

DEMOGRAPHIC PARAMETERS AND BEHAVIOURS OF SULAWESI WARTY PIG (*Sus celebensis* Muller and Schlegel 1843) IN TANJUNG PEROPA WILDLIFE RESERVE, SOUTHEAST SULAWESI

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ABSTRACT

Studi ini bertujuan untuk mengetahui kepadatan populasi, ukuran populasi, struktur umur, jumlah anak per kelahiran (*litter size*) dan perilaku babi hutan sulawesi (*warty pig*) di Suaka Margasatwa Tanjung Peropa di Sulawesi Tenggara. Hasil penelitian menunjukkan bahwa kepadatan populasi babi hutan sulawesi di suaka margasatwa mencapai 43 individu per km² berarti jumlah populasi total diperkirakan sebanyak 13.594 individu (dalam area berhutan seluas 389,37 km²). Di bagian selatan suaka margasatwa dimana studi ini dilaksanakan secara insensif, didapatkan jumlah individu menurut struktur umur berturut-turut untuk bayi, muda, dewasa dan tua adalah 34, 29, 23 dan 2 individu. Seks rasio 1 : 1,44 untuk populasi total dan 1:1,25 untuk populasi reproduktif, dan *litter size* adalah 1-3 bayi. Kategori perilaku yang diamati terdiri dari mencari makan, berkubang dan istirahat. Sedangkan perilaku sosial babi hutan sulawesi yang ditemukan terdiri dari perilaku makan, berkubang, aktivitas seksual dan penghindaran predator.

Kata kunci : *Sus celebensis*, population, struktur umur, seks rasio, perilaku

INTRODUCTION

Sulawesi warty pigs are endemic to Sulawesi Island, and the adjacent Islands of Buton, Muna, Kabeana, Peleng, Lembeh and on some of the Togian Islands (Burton & Macdonald 2006). The population of Sulawesi warty pigs has dramatically decreased, caused by many factors. They have been hunted since they are considered as a garden/agricultural pest and are consumed for their meat, making this animal commercially valuable (Lee 2000). Conversion of forest to agriculture, further leads to a decline in the distribution of this species (Burton & Macdonald 2006). Although this species cannot be regarded as seriously threatened throughout its range at the present time; it is now scarce in South and North-East Sulawesi. This study aims to reveal population size, population density, sex ratio, age structure, litter size, and social group composition of the Sulawesi warty pig in Tanjung Peropa Wildlife Reserve (total area of 389.37 sq. kilometer), Southeast Sulawesi.

METHODS

This study was conducted from June to November 2006 in Kalobo Forest, in the southern part of Tanjung Peropa. Population density of Sulawesi Warty Pig was estimated using Line Transect Method (Buckland *et al.*, 1993). The transects covered many habitat types, including riverine, bamboo, and lowland forests. The transects were

placed more than 100m apart and at least 50m from roads and avoiding major forest trails. Transects were walked at about 1-2 km per hour, though this was difficult to control due to terrain variation. Locations of endpoints and some midpoints from transects were recorded using a GPS, where possible. All transect distances were measured using a 50m measuring tape. Attempts were made not to lay these transects along linear features (such as ridge tops, valley floors, traversing valley sides). These geographical features tend to cause clustering of signs due to animal's preference to follow the easiest path. The data recorded included number of animal, age structure, sex ratio, and general behaviours.

The age structure is a composition of the number of individuals in a population based on the age distribution. The structure of the Sulawesi warty pig was classified into 4 age groups (Huffman 1999), which are:

1. Baby : 0 to 1 year old with stripes on the body, small body size, and without warts on the face.
2. Juvenile : > 1 year old to sexual maturity, without stripes on the body. The hair color is starting to darken and body size increases. Warts are starting to grow but still largely unclear.
3. Adult : Sexual maturity to 8 years old, the adults have three pairs of warts on the face but not fully grown.

4. Old : >8 years old, with bright colored hair, often larger than the adult, and has three pairs of fully developed warts.

RESULTS AND DISCUSSION

Population Size and Density

Along the 83.7 km of transects surveyed, as many as eighty eight individuals Sulawesi warty pig were observed. Therefore, the estimated population density of Sulawesi warty pigs in Kalobo Forest was 34 individuals /km². The highest estimated population density occurred in bamboo forest with 65 individuals /km² (n=19), while the calculated densities in riverine forest and lowland rain forest were 52 (n=22) and 23 individuals /km² (n=19), respectively. Mustari (2003) reports that during 372 km of transect walked in Kalobo Forest, population density of Sulawesi warty pig was 5.6 individuals /km².

