On some additions to the amphibians of Gunung Inas Forest Reserve, Kedah, Peninsular Malaysia

Shahriza Shahrudin

School of Pharmaceutical Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia
shahriza20@yahoo.com

Abstract: A survey on amphibian fauna was conducted in compartments 15, 16, and 17 of Gunung Inas Forest Reserve (GIFR), Kedah, Peninsular Malaysia for a period of two-and-a-half years, starting from January 2016 to May 2018, with a total of 20 visits. Observations and collections of amphibian species were carried out in and along the rivers, forest streams, forest pools, rock pools, cascade areas, waterfalls, ditches, temporary pools, forest floors, and forest trails. In total, 41 species of amphibians, belonging to 25 genera, and seven families were collected over the survey period. Of these, 11 species were ranids, followed by 10 dicroglossids, seven rhacophorids, six microhylids, four bufonids, two megophryids, and a single ichthyophiids (Ichthyophis sp.). From these observations, it is being pointed out that 15 species of amphibians represent new records for GIFR, while two species were not detected. This increases the known amphibian diversity of Gunung Inas Forest Reserve from 28 to 41 species.

Keywords: Anura, checklist, diversity, mountain, rainforest, river.

INTRODUCTION

Banjaran Bintang Hijau is the third largest mountain range in Peninsular Malaysia, and located on the west coast. Its structure, which include hills, slopes, peaks, plateaus, streams, and rivers influences the landscape of northern Peninsular Malaysia. This important mountain range extends approximately 140 km from Bukit Besar, Thailand to the central Malaysian state of Perak. The highest peak in this mountain range is Gunung Bintang (1,862 m), followed by Gunung Bintang Utara (1,835 m) and Gunung Inas (1,801 m), which is within the state of Kedah. The Gunung Inas Forest Reserve (GIFR) is part of Banjaran Bintang Hijau, and placed in the district of Baling, Kedah. This forest reserve is managed by the South Kedah Forest Department. This forest reserve covers 37,346 ha of lowland dipterocarp, hill dipterocarp, lower montane and upper montane forests (Kiew 1998; Manokaran 1998). Tree species, such as *Shorea curtisi* (Meranti Seraya), *Shorea leplosula* (Meranti Tembaga), *Shorea macroprotera* (Meranti Melantai), *Scorodocarpus borneensis* (Kulim), *Artocarpus elasticius* (Terap Nasi), *Ficus conglomerata* (Ara), *Artocarpus lancefolius* (Keledang), *Callophyllum* sp. (Bintangor), *Koompassia excelsa* (Tualang), *Alstonia angustiloba* (Pulai), *Macaranga* sp. (Mahang), and *Dipterocarpus* sp. (Keruing) can be found here. The understorey of the forest is dominated by bushes, ferns, herbs, palms, bamboos, climbers, fungi, and epiphytes. The forest floor receives little light and is covered by leaf litter, twigs, tree branches, and logs. Several important rivers, including the Sungai Sedim, Sungai Reyau, Sungai Teruna, Sungai Badang, and Sungai Tawar drain through this forest reserve. These rivers flow to Sungai Muda which empties into the Straits of Malacca.

Research on the amphibian fauna has been undertaken at various locations in Kedah. These include a study in Ulu Muda Forest Reserve (UMFR), which recorded 56 species of frogs (Norhayati et al. 2005); Gunung Jerai where 14 species were recorded (Ibrahim et al. 2006a); Langkawi Island where 16 and 24 species were recorded respectively (Grismer et al. 2006; Ibrahim et al. 2006b); Beris Valley where 14 species were recorded (Shahriza et al. 2011a); Lata Bukit Hijau where 18 species were recorded (Shahriza et al. 2011b); Gunung Inas Forest Reserve (GIFR) where 28 species were recorded (Ibrahim et al. 2012a); Bukit Perangin Forest Reserve (BPFR) where 15 species were documented (Ibrahim 2012b); Tupah Recreational Forest (TRF) where 13 species were documented (Shahriza et al. 2013a); and Ulu Paip Recreational Forest (UPRF) where 20 species were documented (Shahriza & Ibrahim 2014).

Previous studies on the amphibian diversity (Ibrahim et al. 2012a) and reptile diversity (Shahriza et al. 2013b) have been conducted in GIFR. Ibrahim et al. (2012a) reported 28 species of amphibians, belonging to 21 genera and six families. This included 10 species of ranids, eight dicroglossids, four bufonids, three rhacophorids, two megophryids, and one microhylid (Ibrahim et al. 2012a). This study was undertaken over a period of six months. In this study, we surveyed a larger area including compartments 15, 16, and 17 of GIFR and for a longer duration of 30 months, in the hope that additional amphibian species would be recorded with greater survey effort.

