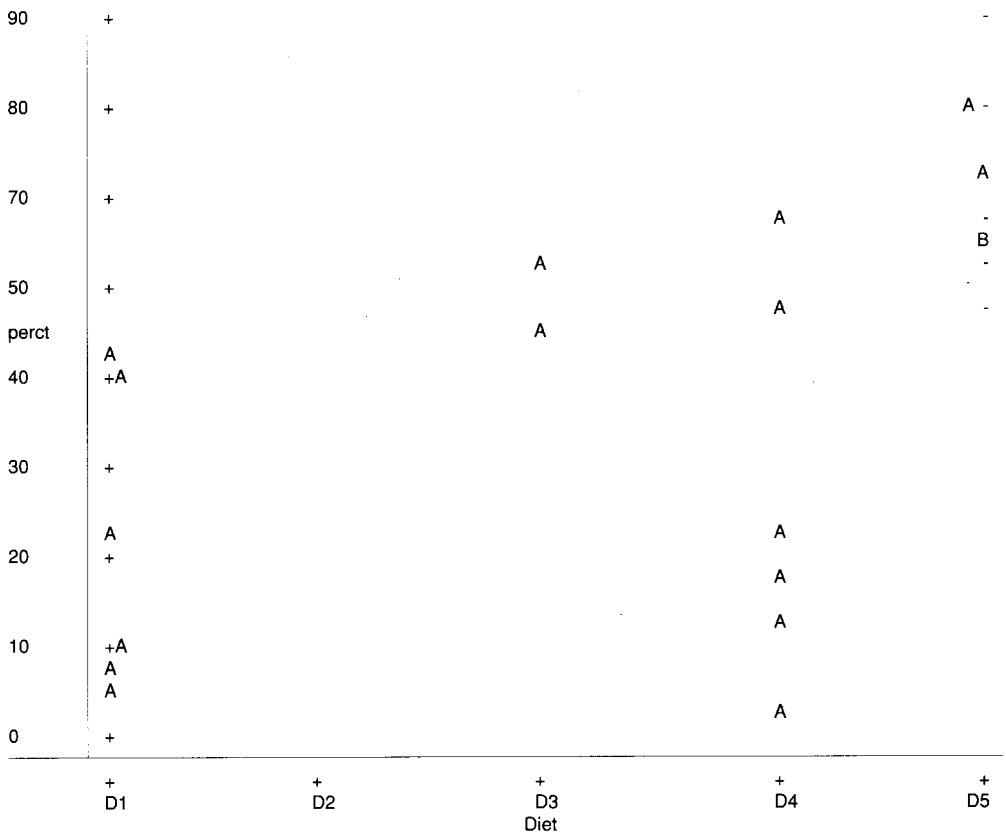
I selected the forage utilization instead of forage availability, food habits, forage selection or forage preference because all of the above topics were bounded to erroneous conclusion. Since we were interested on the attribute of the seladang, the amount of plants and twigs that were grazed or browsed should be taken into account. This utilization measurements were taken without considering a season or a defined period.

Figure 3

The Relationship of browsing rates to the categories of diet

I- WAY ANOVA : DIET FOR SELADANG IN ULU LEPAR 9:33 MONDAY, APRIL 24, 1989 DI = CHENGKENIT, D2 = LALANG, D3 = SELAPUT TUNGGUL, D4 = SHRUBS, D5 = SEEDLING

PLOT OF PERCT * DIET LEGEND: A = 1 OBS, B = OBS, ETC.



Forage availability could be defined as the actual amount of plant species available in the animal habitat or community (in a larger area). These definition was only apply to the time where there was no such grazing or browsing taken place (Martin, 1970). Thus, the only different between forage utilization and forage availability was a time factor. If the measurement of data is taken place before the grazing or browsing, it is called forage availability. But if the measurement of data is taken place after the grazing or browsing then it is called forage utilization.

The availability of various plant species in the seladang habitat especially in the study area could be another factor that may be interested by the researcher in the future. But, the current definition of forage availability was only dealing with the influence of habitat, chiefly climate and soil (Stoddart and Smith 1955). This habitat was governing by the healthy of soil condition. The components of soil such as small organisms, are given greater contribution to soil aeration and thus would supported the growth of various plant species.

The technique for determining forage utilization of seladang in this paper was not precise. But, an accuracy of this method was obtained by using a SAS computer program. This computer program was able to select automatically the highest rate of browsing of each sample plot for further data computing.

Yusof (1982) revealed that the seladang had a wide range of diet. Therefore, it was very difficult to consider all vegetation species into consideration. Because of the high variances, I preferred browsing measurements of only a few plant species known to be key forages. In this case, D1, D2, D3, D4 and D5 variables were selected. Good estimates on a few key species were usually preferable to poor estimated on many.

The percentage of browsing of D5 was recorded as the highest rate and it became the most important components of the diet of seladang. It could be that seladang needed greater amount of seedling species in their range in order to maintaining it's diet. While, the percentage of browsing of D4 scored the second highest rate and it became a second most important components of the diet of seladang. The percentage of browsing of D4 and D5 were became the most highest rate regardless of their representation of the selected species rather as a single diet.

Pooling of diets had to be made which based on the assumption that they were abundant and belong to many species in the seladang habitat. Nevertheless, future research on an individual species of shrub and seedling should be carried out with the purpose of erasing the present results.

The T-test (LSD) results also indicated D5-D4, D5-D3, D4-D3 and D3-D1 pairs were not significantly different but D5-D1, D5-D2, D4-D1, D4-D2 and D3-D2 were significantly different. In general, this forage utilization measurement may be useful in answering questions such as "were perennial plant species overused or underused". From the results also, such inferences about food habits for future research could be made. Martin (1970) and Cook and Stoddart (1953) mentioned that annual forbs

may constitute a significant portion of the herbivores' diet, but if the forbs had already dried up and less in quantity, other components of a relatively not significantly different will be selected by those herbivores species. Therefore, in this scenario the seladang had a couple of alternatives for it's diet. If a pair of D5-D4 is absent, the next alternatives for it's diet would be D5-D3, D4-D3 and D3-D1. The choices among these alternatives might not have significant effect on their diet. But, if a pair of D5-D1 is absent, selecting of only the pairs of D5-D2, D4-D1, D4-D2 and D3-D2 might be some effects on seladang diet.

Since, the Null Hypotheses (H) was rejected and there was a case of inequality among diets of seladang, the combinations of variables as indicated in the previous paragraph must always be present in the seladang range.

Whether a diet was good or adequate, did not mean that the wild animal range conditions were good. Wild animal could be receiving an adequate diet while severely overusing many other plant species on the area. These phenomena could possibly related to the seladang species. To determine these reasons, Holechek and Riper (1983) suggested that further research should be carried out on information especially, the animal densities, forage production and forage utilization. Such comparison of those factors possibly could be done on several areas, seasons and years.

CONCLUSION

The technique for determining forage utilization of seladang was accurate although it was not very precise and relatively time consuming. In order to avoid of the high variances, I selected utilization measurements of only a few plant species that were known to be key forages. An assumption was made during the utilization measurements that all shrub species and seedling species had equal food preferences for seladang. This assumption had to be made because there were too many shrub and seedling species that highly preferable by seladang (Yusof per. observ.). Thus, details comparison among various shrubs species and seedling species cannot be made in this paper.

Nevertheless, the study revealed that there was highly significant statistical evidence that the rates of browsing of seladang under 5 categories of vegetation were not all equal ($P<0.0076$). The seedling species (D5) were grazed by seladang was highest in term of percentage if compared to other vegetation found in the study area. But, it did not mean that other variables such as D4, D3, D2, and D1 were not important.

In order to determine the range conditions of seladang, two other factors such as seladang densities and forage production must be carried out in the future.

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PRAZIQUANTEL IN TREATING LUNG FLUKES (*Paragonimus westermanii*) IN A MALAYAN TIGER AT ZOO MELAKA

ZAINAL-ZAHARI ZAINUDDIN[1] , MOHD TAJUDDIN ABDULLAH[2] AND RAHMAT TOPANI[2]

ABSTRACT

Paragonimus westermanii is found in 80% of the Malayan tigers caught from the wild. The adult flukes are encysted within the lung parenchyma and damages the organ at the later stage of infection. In a Malayan tiger that was previously treated with oral praziquantel, cysts containing the adult flukes were recovered from the lungs during autopsy. Treatment with oral praiquantel at a dose of 20 mg/kg is only effective in eliminating the eggs from the feces but fail to kill the adult parasites.

ABSTRAK

Paragonimus westermanii terdapat di dalam 80% harimau Malaya di dalam hutan. Cacing fluk terdapat di dalam cyst di dalam paru paru dan menyebabkan kerosakkan kepada tisu tersebut pada jangka masa panjang. Di dalam seekor harimau Malaya yang telah dirawat dengan praziquantel sebanyak 20 mg/kg, beberapa cyst yang mengandungi fluk-fluk dewasa masih terdapat di dalam paru-paru semasa bedah siasat. Dengan menggunakan rawatan praziquantel secara oral walaupun telur-telur fluk tidak lagi kelihatan di dalam tinja tetapi ubat tersebut gagal membunuh fluk-fluk dewasa di dalam paru-paru.

INTRODUCTION

Paragonimus westermanii (Kerbert 1878) are found in the lungs of dogs, cats, pigs, goats, foxes (*family Canidae*), pine martens (family Mustelidae), minks (*Mustela vison*), muskrats (*Ondatra zibethicus*) and man. Although it is reported in a variety of felids, it is uncommon in the captive exotic felids (Fox 1971). The adult flukes are encysted within the lung parenchyma and eggs are passed through connecting channels into the bronchi, trachea, pharynx and the gastrointestinal tract. Detailed information on the morphology, life cycle, diagnosis, pathogenicity and clinical manifestation were reporteed previously (Soulaby 1976; Wallach and Boever 1983).

1. Zoo Melaka, Air Keroh, 75450 Melaka.

2. Tiger Management Unit, Dept. Wildlife and National Parks, KM 10, Jalan Cheras, 50664 Kualas Lumpur,

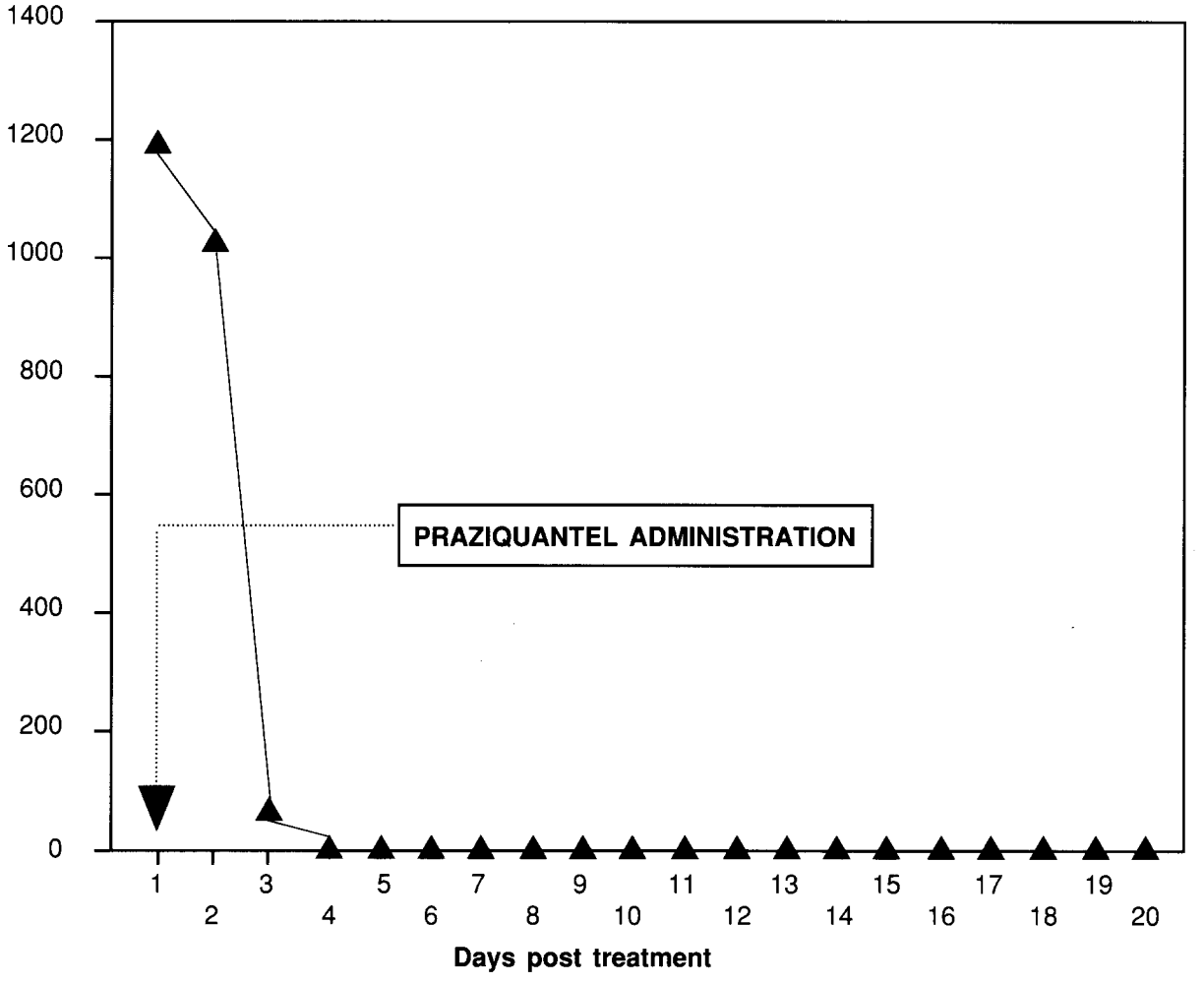

Figure 1: Effect of Praziquantel on *P. westermanii* in a Malayan tiger

In a recent study on 5 wild caught Malayan tiger (*Panthera tigris corbetti*) in Peninsular Malaysia, *P. westermanii* were isolated from 80% of the animals (Zainal-Zahari 1990).

Treatment of lung flukes using bithionel, fenbendazole, albendazole and emetine hydrochloride were reported previously (Soulsby 1976, Frye et. al. 1972, Fraser and Mays 1986). In cestodes, praziquantel exerts its effect by impairing motility and proper functioning of suckers. In vivo, it induces spastic paralysis of the parasite (Fraser and Mays 1986). The use of praziquantel for the specific treatment of lung flukes was studied.

MATERIALS AND METHODS

A wild caught Malayan tiger from Grik, Perak was brought to Zoo Melaka on 5th of September, 1987. The male tiger was approximately 5 months old, weighinh 30 kg and diagnosed by simple floatation to be infected with *P. westermanii*. Physically, the animal was in excellent condition and there was no clinical indication of respiratory problem. It was treated with Praziquantel (Dronsit, Bayer, Leverkusen) at a dosage of 20 mg per kg (600 mg total dose) orally once and repeated 2 weeks later. Subsequently, a fecal egg count per gram feces (epg) was made for *P. westermanii* on a daily basis for 3 weeks using the Modified McMaster technique. When the animal died on 2nd of May, 1988 due to a cagemate fight, an autopsy showed cysts similar to those of *Paragonimus*, found in the lungs. The cysts were counted and then incised to determine the number and condition of the flukes.

RESULTS

Praziquantel has a very dramatic effect on the egg count of *P. westermanii*. The egg count dropped from 1200 epg to 40 epg. 3 days post - treatment (Fig.1). There were no eggs eliminated in the feces after the 4th day. From the autopsy, a total of 12 cysts were isolated from the lungs of the animal. Each cyst contains two living adult flukes.

