Conservation of the Proboscis Monkey, *Nasalis larvatus* in the Klias Peninsula, Sabah, Malaysia

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SUMMARY

This project which is aimed at conserving the last remaining Proboscis Monkey populations in the Klias Peninsula on the west coast of Sabah, Malaysia, is a 2 year project which began in November 2007 and will run until October 2009. The present document reports on the progress from the beginning of the project (1st November 2007) till 31st October 2008, i.e., the first 12 months of the project period. Despite the need to revise the project's objectives due mainly to the unforeseen impediment in the actual fieldwork and other practical reasons, the project has been very active in accomplishing all of its objectives. All activities relating to research component of the project are up and running including the establishment of vegetation plots, monthly collection of phenological data and studying monkey behaviour. 2 Ph.D candidates registered at Universiti Malaysia Sabah (UMS) have been engaged in the project and 5 undergraduate students of UMS have received training on field research techniques relating to studying Proboscis Monkey behaviour and ecology in the wild and in captivity. Environmental awareness education has been conducted focussing on conservation status of Proboscis Monkey in Klias. The project will continue for another 12 months till November 2009.

1. PROJECT BACKGROUND

The Malaysian state of Sabah (72,000km^2) which occupies the north-eastern tip of Borneo Island in Southeast Asia is located within one of the richest bio-geographical regions both in terms of species and habitat richness. Its non-human primate fauna in particular is very diverse. A total of 13 species of non-human primate have been known to exist on Borneo Island, and 10 species are found in Sabah. Amongst the most outstanding non-human primate species is the Bornean endemic Proboscis Monkey (*Nasalis larvatus*).

A statewide survey of the Proboscis Monkey populations in Sabah revealed that there is a minimum population size of close to 6,000 individuals (Sha *et al*. 2008). The main strongholds of the Proboscis Monkey populations in Sabah are located in the east coast within the Lower Kinabatangan and Segama floodplains. Klias Peninsula contains the only remaining viable populations of Proboscis Monkey on the west coast of Sabah with estimated population size ranging from 569 to 818 individuals and forming possibly the third largest populations of this monkey in Sabah (Bernard and Zulhazman 2006, Sha *et al*. 2008). Although considered as a highly charismatic primate species and has received increasing attention in recent years, especially as an important ecotourist attraction, the Proboscis Monkeys in Klias, are increasingly threatened by habitat loss, conversion and fragmentation, mostly as a result of human activities.

Over the past ten years, populations of Proboscis Monkey in Klias have remained relatively stable (Bernard 1997, Bernard and Zulhazman 2006, Sha 2006). Major Proboscis Monkey populations in Klias Peninsula are found at four

general localities namely Garama (in and around the Padas Damit Forest Reserve), Menumbok and Weston which may be discontinuous from each other, and small isolated populations in the Bongawan area, Binsulok and within the Klias Forest Reserve (Bernard and Zulhazman 2006; Fig1). However, the distribution range of this monkey in some places appeared to have reduced such as in Weston where animals are now pushed towards the coast resulting from land development in upstream areas (Bernard 2006). This project on "Conservation of the Proboscis Monkey, *Nasalis larvatus*, in the Klias Peninsula, Sabah, Malaysia" is a 2 year project which started in November 2007 and will run until November 2009. The present paper provides the first year report on the progress of the project for the period from 1st November 2007 to 31st October 2008. The overall aim of the project is to protect the Proboscis Monkey populations through the creation of a multi-disciplinary project, merging research, training and environmental awareness education. The project will increase awareness on the importance of Proboscis Monkey conservation in the Klias Peninsula, and Sabah in general, build human capacity for non-human primate species field research, and gather novel data that will enable effective conservation measures to be taken to protect the Proboscis Monkeys in its natural habitats.

