

**SUMATRAN RHINOCEROS IN ENDAU-ROMPIN, MALAYSIA:**

**Their Plight and Fate**

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## ABSTRACT

Endau Rompin encompasses an area of 867km<sup>2</sup>, 489km<sup>2</sup> of which is located in the state of Johore and was gazetted as a National State Park in 1992. The remaining 378km<sup>2</sup> within the state of Pahang has yet to be gazetted as a National Park. Over the last decade, the population of Sumatran Rhino have decreased considerably from a total estimate of 25 animals to a mere 5 individuals. Breeding activities were still observed during the early 1980's with tracks of cow-calf pairs spotted in the park. However, the two consecutive surveys carried out by the Department of Wildlife and National parks in 1995 and 1996 revealed this sudden drop in numbers with rhino density as low as one animal in 91km<sup>2</sup> as compared to 1/40km<sup>2</sup> in 1984. The main causative agents include, degradation and loss of rhino habitat due to irresponsible individuals, forest encroachment and poaching pressure. Some of the recommendations put forward previously includes increasing the in situ protection of the remaining population; construction of additional guard posts, discouraging exploitation of rhino habitat, improve habitat management and habitat manipulations, intensive management and restriction of activities within the buffer zones around the rhino habitat, limiting the numbers and accessibilities of tourist into the park, education and public awareness program and possibility of translocation of rhinos into the park.

## ABSTRAK

Endau Rompin meliputi kawasan seluas 867km<sup>2</sup>, 489km<sup>2</sup> didapati didalam negeri Johor dan telah diwartakan sebagai Taman Negara Endau Rompin pada tahun 1992. Selebihan 378km<sup>2</sup> yang didapati didalam negeri Pahang masih belum diwartakan. Disepanjang dekad yang lepas, populasi badak Sumatera telah berkurang daripada 25 hingga kepada lima individu. Aktiviti pembiakan masih terdapat pada awal tahun lapan puluhan dengan kesan ibu-anak terdapat semasa bancian dijalankan. Didalam bancian menyeluruh pada tahun 1995 dan diulangi pada tahun 1996, kesan penurunan bilangan ternyata sekali dengan kepadatan sebanyak seekor/91km<sup>2</sup> berbanding dengan seekor/40km<sup>2</sup> pada tahun 1984. Masaalah yang utama adalah termasuk degradasi dan kehilangan habitat badak, pencerobohan hutan dan perburuan haram. Beberapa cadangan yang telah disenaraikan termasuk menambahkan kawalan keatas badak-badak yang ada, menambahkan pos-pos kawalan, mengurangkan exploitasi keatas habitat badak, mempertingkatkan pengurusan habitat, kawalan intensif keatas zon buffer, menghadkan kemasukkan pelancung didalam Taman Negara Endau Rompin, program pengembangan dan kesedaran kepada orang awam dan kemungkinan untuk translokasi badak kedalam Taman Negara Endau Rompin.

## INTRODUCTION

Endau-Rompin includes the state of Johor in the north and Pahang in the south, within latitude 2° 22" and 2° 35" North and longitude 103° 7" and 103° 25" in the East. It encompasses an area of 867 km<sup>2</sup>, with 489 km<sup>2</sup> in the state of Johor and the remaining in the state of Pahang. The area is undulating with altitude ranging from 40-1036 meters above sea level. The forest structure is dominated by the family Dipterocarpaceae. The general forest types encountered throughout the park include the lowland dipterocarp (below 300 m), hill dipterocarp (300-800m) and the upper dipterocarp (800-1200 m). The dense understorey consists of numerous small trees, palms, climbers and herbaceous plants, although many problems exist in the classification of these forests (Poore, 1963). Endau Rompin forms the largest forested area in the south. During the period of 1976-1977, the Pahang side of Endau Rompin was heavily logged, particularly the areas of Sungai Pukin and Sungai Jemai. Towards the end of 1980 and the early 1990's, logging also was apparent in Johor.

The management of Endau Rompin (Johor) as a National State Park was under the Perbadanan Taman Negara, Johor (Warta Kerajaan Johor JPU 8, Jld. 36, No. 5 dated 27th February 1992), fully enforced on the 1st. January 1992. The committee, chaired by the Menteri Besar Johor consists of the a Deputy Chairman and 6 members (State Secretary, State Legal Advisor, Director of State Economic Planning Unit, State Accountant General, State Director of Land and Mines and the State Director of Forestry). A technical advisory committee was also established and is comprised of the Department of Wildlife and National Parks and other related agencies. Endau - Rompin was gazetted as a National Park on the 2nd. September, 1993 (W.K. Johor Bil. 1200 and 1201). The park can be accessed by land through KM 26, Mersing - Kluang road, using a 60km stretch of laterite road that runs through oil palm plantation and forest. A guard post is situated in Kampung Peta, a native village of the Jakun tribe. The area could also be accessed by boat from Jeti Felda Nitar.

Previous reports showed a high density of rhinos along the borders of the states of Johor and Pahang, within the upper watersheds of the Endau and Rompin rivers (Foenander, 1961; Milton, 1963; Stevens, 1968; Ellis, 1971; Flynn and Abdullah, 1983). Rhino tracks were consistently observed in the upper Endau, Selai, Kemidak, Juaseh and Segamat watersheds in Johor; the upper Pukin, Jekatih, Sekin and Kemapan basins in Pahang (Flynn and Abdullah, 1983).

