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SNAKE BIODIVERSITY AND ITS APPEARANCE IN MANGROVE AREA TAMAN HUTAN RAYA NGURAH RAI, SOUTH BALI

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ABSTRACT

This research aims to determine the diversity of snake species, the richness of snake species, the dominance of snakes and the appearance of snakes found in the Mangrove Area of Taman Hutan Raya Ngurah Rai, South Bali. This research conducted in the northeastern area of the Ngurah Rai Forest Park Raya Forest Area, southern Bali. This research was conducted in February to March 2019 with Visual Encounter Survey (VES) with a path plot design method. Data collection is carried out during the day and night, by observing and identifying snakes found in the area referring to the snake identification manual and identifying factors supporting the emergence of sea snakes. Data will be analyzed by comparative descriptive analysis. The results showed that station 3 had a diversity index value of 0.5 with a total of 2 families found, namely Homalopsidae and Colubridae. The predominance of snakes obtained at Station 2 in the northeastern area of the Mangrove Area of the Ngurah Rai Forest Park is a snake from the Homalopsidae family with a type of Cerberus ryncops. The appearance of snakes in the northeastern area of the Mangrove Area in the Forest Park of Ngurah Rai, South Bali, is large at night and very small during the day.

Key Word: Bali, Mangrove, Snake, Visual encounter survey

PRELIMINARY

Indonesia is one of the countries with high biodiversity in the world and one of the richest biodiversity are located in the forest, coral reef, and mangrove areas. Snake is one of the fauna that has a high diversity in Indonesia and it is widely distributed in various habitats in the

territory of Indonesia, which is a mangrove habitat (Widjaja et al. 2014).

Data on snake species in Indonesia are available, but the data is still relatively general because it is limited to a relatively large area. Though snakes have an important role in maintaining the balance of the ecosystem naturally, both as predators and prey. One of the islands in Indonesia which are known to have become a habitat for various types of mangrove snakes, namely the island of Bali. Bali has a mangrove conservation area which is the Ngurah Rai Mangrove Forest Park Area which has the potential to have a high diversity of mangrove snakes and its surroundings because in the Mangrove Area the Ngurah Rai Forest Park has a vast mangrove forest area and has various types of habitats that can support snake life and there are many gaps of rock and wood around the area, snakes have the potential to exist in these habitats (Budden et al. 2010).

In the area of the Ngurah Rai Mangrove Forest Park in the northeastern part, it is a mangrove area bordering an area where there are dream island tourism activities and community activities. The management of the Park area of the Mangrove Area of the Ngurah Rai Forest Park is more aimed at the protection of mangrove and bird habitats. Meanwhile, other wildlife data including snakes are still very limited, allegedly because animals from the herpetofauna group are classified as unpopular. The existence of dream island tourism activities and community activities around the northeastern area has led to this condition to conduct a scientific study so that the emergence and diversity of snake data in the northeastern area of the Ngurah Rai Mangrove Forest Park which borders the area where there are dream beach tourism activities and community activities can be available and can be a useful source of information, especially for the community, tourists and for better management of the area (Rahmat et al. 2015).

RESEARCH METHODS

Time and Place

This research was carried out in the northeastern area of the Mangrove Forest Park Area of Ngurah Rai, South Bali with research time in February - March 2019. Data collection will be carried out at night and during the day.

Figure 1. Research Map

Table 1. Range of Physical Parameter Values

Parameter	Station 1		Station 2		Station 3	
	Data colletion time					
	Noon	Night	Noon	Night	Noon	Night
Temperature (^{0} C)	35-36 °C	26-28 °C	33-34 °C	25-26 °C	33-34 °C	25-27°C
Hummidity (%)	70%	90-94%	64-66%	90-100%	62%	90-98%
weather	Sunny	Drizzle	Sunny	Drizzle & Rain	Sunny	Drizzle

