

# **A REVIEW OF THE MALAYAN SELADANG**

**( *Bos gaurus hubbacki* )**

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## TABLES OF CONTENTS

CHAPTER	PAGE
INTRODUCTION	1
1 IDENTIFICATION	3
Description	3
Weights and Measurements	4
2 DISTRIBUTION	4
History	4
Present Distribution	6
3 ENVIRONMENTAL DISTRIBUTION	7
Vegetational Type	7
Conversion of Forest Land to Agriculture 1971-1980	10
Ecological Impact	10
Topography	12
4 POPULATION	14
Sex Ratio	14
Herd Number	15
Herd Size	15
Population Density	15
5 BREEDING HABITS	16
Gestation Period	16
Nursing of Seladang Calf	17
6 FOOD HABITS	17
Food Preferences	19
Procedures	21
Experiments and results	24
Salt Licks	24
Minerals	26
Minerals needed by Bos Gaurus Hubbacki	26
Salting Problems	28
7 BEHAVIOUR	30
Sense	30
Voice	30
Resting Habit	31

CHAPTER	PAGE
Movement	36
8    LIFE SPAN AND LIMITING FACTORS	39
Predators	39
Accident	40
Habitat Limitation	40
Poisoning	42
9    STATUS OF SELADANG	44
Aesthetic Value	44
Economic Value	45
Land Use Planning	46
10   SUGGESTIONS FOR FUTURE MANAGEMENT	47
Law Enforcement	48
Procedures In Controlling The Seladang	49
Public Relation	53
Wildlife Reserves	54
Habitat Improvement	54
Pasture	55
Desirable Characteristic Of A Pasture	57
Management Of Pasture	59
Pasture Management Program	60
Research	63
Technique And Procedure In Capture	
Operation	64
Approaching The Seladang For Capture	66
Types Of Drugs	67
Trailing/Tracking	68
Transportation	71
Method For Estimating The Drug Dosage For Seladang	72
The Use Of Radio Telemetry For Research	78
Domestication Study Of Seladang	84
Wildlife Reserve And Domestication Project Proposal	87
SUMMARY	88
APPENDIX	90
MAP	98

## INTRODUCTION

The Seladang or gaur is the largest member of the family Bovidae and has an oriental distribution from India into the Sunda region.

Its classification is as follows:-

Class	-	Mammalia
Subclass	-	Ungulata
Sub-order	-	Ruminathia
Family	-	Bovidae
Genus	-	<u>Bos</u>
Species	-	<u>gaurus</u> (seladang)

Much of the habitat for seladang (Bos gaurus hubbacki) in Peninsula Malaysia is being converted to agriculture schemes. The result of this is that this rare animal appears to move from preferred areas to marginal parts of the habitat component.

Stringent measures are needed to save the remaining habitats of the seladang. For the Department of Wildlife and National Parks, the significance and status of this species became evident in the beginning of the 20th century. However little active conservation or management programmes were instituted as both the population of the species and its habitat were plentiful. Since then the population of this species has been reduced. It is therefore important to establish accurately where each herd occurred, and to arrive at the apparant habitat preference of the original population.

To conserve the seladang it is also necessary to carry out research into food habits, habitat, ecology and home range. Such data can then be incorporated into management programmes.

One important aspect of seladang management is habitat improvement aimed at improving the carrying capacity of each area. Strong Law Enforcement also plays an important role in conserving this species. Although poaching is not serious, areas of high poaching risk should be regularly patrolled. The creation of new reserves especially for seladang is also an important aspect of its conservation. Possibilities of such reserves exist in Ulu Lepar, Ulu Nenggiri, Belum, Grik and Ulu Trengganu.

The estimated number of seladang in Peninsula Malaysia at present is about 472 animals. An estimate in 1977 (Khan) was 400 animals.

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## 1. IDENTIFICATION

### 1.1 DESCRIPTION

The mature bull seladang is a very impressive animal standing up to 2.11m (6 feet 4 in) at shoulder with a total body length of 4m (12) feet. In general appearance the animal is large, bulky and powerful with a deep chest and a heavily muscled neck and shoulders. The impression of great bulk and size is further enhanced by the conspicuous dorsal ridge (formed by the extensions of the spinous processes of the third to eleventh vertebrae) extending 7.5cm - 10.0cm above the body line. There may also be a pronounced dewlap hanging below the animals chin and chest. A large bull can reach weights exceeding 2000 lbs. The adult bull has a shiny black, sparsely haired pelage with white stockings and forehead. The underbelly, inside of the thighs and inside of the ears are usually reddish brown. The massive head is arrayed with heavy horns sweeping sideways and up reaching 78.75cm (31½ inches) in length. A large bull (immobilised during the research) had horn 23 inches long and 14 inches in basal circumference. The horns of an old bull are corrugated at the base and with increasing age become frayed and worn at the tips.

Cows are smaller in size and bulk, their dorsal ridge, neck and shoulder being not as strongly developed as the bulls. Cows are brown to dark brown in colour, almost black, with more slender horns that curve in strongly at the tips with edge.

Young calves have a light brown coat up to the age of approximately three months. They then change into the dark brown pelage and white stockings of the adults. This change is gradual commencing around the face, dorsal ridge

and shoulders. The yearlings attain adult size proportion at about 1.5 - 2.0 years of age.

## 1.2 WEIGHTS AND MEASUREMENTS

The weights of mature bulls are normally about 900 kg (1 ton). This measurement for the weight was obtained by measuring the chest diameter and then converting this to weight, along the principle used in cattle farms.

The weight for mature cows as measured were in the range 454.5 kg - 681.8 kg. One cow (# 6) weighing 509.1 kg was about 6 - 7 years old.

Appendix V gives statistics of size and weight of bulls, cows and young. In measuring the total length and the height of the seladang lying on its side, two straight sticks are put vertically into the ground at the top ridge of the shoulder, and another at the end of the fore foot stretched out. The horizontal distance between the two sticks is then measured. The height of one mature seladang exceeded 1.5m.

## 2. DISTRIBUTION

### 2.1 HISTORY

The seladang was once common throughout the hilly, forested regions of the southern part of continental Asia from peninsular India north to Nepal and across Burma, Thailand, Laos, Kampuchea, North and South Vietnam and south along the Malayan Peninsular. It is now limited to scattered remote areas or in parks and other controlled areas.

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The seladang now survives in scattered remnant herds, being harrassed by hunting and driven from its choice habitat. In Malaysia, herds remain near the foothills of middle Dipterocarp forests up to the altitude of more than 333m (1000 feet) above sea level. The more secure herds are found in Taman Negara Pahang, Endau-Rompin in Johore, Krau Game Reserve in Pahang, Ulu Lepar in Pahang (proposed reserve), Sungkai Game Reserve, Belum Game Reserve and Grik Game Reserve in Perak.

In the state of Pahang seladang are still found in the Kuala Lipis and Temerloh areas, north-eastern Raub, northern-eastern Bentong and south-west of Kuantan, in Ulu Lepar (controlled area), Bukit Gebok area in Maran, Lepar Hilir near Kuantan, Jengka 10 and 20, Felda Lancang and Kampong Pinang in Jenderak Selatan (a cultivated area).

In the state of Kelantan seladang are found in an area, south of Sungai Nenggiri (30-40 animals) and 20-25 animals in the proposed Nenggiri reserve itself. Animals in the south of Sungai Nenggiri face serious habitat loss from land development schemes as the area has been classified as suitable for agriculture. But the current distribution may be stable for about 5-7 years. The remaining herds are widely spread through different parts of the state, such as in Tanah Merah and south of Gua Musang.

Across the state boundary in Perak the proposed Belum Wildlife reserve the seladang herd seems assured of a better future. In Perak the estimated number of animals is 86 (Khan 1973) but a large part of these animals are subject to disturbances of development projects such as dam construction and agriculture schemes.

2.2 PRESENT DISTRIBUTION

The total number of seladang in the country is estimated at about 400 animals (Khan, 1974). An overall survey was conducted in 1978 by the Department of Wildlife and National Parks on possible wildlife reserve areas in the country. Through these surveys many small herds of seladang were added to records and included in the present estimation (See Table 1).

Table 1

	Area	Numbers	
		1977	1980
1.	National Park & Reserve	150	150
2.	Ulu Trengganu (including dam)	25	29
3.	Sungai Nenggiri	40	53
4.	Ulu Lepar	56	96
5.	Maran	-	5
6.	Lepar Hilir	-	10
7.	Endau-Rompin	25	25
8.	Ulu Serting	10-12	10-12
9.	Grik Wildlife Reserve	40	40
10.	Belum Wildlife Reserve	60	60
	TOTAL	400	472

The best seladang areas occur in large drainages such as the basin of the Krau Game Reserve, Ulu Trengganu area - Sungai Trengganu upper side, Sungai Chepuan, Sungai Terah and Panggong Lalat in Ulu Kelantan, Ulu Lepar in Pahang and Sungai Chepam in Perak.

The seladang as a rule avoid using hills, though they might occasionally cross over low ridges when

travelling from one river valley to another.

All states once had seladang but they are absent in Selangor, Melaka, Perlis and the single herd in Negeri Sembilan is facing extinction due to total development of its habitat. This herd in Ulu Serting once numbered more than 40 animals. All attempts to create a special reserve for this group animals have failed.

From table 1, the greatest number of seladang in the country are in Ulu Lepar, Pahang (96 animals). This area is the primary research site of the species. As such there is almost complete protection of these animals because of the monitoring and research activities of the Research/Management team in the area.

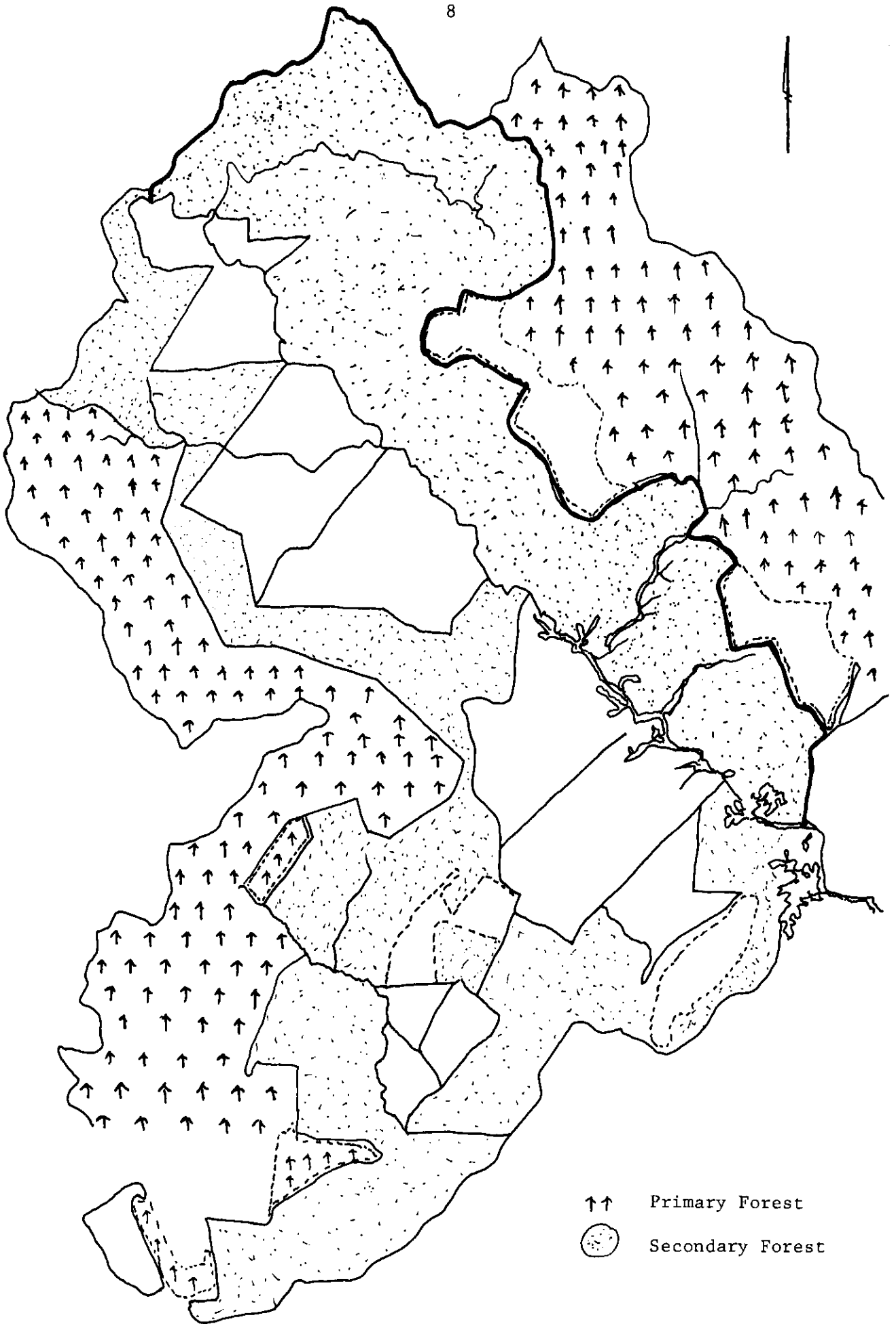
### 3. ENVIRONMENTAL DISTRIBUTION

It appears that the best environment for seladang is a series of isolated open patches interspersed in the forest. This forest may be primary or secondary forest and sometimes developed agricultural schemes. This conclusion has been derived from radio telemetry experiments at Ulu Lepar, Pahang as well as observation at Ulu Lepar, Ulu Trengganu areas, and in Endau Rompin.

#### 3.1 VEGETATIONAL TYPE

3.1.1 The correlation of the vegetation type with the physiographic features can be summed up briefly as follows:-

1. The peaks, higher ridges and plateaus have vegetation which is of limited use to the seladang population. Most of the Dipterocarps are absent from these areas.



2. Descending from such peaks is hill Dipterocarp forest-mostly seraya trees. The vegetation component useful to the seladang is comparatively small.
3. The undulating terrain which is covered by lowland and Dipterocarp forest including some fruit trees. This is obviously preferred by the seladang.
4. Flat lowland Dipterocarp forest. This is also used by seladang.
5. The riverine forest and watershed and marginal flat forest. This is also good seladang habitat.

3.1.2 The Dipterocapaceae is the predominant Family of timber trees in the tropical lowland evergreen rain-forest of the Malay Peninsula. These forests, supply most of the commercial timber of the country.

Identification of the dominant trees in tropical rain-forest is extremely difficult even to botanists because of the large number of different species.

The character of the bark and the cut are those upon which the logger generally rely for identification. But for specific identification leaves must be studied. Thus in the case of seladang research, a collector who can climb high forest trees must be available to collect the fresh twigs of the tree. As an alternative small saplings may be used as a source of fresh leaf specimens.

The proposed permanent forest estate of Peninsula Malaysia is about 5.1 million ha. (12.8 million acres) which is about 39.4% of the country. However, about 1.9 million ha. (4.7 million acres) of this proposed permanent forest estate is currently unproductive

forests (Forestry Department 1977) as the forest crops are inherently poor or are located on very steep terrain and adverse sites which cannot be economically harvested. Some of these forests may have to be set aside for soil, water and environmental protection as well as for protection of wildlife, flora and fauna.

### 3.1.3 CONVERSION OF FOREST LAND TO AGRICULTURE 1971 - 1980

During the second Malaysia Plan (1971 - 1975), about a million acres of forest land were developed for agriculture. Of the 17.8 million acres of remaining productive forest land, about 5 million acres are considered suitable for agricultural development and 3.6 million acres of this area have already been logged. Under the third Malaysia Plan (1976 - 1980) about 0.7 million acres of forest land suitable for agri-conversion will be opened and developed for agricultural purposes. By the end of 1990 the bulk of the area will be developed for agricultural or at any rate will have been exploited for timber. Wildlife conservation will then have to rely heavily on protective forest.

### 3.1.4 ECOLOGICAL IMPACT

Although intensive studies remain to be carried out, general observation are that forestry has a great effect on soil, microclimate, water, flora and fauna. While logging has a detrimental effect on wildlife, this effect is not as great as the nature lover generally believes.

Little study has been done on the exact effect of logging on the seladang.

The main effect of logging is on the soil which gets eroded away rapidly. However the tropical forest with its quick growing capacity is able to reestablish vegetative cover rapidly.

Logging results in a change of composition of the species which, in general, is undesirable. The exact effect is dependent upon the logging practice and the soil type. Logging itself is selective for the more commercially valuable trees (eg. meranti). In addition to these commercially valuable species there is also the removal of species accidentally during the logging operation. Sometimes these species are of use to the seladang.

A fairly stable soil can be re-established by the pioneer species eg. Macaranga and Anthrocephalus and the green cover is quickly produced. However sandy soils tend to result in bare areas in the secondary forest.

Another effect of logging is the heavy siltation of rivers and streams making them unsuitable as drinking or bathing water for the seladang.

The tropical rain forest has been shown to be able to support the seladang indefinitely. Secondary forest need to be properly managed to be able to achieve the same purpose. Much research remains to be done and greater cooperation between agencies are needed to meet this long term goal of conserving which the seladang and its habitat for benefit the people in the long run.

3.2 TOPOGRAPHY

Table 2 shows the distribution of the seladang altitudinally. The species favours flat to gently undulating lowlands rather than steep hills. There appears to be a preference for the lower reaches of streams which provide a regular supply of water.

Table 2

Percentage of seladang use at various categories of elevation

Elevation (feet)	seladang number			
	1C n = 27	2C n = 70	5C n = 12	Areage n = 109
0 - 250	51.9	77.1	75.0	70.6
251 - 500	37.0	22.9	25.0	26.6
501 - 750	0	0	0	0
751 - 1000	7.4	0	0	1.8
1001 - 1250	0	0	0	0
1251 - 1300	3.7	0	0	1.0

The term lowland itself is used to include all the well-drained primary climax forest of the plains and undulating land and foothills up to an average elevation of about 1000 feet above sea level. The seladang usually use the dense secondary growth for cover and shelter, where there is still some freedom of movement. The primary forest itself is divided into the upper emergent storey 100 - 150 feet high, main storey or second tree layer 70 - 100 feet high and the understorey consisting of saplings of the upper two storeys together with shrubs of such families as Annonaceae, Euphorbiaceae, Rubiaceae and Eugenia species. The main herb layer consists of ferns near streams and young seedlings.

This study of seladang indicates that the riverine type habitat was highly preferred in the study area. Disturbed forests were not used very much. This may be because these disturbed forests were relatively new and the herds have not had sufficient time to re-establish themselves there.

At 0 - 250ft. above sea level 70.6 percent of the animal sign was encountered while above 1000ft. above sea level the incidence was almost zero (see Table 2).

