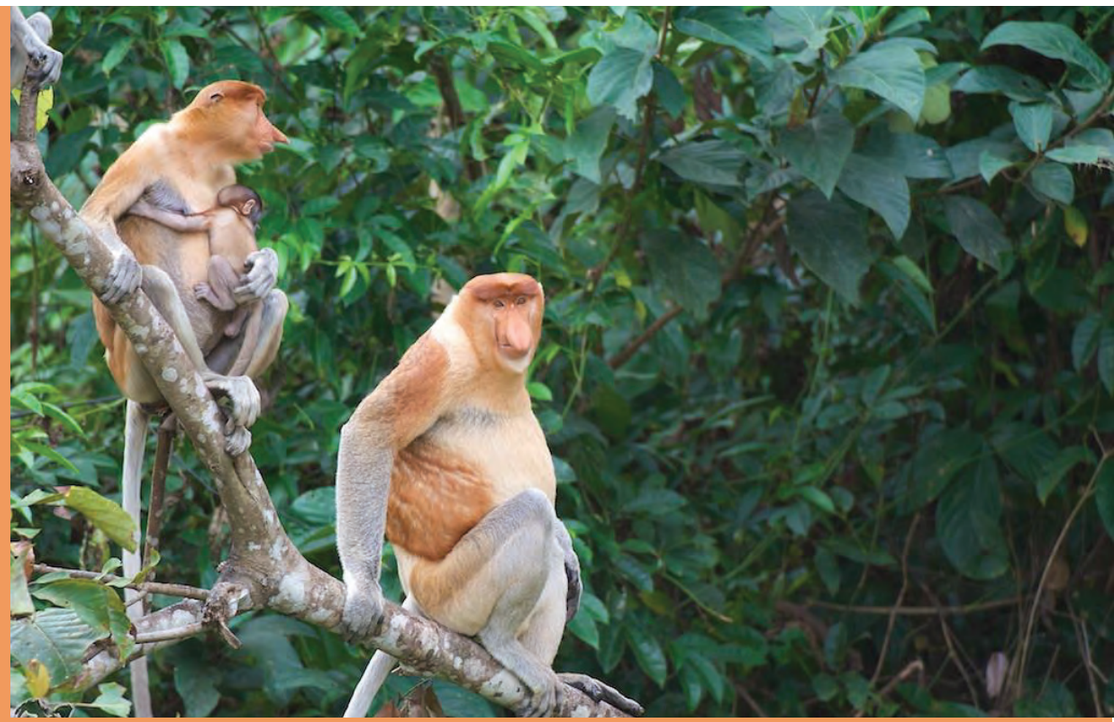
Proboscis Monkey Action Plan for Sabah



2019 - 2028

Sabah Wildlife Department
Ministry of Tourism, Culture and Environment

Sponsors:

Sime Darby YAYASAN

Gaya Island Resort
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Partner:

Danau Girang Field Centre

PROBOSCIS MONKEY ACTION PLAN FOR SABAH

The compilation and editing process of this Proboscis Monkey Action Plan was led by the Director of Sabah Wildlife Department and supported by the Species Action Plan Committee Members.

Published by
Sabah Wildlife Department
5th Floor, Block B, Wisma MUIS Complex
88100 Kota Kinabalu

With assistance from
Danau Girang Field Centre

And funding from
Yayasan Sime Darby

December 2018
Citation: Sabah Wildlife Department 2019. Proboscis Monkey Action Plan for Sabah 2019-2028. Kota Kinabalu, Sabah, Malaysia.

Front cover photo: Proboscis monkeys along the bank of the Kinabatangan River. © Rudi Delvaux

ISBN: 978-983-40057-9-5

Printed in Kota Kinabalu

EXECUTIVE SUMMARY

The Proboscis Monkey Action Plan designed for Sabah is a comprehensive document that emphasises the need for immediate, practical and adaptive conservation actions in order to ensure the long-term survival of the proboscis monkey. This document results from an extensive consultation process initiated during the "Population and Habitat Viability Assessment Workshop" (Gaya Island Resort, Kota Kinabalu, 20-22 February 2017) and the "International Workshop on Proboscis Monkey Conservation in Sabah" (Kota Kinabalu, 23-25 February 2017).

In 2005, it was estimated that about 6,000 proboscis monkeys were distributed along the coastal areas of Sabah in seven major centres of continuous distribution, representing high priority areas for the survival of the species. Moreover, several pocketed populations in the interior of Sabah have also been identified and will need attention.

In Sabah, proboscis monkey decline is directly attributed to recent and drastic habitat losses mainly due to the expansion of aquaculture projects in mangrove areas and logging and conversion of important riparian habitats to agriculture and human settlement. The Pan Borneo Highway also threatens the already small proboscis monkey population in northern Sabah.

It is important to stress out that proboscis monkey"s presence in Sabah offers a range of new opportunities such as eco-tourism that can significantly contribute to the economic development of the local communities and increase revenues to the State Government.

The vision of this action plan is to secure the continued existence of viable proboscis monkey populations in Sabah.

The 10-year goals of this PMAP are to identify, develop and implement strategies and actions that will address the threats of the species in all seven priority populations identified in Sabah by providing guidance to key players that will implement these strategies.

The main objectives of this PMAP are the following:

1. Halt loss and degradation of habitat (mainly, mangroves and riparian forests) used by proboscis monkeys.
2. Increase mangrove and riparian forest areas suitable for proboscis monkeys and increase habitat connectivity between the different proboscis monkey habitat ranges.
3. Increase enforcement by supporting and strengthening Sabah Forestry Department‟s enforcement team „Protect‟ and their „Forest Ranger‟ initiative, Sabah Wildlife Department‟s „Enforcement team‟ and their „Honorary Wildlife Warden‟ initiative and Sabah Parks‟ „Enforcement team‟ and their „Park Ranger‟ initiative.
4. Monitor population changes for the duration of the plan.
5. Cryopreserve proboscis monkey gametes.
6. Improve the level of awareness and education and strengthen regulations for proboscis monkey viewing.
7. Set up an Endangered Species Conservation Unit (ESCU) to monitor the implementation of all action plans on totally protected (Schedule 1) terrestrial species in Sabah: banteng, elephant, Malayan sun bear, orangutan, proboscis monkey, Sunda clouded leopard and Sunda pangolin.

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1) INTRODUCTION

1.1. Origin and taxonomy

The proboscis monkey (*Nasalis larvatus*) is endemic to the Southeast Asian island of Borneo. It is the only species in the genus *Nasalis* within the group of colobines referred to as the "odd-nosed monkeys". This group also comprises five species of snub-nosed monkeys (genus *Rhinopithecus*), three species of Douc langur (genus *Pygathrix*), and one species of pig-tailed langur (*Simias concolor*). Prehistoric Asian colobines separated from the African colobines some 10.8 million years ago and diversified around 6.7 million years ago. It is stipulated that the ancestors of the proboscis monkey and the pig-tailed langur, its closest relative, arrived on the Sundaic islands during the early Pliocene period (Harrison et al. 2006). During the several cold phases of the late Pliocene period, pockets of tropical and sub-tropical forest refugia, alienated by grasslands, were created (Meijaard & Groves 2006). The shrinking of suitable habitat for both primate species resulted in their endemism: the proboscis monkey to Borneo and the pig-tailed langur to several small islands off the coast of Sumatra in Indonesia (Harrison et al. 2006).

1.2. Legal status and legislation

Proboscis monkeys are protected by law throughout their range and are included in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, prohibiting all international commercial trade. The species is listed as Endangered (A2bc) on the IUCN Red List (Meijaard et al. 2008), with a declining population trend.

In Sabah, the proboscis monkey is currently totally protected under Schedule 1, Section One of the Wildlife Conservation Enactment (WCE) 1997. Totally protected animals under Schedule 1 cannot be hunted. For those killing proboscis monkeys illegally and found guilty of an offence under Section 25 WCE 1997, the penalty is a minimum fine of RM50,000 and maximum of RM250,000 plus imprisonment for no less than six months and up to five years.

