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Biodiversity of Small Mammals in Toraut, Bogani Nani Wartabone National Park Sulawesi

Keragaman Jenis Mamalia Kecil di Toraut, Taman Nasional Bogani Nani Wartabone Sulawesi

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Abstrak

Penelitian ini merupakan kegiatan inventarisasi mamalia kecil di Toraut, Taman Nasional Bogani Nani Wartabone, Sulawesi Utara. Pada penelitian ini dilakukan pengamatan diversitas mamalia kecil pada dua habitat utama yaitu hutan dan perkebunan, yang masing-masing diamati selama enam hari. Empat puluh perangkap kawat digunakan untuk mendokumentasi jenis-jenis tikus dan empat buah jaring kabut untuk kelelawar, serta pengamatan langsung di lapangan. Dalam penelitian ini dapat didokumentasikan sebanyak 129 ekor mamalia kecil yang terdiri dari 12 jenis. Lima jenis di antaranya endemik Sulawesi dan tiga jenis mempunyai status konservasi dari IUCN.

Kata kunci : mamalia kecil, tikus, kelelawar, hutan, perkebunan

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Introduction

Island of Sulawesi, which is part of Indomalayan region, exhibits a mixture of Oriental and Australian fauna. Sulawesi is of great interest to the evolutionary biologists and systematists since there is no island like Sulawesi, for its unique fauna encompasses a wide variety of habitats. The long period of isolation from major landmasses and its location in the Wallaceae bio-region allows Sulawesi to have a rich variety in fauna species, as well as a very high level of endemism (Audley-Charles, 1981; Whitten *et al*., 1987; Burrett *et al*., 1991 and Kinnaird, 1997). Sulawesi is well known for its high diversity of mammal species. Some mammal surveys have been carried out in Sulawesi. Some areas are reasonably well surveyed, but some parts are surveyed inadequately.

The mammals of Sulawesi are in general fairly described. Although several general studies have been carried out to date, there is currently no comprehensive checklist for the entire island. By present consideration, as many as 144 mammals have been recorded in Sulawesi, depending on current taxonomy (Corbet and Hill, 1992, Wilson and Reeder, 1993 and Suyanto *et al*., 2002). These figures are constantly reviewed as new species are discovered and scientific studies lead to changes in the classification.

Most of these Sulawesi remarkable fauna depend on their survival on natural primary forest. On the other hand, the need for basic distributional data increases daily, as natural habitat are under mounting pressure from human activities. Forest clearance and habitat conversion are inevitable consequences of increasing human population. All of these activities might cause forest reduction that would lead to the loss of mammals habitat. Another threat to the mammals is hunting, which directly results in low number of certain

species. However, currently Sulawesi has a number of conservation areas, including both national parks and forest reserves but enforcement in these areas is difficult due to illegal development activities that often negatively impacting mammal habitats and populations. Such conservation areas have already been introduced in some regions of Sulawesi. One of these is Bogani Nani Wartabone National Park (Anonymous, 2003).

Formerly, it was declared as Dumoga Bone National Park in 1991 by the Decree of the Minister of Forestry No. 731/Kpts-II/1991 covering an area of about 287,115 ha. The name of Dumoga Bone National Park was then changed into Bogani Nani Wartabone National Park by the Decree of the Minister of Forestry No. 1068/Kpts-II/1992. It is located in two provinces; North Sulawesi and Gorontalo. It is situated at longitude between 123º08' and 124º14' East, and latitude between 0º20' and 0º49' North. Its landscape range widely from 200 to 2000 m above sea level (asl) with four main vegetation types. These are secondary vegetation, lowland forest (300 - 1000 m asl), lower montane forest (1000 – 1600 m asl) and moss forest (above 1600 m asl) (Anonymous 1981 and 2003).

The goal of this study is to document small mammals since there is lack of published information of small mammals from Bogani Nani Wartabone National Park. This survey was carried out in Bogani Nani National Park that focused at Toraut block with average altitude is 300 m asl. The data from this study will provide valuable information to maximize conservation efforts, especially for those species that have limited distribution.

Research Methods

Trapping design

Rats were surveyed using collapsible local wire traps with dimension of 25 x 10 x 10 cm, which has a door that closes when a baited hook releases an attachment to the door. Trapping design for each location were as follows. Each location had one trap line comprised of 40 traps, and each trap alternated with the next trap at a spacing of 10 m. The traps were baited with roasted coconut and a mixture of shrimp paste and peanut butter, and were set at each location for six days. Traps checking was conducted twice a day, every morning and afternoon; while re-baiting normally every two days, depending on bait condition.

