



Welfare Assessment of Maleo Chicks in Hungayono Sanctuary, Bogani Nani Wartabone National Park, Gorontalo

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ABSTRACT

The decline in the Maleo population due to the decrease in suitable nesting sites caused the need for Maleo conservation activities such as protecting Maleo's nesting site and their eggs. This study aims to analyze aspects of Maleo chicks captive management and assess Maleo chicks welfare levels in Hungayono Sanctuary. The method used is direct observation, interviews, and literature studies. Data analysis was carried out by describing the welfare assessment. The results showed that welfare management in Hungayono includes the management of cages, feed, and health. Management activities for the aspects of cages, feed, and overall health are still lacking. This is because several important aspects had not been fulfilled in management, such as the quantity and quality of the cages, feed and water given, also medical personnel and facilities. Maleo chick's welfare level in Hungayono had a value of 49.73, which was categorized as low. The aspect of freedom from pain, injury, and disease had the lowest score, which was 1.92. In conclusion, the overall management of maleo chick's in Hungayono was still lacking and needed to be improved. The welfare level of Maleo chick's was low, with freedom from pain, injury, and disease having the lowest score. Hungayono managers need to add medical personnel and increase the quality and quantity of their medical facilities to improve the aspects of freedom from pain, injury, and disease.

Keywords: animal welfare; Hungayono; maleo; welfare management

INTRODUCTION

Maleo is an endemic species of Sulawesi Island (Indarwan *et al.*, 2012; Froese & Mustari, 2019; Tasirin *et al.*, 2021) which is being protected by Indonesian Law according to Minister of Forestry and Environmental Regulation Number P.106/MENLHK/SETJEN/KUM.1/12/2018 and is also included in CITES Appendix I, which means Maleo is prohibited from being traded for commercial purposes. The International Union for Conservation of Nature (IUCN) listed Maleo as an Endangered species (Summers *et al.*, 2021). Maleo is known as burrow nester species, which makes burrows as their nest to place their eggs. The eggs were incubated by natural heat sources such as sun heat or geothermal. Limited habitat suitable as a nesting site, challenging breeding process, and the existence of predators (Bashari *et al.*, 2020) were factors causing the decline of Maleo populations in their habitats, as well as making them very vulnerable to extinction. To support Maleo populations growth in their natural habitats, conservation activities need to be carried out, such as protecting Maleo's nesting site and their eggs.

Hungayono is one of the nesting sites which is being actively managed by Bogani Nani Wartabone National Park (TNBNW) and Wildlife Conservation

Society (WCS) which aims to monitor Maleo presence and use the hatchery in a sustainable and controlled manner since 2003 (Bashari *et al.*, 2021). Activities carried out in Hungayono include managing Maleo nesting sites, collecting and transferring Maleo eggs to semi-natural hatcheries, hatching Maleo eggs, and releasing Maleo chicks. In order to achieve this goal, it is necessary to implement technical aspects by the manager of Hungayono. These technical aspects include supporting facilities, feed, habitat preparation, and health care which are summarized and used as guidance in assessing the success of captive breeding based on the 5 freedoms of animal welfare. Based on the Regulation of the Director General of Forest Protection and Nature Conservation (Ditjen PHKA, 2011b), the assessment of animal welfare includes 5 aspects, namely 1) freedom from hunger and thirst, 2) freedom from environmental discomfort, 3) freedom from pain, injury, and disease, 4) freedom from fear and stress, and 5) freedom to behave naturally. However, an assessment on the welfare management of Maleo chicks in Hungayono has not been carried out until now. In order to preserve the Maleo population in their natural habitat, it is necessary to have information on captive management and the welfare level of Maleo chicks before they are released. Based on this thought, this study aims to analyze aspects of

Maleo chicks captive management and assess Maleo chicks welfare levels in Hungayono Sanctuary. This study was expected to provide information to TNBNW regarding implementing the appropriate welfare of Maleo chicks in Hungayono.

