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The habitat and estimation population of mamoa bird (*Eulipoa Wallacei*) in Galela-Halmahera

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Abstract

Mamoa birds (*Eulipoa wallacei*) is one of endemic bird species in Wallacea. Currently, egg-laying habitat and population of Mamoa was declined by degradation, fragmentation, and eggs harvesting. The aim of the research was to analyze the habitat and estimate the population of Mamoa in Galela North Halmahera. The method used were the combination of transect line and nest count and line plot method. Result from analysis of nesting ground vegetation of the Mamoa for seedling level in Denamabobane beach, the highest Important Value Index (IVI = 25.03 %) is dominated by Ipomoea pescaprae plant. Stake level the highest Important Value Index (IVI = 14.34 %) is dominated by Marsiela crenata at Uwo Uwo beach. Pole level is dominated by Rhizophora sp (IVI = 16.20 %), in Uwo Uwo beacs. In tree level, IVI is dominated by Terminalia cattapa (IVI = 14.13) in Uwo Uwo beach. Diversity and evennes indices in seedling level in Uwo Uwo beach had highest H' = 2.02 and E = 0.67. Tiabo beach at tree level, H' = 1.62 and E = 0,57. Denamabobane beach stake level, H' = 2.00 and E = 0.71. The population of Mamoa in Galela North Halmahera in 2011 is 5505.09 ± 4.26 and in 2012 is 5000.60 ± 5.90.

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Introduction

Halmahera Island is one of the main islands in North Maluku. Most of endemic bird species is located in the island. It is recorded that 26 endemic bird species are in Maluku Islands and among them, 24 are found in North Maluku (Sujatnika *et al.,* 1995). Mamoa bird (*Eulipoa wallcei*) is one of endemic bird of Moluccas and included in Megapodidae genus, which is in Galela Sub-district, North Halmahera Regency. The distribution of Mamoa bird in Maluku Islands is in Haruku Island (Ambon) and Halmahera Island (Galela) (Dekker *et al.*, 1995; Heij and Rompas, 1997; Gilliant, 1998; Coates and Bishop, 2000; Noerdjito and Maryanto, 2001; Sjafani, 2006). The life habitat of Mamoa bird is in mountainous forests with altitude of 500-1200 asl; whereas, nesting ground is located in a beach with sand area in an open space (Jones *et al*., 1995; Heij and Rompas, 1997; Gilliant, 1998;). The birds will only be found in their nesting ground, which is in beach forest during spawning season since during that season the birds will dig a hole to lay their eggs in the sand in which sand has function as a place to incubate its eggs (Stinson and Glas, 1992; Jones *et al.*, 1995;).

In general, megapoda species do not brood their own eggs as other birds did. During laying time, the parents will lay their eggs by digging the sand as a nest to put their eggs into the sand with the depth between 30-100 cm. After laying their eggs, the parents will leave the eggs until they hatch. Therefore, beach as a nesting ground has important role in the viability of the animal (Heij and Rompas, 1997; Gilliant, 1998).

Mamoa population in nature from year to year caused due to exploitation of eggs, degradation and fragmentatioan of habitat. This results in the loss of this animal in the next few years (Heij and Rompas, 1997 Gilliant, 1998; Coates and Bishop, 2000; Sjafani, 2006). Based on the endangered status of Red Data Book, the status is vulnerable due to an excessive eggs removal and the hunt for the parents (Shannaz and Rudiyanto, 1995; IUCN, 2002; Bernstead *et al.*, 2012). In addition, there is lack information on biology and ecology of the population and the unknown population number. In order to protect Mamoa bird, data on the habitat and population of the animal is needed. Therefore, the research is conducted to analyze the habitat and estimate the population of Mamoa bird in Galela-North Halmahera.

Material and methods

Study Area

This research was conducted on laying habitat of Mamoa bird located at Uwo Uwo beach, Tiabo and Denamabobane beach, Galela North Halmahera, during February 2011 to February 2013.