The rhino population in Endau Rompin, from 1987-1993 was estimated to be between 10-25 (Khan, 1987; Khan, 1989; Anon, 1993). In 1995, the census of about 70% of the park yielded a population estimate of 5-10 rhinos (Zainal - Zahari, et al., 1995). A complete survey of Endau- Rompin was recommended based on the inconsistencies of the previous methodology. The survey was carried out from the 13th-22nd March 1996, covering all major routes of the park.

## Objectives

The survey was carried out 6 months after the previous inventory with the following objectives:

- to determine the number and distribution of Sumatran rhinos in the park
- to examine their population trend
- to evaluate breeding status of the existing rhino population
- to determine the degree of human encroachment,
- to look at the status of habitat and the integrity of reserves and
- to recommend strategies to reverse the population decline

## METHODS

In the late 1970's and the early 1980's, Sumatran rhinos were observed to occur throughout the region in most of the remaining contiguous primary forest, occupying about 1600km<sup>2</sup> (Flynn and Abdullah, 1983). However, in the last few years, the surveys indicated a decline in population and an increase in human encroachment (Mohd Tajuddin and Rahmat Topani, 1992; Zainal-Zahari et al., 1995).

### Census Area

The Endau-Rompin is situated in the southern region of Peninsular Malaysia and includes the states of Pahang and Johor. The main rivers draining the southern, eastern and northern sections of the park include the Endau and Rompin rivers which flow eastwards into the South China Sea. The Muar river drains the western section into the Straits of Malacca.

In Pahang, the Endau-Rompin consists of the Lesong Forest Reserve while the Labis Forest Reserve and the Endau - Kluang Wildlife reserve occupies most of the Johor side. The census area mainly consisted of primary tropical rain forest with smaller areas of logged forest, mixed orchards and agricultural crops. The natural vegetation of Endau-Rompin consists of the tropical evergreen rain forest of the Indo-Malayan formation (Richards, 1952). These forest are characterized by numerous large evergreen, broad-leafed trees dominated by the family Dipterocarpaceae (Whitmore, 1975). The majority of Endau-Rompin is covered by mixed lowland dipterocarp forest with the hill dipterocarp forest on the ridges and elevations above 300m. A large portion of the western mountaneous region contains forests of the meranti - keruing mixed with seraya-keruing predominating on the ridges and drained sites (Gyekis, 1966). In the north and east, the forest is composed primarily of edaphic hill forest, some seraya hill forest and livestonea-kelat-kedendong forest (Lee, 1966). The topography is generally hilly with a central north-south mountain range which rises abruptly above the coastal plains. The elevations ranged from 100 meters to more than 1000 meters with mountains mainly composed of undifferentiated granite rocks of Triassic age (Gobette & Hutchison, 1973). However, in the east and north, Jurassic - Cretaceous sandstones of the Tebak formation overlie the older granite rocks and form distinct plateaus and encarpments (Burton, 1973). The soil is generally poor with most of the areas covered with red and yellow latasols and podzolic soil type derived from acid

igneous rocks. Farther to the east, these soils are derived from sedimentary rocks (Smallwood, 1966).

### Survey

The survey was carried out between 13th and 22nd March, 1996, covering both the Pahang and Johor sector of the park. A total of 50 personnel were involved, divided into 10 groups with one group stationed at the basecamp in Kuala Sungai Jasin (Table 1). The main entry points included Kuala Sungai Jasin, Kepoh, Taman Endau Recreational Complex and Muadzam Shah. During the survey, a minimum of two experienced personnel were included in each group.

Table 1: Survey Teams and Routes taken During the Sumatran Rhino Census of Endau Rompin

Survey Team	Established Routes in Endau-Rompin	Distance covered (km)
1	Kem Kepoh - Ulu Sungai Selai - Sg. Selai - Kem Selai	37
2	Kem Kepoh - Kuala Semerong - Kem Selai	60
3	Kuala Sungai Jasin - Buaya Sangkut - Bukit Segongong - Gunung Pertawai - Ulu Sungai Jasin - Kuala Sungai Jasin	35
4	Sungai Pukin - Sungai Chapau - Sungai Jemai - Sungai Endau - Kuala Sungai Jasin	37
5	Sungai Ulu Jekatih Besar - Sungai Limau - Sungai Malun - Sungai Bertam - Sungai Jawang - Sungai Kemapan - Kuala Sungai Jasin	36
6	Sungai Kuku - Sungai Ulu Kimchin - Gunung Lesong - Bukit Panjang - Gunung Kimchin - Ulu Sungai Sekin (jalan balak)	50
7	Sungai Kuku - Sungai Kimchin - Sungai Jiwang - Bukit Jiwang - Gunung Ulu Kemapan - utara (jalan balak)	24
8	Kompleks Rekreasi Taman Endau, Pahang - Sungai Kimchin - Sungai Gigi - Gunung Ulu Tiang - Sungai Kemapan Dapat - Gunung Ulu Kemapan - utara (jalan balak)	42
9	Kompleks Rekreasi Taman Endau, Pahang - Sungai Genut - Sungai Kemapan - Sungai Endau - Kuala Sungai Jasin	44

10	Kuala Sungai Jasin - basecamp	
	<b>Total area covered</b>	<b>365</b>

The survey was carried out using the permanent transect route along rivers, slopes and ridges. Flynn (1983) observed that the main feeding areas of Sumatran rhinos include the areas around the streams (60%) and slopes (35%). The permanent transect route was also used to estimate the population of other large mammals. In the Sumatran rhino, the maximum width between the lateral hoofs (digit 1-3) and middle hoof (digit 2) of the tracks were taken in centimeters using a steel tape (Stanley Thrifty II) and a plastic calipers (Flynn, 1978). Other indirect signs recorded, included the presence of wallows, feeding, defecation, scraping and rubbing. The topography and habitat type also were noted. The coordinates and altitudes of the tracks were established using the Global Positioning System (GPS). The locations of rhinos observed were plotted on topographic maps and recorded as map grid coordinates.

