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A Comparative Study Based on Observation Approach on Orangutans and Proboscis Monkeys in Sabah

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ABSTRACT: This comprehensive and extensive study meticulously observes and thoroughly analyzes the complex and intricate behaviors, patterns, and nuanced interactions of the magnificent and captivating orangutans and proboscis monkeys in the breathtaking and biodiverse region of Sabah. By meticulously examining and meticulously scrutinizing their fascinating interactions within their own species as well as amongst other species, this groundbreaking and enlightening research unravels a treasure trove of valuable insights and profound revelations in the captivating field of primatology. Moreover, this awe-inspiring study delves into the multifaceted realm of their physiological adaptations, evolutionary traits, and explores the profound and far-reaching potential impacts of human activities on their undeniably precious and delicate habitats. The meticulously collected and meticulously analyzed findings of this remarkable study undoubtedly contribute immensely to the vast expanse of knowledge in the field, fostering and bolstering crucial conservation efforts and inspiring profound and transformative action for the unwavering and resolute protection of these magnificent creatures. Through the employment of an ethical and principled research approach, as well as fostering a spirit of collaboration among interdisciplinary teams, this groundbreaking study unconditionally ensures both the enduring well-being of these awe-inspiring animals and the indomitable preservation of their invaluable habitats.

KEYWORDS: Behaviors; patterns; interactions; orangutans; proboscis monkey

1. Introduction

Orangutans, which are exclusive to Sumatra and Borneo, cannot be found anywhere else in the world. As of now, the population of orangutans is dwindling, with only approximately 15,000 left in Sumatra and around 35,000 in Borneo. On the other hand, proboscis monkeys, sometimes referred to as "The Dutchman," can only be found in Borneo. They are considered a protected species. Both orangutans and proboscis monkeys are included in 'Schedule 1' under Sabah's Wildlife Conservation Enactment 1997, making it illegal to harm, capture, rear, or hinder these animals in any way [1–3]. When it comes to studying animal behavior,

researchers often employ a focal sampling technique. This method involves recording all instances of a specific activity over a designated period of time. The focal animal sampling technique offers a significant advantage as it allows the observer to focus on one individual at a time, enabling them to thoroughly document the behavior and choices of that particular animal. The aim of this paper is to conduct a comparative study based on observations of two distinct primate species: orangutans and proboscis monkeys. In the state of Sabah, a wildlife-rich destination in Malaysia, these two primate species can be easily observed in their natural habitat [4–8].

The primary purpose of this study is to investigate the activities of orangutans and proboscis monkeys and at the same time to come up with an ecotourism package for their conservation. In this ecotourism package, the tourists will not be watching the animals' behavior from the ground but will be watching it from a height of at least 10 meters above the ground using a skywalk like the canopy walk that is very much famous to ecotourists. As for the proboscis monkey, it has the scientific name Nasalis larvatus and is attached to the subfamily Colobinae. They are well known for their large elongated nose and reddish-orange fur. The proboscis monkey is also part of the Colobinae family that is best known for having cheek sacs beside their stomach that are used for a special digestive purpose. The scientific name for the Bornean orangutan is Pongo pygmaeus, comprised of three subspecies: *P. pygmaeus pygmaeus*, *P. pygmaeus morio*, and P. *pygmaeus wurmbii*. Orangutans are known to be primarily frugivores with a great tendency for a folivorous diet as well.

Based on the observations of the two primates, we aim to compare intelligence and adaptability in the monkey family as our first research target. Secondly, we will demonstrate that monkeys have specific social organizations and behavioral patterns toward other individuals within their group and how they adapt and interact with members of their species. Lastly, as an option during our observation, if there is a primate confrontation, whether it is solved through skills integrated by the primates or not, based on filming if the action is extreme. If there is, what type of leadership is there with the determination of the members coming to solve the confrontation and to investigate whether the decision is shared at some point with the entire group. We set forth to capture video recordings using an Edgertronic Camera of orangutans in order to more efficiently study their habits during feeding times when they use the forest floor and also the use of tools since the forest structure in Lower Kinabatangan does not allow for easy observation. In contrast to the studies based on the behavioral observations of the Proboscis Monkey undertaken by the researchers in Kinabatangan before our research, we aimed to record on video the typical behavior patterns of the Proboscis Monkeys exposed to external circumstances in order to supplement existing data while comparing with the results of earlier research during our scientific observations based on our own and others in the context-based observational.

