Journal on Biology and Instruction (JouBIns)
Vol. 5 No. 1 Year 2025 | 46 – 55
ISSN 2978-0863

Daily activities of *Eclectus roratus* at Ragunan Wildlife Park

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Article information

Article history

Received July 18th, 2023
Revised December 14th, 2023
Accepted Mei 2nd, 2025

Keywords

Augmented reality
Critical thinking
Metacognitive
Quantum teaching

ABSTRACT

This study examines the impact of the Augmented Reality (AR)-based Quantum Teaching model on high school students' critical thinking and metacognitive skills in biology. As 21st-century education increasingly demands higher-order thinking, there is a growing need for innovative teaching approaches that foster these skills. The aim of this research was to determine whether combining AR technology with the Quantum Teaching model could enhance students' cognitive and self-regulatory abilities. The study used a quasi-experimental pre-test post-test control group design, involving grade XI biology students at Pakusari State High School during the 2023/2024 academic year. Class XI-5 was randomly assigned as the experimental group and XI-4 as the control group. Data collection methods included observations, interviews, essay tests, and documentation, while data analysis was conducted using ANCOVA in SPSS version 26. The results showed that the experimental group experienced significantly greater improvements in both critical thinking and metacognitive skills compared to the control group. These findings suggest that the AR-based Quantum Teaching model effectively supports the development of essential academic competencies. The study concludes that integrating AR into student-centered teaching models not only enhances engagement but also promotes deeper learning. As a result, educators are encouraged to adopt AR-supported pedagogies, and schools should invest in digital infrastructure and teacher training to ensure successful implementation. The implications also extend to curriculum development, highlighting the potential of combining interactive technology with innovative instructional strategies to better prepare students for academic success and future challenges.

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INTRODUCTION

Indonesia plays a significant role in the global wildlife trade, particularly in the illegal trafficking of birds, including the endangered *Eclectus roratus* (Eclectus parrot). This species, like many others, faces severe threats from habitat loss due to rapid deforestation (Siregar et al., 2023), illegal hunting, and strong market demand—factors that have contributed to alarming population declines. Parrots are among the most trafficked birds in the region, with one report indicating that

96% of birds confiscated in a recent seizure were parrots (Siregar et al., 2023). Although regulations exist, weak enforcement and limited public awareness allow illegal trade to persist (Nijman et al., 2022; Gunawan et al., 2017). While some advocate for regulated trade as a potential conservation tool, current evidence suggests illegal activity dominates the market, calling for urgent and more effective intervention.

Despite many parrot species being classified as "Least Concern" by BirdLife International and the IUCN, population trends show significant declines due to illegal exploitation for ornamental feathers and the pet trade ((International Union for Conservation of Nature (IUCN)., 2022; Garcia & Caetano, 2022). Conservation responses have included both in situ (on-site habitat protection) and ex situ (off-site, such as in zoos and breeding centers) efforts. Ex situ programs, such as those in zoological institutions, not only support breeding but also serve educational and recreational functions(Zegeye, 2017). These programs can raise awareness and play a preventive role in the illegal trade by showcasing the ecological and intrinsic value of parrots.

Ragunan Wildlife Park, situated in Jakarta, Indonesia, serves as a vital hub for nature-based recreational activities, education, and wildlife conservation, primarily through its captive breeding programs aimed at bolstering populations of endangered species. By integrating entertainment and education, the park employs a strategy that not only engages the public but also raises awareness about the ecological challenges facing various species, thus fostering a culture of conservation (Nekaris et al., 2018; Herdiana et al., 2022). The captive breeding initiatives at Ragunan contribute significantly to population reinforcement efforts, particularly for species that are at risk due to habitat loss and illegal wildlife trade (Janssen & Chng, 2018) . The effective management of these breeding programs necessitates comprehensive research and constant monitoring to ensure the sustainability and genetic diversity of the populations being cultivated ((Janssen & Chng, 2018; Nijman et al., 2024). Additionally, educational outreach within the park is essential for promoting community involvement and creating a greater public understanding of the importance of wildlife conservation, aligning with Indonesia's broader goals for sustainable development and wildlife protection as mandated by governmental policies (Nijman et al., 2024). These concerted efforts underscore Ragunan Wildlife Park's role not only as a recreational space but also as a crucial player in Indonesia's conservation landscape, addressing both ecological needs and societal values. Understanding parrot behavior is fundamental for successful conservation, especially in captivity. Behavior, defined as a series of actions or reactions to internal or external stimuli, is influenced by environmental conditions such as habitat structure, temperature, and food availability (Desmudzat et al., 2016). In the wild, *Eclectus roratus* are typically observed alone, in pairs, or in groups within lowland and rainforest habitats (Latumahina et al., 2020). Their behaviors can be classified into four major categories: mobile, silent, ingestive, and sexual (mating).