In Ulu Lepar the seladang utilised a combination of three areas. These are the primary forest of low land dipterocarp, secondary forest (after logging) and oil palm estates. This combination plus the presence of natural salt licks all over the home range provides sufficient food and mineral to support all the herds in Ulu Lepar, Pahang.

Table 2 figures were obtained using radio tagged animals of three groups (1C, 2C and 5C). It is to be noted that the general ranges of groups 2C and 5C were generally flat terrain and with many salt licks. Thus these groups were never recorded above 500 ft. above sea level.

Table 3

The number of seladang at Ulu Lepar, Pahang

Location	Total	Adult bull	Adult cow	Young	Unknown sex
1. Sungai Luit	13	4	6	3	-
2. Block B	15	4	5	4	2
3. Old communist padang	30	8	12	6	4
4. Sungai Hok	5	1	3	1	-
5. Sungai Lepar	14	5	6	3	-
6. Jenut Ketapi	4	1	3	-	-
7. Lepar Utara	15	3	6	3	3
Total	96	26	41	20	9

Table 3 was based upon sight and track data. It also indicates the rough age structure of the seladang population.

#### 4.1 SEX RATIO

The above table also shows seladang breeding activity through the number of calves counted. The proportion of calves born to the number of breeding females is the calf production. The actual calf production might be different from one herd to the other because of many factors. In the above table, 26/41 is the estimated male: female ratio. While the young: female ratio is only 20/41. This very roughly seems to indicate that about half the adult females are breeding.

#### 4.2 HERD NUMBER

In the state of Pahang alone there are about thirteen herds distributed all over the forest and agriculture areas. Seven herds at Ulu Lepar, three herds at Krau Game Reserve, and one herd each at Maran, Jengka 10 and 20 and Lepar Hilir.

There are only four herds in the state of Kelantan and one herd in the state of Trengganu. All the herds in Kelantan and Trengganu are within areas of potential agricultural development. There may be other herds in the deep forests of these states but surveys to establish their presence have not been carried out yet.

#### 4.3 HERD SIZE

The size of herd depends on a number of factors including the amount of grass pasture and water available. Appendix 1 shows the total number of animals at different locations. For these locations herd size varies between 4-30 animals at Ulu Lepar, 1-40 animals at Ulu Kelantan and 4-17 animals in Perak.

#### 4.4 POPULATION DENSITY

There is not much information concerning population densities beyond the fact that the density seems to be increasing in the study area when compared to past records. The density in any given area of Ulu Lepar changes every 2-3 months as animals herds move throughout the area. The saturation point of any given area with respect to Seladang has not been determined. The observed maximum sustained population density for the seladang is 15-30 animals/per 10000 acres.

5. BREEDING HABITS5.1 GESTATION PERIOD

The gestation period of Bos gaurus is nine months (Crandall), and a female can breed again two or three months after birth (Reed, 1958).

With free ranging animals the calving interval was very difficult to observe. The Calving interval has to be worked out by long term observation of a seladang group in the forest. Under the fourth Malaysia Plan it is hoped to be able to add some captivity studies of the seladang and add further information on this topic.

Table 4  
Seladang #5 in Ulu Lepar early 1979

Total No.	Adult bull	Adult cow	Young
13	3	6	+ 3(2)*

\* (+2) The data after December 1979

As indicated in Table 4 above in 1979 only 3 adult cows calved while the other two adult cows calved a year later. The sixth cow did not calve and may in fact be still sexually immature although this animal was large enough to be mature.

## 5.2 NURSING OF SELADANG CALF

One of the observed habits of seladang is that when danger threatens they almost invariably leave the calf to take care of itself on the apparant assumption that immobility is a better safeguard for the calf than flight with the herd. After birth, the calf will remain more or less in the same place unless there is disturbances in the vicinity. The seladang calf stays close to the herd especially its mother by whom its frequently licked. Other cows may also give similar attention to a calf. But if the herd is disturbed (eg. by poachers) all the other cows will disburse from the place leaving the calf behind to rejoin only at the end of the day or sometimes after the disturbance has gone.

A young calf will feed about 4-5 times a day (observations in the Zoo Negara pen). Here the keeper attends to the calf, around 11.00 am, 4.00 pm, 9.00 pm and 12.00 pm every day.

## 6. FOOD HABITS

The food habits of seladang were investigated at the Lepar valley study area by examining feeding sites and dung. The method of examining the feeding site was modified from the 1976 procedure described by Peek. This method was used to determine plant species consumed, relative abundance of plants at feeding site and feeding behaviour.

Dung samples were collected and fixed with a preservative, 10% formalin and sent for parasite ovum inspection to the Institute of Medical Research. (Appendix II). After the inspection and identification of parasite ovum, the dung samples were inspected for seeds of food plants (Appendix III).

As is evident in the food item list (Appendix III and IV) the seladang is a wide spectrum feeder. The animals are found to feed on grasses, herbs, shrubs, vines, and trees, being a grazer or a browser as the environmental situation dictated.

The feeding habits of a seladang begin normally around at 5.00 am. The animals would walk through secondary forest to the edge of the agriculture scheme. Once in the agriculture scheme the animal grazed on lush grasses, herbs and the legume cover crop available, rumput chenkenit (Paspalum conjugatum), centro legume (Centrocima pubesens) and bamboo grass (Danim triganum). Normally, the animals would lay down, rest or continue to feed in the pasture depending upon the temperature of the day. Between 6.15 am and 6.30 am the animals would move back to the jungle. Feeding would continue in the jungle (secondary jungle) where they browse on shrubs, plants, trees, woody vines, and creepers. Some of the most browsed upon items included Mengkirai (Trema angustifolia) and (Trema tomentosa), Mahang (Macaranga sp.). Simpoh fruits (Dillenia ovata and Dillenia indica) and Kerayong (Parkia javanica) were preferred fruit species. Between 11.00 am and 4.30 pm the seladang would reduce its activity in response to temperature rise. The animal would find a safe resting place and bed down for the day. The animals would begin another feeding cycle in late evening between 3.00 pm and 4.00 pm.

Animals would approach an open feeding area with caution pausing among the denser vegetation at the edge for 5-10 mins. to ensure that the open area is safe. Generally the lead bull would be the first to enter the area with the others slowly following.

Once the herd was in the open this bull would take a strategic position and maintain an alert pose over

his herd remaining sensitive to all sounds or smells.

Young calves would join the herd in the open and would be observed playfully frolicking between members of the herd, doing very little actual feeding on the vegetation.

The herd would generally spend 3-3½ hours feeding in the night, before moving back into the forest.

As herds would reuse a pasture it was often observed that the lead bull would either remain in the pasture or retreat to its edge during the day and remain there until the herd returned the next evening.

Large pastures tend to be used for up to 2 weeks before the herd leaves the area entirely for some other part of the herds range.

Contact with animals for these observations was maintained visually and through radio-telemetry.

Feeding in the forest seems to differ to feeding in open pastures in that the animals would tend to feed upon certain plants in their path rather than try to find the more preferred species.

Seladang are basically riparian and each herd will have a system of rivers and streams running through its range.

## 6.1 FOOD PREFERENCES

- 6.1.1 This is a list of the seladang food plants collected in the study area. The list is divided into grasses on one hand and shrubs and trees on the other hand. Class I are the more preferred species and Class II the less preferred species.

## Class I - Grasses

Setaria palmifolia  
Paspalum conjugatum  
Panicum miganum  
Imperata cylindrica

## Class II - Grass

Cyrotocoum orphylum  
Leptaspis urceolata  
Phragmites karba  
Ottochloa nadosa

## Class I - Shrub and tree

Parkia javanica  
Macaranga spesis  
Hevea brasiliensis  
Atalantia monophylla (Merlimau)  
Bridilia pustulata  
Glochidion spiciflorum  
Dillenia ovata  
Dillenia indica  
Mikania corolata  
Eugenia aquearsum  
Trema tomentosa

## Class II - Shrub and tree

Eupatorium odoratum  
Ipomoea batatas  
Ficus fistulos  
Thema nagustifolia  
Melastoma malabathricum

Class I plants were found along rivers and up to 100 m deep from the edge of clearings and in the clearings themselves Class II plants were found spread throughout the study area.

When class I plants were lacking, eg. when an area was being converted into oil palm the affected herd tended to use more Class II plants within its range.

In order to find the food preference of the seladang the animals actual movements are traced beginning usually from its bedding place. As the animals movements are tracked a note is made of all its food species and estimates made of their relative abundance. In addition all actual feeding is also noted.

It was observed that open grass pastures were heavily utilised because these grasses regenerated very quickly especially during the rainy season.

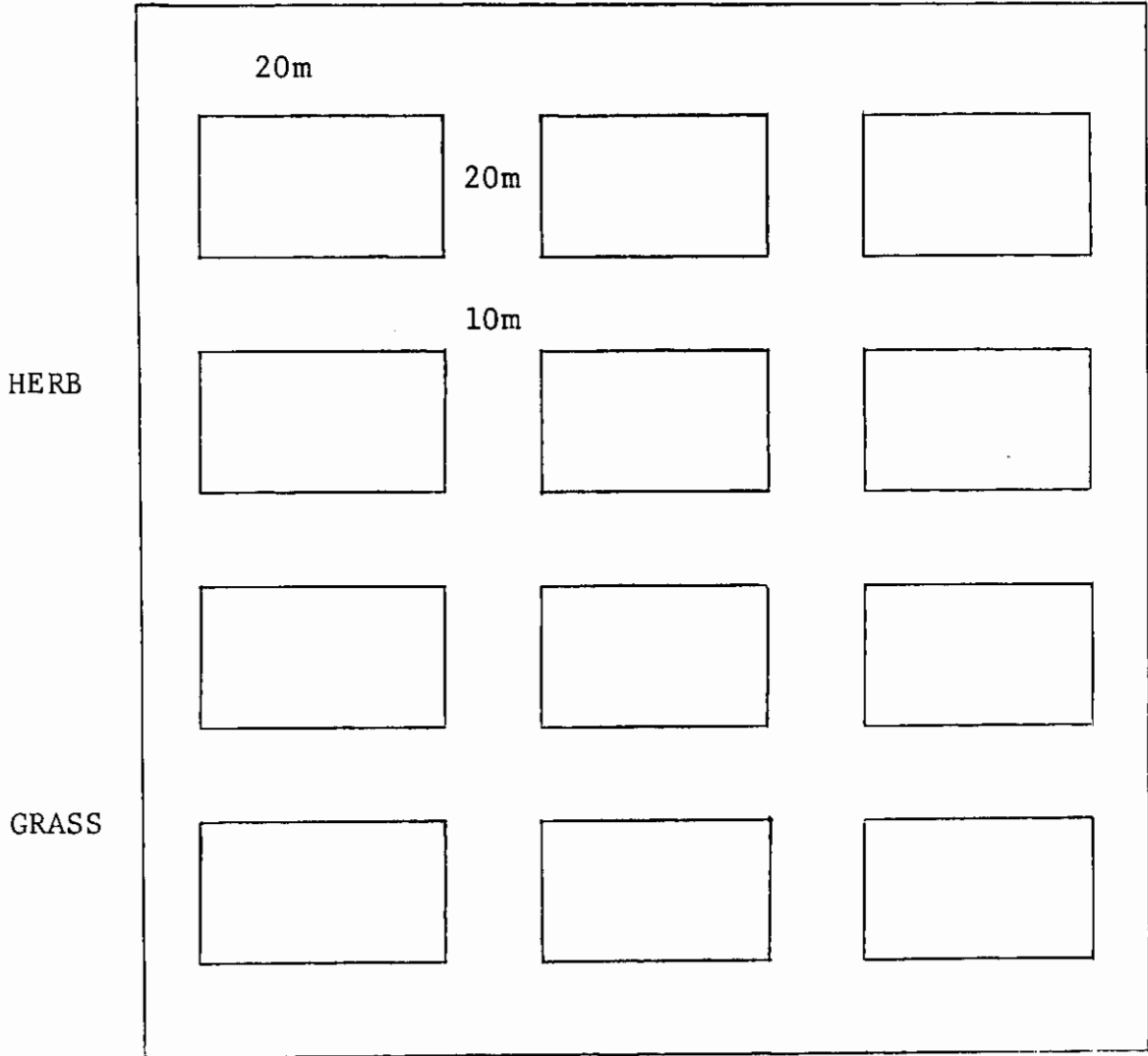
The seladangs feeding behaviour in the secondary forest was much less predictable. It would feed on a plant of one species and then ignoring other plants of the same species would walk away and sample another species sometimes 10-15 metres away.

### 6.1.3 PROCEDURES

This is a diagram of plot No. 1 laid out for sampling the food plants. This plot lies in block B of Asia oil palm Estate Sri Jaya, Kuantan, Pahang. The area was originally planted with oil palm which died or were destroyed. The area was then taken over by grasses and herbs.

The selected area was rich with all kinds of grasses and normally used by at least 10-15 head of seladang. Half of the sample plot is in the forest and the other half is grassland. Six of the sub plots were in the forest (i.e tree and shrub species) and six were in the grassland (grass species).

Fig. 1 Sample plot No. 1



\* Number of mini-plot = 12 plots

\* All the plants species are collected in the plots being group according to the preferences of graze.

Before the sampling was carried out the browse number of each food species was worked out to compare between the more favoured and less favoured species. The forested area was about 3 m high. A small river i.e Sungai Belayar ran down the middle of the plot.

This was the general method of laying out all plots for this study. For each herd's home range 5-10 such plots were set up and the data collected and collated. Table 5 shows the results.

Both grazing and browsing plants are mixed in Table 5, to show the frequency of the plant species eaten by the seladang. Where plots cover grassland only, the readings were taken at random rather than in the subplots of sample plot 1.

All low growing plants were counted in the 20 m block of the sample plots. Obviously Paspalum conjugatum and Atalantia monophylla were the most frequent species present. They were spread in the whole plot but Paspalum conjugatum preferred areas of high light intensity while Atalantia monophylla preferred areas of less light. Antalantia monophylla grows naturally as a lower stratum of the forest being only 2 m in height.

Plots which were overgrown with saplings of Parkia javanica, Hevea brasiliensis, Dillinea ovata, Dillenia indica and other class I - shrub and tree had a high frequency of feeding visits.

The Sungai Luit area is humid but not swampy and is dominated by grasses (Imperata cylenderica and shrub of Hevea brasiliensis and Simpoh). These were skimpy during the dry season and the sample plots were not frequented. However the plots became lush after the

rains and were highly frequented by the seladang allowing for very fruitful observation and data collection for about three weeks.

#### 6.1.4 EXPERIMENTS AND RESULTS

In the experimental plots of 20 x 20 meters all the plants and grasses and (if present) vines were considered. All the other components of the vegetation were ignored.

All the plots were visited with varying frequency. Seven species of grass and 16 shrubs were recorded. Five hundred and thirty-two plant samples were recorded and of these 175 showed high usage, 208 moderate usage and 149 low usage.

#### 6.2 SALT LICK

A small amount of home range overlap occurs among 3 groups of seladang at Ulu Lepar. This overlap is at the northern section of the home range of 1C group and is relevant to note the overlap occurs in the area of two mutually shared mineral licks. The presence of salt licks in the home range of the seladang play an important role in the species watering habits. The seladang will utilise a salt lick regularly for two months. After that it will move to the other part of the home range.

Soil samples from Jenut Sungai Rami and Sungai Lepar were taken and sent to Agriculture Department for soil analysis. The results are given in Appendix IV. These were the seladangs' common drinking places. Salt licks tend to be sandy with a little clay. The major elements found in both samples were phosphorus, potassium, calcium and magnesium among other elements. The location of salt licks, play an important role

Table 5

Summary of browse and graze in the sample plots at Ulu Lepar

	Species	Code	Low	Moderate	High	No. of sapling
1.	<i>Paspalum conjugatum</i>	G	16	18	17	51
2.	<i>Panicum miganum</i>	G	8	13	17	38
3.	<i>Imperata cylindrica</i>	G	5	4	9	18
4.	<i>Parkia javanica</i>	S	9	20	14	43
5.	<i>Macaranga species</i>	S	4	27	3	34
6.	<i>Havea brasilliensis</i>	S	13	18	-	31
7.	<i>Dillenia ovata</i>	S	9	17	13	39
8.	<i>Ficus fistulos</i>	S	9	8	1	18
9.	<i>Melastoma malabathricum</i>	S	7	8	2	17
10.	<i>Trema nagusflolia</i>	S	6	2	1	9
11.	<i>Trema tomentosa</i>	S	5	2	-	7
12.	<i>Atalantia monophylla</i>	S	-	25	30	55
13.	<i>Leptosis urceolata</i>	G	12	2	-	14
14.	<i>Eupathrium odoratum</i>	S	11	4	-	15
15.	<i>Eugenia aquearsum</i>	S	13	-	11	24
16.	<i>Mikania cordata</i>	S	-	2	11	13
17.	<i>Glochidion spiciflorum</i>	S	-	11	14	25
18.	<i>Bridilia pustulata</i>	S	2	7	16	25
19.	<i>Cyroto co cum orphylum</i>	G	6	2	-	8
20.	<i>Phragmites karba</i>	G	4	1	1	6
21.	<i>Impomoea batatas</i>	S	3	3	2	8
22.	<i>Dillenia indica</i>	S	-	13	12	25
23.	<i>Ottochloa nadosa</i>	G	7	1	1	9
	Total		149	208	175	532

\* G - grass

\* S - shrub

in seladang movement and the gross movement of herds is generally from one salt lick to another. There are three salt licks in the oil palm estate at Ulu Lepar located about 2-3 miles apart. These are natural salt licks with continuous flow of water and the smell of sulphur, and sulphides.

In the proposed Grik Game Reserve, the herd moves in the Sungai Piah and Sungai Chepam areas where there are no less than four salt licks. The greatest concentration of Bos gaurus is to be found between Sungai Piah and Chepam. (Khan, 1973).

#### 6.2.1 MINERALS

The seladang herds in Malaysia appear to be affected more and more by decreasing amount of minerals. The amount of minerals in the natural environment especially in the Ulu Lepar study site and other areas has been decreasing as salt licks are exposed during agricultural development, become leached by rains and dry out due to changes in the water table.

The elements which are recognised as performing essential functions in the body are chlorine, calcium, phosphorus, potassium, magnesium and others. The elements that are most likely to be lacking, are sodium, chlorine, calcium, phosphorus, iodine, cobalt, iron and copper. This is elaborated in Appendix IV.

On the other hand seladang herds feeding on legume grown on limed and fertilised soils will usually not be in need of additional minerals.

