DAILY BEHAVIOR AND FEEDING ECOLOGY OF ONE TROOP OF *Macaca fascicularis* IN TELAGA WARNA, BOGOR, JAWA BARAT

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Bogor 2015

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Bogor, February 2015

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NIM G34090090
ABSTRAK

SANTI JULIANTI. Aktivitas harian kelompok dan ekologi pakan *Macaca fascicularis* di Telaga Warna, Bogor, Jawa Barat. Dibimbing oleh KANTHI ARUM WIDAYATI dan PUJI RIANTI.

*Macaca fascicularis* merupakan jenis primata yang mampu beradaptasi dalam segala jenis perubahan lingkungan, termasuk perubahan yang terjadi pada jenis makanan di alam. Penelitian ini bertujuan untuk mengobservasi aktivitas harian dan ekologi pakan yang dikonsumsi oleh kelompok B *M. fascicularis*, yang merupakan kelompok monyet ekor panjang lain yang terdapat di Telaga Warna. Pengamatan aktivitas harian dan ekologi pakan dilakukan dengan metode *scan sampling* dan *ad libitum* yang berlangsung selama 300 jam. Hasil penelitian ini menunjukkan bahwa aktivitas bergerak, makan, dan istirahat merupakan aktivitas harian yang paling banyak dilakukan oleh kelompok B *M. fascicularis*. Ketiga aktivitas tersebut berkaitan erat dengan perilaku mencari makan. Sebanyak 68.85% dari keseluruhan jenis makanan yang dimakan merupakan makanan non alami, sedangkan sisanya (31.35%) merupakan makanan alami. Nasi dan makanan ringan merupakan jenis makanan non alami yang paling banyak dimakan oleh kelompok B *M. fascicularis*. Daun merupakan jenis makanan alami yang paling banyak dimakan oleh kelompok B *M. fascicularis*.

Kata kunci: *Macaca fascicularis*, aktivitas makan, perilaku makan, Telaga Warna

ABSTRACT

SANTI JULIANTI. Daily behavior and feeding ecology of one troop of *Macaca fascicularis* in Telaga Warna, Bogor, Jawa Barat. Supervised by KANTHI ARUM WIDAYATI and PUJI RIANTI.

*Macaca fascicularis* is kind of primate which able to adapt in all various environment changes, including changes of food type in natural habitat. The aim of this study was to analyze the daily activities and feeding ecology of the group B of *M. fascicularis*, the another group of *M. fascicularis* in Telaga Warna. This study was conducted by using *scan* and *ad libitum sampling* methods, which lasted for 300 hours. Result showed that moving, feeding and resting is the most daily behavior, which related to foraging behavior. Artificial food is the most kind of food (68.85%) which are consumed by the group B of *M. fascicularis*, while the rest (31.15%) is natural food. Rice and snacks are the artificial food which is mostly eaten by the group B of *M. fascicularis*. Moreover, leaves are natural food which is mostly eaten by the group B of *M. fascicularis*.

Keywords: *Macaca fascicularis*, feeding activity, feeding behavior, Telaga Warna
DAILY BEHAVIOR AND FEEDING ECOLOGY OF ONE TROOP OF *Macaca fascicularis* IN TELAGA WARNA, BOGOR, JAWA BARAT

SANTI JULIANTI

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FOREWORDS

First of all, I would like to give thanks to Allah SWT for all blessing I have got. This research is made through an experiment entitled Daily Behavior and Feeding Ecology of One Troop of *Macaca fascicularis* in Telaga Warna Bogor which was conducted from April to June 2014 in Telaga Warna, Bogor.

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At last, I hope this research will be helpful for all readers.

Bogor, February 2015

*Santi Julianti*
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INTRODUCTION

Long-tailed macaque (Macaca fascicularis) is a primate species that belong to genus Macaca and sub family Cercopithecinae (Fooden 2006). *M. fascicularis* is distributed in Southeast Asia region (Thailand, Indonesia, Singapore, Brunei, Malaysia, Philippines, Vietnam, and Laos) (Brandon-Jones et al. 2002). *M. fascicularis* live in a group that consists of multi-males and multi-females (Supriyatna and Wahyono 2000). *M. fascicularis* live in various habitats, from lowland areas to highland areas. *M. fascicularis* is known to have six kinds of daily activities: moving, feeding, resting, grooming, playing and mating. The frequency of each activity is different in every individuals in groups. This difference may correlated to age and sex. For example, mating behavior of *M. fascicularis* occur in sub adults and adults. Meanwhile, playing is dominant activity in infants and juveniles (Kipper and Todt 2002).