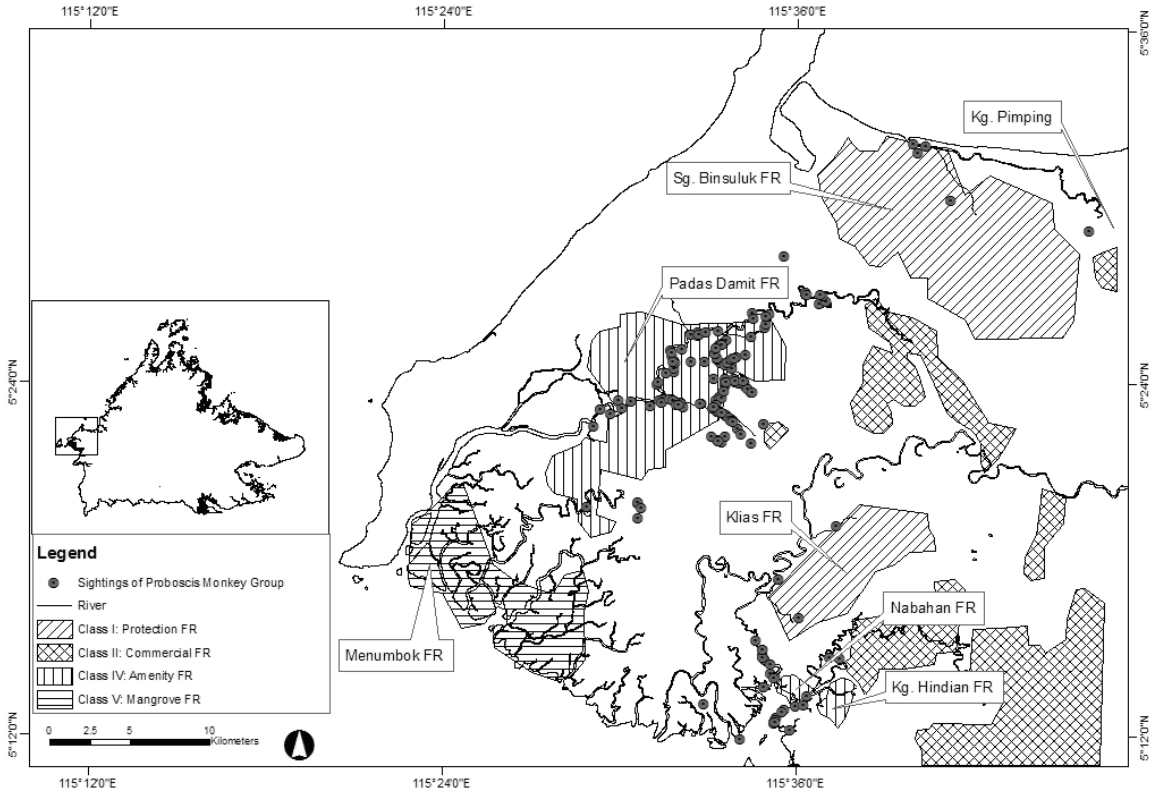

Fig1 Proboscis Monkey distribution in the Klias Peninsula showing the stronghold of Proboscis Monkey population located in and around Padas Damit Forest Reserve at Garama (according to Bernard and Zulhazman, 2006)

The main objectives of the project are to:

(1) study the distribution and estimate the population size of Proboscis Monkey in Klias Peninsula;
(2) study the behaviour and ecology of the Proboscis Monkey;
(3) investigate the effects of habitat alteration/fragmentation and other human-related activities on the Proboscis Monkey populations;
(4) investigate the threats to the Proboscis Monkey in the Klias Peninsula;
(5) train students in a range of ecological and behavioural field research techniques relating to Proboscis Monkey;
(6) increase awareness on the Proboscis Monkey and their conservation needs; and
(7) promote the Proboscis Monkey as an important eco-tourism attraction in Klias Peninsula.

2. PROPOSED ADJUSTMENTS TO THE PROJECT

Although the project was initially intended to cover the entire Klias Peninsula, due to the large area to be covered (3,136km^2) and with access difficulties due to the swampy habitats of Klias, coupled the timidity of the Proboscis Monkey in the wild, it was evidently unfeasible to cover the entire Klias peninsula to allow for detailed study of each important Proboscis Monkey population in the area. Adjustment on the initial aim statement and specific objectives of this project was therefore inevitable. This predicament has been stressed and adjustments to the project have been suggested in the interim report submitted to the secretariat of PRO NATURA FUND in April 2008.

