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Amphibians and Reptiles Survey at Tasik Pergau, Jeli, Kelantan and Its Updated Checklist

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Abstract. A survey of amphibians and reptiles at Tasik Pergau, Kelantan was conducted from 30 until 31 October 2019 and 22 until 23 November 2019. Four sampling locations were surveyed, namely Long 1 & 2, Suda, Renyok, and Terang intake. The study was conducted using the Visual Encounter Survey method, an active sampling technique that is efficient for short observations. A total of 164 individuals were recorded which comprised of six amphibian families and six reptiles families. The amphibian families recorded are Bufonidae, Dicroglossidae, Megophryidae, Microhylidae, Ranidae and Rhacophoridae. A total of 19 amphibian species and eight reptile species were recorded during the sampling period. In addition, this study has recorded about 12 new records of amphibians and reptiles in Pergau area. These species are *Limnonectes dionodon*, *L. malesianus*, *L. plicatellus*, *Megophrys nasuta*, *Hylarana erythraea*, *H. signata*, *Polypedates discantus*, *Calotes emma*, *Cyrtodactylus pulchellus*, *Eutropis macularia*, *Ahaetulla prasina* and *Xenochrophis trianguligerus*, adding up to the total number of amphibians and reptiles to 42 species. Further studies need to be conducted intensive and extensively to obtain more information regarding amphibians and reptiles in Pergau area.

1. Introduction

Water catchment area is a protected area that functions to irrigate a dam. Water catchment areas which are located closely to the manmade lakes are generally protected from any development activities, to avoid negative effects, such as sedimentation and water runoff that adversely causes massive flood at the surrounding area. This catchment do not only serves to channel rainwater into the lake, but also acts as a source of sustenance such as forest products, food, and drinking water sources to humans [1,2,3,4]. It is also a major habitat for most wildlife species, such as mammals, birds, amphibians, and reptiles [5]. Therefore, the ecosystems involved in the catchment area are very important to sustain the life and survival of wildlife, especially amphibians and reptiles.



Amphibians and reptiles are highly sensitive to environmental changes [6]. This group of animals are highly dependent on microhabitat factors which serve as the key to their survival and distribution. This group of animals is susceptible to micro-changes, such as temperature, humidity, and rainfall [7]. Any significant change could wipe out their entire community. A major threat to the extinction of the amphibians and reptiles is deforestation [8]. This human activity will lead to forest depletion which will eventually causes drastic changes in the micro-climate of an area, contributing to species extinction

Therefore, conservation efforts must be undertaken to save the habitat from being destroyed. These efforts are not just one-sided, but various agencies need to play their role in defending the habitats. Stakeholders, such as the state government, forestry departments and land offices need to support conservation efforts [9]. Gazetting the areas around the catchment area as a wildlife sanctuary is one of the efforts to protect wildlife from extinction. Such efforts will enable wildlife to survive and multiply in protected areas. Through this reporting, conservation efforts can be made more systematically and effectively.

Tasik Pergau is a manmade ecosystem that were formed resulted to the construction of the Sultan Ismail Petra Hydroelectric Power Station in 1995. It is located in the heart of Gunung Basor Forest Reserve, Jeli district, Kelantan. The Pergau dam is managed by Tenaga Nasional Berhad. There were two previous study conducted at this area. The first study was conducted by Hassan [10] at the upper Pergau. This study concluded 13 species of herpetofauna, comprised of nine amphibian species and four reptile species. However, the study was conducted before the dam construction. The second study was conducted by Muin *et al.* [11] in 2012, which recorded about 28 species of herpetofauna. Overall, they had recorded seven species of lizards, two species of skinks, 15 species of frogs, two species of tortoises and five species of snakes. Since that, there is no single herpetofauna study exists in the area. The diversity changes of amphibians and reptiles at this catchment area remain doubtful. Therefore, the objectives of this study are to investigate the species present at the intake area of Pergau and to update species checklist of amphibians and reptile at Pergau, Kelantan.

2. Materials and Methods

2.1 Site Study

The study was conducted at four water intakes at Pergau, namely Long 1 & 2, Suda, Terang and Renyok (Table 1) (Figure 1). All locations are located in Gunung Basor Forest Reserve and is under the jurisdiction of Kelantan Forest Department. This study was conducted from 30 until 31 October 2019 and 22 until 23 November 2019. The sampling areas are dominated by pristine forest, a suitable habitat for most wildlife species, such as barking deer, wild boar, clouded leopard, elephant and tiger.