Environmental stressors in captivity, such as limited space or poor enrichment, can lead to abnormal behaviors. For example, feather-damaging behavior (FDB) observed in African grey parrots under stress conditions may be indicative of similar issues in other captive parrots (Costa et al., 2016). These behaviors reflect not only welfare concerns but also the importance of aligning captive environments with natural conditions.

Research into daily activity patterns of *Eclectus roratus* in zoos provides crucial insights for conservation and breeding. Parrots are highly intelligent, social birds, and understanding their behavior supports the creation of enriched environments that foster natural behaviors such as foraging and social interaction (Blanco et al., 2015; Ortiz et al., 2022). Daily activity data can inform

adjustments in husbandry practices to enhance health and reproductive outcomes ((Ferrer-Paris & Sánchez-Mercado, 2021).

Moreover, parrots serve vital ecological roles, such as seed dispersal, and are indicators of broader environmental health. Integrating behavioral studies into conservation planning not only benefits individual species but also supports ecosystem resilience (Ferreira et al., 2015; Amione et al., 2024). Therefore, observing the daily activities of *Eclectus roratus* in two different enclosures at Ragunan Wildlife Park can provide valuable data to optimize captive care and support breeding programs. Animal behavior and feeding practices are key components of captive management strategies for parrots. By aligning environmental design with natural behavior, conservation efforts—both in situ and ex situ—can more effectively address the urgent challenges posed by the illegal bird trade and habitat loss. The purpose of this study was to determine the daily activities of parrots (*Eclectus rotatus*) in two cages in Ragunan Wildlife Park. Animal behavior and feeding in captive management are important aspects that must be considered to support the success of parrot breeding.

METHOD

This research was conducted from February 14 to March 9, 2023. Data collection was conducted over 2 weeks (8 observations) from 07:30 to 14:30 WIB. This research was conducted at Ragunan Wildlife Park, located in Ragunan Village, Pasar Minggu District, South Jakarta. There are two types of cages for observation, display, and quarantine cages, whose sizes are 4 x 5 x 7 m and 6 x 4.3 x 3 m, respectively. The number of parrots observed in the quarantine and display cages was two birds (one male and one female) in each cage. The observed daily activities included movement, ingestion, and perching. Movement activities consisted of flying, walking, climbing, and hanging. Ingestive activities consisted of eating, allofeeding, and drinking. Perching activities include perching, scratching, cleaning the beak, and vibrating the feathers. Data collection in this study used the ad libitum sampling method to obtain activity frequency and description of parrot daily activities. The percentage of parrot activity was calculated using the following formula.

$$\text{Activity percentage (\%)} = \frac{Frequency\ of\ activity\ i}{Total\ activities} \times 100\% \quad (1)$$

i = activities

The formula to determine the relative frequency of activities.

$$\text{Relative Frequency} = \frac{Frequency\ of\ activity\ i}{Frequency\ of\ all\ activities} \times 100\% \quad (2)$$

RESULTS AND DISCUSSION

Based on observations of parrot daily activities in display and quarantine cages, activities that can be observed consist of moving, ingestive, and perching activities. There is a difference in the percentage of different activities in both cages but not so significant. Activity comparisons can be seen in the following graphs.