#### 6.2.2 MINERALS NEEDED BY BOS GAURUS HUBBACKI

The five elements which are considered very important to the seladang are:-

a) Calcium (Ca)

Legumes, herb species and pastures are the best sources of calcium in the Seladangs natural diet. Seladang requires more calcium than phosphorus, because the amount of calcium in the body is much greater than the amount of phosphorus.

b) Phosphorus (P)

Seladang replace and obtain phosphorus from salt licks and herb species. There is an abundance of phosphorus normally in salt licks. Lack of phosphorus retards growth.

c) Magnesium (Mg)

The amount magnesium needed is likely to be the same as phosphorus. Seladang are always deficient in this element and seldom obtain sufficient from grass. However it is easily obtained from salt licks.

The first requirement of a mature animal is food to maintain its internal body processes and support normal muscular activity. This minimum is known as the maintenance requirement. The grasses and minerals constituents necessary to meet these demands include proteins for repairing worn out tissues; minerals for bone building, general body functions; and vitamins which play a multiple role in the normal body processes.

Calcium and phosphorus are essential for bone growth and numerous other body functions. In many animals, such as rusa and kijang the ratio of calcium to phosphorus is of great importance. However for the seladang this seems to be a secondary consideration so long as the minimum requirements for both calcium and phosphorus are

met and animals receive adequate vitamin D.

Chlorine is a constituent of certain body secretions. Its absence causes breakdowns in health, loss of appetite and weight.

### 6.2.3

#### SALTING PROBLEMS

One of the most effective methods of managing wildlife feeding areas and pastures of seladang is to ensure proper salting. It is known that, with sufficient salt, seladang are more contented, are more easily seen and are free from diseases. In an experiment in Taman Negara, a number of artificial salt licks were established. These licks were visited by a herd of seladang. After one month it was observed that their appearance, weight and general condition were profoundly influenced. Chlorine rather than sodium was identified as the most essential element.

The number of artificial salt licks established depends upon the topography, kind of vegetation and pasture in the area. Seladang will go great distances for salt or water if these are absent in its feeding range. If the topography is level or rolling, artificial licks can be set up 2 chains apart in pasture and 1 mile apart in the home range of normal areas of seladang. It was commonly believed that animals desire water after salt and that, by locating salt near water, excessive travel is prevented. However observations have shown that this is not necessarily true and that, as frequently as otherwise, animals will take salt and leave without drinking from the adjacent water.

Thus in siting salt licks, areas in proximity to

water and low saddles between drainages should be avoided, since the use on these areas will be complete without the added attraction of salt. For example in Ulu Lepar strategic siting of artificial salt licks drew animals away from their normal feeding routes, increased the overall feeding range and in consequence reduced the intensity of feeding in the old areas.

No other exact and generally applicable rules can be made for the location of salt licks, but certain principles can be followed. Salt licks should be located on ridges if possible and gentle slopes. These areas should be accessible and should also be in suitable feeding areas.

Little accurate information is available on the amounts of salt needed in each pasture, although such information is basic to a salting plan.

In Taman Negara, the salt lick at Tabing, Belau and Kumbang is frequently visited by a group of seladang, the most frequent being at Kumbang Hide where, around 20 - 30 animals use this salt lick as part of their home range. The seladang use the habitat at Sungai Wa on the way to Kumbang Hide normally.

A herd of seladang was observed at the salt lick early in the morning around 5.00 a.m. It is just before the herd moved to an adjacent agricultural scheme. A second visit was made at 8.00 a.m. after grazing on the grass in the estate. The herd then spent about half an hour at the salt lick.

## 7. BEHAVIOUR

The habits of seladang were known to hunters from the old days. Hunters could recognise the call and smell of the animal. Movement was said to be more complex and less predictable.

### 7.1 SENSE

Wind is more important in tracking than smell or the call of the seladang. It is difficult to get near a herd when the wind direction is parallel to the herd. Body odour or smell of this animal may be sensed from a distance of about 30 - 40 meters. The seladang produces an oily substance when tracked. Fresh tracks, bedding and resting areas are important guides in tracking. The seladang has a good sense of hearing. Hearing is especially important in dense vegetation because of its poor sight. On hearing any foreign sound, the large bulls and cows react by turning in the direction of the sound with their ears erect and alerted. The seladang is able to respond to such noise at 30 - 40 meters in jungle or secondary forest but in open country its sense of hearing and smell are sensitive up to a distance of 2100 meters.

### 7.2 VOICE

It has no less than 5 characteristic calls. The most common is the snort produced when alarmed or suprised at close range. This snort is produced by rapid expulsion of air through the nostrils.

A somewhat similar sound is made by bulls in response to the presence of other big animals such as elephants and tigers in the vicinity. This call which sounds like a whistling snort is accompanied by trampling of the undergrowth and

stamping of the ground.

The 'moo' call is made by cows to locate their calves which may be out of sight normally in the same area due to the dense undergrowth.

The fourth call is a peculiar sound made by young calves. A young calf was observed making such a call at salt lick and a reply from a cow in a deep tone was heard.

The last sound made by a seladang occurs only once, and that is at the end of its life when it is dying from a violent death.

### 7.3

#### RESTING HABIT

Another characteristic of the seladang, which is common to all its relatives, is its bedding habit. This may take place in a ladang or secondary forest.

##### a) Bedding in the Ladang

In an undisturbed area like Taman Negara, Krau Game Reserve, Sungkai Game Reserve and Endau-Rompin, the seladang selects a suitable bedding site to lie and rest. Due to a lack of open clearings in such areas the seladang may journey out into a nearby ladang in search of food such as Imperata cylindrica, Paspalum conjugatum and Mikania cordata.

A herd of seladang starts to move into the ladang using normal route near the river or jungle fringe. A fact peculiar to the herd during the trip to the ladang is that the big bull would be the leader followed by cows, calves and others. The flat alluvial plains of riverine type of the Malayan forest will

hold a number of herds of seladang. The seladang will lie and rest in the ladang after grazing. The position of beds may not be in a definite order but will form a triangular shape. Some members of the herd will rest while others will continue grazing near the bedding animals. In a herd of 5 - 10 animals, about 3 - 4 of them will rest at a time. When a herd leaves its bedding area the undergrowth is usually trampled with signs of dung in close proximity. Resting terminates at sun set. The number of bedding areas on one visit to a ladang does not exceed 7 - 10 places. The animals change beds to cool themselves.

b) Bedding in the jungle

From the ladang, the animals move to the adjacent jungle and start to browse on small trees, shrubs, and climbers or vines. All members of a group, follow the oldest cow as a second leader into the jungle. The old bull in the herd may stay in the vicinity of the ladang for up to one hour before joining the rest of the herd. The master bull, frequently use different routes to the jungle.

Dense vegetation plays an important role in reducing the sensitivity of hearing and smell against predators. A herd of seladang usually looks for a bedding area at about 11.00 a.m. and rests till 2.30 p.m. In the jungle the animals form a circular or oblong pattern when bedding. The mature cows stay close to their calves while the master bull takes an established dominating position that serves as look out to any danger that may approach the herd. Numerous beds may be found

in the same area due to shifting of beds caused by disturbance from other animals. The bedding sites are usually located near a small river, with grasses and shrubs. Among the favourite food items that are readily available at the site are Paspalum conjugatum and Imperata cylindrica.

Small shrubs and trees such as Merlimau Atlanthia Manophylla are utilized by seladang. This tree is about 3 meters high and has a sour taste.

Bedding sites of seladang are found at 250 meters above sea level, where there is abundance of Merlimau trees. The ability of merlimau to withstand browsing indicates that it is not a preferred food species. (Table 6 and 7)

TABLE 6

RADIO TELEMETRY DATA : Aerial Location # 1C

Date : 11/1/78 to 25/10/78

Area : Ulu Lepar, Pahang.

Elevation : Range 150 ft. - 1300 ft.

Elevation	Number	%
0' - 250'	14	52
250' - 500'	10	37
500' - 750'	0	0
750' - 1000'	2	7
1000' above	1	4
TOTAL	27	100

TABLE 7

## DISTANCE TO RIVER

RANGE : 100 m - 5800 m.

X : 717 m.

Distance	Number	%
0 - 500 m	16	59.3
500 - 1000 m	5	18.5
1000 - 1500 m	4	14.8
1500 - 2000 m	1	3.7
2000 - above	1	3.7
TOTAL	27	100

MOVEMENT

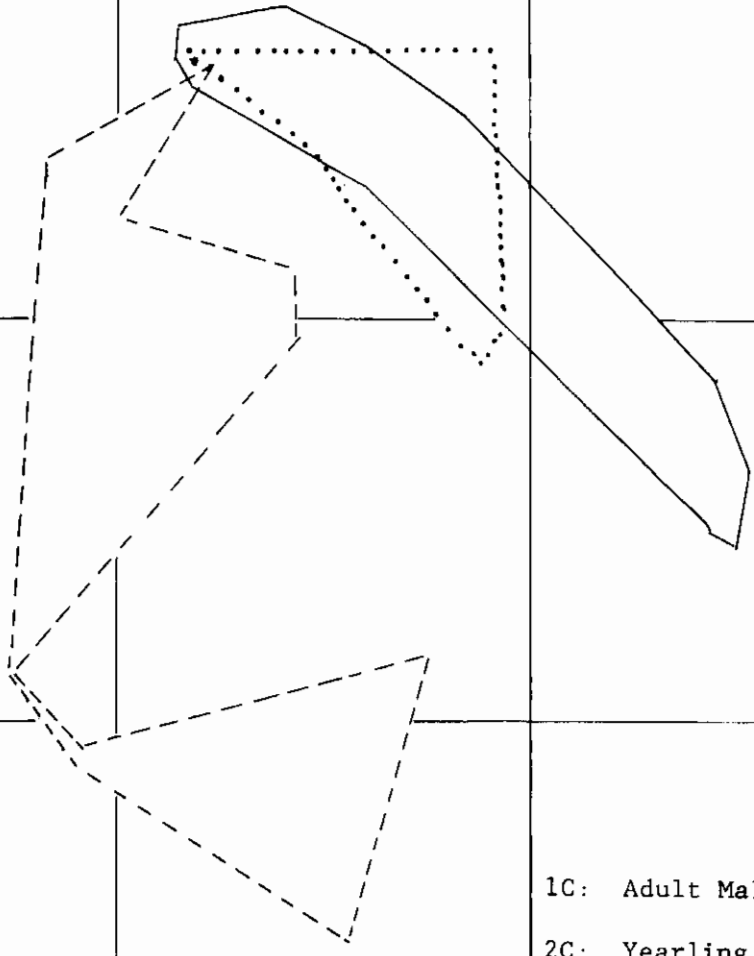
The home range of the seladang is dependent on the animal's travel and distances that they go vary with the relative component of its habitat and the environment. Movements of seladang may be considered under two headings, internal and external.

a) Internal

Movement internally includes short daily travels of an individual within its home range. Visits to salt licks which are made daily for minerals and water are included in internal travels. Internal travels also include distances covered from bedding sites to pastures, movement within pastures while feeding and movements while browsing in forest which also include distances covered from bedding sites to browsing areas. A herd of seladang may remain in an area for up to 2 - 3 months. When disturbed a herd of seladang will leave the area to look for new pastures.

By moving constantly the home range is spared the pressure of excessive grazing that could result in the destruction of cover for the animals.

Part of the home range may be abandoned and not revisited for many years. The entire population may shift to a new region and take up a new migration pattern. This was observed and recorded at an old clearing in Ulu Lepar. About 25 - 30 animals moved in the area that was occupied by an existing herd that was reluctant to move out thus creating two



1C: Adult Male

2C: Yearling Female

3C: Yearling Male



SCALE:  1,000 yds. sq.

distinct feeding grounds, resting places and escape cover.

The home range of animals of both herds were carefully observed and studied. In herd no. 1 the home range was 6000 ha and that of animals in herd no. 2 was 4000 ha. Within the home range each seladang knows the travel routes and can quickly reach any point or type of cover it wants. The home range of herd no. 2 is a single, elongated area, broad in the middle and thin at the end with numerous routes.

Occasionally adult seladang from a herd with an established home range will leave its herd after losing in battle with the master bull and will drift away to some new area in the same home range. In some instances after spending sometime on its own the adult seladang will return to its home ground once more. This wandering was observed among adult seladang in herd no. 5. Sometimes the number of adult bulls may consists of 2 or 3 animals.

b) External

Most of the factors affecting movements are related to the balance of a population. For example fighting with the master bull may force the loser to move out of its home range. A whole herd of seladang may be forced to move out of its home range because of the opening of forest for agriculture or the destruction of its habitat thus necessitating the animals to find new homes. An external movement by the herd in Ulu Trengganu was caused by the construction of the kenyir hydro-electric dam. An area of nearly 260,000 ha will be under water. The habitat of the seladang will be altered and much of it destroyed. The animals

will be broken into small groups and move to new areas.

## 8. LIFE SPAN AND LIMITING FACTORS

The life span of a seladang in the wild is inadequately known due to its shyness. The seladang is estimated to live up to a maximum life span of not less than 20 - 25 years.

Malaysian wildlife is subjected to disturbance wherever there is human habitation. The seladang is no exception. Poaching of seladang probably is not serious in accessible areas where law enforcement is adequate. A few animals are however lost each year. The situation is better in inaccessible areas. Poaching problems are serious where development comes into conflict with seladang to the detriment of the latter. Herds in Sg. Terah, Ulu Serting and Jengka 7 are close to being completely wiped out. The steel wire snare commonly set for wild pigs are known to affect seladang but cases are few.

Many other activities in the seladang area affect the animal in varying degrees, as a result of poaching.

### 8.1 PREDATORS

Normally, a herd of seladang moves from one area to another in a group. This habit of moving in a herd helps to protect the animals against the attacks of predators like tigers. The species has effective herd organization against natural enemies. Attacks by tigers are known to occur. Observation have shown that a seladang attacked by a tiger is saved by the herd forming a protective formation. The victim probably dies of the wounds inflicted by the tiger.

A young seladang was observed standing on a logging track all by itself. It appeared to have been left behind by the rest of the herd. It was further observed that fresh tracks of the tiger were only 50m - 80m away from the animal. After following the calf for about 1 M it was observed to have left the logging track and was on the run probably having sensed the presence of the tiger. Further on about 1.6m from the first sight, sign of the calf being followed by a tiger was observed. In the absence of the herd the calf has no chance of survival.

## 8.2

### ACCIDENT

Partly due to the occurrence of seladang in areas with few busy roads and the animal wary habit accident is rare. A large cow was killed by a fallen dead tree while she was grazing in the river valley of Ulu Lepar in 1980. One or two rescue cases of seladang being bogged down in soft mud were recorded over the years. Herds of seladang in moving from one feeding ground to the next are known to cross large rivers like the Perak river in the Grik area and Sg. Tembling near Kuala Tahan. The crossing is done at shallow points of the river which are usually limited and are not always accident free. Young animals were known to have been carried away by swift current of the rivers.

## 8.3

### HABITAT LIMITATION

The amount of food, water and space available and appropriate to a particular animal determines the 'Carrying capacity' of the habitat for the species. Seladang habitat due to its components is limited in most parts of the country especially in the hilly terrain of Ulu Kelantan and Ulu Trengganu. These

limiting factors are responsible for the occurrence of Seladang in large or small numbers. Development has crept into and destroyed a lot of seladang habitat. In many seladang areas that are encroached by development the main concern is the fate of the existing animals. Present technology does not guarantee success in capture and translocation. There is a shortage of food and cover for the animals that must be provided by artificial means or habitat modification if the animals are to survive. There is an urgent need to get support of settlers not to harm these animals. The vast valley of the Lepar river holds about one hundred animals comprising seven herds. Encroachment is extremely serious.

Presently there are pastures and other requirements of the seladang created in protected areas. These are the Taman Negara, Krau and Sungkai Wildlife reserves with plans for similar measures in Endau-Rompin. These efforts should be extended to forest reserves, state land and other areas where there is an occurrence of the species.

The number of seladang in an area is normally close to its carrying capacity. Where there is an increase in carrying capacity it will be taken up by splinter groups or other animals moving into the area. Food is generally considered the most important element of good habitat but water and cover must be adequately present. Food preference especially those plants included in class I and II have greater nutritional values. To find food with the required nutritional values seladang spend a lot of time in open, sunny places where they feel safe from their enemies as well as shrubs and bushes that they browsed from the forest. A grass called rumput chenkenit is a favourite food item which is often heavily grazed but hardy enough to withstand the pressure.

New shoots grow from this species that was grazed to its roots. Plants and grasses provide a certain amount of moisture for the animals but this is inadequate as the water requirement is quite high for an animal the size of seladang. In fact water is considered as a special form of 'food' and it is being treated separately. Most seladangs live near water.

The seladang faces habitat reduction in Malaysia. This habitat reduction or limitation has caused the herds to become smaller in size. For example in the study area at Ulu Lepar, herd #7 at Ketapi consists of only 5 animals. The habitat of this herd is being converted into agriculture schemes. The seladang has shown an inability to adapt to rapid changes a fact necessitating planners to give due consideration to the specie's requirements. The largest herd in the Lepar river valley consists of 26 animals with adequate feeding grounds. This herd is considered stable and should remain so if there is no further development programs in the area.

#### 8.4

#### POISONING

Each species of wild animal has different requirements for food and cover with various degrees of interspersions of these elements. Since the principal habitat of seladang changes through their biotic succession, these animals have to search for areas. Oil Palm estates are frequented by these animals under such circumstances. Poisonous contaminants like sodium arsenite which are sprayed to control weeds may affect the animals with serious mortality. In 1955-1958, six animals died of sodium arsenite in the Sungkai Game Reserve.

Another six animals died from the same cause in the Lanchang area of Pahang. The effect of sodium arsinite have caused mortalities to large mammals like seladang and elephants as well as smaller animals. What is known of the effects of contaminants like sodium arsinite is alarming but a thorough investigation is needed to find out the full effect. These dangerous contaminants are sometimes in the hands of people who have no idea of their use and effects. Our present knowledge of the effects of contaminants on seladang is that they are serious and capable of causing severe mortality to the extent of total disappearance of whole herds. Total forest clearing is more serious than poisonous chemicals.

In managing the herd at Ulu Lepar, the research branch established a team of renjers to collect grass specimen from areas used by seladang which are partly included in the oil palm estates. The specimen where chemicals were known to have been sprayed were collected from four different oil palm estates to identify the type of chemicals used and the possible harm to the stomach of the seladang. The health Department in Pahang was requested to carry out the examination on the poison used in Ulu Lepar during that period. The general relationship between the grass quality and its abundance has long been known. Grasses which have salty taste as a result of spraying of chemicals are attractive to seladang. Heavy rainfall in time leach away some of the chemicals but were found to be still leathal and poisonous especially when accumulated.