*M. fascicularis* is ecologically plastic in taking any kind of food available in their home range (Nila et al. 2014). They have wide ecological plasticity to adapt and interaction in various environments (Richard, Goldstein, and Dewar 1989). The ecological plasticity is being reflected in food type adaptation, reproduction parameters, sizes of group, home ranges of populations and ability of living in diverse environments. *M. fascicularis* consumed fruit, flowers, leaves, seeds, insects and tubers. This species can be frugivorous if fruits are abundance (Wheatley 1980). Young leaves of bamboo (*Gigantochloa apus*), sadang (*Corypha utan*), and bulu (*Ficus virens*) were the preferable natural food which consumed by the group of *M. Fascicularis* in Cikakak (Hadi et al. 2007). The group of *M. fascicularis* consumed 66.7% fruits from the plants near the Natai Lengkuas site, Kalimantan Tengah (Yeager 1996). The troop number one of *M. Fascicularis* in Ubud, Bali consumed 58% artificial food than natural food, which peanuts and sweet potatoes were the most given food from the tourist and local vendors (Wheatley et al. 1996). Other observation in Telaga Warna reported that group A of *M. fascicularis* consumed 60.1% of natural food and 39.9% artificial food, with the stalk of grass (*Anoxopus compresus*) which was more consumed than the others (Nila et al. 2014).

Previous studies showed that feeding ecology of *M. fascicularis* in one area may different from another area are depend on the environment (Wheatley et al. 1996; Yeager 1996; Hadi et al. 2007; Md-Zain et al. 2010; Hambali et al. 2014; Nila et al. 2014). There are two groups of *M. fascicularis* in Telaga Warna. Information about feeding ecology in group A have been studied by Nila 2014. While no information has been reported for group B. Since both of two groups live side by side, they may share same resources to live. Thus, this study was important to compare the information about daily activities and feeding ecology between two groups of *M. fascicularis* in Telaga Warna.

**Aims**

The aim of the study was to analyze about daily activities and feeding ecology of group B of *M. fascicularis* in Telaga Warna, Bogor.
METHODS

Research site

This research was conducted from April-June 2014 in Telaga Warna, Bogor, West Java, Indonesia. Telaga Warna region is divided into nature reserve (cagar alam) and recreational park (taman wisata alam). The elevation of Telaga Warna is 1097-1400 above sea level (asl) (Nila 2014). Telaga Warna is restricted by Ciseureuh tea field in the east area and Gunung Mas tea field in the west area (Figure 1).

Data collection methods

The one troop of *M. fascicularis* which observed was named by group B. This group was consisted with 21 individuals (Table 1). Every individuals in group were identified by scars, hair colors, body sizes, faces, and differentiating shapes of head and body. For habituation, dried noodles were given to monkey for a month.

![Figure 1](image.png)

Figure 1: Borderline area of Telaga Warna, West Java A. Gunung Mas area; B. Ciseureuh tea field; C. Telaga Warna area.
Table 1 The total of individu in Group B of *M. fascicularis*

<table>
<thead>
<tr>
<th>Individu</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult male</td>
<td>3</td>
</tr>
<tr>
<td>Adult female</td>
<td>6</td>
</tr>
<tr>
<td>Sub adult male</td>
<td>2</td>
</tr>
<tr>
<td>Juvenile</td>
<td>7</td>
</tr>
<tr>
<td>infant</td>
<td>3</td>
</tr>
</tbody>
</table>

**Daily activities observations.** Behavioral data were collected by observing the daily activities, such as moving, grooming, resting, playing, mating, and feeding. The data were collected every day from 7am - 4pm. This study was used *ad libitum* and *scan sampling* methods. In *ad libitum* sampling, the behaviors of macaques were collected without time cycle. The result were counted from the duration of time activity and the frequency of each behavior. The observation stopped when the macaques were not visible (Altmann 1974). Moreover, the *scan sampling* method was used to estimate the proportion of every category of daily activities which performed by individuals in their activities (Lehner 1979). The individual daily activities performance were randomly scan in one minute cycle.