DISCUSSION

Bithionel was reportedly used in humans for the treatment of lung flukes in Japan at a rate of 1.5 - 2.5 g on alternate days for 3 - 4 weeks (Soulsby 1976). Treatment with Emitine hydrochloride (Eli Lilly & Co.) intramuscularly at a dose rate of 0.5 mg per kg daily for 10 days was successful in treating a margay (*Felis wiedii*) infected with *P. kellicotti* (Frye et. al. 1972). However this anthelmentic was reported to have limited values in the treatment of *P. westermanii* (Soulsby 1976).

Praziquantel is rapidly absorbed into the blood stream and re-excreted into the intestinal lumen. It is effective even in cestode parasite embedded in the crypts of

Liberkuhn surrounded by mucous and inflammatory exudate. However in this study, praziquantel markedly reduced the production of eggs by the flukes but failed to eliminate them from the cyst in the lung parenchyma. The cysts is surrounded by thick connective tissue which encroaches on the lung parenchyma (Soulsby 1976). This will affect drug penetration to the adult flukes. Similarly, there was evidence of destruction of the normal architecture of the lung parenchyme around the cyst wall (Singh 1978). Such pathology will couse disruption of normal blood supply to the lung parenchyma and subsequently reduces the distribution of drugs to the flukes. Oral administration of praziquantel will result in an initial hepatic concentration prior to redistribution to the lungs. As much as 80% of the anthelmentic will be inactivated in the liver. The remaining 20% might not be sufficient to act on the adult flukes within the lung parenchyma. The recent availability of injectable praziquantel, locally, could provide sufficient concentration in the lungs.

Regular fecal evaluation for fluke eggs will provide a basis for setting up a deworming program and prevent elimination of eggs in the feces. As in the other anthelmentic used for the treatment of lung flukes, treatment is always recommended for a period of 2 weeks (Fraser and Mays 1986). Proper disposal of fecal matter from infected animals and the elimination of snails from the vicinity will prevent the spread of lung flukes to other cagemates. The eggs will take 2 to 7 weeks before the miracidium escapes and penetrates the snail and crustacea. The tiger is infected by eating the crustacea or drinking the water containing the metacercaria (Soulsby 1976).

It is probable that praziquantel will be more effective in the early stage of the infection where the damage to the lung parenchyma is minimal. In addition, biotransformation by the intestinal epithelial cells and particularly by liver cells can substantially reduce the amount of unchanged drug that enters the systematic circulation following oral administration. This is known as the "first pass" effect (Fraser and Mays, 1986).

The high percentage of *P. westermanii* in Malayan tigers and the unreliable effect of praziquantel on the adult flukes requires more indepth studies on the drug. Similarly, studies should be undertaken on other anthelmentic used in treatment of *Paragonimus* to determine its effectiveness on adult flukes.

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SOME POPULATION PARAMETERS OF LITTLE SPIDERHUNTER (*Arachnothera longirostra*) AT SUNGKAI PHEASANT BREEDING PROJECT, PERAK

BY

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ABSTRACT

A study of the little spiderhunter population parameters was conducted at Sungkai wildlife reserve, Perak in the months of July, August, September and October of 1987 to 1989. Mark and recapture sampling was used to determine the population size, density, age and sex ratio of these birds. Sampling was carried out on 1.2ha study area. The Schumacher-Eschmayer population estimates was used to calculate the population size. The population density was obtained by dividing them by the trapping area. The population estimated in 1987 was 81.57 + 11.83 birds, and increases to 352 + 27.12 in 1988 and dropped to 221.14 + 24.17 in 1989. The estimated population density was calculated to very high in 1988 (316 birds/ha) followed by 1989 (184 birds/ha) and 68 birds/ha in 1987. Age ratios varies greatly with 96% of adults in the pooled years, showing that their breeding season was already toward the very end when capture were conducted. Sex ratios were significantly different in the pooled years (1987-1989), in favour of more females. Males have the greater tendency of getting retrapped indicating that they might have a smaller home range than the females or they are more trap-happy.

ABSTRAK

Satu kajian keatas populasi burung kelicap jantung telah di jalankan di Rezab Hidupan Liar Sungkai, Perak di dalam bulan Julai, Ogos, September dan Oktober bagi tahun 1987-1989. Saiz, kepadatan dan nisbah umur dan jantina bagi populasi burung-burung ini telah di jalankan dengan cara tangkapan dan tangkapan semula. Tangkapan di buat di kawasan seluas 1.2 ha. Cara anggaran populasi Schumacher-Eschmayer di gunakan untuk mendapatkan saiz populasi. Saiz populasi telah di anggarkan sebanyak 81.57 + 11.83 ekor dalam tahun 1987, meningkat kepada 352 + 27.12 dalam tahun 1988 dan kemudian menurun dalam tahun 1989 kepada 221.14 + 24.17. Anggaran kepadatan populasi adalah tertinggi dalam tahun 1988 (316 ekor/ha) di ikuti dengan 1989 (184 ekor/ha) dan 68 ekor/ha dalam tahun 1987. Nisbah usia bagi burung-burung ini amat berbeza sekali dengan dewasa 96% bagi ketiga-tiga tahun, Ini menunjukkan tangkapan telah di buat di akhir musim pembiakan. Nisbah

jantina di dapati lebih signifikan bagi 1987-1989, dengan tangkapan melebihi bagi pehak burung betina. Burung jantan di dapati mempunyai daya tertangkap semula yang lebih tinggi daripada burung betina. Ini menunjukkan ianya mempunyai kawasan keliaran yang lebih kecil atau ianya lebih 'ketagih-perangkap' di bandingkan dengan burung betina.

INTRODUCTION:

There is no similar population density studies have been reported on the little spiderhunters in Sungkai wildlife reserve, Perak or in Peninsular Malaysia before. The little spiderhunter seems to be one of the most common forest edge birds trapped and retrapped in the peninsula.

The purpose of this study is to analyze the trapping data from 1987 to 1989 and to find out:

1. the population estimate and density,
2. the age and sex ratios and
3. the probability of capturing and recapturing both sexes.

STUDY AREA:

The area studied is part of the Sungkai wildlife reserve established in 1928 with an area of 1,805ha. This reserve was later enlarged in 1940 to 3,265ha. It was then revoked in 1957, leaving only approximately 2,428ha. The study area is at an altitude of about 20m. and lies between lowland forest and a rubber plantation on the outside of the reserve. A slow flowing small stream runs through the eastern and south eastern part of the study area.

The study concentrates on the around the Pheasant Breeding Project and deer farmrun by the Department of Wildlife and National Parks. The overall area studied was approximately 1.2ha. Tepus (*Zingiber spp.*) make up the highest percentage (with regard to the approximate number of plants) of the forest cover i.e approximately 43%, followed by shrubs 32%. Bayas (*Onosperma horrida*) and Balik Angin(*Mallotus macrostachys*) make up another 5% and 3.5% respectively. The remaining part of the area is covered by approximately 2% Perah (*Elateriospermum tapos*), 1.5% Kulim(*Scorodocarpus spp.*), 1.1% Pisang Hutan (Musa spp.), 0.8% Kelat(Eugenia spp.), 0.8% Rambai (*Baccaurea spp.*), 0.5% Keruing (*Dipterocarpus spp.*), 0.5% Kedondong (*Canarium spp.*), 0.5% Leban (Vitex spp.)' and 8% others.

METHOD:

The study was conducted between July to October of 1987, 1988 and 1989. The birds were mist-netted from 3 to 11 days each month in an area of about 1.2 ha. Fifteen to 20 nets were set up in straight lines in the study area and were opened

at about 0700hr. and 'closed' for the night at about 1800hr. The mist-nets were checked every 2 to 3 hours.

All the birds caught were identified and ringed. Measurements of their morphometric datas and weights were taken for each birds. The little spiderhunters were aged 'adult' and 'juvenile '. Sexing was done on each bird caught whenever possible. The male is identified through the presence of a chrome-yellow pectoral tuft while the female is without the pectoral tuft (Glenister 1974). These birds were then released into the same area.

The population sizes of the little spiderhunter were calculated using the estimates from their recaptures through Scumacher-Eschmayer calculation (Anon 1980). The following assumptions were made on the little spiderhunter trapped:

i. there is no loss (or gain) of marked birds,

ii. there is no recruitment (birth or immigration),

iii. there is no difference in mortality of the marked and unmarked birds and

iv. catchability is the same in marked and unmarked individuals.

RESULTS

1. POPULATION ESTIMATE

A total of 680 and 317 individuals were ringed and recaptured respectively, comprising 76 species of birds. The little spiderhunter makes up the majority of the catch (412 individuals). There were 167 little spiderhunters recaptured (40.5% of the total little spiderhunter caught) (Table 1).

Table 1: The number of net-days spent between 1987 - 1989.

No. of net - days

Year	July	August	September	October	Total
1987	11	6	5	-	22
1988	7	5	-	6	18
1989	5	4	3	-	12
Total	22	15	8	6	52

Table 2: The number of the little spiderhunters ringed and recaptured between 1987 - 1989.

Year	Number ringed/recaptured			
	July	August	September	October
1987	24/6	15/3	14/9	-
1988	70/24	54/28	-	69/30
1989	44/15	48/22	74/36	-

Using Scumacher-Eschmayer population estimates at p = 0.05, it was found that 1988 gives the highest estimate of 352.54 + 27.12 followed by 1989, 221.14 + 24.17 and lastly is 1987 with an estimate of 81.59 + 11.83 birds. This gives the highest population density in 1988 (approximately 316 birds per hectare), with about 184 birds per hectare in 1989 and 68 birds per hectare in 1987.

2. AGE RATIO

Age ratios could not be associated with the time interval chosen. There were very few differences between percentages of juvenile birds caught in either July (5%), August (2%) or September (3%), and October (3%) (Table 2).

Table 3: The number of adult and juvenile little spiderhunter ringed and recaptured

Year	Age	Number ringed			
		July	August	Septem.	October
1987	Adult	27	16	14	-
	Juvenile	0	0	0	-
1988	Adult	66	53	-	67
	Juvenile	4	1	-	2
1989	Adult	80	45	71	-
	Juvenile	6	1	3	-

3. SEX RATIOS:

The sex composition of little spiderhunter in the Sungkai wildlife reserve is approximately 58% females and 42% males (Table 3). More males were recaptured (56%) compared to the females (44%) during the study (Table 4).

Table 4: The number of birds (male/female) ringed

Year	Sex	Number ringed				Total
		July	August	Septem.	October	
1987	Male	7	3	3	-	13
	Female	8	10	1	-	19
1988	Male	19	9	-	20	48
	Female	22	15	-	19	56
1989	Male	10	9	16	-	35
	Female	20	16	22	-	58
Total	Male	36	21	19	20	96
	Female	50	41	23	19	133

Table 5: The number of birds (male/female) recaptured

Year	Sex	Number recaptured				Total
		July	August	Septem.	October	
1987	Male	4	1	5	-	10
	Female	2	2	4	-	8
1988	Male	16	17	-	13	46
	Female	8	11	-	17	36
1989	Male	14	9	18	-	41
	Female	2	12	18	-	32
Total	Male	34	27	23	13	97
	Female	12	25	22	17	76

The sex ratio among the little spiderhunter population caught and ringed were 58% female to 42% male, different from 50% (P = 0.05). Among the recaptured birds, sex ratios were 56% male to 44% females not different from 50% (P = 0.05).

DISCUSSION

Though the number of days spent to catch the little spiderhunter were more in 1987 compared to 1988 and 1989 (Table 1), fewer were caught in 1987. This is probably due to the habitat condition at the time of capture. The places where the mist-nets were set up had recently been disturbed causing the area to be lacking in cover and thus with less food supply. In 1988 and 1989, most of the disturbed area in 1987 were covered with wild ginger or 'tepus' and wild banana, the flowers of which were feeding sites for these birds.

Weather might play an important part causing the fluctuations in the total capture. The capture period in 1988 was much wetter compared to both 1987 and 1989 and gives the highest population density per hectare of this bird.

The majority of the birds caught throughout the study period were adults (96%). A higher percentage of juvenile (5%) were caught in July which indicates that July might probably be at the end of the breeding season.

More females than males were caught during the study period, which may indicate a tendency to wander greater distances than the males, thus giving less probability of recaptures. Since the Chi-square test indicates that both sexes have equal chances of recaptures (50%), the males probably have a smaller home range than the females.

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NOTES ON THE SKELETON OF THE SEROW (*Capricornis sumatraensis*)

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ABSTRACT

The aim of this paper is to present a preliminary observations of the oesteology of the serow. A complete skeleton of of the serow was examined. The total number of bones counted was 188-190 (excluding the hyoid bone and the auditory ossicles). The authors compared the number of bones in the serow with the ox and sheep. The differences and similarities of the oesteology of these animals were discussed.

ABSTRAK

Kertas kerja ini menunjukkan pemerhatian awal keatas oesteologi kambing gurun. Satu rangka kambing gurun yang lengkap telah diperiksa. Jumlah tulang yang telah dikira ialah 188-190 (termasuk tulang hyoid dan auditoru ossicles). Pengarang telah memandingkan jumlah tulang yang terdapat pada kambing gurun, lembu dan kambing biri-biri. Perbezaan dan persamaan oesteologi mereka turut dibincangkan.

INTRODUCTION

The serow (*Capricornis sumatraensis*) belongs to the family Bovidae and is widely distributed extending from Northern India to Burma, central to southern China, Indochina, Thailand, Peninsular Malaysia and Sumatra. Eleven sub-species are known to exist (Fisher, Simon and Vincent 1972, Medway 1978).

A survey of literature revealed only five publications on biological aspects of the serow in captivity (Lee 1961, West 1979, Yusof and Ibak 1984, Vellayan 1989, and Zainal Zahari, Sheikh Omar and Mustafa 1990a). To the best of our knowledge there is no published information on the oesteology of Malaysian serow. This paper reports on the preliminary findings on the oesteology of the serow.

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MATERIALS AND METHODS

An adult serow was captured in Negeri Sembilan which later died due to capture myopathy. The skeleton was prepared according to the method employed by Zainal Zahari, Vidyadaran, Mohd Tajuddin, Rozyati and Peng (1990b). The number of bones was counted. For further information on the skeleton of the ox and sheep the authors referred to Sisson and Grossman (1968) and Nickel, Schummer, Seiferle, Wilkens, Wille and Frewein (1986). The length of the cervical, thoracic, lumbar and sacral vertebrae were obtained by using a vernier calliper (Mitutoyo, Japan).

RESULTS AND DISCUSSIONS

The number of bones and the length of various segments of the skeleton of serow, ox and sheep is given in Table 1 and Table 2. The skeleton of the serow comprises of 180-190 bones (excluding the hyoid bone and the auditory ossicles) compared to 196-198 bones in the ox and 194-196 bones in the sheep.

The skull of the serow carries 34 bones similar to that of the ox and sheep (excluding the hyoid bones and the auditory ossicles). The vertebral column consist of 41 bones which includes 7 cervical, 13 thoracic, 6 lumbar, 5 sacrum and 10 coccygeal compared to 49-51 bones in the ox and 42-47 bones in sheep.

The thoracic cage is constructed byu 13 pairs of ribs and a sternum. The fore-limbs consist of 44 bones: namely a scapula, a humerus, an ulna-radius, 6 carpals, a metacarpal, 6 phalanges and 6 sasemoids each. The hindlimbs consist of 43 bones: namely a femur, a tibia-fibulam a patella, 5 tarsals, a metatarsal, 6 phalanges, 6 sasemoids and a pelvic girdle each.

