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SAMBAR DEER BIOLOGICAL DATA COLLECTED FROM SEVEN STATES OF PENINSULAR MALAYSIA DURING HUNTING SEASONS, OCTOBER TO NOVEMBER 1982 AND 1983

by
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ABSTRACT

In 1982, the male/female sex ratio of kills in the states of Terengganu, Kelantan and Pahang was 2:1.

This could be for two possible reasons:-

(a) In these states the number of bucks were twice that of the does OR

(b) More bucks were killed because during this time i.e. October and November, the bucks were in rut and were consequently more active

The overall male/female sex ratios obtained in 1982 and 1983 were 2:1 and 1:1 respectively.

No meaningful conclusions could be made for the age structure of the wild deer in the jungle today because of the small sample size. Only 19 lower jaws were collected and out of this, 16 were from the state of Perak. Most of the animals killed were between 2 – 2½ years and 3 – 4½ years.

ABSTRAK

Pada tahun 1982, nisbah rusa jantan/betina yang dapat ditembak di negeri Terengganu, Kelantan dan Pahang ialah 2:1. Di sini terdapat dua kemungkinan sebab-sebabnya iaitu:-

(a) di negeri-negeri ini bilangan rusa jantan adalah dua kali ganda bilangan rusa betina

(b) lebih banyak bilangan rusa jantan dapat ditembak kerana pada masa ini iaitu dibulan Oktober dan November, rusa jantan adalah di dalam musim membiang dan ianya lebih aktif

Keseluruhan nisbah rusa jantan/betina diperolehi dalam tahun 1982 dan 1983 ialah 2:1 dan 1:1.

Kesimpulan yang bermakna tidak dapat dibuat ke atas rusa-rusa liar di hutan kerana saiz sampel yang diperolehi adalah kecil. Hanya 19 rahang bawah dapat dipungut, 16 darinya adalah dari negeri Perak. Kebanyakan rusa yang dapat ditembak ialah berumur antara 2 – 2½ tahun dan 3 – 4½ tahun.

INTRODUCTION

Under the wildlife Protection Act 1972, the open season for deer hunting is from September to November each year. A close season was declared from 1977 until 1982 after which a 2 month open season was declared. This open season was from October to November and arrangements were made to collect as much data as possible from hunters. A total of 108 and 110 animals were shot in 1982 and 1983 respectively, Uteri, fetus, ovaries, lower jaws, hind feet, lung, liver, skin from the neck sore and ectoparasites were collected. In addition some animals were waighed and body measurements taken. For males measurements of the antlers were also recorded.

Aim

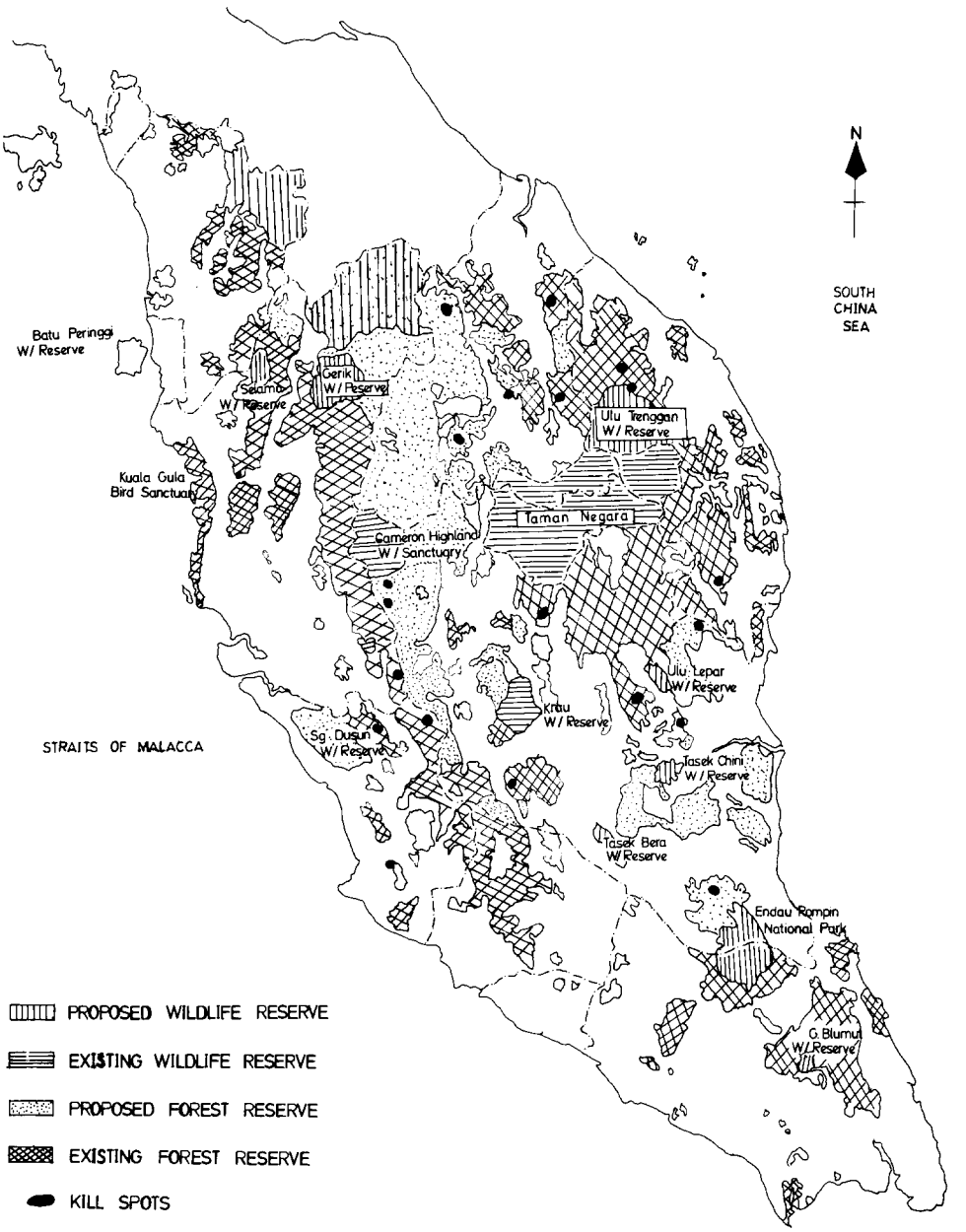
To analyse data of deer shot in the 1982 and 1983 open seasons in Peninsular Malaysia.

MATERIAL AND METHOD

A survey form was designed and distributed to the states concerned. All soft tissues were preserved in 10% formalin. Lower jaws were boiled to remove flesh and soaked in chloroform overnight.

Reproductive organs, fetus and soft tissues were analysed by the veterinary department of the Agriculture University, Malaysia.

The map (Fig. 1) shows the location of some of the kills.



RESULT AND DISCUSSION

The overall kills:

The distribution by state and number of animals killed shown in tables 1a and 1b. Out of 108 and 110 animals reported killed only 17 lower jaws were collected i.e. eighteen in 1982 and nine in 1983. The parameter measured most in 1982 were the antlers while in 1983 other measurements were made as well. Very few specimens were collected and measured due to the poor co-operation from the hunters.

Table 1a. No. of animals measured or collected in 1982

State	MEASUREMENT MADE									PARTS COLLECTED						
	Total Kill	Bosy Wt.	Forw leg	Hind Leg	Antler	Animal height	Body circum-ference	Body length of month to tale base	Open wetsore	Lower jaw	Ectoparasite	Fetus	Repro-ductive organs	neck sore skin	lung	liver
Kelantan	8	4	4	4	3	4	4	4	2	–	–	–	–	–	–	–
Terengganu	10	1	1	1	–	1	1	1	1	2	–	–	1	1	–	–
Pahang	68	4	4	4	26	4	4	4	2	2	3	–	1	1	2	2
Johore	2	1	1	1	1	1	1	1	1	1	1	1	–	–	–	–
Selangor	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
N. Sembilan	1	1	–	–	1	–	–	–	–	–	–	–	1	–	–	–
Perak	17	15	8	8	5	15	15	15	4	13	2	4	5	1	4	4
Total	108	26	18	18	35	25	25	25	10	18	6	5	8	3	6	6

Table 1b. No. of animals measured or collected in 1983

State	MEASUREMENTS MADE										PARTS COLLECTED					
	Total Kill	Body Weight	Fore Leg	Hind Leg	Antler	Animal Weight	Body Circum-ference	Body length from mouth to tale base	Open wetsore	Lower jaw	Actoparasite	Fetus	Repro-ductive organs	Neck more skin	Lung	Liver
Kelantan	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Terengganu	26	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–
Pahang	29	3	6	6	5	4	5	6	4	1	2	–	–	–	1	1
Johore	2	1	2	2	2	2	2	2	1	2	1	–	–	–	–	–
Selangor	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
N. Sembilan	5	3	5	5	5	3	5	5	4	–	–	–	–	–	–	–
Perak	11	11	11	11	4	11	11	11	2	5	4	3	3	–	5	5
Total	110	18	24	24	16	20	23	24	11	9	7	3	4	–	6	6

Hunter success

The number of deer killed per licence issued or hunter success in both hunting seasons is indicated in table 2.

Tabl3 2. Number of kills against number of licences issued

State	Total shot		No. of licence issued		No. of deer caught per licence		Forested areas in December 1981 (hectare)
	1982	1983	1982	1983	1982	1983	
Perak	17	11	83	76	0.21	0.14	1,077,049
Selangor	2	–	27	9	0.07	0.00	287,915
N. Sembilan	1	5	18	13	0.07	0.38	174,471
Johore	2	5	36	49	0.06	0.13	694,463
Terengganu	10	26	60	107	0.17	0.24	707,486
Pahang	68	59	270	342	0.25	0.17	2,189,087
Kelantan	8	4	25	31	0.32	0.13	681,794
	108	110	519	618	0.21	0.18	6,012,265

The overall number of deer shot per licence in 1982 and 1983 were 0.21 and 0.18 respectively. In 1982 Kelantan showed the highest hunter success i.e. 0.32 followed by Pahang and Perak. Negeri Sembilan and Johore showed the lowest hunter success i.e. 0.06 while in 1983 Negeri Sembilan showed the highest hunter success followed by Terengganu and Pahang with Selangor being the lowest.

The states of Perak, Pahang and Kelantan with relatively large areas of forest, all showed a decrease in deer kills for 1983. The decreases were 33.3%, 32.0% and 59.4% respectively.

The decrease in hunter success in these states indicate a decline in deer population. There may be cases of kills not reported for fear of arrest as a result of poaching, killing, immature animals or in access of bag limit but this is believed to be negligible.

The decline in the population of wild deer today could be clearly seen from the total number of kills. According to Khan (1967), in the years 1959 and 1960 the total number of kills in the state of Perak alone were 132 and 110 animals respectively. Whereas in 1982 and 1983, only 108 and 110 animals respectively were shot in the whole of Peninsular Malaysia.

In general the take of all game can be related to population density. Since no factor other than abundance serves to explain the fluctuations in the kill of the game, it is assumed that the total take of each species was broadly proportional to their populations.

Hunting pressure is affected by the number of licences issued. An increase in the number of licences issued in the states of Pahang, Kelantan, Terengganu and Johore in 1983 indicate an increase in the hunting pressure in these states. To reduce this pressure, the number of licences issued should be limited or reduced.

Sex ratio

The sex ratios of the kills obtained from the various state are shown in table 3.

Table 3 shows that during the 1982 hunting season, the number of males shot were twice that of females in the states of Pahang, Kelantan and Terengganu while in Perak the number of females killed were twice that of males.

In 1983, an equal number of males and females were killed in Perak while in Pahang twice as many males than females were killed. The overall male female ratio of deer killed in 1982 and 1983 were 2:1 and 1:1 respectively.

Table 3: Sex ratio of kills

Year	State	Total shot	Male	Female	Male : Female
1982	Perak	17	5	12	1 : 2
	Selangor	2	2	–	2 : 0
	N. Sembilan	1	1	–	1 : 0
	Johore	2	–	2	0 : 2
	Terengganu	10	7	3	2 : 1
	Pahang	68	47	21	2 : 1
	Kelantan	8	5	3	2 : 1
	Total	108	67	41	≃ 2 : 1
1983	Perak	11	5	6	1 : 1
	Selangor	–	–	–	–
	N. Sembilan	5	5	–	5 : 0
	Johore	5	5	–	5 : 0
	Terengganu	26	10	16	≃ 1 : 2
	Pahang	59	35	24	≃ 2 : 1
	Kelantan	4	1	3	1 : 3
	Total	110	61	49	≃ 1 : 1

Age Structure

The age structure of kills obtained during both the hunting years are shown in table 4:

Table 4. Age Structure of the kill

Age Group (Year)	1982			1983		
	Buck	Doe	Total	Buck	Doe	Total
1 – 1½	1	–	1	–	–	–
2 – 2½	2	2	4	1	3	4
3 – 3½	5	3	8	3	3	6
4 – 4½	2	1	3	–	–	–
5 – 6½	3	3	6	3	–	3
7 – 8	–	1	1	4	–	4
> 8	1	–	1	1	1	2

The animals shot were aged by looking at tooth eruption and tooth wear in the lower jaws. In both years most of the animals killed were around 3 – 3½ years of age. Only one immature animal was reported killed and that was in 1982. Animals reported killed above the age of eight years were very few, being only one in 1982 and two in 1983.

Reliable age samples help to measure the effect of hunting on a deer herd. Age classification may provide some idea of the success or failure of a fawn crop. After five years of close season, the fawn and juvenile class made up 21.0% of the total kill in 1982 and 1983. From the study carried out in 1964, 1965 and 1966 by Khan (1967), the fawn and the juvenile class made up 64% of the total kill. This figure is very much higher than the figures obtained in 1982 and 1983.

Body measurements

From tables 5a and 5b, the body length of the largest male was 236.2 cm and that of female was 230.0 cm.

For body weight the heaviest female and male weighed 210.0 kg and 175.8 kg respectively. The lightest female weighed 78 kg and stood 102.2 cm at the shoulder.

According to Kitchener (1961), Malayan Sambar ranks second in size after the Indian Sambar. Well-grown specimens exceed 114 cm at the shoulder.

Antler

Measurements of antlers were made according to existing standards. From table 6a & 6b, out of 47 animals measured during these 2 years of hunting seasons, only 9 animals had 2 tines on each antler. The rest of the animals had 3 tines on each side. The longest antler measured was 64.0 cm with diameter beam of 6.4 cm. The biggest diameter beam obtained was 7.6 cm and the widest spread was 56.0 cm.

Table 5a. Weight and body dimensions of deer killed in 1982

Age (yr)	Body Weight (kg)		Animal height (cm)		Body circumference (cm)		Body length (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female
2		78.0		87.5		127.5	155.0	
2½		73.0		102.3		120.0		150.0
3	78		107.5		150.0		200.0	
3		*104		106.5		110.0		198.0
3		127.5		104.0		115.0		180.0
3		137.5		110.5		130.0		185.0
3½	196.7		120.0		162.0		203.0	

Age (yr)	Body Weight (kg)		Animal height (cm)		Body circumference (cm)		Body length (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female
4		130.2		114.3		114.0		200.0
4	168.0		121.0		122.0		220.0	
4		*125.4		109.0		116.0		202.0
4½	205.0		128.1		165.0		205.3	
5	210.0		103.7		152.5		235.0	
5	195.1		102.2		151.0		155.0	
5	183.3		127.0		139.0		226.0	
5		*163.2		116.5		120.3		211.0
5½		143.4		115.0		132.0		199.1
6	180.5		107.0		160.0		236.2	
6½		*145.5		115.1		130.0		210.0
7–8	121.0							
7–8	193.8		125.0		136.0		814.2	
7–8		150						
–	120.5		112.1		107.0		152.0	
–		*175.8		115.0		140.0		230.0
–		138.0		109.2		119.0		196.3
–	120.0		120.7		150.9		183.0	
–		153.1		110.4		160.0		200.0

*Pregnant female

Table 5b. Weight and body dimensions of deer killed in 1983

Age (yr)	Body weight (kg)		Animal height (cm)		Body circumference (cm)		Body length (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female
2½		*119.0		110.0		109.2		181.0
2½		145.0		110.1		170.3		180.0
3		*106		107.0		108.0		167.2
3		*140		110.2		140.0		170.0
3½		*117.0		104.0		120.2		173.0
3½	144.2		113.5		123.2		208.0	
3½	•150.0		124.0		126.0		153.2	
3½	205.0		120.0		150.1		200.0	
3½			118.0		203.0		221.1	
4½		*134.5		110.0		125.0		178.0
5	201.0		132.0		145.5		204.0	
5½	205.0		135.0		144.0		204.3	
5			110.0		185.2		197.0	
7–8	170.0		123.0		166.0		182.0	

Age (yr)	Body weight (kg)		Animal height (cm)		Body circumference (cm)		Body length (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female
7					154.9		216.0	
7	150.0		127.0		152.5		190.5	
8½	210.0		134.6		142.2		211.9	
–		150.0		118.5		128.0		170.0
–	180.0				132.1		201.0	

• No antler

* Pregnant

Table 6a. Antler measurements of deer killed in 1982.

Age	Right Antler					Left Antler					Widest spread (cm)
	No. of times	a1 (cm)	b1 (cm)	c1 (cm)	Diameter beam (cm)	No. of times	a2	b2	c2	Diameter beam (cm)	
5	3	34.0	32.3	14.0	4.5	3	35.0	33.2	14.5	4.6	30.0
4	3	30.5	28.0	13.0	4.2	3	29.0	26.0	13.8	4.4	37.0
7	3	62.5	61.0	18.0	5.7	3	63.3	60.5	19.0	6.1	46.2
3–5	3	30.0	27.2	18.5	5.9	3	32.5	31.5	18.0	5.7	37.5
4–5	3	50.5	49.0	19.0	6.1	3	50.0	48.5	19.0	6.1	56.0
3	2	37.5	36.0	10.2	3.2	2	35.5	34.0	10.5	3.3	19.8
–	3	40.8	38.5	10.9	3.5	3	40.0	38.0	10.6	3.3	–
–	2	40.0	38.5	15.0	4.8	2	40.1	38.4	15.0	4.8	34.3
7–8	3	23.0	21.0	14.2	4.5	3	25.0	23.0	14.0	4.5	47.5
–	3	45.3	43.0	14.0	4.5	3	40.0	46.0	14.5	4.6	–
–	3	46.0	44.0	18.1	5.7	3	47.0	46.2	17.5	5.6	38.5
–	3	41.0	40.0	15.0	4.8	3	39.0	37.0	15.0	4.8	25.0
–	3	51.0	50.0	14.0	4.5	3	54.0	52.5	14.0	4.5	34.0
–	3	50.0	48.0	14.0	4.5	3	43.7	42.5	14.0	4.5	39.0
–	3	45.2	43.0	15.0	4.8	3	49.0	46.2	14.5	4.6	32.0
–	3	46.0	43.0	18.0	5.7	3	47.0	46.0	17.5	5.6	38.5
–	3	64.0	61.0	20.0	6.4	2	62.0	60.0	20.0	6.4	26.0
–	2	37.0	35.5	19.0	6.0	2	40.0	39.0	19.0	6.0	30.0
–	2	39.0	38.0	15.0	4.8	2	39.0	37.0	14.0	4.6	30.0
–	2	40.5	38.5	12.5	4.0	2	40.0	39.0	12.5	4.0	33.5
–	2	16.0	15.0	10.0	3.2	2	16.0	14.5	10.0	3.2	11.0
–	2	30.5	29.0	15.5	4.9	2	30.0	28.8	15.5	4.9	35.0
–	2	43.0	41.5	23.0	7.3	2	43.5	41.6	24.0	7.6	36.0
–	3	44.5	41.5	11.4	3.6	3	41.9	41.3	11.4	3.6	36.8
–	3	50.5	50.0	17.5	5.6	3	52.0	51.0	17.0	5.4	34.0
–	3	54.8	51.5	16.0	5.0	3	56.0	52.7	16.6	5.3	27.5
–	3	33.8	32.4	14.0	4.5	3	35.0	33.4	13.2	4.2	28.5
–	3	38.0	36.0	15.5	5.5	3	38.0	36.2	18.4	5.9	29.4
–	3	46.0	44.0	16.0	5.0	3	45.0	43.5	15.0	4.8	23.0
–	3	48.5	46.0	16.5	5.3	3	47.0	45.0	16.0	5.0	22.7
–	3	36.0	35.0	11.5	3.6	3	37.5	35.0	12.0	3.8	21.5

Table 6b. Antler measurements of deer killed in 1983.

Age	Right Antler					Left Antler					Widest spread (cm)
	No. of times	a1 (cm)	b1 (cm)	c1 (cm)	Diameter beam (cm)	No. of times	a2 (cm)	b2 (cm)	c2 (cm)	Diameter beam (cm)	
7	3	52.0	46.0	20.0	6.4	3	54.0	48.0	20.0	6.4	32.0
5	3	25.0	23.5	14.0	4.4	3	29.0	27.2	14.4	4.6	25.0
5–5	3	51.0	49.0	14.5	4.5	3	50.0	58.0	14.0	4.4	28.5
4–5	3	34.0	32.0	11.0	3.5	3	33.0	32.0	11.0	3.5	20.0
6	3	56.0	52.0	19.8	6.3	3	57.0	53.3	18.8	5.9	33.6
4–5	3	42.5	36.5	15.0	4.8	3	42.5	37.0	15.0	4.8	35.0
7	3	52.1	51.0	20.3	6.5	3	53.3	52.1	20.3	6.5	52.1
8	3	52.0	50.7	20.2	6.4	3	48.2	46.0	20.2	6.4	31.8
7	3	40.7	42.0	14.8	4.7	3	43.2	42.0	15.0	4.8	22.4
10	3	32.7	32.0	17.7	5.6	3	32.0	31.0	17.5	5.6	30.4
8–5	3	52.1	50.2	22.9	7.3	3	52.3	50.1	22.9	7.3	43.2
–	3	48.0	45.0	18.0	5.7	3	47.0	44.0	20.0	6.4	41.0
–	3	53.3	48.3	16.5	5.3	3	45.7	39.1	19.0	6.0	33.1
3–5	2	16.0	13.0	18.0	5.7	3	17.0	13.5	18.0	5.7	28.0
5	3	27.0	25.0	18.2	5.8	3	27.5	25.5	18.4	5.9	27.0
–	3	52.0	49.5	16.0	5.1	3	52.0	50.5	16.0	5.1	37.0

a1 & a2 = measurement from base to tip of the right and left antler on the outside curve.
b1 & b2 = measurement from base to tip of the right and left antlers on the inside curve.
c1 & c2 = circumference of the right and left antler beams.

Diameter beam of 3.2 cm was the smallest measurement obtained. From the study carried out in Perak by Khan (1967) the biggest and the smallest diameter beam were 9.4 cm and 3.6 cm respectively. Diameter beam is measured at a point 4.0 cm above the burr.

According to Kitcherner (1961), the second antler which is 2 tines, completed its growth at the age of 2½ years. The length of antler from burr to the tip of the beam was 38.1 cm. From the results obtained the longest antler with two tines was 43.0 cm.

Sambar antlers of a length in excess of 63.5 cm measured along the curve of the beam from burr to tip was considered good trophies for this country. From the measurements taken in 1982 and 1983 only one animal had antlers exceeding this measurement.

Analysis of female reproductive organs

In the 1982 hunting season, eight foetuses, five females and three males were collected. In 1983, four foetuses, three females and one male were collected. Only the female reproductive organs were analysed. Reproductive tissues from the males were damaged due to poor treatment.

To evaluate the state of pregnancy, the uterus and the fetus were identified as described in tables 7 and 8:

Table 7. Uterus

Stage of Pregnancy (months)	Number of maternal cotyledon in the uterus	Size of maternal cotyledon Biggest L (cm)	W (cm)	H (cm)	Smallest L (cm)	W (cm)	H (cm)	Appearence of maternal cotyledons
2	6	6.1	4.0	1.0	2.5	2.0	1.0	Mushroom shape
6–7	5	13.0	5.0	5.0	12.1	4.5	3.0	Kidney shaped
8–9	7	24.0	7.2	5.0	18.0	5.3	3.2	Swollen Kidney shaped
2 weeks after conceived	4	17.0	4.5	2.4	15.0	4.0	2.0	Shrinked kidney shaped

L = Lenght
H = Height
W = Width

The physical features of the female reproductive organs and the fetus are shown in plates, 1a to V.

The features obtained were of different ages varying from 2 months to 8–9 months. The 8–9 month old fetus weighed 6.3 – 6.5 kg. and the 2 month fetus weighed 0.30 – 0.32 kg. (table 8). The size and shape of maternal cotyledons vary with the stage of precnancy (table 7).

Table 8. Fetus

Sex	Age (month)	Weight (kg)	Length from mouth to tail base	Crown-rump (cm)	Curved crown rump (cm)	Vertebral Column (cm)	Tail length	Eye	Hair around eyes/ muzzle	Hair coat on on body	Tooth eruption
Female	2	0.32	13.0	12.0	14.0	9.5	2.0	closed	No	No	No
Male	3–4	0.50	25.0	18.0	20.5	16.0	3.0	closed	No	No	No
Male	6–7	1.75	46.5	31.0	36.0	20.5	5.0	closed	Yes	No	Insicor and canine all had erupted
Male	8–9	6.50	68.0	48.0	55.0	43.0	10.0	open	Yes	Yes	Insicor and canine all had erupted
Female	8–9	6.30	65.0	46.0	58.5	41.5	9.5	open	Yes	Yes	Insicor and canine all had erupted
Male	5–6	1.95	50.0	32.5	37.0	30.0	5.2	closed	Yes	Yes	Insicor and canine all had erupted
Female	2	0.30	12.8	11.7	13.8	9.4	2.0	closed	No	No	No
Female	8	5.92	64.7	45.0	58.0	41.0	9.6	open	Yes	Yes	Insicor and canine all had erupted

The sex ratio of the fetus obtained is 1 male : 1 female. No prenatal mortality was detected. All the fetuses were normal and in good condition at the time of kill.