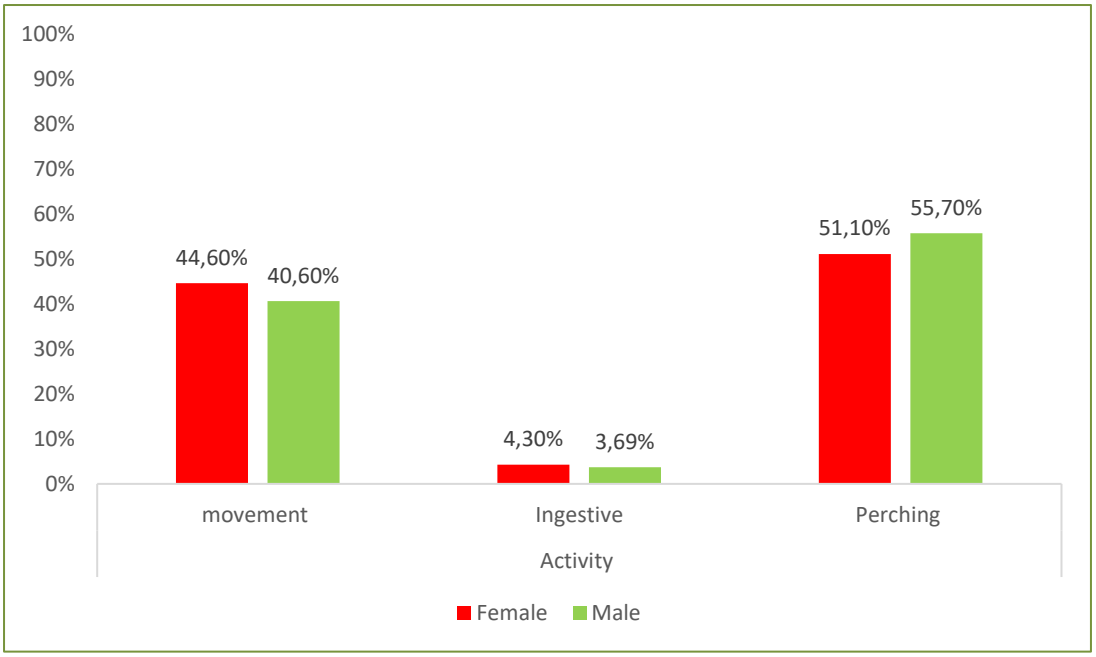
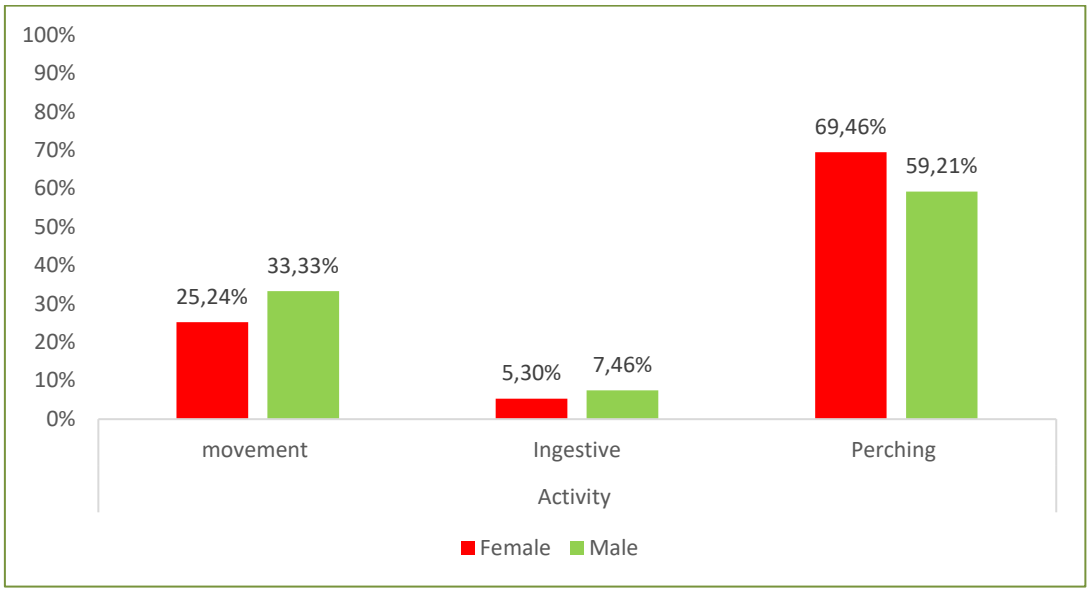