## 9. STATUS OF SELADANG

The status of seladang is vulnerable. Both population and habitat are decreasing as a result of extensive development of the country. Herds are being isolated and harassed deep into the forest. The probable chance of conserving the seladang appear to be in parks and reserves.

Many members of the Family Bovidae like Bos gaurus are endangered species listed in the Red Data Book of IUCN 1974.

### 9.1 AESTHETIC VALUE

To the nature lover the seladang is a most attractive animal standing at maturity six feet at the shoulder. Its value as a park animal is very high as visitors would be thrilled and excited just to have a glimpse of the animal. Visitors to the parks would wait patiently sometimes for hours to get a glimpse of the animal. When properly managed the seladang is known to increase in numbers forming into splinter groups thus providing easy viewing. The species can lose fear of man and will permit visitors to get quite close to them. Its tolerance to set noise and disturbance unfortunately is narrow. The seladang by its size, appearance and behaviour has the quality to inspire and attract man to wilderness and natural beauty stimulating interest in nature.

#### Recreational Value

In the old days seladang provided big game hunting to colonial officers serving in the country. Their exploits are well written in books and journals that provide interesting reading to this day. It seemed only a short while back that there was an abundance of seladang comprising numerous herds.

The seladang was classified as a big game animal requiring suitable firearm for shooting. A licence is required by those intending to hunt seladang. It certainly provides excitement and a form of recreation to big game hunters.

This potential of the species as a big game animal can be developed and brought into reality with proper management. Mature bulls provide trophies that are superior than any other species in the bovine family. The hunt provides a healthy recreation that is exciting and rewarding.

## 9.2

### ECONOMIC VALUE

As a big game animal the seladang will provide revenue from licence fees. Its meat is among the best of wild animals and has therefore high commercial value. Due to its large size an animal can weigh anything up to 1600 - 1800 pounds. Studies of the species over a period of more than six years have provided valuable data for management of the species in the wild. Authorities are hopeful of satisfactory success. Capture of animals has been perfected but handling in captivity appear to need more experience and knowledge particularly for older animals. Calves which have just been weaned hold the most hope of survival. The hope for domestication may very well be found here. A start has been made with the successful capture of one such animal.

Due to the increased demand in meat which has reached 68 million lbs in 1981 there is a short supply as the annual production is only 58 million lbs. The difference is being imported from countries, such as Australia and New Zealand. The seladang certainly has potential for cross-breeding with local stocks. Domestication appear possible

as the species is known to have been successfully managed and bred in zoos in many parts of the world.

As a park animal the seladang provides indirect revenue by attracting visitors to the park. In the case of foreign visitors who comprise about 65% of visitors to the park it indirectly provides foreign exchange.

### 9.3

#### LAND USE PLANNING

With the rapid development of the hinterland the need to include wildlife in the overall plan is very great indeed. From the 75% of forested land in Peninsula Malaysia at the time independence was achieved it is now down to 50%. The land that was developed represents the most fertile as well as the best wildlife habitat. The seladang is an endangered species together with the tiger and rhinoceros. Other species that are presently out of danger will become endangered unless steps are taken now to include all species in the land development plan.

Wildlife is ignorant of man-made boundaries. The overall plan must include wildlife in specific terms. In the case of seladang its requirements are easily met by setting aside adequate pastures, cover and water. Most existing herds are known to the department of wildlife and national parks and appropriate measures can be taken to accommodate them. Good planning with the inclusion of wildlife will avoid future problems that were known to occur in the past. At the same time there will be better hope of survival for wildlife such as seladang that have had an adverse effect from development.

Our knowledge of the seladang and its management has increased manifold with the more than six years intensive research that was carried out. Accumulated and documented are important data on the species with respect to its management and conservation.

The lack of attention given to seladang and other species of wildlife had caused massive losses that could have been avoided with better foresight in planning. With proper planning a situation can be created where the seladang will be able to co-exist with development. There is an urgent need for understanding of the situation.

Habitat destruction is one of the main causes for depletion of seladang. In many states it has brought about the extinction or near extinction of seladang quicker than any other cause. The widespread and indiscriminate destruction of the environment is the more important for the government to give attention to overall planning. The effects on wildlife will then be minimised.

10.

#### SUGGESTIONS FOR FUTURE MANAGEMENT

The seladang can be effectively managed to increase its population in the country. Management plans must be aimed to maintain an adequate quantity of habitat, to improve its quality and minimise loss of animals. Most of the work particularly habitat modification to increase carrying capacity should be done in protected areas so as to offset anticipated losses of animals in unprotected areas.

Public relation and education will be an integral component of seladang management. A greater understanding and appreciation of seladang ecology

and its conservation will promote these goals.

It must be recognised that management practices include the cooperation of various government and private agencies. Input from these agencies should be indicated in the plan.

#### 10.1 LAW ENFORCEMENT

The seladang has been seriously depleted due to poaching and land development activities. The impact of disturbance and habitat destruction resulted in changes in the pattern of distribution. The animals took to deep jungle and uphill where food is in short supply.

- (a) Law enforcement takes into consideration the relationship of every person including staff of the department of wildlife with the powers; to protect it. Increased law enforcement in all areas of frequent seladang-human interactions has to be given top priority. Ulu Lepar and Jengka in Pahang, Sungai Leban in Ulu Trengganu, Sungai Nenggiri in Ulu Kelantan are some of these areas in question.
- (b) In these areas such as Ulu Lepar in Pahang restriction of human activities in critical seladang use areas is needed to minimise disturbance. Various categories of restrictions can be applied depending on the situation. In Ulu Lepar restriction of hunting is of priority. Disturbance resulting in the break-up of seladang herds has to be minimised to avoid endangering the young animals which become easy prey to tigers.

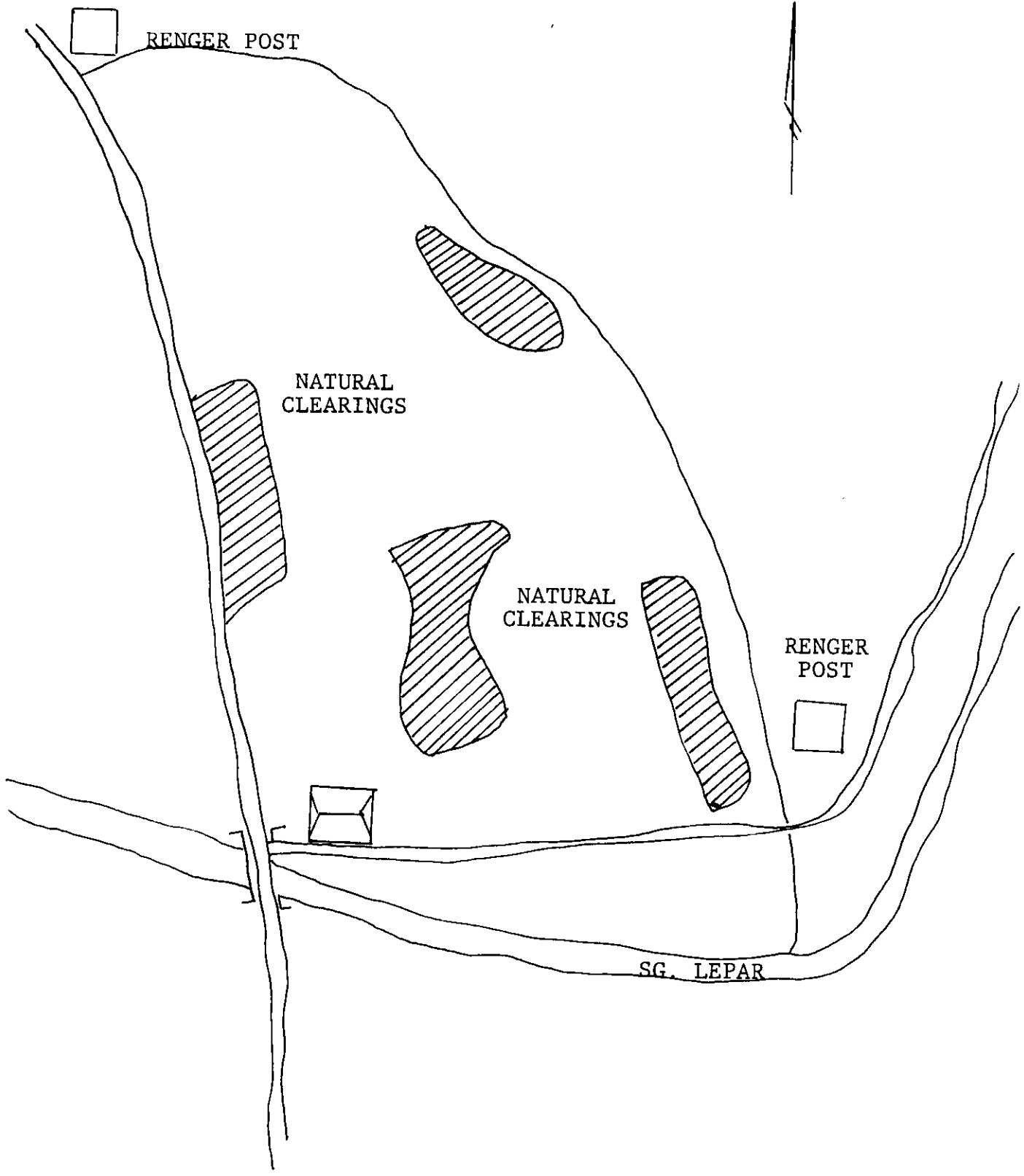
- (c) Domestic bovids should be prohibited from using national parks and wildlife reserves to avoid any form of cattle disease from affecting the seladang and to prevent any interspecific competition of resources.
- (d) Ranger posts are needed at the boundaries of all national parks, wildlife reserves and protected areas to inform the public of their status and restrictions.
- (e) Increased penalty is necessary for poachers to feel that seladang are more important than most of the other animals in the country.

#### 10.1.1 PROCEDURES IN CONTROLLING THE SELADANG

The cooperation of everyone in all agencies of government is needed to effectively enforce the provisions of the Protection of Wildlife Act, 1972. Cooperation from the public in the protection of wildlife has been extremely poor. Information on violations of the wildlife Act from members of the public is almost non-existent. In spite of rewards offered few people are willing to come forward and report violations. Except in cases of malice or competition for the same game prompting parties with vested interest to give accurate information there is a lack of public awareness of the importance to cooperate.

In the old days seladang was poached for its meat when there is a feast or for commercial purpose. The gregarious habit of the seladang in moving to cultivated areas in search of the tender grass

N



known as rumput chenkenit and lallang makes the animals vulnerable. This form of hunting is somewhat reduced today but poaching still takes place by persons from as far as Kuantan and Kuala Lumpur. These poachers come on weekends with an overnight stay in places like Ulu Lepar and Lepar Hilir where the situation is known to be serious. Accordingly these areas are regularly patrolled with check points created at specific areas.

The seladang management unit based at Ulu Lepar covers the central operation areas of the various herds of seladang. This unit was started in 1978 with initially wildlife rangers trained in the ecology and habitat requirement of the seladang. These rangers have a thorough knowledge of the area. Management units also exist in the Krau Game Reserve, Taman Negara and two smaller areas in the states of Kelantan and Trengganu. These units will be enlarged to cover the whole state.

The nature of work carried out by these units is outlined as follows:-

(a) Develop clearings

Three or more natural clearings in each seladang area are developed by cutting, burning and planting of grasses like rumput chenkenit, setaria nandi and guinea grass. No fertilizer is needed in the first planting. The ground is fertile enough for natural growth. As many as three artificial clearings are created in each clearing.

(b) Ranger post

Adequate ranger posts are erected for control and management of seladang. In Ulu Lepar for example there are more than three such posts. All

boundaries - North (FELDA 4), East (Maran Road Sawmill), West (Private Oil Palm Estate) and South are equipped with two-men Posts plus a base camp at the entrance of the proposed Ulu Lepar reserve. One other post is erected at the end of the road that passed through the reserve. This post acts as a double check after and before the base camp. It covers the north boundary of the reserve. There are two uniformed rangers at a time taking turn to guard and patrol the boundaries of their respective responsibilities.

(c) Regulation

The most important thing they have to know is when the poacher will make a visit during Saturday and Sunday. A round the clock four hourly shift is necessary to guard and protect the animals. People living in the schemes are also checked and questioned where they were going and on what business.

Due to the frequent checks by wildlife rangers the number of hunters coming to Ulu Lepar in 1979 and 1980 has decreased considerably. It would be ideal to have the place closed to hunting.

(d) Cooperation with other agencies

Geographically, the proposed reserve is located strategically at the centre of activities comprising oil palm and rubber plantations and logging. The cooperation and assistance of these agencies are important if the wildlife department is to achieve its objectives.

Both rubber and oil palm schemes make use of sodium arsenite in large quantities for weed control because of the massive areas they cover. The poison is sprayed over the entire grass cover to control weeds. Without proper control of the use of sodium arsenite and other herbicides the seladang will suffer heavy mortalities. Since 1978, the seladang management unit has had close cooperation from these agencies on the time and use of herbicide on specific plots. It is possible to predict the movement of all 7 herds of seladang in the area. Although some weed poisons are harmless precaution is necessary - because some estates like FELDA subcontract smaller companies which take advantage of using cheap but more effective herbicide like sodium arsenite.

Logging operation drives seladang away from the area because it is sensitive to noise and destruction of habitat. It is important to know when logging is to begin and for how long to enable the wildlife department to make recommendations to minimise disturbance and habitat destruction.

## 10.2 PUBLIC RELATIONS

- (a) The establishment of an Inter-agency Resource Management Committee composed of representatives from the conservation and land development agencies is strongly recommended. The committee can provide the means through which conservation measures may be taken and land use policies influenced. Such a committee can provide the basis through which compatible projects can be devised and implemented.
- (b) Public relation plays an important role in management. It helps create a better understanding of the present

status and problems of seladang among the public especially the rural folks who come into contact with the species.

- (c) Public relation also helps create closer cooperation with influential kampung leaders and UMNO heads in the area. Good cooperation with owner of land adjacent to the protected Wildlife areas is very important.
- (d) The public must understand the values of wildlife for future generation. Distribution of posters and pamphlets to various schools, government departments and private organizations help to promote a better understanding of the situation.

### 10.3 WILDLIFE RESERVES

- (a) One of the primary objectives of these reserves was for the protection of wildlife including the seladang. Some of these reserved areas have been subjected to shifting cultivation. Presently national parks, wildlife reserves and sanctuaries cover about 5% of the total land area in Peninsula Malaysia.
- (b) National parks, wildlife reserves and sanctuaries while being still inadequate in size provide a good distribution of wildlife species throughout Peninsula Malaysia.

### 10.4 HABITAT IMPROVEMENT

- (a) Habitat modification is practised to improve seladang habitat by developing a series of small clearing and planting preferred food items to increase and maintain production at high level. A series of eight acre plots spaced one-half mile apart are cleared, burned, and planted with a mixed

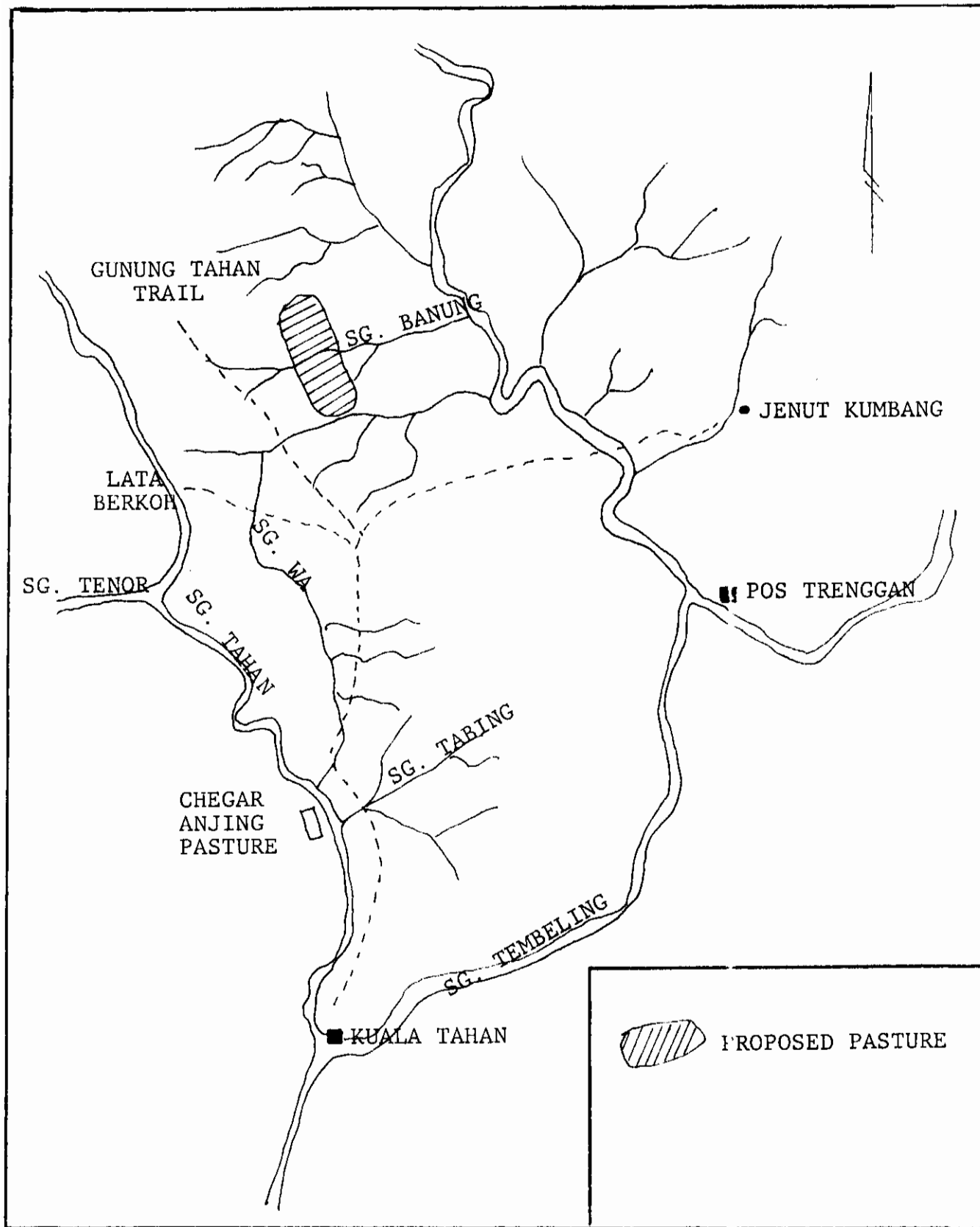
grass and legume pasture. In areas where both browse food and grass production is desired, 15 acre plots may be cleared, burned with an eight acre core area planted with a mixed grass and legume pasture. The remaining seven acres of cleared land are allowed to regenerate naturally forming a browsing belt surrounding the grass pasture core area. The species composition of the plots should be manipulated to favour seladang food items through enrichment planting of highly preferred browse, grass, and fruit tree species. This favoured species composition should be maintained through selective removal of undesired species. Clearing dimensions should be rectangular with a width of 150 meters.

