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# Daily Behavior of Javan Gibbon (*Hylobates moloch*) Ragunan Wildlife Park: Implications for Reintroduction and Welfare Assessment

Perilaku Harian Owa Jawa (*Hylobates moloch*) di Taman Margasatwa Ragunan: Implikasi terhadap Reintroduksi dan Kesejahteraan Satwa di Konservasi Ex-Situ

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Abstrak

Owa Jawa (*Hylobates moloch*) merupakan primata endemik Jawa yang sejak 2015 berstatus terancam punah menurut IUCN. Upaya pelestariannya dilakukan melalui penangkaran dan konservasi ex-situ. Penelitian ini bertujuan menganalisis pola perilaku harian Owa Jawa di Taman Margasatwa Ragunan serta menilai keterkaitannya dengan manajemen satwa, termasuk kondisi kandang, pakan, dan enrichment sebagai dasar rekomendasi peningkatan kesejahteraan satwa. Penelitian dilakukan pada dua individu jantan dan betina menggunakan metode scan sampling dengan fokus pada aktivitas makan, istirahat, bergerak, dan sosial. Analisis data dilakukan secara kualitatif-deskriptif. Hasil menunjukkan aktivitas dominan adalah bergerak (≥20%), diikuti istirahat (15%), makan (≥6%), dan sosial (≥3%). Aktivitas meningkat pada sore hari pukul 14.50–15.00. Pola ini berbeda dengan perilaku Owa di habitat alaminya, yang berpotensi menurunkan kemampuan naluriah dan menghambat keberhasilan pelepasliaran. Penelitian ini memberikan data empiris penting mengenai adaptasi perilaku Owa Jawa di penangkaran, yang masih jarang dikaji dalam konteks konservasi ex-situ di Indonesia.

**Kata kunci:** perilaku harian, Owa Jawa (*Hylobates moloch*), primata, konservasi ex-situ, kesejahteraan hewan

Abstract

*The Javan gibbon (Hylobates moloch) is a primate endemic to Java that has been classified as endangered by the IUCN since 2015. Conservation efforts are carried out through breeding and ex-situ conservation. This study aims to analyze the daily behavior patterns of Javan gibbons at Ragunan Wildlife Park and assess their relationship with animal management, including cage conditions, feed, and enrichment as a basis for recommendations to improve animal welfare. The study was conducted on two male and female individuals using the scan sampling method, focusing on feeding, resting, moving, and social activities. Data analysis was conducted using qualitative-descriptive methods. The results showed that the dominant activity was movement (≥20%), followed by resting (15%), feeding (≥6%), and socializing (≥3%). Activity increased in the afternoon between 2:50 p.m. and 3:00 p.m. This pattern differs from the behavior of gibbons in their natural habitat, which has the potential to reduce their natural abilities and hinder the success of their release. This study provides important empirical data on the behavioral adaptation of Javan gibbons in captivity, which has rarely been studied in the context of ex-situ conservation in Indonesia.*

**Keywords**: *daily behavior, Javan gibbon (Hylobates moloch), primates, ex-situ conservation, animal welfare*

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## INTRODUCTION

Indonesia is among the top three countries with the highest diversity of primate species after Brazil and Madagascar, with around 40 primate species [1]. Four large countries — Brazil, Madagascar, Indonesia, and the Democratic Republic of the Congo — are home to approximately 65% of the world's primate species [3]. Most primates in Indonesia are endemic [2]. Studies indicate that more than 30 Indonesian primate species are found only within the country [4]. One type of endemic primate found in Indonesia is the Javan gibbon (*Hylobates moloch*).

The Javan gibbon belongs to the genus Hylobates and is a native species found in Java, particularly West Java, Central Java, and Banten [5]. The Javan gibbon is the only ape species on the island of Java that has a petite body and lives in trees, or arboreally. These primates live in groups, primarily as leaf-eating species, and inhabit the forest edges [2].

Although classified as an endemic species of Java, the population of this primate is declining. The distribution of the Javan gibbon is now limited to a few locations, such as Mount Honje Ujung Kulon, Mount Gede Pangrango, Mount Masigit, Mount Tilu, Mount Tampomas, Mount Salak, Mount Papandayan, Mount Sawal, Mount Halimun, Kamojang Crater, and Leuweung Sancang Nature Reserve. Researchers have reported that the species extends as far as Central Java, including Mount Slamet and the Dieng highlands [2], [6]. Poaching, logging, and land clearing have reduced the Javan gibbon population. These activities have caused the Javan gibbon to lose its habitat, which is essential for its survival and daily activities [2]. The Javan gibbon (*Hylobates moloch*) is an arboreal primate that depends on forest canopy cover as a means of movement and a source of food. The loss of canopy cover due to land conversion and forest fragmentation has disrupted daily activities and led to a decline in population. Research conducted by Putra and Baskoro in Wana Wisata Kali Paingan, Pekalongan, reveals that Javan gibbons are primarily found in dense forest areas at altitudes of 630–780 meters above sea level, with a population of approximately 92 individuals in an area of roughly 6.7 $km^2$ [7]. This condition indicates limited suitable habitat and high ecological pressure. In addition to habitat loss, poaching also exacerbates the threat to this species, especially in West Java and Banten. As a result, the Javan gibbon is classified as Endangered by the IUCN, making habitat conservation and reforestation of forest corridors crucial steps in preserving its survival.