MATERIALS AND METHODS

We observed and collected amphibians in compartments 15, 16, and 17 of GIFR (5.416N, 100.782E; elevation <300m) (Figure 1), between January 2016 and May 2018, with a total of 20 visits. Surveys were carried out along the Gunung Bintang Trail (Trail 1), Sungai Reyau Trail (Trail 2), Sungai Sedim Trail (Trail 3), Sungai Teruna Trail (Trail 4), and around Sungai Sedim Recreational Forest. Amphibians were observed and inspected in and along the rivers, forest streams, ditches, swampy areas, forest pools, rock pools, animal wallows, waterfalls, cascade areas, forest floors, among leaf litter, and under logs or buttress.

Specimens were collected at night, between 2000 and 2400 h, via active sampling or opportunistic encounters, by teams of three to five people. The amphibians were captured by hand or sweep nets. The specimens were kept in moist plastic bags and brought back to the laboratory for measurements and further inspections. In the laboratory, the snout-vent length (SVL) and head width (HW) of the captured specimens were measured using a digital calliper (LC= 0.1 mm). Voucher specimens were prepared by euthanizing the specimens with tricane. Specimens were fixed with 10% formalin, stored in 70% ethanol and deposited at the School of Pharmaceutical Sciences, Universiti Sains Malaysia (USM) for reference. Tissue samples (thigh muscles) of some selected species were collected, stored in 95% ethanol and deposited at the same location for further analysis. The specimens were photographed in situ or in the laboratory, using an Olympus digital camera, model SP800. Species identification was based on morphological characteristics, such as body shape, colour, pattern, webbing, fingers and toes following...
Additions to the amphibians of Gunung Inas Forest Reserve, Malaysia

Shahrudin


RESULTS

Forty-one amphibian species, belonging to 25 genera and seven families were recorded from compartments 15, 16, and 17 GIFR. These included 11 ranids, 10 dicroglossids, seven rhacophorids, six microhylids, four bufonids, two megophryids, and a single ichthyophioid (Table 1). Comparison of amphibian species recorded by Ibrahim et al. (2012a) and this study is presented in Table 2.

Species accounts
Family Bufonidae
Duttaphrynus melanostictus (Schneider, 1799)  
16USM-GIFR-DM01  
Adult male, SVL= 58 mm, HW= 27 mm  
An adult male was captured beside the road, along the way to Sungai Sedim Recreational Forest, in January 2016. The choruses of this species were recorded in November 2016 and October 2017, along the roadside ditches.

Ingerophrynus parvus (Boulenger, 1887) (Image 1)  
16USM-GIFR-IP01  
Adult male, SVL= 47 mm, HW= 21 mm  
The specimen was collected in November 2016, hiding among leaf litter on the forest floor, along Sungai Reyau trail.

Rentapia flavomaculata Chan, Abraham & Badli-Sham, 2020  
This tree toad was observed in September 2016 and October 2017, perched on the branches of a tree situated adjacent to the river (4–6 m above ground). In October 2017, seven adult males were detected, while actively calling from tree branches along the banks of Sungai Sedim.

Phrynoidis asper (Gravenhorst, 1829) (Image 2)  
This river toad and its chorus were observed in every visit to GIFR. The toad was very common and often sighted perched on the wet granite rocks or bounders, hiding under big rocks or resting on the ground along the banks of Sungai Sedim, Sungai Reyau, and Sungai Teruna. Additionally, the toads were also encountered living along the small forest streams, forest floors, ditches, near the base camp and in the toilets. Sometimes they can be found resting on tree branches, 2–3 m above the ground.

Family Dicroglossidae
Fejervarya cancrivora (Gravenhorst, 1829)  
An adult was sighted in June 2016 and October 2017. When first observed, it was found on the ground, at the edge of a temporary ditch, along the way to Sungai Sedim Recreational Forest.

Fejervarya limnocharis (Gravenhorst, 1829)  
16USM-GIFR-FL01,02  
Adult male, SVL= 44, 49 mm, HW= 19, 21 mm  
This medium-sized dicroglossid and its choruses were recorded in every visit to GIFR. It was very common and
Table 1. Amphibian checklist of Gunung Inas Forest Reserve, Kedah, Peninsular Malaysia

