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Research Article

Density of Tangkasi (*Tarsius spectrum*) Population and Development of Population Estimation Method Based on Duet Call at Tangkoko-Batuangus Nature Reserve, North Sulawesi

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Abstract: *Tarsius spectrum* is an endemic primate of Sulawesi. This primate is categorized into lower risk and recommended as vulnerable and protected species. They have a small round body with nocturnal activity. The research was conducted on primary forest of Tangkoko-Batuangus Nature Reserve (TBNR) in North Sulawesi, 1°30'-1°34'N and 125°10'-125°81'E, in May 2011-August 2012. This research was aimed to know tarsiers' population density by census and estimation methods. A 121 of 100 m²-sized plot was used for population census. Distance of plots was 100 m each and 16-circle plots (r = 100 m) were used for population estimation. Distance between central point plots was 200 m. There were 57 duet call locations inhabited by 229 animals. The population density was 47 groups/km², consisted of 209 adults, 11 sub-adults and 9 infants. Population density was 189 animals/km². The individual in each group was 4.01±1.83 with modus 4. This research showed that population density has increased since 1997. Estimated total of tarsiers in this area (121 ha) were 251.55 animals. This result is 9.6% higher than census. If sampling estimation method will be applied, it should be corrected by multiplying with 91% (ratio of 229 animals censused to 251 animals sampled).

Keywords: Census method, duet call, estimation method, population density, *Tarsius spectrum*, tangkoko-batuangus nature reserve

INTRODUCTION

Tarsius spectrum (*Tarsius tarsier*), local calls them Tangkasi, is a primate endemic to Sulawesi in addition to six other species (Shekelle, 2008). These animals are spread from North Sulawesi to South Sulawesi and its satellite islands, such as Suwu island, Selayar island and Peleng island (Supriatna and Wahyono, 2000; Wirdateti and Dahrudi, 2008). They occupy several habitat types, such as primary and secondary tropical rain forests, shrub, coastal swamp forests and montane forests up to 1300 m above sea level (Saroyo, 2008; Sinaga *et al.*, 2009).

From the aspect of conservation, tangkasi is protected by the Government of the Republic of Indonesia (Noerjito and Ariyanto, 2001) and included in Appendix II CITES. The species is classified as low risk according to IUCN and the currently recommended to be categorized as vulnerable (Gursky *et al.*, 2008). The animal population decline is mostly caused by land clearing activities that leads to the reduction of habitat and capture for the pet (Supriatna and Wahyono, 2000), although breeding efforts have also begun to be developed (Kiroh, 2009a, b). Now, they occupy a

conservation area of 5,852 ha in various parts of Sulawesi.

One of the habitats of this species is Tangkoko-Batuangus Nature Reserve (TBNR) in North Sulawesi which is located at North Bitung District, Bitung City, North Sulawesi. This area is designated as a nature reserve by GB No. 6, 1919, dated February 12, 1919 (Natural resource conservation of North Sulawesi). This nature reserve has an area of 3,196 ha and is located at 1°30'-1°34'N and 125°10'-125°81'E (Sunarto, 1999).

In the Tangkoko-Batuangus and Dua Sudara reserves, this species has a cruising areas ranging from 1.6 to 4.1 ha, with an average area of cruising for males is 3.1 and 2.3 ha for females (Gursky, 1998a). Tangkasi social structure varies from one pair to multi male-multi female groups (Rowe, 1996), in fact they can also live in solitary (Gursky, 2000). This animal gets out of nest to roam at night, especially for food. Before sunrise they will return to their nests, marked by duet call or vocal 'duets' (Kinnaird, 1997). Their nest is a banyan species (*Ficus* spp.), whether grown alone or that which rides on its host (Gursky, 1998a). Saroyo (2008) concluded that Tangkasi has several location for their nest sites, which the choice is based on security from

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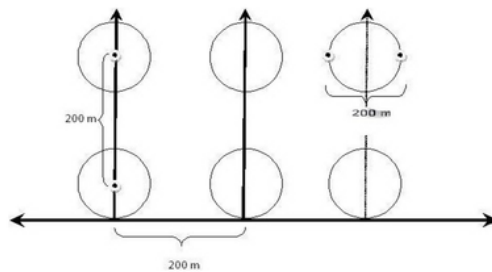


Fig. 1: Circle plot model on sampling method

predator attack and protection from the adverse effects of nature. Their main predator is snake (Gursky, 2005).

