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A SURVEY OF AMPHIBIANS IN THE NILGALA FOREST RESERVE AND ITS VICINITY

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ABSTRACT

This paper presents the findings of a preliminary study on Amphibian diversity in Nilgala Forest Reserve, in the Monaragala District, which is situated in the intermediate zone of Sri Lanka. Our aim was primarily to study the Amphibian species diversity and various threats they face in this remote, unstudied area. We were able to record 19 species of amphibians, which is about 18% of the total Sri Lankan Amphibians described to date. We were also able to record several species for the first time in Nilgala Forest Reserve. There were 6 (31%) endemic species and 5 (26%) nationally threatened species among them. Hence Nilgala Forest Reserve supports a high Amphibian diversity. However, this important forest is threatened by harmful human activities such as man made fire, illegal logging, chena cultivation and road kills.

INTRODUCTION

Sri Lanka and Western Ghats of India is a biodiversity hotspot, rich in herpetofaunal assemblages (Bossuyt *et al.*, 2004; Meegaskumbura *et al.*, 2002). Favorable environmental factors such as high rainfall and humidity, high density of undergrowth found in this region support a rich diversity of herpetofauna. Based on published sources, a total of 184 species of reptiles (Bahir & Maduwage, 2005; Bahir & Silva, 2005; Batuwita & Bahir, 2005; Das & De Silva, 2005; De Silva, 1996; Manamendra-Arachchi & Pethiyagoda, 1998; Manamendra-Arachchi & Pethiyagoda, 2001a; Manamendra-Arachchi & Pethiyagoda, 2001b) and 103 species of amphibians (De Silva, 1996; Dutta & Manamendra-Arachchi, 1996; Manamendra-Arachchi & Pethiyagoda, 2005; Meegaskumbura & Manamendra-Arachchi, 2005) have been recorded from the island to date.

The poikilothermic nature of herpetofauna restricts their distribution to areas with high rainfall such as lowland wet zone forest areas and montane forest areas (Giri & Chaturvedi, 2001). According to published literature wet zone forests harbors more than 60% of the indigenous herpetofauna of Sri Lanka. Furthermore, high percentage of endemism can be seen in the southwest lowland forests where almost 90% of the endemic vertebrates are concentrated (Bambaradeniya *et al.*, 2003; Senanayake *et al.*, 1977; Wijesinghe & Dayawansa, 2002). However, herpetofaunal diversity in the dry and intermediate zone forest areas has not been studied well (De Silva *et al.*, 2004). Reptiles and amphibians play a vital role in the functioning of an ecosystem. Their diet of insects and small animals contributes to control of pests in human habitats, including crops and homes (Knopf, 1998). Frogs are among the most misunderstood group of vertebrates. Hence many people treat them with almost the same revulsion as snake, despite their being ecologically important as pest controllers (Manamendra-Arachchi, 2000). Certain herpetofauna species can be considered as indicator species of environmental change.

Nilgala forest reserve (NFR) is one of the largest and important forest areas in Monaragala District. However, the amphibian fauna of NFR is poorly studied. There are several preliminary amphibian surveys carried out in NFR (De Silva *et al.*, 2004; Hettige *et al.*, 2000). The present survey attempted to document the amphibian fauna of NFR through extensive field surveys made in 2004 and 2005. One of the biggest drawbacks for conserving amphibian fauna of the country is the lack of knowledge of their distribution and ecology, since only a fraction of the Amphibian species present in different areas of the country is hitherto known to science. Hence, it is essential to gather information on the diversity of amphibian fauna in different areas of the country, as a first step towards conservation. This paper would contribute to enhance the current knowledge of amphibian diversity within the Nilgala Forest Reserve.