The estimated population size in Kalobo Forest (20 sq. km) was 698 individuals. The total estimated population within the 389.37 sq. km of Tanjung Peropa Wildlife Reserve area was 13,594 individuals, assuming a similar proportion of habitat types existed across the Park. The high number of Sulawesi warty pig in riparian forest may be related to the availability of food, water, shelter, cover and mud wallows that can be found in this forest type.

Group Size and Density

During this study, 16 groups of Sulawesi warty pig were observed; giving an estimated density of 6.14 groups /km². Eight groups were observed in riverine forest with a density of 8.86 groups /km². However, the highest group density of 14.29 groups /km², were found in bamboo forest (n=4). In lowland rain forest, 4 groups were recorded at a density of 3.29 groups /km².

The number of individuals per group varied between 2 and 9, with an average of 5 individuals. Groups generally consisted of 1 old or adult male, 1-2 adult females, 1-2 juvenile males, 1-2 male babies, 1-3 juvenile females and 1-3 female babies.

Age Structure

For the juvenile Sulawesi Warty Pig, the stripes fade gradually and replaced by the uniform hair colour, yet the black hairs on the upper head and neck are still absent. An adult pig is characterized by the appearance of thick-black hairs along the upper head and neck and as the pigs reach old stage, the warts reach maximum size. Observation in the field revealed that the numbers of baby, young, adult and old pigs were 34 (39%), 29 (33%), 23 (26%), and 2 (2%) respectively, indicating progressive growth of population.

Sex ratio

The combined sex ratio of all age classes was 1:1.44 and the reproductive (adult) sex ratio was 1:1.25. Sex ratios based on age classes were 1:1.83; 1:1.64 and 1:1.09 for baby, young and adult classes, respectively.

Litter size

Observations revealed that the litter size ranged from 1 to 3 young per female. Noel and Yahnke (2004) reported that litter size of wild pig ranged from 1 to 8 youngs (average 2-3) and young will be weaned after 1 year. This study showed, however, that young individuals (more than 1 year old) were still with their mothers.

Feeding behaviour

In the morning, around 06.00 – 11.00 hours, Sulawesi warty pig started to be active in searching for food. At this time, Sulawesi wild boar tends to prefer searching food around the river. Around Amolengo river, Sulawesi warty pig was often found searching for shrimps, crab, worms, tadpoles and small fishes. Food items of Sulawesi warty pig are roots, foliage, fruits, plant shoots, corpses, and insects (Huffman 1999). At 14.00 – 18.00 hours, Sulawesi warty pig started searching for food again after wallowing. At this time, Sulawesi warty pigs searched food in riverine forest, and sometimes were found in lowland forest and bamboo forest. At 21.00 – 04.00, Sulawesi warty pigs were found to be active searching for food in local people's garden, which was conducted to avoid contacts with human beings.

Sulawesi warty pig discharged faeces or urine in locations where this animal eat and drinks. This behavior was intended for marking the locations as the in area for searching food.

In general, the eating behaviors of Sulawesi warty pigs were categorized into two kinds, namely by using their snout (rooting up the soil) and by using the legs (digging). Rooting up behavior of males and females could be distinguished from the traces left from this behavior. Traces left by rooting up males were more irregular than those left by females. This was due to the use of teeth by the males for scouring the soil.

Wallowing behaviour

During day time, around 11.00 – 14.00, Sulawesi warty pig, started to wallow. This is for regulating temperature of the body which is overheated due to activity in high air temperature. Measurement results showed that the maximum air temperature reached 34° C. Furthermore, wallowing was also conducted for cleaning the body from the attacking wild boar lice which caused itchiness.

Sulawesi warty pigs created mudhole (place for wallowing) by digging soil with their snouts. After the mudhole was dug rather deep, the head of Sulawesi warty pig was inserted to the small hole. Afterwards, the head of Sulawesi warty pig which was partly inserted, was lifted, and this create hole which is rather deep. After that, the Sulawesi warty pig laid down its body while sometimes shaking it to seek convenient position. After wallowing, Sulawesi warty pigs cleaned up their bodies by rubbing the bodies to stems of trees, shrub, and other tree parts.

Resting behaviour

Sulawesi warty pigs needed rest to restore their body condition after fatigue due to activities. During feeding,

Sulawesi warty pigs sometimes took shelter from the heat of sun light, under seedlings which were dense enough. Resting behavior of Sulawesi warty pig is in the form of staying motionless while breathing and sniffing the air, or laying down in areas covered by grasses which were not too tall.

Sleeping behavior of Sulawesi warty pig was carried out in slope notches and in horizontal caves. Sleeping behavior of Sulawesi warty pig was observed at 18.00 – 06.00 hours. However, during this time or at this same time, there were found some Sulawesi warty pigs which searched food, mainly in local people’s farmland, around 22.00 – 04.00 hours. Completed data on individual behavior of Sulawesi warty pig is presented in Table 1.