In 2015, the Javan gibbon was classified as an endangered species and included in the Red List by the International Union for Conservation of Nature (IUCN). Additionally, the Javan gibbon has been listed in Appendix I since July 1, 1975, under the Convention on

International Trade in Endangered Species of Wild Fauna and Flora (CITES) [2]. The total number of Javan gibbons recorded is estimated to be only 3,000–4,000 individuals [8]. This status prompted the government to classify the Javan gibbon as a highly protected species due to its role in maintaining the balance of the forest ecosystem [9]. As conservation efforts increasingly rely on ex situ strategies, behavioral studies in captivity are crucial for assessing welfare and determining the feasibility of reintroduction.

As the threat and decline of the Javan gibbon in the wild increase, conservation efforts and strategies are urgently needed to save the Javan gibbon population. Additionally, conservation activities serve as a valuable means of education, research, recreation, and appreciation for natural wealth [10]. However, despite these conservation activities, the issue still requires attention. As shown in a study conducted [11] three Binturong individuals in Ragunan Wildlife Park, several changes in the feeding behavior of Binturong have been observed . In addition, there are indications of feeding behavior patterns and changes in nutritional levels in Timor deer at the Wisma Deer Breeding Center in Sumbawa [12].

Conservation activities that do not adequately prioritize animal welfare may cause these behavioral changes. Behavior is a form of activity that arises as a result of the process of adaptation to the environment [13]. This behavior includes foraging, communication, defending territory, breeding, and avoiding danger [14]. Therefore, in the development of conservation centers, especially ex-situ ones, it is essential to consider several key aspects and components to ensure that animals can live comfortably and feel as if they are in their natural habitat [15]. Javan gibbons (*Hylobates moloch*) exhibit differences in daily behavior between males and females. Males are more active and vocal, using their voices to defend their territory and establish dominance within their group. At the same time, females tend to exhibit social behaviors such as caring for their young and interacting with other individuals. These differences reflect a natural division of roles in maintaining group stability and the survival of the species in its habitat [15].

Researchers have frequently observed the daily activities of Javan gibbons at ex-situ conservation centers. Ilham's research indicates that the daily behavior of Javan gibbons at the Javan Gibbon Center shows no significant changes in behavior, suggesting that Javan gibbons are eligible for reintroduction into the wild [16]. In addition, Srimulyaningsih and Ramdan report that Javan gibbons at the Ciwidey Javanese Primate Rehabilitation Center spend most of their time moving, followed by resting, eating, grooming, vocalizing, urinating, drinking, and defecating [5]. The daily behavior of Javan gibbons at Ragunan Wildlife Park during the pandemic and revealed differences in daily

behavior between weekdays, holidays, and weekends [10].

Although many studies have examined Javan gibbon behavior, only a few have focused on individuals living in urban ex situ conservation facilities, such as Ragunan Wildlife Park. Research remains limited, particularly regarding the impact of environmental factors, enclosure management, and human presence on their natural behavior patterns. This condition is necessary to study because changes in the behavior of captive animals can impact animal welfare and reduce other adaptive abilities, thereby potentially hindering the success of conservation programs, especially reintroduction efforts. Therefore, this study aims to analyze the daily activity patterns of Javan gibbons at the Ragunan Wildlife Park conservation center and evaluate indications of behavioral changes in Javan gibbons from their natural patterns as a scientific basis for monitoring efforts, improving animal management, and strengthening ex-situ conservation programs in the future.

## METHODS

This study took place from January to March 2025 at Ragunan Wildlife Park, Jakarta. The Javan gibbons lived in an enclosure measuring 6 meters high and 5 meters wide. The enclosure consisted of a sturdy iron frame with a solid cement floor, designed to facilitate cleaning and maintain hygiene within the enclosure. Inside the enclosure, there were vertical structures, such as iron poles and ropes, that allowed the Javan gibbons to exhibit some of their natural behaviors, including brachiation and moving from one place to another. However, there was no live vegetation inside the enclosure, which limited the gibbons' natural exploration space and opportunities to forage in the trees. These conditions can affect the complexity of behaviors that emerge, particularly those related to space use, exploration activities, and resting patterns.

However, the area outside the enclosure is surrounded by lush vegetation and trees, so that the surrounding environment resembles the natural habitat of the Javan gibbon. The presence of trees around the enclosure has the potential to provide important visual and psychological stimuli, such as a sense of comfort and protection, so that Javan gibbons still feel conditions similar to their natural habitat, even though the vegetation is not directly accessible to them.

### Research Subjects

The subjects of this study were a male–female pair of Javan gibbons housed together in captivity. The pair consisted of a male named Adul, approximately 14 years old, and a female named Eneng, approximately 19 years old.

**Research Tools**

The tools used in collecting data for this research include cameras, watches, and writing instruments.

**Data Collection Techniques**

The data collected included primary and secondary data. The primary data collected included the gender and age of Javan gibbons, as well as information on their daily activities, such as feeding, resting, moving, and social interactions. The secondary data collected included the general conditions of the research location. Primary data collection: This study employed a sampling technique with a 10-minute interval during three observation periods (morning, afternoon, and evening) for six days a week over a period of two months. Daily observation sessions of the two Javan gibbons were conducted at three times, namely every morning (08.00-10.00), afternoon (11.00-13.00), and evening (14.00-15.00). Researchers observed two individuals—a male and a female. The recorded behavior categories included feeding, resting, movement, and social interaction. The observers established inter-observer reliability through trial sessions before formal data collection began. The observation of daily activities focused specifically on eating behavior, concentrating on feeding actions—putting food into the mouth, chewing, and swallowing—and excluded foraging behavior because the food was already prepared. Movement activities include branchiation (swinging), bipedal/walking on two legs, climbing, and descending from trees. Resting activities include sitting, lying down, or sleeping. Social activities include grooming (allogrooming & autogrooming) and vocalization.

