

# The herpetofauna of a small and unprotected patch of tropical rainforest in Morningside, Sri Lanka

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**Abstract.**—Morningside is an exceptional area in Sri Lanka with highly endemic herpetofauna. However, this relictual forest area lies inside a tea plantation and is mostly lacking conservation protection. Species inventories of remaining rainforest patches are currently incomplete, and information about the behavior and ecology of the herpetofauna of Morningside is poorly known. In our survey, we identified 13 amphibian species and recorded an additional two species that could not be identified with existing keys. We determined 11 reptile species from this patch of forest, and another unidentified *Cnemaspis* gecko was recorded. We did not assess the herpetofauna outside of this forest patch. Some species are described for the first time in Morningside, suggesting a wider distribution in Sri Lanka. We also document a call from a male *Pseudophilautus cavirostris* for the first time. Perspectives for future surveys are given.

**Key words.** Survey, Morningside, Sri Lanka, herpetofauna, conservation, *Pseudophilautus cavirostris*

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## Introduction

Sri Lanka is a small (65,610 km<sup>2</sup>) island south of India. The island lies between latitudes 5°55' and 9°51' N and longitudes 79°41' and 81°54' E. Sri Lanka is divided into four different climatic zones (Domroes and Roth 1998): dry, wet, transitional, and semiarid. The dry zone is situated in the eastern and northern parts of the island, covering 60% of the total land area. Annual rainfall is between 1250 and 1900 mm, and the mean annual temperature ranges from 27° to 30° C. Floristically, the dry zone is characterized by monsoon forests and thorn scrublands. The wet zone encompasses southwestern Sri Lanka, covering 23% of the total land area and receiving an annual rainfall of 2500-5000 mm. The natural vegetation consists of evergreen, semi-evergreen, and rain forest. Between these two zones lies an intermediate transitional zone, with annual rainfall between 1900 and 2500 mm. The two semiarid zones (in the southeast and northwest) receive less than 1250 mm of rainfall annually. Within these zones, climate can also vary along elevational gradients. In mountainous regions, the temperature is lower and can approach freezing at times. This high elevation climate has been recognized previously from both the Central Mountains and the Knuckles Mountains, and more recently from the Rakwana Hills. All three of these mountainous regions have a different climate from the surrounding area, as expected (Werner 2001). The Morningside area lies in the Rakwana Hills.

In our attempt to understand the biodiversity of Sri Lanka, scientists from the Wildlife Heritage Trust (WHT) have made great progress in naming many new species and significantly expanding our knowledge of the region. However, there are likely still undescribed amphibians and reptiles in Sri Lanka (Anslem de Silva, pers. comm., Krvavac, pers. comm). Due to the high levels of endemism found in Morningside, scientists and conservation organizations like Conservation International have identified it as a region of high conservation priority. Located in the eastern part of the Sinharaja forest, Morningside has also been declared a Man and Biosphere Reserve (MAB Reserve) under the UNESCO World Heritage Convention. Sinharaja is the largest remaining tropical rainforest in Sri Lanka, but most unprotected parts of the forest in Morningside are logged. Today, only a few forest fragments remain.

## Methodology

To survey Morningside for reptiles and amphibians, fieldwork was conducted for three days and nights in a small patch of remaining forest near the town of Suriyakanda in July 2010. This patch of forest lies inside a tea plantation and lacks any conservation protection, and it is possible that it will be cleared for tea plants in the near future. The coordinates of our survey starting point were identified

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with a handheld GPS (Garmin eTrex) as 6° 27' 17" N and 80° 37' 9" E at an elevation of 975 m asl (above sea level). We could not ascertain the size of the forest patch using the available resources. The forest lacks large trees (above 10 m) and the canopy is not completely closed. In this open canopy, sufficient light reached the ground and bushes were able to grow; it was often possible to see the sky through holes in the canopy. No attempts were made to identify vegetation. No rain was recorded during the study period, but strong winds prevailed during most of the sampling time. The surveys were conducted by walking along trails and a stream that flows through the forest, as well as by searching in and around ponds. The ponds had a depth of less than 60 cm and were considered to be temporary. Dead logs and rocks were overturned and leaf litter was checked for reptiles and amphibians. These surveys were done during daytime and at night between 8 p.m. and midnight.

