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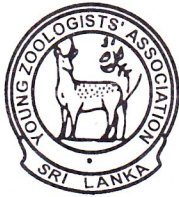
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Email : srilankanaturalist@yahoo.com

Web Site : www.youngzoologist.tripod.com

Telephone: +94 (11) 2712751/3, +94 (11) 4204566

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Sri Lanka Naturalist is a scientific journal that publish recent work in the interrelated fields of ecology, systematics, environmental management, and natural sciences. It attempts to publish papers of high scientific standard in a form that is comprehensible not only to specialists, but also to scientists in other fields, students, professional planners, and interested laymen. It welcomes original research papers, notes on observations, and scientific articles. If any naturalist, who possesses valuable information, is unable to publish them due to the language barrier, YZA is ready to provide translation facilities.

Refer last page for the guide lines for authors.

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COVER

Sri Lankan herpetofauna consists of nearly 250 amphibian species, (more than 200 endemic), 76 inland tetrapod species (48 endemic) and 83 inland serpentoid species (49 endemic). Additionally 5 species of marine Turtles and 13 species of sea snakes are frequently found in coastal waters. Although we have a highly diverse herpetofauna with high endemism, there are severe threats for the existence of the fauna.

There is an article describing the herpetofanna and avifanna of Panama, a coastal village in Eastern Province of Sri Lanka in this issue of "Sri Lanka Naturalist". The total of 57 herpetofauna consists of 14 amphibians, 20 tetrapod reptiles and 23 serpentoid reptiles were recorded from the present study. The cover depicts some of the herpetofauna of Panama.

The main role of the cover is endemic Termite-hill Gecko *Hemidactylus triedrus lankae*. The thumbnails represent, endemic and threatened, Sri Lanka Wood Frog *Rana gracilis*, Dotted Garden Skink *Riopa punctata* and another endemic and threutende frog, Atukorale's Dwarf Toed *Bufo atukoralei*, from top to bottom.

Photographs: Ruchira Somaweera
Back Cover Photographs: H. B. Jayaneththi

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A Preliminary Study on the Diversity of Ichthyofauna of Kukulugala Proposed Forest Reserve, Ratnapura District.

H. B. Jayaneththi¹
H. G. S. Maduranga^{1,2}

Abstract

The tropical rain forests of wet zone of Sri Lanka have a great importance in high species richness and endemism. The ichthyofauna of wet zone streams has a great significant in the sense of biodiversity. The Kalu river basin consists of the largest catchment area in wet zone including many smaller tributaries from foot-hills of Ratnapura district. The ichthyofauna of those foot-hill regions are poorly examined and in this study an effort was made to determine the diversity of ichthyofauna of Kukulugala proposed forest reserve, Ratnapura district. The present survey resulted 16 species of freshwater fishes belong to 7 families. Among them 10 species were endemic to Sri Lanka and the mean endemism of the fishes of study area was 70.0%. Some interesting relationships between water quality parameters and species richness were also detected.

Introduction

Lowland tropical rain forests are the world's most species rich terrestrial communities. This rich diversity is the product of hundreds of millions of years of evolution (Chapmann & Reiss, 1992). If we consider Sri Lanka, the tropical rain forests of wet zone have great importance in high species richness and endemism. Several workers has recently proved that the diversity of ichthyofauna of wet zone streams of Sri Lanka has a great significant in the sense of biodiversity (Senanayake, 1980; Wikramanayake, 1990 & Pethiyagoda, 1994). The fresh water ichthyofauna of Sri Lanka is represented by 107 species, which recorded to occur in the rivers and fresh water bodies of country, including many salt water dispersants. More than 90% of fresh water fish species are found in the wet zone, including almost all the endemic species, except three species (Pethiyagoda, 1991). Hence, the Southwestern rain forests are very important in the existence of fresh water fishes of Sri Lanka, especially for endemic species.

The ichthyofauna of Sri Lanka is mainly supported by a few wet zone river basins such as, Kelani, Kalu and Gin river basins (Pethiyagoda, 1991 & Pers. Obs.). Among them Kalu river basin consists of the largest catchment area (2688 km²)

in wet zone (Somasekeram *et al.*, 1988) and consists of many tributaries arising from foot-hills of Sri Lanka. The rich ichthyofauna of those foot-hill areas are poorly examined and are now threatened due to habitat loss by several development projects.