<table>
<thead>
<tr>
<th>Taxa</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jan</td>
<td>Jun</td>
<td>Sep</td>
</tr>
<tr>
<td>Bufonidae (4 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duttaphrynus melanostictus</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ingerophrynus parvus</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rentapida flavomaculata</td>
<td>-</td>
<td>-</td>
<td>X,V</td>
</tr>
<tr>
<td>Dicroglossidae (10 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fejervarya cancrivora</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Limnonectes blythii</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes utara*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Limnonectes deinodon</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Limnonectes malesianus</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Limnonectes plicatellus</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Occidozyga sumatrana</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Occidozyga lima</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Occidozyga martensii*</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Megophryidae (2 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptobatrachium henderitsoni</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Pelobatracus nasutus</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Microhylidae (6 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaulou pulchra*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Microhyla berdmorei*</td>
<td>-</td>
<td>-</td>
<td>X,V</td>
</tr>
<tr>
<td>Microhyla butleri*</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Microhyla mukhlesuri*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phrynella pulchra*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ranidae (11 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abavorana luctuosa</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Hylarana nicobariensis</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Calcorana labialis</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Humerana miapas</td>
<td>-</td>
<td>-</td>
<td>X,V</td>
</tr>
<tr>
<td>Hylarana erythraea</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Odorrana monjeeri</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pulchrana glandulosa*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pulchrana laterimaculata*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pulchrana sundabaratar*</td>
<td>-</td>
<td>-</td>
<td>X,V</td>
</tr>
<tr>
<td>Rhacophoridae (7 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nyctixalus pictus</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Polypedates discantus*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polypedates leucomyxostax</td>
<td>X,V</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polypedates macrotis*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roorchestes parvulus*</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Rhacophorus nigropalmatus*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zhangixalus prominanus</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Ichthyophiidae (1 species)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ichthyophis sp.*</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Number of species (41 species)</td>
<td>9</td>
<td>13</td>
<td>15</td>
</tr>
</tbody>
</table>

X—Observed | -—Not observed | V—Vocalisations | *—New record.
occupied various habitats, such as open areas, car parks, fields, bushes, under tall grasses, roadside ditches, cement ditches, and swamps. They breed in stagnant water bodies, including temporary puddles, rock pools, and isolated pools. The two voucher specimens were collected in open area, near a car park, after heavy rain in November 2016.

**Limnonectes blythii** (Boulenger, 1920) (Image 3)

16USM-GIFR-LB01

Adult, SVL= 127 mm, HW= 48 mm

This riparian species can be found along the banks of Sungai Sedim, Sungai Reyau and Sungai Teruna. It also can be encountered along the small forest streams, swampy areas and on the forest floors. In September 2016, an adult was captured, perched on tangled roots, on the banks of Sungai Teruna.

**Limnonectes utara** Matsui, Daicus & Norhayati, 2014

(Image 4)

17USM-GIFR-LU01

Adult, SVL= 68 mm, HW= 34 mm

An adult was collected perched on the wet mossy rock, in a small forest stream (1–2 m width), which flows to Sungai Sedim in October 2017. The area was shaded and surrounded by lowland dipterocarp forest. This species, earlier known by the name *L. kuhl*, represents a new record for GIFR.

**Limnonectes deinodon** Dehling, 2014

17USM-GIFR-LD01

Adult, SVL= 38 mm, HW= 20 mm

A single specimen was captured resting on a rotten log, on the banks of a small forest stream, along Sungai Reyau trail in July 2017.

---

**Table 2. Comparison of amphibian species in GIFR between past and present studies**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Ibrahim et al. (2012a)</th>
<th>Present study (2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bufonidae (4 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duttaphrynus melanostictus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ingerophrynus parvus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rentapia flavomaculata</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Phrynoidis asper</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Dicroglossidae (10 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fejervarya cancrivora</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fejervarya limnocharis</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes blythii</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes utara</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes deinodon</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes malesianus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limnonectes plicatellus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Occidozyga sumatrana</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Occidozyga lima</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Occidozyga martensii</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Megophryidae (2 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptobrachium hendricksoni</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pelobatrachus nasutus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Microhylidae (6 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaloula pulchra</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Microhyla beramorei</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Microhyla butleri</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Microhyla mukhlesuri</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Microhyla heymonsi</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Phrynella pulchra</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Ranidae (13 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abavorana luctuosa</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hylarana nicobariensis</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Amolops larutensis</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Chalcorana labialis</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hoplobatrachus rugulosus</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Humerana miopus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hylarana dorae</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Hylarana erythraea</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Odorrana hosii</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Odorrana monjerai</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pulchrana glandulosa</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Pulchrana laterimaculata</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Pulchrana sundobarat</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Rhacophoridae (7 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nyctixalus pictus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Polypedates discontus</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Polypedates leucomystax</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Polypedates macrotis</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Raorchestes parvulus</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Rhacophorus nigropalmatus</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Zhangixalus prominanus</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ichthyophiidae (1 species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ichthyophis sp.</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

Number of species (43 species) 28 species 41 species

X—Observed | ——Not observed.
Additions to the amphibians of Gunung Inas Forest Reserve, Malaysia

Shahrudin

Image 1. *Ingerophrynus parvus*

Image 2. *Phrynoidis asper*

Image 3. *Limnonectes blythii*

Image 4. *Limnonectes utara*

Image 5. *Limnonectes plicatellus*

Image 6. *Leptobrachium hendricksoni*
**Limnonectes malesianus** (Kiew, 1984)

The frog was observed in November 2016 and December 2017. When first observed, it was found on the wet ground, near a temporary puddle, along Sungai Sedim trail after heavy rain.

**Limnonectes plicatellus** (Stoliczka, 1873) (Image 5)

17USM-GIFR-LP01

Adult, SVL= 45 mm, HW= 22 mm

The ‘rhinoceros’ frog was collected in March 2017, hiding among leaf litter, near a swampy area, along Sungai Sedim trail.