MATERIALS AND METHODS

Research Location and Time

Data were collected at Hungayono nesting site, Bone Bolango, Bogani Nani Wartabone National Park (TNBNW), Gorontalo Province. The research was carried out in May-July 2021.

Data Collection

The data collected included Maleo chicks captive management and Maleo chicks welfare level. Data were collected by direct observation and interviews with Hungayono keeper and TNBNW management. Observations were done on Maleo chicks in a habituation cage without direct contact between chicks and researchers. All treatments for Maleo chicks were carried out directly by the keeper according to what was done daily without any special treatment, and the researcher only acted as an observer.

Habituation cages are cages that are used as a means of preparation before Maleo chicks are released into the wild. Maleo chicks were kept in habituation cages for a maximum of 7 days with handling in the form of feeding, drinking, and health checks through visual sights. Maleo chicks in the habituation cage hatched from Maleo eggs in the Hatchery Cage. The hatchery cage is a cage that is used as a means of hatching Maleo eggs, Maleo chicks that hatched were then transferred to the Habituation cage three days after hatching. In hatchery cages, handling of Maleo chicks was only limited to visual health checks. The age of Maleo chicks in the habituation cage ranged from 3 to 10 days. The details of data collection are as follows:

Maleo chicks captive management. Maleo chicks captive management includes aspects managed for the welfare of Maleo chicks while in the Hungayono habituation cage. According to the DitJen PHKA (2011b), five aspects can affect animal welfare. Based on a survey

conducted before the study, three aspects were managed by the Hungayono keeper, namely the aspect of cage management, feed management, and health management. The collection of data can be seen in Table 1.

Maleo chicks welfare level. Maleo chicks welfare indicators were measured about the 5 principles of animal welfare according to the DitJen PHKA (2011a; 2011b) through several criteria (see Table 2), which include: (a) free from hunger and thirst, (b) free from environmental discomfort, (c) free from pain, injury, and disease, (d) free from fear and distress, and (e) free to behave naturally. Animal welfare data were collected through direct observation, interviews with the management and officers of Hungayono, and tracing related documents. The principles of animal welfare used are presented in Table 2.

Data Analysis

Maleo chicks captive management. Data related to Maleo chicks captive management were processed and analyzed by describing all aspects of Maleo chicks rearing in Hungayono.

Maleo chicks welfare level. The welfare assessment data were analyzed by calculating the score for each aspect, the weighted value, and the assessment score. The score for each aspect is the average value of each aspect point assessed by managers and researchers. The details of the score are very bad (1), bad (2), moderate (3), good (4), and very good (5). The aspect score was then entered into the scoring column and multiplied by the weighted value of each aspect to obtain the weighted score (see Table 3). The determination of the amount of weight was carried out based on the level of importance (DitJen PHKA, 2011a).

Based on the results of the weighted value of each aspect of animal welfare, then the calculation of the Implementation Achievement (IA) of animal welfare was carried out using the following formula:

$$IA = (\sum \text{weighted value}) / (\sum \text{management aspect } (5))$$

The final results obtained based on the achievement of the implementation of animal welfare management were classified based on the DitJen PHKA (2011a), which are listed in Table 4.

Table 1. Maleo chicks captive management data

Aspects	Data	Data collection methods
Cage management	Cage construction	Observation and interview
	Cage equipment	
	Enrichment	
	Safety	
Feed management	Feed type	Observation and interview
	Feeding and drinking time	
	Distribution technique	
Health management	Health management conditions	Observation and interview
	Health management technique	

