International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

The Population Study of Maleo Bird (*Macrocephalonmaleo*) in the Nesting Ground of Saluki Village, Lore Lindu National Park

Sri Ningsih Mallombasang[1], Arief Sudhartono[2], Ikhsan Nur Mallo[3]

[1,2,3]Forestry Department, Forestry Faculty, Tadulako University, Palu, Indonesia

Abstract

Sulawesi Island is an island that has a diversity of flora and fauna, some of which are endemic animals. One of the protected endemic fauna species is the maleo bird. Maleo was designated as a protected animal because the number of populations in the wild was decreasing, and its conservation status was in the endangered category. Concrete steps that could be taken to increase the maleo population were through various activities, including conducting ongoing and periodic studies of the maleo population. In particular, this study aims to examine the current population of the maleo bird in the nesting ground of Saluki Village, Lore Lindu National Park. In this study, the estimation of maleo population density uses two approaches. The first approach was direct observation of the maleo population outside the nesting habitat using the transect method. The second approach was using the active nest count approach at nesting sites. Based on the results, it was found that in the egg-laying locations, there were 32 active nests and 31 inactive nests. Based on these results, the maleo population density in the egg-laying locations was 29.7 individuals/Ha. While outside the egg-laying habitat, there were eight maleo individuals consisting of four juvenile individuals and four young adults (sub-adults). These results showed that the population density outside the egg-laying habitat was 1.7 individuals/Ha. Four maleo predators were found at the study site, namely *Varanus salvator*, *Spilornisrufipectus*, *Ictinaetusmalayensis* and *Falco* sp. In addition, there was one type of potential maleo predator, *Macaca tongkeana*, with as many as seven individuals. Two potential factors could disturb the maleo population: the laying location factor and the dense of undercover vegetation.

Keywords: population, maleo bird, nesting ground, Lore Lindu National Park

INTRODUCTION

Sulawesi Island was an island that had a diversity of flora and fauna, some of which were endemic animals. One protected endemic fauna species was the maleo bird (*Macrocephalonmaleo*). Maleo was included in 510 endemic bird species in Indonesia (Prawiradilaga, 2019). Maleo was designated as a protected animal because the number of populations in the wild was decreasing, and its conservation status was in the endangered category.

In Sulawesi, the maleo population declined due to the high illegal hunting of maleo eggs (Froese &Mustari, 2019). (Arista et al. 2015). Maulany et al., 2021), predator threats (Rusiyantono et al., 2011; Santrio, 2022), and habitat damage and fragmentation (Maulany et al., 2021) (BirdLife International, 2016). These conditions led the International Union for Conservation of Nature (IUCN) to include the maleo as a threatened species. Even extinct (BirdLife International, 2021). Consequently, the yellow-

crested cockatoo was a protected bird according to PP No. 7, 1999; Minister of Environment and Forestry Regulation No. P. 106 of 2018 was included in CITES Appendix I (Harris et al., 2014).

The current condition of the maleo requires serious attention to prevent its extinction. Concrete steps that could be taken to increase the maleo population were through various activities, including conducting ongoing and periodic studies of the maleo population. According to (Tucker, 2005), the Species population was one of the critical factors in conservation efforts, where population size was related to the risk of extinction (threatened status) and its geographical distribution. The basis could help determine conservation priorities for species or their habitats. Likewise, Leca et al. (2013) stated that accurate information on the status and trends of animal populations obtained from inventories and socioecological studies was a prerequisite for the success of wildlife conservation programs. In this regard, this study aims to examine the population of maleo birds in the Nesting Ground of Saluki Village, Lore Lindu National Park.

RESEARCH METHOD AND MATERIALS

This research was carried out in the maleo (*Macrocephalonmaleo*) captivity in Saluki Village, Lore Lindu National Park, from July to August 2022. The tools and materials used in this study included: Equipment: writing instruments to record all results obtained in the field, binoculars for observing maleo birds, GPS for determining coordinates, directions and distances, and digital cameras and camera traps for documentation. Materials: work map to determine the area's location and area tally sheet to record field monitoring results.

Data collection used the strip transect method. The line transects were placed in an area where maleo was suspected of frequenting them based on statements to the animal keepers. Each transect's length was 1 km/transect, and each stopping point was observed for 2 hours/km. The observation data obtained in the field were recorded, and photographs of birds passing, flying and perching were based on morphological characteristics and the number of birds. This maleo observation was carried out using binoculars.

The data collected includes: Primary data includes, maleo population data, including the number of populations, namely: number of adult males and females, number of children and adolescents, population density per lane area, total population based on age structure, maleo species obtained from interviews with managers (animals) keepers). The secondary data used was population density data in the Salukis. Secondary data was collected through literature studies from various sources, including textbooks, reports and journals. Data was also obtained from the Central Sulawesi BKSDA area, the community regarding the condition of the community and the extent to which people used or hunted animals, especially maleo.