Table 1. Time allocation of Sulawesi warty pig activity

Time	Duration (hours)	Activity	Location	Frequency
06.00-11.00	5	Feeding (eating)	Riparian, bamboo, lowland	Riparian
11.00-14.00	3	Wallowing	Bamboo, lowland, riparian	Bamboo
14.00-18.00	4	Eating	Riparian, bamboo, lowland	Riparian
18.00-06.00	12	Resting	Bamboo, lowland	Lowland

Grouping behaviour

Sulawesi warty pig is gregarious animal (forming groups) which creates random familial relationship (Huffman 1999). In each group, there are individuals which usually constitute of one family. This animal is polygamous, where the number of male individuals is less than number of female individuals. Group behavior of Sulawesi warty pig comprised of eating (feeding) behavior, wallowing behavior, sexual behavior, and predator avoidance behavior.

Sexual behaviour

Leader of Sulawesi warty pig group often sniffed his nose while sometimes kissed the genitals of adult female individuals. Sometimes this adult male individual followed the female individuals desired by him. The female individual which feels that she was followed, sometimes turned back her body or run away.

Predator avoidance behaviour

Predator avoidance behavior could be conducted by Sulawesi warty pigs by detecting the condition of its surrounding area. This detecting behavior was conducted by adult individuals, either the males or females, by sniffing

and smelling the air around them. After they feel secure, Sulawesi warty pig would afterwards continue their activities. When there is threat of danger, Sulawesi warty pig babies tend to choose to follow where their mother is going, rather than following their father. Therefore, familial relationship within Sulawesi warty pigs could be categorized as matrilineal relation, where the mother had more influence on the youngs. However, in general, the animal group was led by dominant male. If one member of the group was threatened by danger such as being tied up and choked by a python snake, the Sulawesi warty pigs, led by the dominant male tried to free the victim from the snake grip. If members of the group were unable to free it, they would seeked the help of other Sulawesi warty pig group nearby.

CONCLUSION

The population density of Sulawesi warty pigs in Tanjung Peropa Wildlife Reserve was 34 individuals km². Based on this population density, the population size in the reserve with a total area of 389.37 sq. kilometer was estimated to be 13,594 individuals. Based on the direct observation, a total of 88 individuals of Sulawesi warty pig was encountered in the southern part of the reserve consisting 34, 29, 23, and 2 individuals for baby, young,

adult and old individuals respectively. Sex ratios were 1:1.44 and 1:1.25 for total and reproductive sex ratio respectively.

Individual behavior of Sulawesi warty pig comprised of feeding (eating) behavior, wallowing behavior, sleeping and resting behavior. During 06.00 – 11.00 hours and 21.00 – 04.00, they were active in searching food. At 11.00 – 14.00 Sulawesi warty pigs started to wallow. After wallowing, Sulawesi warty pig clean up their bodies by rubbing the bodies to stems of trees, shrubs, and other tree parts. Resting behavior of Sulawesi warty pig is in the form of staying motionless while breathing and sniffing the air, or laying down. Sleeping behavior of Sulawesi warty pig was conducted at 18.00 – 06.00 hours. Social behavior of this wild boar comprised of eating, wallowing, sexual activities, and predator avoidance. Mother wild boars took the lead in searching food, followed by her young. Dominant male choosed to wallow while his group members are eating. Dominant male sometimes sniffs the genitals of female while following her from behind. Prior to Sulawesi warty pig group entering a feeding ground and wallowing area, they first conducted orientation, performed by dominant male and adult females, by sniffing and smelling the surrounding air.

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REFERENCES

- Buckland ST, Anderson DR, Burnham KP, Laake JL. 1993. Distance Sampling: Estimating Abundance of Biological Populations. London: Chapman and Hall.
- Burton, J. A. & MacDonald, A.A. 2006. The Sulawesi warty pig (*Sus celebensis*): A status review. *Suiform Soundings*, 6(2), 5-13.
<http://iucn.org/themes/ssc/sgs/pphsg/Suiform%20soundings/Newsletter.htm> [1 January 2008].
- Huffman B. 1999. "Celebes Pig: Sulawesi warty pig *sus celebensis*" (On-line). Ultimate Ungulate Page. http://www.ultimateungulate.com/Artiodactyla/Sus_celebensis.html [15 May 2007].
- Lee RJ. 2000. Impact of subsistence hunting in North Sulawesi, Indonesia, and conservation options. In: Robinson G, Bennet EL, Eds. *Hunting for Sustainability in Tropical Forest*. New York: Columbia University Press. Pages 455-472.
- Mustari, A. H. 2003. Ecology and conservation of lowland Anoa in Southeast Sulawesi, Indonesia. [PhD thesis], University of New England, Australia.