Table 1. Coordinate of the sampling areas.

| Intake | Coordinate | |
|------------|------------|-------------|
| | North | East |
| Long 1 & 2 | 5.599871° | 101.729852° |
| Suda | 5.437745° | 101.800248° |
| Terang | 5.443714° | 101.802064° |
| Renyok | 5.551196° | 101.76928° |

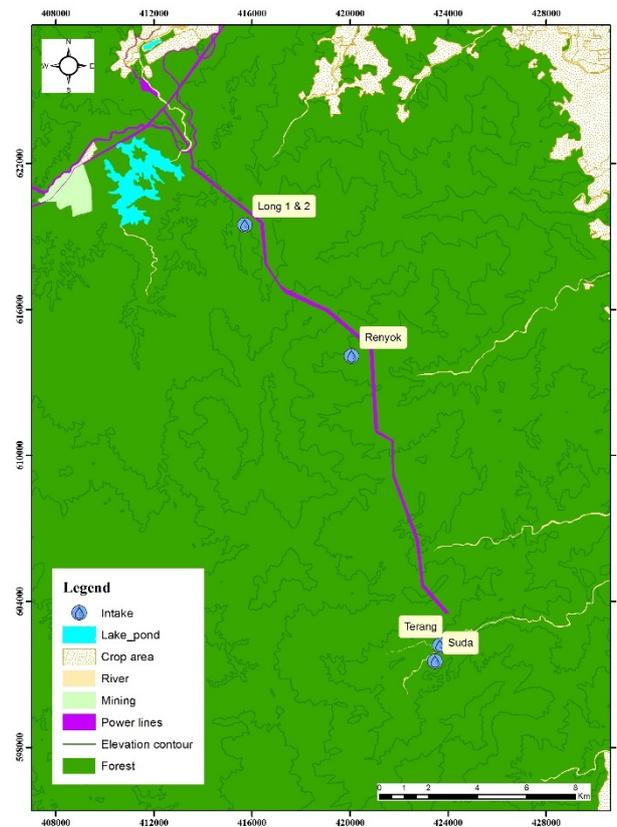


Figure 1. The sampling locations at Pergau, Kelantan

2.2 Sampling Method

The visual encounter survey technique was used since this method is a very useful and practical technique for rapid assessment. Observations were also conducted during the daytime for diurnal species. Specimens were caught by active sampling using bare hands based on visual and audio cues. Measurements of the specimens were measured using a Mitutoyo digimatic calliper to the nearest 0.1 mm. The physical parameters measured are snout-vent length (SVL), measured from the tip of the snout to the tip of the vent and tibia length (TL) and tail (T) for reptiles. At most, two voucher specimens were euthanized with tricaine (ethyl 3-aminobenzoate methanesulfonate salt), fixed in 10% formalin and transferred to 70% alcohol for storage. Colour photographs were taken, and muscle tissues were extracted and stored in 95% ethanol prior to preservation. Taxonomic nomenclature follows [12] for amphibian and [13] lizards and geckos. All specimens were deposited at the Kolej GENIUS Insan (KGI) zoological collection.

3. Result

A total of 164 individuals were recorded (Table 2), comprised of six families of amphibian and six families of reptiles. The amphibian families recorded are Bufonidae, Dicroglossidae, Megophryidae, Microhylidae, Ranidae and Rhacophoridae. For reptiles, the families recorded are Agamidae, Gekkonidae, Colubridae, Scincidae, Trionychidae and Varanidae. Overall, a total of 19 species of amphibians and eight species of reptiles were recorded during the sampling period.

The highest number of individual recorded for amphibians are *Microhyla heymonsi* (n=28), followed by *Rhacophorus prominanus* (n=23) and *Roarchestes parvulus* (n=20). Meanwhile, for reptilian class, the highest number of individuals recorded are *Cyrtodactylus pulchellus* and *Eutropis multifasciata* (n=5). *Calotes emma*, *Xenochorphis trianguligerus* and *Varanus salvator* are the species with lowest represented individual (n=1).