The main proposed adjustment of the project was to give emphasise to the populations of Proboscis Monkeys within the protected Padas Damit Forest Reserve (PDFR) and its immediate vicinity, i.e., collectively called Garama area, located in the central part of the Klias Peninsula. The Proboscis Monkey population densities in Garama have been previously estimated to range from 13.1 to 23.3 individuals/km^2 and were found to be the stronghold of the Proboscis Monkey populations in the entire Klias Peninsula (Bernard and Zulhazman 2006). In addition, instead of giving equal emphasis to all of the initially stated objectives, it was proposed that more time and effort should be appropriated to the research component of the project i.e., to study the ecology and behaviour of the Proboscis Monkey in Garama. The specific objectives of the research component of the project were suggested to be as follows:

(1) to describe the botany of the riverine and mangrove, and the transission zone between riverine and mangrove forests within the Padas Damit Forest Reserve and surrounding areas;
(2) to monitor the production of plant parts of the forests, and to assess changes in food availability over a period of 12 months within the Padas Damit Forest Reserve and surrounding areas;
(3) to monitor the distribution patterns of Proboscis Monkey populations in and around the Padas Damit Forest Reserve and to correlate these with changes in the distribution patterns of the food plants available over a period of 12 months;
(4) to study the general behaviour of Proboscis Monkey with specific reference to feeding behaviour.

The training component was continued as this project proved to be very useful platform for providing training to undergraduate students from Universiti Malaysia Sabah (UMS) to build human capacity on non-human primate species field research. Research projects were in the form of final year dissertation projects and were designed in such a way that they are parts of the larger research project framework. Funding was optimized with the engagement of students to carry out these short termed research projects within the larger project framework. Environmental awareness education component was mainly centred in Garama, targeting school children at schools in the immediate vicinity of Padas Damit Forest Reserve, UMS students and non-government nature based organisations.

3. MAIN ACTIVITIES AND PRELIMINARY FINDINGS DURING THE FIRST YEAR PERIOD OF THE PROJECT

(1) ADMINISTRATION

Permit to conduct this project and to study the Proboscis Monkey in Garama for 12 months from January to December 2008 was granted by the Forestry Department of Sabah through a letter dated 24th December 2007 (Ref. No: JPHTN/PP 100-1/6/8/klt.2/60). In September 2008, an administrative assistant Ms. Donna Christine Simon has been engaged under this project for a maximum period of three months (till November 2008) to assist with administrative matters of the project.

(2) FIELD WORK AND RESEARCH ACTIVITIES

1) GENERAL

A 3 day reconnaissance trip was initiated to Garama in mid November 2007. The aim was to assess the logistical support and other practical support needed to start the project in the field in Garama. These included establishing contact with the local people, to hire field enumerators and boatman, to identify suitable location to set up base camp site, arrange boat transportation and establish a practical telecommunication system. During this field trip, a general survey was conducted going through all accessible waterways in Garama in order to gain a general impression of the topography and vegetations in the area.

2) BOTANICAL AND PHENOLOGICAL STUDY

8 botanical plots measuring 10 meters wide and with a total length of 1km have been established in the forests along 10km length of the Garama river measured from the base camp site to the intersection between the Garama river and Klias river (Fig2). The botanical plots were established in the forests by the river banks starting from about 10m from the river edge up to about 80 to 100m perpendicular distance away from the river edge. These plots included important Proboscis Monkey feeding sites. All trees inside the plots with a girth size at breast height (gbh) of ≧ 30cm were tagged and identified to species level. The overall density of trees recorded was low (279 trees/ha). The rate at which the tree species number increased with increasing tree sample size showed that most tree species with gbh ≧ 30 cm have been sampled (Fig3). Total tree species appeared to have reached asymptote after only about 150trees have been sampled. Most of the trees (60%) from the botanical plots had girths less than 60cm, with maximum recorded girth 400cm. Mean girth size was 67.04cm.