- (b) Artificial salt and mineral licks should be developed when natural licks are destroyed.
- (c) Heavily disturbed areas that are used by seladang may be altered with the strategic placement of feeding areas and salt within protected areas, and additionally through the application of human use restrictions.

#### 10.4.1 PASTURE

Pasture which is a man-made feed for seladang is in many respects the best. Abundance of good seladang ration is a prerequisite to good conservation strategies. A total land area of 213 acres have been developed in wildlife reserves and sanctuaries for grazing and browsing. The areas are listed as follows:-

SELADANG PASTURE AT SUNGAI WA  
TAMAN NEGARA



<u>Krau Game Reserve</u>	<u>acre</u>
1. Kuala Senderoh	45
2. Jenderak Selatan	30
 <u>Taman Negara</u>	
3. Kuala Tahan	6
4. Chegar Anjing	10
5. Kedondong - Kuala Atok	5
6. Kuala Atok	45
*7. Sg. Yong	24
*8. Trenggan (Sungai Wa)	24
*9. S. Kenyam	24
 total	 ----- 213 =====

\* Under Fourth Malaysian Plan

There is an old proverb that says "No grass no cattle (seladang); no cattle; no Manure, no crops. This is true to a certain extent on many sections of our country today.

#### 10.4.2 DESIRABLE CHARACTERISTICS OF A PASTURE

A pasture, to be of greatest benefit to Wildlife, must possess the following desirable characteristics.

##### 1. Young and Growing.

The best pasture is a young pasture, and in order for it to remain good it must be kept actively growing. Young actively growing pastures have a high percentage of protein. They are soft and tender, containing less crude fiber and lignin than old pastures, and hence more digestible. They are rich in all of the vitamins. They are rich in phosphorus and calcium. The vitamins and minerals decrease as the plant grows older.

2. Dense and Abundant

A good pasture should have a dense stand, as this determines the amount of feed that is available for the seladang. The job of opening the fence around the newly planted pasture is a big task. An average seladang will consume about 150 to 200 lbs of pasture daily when the grass is young and tender.

3. The proper height

The seladang appear to feed well when the grass is about 1 foot tall. When it is shorter, it cannot get a mouthful of grass with one bite. When it is taller, the grazing is done by biting into the sward to the depth of 4 or 5 inches. The pasture at Kuala Tahan, has to be cut regularly to obtain a suitable height for grazing by seladang.

4. Palatable and digestible

The palatability and digestibility of the leaves will determine the amount of feed the seladang will consume. Plants change in their composition somewhat differently. For example, setaria grass become woody and lose their palatability much slower than other species. It is important that there be a mixture of grasses or legumes in the pasture that will remain palatable and nutritive throughout the entire season.

5. Even Distribution

A good pasture must have some actively growing species of grass at anyone time. It is necessary to have species of grass that grow well round the year.

### 10.4.3 MANAGEMENT OF PASTURE

Pasture is one of the most economical feeds available for seladang. This is due to the fact that it requires very little labour and care as compared to most other crops. These pastures will last for many years if given proper care, and there is no labour expense in fixing soil each year.

A pasture planted with *setaria nandi* has a wide range of carrying capacity, depending on the soil and the amount of fertilizer applied for its management.

In Taman Negara, pastures are satisfactorily managed by six wildlife rangers who have little knowledge of their own of the techniques but with proper guidance performed rather well under the circumstances.

For the pasture at Kuala Tahan and Chegar Anjing in the park and Jenderak Selatan in the Krau Game Reserve, the amount of permanent pasture depends largely upon the management that it receives. All these three pastures are planted with *setaria nandi*.

Overgrazing is one of the chief sources of the depletion of pastures. The effect of over grazing causes the seladang to move to new areas in search of food. Lack of pastures and over grazing result in poor yield with thinner stand or cover. Replanting is necessary.

Undergrazing also has some undesirable effects. With well-established *setaria* grass pastures, comparatively small size herds of seladang that enter the pasture may result a light grazed plots.

Pastures usually respond remarkably well to fertilisation. They cannot be expected to maintain their yield year after year without fertilisation. If fertilizers of some kind are not added, the yield of pastures gradually decrease.

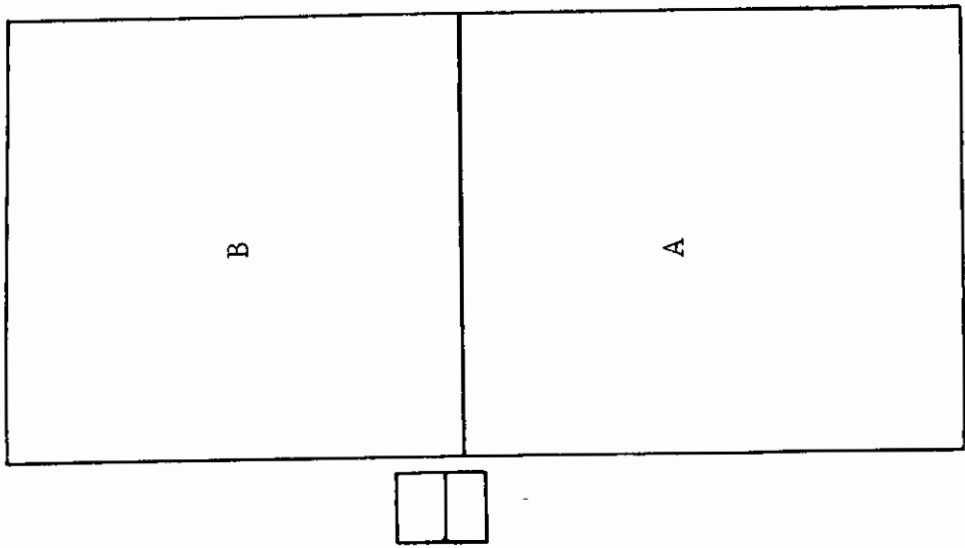
About 30 lbs/acre of fertilizer is needed twice a year to replace the nutrient contents of the soil. Normal application of fertilizer at the time of cutting will almost double the carrying capacity but with no fertilizer the growing will decline steadily.

#### 10.4.4 PASTURE MANAGEMENT PROGRAM

10.4.4.1 In Jenderak Selatan Cegar Anjing and Kuala Tahan permanent plots have been established. A management unit consisting of wildlife rangers are provided with homes and other basic needs. The main duties of the unit rangers are as follows:-

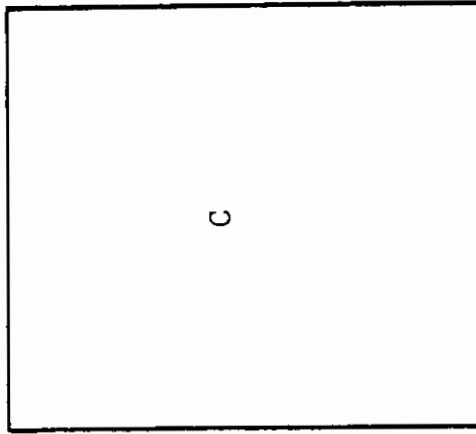
- (a) Cutting and reducing of undesirable species such as 'kelambu harimau' in the 20 acre plot with bush cutters.
- (b) Supply of salt to artificial salt licks every two months. Natural salt licks are treated in the same way but less frequently.
- (c) Take track measurements of seladang entering the pasture every morning. During rainy season track measurements are taken before rainfall.
- (d) Take height measurements of grass after every seladang visit. These records are submitted to the management unit for evaluation and improvement of pastures.

PASTURE PLOTS IN JENDERAK SELATAN

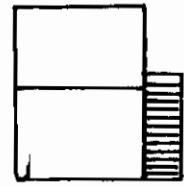
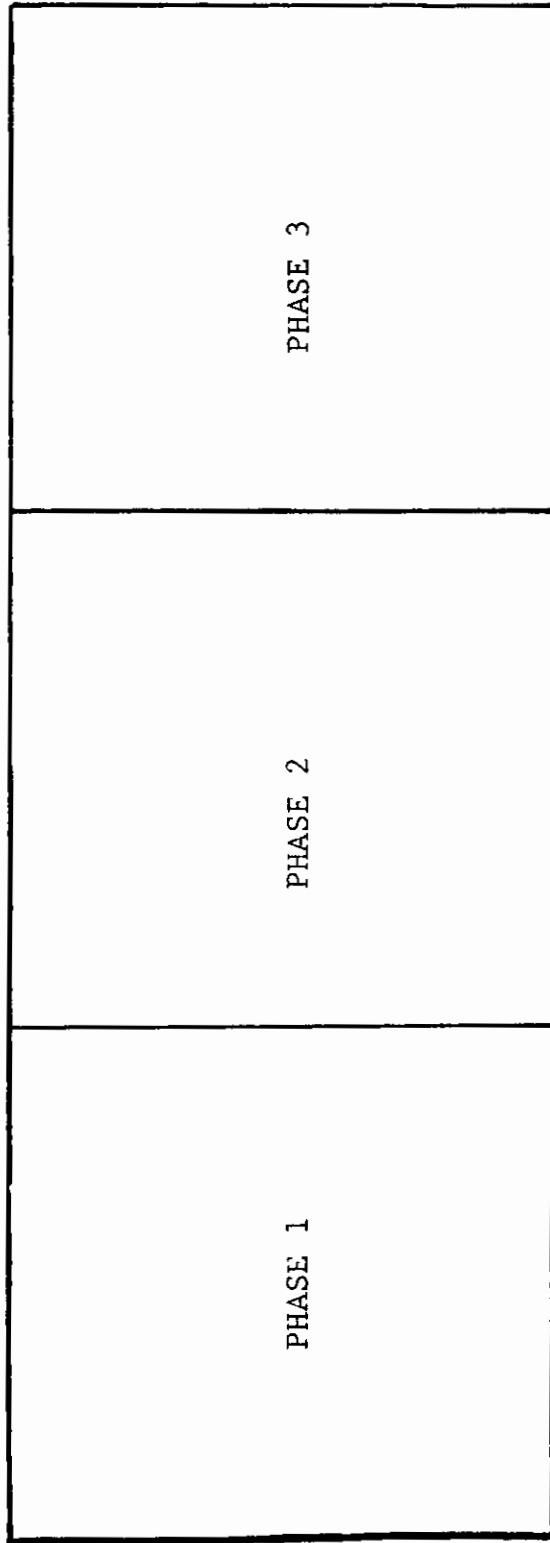


- A - Setaria Nandi
- B - Setaria Nandi
- C - Natural Growth

Acreage= 30 acres



PASTURE PLOTS IN CHEGAR ANJING



HIDE-HIDE

- (e) Monitor herd movements by daily track check.
- (f) Monthly report includes statistics of seladang and pasture plants.

#### 10.5 RESEARCH

- (a) Continue to collect more accurate data on food habit, water and habitat requirement in oil palm estates, primary and secondary forests.
- (b) Develop techniques and procedures for the translocation of seladang and management in captivity.
- (c) Continue the use of radio telemetry technique for studies of movements of all herds.
- (d) Study the problem of domestication of seladang with a view for future meat supply.

The hope for the conservation of seladang lies in its effective management. Wildlife management is an art of making land produce optimum number of seladang through management of its habitat. Sound management can be achieved on the basis of wide and detailed knowledge of the animal and its habitat requirements. The Lepar River valley offers a variety of habitats. This becomes clear when we visit them in order to assess the numbers of animals found there. For making census each group of rangers are required to include in their report ground data.

The continued use of radio telemetry equipment will ensure the systematic collection of data on movement, numbers, age composition, and habitat use of this herbivore. It will enable us to study the species impressive seasonal migrations and its reproduction

The herds of seladang in 'Ulu Lepar do not scatter uniformly over the study area. To concentrate in certain areas for protection purpose, we have to neglect others. Having pastures for the animals which have proved beneficial makes the task of protection easier as the whereabouts of these animals become more predictable. Studies are required to determine food species of plants in their order of importance for the formation of a balanced diet.

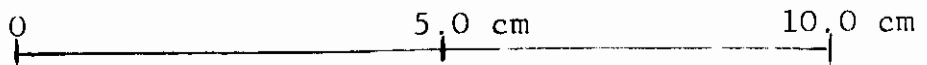
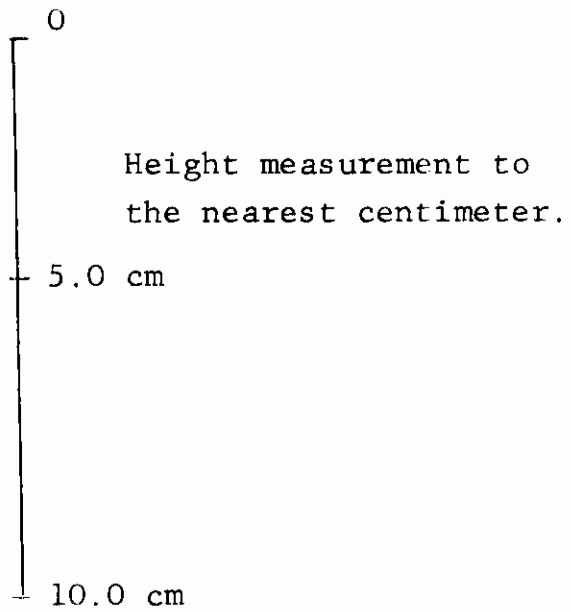
#### 10.5.1 TECHNIQUE AND PROCEDURE IN CAPTURE OPERATION

Many species of wild animals are no longer living in their former normal ecological surroundings because of the damage caused by development to wilderness areas. Through capture we can obtain exact body measurements, body weight, the types of exo and endo parasities present, and related observation associated with the species. The information is important for the conservation and survival of the species.

TABLE 8

Method of measurements

Body measurement



Track measurement

Besides scientific studies the technique of capturing seladang has other important applications. The technique can also be used in translocation programmes to restock areas where the seladang has been exterminated. Animals may also be removed from habitat areas that are due to be completely destroyed or from areas of high poaching risk where adequate protection cannot be given.

#### 5.1.1.1 APPROACHING THE SELADANG FOR CAPTURE

A number of factors play an important part in the approach to a wild seladang. i.e.

- (a) Distance of the animal
- (b) The degree of previous disturbance
- (c) the type of vegetation
- (d) the size of the animal
- (e) The skill of the capture team
- (f) the size of the population
- (g) The quietness of the approach
- (h) Weather conditions.

Good conditions in the Ladang made the first day of operation, very easy, particularly in the early morning. All the seladang tracks were measured and compared to other tracks in other parts of the home range.

Back up equipment in the form of lorries and land rovers to transport the capture teams and the seladang if caught made the operation easier than otherwise possible.

### 10.5.1.2 TYPES OF DRUGS

Two basic drugs have been used by the team for the capture of the seladang

- 1(a) Immobilon (eterphine hydrochloride + aceptomazine) injection. The standard concentration is 2.45 gm/ml. The dart syringe used can hold up to 10.5 ml. of the drug.

#### Calculation

Each vial contains 10.5 ml. of immobilon. This at concentration of 2.45 mg. per ml. gives  $(10.5 \times 2.45)$  mg of etrophine per vial or 25.75 mg of etorphine.

- 1(b) Revivon (or diprenorphine hydrochloride) -  
Used to counteract the effects of immobilon.

Each ml. of revivon contains 3.0 mg of diprenorphine hydrochloride. Methyl blue of concentration 0.001%, and chlorocresol of concentration 0.1% are also added to revivon.

#### 2. Rompun - Xylazine hydrochloride (VA 1470)

It is in the form of colourless crystals. Each bottle contains 583 mg of 2-(2,6-xylidino)-5,6-dihydro-4H-1 and 3-thiazine hydrochloride. This is normally dissolved with 10.0 ml of distilled water. This solution should then be ready for drugging purpose. For medium dossage rates, the size and weight of the seladang should be around 900 to 1000 lbs.

The combination of the two kinds of drugs could also be used, i.e. Immobilon and Rompun, and the time taken for knock down was much reduced. A light dosage is recommended to prevent long sleeping time of the drugged animal.

10.5.1.3 TRAILING/TRACKING

In places where the animals are relatively tame or semiwild, the impact of the projectile syringe on the animal may cause alarm among the herd. After being darted the affected animal would run as far as possible before the drug takes effect. For highly excitable and nervous animals like the seladang, the drug would act on the animal quickly and effectively while it is running.

At Ulu Lepar and Jenderak Selatan, the terrain and nature of the undergrowth limits the distance the darted animal can run.

The darted seladang should in principle be followed at a safe distance while attempting to keep the animal in sight. The leader of the tracking team should attempt this while the second man should be some 20m to 40m in distance from him to minimise the noise and disturbance.

After being darted and dropped the animal should be located as quickly as possible. To delay may mean less time to work on the animal or even losing the animal completely as sometime the effect of the drug may be very short.

When following a drugged animal a major problem is to distinguish the tracks of the darted animal from those of the rest of the herd. It takes experience to do this. The drugged animal tends to wander aimlessly .

Special care should be taken in handling animals that are immobilised with Immobilan + Rumpun. Such animals would normally be paralysed temporarily for about 1 - 1½ hrs.

The following procedures should be adopted in handling a drugged seladang (Bos gaurus) when immobilised with Immobilan and Rompun. When the drugged animal has been located by the team:

- (a) The darted syringe sticking out of the body should be immediately removed.
- (b) Ensure the breathing of the animal is normal and position the body and legs of animal to reduce struggling.
- (c) Cover the eyes and ears with leaves.
- (d) Work on the animal quickly and efficiently. Do not waste time on discussions.
- (e) When all the work has been completed all instruments and artificial objects should be removed and team members should retreat and take cover immediately after the animal has been administered with the antidote.
- (f) Animal should be observed until it rises and walks steadily. Any peculiar behaviour should be noted.

(a) Removal of the syringe

Injury at the impact point is normally not very serious. The injury would normally depend on the size and type of needle used, (collared or barbed type). Always examine the penetration point of the needle carefully before pulling out. There is always a possibility that the needle tip will break, and this should be taken out. Experience has shown that it may be difficult to remove the needle from the thick skin. For Seladang, it is better to use round collared needles.

(b) Position of the body

Animals are best placed on their brisket in sternal recumbency. This position makes regurgitation in ruminants unlikely, while it promotes the release of intestinal gases. Ruminants are more likely to regurgitate and are also prone to bloat.