**Data Analysis and Interpretation**

The researchers analyzed data obtained from observations of the daily behavior of Javan gibbons using descriptive and quantitative methods to identify the frequency and proportion of each activity category—eating, resting, moving, and social activities. The analysis compiled the observation results into frequency distribution tables. The study then calculated the percentage of each activity in relation to the total observation duration. The study presented the data visualization as bar graphs to illustrate behavioral trends across each time range. Data interpretation was carried out by comparing the activity patterns that emerged with references to the behavior of Javan gibbons in their natural habitat, and relating them to environmental conditions and enclosure facilities at the conservation site. The study also conducted a qualitative analysis to identify possible factors that triggered behavioral differences, such as the individuals' origin, breeding history, and the influence of visitors.

**General Conditions of the Research Location**

Ragunan Wildlife Park (TMR) occupies 10 hectares of land in South Jakarta. The total area of Ragunan Wildlife Park is currently 147 hectares and is home to approximately 2,297 animals, including Javan gibbons (*Hylobates moloch*), as well as a diverse range of plant species. In general, Ragunan Zoo offers a range of benefits, including nature protection and conservation, education, research, recreation, and appreciation of nature. According to Nugraha and Yanti, Ragunan Wildlife Park was established in 1814, when Jakarta was still called Batavia, by the Flora and Fauna Lovers Association. However, it was officially inaugurated around 1966 by the then Governor of DKI Jakarta [17]. The park, previously known as Planten en Dierentuin, is now home to more than 2,000 individual species of fauna and approximately 20,000 types of flora.

**Characteristics of Javan Gibbons at Ragunan Wildlife Park**

The Javan gibbons that were the subject of this study consisted of a pair, comprising a male and a female, housed in primate enclosure III. The male gibbon was named Adul and was approximately 14 years old, while the female gibbon was named Eneng and was approximately 19 years old.

**Table 1.** Research Objects: Gibbons at Ragunan Wildlife Park

| Gibbon Data | Adul | Eneng |
|---|---|---|
| Sex | Male | Female |
| Estimated Age | 14 years, 9 months | 19 years, 12 months |
| Birth/Arrival Date | 06/01/2010 | 18/10/2004 |
| Animal Origin | Born at TMR | Confiscated from the wild |

Primate Enclosure III at Ragunan Wildlife Park features several facilities, including an open-air exhibition area that allows the animals to interact more freely with their environment and access food. Additionally, there is a more enclosed enclosure, specifically a sleeping enclosure, designed to allow Javan gibbons to sleep comfortably. In addition to these two enclosures, Primate Enclosure III at Ragunan Wildlife Park also features a quarantine enclosure used to house newly arrived gibbons or individuals that require separation for specific purposes or medical care.

## RESULTS AND DISCUSSION

**Feeding Activity of Javan Gibbons**

Observations of the feeding activities of Javan gibbons were limited to feeding behavior, as there was no foraging or food selection behavior observed. Javan gibbons in Primate House 3 are fed twice a day, in the morning and afternoon. Feeding the Javan gibbons is done by first mixing the food,

then cleaning it with running water. Once mixed, the food is then placed in the enclosure and put in the Javan gibbons' feeding area, specifically at the end of the area where they usually carry out their daily activities. The food provided consists of a mixture of vegetables, fruits, or both.

**Figure 1**. Feeding Activity of Javan Gibbons

Placing food a short distance away from the enclosure aims to stimulate the movement of Javan gibbons through external stimuli, such as food [5]. Increasing the amount of food that requires manipulation by primates can enhance the animals' engagement with food, demonstrating that modifying feeding methods can stimulate activity and reduce social stress [18]. Environmental enrichment, including feeding that requires foraging activities, also encourages exploratory and foraging behaviors in primates, in line to make Javan gibbons more active [19]. Figure 2 shows the activities of Javan gibbons as they descend from their cages to reach their food containers, illustrating their movement and efforts to obtain food. The caretakers have adjusted the food provided to both gibbons to match the natural diet of the Javan gibbon, a frugivorous species that consumes large amounts of fruit. Food for the Javan gibbons (Adul and Eneng) is provided daily, with a weekly variation in the menu. The main types of food are fruits such as bananas, papayas, guavas, apples, and watermelons, accompanied by additional vegetables and light protein sources. This variety aims to maintain the gibbons' natural eating behavior and daily activity patterns, ensuring that their routines remain engaging and varied. In addition, Javan gibbons in the wild also consume leaves, flowers, honey, grains, and small insects [14].

