

Research Article

Orang-utans' (*Pongo pygmaeus wurmbii*) Activity Pattern in Camp Release and Feeding Site of Lamandau Wildlife Sanctuary, Central Borneo, Indonesia

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Keywords:

Activity budget

Camp release

Feeding site

Pongo pygmaeus wurmbii

Reintroduction

Submitted:

26 October 2021

Accepted:

09 November 2022

Published:

17 February 2023

Editor:

Ardaning Nuriliani

ABSTRACT

The Bornean orang-utan (*Pongo pygmaeus wurmbii*) release process at Lamandau Wildlife Reserve applies the soft-release method. In this method, there is still provisioning additional food on the feeding site by human. The existence of camp release and feeding sites in the vicinity of release forests is assumed to have an impact on orang-utans' activity patterns. This assumption is related to the principle of releasing them into their natural forest habitat, namely by reducing direct interaction between humans and orang-utans. The aims of this research were: (i) to measure the intensities of orang-utan presence on camp and feeding site, (ii) to analyze the correlation between phenology and orang-utan's presence on camp and feeding site, and (iii) to assess orang-utan's activity budgets, diet composition, and vertical used on camp, feeding site, and forest. Activity budgets of five group orang-utans with different categories based on age and sex were compared using the focal animal sampling method and instantaneous records. The analysis showed no correlation between the intensities of orang-utan presence and phenology. However, there were significant differences in activity patterns between adult and adolescent orang-utans. The findings revealed that adult orang-utans activity pattern tended to be high in resting at all observation locations while adolescents spending more their activity for feeding. Orang-utans at 0-10 m of height classes tend to do more activity. Almost all orang-utans feed on a non-forest diet (45-67%) in the camp release, feeding site, and surrounding. We assumed that the existence of a camp release and feeding site near the release point are affecting factors in a successful reintroduction of ex-rehabilitate orang-utans.

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INTRODUCTION

Orang-utans are the only member of great apes lived in Asia. Three species of orang-utans in the world are Bornean orang-utan (*Pongo pygmaeus*), Sumatran orang-utan (*Pongo abelii*), and Tapanuli orang-utan (*Pongo tapanuliensis*) (Roos et al. 2014; Nater et al. 2017). Bornean orang-utan is divided into three subspecies based on their distribution, including *Pongo pygmaeus wurmbii*, which spreads from the southwest of the Kapuas River in West Kalimantan to South Kalimantan (Hulu Utara River and Taba-

long) (Warren et al. 2001; Utami-Atmoko et al. 2017). Orang-utans are a critically endangered species by IUCN. The main threats to orang-utans' decreasing population include habitat loss in the wild, habitat fragmentation, habitat conversion, and poaching. Approximately 78% of the wild orang-utan population in Kalimantan (*Pongo pygmaeus*) is found outside of conservation area that is fragmented and degraded. This finding indicates that the Bornean orang-utan faces a high risk of extinction in the wild (Wich et al. 2012). Deforestation and the illegal pet trade have resulted many orang-utans being orphaned. Each immatures individual orang-utan in illegal custody represents at least one individual mother killed by poachers (Rijksen & Meijaard 1999; Basalamah 2016).

Orang-utans that have been confiscated and rescued from illegal custody must be immediately rehabilitated and released back into their natural habitat (reintroduction). The reintroduction process involves a rehabilitation process to help animals learn the ecological and behavioral necessary aspects for survival in their natural habitat (Beck et al. 2007). Ecological skills consist of ranging skills, nest building skills, food selection, foraging techniques, roaming skills, and social skills (Beck et al. 2007; van Noordwijk et al. 2009; Russon et al. 2015). Each rehabilitation center has different steps; some have orang-utan school programs or merely quarantine (Basalamah 2016). Orang-utan school is one of the conservation projects aimed to restore the wild instincts and ecological skills of ex-captive orang-utans.

Ex-captive animals that are released into natural habitats may take longer to acquire these skills (Russon 2006). The adaptability of orang-utans, such as the ability to recognize and consume forest food types and to make sleeping nests are also some of the ecological factors in determining the success of reintroduction as a conservation effort (Beck et al. 2007; van Noordwijk et al. 2009; Russon et al. 2015). The importance of adaptability is related to the important principle of reintroduction, which is done by reducing direct interactions between orang-utans and humans as well as increasing interactions between orang-utans.

The rehabilitation process managed by Orang-utan Foundation International (OFI) does not involve the orang-utan school program. The release process at Lamandau WS applies the soft-released method. This method requires post-release support for released individuals such as additional food. In contrast to soft-released, hard-released does not provide additional food support. The additional food in Lamandau WS is provided routinely once a day.

Orang-utans can live independently in the forest if they have passed at least two fruit seasons and two low/scarcity seasons without human support (Zweifel 2009). This assumption could become invalid based on this case from the history of Sumatran orang-utans at the reintroduction Center in Jambi (PROS) (Soft-released). Despite having been released and underwent an adaption period of more than two years, Siregar et al. (2018) discovered that some orang-utans released in PROS still need humans for feeding. Prior research at Lamandau WS by Nawangsari et al. (2016) found that some individuals have a high level of intensity towards additional food at the feeding site. Furthermore, the results of Basalamah et al. (2018) study in the Kehje Sewen forest also showed that there was one ex-captive individual who had a high human orientation. In other words, individual activity in approaching and initiating interaction with humans is still high even though it has long been released.

Providing additional food from technicians is an alternative to support physical fitness for orang-utans in the forest, yet this can also make ex-captive orang-utans dependent on technicians and cannot live inde-

pendently in the forest (Siregar et al. 2018). Human activities in the release camp of forest, as well as the availability of additional food at the feeding site, are thought to be inhibiting the effective reintroduction of orang-utans, based on the findings of prior studies (Nawang Sari et al. 2016; Basalamah et al. 2018; Siregar et al. 2018). As a result, it is important to study the behavior patterns of orang-utans that are influenced by the existence of the release camps and feeding sites in release sites. Lamandau WS has four camp release locations and four active feeding sites, making it appropriate to serve as research sites.

Basically, animals have an instinct to forage (Kaiser et al. 2015). Similarly, orang-utans will forage in places where food sources are abundant, following the season of fruit availability and the distribution pattern of fruit in the forest (Saputra et al. 2017). As a result, the presence of a feeding site area is assumed to hinder orang-utans' capacity to forage organically, limiting their daily range. The research's results can be used as basic information to perform strategies for further orang-utan conservation efforts by taking into account aspects of orang-utan behavior.