If dyspnea from the bloat is suspected the seladang should immediately be placed upright. The head and neck should be pulled and placed in straightline at an angle of 45 from the horizontal.

The position of the legs should be checked to see that they are in the normal position.

Ruminant animals like the seladang when found in lateral recumbency should have their head and neck lifted immediately. The head should then be held slightly above the level of the abdomen to discourage regurgitation. A sack filled with lallang or leaves of trees is convenient to support the neck. The mouth should at least be placed slightly lower than the neck to allow saliva to drain out.

(c) Eyes

The eyes of the seladang should be carefully covered and protected from the heat and injury. It is advisable to apply bland eye ointment to prevent the eyes from drying. The eyes should further be protected from sunlight and earth contamination by covering with leaves and branches. A soft cloth or towel could also be placed over the eyes to protect them from sunlight.

(d) Injection of antidote

Revivon is the antidote for immobilon. It is normally administered into the superficial veins that are found

in the ear lobes. The most prominent and thickest vein is best selected as the site for the injection. The dosage for the antidote is equal in volume to the amount of immobilon used in the drugging.

## 10.5.1.4

TRANSPORTATION

Once the seladang has been successfully captured, it is ready to be transported. This transportation could be divided into two stages/phases:

Phase 1 - It is the transportation of the seladang from the knock down site to the camp or nearest logging road.

Phase 2 - is the transfer of the animal from the camp or logging road to its destination. Transportation of animals in the rain forest presents special difficulties when compared to other habitats. Newly captured animals remain in a condition of stress before, during and after transportation. The seladang has to be transported as quickly as possible after capture and no second dosage of the drug should be given as it may prove fatal.

When the animal are being transported under phase 1, extra care caution should be adopted because the seladang has the habit of struggling. Nylon and jute nets should be used as additional restraints. To carry a bull seladang, at least 20 people are needed. These personnels should be on stand by before the operation. After carrying the animal to the nearest point or logging road, they should immediately release or put the animal into a box. Caution should be taken to prevent the undue exposure to heat, cold or wet. On reaching the releasing area or zoo, a temporary cage is needed. In the case of the zoo, the animal should be confined in an area/box for at least 3 weeks before releasing it in the temporary

cage which is fenced with a cushion of gunny sacks or grasses to give warmth and comfort.

Several crates and holding enclosures have been designed to accommodate the animals for the period of confinement between the capture and their final destination.

Both the capture and transport period are highly traumatic experiences for wild animals especially seladang. The preparation of the transport box, responsibility on arrival at destination, and transportation of the animal should be well planned and coordinated to make the project successful.

#### 10.5.1.5 METHOD FOR ESTIMATING THE DRUG DOSEAGE FOR SELADANG

A complete set of records have been collected through trial and error on the capturing of seladang in the tropical rainforest. About 17 trial attempts were made before present dosages for varying sizes of seladang were worked out. The basic rompun concentration used is 150 mg of rompun dissolved in 10 ml of water.

The graph in (Fig 2) shows the correlation between immobilon dosage (ml) with body weight (kg) of the seladang as used during the capture work.

#### METHOD

A combination of both immobilon and rompun was used in the seladang drugging operation. The rompun would act as an agent to stop the muscular movements, of the seladang, after it has been brought down.

TABLE 9

Animal number	1	2	3	4	5	6	7
date	13.5.76	13.6.76	18.6.76	7.7.76	12.7.76	20.8.76	16.10.76
drug used singly (s) combination (c)	c	c	c	c	s	c	c
Immobilon	1.0	2.0	3.5	2.5	4.0	4.0	2.0
Rompun	-	-	-	-	-	-	150
sex	0	0	0	n/r	♀	♀	♀
app. age (yrs)	.33	5+	5+	1-2	4-5	2+	.75
app. weight (kg)	100	700	700	400	600	700	250
shoulder height (ft)	3' 7"	6' 0"	6'	5' ?	5' 5"	5' 6"	n/r
chest cir. (in)	40"	-	-	-	82"	82"	n/r
Time to fall	n/r	-	-	-	n/r	5	10
Revovon	1.0	-	-	-	4.0	4+.5	2.5
Time to stand	n/r	-	-	-	n/r	-	5
Radio collar no	-	-	-	-	-	-	2c

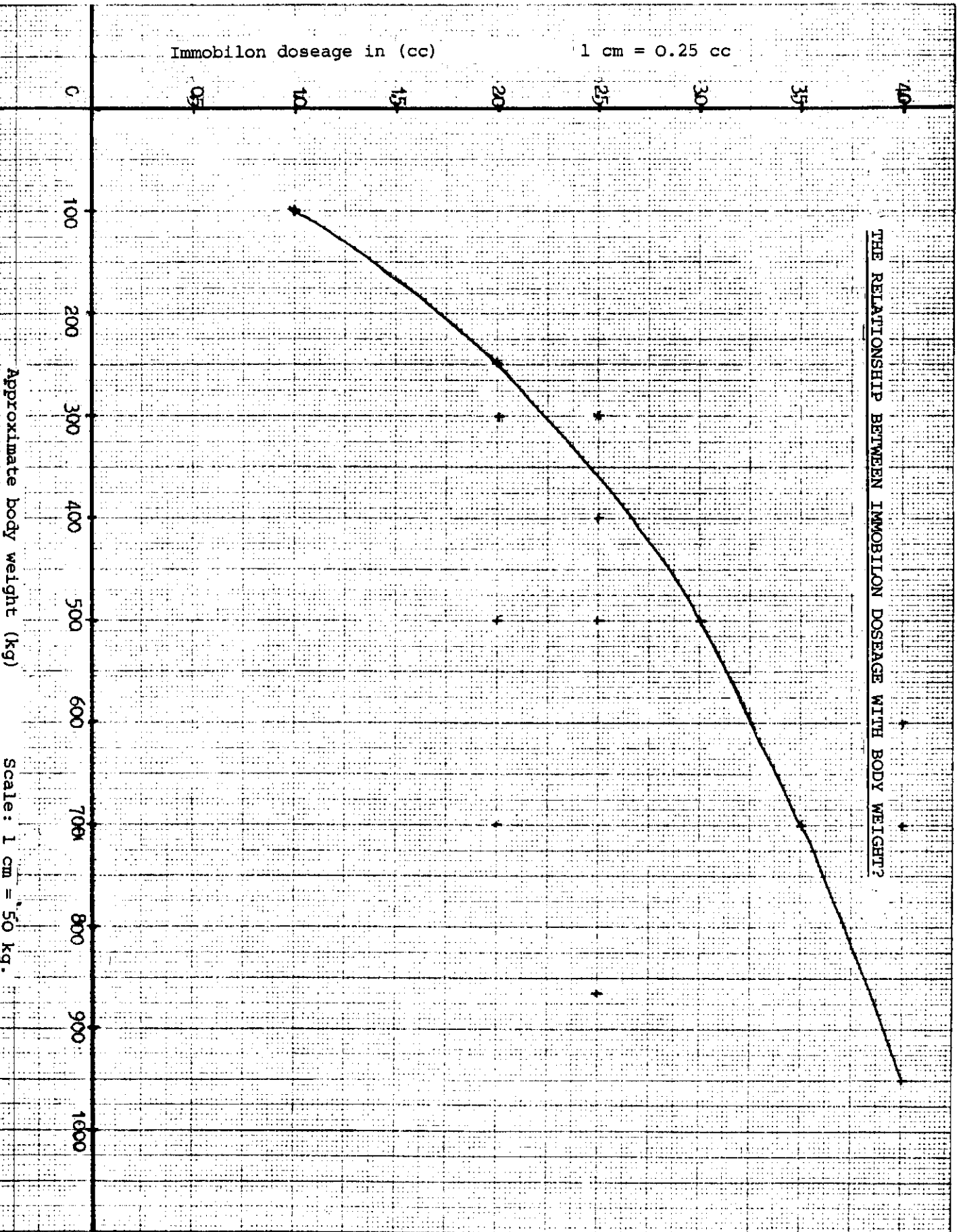
\*immobilon out dated: expiration 6/78  
n/r = not recorded

TABLE 9 (contd.)

Animal number	8	9	10	11	12	13	14
Date	6.1.78	10.1.78	11.5.78	27.10.78	8.11.78	17.11.78	8.11.78
Drug used singly (s) combination (c)	c	c	c*	c*	c*	c*	c*
Immobilon	2.5	3 + 1	2.5	2.0	2.5	2.0	2.5
Roupun	150	200 + 300	150	150	150	150	150
sex	♀	0	0	0	0	♀	♀
app. age (yrs)	3	5-10	1.5	2.0	1.0	5+	5+
app. weight (kg)	400	950	400	500	300	500?	500?
shoulder height (ft)	5'?	6' 4"	5'	5' 2"	4' 8"	5' 6"	5' 6"
chest cir. (in)	-	90"	66"	72"	69"	-	-
Time to fall	-	90	15	25	5	-	-
Radio collar no	-	1c	3c	4c	5c	-	-

TABLE 9 (contd.)

Animal number	15	16	17			
Date	13.3.79	4.4.80	17.12.80			
Drug used singly (s) combination (c)	c*	c	c			
Immobilon	3.0	2.5	2.0			
Roupon	250	150	150			
Sex	0	♀	0			
App. age (yrs)	5+	4-5	.25			
App. weight (kg)	500?	864	300			
Shoulder height (ft)	6' 0"	4' 8"	2' 3"			
chest cir. (in)	-	83	36			
Time to fall	-	20	10			
Rivovon	-	2.5	2.0			
Time to stand	-	4	2			
Radio collar no	-	6c	-			



2. For large animals above 500 kg in weight it is essential for rompun to be added to the immobilon. It is also felt that only one attempt should be made on an animal each time. Should the darting be successful but the animal fail to be knocked down no further attempt should be made on the same animal for several days at least.
3. With this knowledge of correct dosage against animal weight the scope of the seladang units activities has increased, i.e.
  - (a) Now animals can be transferred from one place to another, as during domestication programmes.
  - (b) In the case for captivity work it allows animals to be moved with minimum stress.
  - (c) For research animals can be safely captured.

#### 10.5.2 THE USE OF RADIO TELEMETRY TECHNIQUE FOR RESEARCH

Radio telemetry has played an important part in research on home ranges and the movements of animals. Such regular monitoring even enables the research unit to observe changes in a seladang groups' home range over a period of time.

The equipment used was ordered for the purpose and included special radio collars designed for the seladang. The instruments were very easy to operate. Rangers and labourers quickly learned to use them. Guidance was needed only in setting up new aerials and attaching and checking new collars. The receiver used had 12 channels and was run by replaceable batteries which generally lasted about one week continuous normal use. Within each channel a fine tuner allowed one to pick up more than one transmitter.

Rompun on its own was not sufficiently effective to immobilise a seladang long enough to radio tag the animal and thus was always used in combination with immobilon.

Having made 17 attempts, a better estimate on the correct dosage against the body weight of the seladang was worked out and this is shown below:

Table

Dosage (ml)	1.0	1.75	2.25	2.52	3.00	3.25	3.5	3.75
Body Weight (kg)	100	200	300	400	500	600	700	800

These dosages are of immobilon. Rompun was then added up to a maximum of 150 mg.

(d) CONCLUSION AND COMMENTS

1. As far as the drugging of the animals is concerned, the type and amount of drugs in comparison to the weight of the animals is very important. Unless a better drug is found immobilon is the best for Seladang work. Its main advantage is that a relatively small amount of the drug is needed for such a big sized animal.

10. 5.2.1 COLLARING

The collaring of animal was done by first darting and knocking down an animal. The collar was checked before and after attachment. The animal was then given the antidote. About 1 hour later, the first check on the transmitter was carried out. Following this routine checks were carried out for as long as the transmitter remained in action.

10. 5.2.2 RADIO TRACKING

The radio tracking of seladang was done in the following ways:

- (a) Mobile
  - (i) Land rover
  - (ii) Walking
- (b) High gain system
- (c) Aerial checking

(a) Mobile

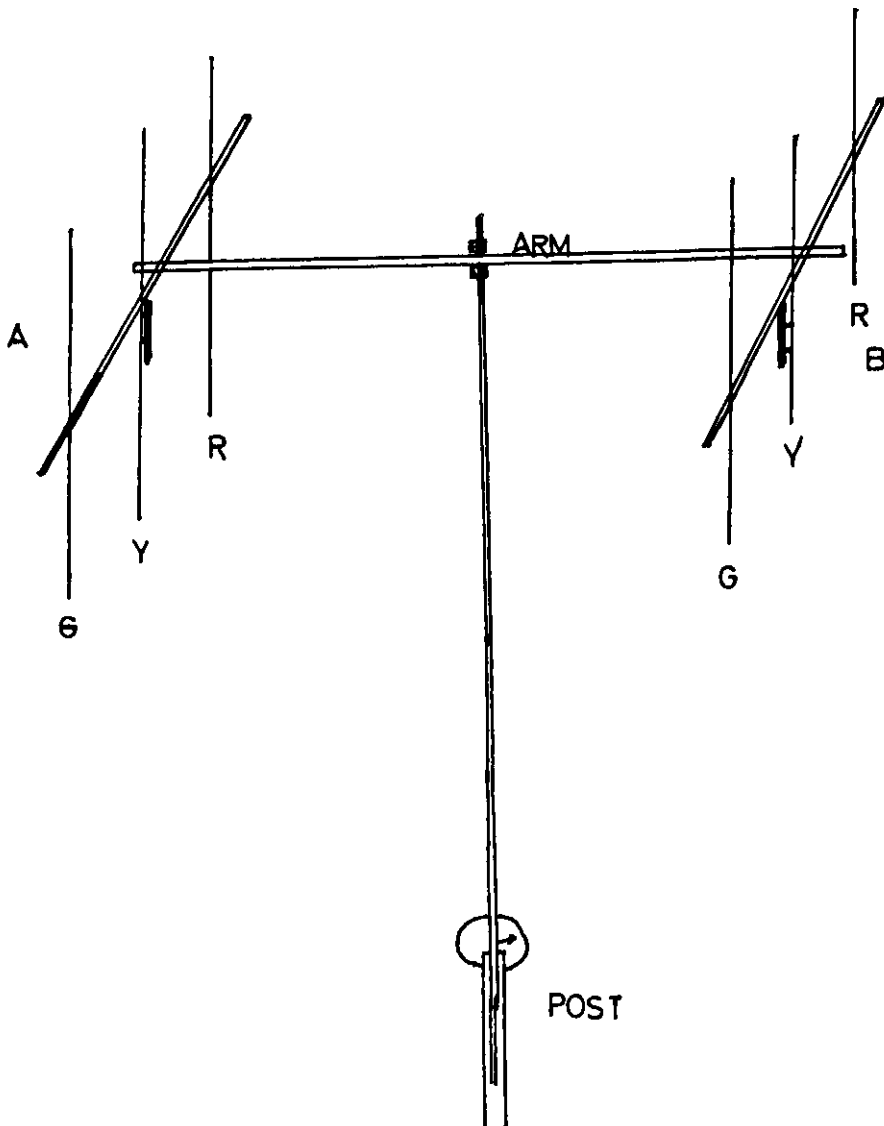
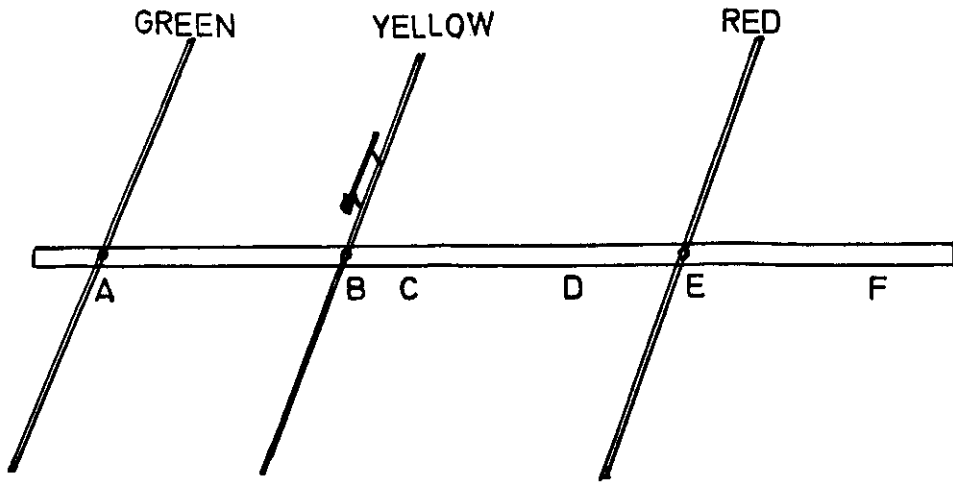
This method allowed tracking to be carried out in the vicinity of the animals. The animal's position was then worked out using simple compasses and map by triangulation, after obtaining the signal from more than one position.

The mobile antennae system consisted of:

- (i) 3 different rods
- (ii) 1 main rod
- (iii) a wire connector
- (iv) a Radio receiver and,
- (v) Head phones

This antennae was highly directional, the maximum signal strength obtain when its main axis was pointed at the transmitter. Minimum signal strength occurred when this axis was at right

ANTENNAE SYSTEM



angle to this direction.

This method of tracking also allowed one to make contact with the herd where necessary to carry out direct observation. One disadvantage of the method is that the antennae proved cumbersome to handle in the forest.

This method of tracking was generally carried out in the early morning or late evening. It was also used when replacing a collar. At the salt licks the team could wait in hiding to work out the time the herd approached the lick, the direction of approach as well as the general behaviour in the vicinity of the salt lick.

(b) HIGH GAIN SYSTEM

This kind of antennae is the most reliable method of checking for the presence of a radio-tagged seladang group. The system is based on a directionally sensitive antennae set up on a tall aluminium post on a hill. The design allows for directional rotation of the antennae. A compass scale at the base enable accurate pinpointing of the direction of a signal. The system consists of two such antennae placed some distance apart which will allow for the exact location of a transmitter by triangulation after synchronised observations have been made from both antennae.

The advantage of this method is that it is simple, accurate and requires only two rangers to collect the readings. In addition, it can be used even at night. A major disadvantage is that a particular radio collar may not be picked up all the times at the two antennae points.

(c) AERIAL CHECKING

This method was very useful for it allowed radiotagged animals to be picked up quickly and positioned accurately.

This is because the horizontal range of the radio signal is far greater a several thousand feet above the forest than at ground level. In addition an aircraft can move quickly and unimpeded in any direction.

