Priscillia Miard 2012

A Comparison of the Habitat and Behaviour of two individual Bornean Slow loris; an adult female and a subadult female

INTERNSHIP REPORT FOR MASTER 1
Biodiversité Ecologie Environnement

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Internship at Danau Girang Field Centre
Lot 6
The Jungle
Lower Kinabatangan Wildlife Sanctuary Sabah
Under the direction of Benoit Goossens

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Abstract :

The Bornean slow loris, *Nycticebus menagensis,* is increasingly threatened by the destruction and fragmentation of their native forests. Deforestation is a very big issue in Borneo because of the palm oil plantation. Housing these nocturnal species allows for researchers to study behavioural traits that may be difficult to be viewed and interpreted in the wild (Rasmussen, 1986; Fitch-Snyder and Elrich, 2003). However, in this study, a wild adult female and subadult female were tracked to observe their habitat and behaviour. This study was 3 months long, starting in April and ending in June 2012. The Bornean slow loris is not a well known species and has only recently been identified as a separate species based on genetic analysis. Most of the studies on this species have been done on individuals in captivity or rescued from wildlife trade. This study supports the need for future projects in an attempt to know more about their habitat and to preserve this species of slow loris in the wild.

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Introduction :

Today, primates from all over the world suffer from human-wildlife conflict, pet trade, habitat loss, bushmeat trade and disease especially little known species, such as *Nycticebus menagensis*, in South east Asia. They are relatively small and are the world's only poisonous primates. Although five species within this genus have been confirmed through genetic analysis (Roos, 2003), systematics of the genus *Nycticebus* are still unresolved with many researchers still considering them as a subspecies.

The Bornean slow loris *N. menagensis* is of the subgroup Prosimians, suborder Strepsirrhini. It is the smallest of all slow lorises, with a body weight between 265 and 300 grams. It can be distinguished from the others genetically but also by light marks on its head and the consistent lack of a second upper incisor (Groves 1998; Ravosa 1998; Chen et al. 2006). This species is present in Brunei; Indonesia (Kalimantan); Malaysia (Sabah and Sarawak) and the Philippines (southernmost).

Nycticebus menagensis can be located by its strong orange-red eyeshine caused by the tapetum lucidum, a reflective layer at the back of the eye. This eyeshine is very similar to that of other sympatric species and so other characteristics were considered during species identification (Schulze, 2004) including slow-climbing movements, hiding of the face and eye-blinking patterns. (Wiens, Cited in Schulze, 2004). These precise movements provide camouflage and protection (Nekaris and Bearder, 2007). They are not visible through dense forest which provides chalenges for field work and census studies (Wiens, 2002).

The tropical forests of Southeast Asia in which these species naturally reside are disappearing at a fast rates. About 300 million hectares of forests over the course of twenty years have been converted to other land uses such as cash crops, farms, and large-scale rubber or palm oil plantations (The World Conservation Union/IUCN, 2006).
The loss and fragmentation of this species' habitat threatens the genetic viability of wild populations and reduces the range in which they may travel, as slow loris movement is restricted to continuous pathways due to the fact that they are incapable of leaping (Rasmussen, 1986).
Regardless of them being totally protected, they are sold in the wildlife trade (Nekaris and Jaffe, 2007). It is currently considered amongst the least threatened of the lorises. On the IUCN (International Union for Conservation of Nature) red list its conservation status was Vulnerable but this was based on old paper and sightings by local people and not on quantitative data.

Observations were made on one female slow loris (*N. Menegensis*) who was caught and collared before she was released. The observations consisted of searching for the sleeping sites, tracking during the night and conducting habitat analysis around the sleeping trees. The aim of the study was to estimate her home range and whether there was a preference of sleeping trees . I also used data collected by Alice Miles, another student at Danau Girang Field Center, who tracked a subadult female between September and November 2011.

Presentation of the species

Nycticebus menagensis is the smallest of the slow loris. It is unknown if there is only one species in Borneo or more. They are nocturnal, solitary and males are thought to be bigger than females. The home range is also thought to overlap between individuals.
Slow lorises have a peculiar slow mode of locomotion; they never jump and rarely make any noise when moving (Ishida, Hirasaki & Matano, 1992; pers. obs.). The combination of nocturnal, solitary and arboreal behaviour together with slow locomotion and no alarm calls seems to be effective in evading the attention of predators, mainly snakes, civets and owls.

They are also poisonous and have very sharp needle-like teeth on their lower jaw, shaped like a spade. Their bite is so painful and agonizing that they can create extreme allergic reactions (in some cases ; anaphylactic shock), followed by haematuria in reaction to the allergen.
They eat essentially insects, sap and sometimes nectar.