There were no differences in the number of bones in the cervical, thoracic cage, forelimbs and hindlimbs among the three animals (Sisson et al. 1968). However, differences were noted in the number of bones in lumbar, sacrum and coccygeal. The number of bones in the lumbar and sacral vertebrae of the serow is similar to that of the ox, but differs from that of the sheep (Sisson et. al. 1986). Comparatively, the number of coccygeal vertebrae of the serow is less than that of the ox and sheep.

By comparison the cervical vertebrae forms (24.8%) of the total length of the vertebral column which is similar to that of the ox (24.4%), but it is shorter than that of the sheep (29.2%). The thoracic vertebrae of the serow forms 37.8% of the totallength of the vertebral column, whereas in the ox and sheep it is 40.0% and 35.6% respectively. The lumbar vertebrae of the serow forms 21.6% of the total length of the vertebral column, which is shorter than the ox (23.4%) and the sheep (25.4%). The sacrum vertebrae forms (15.8%) of the total length of the vertebral column which is longer compared to that of the ox (12.2%) and the sheep (9.9%).

Table 1: The bones of various segments of the skeleton of the serow, ox and sheep

Bones	serow	ox	sheep
Cervical	7	7	7
Thoracic	13	13	13
Lumbar	6	6	6-7
Sacrum	5	5	4
Forelimbs	44	44	44
Hindlimbs	43	43	43
Skull	34	34	34
Ribs	26	26	26
Coccygeal	11	18-20	16-18
Total	189	196-198	194-196

Table 2: Lengths of the bodies of the cervical, thoracic, lumbar and sacral regions of the serow, ox and sheep

	ox	serow	sheep
	cm %	cm %	cm %
Cervical	50 (24.4)	27.5 (24.8)	25.8 (29.2)
Thoracic	82 (40.0)	42.0 (37.8)	31.4 (35.6)
Lumba	r48 (23.4)	24.0 (21.6)	22.4 (25.4)
Sacrum	25 (12.2)	17.5 (15.8)	8.7 (9.9)

Values given in ( ) are the percentage of the total length of the vertebral column.

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THE SMALL MAMMALS OF ULU GOMBAK, SUNGAI LALANG AND BUKIT KEMANDUL FOREST RESERVE, SELANGOR.

by

SAHARUDIN ANAN AND RAFAEE ABD. HAMID

ABSTRACT

Small mammals were trapped in disturbed secondary forest at Ulu Gombak, in disturbed secondary forest frigned by rubber estate and orchard plantations at Sungai Lalang and in forest edge fringed by oil palm and rubber plantations at Bukit Kemandul. A total of 363 specimens from 27 species were obtained from the three sites. Four most abundant species obtained were *Leopoldamys sabanus, Tupaia glis, Callosciurus notatus*, and *Rattus annandalei* Ulu Gombak revealed 9 species of forest inhabitants out of a total of 10 species. Sungai Lalang trapping site which was a distant from Orang Asli setlement yeild higher density of small mammals than the other areas.

ABSTRAK

Mamalia kecil telah diperolehi dari hutan sekunder yang telah diteroka di Ulu Gombak, di hutan sekunder yang telah diteroka bersekitaran dengan ladang getah dan dusun buah-buahan di Sungai Lalang dan di pinggiran hutan bersebelahan dengan ladang kelapa sawit dan ladang getah di Bukit Kemandul. Sebanyak 363 spesimen yang terdiri daripada 27 spesies telah diperolehi dari ketiga-tiga kawasan tangkapan. Empat spesies yang paling banyak diperolehi ialah *Leopoldyms sabanus, Tupaia glis, Callosciurus notatus*, dan *Rattus annandalei*. Dari sejumlah 10 spesies yang diperolehi, 9 spesies diperolehi dari kawasan Ulu Gombak. Kawasan Sungai Lalang yang terletak berjauhan dari perkampungan Orang Asli, telah memberikan lebih kepadatan mamalia kecil berbanding dengan dua kawasan lain.

INTRODUCTION

The study on the small mammals fauna during 1989 was mainly concentrated in 3 forest areas in Selangor namely the 20th kilometer Ulu Gombak forest reserve, Sungai Lalang forest reserve and Bukit Kemandul forest reserve. This is an extension of a long term survey of vertebrate fauna of Peninsular Malaysia by the Department of Wildlife and National Parks. Small mammal studies together with their host - parasites were carried out in other forest areas in Selangor, Perak, and Pahang (Ratnam et al. 1988, Shabrina et. al. 1989 and Azmin et. al. 1988). These studies revealed new and interesting locality record of small mammals and their host - parasites of significant medical importance.

Although small mammals, particularly sciurid and murid species are well known (Medway 1983, Harrison 1966), the distributional records of a variety of species were based on scanty collections from various places. The few studies on small mammals carried out in detail on specific localities wereby Lim (1966, 1970, 1970a, 1974), Lim et. al. (1977) Muul & Lim (1971), Muul and Lim. (1974) and Beck and Lim (1973). Since 1987, the Department of Wildlife and National Parks have started to carry out comprehensive survey of small mammals in specific forest areas primarily in Selangor to inventorize species diversity and its changing distributional patterns in relation to habitat changes. The objective of this study is to gain further insight of the distributional pattern.

STUDY AREAS

The study areas mere the 20th kilometer Ulu Gombak forest reserve (site A) in the Gombak District, Sungai Lalang forest reserve (site B) in the Hulu Langat District and Bukit Kemandul forest reserve (site C) in the Kuala Langat District. Trapping of small mammals at Site A is in a disturbed secondary forest, site B is in disturbed secondary forest inclusive of forest edges fringed by rubber estates and orchard plantations and site C is forest edge fringed by oil palm and rubber plantations.

METHOD

The trpping of small mammals in Ulu Gombak and Sungai Lalang forest reserve was assited by the arborigines during the whole period of about 75 days and 120 days, respectively. In Bukit Kemandul Forest Reserve, trapping for about 125 days was carried out tottaly by the arborigines. In each of the trapping areas, there was no fixed number of traps utilized and thus number of trap - night varies from one area to another. Banana was the primary bait although other baits like oilpalm fruit and tapioca were also used.

Animals trapped from site A and C were brought back to the laboratory and animals trapped from site B were processed in the field. Each of these animals were processed for ecto - parasites and a thick and blood smears were taken for examination of blood protozoans. The method used in processing for each of these animals, such as cataloging the specimens, preserving of ecto - parasites and the fixing of the blood smears was done in accordance to the techniques used by Ratnam et. al. (1988).

RESULT

A total of 363 specimens comprising of 27 species of small mammals from the three trapping sites were captured and identified. They consist of a species gymnure, 4 species of bats, 3 species of tupaias, 7 species of sciurids including a flying squirrel and 12 species of murids. Among these, 10 species were from site A, 17 from site B and 21 from site C (Table 1).

Table 1: Small mammals collected from three forest areas in Selangor

No	Species	Site A			Site B			Site C			Remark
		M	F	Total	M	F	Total	M	F	Total	
1.	*Echinosorex gymnurus*							1	1	2	Forest
2.	*Chnopterus brachyotis*							19	11	30	Free ranging
3.	*Cynopyerus horsfieldi*	3	4	7				1	2	3	Free ranging
4.	*Rhinolophus trifoliatus*	1	1	2							Forest
5.	*Scotophilus kuhlii*							8	6	14	House/plantation
6.	*Tupaia glis*				11	10	21	3	7	10	Forest
7.	*Tupaia minor*							0	2	2	Forest
8.	*Ptilocercus lowii*							1	0	1	Forest
9.	*Rhinosciurus laticaudatus*	1	0	1	1	0	1	1	2	3	Forest
10.	*Lariscus insignis*				1	0	1				Forest
11.	*Callosciurus notatus*				1	0	1	6	7	13	Forest
12.	*Callosciurus caniceps*				7	8	15				Forest
13.	*Callosciurus nigrovittatus*				0	1	1				Forest
14.	*Sundasciurus tenuis*				0	1	1	0	4	4	Forest
15.	*Tomys horsfieldii*							5	4	9	Forest
16.	*Rattus rattus diardii*	1	0	1				4	7	11	Forest
17.	*Rattus tiomanicus*	1	2	3	0	2	2	19	26	45	Field
18.	*Rattus argentiventer*				0	1	1	1	1	2	Field
19.	*Rattus annandalei*	2	0	2				53	37	90	Forest fringe
20.	*Rattus bowersii*	1	0	1	3	1	4	0	1	1	Forest
21.	*Sundamys muelleri*	3	1	4	9	6	15	2	3	5	Forest
22.	*Leopoldamys sabanus*	0	1	1	20	19	39	1	2	3	Forest
23.	*Lenothrix malaisia*	0	1	1	1	0	1	0	1	1	Forest
24.	*Maxomys rajah*				2	1	3	2	2	4	Forest
25.	*Maxommys surifer*				1	0	1	1	0	1	Forest
26.	*Maxomys whiteheadi*				0	1	1				Forest
27.	*Rhizomys sumatrensis*				0	1	1				Forest

In site A, 6 of 10 species of small mammals were residents of the disturbed secondary forest as compared to 15 and 16 in site B and C. The commensal murids (*Rattus rattus diardii, Rattus tiomanicus* and *Rattus argentiventer*) from these trapping sites were either trapped in field around the orang asli settlement or inside houses of resident there. Bats were netted at site A and C only and among the 4 species of fruit bats (*Cynopterus brachyotis*) and *C. horsfieldii*) and a species of house bat (Scotophilus kuhlii) were common and Although this species is fairly common in forested areas only a single specimen of the Trefoil horseshoe bat (*Rhinolophus trifoliatus*) was obtained.

In site A the numbers for each of the species of sciurids and murids trapped were equally low. In site B, *Tupaia glis, Callosciurus caniceps, Sundamys muelleri* and *Leopoldamys sabanus* were found to be fairly abundant, and they together comprised of 82.6% 109 individuals trapped. Among these 4 species , *L. sabanus* was the most abundant followed by *T. glis* which was next abundancy. *T. glis*, C. notatus, *R. annandalei* respectively with the latter 2 species shown to be most abundant and *R. annandalei* being the predominant rat species.

DISCUSSION

The results of the study revealed that the density and species diversity varied between the disturbed forest areas. Site A being confined around an Orang Asli settlement produced the lowest number of individuals and speciation trapped; 9 of the 10 species of small mammals were forest inhabitats. In Site B with the Orang Asli settlement situated quite a distance from the forest area there was a higher density of small mammals with 4.7 times more individuals and 1.6 times more forest species than site A. Site C on the other hand, is a mixed forest/plantation type of habitat where the Orang Asli settlement is situated in the centre of the habitat. Trapping in this site covered a variety of habitat resulting in large numbers of commensal animal species (*R. r. diardii, R. tiomanicus* and *R. argentiventer*) and forest fringe species (*R. annandalei*) which represented 58.2% of the total catch of 254 individuals. Excluding these non - forested species, the total number caught was 106 individuals with 14 forest species as compared to 15 species and 109 individuals trapped in Site B which indicated that both individuals trapped in Site B and C have similar forest eco - system for the sustenance of small mammals, particularly the sciurids and murids.

It must be noted here that the trapping periods were not equal between Site A and that of B and C, the latter two trapping sites were for a duration of 4 months equal as compared to only 2 1/2 months of trapping in Site A, However, judging by the small number and individual spp trapped during the 2 1/2 month period in such restrict area, it is foreseeable that should the period be extended to 4 months, it would still not be able to yield the same number and speciation as that of Site B and C respectively.

SOME ECTOPARASITES OF RODENT AND BATS CAPTURED AT GUA MUSANG, KELANTAN

by

SHABRINA M. SHARIFF

ABSTRACT

A reconnaissance survey of the small mammal fauna was being conducted at Gua Musang, Kelantan Darul Naim for two separate months, in July and October 1991. A total of 104 small mammal fauna were being documented representing 56 bats, 21 squirrels, 22 rats, 3 shrews and 2 gymnures. The rodents comprised of 6 species of squirrels, 7 species of rats and 1 species each of the shrew and gymnure while the bats belonged to 12 species. It was found that 49% of these small mammals were infested with 7 broad group of ectoparasites consisting of the mesostigmatid/ cheyletid mites, the larval trombiculid mites or chiggers, listrophorids, ticks, fleas, lice and bat flies. The maximum infestation rate of the ectoparasites in the host animal was attained in the mesostigmatid/cheyletid mites (32.35%). The lowest infestation rate however was observed in the fleas (1.96%). The infestation rate of the ectoparasites in the host animals thus ranged from 32.35% to 1.96%. Attempts were also undertaken to identify these groups of ectoparasites to the various taxonomic rank and their significance was discussed.

ABSTRAK

Satu kajian permulaan keatas fauna mamalia kecil telah dijalankan di Gua Musang, Kelantan Darul Naim pada dua bulan yang berasingan, iaitu dalam bulan Julai dan Oktober 1991. Sejumlah 104 fauna mamalia kecil telah dapat direkodkan mewakili 56 kelawar, 21 tupai, 22 tikus, 3 tupai-moncong dan 2 gymnure. Kumpulan rodent terdiri daripada 6 spesies tupai, 7 spesies tikus and 1 spesies tupai-moncong dan gymnure manakala kelawar-kelawar tergolong dalam 12 spesies. Adalah didapati bahawa 49% daripada mamalia kecil ini telah dijangkiti oleh 7 kumpulan besar ektoparasit yang merangkumi tungau mesostigmatid/tungau cheyletid, tungau trombikulid peringkat larva atau 'chiggers', 'listrophorids' sengkenit, 'fleas' kutu dan lalat-lalat kelawar. Kadar infestasi maksima ektoparasit pada haiwan perumah telah diperolehi dalam tungau mesostigmatid/tungau cheyletid (32.35%). Kadar infestasi minima pula telah diperhatikan dalam 'fleas' (1.96%). Oleh itu, kadar infestasi ektoparasit pada haiwan perumah berbeza dari 32.35% ke 1.96%. Percubaan juga telah dibuat untuk mengenalpasti kumpulan-kumpulan ektoparasit ke pelbagai darjat taksonomik dan kepentingan mereka telah dibincangkan juga.

INTRODUCTION

The Research Laboratory of the DWNP, Kuala Lumpur continued to trap small mammals in various representative study areas ranging from lowlands to highlands, from the logged-over secondary forest to the area fringing the mangrove forest throughout the year 1991. However in the study of ectoparasites, animal collections obtained from an east coast state located at Gua Musang, Kelantan Darul Naim were reviewed. All the ectoparasites collected were examined to gain an insight on the species distribution of them in the study area of Gua Musang.

STUDY AREA

An area adjacent to the Deer Breeding Farm of DWNP nestled at Gua Musang, Kelantan Darul Naim was selected for the study on ectoparasites. The trapping of small mammals and bats for the collection of ectoparasites was conducted in the middle and late 1991.

The Deer Breeding Farm in the vicinity of the study area, which encompassed an acreage of approximately 96.2 ha was set up in November, 1982. It consisted of 5 staff quarters, 1 rest house and an office besides the deer paddocks .. This provided the nearest human habitation in the area.

