

# Range extension for *Duttaphrynus kotagamai* (Amphibia: Bufonidae) and a preliminary checklist of herpetofauna from the Uda Mälīboda Trail in Samanala Nature Reserve, Sri Lanka

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**Abstract.**—Uda Mälīboda Trail is an unstudied, remarkable forest located in the northwest region of Samanala Nature Reserve (SNR) in Sri Lanka's wet zone. Here we report the first record of *D. kotagamai* from Uda Mälīboda Trail and the lowest elevation records of four highland Rhacophorid frogs: *Pseudophilautus alto*, *P. asankai*, *P. femoralis*, and *Taruga eques*. Further, we present results of a preliminary study of herpetofaunal diversity in Uda Mälīboda Trail. Thirty-four amphibian (26 endemic and 19 Threatened) and 59 reptile (32 endemic and 19 Threatened) species were observed. This wet zone forest supports high herpetofaunal diversity; however activities such as deforestation, human encroachment, mining, agriculture, dumping, road construction, and a hydroelectric power station threaten the ecology of this biologically diverse forest.

**Key words.** Amphibians, awareness, conservation, *Duttaphrynus*, global biodiversity hotspot, *Pseudophilautus*, reptiles, Sri Lanka, threatened, wet zone

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## Introduction

Western Ghats and Sri Lanka have collectively been designated a global biodiversity hotspot (Mittermeier et al. 2004; Myers et al. 2000). Favorable environmental factors such as high rainfall, humidity, and a high density of undergrowth vegetation in this region have assisted in sustaining regional diversity and distinctness (Bossuyt et al. 2005; Gunawardene et al. 2007). Sri Lanka comprises the smaller portion of the hotspot, with a total land area of 65,610 km<sup>2</sup>. Despite its small size, the region has a spectacular assemblage of amphibians and reptiles. Recent molecular studies on amphibians (Rhacophorids and Caecilians) and Uropeltid snakes have shown that Sri Lanka has maintained a fauna distinct from the Indian mainland (Bossuyt et al. 2004; Meegaskumbura et al. 2002; Pethiyagoda 2005), yet these subregions are separated only by about 300 kilometers (direct distance).

Of Sri Lanka's three major climatic zones (wet, intermediate, and dry) the wet zone harbors a significantly high level of herpetofaunal diversity and endemism

(Bambaradeniya et al. 2003; Senanayake et al. 1977; Wijesinghe and Dayawansa 2002). The wet zone receives abundant rainfall (annual average 3,000 mm), has considerable forest cover, and maintains favorable humidity and temperatures to support such high herpetofaunal diversity. Previous studies have noted that some herpetofaunal species as well as the wet zone forests themselves are threatened due to a variety of human activities (e.g., IUCN-SL and MENR-SL 2007). Many wet zone forests have yet to be studied. Uda Mälīboda in the Kegalle district (Sabaragamuwa Province) is one such unstudied wet zone forest.

Kotagama's dwarf toad (*Duttaphrynus kotagamai*) is endemic and Endangered and is one of the rarest bufonids in Sri Lanka (De Silva 2009). Originally described from the Sinharaja World Heritage Site in 1994 by Prithiviraj Fernando and Nihal Dayawansa (Fernando et al. 1994) this toad is known only from the Kitulgala, Massena, Erathna, and Delwala forest areas (Dutta and Manamendra-Arachchi 1996; Goonatilake and Goonati-

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lake 2001). It favors a few primary lowland rain forests in the wet zone with elevations below 1,070 m (IUCN-SL 2011). According to Manamendra-Arachchi and Pethiyagoda (2006) the holophoront (USNM 311595 H) has been lost from the National Museum of Natural History, Washington, D.C. (USA). Herein we describe new localities and a range extension for *D. kotagamai* from a lowland rain forest in the northwestern boundary of the Samanala Nature Reserve (SNR) and further provide a preliminary checklist of herpetofauna from the Uda Mälīboda Forest area.