The relative population density was obtained by counting the number of individuals in each observation path. Then calculated, the average density of each lane was. Data analysis used to determine population density was analyzed based on (Bibby et al., 2000):

$$D = n/ 2 WL$$

remarks:

D = Population density (tail/km²)

W = Tracking Wides (Km)

N = Individual amount (tail)
L = Tracking Long (Km)

The calculation of the birth rate or birth rate was analyzed using a formula based on Tarumingken (1994) in Rosyid (2019).

$$d = \sum B / \sum N$$

remarks:

d = Birth Amount (*birthrate*)

B = Birth Individual Amount

N = Population Total Amount

Calculation of the sex ratio (sex ratio) uses a formula based on Caughley (1977) in Rosyid (2019).

$$SR = \sum JP / \sum BF$$

remarks:

SR= Sex ratio

JP = Reproductive potential male number

BF= Number of potential reproductive females

RESULTS DAN DISCUSSION

A. Result Research

Egg-laying habitats

The observations showed that the maleo spawning area was located on the river's edge with coordinates -1.298499, 119.975445. Based on the shade of the vegetation (McKinnon, 1978), the nesting area was categorized as a nest in a partially shaded place. Meanwhile, based on the distance between nests (del Hoyo et al., 1994), it was included in the category of communal nests. Most of the spawning holes were found at the foot of the hill, and some were on the ridge. Nest holes were dug between tree roots.

Figure1. Maleo Nesting Area

The condition of the nesting area at the foot of the hill caused the distance between nesting holes to be relatively close. Even though the canopy shaded it, this did not affect the location for laying maleo eggs because the nesting holes were selected based on the geothermal sources in the study location. Geothermal was characterized by the flow of hot water at several points in the research location.

Population

In this study, the estimation of maleo population density used two approaches. The first approach was direct observation of the maleo population outside the nesting habitat using the transect method. The second approach was using the active nest count approach at nesting sites.

Based on the study's results, it was found that in the egg-laying locations, there were 32 active nests and 31 inactive nests. Based on these results, the maleo population density at the egg-laying location was 29.7 individuals/Ha. While outside the egg-laying habitat, there were eight maleo individuals consisting of 4 juvenile individuals and four young adults (sub-adults). These results showed that the population density outside the egg-laying habitat was 1.7 individuals/Ha. So, the overall estimate of the maleo population in this study totalled 72 individuals (Table 4). The population size was in a small category. Butchart et al. (1998) used three criteria to determine the maleo population size based on the number of nests found, namely 1) Large, if the number of nests was more than 200 holes. 2) Medium if nests range from 75 to 200 holes. 3) Small if the number of nests is less than 75 holes.

Table1. Maleo Population Estimation in Saluki

Observation Types	Amount	Density (ind/Ha)	Note
Visual	8	1.7	Lay eggs
Non Visual	32	29.7	Active Nesting

The estimated sex ratio between male and female individuals was 1: 1 assuming that a pair of maleo actively used each nesting hole. The maleo bird was known to be long-term monogamous (del Hoyo et al., 1994). The sex ratio outside the adult age class was difficult to determine through direct observation because the maleo was a monomorphic bird (Widnyana et al., 2019). That was, male and female individuals were not much different morphologically.

In the study, maleo was not active in the egg-laying holes. Based on the information obtained, the lack of maleo visits to the egg-laying holes was due to the rainy season when the study was entered and influenced by the egg-laying season.

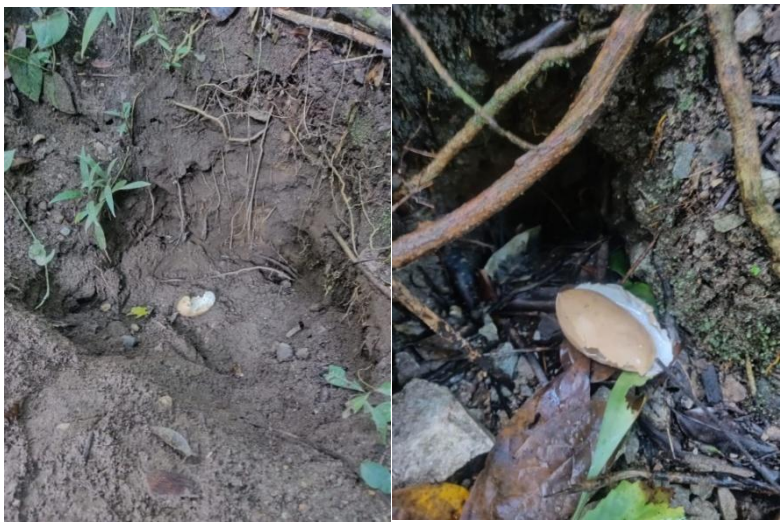
Regarding the spawning season, even though the spawning hole area was in a geothermal location where the egg-laying season lasts all the time, there was a tendency that in certain months, the number of maleo visits was higher than in other months. According to Jones et al. (1995), the maleo bird's egg-laying season in various places varies monthly. The period when the maleo lays more eggs was estimated as the peak of the egg-laying season. In North Sulawesi, egg production was 3 to 4 times more from November to January than in other months. This egg production was because, in these months, the trees that produce maleo feed ingredients bear fruit, so egg production increases sharply (Nurhayati, 1986). In the TNLL area, the peak maleo egg-laying season was reported from May to July (Laban, 2007). Specifically, at the Saluki Resort, previous research showed that the highest peak of