**Figure 2.** Primary food source of Javan Gibbons

Observations of the feeding behavior of Javan gibbons at Ragunan Wildlife Park show different frequencies between adults and juveniles. Adul eats more frequently than Eneng. When eating, Adul tends not to be picky, whereas Eneng is very selective about food. Eneng prefers to eat vegetables and bananas. Both individuals exhibit an increase in feeding frequency in the afternoon, between 2:50 p.m. and 3:00 p.m.,

by 13% and 10%, respectively. The daytime period shows the lowest feeding activity, with a frequency of 0%. This pattern differs from the typical natural behavior of Javan gibbons and siamangs, which usually exhibit the highest feeding activity in the morning [20]. This change may indicate a behavioral adjustment in response to routines formed by human intervention. This pattern is likely related to the feeding schedule, which is conducted twice a day, with the afternoon feeding occurring near the end of the observation session. It may also be because in the afternoon, the gibbons have been active all day, so they feel hungry and need to replenish their nutritional intake. According to Ribut, during the day, Javan gibbons tend to be less active in searching for food and rest more [13]. Foraging activity increases again in the afternoon when the number of visitors begins to decrease. This condition likely occurs because the area around the enclosure remains crowded from morning until noon, creating a chaotic atmosphere that prevents the gibbons from being optimally active. An increase in the number of visitors can also cause social environmental pressure, causing primates to avoid open areas and delay foraging activities until the atmosphere becomes calmer. Thus, the increase in Javan gibbon activity in the afternoon is most likely related to the decrease in disturbance from visitors at that time [21].

In addition, Eneng's feeding activity is lower than Adul's. This difference is not only influenced by the type of feed, but also by the background and psychological condition of each individual. However, Eneng has been in captivity for longer; her status as an animal confiscated from the wild means that the process of adapting her feeding behavior is different. Animals that have lived in their natural habitat generally have stronger food preferences, foraging patterns, and natural rhythms, so their adaptation to regular feeding patterns and standard captivity feed can take longer. In addition, factors such as social hierarchy within the pair, stress levels, past traumatic experiences, and individual temperament have also been reported to influence the frequency and duration of feeding in captive primates [22], [23]. This pattern indicates the importance of providing more varied feed that resembles the composition of natural feed to maintain foraging behavior stimulation. This statement is supported by research findings, which state that Javan gibbons in their natural habitat can eat at least 10 types of natural fruit feed [24].

Thus, the differences in feeding behavior between Adul and Eneng cannot be explained solely by dietary factors but instead reflect a combination of biological aspects, life experiences, and social dynamics within the enclosure.

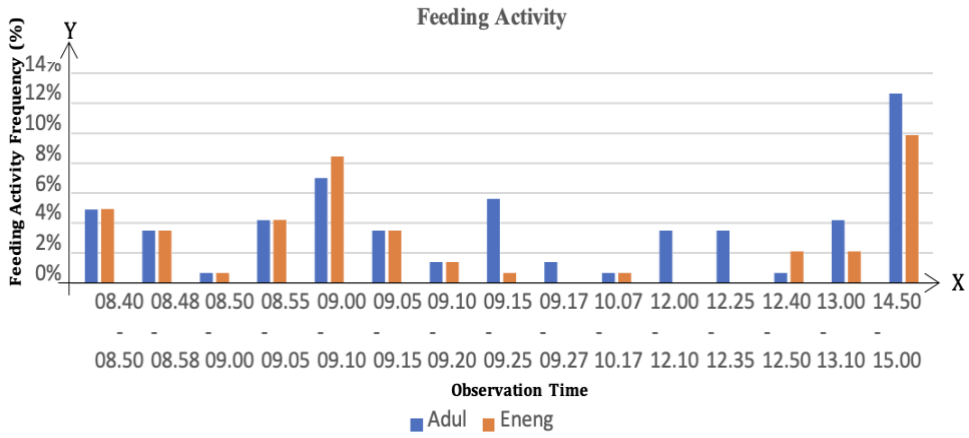


**Figure 3.** Feeding Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park

**Resting Activity of Javan Gibbons**

In this observation, the Javan gibbons were observed engaging in only two types of resting activities: sitting and lying down. Based on the results of this observation (Figure 4), the highest frequency of resting activities for Adul and Eneng was in the afternoon, namely at 14:50-15:00. This is in accordance with Nuraisah's research, which states that long resting behavior generally begins with movement towards the sleeping tree when it starts to get dark [25]. The highest frequency of resting activity for Adul was 17% and the highest resting activity for Eneng was 17%. The high frequency of resting in the afternoon indicates a shift in daily rhythm when compared to Javan gibbons in the wild, which generally have peak activity in the morning until noon, especially for foraging and movement (brachiation). Several studies in natural habitats report that the Javan gibbon's resting period generally begins to increase in the late afternoon; however, this proportion is not dominant, as Javan gibbons in the wild remain active until bedtime [2], [26]. At this time, Javan gibbons will engage in long periods of rest and begin to return to their sleeping enclosures. Gibbons rest in the afternoon as a strategy to protect themselves and support population maintenance in the face of threats [26]. Javan gibbons typically rest for long periods in the afternoon, sleeping in their enclosures until the following morning [5]. Thus, although the pattern of resting in the afternoon is still within a reasonable range, its high proportion in this breeding facility may indicate a decrease in physical activity and exploration due to limited space and a lack of environmental enrichment. This pattern may also be influenced by external factors, particularly the zoo's operational schedule, established feeding routines, and visitor activity. Therefore, the high frequency of afternoon rest needs to be considered in the context of animal welfare, primarily to ensure that the gibbons' daily activity patterns closely resemble their natural behavior.

