

# Herpetofauna of Yao Islands, Phang-nga Province, Southern Thailand: A list of species and habitat notes

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## ABSTRACT

Southern Thailand is part of a biodiversity hotspot. Yao Islands are located on Phang-nga Bay, Phang-nga Province next to Andaman Sea which is known as a famous place for eco-tourism for last couple decades. The conscientiously study of biodiversity on Yao Islands hasn't been done for more than 10 years. This study reported the inventory of herpetofauna from the rapid survey conducted from 4 to 8 April 2021. It was performed by strip transect and visual encounter survey. Five trails of local protected and agricultural areas where various habitats occurred were chosen. Thirty-two species of amphibians and reptiles from chosen trails and nearby areas were found, consisting of one species of caecilian, eighteen species of anurans, seven species of lizards, five species of snakes, and one species of turtle. The occurrence of one Critically Endangered species and 2 Near Threatened species (IUCN Red list) showed the efficiency of the local protected area and the potential of these Islands to be a biodiversity and genetic reservoir. This study is shedding light on herpetofauna diversity in islands of southern Thailand.

**Keywords:** amphibians, diversity, molecular identification, reptiles, southern Thailand.

## INTRODUCTION

An island is an isolated area which supports the uniqueness of evolution (Losos and Ricklefs, 2009). Due to high endemism, the fluctuation of Islands' biodiversity is able to affect regional and global biodiversity (Wilmé *et al.*, 2006; Whittaker *et al.*, 2007; Kier *et al.*, 2009; Condamine *et al.*, 2017; Veron *et al.*, 2019). The studies of islands' biodiversity is not only important to evaluate global stability, but also the distribution patterns and evolutionary processes can also be used as evidence of biogeography and plate tectonics, particularly for terrestrial and freshwater organisms (Myers *et al.*, 2000; Ricklefs, 2004; Ribeiro, 2006; McPeck, 2008; Olden *et al.*, 2010; Medina *et al.*, 2015; Hutama *et al.*, 2016). Amphibian and reptile dispersions are limited by fragmented terrestrial landscapes, thus herpetofauna diversity data can be of island origin and movement evidence. Moreover, amphibians and reptiles' habitat requirements are both in terrestrial and aquatic environments. Their high sensitivity makes them reliable ecosystem health bio-indicators of physical, chemical, landscape, and climate, which rapidly changes, particularly in the Anthropocene (Izam *et al.*, 2019; Izam *et al.*, 2021).

Yao Islands cover an area of approximately 137.6 km<sup>2</sup> (N7.87167 to N8.20054 and E98.49125 to E98.65761) which is comprised of 2 main islands, Yao Noi and Yao Yai. Yao Islands are a part of southern Thailand, located east of Phuket Island in Phang-nga Bay and next to the Andaman Sea. These Islands contain rich of natural resources and a variety of environments such as beaches, waterfalls, evergreen forests, and mangrove forests (Marine and Coastal Resources Research & Development Institute, 2016). In the last couple decades, Yao Islands have become famous for eco-tourism directed by the Community Based Eco-Tourism Club in the community (Wichupankul, 2006). Therefore, the provision of Yao Islands' biodiversity information, especially on herpetofauna, can reflect the islands' history, environmental health and the effect of environmental change by tourism growth. Take these into accounts this study subjects to examine species diversity and habitats of amphibians and reptiles in Yao Islands by rapids visual encounter surveys.

## METHODS AND MATERIALS

The field sites were at Yao Noi and Yao Yai Island and samples of amphibian and reptiles were collected between 4 – 8 April 2021 by visual encounter survey and strip transect methods. Five trails near water sources were selected in this study as indicated in the following description.

Yao Noi Island RSPG's local protected area (Yao Noi): there was evergreen forest and mostly rubber plantations on sloped ground, and a small coastal area. A small trickle stream (1–3 m. wide) was the water source passing through this site and occasionally flowing into a basin form such as swamps in some areas. Ban Nai Wang Reservoir Chong Laad RSPG's local protected area (Ban Nai Wang); the trail started at Ban Nai Wang reservoir which

surrounded by a local gravel road along with a palm plantation and secondary forest, then it converges with the stream. The width of stream was around 5–10 m. with clear water and low velocity passing rocky areas and forming intermittent water basins. Evergreen forest was the main habitat along the stream site and occasionally confounded with bamboo. A paddle field near Mad Rha canal (Mad Rha); rice crop in the field was already harvested in April and became a swamp area covered with grass and vines with some shrubs and trees on a soil ridge. Cape Beach Phru Nai and Kuan Chong Ting forest (Phru Nai): Cape Beach Phru Nai is quite an open estuary area with coastal beach and mangrove. Kuan Chong Ting forest was a steep hill of rubber plantation and secondary forest, there was numerous ponds made by local people and the opposite side was a swamp in an old paddle field. Hin Gong Waterfall (Hin Gong): Hin Gong Waterfall was a small rocky waterfall with 1–3 m in both width and height with clear water, low velocity, and a steep bank. The area was covered by evergreen forest and mostly rubber plantations.