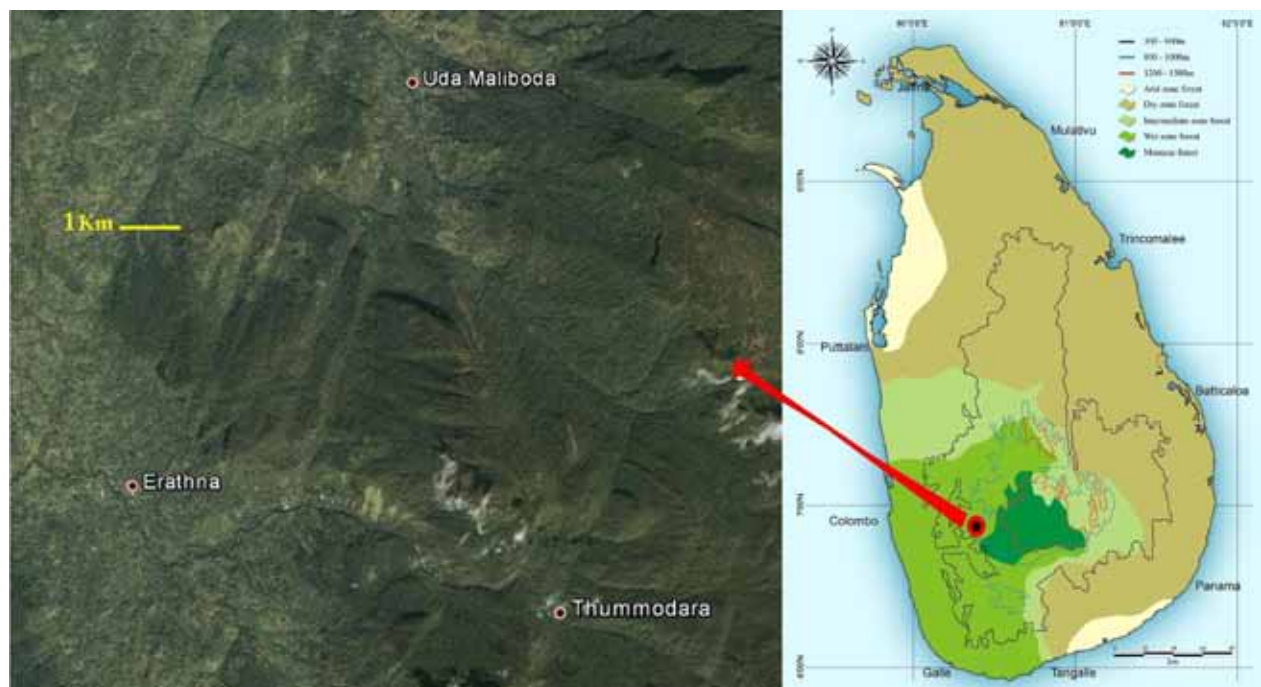
## Materials and methods

We used visual encounter survey methods (Crump and Scott 1994) to conduct herpetofaunal surveys for a total of 17 days and nights between 2006 and 2011. Night searches were performed using headlamps and flashlights. We searched specific microhabitats including underneath stones and decaying logs, inside tree holes, and other potential herpetofaunal retreats. Road kills and data from animals dispatched by villagers were also used as sources of information. Specimens were hand captured, photographed, identified using field guides and scientific publications (Ashton et al. 1997; De Silva 2009; Dutta and Manamendra-Arachchi 1996; Maduwage et al 2009; Manamendra-Arachchi et al. 2007; Manamendra-Arachchi and Pethiyagoda 2006; Meegaskumbura et al. 2010; Somaweera 2006; Somaweera and Somaweera 2009; Vogel and Rooijen 2011; Wickramasinghe et al. 2007a, b),

and then released back to the original capture site without injury. Species nomenclature was based on Frost et al. (2006), Kotaki et al. (2010), Sumida et al. (2007), and Senaratna (2001), and conservation status was evaluated on the IUCN-SL and MENR-SL (2007).

## Study area and habitats

The Samanala Nature Reserve (SNR) is one of the largest and most important forest areas for endemic biodiversity in Sri Lanka and is owned by the Central Highlands World Heritage Centre (UNESCO 2011). The Study area lies between 6°53'01.58" N and 80°26'31.18" E with elevations ranging from 300-700 m (Fig. 1). This forest area is part of the Kegalle district in Sabaragamuwa Province. Average annual rainfall ranges from 3,000-4,500 mm and the average annual temperature is 27.9 °C (Fig. 2). The vegetation of Uda Mälīboda Trail is categorized as lowland wet evergreen forest (Gunatilleke and Gunatilleke 1990) and is comprised of the following dominant genera: *Doona*, *Stemonoporus*, *Calophyllum*, *Syzygium*, *Shorea*, *Dipterocarpus*, *Cullenia*, and *Mesua* (Table 1). Pilgrims use four main trails annually between December and April to reach Adams Peak to worship. The Uda Mälīboda Trail starts from the "Uda Mälīboda village" and continues through Madähinna (Kuruwita trail) via Adams Peak (elevation 2,245 m). This is the longest trail and is seldom used by pilgrims since it consists of rough terrain and narrow foot paths (Karunaratna et al. 2011).



**Figure 1.** Map of study area (sky view source: Google map).

**Table 1.** Floral species presence in different level of Uda Mälilboda area (Uda Mälilboda Trail in SNR).

Prominent layer	Plant species diversity
<b>Canopy</b>	<i>Adinandra lasiopetala</i> , <i>Bhesa ceylanica</i> , <i>Calophyllum trapezifolium</i> , <i>Cullenia ceylanica</i> , <i>Shorea affinis</i> , <i>S. gardneri</i> , <i>Litsea gardneri</i> , and <i>Palaquium rubiginosum</i>
<b>Subcanopy</b>	<i>Apodytes dimidiata</i> , <i>Artocarpus nobilis</i> , <i>Calophyllum walkeri</i> , <i>Caryota urens</i> , <i>Cinnamomum ovalifolium</i> , <i>Cryptocarya wightiana</i> , <i>Dillenia triquetra</i> , <i>Elaeocarpus amoenus</i> , <i>Eugenia mabaeoides</i> , <i>Garcinia quaesita</i> , <i>Gordonia speciosa</i> , <i>Madhuca moonii</i> , <i>Mesua ferrea</i> , <i>Oncosperma fasciculatum</i> , <i>Schumacheria alnifolia</i> , <i>Stemonoporus gardneri</i> , <i>S. oblongifolia</i> , <i>Syzygium firmum</i> , and <i>S. turbinatum</i>
<b>Climbers</b>	<i>Calamus thwaitesii</i> , <i>Cosinium fenestratum</i> , <i>Cyclea peltata</i> , <i>Freycinetia walkeri</i> , <i>Rubus rugosus</i> , and <i>Smilax perfoliata</i>
<b>Understory</b>	<i>Acronychia pedunculata</i> , <i>Agrostistachys coriacea</i> , <i>Alpinia abundiflora</i> , <i>Amomum echinocarpum</i> , <i>Amomum masticatorium</i> , <i>Amorphophallus paeoniifolius</i> , <i>Arundina graminifolia</i> , <i>Calanthes</i> sp., <i>Cinnamomum verum</i> , <i>Clusia rosea</i> , <i>Cyathea crinita</i> , <i>Hedychium coronarium</i> , <i>Hortonia ovalifolia</i> , <i>Ipea speciosa</i> , <i>Macaranga indica</i> , <i>Neolitsea cassia</i> , <i>Osbeckia aspera</i> , <i>Osbeckia lantana</i> , <i>Rhodomyrtus tomentosa</i> , <i>Strobilanthes</i> sp., <i>Syzygium cordifolium</i> , <i>Syzygium revolutum</i> , and <i>Utricularia striatula</i>

## Results and discussion

### New record for *D. kotagamai*

We report the occurrence of the Endangered, rare, and endemic *D. kotagamai* (Fernando and Dayawansa 1994) from Uda Mälilboda forest (Uda Mälilboda Trail) in the northwest region of the Samanala Nature Reserve (SNR = Peak Wilderness Sanctuary). According to Fernando et al. (1994), this species is distinguished from other *Duttaphrynus* species known from Sri Lanka and southern India by combination of the following characters: prominent parietal ridges on the head; long and narrow unlobulated parotoid glands; most areas of the anterior back are smooth; warts present on upper flank, supraorbital, and parietal ridges; tips of digits and tips of spinous warts black; first finger slightly longer than second finger (Fernando et al. 1994). Coloration in life is described as: orange-brown on dorsal surface mottled with dark brown (juveniles dorsal color is light golden); light cross band between eyes and distinct dark cross band on forearm, forefoot, tarsus, and tibia; less distinct cross band on upper arm and femur; lower jaw with alternate dark and

light markings; ventral surface whitish mottled with dark brown, especially over sternum.