Figure 1. Comparison of the percentage of activity in the display cage

Figure 1 presents comparative data on the proportions of bird activity based on sex, specifically between male and female birds. The observed activities are categorized into three main types: movement, ingestive (feeding), and perching. Red bars represent female birds, while green bars denote male birds. According to the chart, female birds exhibit a slightly higher proportion of movement activity at 44.60%, compared to 40.60% in males. Ingestive activity appears relatively low in both sexes, with females at 4.30% and males at 3.69%. Perching is the most dominant activity among both sexes, accounting for 51.10% in females and 55.70% in males. These findings suggest that while male and female birds display similar overall activity patterns, minor differences exist, potentially reflecting differing physiological needs or behavioral roles between the sexes.



Picture 2. Comparison of the percentage of activity in the quarantine cage

Based on the Picture 2, the highest percentage of parrot daily activity in display cages is the activity of perching. The lowest percentage of activity in the display cage was ingestive activity. The highest percentage of parrot activity in quarantine cages was perching activity at 69.46% in females and 59.21% in males. The lowest percentage of activity in the quarantine cage was intensive activity at 5.30% in females and 7.46% in males. A comparison of the percentage of activity of both females and males in display and quarantine cages can be seen in Table 1.

Table 1. Comparison of Activity Percentage

Activity		Display cage		Quarantine cage	
		Male	**Female**	**Male**	**Female**
Movement	Flying	38,64%	46,90%	36,58%	37,63%
	Walking	49,38%	28,48%	46,32%	51,86%
	Hanging	0,62%	6,00%	4,21%	1,69%
	Climbing	11,36%	18,63%	12,89%	8,815
Ingestive	Eating	27,27%	20,59%	19,15%	15,22%
	Drinking	3,03%	8,82%	0,00%	0,00%
	Allofeeding	69,70%	70,59%	80,85%	84,78%
Perching	Perching	45,18%	46,23%	53,33%	46,55%
	Preening	37,35%	39,78%	21,93%	38,05%
	Cleaning of beak	5,12%	4,25%	13,63%	6,53%
	Ruffle feathers	5,12%	3,46%	3,41%	4,56%
	Scratching	7,23%	6,29%	7,70%	4,31%

Based on the Table 1, it can be seen that the difference in the percentage of daily activity of male and female parrots in both cages is not so significant. The daily activity of parrots at each hour also has a different frequency. Activity frequency measurements were limited to every one hour during the observation time. In the morning and evening, birds are actively doing activities, so it will be easier to observe (Nugraha et al., 2021). The highest activity frequency in both display and quarantine cages was at 08:30-09:30 am, while the lowest activity frequency was at 12:30-13:30 pm in quarantine cages and 13:30-14:30 pm in display cages. The comparison can be seen in Figure 3.