The surveys were conducted twice in each area, first at night and repeated afterwards in daytime. Selected specimens were sacrificed by 3% benzocaine and fixed by 70% ethanol or 10% buffered formalin prior to preserve in 70% ethanol and voucher specimens were kept at Thailand Natural History Museum (THNHM), Museum of Natural History Chulalongkorn University (CUMZ) and Thai Island and Sea Natural History Museum.

Ambiguous or unidentified specimens were identified by molecular technique. Total DNA from samples of two caecilians, five mangrove frogs and one sample each species of noisy frog, rugose frog, large-headed frog, rice field frog, red-bellied annulate keelback, dog-faced water snake and lizard in the genus *Lygosoma* were extracted from tissue samples using G-spin™ Total DNA Extraction Kit. Mitochondrial 16s ribosomal RNA gene was PCR amplified with the 2 primer pairs which were F51 5'-CCCGCCTGTTTACCAAAAA-CAT-3' and R51 5'-GGTCTGAACTCAGATCACGTA-3' (Sumida et al. 2002) used in all amphibians and 2 snakes and 16sar-L 5'-CGCCTGTTTATCAAAAACAT-3' and 16sbr-H 5'-CCGGTCTGAACTCAGATCACGT-3' (Palumbi et al. 1991) used with *Lygosoma* sp. The PCR amplifications were performed in a reaction mixture of 25 µL containing 2 µL of genomic DNA (50 ng/µL), 1 µL of each primer (10 mM), 12.5 µL of 2x-PCR Master Solution (i-Taq) and 8.5 µL of distill water. The amplifications were conducted in a thermal cycler (SimpliAmp™ Thermal Cycler) with the following conditions: 94 °C for 4 min then 35 cycles of 94 °C for 1 min, 55 °C for 1 min and 72 °C for 1 min followed by 72 °C for 10 min then store at 20 °C for primer RF51 and R51 and 95 °C for 2 min then 40 cycles of 95 °C for 30 s, 50 °C for 30 s and 72 °C for 1.15 min followed by 72 °C for 5 min, 20 °C for 1 min then store at 4°C for primer for primer 16sar-L and 16sbr-H. Thereafter the PCR products were visualized and checked for expected size (ca. 600 bp) under transillumination after a core solution with a DNA ladder (thermoscientific GeneRuler 100 bp Plus DNA Ladder) through 1% (w/v) agarose gel- electrophoresis (1st Base Agarose Biotechnology Grade)

and staining with MaestroSafe™ Prestained Stains. The PCR amplicons were sent to be purified prior to commercial sequencing with an Applied Biosystems ABI 3730XL DNA Analyzer (sanger method) at BIONICS (Republic of Korea) using both forward and reverse for each primer. The obtained sequences were verified by comparison with other annotated sequences available in the GenBank database using the BLASTn algorithm, and aligned by Muscle in the MEGA-X program.

## SYSTEMATICS ACCOUNT

There are thirty two species of amphibians and reptiles were found during field surveys, nineteen species were amphibians and thirteen species were reptiles.

### **Class Amphibia**

### **Oder Gymnophiona**

#### **Ichthyophiidae**

##### ***Ichthyophis supachaii* Taylor, 1960**

Supachai's caecilians were found on the ground near streams both on Yao Noi and at Hin Gong Waterfall.

Voucher specimens: Three specimens were collected consist of THNHM 29883-84 and CUMZ 8271.

### **Order: Anura**

#### **Bufonidae**

##### ***Ingerophrynus parvus* (Boulenger, 1887)**

Indochinese dwarf toads were found around Ban Nai Wang reservoir bank and on the gravel road to the reservoir.

Voucher specimens: Fourteen specimens were collected consist of THNHM 29843-44 and CUMZ 8286-97.

##### ***Duttaphrynus melanostictus* (Schneider, 1799)**

Black-spined toads were found on the ground or under leaf litter in plantation areas, paddle fields and in the forest.

