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A PRELIMINARY SURVEY OF HERPETOFAUNA AT DELTA TUMPAT MANGROVE FOREST, KELANTAN, MALAYSIA

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ABSTRACT

A rapid survey on the diversity of herpetofauna species at Delta Tumpat Mangrove Forest (DTMF) was carried out from July to September 2017 (36 days). The objective of the study is to determine the diversity of herpetofauna species in five main location sites in DTMF. Amphibians (frogs and toads) and reptiles (lizards) were collected by pitfall trapping within a terrestrial transect utilising active searching and direct observation while reptiles (snakes) were collected by chance during observation. All herpetofauna species were observed and identified by referring to books and journals. The results show three species of amphibians from three families and eight species of reptiles from seven families were present on DTMF. Of all the amphibians, only two species of frogs and one species of toad were collected. Of all the reptiles, only six species of lizards and two species of snakes were collected. The most commonly encountered reptiles were the Bell's butterfly lizard (*Leiolepis belliana*), water monitor lizard (*Varanus salvator*) and garden lizard (*Calotes versicolor*). The number of amphibians and reptiles is considerably low due to the relatively close distance to the sea, which limits herpetofauna species at the sites to disperse despite these animals being hard to find due to their indescribable habits.

Keywords: Herpetofauna, Delta Tumpat mangrove forest, Kelantan, Malaysia

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INTRODUCTION

The herpetofauna species plays a vital ecological role in our ecosystem. They are a vital element of an ecosystem, being the in-between consumers at the mid-level of the food web. They are also believed to be a reliable form of biological control as well as indicators of environmental health (Hammond *et al.*, 2015). The population of herpetofauna species are declining due to several anthropogenic factors such as development and forest landscape alteration. This population decline can be attributed to pollution, diseases, deforestation and habitat degradation (Doherty-Bone, 2008). Other than that, in Peninsular Malaysia, the increasing number of deforestations, logging and development has been alarming (Norhayati *et al.*, 2014). Furthermore, the increasing rate in development, especially along the estuarine, had worsened the habitat alteration for amphibians and reptiles (Gillespie *et al.*, 2005).

The tropical climate condition in Malaysia provides a suitable environment for amphibians and reptiles habitation. Currently, approximately 120 species of amphibians and about 270 reptile's species are recorded in Peninsular Malaysia (Norhayati *et al.*, 2010), and the number is increasing since the current description of the new species (Grismer, 2008; Grismer and Chan, 2010; Grismer *et al.*, 2017). The herpetofauna species can be found across the Malaysian landscape. Their habitats include the forest floor, subsoil and canopy layers of the tropical rain forest. They inhabit beaches and shallow seas as well as lowland areas such as paddy fields, towns, cities and villages (Grismer, 2011).

Generally, the Kelantan Delta contains an ecosystem of mangroves that contribute to social, economic and environmental enrichment (Hapizah, 2009). The mangrove ecosystem often houses diverse terrestrial and aquatic fauna species (Ashton *et al.*, 2005; Nagelkerken *et al.*, 2008). They provide protection, nurturing and breeding sites for many organisms such as shrimps, fishes, amphibians, reptiles and mammals, while at the same time providing living sustenance to the community of animals and plants. The environment has gained a lot of beneficial features due to the special characteristics of the mangrove ecosystem (Kasawani *et al.*, 2007). The objective of this survey is to identify the diversity of herpetofauna species at five main location sites within Delta Tumpat Mangrove Forest (DTMF). The findings of this study could be utilised for preservation and observation purposes while also serving as a reference to stakeholders in proposing guidelines for estuarine and shorelines development.

MATERIALS AND METHODS

Study Site

DTMF is the only delta in the state of Kelantan (06° 11" N to 06° 13" N; 102° 10" E to 102° 14" E) with an estimated of 48 islands in the area. Among the islands are Seratus Island, Pantai Kuda Island, Renjuna Island, Dolah Island, Beluru Island, Haji Nik Mat Island, and Suri Island, to name a few. The selection of islands in the DTMF was determined by the features of having the existence of river and human settlement. Five study areas were selected, namely Suri Island, Pantai Kuda Island, Renjuna Island, Haji Nik Mat Island and Beluru Island (Figure 1).