Each group was equipped with a weather proof camera, relevant topography sheet (Nos: 107, 108, 116 and 117 - Scale 1:63300) and measuring apparatus. The entry points included six from Pahang and three from Johor with an estimated total coverage of 358 km<sup>2</sup>. A total of six main routes were covered in the state of Pahang and five in the state of Johor.

The minimum number of rhinos was estimated using previous methods. However, detection of all rhinos within the study area through the 9 census routes was unlikely. The previous surveys assumed detection of all rhinos within 2 km of the census routes (Flynn and Abdullah, 1983). Therefore the survey routes adequately covered a total of 716km<sup>2</sup>. The areas not covered in the survey are those in the south between latitude 103°16.000E and 103°25.000E. These are the areas that had been logged.

### **Track Size Criteria**

Track size criteria was used to determine the age class of rhinos within the survey area. A combined data of digit 1-3 and digit 2 width were used to class the animals as juveniles or dependent young (8.6-20.1cm and 3.8-7.9cm) up to the age of one year (Table 2). It was also observed that

Sumatran rhinos from Johor and Pahang have greater width of digit 1-3 and digit 2 as compared to those from Selangor and Perak. All other animals beyond the above measurements were assumed to be sub-adults and adults.

Table 2: Age, body weight and hoof measurements of a captive born female Sumatran rhino at Zoo Melaka

<b>Age</b>	<b>Bodyweight (kg)</b>	<b>Width digit 1 - 3 (mm)</b>	<b>Width digit 2 (mm)</b>
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day - old	24	85.6	38.1
6 month	183	159.2	61.4
1 year	338	201	79
2 years	466	219.7	84.3

The total estimated cost for the census ranged from RM30,000-RM40,000, 80% of which included allowances which were paid by the trust funds. A total of 12 vehicles including Toyota Hilux 4WD, Mitsubishi Pajero and Landrovers were utilized for transportation of personnel, food and camping equipment.

## RESULTS

A total of three survey teams (33%), found signs of Sumatran rhinoceros in Endau - Rompin. The areas with Sumatran rhinoceros are Sungai Anak Jasin - Gunung Pertawai (Survey Team 3), Sungai Kemapan Dapat-Gunung Ulu Kemapan (Survey Team 5) and Sungai Kinchin-Sungai Jiwang (Survey Team 7). The tracks observed ranged in width from 17-23 cm for digit 1-3 and 6-8 cm for digit 2 (Table 3).

Table 3: Maximum width of digit 1 - 3 and digit 2 of Sumatran rhinoceros during the survey of Endau Rompin

Survey Team	Digit 1 - 3 (cm)	Digit 2 (cm)	Estimated Nos
3	23	8	
	22.6	6	
	19	6.5	2
5	20	8	
	18.5	7.5	2



7	19 x 17	6.5	
	18 x 17	6.5	1

### Survey Team 1:

Tracks of the Malayan Tapir (*Tapirus indicus*) were frequently observed throughout the survey. However, the signs of Sumatran rhinoceros was absent. Tracks of the elephant (*Elephas maximus*) and Barking deer (*Muntiacus muntjak*) were also seen during the census (Table 4).

Table 4: Species of large mammals observed during the census by Survey Team 1

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	2	tracks, wallows
<i>Tapirus indicus</i>	3	tracks
<i>Muntiacus muntjak</i>	1	vocalization
<i>Panthera pardus</i>	1	tracks

### Survey Team 2:

Two old non-active wallows, 1.6X5.3m and 3.3X6m respectively, were observed but no rhino tracks were found (GPS: 103° 06.6E, 2° 30.1N; 103° 14.8E, 2° 27N). A very old rhino dung was observed close to Kem Selai (GPS: 103° 9.8E, 2° 29.5N); however, no signs of tracks were seen. Areas around Kuala Sungai Semerong (2 map squares) showed tracks of various large mammals including the Sambur deer (*Cervus unicolor equinus*), Barking deer (*Muntiacus muntjak*) and the Malayan Tapir (*Tapirus indicus*). Tracks of an adult Malayan tiger (*Panthera tigris corbetti*) and her two cubs were also reported. Camps used by hunters/poachers also were located in this area. The species of large mammals are listed in Table 5.

Table 5: Species of large mammals observed during the census by Survey Team 2

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	8	tracks, fecal
<i>Tapirus indicus</i>	6	tracks
<i>Panthera t. corbetti</i>	3	tracks
<i>Cervus u. equinus</i>	7	tracks
<i>Muntiacus muntjak</i>	4	tracks

### Survey Team 3:

The altitude along the survey route ranged from 300 - 840 meters above sea level. Three rhino tracks were observed at GPS 103° 17.357'E, 2°30.437'N; 103°17.536'E, 2°30.402'N and 103°17.611'E, 2°31.957'N. Two wallows were observed measuring 230 x 340cm and 2.3 x 4m at GPS coordinates: 103° 16.818'E, 2°32.282'N and 103°17.536'E, 2°30.402'N respectively. The wallows were between 5 - 12 months old. A list of large mammals observed during the survey is provided in Table 6.