MATERIALS AND METHODS

Study area

Nilgala forest reserve (NFR) is a unique forest ecosystem covering 12,432 hectares in the Bibile divisional secretariat division. According to the Gunatilleke & Gunatilleke (1990) the major vegetation type is lowland tropical dry mixed evergreen forest (Figure 13). Commonly found trees are Aralu (*Terminalia chebula*), Bulu (*Terminalia bellirica*), Nelli (*Phyllanthus emblica*). NFR is located between 7° 08` – 7° 14` Northern latitudes and 81° 16` – 81° 20` Eastern longitudes, approximately 11 km southeast from Bibile town. The altitudinal range varies from 200 m to 700 m above sea level within the boundaries of the NFR (De Silva *et al.*, 2004). The general climatic conditions in the Nilgala area is described as moderately cool, which turns humid during the northeast monsoon season. The average annual rainfall is around 1750 mm, with most of the rainfall occurring from December to March, with occasional rains in some months. The weather gradually becomes very dry from August to December and highest temperatures are recorded in August. The mean annual temperature in the NFR is 28°C with maximum of 32°C and minimum of 24°C. NFR is also important as a major watershed for Gala Oya and Panmedilla Oya throughout the year. There are several peaks within the NFR and "Yakun Hela" the highest peak (700 m).

Methodology

The present study was carried out during the period of 2004 to 2005. A total of 56 days (10 hrs/ day) were spent for fieldwork during the two years covering the wet and dry seasons. General area surveys were carried out in different habitat types within the NFR. Surveys were conducted both day and night and flashlights were used at night. All habitats such as water bodies, under the rocks, logs and decaying vegetation, and arboreal amphibians in trees and bushes up to 5 m, were thoroughly searched for the presence of specimens. All collected species were examined carefully and noted down before released back to the same habitats. The diagnostic keys given by Dutta and Manamendra-Arachchi

(1996) and Manamendra-Arachchi and Pethiyagoda (2005) were used for species identification. Furthermore basic environmental parameters were collected at locations, where specimens were collected.

Eleven habitat types were identified and sampled during the survey and a brief description of these habitats is given in (Table. 01).

