The effect of total solar eclipse on the daily activities of *Nasalis larvatus* (Wurmb.) in Mangrove Center, Kariangau, East Kalimantan

Sya Sya Shanida¹, Tiffany Hanik Lestari¹, and Ruhyat Partasasmita¹,²

¹Department of Biology, Faculty of Mathematics and Natural Sciences, University of Padjadjaran. Jl. Raya Bandung-Sumedang Km 21, Jatinangor, Sumedang 45363, West Java, Indonesia. Tel. +62-22-7796412 line 104, Fax. +62-22-7794545
²Programme of Magister Biology, Faculty of Mathematics and Natural Sciences, University of Padjadjaran. Jl. Raya Bandung-Sumedang Km 21, Jatinangor, Sumedang 45363, West Java, Indonesia. Tel. +62-22-7796412 line 104, Fax. +62-22-7794545

E-mail: syasyashanida@gmail.com, tiffanyhaniklestari42@gmail.com, Ruhyat.partasasmita@unpad.ac.id

Abstract. The total solar eclipse is an interesting phenomenon because the sun is covered by the moon. This phenomenon is like a night deception for animals, humans, and plants. One of the animals is Bekantan (*Nasalis larvatus* (Wurmb.)). *Nasalis larvatus* change its activity when this phenomenon occurs. The aims of the present study are (1) daily activity of *Nasalis larvatus* on total solar eclipse on March 9th, 2016 and (2) the effect of total solar eclipse on its activity in Mangrove Center, Kariangau, East Kalimantan. The *ad libitum* method was used in this study on Bekantan’s adult female. The result shows that the total solar eclipse has considerable effect on the daily activity of Bekantan. During total solar eclipse, the activity of Bekantan significantly stopped. When the total solar eclipse finished, Bekantan started its daily activity, and it was indicated by feeding activity which was led by alfa-male.

1. Introduction

The total solar eclipse is an attractive natural phenomenon. This phenomenon happens when the sunlight is not able to reach the earth since it is blocked by the moon. At this moment, the sky becomes dark as the dark in the night. Therefore, some animals, plants, and even humans, presumed the total solar eclipse as a night. Bekantan (*Nasalis larvatus*) is one of the animals that is deceived by total solar eclipse. Bekantan is an animal from Primate (ordo), Cercopithecidae (family), and Colobinae (subfamily) [5].

Bekantan’s activity is affected by the intensity of the light (night to morning). Bekantan starts their activities at 07.00 a.m. The daily activities of Bekantan throughout the day (05.30 – 18.30 a.m.) are walking, playing, resting, running from one tree to another, and feeding. The highest peak of feeding activity was observed in the afternoon. In fact, it is difficult to distinguish the feeding activity and the movement activity of Bekantan. This is because Bekantan did both the feeding and the movement activities within a short
period of time (in minutes) since Bekantan forages for food by moving in the trees. This results the fluctuation of the frequency of movement activity is nearly similar to that of feeding activity. Around 12.00 – 12.30 p.m., the intensity of feeding activity increased. After that, the feeding activity decreased and Bekantan start preparing to rest and sleep until 14.00 p.m.[4].

It was observed that the frequency of the feeding activity of Bekantan is not fixed only on one tree. The feeding activity of Bekantan was always followed by movement activity such as jumping between branches in one tree and/or running to another tree. This observation also exhibited that the movement of Bekantan from one tree to another for feeding occurs in every 10 – 15 minutes. It is worth mentioning that both the number and the distribution of trees are sufficient to supply the food demand of Bekantan. The purpose of the present study is to investigate the Bekantan’s daily activity during total solar eclipse on March 9th, 2016.

2. Method
This study was conducted using the adlibitum method on one Bekantan’s adult female in Somber River, Mangrove Center, Karingau, East Borneo (as shown in Figure 1) on March 9th, 2016 at 06.00 to 11.00 a.m.

![Figure 1. Area Study in Mangrove Center Kariangau, Somber River, Balikpapan, East Kalimantan (1°12'28.25"S and 116°50'18.3 0"E)](image)

3. Data analysis
The result of the present study is a graphic of the frequency of the activities of the Bekantan such as feeding, resting, and moving, as a function of time.
4. Result and discussion

4.1. Daily activity

It can be seen from Figure 2 that the moving activities increased from 29 to 65 at 06.00 to 08.00 a.m, while the duration of feeding activity increased up to 5 minutes followed by movement from one tree to another to eat leaves. It is also observed that the duration of feeding activity of Bekantan at one tree depends on both the type of the tree and the amount of the food in the tree. On *Ganua motleyana*, Bekantan could stay around 20 – 50 minutes [2]. While for doing the movement, at the same range of time the feeding activities increased from 10 to 15 times.

[6] Based on the mealtime, Bekantan used around 66% of their times to eat leaves and 26% to eat fruits [7]. [3] The main main food of Bekantan in Mangrove Center at Kutai National Park is *Avicennia alba*, *Rhizophora apiculata*, and *Bruguiera sexangula*.

