

Biogeographic Distribution on Endemic Stream-Fishes in Palani hills of Kodaikanal, Tamil Nadu, Southern India

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ABSTRACT

The present research has been carried out in different broad aspects viz. bio-ecological parameter analysis of freshwater streams and Biographical distributional status of the endemic stream-fishes in palani hills of southern India. The physical and chemical parameters were taken from the streams of study area and analyzed with regard to freshwater stream fishes, for example, *Devariomalabaricus* (Devario), *Punitus denisonii*, *Punitus dorsalis*, *Horalabiosa joshuai* may be the most threatened group of vertebrates on earth after amphibians and the global extinction rate of fishes was believed to be in excess of higher vertebrates, However, conservatory measures to mitigate the impact of the pressures have not only been slow but also inadequate and as a result many of the aquatic fish species decline rapidly. The main causes behind the loss of biodiversity in freshwater streams were found with habitat degradation and water depth decline, exotic species introduction, water diversions, pollution, and seasonal change impacts. The diversity and system of the genus cyprinidae form genus currently and the genus includes at least eleven species, all endemic to fresh water system of palani hills of south India. While these species found commonly in south India and were frequently used as a food sources, little was known about the morphological diversity within between species and nothing was known regarding intraspecific genetic diversity (or) species relationship. This study provided information of the physical chemical and morphological properties, including morph metrics and distributional variation that have been reported in *Punitius* species, suggesting significant

diversity among the selected species. The clearly the genus warrant more through bio-geographic sampling and examination of morphological data or analysis to reveal the natural lineage exist in this research work. This study would be useful in future to understand the phylogenetic position and biographical distribution of fresh water stream fishes in palani hills of Tamilnadu, South India

Key Words: Bio-ecological studies, Fresh water fishes, diversity conservation, distribution pattern, Palani hills.

1. INTRODUCTION

Western Ghats, India is a renowned UNESCO World Heritage Site and is one of the 'hotspots' of biological diversity, popularly known as "Great Escarpment of India". Western Ghats is well known for the rich freshwater fish fauna with a high level of endemism. However, a major part of the faunal diversity of Western Ghats is threatened by human intervention and invasive species during pandemic situation. Hence, knowledge of the diversity and distribution of the fresh water stream fish fauna is essential for designing and implementing conservation strategies. In the present study, small hill streams located within the Latitudinal range of 10.10 N – 10.44 N, Longitudinal range of 77.23 E to 77.68 E within the altitudinal range of 250m – 205 m Mean Level Sea Level (MSL) that flows southeast and Southwest directions covering about 90.5 sq km area from origin were studied physiochemical parameters during and after pandemic situation that affect the distributional pattern of freshwater stream fishes in palani hills. The streams of Palani hills generally have rough, rocky, boulder and pebbled substratum which affect the occurrence, distribution and productivity of fish sauna. All the fresh water resources of the Palani hills region compound a very rich and colorful ichthys fauna. Drift species of fishes have been abundantly inhabited in drift. Streams in the study area. Fish distribution and abundance from different parts of Western Ghats have been evaluated by different authors. Detail account of freshwater fishes has been provided by [4]. Further, investigations on the freshwater fish fauna of Western Ghats were initiated by [5] and [3] listed 25 fish species from the anamalai Hills and 10 species from the Nelliampathi Hills [6] and [7] reported economically important and cultivable fishes of the Nilgiris biosphere reserve later he described the assemblage structure of stream fishes in the Western Ghats. Meanwhile, [7] and [4] described a new species,

Glyptothorax davissinghi (Pisces: Sisoridae), a new catfish from Nilambur, Nilgiris Biosphere. [7] recorded *Schismatorhynchus* (*Nukta* (*nukta* (Sykes) (Pisces: Cyprinidae) from Moyar River. Later, Arunachalam et al. reported the occurrence of *Neolissochilus wynaadensis*, from Karnataka. Earlier, *Puntius filamentosus* and *Puntius melanampyx* (Day) in Orukomban and thelikal respectively [8] Manimekalan and [9] Arunachalam (2002) rediscovered the critically endangered air – breathing catfish *Clarias dayi* Hora (Pisces: Claridae) in Mudumalai Wildlife Sanctuary. [9] reported the diversity, distribution and assemblage structure of fishes in streams of southern Western Ghats. [10] described a new species of barb *Puntius nigripinnis* (Teleostei: Cyprinidae) (from southern Western Ghats. [11] described *Horabiosia palaniensis*, Cyprinid fish from Palani Hills, Western Ghats. Recently, Nearly 37 species in the Cauvery River System [17]. Meanwhile, Mogalekar of Tamil Nadu with the growing international trade of ornamental fishes, some of the fishes like *Puntius denisonii*, *Tetraodon travancoricus*, *Horabagrus nigricularis* and several species of the genus *Puntius*, *Danio*, *Garra*, *Loaches*, *Bagrids* and *Cichlids* are there in great demand in domestic as well as international market as aquarium fish. These fishes are being collected from natural habitats and exported resulting into drastic in their natural population. Several studies have indicated that breeding of *Nemacheilus* species *Puntius denisonii* is warranted as over exploitation of wild stock of these fishes could be the main reason for their diminution in the wild. However, the primary constraint with the endemic ornamental fish species is the loss of natural bright color under captivity. Therefore, few of the endemic ornamental species have been identified for captive breeding and aquaculture *Puntius denisonii* [1] and *Danio malabaricus* [2] along with other species like *P. Fasciatus*(jerdon,) *P.melanostigma*(day),*P.filamentosus*(valenciennes),*P.arulius* [2] ,*Punitusdorsalis* .*Horabiosia joshuai* [3], and *Nemacheilus* as over-exploitation of wild stock of these highly-priced fishes can lead to their extinction. It has been now well established that fish diversity is determined by the geographical location, ecological condition and physiochemical nature of the aquatic habitat. The Indian species represent about 8.9% of the known fish species of the world.[13] Jayaram (2010) listed 852 freshwater species of fishes under 272 genera, 71 families and 16 orders, including both primary and secondary freshwater fishes from India, Bangladesh, Myanmar, Nepal, Pakistan and Sri Lanka. Freshwater fishes are a poorly studied group since information regarding distribution, population dynamics and threats is incomplete, and most of the information available from few well-studied locations only [14].

