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Daily activities of crowned doves (*Goura cristata*) at Ragunan Zoo, South Jakarta

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Abstract
The Crowned Dove (*Goura cristata*) is an endemic bird species from Papua that is currently experiencing a population decline due to hunting and habitat loss. Ex-situ conservation efforts at Ragunan Zoo (Taman Margasatwa Ragunan) serve as a vital strategy to ensure the survival of this species. This study aims to document the daily activities of *G. cristata* within the Ragunan Zoo collection in South Jakarta. Data collection was conducted through direct observation using the Focal Animal Sampling (FAS) method from 08:00 to 15:00 during both weekdays and weekends.
The results indicated that the dominant activity for the male *G. cristata* was walking, while the female spent more time feeding. These findings provide essential insights into the daily behavior of *G. cristata* within a conservation environment, which can serve as a foundation for implementing more effective management and maintenance strategies at Ragunan Zoo and other conservation institutions.

Keywords: Daily activities, ex-situ conservation. *Goura cristata*, Ragunan Zoo

Introduction
The Western Crowned Pigeon (*Goura cristata*) is an endemic bird species of Indonesia, with its natural habitat located in West Papua. This species is renowned for its unique physical characteristics, most notably the beautiful lace-like crest on its head. This aesthetic appeal has made *G. cristata* a frequent target for illegal hunting, leading to a significant decline in its population. Furthermore, the shrinking of its natural habitat continues to adversely affect its numbers. Currently, *G. cristata* is categorized as a protected species whose preservation is mandatory (Madubun *et al*., 2024) [12]. One vital strategy for maintaining the survival of this species in Indonesia is through ex-situ conservation, such as that conducted at the Ragunan Zoo (Taman Margasatwa Ragunan). According to BKSDA Jogja, ex-situ conservation serves to protect rare plant or animal species at risk of extinction by removing them from unsafe habitats and placing them in protected environments. This form of conservation offers multiple benefits: it not only saves wildlife but also serves as a facility for public recreation and education regarding endangered species like *G. cristata* (Fakhrozi *et al*., 2013) [5].
G. cristata is widely recognized for its plumage beauty and melodious call. Its presence at Ragunan Zoo provides an interesting subject for research, particularly in obtaining data on its daily activities. These activities can be influenced by several factors, including food sources, weather conditions, and interactions with other birds. Variations in daily activities can impact the health and welfare of the birds. Daily activity patterns—encompassing foraging habits, resting, and social interactions—provide valuable information regarding the life patterns of *G. cristata* (Wang & Greenfield, 2020) [20]. As awareness of the importance of biodiversity preservation grows, research into the daily activities of this species becomes increasingly relevant, as these behaviors play a critical role in shaping the overall conduct of the Crowned Pigeon (Carvalho *et al*., 2015) [4].
As a research site, Ragunan Zoo offers a varied environment ranging from green open spaces to areas with high visitor density. This creates a dynamic situation that influences the daily activities of *G. cristata* (Jones & Mitchell, 2022) [8]. At Ragunan Zoo, *G. cristata* can be observed within a relatively controlled habitat, allowing researchers to monitor their daily routines. This is crucial because changes in daily activity can reflect how the species adapts to environmental pressures. By understanding these activity patterns, it is hoped that the factors influencing the survival of this species can be identified (Smith & Brown, 2018) [17]. Consequently, this study aims to explain the daily activities of the *G. cristata* collection at Ragunan Zoo, South Jakarta.

Research methods
Study Site and Time
This research was conducted from August to September, 2025, at Ragunan Zoo located on Jl. Harsono RM No.1, Ragunan, Pasar Minggu, South Jakarta. The *G. cristata* enclosure is situated adjacent to the cockatoo enclosure, with geographical coordinates at -6.3085803, 106.8226748 (Fig, 1)

Data Collection Methods
Data were collected through direct field observations and interviews with the person in charge or the animal keepers to obtain information and data regarding the animals' activity patterns.

Data Collection Stages
The data collected consisted of daily activity patterns and the characteristics of both male and female *G. cristata*. Daily activity data were gathered using the Focal Animal Sampling (FAS) method.

Fig 1: Site Map of Research Activities at Ragunan Zoo, Jakarta (Source: https://ragunanzoo.jakarta.go.id/visitors-info/map-direction/local_maps/). Accessed on March 30, 2025

Data Recording

Data recording was performed daily from 08:00 to 15:00. The recorded data included the daily activities of male and female *G. cristata* during both weekdays and weekends, as well as their specific characteristics and behaviors. Observations were recorded at one-hour intervals to determine the frequency of daily activities performed by both male and female individuals.