Overall tree species richness of the forests of the study area was poor. The recorded total number of plant families was 13 and total tree species number was 16. All plant families showed no dominance with each family was represented by only 1 or 2 tree species. However, in terms of the relative abundance of the tree species, there is a clear dominance of *Excoecaria indica* representing about 28% from the total number of trees enumerated. Other less dominant tree species in order of decreasing representation are as follows; *Cerbera odollam* (13%), *Ficus binnendykii* (12%), *Bruguiera gymnorrhiza* (8.9%), *Psydrax* sp. (7.9%), and *Symplocos celastrifolia* (7.5%) (Table1).

From the botanical plots, the forest of the study site in Garama could generally be divided into 3 classes, namely riverine forest on the upper parts of the Garama river, mangrove forest on the lower parts of the river and mixed mangrove-riverine forest along the intersection between the 2 forest types. The mixed forest type is basically a transitional zone where mangrove forest intergrades to riverine forest.

A total of 300 trees was monitored monthly for their phenological cycles. These included all trees enumerated in the botanical plots, and some trees outside of the plots that are important Proboscis Monkey feeding trees. Phenological study started in January 2008 till October 2008. Partial data analyses have been conducted for data from January to August 2008. Generally, more young leaves were produced during earlier parts of the year, with fruit production was more prominent during the latter parts of the year. Flowering pattern was more or less stable throughout the year with no apparent peaks (Fig4).

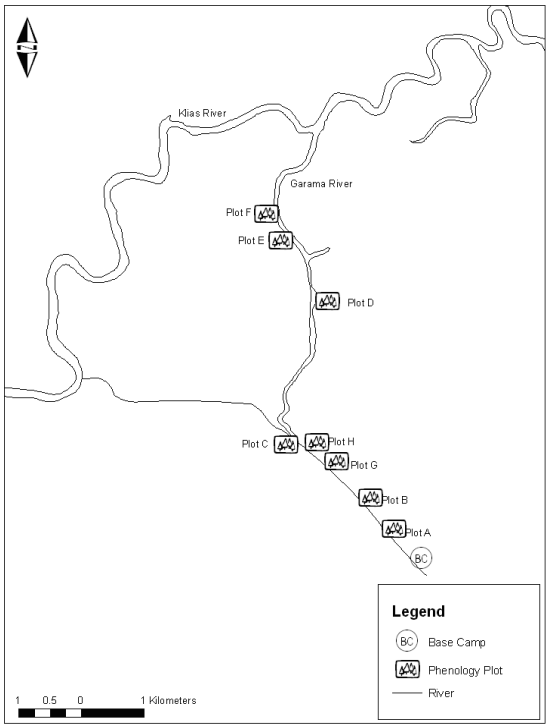

Fig2 Locations of botanical plots along the Garama River in Garama

Table1 Tree families and abundance of tree species (≧30cm gbh) in the botanical plots at Garama

Famili	Species	Number of trees
Euphorbiaceae	*Excoecaria indica*	80
Apocynaceae	*Cerbera odollam*	35
Moracreae	*Ficus binnendykii*	34
Rhizophoracea	*Bruguiera gymnorrhiza*	24
Rubiaceae	*Psydrax* sp.	22
Symplocaceae	*Symplocos celastrifolia*	21
Myrsinaceae	*Rapanea avenis*	13
Meliaceae	*Dysoxylum cyrtobotryum*	13
Myrsinaceae	*Ardisia elliptica*	10
Sterculiaceae	*Heritiera littoralis*	8
Fabaceae	*Pongamia pinnata*	6
Rhizophoracea	*Rhizophora apiculata*	6
Palmae	*Oncosperma tigillarium*	4
Flacourtiaceae	*Casearia grewiaefolia*	1
Malvaceae	*Hibiscus tiliaceus*	1
Rubiaceae	*Nauclea orientalis*	1
	Total	279