Materials and Methods :

Bornean slow loris survey :

1) Study area

We are working in the Kinabatangan River basin, in Sabah, Malaysia (Fig 1). The Kinabatangan River is Sabah's longest and Malaysia's second longest river at 560km long. Much of the lower Kinabatangan river passes through the Kinabatangan Wildlife Sanctuary. It meanders through a flood plain creating numerous oxbow lakes and making it an ideal environment for some of the best wildlife found in Malaysia.

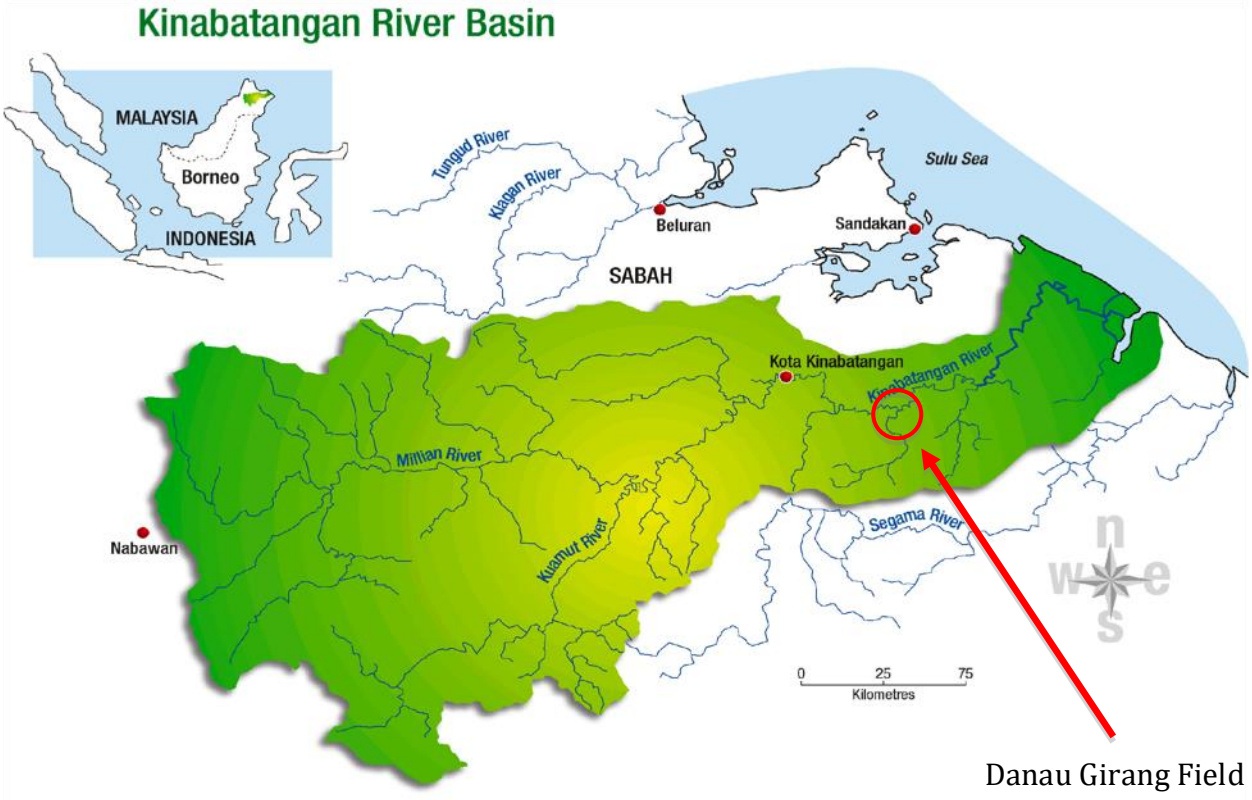

Fig 1 : Map of Kinabatangan River Basin and localisation of the Centre.

Source : WWF Malaysia

Kinabatangan Wildlife Sanctuary is one of the two known places in the world to be

inhabited by ten species of primates four of which are endemic to Borneo. It has the highest concentration of proboscis monkeys and orangutans in Malaysia. Other wildlife includes long-tailed macaque, pig-tailed macaque, Bornean gibbon, two nocturnal primates; the Bornean tarsier and the Bornean slow loris and other mammals including Asian elephant and Sumatran rhinoceros. Many other animals are also found here including the Malayan sun bear, the clouded leopard, Malay civet, crocodile, python, tortoise, monitor lizard and 200 species of bird such as the hornbill.

The climate is tropical hot and wet, with temperatures between 22°C and 33°C. The annual precipitation varies between 1500 to 4000 mm in the monsoon period. The humidity varies between 70% to 90% in the daytime and exceeds 90% during the night. All of these conditions allows the extreme diversity in plants and animals in the rainforest.