Mist net

Bats were typically surveyed using mist net. Four mist nets of 12 x 3 metres, with 30 mm fine mesh and 4 pockets were set for 6 nights at each location. Mist net is difficult for bats to detect by echolocation. When a bat strikes a mist net, it falls into a pocket of loose mesh and becomes ensnared. Mist nets are effective in catching bats when placed in their flight paths such as streambeds, river valleys or forest trail.

Direct observation

Catching small mammals in the field are often difficult because most are nocturnal and secretive (some are diurnal but also secretive and can not be trapped easily). Thus, direct visual observation during both day and night-time was conducted using binoculars.

Specimens processing

Trapped animals were brought to camp to be processed as scientific specimens. This is an essential part of any small mammal survey, since it is not easy to identify species in the field. External measurements were made on all specimens. Sometimes further identification required that skulls and teeth be measured and compared. All specimens were deposited at the Division of Zoology, Research Center for Biology-LIPI, Cibinong, Bogor.

Results and Discussions

A total of 129 individuals in 12 species were recorded from Toraut, Bogani Nani Wartabone National Park, North Sulawesi. These, including collected and released specimens, are presented in Table 1. The collections locality for this study is given in Figure 1. The collection comprised of seven species of rats (*Bunomys chrysocomus*,

Maxomys hellwaldii, *Paruromys dominator*, *Rattus exulans*, *Rattus hoffmanni*, *Rattus tanezumi* and *Taeromys celebensis*); four species of fruit bat (*Chironax melanocephalus*, *Cynopterus luzoniensis*, *Rousettus amplexicaudatus* and *Rousettus celebensis*) and one species of insectivorous bat (*Mops sarasinorum*). Systematic arrangements and English name used in this paper generally follow Suyanto *et al*., 2002; in some cases Wilson and Reeder, 1993 was also referred to.

Five of these rats are endemic to Sulawesi (See Table 1). Some of these species have conservation status since their population tend to decline due to hunting and habitat loss. Two species of rats is on IUCN Red list, these are *Paruromys dominator* is listed in IUCN as Endangered and *Maxomys hellwaldii* as Near Threatened; while the bat of *Mops sarasinorum* is categorized by IUCN as Near Threatened (Hilton-Taylor, 2000). All of these small mammals have crucial natural roles such as seed dispersal, pollinators, prey for various kinds of carnivores and insect population control including pests (Boeadi *et al*., 1983, Fujita, 1988 and Suyanto *et al*., 1997).

Some small mammals of Toraut, Bogani Nani National Park are forest-dweller. Three species of rats *(Maxomys hellwaldii*, *Rattus hoffmanni* and *Taeromys celebensis)* and one species of bat, *Chironax melanocephalus*, were recorded from forest whose distributions did not extend to plantation and agriculture area (Table 1). While forests are apparently the most productive habitat for small mammals, some species of bats (*Rousettus amplexicaudatus* and *Mops sarasinorum*) confined to disturbed areas feed on fruit plantations and/or nectars, and insects. Also several species of rats limited to disturbed area (*Rattus exulans* and *Rattus tanezumi*) take advantage of plantations and crops, contrast to its absence from forest. While two species of rats (*Bunomys chrysocomus* and *Paruromys dominator*) and two species of bats (*Cynopterus luzoniensis* and *Rousettus celebensis*) occured in both forest and disturbed area (See Table 1).

Table 1. List of small mammals recorded from Toraut block, Bogani Nani Wartabone National Park, North Sulawesi. Conservation status as follows: IU: IUCN Red Data Book.

Species	Sample size		Range of distribution		Conservation status
	Forest	Plantation	Sulawesi	Indonesia	IU
Rat					
*Bunomys chrysocomus**	6	1	Throughout	Sulawesi	--
*Maxomys hellwaldii**	1	--	Throughout	Sulawesi	NT
*Paruromys dominator**	3	1	Throughout	Sulawesi	E
Rattus exulans	--	1	Throughout	Kalimantan, Sumatra, Jawa, Sulawesi, Maluku, Papua	--
*Rattus hoffmanni**	4	--	Throughout	Sulawesi	--
Rattus tanezumi	--	2	Throughout	Throughout	--
*Taeromys celebensis**	6	--	Central, North, South East	Sulawesi	--
Megachiropteran/fruit bats			Throughout	Kalimantan, Sumatra, Jawa, Sulawesi, Lombok	--
Chironax melanocephalus	5	--			
Cynopterus luzoniensis	12	4	Throughout	Sulawesi	--
Rousettus amplexicaudatus	--	8	Throughout	Throughout	--
Rousettus celebensis	26	36	Throughout	Sulawesi, Maluku	--
Microchiropteran/insectivo -rous bat					
Mops sarasinorum	--	13	Throughout	Sulawesi	NT

*) Endemic to Sulawesi.

