

The population condition and availability of feed of cuscus in the Arfak Mountain Nature Reserve, West Papua

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ABSTRACT

Sinery AS, Boer C, Farida WR. 2012. The population condition and availability of feed of cuscus in the Arfak Mountain Nature Reserve, West Papua. *Biodiversitas* 13: 86-91. The cuscus is a pouched marsupial grouped in the Phalangeridae family, which is nocturnal, arboreal, herbivore, and in most cases the tail is prehensile. The animals are legally protected due to low reproduction, limited distribution area, and high rate of illegal hunting. The illegal hunting happened not only in the production forest areas but also in the reserve areas such as Nature Reserve of Arfak Mountain, directly or indirectly, affects the life quality of the ecosystem, mainly cuscuses population. Therefore, it is necessary to do efforts to have a better management of the region to ensure the sustenance of many components in it. This research is aimed to know the population density of cuscus in Arfak Mountain Nature Reserve and carried out for two months. The method used was descriptive by using direct and indirect observation. The result shows that cuscuses existing in the Arfak Mountain conservation area were northern common cuscus (*Phalanger orientalis*), ground cuscus (*Phalanger gymnotis*) and common spotted cuscus (*Spiloguscus maculatus*). The biggest individual number is of *P. orientalis* with 39 individuals consisting of 18 males and 21 females, the second is of *P. gymnotis* with 10 individuals consisting of 4 males and 6 females, and the smallest is of *S. maculatus* with 9 individuals consisting of 4 males and 5 females. From the total of 58 cuscuses, there are 38 adult and 20 young cuscuses. There are 20 forest plant species identified as feed resources of cuscus in Arfak Mountain Nature Reserve. The parts of forest plant consumed by cuscus are fruits and young leaves. *P. gymnotis* also consumes small insects such as grasshopper. The cuscuses spread from lowland forest to highland forest (2,900 m asl.)

Key words: cuscus, population, forest plant species, Arfak Mountain

INTRODUCTION

Papua and West Papua as an integral part of Indonesia has the region's natural wealth and tremendous biodiversity in South East Asia. The diversity includes the richness of fauna such as mammals and the terrestrial ecosystem diversity from the coastal to the high mountain ecosystems. Approximately 200 species of land mammals have been found in this region, and 154 species of which form a large population including the endemic species and the introduction one (Petocz 1987).

This abundance is a human life support but its existence cannot be confirmed for sure, because of the lack of information, the uneven distribution and excessive exploitation. According to the International Union for the Conservation of Nature and Natural Resources (IUCN 2000), Indonesian wildlife threatened with extinction are 128 species of mammals, 104 species of birds, 19 species of reptiles, 60 species of fishes, and 29 species of invertebrates (Anon 2004). When linked to deforestation rate, which according to Greenpeace was 2.8 million hectares per year, it is expected to lead to more extinction in the future.

Cuscus is a marsupial mammal (marsupials) which is arboreal, nocturnal, and herbivore. Menzies (1991), Petocz (1994) and Flannery (1994), each states that the deployment of cuscus includes the islands of Indonesia (Papua, Sulawesi, Maluku, and Timor Island), Papua New Guinea, New Britain, Solomon Islands, Cape York Australia, and Queensland. In New Guinea (PNG and Papua) there are 11 species of cuscus from the genus of *Spiloguscus* (spotted cuscus) to the genus of *Phalanger*. In Papua, there are seven species of cuscus, namely common spotted cuscus (*Spiloguscus maculatus*), black spotted cuscus (*S. rufoniger*), Waigeo cuscus (*S. papuensis*), northern common cuscus (*Phalanger orientalis*), ground cuscus (*P. gymnotis*), silk hair cuscus (*P. vestitus*), and hilly forest cuscus (*P. permixtio*).

Cuscus is protected by the Decree of the Minister of Agriculture No. 247/KPTS/UM/4/1979 and Government Regulation No. 7 of 1999 on the preservation of plants and animals. Globally this species is listed in Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2011).