2) Survey techniques

The animal in this survey is a female who was caught and released were she was found after she was collared. With this we can now find exactly where she is using a VHF Receiver. Telemetry is often used to study wildlife, and has been useful for monitoring threatened species at the individual level. The collar has a frequency and the telemetry allows us to track the animal. A minumum of two people is needed when going out in to the forest for safety reasons. The survey can be divided into three parts :

- **Sleeping site during the day** :

Each day we went into the forest to look for the sleeping tree. We used the telemetry to find which tree the loris was in by listening for the loudest signal. Sometimes we could see her, so we knew exactly in which tree she was sleeping, but sometimes she was very high and we could not see her. So here we tried to find the tree which had the loudest signal. We often found her in trees with lots of vines, so this helped to identify which tree she was in. When we found the tree we marked it with biodegradable flagging tape and we took a GPS point.

- **Tracking during the night** :

We used a white light to see the eyeshine. Slow lorises are active from 18h00 to 6h00, so we have divided it in to three hour segments, because it was not possible to tracked the animal for a full night. So the first night we went out from 18h00 to 21h00. The second night we went out from 21h00 to 00h00. The third night we went out from 00h00 to 3h00. Finally the fourth night we went out from 3h00 to 6h00 and a day off between each 4 days of going out in the night.

During these three hours we tracked her and noted what she is doing every 15 minutes (moving, eating, grooming,resting and other). And every 15 minutes we marked her location using a GPS and afterwards we can saw the route she took.

- **Habitat analysis :**

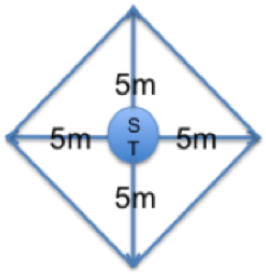

Fig 2 : Sleeping plot

Once we know her sleeping sites we go in to the forest and take measurements. We only chose the trees where we saw her during the day or where she sleeped more than one time. We only measured 10 sleeping sites because we thought this was enough trees to get an idea of the preferred habitat.

We measure a plot of 5 meters around the sleeping tree. We obtained a square of $50m^2$. (Fig 2)
We also identified the species of the sleeping trees.

In all of the plots trees above 1m in height were measured for their circumference at breast height (CBH) and height. We used a clinometer to get the angle and calculated tree height using trigonometry (Fig. 3)

We took a picture of the tree canopy and using the program 'Image J' worked out the canopy density. We worked out the canopy density 5 times and took the mean density. After we use R to compare them.

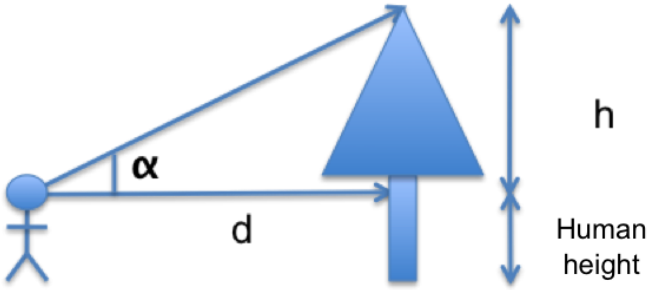

Fig 3 : Trigonometry to calcul the Height of the trees

3) Statistical analysis

GPS points were loaded on to 'Garmin RoadTrip'and Microsoft excel for the habitat analysis and behaviour. After we used ArcGIS to create a map of the home range and R was used for statistical analyses and compare if there was a significant difference between an adult female and a subadult female slow loris. The statistical significance at $\alpha = 0.05$ was accepted.

Results :

Data analysis on the adult female, named Boss, was carried out from the April 12th to the 14 th of May 2012. For the subadult female, named Krik, data was collected from the 27th of August to the 12th of November 2011.

1) Home Range

With the tracking we have enough GPS point to begin to define a home range for Boss and Krik (Fig 4). We can see that Boss has a bigger range than Krik.