## Results

During the field trips, we found 15 species of amphibians, although two of these were unidentifiable using current taxonomy keys (not listed below). A total of 11 species of reptiles were identified, plus one unidentified gecko. All identified species are listed in Table 1.

## Reptiles

### Gekkonidae

#### *Cnemaspis* sp.

The genus *Cnemaspis* consists of day-active geckos. The species are more or less brownish to grayish in coloration. We found all specimens inside or around a small house nearby the forest. The geckos are common around the house, and they lay eggs in small holes in the door-frame. We could not find evidence for communal egg laying. This behavior is described for another member of the



*Cnemaspis* sp.



*Cnemaspis* sp.

genus *Cnemaspis*, and we found a communal laying site of *Cnemaspis* at Morningside Estate, only a few kilometers away from this forest patch. Species identification of these specimens was not possible, as this genus must be reviewed for the whole of Sri Lanka, and in particular for Morningside. Several new species have been discovered, but remain undescribed (Anslem de Silva, pers. comm.).

#### *Cyrtodactylus subsolanus*

This gecko formerly belonged to the species *C. fraenatus* and was identified as a distinct species in by Batuwita and Bahir (2005). We found an adult specimen with total length 20 cm inside the house foraging for insects at night and a single young specimen in a bush during a trip in the late evening. The day gecko *C. subsolanus* is restricted to Morningside.



*Cyrtodactylus subsolanus*.





Tropical rainforest survey area in Morningside, Sri Lanka.

Table 1. Checklist of amphibians and reptiles found during the survey

Amphibians	Reptiles
<b>Bufonidae</b> <i>Adenomus kelaartii</i> (Günther, 1858) endangered*	<b>Agamidae</b> <i>Calotes calotes</i> (Linnaeus, 1758) near threatened <i>Calotes liolepis</i> Boulenger, 1885 vulnerable* <i>Lyriocephalus scutatus</i> (Linnaeus, 1758) near threatened* <i>Otocryptis wiegmanni</i> Wagler, 1830 near threatened*
<b>Dicroglossidae</b> <i>Fejervarya kirtisinghei</i> (Manamendra-Arachchi and Gabadage, 1996) least concern*	<b>Gekkonidae</b> <i>Cnemaspis</i> spec. <i>Cyrtodactylus subsolanus</i> Batuwita and Bahir, 2005 not evaluated* <i>Geckoella triedrus</i> (Günther, 1864) near threatened*
<b>Microhylidae</b> <i>Ramanella obscura</i> (Günther, 1864) near threatened*	<b>Scincidae</b> <i>Lankascincus taprobanensis</i> (Kelaart, 1854) near threatened*
<b>Ranidae</b> <i>Hylarana temporalis</i> (Günther, 1864) near threatened	<b>Colubridae</b> <i>Ahaetulla nasuta</i> (Bonnaterre, 1790) <i>Dendrelaphis pictus</i> (Gmelin, 1789)
<b>Rhacophoridae</b> <i>Pseudophilautus cavirostris</i> (Günther, 1869 ) endangered* <i>Pseudophilautus fergusonianus</i> (Ahl, 1927) least concern* <i>Pseudophilautus folicola</i> (Manamendra-Arachchi and Pethiya goda 2005) endangered* <i>Pseudophilautus procax</i> (Manamendra-Arachchi and Pethiya goda 2005) critically endangered* <i>Pseudophilautus reticulatus</i> (Günther, 1869) endangered* <i>Pseudophilautus singu</i> (Meegaskumbura, Manamendra-Arachchi and Pethiyagoda 2009) not evaluated* <i>Pseudophilautus stictomerus</i> (Günther, 1876) near threatened* <i>Polypedates cruciger</i> Blyth, 1852 least concern* <i>Polypedates fastigo</i> Manamendra-Arachchi and Pethiyagoda 2001 critically endangered*	<b>Viperidae</b> <i>Hypnale hypnale</i> (Laurenti, 1768)* <i>Trimeresurus trigonocephalus</i> (Latreille, 1801) vulnerable*
*Asterisk stands for endemic to Sri Lanka	