The Arfak Mountain Nature Reserve is one of the conservation area in Papua with an area of 68.325 ha

according to the Minister of Forestry Decree No. 783/Kpts-II/1992 with a high biodiversity (Anon. 2003). The explorations done by Lesson (1824-1827) and d'Alberty and Beccari (1872-1873) found at least 320 species of birds, 350 species of butterflies, and 110 species of mammals. Aside from being a center of diversity of butterfly wings (*Ornithoptera* spp.), it also serves as a habitat for many plants such as matoa, nyatoh, gaharu, rattan, bamboo, various species of orchids and a number of endemic animals like paradise birds (cenderawasih), tree kangaroos, porcupines, skunks and various other species of animals (Laksono et al. 2001).

According to Menzies (1991) and Flannery (1994), Arfak Mountains is one of distribution areas of spotted cuscus. According to Sinery (2010), in the southern part of Arfak Mountains exist some populations of cuscus. Petocz (1994) mentioned that unspotted cuscus have a large population allegedly spreads in almost all mainland of New Guinea, including Arfak Mountains. The results of interviews with one of the staff of Natural Resources Conservation Center of West Papua and several communities around the nature reserve of Arfak Mountains show that there are at least three species of cuscus in the region. It is also known that cuscus is often hunted in the surrounding region as a source of food, but scientific things about the population and other aspects of the animals have not been widely known.

This study aims to determine the condition of cuscus population and the carrying capacity of habitat based on the availability of food in Arfak Mountains Nature Reserve. The results are expected as one of the information and consideration for all parties in wildlife management efforts both *in-situ* and *ex-situ* and the development of the Arfak Mountains Nature Reserve area in the future.

MATERIALS AND METHODS

The research was conducted in the area of Arfak Mountains Nature Reserve, Manokwari, West Papua Province, Indonesia. The method used in this research is descriptive with the technique of direct and indirect observations and interviews. The duration of the study was 2 months from July to August 2007.

Equipments used in the study were the Global Positioning System (GPS), binoculars, dissecting set, thermo-hygrometer, clinometers, thirst meter, compass, scales, tape measure, camera trapping, phi band, scissor cuttings, gloves, flashlights, timer, stopwatch, machetes, cage/plastic bags, plastic bracelets, tally sheet, a key of Identification of the type of cuscus, camping equipment, location map (scale 1: 350,000) and 2004 Landsat imagery cotton, alcohol 70% and plastic rope.

The plot of the study was determined in accordance with the presence of cuscus from the previous survey results, namely the information from the regular cuscus hunters. The area of the study site was 420 ha with a baseline parallel to the shoreline and transects direction parallel to the contours which is perpendicular to baseline.

The study began by creating a baseline that was pioneering parallel of 1,200 m along the shoreline. The baseline was divided into six point transects perpendicular to the baseline and proportionally placed at the point of 0-1,200 m with the distance transects of 200 m. Each transect length is 3,500 m so that the length of transect was 21,000 m and the width corresponding to the minimum sight distance (50 m).

The data collected consists of primary data that is the data of observations and field interviews and the secondary data that is data obtained from the relevant authorities. Primary data collected consists of: cuscus population (the description of the population and the type of cuscus), species of feed and the general condition of cuscus' habitat. Secondary data collected includes data on climate and the general state of the study site.