Eleven *D. kotagamai* were encountered during our survey. These toads were only found in primary forest and absent from human-disturbed areas. Except for one specimen, all were found within ~10 m of a small stream. (Fig. 3), and all but four individuals were observed at night. Three individuals from Uda Mälilboda measured: two males SVL 32.6 mm, 35.2 mm, and a female SVL 38.5 mm. We also found *D. kotagamai* in another previously unknown locality on an adjacent mountain in Deraniyagala in Kegalle district (Table 2). This mountain is located about five km north of Uda Mälilboda. There are no previous records of *D. kotagamai* from the Uda Mälilboda Trail (SNR; see De Silva 2009; Dutta and Manamendra-Arachchi 1996; IUCN-SL 2011; Manamendra-Arachchi and Pethiyagoda 2006; Goonatilake and Goonatilake 2001). The Uda Mälilboda locality is approximately six km (direct distance) from “Eratne” (Kuru river basin), the nearest published location. The direct distance between the onymotope and the new location is about 80 km. All of these areas have closed canopies with wet and cool habitats (Fig. 4).



**Figure 2.** View of forest in Uda Maliboda (larger water resource in the SNR).



**Figure 3.** Cascade habitat: shrub mixed with riverine forest patch.



**Figure 4.** Inside forest: tall trees, mixed vegetation with good leaf litter.

Based on the infrequent calls heard during our survey periods this species is presumably rare in Uda Mälīboda. It is aggressive when handled and releases a low-pitched distress call “crick, crick, crick...”. With two new locations and a subsequent range extension, we can trace the probable distribution of *D. kotagamai* prior to fragmentation. The new locations indicate a larger distribution than previously concluded. As a result of severe fragmentation and habitat degradation in the area, local extinctions of previous populations have likely occurred in the past with current populations known only from a few isolated primary forest patches.

### Herpetofaunal diversity

During the study we encountered 34 amphibian species representing 15 genera and seven families (Table 3). Among those genera *Adenomus*, *Lankanectes*, *Nannophrys*, and *Taruga* are endemic to Sri Lanka. Our results show that at least 31% of Sri Lanka’s extant amphibians occur in the Uda Mälīboda area (Fig. 5). Twenty-six of the 34 species encountered (76%) are endemic, five (14%) are considered Near Threatened, four (11%) are Vulnerable, and ten (29%) are classified as Endangered (IUCN-SL and MENR-SL 2007). Families with the greatest number of endemic species include Rhacophoridae (16 species) and Dicroglossidae (six species), while the family Ichthyophiidae, Ranidae (two species each) and Nyctibatrachidae (one species) show the lowest rates of endemism. When considering the 34 species by their primary mode of living, 15 (44.1%) were arboreal, 10 (29.4%) terrestrial, seven (20.6%) aquatic, and two (5.9%) fossorial species.

Most amphibian species observed after brief periods of rain since many species frequently use temporary pools created by these showers. Two large streams course forest acting as barriers that restrict some species to particular habitats. Among the most commonly encountered amphibians were *Pseudophilautus folicola*, found on low growing woody vegetation near water bodies under closed canopy, and *Fejervarya kirtisinghei*, occurred near water bodies lacking canopy. Four Endangered and endemic highland species: *P. alto* (1,890-2,135 m elevation), *P. asankai* (810-1,830 m), *P. femoralis* (1,600-2,135 m), and *Taruga eques* (1,750-2,300 m; Manamendra-Arachchi and Pethiyagoda 2006) were encountered at this study site, approximately 700 m elevation (lowest elevation ever recorded for these species).

We report a range extension for *Pseudophilautus sarasinorum*, an Endangered species previously known only from the following localities: Peradeniya (07°16’ N, 80°37’ E; Onymotope); Bogawanthalawa-Balangoda road (near 25th km post), elevation 1,300 m (06°45’ N, 80°2’ E); Corbett’s Gap, elevation 1,000 m (07°22’ N, 80°50’ E); Hunnasingiriya, elevation 367 m (07°23’ N, 80°41’ E); Agra Arboretum, elevation 1,555 m (06°50’