Summarizing the previous explanation, then the objectives of this study are to (i) measure the intensity of orang-utan presence at camps and feeding sites, (ii) analyze the phenological correlation with the presence of orang-utans at camps and feeding sites, and (iii) assess activity budget of orang-utans, diet composition, and vertical used in camps, feeding sites, and forests.

MATERIALS AND METHODS

Study site

This research was conducted on July to November 2019 in the Lamandau Wildlife Sanctuary. Lamandau WS is former area of permanent production forest (HPH) located in Central Borneo, Indonesia and roughly \pm 76.110 Ha in size. Survey in 2016 by Nawang Sari found that there is a high abundance of orang-utan food species (at least 101 tree species). Each vegetation has a different level of vegetation growth, i.e; seedlings, saplings, poles, and trees. The seedling vegetation type dominates, the vegetation type is the lowest. The ecosystem area of the Lamandau WS is a lowland forest and swamp forest ecosystem affected by tides and periodically submerged. Both of these habitats are orang-utan release habitats.

Lamandau WS has several post-release monitoring camps, i.e; Gemini camp, Siswoyo camp, JL camp, Rasak camp, and Buluh camp (Figure 1). Each camp completed with the feeding sites. The observation sites covered all of those camps except Camp Siswoyo. Orang-utan release camps and feeding sites were built to help orang-utans survive after they were released, as well as to monitor reintroduced orang-utans.

Subjects

The research subjects observed were ex-captive orang-utans released in the Lamandau WS. Orang-utan Foundation UK (OF-UK) has released 56 orang-utans who have been monitored since 1999 to date. Observations of activity patterns at three locations (release locations, feeding sites, and forests) were conducted on 23 orang-utans from 56 individuals who are still being monitored. The orang-utans observed were differentiated based on age classes (adolescents and adults) and sex. Female adults group was divided into two groups based on the presence of offspring. The mother, in this case, should be an adult female with an offspring (Table 1). Most of the orang-utan population in Lamandau WS is

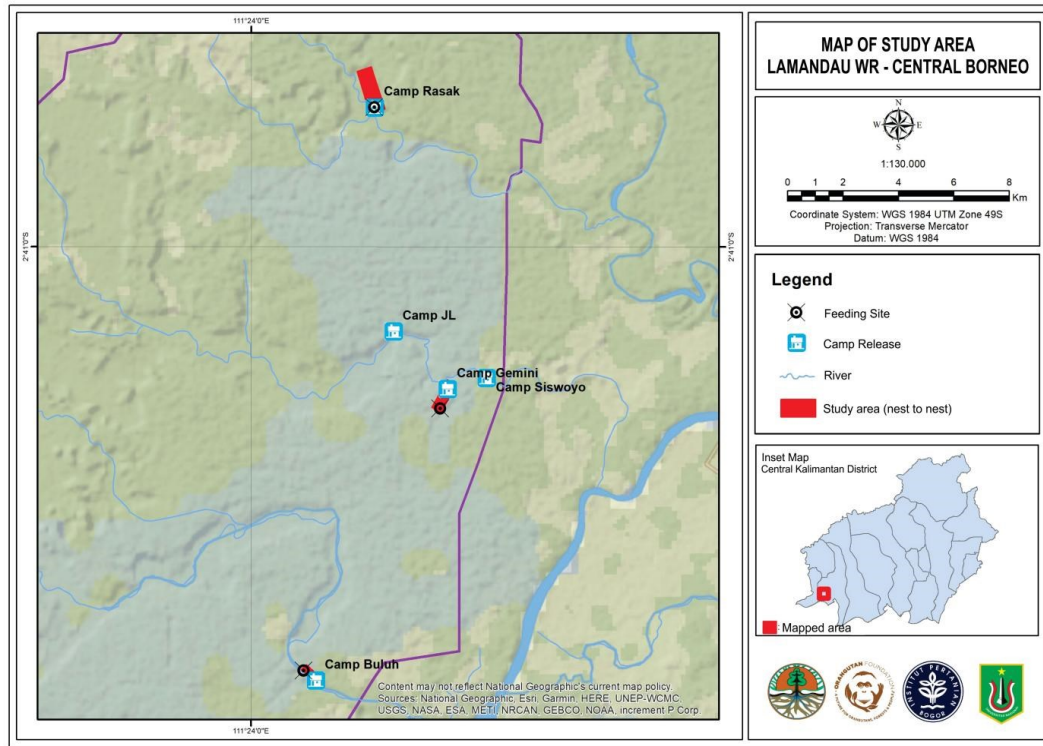


Figure 1. Map of Lamandau Wildlife Sanctuary, Central Borneo, Indonesia.

ex-rehabilitate from OCCQ (Orang-utan Care Center and Quarantine) before released in Lamandau WS (Table 2). OCCQ is a Bornean orang-utan rehabilitation center managed by Orang-utan Foundation International (OFI) located in Pangkalan Bun, Central Kalimantan. Almost all adult female individuals observed in this study were OCCQ ex-rehabilitate orang-utans, while some individuals in the adolescent group were newly reproduced individuals from ex-rehabilitate individuals.

Table 1. Categories, total observed individuals, total observation days and age of subjects.

Categories	(N) Individuals	Σ Day	Age (yo)	Σ Hours
Adult Male	2	12	20-30	84
Adult Female	2	9	20-30	40
Adolescent Male	2	17	6-15	100
Adolescent Female	6	54	8-12	237
Mother	11	68	15-29	397

Data collection

Intensities of orang-utan presence

Observation data includes the frequency of orang-utan presence at the camp and feeding site. The data is a combination of secondary data (data on the presence of orang-utan per month in the camp obtained from the camp staffs' note) and primary data (data during the study period). Every month during the study, observations were conducted in collaboration with camp staff.

Orang-utan's daily activities

The study included the difference of daily activity patterns based on the observation sites (camp, feeding site, and forest). At the forest site, individuals were followed for three consecutive days whenever encountered. Upon finding an animal, they were followed all day until they built their evening nest, and no activities recorded. The next day, start the follow

Table 2. Focal (individuals), history, released/birth year, and locations of camp release.

