Food preferences of Bornean orangutan in Lamandau Wildlife Sanctuary, Central Kalimantan

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Abstract. The Bornean orangutan (Pongo pygmaeus wurmbii) is one of the world's most endangered primates. Orangutan food is highly varied, depending on its habitat. This research was conducted in Lamandau Wildlife Sanctuary, aimed to identify Bornean Orangutan food, and estimate their food preferences. The research was conducted on February-March 2020, by following 5 rehabilitated orangutans for 195 hours by 2 observers. Using Jacobs preference index (D), food were categorized as highly preferred, preferred, less preferred, and not preferred. There were 33 tree species (18 families) consumed. Orangutans also consumed insects, lianas, mushrooms, herbs, soil, and some additional food provided by the Wildlife Sanctuary Manager. Parts of tree selected as the most preferred food are fruits (73.3%), they also eat other parts of the tree including young leaves, flowers, bark, and shoots. Highly preferred food for Orangutans were ‘katikal’ (Ochanostachys amentacea; fruit, D 0.95), ‘gandis’ (Garcinia parvifolia; fruit, D 0.83), ‘kekupui’ (Sarcotheca diversifolia; young leaves, D 0.78), and ‘malukan’ (fruit, D 0.56). Other trees selected for food were categorized as preferred food (6 species), less preferred (11 species) and not preferred food (7 species). Other 5 species were uncategorized due to a lack of data.

1. Introduction
The Bornean orangutan sub-species Pongo pygmaeus wurmbii is classified as Critically Endangered (CR) according to IUCN [1] and is listed in the CITES Appendix I. Logging, forest fires, encroachment and conversion for plantations and human settlements cause loss of habitat and reduced food sources for orangutans such as Ficus spp. and liana [1,2].

Orangutans are highly opportunistic feeders, they can consume any source of feed they can reach, up to more than 300 species [3,4]. Orangutan food has been known to vary widely and is strongly influenced by ecological factors, including differences in habitat conditions in vegetation composition, feed productivity, and fruit season in the forest. Food preference is the use of natural resources that is not proportional to its availability [5]. Orangutans, like other great apes, show strong preferences for fruits along with variety in their food [6]. The preference of food for orangutans will affect their ability to survive, reproduce, and their daily activities [7].

The Lamandau Wildlife Sanctuary is a conservation area targeted for reintroduction of rehabilitated orangutans. Therefore, the research on the food preferences of Bornean orangutans in Lamandau Wildlife Sanctuary is considered important to provide additional information on orangutan habitat management. The objective of this study was to identify the Bornean orangutan food in the Wildlife Sanctuary and estimate their food preferences.
2. Method
The research was conducted in Lamandau Wildlife Sanctuary during February to March 2020 using observation methods. The Bornean orangutans observed in this study consisted of 5 orangutans from four age structures according to Galdikas [8], namely, juvenile (named Macho), adolescence female (Kotim), adult female (Acuy), and adult male (Yoko and Carlos). Data were collected for 195 hours, by focal animal sampling method. Each individual of orangutan was observed for 13 hours per day on three consecutive repetitions.

The observation was conducted by two persons on foot or by boat, following the movement of the orangutan, starting when the orangutan woke up at around 5am until the orangutan making a sleeping nest in the afternoon at around 6pm. Observers recorded the type of food and the eat time length of each orangutans. The feeding activities of the Bornean orangutan that were observed included the time in preparation, reaching, picking, collecting, and chewing the source of food.[9]

The food preference was analyzed by using Jacobs D value index [9] as follows:

\[ D_i = \frac{(r_i - p_i)}{(r_i + p_i - 2r_i p_i)} \]

where \( D_i \): index of preference, \( r_i \): the proportion of food utilization, and \( p_i \): the proportion of abundance of food trees. The Bornean orangutan food trees were arbitrarily grouped into 4 categories, namely highly preferred (\( D_i: 0.51–1.00 \)), preferred (\( D_i: 0.01–0.50 \)), less preferred (\( D_i: -0.51–0.00 \)), and not preferred (\( D_i: -1.00 \sim -0.50 \)).