Last research on Tangkasi density at Tangkoko-Batuangus Nature Reserve (TBNR) was done by Gursky (1997) and estimated density was 156 individuals/km² (Gursky, 1998a). Until recently, latest research on Tangkasi density was never again performed, but for the sake of conservation, analysis of population growth is a major component. For this reason, research on Tangkasi density in TBNR at this time needs to be done. Results are expected to be used in the analysis of population growth trends as a basis for determining Tangkasi conservation planning.

Direct counting on a small nocturnal primate like Tangkasi is very difficult and takes a long time, so rapid estimation method for measuring population is needed. Each family (group) when returning from exploration during night time and return to the nest will perform voice replication (duet call). Nest site is usually fixed if there is no interference. The position of each nest is important to be used as a new method of determining the population. Estimation can also be done by utilizing duet call performed by a pair of Tangkasi when returning to the nest in the morning. Another problem is the unavailability of population data and daily activities of the *Tarsius spectrum*.

METHODOLOGY

19 **Site and research location:** This research was conducted at Tangkoko-Batuangus Nature Reserve (TBNR) North Sulawesi from May 2011 to August 2013. Habitat selected for the study was primary tropical rainforest. Forest in this nature reserve has locations utilized by Tangkasi as nests, for example the banyan tree cavities, holes of dead trees, dead branches on a tree, liana tangle and palm trees.

Materials and equipments: Materials and tools used during the study included: a GPS receiver, a voice recorder, observation sheets, stationery, tags and measurer.

Methods of data collection:

Density determination: The method used in the survey of Tangkasi density is the census. Census area is

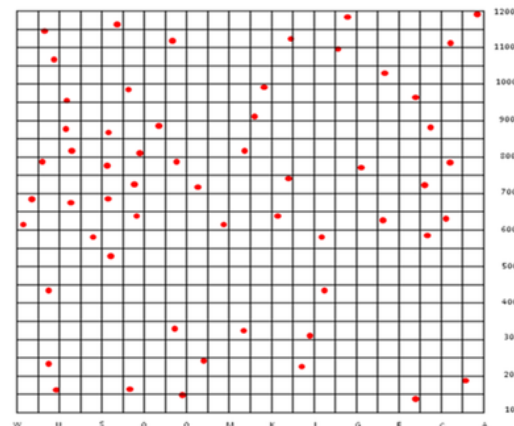


Fig. 2: Distribution of duet call location on the observation area

determined by the size of 1100 m². Location of duet call is determined every morning on one plot. Calculation of the number of individuals in each duet call site, which is also the location of Tangkasi's nest, was performed in the afternoon. This method was carried out on 121 plots.

Development of population estimation method: Sampling plots were made in the form of a circle with diameter of 200 m within the census area. The distance between the midpoint of each plot was 200 m. Placement of plot is presented in Fig. 1.

Data obtained from survey were analyzed as follows:

- Density of *Tarsius spectrum* was calculated by dividing total number of individual in 121 plots by 121 ha
- Group size was calculated by dividing the total number of individuals on 121 plots by the number of groups
- Group density was determined by modification of the formula according to Altman (1981), namely the number of duet call (nest) divided by the sampling area
- Density estimation with sampling method based on duet call was determined by multiplying the number of duet calls with an average group size and then divided by the sampling area.

RESULTS AND DISCUSSION

Density of tangkasi (*Tarsius spectrum*): Observations on 121 plots produced distribution maps of duet call location as shown in Fig. 2. As many as 57 locations of duet call were obtained from the entire plot. Each duet call represents one family or group. Therefore, the density of Tangkas was 0.47 groups/ha or 47 groups/km². As much as 229 individuals were obtained

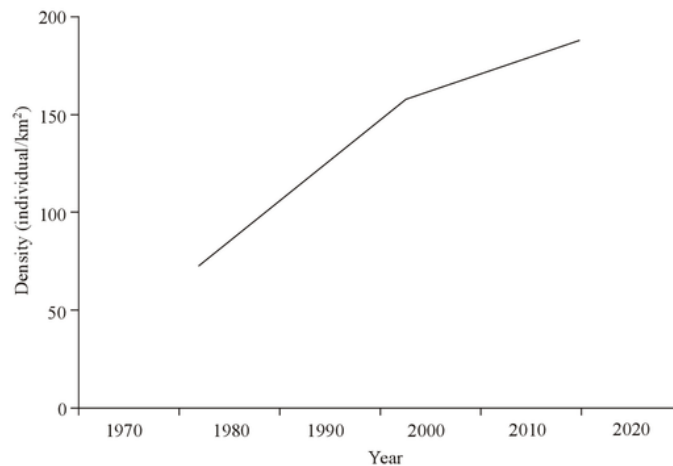


Fig. 3: Trend of population growth of Tangkasi (*Tarsius spectrum*) in Tangkoko-Batuangus nature reserve