Focal	Categories	Age (yo)	History	Released/Birth (yr)	Camps
Yoko	Adult Male	23	Rehabilitation	2004	Buluh
Carlos	Adult Male	?	?	?	Gemini
Ekon	Adolescent Male	6	Ebony's offspring	2014	Gemini
Ewet	Adolescent Male	15	Rehabilitation	2006	Rasak
Kotim	Adolescent Female	10	Rehabilitation*	2014	Rasak
Suwita	Adolescent Female	11	Sawit's offspring	2009	Rasak
La betti	Adolescent Female	12	Ladidi's offspring	2007	Rasak
Sakura	Adolescent Female	11	Sela's offspring	2008	Gemini
Pauline	Adolescent Female	12	Paula's offspring	2007	Gemini
Sugi	Adolescent Female	8	Rehabilitation*	2016	Buluh
Queen	Adult Female	23	Rehabilitation	2003	Buluh
Ilik	Adult Female	20	Translocation	2007	Gemini
Vania	Mother	26	Translocation	2015	Buluh
Morres	Mother	20	Rehabilitation	2003	JL
Dedek	Mother	21	Rehabilitation	2002	JL
Acuy	Mother	22	Rehabilitation	2006	Rasak
Amina	Mother	12	Acuy's offspring	2007	Rasak
Sela	Mother	20	Rehabilitation	2004	Gemini
Passion	Mother	20	Rehabilitation	2005	Gemini
Camelia	Mother	19	Rehabilitation	2006	Gemini
Max	Mother	16	Mantra's offspring	2003	Gemini
Hola honolulu	Mother	15	Huber's offspring	2004	Gemini
Maya	Mother	22	Rehabilitation	2003	Gemini

*Rehabilitation at Lamandau WS.

after they wake up and leave their (morning) nest, whereas observation at camp and feeding site began recorded when orang-utans are seen/come to the camp and feeding site. Orang-utans are considered to be out of sight if the observed orang-utan moves more than the radius specified at camp and feeding site, which is 20 m from each side of camp and feeding site.

Behavioral data was recorded using standard ectograms provided by OF-UK, except for other activity categories. Behavioral observations were made using the focal animal sampling method (Altmann 1974) during orang-utan observations at release sites, foraging areas, and forest areas. The ad libitum method was also used to observe rare activities that occur outside the observation time which were then recorded using the instantaneous recording method with an interval of 2 minutes.

Orang-utan's diet composition

We recorded the type of food consumed: flowers, fruit, leaves, bark, insects, vegetation, water, and others such as; soil, additional food from staff, and human trash food leftovers around the camp. Fruit phenology observations at each camp were conducted monthly with staff during the study. The level of food availability category for fruiting trees in the Lamandau WS refers to Harrison (2009), with the following information: 1) Low < 4%, 2) Moderate 4% -5.9%, 3) Moderate-high 6-7.9%, and 4) High ≥ 8%).

Non-forest food including soil, human food leftovers that are thrown away around the camp/garbage, and other food that is in the river around the camp. Sometimes orang-utans also eat additional food waste around the acclimatization cages around the camp, while non-forest categories at the feeding site are fruit (additional food) provided by the staff at the feeding site.

Vertical used and daily ranges

Vertical use refers to orang-utans carrying out their activities at various height categories, which are divided into four levels: 1-10 m (lower level), 10-20 m (medium level), 20-30 m (upper level), and > 30 m (Top). Individuals were tracked for three days in a row for mapping purposes. Because of the time and energy constraints, only 10 orang-utans out of a total of 23 were followed from nest to nest in this study employing focal animal sampling. The orang-utans in this study were sampled from five different groups of orang-utans. Table 3 show the individuals who were followed. Every 30 minutes, the geographic position of the focal animal was recorded. Data on orang-utan intensity at camp and feeding site, as well as phenology, were collected in collaboration with OF-UK staffs. These staffs were taught and rehearsed the data collection process to standardize data gathering and maximize data comparability.

Data analysis

The data analysis of collected orang-utan activity patterns was done quantitatively and presented in relevant tables and graphs. Non-parametric test of Kruskal-Wallis was used to test differences in frequency of activity patterns in each orang-utan group. The Pearson-chi-square test was used to examine the correlation between phenology and intensity of orang-utan presence at camps and feeding sites. Significance was set at the p-value level ≤ 0.05 . Data analysis was performed using SPSS 20.0 and R software. Orang-utan's daily range maps were created based on the waypoints from Garmin 64s GPS while following orang-utans and analyzed using ARcGIS 10.2 software.

RESULTS AND DISCUSSION

Result

Orang-utan's intensity presence at camp and feeding site

The observed orang-utan divided into mother, adult male, adult females (without offspring), adolescent females, and adolescent males. Intensity of orang-utans' presence at camp and feeding site is dominated by mother with the highest intensity level in July (Figure 2). Some individuals didn't appear at the feeding site but appeared in the camp, and vice versa. Individuals who come to the feeding site almost every day are Hola and Maya, while individuals who frequently come to the camp are Acuy, Sela, and Max. Those individuals were found visiting the camp almost every day. Severe orang-utans are individuals who often come to the camp, but rarely visit and do activities at the feeding site and vice versa. Camelia and Sugi are orang-utans who rarely travel to the feeding site but come to camp almost every day. Maya and Hola rarely travel and do activities around the camp, but often come to the feeding site.

The average amount of fruitful tree availability in almost all camps was low (< 4%), except for Buluh camp which was high (> 8%). However, the results of the phenological correlation test and the intensity of the presence of orang-utans at the camp and feeding sites showed no correlation (P-value: Camp = 0.32 > 0.05; feeding site = 0.44 > 0.05) between the two. Therefore, camp release and feeding sites is one of the factors that can affect the frequency of orang-utan's presence intensity.