3. Results and discussion
During the observation days, there were 33 tree species (18 families) of Bornean orangutan food (table 1). Clusiaceae (4 species), Anacardiaceae (3 species), Moraceae (3 species) and Myrtaceae (3 species) were the dominant family for Bornean orangutan food sources. The other 14 families consisted only 1 to 2 species each. In addition, orangutans also consumed insects, lianas, mushrooms, herbs, soil, and some additional food provided by the Wildlife Sanctuary Manager. The composition of the Bornean orangutan food trees family in Lamandau Wildlife Sanctuary was identical to those in Gunung Palung National Park, East Kalimantan [10,11].

Based on the observations, fruits of Clusiaceae dan Moraceae families were recorded as preferred food by Bornean orangutans during the study period. Fruits were recorded as popular parts eaten by Bornean orangutans, accounted for 73.3%, followed by young leaves (9.6%). The other parts of food sources consumed by Bornean orangutans were lower than 8% each (figure 1).

Orangutans prefer fruit as their main/primary food because its fat content and carbohydrates in fruits has been known to be higher than other food categories [12]. Therefore, fruiting season in the forest is an important factor affecting the amount and composition of food eaten by the reintroduced orangutans in the forest [13]. Unfortunately, when this research was conducted, the fruiting seasons was not on its peak time. Orangutans will consume leaves, barks, and insects when outside fruit season [14]. Therefore, when fruits are abundant in the forest, the other food category is only used as a variation or fallback food.

| Fruit                | Percentage |
|----------------------|------------|
| Young Leaves         | 9.61%      |
| Insect               | 4.39%      |
| Bark                 | 4.29%      |
| Flower               | 0.54%      |
| Other                | 7.86%      |

73.31%

Figure 1. Proportion of food parts that consumed by Bornean Orangutan in Lamandau Wildlife Sanctuary, Indonesia.
The highly preferred food were ‘katikal’ (*Ochanostachys amentacea*; D, 0.95), ‘gandis’ (*Garcinia parvifolia*; D, 0.83), ‘kekupui’ (*Sarcotheca diversifolia*; D, 0.78), and ‘malukan’ (Latin name unknown; D, 0.56). Other species (see table 1) were also consumed in a less frequency.

The fruit of the ‘katikal’ (*O. amentacea*) and ‘gandis’ (*G. parvifolia*) were the most preferred food by adult females and adolescent females, while young leaves of ‘kekupui’ (*S. diversifolia*) was the preferred food for male adult orangutans (figure 2). Frequently, Orangutans preferred fruits with soft fleshy and seedy texture, including single and multiple berries from Ficus or fig trees [2,15]. Only one fig tree species was found in this study, and this fig trees was not dominant in the Lamandau Wildlife Sanctuary.

There were five species of Bornean orangutan food trees that could not be calculated in the preference index due to their low availability in the research area. These species were ‘belale’, ‘idur’ (*Nephelium eriopetalum*), ‘mendoking’ (*Ilex pleiobrachiata*), ‘pulai’ (*Alstonia angustifolia*), and ‘putik’. However, this does not have a significant effect on the overall results of Orangutan food preferences because the low value of the time proportion to consume these food species.

As this research was conducted in a relatively short time during non-peak fruiting season, additional monitoring of the productivity of the fruit tree outside the phenological plots, need to be done. In addition, the Wildlife Sanctuary Manager should assist the regeneration of the preferred tree species (i.e. katikal, gandis, kekupui, and malukan). For the successful releasing program in the future, the additional food given to orangutans should also include the food species preferred by orangutans in their natural habitat.

**Figure 2.** The highly preferred food of Bornean orangutan in Lamandau Wildlife Sanctuary: (a) *Ochanostachys amentacea*, (b) *Garcinia parvifolia*, (c) *Sarcotheca diversifolia*, (d) ‘malukan’.
Table 1. Preferences of Bornean orangutan food trees in Lamandau Wildlife Sanctuary (February-March 2020) based on Jacobs’ preference index.