Table 2. Maleo chicks welfare level data

Animal welfare	Data description
Freedom from hunger and thirst	Is the quality and quantity of feed sufficient?; is there a variety of feed?; does it involve a nutritionist?; are the conditions of feed and drinking good?; how is the distribution of feed and drink?; is feed palatability considered?; is there any control after feeding and drinking is given?; how to place feed and drink to avoid contamination?;
Freedom from discomfort	Are the cage conditions appropriate?; is there shade in the cage?; can cages harm animals?; is the cage free from litter and predators?; is the tree in the cage safe?; how is the condition of the cleanliness of the cage?; are there other cages available?
Freedom from pain, injury, or disease	Are the animals in good health?; is there a health inspection?; are there treatment for sick animals?; are there any disease prevention measures?; is there any predator control activity?; are there medical facilities?; is there a special uniform?; is the handling of dead animals safe and correct?; are there isolation facilities?; are there post-mortem facilities?; are there health keepers or veterinarians?
Freedom from fear and distress	Is the length of stay in accommodation not too long?; are animals only handled by authorized staff?; is treatment by staff consistent with well-being?; are there signs of individual stress?; is there any behavior that suggests pain is present?; are there actions related to stressed animals?
Freedom to express natural behavior	Are there sufficient enrichment facilities?; is the cage size sufficient?; is the cage condition good and cared for?; are there plants or other objects that allow animals to escape?; is the cage door strong and effective?; is there a safety fence around the area?

Table 3. The weight of the assessment of animal welfare aspects

No.	Welfare aspect	Weight	Score	Weighted score
1	Free from hunger and thirst	40	1-5	40-200
2	Free from environmental discomfort	20	1-5	20-100
3	Free from pain, injury, and disease	20	1-5	20-100
4	Free from fear and stress	10	1-5	10-50
5	Free to behave naturally	10	1-5	10-50

Source: Ditjen PHKA (2011a).

RESULTS

Maleo Chicks Captive Management

Cage management. Cage is one of the important elements needed for captive animal breeding activities. Things that must be considered in the cage aspect, namely, the construction of the cage, the equipment of the cage, the type of cage, the enrichment needed for captive animal activities, and also cage security. The Hungayono Sanctuary only has one habituation cage for rearing Maleo chicks before being released into their natural habitat. The details of the Habituation cage can be seen in Table 5.

In Table 5, it can be seen that the available enrichment in the habituation cage is only a perch and several types of trees to give the impression of natural habitat. In terms of security, the handling of predators that enter the cage is to remove the predator from the cage and move it to an area far from the Maleo chicks cage. If there is damage to the habituation cage, the keeper will immediately make repairs directly to the damaged part of the cage.

Feed management. Feed management can determine the success or failure of the Maleo chicks protection

Table 4. Classification of animal welfare assessment

Rating classification	Information
Very good	80 – 100
Good	70 – 79.99
Moderate	60 – 69.99
Low	<60

program. The results of the study can be seen in Table 6. Feeding in Hungayono for Maleo chicks was carried out according to the availability of the feed. Natural feed (melinjo fruit, pangi fruit, and banyan fruit) was given only during the fruiting season in Hungayono, so the type of staple feed given was the keeper-selected feed (peanuts and candlenuts) because it can be purchased in the market. Feeding protein sources such as field snails, earthworms, and insects have not yet been implemented, even though variations in the types of feed given are very important for animal health.

Feeding activities were carried out once a day before the keeper began to search for wild Maleo eggs at 10.00 AM or after the search at 03.00 PM. The provision of drinking water was made only when the drinking container was empty, not every day. During the rainy season, drinking water was only provided when the drinking container was empty due to clear weather.

Health management. This management aspect covers the health management and technical health in Hungayono. Based on Table 7, the management of Maleo chicks health in Hungayono was still low. The absence of medical personnel, medical facilities, and other health support activities causes the health management of Maleo chicks to be less than optimal. For example, based on interviews, the type of disease often encountered is Maleo chicks who suffer injuries to their legs due to impact when hitting the wire cage wall. Injured Maleo chicks were very easily attacked by ants in their eyes and body, which caused the chick's condition

