PHYSICAL ENVIRONMENT, POPULATION PARAMETER, AND MORPHOMETRIC RECORDS MORPHOMETRIC OF THE MONITOR LIZARD IN PAPUA

(*Kajian Lingkungan Fisik, Parameter Populasi dan Catatan Ukuran Hidup Ukuran Tubuh Biawak di Papua*)

Deny A. Iyai[1,2] and Yubelince Y. Runtuboi[3]

[1]Research Centre of Biodiversity. Papua University. Jl. Gunung Salju, Amban. Manokwari.Papua Barat. Indonesia. Postal code. 98314.

[2]Faculty of Animal Science. Papua University. Jl. Gunung Salju, Amban. Manokwari.Papua Barat. Indonesia. Postal code. 98314.

[3]Faculty of Forestry. Papua University. Jl. Gunung Salju, Amban. Manokwari.Papua Barat. Indonesia. Postal code. 98314.

Corresponding author's email: da.iyai@yahoo.com

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Abstract

Many studies have explored animals without providing its physical environment, whereas, this information can provide broad understanding for the importance of ecological components. This study tried to combine some studies on how importance the ecological means on the density and population as well as morphometric of the monitor lizards. Data was analysed using SPSS version 18.0 and presented descriptively using tables and graphics. Results show that density and population had association with wide areas of islands and distances from mainland. Morphometric as well had association with carrying capacity and richness of feeding.

Key words: Zoogeography, Physycal Environmental, Morphometric, Population, Varanidae, Papua

Abstrak

Banyak kajian tentang satwaliar dilakukan tanpa menyajikan lingkungan fisik. Padahal informasi ini dapat menyediakan pemahaman yang luas tentang pentingnya komponen ekologi. Penelitian ini bertujuan untuk membandingkan beberapa hasil kajian peran penting kondisi fisik lingkungan terhadap kepadatan dan populasi, dan ukuran tumbuh satwa biawak yang hidup di Papua. Data dianalisis secara statistic deskriptif (Regresi dan Korelasi) menggunakan SPSS versi 18.0. Hasil Analisis disajikan dalam bentuk tabel dan grafik. Hasil penelitian menunjukan bahwa kepadatan dan populasi memiliki hubungan dengan luasan, jarak daerah pulau terhadap daratan utama. Ukuran tubuh saling berhubungan dengan daya dukung pulau, kekayaan tumbuhan dan keragaman bahan makanan.

Kata kunci: zoogeografi, Lingkungan Fisik, Morfometrik, Populasi, Varanidae, Papua

INTRODUCTION

Monitor lizard is grouped in Herpeth-Fauna from Family of Varanidae (Rooij, 1915; Sprakland, 1991). Many species of this family are spread over the world. In Indonesia there are more than 10 species. The monitor lizard,in Mollucas and Papuan, is called "soa-soa" (*Varanus* spp.). More than six species exist dispersing in Papua, i.e. *Varanus prasinus, V. indicus, V. salvadorii, V. kordensis, V. doreanus, V. Gouldii* (Petocz, 1987; Lisle 1996). Not many data are available yet with related to dispersion of monitor lizards, particularly at the Northern Papua, middle of Papua, Southern part of Papua and several sattelite islands.

Every species has its own habitat and likewise, habitats shape how the species behaves, interact within and response to the environment. Performance or phenotypic (P) of monitor lizards depends on both its genetic (G) and environment (E). Changes in genetic can be evolutionary shifted by inbreeding inside population and similar

progeny. Natural mating could enforce this phenomenon. In line with genetic, some monitor lizards are larger and some are smaller than other, such as comparing morphometric between *Varanus indicus* with *Varanus prasinus* (Rahayu, 2001; Noviriana, 2004), even for the *Varanus salvator* (water monitor lizard) and *Varanus indicus,* which the colour and morphometric are slightly similar. Environmental components are many. Feeds play prominent role in determining several qualitative and quantitative traits. Temperature and humidity are the two components that also cause alternation in qualitative traits and morphometric of monitor lizards.