The present study was carried out at upper Kalu ganga (ganga=river) area near Kukulugala peak (704 m). The major objective of the study was to evaluate fish species composition and diversity of the upper Kalu ganga area. Meantime, the authors trying to understand the relationships between the distribution of fishes in various microhabitats, the environmental factors and water quality parameters. Ultimate objective of this study is to evaluate habitat quality of the study area as a potential conservation zone.

Study Area

Kukulugala proposed reserve is situated in Ratnapura district of Sabaragamuwa province; surrounding the Kukulugala peak (704 m), in which is belong to the Sabaragamuwa upland series. The area consists of low country wet zone rain forests, which represented high biodiversity and endemism of the island. The study was carried out at the upper tributaries of Kalu ganga which is flowing through the area of Kukulugala. Several locations were sampled during the study including, Dumbaramanana, Irahandapana ella, Kaluwanhena ela, Theberumwala and the areas of Kukulugala peak. The study area is accessible via Horana – Bulathsinghala road or via Ratnapura – Panadura road.

Materials & Methods

The study was carried out at selected microhabitats of the study area. Several factors were considered in the defining of sampling sites such as, shade, depth, bottom, flow rate, human activities...etc. Field visits were made at fortnightly including three days for field studies. The study was continued for a period of three months from November 2001 to January 2002. Additionally several night camps were organized to study nocturnal species and their behavioural patterns, throughout the study period.

¹ Young Zoologists' Association, Department of National Zoological Gardens, Dehiwala.

² Department of Zoology, University of Kelaniya, Kelaniya.



Figure 01. Kukulugala Peak.
Photo : Bandula Jayaneththi



Figure 02. Upper Irahandapana
Photo : Bandula Jayaneththi



Figure 03. Fast flowing waters at lower Irahandapana Ella.
Photo : Bandula Jayaneththi



Figure 04. Irahandapana Ella.
Photo : Bandula Jayaneththi

Physico-chemical parameters of water were measured in each sampling session; pH by using a pH meter, temperature by a glass bulb thermometer, flow rate by using a standard float, finally depth and width of streams using a measuring tape. Visibility was measured based on a relative scale (100 = clear water; 0 = muddy-opaque water). Flow rate was measured by timing the motion of a standard float over a measured stretch of water.

The fishes were observed by bank-side observations in shallow areas with clear water, by snorkelling in deeper areas and after capturing by using hand nets and small trawl nets.

Results

Physico-chemical parameters of water and human activities of each sampling site are given in table 1. Total of 16 fresh water fish species were recorded from eleven (11) sampling sites. They belong to 7 families of 5 orders. Among them 10 species were endemic to Sri Lanka (62.5%). Cyprinid fishes were dominated in the study area with high species richness, abundance and endemism. Four of other families were represented by single endemic species in each family (Table 2).

Giant Danio *Danio malabaricus* and Stripped Rasbora *Rasbora daniconius* shown the widest distribution in the study area and the narrowest distribution was displayed by Day's Killifish *Aplocheilus dayi* and Mahseer – *Tor khudree*. The highest species richness was recorded both in Dumbaramanana site 2 (C) and Theberumwala (K). The highest endemism was found in lower and upper Kukulugala (H and

J) and tributaries of Irahandapana (I) where endemism was 100%. The higher altitudes of the Kukulugala peak were dominated by only a single endemic species i.e. Banded mountain Loach *Schistura notostigma*. The average species richness of the study area is 5.2 and the endemism is 70.0% (Figure 1 & Table 2).

Table 01. Physico-chemical properties and human activities of the selected sites.

A-Dumbaramanana site 1, B- Lower Irahandapana, C- Dumbaramanana site 2, D-Upper Irahandapana site 1, E-Upper Irahandapana site 2, F- Kaluwanhena ela site 1, G- Kaluwanhena ela site 2, H-Lower Kukulugala, I- Tributaries of Irahandapana, J- Upper Kukulugala, K- Teberumwala

Sampling site	Width (m)	Depth (m)	Flow rate (ms ⁻¹)	pH	Visibility	Temp. (C°)	Bottom	Shade	Human activities
A	3.5	0.4	0.17	5.2	16	22	sandy		+
B	10.0	1.0	0.27	6.1	21	25	sandy		
C	5.0	1.0	0.25	5.2	17	25	sandy	+	
D	5.0	0.8	0.27	6.8	23	25	sandy	+	
E	10.0	0.4	0.13	6.8	23	25	rocky	+	
F	2.5	0.4	0.06	7.3	17	25	detritus	+	+
G	3.0	0.4	0.06	7.0	12	25	detritus		+
H	2.5	0.4	0.10	7.1	11	24	silty	+	
I							rocky	+	
J							rocky	+	
K	5.5	1.3	0.41			24	rocky	+	+

Table 02 . Occurrence of fish species in sampling sites. Symbols for the sampling sites are indicated as in table-1.