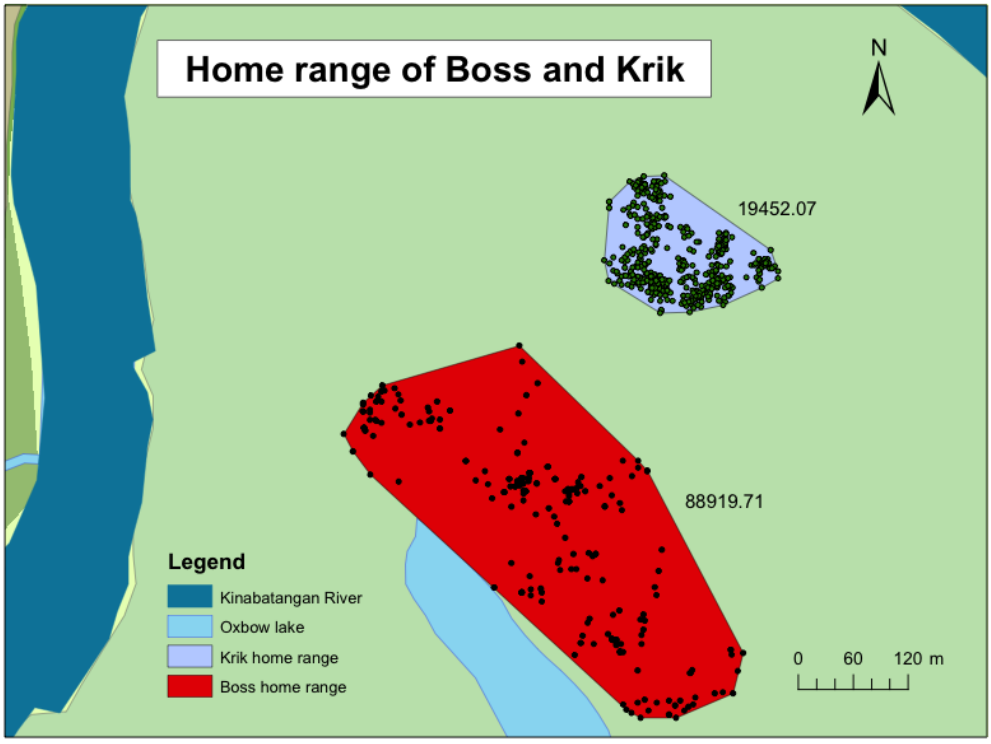

Fig 4 : Home range of an adult female named Boss (red) and a subadult female named Krik (blue). The range is measured in square metres.

2) Tracking

A) Height of sighting

Boss were sighted 61.51% of the time during the study and at a median height of 14.60m (range: 1-30m). Krik was sighted 26 % of the time during the study period and at a median height of 12.15m (range: 2-25m). The height is signifcantly different between Boss and Krik (Student test t = 3.0861, df = 306.668, p-value = 0.002213) and figure 5 shows that Boss stay higher than Krik during the night.

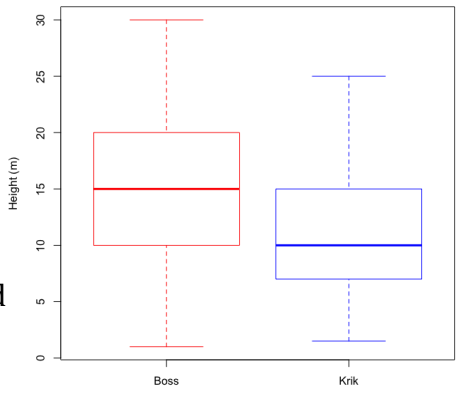

Fig 5 : Height during the sighting in the night of an adult female (red) and a subadult female (blue)

B) Distance travelled in three hours

If we look at the distance travelled:

Boss is more active bewteen 18h00 to 21h00 compared to the other 3 hours segments and showed similar distance traveled for the rest of the night (Fig 6).

For Krik she seem to be more active between 18h00 to 21h00 and 00h00 to 3h00 (Fig 7). When the two lorises were compared there was no significant difference (student test t = -1.8562, df = 5.195, p-value = 0.120).

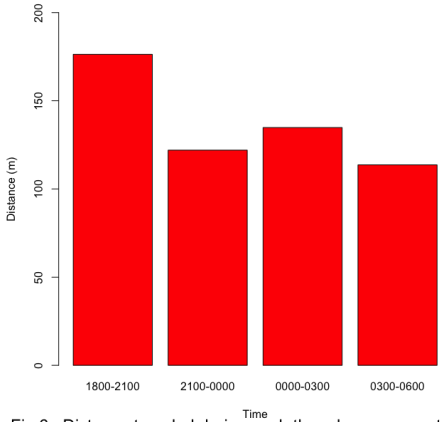

Fig 6 : Distance traveled during each three hour segments by an adult female (Boss)

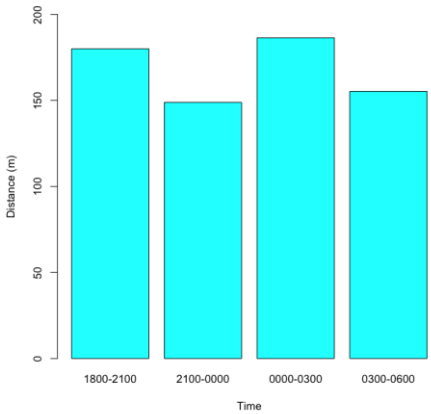

Fig 7 : Distance traveled during each three hour segments by a subadult female (Krik)

3) Behaviour

A) Comparison

When comparing behaviour for Krik and Boss for one night there was no significant difference (kruskal Wallis test : p-value > 0,05 for all the test).