Specific morphometric' inventories of several monitor lizards, i.e. *Varanus indicus* and *Varanus doreanus doreanus,* was made by Faidiban and Iyai (2003) at Mansinam island, Faidiban *at al*. (2002) at Sop island and Iyai and Pattiselanno (2005) at Pepaya island. Besides, some species almost have similar spotted colour. Some similar morphometric could not be distinguished. In deep study has to address so that identification of species will be made correctly. Identifying family of Varanidae needs special master of focus to precisely determine the species. One example that contributes to the confusion is the age of the monitor. Age colours of the monitor lizards are changeable. In conventional animal, some morphometric are related linearly to body weight such as body length, and hearth girth. Identification can be so far made by using a guide written by well-known scholar such as Rooij (1915) and Sparkland (1991) and few other authors. Similar cases are in linear meaning with the monitor lizards. Therefore, the aim of this study was to highlight the importance of several islands called satellite islands in determining physical environmental and morphometric characteristics of monitor lizards in Papua.

MATERIALS AND METHODS

Several satellite islands were visited and observed its ecological characteristics of monitor lizards, i.e. Yaur, Mansinam, and Sop islands. Monitor lizards were observed and people living around the villages were interviewed using semi-structural questionnaire. Using roll meter, digital weighing, data on morphometric were recorded. Data were derived from several field researches done by staffs of Animal production Department, i.e. Iyai (2002) at Yaur village, Faidiban and Iyai (2003) at Mansinam island, Faidiban *et al.* (2002) at Sop island, Sorong regency. Bodyweight was weighted a life using digital balance. Length of body (cm), length of tail (cm) and hearth length (cm) were measured using roll meter. Then these capture monitor lizards were released to their habitat.

Data were stored into excel 2010 and copied to SPSS version 18.0. Comparisons of average body weight and body length were made between the three locations using One-Way Anova. Due to not enough data of other monitor species, i.e. *Varanus salvadorii*, *Varanus prasinus* and *Varanus gouldii*, classification was made between *Varanus indicus* at different locations, i.e. Yaur, Mansinam island and Soop island. Regression and correlation between several morphometric, i.e. body length, tail length and hearth girth were analyzed. Normality of data was tested. All data were analysed using SPSS version 18.0 and Microsoft Excel 2010. Descriptive statistical analyses were displayed. Data were presented using tables and graphs.

RESULTS AND DISCUSSIONS

Habitats

Habitat based on Brower and Zar (1977) is defined as the place where an organism or a group of organism lives. It is described by geographic, physical, chemical and biotic characteristic. Sukarsono (2008) defines a habitat as totality of natural resources consisting of space including substrate and medium, temperature and climate, and vegetation where the animal presence. In Mansinam island, the physical components were recorded by Iyai and Runtuboi (2013). It consisted of humidity 80.2%, temperature 28.98 C, altitude 13.6

m ASL. Soil characteristic was in range of clay to grain and stones.

Zoogeography constitutes the spread of animals in the world (Sharma, 1998). The animal zoogeography named zoogeographic regions is divided into six regions. They are palaearctic region, ethiopian region, oriental region, australian region, neotropical region, neoarctic region. New Guinea and in particular, Papua is included in australian region. Of the reptilian genera, scale-footed lizards are included. The australian region consists of Austro-Malayan, Australian, Polynesian and New Zealand sub-regions.

Wide areas contribute in the number of distributed species. The theory was introduced by MacArthur and Wilson (1967). The author called as *species area relationship*. It says that the wider islands have greater number of species compared to smaller islands. This theory is in line with ecological component, i.e. there are high number of ecological community. The wide islands provide geographic isolation and vest population of each species and therefore it will enhance the speciation and decline the species loss from the new and old shape species. The biogeographic island theory is used to estimating number and percentages of species that will be lost if an island or a habitat will damage.

Table 1. Ecological components of zoogeography of *Varanus* spp

Locations	Width (km)	Density (head/ha)	Population (head/widt)	Distance from main land (km)	Species	Source
Pepaya island	2.42	1.5	360	25	*V. indicus*	Iyai and Pattiselanno, 2006
Mansinam island	3.92	1.7	665	2	*V. doreanus-doreanus* *V. prasinus*	Faidiban and Iyai, 2005
Sop island	9.4	17.85	1370	3	*V. indicus*	Faidiban *et. al*. 2002
Kaki island	3	2	360	1.5	*V. indicus* *V. prasinus*	Anonimous, 2005
Pantura, Nuni	Mainland	-	-	2	*V. indicus* *V. prasinus*	Noviriana, 2004

Width area of Sop island (9.4 km^2) in Sorong regency has wider areas than the other three islands. The smallest island is Papaya island (2.42 km^2) in Nabire. The more width of areas can indicate the role and characteristic of other physical and biophysical components. Explanation is further stated.