Table 2. Species composition of amphibians and reptiles at Pergau, Kelantan

| No. | Family | Species | IUCN Redlist | WCA 2010 | Intake | | | Total | |
|-------------------------|-----------------------|------------------------------------|--------------|----------|------------|-----------|-----------|-----------|------------|
| | | | | | Long 1 & 2 | Suda | Terang | | Renyok |
| AMPHIBIA | | | | | | | | | |
| 1 | Bufonidae | <i>Phrynoidis asper</i> | LC | | | 1 | | 1 | |
| 2 | | <i>Ingerophrynus parvus</i> | LC | | 4 | 3 | | 7 | |
| 3 | Dicroglossidae | <i>Fejervarya limnocharis</i> | LC | | 3 | | 4 | 5 | |
| 4 | | <i>Limnonectes blythii</i> | NT | P | 2 | | 6 | 8 | |
| 5 | | <i>Limnonectes deinodon</i> | DD | | 3 | 7 | | 10 | |
| 6 | | <i>Limnonectes kuhlii</i> | LC | | | | 6 | 6 | |
| 7 | | <i>Limnonectes malesianus</i> | NT | P | | | 1 | 1 | |
| 8 | | <i>Limnonectes plicatellus</i> | LC | | | 5 | | 5 | |
| 9 | Megophryidae | <i>Megophrys nasuta</i> | LC | P | 1 | | | 1 | |
| 10 | Microhylidae | <i>Microhyla heymonsi</i> | LC | | | 7 | 8 | 9 | |
| 11 | Ranidae | <i>Amolops larutensis</i> | LC | P | | 6 | 1 | 7 | |
| 12 | | <i>Hylarana erythraea</i> | LC | P | | | | 3 | |
| 13 | | <i>Hylarana raniceps</i> | LC | P | 1 | | 2 | 3 | |
| 14 | | <i>Hylarana signata</i> | LC | | | 2 | | 2 | |
| 15 | | <i>Odorrana hosii</i> | LC | P | 1 | | | 1 | |
| 16 | Rhacophoridae | <i>Zhangixalus prominanus</i> | LC | P | 5 | 10 | | 8 | |
| 17 | | <i>Polypedates discantus</i> | NA | | 3 | 1 | | 2 | |
| 18 | | <i>Polypedates leucomystax</i> | LC | | 2 | | 2 | 1 | |
| 19 | | <i>Roarchestes parvulus</i> | LC | | | | 12 | 8 | |
| REPTILE | | | | | | | | | |
| 20 | Agamidae | <i>Calotes emma</i> | NA | P | | | 1 | 1 | |
| 21 | Gekkonidae | <i>Cyrtodactylus pulchellus</i> | EN | P | 1 | 4 | | 5 | |
| 22 | Colubridae | <i>Ahaetulla prasina</i> | LC | P | 1 | | | 1 | |
| 23 | | <i>Xenochrophis trianguligerus</i> | LC | | | 1 | | 1 | |
| 24 | Scincidae | <i>Eutropis macularia</i> | NA | | 2 | | | 2 | |
| 25 | | <i>Eutropis multifasciata</i> | LC | | 3 | | 2 | 5 | |
| 26 | Trionychidae | <i>Dogania subplana</i> | LC | P | | | | 2 | |
| 27 | Varanidae | <i>Varanus salvator</i> | LC | P | 1 | | | 1 | |
| Total Family | | | | | 9 | 7 | 6 | 6 | 12 |
| Total Species | | | | | 15 | 11 | 11 | 9 | 27 |
| Total Individual | | | | | 33 | 47 | 45 | 39 | 164 |

Note: LC=Least Concern, NA= Not Available, DD= Data Deficient, EN= Endangered, NT=Near Threatened, WCA 2010= Wildlife Conservation Act 2010, P= Protected

Long 1 & 2 intake recorded the highest number of species (N=15) followed by Suda and Terang (N=11), while Renyok recorded the lowest number of species (N=9). In terms of abundance, Suda intake has the highest number of individuals recorded (n=47), followed by Terang (n= 45) and Renyok (n=39).

All of the amphibian species recorded were listed either as Least Concern or Near Threatened on the conservation status in the IUCN Redlist. However, two species were listed under Near Threatened status, namely *Limnonectes blythii* and *L. malesianus*. Eight species of amphibian were listed under Table Two (Protected) of The Wildlife Conservation Act 2010. The species are *L. blythii*, *L. malesianus*, *Megophrys nasuta*, *Amolops larutensis*, *Hylarana erythraea*, *H. raniceps*, *Odorrana hosii* and *Zhangixalus prominanus*. *Cyrtodactylus pulchellus* is the only species listed as Endangered in the IUCN Redlist while other species were listed as Least Concern and Not Available. In the Wildlife Conservation Act 2010, five species of reptiles were listed under Table Two (Protected), namely *Calotes emma*, *Cyrtodactylus pulchellus*, *Ahaetulla prasina*, *Dogania subplana* and *Varanus salvator*.