1.3. Ecology and behaviour

Proboscis monkeys are large, sexually dimorphic colobines, restricted to riverine, peat swamp and mangrove forests of the coastal lowlands. All colobines possess specialized digestive physiology and sacculated stomachs with anaerobic, cellulolytic bacteria in their forestomach. This adaptation allows them to break down cell wall constituents and defensive chemicals found in plant foods. *N. larvatus* is folivore-frugivore, with a strong preference for seeds when fruit availability is high (Matsuda et al. 2013).

Proboscis monkeys live in either stable one-male groups or all-male groups. A number of groups may occasionally travel together and sleep in close proximity at night, forming a second level of social organization called a band. Groups rarely travel more than half a day"s journey from the river – typically not more than 600 m, because they return to the riverside most nights (Matsuda et al. 2009 but see Stark 2018). Both males and females disperse. Among females, sub-adult female dispersal is more common, although dispersal of adult females with infants has been observed as well (Murai 2004). In the Kinabatangan, the home range of proboscis monkeys was estimated to be 24-165 ha (mean 80.89 ha) (Stark et al. 2017b).

Figure 1. Sub-adult male proboscis monkey in the Kinabatangan. ©Rudi Delvaux

1.4. Population genetics

An *ad hoc* state-wide survey for this action plan has strongly indicated that current proboscis monkey populations pertain to three major lineages (as indicated by phylogenetic analyses on the mtDNA control region) and that one of these lineages expanded to originate the other two (Figure 2). These linages are not restricted to geographical regions but rather show historical demography and, as such, are not sufficiently informative for a population management plan.

However, Bayesian analyses for population structure and F-statistics based on nuclear DNA markers (12 microsatellite loci) show three current genetically distinct groups that correlate with geographical areas as shown in Figure 3. There is a clear indication of a population cluster to the north of the Crocker Range (North group); the populations of Klias, Sugut and Labuk Bay as another group (Middle group); and the populations from Sandakan to the east into a third cluster (East group). Each genetically distinct group appears to have a relatively high level of inbreeding although there also seems to have been historical connectivity allowing gene flow between said groups. Along this line, it is expected that the populations in the Klias peninsula will become a genetically distinct group in the near future since there is no connectivity between this area and the rest of the state.

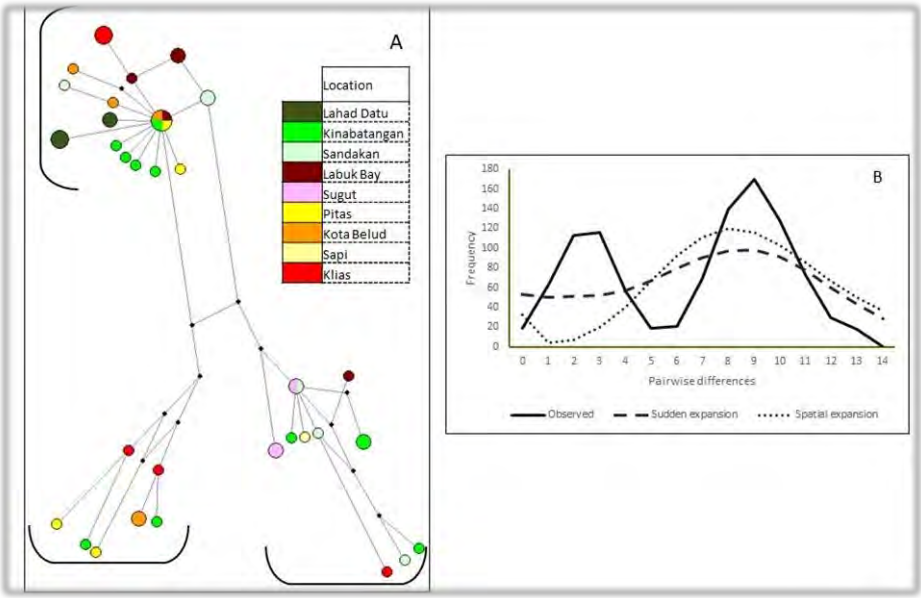

Figure 2. Historical demographic patterns of proboscis monkeys in Sabah indicates an expansion process. A) Median joining network (MJN) of mtDNA control region haplotypes grouped in three lineages. Each circle represents a different haplotype and the diameter indicates haplotype frequency; the smallest circle represents a singleton. No geographical correlation can be observed. B) Mismatch distribution graph corroborating the demographic expansion process with observed (solid line) and expected (discontinuous lines) frequencies of pairwise differences.

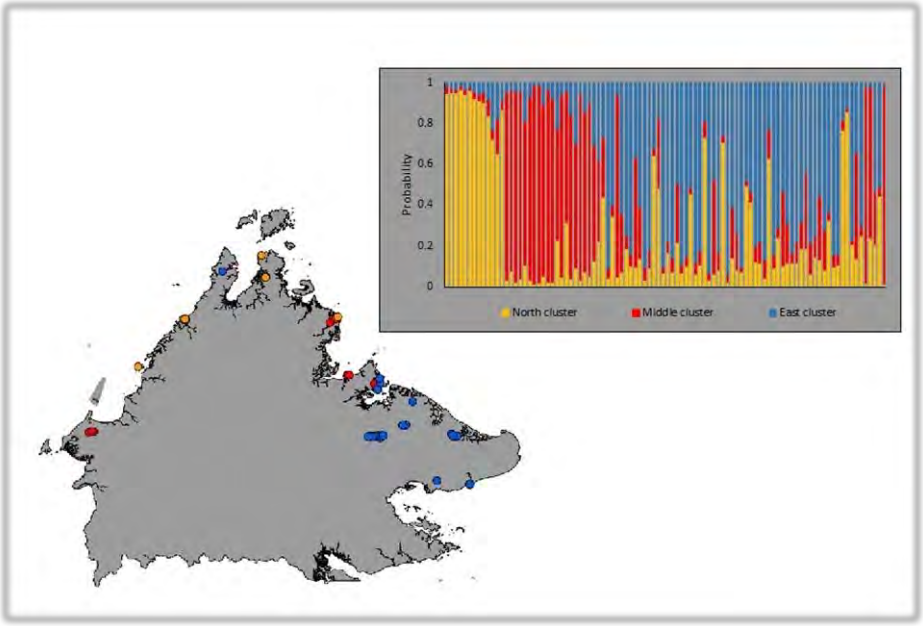

Figure 3. Current population genetic structure of proboscis monkeys in Sabah. The inset graph represents the probability of each individual animal sampled (single bar) to belong to a particular genetically distinct cluster identified by a Bayesian analysis of population structure. Three major clusters were identified grouping the sampled geographical populations.

In general, the populations of proboscis monkeys in Sabah are fit and evolutionarily able to cope with natural environmental pressures. This is due to the historically high levels of genetic diversity and also to the current moderate to high levels of genetic diversity as indicated by the haplotype diversity, mean number of alleles per locus and heterozygosities. However, a decrease in the overall fitness of the whole population might depend on the available connectivity between the genetically distinct groups in the future. Further data analyses should be undertaken to better understand the historical dispersal patterns and gene flow in order to increase the impact of genetic data on the management of the proboscis monkey populations in Sabah.