Figure 1 Map showing the location of sites at the Delta Tumpat Mangrove Forest, Kelantan (Google Earth, 2018)

Herpetofauna Species Collections

The survey was conducted from July to September 2017 (36 days). The amphibians and reptiles species were observed directly along the riverbank from a boat. The terrestrial survey was performed using active searching (0800 hours until 2200 hours) along the transect line in order to increase the chance of encountering specimens. The amphibians and reptiles species were captured by hand and sweep nets. The sampling was conducted from 2000 hours until 2400 hours with at least three collectors. Other than that, the pitfall traps (without drift fence), which is a passive sampling technique was employed along with active searching, as adapted from Nurulhuda *et al.* (2014). There were 33 pitfall traps made of painted buckets with the measurement of 44.28 cm deep and 26.00 cm in diameter buried at the same level with the surface of the semi-wet ground around the location of study. A total of six pitfall traps were located at Suri Island and Beluru Island respectively, while seven pitfall traps were at Pantai Kuda Island, Renjuna Island and Haji Nik Mat Island, respectively. The openings of pitfall traps were covered with leaves or other objects to keep out predators and prevent trapped animals from being overheated during the day and rain (Nurulhuda *et al.*, 2014). The traps were checked daily before noon during the sampling period.

Specimen Identification

The specimens were identified by referring to Ibrahim *et al.* (2009), Norhayati *et al.* (2005), Mattison (2014), and Indraneil (2010). High quality images of the collected specimens were captured using an Olympus digital camera with 10X optimum zoom (Shahriza *et al.*, 2011).

Data Analysis

PAST software (version 3.06) was used to calculate diversity measures, including the Shannon Diversity Index (H) and the Evenness Index (E).

RESULTS AND DISCUSSION

A total of 138 specimens from 11 species and 10 families consisting of amphibians and reptiles were recorded from five different locations along the DTMF (Table 1). A total of 75 reptiles representing eight species from seven families were recorded. From the observation, the two most dominant reptile species at DTMF were *Leiolepis belliana* (N=33, 23.91%) followed by *Varanus salvator* (N=16, 11.59%). Meanwhile, *Dendrelaphis pictus* and *Braghammerus reticulatus* were the least frequent recorded species.

A total of 63 amphibians representing three species from three families were recorded at five localities in DTMF. From the study, three most dominant amphibian species at DTMF were *Duttaphrynus melanostictus* (N=38, 27.54%) followed by *Kaloula pulchra* (N=13, 9.42%) and *Fejervarya cancrivora* (N=12, 8.70%). Renjuna Island shows the highest number of individuals recorded (N=38, 27.54%) followed by Haji Nik Mat Island (N=34, 24.64%) and Pantai Kuda Island (N=31, 22.46%). Meanwhile, the lowest number of individuals were recorded at Suri Island (N=10, 7.25%).

Figure 2 shows the diversity indices, which includes Shannon Diversity Index and Evenness Index used to compare the diversity and species richness of herpetofauna species at DTMF. Renjuna Island recorded the highest value of Shannon Diversity Index (H=1.734), followed by Beluru Island (H=1.678) and Haji Nik Mat Island (H=1.659). These values indicated that the three islands have a diverse species composition compared to other islands. In terms of species distribution, Suri Island shows the highest value of Evenness Index in comparison to other islands (E=0.991), followed by Beluru Island (E=0.862), Haji Nik Mat Island (E=0.852) and Renjuna Island (E=0.834). The high value of Evenness Index is a reliable indication that the species distribution in a particular area is distributed evenly.

The Shannon Diversity Index at Pantai Kuda Island (H=0.491) was the least of all the islands in consideration which also indicated low species richness. Of the 31 individuals found in this area, merely two species from one family of herpetofauna species were recorded. This was because Pantai Kuda Island is a vast and sandy area with fewer trees and shrubs to act as a refuge and a reliable food source for the fauna residing there. The Shannon Diversity Index for Renjuna Island is the highest (H=1.734) followed by Beluru Island (H=1.678), Haji Nik Mat Island (H=1.659) and Suri Island (H=1.089). These varying values of diversity may be due to the demographics (human settlement) found within the vicinity of the area and the fact that the location of study is located near to the river. The location of the river was situated at the Delta Tumpat, which near to the sea. Thus, the salinity content in the water is higher compared to the upstream river and similar to other estuarine at Peninsular Malaysia (Jalal *et al.*, 2012; Cheng-Ann *et al.*, 2012). The high salinity river is not a suitable habitat for most amphibian species since the river is hypertonic to the amphibians, which could cause death. Therefore, it inhibits the dispersion of amphibians and causes variation in diversity. The availability of shrubs and trees contributed to the presence of a variety of food sources and microhabitats for herpetofauna species to inhabit. The low values of diversity, on the other