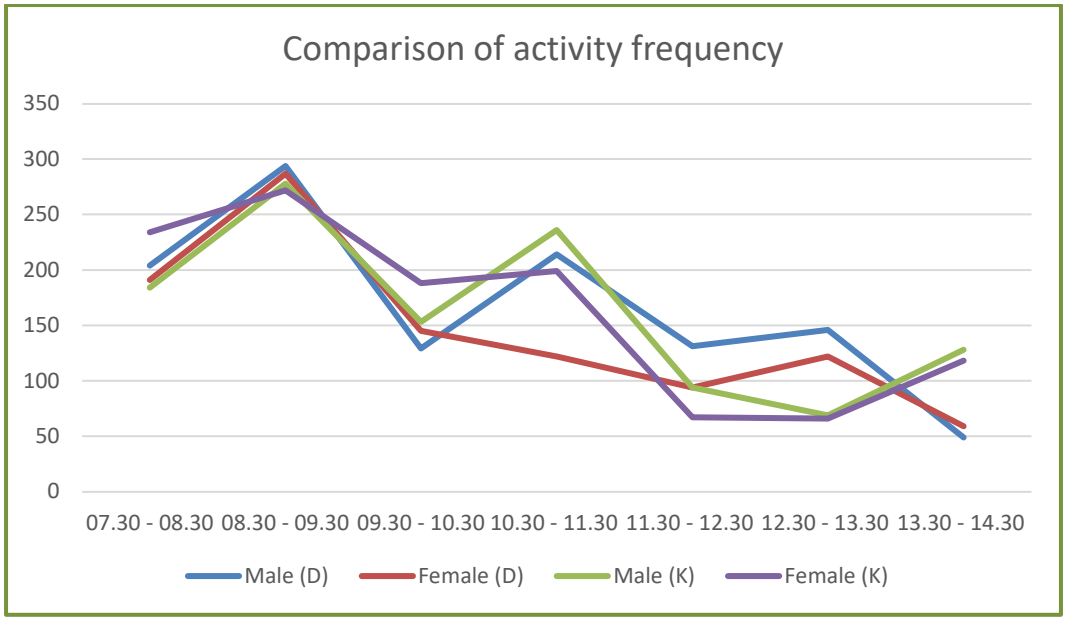


Figure 3. Comparison of activity frequency

Observed activities were categorized into three: moving, ingestive, and perching activities. Moving activities are behaviors that enable parrots to transition from one position to another, such as flying, walking, climbing, and hanging. Ingestive activities are behaviors that enable parrots to fulfill their basic needs, such as eating, allofeeding, and drinking. Perching activities include scritching, beak cleaning, feather rattling, and scratching.

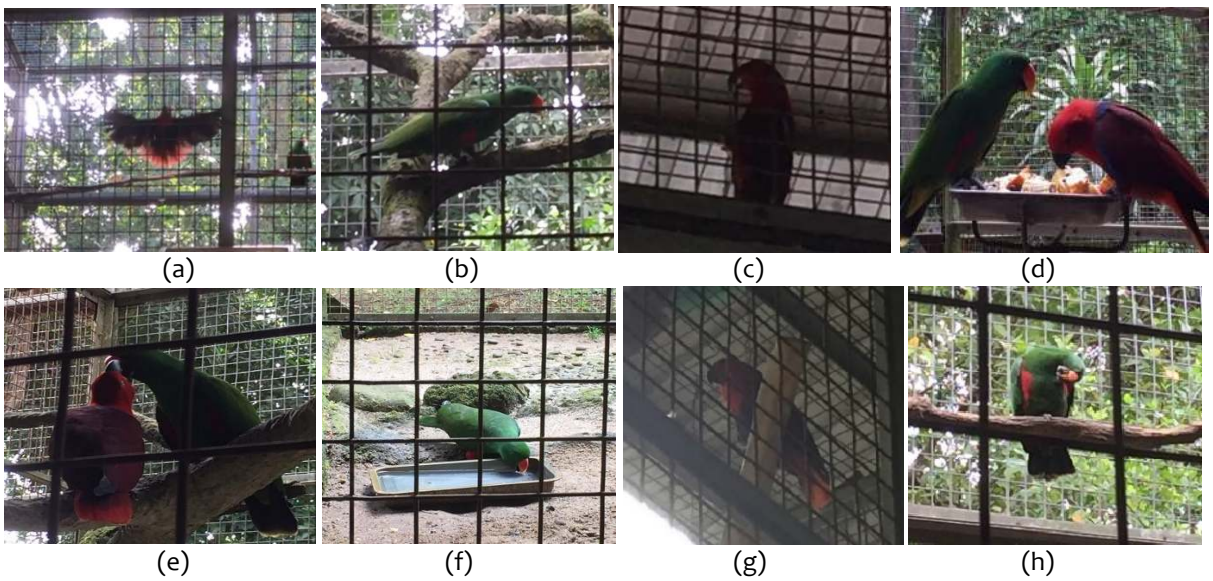
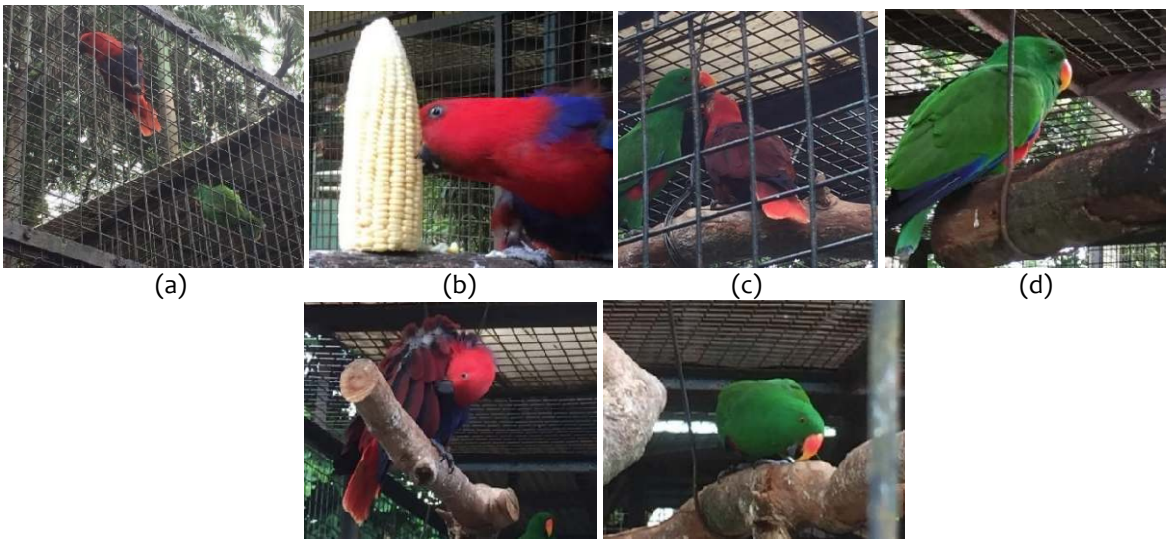