In comparison to the previous study conducted by Muin *et al.* [11], this study had recorded 12 new records of herpetofauna at Pergau area. The species were *L. dionodon*, *L. malesianus*, *L. plicatellus*, *M. nasuta*, *H. erythraea*, *H. signata*, *P. discantus*, *C.s emma*, *C. pulchellus*, *E. macularia*, *A. prasina* and *X. trianguligerus* (Table 3). Thus, this species list adds up the number of amphibians and reptiles to 42 species. Table 2 shows species composition of amphibian and reptile at Pergau, Kelantan and Table 3 shows comparison of species checklist with previous study.

Table 3. Comparison of species checklist with previous study

| No. | Family | Species | This Study | Muin <i>et al.</i> [11] |
|-----------------|-----------------------|---------------------------------|------------|-------------------------|
| AMPHIBIA | | | | |
| 1 | Bufonidae | <i>Phrynoidis asper</i> | / | / |
| 2 | | <i>Ingerophrynus parvus</i> | / | / |
| 3 | Dicroglossidae | <i>Fejervarya limnocharis</i> | / | / |
| 4 | | <i>Limnonectes blythii</i> | / | / |
| 5 | | <i>Limnonectes deinodon</i> | / | |
| 6 | | <i>Limnonectes kuhlii</i> | / | / |
| 7 | | <i>Limnonectes laticeps</i> | | / |
| 8 | | <i>Limnonectes malesianus</i> | / | |
| 9 | | <i>Limnonectes plicatellus</i> | / | |
| 10 | Megophryidae | <i>Megophrys nasuta</i> | / | |
| 11 | | <i>Leptolalax heteropus</i> | | / |
| 12 | Microhylidae | <i>Microhyla heymonsi</i> | / | / |
| 13 | | <i>Microhyla butleri</i> | | / |
| 14 | Ranidae | <i>Amolops larutensis</i> | / | / |
| 15 | | <i>Hylarana erythraea</i> | / | |
| 16 | | <i>Hylarana raniceps</i> | / | / |
| 17 | | <i>Hylarana signata</i> | / | |
| 18 | | <i>Odorrana hosii</i> | / | / |
| 19 | Rhacophoridae | <i>Zhangixalus prominanus</i> | / | / |
| 20 | | <i>Polypedates discantus</i> | / | |
| 21 | | <i>Polypedates leucomystax</i> | / | / |
| 22 | | <i>Roarchestes parvulus</i> | / | / |
| REPTILE | | | | |
| Lizard | | | | |
| 23 | Agamidae | <i>Aphaniotis fusca</i> | | / |
| 24 | | <i>Calotes emma</i> | / | |
| 25 | | <i>Calotes versicolor</i> | | / |
| 26 | | <i>Draco sumatranus</i> | | / |
| 27 | | <i>Draco cristatellus</i> | | / |
| 28 | | <i>Gonocephalus grandis</i> | | / |
| 29 | Gekkonidae | <i>Cyrtodactylus pulchellus</i> | / | |
| 30 | Scincidae | <i>Eutropis macularia</i> | / | |
| 31 | | <i>Eutropis multifasciata</i> | / | |
| 32 | | <i>Eutropis rugifera</i> | | / |
| 33 | Varanidae | <i>Varanus salvator</i> | / | / |
| Snake | | | | |
| 34 | Colubridae | <i>Ahaetulla prasina</i> | / | |
| 35 | | <i>Boiga dendrophilla</i> | | / |

| No. | Family | Species | This Study | Muin <i>et al.</i> [11] |
|-----|---------------------|------------------------------------|------------|-------------------------|
| 36 | | <i>Boiga drapiezii</i> | | / |
| 37 | | <i>Lycodon effraenis</i> | | / |
| 38 | | <i>Xenochrophis trianguligerus</i> | / | |
| 39 | Elapidae | <i>Bungarus candidus</i> | | / |
| 40 | Viperidae | <i>Tropidolaemus wagleri</i> | | / |
| | | Tortoises | | |
| 41 | Trionychidae | <i>Dogania subplana</i> | / | / |
| 42 | Testudinidae | <i>Manouria emys</i> | | / |
| | | No. of Species | 27 | 29 |
| | | Number of Family | 12 | 14 |