The aerial radio tracking system consisted of two antennae each pointing out at  $90^{\circ}$  horizontally to the fuselage of the aircraft. A switch-box enabled the receiver to be switched from one antennae to the other. Using this switchbox the observer would be able to tell whether the transmitter was on the left or right of the aircraft. By correcting the flight path of the aircraft, an equal signal strength from both antennae could be obtained indicating the transmitter to be straight ahead. Maximum signal strength would then be obtained when the aircraft passed over the transmitter. The aircraft would then circle in a descending spiral with one antennae in use. By keeping this antennae pointed at the transmitter, the signal would remain constantly strong. Should the aircraft spiral away from the transmitter the signal would immediately weaken. Thus with practice the aircraft could be brought down to nearly tree top level banking and circling with the signal originating from the centre of the circle. Often in the belukar type vegetation of Ulu Lepar the seladang would be spotted from the air and direct observation could be made of the animals activities. Generally it took a three hour flight to locate all the Ulu Lepar animals.

TABLE 10

LIST OF BEARING AND TIME (DAY 1)

Time	Post A Bearing	Post B Bearing	Post C Bearing
6.00 am	32	275	Nil
7.00 am	35	270	"
8.00 am	33	270	
9.00 am	36	277	
10.00 am	40	268	
11.00 am	41	265	
12.00 am	40	260	
1.00 pm	45	255	
2.00 pm	40	255	
3.00 pm	47	241	
4.00 pm	47	239	
5.00 pm	47	230	
6.00 pm	55	220	
7.00 pm	48	233	
8.00 pm	48	237	
9.00 pm	48	236	
10.00 pm	48	233	
11.00 pm	42	255	
12.00 pm	42	256	
1.00 am	41	260	
2.00 am	33	263	
3.00 am	32	270	
4.00 am	32	270	
5.00 am	35	270	
6.00 am	33	273	

10.5. DOMESTICATION STUDY OF SELADANG

As a development project of the Third Malaysia Plan the Department of Wildlife and National Parks has been allocated funds for a seladang project. This management project is a part of the overall conservation strategy for the seladang. One aim of the project is to provide a breeding population of seladang in captivity and eventually domesticate a herd. Animals will be bred in a semi-wild state to provide wild stock to repopulate areas where the seladang has been eliminated or where their number has been depleted. The captive breeding of seladang and repopulation of such areas can help ensure the continued existence of the species in the future.

Through a taming process, animals in captivity will become domesticated. Young animals captured from the wild will be raised and tamed to the degree that they accept man and his presence and will be used to build a domesticated herd. Once domesticated, the seladang has great potential as a new cattle breed for the tropics. As an indication of the seladangs economic worth, a bull seladang, six feet tall at the shoulder, weighing over 2,000 lbs with a heavily muscled body has twice the amount of meat as the cattle now available in the cattle industry.

In addition to the domestication of the seladang for meat production, the domestication project will also enable research into the crossbreeding of the seladang with domestic cattle. If feasible, the seladang may be crossbred in various combinations to upgrade the local cattle and improve the performance of foreign cattle introduced here.

The seladang will contribute its characteristics of large size, adaptation to local environment and resistance to heat and disease with the desirable traits of domestic cattles i.e. high-milk production and a gentle nature.

In the fourth Malaysia Plan, the seladang management unit was allocated about M\$90,000 for this purpose. A fenced area of forest will serve as a paddock for semi-wild seladang. (see sketch plan). It is planned to have 3 such paddocks to allow for the simultaneous taming of 3 pairs. It is planned to keep the animals under these conditions for two years during which time observations will be made. Each paddock is 100 ft x 30 ft. A roofed shelter will be provided at one end. Except for a few selected persons working in the project, no one will be allowed near the animals for at least six months.

The centre of the paddock will consist of an area of river sand. This should slow and animal attempting to dash around in excitement and should also partially protect the paddock. The edge of the paddock should be thickly planted with trees and further fenced with small gauge wire.

A small 10 ft. sliding door at one end can be used to bring food to the paddock in a small van or lorry.

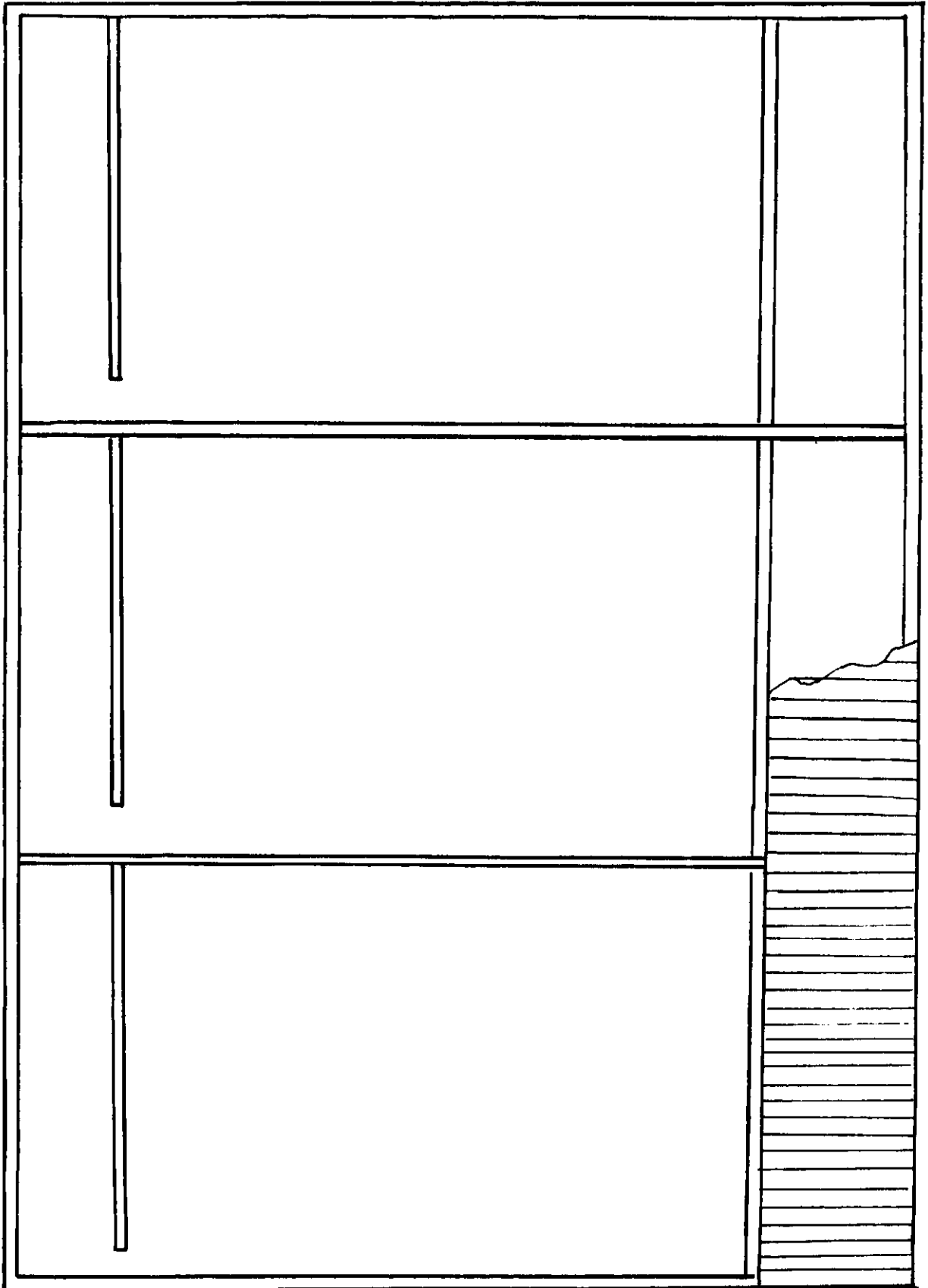
Adjacent will be an 8 acre fenced area into which the partially tamed animals may be released to find supplementary food.

This 8 acre plot will be planted with grasses such as *Setaria* and Guinea grass. Seladang for this project will be taken from the wild of Ulu Lepar and other areas. Animals between 3 and 6 years of age will be selected.

SKETCH PLAN OF SELADANG FENCING CAGE

10'

100'



30'

30'

30'

15'

10.5.4 WILDLIFE RESERVE AND DOMESTICATION PROJECT PROPOSAL

It is proposed that a wildlife reserve 10,000 acres in area, be established in the Ulu Lepar District of Kuantan, Pahang for the conservation of seladang and to serve as the site of the seladang Domestication Project. The suggested boundaries of this proposed reserve are Sungai Lepar to the west, FELDA Lepar Utara Oil Palm Scheme to the North, the Berkelah Forest Reserve to the East and Sungai Berakit to the South, as shown in the map.

The selection, of Ulu Lepar as the site for the Domestication project was made after the assessment of seladang status and site potential in various locations in the states of Pahang, Johor, Kelantan and Trengganu (Conry 1977). Ulu Lepar meets the basic requirements and is perhaps the most suitable area in Peninsula Malaysia because:-

- (1) The presence of a large number of seladang can serve as the source of wild stock. Current estimates are 96 plus animals in the area.
- (2) The proposed wildlife reserve has all ecological requirements to maintain the wild population and ensure future breeding stock.
- (3) The land is available. The area has been logged and there are no proposals to develop it.
- (4) The proposed site has an established infrastructure of roads with access to the major trunk roads and supply points.
- (5) The proposed site coincides with the current seladang Research Project site. The information gained so far would be invaluable to the Domestication project which would also gain from continued research in the area.

Thus Ulu Lepar has been selected as the site of the Domestication Project. The seladang in the area will gain for the project which will prevent the group from being eliminated.

From the view point of wildlife conservation, this proposal is beneficial in that it:

- a) Establishes a wildlife reserve for seladang to serve as the site for the seladang domestication ranch.
- b) Through this domestication project, a strong economic incentive is established to conserve the remaining endangered herds of seladang for economic application. This is the first such project, and can lead to other similar projects in other areas.
- c) It is through projects such as this that the scientific and practical value of wildlife conservation is demonstrated and it become easier in the future to justify wildlife conservation.

There is a sense of urgency about this project as delay many result in the loss of the seladang and the valuable gene resource they represent.

#### SUMMARY

Under the Fourth Malaysia Plan emphasis will be given to modernising agriculture to help raise farming incomes and to reduce poverty of rural people. A target of 543,000 hectares is earmarked for land development from 1981 to 1985. Felcra will continue to play a dominant role in this development, opening up about 149,800 hectares. Risda has set a target of 141,500 hectares for replanting and Felcra the land rehabilitation agency, will 'rescue' 25,500

hectares mainly in Kelantan, Pahang and Perak.

The Department of Wildlife and National Parks is responsible for the continuity of all species whether endangered or not. It is for the benefit of our future generations because if species are lost they cannot be replaced by any amount of money.

The research and management programmes are critical to prevent the seladang from becoming extinct. Many other benefits can also be obtained. These include the tourist factor and better beef yields in the future.

One important factor that will help preserve this species is the greater involvement of local people in the cry to preserve the species.

It is estimated that there are still 472 animals left in the country. Some of these animals live in belukar and estates. People seldom report these matters and often it is the seladang Research Unit that has to discover such herds.

Of the 532 food plant species of the seladang only 23 are preferred. These include Paspalum conjugatum and Panicum miganum among the grasses and Atalantia monoplyla, Bridilia pustulata, Pakia javanica and Glichidion spiciflorum.

## Appendix 1

## POPULATION OF SELADANG

## State 1

Pahang 1 (1979)

1. Ulu Lepar	96
2. Maran (Bukit Gebok)	5
3. Jengka	10
4. Bt. Patong	10-15
5. Kuala Senderok	6-8
6. Jenderak Selatan	6-8
7. Lepar Hilir	10

Perak (1973)\*

1. Ulu Slim	4
2. Sungkai Game Reserve	8
3. Ulu Bukit Tenoh	3
4. Sintok	3
5. Joning	16
6. Sungai Rekam	17
7. Sira Chepam	14
8. Fort Tapong	8
9. Kg. Kuak Ulu	4
10. Sangkak Ayam	9

Kelantan (1979)

1. Sungai Yong	10-13
2. Panggong Lalat	30-40
3. Sungai Terah	20-25
4. Sungai Suih (Batu Melintang)	1-3

Trengganu (1980)

- |                 |     |
|-----------------|-----|
| 1. Sungai Leban | 2-5 |
|-----------------|-----|

Taman Negara (1980)

- |                     |       |
|---------------------|-------|
| 1. Kuala Atok       | 8-10  |
| 2. Kuala Tahan      | 20    |
| 3. Trenggan-Kumbang | 20-25 |
| 4. Jenut Jintoh     | 5-10  |
| 5. Sungai Sepia     | 2     |
| 6. Merapoh          | 5     |

\*\*\*\*\*

Base on - Malay nat. J26: 163-169(73) Khan  
 - Track survey by Seladang  
 Management Unit  
 - Les Weigum

## Appendix 11

## TICKS IDENTIFICATION OF SELADANG

T.4106 - seladang # 5c  
Specimen received 11th. May 78  
Locality: Ulu Lepar, Pahang  
Host: Bos gaurus

Identification

3 ♀ 2N Boophilus microplus

T.4107 - seladang # 4c  
specimen received 1st. November 1978  
Locality: Sungai Lepar Kuantan Pahang  
Host: Bos gaurus

Identification

2 0 5 ♀ 4N Boophilus microplus

\*\*\*\*\*

by Institute Of Medical Research  
Kuala Lumpur. 1979.

Appendix 111  
SEED TYPES AND RELATIVE ABUNDANCE IN SELADANG SCATS

Scat I.D no	Seed type and abundance		notes
	numerous	Trace	
20	-	A, J	
21	A	-	
22	-		
23	A		
24	A		
25	A		
26	A, B		
27	A, B		
28	A	G	seladang #3c
29	A	B	
31	A	B, C, H	
32	A	B, C, D, G	
33	A	B	
34	A	C	
35	A	B, G	
36	A	B, F	
37	A	B, C, F, G	
38	A	B, F	
39	A	*	
40	-	A, B, G	
41	A	C, G	
42	A	C, G	
47	I	A	seladang #4c
112	A, K	-	seladang #5c
113	A, K	F	
114	A, K	B, H	seladang #5c
115	A, K	E, F, H	seladang #5c
116	A	E, H, K	seladang #5c
117	A, K	E, H	seladang #5c
118	J	A, H	
119	A	G, H	
120	A, J	-	

## SYMBOLS: SEED TYPE IDENTIFICATION - appendix 111

A : Gramineae: paspalum conjugatum  
B : Gramineae: Eleusine indica  
C : Gramineae: Digitaria sp.  
D : Euphorbiaceae: Phyllanthus urinaria  
E : Cyperaceae: Brownse species  
F : Euphorbiaceae: only species  
G : Gramineae: paspalum orbicalare  
H : Urticaceae: Trema orientalis  
I : Dilleniaceae: Dillenia indica  
J : Leguminosae: Parkia javanica  
K : Moraceae: Ficus sp.

\*\*\*\*\*

Identification by Forest Research Insitute  
Kepong, Selangor. 1979

Appendix 1V  
SOIL ANALYSE REPORT

Sample no	Conductivity Umhos/cm	Cl	P	K	Ca	Mg
1	76	negligible	68	1400	1441	1651
2	38	"	63	2400	1250	2861
3	240	"	86	200	523	414
4	136	"	48	1720	1729	1785
5	59	"	112	960	853	886
6	54	"	184	1160	800	721
7	210	"	176	680	3521	1542
8	420	"	260	800	2741	994
9	136	"	160	480	1873	1449
10	70	"	280	1480	2081	2080

\* 6N - HCL extract (PPM)

\*\*\*\*\*

Analyse by Soil Science Section  
Department Of Agriculture  
Kuala Lumpur. 1979

## Appendix V

## MEASUREMENT OF SELADANG COLLAR

Seladang #1 - Male

- a) Outside curve = 61 cm
- b) Inside curve = 42 cm
- c) Tip to tip = 24.5 cm
- d) Girth of right horn = 34 cm
- e) Girth of left horn = 34 cm

Seladang #2 - male

- a) Outside curve = 35 cm
- b) Girth of right horn = 57.5 cm
- c) Height at shoulder = 1.9 m
- d) Total length = 2.83 m

Seladang #4 - Male 364 ± 500 kg.)

- a) Outside curve = 43.75 cm
- b) Girth of right horn = 28.75 cm
- c) Tip to tip = 57.5 cm
- d) Height at shoulder = 1.55 cm
- e) Total body length = 3.0 m

Seladang #5 - Male (443 kg.)