Some histological analyses were made on the ovaries obtained from five animals. There was no abnormality of the ovaries.

The size of ovaries varies from 1.9 – 2.7 cm in length, 1.4 – 1.8 cm in height and 0.6 – 2.0 cm in width.

Productivity

Productivity or embryo rate is calculated by dividing the number of fetus by the number of does to give an average number of fetus per doe.

From a total of 18 females reported killed in Perak in both hunting years, 10 had fetuses. There was no twin. The productivity rate from other states could not be determined because records were not complete. The deer productivity in Perak in 1982 and 1983 are shown in table 9.

Table 9. Deer productivity (Perak)

Year	Total female killed	Number of pregnant doe	No. of fetus per doe	% of pregnant doe
1982	12	5	0.42	42
1983	6	5	0.83	83
Average	9	5	0.56	56

The percentage of pregnant doe in 1982 and 1983 were 42% and 83% respectively (Table 9). The average pregnant doe per year was 56% which is equivalent to 0.56 embryo per doe since no twin occured. This figure is higher compared to 0.343 embryo per doe obtained by Khan (1967).

Open wet-sore

In the hair at the base of the throat is a spot from which all the surrounding hairs radiate. This spot is the seat of the sore.

Table 10. Open wet-sore

Year	Sex	Total no. of animals observed	No. of animals with wet-sore	% having open wet-sore
1982	Male	16	6	37.5
	Female	14	4	28.6
1983	Male	15	10	66.7
	Female	7	1	14.3

The number of deer with the open wet-sore was higher in male than in the female. In 1982 and 1983 the percentage of males having the open wet-sore was 37.5% and 66.7% respectively. Whereas for female the percentage having wet-sore were only 28.6% and 14.3% respectively (Table 10).

The size of the open wet-sore varied from 1.5 cm to about 8.0 cm. According to Kitchener, (1961) the size can be as large as 12.5 cm or more.

From the histopatological analysis carried out on the open wet-sore, there was an ulcerative area with necrotic tissue below together with some dead and living inflammatory cells. Some other areas with slight inflammatory reaction with lymphocytes were mainly in the dermis. No bacteria or virus could be cultured from the sample since it was preserved in formalin. It was diagnosed as ulcerative dermititis.

Kitcherner, (1961) indicated that there is no puss or evidence of inflammation or septic condition nor is the flesh beneath the sore in any way affected. No visible parasites are present either to eye or microscope. He suspected the sore might be caused by a specific jungle parasite.

Parasites

There was no endoparasites in the lung and the liver of a total of twelve samples examined in both years. However there was one ectoparasite or tick which belongs to the family Ixodidae resembling *Haemophysabis* species.

CONCLUSION AND RECOMMENDATION

A total of only 108 and 110 deer shot in both hunting years in the whole of Peninsular Malaysia indicated a very low population of deer today even though the season was closed for the past five years. This is most probably due to a rapid and prolonged loss of habitat.

There is a serious decrease in hunter success prompting that a further close season should be declared.

The overall results are not satisfactory due to the lack of co-operation from hunters. For the purpose of study to obtain meaningful results for effective future management of deer, the open season is recommended in one place at a time with a limited number of licences issued.

Acknowledgement

I wish to record my thanks to Professor Jainuddeen of The Faculty of Veterinary Sciences and his staff for helping in the examination of the reproductive organs, foetuses and ectoparasites of the deer.

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IDENTIFICATION OF FEMALE REPRODUCTIVE ORGANS

Plate Ia: Two-months fetus in the uterus

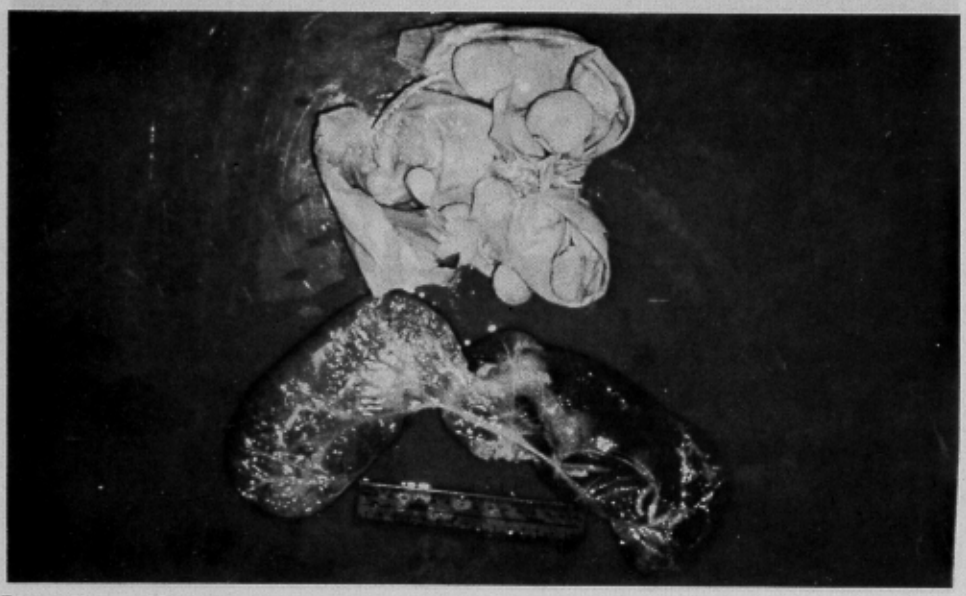

Plate Ib: Uterus cut opened showing the mushroom shaped maternal cotyledons and the 2 month fetus in the sac.

Plate Ic: Two month fetus with its sac cut open.
Eye-lid closed, no hair around eyes or muzzle, no hair coat on body and no tooth eruption

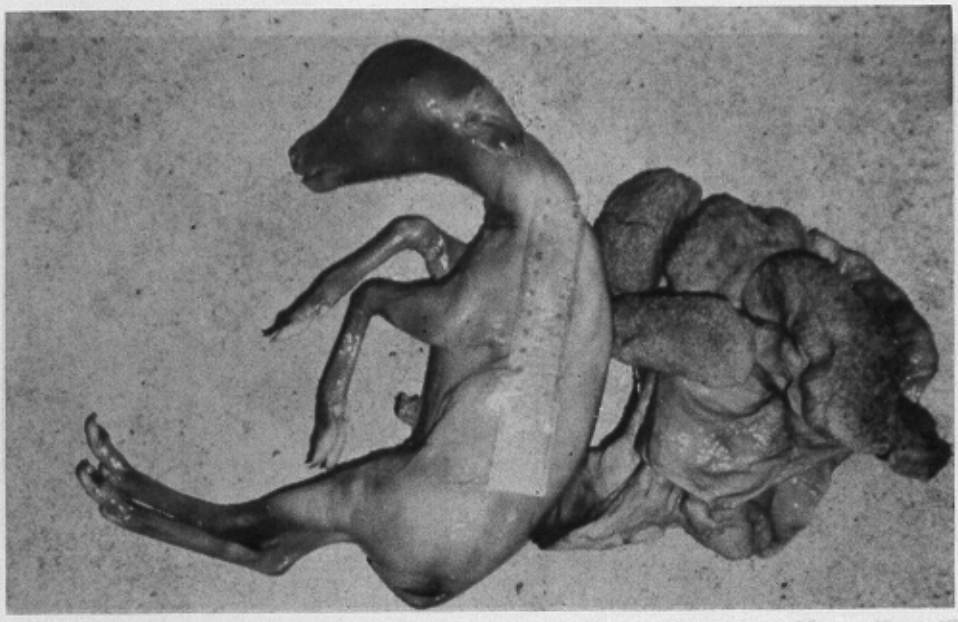

Plate IIa: Six months fetus and its uterus

Plate IIb: Six month old fetus and its maternal cotyledon. There is no hair coat on the body yet. Hairs occur around the eyes and the muzzle. All the incisor and canine teeth have erupted. The maternal cotyledon has grown.

Plate IIIa. An 8 month old fetus an its uterus

Plate IIIb: An 8 month fetus and its maternal cotyledons

The eight month old fetus in both plates IIIa and IIIb show that at this age, the fetus has already a complete hair coat on its body. The eye-lid is already opened. The maternal cotyledons had grown into a kidney shape.

Plate IVa: Uterus of the adult female about 2 weeks after a fawn was born

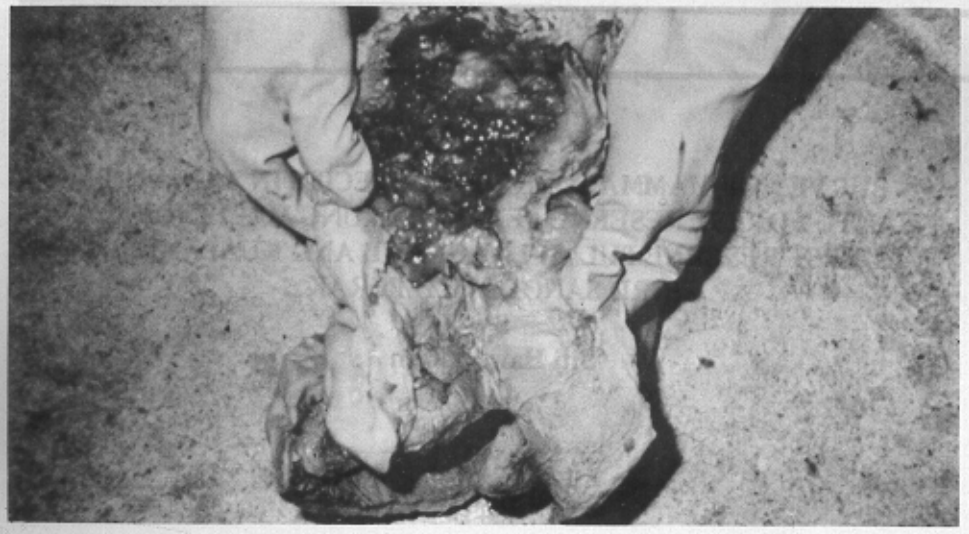

Plate IVb: The cervix of the adult female 2 weeks after birth of a fawn showing much mucus

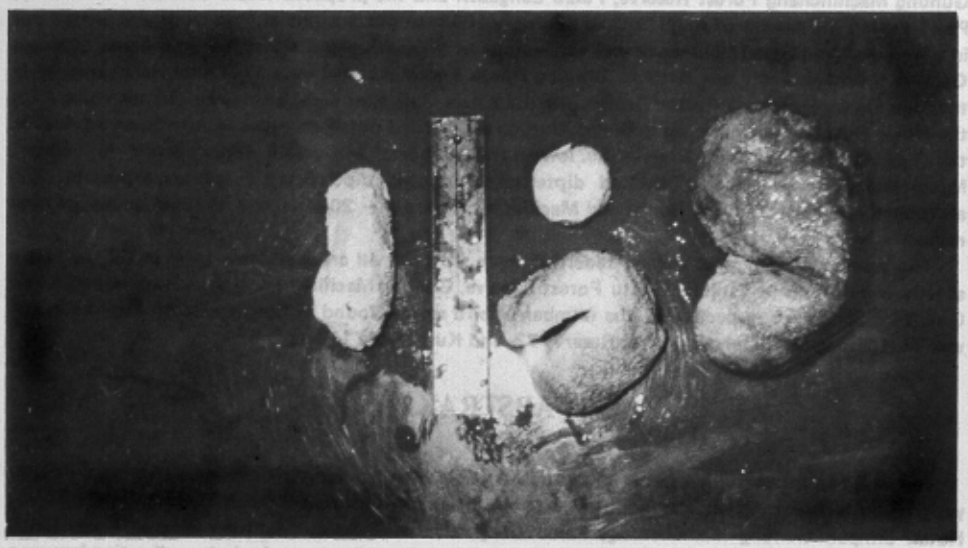

Plate V: Maternal cotyledons at different stages of pregnancy

Top right side of ruler, small maternal cotyledons which is mushroom-shaped come from an animal about two months pregnant. Below, maternal cotyledon from an animal about six-months pregnant. Size increased and curved. Right side of ruler, maternal cotyledon from an animal about eight to nine months pregnant. It has grown and appeares swollen and is kidney shaped. This is the physical nature of maternal cotyledons of the animal ready to be calved. After calving, the maternal cotyledons shrink as seen on the left side of ruler.

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SURVEY OF MAMMALS AND BIRD SPECIES IN TANJUNG HANTU FOREST RESERVE PERAK, GUNUNG MACHINCHANG FOREST RESERVE PULAU LANGKAWI, AND KUALA GULA BIRD SANCTUARY, PERAK

By
Siti Hawa Yatim

ABSTRACT

This study attempts to identify wildlife species, their numbers and distribution in the various habitats found in Peninsular Malaysia. It was carried out in Tanjung Hantu Forest Reserve, Perak, Gunung Machinchang Forest Reserve, Pulau Langkawi and the proposed Kuala Gula Bird Sanctuary, Perak during the month of May 1983 to February 1984. About 3 weeks of field work was carried out in each area. Additional field work was carried out in September and November in the case of Kuala Gula. A thorough study was done in Tanjung Hantu Forest Reserve but only 2 sites were surveyed in the Gunung Machinchang Forest Reserve. In the Kuala Gula Bird area, a survey along the coast from the Kuala Gula fishing village up to Sungai Burung was carried out. Two types of forests were found in the Tanjung Hantu Forest Reserve i.e. lowland dipterocarp and heath forest, while in Gunung Machinchang Forest Reserve lowland dipterocarp and hill dipterocarp forest were present. The altitudinal ranges of Tanjung Hantu and Machinchang were 0 – 204m and 0 – 708m above sea level respectively.

The number of mammal species recorded were poor for all areas where a total of 30, 15 and 4 species were found in Tanjung Hantu Forest Reserve, Gunung Machinchang Forest Reserve and Kuala Gula Bird Sanctuary respectively. The number of bird species found in Tanjung Hantu Forest Reserve was 84, Gunung Machinchang Forest Reserve 73, and Kuala Gula 113.

ABSTRAK

Penyelidikan ini bertujuan untuk mengkaji spesis hidupan liar dan distribusinya di berbagai habitat yang masih terdapat di Semenanjung. Ianya telah dijalankan di Hutan Simpan Tanjung Hantu, Perak; Hutan Simpan Gunung Machinchang, Pulau Langkawi dan ladangan Santuari Burung Kuala Gula, Perak di antara bulan Mei 1983 hingga Februari 1984. Selama 3 minggu kerja luar di setiap kawasan telah dijalankan. Di Kuala Gula, kajian telah diteruskan lagi pada bulan September dan November di tahun yang sama. Kajian yang menyeluruh telah dijalankan di Tanjung Hantu tetapi hanya dua kawasah sahaja yang dipilih untuk Hutan Simpan Gunung Machinchang. Di Kuala Gula, kajian telah dibuat di sepanjang pantai dari kawasan perkampungan nelayan hingga ke Sungai Burung. Di Tanjung Hantu terdapat 2 jenis hutan iaitu hutan Dipterokarp Tanah Rendah dan Hutan Permatang, sementara di Hutan Simpan Gunung Machinchang terdapat Hutan Dipterokarp Tanah Rendah dan Hutan Dipterokarp Bukit, Hutan Bakau boleh dijumpai di Kuala Gula.

Jumlah spesis mamalia yang telah direkodkan adalah kurang memuaskan untuk ketiga-tiga kawasan di mana terdapat hanya 30 spesis di Tanjung Hantu, 14 spesis di Gunung Machinchang dan 4 spesis di Kuala Gula. Spesis burung yang telah direkodkan di Tanjung Hantu ialah 84, 73 di Gunung Machinchang dan 113 spesis di Kuala Gula.

INTRODUCTION

Though Tanjung Hantu Forest Reserve, Gunung Machinchang Forest Reserve and the proposed Kuala Gula Bird Sanctuary are somewhat similar in that all locations are surrounded by sea, their habitats are quite different. The Tanjung Hantu Forest Reserve has two types of habitat; Lowland Dipterocarp and Heath Forest. The Gunung Machinchang Forest Reserve is covered by limestone hills of Hill Dipterocarp and Lowland Dipterocarp especially the south west coastal areas. The Kuala Gula area has a totally different habitat since the area is a mangrove forest. The mangrove wsamp forests at Kuala Gula are fringed by extensive mudflats. Areas deep inside the mangrove forest could only be reached by boat via tidal channels at high tides.

No previous intensive study on mammals, birds, amphibians and reptiles in Tanjung Hantu Forest Reserve or Gunung Machinchang Forest Reserve has been reported. Reports of some sea birds and waders had recently been published in Interwaders 1983 whereby 14 species of waders were recorded at Kuala Gula.

As in other mangrove areas of the Peninsular, much of the coastal mudflats of Kuala Gula is used for Mussels Culture. The Night Heron Project, began in 1973 initially to protect the nesting area of night herons, has resulted in general protection of all protected species in the area.

STUDY AREA

The selected areas for survey during the month of May 1983 to February 1984 were Gunung Machinchang Forest Reserve, Pulau Langkawi, the proposed Kuala Gula Bird Sanctuary, and the Tanjung Hantu Forest Reserve, Perak. Further work was carried out at Kuala Gula in September and November of the same year.

Tanjung Hantu Forest Reserve (Map 1)

The total area of this reserve is about 400.2 ha. of which about 242.4 ha. are mainly Lowland Dipterocarp Forest while the remainder are Heath Forest. The two types of forest are separated by the Puyu River. The Lowland Dipterocarp contains plants of various habits of growth and characteristics. Many Dipterocarp trees were found here such as:- *Shorea sp. Hopea sp. Dipterocarpus sp. Vatica sp.* etc. Besides these, other plants that could be found are the Bertam Palm, Nibung, Pulai, Simpuh Paya, Nyatoh, Pinang Raja *(Crytostadys takka),* Periok Kera *(Nepenthes sp.),* Pandanus *(Kasu pananaceae),* Rotan plants and others.

A few small seasonal streams flow from the hill directly into the sea but were dry during the study period. The height of the area ranges from 0m – 204m above sea level. The eastern part of the forest has been opened up by a group of fisherman for settlement.

The Heath Forest has grown on old raised sandy beaches (known as permatangs or padangs). The soil profile is podsolic with a B horizon about two feet or more below the surface. Often, there is a thick layer of litter with a mass of feeding roots on the surface just beneath. This Heath Forest is the only known such area in the west coast of the Peninsular. It differs from true Lowland Dipterocarp Forest in being simpler in composition and in structure (though still strictly three layered). Most of the area is of low height about 0 – 15.2m high.

The Heath Forest is located in the flat northern part of Tanjung Hantu Forest. It is interesting to note that *Shorea glauca,* which normally occurs in coastal hill forest is dominant in this area. Apart from *Shorea glauca,* other common large tree species are *Irvingia malayana, Melanorrhoea torquata* and *Sindora echinocalyx.* Smaller tree species are: *Eugenia sp. (E: tumida, E. grata), Carcinia hombroniana, C. nigrolineata, Guioa sp, Myrica esculenta, Neolitsea zeylanica, Tristania obovata* and *Vitex pubescens.* The commercial species are: *Hopea semicuneata, Podocarpus blumei* and *Vatica odorata.* The ferns are *Davallia denticulata, Drynaria sparsisora, Nephrolepsis acutifolia* and *Phymatodes scolopendria.* The shrubs: *Agrostistachys borneensis, Ardisia crenata, Alyxia oleifolia, A. tenuifolia, Euphorbia sunadenium, Eurycoma longifolia, Phyllanthus sp.* are common in the undergrowth *Cycas rumphii* is also present. (Smith, 1977).

The study covered the whole area of the reserve.

Gunung Machinchang Forest Reserve (Map 2)

The Gunung Machinchang Forest Reserve is situated on the western part of Pulau Langkawi. The reserve is separated from the adjacent reserve by a stretch of laterite road built for the benefit of the villagers and tourist going to the Telaga Tujuh waterfall.

This waterfall is very famous in Pulau Langkawi. A small part of the area starting from the beach at Tanjung Burau up to the foothill of the Telaga Tujuh area had been opened up for cultivation.

Except for the cleared areas, the reserve is covered partly by the lowland dipterocarp and hill dipterocarp forest ranging from 0 – 708m (Gunung Machinchang). With the exception of the eastern part, the reserve is surrounded by sea. Most of the beaches are rocky except for those areas at Tanjung Burau, Tanjung Dalai, Tanjung Nyior and Tanjung Temurung, where short stretches of sand are found.

Most of this Forest Reserve is covered by limestone hills, lowlying or as high as 708m.

Many commercial trees are found here such as: *Hopea helferi* (Giam Lintah Bukit), *Dyera costulata* (Kelutong), *Artocarpus lanceitolius* (Keledang-keledang), *Coompassia malaccensis* (Kempas), *Dipterocarpus grandiflorus* (Keruing belimbing), *D. baudii* (Keruing bulu), *D. cornutus* (Keruing gombang), *Heritiera javanica* (Mengkulang jari), *Shorea bracteolata* (Meranti pa'ang), *S. rox-*

burghii (Meranti temak nipis), *Intsia palembanica* (Merbau), *Anisoptera laevis* (Mersawa durian), *A. scaphula* (Marsawa gajah) *Pelaguim rostratum* (Nyatoh sidang), *Sindora coriasea* (Sepetir lichin), *Paratocarfus sp.* (Ara berteh), *Calophyllum sp.* (Biritangor), *Durio sp.* (Durian), *Hopea so.* (Giam), *Terminalia sp.* (Jelawai), *Pometia sp.* (Kasai), *Burseraceae sp.* (Kedondong), *Bombax valetonii* (Kekabu hutan), *Artocarpus sp.* (Keledang), *Scaphium sp.* (Kembang semangkuk), *Dialium sp.* (Keranji), *Kokoona sp.* (Mata ulat), *Pentace sp.* (Melunak), *Heritiera sp.* (Mengkulang), *Shorea henryana* (Meranti Jerit) *Shorea assamica* (Meranti pipit), *S. hypochra* (Meranti temak), *Hopea sp.* (Merawan), *Swintonia sp.* (Merpauh), *Sapotaceae* (Nyatoh), *Penta spadon sp.* (Pelong), *Lophopetalum sp.* (Perupok), *Parkia sp.* (Petai), *Alstonia sp.* (Pulai), *Gonystylus sp.* (Ramin), *Vatica sp.* (Resak), *Sindora sp.* (Sepetir), *Endospermum sp.* (Sesendok), *Dillenia sp.* (Simpoh), *Cedrela sp.* (Surian), *Artocarpus sp.* (Terap) and *Compnosperma sp.* (Terentang).

Some of the shrubs found here are: Balik Angin, Mahang, Putat Derum, Rengas, Limau Hitam, Nibung, Ratan, Palas, Kemeyam, Cenerai, Mengkirai, and Tulang Daing. Some plants used in traditional medicine are Tongkat Ali, Selayar, Renaong Besi and Renaong Tembaga.

Beside the Telaga Tujuh Waterfall, the reserve has a few other beautiful waterfalls. Many beautiful streams with clear running water flow from the hilly parts to the sea.

The study which took about 20 days, covered a small part of the reserve as in Map 3.

The Proposed Kuala Gula Bird Sanctuary (Map 4)

This Kuala Gula area forms a part of the Matang Mangrove Forest Reserve situated to the west of Taiping. It consists of a vast stretch of tidal mudflats and mangroves. The fishing village of Kuala Gula lies at the north end of the Matang Forest area and nearby at the mouth of the Sungai Selinsing is the Kelumpang Island. Most of the area surrounding the Kelumpang Island consist of newly formed mudflats where trees locally known as Api-api *(Avicennia sp)* have recently established themselves. The area is now valuable only as a nesting place for waterbirds. Parts of the area are covered by *Rhizophora apiculata* and in some areas weeds like the mangrove ferns, *Acrostichum sp.* could be found.

The areas covered during the study were:- around the Gula fishing village, part of Sungai Gula, along the mudflat of Kelumpang Island up to Tanjung Burung and back to Teluk Rubiah, Tanjung Belanak, part of Sungai Kurau and along the coast of the Malacca Straits till Sungai Burung.

METHODS

The study carried out follows the same procedure as that of 'A Preliminary Survey On Inventory, Habitat and Wildlife in the Ulu Langat Forest Reserve and Sg. Dusun Game Reserve; Siti Hawa (1983).

(i) Tanjung Hantu Forest Reserve

The study area was identified with the assistance of the District Land Office and Manjong Forest Department at Batu Gajah and approval of the Police Training School at Telok Senangin to carry out the survey or to find out the status and nature of the study area.

(ii) Gunung Machinchang Forest Reserve

The study area was identified with assistance from the Forest Department and approval of the Police Department at Kuah, Pulau Langkawi.

(iii) The Proposed Kuala Gula Bird Sanctuary

Identification was done through the District Land Office and the Forest Department and approval of the Police Department at Kuala Kurau, Perak.