The intensity of resting activity increased from 8 to 24 times at 06.00 to 08.00 a.m., and usually done when the Bekantan sat watching the neighborhood. Long resting activities carried out up to 25 minutes. This animal is choosing resting place (tree) as well as providing food, such as buds, flowers, fruits, and leaves, for example *S. Caseolaris, Ilex cymosa*, dan *Ficus* sp [1].

Contact 1, the first phase of partial solar eclipse, occurred at 07.25 a.m. Interestingly, around 35 minutes after Contact 1, it was observed that the moving activity, including the movement of Bekantan to the resting place, decreased to 27 times (at 08.00 to 09.00 a.m). The same fashion also was observed on the feeding activity. The feeding activity decreased to 5 times at 08.00 to 09.00 a.m. The decrease of both moving activity and feeding activity is due to the Contact 2, the phase of total solar eclipse, which occurred at 08.33 a.m. The peak of total solar eclipse happened one minute after Contact 2. It is worth noting that the activities of Bekantan during Contact 1, particularly when Bekantan start moving to resting place, was led by alfa male.

When the the last phase of total solar eclipse (contact 3) occurred (at 08.34 a.m.), it is observed that Bekantan start resuming their normal daily activities (see the activities at 09.00 to 11.00 a.m. in Figure 2), and it is indicated by feeding activity of alfa male. However, it was observed that the feeding activity of Bekantan after total solar eclipse is not as high as before total eclipse. The same pattern also was observed on both moving activity and resting activity. At 10.00 – 11.00 a.m. it was shown that the feeding, resting,
and moving activity decreased to 4, 6, and 4 times, respectively. It is worth mentioning that the feeding activity of the Bekantan is also influenced by the weather. The feeding activity of Bekantan is higher at higher light intensity. Therefore, the feeding activity of Bekantan in the morning is higher than the feeding activity in the afternoon or gloomy weather (in case of raining). Indeed, the gloomy weather and/or raining is mostly happen at noon or afternoon.

4.2. The activity alteration on total solar eclipse
During Contact 1, we observed no considerable effect of solar eclipse on the daily activities of Bekantan such as feeding, playing, and moving. However, it was exhibited that the feeding activity of Bekantan start decreasing at 08.15 a.m., when the sky brightness becomes similar to the sky brightness in the afternoon. The activities of Bekantan such as feeding, playing, and moving, significantly decreased at 08.30 a.m. In other hand, it was observed that Bekantan moves around the tree to look for the comfortable place for resting. At that time, the sky over mangrove forest started going to be dark. Interestingly, the total solar eclipse had many significant effects on other animals such as chicken and bird. During the total solar eclipse, it was shown that the chicken go into its cage and stop crowing, and birds perched on the tree and stop chirping. After several minutes of total solar eclipse, the brightness of the sky increased (Contact 3). It was observed that the environmental condition is similar to the condition in the morning. Interestingly, the activities of the animals also was observed similar to their normal activities in the morning. For example, the chicken was crowing, the birds started flying and chirping. Indeed, Bekantan also started its normal morning activities which is feeding. It is worth noticing that all activities of Bekantan is always led by alfa male. When the total solar eclipse finished, Bekantan resumed to its normal daily activities such as feeding, playing, and moving.

Acknowledgement
We give our best appreciation to GMT-BALIKPAPAN 2016’s team, and Mr. Irfan’s family who have contributed us on facilitating the research. We also thank Mr. Agus and his staff as a manager of Mangrove Center Kariangau Balikpapan.

References
[1] Alikodra H S 1997 Populasi dan Perilaku Bekantan (Nasalis larvatus) di Samboja Koala, Kalimantan Timur Media Konservasi 5 (2) 67-72
[2] Bismark M 1984 Biologi dan Konservasi Primata di Indonesia (Bogor: Makalah Fakultas Pascasarjana Institut Pertanian Bogor)
[3] Bismark M 1986 Perilaku Bekantan (Nasalis larvatus) dalam Memanfaatkan Lingkungan Hutan Bakau di Taman Nasional Kutai Kalimantan Timur (Bogor: Thesis of Magister Science Program of IPB)
[4] Bismark M 2009 Biologi Konservasi Bekantan (Nasalis larvatus) (Pusat Penelitian dan Pengembangan Hutan dan Konservasi Alam Bogor)
[5] Jolly A 1972 The evolution of Primate Behavior (New York: Mac-Millan Publishing Co. Inc.)
[6] Matsuda I Tuuga A and Higashi S 2009 The Feeding Ecology and Activity Budget of Bekantans American Journal of Primatology 7 (1) 478–492
[7] Matsuda I 2008 Feeding and Ranging Behaviors of Bekantan (Nasalis larvatus) in Sabah Malaysia (Hokkaido: Dissertation Graduate School of Environmental Earth Science Hokkaido University)
[8] Purba E F B 2009 Studi Keanekaragaman Jenis Tumbuhan Pakan Bekantan (Nasalis larvatus) di Taman Nasional Tanjung Puting Kalimantan Tengah (Bogor: Thesis of Under Graduate Program of IPB)