**Feeding behavior.** The type of food and its frequency which were consumed by *M. fascicularis* were observed every one minute. The food was categorized as natural and artificial foods. Natural food is the type of food that naturally available in the home range (plants, water, and animals). Artificial food is the type of food that was given to *M. fascicularis* (or spreadly given) by visitors or they got in the trash pots (Nila 2014). Artificial food was divided into two types of food, food from visitors or local vendors and food from the trash pots.

**Identification of plants.** Part of plants that were eaten by *M. fascicularis* were made as a herbarium samples. The herbarium samples were made from one small plant or branch which contain the composition of leaves, flowers, and fruits. The herbarium samples were identified by Herbarium Bogoriense LIPI Cibinong Bogor.

**Data analysis.** R i386 3.0.3 were used to calculated and summarized the data.
RESULTS

Daily behavior

The group B of *M. fascicularis* have a wide home range (795.6 m$^2$) in Telaga Warna, from tea field area in the borderline Cianjur and Bogor to recreational park of Telaga Warna. Most of the research data were collected in Rindu Alam and tea field area. These two places are the borderline of Cianjur and Bogor. The group B of *M. fascicularis* spent most of time in these two areas. The group B of *M. fascicularis* are usually stay in these areas about 3-4 hours a day. In holiday or weekend they can stay there all day long. In daily behavior activities, moving (36.0%) is the most frequent activity followed by feeding (24.6%) and resting (20.9%). Mating (0.4%) was the lowest percentage of daily activity in group B of *M. fascicularis* (Figure 2).

I observed that social activities (playing, grooming and mating) were happened after the foraging activities were done. Playing is the biggest percentage of social activities of Group B in Telaga Warna. This activity was done by juveniles and infants, where is sub adults and adults sometime participate as well. The juveniles are playing between the tree branches, climbing to the top of the tree, moving from one tree to another and wrestling in the tea field area.

Most of the grooming activity was occured every morning by female-female and female-juveniles. This grooming activity also occured by male-female and juveniles-juveniles, but not as much as female-female and female-juveniles. The grooming activity was observed on the tree branches while sunbathing. Meanwhile, mating as the lowest percentage, occured when resting or playing by every age of females in group (from sub adult to adult) with the alpha male and peripheral male. There is a sub adult male in group, but this individu didn’t do the mating behavior when the research was occur.

Figure 2 Home range of Group B of *M. fascicularis* in Telaga Warna; A. Home range area (±795.6 m$^2$); B. Tea field area; C. Rindu Alam area.
Feeding behavior

The group B of *M. fascicularis* consumed more artificial food (68.85%) than natural food (31.15%) (Table 2). Rice (15.70%) was the most preferable artificial food that came from visitors. Fruits (3.86%) was the most preferable artificial food from trash (Table 2).

Among natural foods, *M. fascicularis* mostly ate part of plants (24.58%). Leaves is part of plants which consumed by the group B of *M. fascicularis*. The most preferable natural food of *M. fascicularis* was grass (*Axonopus compressus*) (43.98%). While, tea (*Camelia sinensis*) (7.33%) observed as the less preferable food consumed by group B of *M. fascicularis* (Table 2, Appendix 1).

Table 2 Kind of leaves that was consumed by group B of *M. fascicularis*.

<table>
<thead>
<tr>
<th>Species of Plant</th>
<th>Percentage</th>
<th>Type of plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Axonopus compressus</em></td>
<td>43.98%</td>
<td>Herb</td>
</tr>
<tr>
<td><em>Tridax procumbens</em></td>
<td>21.47%</td>
<td>Herb</td>
</tr>
<tr>
<td><em>Ageratina riparia</em></td>
<td>19.37%</td>
<td>Herb</td>
</tr>
<tr>
<td><em>Echinochloa colona</em></td>
<td>18.32%</td>
<td>Herb</td>
</tr>
<tr>
<td><em>Camelia sinensis</em></td>
<td>7.33%</td>
<td>Tree</td>
</tr>
</tbody>
</table>
Table 3 Kind of food which were preferable by the group B of *M. Fascicularis*.