Two major research stations were established during the duration of the study period. The stations were situated approximately 16 km from the main town of Gua Musang. The two stations however were accessible by a winding tarred road about 3.2 km from the Deer Breeding Farm to the Gua Musang - Kuala Lipis - Highway. The study area was observed to be dominated by secondary logged over forest with the last logging activities occurring in the early 1991. Sungei Keneras coupled with its tributaries interlaced part of the study area. A few caves with Gua Gagak being the most predominant abutted the area too. The elevation hence varied from 76 m asl to 442 m asl. Plantations, such as bananas, rubber, durian and cocoa also thrived throughout the study area. In addition, two gold mines located behind the Farm in the direction of Pulai were also encountered along the way but is exhausted since early 1992.

MATERIALS AND METHODS

The small mammals namely rodents were trapped using cage traps and collapsible traps while bats were captured with mist nets by the Laboratory Unit of DWNP. Trappings were carried out in July and October 1991 with a lapse of 2 months in between. A total of 15 trapping nights with 100 baited traps were placed randomly at 5 points with 20 traps at each point. The traps were checked daily in the morning. Mist nets on the other hand were set up in the late evening in the plantations bordering the caves. The nets were observed during dusk and were left opened overnight.

Animals trapped and netted were individually euthenised with chloroform and

examined for the prevalence of any ectoparasites. The ectoparasites collected were preserved in 70% alcohol. Further techniques and materials involved in the processing were as stated in the previous paper (Shabrina 1990).

RESULTS

The reconnaissance survey conducted at Gua Musang, Kelantan Darul Naim yielded 104 small mammals comprising of 56 bats, 21 squirrels, 22 rats, 3 shrews and 2 gymnures. The bats netted belonged to 12 species while the other trapped small mammals were represented by 6 species of squirrels, 7 species of rats, 1 species of shrew and also 1 species of gymnure (Table 1). They were then determined for the prevalence of any ectoparasites on them. It was found that 49% of these small mammals were infested with ectoparasites of various groups namely the mesostigmatid and cheyletid mites, the larval trombiculid mites or 'chiggers', the listrophorids or hair mites, ticks, fleas, lice and also bat flies.

The various groups of these ectoparasites recovered from the small mammals were further enumerated and tabulated (Table 2). A total of 993 ectoparasites were collected whereby 299 were grossly identified as listrophorids, 290 were mesostigmatid/cheyletid mites, 257 chiggers, 128 ticks, 10 bat flies, 6 lice and only 3 fleas.

The majority were listrophorids followed by the mesostigmatid/cheyletid mites and also chiggers. The lowest parasite load were obtained in the lice and fleas. Hence, providing an ectoparasite pattern of infestation in the mammalian hosts examined with the highest infestation rate of the host animals occurring in the mesostigmatid/cheyletid mites (32.35%) followed by ticks (20.59%) and chiggers (18.63%). The lowest infestation rate of the host animals however was observed in the lice (1.96%) and fleas (4.90%), Thus the infestation rate varied from 1.96% to 32.35% (Table 3).

Attempts were also undertaken to identify the ectoparasites to the various taxonomic rank under the phase contrast microscope. The majority of the mesostigmatid/ cheyletid mites belonged to 3 families comprising of Laelapidae, Spinturnicidae and Cheyletidae. The laelapid mites were mostly encountered on the 5 species of rats with *Laelaps echidninus* and *L. sedlaceki* being the most dominant in *Maxomys surifer* and *Sundamys muelleri* (Table 4). The laelapid mites were also prevalent in the ground squirrels *Lariscus insignis* and *Rhinosciurus laticaudatus* ascribing to the species *Haemolaelaps* and *Longolaelaps longulus* respectively (Table 4). The spinturnicid mites on the other hand were mainly restricted to the 9 species of bats with the highest occurrence in the *Hipposideros* species. The cheyletid mites were mostly located on a species of tree squirrel, *Callosciurus notatus* and a species of ground squirrel, *Lariscus insignis* comprising of the *Chelonotus* species (Table 4). The other laelapid, spinturnicid and cheyletid mites infesting the rats, bats and squirrels were as depicted in Table 4.

The larval trombiculid mites or chiggers were mostly collected from the squirrels, rats and the tree shrews. However, only a single bat of the Hipposideros species

Table 1: Some Small Mammals Recorded at The Study Area of Gua Musang, Kelantan

Host Species	No of Individuals Captured	%
Bats		
Balionycteris maculata	1	0.96
Cynopterus brachyotis	1	0.96
Cynopterus horsfieldi	4	3.85
Eonycteris spelaea	17	16.35
Hipposideros species	6	5.77
Hipposideros diaderma	1	0.96
Macroglossus minimus	6	5.77
Macroglossus sobrinus	8	7.69
Myotis species	1	0.96
Rhinolophus species	7	6.73
Rhinolophus affinis	1	0.96
Rhinolphus refulgens	3	2.88
		0.00
Squirrels		0.00
Callosciurus caniceps	2	1.92
Callosciurus nigrovittatus	2	1.92
Callosciurus notatus	9	8.65
Lariscus insignis	3	2.88
Rhinosciurus laticaudatus	2	1.92
Sundasciurus tenuis	3	2.88
		0.00
Rats		0.00
Leopoldamys sabanus	7	6.73
Maxomys surifer	2	1.92
Niviventer cremoriventer	3	2.88
Rattus species	1	0.96
Rattus r. diardii	1	0.96
Rattus tiomanicus	1	0.96
Sundamys muelleri	7	6.73
		0.00
Tree Shrews		0.00
Tupaia glis	3	2.88
		0.00
Gymnures		0.00
Echinosorex gymnurus	2	1.92
TOTAL	104	100.00

Table 2: Summary of The Ectoparasites Recovered From The Small Mammals Captured at Gua Musang, Kelantan

Species	No Positive	No Examined	No of Ectoparasites Recovered						
			Mesostigmatid + Cheyletid Mites	Chiggers	Listrophorids	Ticks	Fleas	Lice	Bat Flies
Bats									
Balionycteris maculata	1	1	0	0	0	0	0	0	1
Cynopterus brachyotis	1	0	-	-	-	-	-	-	-
Cynopterus horsfieldi	4	1	0	0	0	0	0	0	4
Eonycteris spelaea	17	12	14	0	0	70	3	1	0
Hipposideros species	6	2	33	4	0	1	0	0	0
Hipposideros diaderma	1	0	-	-	-	-	-	-	-
Macroglossus minimus	6	0	-	-	-	-	-	-	-
Macroglossus sobrinus	8	3	12	0	0	0	0	0	1
Myotis species	1	1	3	0	0	0	0	0	2
Rhinolophus species	7	2	5	0	0	0	0	0	1
Rhinolophus affinis	1	1	1	0	0	0	0	0	1
Rhinolphus refulgens	3	1	3	0	0	0	0	0	0
Squirrels									
Callosciurus caniceps	2	1	6	0	0	0	0	0	0
Callosciurus nigrovittatus	2	2	5	43	0	0	0	0	0
Callosciurus notatus	9	5	23	29	0	1	0	2	0
Lariscus insignis	3	2	24	0	2	0	0	1	0
Rhinosciurus laticaudatus	2	1	14	3	7	3	0	0	0
Sundasciurus tenuis	3	0	-	-	-	-	-	-	-
Rats									
Leopoldamys sabanus	7	4	7	37	58	35	0	0	0
Maxomys surifer	2	2	89	15	157	8	0	0	0
Niviventer cremoriventer	3	1	1	0	7	0	0	2	0
Rattus species	1	1	3	1	2	0	0	0	0
Rattus r. diardii	1	0	-	-	-	-	-	-	-
Rattus tiomanicus	1	0	-	-	-	-	-	-	-
Sundamys muelleri	7	6	47	100	66	10	0	0	0
Tree Shrews									
Tupaia glis 3	2	0	25	0	0	0	0	0	
Gymnures									
Echinosorex gymnurus	2	0	-	-	-	-	-	-	-
TOTAL	104	51							

Table 3: Infestation Rate of Some of The Ectoparasites Collected From the Small Mammals at The Study Area of Gua Musang, Kelantan

Ectoparasites Recovered	No. of Host Animal Infested	Infestation Rate (%)
Bat Flies	6	5.88
Chiggers (Larval trombiculid mites)	19	18.63
Fleas	2	1.96
Lice	5	4.90
Listrophorids	16	15.69
Mesostigmatid + Cheyletid mites	33	32.35
Ticks	21	20.59

harboured chiggers of the Diplectria species (Table 4). In the squirrels, rats and the tree shrews, majority of the chiggers identified encompassed the *Ascoschoengastia ctenacarus*, *A. audyi*, *A. indica*, Gahrliepia (G), Gahrliepia (Walchia) and also the *Leptotrombidium* species (Table 4). These chiggers were noted in maximum numbers in the rats S muelleri and *Leopoldamys sabanus* and in the squirrels *C. nigrovittatus* (Table 2).

The hair mites or listrophorids were highly concentrated in the species of rats, and contributing 15.69% of the infestation rate of the host animal. The listrophorids documented include the species *Listrophoroides sculpturatus*, *L. lativentris L. pahangi*, *L. borneoensis* and the *Listrophoroides* species (Table 4). *M. surifer* carried the most abundant listrophorids compared to the others. *S. muelleri* and *L. sabanus* also possessed a sizeable number on their bodies (Table 2). Only the ground squirrels *L. insignis* and *R. laticaudatus* were found to be infested with these mites but the parasite load were very low (Tables 2 and 4).

Ticks attributed 20.59% of the infestation rate (Table 3) and constituted all the 3 stages namely the larval, nymphal and the adult stage. Only 2 species of bats, *Eonycteris spelaea* and *Hipposideros* species were found with *Argasids* and the *Haemaphysalis* spp. respectively (Table 4). Among the squirrels, only *C. notatus* and *R. laticaudatus* were infected with the larval Dermacentor and *Amblyomma spp.* respectively (Table 4). Ticks of the Amblyomma and *Haemaphysalis spp.* were also picked up from the rats *L. sabanus*, *M. surifer* and *S. muelleri* (Table 4).

Fleas were recorded from the bat (*E. spelaea*) only (Table 4).

Lice occurred in low numbers with only 4.90% of the infestation rate (Table 3). They were found particularly in the rat *Niviventer cremoriventer* and the squirrels L. insignis and *C. notatus*. The lice belonged to the nymphal stage but an adult *Hoplopleura dissicula* was identified too (Table 4).

Table 4: Some various types of Ectoparasites Infesting the Small Mammals at Gua Musang, Kelantan

Host Species of Small Mammals	Family/Genus/Species of Ectoparasites						
	Mesostigmatid/ Cheyletid Mites	Chiggers	Listrophorids	Ticks	Fleas	Lice	Bat Flies
Bats							
Balionycteris maculata	-	-	-	-	-	-	Strebid
Cynopterus horsfieldi	-	-	-	-	-	-	Strebids
Eonycteris spelaea	Spinturnicidae	-	-	Larval Argasid Adult Argasidae	No ID	Damaged	-
Hipposideros species	Spinturnicidae	*Diplectria spp*	-	Larval Haemaphysalis	-	-	-
Macroglossus sobrinus	Spinturnicidae	-	-	-	-	-	Nycteribid
Myotis species	Spinturnicidae	-	-	-	-	-	Strebids
Rhinolophus species	Spinturnicidae	-	-	-	-	-	Nycteribid
Rhinolophus affinis	Spinturnicidae	-	-	-	-	-	Strebids
Rhinolphus refulgens	Spinturnicidae	-	-	-	-	-	-
Squirrels||							
Callosciurus caniceps	*Chelonotus spp*	-	-	-	-	-	-
Callosciurus nigrovittatus	*Cheyletus fortis*	*Ascoschoengastia ctenacarus*	-	-	-	-	-
		Ascoschoengastia audyi	-	-	-	-	-
		Walchiella oudemansi	-	-	-	-	-
		Leptotrombidium spp	-	-	-	-	-
Callosciurus notatus	*Cheyletus spp*	*Ascoschoengastia audyi*	-	*Larval Dermacentor spp*	-	Nymph of	-
	Hirstionyssus callosciuri	*Ascoschoengastia indica*	-	-	-	*Hoplopleura spp*	-
	Chelonotus spp						
Lariscus insignis	*Chelonotus spp*	-	*Listrophoroides spp*	-	-	Nymph of	-
	Haemolaelaps spp				-	*Hoplopleura spp*	-
Rhinosciurus laticaudatus	*Laelaps nuttali*	*Gahrliepia (Walchia)*	*Listrophoroides spp*	*Amblyomma spp*	-		-
	Longolaelaps longulus	*Leptotrombidium spp*			-		-
Rats							
Leopoldamys sabanus	*Laelaps sedlaceki*	*Gahrliepia (Walchia)*	*Listrophoroides spp*	*Larval Argasidae*	-		--
	Laelaps nuttali	*Gahrliepia gahrliepia (fletcheri)*	*Listrophoroides pahangi*	*Larval Amblyomma spp|*			

Host Species of Small Mammals	Family/Genus/Species of Ectoparasites						
	Mesostigmatid/ Cheyletid Mites	Chiggers	Listrophorids	Ticks	Fleas	Lice	Bat Flies
Maxomys surifer	*Laelaps echidninus* *Longolaelaps longulus* *Laelaps sanguisugus*	*Gahrliepia spp* *Walchiella spp* -	*Listrophoroides sculpturatus* *Haemaphysalis spp* *Listrophoroides spp* *Listrophoroides lativentris* *Listrophoroides sculpturatus*	Larval and Nymph of *Amblyomma spp* *Larval Argas spp*	-	-	-
Niviventer cremoriventer	*Laelaps echidninus*	-	*Listrophoroides spp*		-	Nymph of *Hoplopleura spp*/ Hoplopleura dissicula	-
Rattus species	*Laelaps nuttali*	*Gahrliepia spp*	*Listrophoroides sculpturatus*	Nymphs of Haemaphysalis	-	-	-
Sundamys muelleri	*Laelaps echidninus* *Laelaps sedlaceki*	*Ascoschoengastia indica* *Walchiella oudemansi* *Gahrliepia (Walchia)* *Leptotrombidium deliense*	*Listrophoroides lativentris* *Listrophoroides sculpturatus* *Listrophoroides borneoensis*		-	-	
Tree Shrews *Tupaia glis*	-	*Gahrliepia (Gahrliepia)* *Walchiella oudemansi*	-	-	-	-	-

In addition, some bat flies namely strebids and nycteribids were also collected from 6 species of bats out of the 12 species of bats examined (Table 2 and Table 4).

There were no ectoparasite recovered from some bats, *Cynopterus brachyotis, Hipposideros diaderma, Macroglossus minimus*; the squirrel, *Sundasciurus tenuis*; the rats , *Rattus r. diardii* and *R. tiomanicus* and the gymnure, *Echinosorex gymnurus*.

DISCUSSION AND CONCLUSION

The study area at Gua Mussang, Kelantan Darul Naim housed an interesting assemblage of small mammals which are the denizens of the secondary forest. The 104 small mammals examined harboured 7 broad groups of ectoparasites.

The mesostigmatid/cheyletid mites comprised of 3 families namely the Laelapidae, Spinturnicidae and Cheyletidae. The Spinturnicidae are exclusively ectoparasites of bats found attached to the fur of the host (Domrow and Nadchatram 1978). This family is not known to be of any medical or economic importance (Prasad 1969). In the Laelapidae family, *L. nuttali* for example, obtained in this study too is known to cause occasional irritation to humans and possessed a worldwide distribution (Flynn 1973). The cheyletid mites common on squirrels (Fain and Nadchatram 1980) agreed with the present findings. These mites especially the Chelonotus spp. inhabit the outer side of the ear lobe within a yellowish mass of debris and they produced mange (Fain and Nadchatram 1980). The number of mites found on each squirrel ranged from 4 to 118 with an average of 36 (n = 68) (Domrow 1964). The females of these mites could be parthenogenetic while another hypothesis is that the males are not parasitic and dwelt in the nests of the squirrels (Fain and Nadchatram 1980). The *Cheyletus* spp. especially *C. fortis* which are also recorded in this study are not known to be parasitic on vertebrates and their presence on mammals was certainly accidental and resulted from contamination in the nests of the hosts (Fain and Nadchatram 1980).