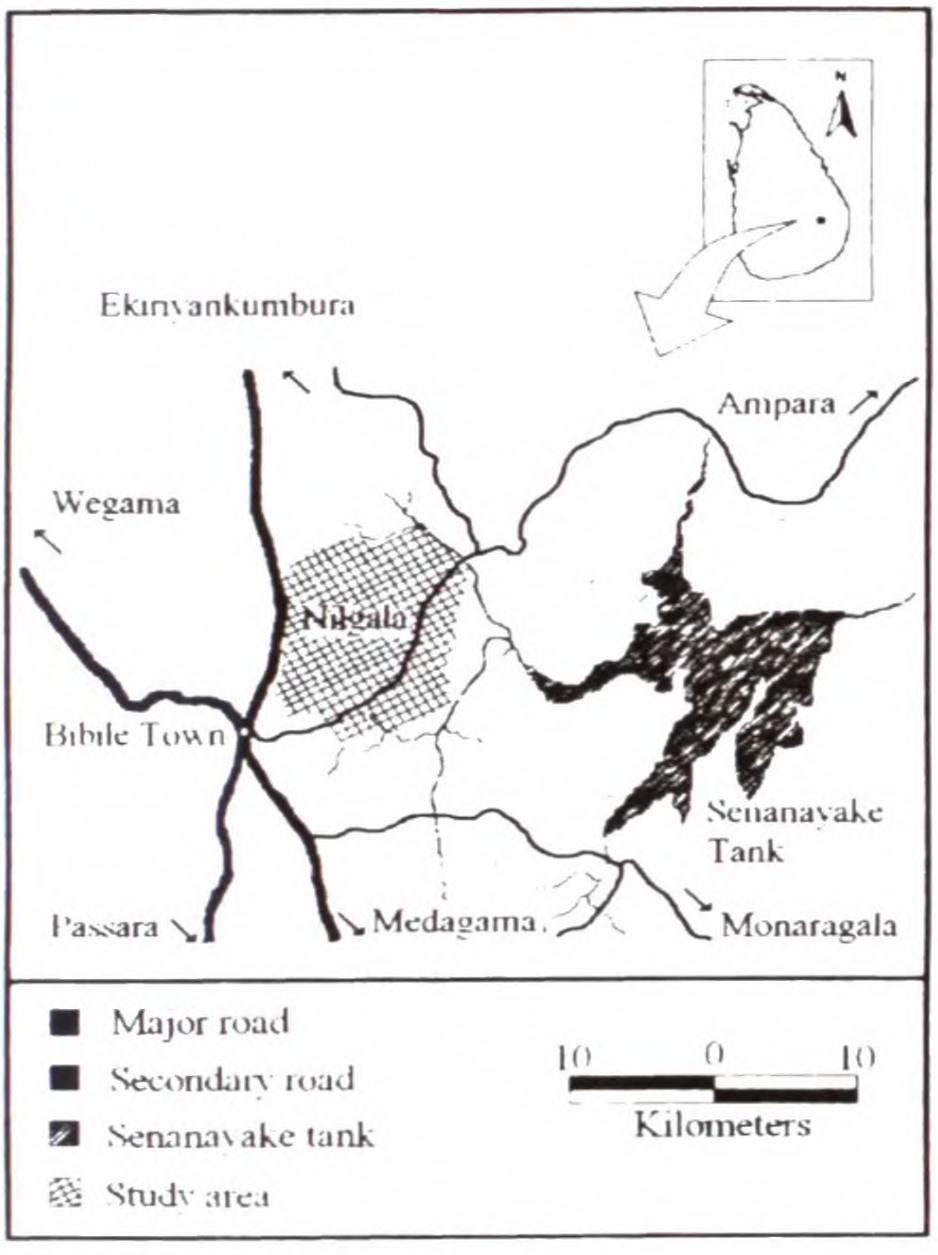

Figure 1. Map of the Nilgala Forest Reserve and Roads.

Table 1. Description of habitats in NFR.

Habitat Type		Description of Habitat
01	Chena	Trees belong to family Rutaceae is dominant and grows up to 5 m, scattered bushes present, main cultivation is maize, banana and finger millet. Leaf litter is very low.
02	Home Garden	Mixed cropping with woody plants like a *Mangifera indika*, *Chloroxylon swietenia*, *Schleichera oleosa*, *Tamarindus indika*, trees grows up to 15 m, shade is about 50%, and Leaf litter content is high and wet.

03	Paddy field	Paddy fields are moderate in extent (about 1 acre), wallowing sites are frequent along the fields, field bunds are narrow.
04	Riverine forest	Shade 80% with large tall trees growing up to 20 m, *Mangifera ceylanica, Maduca longifolia*, *Terminalia chebula Diospyros ebenum and Diospyros malabarica* are the dominant species, thick wet leaf litter layer available, Shady Forest, decaying logs are common.
05	Road Side	Generally consist of small bushes growing up to 2 m. Species such as *Maduca longifolia*, *Terminalia bellirica* and *Mangifera zeylanica* can also be found in several areas.
06	Rock-outcrop	Large rock boulders and grassy areas with seasonally moist cascade habitats. Shade 20% with tall trees.
07	Savannah forest	Only *Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica* Forest.
08	Shrub / Bush area	1m to 2m Tall and randomly distribute with open soil.
9	Small Pond	Seasonally flooded, mud pond, gem pits, Agricultural wells, drinking wells, mud pits, clay pits
10	Stream	Perennial flowing water bodies, 1m to 10m wide, visibility high, and turbidity low.
11	Tank	Open water bodies, covered by macrophytes (25 %)

Figure 1. Paddy fields in near NFR.

Figure 2. Rockout crops (Yakun Hela) in NFR.

Figure 3. Savannah forest in NFR.