Population Densities

Density is the number of individuals in a population per unit area (volume) of environment. Sop island has highest density of the monitor lizards (17.85 head/ha) than the rest three islands, i.e. 1.5, 1.7 and 2 head/ha for Pepaya, Mansinam and Kaki islands. There can be distinguished between crude density and specific density. Crude density is density per unit total space. Specific density or economic density is density per unit of habitat space, i.e. available area or volume that can actually be colonised by the population. Density could be caused by four factors, i.e. natality, immigration, mortality and emigration. The causes inducing the rate of species losses at islands are the human activities. Hunting and forest fire and burned are the primary factors that affect the rate of species losses in islands. Due to the distance from mainlands, it enables human to have an access to the islands. Example was seen during collecting data from Mansinam islands (Faidiban and Iyai, 2003).

A population is commonly a group of individuals of particular species occupying a particular area at a specific time. In Table 1., population of the monitor lizard higher 1370 head/km^2 than the rest of the three, i.e. 360, 665 and 360 head/km^2. While in Table 2, average populationshown 688.75 ±10.90 head/km^2. There are two types of population, i.e. monospecific population

and mixed or polyspecific population. Mono specific population deals with the population of individuals of only one species and mixed or polyspecific population is the population of individuals of more than one species. In ecology polyspecific population is generally reffered to as a community. Populations are characteristised by dispersion, fluctuation in numbes (density), sex ratio, birth rate and death rate.

Table 2. Biophysical characteristics of *Veranus* spp.

Statistical Parameters	Biophysical characteristic				
	Width (km)	Density (head/km^2)	Population (head/km^2)	Distance (km)	Species number
Number of observed Sample (n)	4	4	4	4	4
Average	4.68	2.57	688.75	11.25	1.50
Std.D.	3.20	1.69	476.38	10.90	0.57
Minimum	2.42	1.50	360	2	1
Maximum	9.40	5.10	1370	25	2

Width

Wide area is defined by the spaces as a characteristic of the habitat. The wider the area is in linear with the bigger the spaces. Average of wide areas from the fourth areas was shown 4.68 km/ island. The more spaces the more the habitat to support the natural lives of the organism. Width of areas has linear relationships with the carrying capacity on one condition, i.e. adequate resources. Once discussion with animals, fluctuation between resources and animal population and its health will be in equal position. Equal is meaning that population growth when there are enough resources to support new growing life and its needs.

The relationships of wide islands with density, population, species number and distance from mainland with species number are shown in Figure 1, 2, 3 and 4.