DISCUSSION

None of the three study areas is truly undisturbed. In Tanjung Hantu Forest Reserve, logging was carried out a few years ago. Tracks could be found in both the dipterocarp and the Heath Forests. Though the forest had regenerated, the areas at present are still being traversed either by local people or by the police trainees nearby. Part of the Heath Forest was recently burnt leaving a small remnant part at the northern end of the site. This results in the environment being very hot and exposed and thus not suitable for many types of mammals and birds.

Though no logging had been done in Gunung Machinchang Forest Reserve, part of the area is still considered as a disturbed area. Tourist who visit the Telaga Tujuh areas sometimes camp along the upper part of the streams thereby disturbing the animals especially during the day. Signs of the old camps and new ones can be found all along the streams. Skull and feathers of two pairs of Great Hornbill found were believed shot in the head some time ago. Few animals or their tracks were found in the stony, hilly areas. The Tanjung Hantu Forest Reserves is also being disturbed by poachers.

The Kuala Gula area faces the same problem as the other two reserves. The Forest has been under sustained-yield management since the early part of the century. The forest which is part of the Matang Mangrove Forest Reserve has been worked under a 30 to 40 year rotation plan. At present it is in its' third rotation. The forest was harvested for the manufacture of charcoal and firewood. These activities would at one time or another destroy the breeding sites of some of the sea birds such as Night Herons and Milky Storks.

Besides forest felling, the bird sanctuary also faces the problem of poaching. There is no practical restriction for fishermen or villagers to enter the reserve, thus making enforcement work more difficult.

During the survey, 36 species of mammals were observed either directly, indirectly or by trapping in the 3 reserves. A total of 30 species were found in Tanjung Hantu Forest Reserve, 14 species in Gunung Machinchang Forest Reserve and 4 species in the proposed Kuala Gula Bird Sanctuary. The species that were native to all areas were the Long-tailed Macaque and Dusky Leaf Monkey. The Cream-coloured Giant Squirrel, Grey Giant Rat, Brown Spiny Rat, Long-tailed Giant Rat, Common Musang, Common Wild Pig and Smaller Mouse Deer were native to both Tanjung Hantu Forest Reserve and Gunung Machinchang Forest Reserve. Only the smooth otter could be found in both Tanjung Hantu Forest Reserve and the proposed Kuala Gula Bird Sanctuary.

They were usually found in groups numbering 10 animals or more.

The Tanjung Hantu Forest Reserve is spectacular in its primate population. In such a small area 5 species of primates namely the Pig-tailed Macaque, Banded Leaf Monkey, Dusky Leaf Monkey and White-handed Gibbon have been recorded. More Long-tailed Macaque were found along the coast of the Heath Forest.

Besides the Malayan Bear, another big mammal that could be found in Tanjung Hantu Forest Reserve is the Tiger. Clear foot prints of the tiger were observed, which might have come from the Segari Forest Reserve.

Slow Loris and Smaller Mouse-Deer were observed during night survey while Common Wild Pig; Larger Mouse Deer, Barking and Sambar Deer were observed during day time as well.

In Gunung Machinchang Forest Reserves only two species of primates were recorded mainly the Long-tailed Macaque and the Dusky Leaf Monkey. Unlike Tanjung Hantu Forest Reserves, their calls were seldom heard. A total of 22 animals were caught out of 80 traps that were set. There are 6 species of squirrels and rats namely the Grey bellied Squirrel, Slender Little Squirrel, Swamp Giant Rat, Grey Giant Rat, Brown Spiny Rat and the Long-tailed Giant Rat. The same number of species were caught in Tanjung Hantu Forest Reserve but the actual number caught was only 10 out of the 80 traps set.

No big mammal was recorded in Gunung Machinchang Forest Reserve except for the Common Wild Pig and the Smaller Mouse Deer. The Larger Deer might have moved toward the western part of the reserve after the opening up of land at the eastern part for agriculture. The wild pig is known to come out and destroy some of the vegetables grown by the villagers during the night. Though serow might have been present because of habitat suitability but no sign of this species was noted.

The other reserves are also surrounded by sea, but Kuala Gula was the only one where dolphins were observed. A few pairs were seen in July, January and February.

A total of 178 species of birds were observed or netted in all of the three reserves. 84 species were recorded in Tanjung Hantu Forest Reserve, 73 in Gunung Machinchang Forest Reserve and 113 species in the proposed Kuala

Gula Bird Sanctuary. The birds common to all reserves were the Black-shouldered Kite, Brahminy Kite, White-bellied Sea Eagle, Little Green Pigeon, Spotted Dove, Blue-throated Bee-eater, Stork-billed Kingfisher, White-throated Kingfisher, Black-capped Kingfisher, Barn Swallow, Hairy-backed Bulbul, Ashy-tailor bird, Pied Fantail Flycatcher, Phillipine Glossy Starling, Common Myna, Jungle Myna, Hill Myna and the Brown-throated Sunbird.

The Tanjung Hantu Forest Reserve and Gunung Machinchang Forest Reserve have quite similar habitats with consequent similarities for most of the bird families occuring in these areas.

The most common families in both areas are:- *Columbidae, Culculidae, Alcedinidae, Picidae, Pycnonotidae, Oriolidae, Timalidae, Turdidae, Sylviidae, Muscicapidae, Sturnidae, Nectariniidae.* In Kuala Gula Bird Sanctuary, the most common families were:- *Ardeidae, Ciconidae, Accipitridae, Raillidae, Charadriidae, Scolopacidae, Laridae, Meropidae, Ceractdae, Alcedinidae, Corvidae* and *Sturnidae.*

The Little Heron and the Black-crowned Night Heron were also recorded in Gunung Machinchang Forest Reserve. In the case of the Pond Heron, differentiation between Javan and Chinese Pond Heron was avoided due to the identical plumages of both species during winter. Though both were considered to be quite rare, about 50 birds were observed in February and November at Sungai Burung. One pair of Grey Heron was also observed in the same period at the same area, but in November two pairs were observed at the same place. Flocks totalling nearly a thousand Black-crowned Night Heron were observed in Sungai Burung during the same period. Some of these birds were already breeding. When observations were made in February, the Milky Stork and the Lesser Adjutant which were considered to be rare were also found. About 50 – 100 Milky Storks were observed in September and November. It is believed to breed on the island of Kelumpang.

CONCLUSION

The results show that the distribution of mammals and birds were affected by logging and also by opening up of new areas for agriculture/tourism. The formation of islands of forest not only effected the food sources of the animals and the amount of sleeping or nesting sites but also results in greater exposure to predators and increased danger to poaching.

In the Heath Forest of Tanjung Hantu for example, the bird and mammal fauna is clearly depleted due to the disturbance and partial destruction of the habitat. In Kuala Gula although the department has managed to greatly reduce the poaching of egg and young of the Black-crowned Night-heron, some poaching still exists.

Concrete efforts should be taken to preserve the area especially the Heath Forest of Tanjung Hantu which is the only known area of Heath Forest in the west coast of the Peninsular and the Kuala Gula area which is important not only for the night herons and the milky storks but also for migrants.

Acknowledgement

I am grateful to the bird team for its effort in collecting the data and in preparing this report. In particular I would like to thank the team leader En. Zainuddin Baatu for the good work.

I would also like to thank the Rangers from the Forest Department in Pulau Langkawi for providing the data on plants/trees species found in Gunung Machinchang Forest Reserve.

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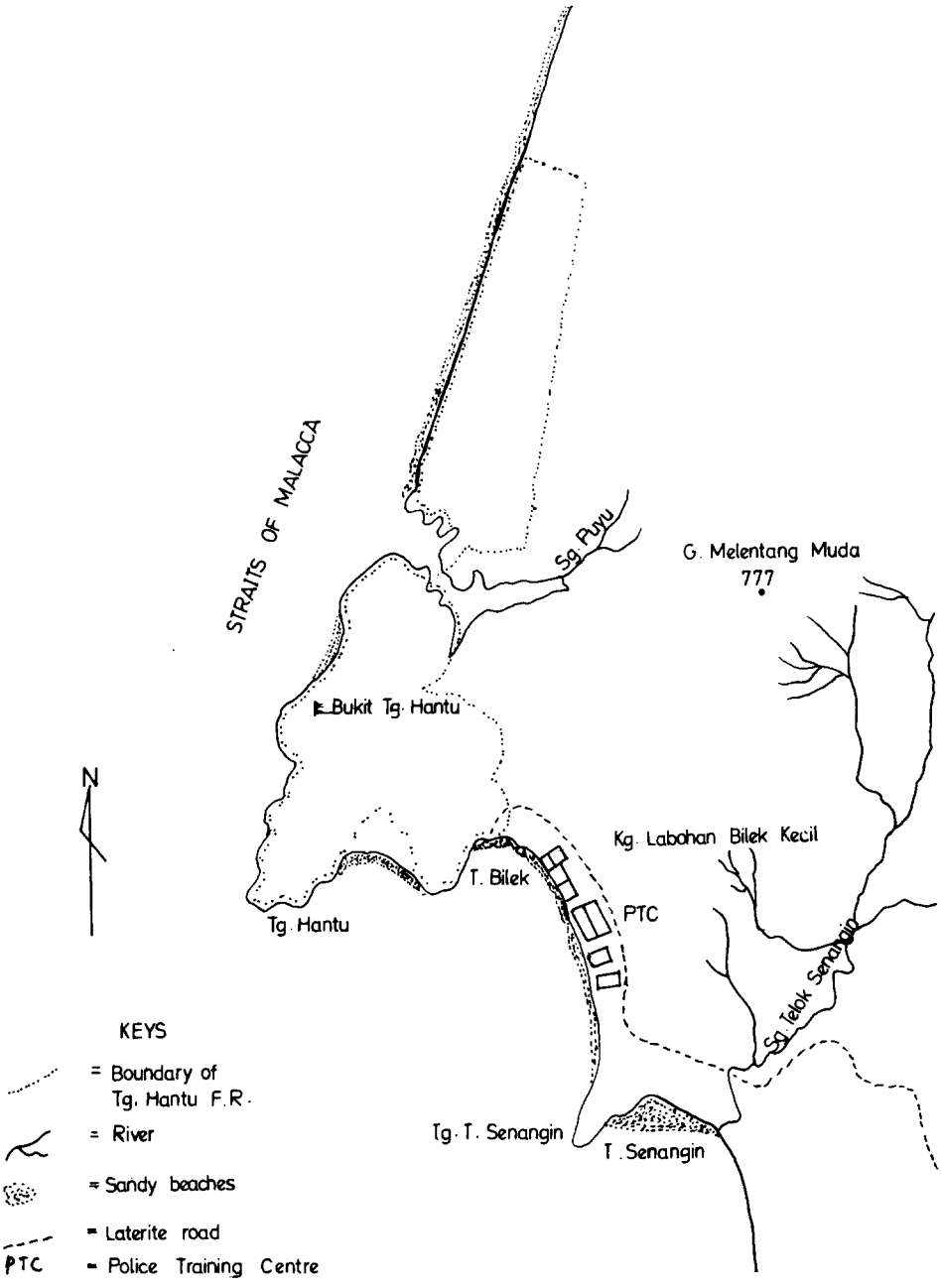
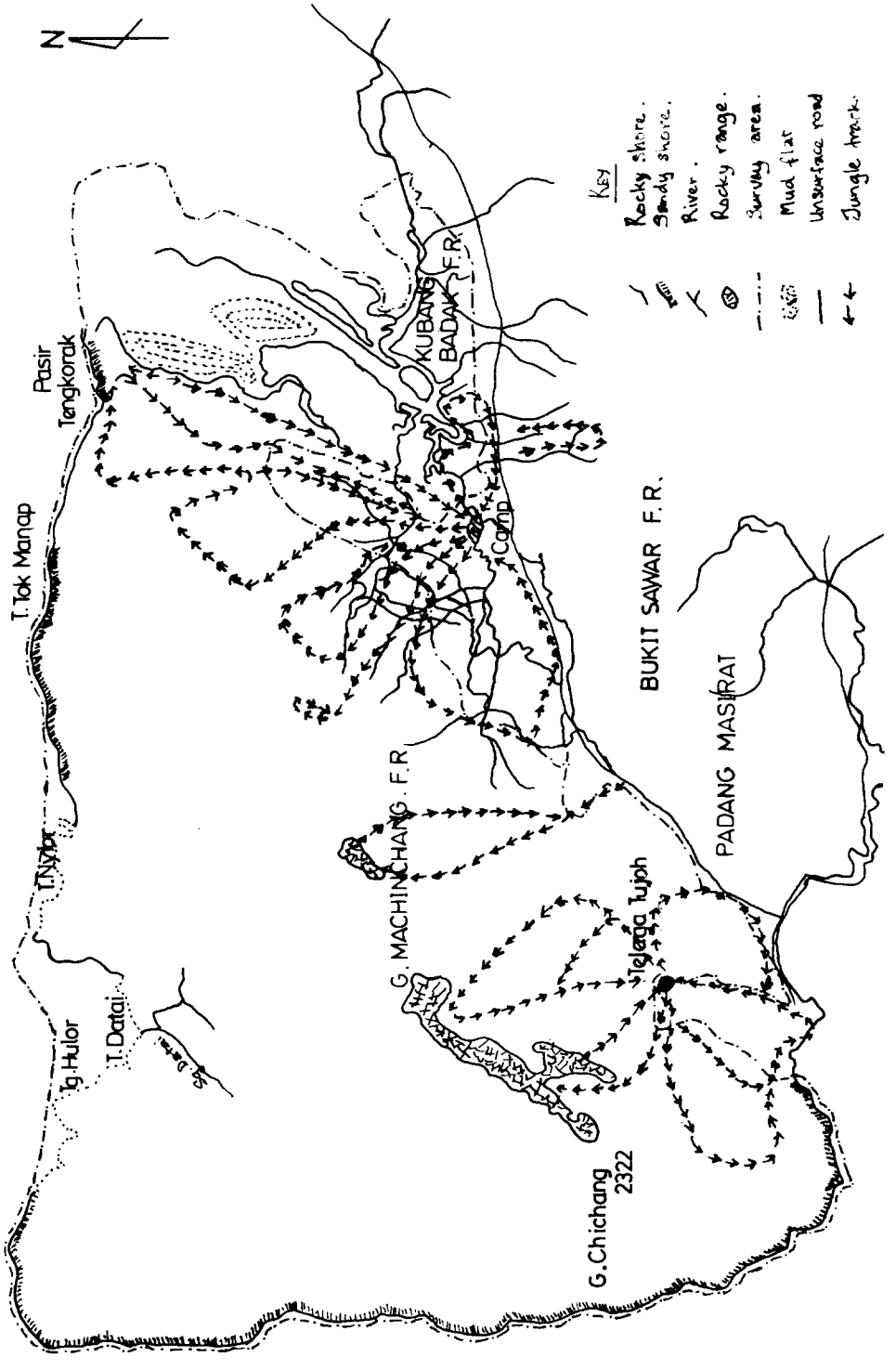
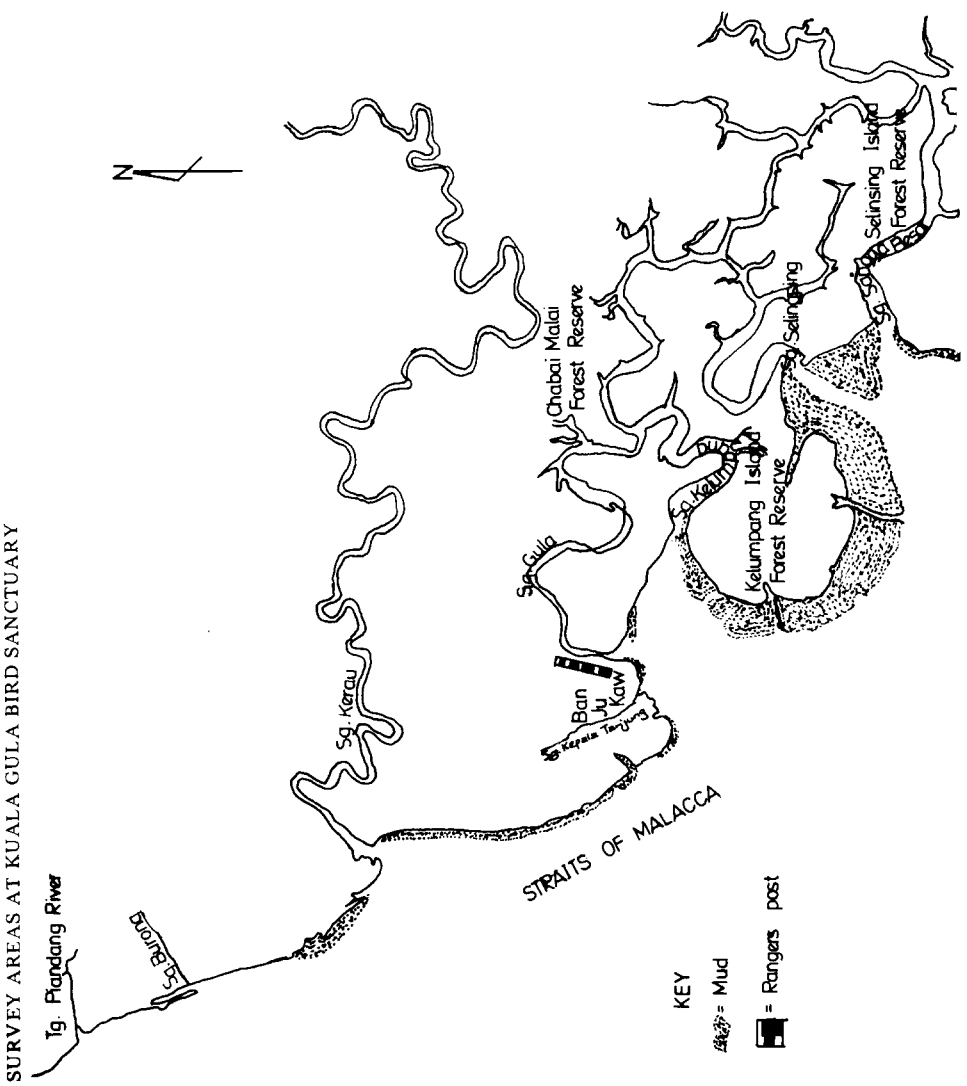
MAP 1: SURVEY AREA IN TANJONG HANTU FOREST RESERVE





SURVEY AREA IN GUNUNG MACHINCHANG FOREST RESERVE


SURVEY AREAS AT KUALA GULA BIRD SANCTUARY
Tg. Piandang River
Sg. Burong
N
Sg. Kerau
Sg. Gula
Ban Ju Kaw
Sg. Kepala Tanjung
STRAITS OF MALACCA
Chabai Malai Forest Reserve
Sg. Kelumpang
Kelumpang Island Forest Reserve
Sg. Selinsing
Selinsing Island Forest Reserve
KEY
= Mud
= Rangers post

LIST OF BIRD SPECIES RECORDED IN:-

A. TANJUNG HANTU FOREST RESERVE, PERAK
B. GUNUNG MACHINCHANG FOREST RESERVE, PULAU LANGKAWI
C. KUALA GULA BIRD SANCTUARY, PERAK

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATION
			O	S	TR	
	ARDEIDAE					
1.	Grey Heron	*Ardea cinerea*	x			C
2.	Little Heron	*Butorides striatus*	x		x	B, C
3.	Javan/Chinese Pond Heron?	*Ardeola speciosa/bacchus?*	x			C
4.	Pacific Reef Egret	*Egretta sacra*	x			C
5.	Chinese Egret	*Egretta eulophotes*	x			C
6.	Great Egret	*Egretta alba*	x			C
7.	Plume Egret	*Egretta intermidea*	x			C
8.	Little Egret	*Egretta garzetta*	x			C
9.	Black-crowned Night-Heron	*Nycticorax nycticorax*	x			B,C
10.	Yellow Bittern	*Ixobrychus sinensis*	x		x	C
11.	Schrenck's Bittern	*Ixobrychus eurhythmus*			x	C
12.	Black Bittern	*Dupetor flavicollis*	x			C
	CICONIDAE					
13.	Milky Stork	*Mycteria cinerea*	x			C
14.	Lesser Adjutant	*Leptoptilos javanicus*	x			C
	ACCIPITRIDAE					
15.	Black-shouldered Kite	*Elanus caeruleus*	x			A, B, C
16.	Black Kite	*Milvus migrans*	x			A
17.	Brahminy Kite	*Haliastur indus*	x	x		A, B, C
18.	White-bellied Sea-eagle	*Haliaeetus leucogaster*	x			A, B, C
19.	Grey-headed Fish Eagle	*Ichthyaetus ichthyaetus*	x			A
20.	Crested Serpent Eagle	*Spilornis cheela*	x			C
21.	Eastern Marsh Harrier	*Circus aeruginosus spilonotus*	x			C
	PHASIANIDAE					
22.	Red Jungle Fowl	*Gallus gallus*	x			A
	RAILLIDAE					
23.	Red-legged Crake	*Rallina fasciata*	x			A, C
24.	White-breasted Waterhen	*Amourornis phoenicurus*	x			C
	CHARADRIIDAE					
25.	Lesser Golden Plover	*Pluvialis dominica*	x		x	C
26.	Little Ringed Plover	*Charadrius dubius*			x	C
27.	Mongolian Plover	*Charadrius mongolus*	x		x	B, C
28.	Greater Sand Plover	*Charadrius leschenaultii*			x	C
	SCOLOPACIDAE					
29.	Eurasian Curlew	*Numenius arquata*	x			C
30.	Whimbrel	*Numenius phaeopus*	x			C
31.	Bar-tailed Gorwit	*Limosa limosa*	x			C
32.	Common Redshanks	*Tringa totanus*	x		x	B, C
33.	Marsh Sandpiper	*Tringa stagnatilis*	x		x	C

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATION
			O	S	TR	
34.	Common Greenshank	*Tringa nebularia*	x			C
36.	Terek Sandpiper	*Xenus cinereus*	x		x	C
37	Common Sandpiper	*Actitis hypoleucos*	x		x	B, C
38.	Pintail Snipe	*Gallinago stenura*	x			B
39.	Red Knot	*Calidris canutus*	x			C
40.	Great Knot	*Calidris tenuirostris*	x			C
41.	Little Stint	*Calidris minuta*	x			C
42.	Long-toed Stint	*Calidris subminuta*	x		x	C
43.	Curlew Sandpiper	*Calidris ferruginea*	x		x	C
44.	Ruff	*Philomachus pugnax*	x			C
	LARIDAE					
45.	Whiskered Tern	*Chlidonias hybridus*	x			C
46.	Common Tern	*Sterna hirundo*	x			C
47.	Black-naped Tern	*Sterna sumatrana*	x			C
48.	Little Tern	*Sterna albifrons*	x			C
49.	Great-crested Tern	*Sterna bergii*	x			C
	COLUMBIDAE					
50.	Thick-billed Pigeon	*Treron cuvirostra*	x			A
51.	Little Green Pigeon	*Treron olax*	x			A, B, C
52.	Pink-necked Pigeon	*Treron vernans*	x		x	A, C
53.	Green Imperial Pigeon	*Ducula aenea*	x			B
54.	Little Cuckoo Dove	*Macropygia ruficeps*	x			C
55.	Red Turtle Dove	*Streptopelia tranquebarica*	x			C
56.	Spotted Dove	*Streptopella chinensis*	x			A, B, C
57.	Peaceful Dove	*Geopelia striata*	x			C
58.	Green-winged Pigeon	*Chalcophaps indica*	x			A, B
	CULCULIDAE					
59.	Plaintive Cuckoo	*Cacomantis merulinus*	x			A
60.	Drongo Cuckoo	*Surniculus lugubris*	x			A, B
61.	Common Koel	*Eudynamys scolopacea*	x			C
62.	Chestnut-bellied Malkoha	*Phaenicophaeus sumatranus*	x			A, C
63.	Greater Coucal	*Centropus sinensis*	x			B, C
64.	Lesser Coucal	*Centropus bengalensis*	x			B, C
	STRIGIFORMES					
65.	Bay Owl	*Phodilus badius*			x	B, C
66.	Buffy Fish-Owl	*Ketupa ketupu*			x	C
	CAPRIMULGIDAE					
67.	Large-tailed Nightjar	*Caprimulgus macrurus*	x		x	A, C
	APODIDAE					
68.	Black-nest Swiftlet	*Collocalia maxima*	x			C
69.	White-bellied Swiftlet	*Collocalia esculenta*	x			
70.	House Swift	*Apus affinis*	x			B, C
	TROGONIDAE					
71.	Scarlet-rumped Trogon	*Harpactes duvaucelii*	x			A