RESULTS AND DISCUSSION

During the survey, 19 species of amphibians (Annex 01) belonging to four families were recorded from NFR. This includes 13 genera. There were 6 endemic and 5 nationally threatened species among them (IUCN Sri Lanka, 2000). Ranid frogs (dominated by *Fejervarya limnocharis*, *Philautus regius*, *Euphlyctis cyanophlyctis*, *Euphlyctis hexodactyla*) were the most abundant amphibian group in NFR according to the present survey (Figure 04), while Caecilians were the least abundant. When considering the primary mode of living there were nine terrestrial, four arboreal, four aquatic and 2 fussorial species. Several species were recorded for the first time in NFR and it is one of the significant findings of the present survey. They are *Philautus regius* and *Philautus fergusonianus*. Furthermore three unidentified species were also recorded during the survey, which probably include new species belonging to genus *Nannophrys*.

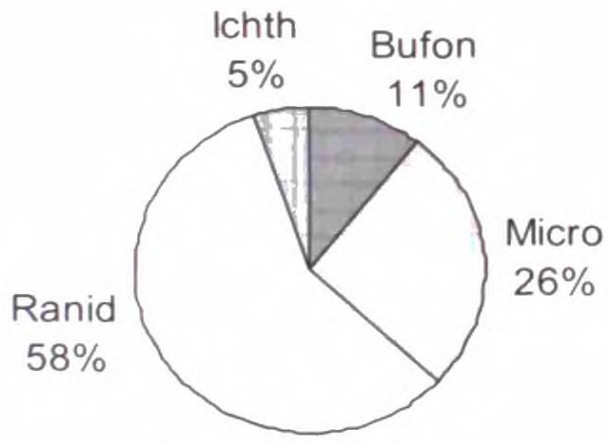

Figure 4.Species composition of Amphibians families in NFR.

When considering the proportional representation of species, the highest abundance was shown by *Fejervarya limnocharis* (13.44 %) and *Philautus regius* (10.67 %). The high abundance of *Fejervarya limnocharis* is possibly related to abundance of aquatic and semi aquatic habitats (Small ponds, streams and paddy fields) within the study area. Hence this species is one of the most common species (Table 02) encountered in the NFR. *Philautus regius* is also a common species

associated with shrub vegetation. The shrub vegetation is very high in the NFR and provides the habitat for this species. It is interesting to note that this species was recorded for the first time in NFR and it is considered as rare in the dry and intermediate zones.

Table 2. Species richness of amphibians in NFR.

Scientific Name	Total Number of Individuals	Proportional Representation
Bufo atukoralei	3	1.19
Bufo melanostictus	17	6.72
Kaloula taprobanica	8	3.16
Microhyla ornata	11	4.35
Microhyla rubra	13	5.14
Ramanella variegata	3	1.19
Uperodon systoma	16	6.32
Hoplobatrachus crassus	19	7.51
Fejervarya limnocharis	34	13.44
Euphlyctis cyanophlyctis	24	9.49
Euphlyctis hexodactyla	24	9.49
Rana gracilis	4	1.58
Sphaerotheca breviceps	7	2.77
Sphaerotheca rolendae	9	3.56
Philautus fergusonianus	3	1.19
Philautus regius	27	10.67
Polypedates cruciger	12	4.74
Polypedates maculatus	18	7.11
Ichthyophis glutinosus	1	0.40

Figure 5. *Rana gracilis* Sri Lanka Wood frog.