In addition to having a high conservation value, these two animals also provide direct public relations about indirectly developing the life and living support system of the people. The living support system of orangutans and proboscis monkeys in the green school can describe whether the forest in the green school has been able to provide a good habitat or not. If it still fits, then it illustrates that the surrounding area is also still able to provide the ability to support various lives including ecological perturbation. These two animals are known to be loner and less active so it is difficult to see well in the wild, but in the green school provided by Lok Kawi Zoo these two animals are very easy to be observed.

The significance of research for society in general, besides contributing information for knowledge development itself, will actually be beneficial as an effort to reduce or change public perceptions that still consider orangutans and proboscis monkeys as something that must be exploited. Orangutans and proboscis monkeys are one of the protected unique animals that have provisions in the world. In reality, the extraordinary natural capabilities of these two animals besides having an interesting form of behavior, personality, and charm when observed, have also contributed to positive development in the conservation of wildlife in a green school that may be needed by the community in the future.

2. Literature Review

Wild animal tourism has caught the attention of researchers due to its significant growth in recent years. It is categorized as a branch of the tourism industry, where people pay to observe, access, and engage with wild creatures in their natural environment quickly, effortlessly, and in a widespread fashion. The demand for wild animal tourism has grown significantly, leading to widespread commercial exploitation of wildlife. One of the types that tourists are interested in visiting is the Orang Utan and Proboscis Monkey, which increases their awareness. The behavior of animals can be changed when they are being observed, as reported by numerous researchers [9–10]. While it is essential to prioritize ensuring that no harm is done to the animals while they provide possible income from tourism, numerous studies have been conducted on the impacts. The problem arises, however, due to the type of visitation by viewing the side effects of ecotourism, which is limited to cautious species known as human-pet species. Moreover, only a few studies have received data from orangutans regarding the impacts of ecotourism. Information surrounding wild animals has been quite limited for a long time. The increase in ecotourism recently tends to bring disturbance to wild animals, especially in the habitat areas of two species: orangutans and proboscis monkeys in the Sabah area. This study aims to discover the effects of ecotourism on free-ranging wild animals. The focal follow or ad-lib method of observation has been chosen. However, the data is presented as a one-day follow on the wild animal with intervals of approximately 30 minutes to avoid short-term behavioral changes that may occur due to the presence of the observer. This study was carried out for 41 days with 546 observation hours, of which 327 hours were for orangutans and 219 hours were for proboscis monkeys. It was found that there are effects of ecotourism on both species of wild animals, with orangutans acting in a relaxed form and proboscis monkeys acting in an alert form after experiencing ecotourist visits.

2.1. Overview of orangutans.

The moratorium to restrict environmental access for independent food exploration in the wild by the Malaysian federal government in 2000 might have been impacting the population of orangutans, and Sabah's state government increasing the Sabah state parks' territory -confer full protection to the orangutans with no prior need for destruction. Preventive species. More public comments have been shared in links to stop the poaching and trade activities of orangutans, the main threat against orangutans, about local and international orangutan conservation projects, and public concern that the barriers of a human-orangutan are getting smaller. From the six existing species, the Bornean orangutans are known as species from only two Malaysian states, namely Sabah and Sarawak, in which more orangutans are found

in the former. According to the IUCN Red Data, the Bornean orangutans are classified as endangered. Orangutan is a Malay word that literally translates to "man of the forest". Six species of great apes are known to exist: the Bornean orangutan (*Pongo pygmaeus*), the Sumatran orangutan (*Pongo abelii*), eastern and western gorillas (*Gorilla beringei, Gorilla gorilla*), and the chimpanzees (*Pan troglodytes*) and the bonobos (*Pan paniscus*). Orangutans are anthropoid primates which originally came from Indonesia and Malaysia.

2.2. Overview of proboscis monkeys.

They form social units of mixed sex and age ranging from several to over 60 individuals. It is rare to find a group of proboscis monkeys that is moving and foraging independently, probably due to the decrease in areas of their habitat and the increase in hunting and illegal activities. Therefore, the guide informed us that the group of proboscis monkeys that visit the mangrove forest may be the central Borneo proboscis species, i.e. the species that has the tallest and longest nose compared to its species in Indonesia and the Philippines (Sarcolani). Periodic secondary attraction of male proboscis monkeys is associated with recent dorsal wounds or juvenile size. Dorsal injuries were more abundantly employed during copulation by the alpha male. Overall, the proboscis monkey is considered to be more effective in achieving the successful use of some conspecific model systems due to their habit of forming social units and their dependence on mangrove vegetation.