Table 5. Habituation cage information

Cage aspects	Description
Cage construction	Open roof covered with black paranet; cage foundations of zinc coated concrete; ground floor enclosure; poles made of steel and iron; wire walls lined with black paranet; and the cage door made from iron and wire.
Cage equipment	Drinking containers made of bamboo and small used pots placed on the floor of the cage; and shelter from used zinc and woka leaves
Enrichment	A bamboo perch; and there are undergrowth, 3 bayur trees, 3 walnut trees, 2 rattan trees, and 1 Bulangita tree
Safety (from predator)	Check the condition of the cage every day; Handling if there are predators around the cage area is to catch the predator and then release it

Table 6. Maleo chicks feed and drinking management

Data	Description	
	Feed	Drink
Type	Natural feed: melinjo fruit, pangi fruit and banyan fruit Keeper selected feed: peanuts and candlenuts	Tap water from keeper's camp
Feed distribution time	Once a day at 10:00 AM or 03:00 PM	Only when the drinking container is empty, not every day
Distribution technique	Spread on the floor of the cage; the feeding of peanuts was given out along with the skin, while the candlenut was given in the form of fruit that has been processed; The amount of feed given is adjusted to the number of maleo tillers, if there is leftover feed, feeding adjusts to the rest of the feed.	The drinking containers used are made of bamboo or used frying pans planted in the ground. Drinking is done every day using water from the camp

Table 7. Health management of Maleo chicks in Hungayono

Cage aspects	Description
Health management conditions	There are no medical check-ups and no medical equipment or medicines; no isolation cage; no first aid training activities for keeper; and there are no maintenance activities and spraying of cages using disinfectants
Health management technique	Maleo chicks health checks were carried out every day by the keeper by paying attention to the condition of maleo children who are injured or limp; Maleo chick who were found dead are immediately buried outside the Hungayono.

to weaken to death. The treatment carried out by the keeper on Maleo chicks in these conditions was only to clean the chick's body from ants until it was clean and move the injured chicks to another place, which remains in the habituation cage. Separation of Maleo birds was not carried out because they did not have an isolation cage.

Maleo Chicks Welfare Level

Based on the research results, the welfare level of Maleo chicks in Hungayono was 49.73, classified as Low (see Table 8). The aspect of freedom to behave naturally shows the highest score (3.92) compared to other aspects. The results of field observations showed that the habituation cage had met the enrichment criteria for Maleo chicks, which were designed to resemble their natural habitats. Aspects of freedom from pain, injury, and disease showed the lowest score (1.92). Although Maleo chicks in Hungayono look healthy, many things from this aspect were considered lacking, such as sick animals not being given immediate help, no preventive measures for disease, no regular health checks,

no medical equipment, and no medical personnel or veterinarian.

DISCUSSION

Maleo Chicks Captive Management

Cage management. Cages are one of the important elements in captive animals because, in almost all stages of their life, they spend it inside the cages. Aspects of the cage related to Maleo chicks that need to be considered include cleanliness, safety, and comfort. These three aspects are very important to support the success of conservation activities and to keep Maleo chicks retaining their natural characteristics. Based on Woods *et al.* (2022), the main concern in the manufacture of cages for birds is the ability of the cage to support the birds to display their natural behavior. In this case, enrichment becomes important as a means of stimulation so Maleo chicks can carry out their natural activities. According to Carvalho *et al.* (2017), it is necessary to carefully select the type of environmental enrichment and adjust it according to the behavioral characteristics and ability

Table 8. The welfare value of Maleo chicks at the Hungayono Neighborhood Wartabone National Park

Animal welfare aspects	Weight	Scoring	Weighted value
Freedom from hunger and thirst	40	2.42	96.67
Freedom from environmental discomfort	20	2.58	51.50
Freedom from pain, injury, and disease	20	1.92	38.40
Freedom from fear and stress	10	2.92	29.20
Freedom to behave naturally	10	3.29	32.90
Total	100	13.12	248.67
Implementation achievements (IA)	49.73		

of each species. Based on observations, the habituation cage has been made to resemble the original habitat conditions of Maleo chicks to support its natural behavior.