Dm- *Danio malabaricus*, Rd- *Rasbora daniconius*, Pt- *Puntius titteya*, Pn- *P. nigrofasciatus*, Pv- *P. vittatus*, Ps- *P. singhala*, Gc- *Garra ceylonensis*, Pp- *P. pleurotaenia*, Bs- *Belontia signata*, Sn- *Schistura notostigma*, Am- *Awaous melanocephalus*, Co- *Channa orientalis*, Cp- *C. punctata*, Ad- *Aplocheilus dayi*, Cb- *Clarias brachysoma* and Tk- *Tor khudree*.

Sampling site	Dm	Rd	Pt	Pn	Pv	Ps	Gc	Pp	Bs	Sn	Am	Co	Cp	Ad	Cb	Tk	Total		
																	Indigenous	Endemic	%Endemism
A	+	+	+				+		+	+	+						7	4	57.1
B	+	+					+	+									5	3	60.0
C	+	+	+				+	+	+	+	+	+					9	6	66.7
D	+	+								+							3	1	33.3
E	+	+								+							3	1	33.3
F	+	+			+	+			+				+		+		7	3	42.8
G	+	+			+	+							+		+		6	2	33.3
H				+			+		+	+		+		+			6	6	100.0
I										+							1	1	100.0
J										+							1	1	100.0
K	+	+		+	+	+	+		+				+			+	9	4	44.4
																	5.2	2.9	70.0

Table 03. Diversity of ichthyofauna of Kukulugala forest. Status according to IUCN (2000) En- Endemic species T- Threatened HT- Highly threatened.

Order	Family	Commn Name	Scientific Name	Status
Cypriniformes	Cyprinidae	Cherry Barb	<i>Puntius titteya</i>	En, HT
		Black ruby Barb	<i>P. nigrofasciatus</i>	En, T
		Silver Barb	<i>P. vittatus</i>	
		Filamented Barb	<i>P. singhala</i>	En
		Black line Barb	<i>P. pleurotaenia</i>	En, T
		Giant Danio	<i>Danio malabaricus</i>	
		Stripped Rasbora	<i>Rasbora daniconius</i>	
		Stone Sucker	<i>Garra ceylonensis</i>	En, T
		Mahseer	<i>Tor khudree</i>	
				<i>Scistura notostigma</i>
Channiformes	Channidae	Smooth-breasted Snakehead	<i>Channa orientalis</i>	En, T
		Spotted Snakehead	<i>C. punctata</i>	
Siluriformes	Clariidae	Walking Catfish	<i>Clarias brachysoma</i>	En, T
Cyprinodontiformes	Aplocheilidae	Day's Killifish	<i>Aplocheilus dayi</i>	En, T
Perciformes	Anabantidae	Combtail	<i>Belontia signata</i>	En, T
	Gobiidae	Scribbled Goby	<i>Awaous melanocephalus</i>	

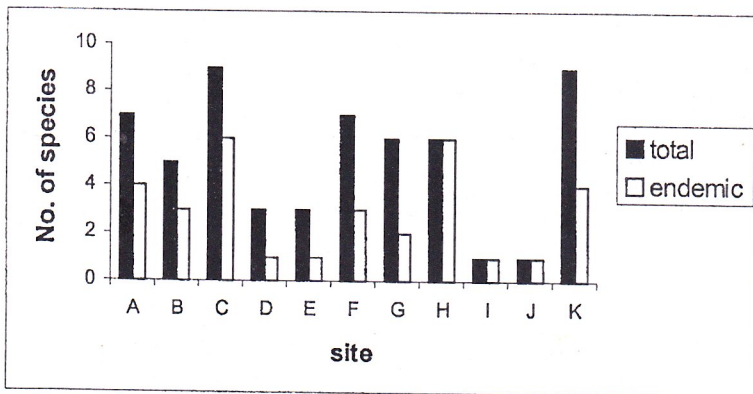


Figure 05. Species richness and endemism of fish in the sampling sites. Symbols for the sites are indicated as in table-1.