1.5. Current distribution and population trends

Wild proboscis monkeys occur mainly along the coastal areas of Sabah (see Figure 4). Earlier estimates of the species in Sabah put the total population at *c.* 3,000 (IUCN 1978) or *c.* 2,000 (Davies and Payne 1982). The most recent and comprehensive survey [1]was carried out in 2005 (Sha et al. 2008). On the west coast, populations of proboscis monkeys were found in Klias Peninsula (five sub-populations of 818 individuals in 75 groups). On the east coast, populations were found at Tangkarason and Paitan (90 individuals in eight groups); Sugut River (787 individuals in 58 groups); Beluran (317 in 30 groups); Sandakan (three sub-populations of 326 in 28 groups); Kinabatangan River (1,454 individuals in 101 groups); Segama River (1.040 individuals in 83 groups); Lahad Datu (four sub-populations of 188 individuals in 16 groups); Semporna Peninsula (four sub-populations of 169 individuals in 16 groups; and Tawau Bay (718 individuals in 63 groups) on the east coast. Proboscis monkeys are present in other locations that were not surveyed by Sha and collaborators, such as Bongawan, Pitas, Gaya Island, Kota Marudu, Kota Belud on the west coast and Bongaya, Labuk Bay, Lokan, Kulamba, Dewhurst Bay, Pulau Sebatik, Kalabakan and others on the east coast. A minimum population estimate of *c.* 5,907 individuals was determined, a number that could have decreased during the past 13 years considering the major threats described below.

[1] Using the boat based survey method i.e. counting the proboscis monkey groups and individuals in the trees located by the riverbanks while cruising in the river at dawn or during the early morning (6.00-7.30 am) and at dusks or late evening (5.00-6.30 pm). This survey method is based on "total count survey method" that assumes that all proboscis monkeys would congregate and sleep in the trees located by the riverbank at night, so proboscis monkey groups and individuals could be counted when they retire for the night and before they move into the forest in the morning. This method is probably regarded as the most pragmatic survey method for surveying proboscis monkeys in the wild in water-logged or swampy habitats and it is widely used by proboscis monkey researchers elsewhere in Borneo. Therefore, it is a widely accepted method for estimating the abundance of proboscis monkeys in Borneo.

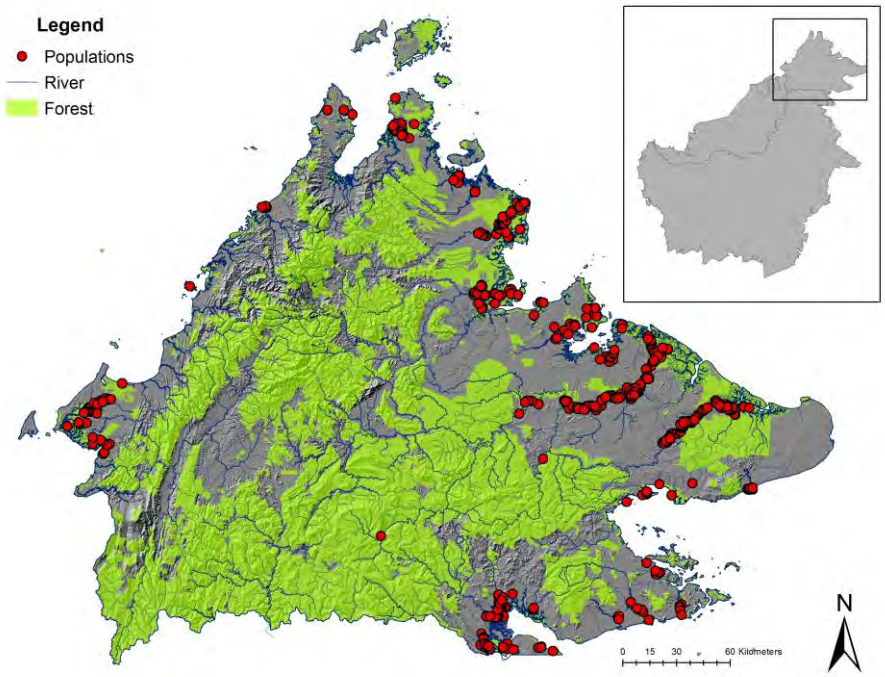

Figure 4. Distribution map of the proboscis monkey populations in Sabah (adapted from Shah et al. 2008, with additional locations).

1.6. Major threats

1.6.1. Habitat loss, degradation and fragmentation

Habitat loss and fragmentation is identified as the major threat to proboscis monkeys in Sabah. Loss of habitat due to expansion of human settlements is most marked in the coastal mangrove areas of Sandakan, Lahad Datu and Semporna. Proboscis monkeys have been recorded in disturbed habitats of secondary growth near human settlements; in remnant tidal forest close to agricultural land, in selectively felled forest and in rubber and coconut plantations. Local extinction of proboscis monkey populations as a result of habitat loss has been recorded in Papar (Davies and Payne 1982). There are many small isolated relict populations known to exist in isolated forest fragments, through their long-term survival is unknown, e.g. in Kuala Penyu near Binsulok Forest Reserve and mangrove forest along Sungai Kawang near Papar, in Maliau/Kuamat and near Danum Valley

(Segama River). There is also a population of less than 100 individuals on Gaya Island (J. Juhun, personal communication).

Habitat loss and degradation due to the expansion of aquaculture projects in mangrove areas has increased in Sabah in recent years. This expansion is particularly of concern in Pitas, with the most recent shrimp farming project led by Sunlight Inno Seafood Sdn Bhd in Kg Telaga, that has already decimated prime proboscis monkey habitat (Figure 5).

Logging and conversion of important riparian habitats to agriculture has also resulted in habitat degradation. This is highly evident along major rivers such as the Kinabatangan and Segama, where an intervening matrix of cultivated land, human settlement or grassland areas between fragments impede movement, dispersal and social activities of groups at important resting sites.

Figure 5. Camera trap photograph of a group of proboscis monkey drinking rain water in a recently cleared area of mangrove forest inside the Sunlight project site. ©DGFC

Finally, several proboscis monkey populations are facing fragmentation due to infrastructure development. The best example is

the bridge in Batu Puteh built in 1991 that split the Kinabatangan population into two sub-populations (Figure 6). Thankfully, a second bridge on the Kinabatangan that was planned to be built in Sukau was cancelled by the Chief Minister of Sabah in 2017. It would have split the proboscis monkey population in three sub-populations. The Pan Borneo Highway is also threatening proboscis monkey populations on the West coast, in Kota Belud.

Figure 6. Batu Puteh bridge built in 1991 over the Kinabatangan River, the only current bridge, that is already splitting the proboscis monkey population in two sub-populations, as well as other species. ©Daily Express

1.6.2. Poaching/hunting and illegal killing

Hunting is a threat to proboscis monkeys. The monkeys are hunted predominantly for food, trade and in several cases, for sporting purposes. Reports of proboscis monkey hunting are few but date back

to the 1970s until today (Boonratana 1993; Boonratana and Sharma 1994; Sha et al. 2008). Hunting proboscis monkeys for food is a practice among non-Muslim and foreign worker communities in Sabah. There is no recorded bias towards any sex when hunting for food – both male and female are prone to fall victims to bushmeat hunting.

The trade in proboscis monkeys predominantly involves males for traditional medicine. One case occurred in Beaufort in 2005, where Sabah Wildlife Department received reports that proboscis monkeys were actively being trapped. It was suspected that the monkeys were to be smuggled out of the country via Kudat. Further to that, a mini zoo was also suspected to be implicated as the intermediary holding facility for said monkeys. The zoo was then raided, but the search did not result in any sighting of monkeys. A less frequent purpose of hunting is for sporting purposes, and there is no gender bias involved.

1.6.3. Tourism

Currently, Sabah‟s tourism development does not seem to pose a high threat to the species as a whole, but smaller populations and individuals may be negatively affected. Major conflicts are isolated and confined to certain areas with high tourism frequency, such as Klias, Kinabatangan and Gaya Island. Labuk Bay presents an isolated case where proboscis monkeys have become habituated for tourism purposes and are provided daily with supplementary food. The population has seen an increase from two groups when the project was initiated in the early 2000s to eight groups today in 2008/2009 (five one-male units and three all-male units). The combined total population was estimated to be 148 individuals comprising 34 adult males, 60 adult females, 33 juveniles and 21 infants (H. Bernard, personal communication).