hand, might be due to the effects of anthropogenic activities from the village's vibrant fishing activity which acts as their primary source of income.

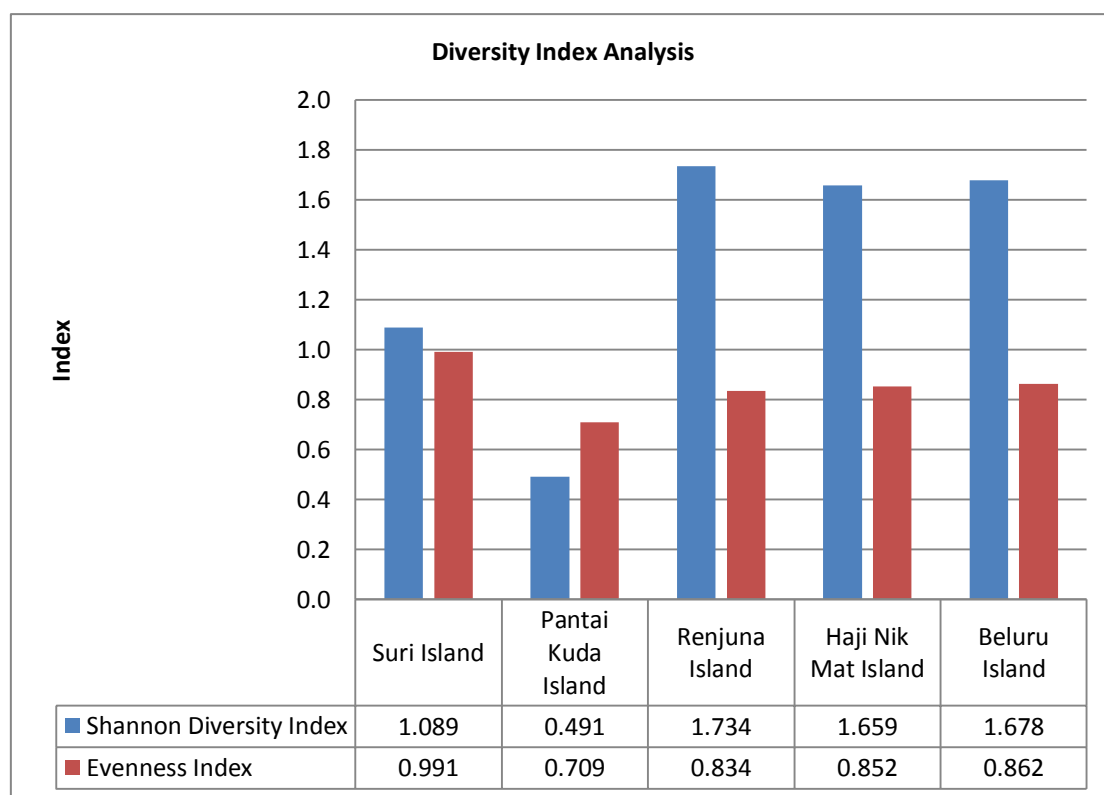


Figure 2 Shannon Diversity Index and Evenness Index at each sampling sites

This preliminary study recorded three species of amphibians and eight species of reptiles. This result is the first report on herpetofauna for the DTMF since no previous studies have been conducted in this area. From the results, the relatively low number of reptilians and amphibian species recorded in DTMF might be due to water salinity. Furthermore, this survey was conducted in a limited period. A more thorough and inclusive list of species under these two class of vertebrates can be collected if the survey was conducted for a prolonged period and broader study area.