## Uda Mälīboda trail and a preliminary herpetofaunal checklist

**Table 2.** Description of the 11 observed *D. kotagamai* individuals during the study period from Uda Mälīboda.

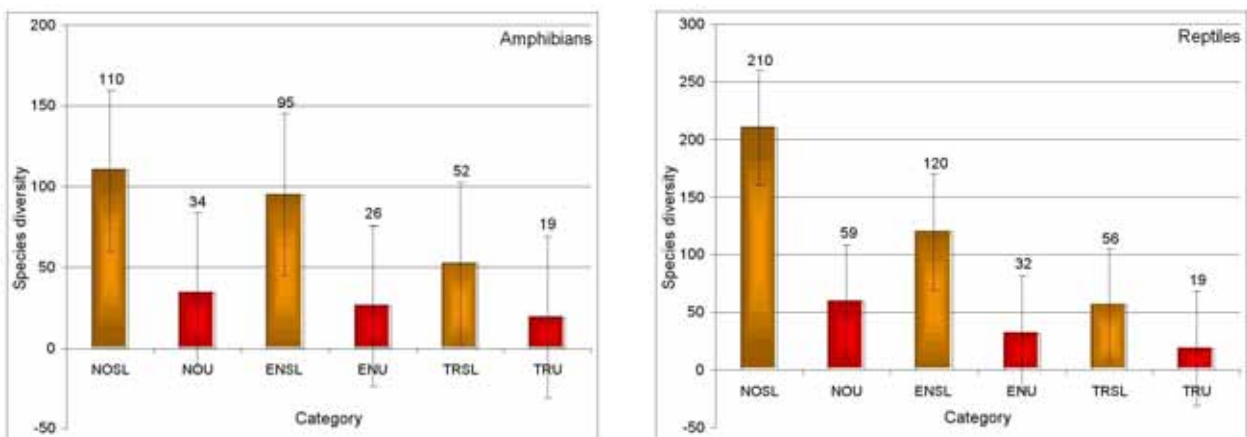
Date	Sex	Micro-habitat
18 January 2009	Male	Mid-stream boulder
	Male	Forest floor with leaf litter
	Female	Stream-bank boulder
17 April 2009	Female	Rock crevice
	Male	Stream-bank boulder
25 December 2009	Male	Stream-bank
07 May 2010	Male	Stream-bank
	Male	Stream-bank
22 August 2010	Female	Forest floor with leaf litter
	Male	On footpath
03 October 2011	Male	Stream-bank boulder

N, 80°40' E; Manamendra-Arachchi and Pethiyagoda 2005). Sumida et al. (2007) suggested the Sri Lankan population of *F. limnocharis* (in Dutta and Manamendra-Arachchi 1996; Manamendra-Arachchi and Pethiyagoda 2006) could be *F. syhadrensis*. However, recent molecular evidence revealed the Sri Lankan population of *F. cf. syhadrensis* is a separate and unnamed population belonging to a unique clade, together with *F. granosa* and *F. pierrei* (Kotaki et al. 2010). Therefore, we refrain from referring to the third *Fejervarya* species in Sri Lanka as *F. limnocharis* (in Dutta and Manamendra-Arachchi 1996; Manamendra-Arachchi and Pethiyagoda 2006) and instead refer it to as *F. cf. syhadrensis*.

Fifty-nine species of reptiles representing 37 genera from 11 families were recorded during these surveys (Table 4). Among those genera *Aspidura*, *Balanophis*, *Ceratophora*, *Cercaspis*, *Haplocercus*, *Lankascincus*, *Lyriocephalus*, and *Nessia* are considered endemic to Sri Lanka. Twenty-eight percent of Sri Lanka's extant

reptiles were recorded in the study area (Fig. 5) including 28 species of lizards and 31 species of snakes. Of these 59 reptile species 32 (54%) are endemic, six (10%) Data Deficient, ten (17%) Near Threatened, five (8%) Vulnerable, and four (7%) Endangered (IUCN-SL and MENR-SL 2007). Families with the greatest species representation include Colubridae (17 species), Scincidae (11 species), and Gekkonidae (nine species), while the least represented family were Cyndrophidae, Pythonidae, and Typhlopidae (one species each). The highest number of endemic species were in the family Scincidae (nine species) and Colubridae (seven species), while the lowest number were in Cyndrophidae, Elapidae, and Typhlopidae (one species each). When considering the 59 species by primary mode of living: 24 (40.7%) were terrestrial, 21 (35.6%) arboreal, 11 (18.6%) fossorial, and three (5.1%) aquatic species.

Among the reptiles, *Otocyrtis wiegmanni*, *Lankascincus greeri*, *Dendrelaphis schokari*, and *Hypnale zara* were the most commonly encountered species in and around footpaths. One unidentified species from the genus *Cyrtodactylus* was recorded during this survey and may be new to science. Several species of lizards (*Cnemaspis scalpensis*, *C. silvula*, *Hemiphyllodactylus typus*, *Eutropis beddomii*, and *Varanus bengalensis*) and snakes (*Boiga beddomi*, *Cercaspis carinatus*, *Haplocercus ceylonensis*, *Aspidura guentheri*, *Balanophis ceylonensis*, and *Typhlops mirus*) are noteworthy records. The Uda Mälīboda forest area also supports three highly venomous snakes: *Bungarus ceylonicus* (Sri Lanka krait), *Daboia russelii* (Russell's viper), and *Naja naja* (Indian cobra). Hence, both venomous and non-venomous snakes are frequently killed in this area due to fear and ignorance as a precautionary measure against snakebites. We failed to record any turtle species in the area, possibly due to low water temperatures in streams.



**Figure 5.** Comparison of amphibian (left) and reptile (right) diversity of Uda Mälīboda area with rest of the Sri Lankan species (Abbreviations: NOSL – total number of species in Sri Lanka; NOU – total number of species in Uda Mälīboda; ENSL – number of endemic species to Sri Lanka; ENU – number of endemic species in Uda Mälīboda; TRSL – number of threatened species in Sri Lanka and TRU – number of threatened species in Uda Mälīboda).

**Table 3.** Checklist of amphibian species in the Uda Mäliboda area (Abbreviations: E – endemic; EN – Endangered; VU – Vulnerable; NT – Near Threatened).