**Occidozyga sumatrana** (Peters, 1877)

16USM-GIFR-OS01,02

Adult, SVL= 37, 39 mm, HW= 15, 15 mm

In November 2016, two specimens were collected submerged in a temporary rain pool, along Sungai Reyau trail after heavy rain. Later three more individuals were also sighted in another rain pool along this trail.

**Occidozyga lima** (Gravenhorst, 1829)

16USM-GIFR-OL01

Adult, SVL= 39 mm, HW= 16 mm

An adult was captured hiding among leaf litter, near a rock pool, at the edge of Sungai Sedim in January 2016.

**Occidozyga martensii** (Peters, 1867)

16USM-GIFR-OM01

Adult, SVL= 35 mm, HW= 15 mm

A single specimen was captured in September 2016, hiding among the grasses, in a temporary rain pool, along Gunung Bintang trail. This is a new record for GIFR.

**Family Megophryidae**

**Leptobrachium hendricksoni** Taylor, 1962 (Image 6)

16USM-GIFR-LH01, 02

Adult, SVL= 53, 55 mm, HW= 32, 32 mm

Two specimens were caught, hiding under rotten log and dead leaves on the forest floor, along Sungai Reyau trail in June 2016. Tadpoles of this species were found inhabits in the rock pools and isolated pools along Sungai Sedim.

**Pelatobatrachus nasutus** (Schlegel, 1858)

17USM-GIFR-PN01

Adult, SVL= 69 mm, HW= 37 mm

In October 2017, an adult male was captured hiding under a big rock, near a small forest stream, which flow to Sungai Sedim. The chorus (‘thok’) of this species were heard in November 2016, December 2017, and May 2018.

**Microhylidae**

**Kaloula pulchra** Gray, 1831

The frog was sighted in November 2016 and July 2017. On first observation, it was on the water surface, in a roadside ditch, along the way to Sungai Sedim Recreational Forest, after heavy rain. This is a new record for GIFR.

**Microhyla berdmorei** (Blyth, 1856) (Image 7)

16USM-GIFR-MB01

Adult, SVL= 42 mm, HW= 19 mm

A single specimen was captured concealed under dead leaves, near a rock pool, on the banks of Sungai Sedim in September 2016. The choruses of this species were heard in September and November 2016, along the banks of Sungai Sedim. This species represents a new record for GIFR.

**Microhyla butleri** Boulenger, 1900

This species was spotted in June 2016, July 2017, and May 2018, and often observed hiding under tall grasses, bushes, under dead leaves or under rotten log around Sungai Sedim Recreational Forest. They breed in stagnant water bodies, such as temporary puddles, rock pools and rain pools. This species represents a new record for GIFR.

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

An adult was spotted in July and October 2017. When first observed, the frog was camouflaged among the grasses, in a temporary puddle, along Sungai Teruna trail. This species, previously known by the name *M. fissipes*, represents a new record for GIFR.

**Microhyla heymonsi** Vogt, 1911

16USM-GIFR-MH01, 02

Adult, SVL= 28, 30 mm, HW= 14, 14 mm

This microhylid and its chorus were observed and recorded in every visit to GIFR. They are ubiquitous and occupied various habitats, including disturbed and undisturbed areas. Two specimens were collected in November 2016, hiding under leaf litter and rocks, on the banks of Sungai Sedim.

**Phrynella pulchra** Boulenger, 1887 (Image 8)

A single specimen was observed perched on a twig, approximately 0.5 m above ground, along Gunung Bintang trail in December 2017. This is a new record for GIFR.
Additions to the amphibians of Gunung Inas Forest Reserve, Malaysia

Shahrudin

Image 7. Microhyla berdmorei.

Image 8. Phrynella pulchra

Image 9. Chalcorana labialis

Image 10. Humerana miopus

Image 11. Odorrana hosii

Image 12. Pulchrana sundabarat
Family Ranidae

*Abavorana luctuosa* (Peters, 1871)
An adult was detected in June 2016 and December 2017. On first observation, the frog was perched on a rotten tree buttress, near a puddle, along Sungai Reyau trail.

*Hylarana nicobariensis* (Stoliczka, 1870)
The frog was spotted in July 2017 and May 2018. On being first sighted, the specimen concealed itself among grasses, near a roadside ditch, along the way to Sungai Sedim Recreational Forest.

*Amolops larutensis* (Boulenger, 1899)
17USM-GIFR-AL01, 02
Adult, SVL= 46, 48 mm, HW= 25, 25 mm
This torrent frog and its chorus were observed in every visit to GIFR. They were very common and often perched on the wet mossy granite rocks or boulders, near waterfalls or cascades. When approached, the frogs jumped into the river or were seen hiding inside the rock crevices near the streams. In December 2017, two specimens were collected, perched on granite rocks, near cascade areas in Sungai Sedim.