Orang-utans' activity pattern

The daily activities of reintroduction of the orang-utan in Lamandau WS are presented in Figure 3. The daily activities of orang-utans are determined by their capacity after years of release, as well as their age-sex classes. In general, the activity patterns of all observed ex-rehabilitate

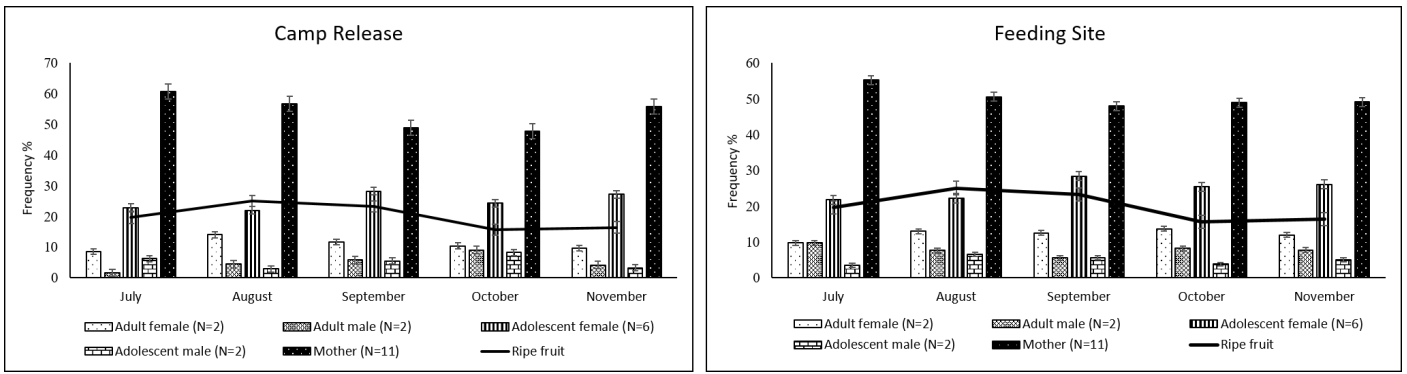


Figure 2. Phenology per months and intensities of orang-utan's presence at A) camp, and B) feeding site.

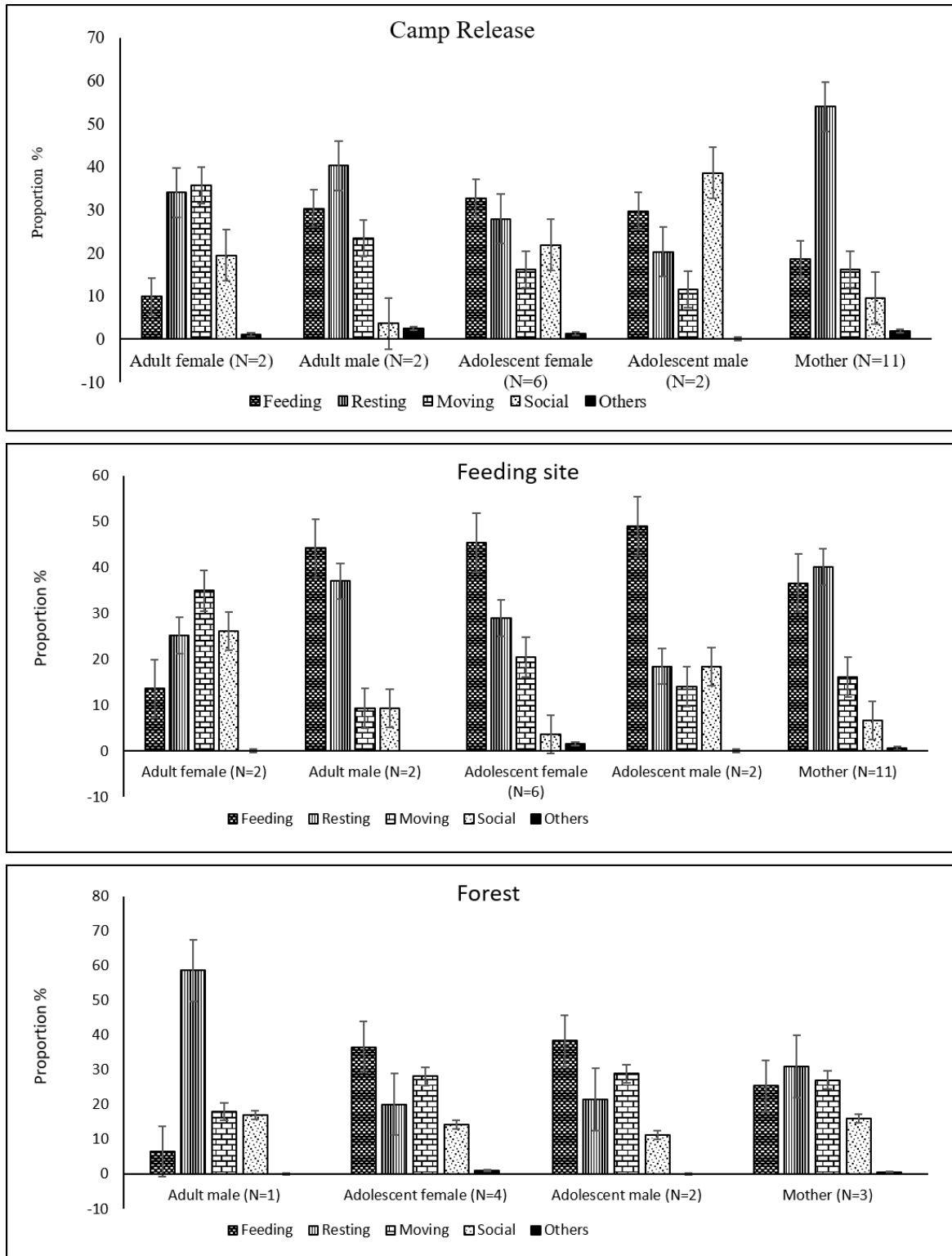


Figure 3. Orang-utans' activity pattern based on different sites.

orang-utan showed a similar pattern but differed from those found among wild counterparts. Resting time accounted for the largest part of the released orang-utans' activity budgets, especially the adult group. Feeding and travelling time was correspondingly reduced.

All individual orang-utans in the adult group, especially those in adult male and mother had the highest allocation of resting activities, while the highest of adolescent female and adolescent male activities was feeding. Feeding and resting time accounted for the largest part of the released orang-utans' activity budget while at camp and feeding site (P-value < 0,05), whereas in forest there is no significant difference between activities. Travelling and social time were correspondingly reduced. Adolescent female spent most time of feeding (32.6%), and Adolescent male spent most time of social (38.5%) while around camp. Adolescent male and adolescent female feeding proportion at feeding site and in forest was similar. Mother spent most time by resting consistently at three observation sites (31-53%).