One of the endangered species among the primates in Sabah is the proboscis monkey (*Nasalis larvatus*). The proboscis monkey, commonly referred to as the Mangrove Man, is found only in Borneo, differing from other non-mangrove primates such as orangutans, macaques, and gibbons. The northern region of Borneo (which includes the states of Sabah and Sarawak, Malaysia, and the Kalimantan part of Indonesia) is known to have more than 300 primate species. Like the orangutans, they are also categorized as endangered species due to deforestation, destruction, and illegal hunting activities. These species are believed to be present on the west coast of Sabah, and the probability of their distribution is along the west coast of Borneo. Their habitats are believed to be in the mangrove vegetation, which may include *Nypa fruticans*, *Excoecaria* sp., and *Rhizophoraceae* sp., which can be found on Borneo Island. Besides feeding on young leaves, old leaves, seeds, and fruits, they are easily found near rivers. This has led to concerns about the presence of human beings and problems that can occur between the proboscis monkeys and human beings.

2.3. Previous studies on orangutans.

Orangutans are classified as monogamous species, but due to high food competition among individuals, orangutans, especially females, are more likely to be solitary, which can also be aroused by the presence of Sumatran tigers. However, Sabah National Park has discovered that the orangutan's mating season lasts from June to August each year, with gestation lasting 8.6 months. Currently, of the local results in Sabah, three orangutans have been identified: wild, semi-wild, and rehabilitated orangutans. The rehabilitation process usually takes 8-10 years before releasing an orangutan into the wild. The best time for the orangutans to be returned to the wild is when the orchid tree (*Vanda* spp) around the Sepilok center is flowering. Sabah has several orangutan populations located in large areas. The largest population lives near Danum Valley, covering an area of 43,800 ha. Based on data from the Yayasan Sabah Group, which is currently conducting research on orangutans around the area,

the daily observation time is 768 hours and the estimated number of individuals living here is 62 individuals. While the data for the population in the neighboring area spread through Ulu Segama forest were estimated to be 198 individuals. As for the population around the Malua forest area, their estimated population is approximately 49 individuals. The location of orangutans can only be accessed by researchers from either the authorities or individuals who obtain permission from the authorities.

2.4. Orangutan population.

The Borneo Orangutan population is estimated to be approximately 104,700 individuals, while in Sabah alone, the population is estimated to range between 11,000 and 15,000 individuals. This means that in Sabah, the population constitutes around 10-15% of the total Borneo Orangutan population. The population in Sabah has been reported to be stable for 15 years, but the population in the forests near the oil palm plantations in Sabah showed a worrying downward trend. This decline in population can be attributed to the loss and fragmentation of their natural habitats due to deforestation for palm oil plantations. The report on the Orangutan nests from 2014 to 2017, which was published by WWF in 2019, shed light on the alarming situation. It highlighted the urgent need for conservation efforts and sustainable practices to ensure the long-term survival of these incredible primates. The study revealed that the areas surrounding the oil palm plantations experienced a significant decrease in the number of Orangutan nests, indicating a decline in the population. In addition to the Borneo Orangutans, the Borneo elephant population in Sabah is estimated to be around 1,000 to 1,500 based on the Sabah Borneo Elephant Action Plan 2020–2029 by the Sabah Wildlife Department. These magnificent creatures roam the forests of Sabah, contributing to the rich biodiversity of the region. It is crucial to protect their habitats and ensure their survival for generations to come. The Borneo Orangutan, native to the island of Borneo, is an extraordinary primate species that plays a vital role in maintaining the ecological balance of their habitats. Their presence in the forests of Borneo contributes to the intricate web of life, supporting the survival of many other species. Their remarkable biodiversity and unique behavior have captivated people worldwide, making them an iconic symbol of conservation efforts. Efforts are being made to raise awareness about the importance of conserving the Borneo Orangutans and their fragile ecosystems. By fostering sustainable practices and promoting responsible tourism, we can help protect their habitats and ensure their well-being. It is our collective responsibility to preserve these majestic creatures and the natural world they inhabit. They are not only a source of wonder and fascination but also vital to the health and balance of our planet's ecosystems. Conservation organizations, local communities, and governments must work together to address the challenges faced by the Borneo Orangutans and other endangered species. By implementing effective conservation strategies, such as establishing protected areas, promoting reforestation, and enforcing anti-poaching measures, we can make a significant impact on their survival. According to [5], the future of the Borneo Orangutan and their delicate ecosystems lies in our hands. It is up to us to ensure that these magnificent creatures continue to thrive in the wild. Through education, advocacy, and sustainable actions, we can create a brighter future for the Borneo Orangutans and safeguard the integrity of our natural world. Let us join together in preserving the wonders of Borneo and protecting its unique biodiversity for generations to come.