Figure 7. Male proboscis monkey in the Kinabatangan. Proboscis monkeys are a major touristic attraction in the Kinabatangan. ©Rudi Delvaux

Proboscis monkeys face some disturbance and negative impacts in areas with high tourism visitation via boat traffic which disrupts the population connectivity (river crossing), ranging and other natural behaviours, human feeding activities that leads to species habituation, and pollution, including noise and waste (Leasor 2010; Boonratana 2013). Even if all these impacts may have a negative correlation to the survival of the species in the long-term, the degree of threat is not yet known. However, it is recognised that tourism development also brings a positive impact towards conserving species. Moreover, local and corporate tourism-related businesses that are intrinsically linked to the area"s wildlife and nature will tend to be more attentive towards conservation, as a negative impact on the environment correlates with a negative impact on their operations/livelihoods (Fletcher 2009). Based on the information available but in the absence of targeted studies, tourism development is evaluated as a factor that does not pose a high threat to the species. It is also assumed that tourism development on a net basis creates positive impacts for the species.

Moving forward, it is expected that the tourism industry will increase in the coming years and will expand to new sites, i.e. Kota Belud. Expansion to include new sites may relieve the (increasing) pressure on existing tourism sites but may also put pressure on a larger number of proboscis monkeys. Future expansion of proboscis monkey tourism will require an intensification of management and regulation (Boonratana and Sharma 1994; Leasor and Mcgregor 2014) and the production of wildlife watching guidelines to be adopted by all tour operators and guides. Additionally, it is important to ensure that the industry"s corporations and stakeholders are engaged to be part of conservation implementation. More commitment from tourism stakeholders should be forged. For example, YTL Corporation is proposing that 1% of its profits be contributed to a tax-deductible conservation fund. There is another option to be considered: implement more low-impact development to lessen adverse impacts in areas that attract a high number of tourists. Government concessions offered to developers in order to encourage low-impact development should be discussed.

1.6.4. Disease and catastrophes

Due to insufficient historical and scientific data documenting catastrophic incidents related to diseases in proboscis monkeys, the disease factors affecting proboscis monkey are classified into two categories:

1. Diseases affecting individuals that potentially have a long-term negative effect on mortality rate. Examples of such diseases include Tuberculosis (*Mycobacterium tuberculosis*), Malaria (*Plasmodium spp*.), Leptospirosis (*Leptospira interrogans)*, Herpes virus, Hepatitis virus etc. These diseases could affect the population in two different ways:
    a) Populations living in natural and human-transformed habitats: infectious organisms are likely to already be present in proboscis monkey habitat, and possibly in circulation within populations. However, these agents will become pathogenic only when extrinsic stress-related factors significantly increase the susceptibility of the proboscis monkeys to these diseases. These factors include, but are not limited to, climate change, low genetic diversity, and lower immunity (due to poor nutrition, inbreeding).

b) Populations living close to human settlements (with significant anthropogenic contact). These populations have an increased risk of:
    a. infection by a pathogen of human or domestic animal origin that would cause an increase of the overall mortality rate. Contamination could happen via dog bites, capturing of monkeys; contamination of food sources; etc.;
    b. catastrophic mortality considering that most of these populations are highly fragmented and subject to regular and chronic stressors.

Populations that are the most at risk in Sabah include Klias, Sandakan, Kota Belud, Lahad Datu.

2. Catastrophic incidents caused by disease outbreaks due to pathogen agents with high transmission rate, high morbidity and causing high mortality rate:
Although such outbreaks have not been described for proboscis monkeys, there is a need to acknowledge the potential risk of disease outbreaks that could have a significant impact on population size. This category would include emerging infectious diseases (cross-species contamination by highly pathogenic viruses) and intense population stress resulting from catastrophic external conditions (such as a super El Niño phenomenon).

3. Other catastrophic events (non-disease related):
Intense drought is known to have a negative impact on the survival of proboscis monkey populations. In 1997-1998, Sabah was hit by an intense El Niño phenomenon, which lasted for approximately nine months. At this time, individuals of the proboscis monkey population in Labuk Bay, Sandakan, started to come closer to settlements to look for water and food. They entered people"s houses. Animals were dehydrated and emaciated. Although the mortality rate was not known, we can assume that reproduction would have stopped during this period of intense food scarcity. It is estimated that this kind of intense drought occurs once every 17 years on average (although the frequency and intensity of El Niño events are expected to increase due to climate change), since a previous event of this magnitude occurred in 1982-1983. Fires that

resulted in habitat loss and degradation in Sabah are evident in Klias, Sugut, Tangkarason and Paitan.

Figure 8. Juvenile proboscis monkey in the Kinabatangan. ©Rudi Delvaux

2) DISTRIBUTION IN SABAH AND SITE DESCRIPTION

The most comprehensive survey to date was published in 2008 by Sha and collaborators and provided an estimated number of proboscis monkeys in Sabah of 5,907 individuals.

In the past, mangroves and nipa palms covered 449,100 ha of Sabah before human settlement occurred. Today, Sabah has about 341,000 ha of mangroves coverage (Sabah Forestry Department 2014). Loss of mangrove area is due to human settlement, agriculture and aquaculture expansion. The level of disturbance in forested areas/mangroves was defined as low, medium or high. The proboscis monkey populations across Sabah were categorized into seven areas (Figure 9), based on GIS and ground-truthing inferred connectivity of mangrove and forest, as well as using the minimum density of each population based on Sha et al. (2008), who used a limit of 500 m on either side of the transect.

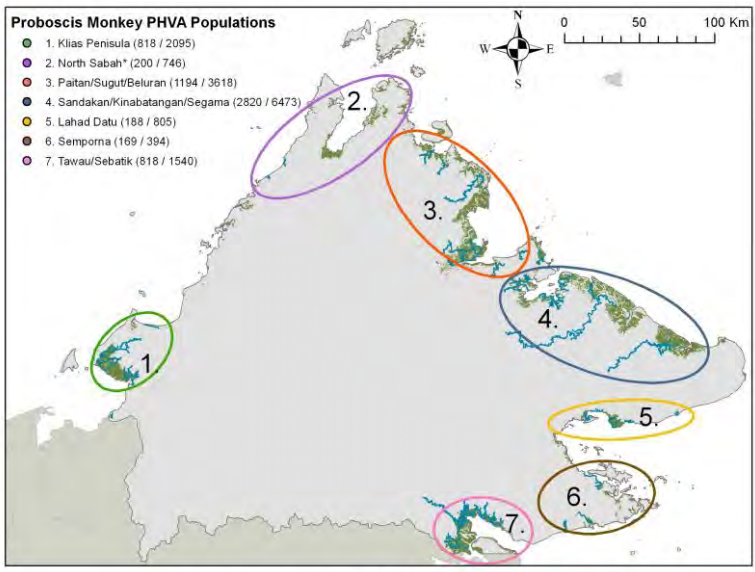

Figure 9. Proboscis monkey populations across Sabah categorized into seven areas, based on GIS and ground-truthing inferred connectivity of mangrove and forest (population number/carrying capacity). Population numbers are based on surveys conducted by Sha et al. (2008), except for populations marked with an (*).

For populations that Sha and colleagues did not survey, the average individual density of proboscis monkeys in mangrove forest was used. The percentage of area that was mangrove forest was calculated by determining the proportion of existing mangrove habitat compared to overall forest coverage, inclusive of both protected and unprotected areas. This was determined across areas surveyed by Sha et al. (2008). It should be noted that these data are largely linked to the reliability of existing GIS shapefiles and therefore figures may have limited accuracy. Since nipa palm (*Nypa fruticans*) is not considered a "suitable" habitat for proboscis monkeys (Kawabe and Mano 1972), the total value for mangrove habitat per population was divided in half, as an approximation of nipa prevalence. Mangrove utilisation of 50% was corroborated through Maxent habitat suitability modelling throughout Sabah (Nicola Abram unpublished data). The nipa palm value was subtracted from the total forested area to give the total suitable habitat availability for each population.