Observation of *G. cristata* Daily Activities.

Animal activity was observed using the Focal Animal Sampling (FAS) method. FAS is a technique for recording all behaviors or events of a specific individual or group during a predetermined period, provided the individual remains visible. Daily activities, such as preening and sunbathing, are performed independently by the subjects. These activities are also influenced by human interventions within the enclosure, such as feeding, watering, and cage cleaning (Ahadi, 2017) [2].

Feeding management aspects included the types of feed, feeding schedules, feed composition, and feed supply storage. Health monitoring aspects covered the current health status of the animals, types of diseases, prevention and control measures, and care facilities for sick animals. Enclosure management aspects included the number of available enclosures, cleaning methods and conditions, and supporting facilities (Suherli *et al*., 2016) [19].

Data Analysis

Data were analyzed using a quantitative descriptive approach by categorizing daily activities and characteristics obtained from direct observation. The observed activity categories included feeding, drinking, walking, hopping, interaction, and behavioral patterns. The data were then processed and analyzed using Microsoft Excel. The analysis focused on the frequency of each activity category and the specific characteristics of the male and female *G. cristata*. Finally, bar charts were created to display activity frequency data, and tables were used to present characteristic data, followed by a descriptive explanation.

Results and discussion

***G. cristata* Enclosure at Ragunan Zoo**

The *G. cristata* enclosure is located within the new poultry section at TMR, with the coordinates 6.306959 °S, 106.822813 °E (Figure 2A). This new poultry section houses several animal species, including peafowl, great argus, emerald doves, silky chickens, Nicobar pigeons, black-capped lories, eclectus parrots, crowned doves, palm cockatoos, yellow-crested cockatoos, white cockatoos, Moluccan cockatoos, African grey parrots, maleo senkawor, *Cacatua sulphurea*, citron-crested cockatoos, and Tanimbar corellas (Figure 2B). The exit of the new poultry section is located near the open reptile enclosure at coordinates 6.306422 °S, 106.822817 °E (Figure 2C). The interior of the *G. cristata* enclosure features dense trees and a floor covered with fine sand (Figure 2D).

The dense vegetation serves as a shelter for *G. cristata* from predators and extreme weather, provides seeds as supplementary food, and reduces stress levels by dampening noise and providing a calmer atmosphere (Blanchett *et al*., 2020) [3]. The sand substrate helps regulate humidity within the cage, facilitates feces removal, and reduces the growth of fungi and bacteria (Pattiselanno *et al*., 2023) [14]. In their natural habitat, *G. cristata* prefer areas with thick vegetation and food sources consisting of fruits, seeds, and small plants growing under the forest canopy. Therefore, the habitat provided for *G. cristata* at TMR closely mimics their original habitat in Papua (Iova *et al*., 2023) [7].

Fig 2: *Goura cristata* Enclosure at Ragunan Zoo (Source: Personal Documentation) A. Entrance to the New Poultry Section; B. Interior of the New Poultry Section; C. Exit of the New Poultry Section; D. Interior of the *Goura cristata* Enclosure

Characteristics of *G. cristata* at Ragunan Zoo

Male and female *G. cristata* differ in body length, body weight, and behavior. The male *G. cristata* has a shorter body length and a lighter body weight compared to the female (Figure 3A). This is attributed to evolutionary factors related to sexual competition and energy efficiency. Males with smaller and lighter body sizes are more agile and faster, making it easier for them to compete and locate mates. They are better equipped to evade predators and cover longer distances in search of females. Additionally, a smaller and lighter frame reduces energy expenditure during the mate-seeking process. In contrast, the female *G. cristata* possesses a longer body and a heavier body weight than the male (Figure 3B). This physical structure allows the female to store the nutritional reserves necessary for egg production and offspring care (Gold *et al*., 2016) [6].

A B

Fig 3: *Goura cristata* at Ragunan Zoo (Source: Personal Documentation) A. Male; B. Female

Male and female *G. cristata* exhibit different behavioral patterns (Table 2). Males are more physically active compared to females. The primary reason for this heightened activity is to locate breeding females. Additionally, this behavior aids males in maintaining optimal body temperature and reducing predation risks through sharper vision and rapid motion detection. In contrast, females exhibit less active behavior than males. This occurs because females tend to be more selective in choosing the best mate and bear the responsibility for the offspring-rearing process (Zhu *et al*., 2025) [23].