Table 6: Species of large mammals observed during the census by Survey Team 3

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	4 - 5	tracks, feces
<i>Dicerorhinus sumatrensis</i>	2	tracks, wallows
<i>Tapirus indicus</i>	2 - 3	tracks, feces
<i>Cervus u. equinus</i>	7	tracks
<i>Sus scrofa</i>	10 - 20	tracks, den

#### Survey Team 4:

The area is rich in large mammals but no signs of the Sumatran rhinoceros were observed throughout the survey. The large mammals are listed in Table 7.

Table 7: Species of large mammals observed during the census by Survey Team 4

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	4	tracks, feces
<i>Tapirus indicus</i>	6	tracks
<i>Cervus u. equinus</i>	3	tracks
<i>Muntiacus muntjak</i>	10	tracks
<i>Sus scrofa</i>	15	tracks
<i>Panthera t. corbetti</i>	3	tracks

#### Survey Team 5:

The total area surveyed was 36 km with altitudes ranging from 100-600 m. A total of two individual Sumatran rhinoceros were observed based on the tracks (GPS: 2°39.000'N, 103°12.150'E and 2°38.700'N, 103° 12.200'E). Signs of feeding and feces were frequent on the ridges of Gunung Ulu Kemapan towards Sungai Kemapan Dapat. The tracks were estimated to be about a month old. A non-active wallow, estimated to be more than a year old was observed

in the vicinity. The list of large mammals observed are listed in Table 8.

Table 8: Species of large mammals observed during the census by Survey Team 5

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	3	tracks, feces, feeding
<i>Dicerorhinus sumatrensis</i>	2	tracks, feces, feeding
<i>Tapirus indicus</i>	6	tracks, feeding
<i>Cervus u. equinus</i>	6	tracks, feces
<i>Muntiacus muntjak</i>	4	tracks
<i>Panthera pardus</i>	2	feces

**Survey Team 6:**

The area surveyed showed no present or previous existence of Sumatran rhinos. The tracks of Malayan tapir, Asian elephant, Sambur deer and Barking deer were frequently seen throughout the survey area (Table 9).

Table 9: Species of large mammals observed during the census by Survey Team 6

Species	Estimated Nos.	Observed Signs
<i>Elephas maximus</i>	4	tracks
<i>Tapirus indicus</i>	6	tracks
<i>Panthera t. corbetti</i>	2	tracks
<i>Panthera pardus</i>	1	tracks
<i>Cervus u. equinus</i>	5	tracks
<i>Muntiacus muntjak</i>	6	tracks, vocalization

**Survey Team 7:**

Old rhino tracks and non active wallows were found between Sungai Kinchin and Sungai Jiwang (GPS: 103° 16.200E, 2° 41.261'N). The wallows measured 2 x 4.5 meters. There were numerous large mammals including Sambur deer, Barking deer, Wildboars, Malayan Tapir and Black Panther (Table 10).

Table 10: Species of large mammals observed during the census by Survey Team 7

Species	Estimated Nos.	Observed Signs
<i>Dicerorhinus sumatrensis</i>	2	tracks, wallows
<i>Tapirus indicus</i>	2	tracks
<i>Cervus u. equinus</i>	6	tracks
<i>Muntiacus muntjak</i>	4	tracks
<i>Sus scrofa</i>	12	tracks, wallows
<i>Panthera pardus</i>	1	tracks

#### Survey Team 8:

The area surveyed ranged from 100-864 m in altitude. There is a very low density of wildlife species within the census area (Table 11). The only large mammals observed were Malayan tapir (*T. Indicus*), Sambur deer (*C.u. equinus*), Barking deer (*M. Muntjak*) and Wildboars (*S. Scrofa*).

Table 11: Species of large mammals observed during the census by Survey Team 8

Species	Estimated Nos.	Signs observed
<i>Tapirus indicus</i>	3	tracks
<i>Cervus u. equinus</i>	3	tracks
<i>Muntiacus muntjak</i>	5	tracks
<i>Sus scrofa</i>	15	tracks

#### Survey Team 9:

Tracks of the Malayan Tapir (*T. indicus*), Sambur deer (*C.u. equinus*), Barking deer (*M. muntjak*) and Wildboars (*S. scrofa*) were observed during the survey (Table 12). Signs of encroachment were obvious in the areas of Sungai Genut.

Table 12: Species of large mammals observed during the census by Survey Team 9

Species	Estimated Nos.	Observed Signs
<i>Tapirus indicus</i>	5	tracks
<i>Panthera t. corbetti</i>	1	tracks
<i>Muntiacus muntjak</i>	2	tracks

<i>Elephas maximus</i>	3	tracks
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The data show a population of only 3-6 rhinos. Only 33% of the nine survey groups (one in Johor and two in Pahang) observed rhino tracks. However, almost 100% of the survey teams located tracks of the Malayan tapir. The rhino tracks observed were between a few weeks to several months old. The areas with signs of the rhinos included Gunung Hulu Kemapan-Sungai Kemapan, Bukit Jiwang-Bukit Betrung (Pahang) and Gunung Pertawai-Anak Sungai Jasin (Johor).