Nevertheless, it is believed that the broad coverage of DTMF which encompasses of 1,200 ha of land has made it almost impossible for researchers to gather and record its entire species. Nazaruddin *et al.* (2013) indicated that there are approximately 48 islands in DTMF. Furthermore, the relatively short distance between the location of study and the sea as well as the elusive nature of these animals, particularly reptiles, are perceived to have limited the presence of herpetofauna species (Yap *et al.*, 2014). This is because such species are well-known for their ability to look for protection upon sensing a possible threat. Thus, the villages surrounding DTMF has made it possible for herpetofauna species and other wildlife species to seek refuge for reproduction and sustenance (Ibrahim *et al.*, 2008). The low number of herpetofauna species is also due to the limited survey area covered in our study. During the sampling process, the location sites were difficult to mark due to the presence of

many shrubs and small trees that grows in brackish water or coastal saline. Some areas were also a little bit muddy, inhibiting our movements.

In addition, the climatic factors are known to exert the most influence on the structure of species richness. According to Kamal *et al.* (1997), DTMF is open to strong waves, mostly during the annual monsoonal season (November to February). It must also be noted, that observation of reptiles and amphibians is dependent on chance and opportunistic sightings in their natural habitat, especially for reptilian species such as lizards and snakes. Compared with other wildlife groups such as birds and mammals, they can directly be observed and trapped (Ibrahim *et al.*, 2003).

In summary, Renjuna Island ($H=1.734$) has the highest value of the Shannon Diversity Index of all the study sites, followed by Beluru Island ($H=1.678$), Haji Nik Mat Island ($H=1.659$), Suri Island ($H=1.089$) and Pantai Kuda Island ($H=0.491$). In terms of species evenness, Suri Island ($E=0.991$) has the most even species composition among all the locations of interest, while Pantai Kuda Island ($E=0.709$) is the least even. In terms of species composition, Renjuna Island has the highest species richness followed by Haji Nik Mat Island and Beluru Island, Suri Island and Pantai Kuda Island. The result from this survey indicated that the herpetofauna diversity in DTMF is still a large frontier to be explored in terms of the distribution of herpetofauna species at all unexplored sites in DTMF at different seasons. For future research, it is recommended to increase time and area of sampling to fully cover the species inhabiting DTMF for documentation and conservation purposes. Besides that, a rigorous study should be performed on the practicality of methods used in the research pitfall traps should also be increased in number and improved with drift fences to increase chances of trapping a specimen. In summary, as a necessary step in conservation preparation, survey or checklists' data are vital so that people and authorities are conscious of the diversity existing in the area. This will also help support better management and conservation of the ecosystem with viable benchmark data.

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Table 1 Species composition of amphibians and reptiles recorded at five localities of DTMF

No.	Class Family Species	Island					Total	Relative Abundance (%)
		Suri	Pantai Kuda	Renjuna	Haji Nik Mat	Beluru		
Amphibia								
	Bufonidae							
1.	<i>Duttaphrynus melanostictus</i>	-	-	15	13	10	38	27.54
	Dicroglossidae							
2.	<i>Fejervarya cancrivora</i>	-	-	6	4	2	12	8.70
	Microhylidae							
3.	<i>Kaloula pulchra</i>	4	-	4	3	2	13	9.42
Reptilia								
	Agamidae							
4.	<i>Calotes versicolor</i>	3		3		3	9	6.52
	Gekkonidae							
5.	<i>Gekko monarchus</i>			2	1	1	4	2.90
	Liuolepididae							
6.	<i>Leiolepis belliana</i>		25		8		33	23.91
7.	<i>Leiolepis triploida</i>		6				6	4.35
	Scincidae							
8.	<i>Eutropis longicaudata</i>				3	2	5	3.62
	Varanidae							
9.	<i>Varanus salvator</i>	3		6	2	5	16	11.59
	Colubridae							
10.	<i>Dendrelaphis pictus</i>			1			1	0.72
	Phytonidae							
11.	<i>Broghammerus reticulatus</i>			1			1	0.72
	No. of Individual	10	31	38	34	25	138	
	No. of Species	3	2	8	7	7	11	
	No. of Family	2	1	8	7	7	10	
	Relative Abundance (%)	7.25	22.46	27.54	24.64	18.12	100	

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