In addition, almost all observed individuals have an other activities time (1-3%) such as; trying to enter the camp building, trying to damage the camp facilities, trying to take objects/diet related to humans, picking up fruit in the acclimatization cages for orang-utans juvenile around camp, and interacting with the camp staffs. These activities tend to occur more around camp. Based on observation, it results that the other activities were done by almost all individuals. Yoko had the most other activities time reached 3.3%, but this can occur due to the limitations of adult male individuals as observed subjects for long period. Yoko was the only individual that representative the adult male sample, if Yoko not included in the assessment, then the individual who has the highest time in other activity is Acuy (2.4%) from mother group.

Other activity categories are created based on observation results of activities outside main activity that lead to an interest in humans. Other activities are classified into four categories 1) Break in, when orang-utans try/are entering camp buildings such as stockrooms, staffrooms, and kitchens; 2) Steal, when orang-utans try/are taking object/food related to humans such as fruit stock/food from the staff in the stockrooms or kitchen, or also fruit provided for baby orang-utans in acclimatization cages around the camp; 3) Interact, when orang-utans initiate interactions/respond to staff/humans around the observation site, and; 4) Botch, when orang-utans are trying to/are destroying camp facilities.

Sela, Sakura, Hola, and Max are the same individual orang-utans observed by Nawangsari et al. (2016). Hola and Max were adolescents (no offspring) when the study was conducted. Max and Sakura are individuals who actively explore and forage sources in the forest to fulfill their daily necessities. Sakura's average daily movement distance is the farthest among other adolescent individuals. The results of the current study also showed that the proportion of Sakura spent exploring was higher (37.9%) than all the individual orang-utans observed. The feeding proportion of Max was found to be decreased from the previous study, namely from 45.7 to 23% while the feeding proportion of Sakura was increased from 25.8 to 28.6%. Max is one of Mother individuals who often come to the vicinity of the camp and spends most of their time resting (52.3%) at the camp while the resting proportion in the forest is lower (29.4%).

The intensity of Sela's presence at the feeding site was less than the intensity of her presence around the camp during the study. Most of Sela's daily activities were spent by resting (55.9%) and playing (14.5%) around the camp. Sela showed her interest several times in activities/ objects used by humans such as washing her face using water in the

camp staff's bathroom and trying to put on staff's socks. These activities are included in the category of other activities, with a total proportion of Sela's being 2.1% of all daily activities.

Orang-utan's diet composition

The proportions of the food types eaten by orang-utans are shown in Figure 4. The Diet composition of orang-utans in the camp is almost the same as when they are around the feeding sites. Non-forest food have the highest proportion (Camp; 39-75% and feeding site; 50-98%). The category of non-forest food in camp site such as soil, human food scraps that are disposed of around the camp/garbage, and other food in the rivers near camp.

Furthermore, orang-utans also eat additional leftover food around the acclimatized cages located surrounding the camp, whereas non-forest food at the feeding site is fruit (additional food) provided by staff at the feeding sites. The total percentage value in the adult male group reached 97% due to the limited number of samples, only one adult male (Yoko) was observed eating non-forest food.

Adolescents tend to be more active in exploring the food forest around the camp compared to adult orang-utan groups. Fruit, leaves, bark, vegetation, and insects are among the food forest kinds consumed by orang-utans when they visit the camp, however fruit consumption is quite low (3-5%). The location of the camp near the river allows orang-utans to explore the river and its surroundings during low tide. From September to November, the condition of the river water around the research camp receded. In this condition, it was observed that orang-utans mostly eat tubers from alternating vegetation such as selingsing (*Hypolytrum nemorum*) and rasau (*Pandanus helicopus Kurz ex Miq*) around the river (7-12%).

Various forests food that orang-utans eat when at the feeding site and surroundings are fruit, leaves, bark, and insects. Forest-food mostly eaten by orang-utans are leaves (14-30%) and fruit (9-17%). Adolescents mostly eat leaves and fruit, while adult orang-utans, especially Mother, eat more insects (14.6%). The activity of eating insects is done after eating additional food ends, with a long enough duration.

Mother orang-utans consistently prefer non-forest food over forest food types with the highest percentage value of 25.1% while in the forest. Female and male adolescent groups chose to eat more fruit than other types of food, with the percentage of 41.8% for female adolescents and 61.4% for male adolescents. The types of fruit that orang-utans eat are puak (*Artocarpus anisophyllus*), pemponing (*Quercus bennettii*), jejambu (*Eugenia cuprea*), and bekunyit (*Diospyro spolita*).

Vertical used

Height usage by orang-utans is shown in Figure 5. Orang-utans are more active on the ground and at low altitudes at the camp and feeding site, although adult orang-utans spend more time on the ground. All orang-utan groups use the maximum height in the middle category at the camp and the feeding site, while in the forest the maximum height is at upper level. The adolescent female and adolescent male groups mostly utilized lower and middle levels, whereas adult orang-utans were at the lower height only.

Mothers do most of their activities on the ground while at the camp (84.7%) and the feeding site (53.8%). When in the forest, orang-utans tend to take advantage of the low-medium altitude category. Because the restricted number of samples was only represented by one person, Yoko,