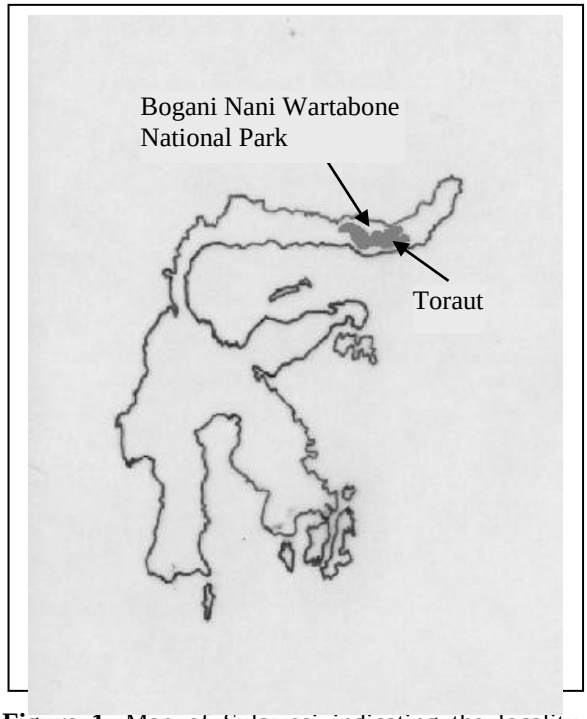

Figure 1. Map of Sulawesi indicating the locality surveyed in this current study.

The recorded rats were dominated by *Bunomys chrysocomus* with seven individuals trapped from all habitats surveyed in the Toraut forest and plantation. This rat is endemic to Sulawesi and reported to occur throughout the island (Cobert and Hill, 1992). The second most common type of rat was *Taeromys celebensis* with 6 individuals trapped in the forest area. Corbet and Hill (1992) recognized that *T. celebensis* occurrs only in the region of Central, North and South-East of Sulawesi in lowland forest habitat. While Musser (1987) reported this species from South-West Sulawesi, it was in the form of sub fossil. Information on behaviour and reproduction of these two species of rat is scarce.

The most striking species of rat recorded in this survey was *Maxomys hellwaldii* and *Rattus exulans*, only one occasion respectively. One individual of *M. hellwaldii* was trapped in the forest of Toraut. This species is endemic to Sulawesi and its habitat is confined to lowland forest (Cobert and Hill, 1992). Single individual of *R. exulans* was trapped else where only from plantation area. *R. exulans* is closed to commensals with human and not found in forest habitat. This species is primarily terrestrial, frequently found surrounding houses, garden, rice field, grassland, scrub and secondary forest throughout South East Asia to Pacific Islands (Medway, 1977; Payne *et al*., 1985 and Suyanto, 2002).

Although only two specimens of *Rattus tanezumi* were recorded in the current survey, this rat is very common. The house rat, *Rattus tanezumi*, was recorded from plantation at the edge of Toraut forest. It is native to Asia and considered commensal, existing in most areas of human activity from sea level to 1,700 m asl, including environs of human habitation, rice fields and plantations (Medway, 1977, Payne *et al*., 1985 and Suyanto, 2002).

At least 4 megachiropterans (fruit bats) and 1 microchiropteran (insectivorous bat) are thought to occur within the Toraut block, Bogani Nani Wartabone National Park. These bats play a crucial role in seed dispersal and pollination of many tropical plants in the forest. While *Rousettus celebensis* and *Cynopterus luzoniensis* are widely distributed through out plantations and forests, some bats are restricted to occur in forest habitat such as *Chironax melanocephalus*. Other bats enjoy disturbed areas such as plantations *Rousettus*

amplexicaudatus and *Mops sarasinorum*. Several bats fall into this category. These two species of bats are likely to tolerate human presence. Of particular interest is the specialized highland bat, *Chironax melanocephalus.* This species is normally abundant at elevations above 500 m in Borneo (Medway, 1977) and recorded in Sulawesi up to 1000 m (Bergmans and Rozendaal, 1988). Being restricted to highland region, it appears that this species may be susceptible to demolition and therefore is of importance for protection efforts.