Material

Tools used in the research were GPS, area map, meter, camera and tally sheet.

Vegetasi Analysis

Vegetation analysis was done to calculate Important Value Index (IVI) (Soerianegara dan Indrawan 2005). To calculate Diversitas Indeks (H') (Soegianto, 1994), Similaritas Index (S) (Odum, 1994) and Evennes Index (E) (Ludwig and Reynold, 1988) were determined using equation below :

$$IVI = Relative\ Densit + Relatif\ Frequenci + Relative\ Dominance$$

$$H' = -\sum \text{Pi ln P}$$

Where H' = Shannon-Wiener Diversity Index
Pi = Proportion of important value
ln = Natural logarithm

$$S = \frac{2C}{A + B}$$

Where S = Similarity index,
A = Number of sample A
B = Number of sample B
C = Number of the same type in both samples

Level category used by Odum (1994) is 0 to 1. The similarity index was used to find out the community similarity of vegetation type among research locations

$$E = \frac{H'}{\ln S}$$

Where E = Evenness Index
H'= Shannon-Wiener Diversity Index
S = Number of species
ln = Natural Logarithm

Estimation Population

Estimation of population and nesting ground was based on the inventory of the nest using combination of transect line and nest count methods (Argelo and Dekker, 1994; Caughley and Sinclair, 1994; Hoyo *et al.*, 1994; Alikodra, 2002), the formula is as follow:

$$f = \frac{n}{N}$$

Where f = Sampling intensity
n = Area of sample unit
N =Total of research area

The value of population estimation was using the following formula:

$$P = \frac{\sum Pi}{\sum ai} \times A$$

Where P = Estimation population
P_i = Number of birds
a_i = Area of sample plot (ha)
A = Total of research area (ha)

The following formula was used to find out the value of population density of Mamoa bird per area of sample unit:

$$Y_i = \frac{2\,Xi}{ai}$$

Where Y_i = Population density per sample unit
X_i = Number of active nets found in the i^{th} sample unit
a_i = Area of the i^{th} land cover type of sample unit

The estimation value of population density was calculated using the following formula:
P = (1 – CV) x 100%; CV = Sd / Ď

Where P = the Carefulness of estimation value of population density (%)
CV = Variation coefficient of estimation value of population density
Ď= Estimation value of population (group/km²)

Data Analysis

Data analyzed population estimates was conducted were descriptive (Slamet, 2006).

Result and discussion

Vegetation Condition

Geographically, Uwo Uwo Beach is located at 127°53.213´ of east longitude and 1°47.818´ of north latitude, pantai Tiabo is located at 127°50.895´ east longitude and 1°51.533´ north latitude and Denamabobane beach is located at 127°50.964´ east longitude and 1°53.309´ north latitude. The map of nesting ground location of Mamoa bird (Fig.1) shows the nesting ground of the bird in the beach at Limau Village (Denamabobane Beach), Toweka Village (Tiabo Beach) and Mamuya Village (Uwo Uwo Beach) located in Galela Sub-district. Those three beaches are the locations use by bird parents to lay their eggs. The area usually has flat topography (0-499 m).

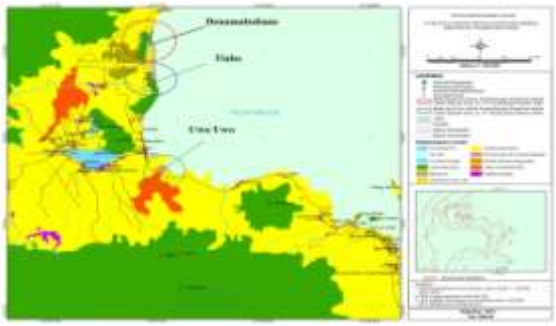

Fig. 1. Map of Nesting ground Location of Mamoa Bird (*Eulipoa wallacei*).