Voucher specimens: Eight specimens were collected consist of THNHM 29842, THNHM 29875, CUMZ 8282-85 and CUMZ 8244-45.

#### **Microhylidae**

##### ***Kaloula pulchra* Gray, 1831**

Banded bullfrogs lived in various habitats, from the ground to tree trunks and were found in the villages to the forests (every study site except Hin Gong Waterfall). Notice that banded bullfrogs exploded in numbers for breeding in paddle field swamp after heavy rain.

Voucher specimens: Eight specimens were collected consist of THNHM 29825, THNHM 29846, THNHM 29874, CUMZ 8279-81 and CUMZ 8336-37.

***Micryletta inornata* (Boulenger, 1890)**

Inornate froglet was found at a water source in a rubber plantation on Yao Noi Island.

Voucher specimens: One specimen were collected consist of CUMZ 8375.

***Microhyla butleri* Boulenger, 1900**

Noisy frogs were found alongside the water sources in rubber plantations on Yao Noi Island.

High variation of noisy frogs' dorsal patterns was noticed.

Voucher specimens: Seven specimens were collected consist of CUMZ 8247-53.

***Microhyla mukhlesuri* Hasan, Islam, Kuramoto, Kurabayashi, and Sumida, 2014**

Mukhlesur's narrow-mouthed frogs lived interspecifically with noisy frogs on Yao Noi Island. However, on Yao Yai Island Mukhlesur's narrow-mouthed frogs normally were found around swamps, especially in paddle fields.

Voucher specimens: Twenty six specimens were collected consist of THNHM 29854-56, THNHM 29877-78, CUMZ 8263-66, CUMZ 8314-15, CUMZ 8346-53 and CUMZ 8367-73.

***Microhyla heymonsi* Vogt, 1911**

Dark-sided chorus frog lived in the leaf litter along the gravel road of Yao Noi trail.

Voucher specimens: One specimen were collected consist of THNHM 29836.

**Dicroglossidae**

***Phrynoglossus martensii* Peters, 1867**

Marten's puddle frogs were found at water sources in rubber plantations on Yao Noi Island

Voucher specimens: Six specimens were collected consist of THNHM 29831-35 and CUMZ 8270.

***Hoplobatrachus rugulosus* (Wiegmann, 1834)**

Rugose frog was found, only one individual, at Klong Mad Rha paddle field.

Voucher specimens: One specimen were collected consist of THNHM 29882.

***Limnonectes hascheana* (Stoliczka, 1870)**

Adult and froglet Stoliczka's frogs were found around a tiered stream on Yao Noi Island and lived in the leaf litter near the stream at Ban Nai Wang Trail and Hin Gong Waterfall.

Voucher specimens: Five specimens were collected consist of THNHM 29853, THNHM

29886, CUMZ 8268-69 and CUMZ 8374.

***Limnonectes blythii* (Boulenger, 1920)**

Variable sizes of Malayan giant frogs were found near the stream within the Chong Laad RSPG's local protected area.

Voucher specimens: Twenty specimens were collected consist of THNHM 29861-65 and CUMZ 8299-313.

***Limnonectes macrognathus* (Boulenger, 1917)**

Large-headed frogs were often found close to water sources, especially in sloped areas (Chong Laad RSPG's local protected area, Hin Gong Waterfall and Kuan Chong Ting Forest). Adult males were only caught at Hin Gong Waterfall.

Voucher specimens: Four specimens were collected consist of THNHM 29885, CUMZ 8267 and CUMZ 8355-56.

***Limnonectes* sp.**

One adult and one juvenile were found in Klong Mad Rha paddle fields.

Voucher specimens: Two specimens were collected consist of THNHM 29888 and 29890.

***Fejervarya limnocharis* (Gravenhorst, 1829)**

Rice field frogs were found on every trail except Hin Gong Waterfall but were common in plain areas.

Voucher specimens: Twenty three specimens were collected consist of THNHM 29847-52, THNHM 29876, CUMZ 8277-78, CUMZ 8325-31 and CUMZ 8357-63.

***Fejervarya moodiei* (Taylor, 1920)**

Adults and sub-adults of mangrove frogs were found in coastal areas of Phru Nai Cape Beach, and also distributed in the Klong Mad Rha paddle fields overlapping with the rugose frog and rice field frog.

Voucher specimens: Six specimens were collected consist of THNHM 29889, 29891-92, CUMZ 8334-35 and CUMZ 8354.