Methods

This method is survey research carried out in a sustainable manner which was carried out using the Visual Encounter Survey (VES) data collection method with a plot design in the form of a path (Figure 2). Each station was made two observation point plot points each observation path plot in the mangrove habitat and its surroundings along 50 meters (50 steps). Data collection was carried out day and night at 3 stations that have been determined with 2 observation path plots at each station in the northeast area of the Ngurah Rai Forest Park Mangrove Area on a daily basis in 3 days (Mcdiarmid et al. 2012).
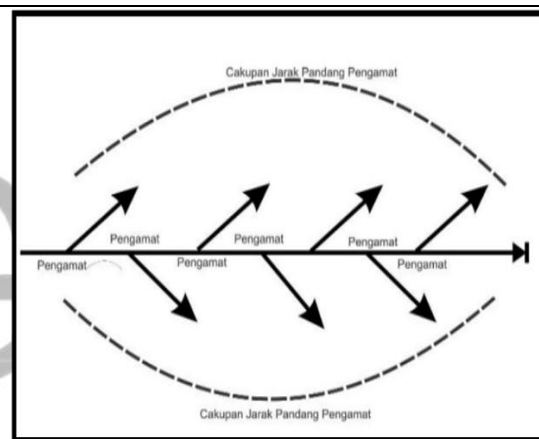

Figure 2. Illustration of Data Collection (Maulana, 2017)

HASIL DAN PEMBAHASAN

Environment and Environmental Physics Parameters

The results of measurements of physical parameters in the environment around the eastern area of the Mangrove Forest Area Ngurah Rai Forest (table 1) shows the parameter values at each station during the day and night, measurements

were made on each plot. The measurement results are compared for each station.

The temperature in the station environment during the day and night have very different differences from the range, depending on the level of appearance of each particular type, regional stations with the same observation time the temperature range obtained during the day is 33°C - 35°C and Temperature at night the range is 25°C - 27°C

Information:
Data collection in the afternoon
= 9:00-12:00 am

Data collection in the night
= 8:00-11:00 pm

According to Lillywhite (2014), snakes generally inhabit habitats that have temperatures of 21°C - 35 °C but snakes cannot regulate body temperature, snakes maintain their body temperature by sunbathing. One way the snake adjusts its body temperature to environmental conditions is that if it is too cold the snake will move to a hotter place and vice versa. From the condition of the station's ambient temperature during the day the hot temperatures have a smaller chance of the appearance of snakes than at night. According to King (2018), snakes will generally hide to cool their bodies and prefer to be in cooler regions, and vice

versa if the snake's body is too cold the snake will
out of hiding to look for hot places, it is one of the factors that make the appearance of snakes during the day with hot temperatures smaller than the appearance at night with cold temperatures.

Humidity in every data collection at the station has a difference in data collection day and night, at night humidity has a higher percentage than in the daytime, one of the factors that influence humidity is the weather in the environment. The humidity range during the day at the station is 62% - 70% and at night 90% - 100%. According to Vitt and Caldwell (2009), in high humidity generally, mangrove snakes prefer to inhabit the area compared to areas with low humidity. From the percentage of humidity obtained the chance of snakes appearing at night is higher than during the daytime.

The weather is the factor that most influences the humidity and temperature in the area where the data is collected, the weather obtained in the data collection day and night is different, sunny weather (sunny) during the day dominates during data collection and drizzle with rain. on nighttime data retrieval. According to Karns et al (2002), one of the environmental conditions that influence

the appearance of snakes in mangrove habitats is the tide and ebb conditions of sea water, based on observations of the appearance of snakes in collecting research data on mangrove habitats found more in medium tide conditions than when high tides and lows.

The receding conditions caused the appearance of snakes in the northeastern area of the Mangrove Forest of Ngurah Rai Forest has very little potential to be found. As a result of the recedes conditions when taking data causes limiting factors in the station area becomes more extreme. The limiting factors are drought, temperature, and sunlight, these three factors are interrelated. If the sea recedes, the mangrove area is exposed to sunlight, as a result the temperature rises. Increased temperature causes evaporation and the impact of the area becomes dry, in these conditions organisms including snakes try to adapt to extreme conditions, one of which is to bury themselves, in general mangrove snakes will hide in damp areas and look for holes to wallow when their habitual areas are dry.