*Chalcorana labialis* (Schlegel, 1837) (Image 9)
16USM-GIFR-CL01, 02
Adult, SVL= 47, 48 mm, HW= 22, 22 mm
Two adult males were collected in September 2016, perched on leaves of low vegetation, near swampy area, along Sungai Sedim trail. Other individuals were detected in January 2016, October 2017 and December 2017.

*Humerana miopus* (Boulenger, 1918) (Image 10)
17USM-GIFR-HM01
Adult, SVL= 85 mm, HW= 37 mm
In December 2017, a single specimen was captured at the edge of a forest pool, along Sungai Sedim trail. Two other individuals were also sighted in November 2016, at the same location, though they weren’t collected.

*Hylarana erythraea* (Schlegel, 1837)
17USM-GIFR-HE01
Adult, SVL= 74 mm, HW= 33 mm
This human-commensal species was observed several times. In July 2017, an adult male was captured, hiding among tall grasses, near a roadside ditch, along the way to Sungai Sedim Recreational Forest.

*Odorrana hosii* (Boulenger, 1891) (Image 11)
17USM-GIFR-OH01, 02
Adult, SVL= 57, 59 mm, HW= 26, 26 mm
This poisonous rock frog is very common, and often found along the fast-flowing streams or cascade areas of the rivers. They were often perched on wet mossy rocks or boulders, rotten logs, creepers, small vegetation or tangle of roots, along the river banks. Sometimes, this species was sighted perched on tree branches or leaves, up to 2 m above the ground. Two adult males were captured in February 2018, perched on creeping plants (approximately 1.5 m above ground), on the banks of Sungai Sedim. This species and its call were detected in every visit to GiFR.

*Odorrana monjerai* (Matsui & Ibrahim, 2006)
An adult was sighted perched on rotten tree buttress, near a small forest stream, along Sungai Reyau trail in November 2016. Another specimen was observed in December 2017, along Gunung Bintang trail.

*Pulchrana glandulosa* (Boulenger, 1882)
The chorus of this species was recorded in November 2016, March 2017, July 2017, October 2017, and May 2018, along the banks of Sungai Teruna and roadside ditches. A single specimen was observed in July 2017, hiding among aquatic plants, in the roadside ditch, along the way to Sungai Sedim. This species denotes a new record for GIFR.

*Pulchrana laterimaculata* (Barbour & Noble, 1916)
In July 2017, an individual was observed, perched on a tree fern, at the swampy area, along Sungai Sedim trail. This species represents a new record for GiFR.

*Pulchrana sundabarat* Chan, Abraham, Grismer & Brown, 2020 (Image 12)
16USM-GIFR-PS01
Adult, SVL= 47 mm, HW= 21 mm
An adult male was collected in September 2016, while actively calling on a rotten log, along Gunung Bintang trail. Another specimen was observed in May 2018, and this species, previously by the name *P. picturata*, represents a new record for GiFR.

Rhacophoridae

*Nectixalus pictus* (Peters, 1871)
An individual was observed resting on the leaves of small vegetation (approximately 0.5 m above ground), along Sungai Reyau trail in September 2016.
Additions to the amphibians of Gunung Inas Forest Reserve, Malaysia

Polypedates discantus Rujirawan, Stuart & Aowphol, 2013 (Image 13)
17USM-GIFR-PD01
Adult, SVL = 53 mm, HW = 24 mm

In March 2017, an adult male was captured perched on the twig of a creeping plant (approximately 2 m above ground), at the edge of Sungai Sedim. Another individual was spotted in November 2016 along Gunung Bintang trail. This species, earlier known by the name *P. leucomystax*, denotes a new record for GIFR.

Polypedates leucomystax (Gravenhorst, 1829)
17USM-GIFR-PL01
Adults, SVL male = 48 mm, SVL female = 77 mm, HW male = 22 mm, HW female = 34 mm

An amplexed pair was captured in December 2017, sitting on the ground, near an intermediate-sized rock pool, on the banks of Sungai Sedim. The choruses of this species were also recorded in June 2016, March 2017, October 2017 and December 2017, along Sungai Sedim and roadside ditches.

Polypedates macrotis (Boulenger, 1891)

An adult was observed, resting on a tree branch (approximately 2 m above ground), near a temporary puddle, along Sungai Reyau trail in February 2018. This is a new record for GIFR.

Raorchestes parvulus (Boulenger, 1893)

An individual was sighted, perched on the leaves of a creeping plant (approximately 1.5 m above ground), along Gunung Bintang trail in September 2016. This represents a new record for GIFR.
**Rhacophorus nigropalmatus** Boulenger, 1895 (Image 14)

17USM-GIFR-RN01

- Adult, SVL = 93 mm, HW = 41 mm

In October 2017, an adult was captured perched on leaves (approximately 2.5 m above ground), near an intermediate-sized forest pool, along Sungai Sedim trail after heavy rain. Another specimen was also observed in July 2017 at the same location, and this species denotes a new record for GIFR.