maleo visits was reported in May (Samana, 2015), that when the research was carried out, it had passed the peak of breeding.

Figure2. Maleo eggs in the active laying hole before being transferred to the hatchery

Predator

At the time of the study, the predation events were not immediately visible, but two maleo egg shells monitor lizards had eaten. Lizards were known to be egg predators and newly hatched maleo chicks. In addition, to monitor lizards, three species of birds of prey were found at the study site: the Sulawesi snake-eagle (*Spilornis rufipectus*), the black eagle (*Ictinaetus malayensis*) and the kestrel-alap (Falco sp.). In addition, one type of potential maleo predator, Macaca tongkeana, was found 500m from the maleo egg-laying area of seven individuals. This species had never been reported to prey on maleo in the Saluki. However, in other locations in Southeast Sulawesi, this type was reported to be one of the



maleo predators (Santrio, 2022).

Figure3. Maleo eggshells eaten by monitor lizards

B. Potential Population Disturbance

Currently, the disturbance to the maleo population in the Saluki was predators and human disturbance. In addition, based on the results of research in the field, it was shown that two primary disturbances that have the potential to become factors causing future population disturbances at maleo Saluki nesting sites, namely:

1. Laying location factor

The nesting sites in the study area were located on a relatively flat stretch of land between the foot of the hill and the banks of the Saluki River, and there were even three active nesting holes on the banks of the river. The location of the nesting holes on the banks of the river, allegedly because the location was a location of shallow hot water flows (not too deep from the ground), the shallow hot water flows were the ideal place for maleo nesting holes. However, the egg-laying location was threatened by flooding that had occurred several times in the Saluki River. Such floods could cause landslides on riverbanks as well. In addition, the location of the egg-laying holes directly at the foot of the hill could cause the egg-laying holes to be submerged by rainwater from the hill during the rainy season, which could disrupt the process of hatching maleo eggs.

2. Cover Crop Vegetations

The density of cover crop vegetation could reduce the quality of the egg-laying sites, which could cause the area to become narrower. From the results of observations, most of the maleo egg-laying holes were between the roots of plants. However, it could not be ascertained that these conditions were ideal for maleo nesting holes. The egg-laying holes between the roots might have been caused by the maleo adapting to the conditions of the egg-laying holes where there was lots of cover crop vegetation.

Both of these factors would cause real disruption if there were no efforts to overcome or minimize the potential sources of disturbance that would occur.

CONCLUSION AND SUGGESTION

A. Conclusion

At the nesting sites, there were 32 active and 31 inactive nests, with a maleo population density at the nesting sites of 29.7 individuals/Ha. While outside the egg-laying habitat, there were eight maleo individuals consisting of 4 juvenile individuals and four young adults (sub-adults), with a population density outside the egg-laying habitat of 1.7 individuals/Ha. So, the overall estimate of the maleo population in this study amounted to 72 individuals. At the study site, four maleo predators were found, namely monitor lizards (Varanus salvator), Sulawesi snake-eagle (Spilornisrufipectus), black eagle (Ictinaetusmalayensis) and kestrela (Falco sp.). In addition, there was one type of potential maleo predator, Macaca tongkeana, with as many as seven individuals. Two potential factors disturb the maleo population: the location of the nesting holes and the dense cover crop vegetation.

B. Suggestion

Further research was needed regarding the maleo population with broader coverage and outside the egg-laying habitat so that the sex ratio and composition of the maleo population structure could be known.

REFERENCES

BBTNLL (BalaiBesar Taman Nasional Lore Lindu). 2019. Laporan HasilPelaksanaan Monitoring Populasi Maleo di Nesting Ground Maleo Salukitahun 2019. Publisher: BalaiBesar Taman Nasional Lore Lindu. SulawesiTengah.