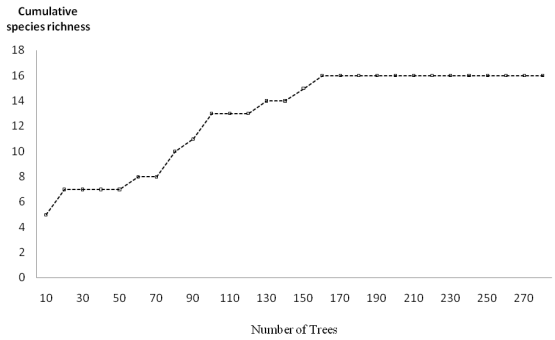

Fig3 Cumulative number of tree species against the number of trees sampled in the botanical plots at Garama

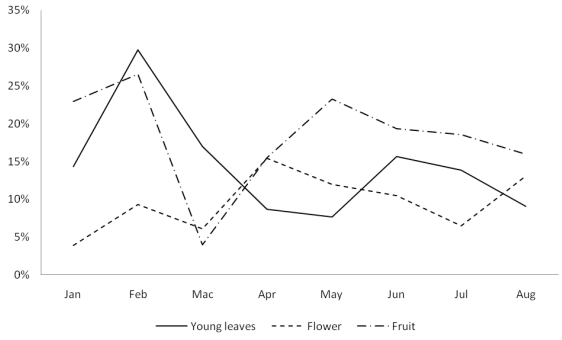

Fig4 Phenological patterns of the forest from Jan- Aug 2008 at Garama

3) SURVEY OF POPULATION DISTRIBUTION, ESTIMATES OF POPULATION SIZE AND DENSITY

Monthly variations in the range of distribution of the Proboscis Monkey in Garama have been recorded from January to October 2008, except August 2008 due to illness of the principal investigator. Distribution of Proboscis Monkey was determined by plotting the latitude and longitude location coordinates of groups of the monkeys encountered in every month. Latitude and longitude coordinates were determined using 100 GPS devices. A total of 120 location coordinates has so far been recorded until September 2008. The monkeys were found in all forest types including riverine and mangrove forests from January to June 2008, but there appeared to be a shift in preference to riverine forest during July and September 2008 coinciding with higher fruits production during those periods (Fig5). The encountered number of Proboscis Monkey groups per month varied from a minimum of 10 groups, recorded in April 2008, to a maximum of 25 groups, in March 2008. Estimate of population size and relative population densities are yet to be calculated.