In a high tidal conditions, mangrove snakes will generally rely on hiding or shelter to pass through large currents, large currents cause snake can't find food because organism in mangrove also hiding from large current, that cause snakes hard to find it's food. Medium tide in a mangrove habitat that has a higher chance of the emergence of mangrove snakes, when the tide appears organism comes out from it's hiding place that cause snakes will to hunt and the energy expended by snakes to look for food is not big. One of the environmental factors that influence most of snakes emergence is appearanced of human activities around snake habitat.

Diversity

Based on observations, the contribution and emergence of snakes in the eastern region of the Mangrove Sea Forest Raya Ngurah Rai at each station has different values and the appearance of snakes at each station. During the day no snake appearance was obtained at each station and at night there was a snake appearance with a total appearance of all 19 stations.
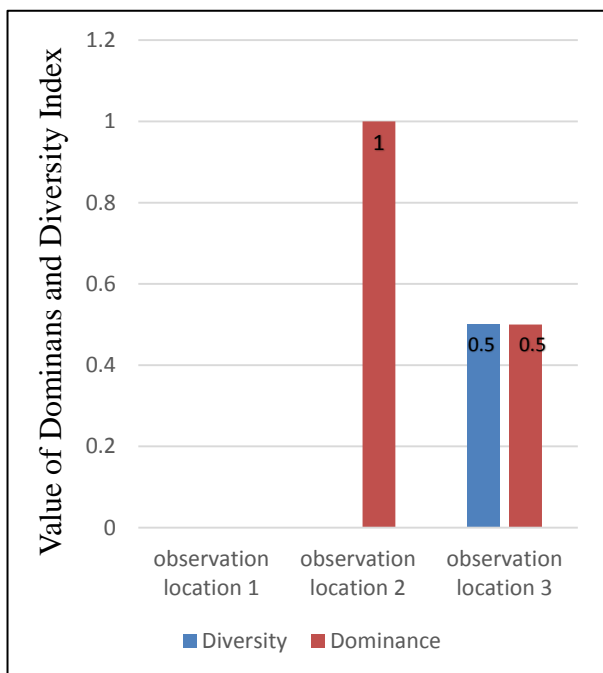
Figure 3. Simpson Diversity an Dominance Index Graph Value at Each Observation Location

genus Cerberus and appearance at station 3 obtained the appearance of 2 snakes from the genus Xenochorpis and Cerberus (Table 2). Of the total number of snakes found in the Cerberus genus, 12 juveniles and 5 adults and Xenochorpis were found in 2 adults. Based on the data obtained and the Simpson diversity index of the station which has diversity, namely at station 3 with the Simpson diversity index value of 0.5 based on the Simpson diversity category is a moderate diversity value (Figure 3).

The diversity of mangrove snakes in the northeastern area of the Mangrove Area of the Taman Hutan Raya Ngurah Rai, South Bali on 3 days of observation was compared in the following tabel (tabel 2). From the results obtained a comparison of the appearance of snakes during the day was not found any snakes and at night

The appearance of snakes at station 1 did not occur, the appearance of snakes at station 2 was obtained 15 from the

Tabel 2. Comparison of the appearance of snakes in observations day and night

Station	Observation time	Genus	Total	Observation time	Genus	Total
1	Noon	xenochorpis	0	Night	xenochorpis	0
		cerberus	0		cerberus	0
2	Noon	xenochorpis	0	Night	xenochorpis	0
		cerberus	0		cerberus	15
3	Noon	xenochorpis	0	Night	xenochorpis	2
		cerberus	0		cerberus	2
		total	0		total	19

there is 2 types of snakes found with a total of 19 snakes.

From 3 stations snake diversity in the northeastern station, the Ngurah Rai Forest Park at Station 3, with Simpson's diversity index value of 0.5 and at locations 1 and 2, there was no diversity because there were no snakes at station 1 and only 1 snake species was found. at station 2 namely Cerberus ryncops which is a member of the Homalopsidae family. One of the factors that makes the absence of diversity at location 1 (beach) and location 2 (mangrove) is the habitat characteristics that are not suitable with mangrove snakes and human activities around the station. According to Lillywhite (2014), mangroves are one of the snake habitats of the Homalopsidae family and only a few snakes from the Colubridae and Achrocordidae families, in general snakes from the Colubridae family inhabit forests, swamps, brackish swamps and estuaries compared to mangroves.