Bibby, C. , M. Jones dan S. Marsden. 2000. Teknik-teknikEkspedisiLapangan; survey Burung.BirdLifeInternasional – Indonesia Programme. Bogor.

Butchart SHM, B Ma'dika, Zarlif, M Yamin, L Nurdin, M Irfan, I Tinulele, R Intjehatu, FN Mallo. 1998. Status burungmaleo (Macrocephalonmaleo) di Sulawesi Tengah bagian barat dan Sulawesi Selatan bagianutara. Yayasan Jambata. Palu. Sulawesi Tengah.

Dekker, R.W.R.J. 1990. Conservation and Biology of Megapodes. Radopi. Amsterdam.

del Hoyo, JA Elliott and J Sargatal. 1994. Handbook of the Birds of the WorldbVolume 2. New World Vultures to Guineafowl. Bird Life International andbLynx Edition. Barcelona.

Hafsah, T. Yuwanta, Kustono dan Djuwantoko, 2008. Karakteristik Habitat MikroSebagai Dasar Pola PenetasanTelur Maleo di Taman Nasional Lore Lindu Sulawesi Tengah. *J. Agroland*, 15(3): 233-228.

Jones, D. N., R. W. R. J. Dekker. dan C. S Roselaar. 1995. The Megapodes. Oxford University Press, Oxford.

Laban L.M. 2007. PendugaanPopulasi, Preferensi Habitat Peneluran Dan PolaSebaran Maleo (Macrocephalonmaleo Sal. Muller 1846) BerdasarkanKeberadaan Sarang Di Kawasan Taman Nasional Lore LinduKabupatenDonggalaPropinsi Sulawesi Tengah. Tesis. Forestry Faculty. InstitutPertanian Bogor. Bogor.

Leca J.B, Gunst N., Rompis A., Soma G., Putra I.G.A.A, Wandia I.N. 2013. Population density and abundance of ebony leaf monkeys (*Trachypithecus auratus*) in West Bali National Park, Indonesia. *Primate Conservation*. 26(1):133–144. Doi: https://doi.org/10.1896/052.026.0106.

MacKinnon J. 1978. Sulawesi Megapodes. World Pheasant Association Journal.

Nurhayati NF. 1986. MasalahKelestarianBurung Maleo (Macrocephalonmaleo). MakalahPengelolaanSuakaAlam dan Margastwa. Program StudiIlmuLingkunganEkologiManusia. Post Graduate Faculty. UniversitasIndonesia. Jakarta.

Ogutu J.O, Bhola N., Piepho HP, Reid R. 2006. Efficiency of strip and line transect surveys of African savanna mammals. *Journal of Zoology*. 269(2006): 149–160. Doi:10.1111/j.1469-7998.2006.00055.x.

Rosyid A. 2019. Populasi dan PemodelanKesesuaian Habitat Tangkasi (Tarsiuslariang) di Kawasan Taman Nasional Lore Lindu. Dissertation. InstitutPertanian Bogor. Bogor.

Samana J.Y. 2015. EstimasiPopulasi Dan KaresteristikFisikBurung Maleo (Macrocephalon Maleo) Di Resort Saluki Desa Tuva Kawasan Taman Nasional Lore Lindu (TNLL) FakultasGeografi Universitas Tadulako.

Santrio A. 2022. TingkahLakuBertelur dan Karateristik Sarang Burung Maleo Senkawor (Macrocephalonmaleo) di SuakaMargasatwaButon Utara, Sulawesi Tenggara. Tesis. InstitutPertanian Bogor. Bogor.

Taufik, L. O. Nafiu dan A. S. Aku, 2020. KarakteristikTelurBurung Maleo (*Macrocephalonmaleo*Sal. Muller 1846) Di KecamatanMaliganoKabupatenMuna. *JurnalIlmiahPeternakanHalu*, 2 (1) :103-109. Jamili, Analuddin dan L. O. A. P. Rudia. 2015. StudiKarakteristikMikro Habitat Burung Maleo (*Macrocephalonmaleo*) Pada Kawasan Taman Nasional RawaAopawatumohai (TN RAW) Sulawesi Tenggara. *Biowallacea*, 2 (1) : 182-195.

Tucker G. 2005. Biodiversity evaluation methods. Di dalam: Hill D, Fasham M, Tucker G, Shewry M, Shaw P (editor). *Handbook of Biodiversity Methods Survey, Evaluation and Monitoring*. Cambridge (UK): Cambridge University Press. hlm 65-104.

Widnyana PN, Sundu, Rusdin, Tanari M. 2019. Sex Detection in Maleo Bird (MacrocephalonmaleoSal.Muller 1846) Nurtured in Ex-Situ Conservation Through Body Morphological and Hormonal Studies. International Journal of Veterinary Science and Agriculture Research. 2 (1): 17–22.