Table 1: Characteristics of Male and Female *Goura cristata* at Ragunan Zoo

Characteristics	Male	Female
Body Length	Approximately 65–70 cm	Approximately 70–85 cm
Body Weight	Approximately 2–2.3 kg	Approximately 2–2.5 kg
Plumage Color	Bluish-grey	Bluish-grey
Crest Shape and Color	Lace-like crest, bluish-grey in color	Lace-like crest, bluish-grey in color
Wing Pattern	Bluish-grey wing pattern with slight white variations	Bluish-grey wing pattern with slight white variations
Eye Color	Bright red	Bright red
Beak Color	Bluish-grey	Bluish-grey
Chest Color	Reddish-brown covering the chest up to half of the wings	Reddish-brown covering the chest up to half of the wings
Diet Type	Fruits, seeds, nuts, and vegetables	Fruits, seeds, nuts, and vegetables

Diet Composition of *G. cristata* at Ragunan Zoo

The diet for *G. cristata* at Ragunan Zoo consists of seeds, nuts, vegetables, and fruits (**Figure 4**). Seeds contain small amounts of protein and fat, which help strengthen stamina and accelerate feather growth and the overall health of *G. cristata* (Yamin *et al*., 2023) [22]. Nuts provide high protein content, which is essential for growth and tissue repair in *G. cristata* (Xie *et al*., 2016) [21]. Vegetables serve as a source of plant-based protein and are rich in vitamins and minerals, such as vitamins A, C, and iron, to aid digestion and enhance the resistance of *G. cristata* against diseases (Adawy & Abdel-Wareth, 2023) [1]. Fruits contain vitamin B6 to support energy metabolism and the nervous system of *G. cristata*, as well as to strengthen their immune system (Struthers, 2024) [18]. The seed category includes commercial feed (pellets/pur) and corn kernels. The vegetable category consists of bean sprouts and water spinach (*kangkung*), while the fruit category includes papaya and banana (Figure 4).

Fig 4: *Goura cristata* Feed at Ragunan Zoo (Source: Personal Documentation)

The portion of commercial feed (pellets) provided is 100 grams. The quantity of nuts provided is 60 grams, while bean sprouts, water spinach, papaya, and bananas are each provided in portions of 100 grams (Table 2).

Table 2: Feed Portions and Roles for *G. cristata*

Feed Component	Quantity	Role
Commercial Feed (Pellets)	100 grams	To support the formation of a strong skeletal structure in G. cristata (Putri & Ansari, 2019) [15].
Corn Kernels	100 grams	To help strengthen stamina and accelerate feather growth and overall health in G. cristata (Yamin *et al*., 2023) [22].
Nuts	60 grams	For growth and tissue repair in G. cristata (Xie *et al*., 2016) [21].
Bean Sprouts	100 grams	To support the digestive process and increase the appetite of G. cristata (Adawy & Abdel-Wareth, 2023) [1].
Water Spinach	100 grams	To help facilitate digestion and enhance the resistance of G. cristata against diseases (Adawy & Abdel-Wareth, 2023) [1].
Banana	100 grams	As a source of quick energy and to support energy metabolism and the nervous system of G. cristata (Struthers, 2024) [18].
Papaya	100 grams	To strengthen the immune system of G. cristata (Struthers, 2024) [18].

Daily Activities and Walking Patterns of *G. cristata* at Ragunan Zoo

The highest daily activity of male *G. cristata* at Ragunan Zoo, on both weekdays and weekends, was walking, with a frequency of 3,694 on weekdays (Figure 5A) and 1,201 on weekends (Figure 5B). The primary reason for the male *G. cristata* having the highest frequency in walking activity is that males are typically more active in territorial marking. They walk around their enclosure to disperse pheromones from their bodies and assert dominance over other males. Furthermore, males exhibit the highest mobility as a result of searching and competing for mates (Murton *et al*., 2021) [13].

The highest daily activity for female *G. cristata* at Ragunan Zoo, during both weekdays and weekends, was feeding, with a frequency of 576 on weekdays (Figure 5A) and 311 on weekends (Figure 5B). The reason female *G. cristata* exhibit the highest level of daily feeding activity is that they require more energy for reproductive processes, such as oocyte maturation, accumulation of nutrient reserves, and nursing their offspring. Additionally, hormones involved in their reproductive cycle can trigger an increase in feeding activity (Kabir, 2019) [9].