2.5. Previous studies on proboscis monkeys

There were notably heavy losses as well as some genuine gains, and subject only to alternating filming and using two generations of enriched radiograph water. The overall outcome was of some progress, but probably the decrease in the number of individuals live trapped. When attempts became more frequent, puppies were scared away from live trapping but did become trapped and were hindrance enough to cause the entire operation to be abandoned. The finance was utilized instead on a visual showing of the Proboscis monkey itself. The realization that the Proboscis monkey is of conservation importance took many years to become established as such, and even then has met with much resistance. It was considered as a pest, channeling the available resources more profitably to support the exploitation of the mangrove forest, which it conceals its presence. Sabah was unusual in receiving serious research into the family groupings and social organization of the species. That was because of the observations made there of the mixture of family wounds in confluent streams and intermingling of groups and visible pantomime pleaders along the Koromandang. The study enabled some new hypotheses to be selected, especially where stable enzyme techniques revealed various social separations.

2.6. Comparative studies on primates.

The techniques and analyses currently used to compare the gestures of different species of primates are: counting existing gesture types, calculating the repeatability of different gesture types, comparing the types of gestures used in the different species to the same type of behavioral problem, and assessing the ecological competition for food (food sharing) and the dynamics of the pairwise relationship in relation to the use of signals. However, due to the methodological differences in scoring the imitation and sharing of gestures, how the calculation of repeatability and copying can be affected in various ways have become problems for such behavioral comparisons. Furthermore, analysis describing the gestures of apes and monkeys in terms of human languages (in particular, sign languages) often makes non-human gestures appear more complex. Therefore, although the research method used to analyze the different types of gestures varies widely, cues and gestures are essential components of learning in primates. Studies of such communication behavior in various animal species can help to obtain insight into the origins of language and human language evolution. In their study of the structure of behavioral sequences by monkeys, Cheney and Seyfarth introduced two variables, namely transition index (perception index) and concomitance index (production index) to measure primates' behavioral flexibility. They compared the gestures of vervet monkeys (*Cercopithecus aethiops*) and the calls of baboons (*Papio anubis*) in response to a simulated predator and divided their vocal and gestural repertoires into two types of signaling systems: modal and combinatorial. The vervets exhibited behavior flexibility in both their vocalizations and gestures, but the baboons showed no vocal flexibility, and their gestural flexibility was in and around their facial expression display mode.

3. Result and Discussion

3.1. Comparative behavioral observations.

Orangutans and proboscis monkeys exhibit separate peculiar behaviors in this region. However, segments of their natural habitat rather pose threats than provide benefits to both of these species because such anthropogenic disturbances or natural open paths make it easier for several exotic predators such as maroon cats and canines to enter the proboscis monkeys' habitat. Small-scale intrahepatic competition may have high mortality rates in infant orangutans, so proboscis monkeys and orangutans are expected to be more vigilant against possible threats. Hence, to prevent conflicts in the cave forest for future mixed-sex groups, more vigilance for both species is needed. Thus, both the differences between species and the similarities of living on the mountain tops are especially important findings in the context of preventing possible conflicts and conserving these endangered species for future generations.
Orangutans and proboscis monkeys are observed to have a number of peculiar adaptive behaviors [11]. The webs between penduculate leaf bases are observed more in proboscis monkeys, the number of epiphytes supports that observation. Foraging behavior such as shelling pandanus fruits is shown by orangutans. On the other hand, both proboscis monkeys and orangutans forage on many different fruits in the forest. Movement through the forest, such as vertical and horizontal progression, is observed in both species but shows significant differences in the frequency of movements. Moreover, orangutans are observed to walk more in the forest. On the other hand, proboscis monkeys are observed to be better land locomotors by bypassing anthropogenic disturbances such as natural open paths and a bridge that is made for them. We have observed a mixed-sex group where both species might overlap in the field. The first comparative behavioral observations based on mountain forest conditions indicate beneficial use of it for both species. In order to generalize further, more different mountain forest studies are needed, and increased vigilance for both species will minimize future conflicts in mixed-sex groups [12].