The recent patrolling and monitoring revealed that encroachment is still rampant in the areas known to have rhinos. These areas are as follows:-

Table 13: Areas of encroachment into Endau Rompin in 1996

Dates	Grid Location	Comments	Signs of Encroachment
10.4.1996	741695	Kem Kepoh-Selai 1	Camps
11.4.1996	721725	Selai 1-Selai 2	pathways, camps
12.4.1996	715745	Selai 2-Bkt. 2065	camps
13.4.1996	718815	Bkt.2065-Kuala Sg. Serachong	pathways, camps
21.4.1996		Jeram Tinggi	pathways, camps
22.4.1996	681700 - 712800	Kuala Sg. Serachong-Bkt. Donad	pathways, camps
18.5.1996	775875	kaki Gunung Petawai	pathways, tracks
8.6.1996	894936	Dept. Forestry campsite	camps
	931900	State Park pathway	vehicle tracks
9.6.1996	930901 - 905915	Dept. Forestry clearance	pathways
22.6.1996	438055		camps

## **DISCUSSIONS**

The yard-stick to development in socio-economics and industrialization is reflected in the magnitude and rate of deforestation. Apart from the endangered Sumatran rhinoceros, other species of large mammals coexist and are found in much more abundant population. The Sumatran rhinoceros serves as a surrogate for the other existing species in Endau Rompin that do not possess a symbolic significance. Extinction of this species would have a cascading impact on the other species and the ecosystem. The Malayan Tapir are found in 100% of the areas covered. The Barking deer occupies 89% of the areas surveyed while the elephants and Sambar deer occur in 78% of the census area. The Malayan tiger, Black Panther and the wildboar occupies 44% of census area. Species richness would also include the smaller mammals, birds and reptiles that occupy and share the same habitat. However, only 33% of the area surveyed showed the presence of rhinos. The Malayan Tapir, an indicator species of the extent of rhino density was found throughout the census.

Incidence of rhinos in Endau Rompin have decreased by about 67%. The result of the census was expected as previous data indicated severe encroachment and habitat degradation. In the surveys of 1992, 67% of the total area surveyed was encroached by "orang asli", rattan collectors and poachers. Bullet casings were discovered in Sungai Jemai and Sungai Semerong. The use of snares was pronounced in 33% of the areas surveyed (Burhanuddin et al. 1995). In 1995, the population was estimated at 5-10 animals. This result was extrapolated based on the discovery of tracks of five individuals in 70% of the area surveyed. In the 1996 survey, a total of 4-6 animals were identified based on track measurements.

The surveys of 1995 and 1996 indicated that the rhinos were concentrated around the area of Sungai Anak Jasin, Gunung Pertawai, Bukit Taroeh and Bukit Segonggong in Johore and Sungai Kinchin and Sungai Kemapan Dapat in Pahang.

### **Crisis and Conflicts for Sumatran Rhinos in Endau Rompin**

#### **Degradation and loss of rhino habitat**

Degazettment of reserves by State Legislatures for agriculture began as early as the 1920s, starting a conflict between man and wildlife (Stevens, 1968a; Aiken et al, 1982). In 1968, a total of 1,300 km<sup>2</sup> were degazetted from wildlife reserves and parks (Stevens, 1968a; Marshall, 1973). In the early 1960s, rubber (*Hevea brasiliensis*) and oil palm (*Elais guineensis*) were introduced by the Federal Land Development Authority (FELDA) as a monocultural cash crop. Productive land areas were mapped out ranked by three economic priorities: (1) mineral potential, (2) soil suitable for agriculture and (3) productive forest. In contrast, wildlife habitat was defined as land without the above economic priorities or an unproductive area situated on steep regions. The Land Capability Classification (LCC) of the National Development Committee was widely accepted as the unofficial land use policy for planning. This resulted in massive utilization of lowland areas for agriculture,

timber, mining, industries and population growth. In May, 1996, the land area under the FELDA scheme totalled 135, 299.63 hectares. Previous studies have shown that about 78% of terrestrial mammals and 60% of bird species utilizes the lowland rain forests (Wells, 1971; Stevens, 1968a).

Under the Third Malaysia Plan (1976-1980), a proposal was included to add almost 9,000 km<sup>2</sup> into parks, nature monuments, sanctuaries and wildlife reserves (Government of Malaysia, 1976). However, during the implementation of the Fourth Malaysia Plan (1981-1985), the above wildlife philosophy was entirely omitted.

The protection of wildlife reserves was complicated by the state's authorities over the land resources which is clearly seen in the reluctance of some states to establish wildlife reserves under the Federal law. In 1977, a significant portion of Endau-Rompin at Jemai and Kemapan rivers in Pahang were denuded by destructive logging activities which open further access to the region. These disturbances forced the Sumatran rhinoceros into the surrounding forest and increased its vulnerability to poaching. Deforestation modifies the regenerative properties of plant community. The loss of soil nutrients, compaction of soil, erosion and increased exposure has detrimental effect on the growth and growth rate. The soil compaction also causes a reduction of the productivity of forest plants (Ng, 1983).

A total of 209, 879ha (56.9%) of wildlife reserves (WR) were degazetted from Segamat, Endau Kluang and Endau Kota Tinggi from the period 1961 - 1993. The largest degazettment involved a total of 55.2 percent or 125, 412ha of the Endau Kota Tinggi WR (Table 14).