2.1 Klias Peninsula

The estimated population size of the proboscis monkey in the Klias Peninsula was 818 individuals (minimum count; Sha et al. 2008). It is estimated that the percentage of mangroves compared to forested areas is 33.22%. The proboscis monkey population is not connected to other populations in Sabah. However, a certain level of connectivity with populations in Sarawak is possible. Threats to the population in Klias mainly comprise hunting, loss of habitat (human settlement), dog attacks, expansion of palm oil plantations and other agricultural activities including aquaculture, construction of roads and highways (Pan Borneo Highway), and forest fires. Moreover, sedimentation in the estuaries near Weston in Brunei bay area due to silt and mud transported through the Padas river and other rivers from inland Sabah makes the area unsuitable for mangrove trees to grow. Therefore, loss of food tree species and mangrove habitat is threatening the proboscis monkey population in Weston. The disturbance in forested areas in the Klias Peninsula is low.

2.2 North Sabah (Kota Belud-Kudat-Pitas)

The current estimated population size of the proboscis monkey in Kota Belud-Kudat-Pitas region is about 200 individuals (DGFC/SWD surveys). The percentage of mangroves is estimated at 46%. Proboscis monkey populations in Kota Belud, Kudat and Pitas are not connected; being isolated from all populations in the state, and likely from each other as well. However, there is a slim possibility that the

population in Pitas is connected to the population in Paitan (to be confirmed by survey). The North Sabah populations are all affected by fragmentation and habitat loss. The population in Kota Belud is adversely affected by human settlement, dog attacks and hunting while the population in Pitas is affected by hunting and habitat loss caused by shrimp farming. The population in Kudat is affected by habitat loss and hunting. The disturbance in North Sabah"s forested areas is high. It is also very likely that several groups of proboscis monkeys will be affected by the development of the Pan Borneo Highway from Kota Kinabalu to Kudat.

2.3 Paitan-Sugut-Beluran

The estimated population size in Paitan, Sugut and Beluran is 1,194 individuals (minimum count; Sha et al. 2008). The percentage of mangroves is estimated at 26.5%. Proboscis monkey populations in Paitan, Sugut and Beluran are connected to each other. There is a possibility that the populations in Paitan and Pitas are connected via the mangrove areas along the coast. There is also a small likelihood of dispersal between the Sandakan and Beluran sub-populations. The populations in Paitan, Sugut and Beluran are all affected by hunting, oil palm cultivation, fragmentation and habitat loss. The proboscis monkey population in Sugut is affected by cultivation in riparian reserves. The disturbance in all three areas is quite significant, with Paitan and Sugut featuring higher fragmentation than Beluran. Overall, the disturbance is rated as medium.

2.4 Sandakan-Kinabatangan-Segama

The estimated population size in Sandakan, Kinabatangan and Segama is 2,280 individuals (minimum count; Sha et al. 2008). The percentage of mangroves is estimated at 17.75%. The proboscis monkey populations in Sandakan, Kinabatangan and Segama are connected to each other, with a higher connectivity level between the Kinabatangan and Segama populations compared to Sandakan and Kinabatangan. The population in Sandakan is affected by habitat loss, human encroachment, highways, roads and dog attacks. Proboscis monkeys in the Kinabatangan are likely split into two demographic groups, as a result of the construction of the bridge at Batu Puteh in 1991. The number of isolated sub-populations would have increased to three if the construction of the proposed Sukau Bridge had been implemented. The population is also threatened by habitat loss (see Stark et al. 2017a). In the Kinabatangan, tourism may have an impact on monkey ranging behaviour in small tributaries (Stark et al. in prep).

The Segama population is affected by habitat loss caused by oil palm cultivation, fragmentation of mangrove areas along the river, lack of riparian reserves at the Segama river, low incidence of hunting and high riverbank erosion caused by sand dredging. Overall, the disturbance is rated as medium.

2.5 Lahad Datu

The estimated population size in Lahad Datu is 188 individuals (minimum count; Sha et al. 2008) with the percentage of mangroves to forested areas being 68.5%. The monkey population in Lahad Datu is not connected to the populations in Segama and Semporna and is isolated. The population in Lahad Datu is affected by hunting, road kills and by habitat loss caused by oil palm plantations. The disturbance in Lahad Datu is among the highest of all areas in Sabah and therefore, is rated as high.

2.6 Semporna

The estimated population in Semporna is 169 (minimum count; Sha et al. 2008). The percentage of mangroves to forested areas is 95%. It should be noted that 50% of the areas that were surveyed in 2005 have been converted to oil palm plantations. The population in Semporna is isolated and not connected to the populations in Lahad Datu and Tawau. The main threats to the proboscis monkey population in Semporna are oil palm plantations, fragmentation, habitat loss and hunting. The disturbance rate in Semporna, along with Lahad Datu, is among the highest of all areas in Sabah and is rated as high.

2.7 Tawau-Sebatik island

The estimated population in Tawau and Sebatik is 811 (minimum count; Sha et al. 2008) with 70% of mangroves. The populations in Tawau and Sebatik are not connected to the population in Semporna. However, there is a possibility that the population in Tawau is connected to the population in North Kalimantan. The main threats to the proboscis monkey populations in Tawau and Sebatik are habitat loss, human settlements, hunting and fragmentation. For the Sebatik population, loss of genetic diversity, due to its small size, is a threat. The disturbance rate in Tawau and Sebatik is similar to Lahad Datu and Semporna and is also rated as high.

3) NON SITE-SPECIFIC PRIORITY ACTIONS

OBJECTIVE 1. HALT LOSS AND DEGRADATION OF HABITAT USED BY PROBOSCIS MONKEYS
Action 1.1: Prevent any further loss and degradation of suitable habitat for proboscis monkeys. Any area (including riparian forests) with presence of proboscis monkeys should be set aside as protected area and any aquaculture project development or settlement should be prevented in proboscis monkey habitat.
Rationale: Slowing the current rate of habitat destruction can drastically improve the future prospects of the proboscis monkey. It is imperative to adopt sustainable forest management certification within the next 10 years where proboscis monkeys exist and to reduce the risks associated with forest fires (education and prevention).
Goal 1: Lower the intensity of habitat conversion within proboscis monkey habitat by: • Providing clear reward/punishment mechanism, including clear incentive system for government and private entities as well as local community groups. • Working with oil palm plantations (OPP) to protect riparian forests (maintain corridor, decrease the flood effect). Goal 2: Promote the forest management unit of legal logging where proboscis monkeys exist to adopt the sustainable forest management certification by an independent (unbiased) party by: • Conducting training course on sustainable use of forest resources related to proboscis monkey habitat. • Accelerating the implementation of SFM certification by high priority forest management unit through available bridging program.
Priority: 10 years **Lead agencies:** SFD, SLSD, NGOs **Success measure/indicator:** No more destruction of riparian forests and mangroves (except alienated land).
Action 1.2: Quantify and compile current rates of proboscis monkey habitat loss in order to identify priority areas where loss of riparian/mangrove forests is highest.
Rationale: Mangrove and riparian forests are declining rapidly in Sabah and this is a major threat to proboscis monkeys because it reduces their habitat and fragments it into smaller disconnected patches. Compiling current rates of loss of proboscis monkey habitat in

Sabah will help to identify areas more at risk and therefore help prioritise conservation interventions. Identifying areas within proboscis monkey"s range where habitat loss is highest will inform the allocation of limited conservation resources to have the greatest positive impact on the conservation status of the species.

Resources available:
1. Definition of high-quality habitat for proboscis monkeys;
2. National mangrove and riparian forest cover targets;
3. Rates of mangrove and riparian forest loss, and identify hotspots of loss;
4. Satellite-based alert system to detect fine-scale deforestation in near-real time through Global Forest Watch (GFW).