Family and species name	Common name
<b>Bufonidae</b>	
<i>Adenomus kelaartii</i>	Kelaart's dwarf toad <sup>E</sup>
<i>Duttaphrynus kotagamai</i>	Kotagama's dwarf toad <sup>E, EN</sup>
<i>Duttaphrynus melanostictus</i>	Common house toad
<b>Microhylidae</b>	
<i>Kaloula taprobanica</i>	Common bull frog
<i>Microhyla rubra</i>	Red narrow mouth frog
<i>Ramanella nagaai</i>	Nagao's pugsnout frog <sup>E, VU</sup>
<i>Ramanella obscura</i>	Green-brown pugsnout frog <sup>E, NT</sup>
<b>Nyctibatrachidae</b>	
<i>Lankanectes corrugatus</i>	Corrugated water frog <sup>E</sup>
<b>Dicroglossidae</b>	
<i>Euphlyctis cyanophlyctis</i>	Skipper frog
<i>Euphlyctis hexadactylus</i>	Sixtoe green frog
<i>Fejervarya kirtisinghei</i>	Mountain paddy field frog <sup>E</sup>
<i>Fejervarya</i> cf. <i>syhadrensis</i>	Common paddy field frog
<i>Hoplobatrachus crassus</i>	Jerdon's bull frog
<i>Nannophrys ceylonensis</i>	Sri Lanka rock frog <sup>E, VU</sup>
<b>Rhacophoridae</b>	
<i>Pseudophilautus abundus</i>	Labugagama shrub frog <sup>E</sup>
<i>Pseudophilautus alto</i>	Horton plains shrub frog <sup>E, EN</sup>
<i>Pseudophilautus asankai</i>	Asanka's shrub frog <sup>E, EN</sup>
<i>Pseudophilautus cavirostris</i>	Hollow snouted shrub frog <sup>E, EN</sup>
<i>Pseudophilautus femoralis</i>	Leafnesting shrub frog <sup>E, EN</sup>
<i>Pseudophilautus folicola</i>	Leaf dwelling shrub frog <sup>E, EN</sup>
<i>Pseudophilautus hoipolloi</i>	Anthropogenic shrub frog <sup>E</sup>
<i>Pseudophilautus popularis</i>	Common shrub frog <sup>E</sup>
<i>Pseudophilautus reticulatus</i>	Reticulated-thigh shrub frog <sup>E, EN</sup>
<i>Pseudophilautus rus</i>	Kandiyan shrub frog <sup>E, NT</sup>
<i>Pseudophilautus sarasinorum</i>	Muller's shrub frog <sup>E, EN</sup>
<i>Pseudophilautus sordidus</i>	Grubby shrub frog <sup>E, NT</sup>
<i>Pseudophilautus stictomerus</i>	Orange-canthal shrub frog <sup>E, NT</sup>
<i>Polypedates cruciger</i>	Common hour-glass tree frog <sup>E</sup>
<i>Taruga eques</i>	Mountain tree frog <sup>E, EN</sup>
<i>Taruga longinasus</i>	Long-snout tree frog <sup>E, EN</sup>
<b>Ranidae</b>	
<i>Hylarana aurantiaca</i>	Small wood frog <sup>VU</sup>
<i>Hylarana temporalis</i>	Common wood frog <sup>E, NT</sup>
<b>Ichthyophiidae</b>	
<i>Ichthyophis glutinosus</i>	Common yellow-band caecilian <sup>E</sup>
<i>Ichthyophis pseudangularis</i>	Lesser yellow-band caecilian <sup>E, VU</sup>

## Threats and conservation

We believe the high diversity in wet zone forest habitats is due mainly to availability of abundant suitable micro-habitat features (e.g., tree holes, caves, tree barks, rock boulders, crevices, water holes, decaying logs, loose soil, and other small niches) which create favorable environmental conditions for herpetofauna. According to our results, Uda Mäliboda area has a rich herpetofaunal diversity and endemism compared with other wet zone forests in Sri Lanka. A large number of people including tourists, devotees, and laborers annually visit Adams Peak via Uda Mäliboda Trail located within the SNR. As a result endemic and Threatened species, like many other fauna, are seriously affected by increasing pressure caused by habitat loss and degradation in montane forests, lower montane forests, and marshes. Major threats identified include illegal timber harvesting, illegal human encroachment, slash and burn forest clearing for human settlement and monoculture plantations (especially for tea cultivation), and gem mining. According to interviews with illegal timber harvesters, some rare tree species may be new to science are being harvested. Therefore, a further comprehensive study of flora is recommended.

Present human activities, the most severe being the construction of a hydroelectric power plant, continue to degrade and erode the remaining vestiges of this lush primary forest. Additionally, garbage (polythene) disposal along the Uda Mäliboda Trail by visitors and devotees is a threat that must be duly monitored by the Department of Wildlife Conservation (DWC) and the Forest Department (FD) of Sri Lanka. The Young Zoologists' Association (YZA) together with the Central Environmental Authority (CEA) has conducted annual polythene removal programs on other trail (Hatton) of SNR for the past 10 years. This has prompted other Government institutions and non-governmental organizations to engage in similar activities. We recommend that such programs be initiated on this trail in order to prevent further degradation of this lush forest.

Some human-altered landscapes such as tea plantations and *Pinus*, *Eucalyptus*, *Cyprus*, and *Casuarina* forest plantations are located in the foothills of the SNR. Most of these altered landscapes can be found up to about 800 m in elevation. There is an ongoing hydroelectric power plant development project in the study area (Fig. 6) and increased road traffic further threatens the area's fauna. Since a considerable area of the forest is altered by human activity, herpetofauna face increased threats because, in general, they are often highly sensitive to even slight environmental changes (e.g., McCallum 2007; Pough et al. 2004; Spellerberg 1991). Thus, the identification and designation of forest reserves on the perimeter of the SNR could function as suitable buffer zones. Additionally, public awareness programs are needed to help guide local people and policy makers de-

## Uda Mälīboda trail and a preliminary herpetofaunal checklist

**Table 4.** Checklist of reptile species in Uda Mälīboda area (Abbreviations: E – endemic; EN – Endangered; VU – Vulnerable; NT – Near Threatened; DD – Data Deficient).