Table 14: Degazettment of the Segamat, Endau Kluang and Endau Kota Tinggi Wildlife Reserves (WR) from the periods 1941-1993

Year	Total Acreage (ha)	Segamat WR (ha)	Endau Kluang WR (ha)	Endau Kota Tinggi WR(ha)
1941-1951	125, 730	-	-	125,730
1952-1961	3, 643	3, 469	-	174

1962-1971	14, 808	7, 015	1, 829	6, 130
1972-1981	30, 374	1, 757	304	28, 313
1982-1991	32, 699	12, 223	328	20, 148
1992-1993	2, 459	1, 134	-	1, 325
Total	209, 879	25, 598	2, 461	181, 820

Habitat loss and degradation reduces the carrying capacity of a viable Sumatran rhinoceros population and will ultimately lead to the extinction of this species within Endau Rompin. There is an urgent need to reduce the economic and social pressure on the park to enable the small population of rhinos to gain momentum to start propagating to increase its numbers.

### **Tourism**

Endau Rompin National Park (Johore) was gazetted as a National Park on the 2nd September 1993 (W.K. Johor bil. 1200 & 1201). This is in relevance to the National Park (Johor) Enactment of 1989 which emphasized the important role of conserving and protecting wildlife, plants and other heritage found within the park. Three zones were created for maximum preservation of the park and minimum damage to its environment: zone for tourist utilization; zone for natural processes and zone for wildlife. The second and third zone are preserved for ecological studies including flora, fauna and the habitat. The zone for tourist include Kampung Peta, Kuala Jasin, Upeh Guling, Batu Hampar and Kuala Marong. A bridge and road will be built between Sungai Emas and Kampung Peta. A jetti is being built at Nitar.

The high-use rhino area around the Gunung Pertawai and Bukit Segongong would be very disturbed by human visitations as the strategic routes were opened for ecotourism. Previously, the park contained about 65% of rhino habitat. The present track from Kampung Peta connects to Buaya Sangkut. Recently, a proposal was accepted to construct a jeep track from Bukit Segongong to Sungai Endau/Sungai Kemapan via Gunung Pertawai. This is to extend the fishing activities of the tourist into the heart of Endau Rompin.

Development of parts of the park for ecotourism, without taking into consideration the rhino habitat would have a devastating effect on the rhino population. Population fragmentation would reduce breeding chance and displaced animals into threatened or unnatural habitat. A total of 19 animals were displaced into unnatural habitat from the periods 1975-1995 (Table 15). About 50% of these animals were killed with 37% rescued by the DWNP. Between 1988-1989, all rhinos displaced in the state of Johor were poached. The displaced animals would be easy targets for poachers.

Table 15: Displacement of Sumatran Rhinoceroses and their Outcome in Peninsula Malaysia



Nos.	Year	Age	Sex	Habitat	State	Status
1	1975	Adult	Unknown	Secondary Forest	Kelantan	Killed
2	1984	Calf	Male	Secondary Forest	Perak	Rescued
3	1984	Adult	Female	Oil Palm Plantation	Selangor	Rescued
4	1984	Adult	Female	Oil Palm Plantation	Perak	Rescued
5	1985	Adult	Unknown	Oil Palm Plantation	Johore	Killed
6	1986	Adult	Unknown	Secondary Forest	Johore	Killed
7	1986	Adult	Female	Secondary Forest	Selangor	Killed
8	1986	Adult	Unknown	Secondary Forest	Johore	Escaped
9	1986	Adult	Unknown	Rubber Plantation	Pahang	Escaped
10	1986	Adult	Female	Oil Palm Plantation	Perak	Rescued
11	1987	Subadult	Female	Rice Field	Perak	Rescued
12	1988	Adult	Female	Village	Pahang	Rescued
13	1988	Adult	Unknown	Secondary Forest	Johore	Killed
14	1988	Adult	Unknown	Secondary Forest	Johore	Killed
15	1989	Adult	Female	Secondary Forest	Johore	Killed
16	1989	Calf	Unknown	Secondary Forest	Johore	Killed
17	1993	Adult	Male	Logging Area	Kelantan	Killed
18	1994	Subadult	Male	Logging area	Johore	Rescued
19	1994	Adult	Female	Logging Area	Johore	Undetermined
20	1995	Adult	Unknown	Logging Area	Johore	Undetermined

The high rate of flushing out of rhinos into unnatural habitat in the past decade resulted in 16 animals being dislocated and a mortality rate of 50%. If the current trend of habitat degradation and encroachment is not reversed, another eight rhinoceros would be killed and more animals displaced. These displaced animals become very vulnerable to poachers during their "wandering" stages. Similarly, these animals were trapped or caught by the DWNP staff without much effort or elaborate techniques. Based on the present trend of habitat destruction, long gestation period and calving interval, small home ranges of the females, existence of these animals in isolated island of forest, high poaching incidence (6 animals poached in Johore from

1985-1989) and the current conservation problems, the remaining five would be extinct by the year 2000.

There must be a balance between what is comfortable for tourists and what is essential for the rhinos. The rhinos could be viewed as the flagship and selling point of the park and every effort should be made to keep them healthy and breeding.