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATION
			O	S	TR	
	ALCEDINIDAE					
72.	Common Kingfisher	*Alcedo atthis*	x			C
73.	Black-backed Kingfisher	*Ceyx erithacus*	x			C
74.	Rufous-backed Kingfisher	*Ceyx rufidorsus*	x			C
75.	Stork-billed Kingfisher	*Pelargopsis capensis*	x		x	A, B, C
76.	Ruddy Kingfisher	*Halcyon coromanda*	x			C
77.	White-throated Kingfisher	*Halcycon smyrnensis*	x		x	A, B, C
79.	Collared Kingfisher	*Halcycon chloris*	x		x	A, C
	MEROPIDAE					
80.	Blue-tailed Bee-eater	*Merops phlippinus*	x			A, C
81.	Blue-throated Bee-eater	*Merops viridis*	x			A, B, C
	BUCEROTIDAE					
82.	Indian Pied Hornbill	*Anthracoceros albirostris*	x			B
83.	Southern Pied Hornbill	*Anthracoceros convexus*	x			A, B
84.	Rhinoceros Hornbill	*Buceros rhinoceros*	x	x		B
85.	Great Hornbill	*Buceros bicornis*	x			B
	CORACIIDAE					
86	Dollarbird	*Eurystomus orientalis*	x			A, C
	PICIDAE					
87.	Rufous Piculet	*Sasia abnormis*	x		x	A
88.	Rufous Woodpecker	*Micropternus brachyurus*	x			A
89.	Crimson-winged Woodpecker	*Picus puniceus*	x			A
90.	Buff-necked Woodpecker	*Meiglyptes tukki*	x		x	A
91.	Great Slatybacked Woodpecker	*Mulleripicus pulverulentus*	x	x		B
92.	White-bellied Woodpecker	*Dryocopus javensis*	x		x	A
93.	Brown-capped Woodpecker	*Hemicirus moluccensis*	x			C
94.	Oranged-backed Woodpecker	*Chrysocolaptes validus*	x			A
95.	Common Golden-backed Woodpecker	*Dinopium javanense*	x		x	C
	PITIDAE					
96.	Blue-winged Pitta	*Pitta moluccensis*			x	B
	HIRUNDINIDAE					
97.	Barn Swallow	*Hirundo rustica*	x		x	A, B, C
98.	Pacific Swallow	*Hirundo tahitica*	x			C
	CAMPEPHAGIDAE					
99.	Common Wood Shrike	*Tephrodornis pondicerianus*			x	C
100.	Pied Triller	*Lalage nigra*	x		x	A, C
101.	Scarlet Minivet	*Pericrocotus flammeus*	x			A

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATIONS
			O	S	TR	
	CHLOROPSEIDAE					
102.	Common Iora	*Aegithina tiphia*	x			A, C
103.	Greater Green Leafbird	*Chloropsis sonnerati*	x			A
	PYCNONOTIDAE					
104.	Stripe-throated Bulbul	*Pycnonotus finlaysoni*	x			B
105.	Yellow-vented Bulbul	*Pcynonotus goiavier*	x		x	A, B, C
106.	Olive-winged Bulbul	*Pycnonotus plumosus*	x		x	A
107.	Cream-vented Bulbul	*Pycnonotus simplex*	x		x	A, B
108.	Red-eyed Bulbul	*Pycnonotus brunneus*	x			A, B
109.	Spectacled Bulbul	*Pycnonotus erythropthalmos*	x			A
110.	Ochraceous Bulbul	*Criniger ochraceus*	x			B
111.	Grey-cheeked Bulbul	*Criniger bres*	x			A
112.	Yellow-bellied Bulbul	*Criniger phaeocaphalus*	x		x	A, B
113.	Hairy-backed Bulbul	*Hypsipetes criniger*	x		x	A, B, C
114.	Olive Bulbul	*Hypsipetes viridescens*	x			A
	DICRURIDAE					
115.	Ashy Drongo	*Dicrurus leucophaeus*	x			C
116.	Crow-billed Drongo	*Dicrurus annectans*	x			A, C
117.	Bronzed Drongo	*Dicrurus aeneus*	x			C
118.	Lesser Racket-tailed Drongo	*Dicrurus remifer*	x			A
119.	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	x			A, B
	ORIOLIDAE					
120.	Black-naped Oriole	*Oriolus chinensis*	x			A, B, C
121.	Asian Fairy Bluebird	*Irena puella*	x	x		A, B
	CORVIDAE					
122.	Slender-billed Crow	*Corvus enca*	x			C
123.	Large-billed Crow	*Corvus macrorhynchos*	x			A, C
124.	Collared Crow	*Corvus torquatus*	x			C
	PARIDAE					
125.	Great Tit	*Parus major*	x		x	C
	TIMALIDAE					
126.	Black-capped Babbler	*Pellorneum capistratum*	x		x	A
127.	Short-tailed Babbler	*Trichastoma malaccense*	x		x	A, B
128.	Ferruginous Babbler	*Trichastoma bicolor*	x			A
129.	Abbot's Babbler	*Trichastoma abbotti*	x		x	A, B
130.	Moustached Babbler	*Malacopteron magnirostre*	x		x	A, B
131.	Scally-crowned Babbler	*Malacopteron cinereum*	x			A
132.	Rufous-crowned Babbler	*Malacopteron magnum*	x		x	A, B
133.	Grey-throated Babbler	*Stachyris nigriceps*	x			A
134.	Grey-headed Babbler	*Stachyris poliocephala*	x			A
135.	Striped-Tit Babbler	*Macronous gularis*	x			A, B
136.	White-bellied Yuhina	*Yuhina zantholeuca*	x		x	A, B
137.	Chestnut-winged Babbler	*Stachyris erythroptera*	x			A, B

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATION
			O	S	TR	
	TURDIDAE					
138.	Magpie Robin	*Copsychus saularis*	x		x	A, B, C
139.	White-rumped Shama	*Copsychus malabaricus*	x		x	A, B
140.	Siberian Thrush	*Zoothera sibirica*			x	C
141.	Eye-browed Thrush	*Turdus obscurus*			x	C
	SYLVIIDAE					
142.	Flyeater	*Gerygone sulphurea*	x			C
143.	Arctic Warbler	*Phylloscopus borealis*			x	C
144.	Great Reed Warbler	*Acrocephalus arundinaceus*			x	C
145.	Pallas's Warbler	*Locustella certhiola*	x		x	C
146.	Lanceolated Warbler	*Locustella lanceolata*			x	C
147.	Common Tailor bird	*Orthotomus sutorius*	x			A, B, C
148.	Dark-necked Tailorbird	*Orthotomus atrogularis*	x		x	A, B
149.	Ashy Tailorbird	*Orthotomus ruficeps*	x		x	A, B, C
150.	Yellow-bellied Prinia	*Prinia flaviventris*	x			A, B, C
	MUSCICAPIDAE					
151.	Yellow-rumped Flycatcher	*Ficedula zanthopygia*	x		x	B, C
152.	Pale-Blue Flycatcher	*Cyornis unicolor*	x		x	B
153.	Tickell's Blue Flycatcher	*Cyornis tickelliae*	x		x	B
154.	Pied Fantail Flycatcher	*Rhipidura javanica*	x		x	A, B, C
155.	Black-naped Monarch	*Hypothymis azurea*	x		x	A, E
156.	Rufous-winged Flycatcher	*Philentoma pyrhopterum*	x			A
157.	Asian Paradise Flycatcher	*Terpsiphone paradisi*	x			A
	PACHYCEPHALIDAE					
158.	Mangrove Whistler	*Pachycephala cinerea*	x	x		C
	MOTACILLIDAE					
159.	Yellow Wagtail	*Motacilla flava*	x			B
160.	Forest Wagtail	*Dendronanthus indicus*			x	C
161.	Richard's Pipit	*Anthus novaeseelandiae*	x			B
	LANIDDAE					
162.	Brown Shrike	*Lanius cristatus*	x		x	B, C
163.	Tiger Shrike	*Lanius tigrinus*	x		x	B
164.	Long-tailed Shrike	*Lanius schach*	x			B
	STURNIDAE					
165.	Philippine Glossy Starling	*Aplonis panayensis*	x			A, B, C
166.	Common Myna	*Acridotheres tristis*	x	x		A, B, C
167.	Jungle Myna	*Acridotheres fuscus*	x			A, B, C
168.	Hill Myna	*Gracula religiosa*	x	x		A, B, C
	NECTARINIIDAE					
169.	Brown-throated Sunbird	*Anthreptes malacensis*	x		x	A, B, C

NO.	FAMILY/SPECIES	SCIENTIFIC NAMES	OBSERVATION			LOCATION
			O	S	TR	
170.	Ruby-cheeked Sunbird	*Anthreptes singalensis*	x			A
171.	Purple-naped Sunbird	*Hypogramma hypogrammicum*	x		x	A
172.	Copper-throated Sunbird	*Nectarinia calcostetha*	x			A, C
173.	Olive-backed Sunbird	*Nectarinia jugularis*	x			C
174.	Crimson Sunbird	*Aethopyca siparaja*	x			B
175.	Little Spider-hunter	*Arachnothera longirostra*	x		x	A, B
	DICAEIDAE					
176.	Yellow-breasted Flowerpecker	*Prionochilus maculatus*	x			A
	ZOSTEROPIDAE					
177.	Oriental White eye	*Zosterops palpebrosa*	x			C
	PLOCEIDAE					
178.	Eurasian Tree-Sparrow	*Passer montanus*	x			C
179.	White-bellied Munia	*Lonchura leucogastra*	x			A

O = directly observed
S = sound/call
TR = Trapped/netted

LIST OF MAMMAL SPECIES RECORDED IN:-

A. TANJUNG HANTU FOREST RESERVE, PERAK
B. GUNUNG MACHINCHANG FOREST RESERVE, PULAU LANGKAWI
C. KUALA GULA BIRD SANCTUARY, PERAK

NO.	ORDER/FAMILY/ SPECIES	SCIENTIFIC NAMES	OBSERVATION				LOCATION
			O	S	T	TR	
	MANIDAE						
1.	Scally Anteater	*Manis javanica*	x				A
	TUPAIIDAE						
2.	Common Treeshrew	*Tupaia glis*	x			x	B
	LORISIDAE						
3.	Slow Loris	*Nycticebus coucang*	x				A
	CERCOPITHECIDAE						
4.	Pig-tailed Macaque	*Macaca nemestrina*	x				A
5.	Long-tailed Macaque	*Macaca fascicularis*	x	x			A, B, C
6.	Banded Leaf Monkey	*Presbytis melalophos*	x				A
7.	Dusky Leaf Monkey	*Presbytis obscurus*	x	x			A, B, C
	PONGIDAE						
8.	White-handed Gibbon	*Hylobates lar*	x	x			A
	PTEROPODIDAE						
9.	Black-capped Fruit Bat	*Chironax melanocephalus*				x	A
	MEGADERMATIDAE						
10.	Malayan False Vampire	*Megaderma spasma*				x	B
	RHINOLOPHIDAE						
11.	Horse-shoe Bat	*Rhinolophus spp.*				x	A
12.	Malayan Tailless Horse-shoe Bat	*Rhinolophus robinsoni*				x	A
13.	Siamese Horse-shoe Bat	*Rhinolophus coelophyllus*				x	A
14.	Lesser Wolly Horse-shoe Bat	*Rhinolophus sedulus*				x	A
	SCIURIDAE						
15.	Grey-bellied Squirrel	*Callosciurus caniceps*				x	B
16.	Common Red-bellied Squirrel	*Callosciurus notatus*	x				A
17.	Black-banded Squirrel	*Callosciurus nigrovittatus*	x			x	A
18.	Slender Little Squirrel	*Sundasciurus tenuis*				x	B
19.	White-tighed Giant Squirrel	*Ratufa affinis*	x				A, B
	MURIDAE						
20.	Swamp Giant Rat	*Rattus muelleri*				x	B
21.	Grey Giant Rat	*Rattus bowersi*				x	A, B
22.	White-bellied Mountain Rat	*Rattus niviventer*				x	A
23.	Dark-tailed Tree Rat	*Rattus cremoriventer*				x	A

NO.	ORDER/FAMILY/ SPECIES	SCIENTIFIC NAMES	OBSERVATION				LOCATION
			O	S	T	TR	
24.	Brown Spiny Rat	*Rattus rajah*				x	A, B
25.	Long-tailed Giant Rat	*Rattus sabanus*				x	A, B
	URSIDAE						
26.	Malaysian Bear	*Jelarctos malayanus*			x		A
	MUSTELIDAE						
27.	Smooth Otter	*Lutra perspicillata*	x		x		A
	VIVERRIDAE						
28.	Tangalung	*Viverra tangalunga*	x		x		A
29.	Common Musang	*Paradoxurus hermaphorditus*	x				A, B
	FELIDAE						
30.	Tiger	*Panthera tigris*			x		A
	DELPHINIDAE						
31.	Ridge-backed Dolphin	*Sousa plumbea*	x				C
	SUIDAE						
32.	Common Wild Pig	*Sus scrofa*	x		x		A, B
	TRAGULIDAE						
33.	Larger Mouse Deer	*Tragulus napu*	x				A
34.	Smaller Mouse Deer	*Tragulus javanicus Kanchil*	x				A, B
	CERVIDAE						
35.	Barking Deer	*Muntiacus muntjak*	x				A
36.	Sambar Deer	*Cervus unicolor*	x				A

O = directly observed
S = sound/call
T = Tracks
TR = Trapped/netted

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RIVER TERRAPIN RECOVERY PLAN For MALAYSIA.

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1. BACKGROUND

General description and ecology:

The river terrapin *Batagur baska* is a large (60 cm shelf length) member of the family, Emydidae which inhabits major river systems throughout much of southeastern Asia.

The species is diagnosed by having four (rather than five) claws or the forefeet and by the presence of a double denticulated ridge on the triturating surface of the upper jaw. The shell is deep massive and heavily buttressed Juveniles and females are drably coloured. The exposed soft parts are shades of gray; the shell varies from dull brown to gray and the iris is brown. Adult males are dichromatic, however. During the breeding season the shell and much of the skin becomes jet black and the iris becomes immacuately white. Females are larger than males maturing between 43 and 45 cm shell length and attain a maximum size of over 60 cm. Males mature at 40 cm and rarely exceed 50 cm shell length.

The ecology of the river terrapin in Malaysia has been reviewed by Moll (1980). In summary, river terrapins inhabit the lower reaches or estuaries of larger rivers a habit it shares with the chelonians *Callagur borneoensis, Trionyx cartilagineus* and *Pelochelys bibroni.*

River terrapins are very aquatic and rarely venture out on land. At least on the Perak River, their movements correlate closely with tides. During tidal ingress, the turtles move upstream and into small tributaries to forage. At ebb tide they leave the streams and again move with the current downstream.

Nesting occurs on sandbanks within the river which are usually outside of the feeding areas. On the Perak River the nesting areas are some 50 miles upstream of the feeding areas. Only females undertake the nesting migrations which occur from late November through January on the west coast and February through March on the east coast. Nesting occurs at night enmasse with cohorts varying in size from a couple up to fifty or more turtles. In former times the cohorts were reportedly much larger (Loch 1950). Females often excavate a deep body pit of up to two feet with the egg cavity at the

bottom but nest depths very greatly. In west coast populations, a false body pit is often dug some distance from the actual nest site. Whereas east coast populations may divide a clutch up into two or more separate nests.

Clutches average 26 eggs in nests on the Perak River. The number of clutches laid annually per female is unknown but Burmese Batagur reportedly lay three per nesting season (Maxwell 1911). Eggs average 66 x 40 mm in length and width and 64 grams in weight. Incubation time at ambient temperatures of 23°– 33°C varied between 66 and 88 days. Emergence from nests at a Game Department egg hatchery averaged 88 days after planting. Hatchlings move downriver after emergence and establish home ranges in estuarine areas of the river.

Batagur are omnivorous – riverside plants and their fruits comprise most of their diet. Mangrove fruits of the genus *Sonneratia* appear to be a staple. Mollusks were the only animal food found in the faeces of wild individuals. Juveniles in captivity will eat fish and prawns along with vegetable matter.

Little is known about growth under natural conditions. Captives are known to have averaged 34 mm growth in shell length per year for their first eight years. Data gained from a few observations on the Trengganu River suggest that the average growth rate here is somewhat less than 20 mm/year over the same period. At the latter rate, sexual maturity may require some 25 years (Moll 1980).

Other than man, adults have few predators although large crocodiles may take moderate-sized individuals. Most natural mortality involves eggs and juveniles. Water monitors *(Varanus salvator)* are efficient nest predators. Otters and dogs have been seen pulling females off of nests to get at the eggs. Juveniles are likely prey to a variety of predatory species within their habitat (e.g. predatory fish, crocodiles, sea eagles, kites, and others). A brackish water shark reportedly takes a heavy toll of young *Batagur* at the Tale Sap nesting area in Thailand (Smith, 1945).

Distribution and status:

River terrapins have historically inhabited southern and southeastern Asia from West Bengal, India to South Vietnam (Cochin China) and Sumatra. To what extent this former range is still occupied is little known. For regions where information is available, there appears to have been general long term declines in population size.

During the mid-ninteenth century *Batagur* abounded in the Sunderbans of West Bengal (Gunther 1864) but now it is rare and may be extinct in the region (Biswas and Biswas 1982). Some river terrapins still nest in the Sunderbans of Bangladesh but their numbers have not been estimated. No recent reports are available from Burma but populations there were reported to be rapidly declining around the turn of the last century (Maxwell 1911). The species is threatened with extinction in Thailand and is presently known to occur in only three peninsular provinces (Wirot 1979, Bain and Humphrey 1980).

The river terrapin is still widely distributed in Malaysian Rivers (Fig. 1) but information on population size and declines is only available for the Perak River population. Prior to World War II, egg harvests on the Perak ranged from 450,000 to 650,000 eggs annually whereas presently harvests of 20,000 to 30,000 eggs are considered large (Mohamed Khan 1964, Moll 1978, Siow and Moll 1982). Moll (1980) estimated the entire Perak population at between 1200 amd 3600 individuals and comprising 43 percent males 33 percent females and 24 percent juveniles and immatures. Nothing is known of the status of *Batagur* populations in Sumatra and Viet nam.

Economic importance:

Although adults are rarely eaten in Malaysia, river terrapin eggs are in great demand selling for 5 times the price of chicken eggs. *Batagur baska* along with *Callagur borneoensis* are the only fresh water species which figure prominately in the Malaysian turtle egg industry (see review by Siow and Moll 1982). On the Perak River, the largest remaining population will still lay some 25,000 eggs per year having a market value in 1979 of M$10,000. No figures are available from other sites in Malaysia.

Batagur also figured prominately in the turtle egg industry of Burma in the late 19th and early 20th century (Maxwell 1911). Perhaps this is still true but there is no recent information to confirm this.

Factors contributing to endangered status of species:

The two most significant reasons for the decline of *Batagur* throughout its range have been over exploitation for food and alteration of the turtles habitat.

Batagur baska is perhaps the most heavily exploited of the Emydids inhabiting tropical Asia.

In West Bengal, India, the turtle was much used for soup during the mid 19th century (Theobald 1868) and large numbers were shipped from the mouth of the Hooghly River up to Calcutta to be sold in markets. Whether its subsequent disappearance from the Hooghly is due to over exploitation, to extensive water development projects on the river or to some other factor is unknown.

Heavy exploitation of eggs along with increased cultivation of inland nesting areas and heavy steamer traffic were contributing factors to the river terrapin decline on the Irrawaddy River of Burma (Maxwell 1911); Similarly the decline of the species in Thailand has been attributed to over exploitation and habitat modification (Bain and Humphrey 1980).

A major decline of *Batagur* populations in Malaysia occurred during the Japanese occupation of World War II (Lock 1950, Mohamed Khan 1964). Due to food shortages at this time, eggs and adults were eaten in large numbers. Continued exploitation and habitat destruction following the war have prevented recovery of the population to pre war levels.

Eggs continue to be in great demand and have high market value (5 times the price of hens eggs) thus nesting beaches are closely patrolled and few nests escape detection (see Siow and Moll 1982 for review). Only on the Perak River (Kedah?) is the egg take controlled (see next section). Adults though protected in most states are still occasionally killed for food. The practice is most common on the west coast but because of the illegality it is impossible to determine how extensive this killing might be.

River terrapins are directly killed by humans for a variety of other reasons some accidental and some intended. Motor boats and ships occasionally collide with the *Batagur.* Conversations with boatmen on the Perak River indicate that collisions sufficient to snap a motor shear pin are not infrequent. Eight percent of the adult *Batagur* examined on the Perak River possessed shell injuries which could have resulted from such encounters. Two of five dead *Batagur* found along river banks had large portions of the shell cracked or broken away suggesting that these collisions can be fatal (Moll 1976a).

Batagur are sometimes caught incidentally in nets or on hooks. As these large turtles can damage the fishing equipment, angry fishermen have been known to kill the turtles or to tether them to some floating object as a deplorable form of sport. A large male was found on the Trengganu River with a plastic tie around its hind leg which had cut to the bone. The gangrenous hind foot had to be amputated. On another occasion a female was found tethered to a coconut by means of a hook. The exhausted terrapin would have perished if not discovered. Egg collectors along the Kedah River reputedly catch gravid female terrapins in the water and keep them in wooded cages on a beach to induce egg laying. If this is unsuccessful they may kill and break open the female to obtain the eggs (Moll 1976a).

Fishermen have also been known to dump a variety of toxic substances into rivers to kill fish. According to residents along the Trengganu River such practice has greatly reduced fish and terrapin populations. Derris has minimal affect on terrapins but potent insecticides (e.g. DDT, Aldrin, Dieldrin) can kill turtles directly or can build up in certain tissues and eggs becoming health hazards to human consumers (see Hall 1980 for review).

Indirect factors such as habitat alteration are perhaps still more important to the decline of *Batagur.* Again these factors take many forms which can adversely affect feeding areas, nesting sites or both.

Habitat deterioration is most serious on the more developed west coast. Clearing of forested water sheds and tin mining can lead to a greater silt load with associated problems of increased flooding, silt deposition, and reduced productivity. Unseasonal floods are most dangerous to *Batagur* for when they occur during the nesting and incubation periods, the entire annual reproductive output can be destroyed. A flood on the Perak River in 1967 destroyed most of the terrapin reproductive output for that season as well as 200 eggs in a Game Department hatchery program (Balasingam and Mohd.

Khan 1969, Mohd. Khan 1977). It has also been suggested that increased silt deposition has encouraged lallang grasses to grow on those sand banks of Perak River used by *Batagur* for nesting. Were it not for annual clearing of the grass by egg collectors, few open nesting sites would remain. Finally turbidity reduces growth of aquatic vegetation which may be used for food.

Clearing banks of vegetation in downstream areas lowers the rivers productivity and carrying capacity by directly eliminating a food source and indirectly by further increasing turbidity and sedimentation. On the lower Perak River, a staple food in the terrapin diet, the mangrove fruit, *Sonneratia,* grows along the river bank. Certain estates have been clearing the mangrove vegetation and substituting sterile brick brack (rock) to hold the bank.

Dams create a variety of ecological effects (see Faxter 1977 for review) some of which are harmful to river terrapins. Dams or tidal barrages blocking a major river (Kedah River) can block movement between the turtles feeding and nesting areas. A complete blockage will eventually destroy the population. Tidal barrages on smaller tributaries prevent terrapins from using the rich productivity of these streams. Many small tributaries on the lower Perak had been blockaded for irrigation or building roads etc. when I surveyed this area in 1976 (Moll 1976a).

Commercial sand removal was observed in all major nesting areas observed. On the Kedah River one of the most favourable nesting sites was completely destroyed by the practice (Moll 1967).

Protective measures

Five out of eleven states currently have laws regulating collection of eggs and/or protecting adult turtles. For the most part these were aimed at marine turtles but often included river terrapins as well.

The first such acts were passed in 1915 in Perak and Pahang. The former entitled the 'River Rights Enactment' prohibits the killing of *Batagur* and made the collection of eggs a perogative of the Sultan. The Pahang Act, the 'Turtle's Eggs Enactment,' empowered the Resident to control collection of turtle eggs. In the Fisheries Rules of 1938, this legislation was revised to prohibit capturing, killing or hindering turtles from laying their eggs. Similar legislation was promulgated in the state of Kelantan under its 'Turtles and Turtles' Eggs Enactment of 1932' which was amended by Enactment No. 8 of 1935 to provide firmer control.

Trengganu promulgated the 'Turtle Enactment of 1951' to prohibit killing and to control collection of eggs. Most recently Kedah passed the Turtle Rules 1975 Enactment' but this only controlled the licensing of collectors and offered no protection.

In 1975, the Fisheries Department reviewed existing legislation and drafted new legislation to provide increased and uniform protection for turtles throughout Malaysia. The act prohibits killing or possession of adults and

requires that the collector sell a specified percentage of the egg harvest to a hatchery. The legislation which includes *Batagur baska* has been submitted to the various states for approval.

In addition to protective legislation, the Department of Wildlife and National Parks operates conservation programs for *Batagur* involving hatchery and head starting techniques in three states – Perak, Kedah and Trengganu. The first such program to be established was in Perak in 1967 under the 2nd Malaysia Plan. Egg collectors in Perak must purchase licenses which stipulate that one third of the eggs must be given to the Sultan and one third to the Department of Wildlife for the hatchery. In the hatchery, eggs are buried in an artifical sand beach or are incubated in styrofoam boxes or plastic buckets full of sand. Following hatching, the young are placed in shallow concrete pools where they are fed such as Kangkong *(Ipomeae reptans)*, ;banana and fish. At the end of one year the turtles are released at the nesting beaches. Hatcheries in Trengganu and Kedah begun in 1976 and 1978 respectively, operate similarly except that egg collecting licenses are not required for Trengganu's *Batagur.*

II RECOVERY

Recovery Plan Outline for Malaysia

Primary objective: To maintain and attempt to increase populations of river terrapin by controlling egg collection, developing hatcheries and sanctuaries and protecting adults along with their essential habitat.