### *Geckoella triedrus*

This small gecko is a typical inhabitant of forests in the wet zone, but it is recorded from some parts of the dry zone as well. Das and De Silva (2005) restricted the elevational distribution to 700 m asl. However, we found our only specimen active at night at an elevation of 975 m asl. *Geckoella triedrus* is a small brown to black colored gecko with tiny whitish dots on the dorsum. This gecko is a member of the leaf litter herpetofauna living on the ground, and it is difficult to find.



*Geckoella triedrus*.

### Agamidae

#### *Calotes calotes*

*Calotes calotes* is a widespread arboreal agamid found all over Sri Lanka up to 1500 m asl. The distribution ranges north into India. This agamid lizard is a typical anthropophilic species and is often found in gardens. We found a male *C. calotes* sleeping in the late evening at the forest border.



*Calotes calotes*.

#### *Calotes liolepis*

This agamid lizard is generally restricted to the wet zone, with a few exceptions in the intermediate and dry zone. In these drier areas, it is found on small hills with

a slightly higher rainfall than the surrounding area. It is distributed in forests and plantations up to 1000 m asl. Our detection of *C. liolepis* in Morningside represents the highest regions in the distribution. *Calotes liolepis* is endemic to the region. This agamid species is difficult to find because it climbs the stems of trees and then curls around the stem, avoiding detection. All three specimens (one female and two males) that we found sat on a stem at heights between 4 and 6 m. One of the males had two bluish stripes laterally and an orange throat. The female was grayish colored. Somaweera found a specimen with red stripes (Manthey 2008). One of the authors (M.B.) found *C. desilvai* on an earlier trip in this forest patch. *Calotes desilvai* looks quite similar to *C. liolepis* and is restricted to a small part of the Morningside area (Bahir and Maduwage 2005). This is one of the few places where both species live in sympatry. However, we did not detect any *C. desilvai* on this trip.



*Calotes liolepis*.

#### *Otocryptis wiegmanni*

The kangaroo lizard is very common in the forests of Morningside. We found adults and young specimens frequently. This agamid is distributed throughout the wet zone and some parts of the intermediate zone as well. Only one species of the genus was described for Sri Lanka until Bahir and Silva (2005) described a new species



(*O. nigristigma*). *Otocryptis nigristigma* is restricted to the dry and intermediate zones. Male *O. wiegmanni* have a black patch on the dewlap, and by this they can be distinguished from *O. nigristigma*. *Otocryptis wiegmanni* is able to run bipedally when fleeing. *Otocryptis wiegmanni* can be found active during daytime or sleeping in the darkness on branches of trees and bushes.



*Otocryptis wiegmanni* male specimen.



*Otocryptis wiegmanni* sleeping.

### *Lyriocephalus scutatus*

*Lyriocephalus scutatus* is restricted to the wet zone and few places of the intermediate zone below 1600 m asl,



*Lyriocephalus scutatus* young specimen.

where it inhabits forests and home gardens. It is a slow-moving species and is mostly arboreal. Most specimens are light green or yellowish in coloration, although females are sometimes grayish or brownish. Young specimens are brownish and live on or near the ground in bushes or small trees. A unique defensive posture of this species is the display of the deep red color of the mouth. *Lyriocephalus scutatus* can easily be found in the darkness when they sleep and hang on tree stems. In the light of a torch, one can see them easily by the light coloration of the body. We found *L. scutatus* often, from very young to adult male specimens during both daytime and at night.