Figures 7 and 8 show the different behaviours of Boss and Krik for each three hour segments.

Krik eats more during the periods 18h00 to 21h00 and 3h00 to 6h00. She moves a lot during all time periods. She grooms herself for almost the same lenght of time each nigh. She tends to just rest between 00h00 to 3h00. We heard vocalization just one time (Fig 8).

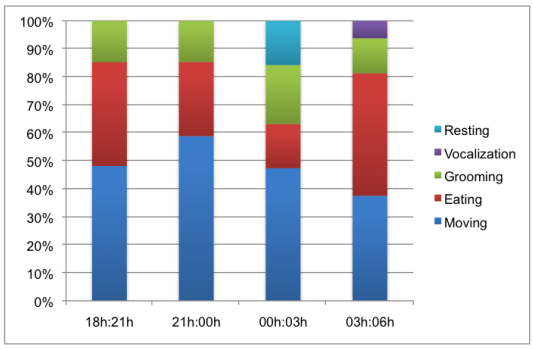

Fig 8 : The mean percentage of the different behaviours for each three hour segments of a subadult female (Krik)

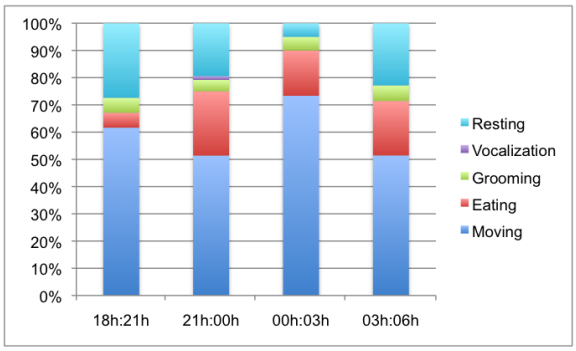

Fig 9 : The mean percentage of the different behaviours for each three hour segments of an adult female (Boss)

Boss spend a lot of time moving. She eats more after 21h00 and until sunrise. She rests a lot at 18h00 to 21h00 and 3h00 to 6h00 and is less likely to be found resting at other times especially until during the period 00h00 to 3h00. We heard vocalization just once (Fig 9).

B) Other

We saw Boss interact with other loris on just a few rare occasions. Boss was seen chasing another slow loris which was in the same tree as her, possibly another female who was in her home range or maybe a male. We heard vocalization just one time between our loris and another one. They were on the same tree and eating sap.The other loris was a little bigger but we are not sure whether it was a male. . On a few occasions, Boss was seen with two other lorises in the same tree one was much larger and an other one is known to be her baby so we thought the bigger one was the male. Krik was seen with her mother in the same tree few times and once in a tree with three other individuals.

4) Habitat analysis

A) Canopy cover

Boss has a mean canopy cover of 89.450% and for Krik 89.312% (Fig 10). There is no significant difference between Boss' and Krik's results (Student test t = 0.0833, df = 15.162, p-value = 0.9347).

They utilise habitat which has the same tree density (Fig 10).

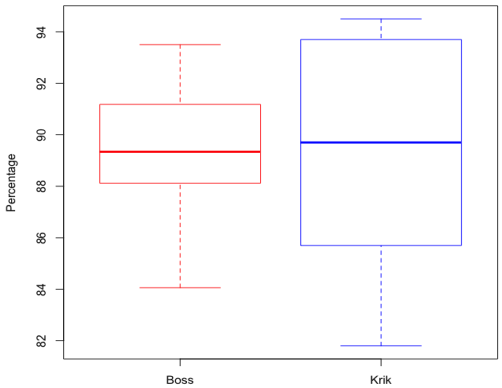

Fig 10 : Mean percentage of canopy cover in sleeping sites of an adult female named Boss (red) and a subadult female named Krik (blue)

B) Sleeping trees

a) General

Between each sleeping tree there was a mean distance of 142.46 m. The mean height of the sleeping trees was 16.67m. She was seen 45.95% of the time. Krik was never sighted in a sleeping tree.