The habitat of Mamoa bird in Galela Sub-district consisted of beach forest, swamp, mangrove, coconut plantation and low land forest. Nesting ground found in those three locations was located in a beach with open sand area and had direct sunlight. The locations of egg nest were bordering the beach and river; whereas, their life habitat was in the mountainous forests. Moluccan Scrubfowl was found in their nesting ground during their spawning season.

Results of research on the type of vegetation on bird nesting habitat Mamoa found 21 species of plants on the coast Uwu Uwo, 19 species on the coast and 17 types Tiabo in Denamabobane beach. The Results of analyzed Important Value Index (IVI) of vegetation on each eggs nest location in Table 1.

Table 1. Important Value Index (IVI) of vegetation in every egg location.

No	Local Name	Scientific Name	IVI (%)		
			Uwo Uwo Beach	Tiabo Beach	Denamabobane Beach
Breed					
1	Loloro	*Ipomea pescaprae*	8.37	10.15	25.03
2	Takiu pantai	*Hypolitrium latifolium*	4.39	12.09	17.10
3	Jara-jara	*Andropogon acciculatus*	4.71	13.38	23.27
4	Tali putri	*Passiflora foetida*	6.64	7.20	9.87
5	Akar kuning	*Arcangelisia flafa*	8.06	9.67	14.81
6	Nenas	*Ananas comosus*	4.69	8.55	
Stake					
1	Bidara	*Calothropis gigantera*	7.83	8.41	9.78
2	Semanggi pante	*Marsiela crenata*	14.34	12.55	10.75
3	Buro-buro	*Marsiela crenata*	7.68	7.47	9.96
4	Nipah	*Nypha fruticans*	12.26	7.50	7.53
5	Kamodha		6.62	13.59	
Pole					
1	Popaceda	*Scaevolia taccada*	12.86	9.14	9.69
2	Tancang	*Bruguiera gymnorrhiza*	10.53	13.37	8.15
3	Mengkudu	*Morinda sp*	3.43	11.92	5.80
4	Soki-soki	*Rhizophora sp*	16.20	2.11	7.30
5	Baru	*Hibiscus tiliaceus*	12.67	15.38	
6	Sirsak	*Anona muricata*	3.88		
Tree					
1	Baringin pante	*Ficus sp*	12.72	9.21	10.84
2	Mangga	*Mangifera indica*	5.13	6.46	8.12
3	Kelapa	*Cocos nucifera*	13.06	13.80	5.53
4	Ngusu	*Terminalia cattapa*	14.13	8.09	5.22
5	Capilong	*Calophyllum inophyllum*	9.78		

Analysis result in Table 1 shows the highest IVI value in breed level vegetation was *Ipomoea pescaprae* in Denamabobane Beach (IVI = 25.029 %). In Uwo Uwo Beach, stake and pole levels had the highest IVI, *Marsiela crenata*= 14.34 %, *Rhizophora sp*= 16.22 %, respectively. In tree level, in Uwo Uwo Beach, *Terminalia catappa* has the highest IVI = 14.30 %. Research result indicates that dominated types in a growth level did not always dominant in other growth levels. Dominant types in one place indicated that those types were adaptive types in their habitat. Plants had significant correlation to habitat in terms of types' distribution, density and dominance. A type is considered dominant in a community if the type is able to utilize most of the existing resources for its growth compare to other types (Sudarisman, 2002; Soerianegara and Indrawan, 2005; Sivakumar, 2007).

Diversity and Similarity of a Community

Result of analysis of vegetation community similarity shows that all vegetation levels (seedling, stake, pole and tree) in Uwo Uwo Beach had species composition value of 100 %; whereas, in nesting ground locations in Tiabo and Denamabobane Beaches, the species composition was 90%. In general, the analysis result shows that nesting ground had similarity of species composition between each other.

Table 2. Diversity Index (H') and Evenness Index (E).