| Category          | No | Local Name         | Species                        | $r_i$ | $p_i$ | $D_i$ |
|-------------------|----|--------------------|--------------------------------|-------|-------|-------|
| Highly Preferred  | 1  | Katikal            | Ochanostachys amentacea        | 29.22 | 0.71  | 0.95  |
|                   | 2  | Gandis             | Garcinia parvifolia            | 7.86  | 0.71  | 0.83  |
|                   | 3  | Kekupui            | Sarcotheca diversifolia        | 5.72  | 0.71  | 0.78  |
|                   | 4  | Malukan            | Unknown                        | 19.06 | 5.30  | 0.56  |
| Preferred         | 5  | Kariwaya           | Ficus sp.                      | 1.92  | 0.71  | 0.46  |
|                   | 6  | Jelutung           | Dyera costula                  | 2.47  | 1.06  | 0.40  |
|                   | 7  | Pudu               | Artocarpus kemando             | 1.62  | 0.71  | 0.39  |
|                   | 8  | Pempaning          | Quercus bennettii              | 0.77  | 0.35  | 0.38  |
|                   | 9  | Bekunyi            | Diospyros polyalthioides       | 6.05  | 4.24  | 0.18  |
|                   | 10 | Rambutan Hutan     | Nephelium sp.                  | 0.46  | 0.35  | 0.14  |
| Less Preferred    | 11 | Puak               | Artocarpus anisophyllus        | 2.68  | 2.83  | -0.03 |
|                   | 12 | Ramin              | Gonystylus bancanus            | 1.12  | 1.77  | -0.22 |
|                   | 13 | Mola               | Garcinia nigrolleata           | 1.39  | 2.47  | -0.28 |
|                   | 14 | Ubar Merah         | Syzygium leucocylon            | 0.57  | 1.06  | -0.30 |
|                   | 15 | Pantis             | Calophyllum pulcherrimum       | 0.74  | 1.41  | -0.31 |
| Not Preferred     | 16 | Rengas             | Gluta renghas                  | 0.68  | 1.41  | -0.35 |
|                   | 17 | Mansira            | Actinodaphne sp.               | 0.34  | 0.71  | -0.35 |
|                   | 18 | Lamananduk         | Dyospyros pilosanthera         | 0.48  | 1.06  | -0.37 |
|                   | 19 | Satar              | Bouea oppositifolia            | 0.15  | 0.35  | -0.39 |
|                   | 20 | Ubar Samak         | Syzygium polyanthum            | 0.14  | 0.35  | -0.43 |
|                   | 21 | Medang             | Elaeocarpus griffithii         | 1.22  | 3.18  | -0.45 |
| Uncategorized     | 22 | Pupung             | Sandoricum emarginatum         | 0.66  | 3.18  | -0.66 |
|                   | 23 | Ketiau             | Ganua motleyana                | 1.45  | 8.48  | -0.71 |
|                   | 24 | Kangkoban          | Neoscoertechinia philippinensis| 0.43  | 4.24  | -0.81 |
|                   | 25 | Ubar Putih         | Syzygium taiwense              | 0.28  | 4.26  | -0.87 |
|                   | 26 | Kemanjing          | Garcinia dioica                | 0.02  | 0.35  | -0.90 |
|                   | 27 | Semonu             | Elaeocarpus microphyllus       | 0.04  | 2.47  | -0.97 |
|                   | 28 | Tentulang          | Hypobathrum microcarpense      | 0.02  | 1.89  | -0.98 |
|                   | 29 | Belale             | Unknown                        | 0.86  | No data | -    |
|                   | 30 | Idur               | Nephelium eriopetalum          | 0.43  | No data | -    |
|                   | 31 | Mendoking          | Ilex pleiobrachiata            | 0.59  | No data | -    |
|                   | 32 | Pulai              | Alstonia angustifolia          | 0.30  | No data | -    |
|                   | 33 | Putik              | Unknown                        | 0.04  | No data | -    |

$r_i$: the proportion of food utilization, $p_i$: the proportion of abundance of food trees, $D_i = Jacobs’$ preference index

4. Conclusion

There were 33 tree species (18 families) of orangutan food. Yet, orangutan also consumed insects, lianas, mushrooms, herbs, soil, and some additional food provided by the Wildlife Sanctuary Manager. As a result, for tree species, fruits were classified as preferred food (73.3%), although other parts of the tree including young leaves, flowers, bark, and shoots were also eaten. Highly preferred food for orangutans were ‘katikal’ (Ochanostachys amentacea; fruit, $D_i = 0.95$), ‘gandis’ (Garcinia parvifolia; fruit, $D_i = 0.83$), ‘kekupui’ (Sarcotheca diversifolia; young leaves, $D_i = 0.78$), and ‘malukan’ (fruit, $D_i = 0.56$). The rest of the food species resulted in which 6 species categorized as preferred food, 11 as less preferred and 7 as not preferred food. Other 5 species were uncategorized due to a lack of data.

References

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