The cage cleanliness was still lacking, and the cleaning procedure was not following the existing Management Procedures. Based on the existing procedure, the cage should be cleaned once a week, whereas, in reality, the cleaning is only done once a year. This means that the cage's cleanliness was not well maintained. Although the habituation cage was made to release Maleo chicks to their natural habitat by maintaining their natural characteristics, the cage's cleanliness still needs to be maintained because it will affect the health of Maleo chicks prior to release.

The comfort aspect of the cage, one of which, is related to the capacity of the cage. Each animal has a minimum need for space to feel comfortable, and these needs are different for each animal for each age; the larger animals need more space. Based on Bashari *et al.* (2020), the ideal area for Maleo chicks in a habituation cage is 10 m²/individual, which means the habituation cage in Hungayono with an area of 590.25 m² ideally can only accommodate as many as 59 Maleo chicks. According to field observation, in Hungayono, the habituation cage was filled with ±370 Maleo chicks, meaning that each chick only has about 1.6 m² of space to move. Rose *et al.* (2017) stated that space constraints could cause disturbances in animal behavior patterns, while Polverino *et al.* (2015) stated that limited space can cause animals to be unable to perform a behavior with a specific purpose, causing animals to perform abnormal behavior. Furthermore, Rose *et al.* (2017) explained that birds must be provided with an outlet that could channel all their species-specific behaviors in captivity, one of which is by providing enrichment or functional replicas of habitat features in cages.

Feed management. Feed is a determining factor for the success of captive breeding programs because it is related to the health and mortality of Maleo chicks. Until now, the provision and selection of the feed type were done based on the keeper's experience and have not involved nutritionists or calculations according to the needs of Maleo chicks. According to Fidgett & Gardner

(2014), the determination of the proportion of bird feed and nutrition depends on the physiological state of the bird, so special calculations were needed. Greggor *et al.* (2018) explained that the feed (diet) must provide all the nutrients needed in sufficient quantity, quality, and variety. Based on Peron & Grosset (2014), diet is a key factor in preventing and reduce health problems, and feed imbalances can cause discomfort and even death of birds. The involvement of nutritionists or veterinarians can ensure a balance of quantity and quality of Maleo chicks feed to support optimum growth

Feeding was done by directly placing/spreading feed on the ground without being given a container. This was done to maintain the wild nature of Maleo chicks under their natural conditions in their natural habitat. According to Wiantoro *et al.* (2019), adult Maleo in their natural habitat foraging above ground by scavenging soil and litter. In addition to feeding according to natural conditions, providing enrichment-related feed could also be a stimulus for Maleo chicks to express their natural behavior. Based on Sha *et al.* (2016), the provision of feed enrichment to increase environmental complexity can increase the presence of species-specific behavior. Furthermore, according to Woods *et al.* (2022), the addition of enrichment that can increase the foraging time can significantly improve the behavior and physical condition of birds. Maintaining the original nature of Maleo chicks as in their natural habitat is very important to support the successful reintroduction of Maleo chicks.

Health management. Health management is related to the freedom of Maleo chicks from pain, injury, and disease. The absence of veterinarians or medical personnel causes no physical and health check-ups for Maleo chicks. In addition, the knowledge of the existing keeper regarding disease prevention measures and handling of sick Maleo chicks was lacking or almost non-existent. This was due to the absence of training and competency improvement for keepers related to Maleo health and disease, and this resulted in a lack of knowledge and experience of the keeper regarding the identification of sick Maleo and their treatment. Pain assessment is very important for preventing and reducing pain (Prunier *et al.*, 2012), where special experiences and knowledge are needed to assess pain accurately.