1. Preserve and protect existing populations and habitats of river terrapins in Peninsular Malaysia.
   A. Conduct status surveys of major river systems.
      1. Determine which river systems of Malaysia are inhabited by the river terrapin.
      2. Identify important nesting sites and feeding areas on these rivers.
      3. Estimate numbers of nesting females by censusing numbers of nests or eggs collected on major sites.
      4. Determine levels of exploitation of eggs and turtles.
      5. Identify potential environmental threats to the population (dams pollution, clearing bank vegetation, removal of sand from nesting sites etc.

   B. Preserve essential habitat (nesting and feeding areas) on each river having extant terrapin populations.
   C. Control exploitation by protecting turtles and by developing licensing systems which limit exploitation of eggs.
   D. Conduct studies on habitat life history and limiting factors.

1. Determine physical, chemical and biological characteristics of the turtles habitat. Monitor habitats periodically for signs of deterioration.
2. Determine kinds and levels of mortality on eggs, during ontogeny and for each sex.
3. Determine diet throughout ontogeny and for each sex.
4. Determine rate of growth and sexual maturity for each sex.
5. Determine reproductive parameters cycles and habits.

E. Conduct studies on the effectiveness of hatchery and headstarting procedures.
   1. Determine effects of incubation temperature on sex determination.
   2. Determine hatching success in nature compared to replanting on protected beaches or in sand filled containers.
   3. Compare survival of hatchlings released immediately after emergence with that of yearling turtles which go through a one year headstarting program prior to release.

F. Conduct public education programs advising local residents on the value of river terrapins, the need for protecting turtles and habitat and for limiting egg exploitation. Include public participation in the conservation program whenever possible.

G. Enforce laws currently protecting river terrapins and their remaining habitat. Inform agencies of their enforcement responsibilities.

II. Improve habitat where feasible.
   A Nesting beaches
   B. Feeding areas

Recovery Narrative:

Although widespread habitat deterioration may prevent returning river terrapin populations to pre World War II levels, methods cited herein should bring about stabilization of populations at several times their present levels.

The following discussion of the plan is keyed to the preceding outline.

IA – The first step to designing a comprehensive recovery plan for peninsular Malaysia is to pin point locations of existing populations and their key habitats, estimate the size of each and determine what limiting factors are operating.

IB – Next the most critical habitats to the turtles survivals, nesting and feeding areas must be protected. Ideally at least one important nesting area on each river should be gazetted and maintained as a sanctuary or to provide eggs for hatchery purposes. In feeding areas clearing of river bank vegetation should be discouraged and access of turtles to small tributaries maintained. Zoning laws may be useful for this purpose.

IC – The third step seeks to control but not eliminate exploitation. To maximize sustainable long term benefits of the resource, exploitation should

be limited to eggs while the long-lived, slow-maturing turtles are totally protected. Some form of licensing system should be developed for each river to regulate levels of egg exploitation. The licensing system used for *Batagur* in Perak or the one used for sea turtles in Trengganu are recommended as models. Important requirements would be that the egg collector in return for the exclusive collection rights to a specified beach would agree to:

a. pay a fee set by the state or the highest bid in a site action.
b. provide accurate statistics on numbers of eggs and nests in the licensed area each year.
c. sell a designated portion of the eggs collected for use in a hatchery. Until it becomes evident that terrapin populations are increasing, a large portion of eggs laid should be purchased for the hatchery. An initial figure of at least 50 percent is suggested.

Ideally fees collected for licenses should be recycled into the program to purchase eggs and maintain hatcheries.

ID – Thorough studies on the ecology of *Batagur* are needed to design and evaluate management procedures Moll (1980) reviewed the knowledge of terrapin ecology on the Perak and Trengganu rivers. However, certain key data were not obtained (e.g. annual reproductive potential, longevity) and require more study. This research indicated that rather major differences in ecology can occur between major river systems requiring the populations on each river system be investigated at least cursorily.

IE – Any time eggs have to be handled and transported there is likely to be a reduction in hatching success. Where feasible one of the most economical and potentially very effective conservation systems is that of a sanctuary where nests are left intact and the area is periodically patrolled to discourage poachers and predators. In areas of frequent flooding and/or high human density, a hatchery is recommended, however, the physiological requirements of the eggs should be carefully studied before designing hatchery procedure.

Until recently the chief criterion used to evaluate hatcheries has been hatching success. It has now become evident that sex ratio production is a more important parameter for most species. Recent studies (Pieau 1975, Bull and Vogt 1979, Mrososky and Yntema 1980) have shown that temperature influences sex determination. Frequently higher temperatures produce females and lower temperatures males. This is highly significant to hatchery operation which eggs kept in styrofoam boxes or plastic buckets within buildings, in shaded areas of beach or other relatively cool sites could be producing only male hatchings. The effect of temperature on sex determination in *Batagur* should be studied and then hatchery procedure should be designed to produce at least equal numbers of each sex or possibly somewhat greater numbers of females.

Headstarting (i.e. raising hatchings for a period prior to release) is

presently coupled with the three hatchery programs for *Batagur* in Malaysia. This technique also should be used with caution. It is not known how female terrapins find their way up river to the nesting areas each year. One theory proposed for sea turtles is that hatchings imprint to key features of the nesting beaches as they leave the nests and move to feeding areas. If hatching imprinting is important in *Batagur* a years captivity could affect their ability to return to the proper sites and nest in a satisfactory manner. The technique should be carefully studied.

Prior to release from headstarting enclosures, juveniles should be marked (Plummer 1979) so that they can be reidentified if they return to nest as adults. This, however, may take many years. A useful short term study to evaluate the head starting technique would be to compare survival of *Batagur* that were marked and released at hatching with equal numbers of those which went through head starting.

IF – The long term success of any conservation program requires public support. Cooperation is more likely when the public understands the needs for the program and how it will benefit them by increasing the numbers of river terrapin (IUCN 1980). Use of mass media (such as the television special on the Tuntong in 1976) and environmental education in the schools are particularly needed to build a conservation ethic among the people. Involving members of the local community in the program either as paid workers or volunteers will also help build local confidence and acceptance of the project.

IG – There are already laws in most states which if strictly enforced can benefit the river terrapin. These include laws prohibiting clearing of bank vegetation, pollution of water ways, and killing or harassing adult turtles. Where licensing systems and egg quotas exist, non-licensed collectors should be closely controlled and licensees should be checked periodically to see that the hatchery is receiving its entire quota. Make sure that the responsible agents and agencies are aware of these laws.

II – In some instances it is possible to improve the critical habitat. For nesting, *Batagur* seem to prefer large open high banks of sand. Popular nesting sites destroyed by sand removal or through erosion can be rebuilt by importing sand from other areas. Removal of vegetation which encroaches on the nesting area is a necessary annual practice at the Perak nesting sites.

Planting the Mangrove, *Sonneratia,* in areas where bank vegetation has been removed or destroyed could be undertaken in areas near river mouths.

Thorough study of the river terrapin's ecology is likely to reveal other ways in which the habitat can be improved.

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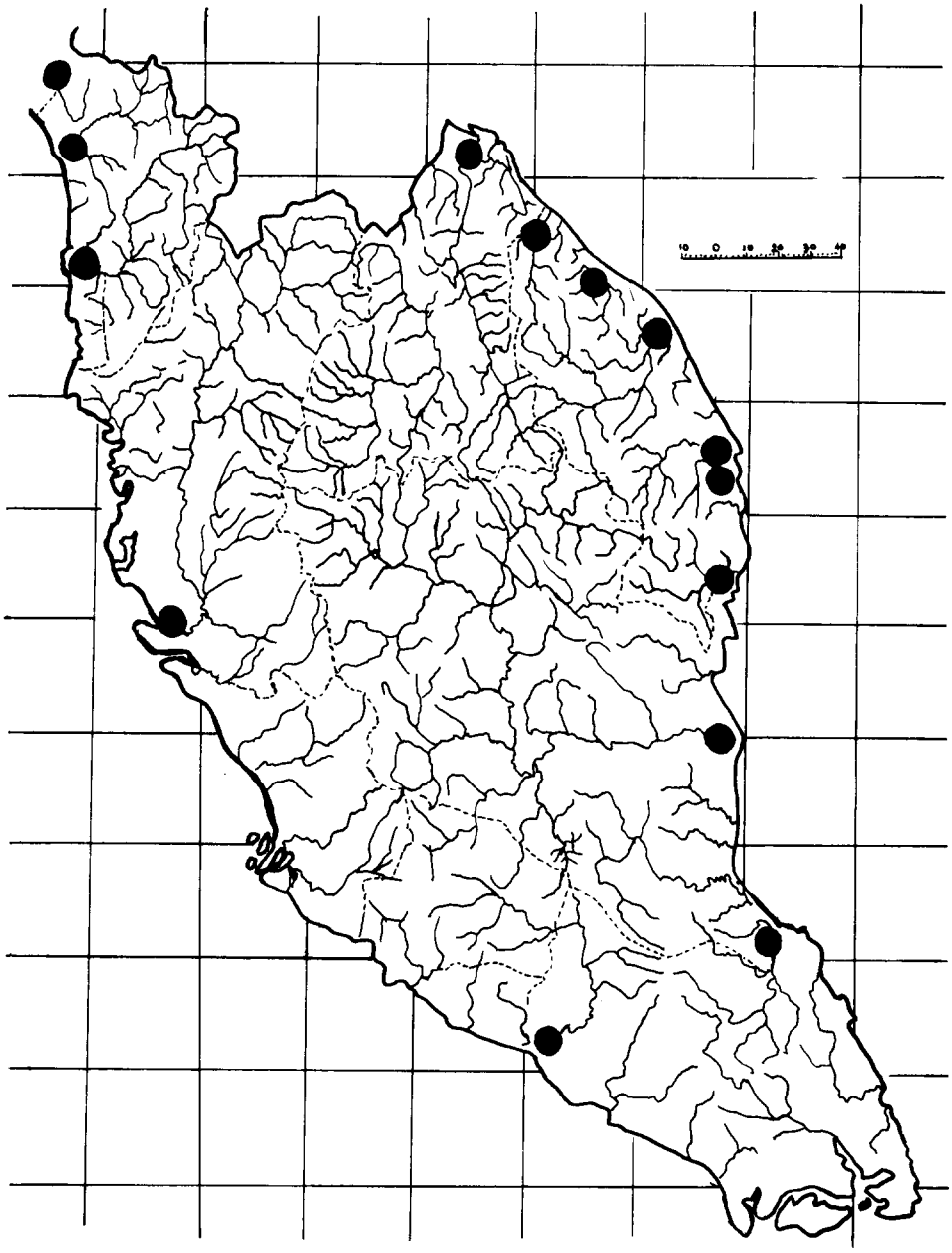
Figure 1. Distribution of the river terrapin, *Batagur baska* in Malaysia. The localities shown were obtained from Hendrickson, 1961 and from field work by the author in 1975–76, and in 1978. I have seen *Batagur* from the Kedah, Perak and Trengganu Rivers. Other sites determined from interviews with fishermen and egg collectors, by myself and earlier by Hendrickson need substantiation.



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PRELIMINARY OBSERVATIONS ON A SUMATRAN RHINOCEROS IN AIR KEROH ZOO MALACCA

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ABSTRACT

This is the first account on observations made on one of the rarest mammal i.e. female Sumatran rhinoceros *(Dicerorhinus sumatrensis)* that was captured on 30th April 1984 in Jeram Selangor. The animal was then brought to Zoo Air Keroh Malacca and has been kept there ever since in a temporary enclosure. This rhino is the only captive specimen anywhere in the world. The paper describes the animal and the preliminary observations made of the animal's eating habits, behaviour and notes on the presence of parasites. The rhino has since been named Jeram.

ABSTRAK

Ini adalah merupakan lapuran pertama ke atas pemerhatian yang telah dibuat ke atas salah satu mamalia yang jarang sekali dijumpai iaitu seekor badak kerbau *(Dicerorhinus sumatrensis)* betina yang telah dapat ditangkap pada 30hb. April 1984 di Jeram Selangor. Binatang itu telah diletakkan di dalam kurungan sementara Zoo Air Keroh Melaka. Ia merupakan satu-satunya spesimen dalam kurungan di dunia ini. Kertas ini menerangkan ciri-ciri binatang itu dan hasil pemerhatian awalan ke atas cara pemakanan, perlakuan dan catatan mengenai parasit. Badak ini telah diberi nama Jeram.

INTRODUCTION

The sumatran rhinoceros *(Dicerorhinus sumatrensis),* Rhinocerotidae, Perissodactyla is one of the three species of rhinoceros living in Asia. The other two are the Javan or smaller one – horned rhinoceros *(Rhinoceros sondaicus* DESMAREST) and the Indian or great one – horned rhinoceros *(Rhinoceros unicornis* L.). These two Rhinoceros species are characterised by the presence of several folds in the skin, giving the animal an armoured appearance, and the possession of only one horn on the nose. In Dicerorhinus the skin folds are less marked and there are two horns on the nose. Dicerorhinus is by far the smallest of the three species (Van Strien 1974).

BACKGROUND

On 30th April 1984, the Department of Wildlife and National Parks was informed that a rhino was caught in an oil palm estate in Jeram Selangor. When officials from the Department arrived at the scene, the rhino was

already tied to an oil palm tree and animal was drinking from a bucket held by a man. The animal seemed calm even though it was surrounded by about 200 people. A transport cage that was previously constructed for another rhino capture project was brought in. The animal was manouvered into the cage and a crane was used to lift the cage and its load onto a lorry. The animal was then transported to Air Keroh Zoo in Malacca.

A temporary paddock was quickly constructed and completed within two days at the Zoo. The animal was released into the paddock.

At the moment, this rhino is the only captive specimen of its kind in the world. The last captive sumatran rhino died in Copenhagen Zoo in 1972. There is great interest worldwide in this rhino and it has become the focus of attention of many scientists internationally. However the animal is not exhibited to the public. It is being kept in the temporary enclosure for close observation and preliminary research on this unique species.

STUDY AREA

The rhino is kept in a wooden enclosure in the Air Keroh Zoo, Malacca. The Zoo is situated 14 km from Malacca town centre. It has a total area of 53 acres which are being developed in phases. A permanent paddock comprising a barn with eight stalls is now under construction and is reaching completion.

METHOD

The method involved direct observation of the animal. The general appearance, the horns, the dentition, the sensory organs and the call were recorded. The initial body measurements and weight were recorded when the animal was first caught.

Measurements of the body parts were done once every month. Observations on the animal's behaviour and habits were done daily. Faecal analysis to check on the presence of parasites were done once a month. The animal was also dewormed after some worms were observed in its faeces. The types of plants and other food items preferred by the animal were noted. Three types of litter beds were experimented on the floor of the sleeping stall and the reaction of the rhino to the beds was noted.

RESULT AND OBSERVATION

General Appearance

If one were to look at Jeram from the back one would have thought that she was a buffalo because of her small size and the colour of her skin i.e. dirty greyish brown. The animal also emitted odour typical of bovines. This resemblance is further enhanced by the bristly hair on her body and her four limbs.

Body measurements

Foot size	16.0 cm
Width of central toe	7.9 cm

Height at shoulder level	112.0cm
Length of body from tip of nostril to tip of tail	258.0 cm
Body weight	400 – 500 kg

All the above measurements were actual sizes of the animal as they were measured on the animal itself, except for the body weight which was estimated.

The Horns

When the animal was first caught, her anterior horn was clearly developed and measured about 6 cm. However the horn broke during her transfer from Jeram to Zoo Air Keroh, Malacca.

The posterior horn was represented by a small stub. Once in the enclosure Jeram developed the habit of constantly rubbing her horn on the wood of the paddock with the result that the horn was completely worn away and has remained so.

The skin

The skin was tough and on closer examination cracks could be seen especially along the spinal region from behind the ear to almost the top of the tail region. The cracks were more obvious after the animal had been bathed and if the animal did not wallow in the muddy water the exposed cracks could become infected. Other parts of the skin were much smoother. The cracks are believed to be caused by the more open and drier conditions that the animal is exposed to as compared to its natural habitat. To overcome this problem mud is applied to the animals back several times a day.

There were two folds on the body, one major fold behind the fore limbs encircling the abdominal region and a smaller one in front of the hindlimb. The skin on the top halves of the fore limbs were also folded.

The skin was dirty greyish brown in colour. However the inner parts of the folds, the lips region, inside the ears and below the neck, the skin was pinkish in colour.

The Dentition

The dental formula is as below:-

$$i = \frac{1}{1} \qquad c = \frac{0}{0} \qquad pm = \frac{3}{3} \qquad m = \frac{3}{3}$$

The animal lacked canines. The teeth were well developed and the premolars and molars were blackened due to the animal's preference for leaves that produced latex. Otherwise they were in good condition.

The Sensory Organs

Her left eye was damaged and infected when she was caught. The wound has since been treated and has healed. However the eyeball was pierced

resulting in total blindness. The right eye is perfect. It is not known how sharp her hearing is. However it has been observed that the external ear lobes would stand up whenever she heard any sound in her vicinity. She was also aware of any human movement and sound outside her enclosure. As to her sense of smell, that was also unknown. In the wild, whenever the animal picks up human smell, it would run away. In the case of Jeram, she has become quite accustomed to human presence especially her keeper and the fear of human does not exist.

The Call

The animal emits a squeal rather unexpected of a large animal. The sound comes from her nostrils.

She would squeal while she was resting and also during feeding. Sometimes she would also snort especially after feeding, while wallowing and especially when annoyed.

The Limbs

The legs were short and stout in comparison with the large body. Each of the feet had three toes complete with hooves. The hooves were dirty brown in colour. The sole of the foot was soft and elastic. Thus when the animal walked, her feet would spread out.

Behaviour

The animal is let out of the stall at 7.00 am everyday by her keeper. She then proceeds straight to the feeding cage even though the cage door has not been opened yet. She has related the cage as her 'food source' because feeding has been done in the cage all the time. After the first feeding of the day she would urinate and defaecate. Defaecation always takes place in the wallow. Defaecation would always be preceeded by her pawing the ground with her hind feet. Urine is squirted backwards.

At one feeding, she would consume between 15 to 20 kg. of leaves. After feeding she would go to sleep either in the feeding cage itself or in the wallow. If she was in the wallow, she would either squat or lie on her sides, changing sides from time to time with her head 'planted' in the soft mud.

She would squeal and snort at the same time. When hungry she would proceed back into the feeding cage. If her keeper was not around, she would squeal almost continously. At other times, she would walk within the compound rubbing her head against the tree trunks and the walls of the wooden enclosure. She would sometimes rest against the wall of the enclosure.

Diet

From the first day Jeram was caught up till now (September 1984), she has been fed with leaves obtained from nearby forests. The types of leaves

fed to Jeram was based on observations made on plants browned by rhinos in the wild and through references in the rhino literature. Besides that other leaves not known to be eaten in the wild were also given and the preference for these leaves was noted. Commercially obtained food was also fed to her.

Listed below are the plant species eaten by Jeram.

No.	Scientific names	Vernacular name	Parts eaten
1.	*Macaranga triloba*	Mahang merah	leaves
2.	*M. gigantea*	Mahang gajah	leaves
3.	*M. hypoleuca*	Mahang putih	leaves
4.	*Ficus grossularoides*	ara	leaves, fruits
5.	*F. fistulosa*	ara	leaves, fruits
6.	*Artocarpus integer*	cempedak	leaves
7.	*A. heterophyllus*	nangka	leaves
8.	*A. elasticus*	terap nasi	leaves
9.	*Garcinia spp.*	kandis	leaves
10.	*Elaeis guienensis*	kelapa sawit	leaves
11.	*Saccharum officinarium*	tebu	leaves, stem
12.	*Hevea brasiliensis*	getah	leaves
13.	*Mangifera odorata*	quini	fruits
14.	*M. indica*	mangga	fruits
15.	*Flacouratia rokum*	rokum	leaves
16.	*Mikaniea cordata*	akar malayalam	leaves
17.	*Spatholobus spp.*	kacang gila	leaves
18.	*Pyrus malus*	apple	fruits
19.	*Ipomea reptans*	kangkong	leaves
20.	*I. batatas*	keledek	leaves
21.		kambing	leaves
22.	*Manihot utilissima*	ubi kayu	leaves
23.		temperar	leaves
24.	*Cratoxyllum formosum*	derum	leaves
25.	*Adinandra dumosa*	tiup-tiup	leaves
26.		jolok hantu	leaves
27.	*Mallotus spp.*	balik angin	leaves
28.		puding	leaves

On average Jeram was fed about 55 kg. of leaves a day. The amount was spread into five separate feedings during the day. During the night about 20 kg of leaves were left in the sleeping stall for the animal to feed herself.

Among the plant species listed above, the most favoured by Jeram were from the *Macaranga* and *Ficus genera.* During the day the animal was handfed and usually no leaves were wasted. If allowed to feed by herself, she would select and pick the leaves that she liked and waste the rest. Feeding was done in a wooden cage placed at one corner of the stockade.

Besides the leaves each day Jeram was fed one kilogramme of special pellets. She was also given salt.

Parasites

i) Ectoparasites

No ectoparasites were detected on the body of the animal. The animal

was bathed every evening before being kept in the sleeping stall. That was done to prevent any external infection because the animal liked to wallow in her faeces and urine.

ii) Endoparasite

The animal was given a deworming drug MEBENDAZOLE (Methyl–5 –benzoyl–1H–benzimidazoil–2yl) carbamate in early July. This was immediately after some worms were observed in faecal sample sent for laboratory examination. The following day the faecal sample had a very heavy worm load (up to 200 worms/g of faeces). The dosage was 10–15 mg/kg body weight. The faeces was sent for analysis to Universiti Kebangsaan Malaysia and Institute for Medical Research. The nematode worm is akin to the pinworm found in the horse colon. There is a similarity between a horse and a rhino's digestive system. Thus the first conclusion was that the worm belonged to the genus *Probsmayria.* After detailed analysis it was found that the nematode was quite different from those found in this country. In fact according to experts it has never been encountered here before. Both UKM and IMR parasitologists, Dr. Inder Singh (IMR) and Dr. Zahidi (UKM) agreed that the nematode was from the *Crossocephalus* genus.

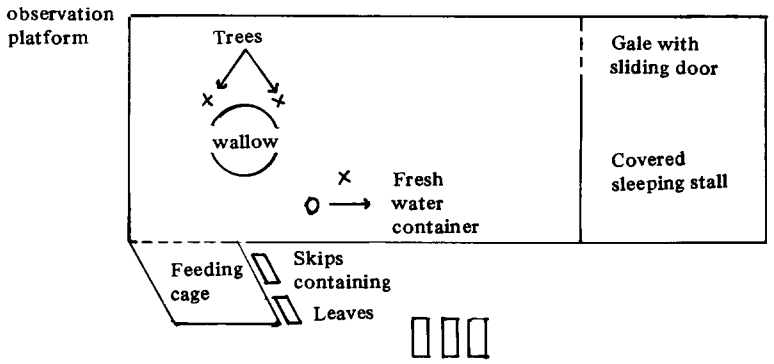
However the species have not been identified as with the cestode found in the faeces. Some specimens have been sent to the United Kingdom for identification.

The faeces was then analysed once a fortnight and was observed to be clear of worms. At the end of August a few worms were again spotted in the faeces. The presence of worms were expected because although the animal was dewormed the worm's eggs and cysts must still be present in the animal's system. But because they was no reinfection as the animal was kept in captivity, the infestation was very little. However the animal is being dewormed once a month.

Further Studies

At the moment samples of the animal's urine is being collected for analysis of reproductive hormone metabolites. The assay will be carried out in San Diego Zoo, California, U.S.A. As an attempt to study the animal's reproductive cycle which will help us to determine when the animal is in oestrus such that when a male is available, the pair can be mated. This will prevent accidents that are known to occur in the African species when a male was released into the paddock of a non-receptive female. The Sumatran rhino nay react differently from the African as observation have shown this animal to be more docile and appear closer in behaviour to the Indian rhino.

The Temporary Enclosure



The Temporary Enclosure

The temporary enclosure is made of wood, 45' x 25' wide. The sleeping stall is covered with attap roof and the floor concreted. The door of the stall is opened from the outside and the door also slides out. The 'playing and resting' area is exposed and include a wallow, a concrete water container and a number of trees. The wallow is drained daily in the evening after the animal has been placed in the sleeping stall. Feeding during the day was usually done in a crate at one corner of the enclosure.

It was suggested that the animal be allowed to sleep on a soft litter bed. It was experimented with wood-wool which was placed at one corner where the animal usually slept. This was observed to be unsuitable as the animal littered the whole stall and so the idea was abandoned. Experiments with straw and fronds from oil palm will be carried out.

The sleeping stall was cleaned daily with antiseptic agents to minimise infection that can arise from her own urine and faeces.

DISCUSSION AND CONCLUSION

The above is only a preliminary observation on a sumatran rhino held captive in Zoo Air Kroh Malacca. The animal was observed at close quarters daily and all the physical parameters recorded. This is the first time detailed direct observation was possible since the last specimen died in Copenhagen Zoo. No detailed research has been done on the animal as it has been allowed to acclimatize itself to a new environment in captivity. Construction of a permanent paddock and stalls are under way. Trapping work is being done to capture more rhinos so that captive propagation can be started.

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Vol. 3 October, 1984

THE RELATION OF BODY CIRCUMFERENCE TO HORN DEVELOPMENT OF TWO SELADANG RAISED IN CAPTIVITY

By
Ebil bin Yusof

ABSTRACT

The growth rates of two young captive seladangs (Ahad) male and (Biak) female, were measured. 18 measurements of both horn and body circumference were taken from Ahad and 17 from Biak. Ahad was 18 months old, while Biak was 17 months old. During the early period in captivity, both animals were fed with powdered milk until the age of 3 weeks. After that supplementary food, mainly grasses and leaves were added.