The larval trombiculid mites or chiggers were mostly of the family Trombiculidae. They are parasitic in the chigger stage only and are normally found attached to the ear lobes, ear fringe, chin, muzzle, axillae of legs, inguinal regions and the midline of the belly in the rats, squirrels and tree shrews. In the bats however, they are mostly located on the wing membrane and occasionally in the ear and nose-leaf. They are habitat specific being nest-dwellers, field-dwellers or host-dwellers. Chiggers are found in a kaleidoscope of colours varying from white, pale yellow to pale orange and red depending on the species. To a certain extent, the colour is governed by the type of food consumed but largely it is dependent on the biotope of the chiggers (Nadchatram 1970). Among the species observed, only *Leptotrombidium deliense* is a known vector of scrub typhus in Peninsular Malaysia (Nadchatram 1970). Nevertheless, an abundance of information has been attained on the host associations, habitat preferences and general ecology of these mites.

Only 3 fleas were noted from the single bat host, *E. spelaea* from this survey. Fleas are known to parasitize that is it sucks blood in the adult stage but generally temporarily. The larvae are not parasitic but feed on organic matter which they mainly find in their usual abode, the nest of the host (Smit, 1954).

The cosmopolitan distribution of most of these various acarines has made them suitable subjects of biomedical research especially on the aspects of medical and veterinary importance of parasites, allergens and vectors of diseases. Continuing research programme however should be carried out on these ectoparasites to build up a further extensive wealth of information on various aspects such as host-parasite relationship, biology and ecology to code a few.

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DIET OF SMALL MAMMALS IN THE SECONDARY TROPICAL FORESTS IN MALAYSIA

by

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ABSTRACT

The diet of squirrels, treeshrews, insectivorous bats and frugivorous bats were studied from the stomach contents of these animals captured from the various localities of secondary forests. *Tupaia glis* seemed to take more variety of insects besides fruits and vegetative matter as compared to the other species of tree and ground squirrels examined. Among the various insects examined, Hymenoptera was the most frequent prey followed by Coleoptera. *Callosciurus notatus, C. prevostii, Sundasciurus tenuis, Rhinosciurus laticaudatus and Lariscus insignus* were found with insects which formed part of the *T. glis* diet. Among the insectivorous bats, *Rhinolophus affinis* had the greater variety of insects followed by *Hipposideros armiger*. Coleoptera seemed to be the most preferred insects among the insectivorous bats. All insect fragments from frugivorous bats were too far digested making identification to taxonomic level not possible.

ABSTRAK

Pemakanan tupai, tupai - moncong, kelawar pemakan serangga dan kelawar pemakan buah - buahan adalah dikaji dari binatang - binatang yang ditangkap dari berbagai kawasan hutan sekunder. *Tupaia glis* adalah merupakan spesis yang mengambil lebih banyak kepelbagaian pemangsa disamping buah-buahan dan bahan vegetatif berbanding dengan lain-lain spesies tupai yang telah dikaji. Dikalangan pelbagai serangga yang telah diperiksa, Hymemoptera merupakan pemangsa yang paling kerap dijumpai diikuti oleh Coleoptera. *Callosciurus notatus, C. prevostii, Sundasciurus tenuis, Rhinosciurus laticaudatus* dan *Lariscus insignus* didapati mengandungi kumpulan serangga yang menjadi sebahagian daripada makanan *Tupaia glis*. Dikalangan pelbagai kelawar pemakan serangga, *Rhinolopus affinis* adalah merupakan spesies yang mempunyai paling banyak kepelbagaian serangga diikuti oleh *Hipposideros armiger*. Coleoptera merupakan serangga yang paling digemari dikalangan spesis kelawar pemakan serangga. Kesemua serpihan-serpihan serangga terdapat dalam kelawar pemakan buah-buahan adalah terlalu hancur dan tidak dapat diidentifikasi keperingkat taxanominya.

INTRODUCTION

Few studies have been carried out on the natural diet of small mammals in Peninsular Malaysia, and those were mainly on bats and some individual species of some small mammals (Zubaid 1988, Lim Boo Liat 1965, 1966 and 1970). Such in-

formation on squirrels and tree-shrews are scarce, although it is easier to assume that the squirrels, being fruit eaters will only feed on fruits and the frugivorous bats are mainly fruit eaters.

In nature most animals not only have a preference on the type of food normally consumed, but they also take other alternative type of food as well. In order to find out the natural diet of wild animals, the author had started to look into stomach contents of whatever animals that were freshly caught. Some of these animals were the tree and ground squirrels, tree-shrews and bats. Presented herewith are analysis of the food contents of these mammals.

MATERIALS AND METHODS

For this study, the squirrels, tree-shrews, insectivorous and frugivorous bats were captured from January to June 1992 at the various secondary forests reserves Serting, Jempol, Negeri Sembilan; Bukit Labis Segamat, Johor; Charok Durian, Bintang Hijau Selama, Perak; Bukit Belata, Ulu Selangor; Bukit Sungai Puteh, Selangor; Batu 14, Puchong, Selangor and Bukit Kemandul, Selangor. Squirrels and tree-shrews were captured using banana baited live traps while the bats were captured by mist nets. Bananas were used as bait because the masses are easily recognised and separated from the rest of the stomach contents.

A total of 197 stomach samples were obtained from 45 tree-shrews, 26 squirrels, 60 insectivorous bats and 66 frugivorous bats. The respective species and numbers of these animals are presented in Table 1 and Table 2.

Animals captured were killed in killing jar containing chloroform. The stomachs were removed and preserved in 70% alcohol. In the laboratory the stomachs were cut opened and their contents were emptied into petri-dishes. Stomach contents from each animal were examined by spreading it out in petri-dish with a few drops of 70% alcohol added to it. Under the dissecting microscope insect fragments, seeds and other large fragments were separated from the rest of the food masses. The insect fragments were identified to taxonomic level using the keys to insect identification (Borrow & Delong 1970). Doubtful identifications of insect fragments were referred to the entomologist from the University of Malaya. The different food items identified were listed and the percentage of stomach samples containing each of these food items were calculated.

RESULTS

The list of food items encountered in the different species of squirrels, tree-shrews and bats are presented in Tables 1 and 2. Analysis of 44 stomach contents of Tupaia glis identified 9 orders of insects and 2 other animal types, the latter belonging to the orders of Arachnida and Crustacea. Hymenoptera (ants) and Coleoptera (beetles) were the most frequently encountered with 18.2% and 13.7% of the stomach samples examined respectively. Next in order of frequently encoun-

tered were the Hemiptera (bugs), Isoptera (termites) and Lepidoptera (caterpillar) each in 9.1% of the stomach samples examined followed by Orthoptera (grasshoppers) in 6.8%. Other food items found were Neuroptera (Alder flies), Diptera (flies), Ephemeroptera (mayflies), Arachnida (spider) and Crustacea and each of these orders was found in 2.3% of the samples. Unidentifiable food items include seeds, insect fragments and masses were in 45%, 36.4% and 70.4% of the samples respectively. The single specimen of *Tupaia minor* was found with only unidentifiable masses (Table 1).

Stomach contents of 14 *Callosciurus notatus* revealed 3 orders of insects comprising Hymenoptera, Coleoptera and Lepidoptera . They were found in 57.1%, 21.4% and 7.1% of the stomach samples respectively. In addition, 7.1% of the stomach samples also contained Arachnida and Crustacea. A high percentage of samples with unidentifiable insect fragments, vegetable masses and plant seeds of 64.3%, 37.7% and 14.3% were found while oil palm fruit of 7.1% (Table 1).

Three of the 4 *C. prevostii*, Hymenoptera, Isoptera and oil palm fruit were found with high percentage of occurance in their stomachs. Unidentifiable insect fragment were also found in all of the 4 species as well (Table 1). In the case of 2 *Sundasciurus tenuis*, particle of Orthoptera, Coleoptera and unidentified larva were found (Table 2). Like C. notatus unidentifiable masses were also present in all these animals.

On the other hand, the ground squirrels, *Rhinosciurus laticaudatus* and *Lariscus insignus*, Isoptera remains were found to be the common food of both these animals. Nevertheless, the finding of oil palm fruit fibres in the former species was most interesting (Table 2). As usual, unidentifiable masses were also present.

Among the 13 species of insectivorous bats, stomach contents of 6 species have unidentifiable insect fragments and one *Nycteris javanica* had an empty stomach. The stomach contents of the remaining 6 species showed insect remains of Hymenoptera and Coleoptera and they were common food diet of these bats. *Rhinolophus affinis* and *Hipposideros armiger* among these 6 species showed a more varied diet as remains of Orthoptera and Ephemeroptera were found in the former species and Lepidoptera remains in the latter species (Table 2). High percentage of frugivorous bats on the other hand, were found with unidentified vegetative masses. Unidentifiable insect particles were also found in *Cynopterus brachyotis, C. horsefieldii and Eonycteris spelaea* (Table 2).

DISCUSSION

The survey of the food diet among the tree-shrews, tree squirrels and ground squirrels revealed that *Tupaia glis* consumed a greater variety of insects compared to the latter two groups of squirrels. This could be due to *T. glis* being a very active diurnal animal spending most of its time on the ground among the roots of trees or bushes in the under storeys of the forest. Among the 11 orders of insects and other animals investigated, Hymenoptera and Coleoptera were shown to be the preferred

Table 1 : Occurance of the different food items in some ground and tree-squirrels (continued)

Species of squirre and shrews	Total No. of stomach examined	Identified food items	% Stomach with different type of food items
TREE-SHREW			
Tupaia glis	44	Coleoptera (Beetles)	11.4
		Coleoptera larva	2.3
		Hymenoptera	6.8
		Formicidae (ants)	9.1
		Ant pupa case	2.3
		Hemiptera (bugs)	9.1
		Orthoptera (grasshopper)	4.5
		Orthopteroid	2.3
		Isoptera (Termites)	9.1
		Lepidoptera (caterpillar)	9.1
		Neuroptera (Alderflies)	2.3
		Diptera (Flies)	2.3
		Ephemeroptera (mayflies)	2.3
		Arachnida (spider)	2.3
		Crustacea	2.3
		Unidentified insect fragments	36.4
		Seed	4.5
		Unidentified masses	70.4
Tupaia minor	1	Unidentified masses|	
	45		
TREE-SQUIRRE			
Callosciurus notatus	14	Hymenoptera	21.4
		Formicidae (ants)	28.6|
		Ant pupa case	7.1
		Coleoptera (beetles)	14.3
		Coleoptera larva	7.1
		Lepidoptera (Caterpillar)	7.1
		Crustacea	7.1
		Unidentified insect fragments	37.7
		Oilpalm fruit mass & fibre	7.1
		Seed	14.3
		Unidentifiable masses	64.3
Callosciurus nigrovittatus	4	Unidentifiable masses	50.0
		Unidentifiable insect fragments	25.0

Species of squirre and shrews	Total No. of stomach examined	Identified food items	% Stomach with different type of food items
Callosciurus prevostii	3	Hymenoptera (Formicidae)	66.6
		Isoptera (Termites)	33.3
		Oilpalm fruitmass and fibre	66.6
		Unidentifiable masses	33.3
Sundasciurus tenuis	2	Orthopteroid wing	-
		Coleoptera	-
		Insect larva	-
		Unidentifiable insect fragments	-
		Unidentifiable masses	-
GROUND SQUIRRE			
Rhinosciurus laticaudatus	2	Isoptera (Termite)	-
		Pupa case of Termite	-
		Oilpalm fruit fibre & masses	
		Unidentifiable insect fragments	-
		Unidentifiable masses	-
Lariscus insignus	1	Termite	-
		Insect larva	-
		Unidentifiable masses	-
	26		

Table 2 : Occurance of the different food items in some insectivorous and frugivorous bats (continued)

Spesis of insectivorous bats and frugivorous	Total No. of stomach examined	Identified food items	% Stomach with different food items
INSECTIVOROUS BAT			
Rhinolophus affinis	27	Hymenoptera	3.7
		Coleoptera	3.7
		Orthoptera	3.7
		Ephemeroptera (Mayflies)	3.7
		Unidentifiable insect fragment	33.3
		Unidentifiable masses	37.0
Hipposideros larvatus	6	Coleoptera	16.7
		Unidentifiable insect fragments	33.3
		Unidentifiable masses	16.7
Megaderma spasma	6	Hymenoptera	16.7
		Coleptera	16.7
Hipposideros cineraceus	5	Unidentifiable insect fragments	40.0
		Unidentifiable masses	40.0
Glishropus tylopus	4	Unidentifiable insect fragments	75.0
		Unidentifiable masses	50.0
Hipposideros diadema	3	Unidentifiable insect fragments	66.7
		Unidentifiable masses	66.7
Hipposideros bicolor	2	Unidentifiable insect fragments	-
		Unidentifiable masses	-
Rhinolophus trifoliatus	2	Formicidae (ants)	-
		Coleoptera (beetles)	-
		Unidentifiable masses	-
Rhinolophus sedulus	1		-

Spesis of insectivorous bats and frugivorous	Total No. of stomach examined	Identified food items	% Stomach with different food items
		Unidentifiable insect fragments	-
Hipposideros nequam	1	Isoptera (Termites)	-
		Unidentifiable masses	-
Hipposideros armiger	1	Hymenoptera	-
		Coleoptera	-
		Lepidoptera (Caterpillar)	-
		Unidentifiable insect fragments	-
		Unidentifiable masses	-
Murina aenea	1	Unidentifiable insect fragments	-
Nycteris javanica	1	Empty	-
	60		
FRUGIVOROUS BAT			
Cynopterus brachyotis	30		
		Unidentifiable insect fragments	16.7
		Seed	3.3
		Unidentifiable masses	50.0
Eonycteris spelaea	17	Insect larva	5.8
		Unidentifiable insect fragments	35.3
		Unidentifiable masses	47.0
Macroglossus sobrinus	6	Unidentifiable mashed food	66.7
Cynopterus horsfieldi	12	Insect larva	8.3
		Unidentifiable insect fragments	8.3
		Unidentifiable masses	25.0
Chironax melanocephalus	1	Unidentifiable masses	-
	66		

food of *T. glis*. Both these orders of insects are abundantly found almost in every type of habitat of the under-storeys and ground level. Such a prey-predator association appeared to be correlated with the behaviourial pattern of this group of animal. The fact that *T. glis* consumed such a great variety of insects and other food items suggest that the tree-shrew is less selective in its diet.

Like *T. glis*, again Hymenoptera and Coleoptera formed the choice insect food items for *Callosciurus notatus*. Although this squirrel is arboreal in nature, it does also descend to ground level more frequent than its contempararies. The findings of these two orders of insects with higher percentage of occurance could also be due to the abundance and easy assessibility of these insects on the ground.

In the case of *T. minor, C. nigrovittatus, C. prevostii, S. tenuis, R. laticaudatus* and *L. insignus*, the food items in their stomach were in comparable because the samples obtained from each of these animals was too small.