### Adjacent Forest Reserves

A list of forest reserves in the state of Johore is provided in Table 15. The Lesong and the Panti Forest Reserves are situated in the north and south-east of Endau Rompin National Park, respectively. The situation with the adjacent forest reserves are very questionable as the low habitat quality and inadequate protection will not suffice the existence of a viable rhino population. The integrity of reserves, sanctuaries and parks is always a controversial issue, particularly when it comes under the jurisdiction of the various states. Similarly, the Panti Forest Reserve, about 30km<sup>2</sup>, forms a forest island on its own and is disconnected from the rest of the reserves by stretches of plantations and roads.

Table 15: Wildlife Reserves Located in the State of Johore

Wildlife Reserves	Acreage (ha)
Endau Kluang	5,860
Endau Kota Tinggi East	61,959
Endau Kota Tinggi West	7,413
Endau Rompin National Park	48,905
Segamat Wildlife Sanctuary	31,079
Total	155,216

Lesong Forest Reserve is situated on the borders of Endau Rompin National Park within the state of Pahang and with a total acreage of 63,772 ha (Gazetted in 1977). A total of 54,066 ha or 84.7% of the reserve had been logged or developed since 1977. Selective logging will be carried out on the remaining 9705ha within the reserve. Presently, the entire Lesong Forest Reserve consists of 8 fragments with two major areas connecting to the Endau Rompin National Park. Logging would be carried out to the boundaries of the park. As with the previous logging activities that created an "infrastructure" within the logged areas, the "buffer zones" are neglected and provide easy access into the park. Encroachment into the buffer zones is rampant and benefit poachers. A previously recommended 15-20km wide forested buffer around the park should reduce the impact of agricultural development and human disturbance if they are managed more efficiently (Flynn, 1983).

The forest around Sungai Egon and north of Sungai Lemakoh were currently being logged. In addition, the forest around Sungai Melantai and Sungai Emas have been tendered out for logging. The areas, south of Sungai Egon, extending to Sungai Emas have been planted with rattan (*Calamus spp.*) and Acasia (*Acacia mangium*). Similarly, the planting of *A. mangium* were carried out in Kepoh.

With reference to the above table, except for the Endau Rompin National Park, the remaining wildlife reserves are overlapped with the Labis Forest Reserve. The Segamat Wildlife Sanctuary were largely developed into plantations and a major portion are extensively logged. The Ulu Sedeli Forest Reserves in the district of Mersing and Kota Tinggi were reserved as a water catchment area. The remaining forest reserves were previously logged (Table 16). Logging was carried out around Kampung Peta and a total of 350 acres of practically “virgin forest” were removed due to such activity.

Table 16: The existing Forest Reserves in Johore

District	Forest Reserves	District	Forest Reserves
Mersing	Gunung Arong	Kota Tinggi	Kluang
	Mersing		Ulu Sedeli
	Jemaluang		Panti
	Tenggaroh	Kluang	Kluang
	Lenggor		Lenggor
	Ulu Sedeli		

### Population Trend and Current Status

In the state of Johore, the legislation to protect wildlife was enacted in 1912 but enforcement of the law was only observed in 1923 (Aikens et al, 1982). Total protection for the Sumatran rhinoceros was offered with the introduction of the 1972 Wildlife Protection Act. In surveys conducted between 1974 and 1981, the population of Sumatran rhinoceros in Peninsula Malaysia was estimated as 50-75 animals and those in Endau Rompin ranged from 20-25 (Flynn, 1983). Two recent censuses covering all potential Sumatran rhinoceros areas in Endau Rompin were carried out in 1995 and again in 1996 provided an estimate of 4-5 animals distributed over an area of 870km<sup>2</sup>. This indicates a reduction of 80% in the numbers over a period of 15 years.

These animals are concentrated in the areas of Sungai Anak Jasin-Gunung Pertawai (2 animals), Sungai Kemapan Dapat- Gunung Ulu Kemapan (1 animal) and Sungai Kinchin-Sungai Jiwang (2 animals). The declining trend was only observed recently due to animals migrating into adjacent reserves or due to a possible overestimation in the past. The small population that exists is very vulnerable to natural and unnatural catastrophies including epidemic diseases such

as anthrax, viral encephalitis and salmonellosis. The problem of forest fires can have a devastating effect on a small population. The undetermined sex ratio that exist in this small population further elevate the problem associated with breeding soundness. A skewed sex ratio is sufficient to upset the breeding potential of a population and destabilize the population demographically. Detrimental fluctuations in demographic performance and loss of genetic diversity in a small population result in a pronounced reduction of individual vigor and an eventual extinction. Inbreeding decreases reproductive success and survivability and increases susceptibility to diseases and environmental changes. Even with a favourable habitat, small populations are very vulnerable due to stochastic perturbations. The low recruitment indicate strongly that these populations are approaching minimum number required for reproduction.

### **Orang Asli - the current trend of forest utilization**

The natives or local aborigines have coexisted with the flora and fauna of Endau Rompin long before civilization. The forest utilization by these orang asli included the plants and animal species, among them was the extinct Javan Rhinoceros. These natives were thought to originate from the Hoabinhian between late Pleistocene and early Holocene periods (Rambo, 1979a). In Endau Rompin, the Proto-Malays (Jakun) lives on the fringes of the park, mainly in Kampung Peta, Segamat Kecil, Kepoh, Kampung Selai, Kampung Juaseh and Ulu Pukin. The forest resources harvested includes rattan (*Calamus spp*), gaharu, fuelwood, resin, fruits, medicinal plants, wild animals and fish. In the past, these resources were mainly for their own consumption and to a lesser extent for cash trade. The current trend is almost exclusively to trade forest products for cash. The Proto-Malays supplement their protein and carbohydrate resources from poultry farming, growing food crops and orchards. Occasionally, they were employed as labourers in nearby plantations.