ABSTRAK

Kadar tumbesaran kedua-dua ekor anak seladang (Ahad) jantan dan (Biak) betina telah di ukur. 18 ukuran kedua-dua tanduk dan lilitan badan di ambil daripada Ahad dan 17 ukuran di ambil daripada Biak. Ahad berumur 18 bulan sementara Biak berumur 17 bulan. Pada peringkat awal kurungan, kedua-dua seladang ini diberikan susu tepung biasa dan sehingga umur 3 minggu baru diberikan makanan tambahan yang lain sebahagian besar rumput dan pucuk-pucuk daun.

INTRODUCTION

Since the seladang were restricted to the paddock, the natural habitat components as derived from telemetry locations (Ebil '82) had to be modified. Artificial grasses i.e. *Setaria nandi* and *Centrocema pubscens* were also planted in the paddock. In the previous research work at Ulu Lepar, grass species – *Paspalum conjugatum* and shrub species *Atalantia monophylla* were the most preferred species (Ebil '82). A lot of *Paspalum conjugatum* grew naturally in the paddock, while the other species had to be supplemented everyday from the nearby forest.

AIM

This study attempts to list some of the food properties of the pasture species found in the paddock with a view to gain a better understanding of the growth of Seladang particulary its horn and body girth. It further attempts to reveal the correlation that appear to exist between these two measurements.

The growth of seladang in captivity, depends solely on healthy pastures and supplementary food. A young pasture provides high proteined foods and are more digestible. *Setaria nandi* is rich in vitamins, phosphorus and calcium.

Body growth is dependent on food supply.

METHOD

The horn/body measurement were taken in the study period from 21.4.81 – 8.11.83. The length of the horn is measured on the outer curve from the base to the tip. Body girth or circumference is taken just behing the fore-limbs where it is at its maximum. Using the least square line method both measurements for Biak Ahad were plotted on a graph and the standard deviation was then calculated.

Table 1

Correlation between horn length (X) and Body Circumference (Y) of male seladang

No.	X	Y	X^2	XY
1.	2	96	4	192
2.	2.5	96.5	6.25	241.25
3.	2.6	96.5	6.76	250.9
4.	5	09	25	495
5.	5.4	106	29.16	572.4
6.	6.2	107.5	38.44	666.5
7.	8	120	64	960
8.	9.5	136	90.25	1292
9.	11	138	121	1518
10.	19	174	361	3306
11.	19	170	361	3230
12.	24	168	576	4032
13.	24.2	181	585.64	4380
14.	27	193	729	5265
16.	29.5	191	870.25	5634.5
17.	28	210	784	5880
18.	31	231	961	7161
$\Sigma N = 18$	$\Sigma X = 280.9$	$\Sigma Y = 2708.6$	$\Sigma X^2 = 6341.75$	$\Sigma XY = 50,287.55$

Equation $Y = a_0 + a_1 X \rightarrow \Sigma xy = a_0 \Sigma N + a_1 x^2$

$$a_0 = \frac{(\Sigma Y)(\Sigma X^2) - (\Sigma X)(\Sigma XY)}{NX^2 - (X)^2}$$

$$= \frac{(2708.6 \times 6341.75) - (280.9 \times 50,287.55)}{(18 \times 6341.75) - (280.9 \times 280.9)}$$

$$= \frac{(17,177,264.05 - 14,125,772.79)}{(114,151.5 - 78,904.81)}$$

$$= \frac{3,051,491.26}{35,249.69}$$

$$= 86.567$$

$a_0 = 86.567 \neq$

$$a_1 = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2}$$

$$= \frac{(19 \times 50{,}287.55) - (290.9 \times 2708.6)}{(18 \times 6341.75) - (280.9 \times 280.9)}$$

$$= \frac{(905{,}175.9 - 760{,}845.74)}{(114{,}151.5 - 78{,}904.81)}$$

$$= \frac{14{,}4330.16}{35{,}249.69}$$

$a_1 = 4.094 \neq$

Substitute $a_1 = 4.094$ and $a_0 = 86.578$ in $y = a_0 + a_1 x$

When $x = 1$

$y = a_0 + a_1 x$

$= 86.567 + 4.094$

$= 90.661$

When $y = 100$

$y = a_0 + a_1 x$

$100 = 86.567 + 4.094x$

$100 - 86.567 = 4.094x$

$x = \frac{13.433}{4.094}$

$x = 3.284 \neq$

Therefore, the coordinate for this line after calculating the standard deviation

$P_1 = (1, 90.661)$

$P_2 = (3.284, 100)$

By plotting this two points (P_1 and P_2) the actual line is drawn to the Y – axis purposely to find the body circumference when $x = 0$.

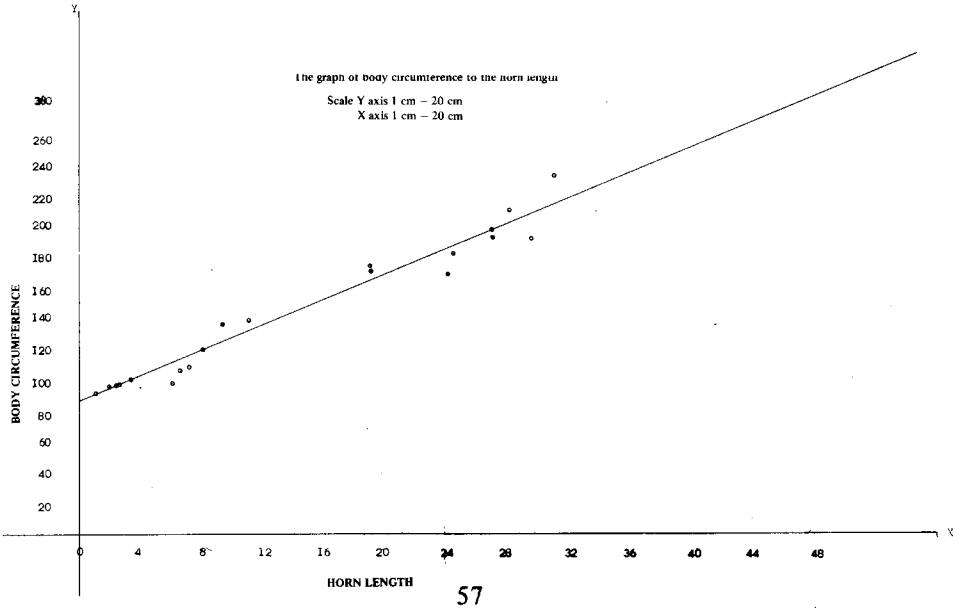

Table 2

Correlation between horn length (x) and body circumference (y) for female seladang.

No.	X	Y	X^2	XY
1.	1	86.05	1	96.05
2.	2	93	4	186
3.	3	97	9	291
4.	3.5	97.7	12.25	341.95
5.	5	99	25	495
6.	6	110	36	660
7.	7	128	49	896
8.	9	135	81	1215
9.	12	151.5	144	1818
10.	14	156.4	196	2189.6
11.	16	168	256	2688
12.	13	168	169	2184
13.	21	172	441	3612
14.	25.2	185	650.25	4717.5
15.	28.1	197	789.61	5535.7
16.	31	216.7	961	6717.7
17.	31.6	238	998.56	7520.8
$\Sigma N = 17$	$\Sigma X = 228.7$	$\Sigma Y = 2498.35$	$\Sigma X^2 = 4847.42$	$\Sigma XY = 41154.3$

Equation $y = a_0 + a_1 x$

$$XY = a_0 N + a_1 x^2$$

$$a_0 = \frac{(\Sigma Y)(\Sigma X^2) - (\Sigma X)(\Sigma XY)}{N\Sigma X^2 - (\Sigma X)^2}$$

$$= \frac{(2{,}498.35 \times 4{,}847.42) - (228.7 \times 41{,}154.3)}{(17 \times 4{,}847.42) - (228.7)^2}$$

$$= \frac{(12{,}110{,}551.75 - 9{,}411988.41)}{(82{,}406.14 - 52{,}303.69)}$$

$$= \frac{2{,}698{,}563.34}{30{,}102.45}$$

$$= 89{,}645$$

$a_0 = 89.645 \neq$

$$a_1 = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2}$$

$$= \frac{17(41{,}154.3) - (228.7 \times 2{,}498.35)}{17 \times 4{,}847.42 - (228.7)^2}$$

$$= \frac{699,632.1 - 571,372.645}{82,406.14 - 52,303.69}$$

$$= \frac{128,250.455}{30,102.45}$$

$$= 4.26 \neq$$

When x = 1

$y = a_0 + a_1 x$

$= 89.645 + 4.26$

$= 93.905$

When y = 100

$y = a_0 + a_1 x$

$100 = 89.645 + 4.26x$

$4.26x = 100 - 89.645$

$$= \frac{10.355}{4.26}$$

$= 2.43$

The coordinate for this line

$P_1 = (1, 3.905)$

$P_2 = (2.43, 100)$

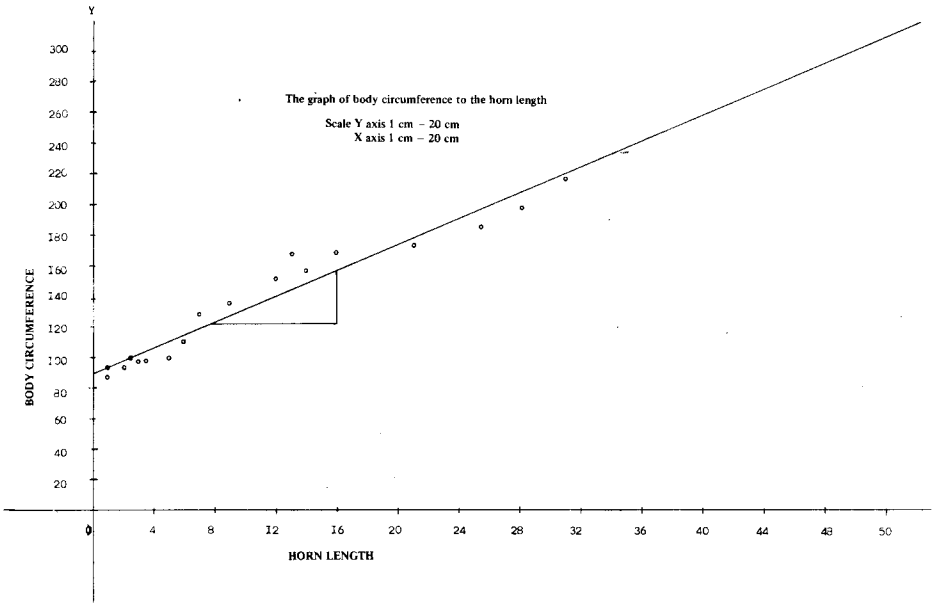

Table 3

Body circumference for male seladang X = Horn length (cm)

X	0	0.2	0.4	0.6	0.8
0.1	87.0				
0.2	87.5				
0.3	88.0				
0.4	88.5				
0.5	89.0				
0.6	89.5				
0.7	89.5				
0.8	90.0				
0.9	90.5				
1.0	90.7	92.0	92.5	93.0	94.0
2.0	95.0	96.0	96.5	97.0	98.0
3.0	98.5	100.0	100.5	101.0	102.0
4.0	102.5	104.0	104.5	105.0	106.0
5.0	106.5	108.0	108.5	109.0	110.0
6.0	110.5	112.0	112.5	113.0	114.5
7.0	114.5	116.0	116.5	117.0	118.0
8.0	119	120	121	122	123
9.0	124	124.5	125	126	127
10.	128	128.5	129	130	131
11.	132	133	133.5	134	135
12.	136	136.5	137	138	139
13.	140	141	142	142.5	143
14.	144	144.5	145.5	146.5	147
15.	148	149	150	151	151.5
16.	152	153	154	155	156
17.	156.2	157	158	159	159.5
18.	160	161	162	163	164
19.	165	165.5	166	167	168
20.	169	169.5	170	171	172
21.	173	174	174.5	175	176
22.	177	178	178.5	179	180
23.	181	182	183	183.5	184
24.	185	186	187	187.5	188
25.	189	190	191	192	192.5
26.	193.5	194	195	196	197
27.	198	198.5	199	200	201
28.	202	202.5	203	204	205
29.	206	207	207.5	208	209
30.	210	211	212	212.5	213
31.	214	215	216	217	217.5
32.	218	219	220	220.5	221
33.	222	223	224	225	225.5
34.	226	227	228	229	230
35.	230.5	231	232	233	234
36.	234.5	235	236	237	238
37.	239	240	240.5	241	242
38.	243	244	244.5	245	246
39.	247	248	249	249.5	250
40.	251	252	253	254	254.5
41.	255	256	257	258	259

X	0	0.2	0.4	0.6	0.8
42.	260	261	261.5	262	263
43.	263.5	264	265	266	267
44.	268	269	270	270.5	271
45.	272	273	274	274.5	275
46.	276	277	278	279	280
47.	280.5	281.5	282	283	284
48.	284.5	285	286	287	288
49.	289	290	290.5	291	292
50.	293	294	295	296	297

Table 4

Body circumference for female seladang X = Horn length (cm)

X	0	0.2	0.4	0.6	0.8
0.1	89				
0.2	90				
0.3	91				
0.4	91.5				
0.5	91.6				
0.6	92				
0.7	92.5				
0.8	93				
0.9	93.5				
1.	93.9	94	95	95.5	96
2.	97	98	99	100	100.5
3.	101.5	102	103	104	105
4.	105.5	106.5	107	108	109
5.	110	111	111.5	112	113
6.	114	115	116	116.5	117
7.	118	119	119.5	120.5	121
8.	122	123	124	125	125.5
9.	126.5	127	127.5	128	130
10.	131	132	132.5	133	134
11.	135	136	137	137.5	138
12.	139	140	141	142	142.5
13.	143	144	145	146	147
14.	147.5	148	149	150	151
15.	152	153	153.5	154	155
16.	156	157	157.5	158	159
17.	160	161	162	163	163.5
18.	164	165	166	167	168
19.	169	169.5	170	171	172
20.	173	174	175	175.5	176
21.	177	178	179	179.5	180
22.	181	182	183	184	185
23.	186	186.5	187	188	189
24.	190	191	191.5	192	193
25.	194	195	196	197	197.5
26.	198	199	200	201	201.5
27.	202	203	204	205	206
28.	207	208	208.5	209	210

X	0	0.2	0.4	0.6	0.8
29.	211	212	213	214	215
30.	215.5	216	217	218	219
31.	220	220.5	221	222	223
32.	223.5	224	225	226	227
33.	228	229	229.5	230	231
34.	232	233	234	235	235.5
35.	236	237	238	239	240
36.	241	241.5	242	243	244
37.	245	246	246.5	247	248
38.	249	250	251	251.5	252
39.	253	254	255	256	257
40.	257	258	259	260	261
41.	262	263	264	264.5	265
42.	266	267	268	269	270
43.	271	272	272.5	273	274
44.	275	276	277	278	279
45.	279.5	280	281	282	283
46.	284	285	286	287	288
47.	289	290	291	291.5	292
48.	292.5	293	294	295	296
49.	296.5	297	298	299	300
50.	301	302	303	304	305

DISCUSSION

There appears to be correlation between horn length, body circumference and body weight (Tables 3 and 4). However, of the three physical factors observed, only the horn (X) was found to be significantly correlated to body circumference (Y). Significant correlation being where $x<1.0$. Comparing the body circumferences of the two seladangs in the paddock, the female seladang was much larger in size.

CONCLUSION

1. The growth of horn and body circumference for the seladang in the paddock is in the ratio of 1:3.5 and 1:4 for the male and female respectively.
2. In comparison, when body size are equal, the male has longer horns.
3. After calculating the standard deviation of two graphs, the table 1 and 2 can be used for obtaining the body circumference of seladang.

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Vol. 3 October, 1984

TERRITORIAL RANGE OF AN ADULT TIGERESS AT THE BEHRANG ULU CATTLE FARM

By
Sivanathan Elagupillay

ABSTRACT

This paper discusses the territorial range of an adult tigeress. Observation shows that it has become less dependent on cattle and is able to establish for itself a far ranging territory and survive as a normal tiger. Its territory overlaps with part of the farm. As a result some cattle that were introduced into these paddocks were attacked immediately.

ABSTRAK

Kertas ini membincangkan tentang banjaran kewilayahan seekor harimau betina dewasa. Pemerhatian menunjukkan harimau ini kurang bergantung kepada lembu-lembu sebagai sumber makanannya dan ia telah dapat mewujudkan satu wilayah yang luas dan dapat hidup sebagai seekor harimau yang biasa. Wilayahnya merangkumi sebahagian daripada ladang lembu tersebut, menyebabkan setengah daripada lembu-embu yang dimasukkan ke dalam kawasan ini telah diserang dengan serta merta.

AIM

The aim of this paper is to look into the territorial range of an adult tigeress (named B1) and its relation to the adjacent cattle farm.

INTRODUCTION

B1 is one of the last remaining tigers found around the Behrang Ulu Cattle Farm. B1 is an adult female and has been discussed in an earlier article (Sivanathan, 1983). Up to and including early 1982 a number of tigers were found in and around the farm. The farm in consequence experienced a minimum of 50 heads of cattle killed each year by tigers between 1979 and 1982. In July, 1981 and October 1982 a young female tiger (B3) and a young male tiger (B4) respectively were eliminated. What now remains in the farm is B1 (believed to be a litter mate of the animals killed) and B2 a large adult tiger that has not been seen around the farm in recent times. As the farm is located of the foothills of the Main Range (See Map 1) B1 is not an isolated tiger since there are evidence of tiger activities in Ulu Slim and Sungkai forest which are located just north of the farm. There are also tiger movement around Fraser's Hill which is just south of the farm. And of course there are tigers in Raub district on the other side of the Main Range. As part of a continuous tiger population along the Main Range it would be interesting to study the territorial development of B1 as this forms an important aspect of survival of a normal tiger.

METHODS

Tracking of B1 was done by locating it and identifying its pugmarks. Once located its identification was based upon methods previously used. (Blanchard, 1977 and Panwar, 1979). Details of such methods has been further described by the author. (Sivananthan, 1983).

The territorial range of B1 was based on various events that took place at the Behrang Ulu farm especially livestock kills during 1983 and 1984. In addition tracks were also picked up and identified in the forest adjacent to the farm. Accounts given by the surrounding villagers were also noted. Regular tracking was done by the Department's Tiger Unit based at Slim Village. Track surveys were often limited to the farm area because of security conditions.

RESULTS

Killing trends

Between January 1982 and August 1984 a total of 78 heads of cattle were killed by tigers (See Table 1). Throughout 1982 most of the kills were caused by two young tigers. One of the young tigers was shot dead in October 1982 and the survivor B1 grew up alone. For a period of three months between December 1982 and February 1983 not a single cattle was killed though B1 was still present at the forest adjacent to the farm. (See Table II).

After a lapse of 3 months it made its first kill in March 1983. It continued to make constant kills up till August 1983. Between September 1983 and August 1984 (a period of one year) it only killed 4 heads of cattle, three of which were in January 1984 and after a lapse of 6 months it made its fourth kill in August 1984.

Table I *Cattle killed by Tigers 1979 – Aug. 1984*

Year	1979	1980	1981	1982	1983	1984 (up to August)	Total
Kills	52	57	132	54	20	4	319

Table II *Cattle Killed by Tigers Jan. 1981 – Aug. 1984*

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total
1981	2	5	13	16	17	11	15	10	18	6	15	4	132
1982	6	2	3	12	9	3	4	4	3	5	4	–	54
1983	–	–	4	1	2	5	3	5	–	–	–	–	20
1984	3	–	–	–	–	–	–	1					4

Movements outside the farm

Observation shows that B1 did not confine itself to the farm alone. As shown in Table III, B1 did move a minimum of five miles to the north and two miles to the east of the farm during the period 28th July '83 to 17th August '83 (See Table III and Map I).

Table III *Kills made by B1 and observation of its movement*

Date	28.7.83	1.8.83	4.8.83	7.8.83	9.8.83	17.8.83
Events	Killed a cattle at Salak–Tanjong	Killed a cattle at Salak–Tanjong	Killed a cattle at Salak–Tanjong	Tracks of B1 seen near Sg. Dara, 5 miles north of Salak–Tanjong	Killed an Orang Asli Dog, 2 miles upstream of Sg. Gapis	Killed a cattle at Malim Dalam

Between 28th July and 4th August, the tiger was within the vicinity of the farm. Kills took place at three different paddocks and there was immediate response from the farm personnel and the Tiger Unit. Regular night patrols were intensified. After the third kill B1 was not seen anywhere near the farm. Around 7th August B1 was near the Sg. Dara Orang Asli village. After receiving a report, fresh tracks of B1 were located two miles upstream of Sg. Gapis. A day before that on 9th August it pounced and killed on the spot a curious Orang Asli dog that was apparantly tracking it. The Orang Asli team that was on its way to collect some wild durians returned immediately on seeing the incident.

Paths used by B1

Throughout 1983 and 1984 it was observed that the Salak – Tanjong path that links to Sekiah paddocks was regularly used by B1. Nearly all the kills took place at paddocks adjacent to this path.

On a few occassions B1 did venture along the path that leads towards Malim Dalam and on such occasions it killed cattle in these paddocks. On one such occassion it was seen to follow the tracks of wild boars into Malim Dalam.

Tracks of B1 were not seen at all at Sekiah cattle paddocks although these paddocks also borders the adjacent Behrang Forest Reserve. Unlike the Tanjong – Salak cattle paddocks the Sekiah paddocks also borders human settlement (Kampung Baharu Behrang Ulu) and is subjected to a higher level of human activity such as the extraction of bamboo.

DISCUSSION AND CONCLUSION

It is evident from the results that B1 is not totally dependent on cattle for food. In fact over the years it has become less dependent on cattle for food. One reason for this is that as the tiger grew and matured it was able to

establish a territory for itself. The territory is large enough to allow the animal to hunt for its normal wild prey species.

As a normal tiger it is now able to prevent the intrusion of other members of the same species into its territory. This could be the reason why no other neighbouring tigers have moved into the area.

Another interesting observation is that part of B1's territory overlaps with the unused outer paddocks of Salak – Tanjong. All these paddocks are to the east of the Salak–Tanjong Path. Therefore when some cattle were introduced into these outer paddocks in late February 1983, 3 of the cattle were immediately attacked by B1.

B1 has also shown some sense of adaptation to the farm. It is able to use the Salak–tanjong Path as its territorial boundary. And like any normal tiger B1 has on occassions, ventured beyond its boundary in search of food. But unlike some tigers which permanently resided inside pocketed forest within the cattle farms (Sivanathan, 1983), B1 apparantly does not venture beyond its territory for a long period to look for food.

Since B1 is now a normal far ranging adult tigeress it is very unlikely to pose any significant threat to the cattle in the farm. Some cattle may be killed occassionaly but this could be considered as incidental and insignificant. Killing this animal in defence of livestock would create a vacuum for another tiger to occupy which may prove to be more prone to cattle lifting.

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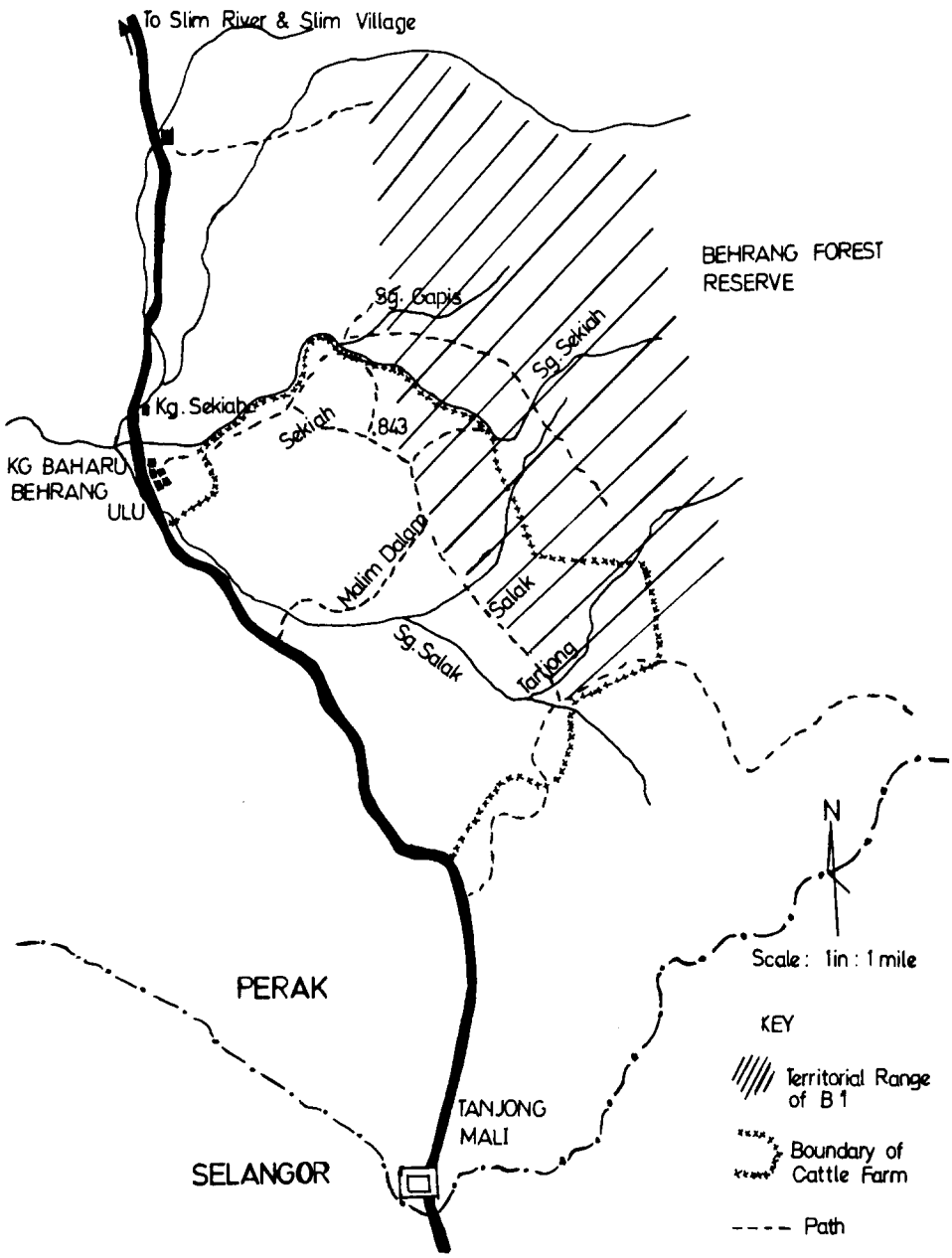
BEHRANG ULU CATTLE FARM



Vol. 3 October, 1984

HABITAT SUITABILITY INDEX MODEL: SELADANG *(Bos gaurus hubbacki)*

By
Saharudin Anan

HABITAT USE INFORMATION

General

The seladang or gaur *(Bos gaurus hubbacki)* inhabits early successional forest communities to seek grass and forbs from natural or artificial clearings (Conry 1981). Hubback (1937) observed calving throughout the year except October to December but other investigators noted that calves were born throughout the year including October to December (Weigum 1971, Conry 1981).