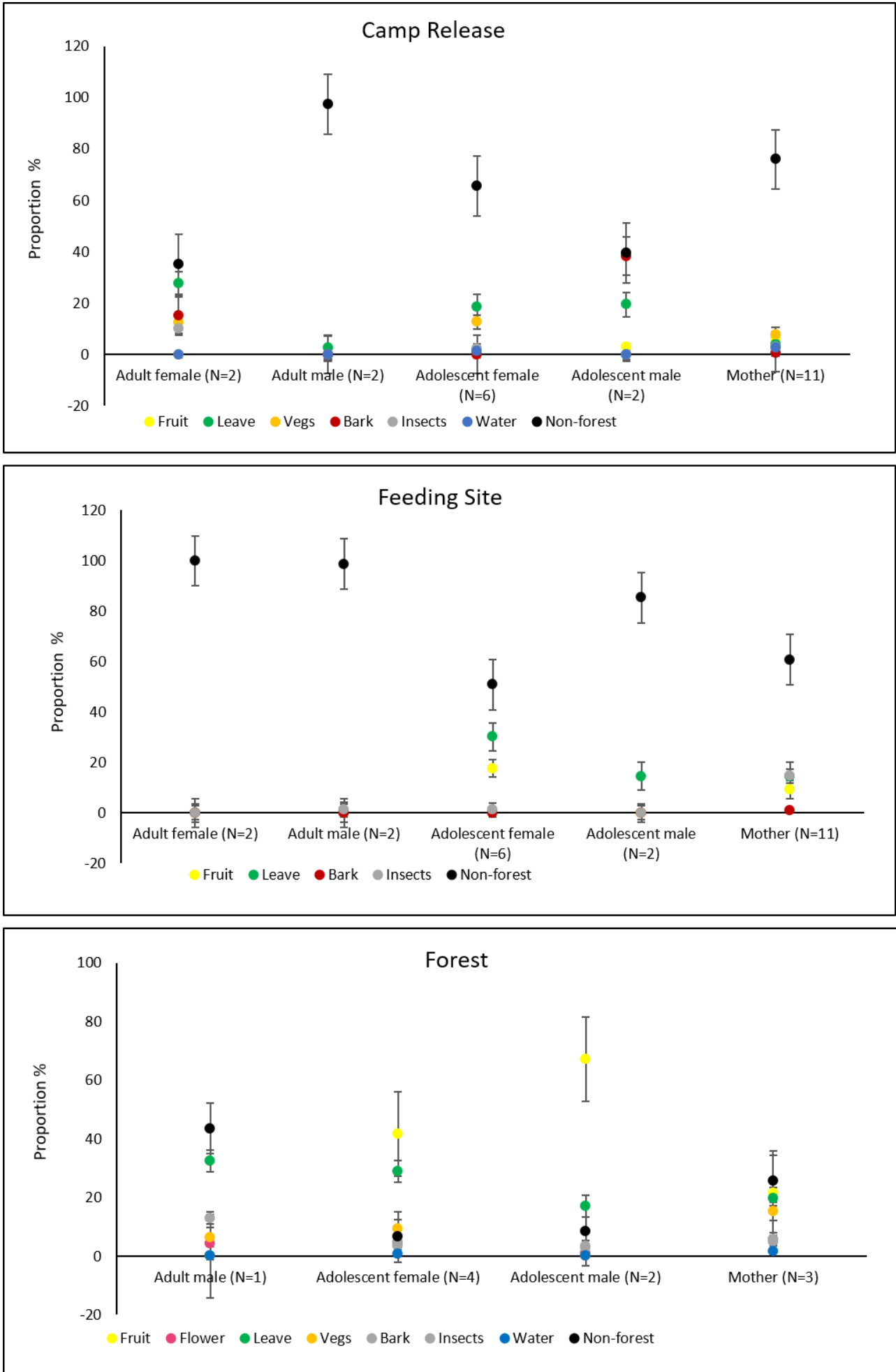


Figure 4. Orang-utans' diet composition at different sites.

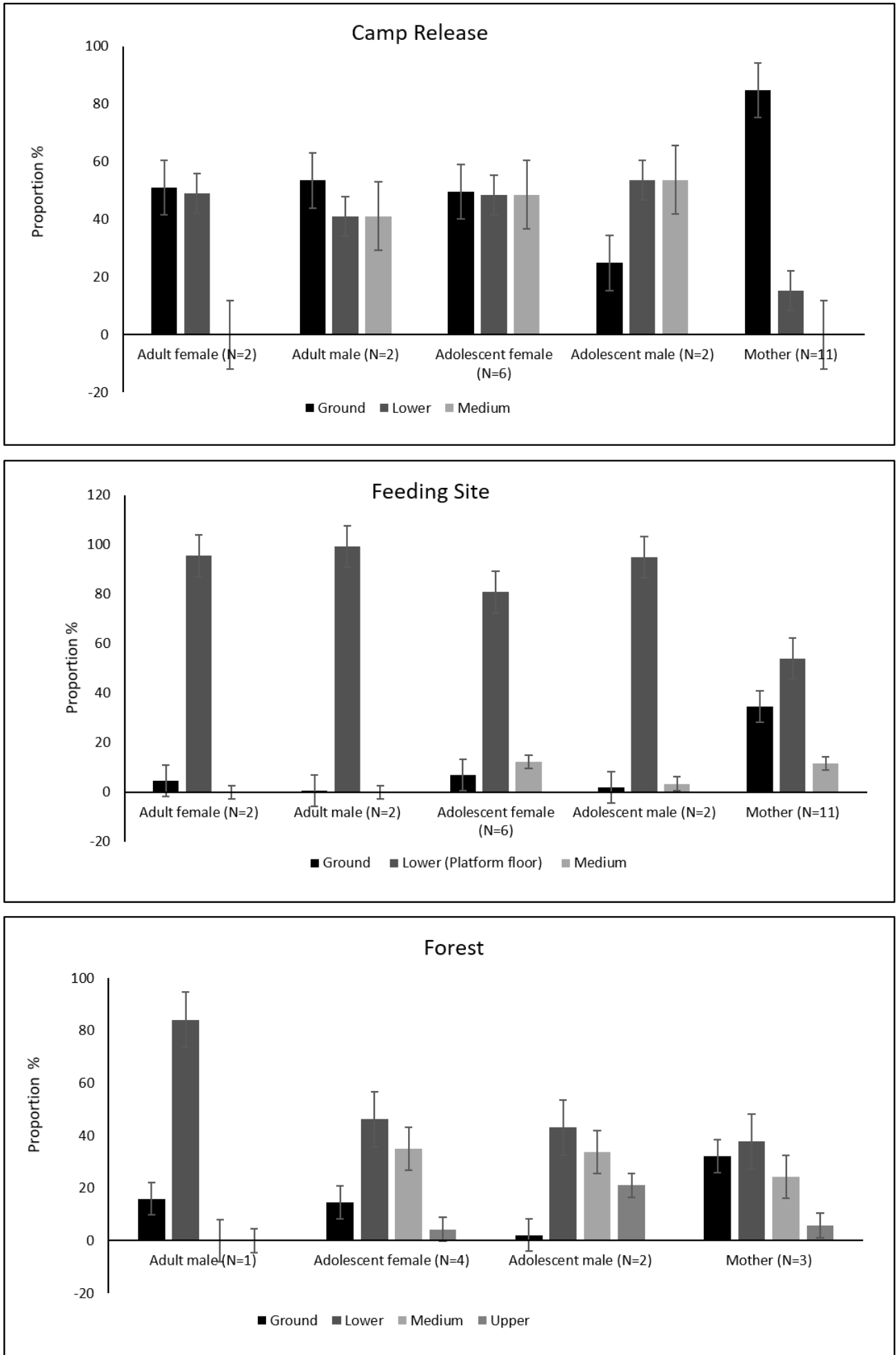


Figure 5. Orang-utan's vertical used at camp, feeding site, and forest.

the number of percentages in the adult male group that reached (> 80%) was negligible. Individuals that use the upper level are Suwita, Acuy, Kotim, Amina, Ekon, and Ewet while in the forest.