Station 3 is a meeting habitat between rivers and mangroves in the northeastern area of the Ngurah Rai Forest Park, which has the potential for snakes to appear in more than 1 family. According to Budden et al (2010), habitat meeting between river and mangrove are habitat from various kinds of snakes from the family Colubridae, Homalopsidae and Acrochordidae, and the mangrove habitat

is the habitat of several snakes from the family Colubridae, Homalopsidae and Acrochordidae.

a.   Station 1

Snakes in the eastern area of the Ngurah Rai Forest Park Mangrove Area at Station 1 have a Simpson 0 variation index value or there is no variation. This is caused because there is no appearance of snakes at station 1 at night and during the day because this location is not in accordance with the habitat and characteristics of mangroves. This location is a coastal area which is an environmental and humidity factor that suits the snake's environmental needs, but this area is an open area that does not have much shelter and hiding for snakes. At station 1 there is community activity which is a tourist attraction in the area which is a factor in the absence of snakes found in the area.

According to King (2018), snakes have a variety of ways to defend themselves when kept threatened from predators and receive humans. One way to defend itself is on oneself, at a location that is mostly done by mankind will avoid places that are caused by humans as a challenge for snakes.

b.   Station 2

Snakes in the northeast area of the Ngurah Rai Mangrove Forest Park Area at

Tabel.3 List of Types of Snakes Found at the Station

Species	Habitat Type			Σ
	Seashore	Mixing of area mangrove and river area	Mangrove	Total
Cerberus ryncops	0	2	15	17
Xenochrophis triangularis	0	2	0	2
Σ Total	0	4	15	19
Σ Jenis	0	2	1	2

station 2 have a Simpson diversity index value of 0 or no diversity. This is because there is only 1 snake family found at night, the Homalopsidae snake family with 15 snakes of the Cerberus ryncops type. At station 2 is one of the mangrove habitats in the northeastern area of the Ngurah Rai Park Forest Area which is the main habitat of the Homalopsidae snake family of the genus Cerberus.

According to Murphy (2007), snakes of the genus Cerberus are mangrove snakes that are often found in mangroves and estuaries and a small portion can be found in fresh water, snakes of the genus Cerberus are generally nocturnal snakes and inhabit many crab holes and between mangroves of fissures.

c.   Station 3

Snakes in the northeastern area of the Mangrove Area Forest Park Ngurah Rai at station 3 have a Simpson diversity index value of 0.5, at that location found 2 snakes from different families namely Colubridae and Homalopsidae, with the emergence of 2 species of Cerberus ryncops and Xenochrophis triangularis 2 heads. Station 3 is an area that has a potential for the emergence of snakes that is quite large because the area is a meeting area between rivers and mangroves, based on the

characteristics of snake habitat the area is suitable for the characteristics of various kinds of snakes, such as suitable temperature, humidity high, availability of food sources and there are many hiding places and shelter for snakes such as crevices of stone and wood and away from human activities.

According to Green et al (2009), Colubridae is a family of snakes that inhabit diverse habitats from forests,

swamps, brackish swamps, rivers, mangroves to the sea. The habitat most inhabited by the Colubridae snake family is the habitat of forests, rivers and brackish swamps. Brackish swamp habitat is a snake habitat of the Colubridae family, one of which is from the genus Xenochrophis and Rhabdophis.

Dominance

The Simpson dominance index value in the northeastern area of the Mangrove Area of the Ngurah Rai Forest Park at all observation locations as a whole ranges from 0-1. At observation location 1 there was no dominance because no snakes were found at that location, and at the 2 and 3 siting sites were obtained Simpson's dominance index value with values 1 and 0.5 (Figure 3).