The morphological data of the cuscus were tabulated from the measurement results, direct identification, and documentation via camera trapping. Cuscus population density analysis was made using the equation according to Sugianto (1994) which was as follows:

$$N = \frac{n(2n-1)A}{2Lr}$$

N = density of population,
n = number of individuals encountered, A = Area of the region (plot observations),
L = length of line / transect,
r = Distance of the points where the cuscus were found with a track point / transect

Determination of the diversity of feed types as indicators of habitat carrying capacity to the existence of cuscus is done by using species diversity indices (H) with the formula from Shannon and Wiener, (1949) in Odum, (1993):

$$H = -\sum \left[\frac{n_i}{N} \right] \log \left[\frac{n_i}{N} \right]$$

H = diversity index (Shannon Index),
n_i = number of individuals of each species
N = Number of individuals of all species

Determination of the individuals which are more concentrated in one or several species in the study site was conducted by using the dominance index (D) according to the formula Simpson (Odum 1993) as follows:

$$C = \sum \left[\frac{n_i}{N} \right]^2$$

C = dominance index, n_i = number of individuals of each species, N = Number of individuals of all species

Determination of individual distribution of each species in the region carried out by using the evenness index (e) of Pielou (Odum (1993) with the following formula:

$$e = \frac{\check{H}}{\log S}$$

E = the evenness index,

\check{H} = the diversity index

S = number of species that was present

Data related to the climatic condition of the study site consisting of rainfall, temperature, and humidity will be analyzed in the tabulation.

RESULTS AND DISCUSSIONS

The results show that there are 3 species of cuscus in the Nature Reserve of Arfak Mountains which were captured, namely northern common cuscus (*P. orientalis*), ground cuscus (*P. gymnotis*) and the common spotted cuscus (*S. maculatus*) (Figure 1).

Communities surrounding the Arfak Mountains Nature Reserve group cuscus into several distinct species based on morphological characters such as coat color, body size, and habitat. The *Hatam* people who were the majority in the Arfak Mountains Nature Reserve recognizes three species of cuscus in the region, namely *mengrep* (plain brown cuscus, that is *P. orientalis*), *minyam* (ground cuscus, that is *P. gymnotis*) and *mbrat* and *mifan* (common spotted cuscus, males and females, that is *S. maculatus*).

Description of species and number of cuscus

The identification of six samples of *P. orientalis* from Arfak Mountains Nature Reserve shows that this type of male has a body length and weight that range from 400 mm to 445 mm and 2,200 grams to 2,800 grams. Female's body size is smaller than the male's, namely body length ranges from 385 mm to 425 mm and body weight ranges from 2,000 grams to 2,500 grams.

The males and females of *P. orientalis* have similar hair dominated by brown, along the middle dorsal stripe that extends from the base of the nose (anterior) through the inter-parietal bone, dorsal and to the rear (posterior) to the base of the tail. The females' fur is dark (dark brown) when compared with males who have lighter fur (grayish brown). The head of both is more elongated with a protruding ear condition.

The identification of six samples of the captured *P. gymnotis* of both male and female adults from the area of Arfak Mountains Nature Reserve showed that males of this species has body length and body weight ranged from 405 mm to 446 mm and 2,200 grams to 2,800 grams. The size of the female body's length and weight ranges from 385 mm to 425 mm and 2,000 grams to 2,500 grams. There are white patches behind the ear which is clearly visible because it is not covered with feathers in it. The color of the dorsal of the males is like the head which is brown with silvery effect on the tip of the feather. Finer hairs similar to wools spread from the dorsal to ventral and ends on the outer side of the wrist and leg.

Based on the observation on *S. maculatus* in the region of Arfak Mountains Nature Reserve, there are two

variations of cuscus, namely the plain white and spotty brown. The identification of six examples of this type of the captured cuscus showed that males from this region have body length and body weight ranged from 515 mm to 555 mm and 4,000 grams to 4,800 grams. The female body's length and weight range from 485 mm to 525 mm and 3,000 grams to 4,100 grams. The head of the male is yellowish brown and spread out from the base of the nose through the inter-parietal bone toward the back (posterior). The dorsal feathers with yellowish brown spots are spread from the base toward the back of the head spotted with the darker color (dark brown). This color is spread toward the side of the body until the outer part of arms and legs and ventral borders.