No	Level	H'	E
Uwo-Uwo Beach			
1	Seedling	2.02	0.67
2	Stake	1.71	0.56
3	Pole	1.74	0.57
4	Tree	1.72	0.57
Tiabo Beach			
1	Seedling	0.60	0.20
2	Stake	0.61	0.21
3	Pole	0.59	0.20
4	Tree	1.66	0.57
Denamabobane Beach			
1	Seedling	1.90	0.67
2	Stake	0.72	0.25
3	Pole	2.00	0.71
4	Tree	1.62	0.57

Table 2 records that vegetation in breed level at Uwo-Uwo Beach had the highest diversity and evenness indices compare to other levels, H' = 2.02 (good) and E = 0.67. Meanwhile, tree level in Tiabo Beach had the highest diversity and evenness indices, H' = 1.62 (medium) and E = 0.57. In Denamabobane Beach, on the other hand, stake level had the highest diversity and evenness indices compare than other levels, H' = 2.00 (good) and E = 0.71.

Result of analysis shows that seedling level had higher diversity index in nesting ground of Uwo-Uwo and Denamabobane Beaches but lower in Tiabo Beach. Tiabo Beach has open sand area and wide area; whereas, Uwo Uwo and Denamabobane Beaches has narrow area and the sand area is covered with undergrowth plants. The covering of sand area with undergrowth plants could affect the number of bird parents during spawning season. However, plants in seedling level that located in nest location functioned as a protection place for the little birds when they hatch and appear on the sand surface. When they appear on the surface, the little birds will run into the bushes to take cover from such predators as dog and human. Goth and Vogel (2002) reported that vegetation of seedling level has significant influence in the viability of little birds of *brush-turkey* (*Alectura lathami*) that live in Alpin Forest compare to that of live in Mary Cairncross Rainforest Park. Bush covering in Alpine Forest (31 %) and in Mary Cairncross Rainforest Park (6 %) (Goth and Vogel, 2003).

Although Tiabo Beach had low vegetation of seedling level; however, the beach was the biggest location for nesting ground and had bigger population compare to two other locations (Table 3). It indicates that vegetation is not a limitedfactor for Mamoa bird in their nesting ground selection. According to Gunawan (2000), Mamoa bird vegetation in Tanjung Binaran and Tumongkang had different condition but it had no influence on the birds' parents in the utilization of their nesting ground.

The value of diversity index in stake, pole and tree levels was range from less to medium. It indicates that type of vegetation found in the nest habitat had low evenness. Mamoa bird used the vegetation in nest habitat as a place to lurk, take cover, rest and move during nesting. Type diversity is considered different if the existing population has abundance evenness and the higher is the value of diversity index the more is the type found (Desmukh, 1992; Sudarisman, 2002). During the research, there was no bird parents found that look for food in nest location. It is differ to other megapoda species where nest location is also a place to look for food (Dekker *et al.,* 1995; Birks, 1999; Goth, 2000; Gunawan, 2000; Goth and Jones 2003; Dekker, 2007).

Result of type Evennes Index (E) in Table 2 indicates that the three research locations had low index (E < 1). According to Odum (1994), higher type similarity index of a location will be similar to the location itself. Animal identifies and choose their habitat to be inhabited and made as nesting place by looking for structure and nutrition factor; however, most studies gave more attention to the response of wildlife toward structural component. Some bird of species, mammal and reptile use the same nest or hide in a tree or floor. Wildlife need a cover functioned as a resting place, a place to look for food and to move (Bailey 1984). Mamoa bird uses the vegetation to move, rest, hide

and lurk. Therefore, structural aspect is an important aspect compare to nutrition aspect in habitat selection activity for nesting ground.

Estimation of Population and Density

Based on Table 3, the population of Mamoa bird in 2011 and 2012 was 5505.09±4.26 and 5000.60±5.90 and density of 22.62 and 22.57 bird/ha, respectively.

Table 3. Estimation of Population and Density of Mamoa Bird in Egg Location in North Halmahera Regency.