### Scincidae

#### *Lankascincus taprobanensis*

*Lankascincus* are ground living species found in leaf litter. It is difficult to photograph these skinks because they quickly hide under leaf litter upon detection. *Lankascincus taprobanensis* is a mountainous species, distributed from 1000 m to 2300 m asl. We found this skink at their lowest distribution level in Morningside. The skinks are active during daytime and can be easily photographed at night.





*Lankascincus taprobanensis*.



*Hypnale zara*.

## Colubridae

### *Ahaetulla nasuta*

Only one specimen was found in tree branches at the border of the forest at night. *Ahaetulla nasuta* is widely distributed across Sri Lanka and mainland Asia. This snake is often found in gardens in every climatic zone. There are no color varieties of *A. nasuta* in Sri Lanka. This opistoglyph snake is green-colored and becomes mottled when disturbed.

### *Dendrelaphis tristis*

This slender and long snake has nearly the same distribution as *A. nasuta*, and we found one specimen nearly at the same place as the *A. nasuta* specimen. *Dendrelaphis tristis* is a common snake, more typically found in the lower parts of Sri Lanka. Das and De Silva (2005) gave a distribution range up to 750 m asl. We found this species 200 m higher in Morningside. The snake was hiding in bushes at night.

## Viperidae

### *Hypnale zara*

This venomous snake is endemic to Sri Lanka. It is a small brownish snake found in mountain and submontane forests living in leaf litter, where it can easily be overlooked. We found a specimen hiding around a pond at night.

### *Trimeresurus trigonocephalus*

*Trimeresurus trigonocephalus* is an arboreal snake with greenish ground color and often variegated black patterns. This species is distributed throughout Sri Lanka below 1075 m asl. We found one specimen hanging on branches next to a pond in the dark. It is a very docile species; the snake did not try to bite, but it did try to escape.



*Trimeresurus trigonocephalus*.





*Trimeresurus trigonocephalus*.



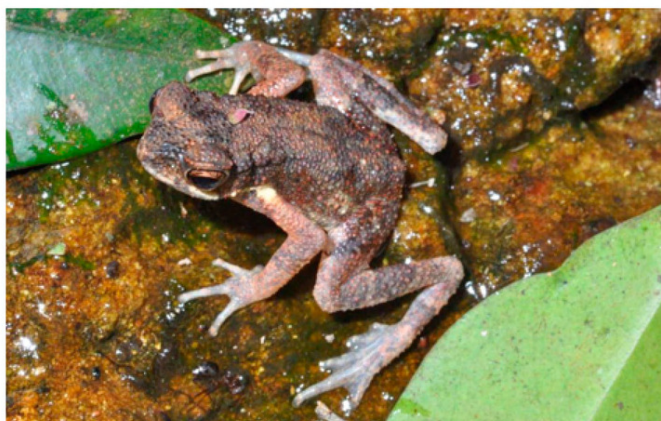
*Fejervarya kirtisinghei*.

## Amphibians

### Bufonidae

#### *Adenomus kelaartii*

*Adenomus kelaartii* is a small slender toad found near streams, which is where we found our only specimen during the survey. It is a ground-dwelling species, but it can sometimes be found climbing on trees. *Adenomus kelaartii* is restricted to the wet zone and mountainous areas of Sri Lanka. There are no descriptions of eggs or tadpoles in nature, but there is a description of tadpoles from captive bred specimens (Haas et al. 1997; Haas 1999). We found one specimen together with *Hylarana temporalis*.



*Adenomus kelaartii*.

### Dicroglossidae

#### *Fejervarya kirtisinghei*

This ranid like species is widely distributed in the lowland areas of Sri Lanka in the wet and the dry zone. In the past, *F. kirtisinghei* has been confused with *F. greeni*. The latter is restricted to the higher elevations of Sri Lanka. We found *F. kirtisinghei* near ponds together with *Hylarana temporalis* and *Ramanella obscura*. We observed tadpoles with the typical black tag in the pond.