The highest overall dominance index value is found in the second tanning location with a dominance index 1, this is because there are only snakes of Cerberus ryncops with a high number of occurrences at observation location 2 namely 15 tails. At the observation location 3 the dominance index value obtained was 0.5, at location 2 found 2 types of snakes namely Xenochrophis *triangularis* dan *Cerberus ryncops* with the same appearance that is 2 snakes. At location 1 is a location that does not have a

dominance index value due to snakes not found at the observation location 1.

From the results of all observation locations, locations 2 and 3 are locations that have a Simpson dominance index value. According to Mcdiarmid et al (2012), the Simpson dominance index value with a value greater than 0.5 means that there is a genus that dominates at that location. Observation location 2 is the location of the genus that dominates it because the value obtained is 1.

Species Richnes

According to Santosa (1995), species richness is a measure of biodiversity that illustrates the number of species in a community. The types of snakes found at each station have a different number of species, at station 1 no snakes were found, at station 2 there was only 1 snake type and at station 3 there were 2 species from 2 snake families (Colubridae and Homalopsidae) (Table 3).

The area with the highest number of species in the northeastern area of the Ngurah Rai Forest Park is located in the confluence area of rivers and mangroves (2 species), while the least number of species, namely mangrove habitat (1 species), and coastal habitats are no snake found. According to Budden et al (2010), snakes from the Homalopsidae family generally inhabit the habitats of brackish and swamp

swamps and a small part inhabits mangrove habitats. A list of snake species found at the station is presented in Table 3.

Overall, the Margalef species richness index in the northeastern area of the Ngurah Rai Forest Forest Park was obtained at Station 3, which has a Margalef type wealth value (DMG: 0.34). According to Ariyanto et al (2012), the value of Margalef species richness is less than 2.5 which means that species richness is not good.

Chance of emergence

The opportunity for an encounter illustrates the time period of an encounter with an hour in 1 hour. Opportunities for snake encounters are presented in (Table 4)

Tabel 4. The chance of a snake encounter

Species	Σ Total	Chance (Ind/hour)
Cerberus ryncops	17	2-3
Xenochrophis triangularis	2	0-1
Σ	19	1-2

The chance of a snake encounter during the day is 0 or no snake is found at daytime observations. According to Karns et al (2002), mangrove snake activity starts at sunset (dusk) and rests after sunrise (morning), so that when observing the mangrove snakes are not found during the day. Tides also affect the activity of mangrove snakes which causes snakes to hide in crab holes if the water is high tide and out of the hole at low and low tides.

The biggest chance of encounter is Cerberus ryncops 2-3 individuals / hour, this species is mostly found in mangrove habitat at night. According to Green et al (2009), snakes of the genus Cerberus are snakes that are often found in brackish waters such as mangrove habitats and snakes of the genus Cerberus are nocturnal snakes. Another type with the smallest chance of meeting is Xenochrophis triangularis 0-1 individuals / hour, in this research Xenochrophis triangularis species were found in habitat of meeting between rivers and mangroves. Opportunities for encounters are a description of how much effort to search for a particular snake species, habitat and living habits of each snake type also need to be known to be able to predict its existence.

Conclusion

Based on research results on the biodiversity of snakes and their emergence in the northeastern area of the Mangrove Forest Park Area of Ngurah Rai, South Bali, several conclusions can be obtained as follows:

1. Snake diversity in the northeast region of the Mangrove Area of the Ngurah

Rai Forest Park, South Bali was only obtained at Station 3 which has a moderate diversity of snakes with a diversity index value of 0.5 with a total of 2 families found, namely Homalopsidae and Colubridae families. The predominance of snakes obtained at Station 2 in the northeastern area of the Mangrove Area of the Ngurah Rai Forest Park is a snake from the Homalopsidae family with a type of Cerberus ryncops.

2. The appearance of snakes in the north eastern area of the Mangrove Area in the Forest Park of Ngurah Rai, South Bali has a biggest emergence of snakes at night than at noon.

Suggestion

The lack of data about snakes in the area of the Mangrove Area Forest Park Ngurah Rai, South Bali specifically regarding the diversity of species, emergence and other aspects it is necessary to do similar research on snakes, especially in the areas of the mangrove area of the Ngurah Rai Forest Park more specific information for better management of the region.

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