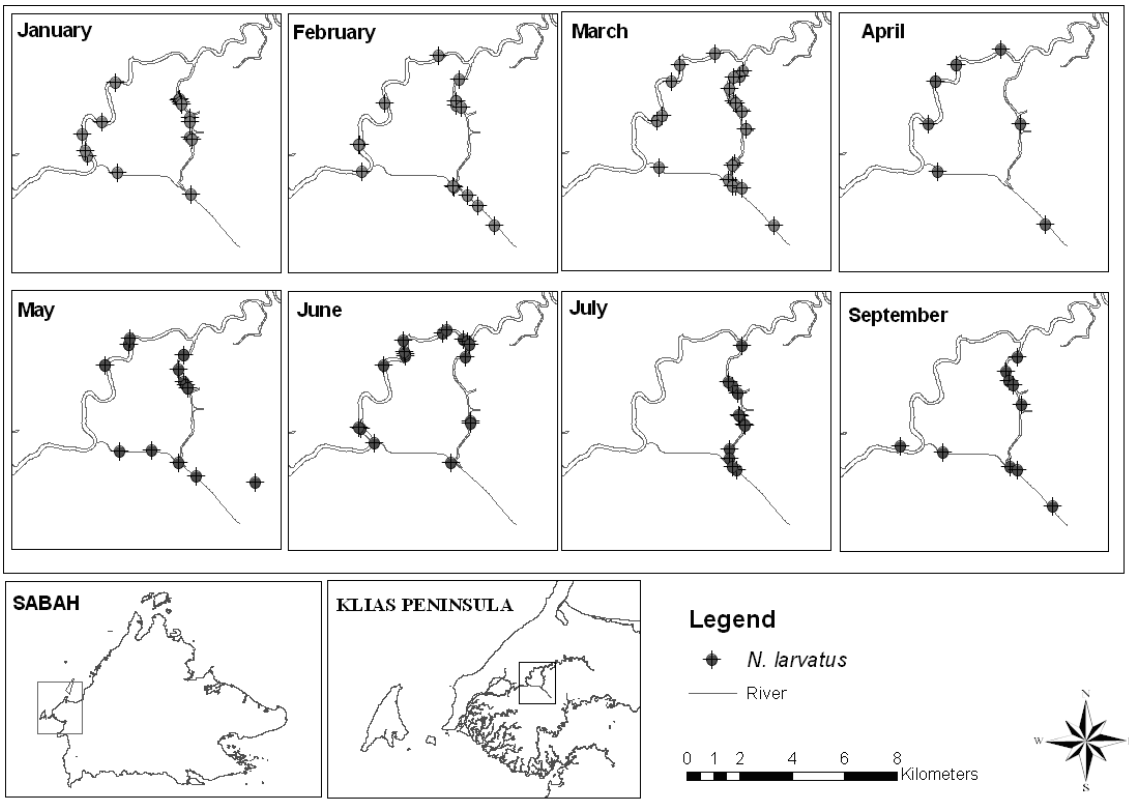

Fig5 Monthly distribution of Proboscis Monkey groups in Garama from January to September 2008
(Data in August 2008 is not available due to illness of principal researcher)

4) BEHAVIOURAL DATA COLLECTION

Preliminary data collection on the general behaviour of the Proboscis Monkey was conducted from 17th to 22nd December 2008. The purpose was to describe and define the different categories of behavioural activities of the Proboscis Monkey in Garama. This study was also conducted in conjunction with an undergraduate's dissertation project.

Actual behavioural study was started in January 2008. This was continued every month through the month of October 2008, except August due to illness of the principal researcher. Observations technique used in this study followed that by Altman (1974). Behavioural study was difficult to conduct due to the timidity of the monkey. Although the monkeys were not alarmed by the presence of humans in boat, the animals were extremely shy of humans on land. The monkeys would flee very quickly by descending from the trees to the thick vegetation covered ground upon encountering a human observer on land.

Full day follow of Proboscis Monkey groups was still not possible, even after about eight months since commencing the behavioural study. However, it was encouraging that 2 groups could be identified reasonably well using marker individuals (adult females) and these groups could be approached reasonably close (20m). But, caution has to be exercised when identifying groups based on adult females as adult females in Proboscis Monkeys were know to shift groups frequently (Murai *et al*. 2006).

No analysis has been made thus far on the behavioural data. Not inclusive of data recorded in October 2008, the total direct contact hours with Proboscis Monkey in Garama was 108 hours; total number of scans made was 1,005 and total number of observations made was 3,264. These data were recorded from observations made on 15 identified groups, i.e., 6 groups in mangrove forests while 8 groups in riverine forests. 1 group was observed in the mixed forest or transitional zone of mangrove-riverine forest. On the average a total of 3 to 6 days has been spent per month for observing monkey behaviour. Although full day follow was still not possible, 1 group has been followed continuously for 5 hours from 06:00hrs to 13:00hrs. At least 17 different plant species have been used as food sources by Proboscis Monkeys in Garama, with preference for *Ficus binnendijkii, Bruguiera gymnorrhiza, Hibiscus tiliaceus* and *Excoecaria indica*.