Estimated population of cuscus

Based on the results of monitoring, it is known that in the area of 14,780 m² or 1.4 ha there are as many as 58 individuals. From that number, 39 individuals or 67.2% is the type of *P. orientalis* with the highest individual spread compared with the other two cuscus species found at the sites. *P. gymnotis* consist of 10 individuals or 17.2% and *S. maculatus* consist of 9 individuals, or 15.5%. *P. orientalis* has a larger population so its existence is predicted to be able to continue even improved in the future when compared to *P. gymnotis* and *S. maculatus*. This is because *P. orientalis* has a higher reproductive capacity than the two other species (Farida et al. 2001; Sinery 2006, 2010). But this is not true in general, because to this date on their population has not been known.

The results of observation indicate that two of the three samples found each having 2 and 1 young aged about 1 to 3 months in the pouch. Body length of the young ranges 50-85 mm. Based on these results it can be concluded that the litter size of *P. orientalis* is one or more infants. This is consistent with the statement of Menzies (1991) stating that the genus of *Phalanger* usually gives more than one infant in one birth so this type of cuscus has a large population compared to the genus of *Spiloglossus*. But the statement did not say how many individuals of cuscus were in a specific scale area. According to Sinery (2010), in their natural habitat and in the captivity cuscus deliver 1 or 2 infants in each birth with the reproductive phase of 1-2 times per year. The life span of cuscus ranges from 10 years to 13 years in the wild. The young cuscus aged less than a week is not covered with fur. The body length of young cuscus just weaned ranges from 100 mm to 125 mm. Its body is covered with fine hairs evenly on the dorsal, ventral, head, hands and feet.

Based on the number of individuals in the population documented, there are 44.83% male and 55.17% female. These conditions indicate the existence of equilibrium in reproduction pair because cuscus is not monogamous. This fact indicates that the regeneration cuscus population in the region is expected to continue in the future.

Table 1 shows that total population of cuscus in an area of 105 ha is 95 individuals. Population distribution of cuscus is as follows: *P. orientalis* 67 individuals, *P. gymnotis* 17 individuals, and *S. maculatus* 11 individuals. The estimation of cuscus population at the study site is 317

individuals in the area of 420 ha or approximately one individual per ha. Therefore, the cuscus population is potential to be pursued as one of the objects in the development of the area of Arfak Mountains Nature Reserve in the future.

Tabulated results show effective population size of cuscus can be managed, because population density reached 317 individuals, or approximately 105 cuscuses for each species. The number of 317 is considered to comply the effective population size of the threat of local extinction in the northern region of Arfak Mountains Nature Reserve. According to Franklin (1980) in Maturbongs (1999) it is required at least 50 individuals to maintain genetic diversity in captivity. The number is determined accordance to the experience that the stock of animals in captivity can be

maintained if the loss of biodiversity as much as 2-3% per year, while for the 50 individuals will only lose 1% of genetic diversity.

Table 1. Population density of cuscus in the Arfak Mountains Nature Reserve

Species of cuscus	Number of individuals (ni)	Distance between cuscus and transect (r)	Population density (N)
<i>P. orientalis</i>	39	1131	67
<i>P. gymnotis</i>	10	276	17
<i>S. maculatus</i>	9	341	11
Total	58	1748	95

Note: $r = m^2$; transect's length (L) = 21 000 m transect's area (A) = 105 ha



Figure 1. A. *Phalanger orientalis*, B. *Phalanger gymnotis*, C. The male (left) and D. female (right) of *Spiloglossus maculatus* found in the Arfak Mountains Nature Reserve, Manokwari.

Based on these assumptions, the size of the open population such as cuscus population in Arfak Mountains Nature Reserve will be able to survive in the future because of the flexibility activities (feeding, mating, and other activities) and the abundant of feed resources. The estimation results if connected with home range per individual cuscus which is between 1,225 m² and 2,400 m², then the population of 317 cuscuses will require a minimum area of 388,325 m² (38 ha) and a maximum of 760,800 m² (76 ha). The analyzes indicate that the carrying capacity of cuscus habitat at the site of this study is sufficient because the cuscus in the region has a larger effective area compared to its population.