- a) Outside curve = 28.8 cm
- b) Girth of right = 26.2 cm
- c) Tip to tip = 48.3 cm
- d) Height at shoulder = 1.4 m
- e) Total body length = 2.58 m

Seladang #6 - Female (509 kg)

- a) Outside curve = 43.75 cm
- b) Girth of right horn = 21.88 cm
- c) Tip to tip = 16.25 cm
- d) Height at shoulder = 1.78 m
- e) Total body length = 3.0 m

Seladang #7 - Male (300 kg)

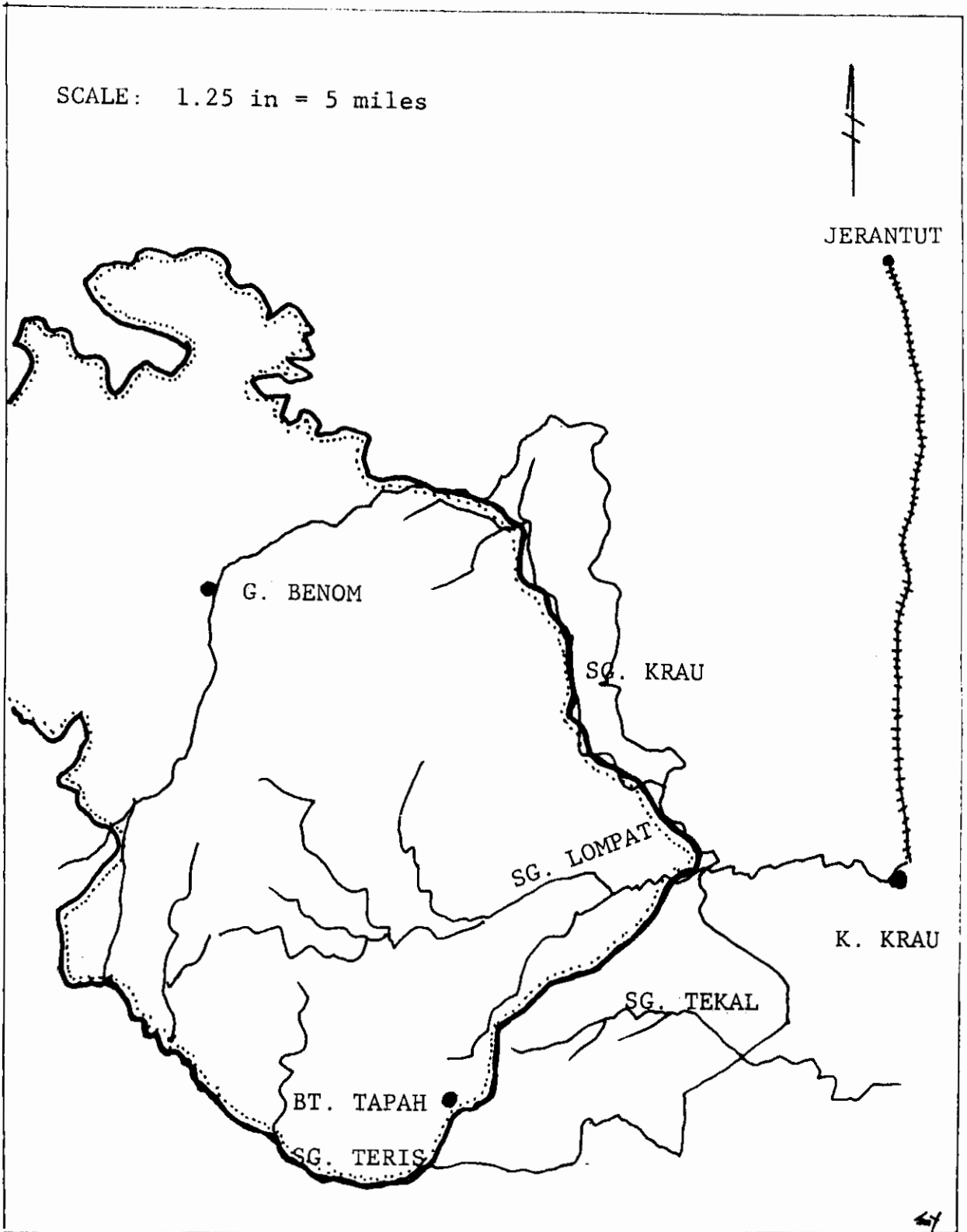
- a) Outside curve = calf
- b) Girth of right horn = calf
- c) Tip to tip = calf
- d) Height at shoulder = 0.84 m
- e) Total body length = 1.53 m

Literature Cited

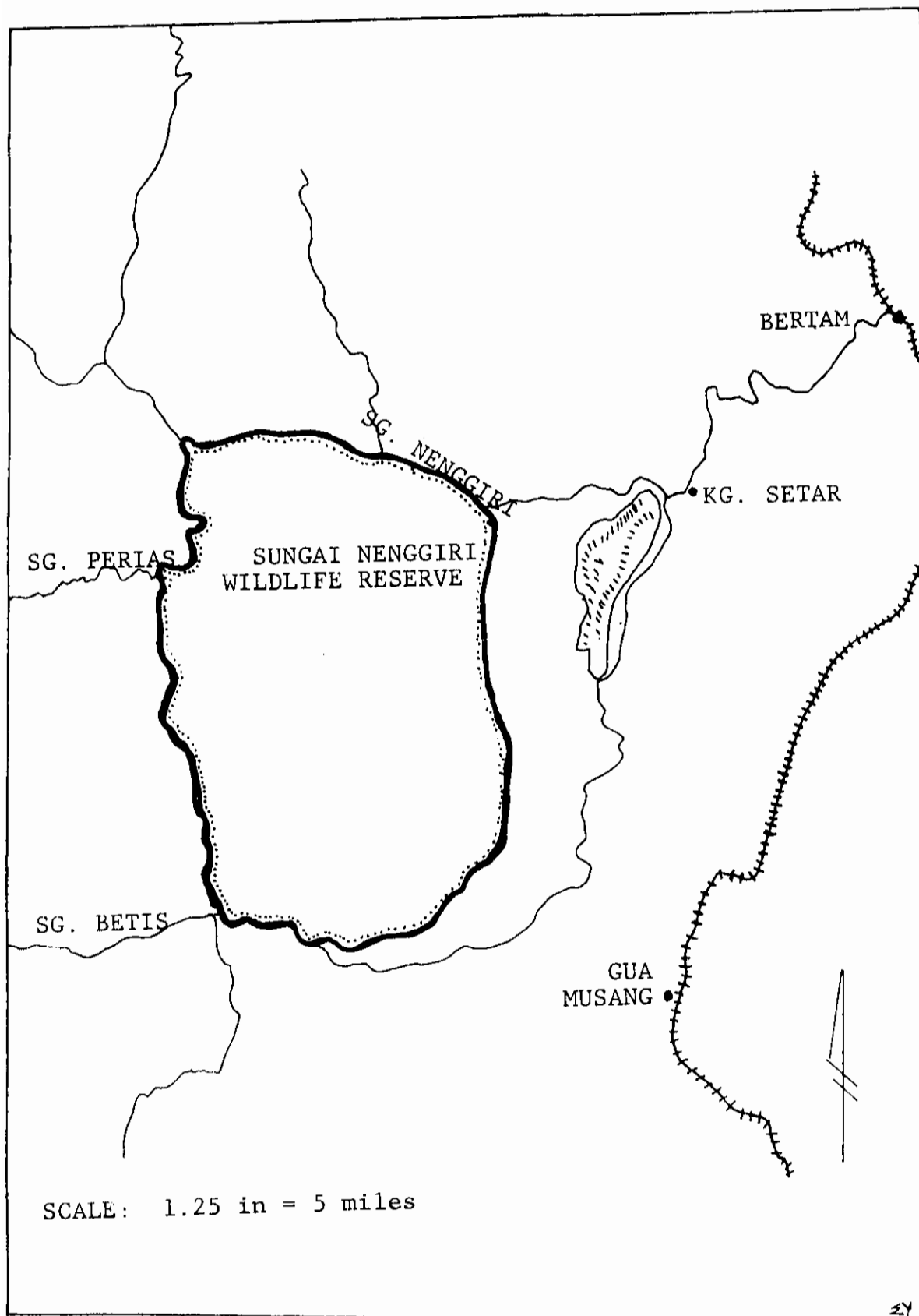
- A blue Print for conservation In West Malaysia  
John A Bullack (HQ Library, Kuala Lumpur)
- The Problem In The Preservation Of The Seladang In The  
Malaysia National Park by Les E Weigum 1972
- Studies of the Seladang in the State of Perak  
by Mohd. Khan 1973
- Seladang Brief Project at Ulu Lepar (HQ Library, Kuala Lumpur)
- Seladang Management Plan - Paul Conry 1979
- The Malaysia Gaur or seladang - HQ 1972
- The impact of Development And the behavioral responds of the  
Malaysian Seladang - Paul Conry
  - a) July 1979
  - b) Quarterly report 1/80 (research)
- Malayan Gaur or Seladang and Principles of Wildlife  
Conservation  
by Theodore Hubback

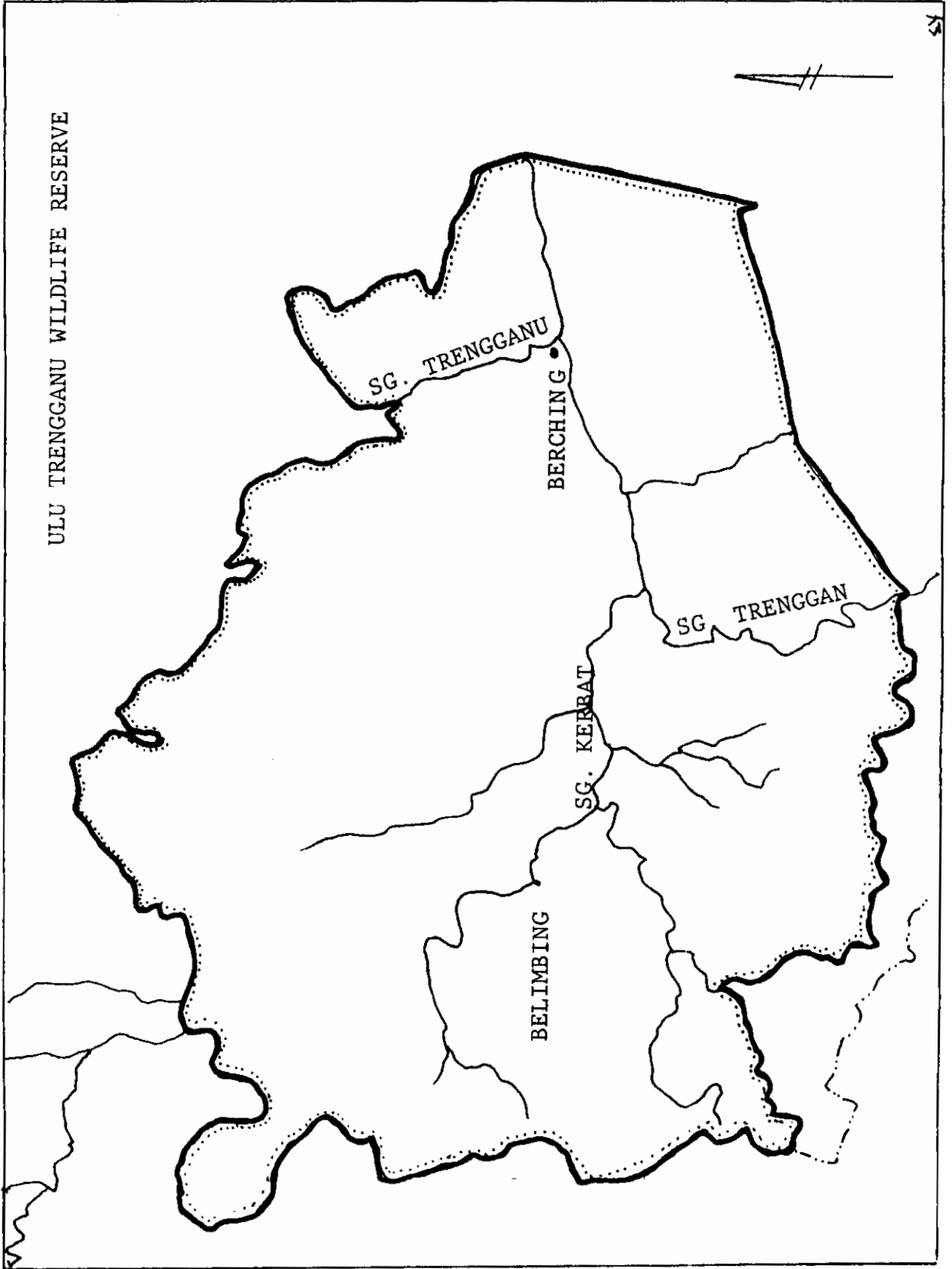
KRAU WILDLIFE RESERVE  
PAHANG

SCALE: 1.25 in = 5 miles

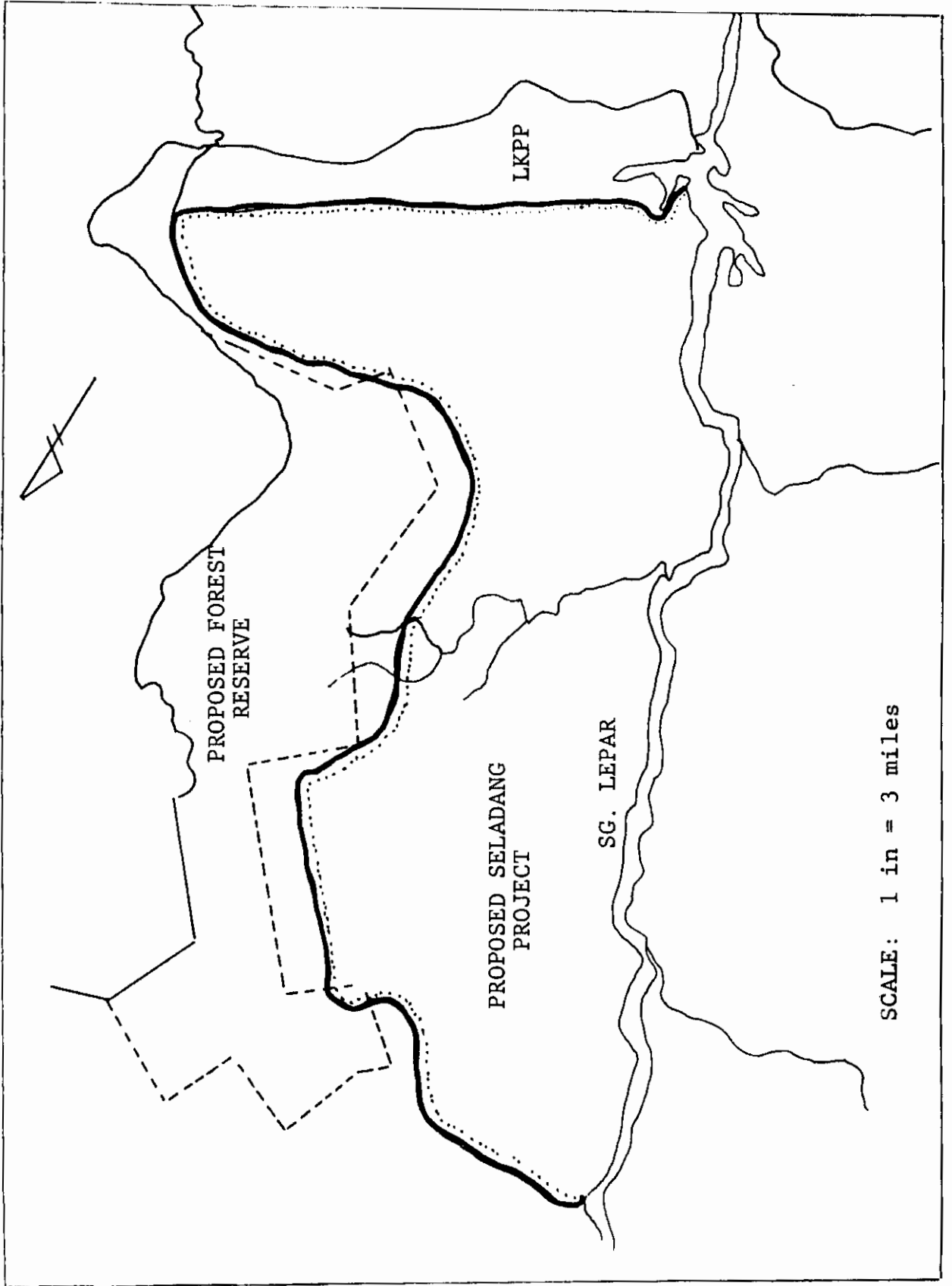


SUNGAI NENGGIRI WILDLIFE RESERVE  
(ULU KELATAN)



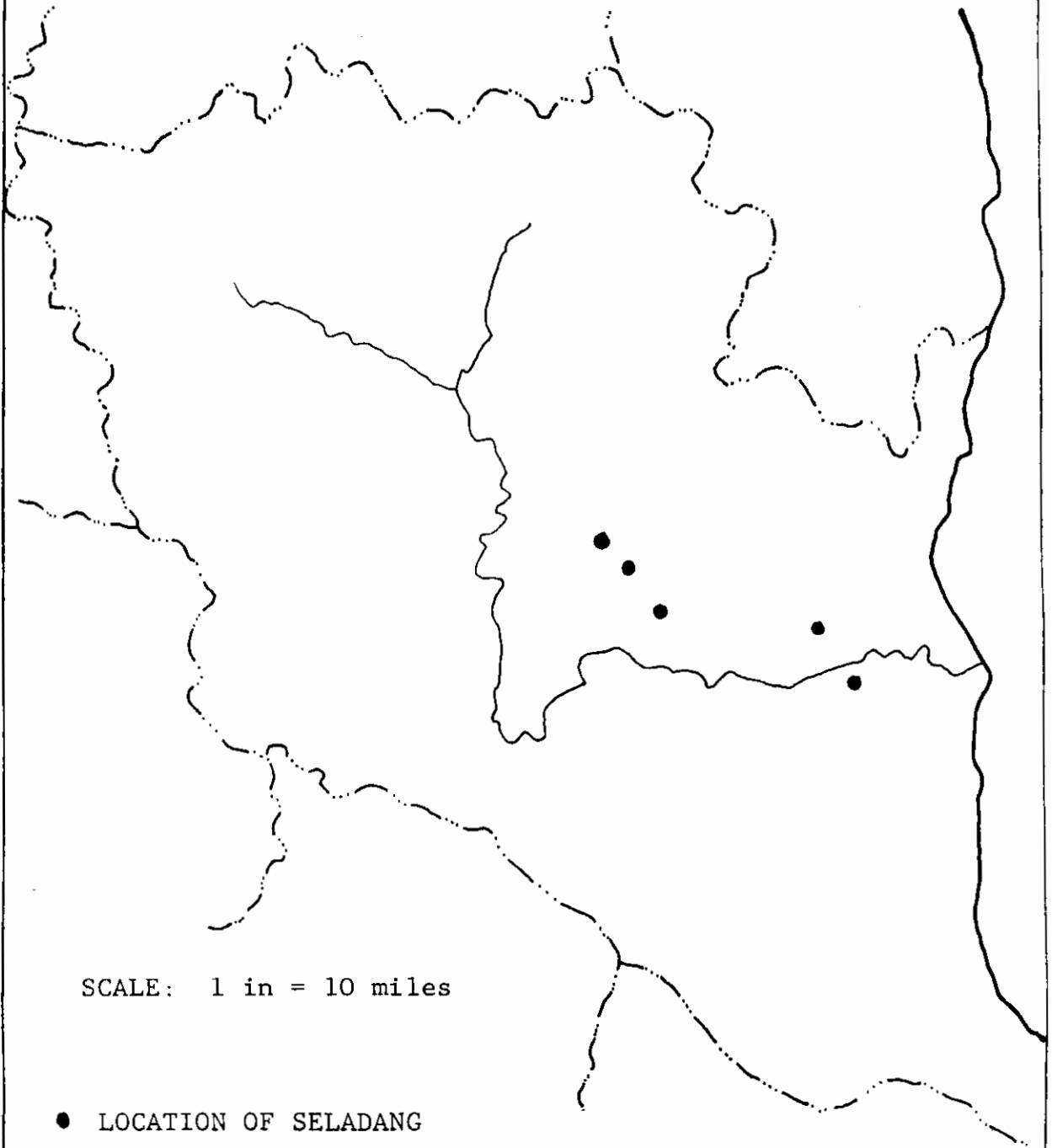


PROPOSED ULU LEPAR WILDLIFE RESERVE (PAHANG)



SCALE: 1 in = 3 miles

PAHANG WILDLIFE RESERVE



SCALE: 1 in = 10 miles

● LOCATION OF SELADANG