Daily range

Some orang-utans still spend their time for activities around the camp and feeding sites during nest to nest observation periods (Table 3). These individuals remain stuck at a lower diet breadth from the staff to fulfill their nutritional intake and tend to spend most time just around the camp and feeding sites. Orang-utan even comes around the camp before the staff departs for the feeding site to provide additional food.

Table 3. Duration of orang-utans in the camp, feeding site, and forest during the nest-to-nest observation period.

Focals	Categories	Duration (%)			Daily ranges (km)
		Camp	Feeding site	Forest	
Yoko	Adult male	8.2	27.8	64	1.7
Ewet	Adolescent male	0	8	92	6.2
Ekon	Adolescent male	14.8	0	85.1	4.7
Sakura	Adolescent female	23.4	10	66.7	2.2
Kotim	Adolescent female	18	14	68	4.9
Suwita	Adolescent female	0	18.4	81.6	5.5
Sugi	Adolescent female	18.1	0	81.8	1.5
Acuy	Mother	43.7	0	56.2	1.8
Amina	Mother	0	14.4	85.6	5.6
Max	Mother	40	0	60	1.5

The ranges of followed orang-utans are shown in Figure 6. The longest daily range was dominated by adolescent groups with an average movement which is 6.2 km. Adolescents tend to be more active than adult orang-utans in roaming into the forest. Adult orang-utans, especially mother, are still comfortable and doing activities around camp, so they have less time to roam into the forest.

Discussion

This study analyzed the effect of the release camp and feeding site on orang-utan activity patterns in Lamandau WS by measuring two parameters; the intensity of orang-utans' presence at the camp and feeding site as well as the activity patterns of orang-utans (also including the diet composition and vertical used). Female orang-utans were found to be the ones who visited and spent the most time at the camps and feeding places, according to the findings. Mother and adolescent female had a high intensity of presence at camp and feeding sites. Enhancement of orang-utans' presence at camp and feeding site did not correlate with the phenological in Lamandau WS.

These results implied that female individuals have a higher interest in camp and feeding sites than male individuals. One possible explanation for this difference is closely related to the philopatry character of female orang-utans (van Noordwijk et al. 2012). Female orang-utans tend to stay in their natal range. They begin to explore extensively around their natal range and increase the size of their daily range when they enter the independent immature phase (Wartmann et al. 2010; van Noordwijk et al. 2012). Exploration continues into the sexually active phase, in which adolescent females associate with flanged/unflanged males (Ashbury et al. 2020). The philopatry nature of females will have a serious impact on population stability when in disturbed habitats (habitat fragmentation and degradation occurs) (Ashbury et al. 2020). In this case,

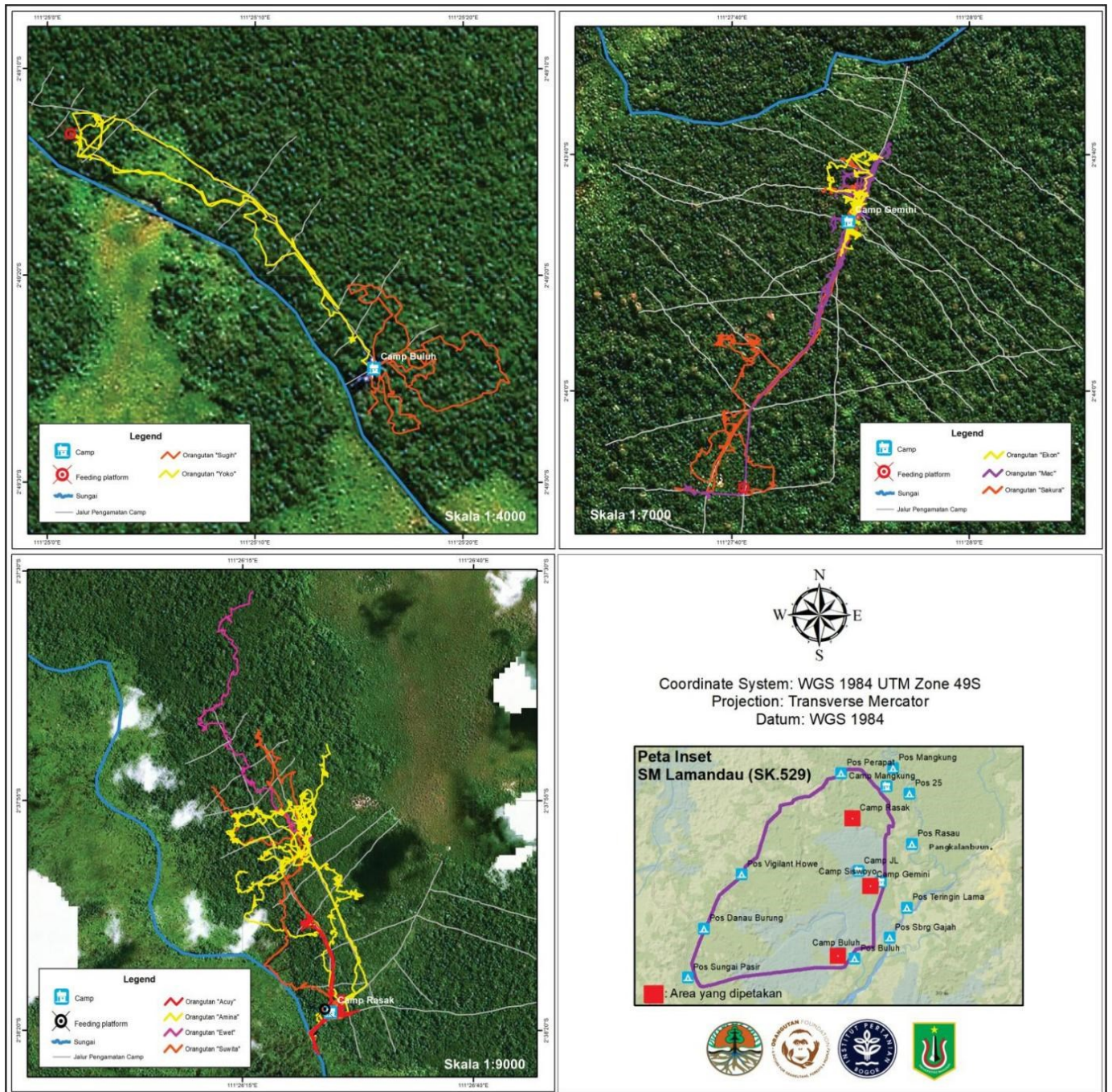


Figure 6. Orang-utan’s daily ranges at A) Camp Buluh: Yoko dan Sugi, B) Camp Gemini: Sakura, Ekon, dan Max, C) Camp Rasak: Acuy, Amina, Suwita, dan Ewet.

the philopatry of females may influence the independence of orang-utans which leads to high inactivity and decreasing the quality of each individual.