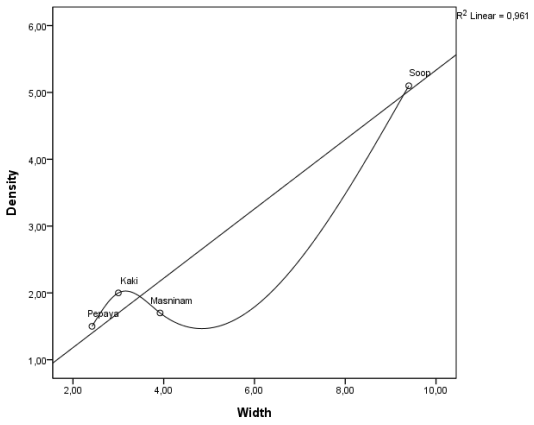

Figure 1. Density vs wide areas

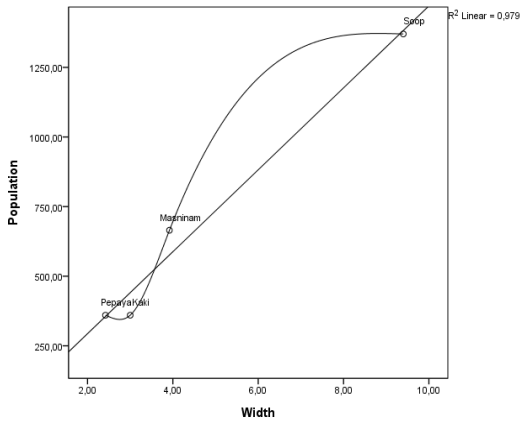

Figure 2. Population vs wide areas

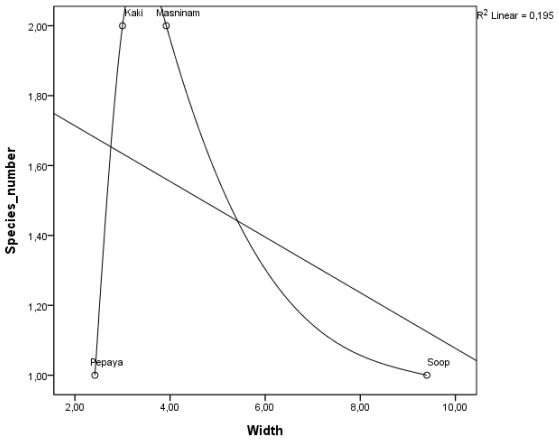

Figure 3. Number of species vs wide areas

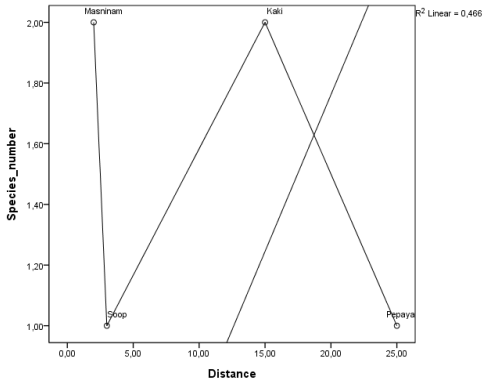

Figure 4. Species number vs distance from mainland.

Figure 1 shown that positive relationship between width areas and density of the monitor lizards was exist. Similar finding was also proven from width areas and population. The more wider an areas, the more head of animal will be found (Figure 2). In contrary, width areas do not always support the number of species. Negative linear relationship was found in these islands (Figure 3). In Figure 4, number of species does not have strong relationship with distances from main land.

Number of Species

In average the number of Varanid species found at several satellite islands in Papua was two species. Of Table 2, number of species was found in range of 1-2 species. Mansinam and Kaki islands had two species of monitor lizards and Pepaya and Sop only had 1 species. It seemed that Sop island is predominantly occupied by *V. doreanus-doreanus* (Table 1). The number of species existed at islands is depended on distance from mainland. It stated that the rate of species loss occurs at islands. Example of the island species loss was studied at Hawaii. The 4th Figure shown the amount of species in islands was independently associated to mainland. Number of species existing in an island depends strongly on abundances of resources such as feeding, water, and other physical environment.

Distance from mainland

The number of Varanid species in mainland was studied by several authors, i.e. Rahayu (2001) at Arfak Nature Park, Iyai (2002) at Yaur, Cenderawasih Bay Natural Park. Distance from mainland is proven by the inventored species of monitor lizards at several satellite islands. Number of species in one island has association with many components. Varanid is a good swimming animal. By using its tail, hands and body, this reptile can reach certain distances. Almost all islands in Papua can be seen by its presences. It is a good swimmer. The varanid also can eat any kinds of food. It can survive even in areas with less food available.

Morphometric

Several monitor lizards found and identified at some satellite islands in Papua were *Varanus indicus, Varanus salvadorii, Varanus prasinus* and *Varanus gouldi* (Iyai, 2002). Petocz (1984) confirmed that monitor lizard species at Yapen island called *Varanus jobiensis*. This monitor lizard has to be identified further. *Varanus indicus* has typical characteristic such as the nostrils is circle; tail is flat. The nostril is slightly closer to the corner of snout than to the eyelid; The upper scale of the eye at the middle rows is bigger vertically (Rooij, 1915). *Varanus indicus* has wide distribution areas.

Varanus indicus mostly distributes at wet areas (Iyai, 2002; Iyai and Pattiselanno,

2005; Bennet, 2004) such as swampy land and mangrove; islands (McCoy, 1980; Faidiban and Iyai, 2003; Iyai and Pattiselanno, 2005) and secondary forest (Rahayu, 2001). A such was reported by de Lisle (2007) in the North Sulawesi and other name called by local Papuan is "biawak manggrove". The color of *Varanus indicus* is slightly similar to *Varanus doreanus-doreanus*. The difference is only at tail colour that is slightly blue (Faidiban and Iyai, 2003; Faidiban *et al*., 2002).

Varanus salvadorii has the typical characteristic as the nostril is narrow and tail is flat. The upper scale close to the eye is irregular. The nostril is slightly closer to the corner of snout than to the eyelid (Rooij, 1915). The size of *Varanus salvadorii* can achieve more body size than what was found during study. *Varanus salvadorii* is a New Guinea endemism monitor lizard. This species can have wide area distribution until Papua New Guinea (Whitaker *et. al*., 1982). This species is dispersed at primary forest.