### Microhylidae

#### *Ramanella obscura*

*Ramanella obscura* is a small species (32 mm) living on the ground in leaf litter in shaded forests, but it sometimes climbs on trees and can be found in tree holes up to two meters high. It is distributed throughout the wet zone up to 1200 m asl. We found several specimens near or inside ponds. Egg clutches rest in a single layer on the water surface. We found *R. obscura* tadpoles together with tadpoles of *Fejervarya kirtisinghei* in the pond. Breeding of *R. obscura* in phytotelmata is described, but we only found egg clutches in ponds.



*Ramanella obscura*.



*Ramanella obscura* egg masses.





*Ramanella obscura* tadpoles in pond.

## Ranidae

### *Hylarana temporalis*

This is a typical species of the forest patch in Morning-side. It is widely distributed in Sri Lanka's wet zone from the lowlands up to 1800 m asl. The frogs are mostly brownish-colored, with cross bars on the arms and legs. We found *H. temporalis* near the stream and near ponds, where the ground is wet or muddy. One frog had only one hind foot.



*Hylarana temporalis*.



*Hylarana temporalis* with missing foot.

## Rhacophoridae

### *Pseudophilautus cavirostris*

An arboreal species, *P. cavirostris* is perhaps found most often in canopies (Dutta and Manamendra-Arachchi 1996). This frog reaches 50 mm in length and has a tuberculated dorsum and fringes along the lower arms and tarsus. The coloration can be greenish or mottled with grey and brown. The frog is well camouflaged to look like lichens on a stem and is difficult and rare to find. Descriptions of eggs and mating behavior are not given elsewhere. We found a male specimen calling from leaves 1.5 m above ground around 11 p.m. Manamendra-Arachchi and Pethiyagoda (2005) suggested that males do not come down from the canopy because they could not find male specimens.



*Pseudophilautus cavirostris* calling.



*Pseudophilautus cavirostris*.



### *Pseudophilautus fergusonianus*

This frog is found on trees and rocks in rainforests and rubber plantations in the hills of the wet zone between 300 and 700 m asl (Manamendra-Arachchi and Pethiyagoda 2005). We found several specimens, but only inside or at the house where we also found *Cnemaspis*. No specimens were observed in the forest. The coloration of *P. fergusonianus* gave an ideal camouflage on the house walls. This frog reaches 45 mm (females).



*Pseudophilautus fergusonianus*.



*Pseudophilautus fergusonianus*.

### *Pseudophilautus folicola*

*Pseudophilautus folicola* was described as a lowland species from the wet zone (Manamendra-Arachchi and Pethiyagoda 2009). Our survey expands the distribution up to 975 m asl. It seems to be a common species, even found hiding in the daytime on garden plants.



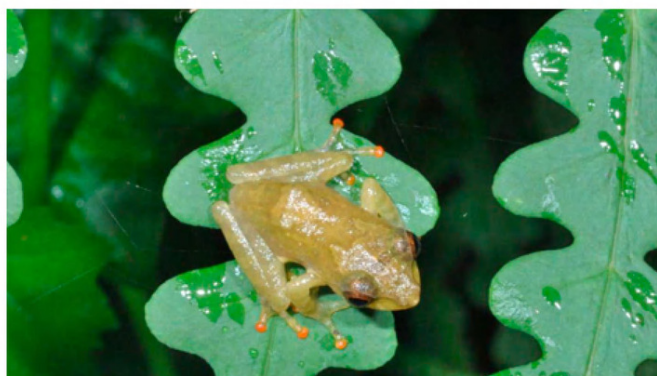
*Pseudophilautus folicola*.

### *Pseudophilautus procax*

*Pseudophilautus procax* is a tiny species (27 mm) found at night on leaves one to two meters above the ground. The coloration is light brown, sometimes a bit yellowish, with a yellowish to white infraorbital patch and red fingertips. This species is endemic to Morningside.