Figure 6. ***Kaloula taprobanica*** **Common Bull Frog.**

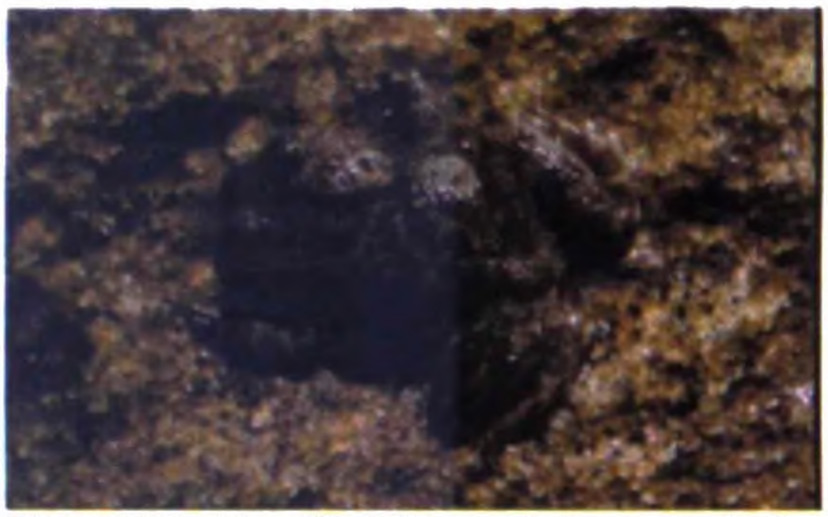

Figure 7. Unidentified ***Nannophrys*** **species in NFR.**

Figure 8. ***Sphaerotheca rolendae*** **Marbled Sand Frog.**

Figure 9. *Philautus fergusonianus* Ferguson's shrub frog.

When considering the proportional representation of species in each habitat type (Figure 10), the highest species richness occurred in home gardens (21.05 %) followed by Roadside habitats (19.74 %) and Riverine forests (13.16 %), while Rock outcrop habitats showed the lowest species richness (1.32 %). The high species richness in the home gardens might be due to several reasons. The high amount of leaf litter and shade and also the availability abundant of food items such as insects attracted to electric light would have been the reasons for high species richness in home gardens. Furthermore the sampling time allocated to home gardens was significantly higher than the time allocated to other habitats. This would have lead to the record of more species from home gardens than other habitat types. Nevertheless, these home gardens with large number trees, high shade and high amount of leaf litter, in the vicinity of NFR is vital refuge for amphibian fauna. It appears that a higher species richness of amphibians occur in disturbed habitats such as home gardens, chena and roadside shrub, and this may be due to the 'edge effect' phenomenon.

The species richness is also high along the road side (On Bibila – Ampara main road). This may also due to the increased sampling effort in this particular habitat type. The lowest species richness (1.32%) was shown by Rock Outcrop habitats. These rocky outcrops is exposed to the sun hence the high temperature is not suitable for amphibians (Pough *et al*., 2004).