The bat of genus *Rousettus* appeared to occupy different habitat zones, with only a fine degree of overlap at plantation. *R. celebensis* was recorded in the whole area surveyed both in the forest and the plantation, while *R. amplexicaudatus* has been documented in disturbed areas such as plantations and not encountered in the forest of Toraut. This pattern suggests that these two species might interact competitively causing them to exist apart from each other, leading to more directional habitat selection for particular species (Maharadatunkamsi, 2001). The bat of Celebes Rousette, *Rousettus celebensis*, was very common in the area surveyed. It was recorded in high numbers both in forest and plantation. This medium size fruit bat is particularly abundant in disturbed habitats (Flannery, 1995) such as plantation and agriculture areas.

During this survey, two different localities were sampled as representative of forest and disturbed habitats by humans (plantation). A total of 240 trap nights and 864 m^2 of mistnet nights were set up for each location. Collection effort in the area of forest resulted with 20 individuals of rat and 43 individuals of bat, while observation in disturbed area resulted with 5 individuals of rat and 61 individuals of bat. In average, 11.4 trap nights were required to capture one individual rat and 20 m^2 of mistnet nights for one individual bat, in the forest, while for disturbed area, 40 trap nights for an individual rat and 14.08 m^2 of mistnet nights for an individual bat. All habitats in Toraut, both forest and disturbed area were important for small mammals faunae. The environmental differences between forest and disturbed area might have partly affected the distribution pattern of rats and bats in Toraut. It should be stated that forest gives more suitable environment for rat community. On the other hand, disturbed area (plantation) was clearly more important for bat community, particularly fruit bat.

It would be interesting to further investigate the species diversity between the two localities. The variability of diversity values between localities were calculated using the method of Shannon index of diversity, which was described in Ludwig and Reynold (1988) as follows:

$$H = -\sum_{i=1}^{s} (pi \ln pi)$$

where H: Shannon index of diversity.
s: Number of species observed in site.
pi: Proportion of total sample belonging to ith species.

The highest value of Shannon index of diversity was in the forest area (2.47) and the lowest was in plantation area (1.98). It is understandable as forest provides sufficient supply of food and minimizes predation risk and home range (Ginsberg and Clode, 1994). Furthermore, with many kind of vegetations, forests protect living systems and preserve the diversity of fauna, as well as their ecosystems (Setyono, 2003). On the other hand, in disturbed habitats the opposite has been observed, since loss of forest might lead to the loss of habitat, insufficient supply of food, and higher predation risk. While forest is the most productive habitat for small mammals, there are several other which also deserve to be mentioned including plantation and agriculture (Kitchener *et al*., 1990; Lekagul and McNelly, 1997). Some small mammals have been recorded to inhabit these disturbed areas feeding on fruits and crops (Mickleburgh *et al*., 1992 and Ueda, 1996). They are able to adapt and become tolerant to some human activities. In addition, as a consequence of this brief survey, the range of diversity indices between localities sampled partly affected by fluctuation of species numbers and low number individuals

of certain species, particularly in plantation. But it is likely that other environment factors, such as floristic and vegetation structure, soil type, disturbance level, altitude, and rainfall also contribute to the distribution and diversity of small mammals in Toraut.

As stated earlier, human activities are the biggest threat to existence of small mammals. Expansion of human settlements and forest conversion continue in and around Bogani Nani Wartabone National Park. These activities lead to forest reduction, which in turn lead to loss of habitat for small mammals. Another threat to small mammals is hunting. Driven by economic gain, more people become dependent on the animal trade as a source of income. Many types of fruit bats and rats are hunted for both local and commercial purposes. In addition small mammals are also threatened by natural factors such as disease and natural disasters. Taken together, human activities and nature changes, already have an impact on these small mammals of Toraut, Bogani Nani Wartabone National Park.

While the mounting pressure of increasing human population the survival of these small mammals, will be at stake especially those with limited distribution range. These preliminary data have several worthwhile implications for the development of conservation strategy for this area. Therefore it seems noteworthy to include such potential small mammals conservation program in management plan of this valuable national park. In addition, information resulted from this current survey would help establish a more complete view of the Sulawesian small mammals.

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