Figure 4. Parrot activities in the display cage, a. Flying; b. Walking; c. Climbing; d. Eating; e. *Allofeeding*; f. Drinking; g. Perching; h. Preening



(a) (b) (c) (d)

(e) (f)

Figure 5. Parrot activities in the quarantine cage, a. Climbing; b. Eating; c. *Allofeeding*; d. Perching; e. Preening; f. Cleaning the beak

Movement Activity

Parrots fly from wooden perches to iron fences, from one wooden perch to another, and from iron fences to wooden perches. The parrot's flying ability in the cage is limited due to the small size of the cage. This prevents parrots from flying high and for a relatively long time. The flight and aggressive behavior of birds that have been in captivity for a long time will be reduced compared to birds that live in the wild (Revilia et al., 2017). Flying activities are usually carried out when the weather is not hot, there is a distraction from outside, and when going to eat.

The parrot walks by using both legs alternately. This activity is usually carried out on a wooden perch when approaching food or the opposite sex, and occasionally also done on the ground. Walking activity can be caused by internal stimuli such as hunger, thirst, and mating desire, while external stimuli such as disturbances from the environment around the cage (Takandjandji & Mite, 2016). Similar to walking, climbing is also an activity carried out by parrots with the aim of being able to move places. Parrots often climb iron fences using their feet and beaks. After climbing, the parrot will usually hang its body on the iron fence so that its body is in an inverted position. The parrot's legs have a strong grip to support its body weight. This activity is carried out by gripping the iron wire or rope using its feet.

Ingestif Activity

Ingestive activities consist of feeding, allofeeding, and drinking. Parrots are fruit and seed eaters. Parrots will be fed by the zookeeper at 08.30-09.30. There are differences in the dosage and presentation of feed for parrots in the display and quarantine cages. In the display cage, there is a special feeder for parrots, which is a rectangular tray made of aluminum. This container is placed on a pole. When eating, the parrot will perch on the side of the tray. The parrot eats by lowering its head, then its beak will peck at the food. In addition to using its beak, the parrot also uses the help of its feet to take its food (Shabrina, 2015).