Meanwhile, in the morning and afternoon, Javan gibbons do not show particularly high levels of resting activity. The highest percentage of resting activity occurs in the morning and afternoon, at 4% and 3%, respectively, between 12:40 and 12:50 p.m. Such a pattern may result from the tendency of Javan gibbons to engage only in short resting intervals between their morning and afternoon activities [5]. Temporary resting activities generally have a relatively short duration, followed by other activities [14]. Female Javan gibbons only rest by sitting and staying still in trees [26].

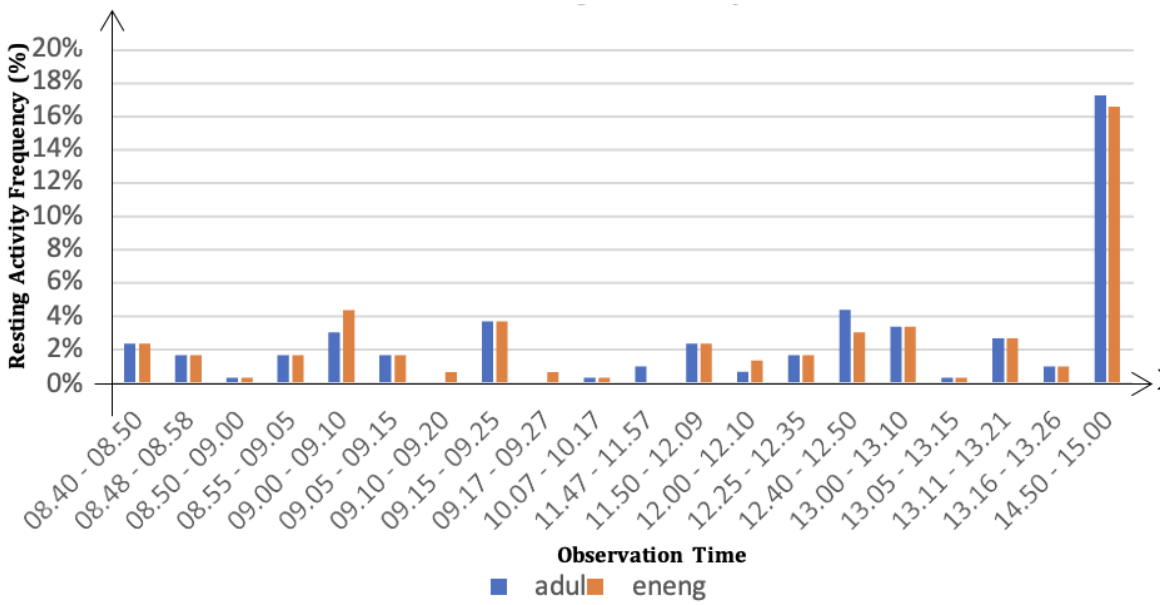


**Figure 4.** Resting Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park.

**Figure 5.** Javan Gibbon resting *(lying)*

Figure 5 shows the resting activity of a Javan gibbon hanging from a tree, remaining still and not doing much, but with eyes that are still alert and watching their surroundings. Among the resting behaviors observed in male Javan gibbons is the act of hanging from the edge of the enclosure while monitoring their surroundings. Meanwhile, female Javan gibbons will choose to remain in a different location from the resting place of male Javan gibbons [5].

**Social Activity of Javan Gibbons**

The social activities observed in this study among Javan gibbons included grooming and vocalization behaviors. Grooming is a self-care activity performed by Javan gibbons. There are two types of grooming,

namely autogrooming and allogrooming. Autogrooming is a grooming activity performed by an individual alone, while allogrooming is a grooming activity performed with other individuals. The grooming behavior of Javan gibbons mainly involves the hands, feet, and body, and they additionally engage in touching and rubbing the anus and genitals following defecation [5]. Meanwhile, vocalization is an activity that involves making sounds as a means for Javan gibbons to communicate, avoid conflict, maintain direct contact between groups, and mark their territory [5].

Adul's highest frequency of grooming activity occurred during the day, between 1:11 p.m. and 1:21 p.m., at a rate of 9%. This result aligns with the statement that daytime grooming occurs during rest periods [5]. In this case, Adul groomed during his daytime rest periods. Meanwhile, Eneng's highest frequency of grooming activity happened in the afternoon, between 2:50 p.m. and 3:00 p.m., at a rate of 13%. Eneng performed this activity during her mealtimes and long rest periods. Such behavior may occur when a Javan gibbon engages in self-cleaning after feeding and before resting [14].

In vocalization activity, Adul, as an adult male individual, was not recorded as having made any sounds at all (0%). In contrast to Adul, Eneng's vocalization records actually show significant data. Eneng, as an adult female individual, was recorded as frequently making sounds, and the highest vocalization frequency performed by Eneng occurred during the day, from 11:50 to 12:09, accounting for 41%. Such behavior may arise due to the role of female Javan gibbons as the primary guardians of their home range. This phenomenon aligns with the natural characteristics of Javan Gibbons, where females play a more dominant role in territorial communication through their long calls. The absence of vocalization in male individuals may indicate adaptation barriers or the influence of a captive environment that limits social stimuli. Eneng's vocalization activity may be triggered by her instincts in the wild, where this is the second peak time for female Javan Gibbons to make long calls, which can also trigger other female gibbons to make long calls [27]. Compared to gibbons at the Javan Gibbon Center, individuals in Ragunan showed a lower vocalization frequency, possibly due to reduced auditory stimulation and the lack of conspecifics [16].