Food requirements

Seladang consume a wide variety of plant species. Grasses comprised the largest proportion of the diet in clearing and agricultural estate habitats, and browse from young shoots and leaves accounted for the largest proportion of the diet in the secondary forest habitats in Pahang (Conry 1981). Weigum (1972) concluded that 43% of its diet was grasses and sedges and 36% was represented by browses from trees, shrubs and vines. The grass, rumput cengkenit *(Paspalum conjugatum)* was an important food highly preferred by seladang (Medway 1969, Weigum 1972, Hubback 1937, Conry 1981, Foenander 1952).

Early seral vegetation inhabited mainly by rumput cengkenit and selaput tunggul *(Mikania cordata),* another important plant species, would eventully decline in frequency three years after gap opening (Wyatt-Smith 1955). A density of 24% rumput cengkenit and 26% selaput tunggul from available forage will suffice seladang requirements (Weigum 1972).

Water requirements

Seladang was always found at close proximity to riparian zones i.e. within 250 m of rivers and use of this zone accounted for over 45% of its total use (Conry 1981). Gaurs do not wallow (Vietmeyer 1983, Medway 1969). There was no reports on actual free water requirements described in the literarute but an observation on seladang in captivity at Wildlife Department's inbreeding program in Jenderak, Pahang indicated that it requires 91 liters of free water per day (Ebil Yusof and Lim Tze Chew, pers. comm.).

Cover requirements

Conry (1981) conducted a thorough study on habitat use. From telemetry data and statistical analysis, seladang had a high selection on agricultural estate and secondary forest habitats: but primary forests were selected against. The most preferred habitat was seral community of grasses and forbs adjacent to secondary forest of lowland dipterocarp forest of elevation 91 m or less. Secondary and primary forests were used for browse as well as for cover against the day's intense heat and predator avoidance (Khan 1973, Conry 1981).

Seladangs restrict themselves to the vicinity of abandoned cultivation or natural banks (Medway 1969, Conry 1981). This cover element is directly related to food requirements. An area within 250 m to ecotones and within 500 m to cultivation were readily used by seladang. Habitat of high diversity was selected for and an area of low diversity was selected against (Conry 1981).

Reproductive requirements

The reproductive requirements of seladang are considered to be identical with cover requirements, as described above.

Special requirements

The availability of adequate salt licks is vital (Khan 1973). Two to three mineral licks were present in the home range of a seladang in central Pahang (Conry 1981). Analysis of salt licks revealed that seladang were seeking sodium which was not readily absorved by plants (Weigum 1972). Location of salt licks will influenced its mobility. An adult bull in Pahang travelled 19 km for a mineral lick. A salt lick within 3.5 km was readily used by seladang (Conry 1981).

Interspersion requirements

Shape and size of home range were highly influenced by available resources and physiological features. Availability of grasses and salt licks was of optimum importance. The home range of seladang in central Pahang varies with sex and age. Conry (1981) calculated a home range of 7018 ha, 5213 ha and 2989 ha for adult male, adult female and yearling male seladang, respectively. A herd in Taman Negara had a home range of 1296 ha (5 sq. miles) (Weigum 1972).

Boundaries of home ranges often coincide with edges of topographic or vegetative features such as rugged mountain, jungle clearing and agricultural estates. The ranges of different herds often overlap at an area with a very critical resource i.e. a salt lick. Temporal use of salt lick avoids aggression. Groups were not strongly cohesive and a slight disturbance will disintegrate them into smaller subgroups (Conry 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

(1) *Geographic area.* This HSI model has been developed for application in

lowland dipterocarp forests east of the main range excluding Johore.

(2) *Cover types.* This model was developed to evaluate habitat in: 1) Grassland 2) Primary Lowland Dipterocarp Forest (PLDF) 3) Secondary Lowland Dipterocarp Forest (SLDF).

(3) *Minimum habitat area.* Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before as area will be occupied by a species. Information on the minimum habitat area for seladang was not reported in the literature. However, home range for animals in Pahang varies from 1296 ha to 7018 ha. Based on this information, it is assumed that at least 5,000 ha of suitable habitat must be available before an area will be occupied by this species. If less than 5,000 ha of suitable habitat is present, the HSI is assumed to be 0.0.

(4) *Verification level.* This model have not been reviewed by anybody. No field tests have been conducted.

Model description

(1) *Graphic overview.* This HSI model for seladang considers specific variables and their relationship to life requisites, cover types and HSI, as shown in Figure 1. Cover and reproductive needs are assumed to be the same and it is assumed that water is not limiting.

The following sections attempt to document the logic and assumptions used to transform habitat information for the seladang to variables and equations used in the HSI model.

These sections cover:

1. Identification of variables used in the model
2. Defination and justification of the suitability level of each variable
3. Description of the assumed relationships between variables.

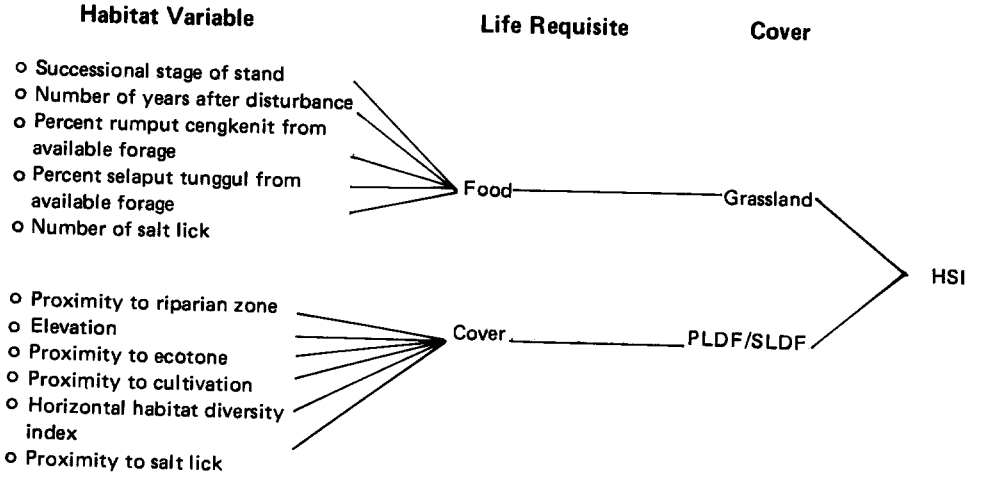


Figure 1. Relationships of habitat variables, life requisites and cover types in the seladang HSI model.

(2) **Life requisite components**

Food component. Seladang may consume varieties of vegetative food throughout the year but rumput cengkenit and selaput tunggul are the main food items.

Overall food suitability is a function of successional stage of the stand, number of years after its disturbance, percent rumput cengkenit from available forage, percent selaput tunggul from available forage and number of salt licks.

Early successional stage such as seral vegetation provides optimum food. Mature and old growth forest do not provide food. It is assumed shrub-bush and pole-sapling successional stage provede minimal food. The first three years after a plot is disturbed provide optimum forage for seladang. Three years after the plot is considered unsuitable unless it is redisturbed.

Grassland or forest with 25% or more rumput cengkenit and 27% or more selaput tunggul from available forage will provide optimum food. Home range with one salt lick would provide minimum requirement and optimum number of salt lick is three.

The food value for seladang is related to the percent available rumput cengkenit and percent available selaput tunggul from available forage. The overall food suitability value is the suitability of successional stage or suitability for number of years a plot has been disturbed or suitability for available forage of both species mentioned or suitability of number of salt licks.

Cover component. Throughout the year, Seladang may range through forested and non-forested cover types. Based on literature, grassland and secondary lowland dipterocarp forest are highly selected. Grassland provides food and forest provides cool cover during the day

Suitable cover is a function of the proximity to riparian zone, elevation, proximity to ecotone, proximity to cultivation, horizontal habitat diversity index (HHDI) and proximity to salt lick. An area within 250 m from riparian zone is assumed to provide optimum habitat and if more than 250 m, it is considered unsuitable. Elevation of 91 m or less is assumed to have a high suitability, elevation between 91 m and 120 m provide marginal suitability and elevation more than 120 m is assumed unsuitable.

A location within 250 m from ecotone or 500 m from cultivation has a high cover value and if more than 250 m and 500 m, respectively, it has 0.0 suitability value. A stand with HHDI 3 is assumed to have optimal cover, HHDI 2 is marginal and HHDI 1 is unsuitable.

Presence of a salt lick and its distance from a suitable area is vital. A distance of 3.5 km or less is optimum and a distance of 12 km is readily used. Nevertheless a distance of more than 12 km is assumed not available for seladang thus unsuitable.

The cover value for seladang is related to the proximity to riparian zone, proximity to ecotone and proximity to cultivation. The overall cover suitability value is the suitability of gaps mentioned above or suitability for elevation or suitability for HHDI or suitability for proximity to salt lick.

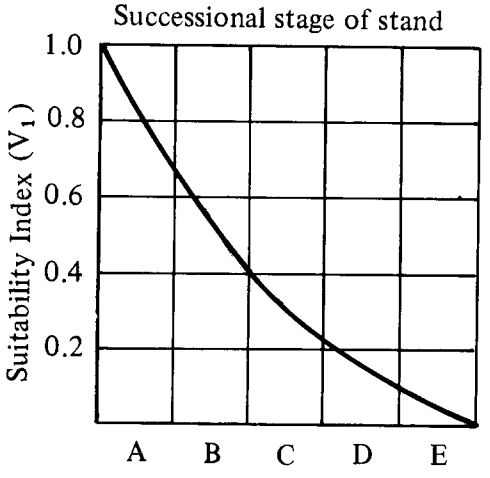
Model Relationships.

The relationships between various conditions of habitat variables and habitat suitability for seladang are graphically and mathematically represented in this section.

(1) **Suitability index curves**

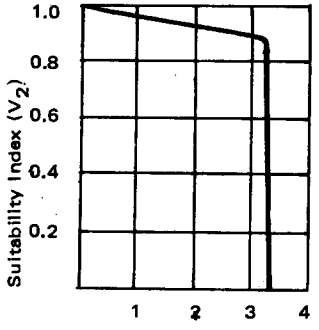
C	Cover type	Variable
	All	(V_1)

A – grass-forb
B – shrub-bush
C – pole-sapling
D – young
E – mature
F – old growth



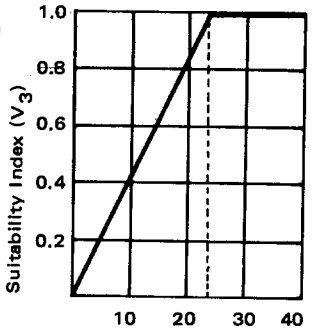
G (V_2)

No. of years after disturbance



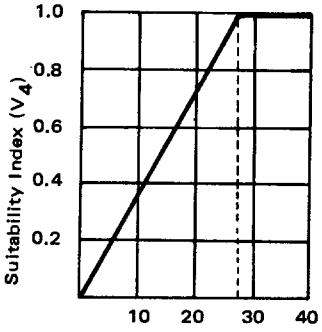
G (V_3)

Percent rumput cengkenit from available forage



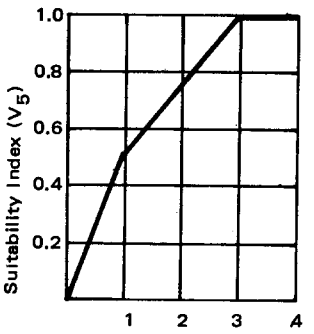
G (V_4)

Percent selaput tunggul from available forage



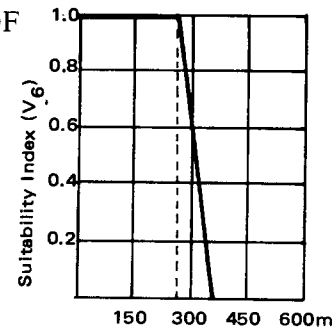
PLDF, SLDF (V_5)

Number of salt licks



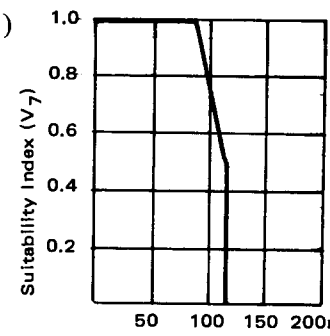
PLDF, SLDF (V_6)

Proximitry to riparian zone



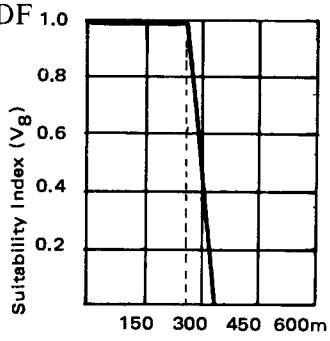
All (V_7)

Elevation



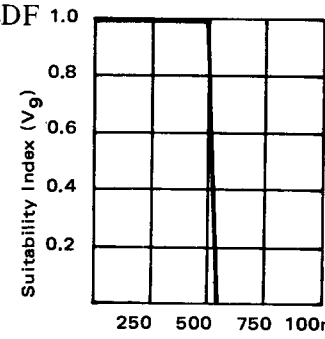
PLDF, SLDF (V_8)

Proximity to ecotone



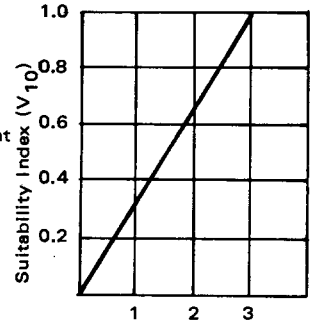
PLDF, SLDF (V_9)

Proximity to cultivation



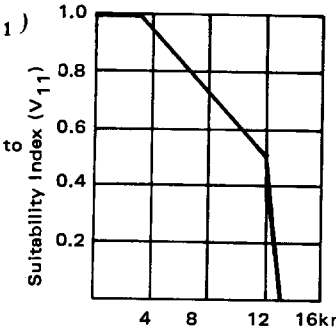
PLDF, SLDF (V_{10})

2 Horizontal Habitat Diversity Index



All (V_{11})

Proximity to salt lick



(2) **Equations**

a) Equations for food component.

Cover Type	Equation
G, PLDF, SLDF	Food value = $\min \left[V_1, V_2, \left(\frac{2V_3 + V_4}{3} \right) V_5 \right]$

b) **Equations for cover component**

Cover Type	Equation
G, PLDF, SLDF	Cover value = $\min \left[(V_6, V_8, V_9^{2}), ^{1/4}, V_7, V_{10}, V_{11} \right]$

HSI determination

Based on limiting factor concept, the HSI is equal to the lowest requisite value.

Application of the model

Defination of variables and suggested field measurement techniques are provided below. A field form can be developed from this list.

Variable (Defination)	Cover Types	Suggested Technique
(V_1) Successional stage of stand. (The structural condition of a forest community which occurs during its development)	G, PLDF, SLDF	On-side inspection, remote sensing.
(V_2) Number of years after disturbance. (Number of years after tree removal and succession is reversed to seral community).	G	Record gathering, visual estimate.
(V_3) Percent rumput cengkenit from available forage (self explanatory)	G	Line transect and plot frame.
(V_4) Percent selaput tunggul from available forage (self explanatory)	G	Line transect and plot frame.
(V_5) Number of salt licks (self explanatory)	PLDF, SLDF	On-site inspection.
(V_6) Proximity to riparian zone, (Horizontal distance of a spot to the nearest river bank)	PLDF, SLDF	On-site inspection, remote sensing.
(V_7) Elevation. (Vertical distance of a spot from sea level).	G, PLDF, SLDF	Direct reading from altimeter.
(V_8) Proximity to ecotone (Horizontal distance of a spot to a transitional zone of adjacent community)	PLDF, SLDF	On-site inspection.
(V_9) Proximity to cultivation (Horizontal distance to the nearest cropland)	PLDF, SLDF	On-site inspection, remote sensing.
(V_{10}) Horizontal Habitat Diversity Index. (The number of habitat types found within 500m of the location (Conry 1981)	PLDF, SLDF	On-site inspection, remote sensing.
(V_{11}) Proximity to salt lick. (Distance to the nearest exposed mineral rack visited by animals)	G, PLDF, SLDF	On-site inspection.

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SOME OBSERVATIONS ON OTTERS AT KUALA GULA, PERAK AND NATIONAL PARK, PAHANG

By
Sabrina M. Shariff

ABSTRACT

This paper relates a preliminary survey of otters conducted at two different types of habitat. The selected areas include Kuala Gula, Perak (Mangrove area) and the National Park, Pahang (Freshwater system). 83 days field work were spent at these study areas. An intensive study of about 8 days was then followed up at the Park.

Observations were carried out directly and indirectly. Through these observations, the encountered specie was identified and some associated characteristics were determined. In addition, parameters relating to the occurence of the specie at the specific site and the apparent disturbance factor were also noted. Rough population densities were estimated.

ABSTRAK

Kertas kerja ini merangkumi kajian preliminari mengenai memerang-memerang pada dua habitat yang berbeza. Tempat-tempat yang dipilih ialah Kuala Gula, Perak (habitat paya bakau) dan Taman Negara, Pahang (habitat air tawar). 83 hari kerja-kerja lapangan telah dijalankan ditempat-tempat tersebut. Penyelidikan intensif selama 8 hari seterusnya telah dilakukan di Taman Negara.

Pemerhatian-pemerhatian dibuat secara langsung dan tidak langsung. Melalui pemerhatian-pemerhatian ini, spesis-spesis yang ditemui telah dikenalpasti dan ciri-ciri yang bertalian telah ditentukan. Selain daripada itu, parameter-parameter yang bersangkut paut dengan kehadiran sesuatu spesis di tempat-tempat yang tertentu dan faktor penghalang yang jelas telah dicatatkan juga. Melalui penyelidikan intensif, densiti populasi telah dianggarkan secara kasar.

INTRODUCTION

There is a lack of studies on the distribution and biology of otters in South East Asia with the result that greater attention has to be given to this group. At present, four species are recorded in this country namely the (i) Hairy-nosed otter *(Lutra sumatrana),* (ii) Smooth otter *(Lutrogale perspicillata)* (iii) Small-clawed otter *(Amblonyx cinerea)* and (iv) Common otter *(Lutra-lutra).*

The Hairy-nosed otter is widespread near water throughout the mainland and has been recorded from the sea off Penang; the Smooth otter usually inhabits estuaries, large rivers on the mainland as far as south Selangor and also at Pulau Salanga, Melaka. The Small-clawed otter is found both in the inland and coastal waters, from the sea beach to mountain streams. The Common otter is known from a single specimen recorded from the island of Langkawi (Medway, 1978).

To date, no detailed work has been conducted on the habitat use, dietary requirements or social behaviour of these species. A number of general state-

ments about these species have been published by various authors (Hawkins, G. 1961; Harrison J.L. 1966, Medway 1969) but these are based more or less on similar source material. Hence, more detailed work is needed to fill gaps in existing knowledge and to ascertain if the species require active conservation efforts.

AIM

The aim of this preliminary study was to identify the species of otter and investigate their biology and ecology including density and distribution, their environments and behaviour including feeding and social interactions.

METHOD

The study was conducted in two areas, the Kuala Tahan area of the National Park, representing a freshwater system and Kuala Gula in Perak, representing a coastal and mangrove system.

In the Park the study area was divided and marked using aluminium discs (see maps). In Kuala Gula otter observations were plotted on a one inch map. Observation and identification was aided with binoculars and camera and a small boat was used most of the time. The daily study routine was between 7.00 a.m. and 7.00 p.m. in the Park and 8.00 a.m. and 7.oo p.m. at Kuala Gula.

Each observation included noting the behaviour of the otter/otters observed and the conditions and nature of the immediate environment and the prey species if seen. Appendix A attached is a sample of actual observations made. The criteria used was after Chapman, P.J and Chapman, L.L (1982).

Indirect observations were also carried out. These included mapping spraints sites, dens and pad marks. Pad marks were also measured wherever possible.

STUDY AREAS

(a) Location and Physiographic characteristics

(i) The National Park, Pahang

This forms the largest of the Malaysian National Parks comprising an area of 4,343 sq. km. It is situated in the centre of Peninsular Malaysia covering the states of Pahang, Terengganu and Kelantan and contains a variety of habitats. Shales, sandstones, limestone and granite make up the main mountain massifs and contribute to the complex biological composition of the Park. The eastern third is also mountainous with a central strip of shales surrounded by granite. Gunung Gagau (1,376 m) and Mandi Angin (1,459 m) from the two main peaks of this area. The Gunung Tahan Massif (2,187 m), the highest mountain in Peninsular Malaysia dominates the western third of the Park. Limestone hills with caves are also plentiful. The central part of the Park is occupied with hills interspersing with lowlands.

The Tembeling river forms the border line for the Park. Survey was conducted along:

i) Tembeling river – (a) from Kuala Tahan to Kuala Atok (downstream).
(b) from Lubok Kelembai to Jeram Teras (upstream).
ii) Tahan River till Lubok Lesong
iii) Kenyam River till Cegar Terong

There is no road in the study area and all communication is by river boats or on foot.

(ii) Kuala Gula, Perak

Another area for this preliminary study is Kuala Gula, a small fishing village in the Krian District of Perak. It is situated at the mouth of the Gula river along the Straits of Malacca. It lies approximately 32 km north of Port Weld and 11 km south of Kuala Kurau. The study area straddles some of the forest reserves managed by the Forestry Department. These reserves consist of the Gula Island Forest Reserve, Chabai Malai Forest Reserve and the Kelumpang Island Forest Reserve. Of interest are the neighbouring forest reserves namely the Selinsing Island Forest Reserve and the Sangga Kecil Island Forest Reserve. The rivers in the study area are the Selinsing, Gula, Kelumpang and Terusan Gula. The area is almost entirely flat lowland.

(b) National Park, Pahang

(i) The lowlands of the Park within which the study area is situated are basically lowland Dipterocarp forest. A high concentration of commercial important tree species dominates the western section of the Park. The Dipterocarp forest of the eastern section of the Park are smaller in stature and hence possess lower timber value. *Shorea, Anisoptera* and *Dipterocarpus* form the dominant genera. The non-Dipterocarp tree genera comprise of *Diospyros, Canarium, Knema, Myristica, Eugenia, Durio, Xerospermum, Calophyllum, Garcinia, Castanopsis, Lithocarpus, Agathis, Koompassia* and *Parkia.* Other vegetation of significance to this study in the Park include padang vegetation, the forest on limestone and the riverine forest.

(ii) Kuala Gula, Perak

Mangrove forests is the dominant vegetation of the area. The forest forms part of the mangrove belt of the West Coast of Peninsular Malaysia which is prevalent in muddy intertidal areas particularly in the sheltered parts of the coasts and near river mouths. Debris from the rivers is entangled between the stilt roots of the mangrove trees and shrubs. This together with the other detritus washed in by the tide provides an enrich-

ed mud in the area, which forms the basis of a luxuriant and unique community of plants and animals. In the study area the genera *Avicennia* and *Rhizophora* form the common species. Both species possess a high commercial value.

In the landward side of the mangrove, surviving in ditches or swampy ground is the very large mangrove fern, *Acrostichum aureum.* Being a pantropic specie, it is able to withstand partial immersion by the tide each day.

RESULTS AND OBSERVATIONS

Out of 83 field days in Kuala Gula and the National Park, 125 observations were made on 39 days and no observations on 44 days. During 8 days of intensive study at the National Park 71 indirect field observations and 15 direct observations were obtained.