<table>
<thead>
<tr>
<th>Type of food</th>
<th>Food Items</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>From visitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial food</td>
<td>Rice</td>
<td>15.70%</td>
</tr>
<tr>
<td></td>
<td>Snacks</td>
<td>11.58%</td>
</tr>
<tr>
<td></td>
<td>Vegetables</td>
<td>11.45%</td>
</tr>
<tr>
<td></td>
<td>Noodles</td>
<td>10.55%</td>
</tr>
<tr>
<td></td>
<td>Fruits</td>
<td>3.99%</td>
</tr>
<tr>
<td></td>
<td>Bread</td>
<td>3.86%</td>
</tr>
<tr>
<td></td>
<td>Tofu</td>
<td>0.90%</td>
</tr>
<tr>
<td></td>
<td>Total food from visitors</td>
<td>58.04%</td>
</tr>
<tr>
<td>From trash</td>
<td>Fruits</td>
<td>3.86%</td>
</tr>
<tr>
<td>Artificial food</td>
<td>Leftover sauce</td>
<td>2.06%</td>
</tr>
<tr>
<td></td>
<td>Unidentified food*</td>
<td>1.16%</td>
</tr>
<tr>
<td></td>
<td>Tofu</td>
<td>0.90%</td>
</tr>
<tr>
<td></td>
<td>Vegetables</td>
<td>0.77%</td>
</tr>
<tr>
<td></td>
<td>Snacks</td>
<td>0.77%</td>
</tr>
<tr>
<td></td>
<td>Wrap</td>
<td>0.39%</td>
</tr>
<tr>
<td></td>
<td>Noodle</td>
<td>0.26%</td>
</tr>
<tr>
<td></td>
<td>Ketchup</td>
<td>0.26%</td>
</tr>
<tr>
<td></td>
<td>Noodles seasoning</td>
<td>0.26%</td>
</tr>
<tr>
<td></td>
<td>Mungbean Extract</td>
<td>0.13%</td>
</tr>
<tr>
<td></td>
<td>Total food from the trash</td>
<td>10.81%</td>
</tr>
<tr>
<td>Total Artificial food</td>
<td></td>
<td>68.85%</td>
</tr>
<tr>
<td>Plants</td>
<td>Leaves</td>
<td>24.58%</td>
</tr>
<tr>
<td>Natural food</td>
<td>Litter</td>
<td>4.38%</td>
</tr>
<tr>
<td></td>
<td>Flowers</td>
<td>0.90%</td>
</tr>
<tr>
<td></td>
<td>Fruits</td>
<td>0.26%</td>
</tr>
<tr>
<td></td>
<td>Rod</td>
<td>0.13%</td>
</tr>
<tr>
<td></td>
<td>Moss</td>
<td>0.13%</td>
</tr>
<tr>
<td></td>
<td>Young leaves</td>
<td>0.13%</td>
</tr>
<tr>
<td></td>
<td>Total part of plants</td>
<td>30.50%</td>
</tr>
<tr>
<td>Others</td>
<td>Soil</td>
<td>0.64%</td>
</tr>
<tr>
<td></td>
<td>Total other natural food</td>
<td>0.64%</td>
</tr>
<tr>
<td>Total natural food</td>
<td></td>
<td>31.15%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

*Unidentified food: the food which ate before we categorized it.
DISCUSSIONS

Daily behavior

The most percentage of daily activities (moving, feeding and resting) were related to foraging activities. The results were same as previous study (Wheatley 1980; Wheatley 1996; Yudhanegara 2006; Md-Zain et al. 2010; Nila et al. 2014). Group B of *M. fascicularis* spent most of their foraging behavior in Rindu Alam and tea field area. Food were more available in Rindu Alam and tea field area. Their moving activity are connected to the food availability in the home range. This group is habituated to people. They usually foraging in the area where people were there. Moving, feeding and resting are the daily activities of *M. fascicularis* that related to foraging behaviors. However, the explanation was different from the result in another place. The individual in the group B of *M. fascicularis* are moving from one point to another point in short range area because there are plenty of food exist in small area. Meanwhile, in other place, the group of *M. fascicularis* moving to extending their home range. *M. fascicularis* often moved when the food source become shortage (O’Brien and Kinnaird 1997). In Malaysia, *M. fascicularis* has been proved to expand their home range when the food was limited (Md-Zain et al. 2010).