Prevention and control of pain, injury, and disease are essential in an animal conservation program because it is related to animal health, which is paramount to conservation goals. Velarde & Dalmau (2012) explained that healthy animals are animals that are free from injury/wounds, disease, and pain. Furthermore, Velarde & Dalmau (2012) also explain that injury can cause pain, which can be defined as an unpleasant emotional experience that could be considered a welfare problem. Concerning Prunier *et al.* (2012) and Velarde & Dalmau (2012), freedom from pain, injury, and disease aspects are related to the management and prevention of animals from negative emotional feelings or experiences that can arise from the pain felt by animals. Based on this, the management of Hungayono, especially the keeper in the field, must focus on preventive measures

so that Maleo chicks do not experience injury or pain, one of which is to increase the knowledge and competence of the keeper on health and medical knowledge as well as the procurement of medical personnel and equipment in Hungayono.

Maleo Chicks Welfare Level

The low level of Maleo chicks welfare in Hungayono was caused by several factors, such as lack of management and the form of management of Hungayono, which is not fully captive. Hungayono's nesting site is being managed on the principle of semi-captive breeding, where Maleo eggs are taken from their natural habitat and then transferred to the hatcheries for hatching. After the eggs hatch, Maleo chicks will be left in the hatchery for around three days before being transferred to a habituation cage. The transfer of Maleo chicks to the habituation cage was done directly by placing the chicks into a bag. Maleo chicks will live in the habituation cage for at most seven days before being released back into the wild without any special treatment. This captive system causes the lack of animal facilities in Hungayono other than cage facilities. Not only that, until now, Hungayono still does not have a clear institutional structure which causes Hungayono's management not to operate optimally.

The welfare aspect is very important to be fulfilled by the management because it is closely related to animal health and safety (Ditjen PHKA, 2011b). Based on Peng & Broom (2021), there is a relationship between poor animal welfare and animal vulnerability to disease, and Veasey (2017) explains that animal welfare is related to animal happiness/ satisfaction. Unfulfilled happiness/ satisfaction of animals could lead to poor welfare and not achieving the management's goals. To achieve the goals of captive breeding and management, managers need to improve aspects with high assessment and rectify aspects with low assessment.

In Hungayono, the 5 aspects of freedom need to be improved, especially the freedom from pain, injury, and disease, which has the lowest value (1.92). This is due to the lack of treatment for Maleo chicks, especially regarding health. Hungayono still lacks medical facilities, both medical personnel and medical equipment. Up until now, medical treatment was still limitedly carried out by keepers, with their limited knowledge and competence. One of the reasons for the lack of medical personnel in Hungayono was due to its remote location, which made it difficult to access. According to Greggor *et al.* (2018), basic treatment and diagnostic sample collection techniques training by veterinarians should be given to on-site keepers to overcome remote locations. Basic medical training for keepers is one of the things that the manager of Hungayono must do to improve the health quality of Maleo chicks. The on-site keeper is at the forefront of sick Maleo chicks treatment and care.

Aside from the health aspect, freedom from hunger and thirst also needs to be improved. Feed quality needs to be improved and the participation of animal nutritionists/veterinarians needs to be included. Based on Mellor *et al.* (2021), one way to improve the welfare

of captive birds is to provide them its naturalistic food. In terms of the aspect of being free to behave naturally, based on observations, the Hungayono habituation cage is only sufficient to accommodate approximately 59 Maleo chicks without compromising their comfort and freedom of movement. However, in Hungayono, the habituation cage with an area of 590.25 m² is used to accommodate around 370 Maleo chicks. This causes Maleos to be unable to freely channel their species-specific behavior (Rose *et al.*, 2017). The management of Hungayono needs to increase the area of the habituation cage to provide sufficient space for Maleo chicks, either by increasing the number of habituation cages or expanding the existing habituation cages.

CONCLUSION

Maleo chicks captive management in Hungayono includes the management of cages, feed, and health which are still lacking. The Maleo welfare level in Hungayono has a value of 49.73, which is categorized as Low. Overall management activities for the welfare of Maleo chicks are still lacking and need to be improved, especially in terms of freedom from pain, injury, and disease by adding medical personnel and medical facilities.

CONFLICT OF INTEREST

We declare no conflict of interest with any financial, personal, or other relationships with other people or organizations related to the material discussed in the manuscript.

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