**Ranidae**

***Chalcorana eschatia* (Inger, Stuart & Eskandar, 2009)**

White-lipped frogs were found mostly above ground on tree branches or on the rocks at streams up to Ban Nai Wang reservoir.

Voucher specimens: Nine specimens were collected consist of THNHM 29858-60 and CUMZ 8316-21.

***Hylarana erythraea* (Schlegel, 1837)**

Green-backed frogs were found mostly on the pond bank at Yao Noi, Ban Nai Wang and Mad Rha.

Voucher specimens: Thirteen specimens were collected consist of THNHM 29826, THNHM 29845, THNHM 29869-73 and CUMZ 8338-43.

**Rhacophoridae*****Polypedates leucomystax* (Gravenhorst, 1829)**

Common tree frogs were found on the trees on every trail except Hin Gong Waterfall.

Voucher specimens: Eighteen specimens were collected consist of THNHM 29827-30, THNHM 29857, CUMZ 8272-76, CUMZ 8322-24, CUMZ 8332-33 and CUMZ 8364-66.

**Order Reptilia****Suborder Suaria****Gekkonidae*****Gekko gecko* (Linnaeus, 1758)**

Tokay geckos were found on buildings at Mad Rha and Phru Nai.

Voucher specimens: Four specimens were collected consist of THNHM 29879, CUMZ 2633-34 and CUMZ 2639.

***Hemidactylus frenatus* Duméril & Bibron, 1836**

Same as Tokay geckos, common house geckos were found mostly on buildings at Yao Noi, Ban Nai Wang and Phru Nai.

Voucher specimens: Five specimens were collected consist of CUMZ 2621, CUMZ 2632 and CUMZ 2640-42.

**Varanidae*****Varanus nebulosus* (Gray, 1831)**

First Bengal monitor was found in daytime high up a tree (8 m) and the second one was found at Hin Gong Waterfall.

Voucher specimens: One specimen were collected consist of THNHM 29866.

**Agamidae*****Calotes emma* Gray, 1845**

Forest garden lizards were found on trees along the road at Yao Noi Island and Mad Rha paddle field.

Voucher specimens: Seven specimens were collected consist of THNHM 29837-38, THNHM 29841, THNHM 29881 and CUMZ 2623-25.

***Draco taeniopterus* Günther, 1861**

Barred flying dragons were found on trees at Yao Noi and Ban Nai Wang Trail.

Voucher specimens: Two specimens were collected consist of THNHM 29868 and CUMZ 2627.

**Scincidae*****Eutropis multifasciata* (Kuhl, 1820)**

Common sun skinks were found normally on leaf litter on every trail except Hin Gong Waterfall.

Voucher specimens: Nine specimens were collected consist of THNHM 29839-40, CUMZ 2626, CUMZ 2630-31 and CUMZ 2635-38.

***Lygosoma* sp.**

The skink was found on tree trunk about one meter above ground on evergreen forest at Yao Noi Island.

Voucher specimens: One specimen were collected consist of CUMZ 2622.

**Suborder Ophidia****Pythonidae*****Malayopython reticulatus* (Schneider, 1801)**

Reticulated python was found on a stream bank at Ban Nai Wang Trail

Voucher specimens: Specimen was released at capture spot.

**Cylindrophiiidae*****Cylindrophis jodiae* Amarasinghe, Ineich, Campbell & Hallermann, 2015**

Red-tailed pipe snake, one was found on the gravel road at Ban Nai Wang Trail and another one was found in the grassland at Mad Rha Trail.

Voucher specimens: Two specimens were collected consist of THNHM 29880 and CUMZ 2629.

**Colubridae*****Xenochrophis trianguligerus* (Boie, 1827)**

Red-bellied annulate keelback was found in the stream at Ban Nai Wang Trail.

Voucher specimens: One specimen were collected consist of CUMZ 2628.

**Homalopsidae*****Cerberus schneiderii* (Schlegel, 1837)**

Dog-faced water snake was found on the Phru Nai Trail.

Voucher specimens: One specimen were collected and was kept at Thai Island and Sea Natural History Museum.

### **Xenopeltidae**

#### ***Xenopeltis unicolor* Reinwardt, 1827**

Sunbeam snake was found on the gravel road at Ban Nai Wang Trail and in the swamp opposite Kuan Chong Ting Forest.

Voucher specimens: Two specimens were collected consist of THNHM 29867 and CUMZ 2643.