Evidence indicates that immature female Javan gibbons develop vocalization skills (vocal control) under the guidance of their mothers [28]. Therefore, it is not surprising for Eneng, as a mature female Javan gibbon with maternal instincts, to vocalize frequently. Meanwhile, studies indicate that male Javan gibbons seldom vocalize. During a 130-day observation period, one adult male produced only one vocalization [28].

In addition, according to Khairina et al., Javan gibbons exhibit characteristics where

female individuals play a greater role in maintaining territorial areas, resulting in a higher allocation of vocal time compared to male individuals [6]. The observed pattern aligns with previous findings that adult female Javan gibbons vocalize more frequently within their territories, leading to overlaps with vocalizations from females in other groups [28]. These vocalizations suggest that the gibbons produce these sounds to defend their territorial areas.

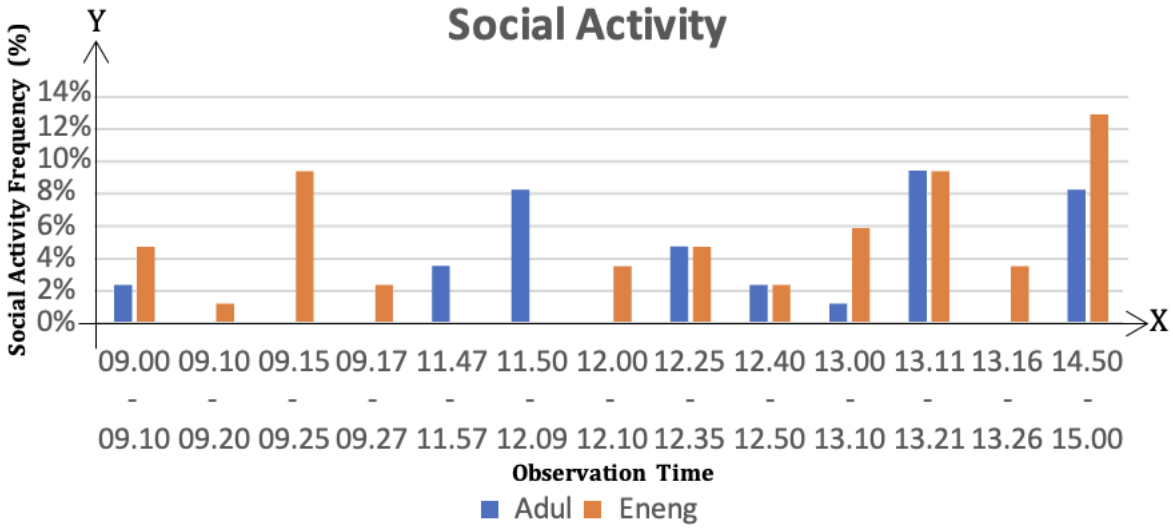


**Figure 6.** Grooming Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park

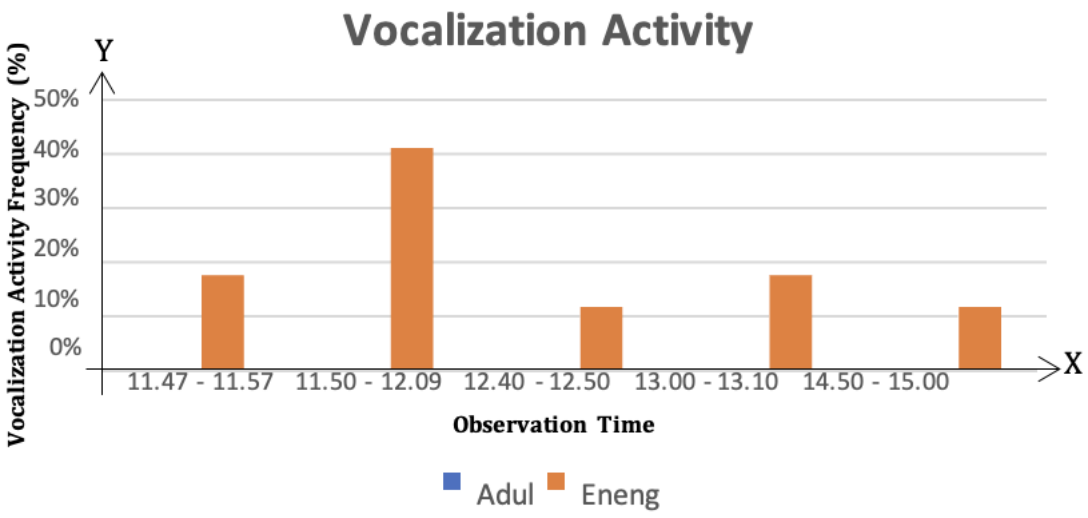


**Figure 7.** Vocalization Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park

**Figure 8.** Female Javan Gibbon Engaging in Vocalization

**Figure 9.** Female Javan Gibbon Engaging in Allogrooming with a Male

**Moving Activity *(Locomotor Behavior)***

Based on the results of the observations carried out, the Javan Gibbon in the Primate 3 enclosure is actively moving. The Javan Gibbon's movement activities in this observation consisted of descending from trees, climbing, brachiation, bipedal, and jumping. The highest movement activity occurred in the afternoon, from 2:00 p.m. to 3:00 p.m., where Adul showed a movement frequency of 10% and Eneng showed 7%. The most dominant movement activities in adults were brachiation and climbing, whereas in Eneng, climbing movements of shorter durations were more dominant. There were differences in the types of activity between male and female individuals. Adul (male) tended to engage in more exploratory movement activities, with a higher intensity of brachiation, indicating a tendency to use vertical space more actively. Meanwhile, Eneng (female) exhibited a more energy-efficient movement pattern, characterized by lower jumping and brachiation intensity, compared to Adul. Dominance factors, psychological conditions, and individual adaptation strategies to the cage environment may influence this difference. This finding contrasts with the observations of Srimulyaningsih and Ramdan, which showed that Javan gibbons are more active in the morning and afternoon [5]. However, Javan gibbons in the wild will prefer to rest during the day, so their activity will decrease [14]. The large number of visitors at Ragunan Zoo also causes this. In arboreal primates, males generally exhibit higher locomotion intensity than females, which is related to spatial exploration patterns and anticipatory behavior towards potential threats.