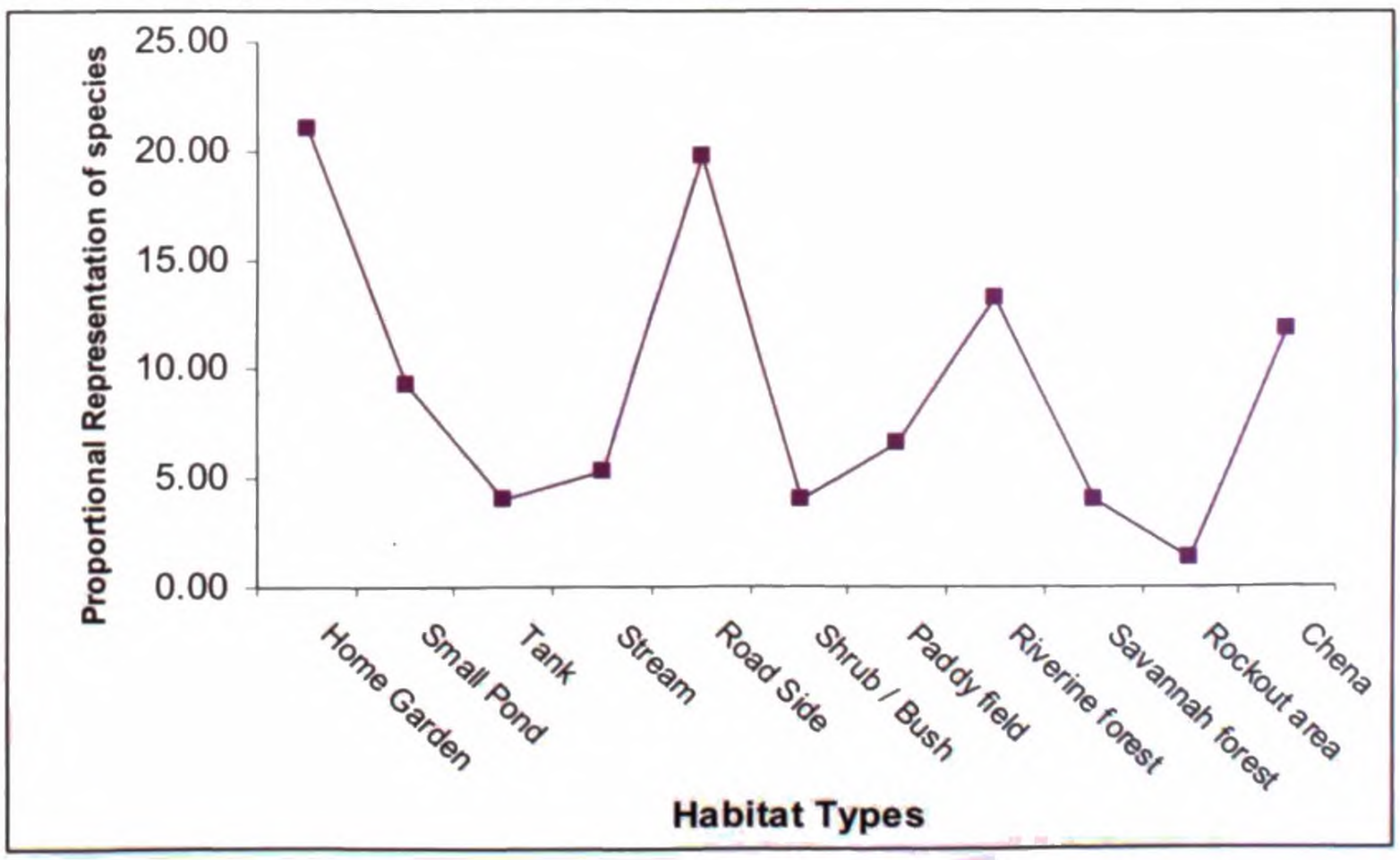

Figure 10. Species richness of Amphibians in various habitat types in NFR.

Threats

During the survey period several threats to the amphibian fauna in the NFR was observed and recorded. These include forest fires, logging, and extensive use of chemicals for agriculture, forest clearing for chena cultivation and road kills.

People living around the NFR frequently make fire to clear the underbrush, prepare the ground for the next cultivation cycle and to hunt animals. These fires are very frequent in the months of August and September. This activity destroys the habitats of amphibians. Illegal logging activities take place around and within the NFR and this seriously affect the quality of the forests and in turn its inhabitants.

The local communities are involved in paddy and chena cultivation in the vicinity of the NFR. These people use chemical fertilizers, pesticides and weedecides. This extensive use of chemical is a threat to the many animals including amphibians.

Another significant threat to the amphibian fauna of the area is road kills. Bibila – Ampara main road is cutting across the NFR and many animals subjected to road kills. The team has observed and recorded that amphibian mortality is particularly high on this road especially after a rain. The team has carried out a separate survey to document the impacts road kills.

Figure 11. Forest fire inside the NFR.

Figure 12. Road kill (*Microhyla ornata* on Bibile – Ampara Main Road within NFR)

CONCLUSIONS

This preliminary investigation of the amphibian fauna of the Nilgala Forest Reserve and its vicinity clearly shows that NFR is an important location in terms of amphibian diversity.

It also evident that NFR act as an important refuge for threatened amphibians, in the intermediate zone belonging to the uva province.

The NFR and its surrounding habitats have not been studied well and it is evident from the fact that 6 species were new sight recordings for NFR. Therefore detailed studies have to be carried out to document the amphibians in this site.

There are several human activities that have a negative impact to the amphibian fauna as well as to other faunal and floral groups such as fire, logging, gem mining and road kills. Therefore suitable mitigatory action has to be initiated to conserve Nilgala Forest Reserve and its surrounding habitats.

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