Varanus prasinus has the typical characteristic, i.e. the snout is circle. Tail is circle or slightly flat at the hip; without plume. The upper scale of the eye at the middle rows is bigger vertically. Nuchal scale is not turned up. *V. Prasinus* may be the smallest monitor lizard (Fam. Varanidae). Its body colour is mostly green. Its tail is long compare to its body size. The ventral of green monitor lizard is yellowish white. It can be found at secondary forest and some fruit trees. *Varanus gouldii* has the nostril that is circle; tail is flat; the upper scale of the eye is similarly distributed. The nostril is slightly closer to the corner of snout than to the eyelid (Rooij, 1915).

Many data of morphometric were derived from the monitor lizard of *Varanus indicus*. *Varanus salvadorii, Varanus prasinus, Varanus gouldii* were slightly difficult to observe. Besides, the relevant information and the importance of *Varanus prasinus* are lagging behind. The ecological roles of these three species are unknown. Little information was measured by Iyai (2002), i.e. on *Varanus salvadorii* faund at Yaur. The average body weight of *Varanus salvadorii* is 2.02±0.73kg (1.10-2.90 kg) and body length is 99.20±10.76 cm (82-110.40 cm). Some notes recorded several morphometric of *Varanus indicus* at the three research sites in Papua. It described that, from the three sites, body weight found in Mansinam island was bigger (1904.16 g) than that in Yaur (1420 g) and Sop island (656.67 g) (Karubaba, 2004). Other morphometric was body length, Mansinam had more length (123 cm) than that Yaur (91.84 cm) and Sop island (87.9 cm). These had similar comparison between three sites on tail length and hearth girth (Fig. 5).

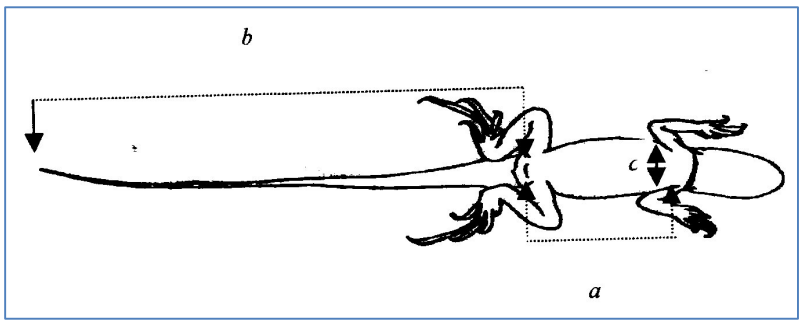

Fig. 5. Morphometric components. a. Body length, b. Tail length. c. Hearth length.

Based on Post-Hoc test of Duncen Multiple Comparison body weight of the three sites shown Mansinam had higher compared to the other two ($p<0.01$). Body length of *Varanus indicus* at Mansinam island had highest number compared to Yaur and Sop. Tail length of the three sites were shown strong significant difference ($p<0.01$) between the three sites. Higher number of tail length was found at Mansinam island compared to those two sites. This was also seen at hearth length

($p<0.01$), where the Mansinam has the highest size of hearth length compared to the other two sites. Therefore, what could be concluded was that morphometric of these three indicators were in line with the growing phases of ages and this should be linear growth.

Reasons for this significant growth was based on feeding abundance when *Varanus indicus* was found. In Mansinam island, megapodes nesting habitat become the feeding location for *Varanus indicus* (Sofyan, 2001; Faidiban and Iyai 2003; Janggo, 2005). It seems that *Varanus indicus* had no predator and become the primary predator in Mansinam for megapodes. Likewise, at Soop island feeding were competed amongst the monitor lizards and the abundance was low (Hariadi *et al*., 2002; Sidarman, 2004; Harsiani, 2004). In Yaur, feeding was competed amongst *Varanus indicus* and other animals. *Varanus indicus* is frequently observed at hunting sites at Waroromi valley, the place where Yaur people are often doing hunting.

CONCLUSION

Relationship of physical environment with density and population exist as well as between wide areas and distances of mainland. Wide areas of island can support the density and population of monitor lizards as well as body weight and other morphometrics. Some samples of sites need in consideration for further studies are such as in Yapen island, Raja Ampat islands, Biak islands and inside Cenderawasih National Sea Park in Nabire and Wondama.

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