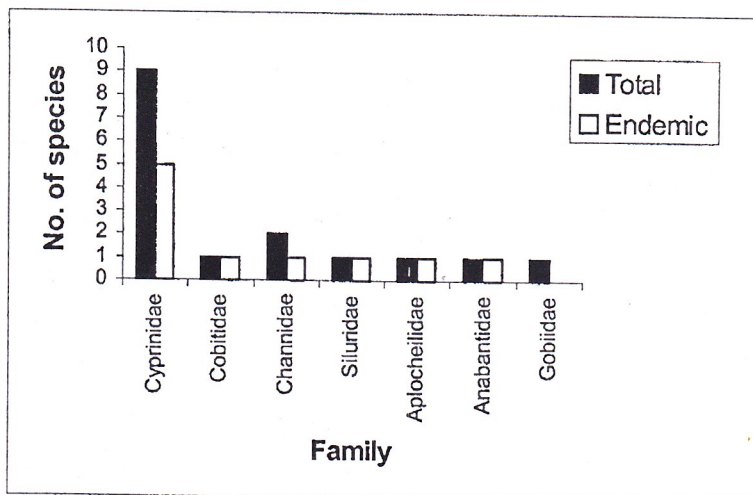


Figure 06. Species occurrence of fish families in Kukulugala proposed forest reserve.

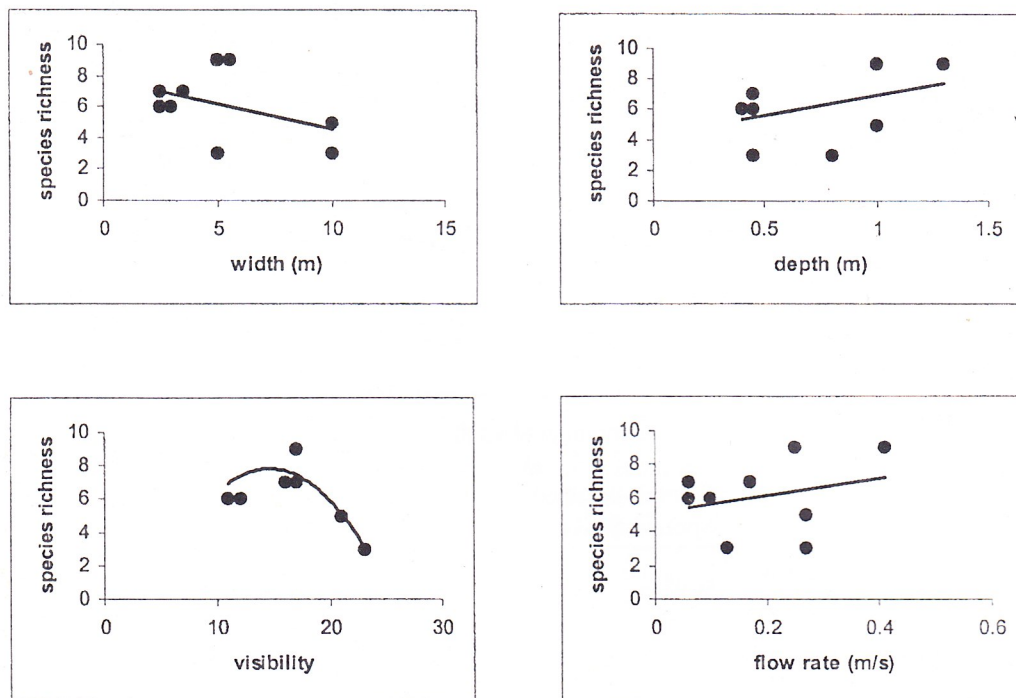


Figure 07. Relationships between species richness and physical parameters.