The food of the cuscus

The species of forest plants consumed by cuscus as a feed resource in Arfak Mountains Nature Reserve is quite varied, consisting of fruit and leaves. There are 17 types of forest plants consumed by cuscus in the region. The analysis showed that the pole stage vegetation has the largest number of 87 individuals consisting of 16 species. Ten species of them are the main feed of cuscus which are dominant and spread evenly over the study site. They are *Sterculia parkinsonii*, *Dracontomelon edule*, *Pometia* sp., *Myristica* sp., *Syzygium* sp., *Ficus* spp., *Lansium domesticum*, *Hernandia peltata*, *Cerbera floribunda* and *Intsia bijuga*, respectively. On the other side, saw timber stage vegetation has 81 individuals consisting of 15 species. Ten species of them are the main feed of cuscus which are dominant and spread evenly on the observed location. They are *Cerbera floribunda*, *Intsia bijuga*, *Gnetum gnemon*, *Hernandia peltata*, *Ficus* spp., *Syzygium* sp., *Lansium domesticum*, *Myristica* sp., *Pometia* sp., and *Sterculia parkinsonii*, respectively. Sinery (2002, 2006) states that any species of cuscus is fruit eater (frugivores). However *Phalanger gymnotis* is also carnivores, especially against insects and other small animals.

Analysis of the level of diversity, dominance, and evenness showed that species diversity index was 0.301. Regarding the criteria of diversity index or the degree of species diversity, Shannon in Sugianto (1994) considered that species diversity is high when $H > 3$, moderate when $1 < H < 3$, and low when $H < 1$. Therefore, Arfak Mountains Nature Reserve has a low diversity of vegetation species for the cuscus' feed ($H < 1$). The high diversity of species within a vegetation community is characterized by an abundance of many species with the same or nearly the same.

The analysis of the dominance level shows that the dominance index of the vegetation which is cuscus' feed at the study site was 0.501. This condition illustrates that the distribution of cuscus' feed according to each type is low. Distribution of individuals of each species is not balanced, and only a few species have the number of individuals that is dominant. The analysis of the level of evenness shows that evenness index of vegetation which are cuscus' feed in the study site was 0.253. This figure illustrates that the distribution of cuscus' feed according to the species is not well spread. According to Santosa (1995), evenness index indicates the proportion size of individuals number in each

species found in a particular community. When each type has the same number of individuals then the community is said to have a maximum value of evenness index. The value of species evenness ranges from 0 to 1 according to Krebs (1989).

Estimated availability of cuscus' feed as an illustration of habitat carrying capacity is as follows: the basic assumption that the average feed requirement is 0.5 to 1 kg per head per day. Individual density is 1 head per ha. When a tree (e.g. *Ficus septica* or *Syzygium* sp.) produces 30-50 kg of fruit per season with a frequency of at least 2 times a year then the estimated availability of food is abundant at the sites. According to Sinery (2010), of all species of cuscus' feed in the forest, *Ficus septica* or *Syzygium* sp. is a key species for wildlife frugivore like cuscus because it can bear fruit throughout the year.

CONCLUSION

Of the seven species of cuscus found in Papua and West Papua, three species are found in the area of Arfak Mountains Nature Reserve, especially in the southern region. The three species of cuscus are northern common cuscus (*Phalanger orientalis*), ground cuscus (*P. gymnotis*), and the common spotted cuscus (*Spilocuscus maculatus*). The number of cuscus found during the study period was 58 with an estimated density of 95 cuscus per 105 ha, then it is predicted only one cuscus is found in 1 ha. *P. orientalis* has the biggest number of individuals with the highest level of dominance compared to others species because this species has higher reproductive capacity. There are 17 species of forest plants consumed by cuscus as feed resources consisting of 16 species of pole stage vegetation and 15 species of saw timber stage vegetation. In term of quantity, the amount of feed available is abundance for the needs of cuscus in the region.

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