4. Discussion

The total number of individuals recorded during the sampling period indicates that this sampling area has suitable habitat for amphibians and reptiles. In addition, this sampling was carried out in the early monsoon season which promotes most of the species came out from their hiding places [14]. Habitat heterogeneity and diverse habitat niches also indicate high diversity of amphibian and reptile species [15]. Different altitudes as low as 60 meters from sea level to a height of 1097 meters above sea level promote various species assemblages. It is known that each amphibian species prefers their own altitude to inhabit. In addition, a large number of searching hours during night times explain many nocturnal species recorded in the areas [16]. This is because, nocturnal animals will become active at night, in which they will come out from their hiding place to find food and mate.

Microhyla heymonsi is a species that lives congregated near puddles. Its strong calling sound despite their small size makes it difficult to be encountered individually, but it is easy to spot. Similarly, *R. parvulus* is a small tree frog that can produce loud calling sound [17]. This frog can be recognised easily based on altitude, in which they live at 600 meters above sea level and in bushy areas. High numbers of *C. pulchellus* were recorded in the sampling areas as they are nocturnal species that are active at night. This species can be found easily in rocky areas and culverts [18]. They prey on insects that come near to them. The open environment in the sampling area, especially alongside the road, is an excellent habitat for *Eutropis multifasciatus*. This species can be often found basking under the sun at the roadside.

Long 1 & 2 sampling area recorded the highest number of species. This area had varieties of habitats, such as open and grassy, swampy, shallow rivers, and small streams that are suitable for many species of amphibians and reptiles. At the same time, riparian vegetation also plays an important role [19]. For this reason, the dense riparian vegetation provides a safe haven for amphibians and reptiles. Renyok sampling areas are different because most areas in Renyok are open and grassy, as well as sloppy landscapes, thus contributing to smaller number of species recorded.

In general, not many species of amphibians and reptiles are classified as endangered (Endangered - Extinct) in the IUCN Red List. However, there are some species listed in this list. Two species of amphibians are classified in the Near-Threatened group, namely *L. blythii* and *L. malesianus*. These species are popularly hunted for economic value reason [20]. These species are a source of food, which are high in demand in many exotic food restaurants. Whereas, *C. pulchellus* is classified under the Endangered group and is a popular species to be sought for the purpose of pet collections [21]. The beautiful yellow and black stripes make it highly in demand in the black market. In addition, deforestation for the purpose of opening agricultural areas, development and construction of residential areas has made the species' habitat completely destroyed.

In comparison to the previous studies, this sampling has successfully listed 12 new records in the list of amphibians and reptiles in Pergau, thus reflecting the Pergau area in Gunung Basor Forest Reserve is still well preserved.

During this sampling, some observational findings of other living species were also found. These species were also observed during amphibian and reptile survey. A total of nine species were observed and recorded, which comprised of birds and mammals' group (Table 4).

Table 4. Other animal observed during study.

| No. | Species | Common Name |
|----------------|----------------------------|---------------------|
| Mammals | | |
| 1 | <i>Coun alpinus</i> | Dhole |
| 2 | <i>Macaca nemestrina</i> | pig-tailed macaque |
| 3 | <i>Macaca fascicularis</i> | Long-tailed macaque |
| 4 | <i>Muntiacus muntjak</i> | Barking deer |
| 5 | <i>Panthera pardus</i> | Leopard |
| 6 | <i>Sus scrofa</i> | Wild boar |
| Birds | | |
| 7 | <i>Tyto alba</i> | Barn owl |
| 8 | <i>Gallus gallus</i> | Junglefowl |
| 9 | <i>Centropus sinensis</i> | greater coucal |

5. Conclusion

In conclusion, the surrounding area of Tasik Pergau is believed to house more species of amphibians and reptiles that have not yet been recorded. The protected environment allows this area to be an ideal habitat for wildlife, especially amphibians and reptiles. Therefore, this area is very suitable to be gazetted as wildlife protected area. Further studies need to be conducted intensive and extensively to allow more discoveries of amphibians and reptiles in Pergau area.

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