**Zhangixalus prominanus** (Smith, 1924) (Image 15)

16USM-GIFR-ZP01

A single specimen was collected in November 2016, sitting on tree branch (approximately 1.5 m above ground), near a temporary rain puddle, along Gunung Bintang trail. Another individual was also sighted in October 2017 along Sungai Sedim trail.

**Ichthyophiidae**

**Ichthyophis sp.** (Image 16)

A juvenile, approximately 15 cm long, was sighted crawling on the mud, near a forest pool and later disappeared under leaf litter. It was encountered along Sungai Sedim trail in June 2016 and represents a new record of this caecilian genus for GIFR.

**DISCUSSION**

Fifteen species of amphibians, including *Limnonectes utara*, *Occidozyga martensii*, *Kaloula pulchra*, *Microhyla berdmorei*, *M. butleri*, *M. mukhlesuri*, *Phrynella pulchra*, *Pulchrana glandulosa*, *P. laterimaculata*, *P. sundabarata*, *Polypedates discantus*, *Raorchestes parvulus*, *Polypedates macrotis*, *R. nigropalmatus*, and *Ichthyophis sp.* were incorporated to the list as new records for GIFR. Two species of frogs, *Hylarana doriae* and *Hoplobatrachus rugulosus*, which were detected in a previous study (Ibrahim et al. 2012a) were not detected. We reviewed the material deposited by Ibrahim et al. (2012a), and we assigned the specimen they identified as *H. doriae* to *L. blythii* based on the morphological characters (large and stout body, broad head, obvious tympanum, supratympanic fold present, dark brown coloration on dorsal surface and dirty white on ventral surface). However, we could not confirm the identity of the specimen Ibrahim et al. (2012a) assigned to *H. rugulosus* as the specimen was missing. To date, the only confirmed records of *H. rugulosus* in Malaysia are from disturbed areas in Sabah, where they are invasive (Inger & Stuebing 1989; Inger 2005).

Ibrahim et al. (2012a) referred to 11 frog species encountered in GIFR as rare (*P. nasutus*, *L. hendricksoni*, *D. melanostictus*, *L. malesianus*, *L. deinodon*, *L. picatellus*, *H. erythraea*, *A. luctuosa*, *H. miopus*, *N. pictus*, and *Z. prominans*). They are not rare species but...
are species with elusive and secretive behaviours that could otherwise be recorded with suitable /specialised sampling methods. For example, both *P. nasutus* and *L. hendricksoni* are typical forest frog species, which can be found on the forest floors of old secondary forests or primary rain forests. They are usually encountered hiding among leaf litter, under big rocks or under rotten logs (Berry 1975; Ibrahim et al. 2008; Grismer 2011). Additionally, its dorsal pattern and colouration are very similar to their surrounding environments (ground, leaf litter, and twigs), thus providing a perfect camouflage.

*Duttaphrynus melanostictus* and *H. erythraea* are frequently seen, human-commensal species living in disturbed environment where they breed in stagnant water bodies (Inger 2005; Grismer 2011). In our study, both of these species were more frequently observed around villages, chalets or toilets when compared to that within the forest reserve areas. They can also be encountered around the roadside ditches, especially after heavy downpour. Although not many individuals of *Limnonectes deinodon* were observed in GIFR, this species is not considered rare. They can be found if more effort and careful observation were made during sampling periods. Usually, these small dicroglossids are encountered perched on rocks or boulders, sitting on the ground or hiding under leaves along the rivulets. *Humerana miopus* also is not a rare species and is often found around swampy areas and forest pools in GIFR. This species is very sensitive to sound and can immediately disappear, making it very difficult to detect.

Some species of frogs were reported at nearby areas, but were not recorded in GIFR. They are *Limnonectes paramacrodon* which was encountered at Bukit Hijau, Tupah, and Ulu Paip, *Sylvirana malayana* at Bukit Perangin, *Rentapia flavomaculata* at Ulu Paip, and *Ichthyophis nigroflavus* at Bukit Perangin. Ulu Paip, Bukit Hijau, Tupah, and Bukit Perangin are located 19, 24, 75, and 151 km from GIFR, respectively. According to Inger (2003), the presence of frog species in a particular area depends on various factors, including duration of sampling period, area of coverage, sampling technique, topography, weather, microhabitats, and activity pattern. Additionally, the physical characteristics of a stream also determine the presence and absence of frog species (Inger 1969).