Resources not available: Dedicated person to collate available data (Master student).

Priority: 1 year

Lead agencies: UMS, SFD, SaBC

Success measure/indicator:
1. Information compiled.
2. List of priority sites where mangrove/riparian forests loss is highest.
3. Documentation in the form of scientific reports/thesis/publications.

Action 1.3: Identify and map ecosystem services beneficial to people emanating from conservation of proboscis monkey habitat.

Rationale: Identifying ecosystem services from conservation of intact proboscis monkey habitat may increase political and public will, as well as financial resources through payment for ecosystem services, for protecting proboscis monkey habitat.

Resources available:
1. Existing action plans for other species;
2. Existing studies of ecosystem services.

Resources not available: Dedicated person to collate available data (Master student).

Priority: 1 year

Lead agencies: UMS, SaBC

Success measure/indicator:
1. Information compiled.
2. Documentation in the form of scientific reports/thesis/publications.

Action 1.4: Disseminate information about mangrove and riparian forests loss and its negative ecological consequences to authorities, RSPO, industry (aquaculture and agriculture), and the public in order to stimulate interest in maintaining intact mangroves and riparian forests.

Rationale: Proboscis monkeys are mangrove and riparian forest-dependent species. Greater awareness of the loss of those two crucial habitats among the authorities and the public may lead to increased interest in maintaining intact forest which may result in greater protection of proboscis monkey habitat.

Resources available:
1. State mangrove cover target;
2. Rates of mangrove and riparian forests loss, and hotspots of loss in Sabah;
3. Charismatic flagship species that are dependent on these habitat types (proboscis monkeys, orangutans, storm stork,…).

Resources not available:
1. Results from Action 1.1.
2. A plan and process to use the information to affect national policies.
3. Connection to existing networks and institutions working on advocacy regarding mangrove loss and ecosystem services (i.e. ALERT; NGOs, government department, and UMS).

Priority: 2 years

Lead agencies: SWCS, IUCN Primate SG and country nationals, to take forward policy recommendations; Effectively communicate with: (1) appropriate levels of government or stakeholders that can influence or impact land-use planning as well as (2) parties that impact mangrove and riparian forests change and loss such as aquaculture organisations and palm oil estates.

Success measure/indicator: Recommendations and solutions proposed to relevant decision-makers.

OBJECTIVE 2. INCREASE MANGROVE AND RIPARIAN FOREST AREAS SUITABLE FOR PROBOSCIS MONKEYS AND INCREASE HABITAT CONNECTIVITY BETWEEN THE DIFFERENT PROBOSCIS MONKEY HABITAT RANGES
Action 2.1: Perform a state-wide survey to determine current numbers of proboscis monkeys in the seven identified proboscis monkey areas, as well as in other locations where systematic surveys have not been done but where proboscis monkeys have been reported.
Rationale: The last comprehensive survey was carried out in 2005, 13 years ago. It is therefore necessary to assess the current status of the seven identified proboscis monkey populations in order to determine the best connectivity scenarios. It will also allow to identify pocketed groups, especially in the interior of Sabah.
Resources available: Data from 2005 survey: *ca* 5,907 individuals. **Resources not available:** Current information on previously surveyed populations and populations not surveyed. **Priority:** 2 years **Lead agency:** SWD **Partners:** ESCU (under SWD), UMS, NGOs, SaBC **Success measure/indicator:** Estimation of a new minimum population size.
Action 2.2: Mapping habitat quality in proboscis monkey habitat ranges
Rationale: Performing a habitat assessment in parallel with the state-wide survey that will include current and future land use, connectivity, status of protection and resource availability and will be crucial to identify the prime areas for connectivity**.**
Priority: 2 years (in conjunction with state-wide survey) **Lead agency:** ESCU (under SWD) **Success measure/indicator:** Maps of habitat quality in all proboscis monkey habitat ranges are produced.
Action 2.3: Identify potential connectivity between proboscis monkey habitat ranges

Rationale: Small populations are more likely to go extinct; keeping them connected increases likelihood of persistence, allows for rescue of declining populations through immigration, and promotes long-term genetic viability.
Priority: 2 years (in conjunction with the state-wide survey) **Lead agency:** ESCU (under SWD) **Success measure/indicator:** Connectivity maps for all proboscis monkey ranges are produced.
Action 2.4: Ensure that any lands harbouring proboscis monkeys are fully protected (riparian reserves, mangroves, semi-inundated forests, peat swamps, etc).
Rationale: Total protection and enforcement of the law should prevent any illegal harvesting of forest in those lands.
Priority: 5 years **Lead agency:** NRO **Partners:** SLSD, SP, SFD, SWD **Success measure/indicator:** All mangroves and riparian reserves are fully protected under SFD and DID. No illegal harvesting is happening in mangroves and riparian reserves.
Action 2.5: Encourage riparian reserves rehabilitation.
Rationale: The rehabilitation of riparian reserves (naturally or through replanting) would increase the stability of the riverbanks, as approximately 1 to 1.3 m of forest is lost annually along the Kinabatangan River. Moreover, large areas near the river have been classified as underproductive oil palm, making them not economically worthwhile. Although some areas have already been abandoned, they still belong to the plantation. Plantations should be encouraged to offer up the land where they are not able to grow oil palm.
Priority: 10 years **Lead agencies:** SFD, SLSD, SWD, OPP, NGOs, **Success measure/indicator:** Encroached riparian reserves are reclaimed, underproductive oil palm areas are offered for restoration.
Action 2.6: Improve policy/EIA for habitat protection.
Rationale: A special EIA must be produced for any development of

lands harbouring proboscis monkeys to prevent any loss of habitat and local extinction of proboscis monkeys.

Priority: 10 years

Lead agency: EPD

Success measure/indicator: No more loss of habitat and proboscis monkey populations in Sabah.

Action 2.7: Enforce the existing law in riparian reserves

Rationale: Despite riparian laws established riparian reserves within 20 m from rivers greater than 3 m in width (State of Sabah 1998), these laws are inconsistently enforced. Big oil palm companies need to be held to the same standards as small-holders and be held to the same degree of responsibility for any violations. The laws should also be made clear who is responsible for any land issues. Establishing a monitoring network that includes remote sensing activities (habitat monitoring) and involves local communities in programmes such as the Honorary Wildlife Warden Programme to monitor and regularly report on actions and threats.

Priority: 10 years

Lead agencies: SLSD, DID, SFD, SWD

Success measure/indicator:
1. A monitoring network is established.
2. Law is enforced in riparian reserves.
3. There is an increase of prosecution cases.

OBJECTIVE 3. LAW ENFORCEMENT AND PATROLLING

Action 3.1: Combat wildlife poaching.

Rationale: There is a need to increase the capacity and effectiveness of the State"s agencies in combatting wildlife poaching.

Resources available:
1. Existing PROTECT team at SFD.
2. Network of Honorary Wildlife Wardens (under SWD).
3. Enforcement unit at Sabah Foundation focusing on DaMaI Rainforest Complex.
4. SWD wildlife and enforcement officers.
5. Conservation units by concession holders upholding existing protocols on forest management.
6. Network of researchers collecting data in the field.

Resources not available:
1. Increase the capacity of PROTECT team with additional rangers and one crime analyst (intelligence unit using the SMART intelligence platform).
2. Increase the capacity of DaMaI enforcement unit.
3. Improve efficiency of HWW network (systematic HWW training could be given to security personnel of private sector companies whose properties are within clouded leopard ranges).