Family and species name	Common name	Family and species name	Common name
<b>Agamidae</b>		<b>Colubridae (cont.)</b>	
<i>Calotes calotes</i>	Green garden lizard	<i>Dendrelaphis schokari</i>	Common bronze back <sup>E</sup>
<i>Calotes liolepis</i>	Whistling lizard <sup>E, VU</sup>	<i>Haplocercus ceylonensis</i>	Black spine snake <sup>E, DD</sup>
<i>Calotes versicolor</i>	Common garden lizard	<i>Lycodon aulicus</i>	Common wolf snake
<i>Ceratophora aspera</i>	Rough horn lizard <sup>E, EN</sup>	<i>Lycodon striatus</i>	Shaw’s wolf snake
<i>Lyriocephalus scutatus</i>	Lyre-head lizard <sup>E, NT</sup>	<i>Oligodon calamarius</i>	Templeton’s kukri snake <sup>E, VU</sup>
<i>Otocryptis wiegmanni</i>	Sri Lankan kangaroo lizard <sup>E, NT</sup>	<i>Oligodon sublineatus</i>	Dumerul’s kuki snake <sup>E</sup>
<b>Gekkonidae</b>		<i>Ptyas mucosa</i>	Rat snake
<i>Cnemaspis scalpensis</i>	Gannoruva day gecko <sup>E, DD</sup>	<i>Sibynophis subpunctatus</i>	Jerdon’s polyodont
<i>Cnemaspis silvula</i>	Forest day gecko <sup>E</sup>	<b>Natricidae</b>	
<i>Cyrtodactylus cf. subsolanus</i>	Forest gecko sp.	<i>Amphiesma stolatum</i>	Buff striped keelback
<i>Geckoella triedrus</i>	Spotted bowfinger gecko <sup>E, NT</sup>	<i>Aspidura guentheri</i>	Ferguson’s roughside <sup>E, NT</sup>
<i>Gehyra mutilata</i>	Four-claw gecko	<i>Balanophis ceylonensis</i>	Sri Lanka keelback <sup>E, VU</sup>
<i>Hemiphyllodactylus typus</i>	Slender gecko <sup>EN</sup>	<i>Atretium schistosum</i>	Olive keelback
<i>Hemidactylus depressus</i>	Kandyan gecko <sup>E</sup>	<i>Xenochrophis asperrimus</i>	Checkered keelback <sup>E</sup>
<i>Hemidactylus frenatus</i>	Common house gecko	<b>Typhlopidae</b>	
<i>Hemidactylus parvimaclulatus</i>	Spotted house gecko	<i>Typhlops mirus</i>	Jan’s blind snake <sup>E, DD</sup>
<b>Scincidae</b>		<b>Elapidae</b>	
<i>Eutropis beddomii</i>	Beddome’s stripe skink <sup>E, EN</sup>	<i>Bungarus ceylonicus</i>	Sri Lanka krait <sup>E, NT</sup>
<i>Eutropis carinata</i>	Common skink	<i>Naja naja</i>	Indian cobra
<i>Eutropis macularia</i>	Bronzegreen little skink	<b>Viperidae</b>	
<i>Eutropis madaraszii</i>	Spotted skink <sup>E, NT</sup>	<i>Daboia russelii</i>	Russell’s viper
<i>Lankascincus dorsicatenatus</i>	Catenated lankaskink <sup>E</sup>	<i>Hypnale hypnale</i>	Merrem’s hump nose viper
<i>Lankascincus fallax</i>	Common lankaskink <sup>E</sup>	<i>Hypnale zara</i>	Zara’s hump-nosed viper <sup>E</sup>
<i>Lankascincus gansi</i>	Gans’s lankaskink <sup>E, NT</sup>	<i>Trimeresurus trigonocephalus</i>	Green pit viper <sup>E</sup>
<i>Lankascincus greeri</i>	Greer’s lankaskink <sup>E</sup>	<p>velop agendas that consider the importance of herpetofauna in maintaining a balanced and healthy ecosystem.</p> <p>There is no doubt that SNR provides habitat for a high number of amphibian and reptiles species (many endemic and Threatened). We affirm that it is one of the most important herpetofaunal diversity areas in Sri Lanka, especially when considering the future conservation of endemic and threatened herpetofauna. Sri Lanka is known as an important herpetofaunal global hotspot (Bossuyt et al. 2004; Gunawardene et al. 2007; Meegaskumbura et al. 2002; Pethiyagoda 2005) and harbors an unusually high number of endemic species. Therefore, scientists and policy makers are strongly encouraged to make efforts conducting further research on other faunal groups, vegetation, and the forest’s ecosystem as a whole. Furthermore, preserving the valuable herpetofaunal resources of the Uda Mälīboda Trail is paramount to the conservation of global biological diversity.</p>	
<i>Lankascincus munindradasai</i>	Munindradasa’s lankaskink <sup>E, DD</sup>		
<i>Lankascincus sripadensis</i>	Peakwilderness lankaskink <sup>E, DD</sup>		
<i>Nessia burtonii</i>	Three toed snakeskink <sup>E, EN</sup>		
<b>Varanidae</b>			
<i>Varanus bengalensis</i>	Land monitor	<p><b>Acknowledgments.</b>—We would like to express our sincere gratitude to Thasun Amarasinghe (Taprobanica) for reviewing the earlier draft of the manuscript. We also thank Mendis Wickramasinghe (HFS), Aruna Ka-</p>	
<i>Varanus salvator</i>	Water monitor		
<b>Pythonidae</b>			
<i>Python molurus</i>	Indian python		
<b>Cylindrophidae</b>			
<i>Cylindrophis maculatus</i>	Sri Lanka pipe snake <sup>E, NT</sup>		
<b>Colubridae</b>			
<i>Ahaetulla nasuta</i>	Green vine snake		
<i>Ahaetulla pulverulenta</i>	Brown vine snake <sup>NT</sup>		
<i>Boiga barnesii</i>	Barnes’s cat snake <sup>E, NT</sup>		
<i>Boiga beddomei</i>	Beddoms cat snake <sup>DD</sup>		
<i>Boiga ceylonensis</i>	Sri Lanka cat snake <sup>VU</sup>		
<i>Cercaspis carinatus</i>	Sri Lanka wolf snake <sup>E, VU</sup>		
<i>Coeloganthus helena</i>	Trinket snake		
<i>Dendrelaphis bifrenalis</i>	Boulenger’s bronze back <sup>E</sup>		
<i>Dendrelaphis caudolineolatus</i>	Gunther’s bronze back		



**Figure 6.** Hydroelectric power plant (note: concrete wall built across the stream and concrete particles dump into the stream).