Bats particularly the insectivorous species, on the other hand, were more easily predictable in their food diet. They exclusively feed on insects. But the problem faced was that most of the insect particles found in their stomachs were already highly digested and unidentifiable. However those insect remains which could be identified were mainly of the orders Hymenoptera and Coleoptera. To overcome the problem is to find ways to net these bats later in the night after they have had their meals or by collecting their faecal samples at the roosting sites (Zubaid 1988).

In contrast some insect remains were also found in the stomach of the frugivorous bats which are mainly fruit eaters. This could be due to the bats eating the fruits while the insects were preying on it. However, it is most interesting to note that quite high percentage of *Cynopterus brachyotis, C. horsefieldii* and *Eonycteris spelaea* were found with insect remains in their stomachs. Follow-up studies will be continued to find out whether these insect items play an essential food components in their diets.

Besides the above studies, future samples will also be taken to assess seasonal changes in the diet of those animals which are easily available at monthly intervals.

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MELIOIDOSIS IN A CAPTIVE ORANG UTAN (*Pongo pygmeus*) AT ZOO MELAKA

by

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ABSTRACT

Melioidosis is a generally fatal zoonotic disease in man and the orang utan. It is caused by *Pseudomonas pseudomallei*, a Gram negative bacteria. It is primarily a disease of rodents but it has been observed in wild and domesticated animals. This bacteria was isolated from the lungs, spleen and liver of an orang utan at the Zoo Melaka, Peninsular Malaysia. The epidemiology and pathogenesis of the disease is discussed. The outbreak of melioidosis in the young orang utan was possibly due to the contamination of feed by rats and zoo visitors, coupled with stress. The focal abscesses in the liver and spleen were large.

ABSTRAK

Melioidosis pada umumnya merupakan penyakit zoonotik yang merbahaya pada manusia dan orang utan. Ia disebabkan oleh bektiria yang tidak aktif yang dipanggil *Pseudomonas pseudomallei*. Pada asalnya ia merupakan penyakit 'rodents' tetapi telah dibuat terjadi pada binatang-binatang liar dan jinak. Bektiria ini telah diasingkan daripada paru-paru, limpa dan hati pada seekor orang utan di Zoo Melaka, Semenanjung Malaysia. Epidemiologi dan pathogenesis bagi penyakit ini turut dibincangkan. Melioidosis pada anak orang utan kemungkinan disebabkan oleh keracunan makanan yang dibawa oleh tikus dan juga oleh para pelawat Zoo dan ditambahi pula oleh keadaan 'stress' pada binatang berkenaan.

INTRODUCTION

Melioidosis has been reported in man, domestic mammals, wild mammals and birds. Among wild animals, this disease has been recorded from the macaque (Retnasabapathy 1966 and Strauss et. al. 1969), banded leaf monkey (Mutalib et.

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al. 1984), spider monkey, gibbon (Lim and Mukundhan 1968), orang utan (Smith and Damit 1982, Wallach and Boever 1983) serow (Lee 1961) and parrot (Lim and Tan 1967). This pathogen has also been isolated from soil and water in South East Asia and some parts of Australia (Soltys 1979).

Characteristics lesions occur as multiple abscesses particularly in the lungs, spleen, liver and associated lymph nodes. However, previous reports indicated various strains with varying pathogenicity (Blood et. al. 1979).

This paper records a first case of melioidosis in an 11 month old female orang utan that died at Zoo Melaka, Peninsular Malaysia.

CASE HISTORY

The orang utan was born on the 29 August, 1987 and was reared by the mother. They were housed in an enclosure measuring 10 x 5 x 5 meters. The sire remained within the same enclosure. An adjacent empty enclosure was used to rotate the animals during routine daily cleaning by keepers.

In March 1988, a male orang utan that was previously taken by the royal family of Kedah was returned to the Zoo Melaka. Due to insufficient enclosure space the male was put into the adjacent enclosure, next to the breeding pair. All the orang utan were aggressive and therefore, without an adjacent empty enclosure, cleaning became very difficult. A water pump had tobe used on alternate days to clean the cages.

The baby orang utan was observed to cling to its mother most of the time. No abnormal clinical signs were seen prior to its death. On the 27 July 1988, the baby orang utan was reported dead by the keepers. She was immediately taken out for autopsy.

POST MORTEM FINDINGS

Multiple abscesses 4 - 11 cm in diameter were observed on the visceral and parietal surfaces of the liver. The abscesses extended a few millimeters to one centimeter into the liver parenchyma. The lesions were irregular to round in outline and contained a yellow mucoid to caseous material. The liver was moderately congested.

Several smaller abscesses, 2 - 3 mm in diameter were located on the mesentery. Ulcerations and nodules with "ballooning" were observed on the serosal layer of the duodenum, jejunum and stomach. These rounded lesions measures 3 - 5 mm in diameter and were surrounded by an area of severe erythema. No significant lesions were observed on the corresponding mucosal layers.

Five irregular abscesses were found on the parietal and visceral surfaces of the spleen. They measured 5 - 10 mm in diameter and projected from the surface of the organ.

The lungs were pneumonic with 15 -20 granulomatous raised areas, 5 - 7 mm in diameter. These nodules were circular and surrounded by severe erythema. Some degree of hemorrhage was found central to the lesion. These nodules were encapsulated and contained a creamy substance.

HISTOLOGYPATHOLOGY

The liver had a well encapsulated pyogranulomatous focus typical of melioidosis. The intestine had similar nodule in the submucosa. There were similar nodules in the kidney but smaller and uncapsulatedc. The lungs exhibited similar nodules as well as alveolar edema and marked thickening of the adjacent alveolar walls with inflammatory cells. Several giant cells were also present. Granulomatous hepatitis, granulomatous embolic pneumonia, granulomatous embolic pneumonia, granulomatous embolic nephritis and granulomatous enteritis were diagnosed morphologically.

BACTERIOLOGY

A pure growth of *Pseudomonas pseudomallei* was isolated from the lungs, liver and spleen. Hemolytic Escherichia coli was found in the duodenum, jejunum and stomach. Soil and water samples from the enclosure were negative for *P. pseudomallei*. The rodents sampled within the vicinity were also negative for this pathogen. Keepers also tested negative for this pathogen.

DISCUSSIONS

The epidemiology of melioidosis is largely conjectural. Although rats have been regarded as the source of infection, no convincing evidence has been reported (Wallach and Boever 1983); Jubb and Kennedy 1970). In Malaysia it was suggested that contaminated water is the most likely vehicle for the transmission of melioidosis (Strauss et al. 1969). The incidence of melioidosis in animals is sporadic but epizootic cases have been reported (Omar et al. 1962).

The orang utan might have acquired the pathogen from contaminated water or floor of its enclosure. However, soil and water samples surrounding the enclosure were negative for *P. pseudomallei*. Similarly, the rats trapped around the enclosure were negative for this bacteria. The keepers too did not have titres fir this bacteria. However, inadequate cleaning of the enclosures may result in contamination of food. In addition, the public would throw food into the enclosure and these may later be contaminated by waste materials, including faeces. Rodents present in and around the enclosure could act as a reservoir. Although samples of trapped rodents were negative for melioidosis, the possibility should not be overlooked. In melioidosis, the routes of infection include oral, inhalation, insect bites and cutaneous abrasiond (Blood et al. 1979, Wallach and Boever 1983). The free moving vectors in the zoo compound should be identified and eliminated. In Zoo Melaka, rats, squirrels, birds, dogs and macaques often come in contact directly or indirectly with the zoo animals. The

presence of vectors could hasten the spread of this pathogen from enclosure to enclosure and from animal to man.

In experimental animals, conditions of stress, increases susceptibility to melioidosis (Dannenberg and Scott 1958). At Zoo Melaka, the introduction of a new male in the adjacent enclosure could have stressed the young orang utan and increased its susceptibility to the infection. An 18 month old orang utan was infected with *P. pseudomallei* subsequent to a mild upper respiratory tract infection of human origin (Smith and Damit 1982).

The lesions described were similar to reported cases of melioidosis with variations in the organs involved (Smith et al. 1972, Jubb and Kennedy 1970, Omar 1963 and Wallach and Boever 1983). No lesions involving the bones or articular surfaces were observed in the orang utan. The focal abscesses in the liver and spleen were large as compared to minute abscesses in the Siamang (Velayan 1986).

There was no apparent clinical symptoms in the orang utan before death suggesting an acute infection. In Brunei, a young male developed pneumonia and was inappetance before succumbing to death (Smith and Damit 1982). In the present case, the mother orang utan was constantly observed to cuddle the baby making it almost impossible to make any visual acessment.

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SHORT NOTES ON BAND RECOVERY OF WADERS IN 1991/1992

by

SITI HAWA YATIM

One record of movement of banded curlew sandpiper (*Calidris ferruginea*, four records of terek sandpiper (Xenus cinereus), and one record of Mongolian plover (*Charadrius mongolus*) were observed between the west coast of Peninsular Malaysia and their staging and breeding areas in Indonesia, China, Kazakshtan and Russia. Details of the recoveries were as follows:

MUSKWA K-390707 Curlew sandpiper
Banded 19 July 1991, Western shore of Alakoul Lake, Kazakhstan, Taldy-Kurgansky Reg., Alakoulsky Distr., 46° 18' N 81° 24' E; Adult (2+).
Controlled (Captured and released alive - Ring D06248 added): 6 February 1992; Kuala Kurau, Perak; 4° 55-60' N 100° 30' E.
Time elapse: 203 days; Distance: >7,000 km

PERHILITAN D04363 Terek sandpiper
Banded 3 October 1990, Tanjung Karang, Selangor 3° 24-27' N, 101° 12-14'E; Adult
Controlled (Captured and killed by hunter): 4 May 1991; Chongmin Island, Shanghai, China; 31° 30' N, 121o 52'E.
Time elapse: 214 days; Distance: ~ 3,325 km

PERHILITAN D02426 Terek sandpiper
Banded 19 April 1989, Tanjung Karang, Selangor 3° 24-27'N, 101° 12-14' E; Adult
Controlled (Caught in fish-net): 13 May 1991; East Panjin Coastal Area, Liaoning Province, China 40° 50' N 121° 50' E.
Time elapse: 694 days; Distance: ~ 4,750 km

PERHILITAN E02068 Terek sandpiper
Banded 2 December 1990, Tanjung Karang, Selangor 3° 24-27' N, 101° 12-14' E; Adult.
Controlled (Shot dead): May/June 1991, Yakuskaya, Sakha SSR, Verkhoyanskiy District, Near Batagai Village, Lake Labanova, Russia 67° 41' N 134° 45' E.
Time elapse: 149-179 days; Distance: > 10,300 km

PERHILITAN D04375 Terek sandpiper
Banded 3 October 1990 Tanjung Karang, Selangor 3° 24-27' N, 101° 12-14' E. Adult

Controlled (Caught on fish-net and killed): 27 September 1992. Desa Sarang Helang Coastal area, Sumatra, Indonesia.
3-4° N 99-100° E
Time elapse: 698 days; Distance: ~ 150 km

PERHILITAN D04574 Mongolian plover
Banded 11 September 1991 Kelompang Island, Matang Forest Reserve, Perak 4° 54' N, 100o 33' E. Adult
Controlled (Caught on fish-net and released): 12 April 1992; Pantai Labu, Kab. Deli, Serdang, Sumatra Utara, Indonesia 2-3° N 98-99° E .
Time elapse: 214 days; Distance: ~ 200 km

The curlew sandpiper was banded at their breeding ground on the western shore of Alakoul Lake (MUSKWA K-390707). It was on its southward migration when caught and banded at Kuala Kurau, Perak. Since it was captured in February, it can be deduced that Kuala Kurau and its surrounding area is the non-breeding area for this particular bird. Since Alakoul Lake is situated on the Indo-Asian Flyway (Howes & Bakewell 1989), this bird must have crossed-over from this flyway to the East Asia/ Australian flyway. A similar cross-over occured in 1978 when one of our banded birds at Kuala Selangor was recaptured in Kazakhstan in the same year.

The bird which was banded at Tanjung Karang, Selangor (D04363) was on its northward migration from its non-breeding ground in Peninsular Malaysia. It must have started its flight north in early April or late March in order to reach China in early May. It was known that the same species was found to take about 42 days to travel from Hong Kong to Kuala Selangor (Siti 1990).

The third bird (D02406) was caught and banded in Mid-April, probably on its northward migration. It survives two winters but was later caught and probably killed on its northward migration.

The fourth bird (E02068) was wintering at Tanjung Karang, Selangor when it was banded and later was found shot dead when it reached its breeding ground in May/June the following year. The distance covered by this bird to reached its breeding ground was more than 10,300 km.

The fifth bird (D04375) banded at Tanjung Karang, Selangor on 3 October 1990 was caught in a fish-net and killed for food on 27 September 1992 at Desa Sarang Helang coastal area in Sumatra, Indonesia. It was caught during its southward migration, surviving two winters at its staging area after being banded.

The last bird, the mongolian plover (D04574) banded on 11 September 1991 at Kelompang Island, Kuala Gula, Matang Forest Reserve, Perak was later caught on a fish-net and was released. The area where it was caught was at Labu coastal area, Serdang, Northern Sumatra, Indonesia on 12 April 1992. This bird was re-captured when on its northward migration from its staging area or its wintering ground in Indonesia or further south.

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A STUDY ON HABITAT USE BY OTTERS IN TAMAN NEGARA, PAHANG

by

BURHANUDDIN HJ. MOHD. NOR
NORIZAN AHMAD

ABSTRACT:

A study on habitat use by otters was conducted along the Tembeling river in Taman Negara, Pahang. Three sites along the river, Sungai Tabong, Pasir Tempan, and Sungai Kerlis were most frequently used by otters due to the presence of deep pools, sandy banks, and small rivers flowing into the Tembeling river. The otters in the river are able to adapt to the presence of human activities such as boating and fishing.

ABSTRAK:

Satu kajian mengenai pemilihan habitat oleh memerang telah dijalankan di sepanjang Sungai Tembeling di Taman Negara, Pahang. Tiga kawasan di sepanjang sungai tersebut iaitu Sungai Tabong, Pasir Tempan, dan Sungai Kerlis merupakan kawasan yang paling kerap dilawati oleh memerang kerana terdapatnya lubuk yang dalam, pantai berpasir dan anak sungai yang mengalir ke dalam Sungai Tembeling. Memerang di dalam kawasan ini juga didapati dapat menyesuaikan diri dengan kehadhiran aktiviti manusia seperti bot dan menangkap ikan.

INTRODUCTION:

The distribution of otters throughout the country is largely influenced by the availability of suitable habitats (Burhanuddin, unpubl). However, the number of otters that can be supported in an area depend on the quality of each habitat. The quality of otter habitat, to a certain extent is determined by the availability of several factors such as food, vegetation cover, activity areas, and level of human activities (Harris 1984).Otters are known to travel quite extensively in its range searching for food and resting place. The above factors are also significant in determining the size of an individual home range. Pat Foster-Turley (pers.comm) recorded 14 individuals over a distance of 20 km along the Tembeling River in Taman Negara, Pahang.

Burhanuddin (1991) found out that otters living near human inhabitants like Pulau Aman and Kuala Gula are able to adapt to the human activities in the areas and in some cases, benefits from this interaction. However, the continuous presence of

these animals will depend on the level of human activities in the area as conflict between them might occur after a certain period.

The aim of this study was to record habitat use by otters along the Tembeling River in Taman Negara. It also help to ascertain whether the presence of human activities in the river will affect these animals in their selection of activity areas. This study also serve as a basis for future studies on habitat use pattern in the same habitat.