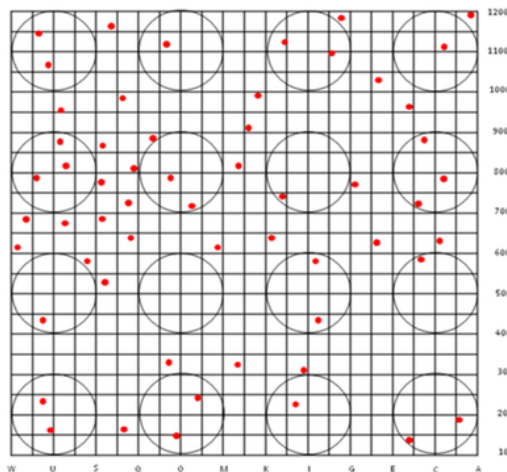


Fig. 4: Position of circular plots with a radius of 100 m

from the calculation on the entire duet call location, ie, with the composition of the age group as follows: adult 209 adults, 11 teens and 9 babies. Based on the total number of individuals, then Tangkasi density in the study area was 1.89 individual/ha or 189 individual/km².

When compared with the previous survey, Tangkasi density in TBNR has increased (Fig. 3). Estimated population density of Tangkasi in TBNR in 1980 was 70 individuals/km² (MacKinnon and MacKinnon, 1980) and 156 individuals/km² in 1997 (Gursky, 1998b). This result is of course contrary to the common assumption that the population of wild animals in North Sulawesi has decreased. This is because the research location is also used for other research and tourism activities. Although according to the legislation, tourism activities are not permitted in the nature reserve, but in reality this activity, which was

originally conducted in the Batuputih Nature Park, has entered the adjacent nature reserve area. With so many activities carried out in this area, the hunting activity has become lower. This species is also not a hunting target for consumption because of its small size and nocturnal nature. The hunt for animals to be sold as pets usually occurs in plantation area and not in the study area. Society in general does not like to keep and raise Tangkasi because they are easily died and people realize that this species is protected.

Based on the results of the census in the entire plot, there were 57 duet calls nest. According to assumption, each duet call/nest consists of one group, so that on average the size of Tangkasi group was 4.01 ± 1.83 with modus 4. Previous research conducted by Gursky (2000) showed that average group size of Tangkasi was 3.1 with modus 2, while Saroyo (2008) showed 4 ± 2.45 individuals with modus 3. If the above two studies are compared, there have been an increasing number of individuals per group of Tangkasi. The result showed that the range of the number of individuals in a group is 2 to 9. In previous research, number of individual in one group ranged from 1 to 9 (Saroyo, 2008) and 2 to 6 (Nietsch and Niemitz, 1991).

Development of population estimation method: The use of duet call in making estimation of Tangkasi population is made using circular plots with a radius of 100 m which were placed in positions, as shown in Fig. 4. The result was 16 circular plots. Results from counting the number of duet call on the 16 circular plots produced 26 locations or nests. The total area of the 16 plots is 50.24 ha. Based on the results of the census in the entire quadrant, there were 57 duet calls inhabited by as many as 229 individual of Tangkasi. Assuming that the duet call contains one group, the average group size was 4.01 ± 1.83 Tangkasi with modus 4.

By using this group as a standard size, the density was 2.10 individuals/ha. Thus, the total estimated population of the entire area (121 ha) was 251.55 individuals. This result, when compared with the results of the census, was 9.6% higher. Therefore, if the sampling method of estimation is to be used, then the results should be corrected by multiplying it by 91%. This percentage is obtained by dividing the 229 individuals from the census by 251 individuals from the sampling results.

Conclusion and outlook: This [20] arch concluded that group density of Tangkasi (*Tarsius spectrum*) in Tangkoko-Batuangus Nature reserve North Sulawesi is 0.47 groups/ha or 47 groups/km². The average group size was 4.01±1.83 Tangkasi with modus 4. Duet call can be used to perform density estimation tangkasi using a circular plot with a radius of 100 m and the result is corrected by multiplying it by 91%.

From the initial study, the distribution of Tangkasi also included agricultural areas and gardens, especially in the bamboo groves, thus Tangkasi population studies should also be done in these habitat.

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