Based on the results of observations, it also shows that Adul is more dominant in carrying out movement activities than Eneng. Higher movement activity in male individuals is consistent with the literature, which states that male gibbons play a role as territorial supervisors and are more active in terms of mobility. However, the tendency for the highest activity in the afternoon is contrary to the activity pattern in the wild,

which usually shows a peak in the morning. The cage environment likely presents fewer challenges than the gibbons' natural habitat, restricting the expression of natural behaviors and reducing cognitive stimulation, which in turn affects their daily activities. Interaction with visitors, especially when the number increases in the afternoon, can also change behavior patterns such as alertness, feeding times, and movement, as well as increase environmental stress for animals that are sensitive to human disturbance [29], [30]. Additionally, movement activities are more frequently carried out by adult males than adult females [10], as males often assume the role of group leaders and are responsible for supervising family members. This movement activity can be considered a form of surveillance behavior [9].

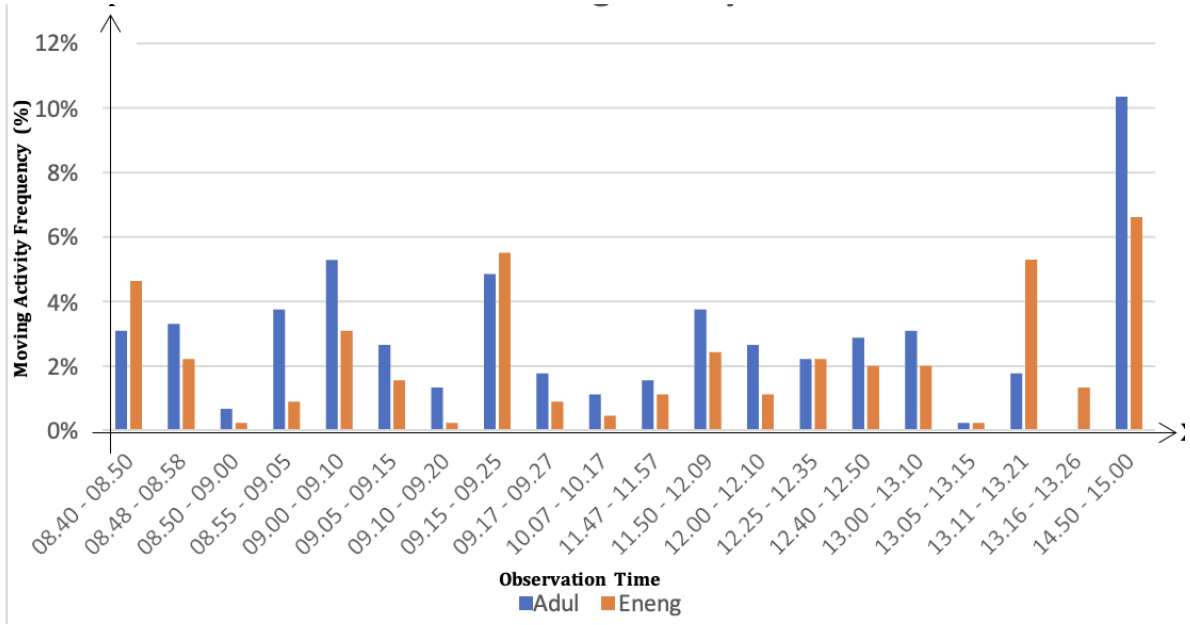


**Figure 10.** Moving Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park

**Figure 11.** Javan Gibbon Engaging in Swinging Activity

### Overall Activity

Overall, the most dominant activities were movement, followed by resting, feeding, and social interactions. Adul (male) showed a higher proportion of movement and feeding activities, while Eneng (female) was more dominant in social activities. In movement activities, adult males showed a greater frequency (26%) than adult females (20%). This difference indicates distinct social and physiological roles between the sexes of the

Javan Gibbon, reflecting the level of adaptation of each individual to the captive environment. The higher frequency of male movement demonstrates their role in monitoring and guarding both family members and their territory. In contrast, adult females exhibit a lower frequency of movement activities, as they are primarily intended for foraging and caring for their offspring [9].

In resting activities, males and females exhibit approximately the same frequency, with each accounting for 15% of the total activity. Resting or still activity in males is interpreted as a form of supervision of family members. Adult males are leaders in the family and have the responsibility of guarding [9]. Likewise, eating activity in males is also higher, at 8% compared to females, at 6%. These findings correspond to the higher movement activity in males, which demands more nutrition than in females [5].