Krik had 33 supposed sleeping trees and went back to some of them more than once in some of them. Boss has 33 sleeping trees n the 14th of May but more have been found since the completion of this field study.

b) CBH of sleeping trees

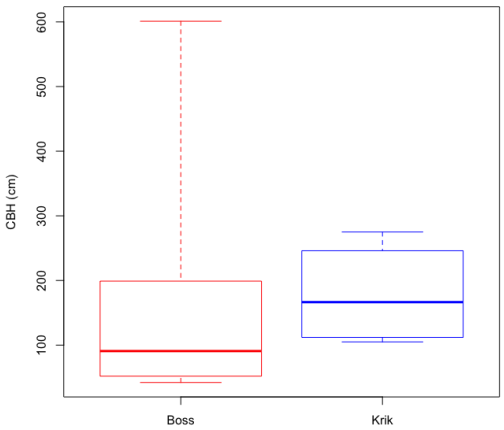

Fig 11 : CBH of sleeping trees of an adult female named Boss (red) and a subadult female named Krik (blue)

The sleeping trees have a mean CBH of 148.96cm for Boss and a mean of 178.65cm for Krik. These result are not significantly different (Wilcoxon test W = 24, p-value = 0.05381) (Fig 11). So Boss and Krik stay during the day in tree with similar CBH.

c) Height of sleeping trees

The sleeping trees have a mean height of 22.20m for Boss and 23.54m for Krik. These result are not significantly different (Wilcoxon test W = 36, p-value = 0.3073) (Fig 12). So they stay during the day in tree of similar height.

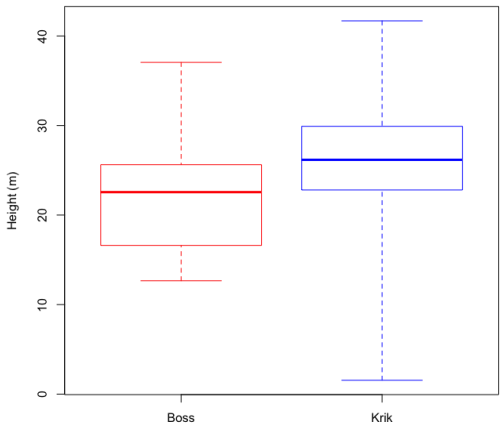

Fig 12 : Height of sleeping trees of an adult female named Boss (red) and a subadult female named Krik (blue)

C) Sleeping plot

a) Number of trees in sleeping plot

The number of trees in Boss sleeping plot was 29.2 and Krik 20.6 (Fig 13). The numbers are really close but there is a significant difference (Student test t = 2.2473, df = 17.91, p-value = 0.03746) and Boss have sleeping plot with more tree.

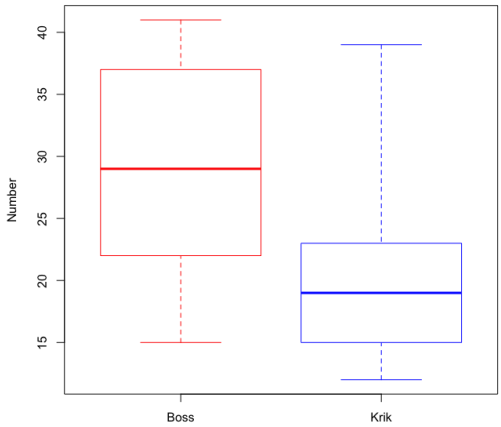

Fig 13 : Number of trees in sleeping plot of an adult female named Boss (red) and a subadult female named Krik (blue)

b) CBH of trees in sleeping plot

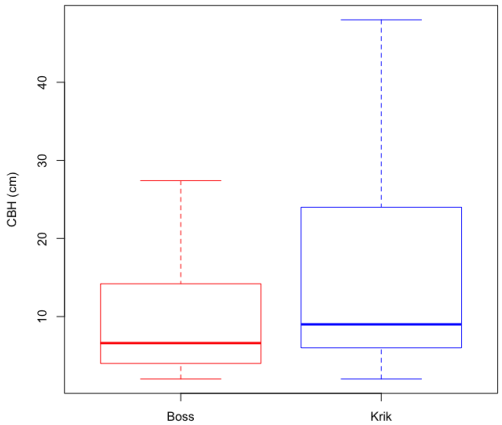

Fig 14 : CBH of trees in sleeping plot of an adult female named Boss (red) and a subadult female named Krik (blue)

The mean CBH of trees in Boss's sleeping plot is 18.71cm and for Krik 27.01cm. The means are significantly different (Student test t = -2.0138, df = 423.816, p-value = 0.04466) so Krik uses sleeping sites with bigger trees than Boss (Fig14).

c) Height of trees in sleeping plot

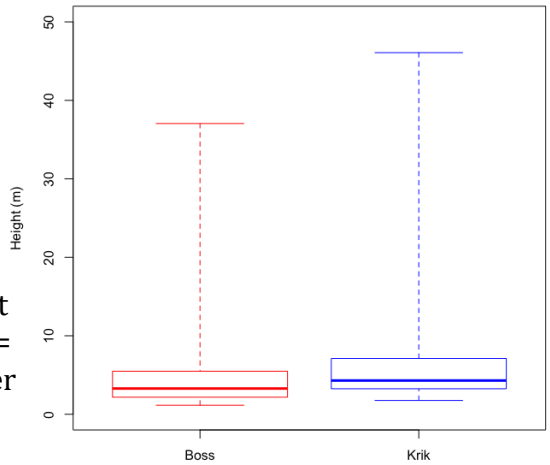

Fig 15 : Height of trees in sleeping plot of an adult female named Boss (red) and a subadult female named Krik (blue)

The mean height of trees in Boss' sleeping plot is 5.32m and for Krik 7.36m. The means are significantly different (Student test t = -3.1119, df = 352.928, p-value = 0.002011) so Krik use sleeping site with taller trees than Boss (Fig 15).