Discussion

The present study reveals that the species diversity of ichthyofauna of Kukulugala forest is much higher and the degree of endemism is also high. According to this preliminary survey, a total of sixteen (16) freshwater fish species were recorded (table 3). The mean species richness i.e. number of species of freshwater fishes of the study area was 5.2, but the species richness was gradually decreased towards the high altitude areas. The species richness in low altitude areas with sandy bottoms was comparatively higher than that of high altitude-rocky bottom areas. Banded mountain Loach *Schistura notostigma* was the only existing species in swift waters in high altitude areas. It is well adapted to its bottom dwelling habits with sub-cylindrical body and wide-ventrally directed pectoral and pelvic fins. The present study indicated that the endemism of fish species decreases with the increasing human activities. This may be due to poor tolerance of endemic species for such sudden environmental changes, because they are highly adapted - sensitive species. On the other hand, the overall species richness of fishes increases proportionately with human impacts. Disturbance can cause an increase in community species richness by preventing dominance by a few competitive species and allowing opportunistic species to invade (Mackenzie *et al.*, 1997).

Giant Danio *Danio malabaricus* and Stripped Rasbora *Rasbora daniconius* occupied wide range of habitats including sandy and rocky bottoms, also slow-flowing and moderately fast-flowing waters. Both species occurred as scattered schools. They always swim into the opposite direction of the water flow and feed on small organic particles and small animals suspended in the flowing water.

Although statistically not significant, the species richness of freshwater fishes of the study area showing several relationships with some water quality parameters (fig. 3). The species richness had a linear relationship with a negative slope, with width of the stream. But had a linear relationship with a positive slope, with the depth of the stream. In general, most of the recorded fish species are small-shallow water species. Hence, these fishes are normally living in waters not deeper than 1.5 m. The species richness was gradually increased up to moderately fast-flowing waters, but some species may tolerate even fast-flowing waters such as Scribbled Goby *Awaous melanocephalus* and Banded mountain Loach *Schistura notostigma* due to their special morphological adaptations. The species richness was increased with visibility up to some extent, and then gradually decreased. Under poor visibility the level of the suspended particles in water may be high, causing some problems with fish such as breathing difficulties and difficulties in breeding, especially in egg layers. Therefore the species richness may decrease with poor visibility. In other hand the species richness was again decreased with high visibility. This may be due to lesser amounts of suspended particles, especially planktons in water causing depletion of food materials for most fish species.

The documentation of water quality parameters may be helpful in *ex-situ* conservation of some threatened species. These data may help to provide them conditions more or less closer to their natural environment, especially in captive breeding programmes.



Figure 08. Day's Killifish - *Aplocheilus dayi*
Photo : Bandula Jayaneththi

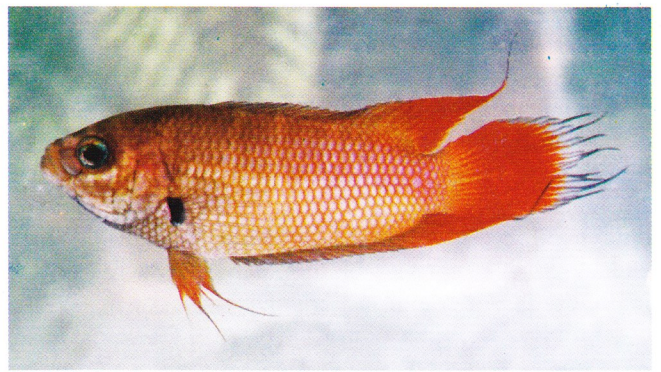


Figure 09. Combtail - *Belontia signata*
Photo : Bandula Jayaneththi



Figure 10. Banded - mountain Loach - *Schistura notostigma*
Photo : Bandula Jayaneththi



Figure 11. Black line Barb - *Puntius pleurotaenia*
Photo : Bandula Jayaneththi



Figure 12. Spotted Snakehaed - *Channa punctata*
Photo : Bandula Jayaneththi



Figure 13. Stone Sucker - *Garra ceylonensis*
Photo : Bandula Jayaneththi



Figure 14. Walking Catfish - *Clarias brachysoma*
Photo : Bandula Jayaneththi



Figure 15. Scribbled Goby - *Awaous melanocephalus*
Photo : Bandula Jayaneththi

Several threats for the existence of diverse ichthyofauna of Kukulugala area were observed by the authors such as continuous clearing of forests, expansion of the and other economical plantations, siltation of streams, leaching of pesticides and fertilizers from the adjacent plantations..etc. An immediate conservation measures have to be taken in order to preserve the diversity of ichthyofauna with its high endemism. A deeper study should be conducted on the ichthyofauna of the area with the participation of the community. By such community based conservation programmes, both public awareness on their natural resources and conservation of proposed forest reserve may fulfilled.

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