Social activities, both grooming and vocalization, are dominated by Eneng, an adult female gibbon. Eneng's grooming activity shows a percentage of 5%, while Adul's is only 3%. Meanwhile, Eneng's vocalization activity reaches 2% of the total activity, while Adul's is 0%. The findings align with previous studies, which indicate that adult female Javan gibbons engage in social activities more frequently. Female individuals will more often make sounds, play, and groom in connection with their role as territorial markers and caretakers of offspring [9]. Adul's social activities as a male gibbon in this observation show a relatively low frequency. Previous studies further support the observation, showing that male gibbons participate in social activities, including playing and fighting, albeit less frequently [9].

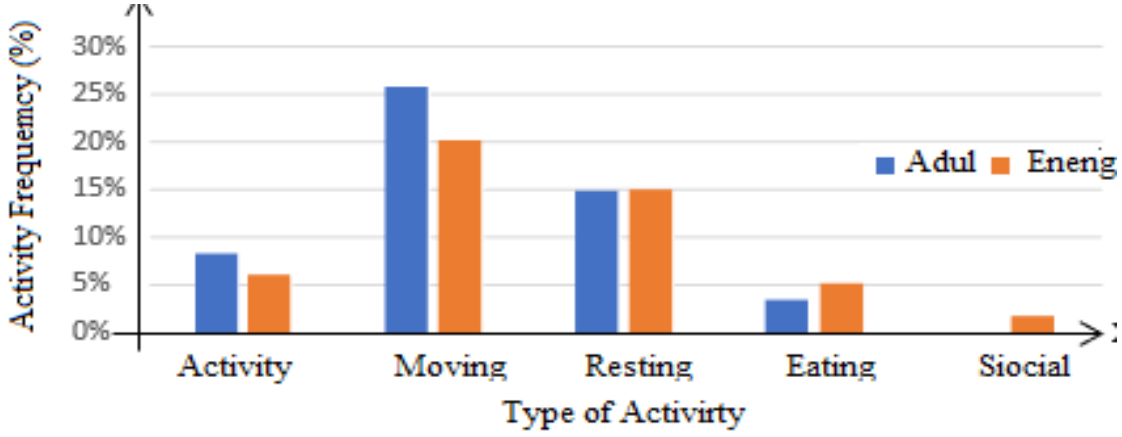


**Figure 12.** Overall Activity Percentage of Javan Gibbons (*Hylobates moloch*) at Ragunan Wildlife Park

Based on the results of observations of the daily behavior of the Javan Gibbon, there are several differences in behavioral patterns between the daily behavior of the Javan

Gibbon in its natural habitat. One apparent thing is the daily behavior, which exhibits a trend of increasing frequency between 2:30 and 3:00 p.m. The daily Activity of the Javan Gibbon generally begins in the morning around 05:30 - 05:45, with the first peak occurring between 07:00 - 08:00. After that, the activity level decreases and increases again at the second peak around 11:00 - 12:00. Activity then decreases again before reaching the third peak in the afternoon, namely between 15:00 - 16:00 [27].

This anomaly may indicate that Adul and Eneng, the subjects of observation, are undergoing a new adaptation due to human presence, which has altered their daily activity patterns. The structure of the enclosure and the frequent presence of visitors can act as environmental stressors or behavioral modifiers, which affect the rhythm of the animals' activities [10]. Judging from the facilities provided by TMR to the animals, which include enclosure facilities, food, and cleanliness, it is unlikely that the animals will experience stress due to habitat relocation. However, the Javan gibbon may be starting to adapt to the crowded environment. The activities of Adul and Eneng are often carried out in the display enclosure, making them clearly visible to visitors.

Moreover, animals in zoos are classified as wild animals because they have not undergone the domestication process. This statement aligns with the research of Fischer and Romero, which suggests that wild animals in captivity still exhibit their natural behavior and meet their unique needs, distinct from those of animals that have undergone prolonged domestication [31]. Domesticated animals show more normal behavior in the presence of humans and their environment because they have undergone genetic changes over generations. Meanwhile, wild animals do not experience the same thing, so this can evoke new feelings in them towards humans. The discomfort experienced by these animals due to the presence of humans can then trigger changes in their daily behavioral adaptations [32].

## CONCLUSION

Observations indicate that Javan gibbons (*Hylobates moloch*) in Ragunan Zoo continue to exhibit the four primary activity categories characteristic of their natural habitat: movement, feeding, resting, and socializing. However, the intensity of activity patterns in the morning, afternoon, and evening shows significant differences compared to those in their natural habitat. The data indicate that daily activity tends to increase in the afternoon, especially as they approach the time they return to their sleeping enclosure. This pattern differs from that of Javan gibbons in the wild, which are generally more active in the morning and decrease in activity in the afternoon. Differences in activity patterns appear to result from the enclosure environment, zoo operations, and visitor

presence, all of which impact the animals' behavioral rhythms.

These findings suggest that Javan gibbons have adapted to non-natural conditions; however, their activity patterns do not fully reflect their natural behavior. Therefore, the results of this study provide a scientific basis for improving captive management through improved enclosure design, more varied enrichment programs, and regulating visitor interactions to further stimulate Javan gibbon behavior as part of efforts to improve animal welfare and support the success of future reintroduction programs into their natural habitats.

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## CONFLICT OF INTEREST

We hereby declare that there is no conflict of interest in writing this scientific work.

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