D) Overall analysis of sleeping sites

a) Comparison of sleeping site

Boss sleeping site : Canopy cover : 89.45%
Plot : Tree height : 5.32m
Tree CBH : 18.71cm
Number of tree : 29.2

Krik sleeping site : Canopy cover : 89.31%
Plot : Tree height : 7.36m
Tree CBH : 27.01cm
Number of tree : 20.6

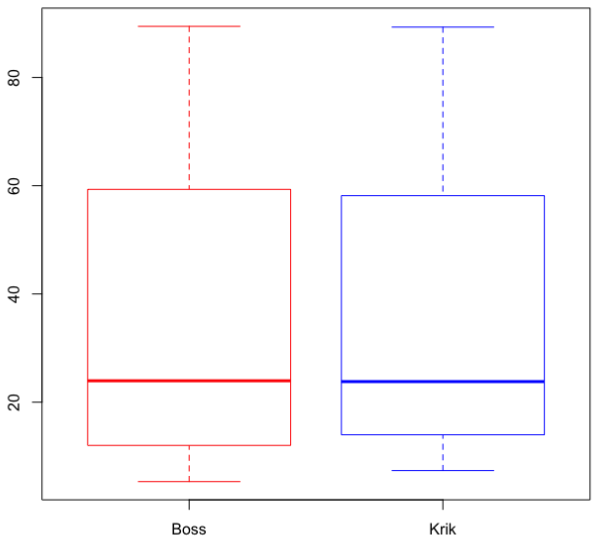

Fig 16 : Comparison of sleeping site of an adult female named Boss (red) and a subadult female named Krik (blue)

Even if there is a general difference in the sleeping plot Boss and Krik use similar sleeping sites (Student test t = -0.0154, df = 5.998, p-value = 0.9882) (Fig 16).

b) Map of sleeping trees

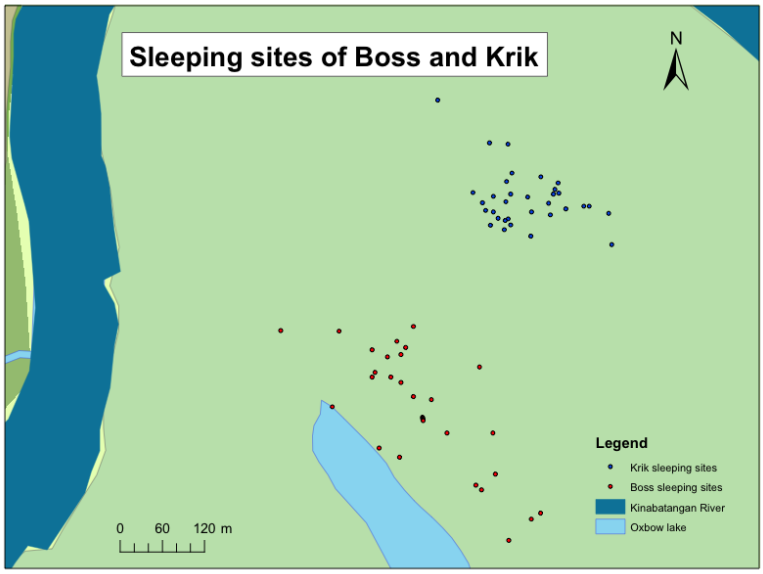

Fig 17 : Sleeping sites of an adult female named Boss (red) and a subadult female named Krik (blue).

The sleeping trees are distributed acros both loris's home ranges (Fig 17).
Out of 10 sleeping trees analysed for Boss there were 8 different tree species represented. Likewise, of 10 sleeping trees analysed for Krik there was 8 different tree species.

On the analysis of the tree the same species appear for both of them for example the *Pterospermum sp*. (family: Sterculiaceae), *Alstonia sp* (family : Apocynaceae) and others.

Discussion :

The principal objective of this study is to compare the habitat of two individuals of Bornean slow loris because this has never been done before. The data from the female subadult whas the first on this species in all of Borneo and the female I studied was the second.

Determination of home range is an essential basis for ecological study of any species, and equally essential for efforts directed at conservation and management (Mohr, 1947; Layne, 1954). We saw differences between the range of the female adult and the female subadult, the adult has a range 4.6 time greater than the subadult female. This was an expected result because krik was younger than Boss and younger primates need time to find their own range.