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## Literature cited

- ASHTON MS, GUNATILLEKE CVS, DE ZOYSA N, DASSANAYAKE MD, GUNATILLEKE IAUN, WIJESUNDARA S. 1997. *A Field Guide to the Common Trees and Shrubs of Sri Lanka*. Wildlife Heritage Trust of Sri Lanka, Colombo. 432 p.
- BAMBARADENIYA CNB, PERERA MSJ, PERERA WPN, WICKRAMASINGHE LJM, KEKULANDALA LDCB, SAMARAWICKREMA VAP, FERNANDO RHSS, SAMARAWICKREMA VAMPK. 2003. Composition of faunal species in the Sinharaja world heritage site in Sri Lanka. *Sri Lanka Forester* 26(3):21-40.
- BOSSUYT F, MEEGASKUMBURA M, BEENAERTS N, GOWER DJ, PETHIYAGODA R, ROELANTS K, MANNAERT A, WILKINSON M, BAHIR MM, MANAMENDRA-ARACHCHI K, NG PKL, SCHNEIDER CJ, OOMMEN OV, MILINKOVITCH MC. 2004. Local endemism within the Western Ghats – Sri Lanka Biodiversity Hotspot. *Science* 306:479-481.
- BOSSUYT F, MEEGASKUMBURA M, BAENERTS N, GOWER DJ, PETHIYAGODA R, ROELANTS K, MANNAERT A, WILKINSON M, BAHIR MM, MANAMENDRA-ARACHCHI K, NG PKL, SCHNEIDER CJ, OOMMEN OV, MILINKOVITCH MC. 2005. Biodiversity in Sri Lanka and Western Ghats - Response. *Science* 308:199.
- CRUMP ML, SCOTT NJ. 1994. Visual encounter surveys. In: *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians*. Editors, Heyer RW, Donnelly MA, McDiarmid RW, Hayek LC, Foster MS. Smithsonian Institution Press, Washington, D.C. 84-92.
- DE SILVA A. 2009. *Amphibians of Sri Lanka: A Photographic Guide to Common Frogs, Toads and Caecilians*. Published by the author. 82 plates + 168 p.
- DUTTA SK, MANAMENDRA-ARACHCHI KN. 1996. *The Amphibian Fauna of Sri Lanka*. Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka. 230 p.
- FERNANDO P, DAYAWANSA, N, SIRIWARDENE M. 1994. *Bufo kotagamai*, a new toad (Bufonidae) from Sri Lanka. *Journal of South Asian Natural History* 1(1):119-124.
- FROST DR, GRANT T, FAIVOVICH J, BAIN RH, HAAS A, HADDAD CFB, DE SA R, CHANNING A, WILKINSON M, DONNELLAN SC, RAXWORTHY CJ, CAMPBELL JA, BLOT-TO BL, MOLER P, DREWES RC, NUSSBAUM RA, LYNCH JD, GREEN DM, WHEELER WC. 2006. The amphibian tree of life. *Bulletin of American Museum of Natural History* 297:1-370.
- GOONATILAKE WLDPTS DE A, GOONATILAKE MRMPN. 2001. New sight records of *Bufo kotagamai* (Anura: Bufonidae) from Adavikanda in Eratne and Delwala proposed forest Reserve. *Sri Lanka Naturalist* 4(4):55-56.
- GUNATILLEKE IAUN, GUNATILLEKE CVS. 1990. Distribution of floristic richness and its conservation in Sri Lanka. *Conservation Biology* 4(1):21-31.
- GUNAWARDENE NR, DANIELS AED, GUNATILLEKE IAUN, GUNATILLEKE CVS, KARUNAKARAN PV, NAYAK KG, PRASAD S, PUYRAVAUD P, RAMESH BR, SUBRAMANIAN KA, VASANTHY G. 2007. A brief overview of the Western Ghats-Sri Lanka biodiversity hotspot. *Current Science* 93(11):1567-1572.
- IUCN-SL 2011. *Threatened Biodiversity* (A coffee table book). IUCN Sri Lanka country office, Colombo, Sri Lanka. 212 p.
- IUCN-SL, MENR-SL. 2007. *The 2007 Red List of Threatened Fauna and Flora of Sri Lanka*. IUCN Sri Lanka, Colombo, Sri Lanka. 148 p.
- KARUNARATHNA DMSS, AMARASINGHE AAT, BANDARA IN. 2011. A survey of the avifaunal diversity of Samanala Nature Reserve, Sri Lanka, by the Young Zoologists' Association of Sri Lanka. *Birding Asia* 15:84-91.
- KOTAKI M, KURABAYASHI A, MATSUI M, KURAMOTO M, DJONG TH, SUMIDA M. 2010. Molecular phylogeny for the diversified frogs of genus *Fejervarya* (Anura: Discoglossidae). *Zoological Science* 27(5):386-395.
- MCCALLUM ML. 2007. Amphibian decline or extinction? Current declines dwarf background extinction rate. *Journal of Herpetology* 41(3):483-491.
- MADUWAGE K, SILVA A, MANAMENDRA-ARACHCHI K, PETHIYAGODA R. 2009. A taxonomic revision of the South Asian hump-nosed pit vipers (Squamata: Viperidae: *Hypnale*). *Zootaxa* 2232:1-28.
- MANAMENDRA-ARACHCHI K, PETHIYAGODA R. 2005. The Sri Lankan shrub-frogs of the genus *Philautus* Gistel, 1848 (Ranidae: Rhacophorinae) with description of 27 new species. In: *Contribution to Biodiversity Exploration and Research in Sri Lanka*. Editors, Yeo DCJ, Ng PKL, Pethiyagoda R. *The Raffles Bulletin of Zoology*, Supplement 12:163-303.
- MANAMENDRA-ARACHCHI K, PETHIYAGODA R. 2006. *Sri Lankawe Ubhayaeeeween* [Amphibians of Sri Lanka]. Wildlife Heritage Trust of Sri Lanka, Colombo, Sri Lanka. 88 plates + 440 p. (Text in Sinhala).