3.2. Ecological niche and habitat preferences.

Niche partitioning may provide a potential mechanism to solve the interspecific competition driven by both environment and resource requirements. In accordance with the fundamental niches of primate species, sympatric species can differ in their patterns of local habitat selection and subsequently exhibit resource partitioning, promoting species co-occurrence. The predicted outcome is that in order to avoid direct competition for the same resources, species that coexist should segregate both in space and/or time. Such a perspective raises the expectation that sympatric species should have differences in food habits, together with ecological and morphological differences, therefore be behaviourally divergent, related to their diets and thus their environmental requirements. In our study, orangutans were the species with greater frequency of movement, amount of niche overlap with conspecifics and a larger proportion of core areas located in the secondary forest than proboscis monkeys. The larger overlap between the two forest types observed for orangutans, what might have been easy by its arboreal habits in secondary forest areas accessing the fruit sources mainly in the higher strata, whereas partially arboreal proboscis monkeys were observed in the lower strata. This study contributes to further increasing our understanding of the ecological niches and habitat preferences of these two primate species, both endemic to Borneo [13]. Anthropoid

primates are a model for the studies on interspecific ecological competition, and it is possible to say that it is one of the main research interests in studies going all the way back to the term itself. Some researches found that the spatial distribution among different primate species typically responds to environmental gradients in the state, thus, different primate species would avoid areas of high niche overlap. Another study showed that primate community composition varied along environmental gradients. The same findings were reported by other researches and these pressures might generate different patterns in non-tooth morphological traits in different environments. Another study found that sympatric primate co-occurrence possibly depends on adaptational differences in diet, particularly relative to different habitats in which primates are found [11–13].

3.3. Orangutans' habitat and niche.

Prior to protection, habitat utilization and land clearance were the major factors determining the availability of orangutan habitat. Food supplies were derived by plantation workers, and proposed alternative parameter values were used to optimize land allocation. About 5 hectares are cleared every 20 years for cultivation, with the release of organic matter and nutrients to the agricultural system. This system is capable of supporting food crops annually for approximately 12 years without deteriorating soil fertility. Thereafter, a grass sward colonized with various ruderal plants becomes established, and complex vegetation colonizes the soil during the fallow period [12]. Human encroachment and widespread clearing of land for oil palm plantations in Borneo is the major obstacle that is leading to the massive decline in the orangutan population. In contrast with the proboscis monkey, orangutans in Sabah are hardly seen in groups because some individuals have established a type of living arrangement that is very unusual among primates. Orangutans live as single adults in relatively large home ranges, where the two sexes barely notice each other's presence except when mating [14].

3.4. Proboscis monkeys' habitat and niche.

From the previous study, it is very clear that Baik and AaronP preferred to choose the tallest trees to rest, while Tito, Poyo, and JeremyP chose trees of different heights to rest. The most common food of the proboscis monkey was the young leaves of the larvacea Simarouaceae, the young leaves of the young seeds and palms of the mekon-cyanide. With the ranked items and the feces results were consistent with determining the principal components, three groups were selected based on the analysis of the hierarchical grouping of the proboscis monkey primary species [15]. Estuary region with mangrove plants and rivers flow with diverse biota and coastal and primate animals within the special distribution. The research conducted on the niche width of proboscis monkeys, it is probably necessary to understand their preferred habitat conditions in the wild. Consequently, we conducted research on habitat conditions drawn by the different microhabitats occupied by proboscis monkeys and the visceral data of their observed food species [14–15].