STUDY AREA

Taman Negara with a total area of 4,343 sq. km is located in the middle of Peninsular Malaysia and comprises of areas from three states ie. Pahang, Trengganu, and Kelantan. This national park houses one of the oldest rainforest in the world. There are four main rivers,namely Tembeling river, Tahan river, Trenggan river, and Kenyam river, which form part of the park boundary. Aside from the Tembeling river, the other rivers originate from within the park and flow into the Tembeling river. The level of the Tembeling river fluctuates during the wet and dry season. Wet season starts from November to February every year and may sometimes result in flood while the dry spell usually occur during the middle of the year. During the dry period , most small streams in the interior of the park dried up and most wildlife frequent the bigger tributaries including the Tembeling river to get their water supply.

The Tembeling river forms an integral part of the local human population living along it. They depend on it for communication and livelihood. Commercial fishing which include the use of nets and lines are common along this river. However, no commercial fishing is allowed in the park. Zakaria (1991) noted that the rivers in Taman Negara support more than 50% of the freshwater fishes found in the peninsular, thus reflecting the importance and richness of the rivers in Taman Negara.

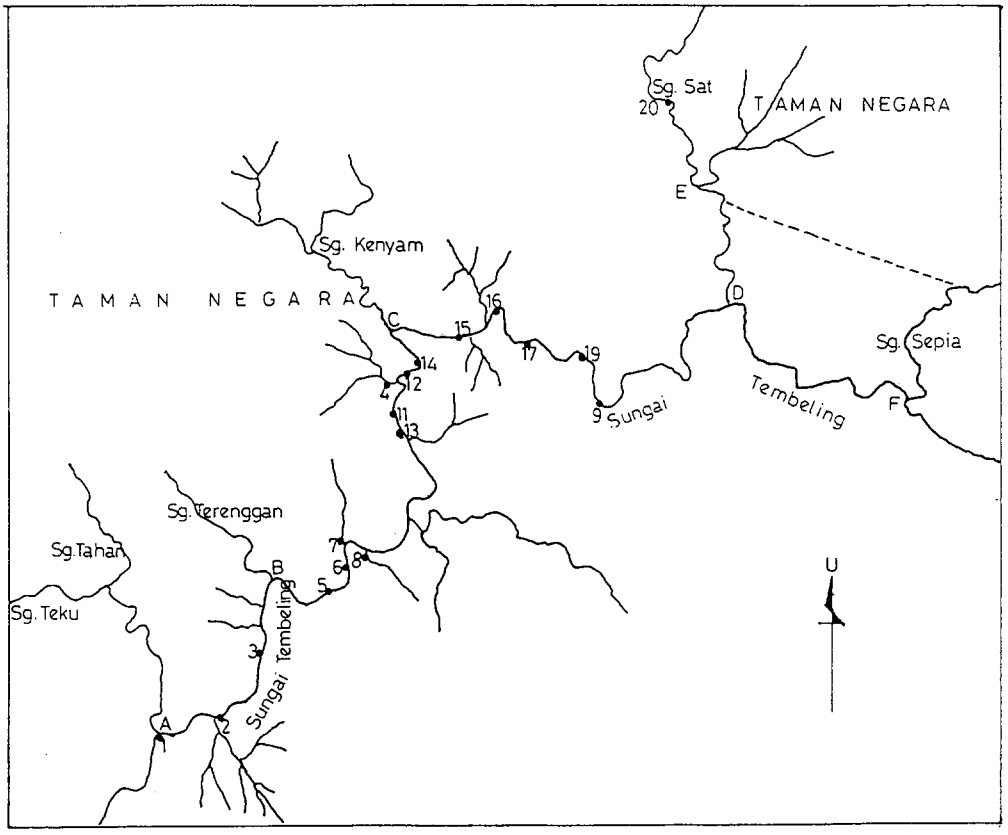
The Tembeling river is the most important river in the park as it provides access to several areas in the park by boat. River activities such as rafting, boating, rapid shooting, and fishing has resulted in the increase in the number of boats in the river.

There are two species of otter present in the park, the smooth-coated otter (*Lutra perspicillata*) and small-clawed otter (*Aonyx cinerea*). Both species are normally observed swimming in the river or resting on the sand banks during the early morning and evening. The presence of fishing nets and lines along the river usually provide easy food supply to these animals and this often lead to the conflict between them and the local fishermen.

METHOD AND MATERIALS

An initial survey on areas frequented by otters along the Tembeling river was conducted prior to the study. This enabled the study team to identify and marked the sites for the purpose of this study. A total of 21 sites were identified and selected

Map 1: Location of study area in Taman Negara



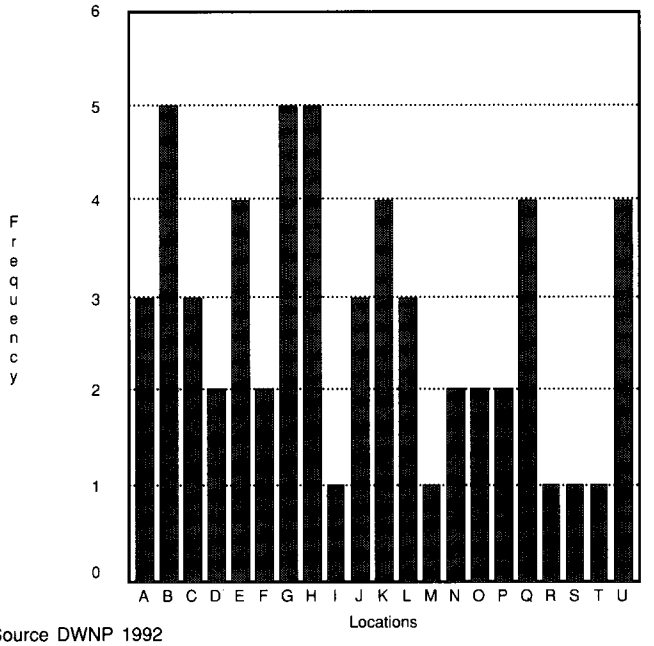
1. Lubuk Cerok
2. Sg. Tabung
3. Jeram Dedari
4. Sg. Luas
5. Lubuk Gambir
6. Lubuk Katak
7. Pasir Tempan
8. Sg Keris
9. Pasir Kubur
10. Sg. Lembing
11. Jeram Belau
12. Pasir Luas
13. Sungai Luas
14. Sg. Sari
15. Jeram Kekabu
16. Sg. Galong
17. Sg. Siak
18. Pasir Samah
19. Cegar Buluh
20. Lubuk Pauh

A. Kuala Tahan
B. Kuala Terenggan
C. Kuala Kenyam
D. Kuala Sat
E. Kuala Kelapur
F. Kg. Bantal

Table 1. Frequency of otter visits to various sites in the study area

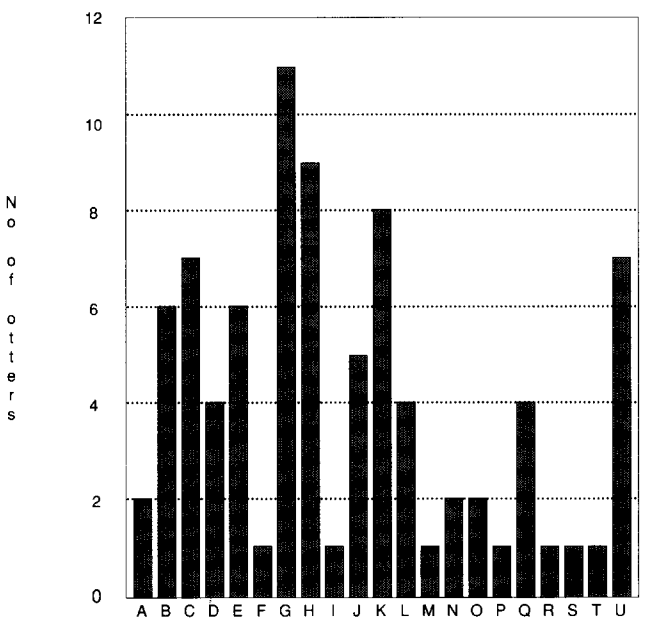
Locations	Frequency of visits	Total number of otter observed
1. Lubuk Cerok	3	2
2. Sg. Tabung	5	5
3. Jeram Dedari	3	7
4. Sg. Luas	2	4
5. Lubuk gambir	4	6
6. Lubuk Katak	2	1
7. Pasir Tempan	5	11
8. Sg. Kerlis	5	9
9. Pasir Kubur	1	1
10. Sg. Lembing	3	5
11. Jeram Belau	4	8
12. Pasir Luas	3	4
13. Sg. Luas	1	1
14. Sg. Sari	2	2
15. Jeram Kekabu	2	2
16. Sg. Galong	2	1
17. Sg. Siak	3	4
18. Pasir Samah	1	1
19. Cegar Buluh	1	1
20. Lubuk Pauh	1	1
21. Lubuk Buaya	4	7

Fig. 1. Frequency of otter visits to various sites in the study area



Source DWNP 1992

Fig. 2. Number of otters observed at the various sites in the study area



Source DWNP 1992

along the river (Map 1). These sites were selected based on the presence of otters or their signs during the initial survey.

Direct and indirect observations of otter presence which form the main part of data collection were conducted every two weeks beginning from March 1991 to April 1992, a period lasting for one year. Data collection was carried out by the staff of Taman Negara and it concentrated on the frequency of otter visits to individual site and the estimated number of individuals visiting these sites during the period. This was determined by direct observation of the animals or based on their signs such as footprints and scats which are found in the area.

The frequency of otter visits at each sites were tabulated and discussed in the following section.

RESULTS

The frequency of visits showed that three sites, Sg. Tabong, Pasir Tempan, and Sg. Kerlis were used most by otters (Table 1)(Fig 1). Consequently, the most number of otters was recorded from Pasir Tempan(11), Sungai Kerlis(9), and Jeram Belau (8) respectively (Table 1).

DISCUSSION

The study indicated that three areas namely Sg. Tabong, Pasir Tempan, and Sg. Kerlis were used most by otters in the study area. One of the characteristic found to be common among these three sites was the presence of rapids and deep pool in each of the site. These pools which are abundant with prey species are visited by the otters in search for food. Otters were also observed to catch fish near the rapids where the water is much shallower. Some of the common fishes found in these pools include the Temelian (Puntius bulu), Kerai (Puntius daruphani), Kelah (Tor tambroides), Baung (Mystus baramensis) and Belida (Notopterus notopterus). Udang galah is also abundant during certain period of the year.

Another feature that is common in these sites is the presence of sand banks which the animal use as their resting area after feeding. Traces of the animal resting and rolling were found on these sand banks during visits to Pasir Kempan. It should be noted that sandy banks are only present in several areas along the Tembeling river. Most areas along the river bank are either made up of rocks or steep banks thus making them unsuitable for resting areas. Therefore, the frequency of otter visits to the various sites in the study area could be influenced to some extent by the presence of these sandy banks. Both MacDonald (1986) and Lesley (1982) indicated that resting area forms an integral part of otter habitats and the presence of good resting areas can influence the distribution pattern of otters in an area.

Sungai Tabong and Sungai Kerlis are two small rivers which flow into the Tembeling river. These rivers are frequently used by the otters based on the signs found in the vicinity. An otter nest was also found under the bankside vegetation in Sungai Kerlis. It is interesting to note that no otters were observed in the Tembeling river when the water level was high due to heavy rain. It could be possible that these animals confined themselves to the smaller rivers during this period as the river was too fast and strong for them. Furthermore, no sand bars are present along the Tembeling river during this period as these areas are usually under water.

The presence of boats and fishermen in the study area did not affect the presence of otters. This was due to the fact that there are less boats passing this stretch of the Tembeling river compared to the lower part of the river where most villages are located. Currently, there are only three villages located between the park headquarters at Kuala Tahan and Sungai Sepiar, on the eastern part of the park. The otters are more frequently observed in the study area compared to the lower part of this river. Therefore, it could be assumed that these animals are not seriously affected by the human activities in the river. Most activities in the river like boating and fishing are carried out during the earlier part of the day while most otters are observed during early evening and at night. However, these animals can be observed during daytime in areas where human activities are minimum or absent. Nevertheless, further increase in human activities especially boating if not controlled will to a certain extend affect the habitat use by otters in the area. This will lead to either the migration of otters from this area or reduction in the number of otters due to the limited habitat available to these animals.

CONCLUSION

This study showed that the habitat selection pattern by otters in Taman Negara is governed by several factors found in each selected site. These factors when present together would provide an ideal habitat for otters in Taman Negara. Although human activities are present, they are not detrimental to the extend of affecting the habitat use in the area by otters. However, it is assumed that further increase in human activities in the river will to a certain extend affect the habitat use pattern of otters in the river.

ACKNOWLEDGEMENT

We wish to extend our gratitude to the staff of Taman Negara, especially to the Deputy Park Superintendant, Ahmad Azhar Mohamad and the Research Unit of Taman Negara for assisting in the data collection during the study period. We also appreciate the support given to us by En. Jasmi Abdul, the Head of Research, Management and Development Section of the Department of Wildlife and National Parks, Peninsular Malaysia.

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PRELIMINARY STUDY ON TRANSLOCATED ELEPHANTS AT SUNGAI CHENANA, NATIONAL PARK TERENGGANU.

By

HASSAN KASSIM

INTRODUCTION

In Mac 1984, nine elephants were marooned in isolated island while the formation of Kenyir lake. All of them were translocated to mainland nearby.

Since 1989 until september 1991 thirty eight elephants were translocated to Sungai Chenana which was about 6 km. from the place mentioned above. These elephants came from all over the country which faced problem to aggriculture andother development.

All the translocation were carried out to save the elephants from extinction because their habitat became smaller which were converted to development project.

The objective of the study was to relocate the elephants. The study will touch on the formation of group and their social structure. The failure or success of such translocation can be seen from motality and natality as a result to adapt new habitat.

The study area is situated at the South-West of Kenyir Lake in State of Terengganu. It was a forest reserve and bordering part of Taman Negara (Figure 1).

North part of the study area was surrounding by lake. Most of the land was hilly and the altitude is between 140m to 940m. Sungai Chenana is one of the main river which is running to the East of the study area. Others rivers are sungai Lawit and sungai Genong which are running to the West of the study area. Several streams have formed during raining season and finally dry out when dry season has begun.

Vegetation types in the study area are hilly dipterocarp forest and montaneous dipterocarp. All the lowland dipterocarp below 145m a.s.l. have submerged.

METHOD

In general method that had been used in the study was to investigate identified areas which frequently visited by the elephants. This indirect method is stressed on elephants tracks such as footprint, path and trail , dung piles and feeding. Direct observations were also recorded although the chance to have visual contact was very seldom.

The study was started in Ogos 1991 until Februari 1992. Four personel of the department involved in the study. The schedule of the trip to the field as shown in table 1.

Compass and topography map were used to determine the direction and position of elephants tracks and were plotted into the map. The measuring tape were used to measure the lenght and widht of elephant's footprint.

The study sites were visited by boat and then walk up further into the forest following the elephant's track. The sites were identified as areas which were frequently visited by elephants. The criteria of the chosen areas based on riparians, bay of the lake, old logging road, hill ridge and the edge of the lake. The sites were often visited to know wether the elephants had come and utilized to the sites.

The size of the footprints were recorded which was including the lenght and wide of the footprint. The size of the centre nail were also recorded. The dung piles were also counted along the trails. If the elephants were seen, their number, sex and activities were recorded too.

Four study sites were identified. All of them were visited oftenly to investigate whether the elephants had come to utilized the areas. The study sites as describe below;

1. **Sungai Chenana-upper Sungai Chenana**

   The river is a border between forest reserve and National Park which has two streem,sungai Penubong and Sungai Lata jagong.