**Figure 7.** *Duttaphrynus kotagamai* (Male; Endangered).



**Figure 8.** *Lankanectes corrugatus* (relict).



**Figure 9.** *Pseudophilautus femoralis* (Endangered).



**Figure 10.** *Pseudophilautus reticulatus* (Endangered).



**Figure 11.** *Pseudophilautus alto* (Endangered).



**Figure 12.** *Pseudophilautus sarasinorum* (Endangered).



**Figure 13.** *Ramanella nagaui* (Vulnerable).



**Figure 14.** *Taruga longinasus* (Endangered).



**Figure 15.** *Oligodon calamarius* (Vulnerable).



**Figure 16.** *Dendrelaphis schokari* (Endemic).



**Figure 17.** *Amphiesma stolatum* (red variety).



**Figure 18.** *Trimeresurus trigonocephalus* (plain variety).



**Figure 19.** *Hemidactylus depressus* (endemic).



**Figure 20.** Unidentified *Cyrtodactylus* cf. *subsolanus*.



**Figure 21.** *Lankascincus greeri* (endemic).



**Figure 22.** *Eutropis macularia* (common).



**Figure 23.** *Ceratophora aspera* (Endangered).



**Figure 24.** *Calotes liolepis* (Vulnerable).

- MANAMENDRA-ARACHCHI K, BATUWITA S, PETHIYAGODA R. 2007. A taxonomical revision of the Sri Lankan day-geckos (Reptilia: Gekkonidae: Cnemaspis), with description of new species from Sri Lanka and India. *Zeylanica* 7(1):9-122.
- MEEGASKUMBURA M, BOSSUYT F, PETHIYAGODA R, MANAMENDRA-ARACHCHI K, BAHIR M, MILINKOVITCH MC, SCHNEIDER CJ. 2002. Sri Lanka: An amphibian hotspot. *Science* 298(5592):379.
- MEEGASKUMBURA M, MEEGASKUMBURA S, BOWATTE G, MANAMENDRA-ARACHCHI K, PETHIYAGODA R, HANKEN J, SCHNEIDER CJ. 2010. *Taruga* (Anura: Rhacophoridae), A new genus of Form-nesting tree frogs endemic to Sri Lanka. *Ceylon Journal of Science* (Bioscience) 39(2):75-94.
- MITTERMEIER RA, GIL PR, HOFFMAN M, PILGRIM J, BROOKS T, MITTERMEIER CG, LAMOREUX J, DA FONSECA GAB. 2004. *Hotspots Revisited: Earth's Biologically Richest and Most Threatened Terrestrial Ecoregions*. CEMEX, Mexico City and Conservation International, Washington, D.C. 164 p.
- MYERS N, MITTERMEIER RA, MITTERMEIER CG, FONSECA GAB, KENT J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853-858.
- PETHIYAGODA R. 2005. Exploring Sri Lanka's biodiversity. In: *Contribution to Biodiversity Exploration and Research in Sri Lanka*. Editors, Yeo DCJ, Ng PKL, Pehiyagoda R. *The Raffles Bulletin of Zoology*, Supplement 12:1-4.
- POUGH FH, ANDREWS RM, CADLE JE, CRUMP ML, SAVITZKY AH, WELLS KD. 2004. *Herpetology*. 3rd Edition. Pearson Prentice Hall, San Francisco, USA. 726 p.
- SENANAYAKE FR, SOULE M, SENNER JW. 1977. Habitat values and endemicity in the vanishing rainforest of Sri Lanka. *Nature* 265:351-354.
- SENARATNA LK. 2001. *A Check List of the Flowering Plants of Sri Lanka*. National Science Foundation of Sri Lanka, Colombo. 342 p.
- SOMAWEERA R. 2006. *Sri Lankawe Sarpayan* [Snakes of Sri Lanka]. Wildlife Heritage Trust of Sri Lanka, Colombo Sri Lanka. 88 plates + 440 p. (Text in Sinhala).
- SOMAWEERA R, SOMAWEERA N. 2009. *Lizards of Sri Lanka: A Colour Guide with Field Keys*. Edition Chimaira, Frankfurt am Main, Germany. 303 p.
- SPELLERBERG IF. 1991. *Monitoring Ecological Changes*. Cambridge University Press, Cambridge, UK. 334 p.
- SUMIDA M, KOTAKI M, ISLAM MM, DJONG TH, IGAWA T, KONDO Y, MATSUI M, DE SILVA A, KHONSUE W, NISHIOKA M. 2007. Evolutionary relationships and reproductive isolating mechanisms in the Rice frog (*Fejervarya limnocharis*) species complex from Sri Lanka, Thailand, Taiwan and Japan, inferred from mtDNA gene sequences, allozymes, and crossing experiments. *Zoological Science* 24:547-562.
- UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO). 2011. UNESCO Headquarters, 7, Place de Fontenoy, 75352, Paris, 07 SP, France. [Online]. Available: <http://whc.unesco.org/en/list/1203/documents/> [Accessed: 25 November 2011].
- VOGEL G, ROOIJEN JV. 2011. A new species of *Dendrelaphis* (Serpentes: Colubridae) from the Western Ghats – India. *Taprobanica* 3(2):77-86.
- WICKRAMASINGHE LJM, RODRIGO R, DAYAWANSA N, JAYANTHA ULD. 2007a. Two new species of *Lankascincus* (Squamata: Scincidae) from Sripada. *Zootaxa* 1612:1-24.
- WICKRAMASINGHE LJM, MUNINDRADASA DAI. 2007b. Review of the genus *Cnemaspis* Strauch, 1887 (Sauria: Gekkonidae) in Sri Lanka, with the description of five new species. *Zootaxa* 1490:1-63.
- WIJESINGHE MR, DAYAWANSA PN. 2002. The amphibian fauna at two altitudes in the Sinharaja rainforest, Sri Lanka. *Herpetological Journal* 12:175-178.

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## Uda Mäliboda trail and a preliminary herpetofaunal checklist



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