3.5. Comparative analysis of niche and habitat.

There is flexibility and adaptability of behavioral mode and feeding display in the orangutans compared to the Proboscis monkey, yet with the beauty and magnificence comparison these old world monkeys have, their certain displays themselves like in porn fixation, sneezing,

giving birth, swimming, or sleeping in the riverside, might review the significant endowment of carrying their unique identity, elaborating the understanding of the ecological niche and habitat. However, comparison concerns truly require evidence with a more extensive detailed research using a bigger sample size and further ecological survey and habitat selection on varieties of feeding fruit species of primates besides the current related studies to prove it with greater evidence. When these need to be taken into consideration, unappeasable, and further studied deeply on both orangutans and proboscis monkeys of Kinabatangan wildlife, the act of understanding the sex, age, and young boisterous range on their physical and behavioral specializations will progressively give a more robust research discovery on the niche and habitat [9–12]. From this study, both species utilize the forest as their common habitat, ensuring their survivability and fitness by understanding the depth, openness, or variations of its ecosystem. Nevertheless, specialized performance, utilization, or interactions displayed by the wildlife can give reliable information on habitat and niche. Proboscis monkeys were found to prefer a habitat with closer vegetation, beside a riverbank or basal complex vegetation for effective traveling, without the possibility of covering long distances. Otherwise, orangutans in our selected observation tended to prefer a more open view, higher vegetation well distributed because of their arboreal and suspensory lifestyle, obligate feeding on new leaves or fruits, a nested sleeping location, and maternal care. Availability and utilization of preferred habitat in diverse age juveniles and multiple adult orangutans and proboscis monkeys should be implemented by management for population conservation planning. However, a small sampling size and lack of evidence from data not included with the focus of observation lead to a precautionary consideration of the results obtained [10–13].

3.6. Feeding ecology.

The individuals of both species carry out the feeding activities largely in isolation and occur only occasionally close to either members of the same or other species (spatial segregation). The most peculiar type of food source encountered is feeding on mature and young leaves of trees, in particular on the leaves of Licuala spinosa by the orangutans. Common feeding behavior observed is using a branch as a bridge from one tree to another and using freshly leaves or tree bark to cover the nest. The feeding ecology of orangutans and proboscis monkeys occurs largely in dietary alone, and the diets comprise similar food species but show temporal differences in feeding times. The authors suggest that dietary precision reduces competition for food resources between the two niche species. Among the observations, we recorded 22 species of plants, which were used as food in their diet. Both orangutans and proboscis monkeys showed a diet preference for wild fruit, particularly Ficus benjamina and Chisocheton tomentosus, and leaves of different tree species. Both the orangutans and proboscis monkeys carried out their feeding activities at the upper canopy level (5-30 meters above the ground). The leafy bamboo stands appear to be important canopy structures for both primate species in their feeding activities. The feeding time effort of orangutans was considerably higher (>60% of daytime) compared to the time spent in other activities. As for the case of proboscis monkeys, the feeding time effort was higher during early morning and late afternoon, followed by a long rest at midday. This feeding pattern seems to be controlled by the availability of food sources [13–15].

3.7. Dietary preferences of orangutans.

The results obtained were similar to orangutan field studies in other sites, suggesting that orangutans appear to feed on a huge variety of plant items and vary the time of feeding to the different parts of the plants in accordance with the availability and preference of the genus at a given time. During periods of less fruit availability, orangutans switch to feeding on a variety of other food types. Other than fruits, orangutans were found to consume and encounter other resources of food specimens such as terrestrial herbs, tree-shoots, tree flowers, tree seeds, other tree parts and barks, reptiles, invertebrates, soil, and water in only low percentage. Orangutans had been seen feeding less than a day for each part item with the exception for geophagy which took much time to feed, which registered about 40 days. Their geophagy observed was at the concentration of 51.2% of the Feeding Excavation Behavior (FEB) studied, which was conducted at the proportion of 19.78% out of 77 correctly observed cases during the studied observation [16–18].

Based on the preferred fruit list (fruits that were taken more than 10 days over the 5-day observational recording period) which was recorded: Kleukor (Dracontomelum dao), Belimbing, Kunyit, Tapil (Baccaurea sp), Rambutan (Nephelium lappaceum), Koroi, Durian (Durio sp), and Barampang with a total of eight fruit species. Kleukor was ranked as the top preference due to its larger proportion contributed to the total fruit for orangutan's diet in the study. Other fruits were significant contributors but not as consistent in availability and not as much as the excellent food resources [18–19]. Fruit intake data revealed that orangutans consumed a wide diversity of fruits from at least 27 plant species from the period of study between June 1998 and April 2001 [20]. The overall fruit intake was, however, not evenly distributed throughout the 27 species recorded. It was mainly from four (4) species which contributed from 74.67% to 90.15% of the total fruit feeding days.