### **RESULTS**

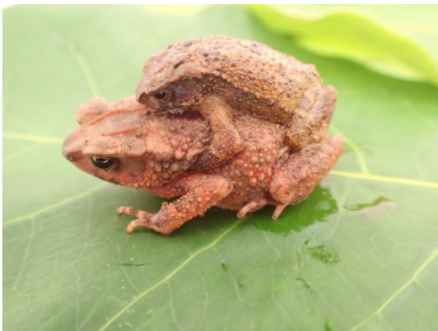
Nineteen amphibian species were found from five trials, twelve species in Yao Noi, ten in Ban Nai Wang, nine in Mad Rha, five in Phru Nai and three in Hin Gong, as shown in Table 1. Thirteen reptile species were found, seven species in Yao Noi, seven species in Ban Nai Wang, four species in Mad Rha, five species in Phru Nai and one species in Hin Gong as shown in Table 2.

*Kaloula pulchra*, *Fejervarya limnocharis*, and *Polypedates leucomystax* were common species on Yao Island (found at four trails). *Fejervarya limnocharis* and *Microhyla heymonsi* were the dominant species found in Mad Rha paddle field, and after heavy rain, *Kaloula pulchra* and *Microhyla heymonsi* exploded in numbers for breeding in the paddle field swamp. Moreover, the habitat *Hoplobatrachus rugulosus* and *Fejervarya moodiei* overlapped at Mad Rha paddle field.

Additionally, one amphibian and five reptiles species were reported to be found apart from our survey period or five study trails including: *Leptobranchium smithi* Matsui, Nabhitabhata, and Panha, 1999 at Ban Nai Wang stream; *Dasia olivacea* GRAY, 1839 at Thiwson Beach Resort, *Boiga cyanea* (DUMÉRIL, BIBRON & DUMÉRIL, 1854) at Yao Noi Island; *Laticauda colubrina* (SCHNEIDER, 1799) at Khai Nok Island's coral reef; *Chrysopelea ornata* (SHAW, 1802); and *Leiolepis belliana* (HARDWICKE & GRAY, 1827) (THNHM 29887 and CUMZ 2644-49) at Laem Had Beach.

### **DNA confirmation**

All ambiguous species were proved to be as same as expected species. Even the dorsal pattern of Noisy frogs, which were quite unusual, compared to *Microhyla butleri* from other localities, but DNA sequencing confirmed that they are *Microhyla butleri*. Interestingly, DNA of four samples from five of mangrove frogs found from both Mad Rha and Phru Nai were confirmed as *Fejervarya moodiei* except one specimen from Mad Rha which 16s gene showed it to be close to *Limnonectes blythii*. With some morphology of ambiguous *Limnonectes* such as its size, dorsal pattern and metacarpal tubercles were different to *L.*

*Microhyla biddleri**Ichthyophis supachaii**Hydrophylax eschscholtzii**Limnonectes thascheana**Ingerophrynus parvus**Limnonectes ibyithii**Limnonectes macrognathus**Fejervarya monodactyla*

**Plate I.** Amphibians observed during 4–8 April 2021 at Yao Islands, Phang Nga Province, Thailand.



*Cylindrocephalus surinensis*



*Cerobus rynchops*



*Sinonatrix annulata*



*Lygosoma* sp.



*Draco taeniopterus*



*Leiolopis balliana*



*Varanus bengalensis*



*Indotestudo elongata*

**Plate II.** Reptiles observed during 4–8 April 2021 at Yao Islands, Phang Nga Province, Thailand.

*blythii* which confirm that they are not the same species, therefore in this article reported this species as *Limnonectes* sp. Moreover, the sequencing of 16s gene of the skink from Yao Noi Island (Figure on Plate II) grouped with *Lygosoma bowringii* but with its red tail character confirm that this skink was not *L. bowringii*. *Limnonectes* sp. and *Lygosoma* sp. needed more molecular evidence or examining in the detail of their morphology in further analyses.