Measures to be taken:
1. Establish SMART patrols across all proboscis monkey ranges and standardise the reporting system and the data base (real time monitoring). There should be a centralised person that collects and analyses all the data (based at SWD or SFD headquarters). Ensure proper training in SMART data entry is given to at least one enforcement officer per site.
2. Hire and train crime analysts, investigators and intelligence gatherers to use the SMART intelligence platform and train a certified forensic technician at the Sabah Wildlife Health, Genetic and Forensic Laboratory.
3. MoU between oil palm plantations adjacent to protected areas and enforcement agencies (SFD, SWD) stipulating „no hunting" must be signed and enforced.
4. Pay reward to valid informants leading to prosecution of poachers.

Priority:
1. One person at SFD or SWD headquarters to compile all SMART data.
2. Two years for PROTECT and DaMaI enforcement units to be operational and confident in the use of SMART to document all patrols.
3. Two years to train a crime analyst and an intelligence gathering team in the use of SMART for queries and the SMART intelligence platform.
4. Two years for at least one officer at each site to be familiar and confident in the use of SMART for data entry.
5. Three years to train a forensic technician at SWHGFL.

Lead agencies: SFD (PROTECT), SWD (Enforcement team), SF (DaMaI)

Partners: WWF-Malaysia (Enforcement team), NGOs (HWW), OPP, SWHGFL, DGFC

Success measure/indicator:
1. Decrease of poaching in Sabah.
2. Increase of prosecutions of wildlife criminals in Sabah.
3. SMART database established.
4. Data base on enforcement operations established for each department and shared between departments.
5. Appointment and training of forensic technician for laboratory.

OBJECTIVE 4. RESEARCH

Action 4.1: Monitoring population sizes through time.

Action 4.2: Investigate demographic rates across several populations.

Action 4.3: Identify proboscis monkey habitat and measure its rate of loss.

Priority: These three actions should be carried out throughout the whole duration of the action plan.

Lead agencies: Research organisations (DGFC, UMS,…), NGOs and SaBC, with inputs from SFD, SWD, DID and SLSD

Success measure/indicator: Information compiled. Documentation in the form of scientific reports/thesis/publications.

OBJECTIVE 5. EX SITU, SEMI-WILD, TRANSLOCATION AND CRYOPRESERVATION

Action 5.1: *Ex-situ* programs are only encouraged for educational and awareness purposes but NOT as a conservation management strategy.

Rationale: The difficulties of maintaining captive populations of proboscis monkeys are well known and should not be encouraged in countries outside the tropics. The estimated numbers and general health of the current population in Sabah indicate that captivity is not currently necessary for conservation but can be encouraged for educational and awareness purposes.

Action 5.2: Discourage any semi-wild/habituated proboscis monkey programs in which artificial provisioning is a key for their success (i.e. Labuk Bay).

Rationale: Although the number of animals has increased in Labuk Bay, the diet provided is neither natural nor adequate. Moreover, it exposes the animals and the people to zoonoses and anthropozoonoses.

Action 5.3: Encourage expatriation of animals only under certain conditions.

Rationale: Animals could be sent to other captive populations, either existing or to be developed (preferably in countries with suitable climate). However, this has to be closely monitored due to the difficulties of maintaining captive proboscis monkeys. Husbandry methods must be shared and closely observed by the new facilities before any expatriation. It is recommended that the animals are sent as ambassadors with a monetary „compensation" from the receiving facility. These funds must only be used for *in situ* proboscis monkey conservation.

Action 5.4: Re-introduction and translocation

Rationale: Proboscis monkey translocation is not recommended. According to the IUCN guidelines, primates should not be released in a habitat where that species is already present. However, due to the rate at which forest is being lost in Sabah, translocation has become a critical issue and has occurred a number of times without any strict protocols. Therefore, if translocation is deemed necessary, then a protocol must be developed and adhered to and the following recommendations should be considered:

a. *Origin and release sites*: Although proboscis monkeys are found in riparian, swamp and mangrove forest, these forests are vastly different from each other and an individual from a riparian habitat may not fare as well in a mangrove habitat. The origin of the individual needs to be considered when identifying release spots.
b. *Post-release monitoring*: GPS collars can be programmed to record fixes at different schedules, and for some collars, the schedule can even be re-programmed when the collar is on the animal. Fix intervals can be adjusted throughout the post-release monitoring from frequent (detect small-scale movements) to less frequent. Activity sensors could also be included. The data from translocated individuals could be compared to those of wild proboscis monkeys. However, regular visual observations need to be made to ensure the health of the animal and to monitor any change in social status (e.g., solitary or formed/joined a social unit).
c. *Individuals released*: The social system of proboscis monkeys needs to be considered. It is unlikely that a single monkey released in an area with an existing population would be able to join a breeding group. However, younger individuals may have

more success by joining non-breeding groups. These groups are known to be fluctuating and used as a sort of half-way house before males are big enough to challenge the alpha male of a breeding group. Females have also been observed entering these groups. Population monitoring in an area can inform as to where these non-breeding groups normally are, and releases can be done near there. If a social unit requires translocation, then best efforts should be made to release in an area with few or no proboscis monkeys.

Action 5.5: Cryopreservation of gametes and cell culture

Rationale: To provide a source of genetic material that can help sustain genetic diversity long-term and that can be used to produce animals in the future. Semen and embryos produced in vitro can be cryopreserved in liquid nitrogen. Cell culture can also be developed and maintained, with samples cryopreserved.

Priority: 2 years

Lead agency: SWD

Partners: UMS, BORA

Success measure/indicator: Proboscis monkey tissue is cryopreserved.

OBJECTIVE 6. IMPROVE LEVEL OF AWARENESS AND EDUCATION AND STRENGTHEN REGULATIONS FOR PROBOSCIS MONKEY VIEWING

Action 6.1: To improve the level of awareness and education about proboscis monkey and their conservation.

Rationale: Local landowners are often unfamiliar with land and wildlife laws. Community forums should be held to inform local communities what the laws and punishments are for land and wildlife violations, but also to discuss options for developing their land in a way to promote co-existence with local wildlife.

Lead agencies: MTCE, SWD, SFD, SWCS, EPD, SEEN

Action 6.2: Develop guidelines for good tourism practices on proboscis monkey viewing.

Rationale: Proboscis monkeys are a focal species for tourism in Sabah. Although often referred to as eco-tourism, the lack of guidelines for tour operators, guides, boat drivers prevent it from being true “eco-tourism” and more nature tourism. Although tourism is a major financial income for Sabah, there are many foreign tour

operators that bring in their own guides, resulting in little financial gain by local communities. Furthermore, boat traffic in tributaries and small rivers may be disturbing proboscis monkeys, preventing river crossing or reducing feeding behaviour due to increased vigilance. The most popular viewing times of proboscis monkeys is early morning/late afternoon, and therefore limiting the number of boats that can enter small tributaries may reduce stress to the animals. There are also often boats that go out at night for wildlife spotting, and therefore, guidelines also need to include nocturnal observations of proboscis monkeys to avoid increasing disturbance when they are trying to sleep.

Targets: Tour operators, tour guides, tourists, independent lodges and jetties, independent boat men.

Recommendations:

1. Regular monitoring of tourists and proboscis monkey groups in major tourist destinations should be conducted. Proboscis monkey observations should include recording number of groups, group composition, activity patterns, and river-crossing behaviour. Tourist observations should include: number of people on a boat, the number of boats, and behaviour of tourists/guides/boat man. These data can be used to monitor the effectiveness of the guidelines and suggest improvements where necessary. Regular monitoring by enforcement agencies should increase (i.e. Honorary Wildlife Warden).
2. Only approved tour guides and local boat drivers who have undertaken official training (CTRE) should take tourists on river cruises.
3. Tourist/Guide/Driver behaviour: no vocal playbacks, spotlights, laser pointers, feeding, smoking, or littering. Speaking should be kept to a minimum and at hushed levels.
4. Boat behaviour: slow boat speed when approaching group, recommended distance of 20 m on main rivers; in tributaries on the opposite bank, never perpendicular or directly under the group (can allow for crossing behaviour). The engine should not be revved.
5. Number of boats: limit the number of boats that can enter a tributary at once. Research is needed to identify the current number in order to make an informed suggestion as to how many it should be.