Different with the display cage, in the quarantine cage the feed will be attached to a nail on a wooden perch. The feed given in both cages is also different. Parrots in the display cage are fed with fruits (banana, guava, papaya, and corn), seeds (sunflower seeds, walnut seeds and peanuts) and bread, while in the quarantine cage only fruits such as guava, banana and corn are given. This

was done because the parrots in the quarantine cage are already 4 years old (adults), if given seeds containing protein it is feared that they will experience feather loss. Eating activities are mostly carried out by male parrots compared to females.

Allofeeding activity is carried out by male parrots to females. Initially, the male will take the food, chew it, and store it in his mouth. Next, the male parrot will approach the female and their beaks will meet each other in an open state. At that time, the male bird will give the food that was stored in his mouth to the female. Similar to research (Handayani et al., 2021), allofeeding activities are activities that provide food through the beak carried out by males to females. During the observation, parrots were rarely seen doing drinking activities. This is because parrots have consumed a lot of fruits that contain water so that their drinking needs have been met (Revilia et al., 2017). Drinking activities can only be observed in display cages, because in quarantine cages there is no place to drink. Drinking activities are carried out by parrots by lowering their heads close to the water, their beaks will open wide, the tip of their tongue touches the water and takes water into the mouth.

Perching Activity

Perching is the most dominant activity performed by parrots in both display and quarantine cages. This is consistent with the observation of Harian et al. that birds spend more time perching than doing other activities such as flying, walking, and others. Perching activities are mostly carried out by male parrots compared to females. According to (Handayani et al., 2021), male birds have a protective nature, are more aggressive and brave against disturbances than female birds. This activity is usually done more often when environmental conditions are too low or too high. Low temperatures such as rainfall cause birds not to do any activity. During the day with high temperatures, the birds only perch in shady places so that their bodies remain protected. Swallowing activities are carried out by parrots to clean their bodies from feces. This activity is carried out by inserting and moving the beak into body parts such as the chest, wings, back, and tail. This activity is usually done repeatedly.

Apart from cleaning its feathers, the parrot also cleans its beak. The activity of cleaning the beak is done after eating. This aims to remove food debris or dirt that sticks to the beak and keep it sharp. This activity is carried out by rubbing the beak on the side of the wood with the body position leaning forward. Another activity is vibrating the feathers which aims to be able to tidy up the arrangement of the feathers again. This activity is carried out by developing body feathers and wagging the tail. Parrots will do this activity if their body is exposed to water such as rainwater. Parrots also perform scratching activities that aim to remove foreign objects that stick to the body and tidy up the feathers. The parrot scratches the head or neck using one of its legs quickly.

The frequency of daily activities performed by parrots can be influenced by environmental factors such as temperature and humidity. In the morning with a temperature of around 26oC, parrots appear active because they do more activities. The increasing temperature during the day causes birds to stay more silent, such as perching or resting (Revilia et al., 2017). According to Pasito (2015), when the ambient temperature increases, the silent behavior aims to reduce the evaporation of body fluids due to hot sunlight, and to inhibit the release of body heat into the environment when the ambient temperature decreases.

Daily activities of parrots in display cages showed a higher percentage of movement and ingestive activities compared to quarantine cages. In contrast, perching activity was higher in the quarantine cage compared to the display cage. This may indicate that parrots in display cages are

more active than those in quarantine cages. The difference in the percentage of parrot daily activity in the two cages can also be influenced by several factors, including the size of the cage and the age of the parrot. Display cages are wider and taller than quarantine cages, so parrot movement is freer to fly and perform other activities. Another factor is the age difference in parrots. Both male and female parrots in display cages are around 3 years old, while those in quarantine cages are around 4 years old. Parrots in display cages with this age are in the productive period, so the percentage of daily activity is higher.

CONCLUSION

Based on the results of the study, it can be concluded that the primary daily activities exhibited by parrots include locomotion, ingestive behavior, and perching, with perching being the most predominant activity (51.10%–69.46%) and ingestive behavior the least frequent (3.69%–7.46%). Notable differences in activity proportions were observed between male and female parrots in both display and quarantine enclosures. It is therefore recommended that further research investigate the effects of environmental enrichment, enclosure design, and social dynamics on behavioral patterns, with the aim of promoting more diverse activity and enhancing the welfare of parrots in captive settings.

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