*Pseudophilautus procax*.



*Pseudophilautus procax*.

### *Pseudophilautus reticulatus*

*Pseudophilautus reticulatus* is a larger species of the genus, with females reaching 61 mm. The scientific name for this species is derived from the markings down the lateral sides of the body and on the inner part of the femora. It is an arboreal species that comes down from canopies at night. In our estimation, this frog should be distributed in forests of the wet zone up to an elevation of 975 m asl. The true distribution of this species is unclear.



*Pseudophilautus reticulatus*: note markings down the lateral sides of the body and on the inner part of the femora.

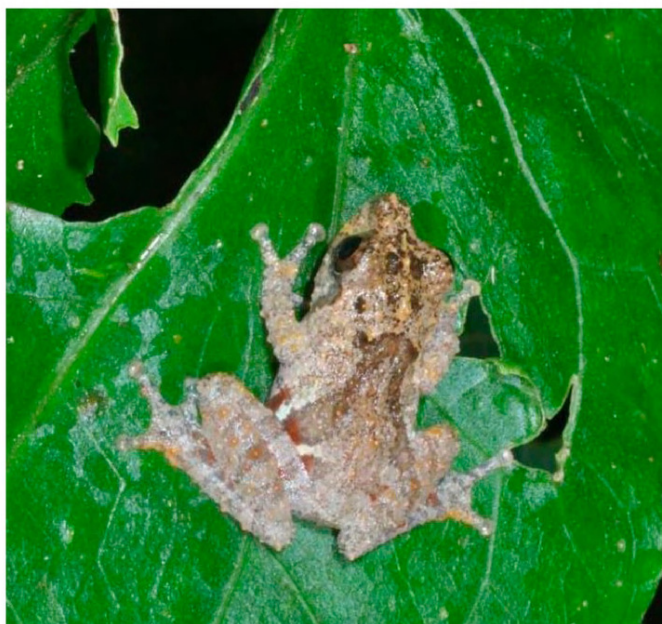




*Pseudophilautus reticulatus*.

### *Pseudophilautus singu*

We found specimens with grayish or light brownish ground coloration, which is in contrast to the original description of the species (Meegaskumbura, Manamendra-Arachchi, and Pethiyagoda 2009). It is a small species (males less than 20 mm), but females are not described and their size is unknown and undescribed in scientific papers. *Pseudophilautus singu* was found near ponds on leaves 1-2 m above the ground.



*Pseudophilautus singu*.

### *Pseudophilautus stictomerus*

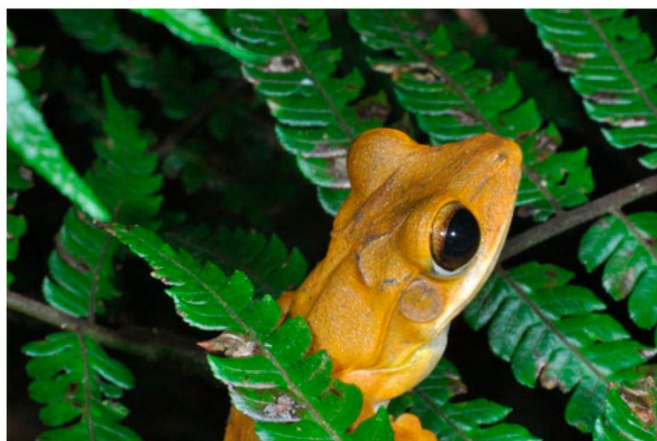
*Pseudophilautus stictomerus* is a small species (23 to 36 mm) from Sri Lanka's wet zone. Although it was assumed that this species is distributed to 700 m asl, we found this species at an elevation of 975 m asl. We found a small specimen, brownish-colored, with a fine white line from snout to vent and further along the hind legs and a yellow throat. The coloration of the throat could be an indicator for a male specimen.



*Pseudophilautus stictomerus*.