From this research its shows that GIFR is very rich with amphibian species. Various type of habitats in GIFR contributed to higher richness of frog diversity. These included rivers, small forest streams, swamps, ditches, forest pools, rock pools, temporary pools, tree buttress pools and animal wallows, which provided suitable sites for amphibians to live and breed. Additionally, the presence of Banjaran Bintang Hijau with several prominent peaks such as Gunung Bintang and Gunung Inas influence the landscape of this area, which lead to the diverse amphibian species. Amphibians are essential to be conserved and protected as they play many important roles in the ecosystem. They are significant as a biological indicator, to control insects, as a prey for various types of predators and as medicinal species. Current research shows that amphibians skin secretions comprise various bioactive compounds including the antimicrobial peptides (AMPs), which is effective to various strains of bacteria (Conlon et al. 2008; Al-Ghaferi et al. 2010). These AMPs are able to use as a template, to develop and produce a new therapeutic agent (Conlon & Sonnevend 2011). Thus, amphibian species are required to be totally protected, so that the natural drugs resources, which have valuable potential are preserved forever. For a strategic conservation planning, their habitats and breeding sites must be defended and restricted from human disturbances. Deforestation and forest alteration for any purpose should be minimised or totally stopped in GIFR, so as to sustain and promote the amphibian richness and other biodiversity in general.

**REFERENCES**


Additions to the amphibians of Gunung Inas Forest Reserve, Malaysia

Shahrudin


Dr. Gernot Vogel, Heidelberg, Germany
Dr. Raju Vyas, Vadodara, Gujarat, India
Dr. Pitpal S. Soorae, Environment Agency, Abu Dhabi, UAE.

Dr. Zafar-ul Islam, HNG University, Patan, Gujarat, India
Dr. Spartaco Gippoliti, Socio Onorario Società Italiana per la Storia della Fauna “Giuseppe Altobello”, Rome, Italy
Dr. Justin Joshua, Green Future Foundation, Trichirappalli, Tamil Nadu, India
Dr. H. Raghuram, The American College, Madurai, Tamil Nadu, India
Dr. Paul Bates, Harison Institute, Kent, UK
Dr. Jim Sanderson, Small Wild Cat Conservation Foundation, Hartford, USA
Dr. Dan Challenger, University of Kent, Canterbury, UK
Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK
Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA
Dr. S.S. Talmale, Zoological Survey of India, Pune, Maharashtra, India
Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka
Dr. Sanjay Sondhi, TITLI TRUST, Kalpavriksh, Dehradun, India
Dr. John E.N. Veron, Coral Reef Research, Townsville, Australia
Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA
Dr. Ian Redmond, UNEP Convention on Migratory Species, Lansdown, UK
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India

Dr. Gernot Vogel, Griffith University, Nathan, Australia
Dr. Sameer Padhye, Katholeke Universiteit Leuven, Belgium
Dr. Nancy van der Poorten, Toronto, Canada
Dr. Karen Schnabel, Niwa, Wellington, New Zealand
Dr. R.K. Sharma, (Retd.) Scientist, Zoological Survey of India, Pune, India
Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India
Dr. J.W. Dukworth, IUCN SSC, Bath, UK
Dr. Rajiv Jayapal, SACC, Coimbatore, Tamil Nadu, India
Dr. Raju S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India

Dr. Albert G. Orr, Griffith University, Nathan, Australia
Dr. J.A. K. Singh, Madhya Pradesh Agricultural University, Bhopal, India
Dr. D. Sudarsan, Indian Institute of Technology, Kharagpur, India
Dr. V. Narayanasamy, Indian Institute of Remote Sensing, Dehradun, India
Dr. Devakumar, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India
Dr. Jeevarthi Senthilkumar, Zoological Survey of India, Thiruvananthapuram, Kerala, India
Dr. R. Sundararaj, Institute of Zoology, Bangalore, Karnataka, India
Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong

Dr. R. Sundararaj, Institute of Zoology, Bangalore, Karnataka, India
Dr. K. A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India
Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India
Dr. M. Sathyanandan, Environmental Department, La Aia Al Kuwait Real Estate Co. K.S.C., Kuwait
Dr. Himender Bhart, Punjab University, Punjab, India
Dr. Purnendu Roy, London, UK
Dr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan
Dr. Sanjith Sridh, TITU TRUST, Calpavurkh, Dehradun, India
Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam
Dr. Neit Kulkarni, Tropical Research Institute, Jabalpur, India
Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. Manjul Sillwal, WILD, Coimbatore, Tamil Nadu, India
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India
Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India
Dr. M. Sathyanandan, Environmental Department, La Aia Al Kuwait Real Estate Co. K.S.C., Kuwait
Dr. Himender Bhart, Punjab University, Punjab, India
Dr. Purnendu Roy, London, UK
Dr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan
Dr. Sanjith Sridh, TITU TRUST, Calpavurkh, Dehradun, India
Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam
Dr. Neit Kulkarni, Tropical Research Institute, Jabalpur, India
Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. Albert G. Orr, Griffith University, Nathan, Australia
Dr. J.A. K. Singh, Madhya Pradesh Agricultural University, Bhopal, India
Dr. D. Sudarsan, Indian Institute of Technology, Kharagpur, India
Dr. V. Narayanasamy, Indian Institute of Remote Sensing, Dehradun, India
Dr. R. Sundararaj, Institute of Zoology, Bangalore, Karnataka, India
Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong


NAAS rating (India) 5.64

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the boundaries shown in the maps by the authors.