2. **Sungai Pengait**

   The valley of the river was submerged and formed river bay between two hilly. Old logging track can be clearly seen in the forest vacinity. In past this area was active in logging.

3. **Sungai Kepayang**

   Since 1989, thirty eight elephant had been released here. The embarkation area for elephants with pontoon situated not far from the river tributary. The surrounding area is hilly terrain and the highest peak is Bukit Kelebor (947m).

4. **Sungai Buai**

   The area is situated to the North of the study area. In 1984, nine elephants were translocated here after they had marooned in 'main made' island while the formation of Kenyir lake. The distance between the area and Sungai Kepayang is about eight kilometer only. Both areas are separated with the range of Bukit Kelebor and Bukit Arong.

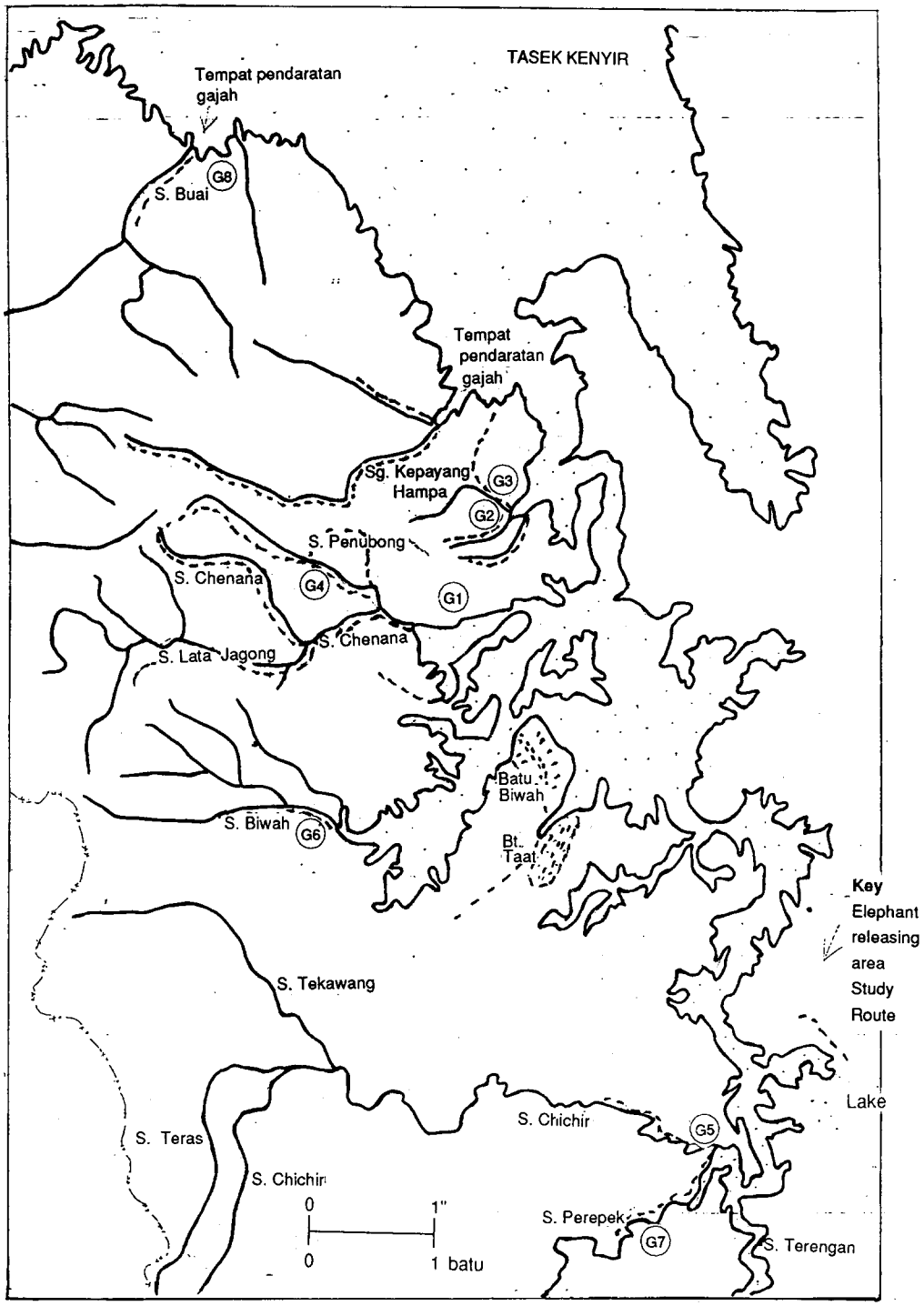

Figure 1. Distribution of Elephant in Study area.

5. **Sungai Terenggan-Cicir-Perepek**

The location of the area is in National Park. As same as Sungai Biwah it is more flatter terrain than others. Both the rivers tributary join together before meet Sungai Terengan

Table 1: Study trips to the study area

No. of visit	Date			Days of study
1.	7.8.91	-	14.8.91	6
2.	23.9.91	-	29.9.91	4
3.	25.10.91	-	30.10.91	5
4.	16.11.91	-	21.11.91	5
5.	14.12.91	-	19.12.91	5
6.	11.1.91	-	22.01.91	10
7.	24.2.92	-	2.3.92	6
8.	18.3.92	-	27.3.92	7
			Total days	38

RESULT

During the study, the frequency to find the elephants tracks were 22 time. Only 2 times had visual contact with them. Most of the tracks were found around less than five kilometer from the released area. It shown that the elephants were still living in the vicinity of the released area. Most of the time the elephant were seen solitary. But sometime it was seen in group.

About eight group of elephants were identified (Table 2). Group of G2 consisted nine members whish were 2 juvenile, 2 sub-adults and five adults. The group was found roaming near Sungai Pengait. Other group, the G8 contained twelve members which were roaming around Sungai Buai. The age structure of the group was 1 calf, 2 juvenile, 5 sub-adults and 4 adults.

In Sungai Chenana, there was one group of elephants (G4) with members of

4 adults. A solitary elephants were also found in three different places i.e. Sungai Chenana (G1), Sungai Pengait (G3) and Sungai Terengan (G5).

Table 2: Translocation of elephants from Buai Island to the study area

Date transfered	fft	sex	Age structure
16/3/84.	29.2	female	sub-adult
12/3/84.	34.3	female	adult
19/3/84.	29.2	male	sub-adult
19/3/84.	28.6	female	sub-adult
20/3/84.	36.8	male	adult
21/3/84.	40.6	female	adult
21/3/84.	15.2	male	calf
22/3/84.	39.4	male	adult
22/3/84.	39.4	female	adult

Table 3: Translocation of elephants from various districts to the study area from 1987 to Sept.1991

No.	Date transfered	ffd	sex	Age structure
1.	/ 87	31.3	female	sub-adult
2.	87	27.9	male	sub-adult
3.	7/3/89	36.8	female	adult
4.	7/3/89	33.0	female	adult
5.	24/5/89	27.9	female	sub-adult
6.	24/5/89	33.0	male	adult
7.	31/5/89	30.3	female	sub-adult
8.	31/5/89	27.9	male	sub-adult
9.	28/9/89	33.0	male	adult
10.	7/10/89	41.9	male	adult
11.	11/10/89	29.2	male	sub-adult
12.	26/10/89	33.0	male	adult
13.	7/11/89	29.2	female	sub-adult
14.	7/11/89	25.4	male	sub-adult
15.	12/11/89	31.8	male	sub-adult
16.	13/11/89	43.2	male	adult
17.	16.2.90	35.6	female	adult
18.	14.3.90	43.2	male	adult
19.	16.6.90	40.6	male	adult
20.	20/7/90	21.6	male	juvenile

No.	Date transfered	ffd	sex	Age structure
21.	30/8/90	39.4	male	adult
22.	17/9/90	32.8	male	adult
23.	8/11/90	27.9	male	sub-adult
24.	8/2/91	36.9	female	adult
25.	8/2/91	22.9	male	juvenile
26.	5/3/91	35.6	female	adult
27.	5/3/91	33.0	female	adult
28.	1/4/91	38.1	female	adult
29.	30/4/91	35.6	female	adult
30.	13/5/91	33.0	female	adult
31.	16/6/91	41.9	male	adult
32.	30/6/91	38.1	female	adult
33.	9/7/91	22.9	male	juvenile
34.	9/7/91	38.1	female	adult
35.	27/8/91	30.5	female	sub-adult
36.	27/8/91	30.5	female	sub-adult
37.	13/9/91	40.6	male	adult
38.	16/9/91	33.0	female	adult

Table 4: Composition of the elephant population in study area based on number being released and track count data collected.

	ACTUAL NUMBER	TRACK COUNT
ADULT	62%	59%
SUB-ADULT	30%	26%
JUVENILE	6%	12%
CALF	2%	3%

DISCUSSION

The total of elephant which have been translocated in study area is 47 elephants. Nine of them were translocated in 1984. The first operation was succesfully done in two weeks only because the elephants had been marooned in isolated 'island' closely to mainland naer Sungai Buai.

In 1989, the translocation to this area was started again but this time the elephants were captured and translocated here from time to time. Since that thirty eight elephants had been released here. These elephants had come from district all over the Peninsular which had faced the elephant problem. Since that year,all the elephants had been released near Sungai Chenana which was about six kilometer from Sungai Buai.

Base on foot track, about thirty four elephants were relocate again. Others may be have migrated to the South-west of the study area or crossing the lake to the East.

During the study, no carcus was found. It shown that the elephants have survived in this new habitat.

Although after seven years the elephants had been released here, Group of G8 was still staying around that area. But there was slightly different in age structure. At least three calfs were born. While translocation, the age structure of the group was 1 calf, 3 sub-adult and 5 adult but now the age structure of the group have become 1 calf, 2 juvenile, 5 sub-adult and 4 adults.

Although part of their origin habitat had been submerged, the group was still staying together because the remaining habitat was part of their homerange. Translocation occured within their homerange. The situation is different comparing with elephants which were translocated affter 1989.These elephants came from different herd and different places. They were released here not simultineously but whenever there was an operation.

From the study, it was obtained that few elephants had formed several groups and utilized the releasing area as part of their homerange. For example, group of G2 consisted 9 elephants. This group was found at Sungai Pengait. The age structure of the group was 2 juvenile, 2 sub-adults and 5 adults. Although there was no parental relation between them because of originating from different herd and places but they could have formed grouping.

Other elephants were still scatterd in that area. Few of them had formed small group consisting of 2 or 4 animals. Most of them were still solitare especially which were newly introduced to the area. From observation,none of them had given birth except group of G.8. The elephants need time to establish their group firstly before they could produce their youngs.

ACKNOWLEGMENT

We would like to express of thanks to the Director General of DWNP for his approval to us to carried out the study. And we also would like to express thanks to the head of research, management and developmement who spares his time to give comment and advise to our study.

Our grateful thanks to all staff of the department who assist us during collecting data. We could not carried out our study successfully without their help.

We also appreciated to the Director of DWNP Terengganu and staff who have given us facillities and effort to get the study in progress.

A RADIOTELEMETRY STUDY OF THE HOME-RANGE OF A WATER MONITOR (*Varanus salvator*) AT BUKIT SUNGEI PUTIH FOREST RESERVE, CHERAS

BY

JASMI BIN ABDUL

INTRODUCTION

Monitor Lizards (*Varanus spp*) are familiar reptiles. Among the four species recorded in Peninsular Malaysia (Harrison & Lim, 1957), two species, the Water monitor (*V. salvator*) and the Clouded monitor (*V. nebulosus*) are common occurrences in open habitats and secondary forested areas while the other two species, the Harlequin monitor (*V. rudicollis*) and the Dumeril's monitor (*V. dumerilii*) are more restricted to pristine type of forest. In Peninsular Malaysia there is hardly any field study being carried out on the status of the *V. rudicollis* and *V. dumerilii* including the *V. nebulosus*, the latter is as common as the *V. salvator* but is not as abundant. Lim (1958) studied the behaviour habit and the speed of travel of a *V. rudicollis* in captive condition only, and probably this was the only observationary study carried out among one of the these three species.

The Water monitor (*V. salvator*), the largest and most common and abundant amongst the four *Varanus* spp. is known of its economic importance. Economically it provides substantial good income to animal's traders especially in terms of foreign exchange. Approximately 60,000 to 100,000 of this monitor lizard skins are being exported yearly with the return of between MR 600,000 to MR 1,000,000 through Peninsular Malaysia (Jasmi, 1989). Based on the exported yearly figures it is undoubtedly that this particular monitor lizard must have a high capacity of reproduction rate in nature. However, it is doubtful whether the natural population could continue to be sustainable for the long-term economic yield despite the fact that the mangrove forest, the primary habitat of this monitor lizard, is deteriorating due to development of other economic needs. Although the species is also found in other eco-types of habitats, but there is not muchinformations available to date regarding the status of this species of viable economic importance, such as the distribution and population density in the different eco-habitat types.

In view of this fact, a study on the movement of this monitor lizard was carried out by radiotelemetry in its wild state. Using this method, it is hopeful that such an exercise would provide a more indept knowledge of the behaviour pattern of this monitor lizard in its natural state.

STUDY AREA

The study was carried out at the Bukit Sungai Putih Forest Reserve (BSPFR). In 1932, this forest was set aside as a wildlife reserve. But in later years it was degazetted and put under the Forest Reserve. The BSPFR forms a small valley in which a small stream called Sungai Putih flows to the south into Sungei Langat. The forest is a logged over forest with the remaining 40 hectares of good secondary standing forest under the Federal Territory. Much of the area has been developed especially on the northern and southern parts. The forest is also used by the Police Field Force personnel for their jungle warfare training from time to time. One hectar of this forest area was given to the Department of Wildlife and National Parks (DWNP) to build its headquarters which was completed in September 1986.

The study area covers, approximately 500 metres long and 30 metres wide which is close to the DWNP office headquarters. This area consists of a small stream and a natural fish ponds. The Department of Irrigation and Drainage (DID) water supply pipe, is located about 200 metres from the DWNP headquarters passed through this area. The Water monitor, (*V. salvator*) inhabits this patch of the forest and is often sighted near the fish pond at around the small stream in the area.

METHOD

On 17th February 1989, four sets of soft nylon snare were set at the fish pond and small stream. The type of nylon snares set was similar to the one that used by Jasmi (1986) at Sungai Tembeling. Two were set near the fish pond and the other two were set south at approximately 300 meters downstream from the fish pond. Dead fish 'ikan selar kuning' were used for baiting.

On 17th February 1989 about 9.45 a.m. an adult female (V. salvator) was caught near the fish pond. The animal weighed 3,100 gm, total length 140.4 cm, body and head length 54.5 cm, tail length 85.9 cm, and body circumference 27 cm. The colour of the body was rather reddish probably caused by the colour of the laterite or soiled by the reddish colour of the water from the pond. No external parasite was found from the animal. A small radio transmitter with 164.374 frequency was collared on the neck of this reptile. The weight of this radio transmitter was approximately 10 gm. This radio transmitter when tested have a range of about 1000 metres.

At about 11.00 a.m. on the same day, the animal was released to where she was captured. Upon released she ran across the pond to the bushes on the other side of the pond and disappeared. Daily monitoring was carried out by a researcher equipped with a radio receiver model TRX-1000S. A portable antenna and a ear phone was assigned to locate the position and movement of the animal in the morning, midday and in the afternoon.

A field data sheet was also used to record the daily movement activity and position of this animal. Sometimes data were not available because of rainy days or the