### *Polypedates cruciger*

*Polypedates cruciger* is a large rhacophorid frog (male 60 mm and female 90 mm). It is a common species, found from the wet zone to the dry zone. It is a species that can be found in gardens and inside houses. Mating and breeding of this species is well known and documented (Herrmann 1993). We found two specimens at a pond inside the forest, sympatric with *Taruga fastigo*.



*Polypedates cruciger*.





*Polypedates cruciger*.



*Taruga fastigo*.

### *Taruga fastigo*

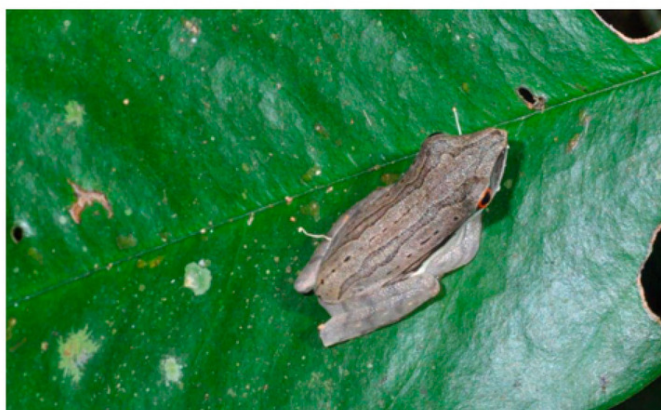
*Taruga fastigo* is a beautiful tree frog and very similar to *P. longinasus*. *Taruga fastigo* is restricted to Morningside, and *P. longinasus* is a lowland species in forests of the wet zone. Unfortunately, there is no genetic verification that these are separate species. However, it is possible that both species live sympatrically in the Sinharaja forest. *Taruga fastigo* is a common species in this forest patch, and we found young and adult frogs at night on leaves and branches up to 2 m above ground. At the pond, we found a foam nest of *Taruga fastigo* containing a few unfertilized eggs. Further observations of *Taruga fastigo* are necessary, especially for breeding information, because this is a critically endangered species.



*Polypedates fastigo*.



*Taruga fastigo* foam nest.



*Polypedates fastigo*.

### Discussion

During our brief survey, we found an interesting diversity of reptile and amphibian species, some of which were previously unknown from Morningside. This survey shows how much knowledge we are lacking about the distribution and ecology of reptiles and especially of the amphibians of Sri Lanka. Further investigations are necessary to answer these and future questions. The behavior and ecology of some of these species is currently not well known. One example of this lack of knowledge



is that we provide the first published record of a calling male *P. cavoristris*. This small patch of remaining tropical rainforest is ecologically valuable, an ideal place for a larger study of the ecology of such small forest patches and also for the ecology of these species of reptiles and amphibians. Also, little is known about the mating behavior and breeding of Sri Lankan amphibians (Karunaratna and Amarasinghe 2007). Future research is necessary and should be done in both nature and in captivity, as was previously conducted by Wildlife Heritage Trust at Agrapatana (Bahir et al. 2005).

This survey also highlights the need for more research at Morningside because some expected species were not detected on our trip. We could not find any specimens of the genus *Ceratophora* (*C. erdeleni* and *C. karu*), even though the Morningside Estate where they are known to occur is not far away from this forest patch. Both species are restricted to the Morningside region. We also found a few frog species only at Morningside Estate (*Pseudophilautus poppiae*, *P. sordidus*, and *P. decoris*), but not in the forest patch. It is possible that these frogs could be present in the forest patch as well, but escaped detection. One of the authors (M. B.) found *Microhyla karunaratnei* on a previous trip, but we did not find any specimens on the trip described here. We also found two species of *Pseudophilautus* that we could not accurately identify to the species level. These uncertainties, as well as its conservation priority, suggest that Morningside should be a target for future research on reptiles and amphibians.

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*Pseudophilautus* unknown species.



*Pseudophilautus* unknown species.



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