5) CONSERVATION GENETIC OF PROBOSCIS MONKEY

In early August 2008, Dr. Jason Munshi-South travelled to Institute for Tropical Biology and Conservation (ITBC), UMS to commence a conservation genetics study of the Klias Proboscis Monkeys under the larger framework of the present project. During his visit, Dr. Munshi-South and the principal researcher collected 25 new fecal samples from Proboscis Monkey individuals inhabiting 2 different river systems in the Klias peninsula i.e., Garama and Weston located in the south of the peninsula. While at ITBC, J. Munshi-South extracted DNA from these 25 fecal samples plus an additional 26 fecal samples collected earlier in the year by the principal researcher. Preliminary PCR amplification and DNA sequencing of a segment of the mitochondrial d-loop began at ITBC and has continued in Dr. Munshi-South's laboratory in New York. Sequences from all 51 samples are expected in November 2008. These mitochondrial d-loop haplotypes will be used for a preliminary assessment of remaining genetic variation within the Klias peninsula, as well as for a phylogeographic study of Proboscis Monkeys throughout the state of Sabah.

Dr. Munshi-South has also obtained primers from 19 human-derived microsatellite loci that will be screened for amplification in these fecal samples, plus 12 liver samples Dr. Munshi-South obtained from the Bronx Zoo in New York. If successful, then these markers will be used for a higher-resolution examination of genetic variation in the Klias peninsula.

(3) TRAINING and EDUCATION

2 students registered for Ph.D degree programmes at UMS have been engaged on the project since January 2008. Lee Shan Khee is studying the proboscis population in Garama, while Joseph Tangah in Labuk bay. Lee S.K. is a senior staff of the World Wildlife Fund (WWF) Malaysia based in Kota Kinabalu, Sabah. Joseph is a senior Forestry Officer employed by the Sabah Forestry Department and is based at the Forest Research Centre in Sepilok, Sandakan, Sabah. Lee S, K. also works as a part time research assistant under the present project since December 2007.

The Labuk Bay Proboscis Monkey population is semi wild located in a private land in a small $1km^2$ fragment of mangrove forest surrounded by large oil palm plantations. The monkeys in Labuk bay have been fed with artificial feed (pan cakes) to supplement their natural diet of leaves and unripe fruits. Comparisons of data on behaviour and ecology of Proboscis Monkey in Garama and Labuk Bay will be important to demonstrate how Proboscis Monkeys adapt to living in two different habitat types that also differ in terms of level of disturbance.

2 undergraduate students, Mohamed Ridzwan Bin Ali and Halley Clestina Gom Awing, from the Conservation Biology Degree Programme of UMS have been trained and partially funded under this project. Mohamed Ridzwan has worked on a dissertation project on some aspects of behaviour of the Proboscis Monkey in Garama, while Halley did a behavioural study of nine individuals of Proboscis Monkey in captivity at the Lok Kawi Zoological Park in Kota Kinabalu. Both students have presented their findings during a viva voce session in the third week of April 2008.

2 new undergraduate students, Leong Ann Ying and Siti Zaraurah Binti Ag Gabor, from the Conservation Biology Degree Programme of UMS have started their dissertation projects in May 2008 in Garama studying (1) how Proboscis Monkey selects their sleeping trees - using a multivariate approach; and (2) feeding ecology of the Proboscis Monkey using focal animal sampling as oppose to the usual instantaneous scan sampling method used for studying this monkey previously. Field expenses of both students were fully covered by the present project.

One graduate student, Goh Cherng Jen, dissertation project that is not related to Proboscis Monkey study, but has received partial funding from the project has also commenced in May 2008. The project entitled "Diversity of non-volant small mammal fauna" is carried out in Garama. No such study has been conducted in Garama before and when completed, the results of this study will form a basis for information on small mammal from this area in the future.

(4) ENVIRONMENTAL AWARENESS EDUCATION

On the 13th October 2008, a talk titled "Conservation of the Proboscis Monkey (*Nasalis larvatus*) in Klias Peninsula, Sabah" was presented by the principal researcher to 35 students in their 3rd year from the Natural Park and Recreation Degree Programme of the International School of Tropical Forestry, UMS. The talk was presented at the Sabah Forestry Field Training Centre in Klias Forest Reserve. Additionally, on the 14th October 2008 the principal researcher accompanied the same group of students to Garama to observe the Proboscis Monkey and learn technique to take a census of the monkey populations.