The Federal laws and the State enactments allow the natives to enter forest and wildlife reserves for the purpose of harvesting wildlife and plant resources for their own consumption. The Jabatan Hal Ehwal Orang Asli (JHEOA) must be more responsible in educating the natives on the law and the judiciary should start treating all crimes as the same irrespective of whoever commits them. Illiteracy of the law is inexcusable in cases that involve firearms and the use of snares. Sentences for most offences by orang asli were handled very lightly with the excuse of illiteracy. The law is always more lenient with crimes committed by the natives. The recent conflicting evidence regarding the "illegal logging" that occur in Bekok, Segamat involving the JHEOA whereby the state director acting as one of the Board of Directors of Koperasi Daya Asli Johor Berhad was awarded the logging concession. Although the said motive was for the well-being of the orang asli, the logging activities were not made known to the natives. A conflict of interest was also indicated by the disagreement on awarding a logging contract by the Menteri Besar and JHEOA (Berita Harian, 1996).

Presently, the activities of the natives are more commercialized and with the introduction of firearms and the greed for wealth, forest harvest becomes more rampant. The use of snares for all kinds of wildlife including the Sumatran rhinoceros requires minimum effort and is maintenance free but promises excellent returns. The recent discovery and arrest of orang asli with home-made shotguns further deepens the gravity of the situation. A question to ponder is "who supplies the ammunition?"

Forest harvest is also carried out rampantly by the villagers, particularly the harvest of rattan, sandalwood (gaharu), resin (damar) and decorative roots (vines). The harvest of wildlife is also increasing with the increased demands from both local and international traders. The horns of the

Sumatran rhinoceros is highly demanded and the current price of a kilogram of the horn is as high as USD25,000.00 - USD62,455.00 in Taiwan (Williams, 1992). Incidences of hunting and discoveries of cable snares were previously observed in some areas of Endau-Rompin.

### **Recommendations for Survival of the Remaining Five**

- Increased *in situ* protection of the remaining population. A joint effort should be made by the concerned authorities which includes the DWNP, Department of Forestry and the Endau Rompin National Park. Strict enforcement should be exercised to deter potential poachers. The Rhino Protection Units will carry out constant and regular patrolling of these areas and update on the distribution and trend of the population. Determination of the numbers, age and sex is important for the *in situ* management of this small population. These activities are carried out monthly and records on encroachment, gathered to facilitate enforcement. The “orang asli” living around the park should be employed as park staff and informers, to serve as guardians for the rhinos.
- The construction of guard posts at strategic location is necessary to provide effective coverage of the area. The present guard posts are located in the areas of Sungai Kepoh in the west, Selai in the south, Sungai Emas in the south-east and Kampung Peta in the east. A fourth will be built in Nitar to cover the areas of Sungai Semberong and Sungai Endau. A fifth guard post will be constructed in the north, within the state of Pahang.
- Exploitation of the rhino habitat must be discouraged. A controlled forest utilization by the natives and other common-users must be enforced to reduce habitat over-exploitation and degradation.
- Improve habitat management would improve the well being of species found within them. Habitat manipulations were successful for species of ungulates and waterfowls in North America. Studies by Flynn (1983) in Endau Rompin indicated that rhinos utilized areas of forest gaps and the riverine for browsing. Feeding sites of the rhinos were concentrated in the stream bottoms and lower slopes (60% and 35% respectively). These forest gaps can be created by selective felling of trees in strategic locations. Replanting of food plants for the rhinos is another option that could be recommended to enrich the habitat. Currently work is being carried out to replant *Ficus glossolarioides* in Sungai Dusun as food source for rhinos.
- Improve maintenance of the 10-15km wide “buffer zone” around the park and limit activity within the buffer to a minimum. Prime rhino areas around the Gunung Pertawai, Bukit Segonggong Bukit Taroeh, Sungai Kinchin and Gunung Ulu Kemapan should not be developed.
- The number of tourist using the park and the areas of access must be limited to reduce disturbance on the rhinos and to encourage these animals to maximize their habitat

utilization.

- A more constructive and aggressive education and public awareness effort needs to be initiated to infiltrate the people around Endau Rompin, particularly the “orang asli”. The school children must be informed of the fate of these endangered animals, their importance to the biological diversity and the repercussion of the environment on their well being. Emphasis must be made on the issues of protecting their biological heritage and maintaining a sustainable and healthy ecosystem. A series of posters, pamphlets and booklets should be produced from time to time to keep the public informed of the plight of the rhinos and what can be done to help the population grow. The DWNP homepage will also be utilized to disseminate information on these rhinos.
- Translocation of rhinos from other threatened areas into Endau Rompin would benefit the small population provided enough protection is available to ensure the safety of these animals. The surveys showed small sized tracks (females or subadult males) not exceeding 23cm across. Therefore it would be advantageous to inject a male into the population of Endau Rompin to ensure breeding, assuming the present population lacks a mature male. It was shown that a prolonged state of dormancy in females could lead to pathology of the reproductive track which would eventually prevent successful breeding (Schaffer et al., 1994).

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