1. Specie/Species identification

The Smooth otter *(Lutrogale perspicillata)* was identified at both study areas. The Small-clawed otter *(Amblonyx cinerea)* was reported in the Park (pers comm. Park staff) but not encountered during this study.

2. Group size

Variations existed in the overall group size or composition of the otters although they belonged to the same specie. Table 1 shows the number of times different group sizes were encountered. This table also indicates that large groups were rare and solitary animals very common.

3. Activities

The table below illustrates the number of times various activities were recorded.

Activity	Occurrence	
	National Park	Kuala Gula
Movement	17	8
Feeding and foraging	6	7
Generally active (mostly indirect observations)	9	4
Playing and social activity	17	2
Rolling	10	4
Marking through urination and defaecation	21	2
Resting	3	3

It also revealed that marking through urination and defaecation, playing and social activity and movement seemed to occupy a significant part of the animals active period at the Park. At Kuala Gula, movement, feeding and foraging formed the important activities. Very often it was not possible to determine the actual purpose of movement.

Rolling

Rolling and rubbing on a small patch of non-woody vegetation by a single animal was observed several times on the river banks. Tha animal would roll around for a few minutes, slide partially down the bank and then return and roll. Often this cycle would be repeated many times and sometimes this activity occupy up to half an hour. The animal would them descend into the water. Examination of these rolling sites generally revealed fresh spraints within one metre.

Playing and Social Activity

The otters participates in this activity either in small (2–3) or in large (8–11) groups. This include diving and swimming in the water, chasing each other and sometimes playing with the captured prey. It also involves ascending the bank and sliding, often repeatedly.

Feeding

The otters foraged among fallen tree trunks, rapids, fishing nets and other obstructions. They were often observed at the surface with their head held above the water moving forward slowly and suddenly, the animals would glide into the water. This was interpreted as an attempt to fish because sometimes an animal would emerge on a nearby bank with a fish in its mouth.

Resting

Solitary animals were observed to rest on the shoulders of river banks on bare sand or non-woody vegetation.

Activity

Analysis of activity patterns does not allow for any meaningful conclusion due to the random nature of the readings and a relatively low sample size. (See table 2 (a) and (b)).

Grossly speaking, there appears to be two peaks of activity with a lull around midday. There also appears to be a smaller activity peak in the late evening. These peaks are regulated mainly by travelling and general social behaviour. Feeding and foraging appear to be evenly, if somewhat randomly, distributed throughout the day. (Please see Table 2 (c)).

Pad mark

Table 4 shows the occurrence of different pad mark measurements of the Smooth otter *(Lutrogale perspieillata).* The smallest measurement recorded was width 3 cm x length 4 cm. This measurement belonged to a young otter. In fact, measurement groups (i) and (ii) (Refer to Table 4) are probably due to young animals while (iii), (iv), (v), (vi) and (vii) are those of adult animals. These pad marks were usually encountered running upstream along the banks. Pad marks were sometimes seen at distance from the river bank. It appears possible that these represented short cuts between two separated bodies of water or across meanders in the river system.

Dens and resting sites

Dens and resting sites were identified within the habitat. Resting sites occurred on sandy banks at the Park and mud banks at Kuala Gula. Various types of dens were noted. Dens at the Park were observed under the roots of trees such as *Ficus variegata* or in openings created within piles of boulders. These made good holts for the otters as evidenced through pad marks and spraints. Several dens of current and frequent use were recorded at (i) Chemetong – downstream along the Tembeling river and (ii) at the estuary of the Terenggan river.

At Kuala Gula, dens were primarily located among the *Acrostichum* vegetation (pers comm. Kuala Gula staff and local residents).

Population densities

The intensive survey on population densities was made from 88% of indirect observations. This survey at the Park revealed about 23 otters in 8 groups along a waterway of 18 km. from Kuala Tahan to Kuala Atok and approximately 18 otters in 8 groups along a waterway of 26 km. from Kuala Tahan to Cegar Terong (Kenyam river).

At Kuala Gula, the population densities were estimated to be 22 otters from 3 groups over a total distance of about 23 km. of waterway. Table 5 reflect that densities were higher at Kuala Gula than at the Park. The possible factors that contributed to this are probably the nature of the habitat, den and resting sites, the availability of prey and degree of tolerance to man. Within the Park, densities varied. It was higher downstream (from Kuala Tahan to Kuala Atok) than upstream (from Kuala Tahan to Cegar Terong (Kenyam river). The only observable factor to account for this was the greater occurrence of suitable banks downstream of Kuala Tahan.

DISCUSSION AND CONCLUSION

This study has shown that the Smooth otter *(Lutrogale perspicillata)* is the most prevalent species and appears comfortably adapted to both a freshwater and a brackish water (mangrove system). The occurrence of the species in Kuala Gula, an area of intense human activity (fishing, cockle culturing and crab hunting) also indicates that the species is tolerant and adaptable to the presence of man provided its food resources are not affected and there remains sufficient habitat for its other requirements.

The study also tends to reveal that there is a higher otter density in Kuala Gula than the Park. However, the former area allows for much better and longer range observation. This and the apparent tolerance of the Gula otter population to man may nullify the validity of this conclusion for the present.

It also appears that the Small-clawed otter *Amblonyx cinerea)* is incommon in the study area of the Park which were confined to the larger rivers.

The Hairy nosed otter *(Lutra sumatrana)* was neither encountered nor reported during this study.

APPENDICES

Table 1: Group sizes as observed at the National Park and Kuala Gula.

Group Size \ No. of times observed	National Park		Kuala Gula
	Smooth Otter	Small-clawed Otter	Smooth Otter
1	65	2	6
2	25	1	4
3	9	3	2
4	–		–
5	–		2
>5	–		2 (i) 8 – 11 (ii) 11

Table 2: Activities observed at different times of the day.

(a) National Park

Time (hours)	Travelling	Foraging and feeding	Resting	General Social Behaviour	Total
0700 – 0800	–	–	–	4	4
0800 – 0900	1	–	–	2	3
0900 – 1000	3	1	–	2	6
1000 – 1100	2	–	–	–	2
1100 – 1200	2	–	–	1	3
1200 – 1300	2	–	1	2	5
1300 – 1400	–	1	–	1	2
1400 – 1500	3	–	–	5	8
1500 – 1600	–	–	–	1	1
1600 – 1700	–	1	–	–	1
1700 – 1800	1	1	–	2	4
1800 – 1900	–	–	1	–	1
	14	4	2	20	40

(b) Kuala Gula

Time (hours)	Travelling	Foraging and feeding	Resting	General Social Behaviour	Total
0700 – 0800	–	–	–	–	–
0800 – 0900	–	–	–	–	–

Time (hours)	Travelling	Foraging and feeding	Resting	General Social Behaviour	Total
0900 – 1000	–	–	–	–	–
1000 – 1100	5	1	–	5	11
1100 – 1200	2	1	–	3	6
1200 – 1300	1	–	1	1	3
1300 – 1400	–	1	–	5	6
1400 – 1500	1	–	1	2	4
1500 – 1600	1	1	–	1	3
1600 – 1700	–	–	–	–	–
1700 – 1800	2	1	–	–	3
1800 – 1900	–	–	–	–	–
	12	5	2	17	36

Table 2(c)

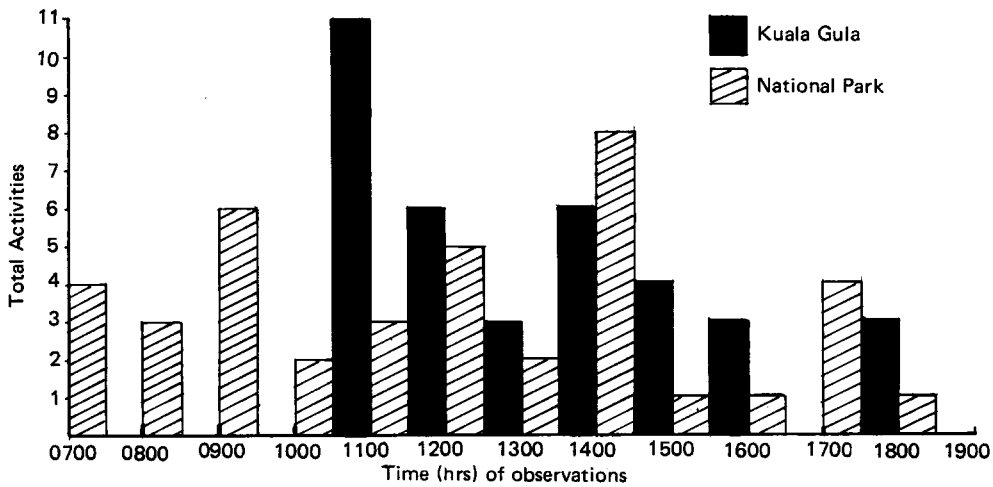


Table 3: Possible Prey Species (Fish species known to exist in area – pers comm. local fisherman)

National Park

Scientific Name	Common Name	Observation
(1) *Puntius daruphani*	Kerai	
(2) *Tor tambroides*	Kelah	
(3) *Puntius bulu*	Tenggalan	
(4) *Prabarbus jullieni*	Temelian	
(5) *Pangasius pangasius*	Patin	

Scientific Name	Common Name	Observation
(6) *Pangasius micronemus*	Lawang	caught by research team
(7) *Mystus nemurus*	Baung	
(8) *Wallago attu*	Tapah	
(9) *Lobocheilus spp.*	Jemerong	
(10) *Proterocanthus sarisspphorus*	Batu ulu	caught by research team
(11) –	Kelampar	
(12) –	Kawai	
(13) *Cyclocheilichthys spp.*	Kemperas	
(14) *Mystacoleucus marginatus*	Sia	
(15) *Notopterus notopterus*	Bellida	
(16) *Botia sp.*	Lali	caught by research team
(17) *Siganidae tetroden*	Buntal	
(18) *Hampala macrolepidota*	Sebarau	
(19) *Barilius guttatus*	Sikang	the fish was observed to be in the otter's mouth
(20) *Morulis chrysophekadion*	Jenkua	
(21) *Osteochilus vittatus*	Rong	caught by the research team

Kuala Gula

Scientific Name	Common Name	Observation
(1) *Osteiogeneiosus spp.*	Catfish	the fish was observed to be in the otter's mouth
(2) *Tachusurus Carutta*	Catfish	
(3) *Plotosus spp.*	Catfish eel	the otter was found to be eating the fish
(4) *Johnius carutta*	Jewfish	
(5) *Mugil spp.*	Mullet	
	Senangin	
	Siakap	

Table 4: Occurence of different measurements (Parenthesis for occurence by length only).

(a) National Park

Length (cm)	Width (cm)	Occurence	
(i) 4.0	3.0	2	(4)
4.0	4.0	1	
4.0	5.0	1	
4.5	4.0	1	

	Length (cm)	Width (cm)	Occurence	
(ii)	5.0	2.0	1	
	5.0	2.0	1	(4)
	5.0	4.0	2	
	5.5	4.0	2	(2)
	5.8	6.5	1	
(iii)	6.0	3.0	1	
	6.0	4.0	2	(8)
	6.0	5.0	4	
	6.0	9.1	1	
	6.5	5.0	1	
	6.5	6.0	1	(3)
	6.5	6.5	1	
(iv)	7.0	3.0	2	
	7.0	4.0	1	
	7.0	5.0	3	(17)
	7.0	5.5	1	
	7.0	6.0	8	
	7.0	6.5	1	
	7.0	7.0	1	
	7.1	9.5	2	
	7.3	6.5	1	
	7.5	6.5	1	
	7.5	7.0	1	(3)
	7.5	9.0	1	
	7.9	6.0	1	
(v)	8.0	4.0	3	
	8.0	5.0	1	
	8.0	6.0	10	(30)
	8.0	7.0	14	
	8.0	7.3	1	
	8.0	7.8	1	
	8.5	7.0	2	(3)
	8.5	8.0	1	
(vi)	9.0	4.0	2	
	9.0	6.0	1	
	9.0	6.5	1	(12)
	9.0	7.0	6	
	9.0	8.0	2	
	9.3	6.0	1	
	9.3	7.0	1	(2)
	9.5	7.0	3	
	9.5	7.5	1	
	9.5	8.0	1	(5)
(vii)	10.0	4.0	2	
	10.0	7.0	2	
	10.0	7.0	2	
	10.0	8.0	6	(18)
	10.0	8.5	1	
	10.0	9.0	4	
	10.0	9.6	1	

Length (cm)	Width (cm)	Occurence
10.2	8.0	1
10.3	8.0	2 } (2)
10.5	8.0	1 }
10.5	8.5	1 } (2)
10.8	8.8	1

(b) Kuala Gula

	Length (cm)	Width (cm)	Occurence
(i)	4.0	3.0	1
(iv)	7.0	10.2	1
	7.6	5.1	1 } (2)
	7.6	6.4	1 }
(v)	8.1	5.7	1
(vi)	9.5	6.0	1
(vii)	10.2	6.3	1
	10.2	7.6	2 } (3)
	10.3	6.4	1
	11.0	7.0	1

Table 5: A Rough Estimation Of The Population Densities

Study Area	Region	Area of the region (sq. km)	Length of waterway (km)	No. of groups of otters	No. of otter in the group
National Park (Pahang)	Kuala Tahan – Kuala Terenggan	3.1	7.5 – 7.8	3	7
	Kuala Terenggan – Kampung Pagi	3.3	8.2 – 8.3	2 – 3	8
	Kampung Pagi – Cegar Terong (Kenyam river)	5.6	9.6 – 9.8	2	3
	Kuala Tahan – Chemetong	2	5	4	9
	Chemetong – Kuala Atok	5.2	12.5 – 13.5	4	14
Kuala Gula (Perak)	Gula river	14.5	14 – 15	1	8
	Kalumpang river	27.6	9.0 – 9.4	1	3
	Ju Kaw Embankment (Kepala Tanjung River)	varies	1.1	1	11

APPENDIX A

FIELD OBSERVATION DATA ON OTTERS

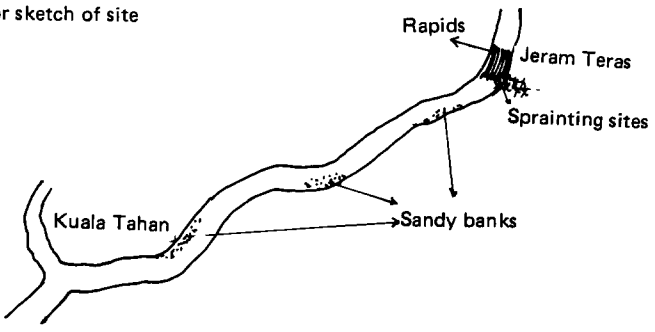
A	1. Site No: 19						2. Site Name: Pasir Jeram Teras				
B	1. Specie/s Smooth otter *(Lutrogale perspicillata)*	2. Quantity 2	3. Size (Approximate) Big	4. Time 6.35 p.m.	5. Activity Generally Active	6. Weather Cloudy					
C	1. Observer Sabrina Shariff Amin Abdullah	2. District Location National Park		4. Date of visit 10th August 1983							
D	HABITAT Main river/river Utilization	Tributary	Estuary	Pool	Sea Coast	Brackish water	Miscellanous				
E	SHORE TYPE Boulders	Stones	Gravel	Sand	Silt	Earth	Rock cliffs	Earth Cliffs			
F	CURRENT Rapid	Fast	Slow	Sluggish	Static	Tidal					
G	WIDTH 10m	15m	20m	25m	30m	35m	40m	45m	50m	55m	60m	> 60m
H	MEAN DEPTH < 10m	20m	30m	40m	50m	60m	70m	80m	90m	100m		
I	VEGETATION Bankside Trees	Shrubs	Herbs	Emergent	Floating Attached	Free Floating	Submerged					
J	LAND USE 1) Primary Forest BORDERING a) Montane i) Montane ericaceous forests ii) Montane oak forests	b) Upper Dipterocarp Forests	c) Hill Dipterocarp Forests — Submontane	d) Lowland Dipterocarp Forests	e) Coastal Hills Forest	f) Peat Swamp Forests	g) Riparian Fringes				

2) Secondary Forest a) Montane	b) Submontane	c) Lowland	d) Old mining land	e) etc			
3) Man-made habitats a) Oil palm plantation	b) Rubber plantation	c) Rice field	d) Vegetables garden	e) etc			
4) Park/Reserve							
K BANK TREATMENT	Canalised	Maintained	Wild				
L WATER USE Water abstraction	Boating/ Powered 25 h/p	Boat/Sail	Boat/Man Power	Bank/Angling	Bankside shooting	Keepered	None Reserve
M TYPE OF OBSERVATION	a) Direct						
	b) Indirect i) Seals/Pad morks ii) Spraints						
N PAD MARKS	– fresh/old – size – width – length	(a) 6.5 cm 9.0 cm	(b) 7.0 cm 7.5 cm				

O FISH (Species present)
Freshwater fishes especially riverine carps e.g. Kerai *(Puntius daruphani)*, Patin *(Pangasius pangasius)*

P APPARENT DISTURBANCE FACTOR
— Intense human activities e.g. fishing
— sounds e.g. boats engines

Description or sketch of site



Distance surveyed 92 m interval

Description or sketch of spraint site
The area was full of fresh spraints (2 piles) and pad marks which were clearly well-defined. This showed that the otters have just defaecated in the area. The pad marks were found going upstream.

Miscellanous

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NOTES OF SEROW *(Capricornis sumatraensis)* IN CAPTIVITY IN WEST MALAYSIA,

By
M. Yusof Said and Ibak

INTRODUCTION

The serow species is divided into eleven races, which are widely distributed from eastern and southern China through Nepal and Assam to Kashmir, and extend to much of South East Asia into Sumatra (1). Serow are rather short-bodied long legged goat-antelopes, with a short thick neck. The coat is coarse and rather thin with little inderwool; the upper part is usually black. There is usually a stiff mane, usually lighter than the back. The horns are rather thick,slightly curved with numerous rings at the base. Serow typically inhabit steep limestone mountains and cliffs which are thickly clad with forest inaccessible to man (2).

On 25 May 1978, Zoo Negara acquired one adult female serow, through the courtesy of The Department of Wildlife and National Parks. The serow had been caught in the neighbourhood of Subang International Airport Kuala Lumpur and it was decided to name her 'Subang'. Initially the animal was released in a darkened enclosure whose metal railings were padded with gunny sacks stuffed with sawdust and straw to minimise any injury the animal might cause itself. Sater was provided in a trough and known food plant leaves were gathered by the second author from the natural-habitat and given. The animal was next transferred to a larger open air enclosure with a hut at one end while plans were made to construct a more permanent enclosure for the display of a family group of serow eventually. The first author found to his surprise that the female serow responded to her name 'Subang' when called and she could be hand fed! It is possible that she could have been raised as a pet illegally, and escaped; this would explain her capture near the airport.

On 5 January 1980, about eighteen months after the capture of the female serow, 'Subang', Zoo Negara were fortunate to acquire a male serow captured at a dusun in Ulu Langat. We named this male 'Rujang', this being the Orang Asli name for serow. He was released in the permanent display enclosure where the female had been the sole occupant for some time before that.

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° Zoo Negara, Kuala Lumpur, Malaysia.

Diet

The second author has had experience of observing and tracking serow in the wild. We decided to study the response of serow to various natural food plant leaves and some tubers and beans fed to other ungulates (3). See Table 1.

Table 1. Response of Serow (Capricornis sumatraensis) to food plant leaves and tubers.

Local/Orang Asli name	Scientific name	Response
1. Tembusu	*Fagria fagrans*	+
2. Leban	*Vitex sp.*	– fresh leaves on twig. + fallen leaves on ground.
3. Zaiton	*Ficus sp.*	++
4. Kelepong putih	*Ficus fistulosa*	++
5. Kelepong balek angin	*Ficus alba*	++
6. Nangka	*Artocarpus heterophyllus*	++
7. Penungkak		+++ aromatic
8. Acacia	*Acacia auriculeaformiss*	–
9. Keledek	*Ipomea batatas*	++ leaves as well as tubers
10. Kacang Panjang	*Vigna sinensis*	+
11. Lobak merah	*Daucus corota*	++
12. Kaduk	*Piper sarmentosum*	++ aromatic
13. Kaduk hutan	*Piper stylosum*	++

It is interesting to note quite a number of the above plants, those of the genera *Ficus and Artocarpus,* have latexlike sap and fruit by the process of cauliflory, i.e. they bear fruit not on the end of twigs but on the thicker branches or even hanging singly or in clusters on the trunk itself. It is possible that the serow may find the latexlike sap and aromatic plants palatable. We have not observed the serow eating the fruit of Ficus – the figs.

Initially, the serow were fed mainly with the natural food plants but subsequently dried food supplements meant for ungulates and artificial salt licks were supplied.

Breeding

Despite a careful search of the literature we could find no record of the breeding of serow in captivity prior to 1980. It was our aim to reproduce the natural environment and ecosystem as closely as possible to encourage captive breeding of an endangered species listed in the IUCN The Red Book. Mating had been observed by the keeper and was as in the manner of goats but the first author has not been able to confirm this observation. Table 2 shows a record of seven births from 1980 to 1984.

Table 2: Breeding of Serow (Capricornis sumatraensis) in captivity

Female named 'Subang' acquired 25 May 1978.
Male named 'Rujang' acquired 5 January 1980.
Mating was observed by the keeper soon after the introduction of the male to the female in the large permanent display enclosure.
Date of birth of kid.

1. 18.10.80	twins	♂	1. 1	♀	– stillbirths/neonatal deaths.
2. 26.07.81		♂	1		
3. 17.06.82		♀	1		
4. 26.02.83		♂	1		
5. 11.02.84		♀	1		
6. 01.03.84		♂	1		

The female born on 17.06.82 gave birth to a kid on 11.02.84. If we take the period of gestation to be seven months Medway (4), she must have reached sexual maturity at the age of thirteen months. We were not able to determine in this case whether this young female had mated with her father or her elder male sibling. Maternity is a fact, paternity is a matter of opinion!

We observed the young and subadults and the parents were able to exist as a family group without showing aggressive behaviour initially.

Behaviour

Observations on serow were made from first light to dark. The serow browses at daybreak and by eight or nine o'clock in the morning when the sun is noticeable, the whole family group would make a beeline for the top of the artificial igloo in the enclosure to bask in the sun and spak its morning warmth. We believe this to be particularly useful in the natural habitat where the mountain and cliffs can be very cold early in the morning. Carter (1958), (Curator Emeritus of Mammals of the New York Zoological described vividly how the expedition members found serow among the forest-clad slopes of the mountains in Western Szechwan, China and also on the numerous rocky islands on the northeastern coast of Vietnam, in their quest for specimens for the American Museum of Natural History (5). Serow take shelter in the shade of the igloo cave and also the wooden hut in the heat of the noon and afternoon sun. They have been observed to seek water, soaking their feet in the water trough in the enclosure. Boonsong Lekagul (1977) mentions that as early as 1919 Kloss had made the observation that serow are known to swim to and fro between the mainland and the islands (2).

In the late afternoon and evening serow browse again on the leaves along the footpaths. They seem to prefer tender leaves and shoots especially from aromatic plants.

The family group of serow have not been observed to make calls to each other in the enclosure; in fact they have been singularly quiet. Once the superintendant of the zoo had heard the alarm call which he described as 'a high pitched sound like the air-brakes of a bus.' Territorial behaviour is very interesting and ritualised. Trees in the large enclosure especially those

adjacent to the perimeter fence and the igloo where the serow bask, are marked first with the facial glands situated in front of the eyes and then with the horns which are rubbed against the bark, leaving distinct markings. We agree with West (1978) this behaviour is particularly prominant when strangers approach and unfamiliar keepers enter the enclosure (3). The mother 'Subang' has been hand-fed regularly by the first author, responding to call by name; she does not show territorial marking behaviour to him! All her offspring do. Other workers have mentioned the presence of pedal glands on all four feet but their significance is a matter of conjecture. Threat behaviour has been observed in 'Subang' the mother when she raises both front legs striking the ground hard with the hooves as she comes down. The father 'Rujang' which had been caught wild has remained wary despite several years in captivity. He has not been observed to show threat behaviour.

Serow has the habit of defae cating at the same place in the enclosure or rock shelter in the wild as observed by the second author. Boonsong Lekagul (1977) mentions that large heaps of droppings in these shelters are a sure indication of their presence (2).

Dominance.

By the age of two years it was found that the first male offspring had reached adult size and presumably sexual maturity. Gradually it began to show the phenomenon of dominance, by challenging the father. At the time of writing, it had completely displaced the father as the dominant male. The large enclosure had to be further enlarged and partitioned to prevent fighting among contending males.

We are of the opinion that captive breeding of this endangered species can be successful and very rewarding if special care is taken to reproduce the natural habitat and ecosystem as closely as possible so that the naturalist's dream of translocating or returning these rare goat-antelopes to their natural habitat may be realised.

Acknowledgements

We wish to express our deep gratitude to the Director-General of the Department of Wildlife and National Parks Encik Mohd Khan for allowing the serow to be kept at Zoo Negara, the Superintendant of Zoo Negara, Encik Zainal Abidin Tahir without whose kind cooperation this study could not have taken place and the Chairman of the Scientific Conference of the Malaysian Veterinary Association Dr. Mohd Zahedi Daud for providing us a forum to present this paper in 1984.

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Plate 1 – Serow on top of igloo. Basking in the sun.

Plate 2 – Serow basking in the sun.

Plate 3 – Territorial marking with facial glands.

Plate 4 – Territorial marking with horns.