Similar talk was scheduled on 6th November 2008 for members of the Sabah Soceity and the general public. The talk was presented at the secretariat office of the Sabah Society in Kota Kinabalu. A total of 20 people attended the talk. In both presentations, Pro Natura Foundation-Japan and The Nature Conservation Society of Japan has been duly acknowledged as one of the main funding agencies of the conservation of the Klias Proboscis Monkey project.

PRO NATURA FUND has been acknowledged by the Director of ITBC, UMS, Assoc. Prof. Dr. Abdul Hamid Ahmad, during an opening ceremony of an international workshop held in UMS. The director's speech was published in the Daily Express and The Borneo Post 2 popular local tabloids, dated 23/10/2008.

4. WORK PLAN FOR NEXT SIX MONTHS, NOVEMBER TO APRIL 2009

Proboscis Monkey Research in Garama

- Permission to extend the study in Garama for another 12 months from January to December 2009 will be obtained from the Forestry Department of Sabah.
- All major research activities in Garama concerning collection of phenological data, mapping of distribution pattern, estimating population size and relative density and observation of Proboscis Monkey behaviour will be continued on a monthly basis. Effort will be increased especially in studying the behaviour of the monkey and full day follow will be endeavoured.
- A fibreglass boat with sitting capacity of 4 people incl. a boatman, and 30hp outboard engine will be purchased to assist with monthly boat survey of the Proboscis Monkey populations.
- Local field assistants have been taught how to assess the phenological cycle of the trees in the botanical plots and how to observe monkey behaviour so that data collection could be done even in the non-attendance of the principal investigator. While the field assistants are now highly competent with the monthly phenological data collection, they are still not willing to carry out the behavioural study without supervision from the principal investigator. Beginning in October 2008, a temporary graduate field assistant Ms. Lisa from Lawas, Sarawak, has been employed to assist with behavioural data collection. Lisa will continue to be employed as a field assistant in this project in the next six months. In addition, Lee Shan Khee will continue to be employed as a part time research assistant in the project.
- Data analysis and writing of research papers will be started. While data collection on the main research project is not yet completed, some of the undergraduate dissertation projects can be turned into research manuscript for submission to the monthly journal of NACS-J or other journals. At least one research manuscript will be produced in the next 6 months.
- Research component on conservation genetic of Proboscis Monkey will continue. Collection of DNA materials of Proboscis Monkey will continue in other places within the Klias Peninsula. This endeavour may be extended to cover populations elsewhere in the state of Sabah and possibly also the entire Borneo Island.
- Training of undergraduate students will continue under this project. Two more new students will be engaged in April 2009.
- Environmental Awareness Education will be continued in the form of talks to School children in Garama, undergraduate students in UMS and Non-Government organisations. A poster about the conservation status of the Klias Proboscis Monkey will be designed, printed and distributed to all tour operators based in Garama to disseminate research findings with the aim to create awareness on the importance of Proboscis Monkey conservation.

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要約

このプロジェクトは、マレーシアサバ州西海岸に最後に残った個体群である、クリアス半島のテングザルの保全を目指すものであり、2007年11月から始まって2009年10月まで続く2年間のプロジェクトである。この報告書では、このプロジェクトが開始された2007年11月1日から2008年10月31日までの、このプロジェクトの最初の1年間の中間状況を報告する。野外調査を遂行していく過程で、事前には予測不能だった障害があることが明らかになったため、プロジェクトの目的を修正しなければならなくなったが、それにもかかわらず、プロジェクトは現在順調にその目的を達しつつある。このプロジェクトのうち、調査に関する項目はすべて現在進行中で、それには植生調査区の設置、樹木のフェノロジー（開花・結実・展葉にみられる季節変化）の資料の収集、テングザルの行動観察が含まれる。マレーシアサバ大学の二人の大学院生がこのプロジェクトを通じて、野外および飼育下のテングザルの行動や生態を調査する訓練を受けた。クリアス半島のテングザルの保全状況に焦点を当てた環境教育も行った。このプロジェクトは2009年11月まで、さらに12ヶ月続く予定である。

（推薦者：半谷 吾郎）