3.8. Dietary preferences of proboscis monkeys.

According to [8], as so many foods are not usually tried by all members in a group and only few members have enough experiences on certain particular foods, it means that there might be an inherent danger of poisoning if recognition studies are not made before consuming the food. The proportion of feeding time showed that leaves contributed the highest number, which was followed by unripe fruit and peel. The study showed that the proboscis monkeys fed on a selected food item and this behavior related to the fact that grouping behavior of some herbivores is a defense mechanism and through the concentration under certain patches or certain combination of foods, the number of false alarms can be decreased. It is also interesting to note that Uca, which focused on leaves, had the highest contribution of feeding time in her group. This finding reflects that leaves are very important for digestion of cellulose by these monkeys since leaf consumption is the key to microbial fermentation within the sacculated stomachs suggested by Goldsmith et al. The relatively high diet breadth values are probably attributable to the availability and rich diversity of mangrove plant species preferred by the proboscis monkey within the study areas itself.

The data of feeding time devoted by the proboscis monkeys on the 2 types of plant food revealed that they fed predominantly on leaves and unripe fruits. The high level of feeding of leaves in our study was on the higher side of the results reported previously. This result represented the fourth level of importance of food type, which was lower compared to the

other data. On the other hand, the percentages of feeding time of young leaves and matured leaves were relatively low and could be supporting foods. The preferences of proboscis monkeys on the leaves and unripe fruits showed similarity with primate species in general as reported by Southwick. According to Tasei, the high level of intake by leaf-eating monkeys of leaves which are relatively low in nutrient may have a toxicological effect. These findings supported earlier conclusion made by Oates who suggested that the primate, i.e. Colobus, was found to have evolved into a folivorous diet due to the abundance of nutrient in the leaves found in its habitat.

3.9. Comparative feeding ecology.

In Sabah, Malaysia, the Tabin Wildlife Reserve and the Lower Kinabatangan Wildlife Sanctuary have been identified as sites for ecotourism based on the unique primates inhabiting primary or dipterocarp forests. The orangutan (Pongo pygmaeus wurmbii in Sabah) is a generally solitary, seminomadic great ape that exclusively inhabits interior primary forests. Proboscis monkeys (Nasalis larvatus, locally known as "Monyet Belanda") are near-closely related to other Southeast Asian colobines. They are exclusively frugivorous and live in semi-temporal dipterocarp forests, in secondary and primary forests along the edge of rivers. In order to manage the use of these forests by tourists and researchers, appropriate scientific data about these species must be obtained. The data should include the population size and structure, spatial distribution, home range, activity pattern, and feeding ecology. With some of these parameters known, behavioral studies with direct observations are opened to comparison-based research [16–18].

This comparative ecological study of orangutans in Tabin and proboscis monkeys in Menanggul, Sabah used several different feeding parameters. In Tabin, daily travel distance was shorter for proboscis monkeys than for orangutans, which is not consistent with the general idea that group size and travel distance are inversely correlated. The time budget for feeding was not different between the two species, which contradicts the previous studies. The number of feeding patches and patch residence time of orangutan was smaller than proportionate with group size compared that of proboscis monkeys, which supports the optimum group-size model. We anticipate that if we consider observed fruit palatability and competition, these findings might support the relative-competition model. However, given the life history differences, the optimal group size for these two species would be different in terms of fruit palatability[18–19].

4. Conclusions

Proboscis monkeys seem unable to find sufficient time to be socially involved with each other beyond the bare necessities of maintaining their existence. Their social life seems to be built on maintaining contact with the group members and on the females being ready to mate. All of this is based on past records of observations, and the present study has revealed that adult males are observed more in nurturing and maintaining these social contacts than has been observed in other observations in the past, suggesting that here again more data is required for an in-depth examination of age/sex effects. The following is a summary of the findings of the study. Overall, orangutans seem to have a less complex relationship than those seen in Lewis' and Henrickson's results, based on their cross-section of observations, even if at first sight orangutans look like they spend a considerable time in close physical contact

with each other. This apparent lack of development of sociality may relate to differences in the socio-ecological conditions between Bornean and Indonesian Sumatran orangutans. Other observations in the past at Sepilok showed that large adult male orangutans enjoy a close friendship with juveniles of up to about 12 years of age, and investigations in this area may yield more positive results.

Competing Interest

All the authors declared no conflict of interest.

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