**Table 1.** The amphibians inventory of Yao Noi Island, Ban Nai Wang Reservoir Chong Laad RSPG’s local protected area, Old paddle field near Mad Rha Canal Hin Gong Waterfall Cape Beach Phru Nai and Kuan Chong Ting Forest

|                                   | Yao Noi | Ban Nai Wang | Mad Rha | Phru Nai | Hin Gong |
|-----------------------------------|---------|--------------|---------|----------|----------|
| <i>Ichthyophis supachaii</i>      | ✓       |              |         |          | ✓        |
| <i>Ingerophrynus parvus</i>       |         | ✓            |         |          |          |
| <i>Duttaphrynus melanostictus</i> | ✓       | ✓            | ✓       |          |          |
| <i>Kaloula pulchra</i>            | ✓       | ✓            | ✓       | ✓        |          |
| <i>Micryletta inornata</i>        | ✓       |              |         |          |          |
| <i>Microhyla butleri</i>          | ✓       |              |         |          |          |
| <i>Microhyla mukhlesuri</i>       | ✓       |              | ✓       | ✓        |          |
| <i>Microhyla heymonsi</i>         | ✓       |              |         |          |          |
| <i>Phrynoglossus martensii</i>    | ✓       |              |         |          |          |
| <i>Hoplobatrachus rugulosus</i>   |         |              | ✓       |          |          |
| <i>Limnonectes hascheana</i>      | ✓       | ✓            |         |          | ✓        |
| <i>Limnonectes blythii</i>        |         | ✓            |         |          |          |
| <i>Limnonectes macrognathus</i>   |         | ✓            |         |          | ✓        |
| <i>Limnonectes</i> sp.            |         |              | ✓       |          |          |
| <i>Fejervarya limnocharis</i>     | ✓       | ✓            | ✓       | ✓        |          |
| <i>Fejervarya moodiei</i>         |         |              | ✓       | ✓        |          |
| <i>Chalcorana eschatia</i>        |         | ✓            |         |          |          |
| <i>Hylarana erythraea</i>         | ✓       | ✓            | ✓       |          |          |
| <i>Polypedates leucomystax</i>    | ✓       | ✓            | ✓       | ✓        |          |

DISCUSSION

Thirty-two species of amphibians and reptiles were found in this survey, of which 7 species were under protected species status (the Wild and Protected Animals Act of Thailand 2003). Additionally, *Indotestudo elongata* was classified as a Critically Endangered species, while *Varanus nebulosus* and *Limnonectes blythii* were classified as Near Threatened species

**Table 2.** The reptiles inventory of Yao Noi Island, Ban Nai Wang Reservoir Chong Laad RSPG's local protected area, Old paddle field near Mad Rha Canal Hin Gong Waterfall Cape Beach Phru Nai and Kuan Chong Ting Forest.

|                                    | Yao Noi | Ban Nai Wang | Mad Rha | Phru Nai | Hin Gong |
|------------------------------------|---------|--------------|---------|----------|----------|
| <i>Indotestudo elongata</i>        | ✓       |              |         |          |          |
| <i>Gekko gekko</i>                 |         |              | ✓       | ✓        |          |
| <i>Hemidactylus frenatus</i>       | ✓       | ✓            |         | ✓        |          |
| <i>Varanus nebulosus</i>           | ✓       |              |         |          | ✓        |
| <i>Calotes emma</i>                | ✓       |              | ✓       |          |          |
| <i>Draco taeniopterus</i>          | ✓       | ✓            |         |          |          |
| <i>Eutropis multifasciata</i>      | ✓       | ✓            | ✓       | ✓        |          |
| <i>Lygosoma</i> sp.                | ✓       |              |         |          |          |
| <i>Malayopython reticulatus</i>    |         | ✓            |         |          |          |
| <i>Cylindrophis jodiae</i>         |         | ✓            | ✓       |          |          |
| <i>Xenochrophis trianguligerus</i> |         | ✓            |         |          |          |
| <i>Cerberus schneiderii</i>        |         |              |         | ✓        |          |
| <i>Xenopeltis unicolor</i>         |         | ✓            |         | ✓        |          |

by The IUCN Red (2021-2). Therefore, Yao Islands showed potential to be as an essential biodiversity and genetic reservoir, both nationally and globally. Moreover, large predators may reflect overall biodiversity (Dalerum *et al.*, 2008; Roth and Weber, 2008). RSPG's local protected area showed the efficiency of diversity enrichment by the occurrence of *Malayopython reticulatus*, *Varanus nebulosus*, and *Limnonectes blythii*.

Due to the isolation of islands from mainland, this may have caused speciation events (Rosen, 1976; Nelson and Platnick, 1981), from the strange morphological characters of *Microhyla butleri* also an unidentified *Lygosoma* sp. and *Limnonectes* sp., Yao Islands had the potential to contain cryptic or complex species. Consequently, this study shed light on hidden diversity of herpetofauna in islands of southern Thailand, where there has been a high level of ecotourism. The findings of this study can used to be a prior study for habitat and forest managements for herpetofaunal species and lead to wildlife conservation.

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