Playing activities is a form of social competition and also assist to learn the social relationship. This playing activity usually done by sub juveniles, juveniles, and infant (Kipper and Todt 2002). Grooming and mating behavior are happen between other activities (moving, feeding, resting, and playing). Grooming is activity which has many function, such as the mating opportunities (Gumert 2007) and range from ectoparasite and debris removal (Hewlena et al. 2007). Grooming activities typically done every morning by all ages and genders of *M. fascicularis*. Grooming activity of group B of *M. fascicularis* usually happened after foraging activity in the morning. Grooming activity is occur between female-female, female-male, or female-juveniles (Gomert and Ho 2008).

Mating activity has the lowest percentage of daily behavior. In *M. fascicularis*, male with the highest rank of hierarchy have biggest possibilities to monoply the mating activity with estrus female in group (Shively and Smith 1985). This monopoly activity reflected by ac correlation between mating success and males rank in groups (de Ruiter and van Hoooff 1993).

Feeding behavior

Food is the most important thing for living organism. Food is not just functioning as a source of energy, but also affected the behavior of organism. The most preferable food by *M. fascicularis* in group B was artificial food. Rice was preferable artificial food of the group B of *M. fascicularis*. Rice sources were came from the local vendors near Rindu Alam and tea field area. Group B of *M. fascicularis* also prefer the leftover fruits from visitors or they can get in the trash pots. The result in this study were different from previous study of group A of *M. fascicularis* in Telaga Warna. Group A of *M. fascicularis* consumed 60.1% natural food, peanut (19.8%) as the most preferable artificial food from visitors and 12.1 % is the artificial food from the trash pots (Nila et al. 2014). The
differences occur because the home range of group B of *M. fascicularis* is closer to human environment than the group A of *M. fascicularis*.

These result were also different from study in other places. In Ubud, Bali, 58% food were came from tourist and local vendor. The peanuts were provided by tourists whereas sweet potatoes were provisioned by local guards (Wheatley et al. 1996). *M. fascicularis* of pancalikan group in Ciamis consumed 50.93% nuts as artificial food from the visitors (Yudhanegara 2006). The group of *M. fascicularis* in Kuala Selangor Nature Park Malaysia consumed 26.1% artificial food such as breads, nuts, snacks, and sweets from garbage cans near the area (Hambali et al. 2014).

The group B of *M. fascicularis* consumed more artificial food than natural food which is given by visitors and local vendors. The frequency of visitors increased in holidays and weekends. They left their leftover to be consumed by the group B of *M. fascicularis*. This action affected the artificial feeding behavior of group B of *M. fascicularis*. The *M. fascicularis* prefer artificial food because it is easier to get than natural food. The food given by visitors trained *M. fascicularis* to identify visitors as food source.

In India, local vendors giving food to *M. mullata* (rhesus monkey) everyday for several purposes: to avoid them from disturbing crops and orchads, to limit movements of monkeys to certain area, and to maintain the cultural and amusement advantages of an open zoo (Southwick et al. 1976). Another study in Kuala Selangor national Park explained that the habituation of feeding behavior in *M. fascicularis* changed from natural food to artificial food happened by the changed of environment situation. When the natural environment changed into most of human living environment, the *M. fascicularis* also changed kind of food which most available in the new environment, besides natural food still available there (Hambali et al. 2014).

The group B of *M. fascicularis* preferable 31.15% natural food from the total food in the home range. The result were different from study in other place. In Kalimantan Tengah, the group of *M. fascicularis* consumed 66.7% fruits from all natural food (Yeager 1996). In Mauritius, 70% from all natural food which consumed by the group of *M. fascicularis* was fruit which came from *Ficus* family plants (Sussman and Tatersall 1981). Soil is the lowest number (2%) of preferable natural food by the group B of *M. fascicularis* in Telaga Warna. Soil consumed have many function, such as for fulfill nutritional requirement (Oates 1978), adsorb some ingested organic plant toxic (Johns 1986) and maintaining the pH of the gut (Bolton et al. 1998).