Male *G. cristata* exhibit a vertical walking pattern from back to front (Figure 6).

This walking pattern is related to intraspecific communication strategies, mate attraction, and predator avoidance. This pattern also serves as a visual cue to potential mates that the male is active and healthy. In crowned pigeons, such walking patterns also help them conserve energy during the mating process or while moving to search for a mate (Rico-Guevara & Hurme, 2019) [16].

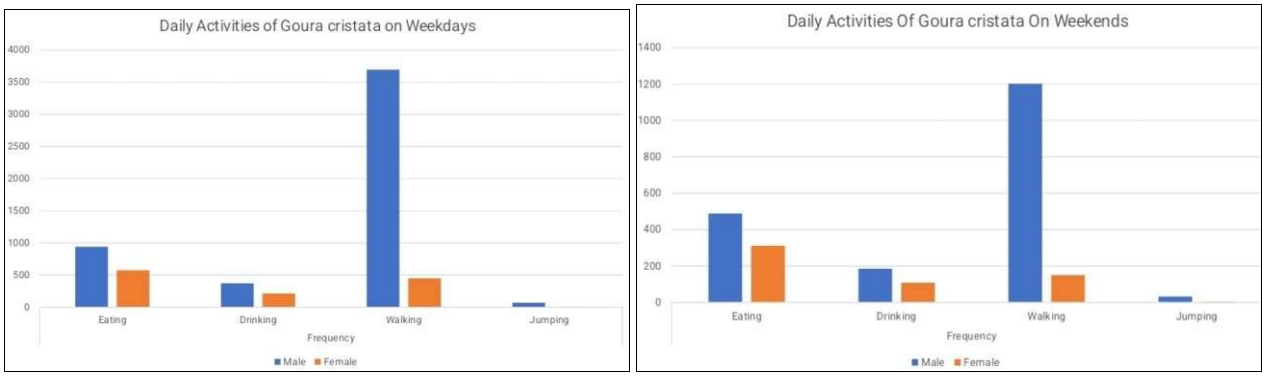
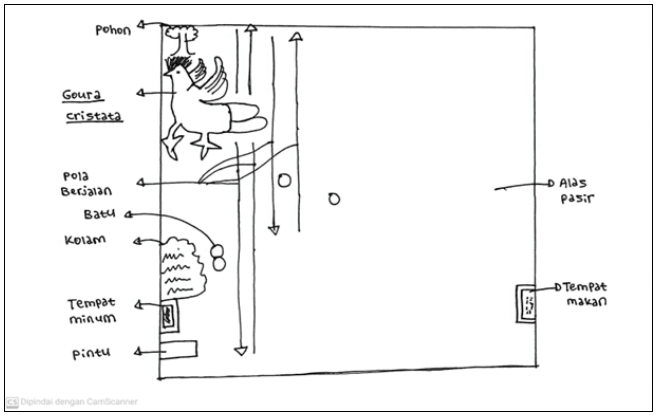


Fig 5: Daily Activity Data of *Goura cristata* at TMR A. Weekdays; B. Weekends



(**Source:** Personal Documentation)

Fig 6. Walking Pattern of Male *Goura cristata* at Ragunan Zoo

The walking pattern of *G. cristata* is accompanied by a forward and backward head movement. This rhythmic head-bobbing while walking helps them balance each step. These head movements also ensure that their vision remains focused and stable. In addition to providing balance and maintaining visual focus, the forward and backward head movements allow them to observe their surroundings without having to stop, enabling them to remain vigilant against predators while foraging. Furthermore, these head movements serve as social signals to other birds, indicating that they are actively in motion (Kano *et al*., 2022) [10].

Conclusion

Based on the research results obtained, it can be concluded that the highest frequency of daily activity in male *G. cristata* throughout both weekdays and weekends is walking. Males are more physically active in exploring their surroundings, whereas the most dominant daily activity for female *G. cristata* is feeding. Male birds exhibit higher mobility to mark their territory and search for mates, while females spend more time feeding to fulfill energy requirements and prepare for reproduction. The walking pattern of the males tends to be vertical from back to front, accompanied by forward-and-backward head movements that function to maintain balance and enhance vigilance toward the surrounding environment. These differences in activity demonstrate a division of physiological roles between males and females in maintaining health, reproduction, and the overall survival of the species.

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