Location	Area (ha)	Number of Nest	Population(mean±SD)		Density (E/Ha)	
			2011 (year)	2012 (year)	2011	2012
Uwo Uwo	1.00	30	925.81±1.23	724.10±1.23	6.70	6.67
Tiabo	1.50	142	4308.28±1.31	4002.25±1.14	13.70	13.68
Denamabobane	0.67	20	271.00±1.73	274.25±3.53	2.22	2.22
Total			5505.09±4.26	5000.60±5.90	22.62	22.57

Result of analysis on the number of population of Mamoa bird (Table 3) shows that total population in 2011 was higher than in 2012. Based on the result of observation and interview in nesting ground, the number of egg was decreasing. Result of analysis in Table 2 shows that population of Mamoa bird was decreasing due to the excessing eggs removal and no protection efforts conducted on Mamoa bird in terms of prohibition for excessive egg removal and harvest during spawning season.

Based on endangered status set by IUCN (Shannaz and Rudiyanto, 1995), Mamoa bird is categorized in vulnerable status, which is an animal with population more than 10000. Result of calculation in the estimation of Mamoa bird population shows that currently the bird in nature was less than 10000. Refer to the endangered status set by IUCN (vulnerable), animal with population more than 10,000 in nature shows that the endangered status of the bird in nature currently is not vulnerable but it should be considered as endanger since the population is less than 10,000.

The calculation of population in the three nesting grounds (Table 3) shows that the number of population of Mamoa bird in nesting ground located in Tiabo Beach of Simau Village was higher than other two locations. The difference in the number of population in three nesting ground locations of Mamoa bird was presumed due to the field area/nesting ground. Nesting ground in Tiabo Beach was wider than that of in Uwo Uwo and Denamabobane Beaches. It could be seen from the number of nest located in each nesting ground. There were more nest in Tiabo Beach (142 nests) and it had more open sand area; whereas in Uwo Uwo and Denamabobane the number of nest were 30 and 20 nests, respectively. In nesting ground in Uwo Uwo Beach the sand area was mostly covered by undergrowth plant *Ipomea pescaprae* and *Arcangelisia flea*) and closer access to the road that could disturb Mamoa bird when laying their eggs.

Differ to Uwo Uwo Beach, Denamabobane Beach had narrow low land and bordered by sea and river; however, nesting ground in the beach showed increase in the number of egg. It was likely due to the protection activity at mangrove forest located at the back of the nesting ground and access to the location was harder than other two nesting grounds. The coverage of sand surface by undergrowth plant and the existence of mangrove forest in the nesting ground were related to the existence of Mamoa bird in the location. According to Gunawan (2002) and Gorog *et al.,* 2005, there is positive relationship between valley area and the number of total nest of Mamoa bird.

Mamoa bird density in each location of nesting ground was highly influenced by area and condition of egg laying location. The highest density of Mamoa bird population in nesting ground location was located in Tiabo Beach of (13.70 :13.68 bird/ha) and the lowest was located in Denamabobane beach of

2.22 bird/ha. The high density of Mamoa bird in nesting ground was assumed to occur since the habitat was considered appropriate and qualify as nesting area for the bird to lay egg. Based on observation result in field, the area and condition of habitat in Denamabobane and Uwo Uwo Beaches was endangered due to human activities, such as expansion of plantation area, regional development plan by local government.

Conclusion

1. The nesting ground of Mamao bird was dominated by beach plant such as *Ipomea pescaprae* and *Andropogon acciculatus*. The three nesting grounds had flat topography (0-499 m) and consisted of sand area usable by the bird parents to incubate the eggs. The availability of vegetation types (seedling, stake, pole and tree) influenced the coverage of sand surface and related to the protection of little birds.

2. The estimation of population of Mamoa in Halmahera Island in 2011 and 2012 were 5505.09 and 5000.60, respectively. However, the population was decreasing every year due to activity of excessive eggs removal, habitat degradation problem and human activities.

Recommendation

Based on protection status, Moluccan Scrubfowl is protected by PP No. 7, 1999 and categorized as vulnerable species in IUCN. However, based on research result, it was known that the population of the species was less than 10000 birds in nature thus the protection status should be endangered.

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