Naturally, *M. fascicularis* is frugivorous, but they can also be omnivorous (Wheatley 1980; Md-Zain et al. 2010). *M. fascicularis* is frugivorous when food in natural habitat is abundance, and they will be omnivorous when the natural food become scarce or foliovorous (eat more leaves than anything else) when the number of fruits is less or nothing at all (Yudhanegara 2006). The group B of *M. fascicularis* in the tea fields and nature recreational park consumed the fruit of wild berry (*Rubus fraxinifolius*). The *M. fascicularis* prefer to consume the ripe fruit (Wheatley 1980). The fruiting season of tropical rainforest cannot be predicted because the fruiting period of time is not same every year (Hanya et al 2013). The other plants that are consumed by the group B of *M. facicularis* are *Axonopus compresus*, *Camelia sinensis*, *Tridax procumbens*, *Ageratina riparia*, *Camelia sinensis*, *Tridax procumbens*, *Ageratina riparia*,
and *Echinochloa colona* (Appendix 1). They consumed the leaves from the plants, with *Axonopus compressus* as the most preferable food. The result is same with troops A in Telaga Warna (Nila 2014). Based on this study, leaves are the most consumed food of all. Leaves were also consumed in the middle of eating the artificial food.

From all consumed natural food, which were most of it was herb plants which grow decrease than 1 metres tall (*A. compressus, T. Procumbens, A. riparia, E. colona*), we can explained that the group B of *M. fascicularis* were no fully arboreal animals. This different behavior happened because the group B of *M. fascicularis* spent most of time to do foraging behavior on the ground beside on the tree branches. From the previous study, *M. fascicularis* was known as arboreal animal, which spent most of their activities in the top of the tree (Richard *et al.* 1989). Wheatley (1980) also explained that the group of *M. fascicularis* was the tree branches feeder, which spent the foraging activity on the top of the tree branches.

The *M. fascicularis* have unusual dietary behavior to fulfill their body nutrient content. One of the unusual *M. fascicularis* behavior is the temple licking stone in Bali (Wheatley *et al* 1996). This kind of behavior happened to avoid the sodium deficiencies in their bodies (Takenaka 1986). Instead of temple licking stone in Bali, group B of *M. fascicularis* will immediately eat grass (*Axonopus compressus*) after consume the artificial food which contains sauce. This behavior may speed up the food digestion. This finding is firstly observed.

**CONCLUSIONS**

Result showed that moving, feeding, and resting is the most daily behavior, which related to foraging behavior. These three daily behavior are related to foraging activities. The group B of *Macaca fascicularis* in Telaga Warna consumed more artificial food than natural food. This changing behavior occured because they were habituated with artificial food which are given from visitors and local vendors. The most natural food which consumed by group B of *Macaca fascicularis* is *Axonopus compressus*.

**REFERENCES**


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1. Dilihat dari halaman depan, bagian akhir dengan teks "Hak Copy Ditindungi Undang-Undang"

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Appendix 1 The morphology of preferable plant of group B of *M. Fascicularis*; A. *Ageratina riparia*; B. *Tridax procumbens*; C. *Camelia sinensis*; D. *Echonochloa colona*; E. *Rubus fraxinifolius*; F. *Axonopus compressus*. 
CURRICULUM VITAE

Author was born on 31st of July 1991 as the second of two from the parents Adimin Haryadin and Entin Suryati Wisantadipura. In 2009, author graduated from SMAN 7 Bandung and entered the Department of Biology, Faculty of Mathematics and Natural Science, Bogor Agricultural University by USMI selection. In 2011, author conducted the Field Study with the research title Ecology of Freshwater Fish in Gunung Walat University Forest and in 2012 author conducted the Field Work at Balai Inseminasi Buatan. The author also became laboratory assistant for Prokaryotes Physiology on year study 2012-2013 and laboratory assistant for Basic microbiology on year study 2014-2015.