The presence of orang-utans at the camp and feeding site was then continued by starting activities around. All age-sex classes of orang-utans show different activity patterns. Adult orang-utans, especially mothers, spend most of their time resting and playing on the ground. Almost all individuals of the mother are ex-rehabilitate orang-utans and oriented toward human activity around the camp. Human interest can be a factor in the high inactivity of adult orang-utans. The different experiences of each orang-utan with humans cause a difference of each individual curiosity (Damerius et al. 2017).

Adolescent orang-utans spend time feeding while at the feeding site. However, there are differences in their activity patterns when at

camp where the male adolescent is remarkably more gregarious. Adolescent male was represented by Ekon and Ewet individuals. Both are quite different individuals. Ekon often visits the camp, while Ewet rarely visits and ranges around the camp, except during the consortship period.

According to information from the camp staff, Ekon often followed Max, precisely after Ekon's mother died (Ebony) shortly before this research began. Ekon is known to be in frequent contact with Max and other individuals who often visit the camp. The study conducted by [Schuppli et al. \(2016\)](#) showed that observational social learning occurs at an immature age. Social learning outcomes, when combined with individual socially selective practices over several years, will be an important component in acquiring important skills in orang-utans. In this case, Ekon was 6 years old at the time of observation and was still in the semi-independent stage ([Schuppli et al. 2016](#)) when his mother died. For this reason, social learning through adult individuals around them becomes crucial.

Comparison of activity pattern on reintroduced orang-utans have similarities in adolescent with the Kehje Sewen forest, ex-captive orang-utans spend most of their time eating fruit ([Basalamah et al. 2018](#)). Some ex-captive orang-utans in Jambi's PROS forest (Sumatran Orang-utan Reintroduction Center) do not exhibit the same activity patterns as wild orang-utans, with longer rest time ([Siregar et al. 2018](#)). Ex-captive orang-utans, on average, spend more time resting than feeding and moving ([Riedler et al. 2010](#)).

The differences in activity patterns can be attributed to adaptability. In wild orang-utans, the adaptability is acquired from their mother from an early age, while in ex-rehabilitate orang-utans the role of the mother in the Rehabilitation Center is replaced by humans as mother-care ([Russon & Galdikas 1995](#); [Morrogh-Bernard et al. 2009](#)). The diet composition of orang-utans in Lamandau WS tends to be similar. There is also a fairly high tendency to eat non-forest diet types. This tendency, where orang-utans rely on additional food obtained from humans, can be a deterrent to successful reintroduction. The selection and composition of broad and good quality of forest-diet depend on the experience and ability of each individual in recognizing and processing diet. Ex-captive orang-utans may gradually expand their diet, but the quality of their diet remains low when compared to wild orang-utans ([Russon 2002](#)).

There are different results of daily ranges between adult and adolescent orang-utans. Adolescent orang-utans were more active than adult orang-utans in exploring forest diets. Adult orang-utans, especially mother, are still comfortable and doing activities around camp, which make their forage skill may have less. The ranging movement of reintroduced orang-utans is influenced by the abundance of diet sources ([Nayasilana et al. 2017](#)). Orang-utans used the central area/near the main camp area if it is supported by the availability of a patch diet. The presence of orang-utans around the camp also shows that released orang-utans are still comfortable with humans.

Adolescent orang-utans will expand their home range when fruit availability is abundant, with monthly home ranges distance referring to areas with high to medium levels of fruit abundance ([Saputra et al. 2017](#)). They will reduce their monthly range to a narrower range and tend to explore areas with moderate to high liana abundance when fruit scarcity. This foraging strategy is an effort to optimize low-quality habitat for orang-utans to survive ([Morrogh-Bernard 2009](#); [Saputra et al. 2017](#)).

Ex-rehabilitate orang-utans released through different pre-release stages and release methods generally have different activity patterns. Re-

leased orang-utans through a pre-release stage such as forest school suggest higher feeding and exploring time (Basalamah et al. 2018; Bani et al. 2018) than those who did not (Nawang Sari et al. 2016; Siregar et al. 2018). Then orang-utans released by the hard-release method suggesting to have a higher feeding and exploring time in the forest (Basalamah et al. 2018; Bani et al. 2018) compared to orang-utans released by the soft-release (Nawang Sari et al. 2016; Siregar et al. 2018).

CONCLUSION

In conclusion, the intensity of the presence of orang-utans at camps and feeding sites is dominated by the Mother group. There is no correlation between the intensity level of orang-utan presence at the camp and the feeding site with the phenological conditions. Factors that influence the pattern of orang-utan activity are the existence of the release camp and the feeding site in the release forest area. Interest in humans may also be another factor affecting the presence of orang-utans around camps and at feeding sites. So, further efforts are needed to reconsider the placement of the camps' release and feeding sites around the orang-utan release points especially those built without barriers.

AUTHORS CONTRIBUTION

D.P.F and S.S.U designed the research and supervised all the process, N.A. collected and analyzed the data and wrote the manuscript, A.P supports in collecting data.

ACKNOWLEDGMENTS

This study was funded by the Orang-utan Foundation UK (PK.005/OF-Ris/VII/2019). We thank to Nature Agency, Central Kalimantan, Indonesia and Lamandau Wildlife Reserve staffs who have given the support for conducting research in Lamandau Wildlife Reserve. We also thank all assistance and staffs of OF-UK for the helps and supports during the study.

CONFLICT OF INTEREST

Authors do not have any conflict of interest regarding the research or the research funding.

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