For the species *Nycticebus cougang* " Home ranges of males being larger than those of females with females' home ranges laying almost entirely within the males" (Wiens and Zitzmann, 2003). So we can suppose it is the same for our species because we saw more than one loris together.

Conditions at night are not optimal for animal observation. This, along with the cryptic behaviour of some nocturnal species means that the study of interactions, relationships and levels of sociality can be difficult to research (Sterling and Richards, 1995).

The data may have been biased at the beginning of the study, because she had to adapt to us and we needed time to become familiar with her normal behaviours. We never see the two individuals during all the tracking time. When they were really high we could not really see what they were doing and make mistake because we are not specialist on this species but were able to identify some basic behaviour.

During the tracking we can see that the adult stay higher than the younger but they moved the same distance. Maybe as a subadult they stay lower in the trees. But this is just assumption because Krik was seen less than Boss so maybe there is data lacking. In all the tracking on the two individuals they never went on the ground they always stayed on vines when they came low. Slow lorises are exclusively nocturnal and become active soon after sunset (Wiens and Zitzmann, 2003).

This species seems to be solitary but we saw them with other individuals so they could share eating trees and home ranges. Previous research into slow loris social systems by Wiens and Zitzmann (2003) suggested that spatial groups of slow lorises consist of an adult pair and its own offspring. Therefore, this could support my findings.

My observations of the diet comfirm the fact that *Nycticebus menagensis* eats primarily insects unlike the other slow loris species who eat fruit. I saw her eating sap and we suppose she eat nectar too (slow lorises consumed phloem sap, floral nectar/flower parts, fruit, gum, and arthropods; reported in Wiens, 2002). The subadult female ate a lot when she first woke up and before she sleep again in the morning, maybe because she is younger and needs it more than an adult who eats throughout the night. However data maybe lacking because there are so high and hard to see.

One important thing in this study is that the species needs forest with high connectivity, as my results showed they prefer trees with more than 80% canopy density. Without this the individual can't move because they can't jump and they rarely go on the ground. We suppose that this finding provides evidence that habitat loss and fragmentation is a significant threat to such a species which requires high connectivity.

We have found 33 sleeping trees for Krik and for Boss the same but we now know she has more trees since I write my report. Another study on *Nycticebus coucang* on peninsula malaysia (Wiens and Zitzmann, 2003) said they have 60 sleeping tree but this species is bigger than ours. From my results they don't have a preferred trees species to sleep in, but they prefer an environment with dense vines and high connectivity.

The problem with the slow loris species and the fact they are not often studied in the wild is that even professional people who release them from the pet trade don't know the difference between the species. Sometimes this leads to bad things such as the realease of slow loris in the wrong habitat as Schulze and Groves (2004) showed; and especially for the Bornean slow loris because it is the least known species. Other survey (Grace Blackham, 2005) suggests a lower abundance of *Nycticebus menagensis* in few places. One thing what is not clear is to see if they has a difference between habitat conditions, including seasonal variation can affect the detection (Ross and Reeve, 2003).

This survey occurred on only two female individual and maybe another survey like this one with more individuals including males and females of different ages could better represent this species. Other studies have been conducted on the differences bewteen the 5 species of slow loris to recognize them but not on their habitat. With more individuals we can see if they have special social groups like in other species. We can also do a study on different sorts of habitat to see if it makes a difference or not in the range and the behaviour. This is important because of the deforestation in Sabah.

If we want to do another study on the loris we have to change some things. For example, study more the canopy and less of the smaller trees in the plot. For the tracking in the night something like night vision binoculars could help us to really see what she is doing when she is really high.

With a study with more individuals and with samples for genetic testing, it will show us if there is only one species in Borneo or more because this is not really clear for now. In fact this

species is known at data deficient on all protection organization and if we know it more it could help for their protection.

Acknowledgements

I first would like to thank my teacher, Dr Francois Pompanon, because without him I never have a contact with Dr Benoit Goossens and all of this experience never happened.

I really want to thank Dr Benoit Goossens for welcoming me here in this wonderfull place where student can come and leave with beautiful memory. We also learn so much here we never come back the same.

I want to thank my family and especially my grandmother, for their support not only during this project but also throughout all of my studies and helping me realised my dream and this is just a start do to more work around here.

Last but not least I would like to thank everyone in the center to being so nice and helpfull during all my stay, I have a wonderfull time here and I am going to miss all of you guys. Thank to you Alice Miles to help me so much with my work ; show me how to do at the begining and for my report to tell me if my English is good or not because it is not my first language and sometimes it was not really easy.

This is not a goodbye, see you later !!!

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