OBJECTIVE 7. MONITORING

Action 7.1: Set up an Endangered Species Conservation Unit (ESCU) that will monitor the implementation of all action/conservation plans on totally protected (Schedule 1) terrestrial species in Sabah: elephant, banteng, proboscis monkey, orangutan, Sunda clouded leopard, Malayan sun bear and Sunda pangolin.

Rationale: Sabah Wildlife Department, the custodian of wildlife in Sabah, need assistance to implement these endangered species action plans. ESCU will provide manpower and expertise to monitor the implementation of the action plans, meet with the different stakeholders and prepare the annual reports and mid-term reviews for each action plan.
Priority: 10 years **Lead agency:** SWD **Partners:** NGOs, DGFC, UMS **Success measure/indicator:** The action plan is implemented. A short review is carried out every year by ESCU. A mid-term review is drafted after 5 years by ESCU.

4) SITE-SPECIFIC PRIORITY ACTIONS

In order to prevent the extinction of the proboscis monkey in Sabah the following conservation strategies are needed in each site harbouring proboscis monkeys: (1) maintaining and/or increasing the current population size, (2) eliminating hunting, (3) eliminating deforestation, (4) implementing reforestation programs, especially in mangroves and (5) reconnecting sub-populations.

4.1 Klias Peninsula

The major issue for the proboscis monkey population in Klias is that it is not connected to any other populations in Sabah.

Action 1: Maintain the current population size (around 800 individuals) as it is totally isolated.

Action 2: Develop and promote responsible proboscis monkey tourism guidelines (training tour guides and boatmen, maintain distance between tourists and monkeys, etc. See Objective 6). Reduce boat traffic and noise disturbance when the animals are preparing to sleep for the night. Prevent disease transmission due to close contact between people and monkeys.

4.2 North Sabah (Kota Belud-Kudat-Pitas)

Action 1: Avoid any process that would further fragment the proboscis monkey population along the west coast of Sabah between Kota Kinabalu and Kudat (e.g. Pan Borneo Highway).

Action 2: Promote responsible eco-tourism opportunities in Kota Belud around proboscis monkeys.

Action 3: Increase enforcement in Pitas area where hunting pressure is high.

Action 4: Partner with the shrimp industry for mangrove forest rehabilitation in Pitas and Kudat in order to reduce the environmental and social impacts of shrimp aquaculture.

4.3 Paitan-Sugut-Beluran

Action 1: Enhance connectivity between Paitan and Sugut and between Sugut and Beluran.

Action 2: Reduce hunting by increasing enforcement.

4.4 Sandakan-Kinabatangan-Segama

Action 1: Maintain connectivity between Sandakan Bay and the Lower Kinabatangan-Segama Wetlands Ramsar Site through protection and enhancement of mangrove forests.

Action 2: Avoid any process that would further fragment the proboscis monkey population (bridges, highways, etc).

Action 3: Investigate the feasibility of re-connecting upper and lower Kinabatangan at Batu Puteh bridge.

Action 4: Recover and restore all illegally-encroached riparian forests by oil palm plantations along the Kinabatangan and Segama rivers.

Action 5: Develop and promote responsible proboscis monkey tourism guidelines (training tour guides and boatmen, maintain distance between tourists and monkeys, etc)

Action 6: Prevent disease transmission due to close contact between people and monkeys (Labuk Bay). Ban proboscis monkey feeding in Labuk Bay and at any touristic site.

4.5 Lahad Datu

Action 1: Ensure that connectivity between the small sub-populations in the area is not jeopardised.

Action 2: Enhance connectivity between sub-populations.

4.6 Semporna

Action 1: Ensure that connectivity between the small sub-populations in the area is not jeopardised.

Action 2: Reduce loss of habitat where proboscis monkeys are present.

4.7 Tawau-Sebatik island

Action 1: Reduce habitat loss and disturbance rate in Tawau and Sebatik island.

Action 2: Ensure that connectivity between the small sub-populations in the area is not jeopardised.

5) IMPLEMENTATION, MONITORING, EVALUATION AND BUDGET

5.1 PMAP implementation

This is a 10-year action plan (2019-2028). In order for this plan to achieve its ultimate objective of securing the future of the proboscis monkey in Sabah, all recommendations should be formulated by SWD and endorsed by the Sabah State Cabinet.

The implementation of the PMAP remains the responsibility of SWD. However, assistance from other relevant government departments such as SFD, SF and SP will be provided.

A Plan of Operation (PoA) for all suggested activities and their time line will be needed and must be prepared before implementing the PMAP. The PoA will also serve as a basis for monitoring the implementation of the activities. The PoA will be prepared by ESCU.

It is proposed that a SPECIES ACTION PLAN COMMITTEE led by Ministry of Tourism, Culture and Environment is created, consisting of members from relevant NGOs, research institutions and government departments that will assess the implementation for each species action plan (elephant, orangutan, proboscis monkey, Sunda clouded leopard, Bornean banteng and any future action plans (sun bear, pangolin, etc.). The relevant NGOs in Sabah are namely: HUTAN, LEAP, WWF-Malaysia, SET, PACOS, etc. The relevant research institutions in Sabah are namely: Universiti Malaysia Sabah, SEAARP and DGFC. The relevant government departments in Sabah are namely: SFD, SF, SP, Land and Survey, DID, MAFI.

5.2 PMAP monitoring and evaluation

On a yearly basis, an overview and analysis of progress will be produced by SWD and circulated to the relevant government departments and stakeholders. A mid-term review will be carried out at the end of 2023 (five years) by SWD with the assistance of the main stakeholders. The plan will be fully reviewed and rewritten at the end of 2028 (10 years). SWD will be assisted by the ENDANGERED SPECIES CONSERVATION UNIT that will be set up in 2019, providing that funding is obtained.

5.3 PMAP budget

Survey and habitat quality mapping	RM1,000,000 for 2 years
Endangered Species Conservation Unit	RM10,000,000 for 10 years
Enforcement unit	RM20,000,000 for 10 years

6) LIST OF ABBREVIATIONS

CTRE	Continuing Tourism Related Education
DaMaI	Danum Valley-Maliau Basin-Imbak Canyon
DGFC	Danau Girang Field Centre
DID	Department of Irrigation and Drainage
EPD	Environment Protection Department
ESCU	Endangered Species Conservation Unit
EIA	Environmental Impact Assessment
HFR	Honorary Forest Ranger
HPR	Honorary Park Ranger
HWW	Honorary Wildlife Warden
KOCP	Kinabatangan Orang-utan Conservation Programme
LEAP	Land Empowerment Animals People
MAFI	Ministry of Agriculture and Food Industries
MTCE	Ministry of Tourism, Culture and Environment
NRO	Natural Resources Office
OPP	Oil Palm Plantations
PHVA	Population and Habitat Viability Analysis
PMAP	Proboscis Monkey Action Plan
RSPO	Round Table on Sustainable Palm Oil
SEAARP	South East Asia Rainforest Research Partnership
SEEN	Sabah Environmental Education Network
SF	Sabah Foundation
SFD	Sabah Forestry Department
SFM	Sustainable Forest Management
SG	Specialist Group
SLSD	Sabah Lands and Surveys Department
SP	Sabah Parks
SWCS	Sabah Wetland Conservation Society
SWD	Sabah Wildlife Department
UMS	Universiti Malaysia Sabah
YSD	Yayasan Sime Darby

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19. Meena Lakshana a/p Mahadevan Ramadas, Yayasan Sime Darby
20. Erica Choong Mei Ling, Yayasan Sime Darby

Figure 10. Members of the Species Action Plan committee during the "Population and Habitat Viability Assessment" carried out at Gaya Island Resort.

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