Print copies of the Journal are available at cost. Write to: The Managing Editor, iot, c/o Wildlife Information Liaison Development Society, No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalpatari Road, Saravanampatti, Coimbatore, Tamil Nadu 641035, India

Due to paucity of space, the list of reviewers for 2018-2020 is available online.

Reviewers 2018–2020

The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at www.threatenedtaxa.org. All articles published in JoTT are registered under Creative Commons Attribution 4.0 International License unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

September 2021 | Vol. 13 | No. 11 | Pages: 19431-19674
Date of Publication: 26 September 2021 (Online & Print)
DOI: 10.11609/jott.2021.13.11.19431-19674

Communications

The diel activity pattern of small carnivores of Western Ghats, India: a case study at Nelliyampathies in Kerala, India
– Devika Sangamithra & P.O. Nameer, Pp. 19466–19474

Distribution and threats to Smooth-Coated Otters Lutrogale perspicillata (Mammalia: Carnivora: Mustelidae) in Shuklaphanta National Park, Nepal
– Gopi Krishna Joshi, Rajeev Joshi & Bishow Poudel, Pp. 19475–19483

Wildlife hunting practices of the Santal and Oraon communities in Rajasthan, Bangladesh

Ethnobotanical use of primates in northeastern India
– Deborah Daolagupu, Nazimur Rahman Talukdar & Parthankar Choudhury, Pp. 19492–19499

Factors influencing the flush response and flight initiation distance of three owl species in the Andaman islands

Birds of Barandabhar Corridor Forest, Chitwan, Nepal

On some additions to the amphibians of Gunung Inas Forest Reserve, Kedah, Peninsular Malaysia
– Shahzra Shahrudin, Pp. 19527–19539

Reviews

A review of research on the distribution, ecology, behaviour, and conservation of the Slender Loris Loris lydekkerianus (Mammalia: Primates: Lorisidae) in India

Bivalves (Mollusca: Bivalvia) in Malaysian Borneo: status and threats
– Abdulla Al-Asif, Hadi Hamli, Abu Hena Mustafa Khal, Mohd Hanafi Idris, Geoffrey James Genus, Johan Ismail & Muyassar H. Abulreesh, Pp. 19553–19565

Disentangling earthworm taxonomic stumbling blocks using molecular markers
– Azhar Rashid Lone, Samarendra Singh Thakur, Navalini Tiwari, Olusola B. Sokefun & Shweta Yadav, Pp. 19566–19579

A reference of identification keys to plant-parasitic nematodes (Nematoda: Tylenchida, Tylenchomorpha)

A preliminary assessment of odonate diversity along the river Tirthan, Great Himalayan National Park Conservation Area, India with reference to the impact of climate change
– Amar Paul Singh, Kritish De, Virendra Prasad Uniyal & Sambandam Sathyakumar, Pp. 19611–19615

A checklist of orthopteran fauna (Insecta: Orthoptera) with some new records in the cold arid region of Ladakh, India

New distribution records of two Begoniaceae to the flora of Bhutan
– Phub Gyeltshen & Sherab Jamthsho, Pp. 19626–19631

Rediscovery of Aponogeton lakkonensis A. Camus (Aponogetonaceae): a long-lost aquatic plant of India

Glyphauchia acuminata (Hack.) Clayton var. laevis (Poaceae): a new variety from central Western Ghats of Karnataka, India

A cytomorphological investigation of three species of the genus Sonchus L. (Asteraceae) from Punjab, India
– M.C. Sidhu & Rai Singh, Pp. 19640–19644

Dryopteris lunanensis (Dryopteridaceae) - an addition to the pteridophytic diversity of India
– Chhandam Chanda, Christopher Roy Fraser-Jenkins & Vineet Kumar Rawat, Pp. 19645–19648

Notes

First record of Spotted Linsang Prionodon pardicolor (Mammalia: Carnivora: Prionodontidae) with photographic evidence in Meghalaya, India
– Papori Khatonier & Adrian Wansaindor Lyngdoh, Pp. 19649–19651

First record of the Eastern Cat Snake Boiga gocool (Gray, 1833) (Serpentes: Colubridae) from Tripura, India

First record of the genus Tibetanja (Lepidoptera: Eupterotidae: Janinae) from India
– Alka Vaidya & H. Sankaranarayam, Pp. 19657–19659

Austrodobrus cordillerae (Mollusca: Gastropoda) from central Argentina: a rare, little-known land snail
– Sandra Gordillo, Pp. 19660–19662

Intestinal coccidiosis (Apicomplexa: Eimeriidae) in a Himalayan Griffon Vulture Gyps himalayensis

Two new additions to the orchid flora of Assam, India
– Phub Gyeltshen & Sherab Jamthsho, Pp. 19657–19659

Wildlife art and illustration – combining black and white ink drawings with colour: some experiments in Auroville, India

Short Communications

Catalogue of herpetological specimens from Meghalaya, India at the Salim Ali Centre for Ornithology and Natural History

www.threatenedtaxa.org

Publisher & Host

Threatened Taxa