1.1. OBJECTIVES

1. To study biographical analysis of fresh water streams in palani hills.
2. To study the distributional status of endemic stream-fishes in palani hills status of freshwater stream fishes in palani hills.

2. METHODOLOGY

2.1. SAMPLING AREA

Palani hills (Tamil: பழநிமலை) are a mountain range in the southern Indian states of Kerala and Tamil nadu. The palani hills are an eastward extension of the Western Ghats ranges, which run parallel to the west coast of India. The palani hills adjoin the high annamalai range (kerala) on the west, and extend east into the plains of Tamil nadu, covering an area of 2,068 square kilometers (798 sq mi). The highest part of the range is in the southwest, and reaches 1,800-2,500 meters (5,906-8,202 feet) elevation; the eastern extension of the range is made up of hills 1,000-1,500 m (3,281-4,921 ft) high. It is also home to the main temple of lord Muruga, who is worshipped as the primary god in Tamil nadu. vandaravu peak is the highest peak in the palani hills. The range lies between the cumbum valley on the south, which is drained by the Vaigai River and its upper tributaries, and the kongunadu region to the north. The northern slopes are drained by the shanmukha river, Nanganji River, and Kodavanar River, which are tributaries of the Kaveri River. The range lies mostly within Dindigul district, except in the western portion, where it forms the boundary between Dindigul district and Theni district to the south and Idukki district to the south west. The hill station of Kodaikanal lies in the southern central portion of the range. Palani hills joined with annamalai hills and cardamom hills at aanamudi peak in Kerala state. The palani hills are currently subject to increasing development pressure as it is under developed for a long time. The palani hills conservation council, a non-governmental organization headquartered in Kodaikanal, was founded in 1985. In the early 1990s the Tamil proposed to the Tamil nadu state government that much of the range be granted protected status as a wildlife sanctuary or palani hills wildlife sanctuary and national park. The palani hills are a mountain range in the southern Indian states of Kerala and Tamil nadu. The palani hills are an eastward extension of the Western Ghats ranges, which run parallel to the west coast of India. Palani hills, range of hills, an eastward extension of the Western Ghats,

in southwestern Tamil state, southern India. The range is a Continuation of the annamalai hills in Kerala state. The palnis are about 45 miles (70 km) wide and 15 miles (23 km) long. In the south the hills terminate abruptly in steep slopes. The upper palani, in the west, consist of rolling hills covered with coarse grasses; dense forests grow in the valleys. Peaks include vandaravu, 8,376 feet (2,553 metres) vembadi shola, 8,221 feet (2,505 meters); and karunmakadu, 8,042 feet (2,451 meters). The town of Kodaikanal is located in a high basin about 7,000 feet (2,150 meters) above sea level. Potatoes, beans, root crops, pears, and peaches are cultivated in and around the hill villages. There are also bauxite mines. The lower plain, in the east, form a jumble of peaks that range in elevation from 3,000 to 5,000 feet (900 to 1,500 meters) and are separated by steep wooded valleys. Teak trees have been extensively planted. Important cash crops include coffee, bananas, cardamom, citrus fruit, and turmeric.

2.2. ECOLOGICAL STUDY

The ecological study selected of fifteen sites (5 low, 10 high elevations) will be selected from palani hills. 15 sites (5 low, 5 mid and 5 high elevations) have been selected from Palani hills. In each site, three replicas were made between 1 m intervals. Month-wise sampling was carried out for a year. The physico-chemical parameters of sampling site were measured by following: latitude, longitude and elevation of sampling sites have been taken from GPS (Global Positioning System); temperature, pH, dissolved oxygen, velocity depth, substrates, etc will be measured. The fish surveys and identification were carried out through non-destructive sampling by using sampling methods suited to the nature of river course, stream order, flow, presence of aquatic vegetation and local human disturbance. Visual surveys, cast nets, gill-nets and hooks and lines were used to sample fish species. Fish species were identified with the aid of taxonomic keys and field guides [15]. Information on threats to and ecology of species were also collected based on observation, measurements of stream related ecological covariates and semi structured interviews with local key informants. The collected fishes have been preserved separately in the field using 99% ethanol. Isolation of Fish from In this study 15 fish samples were collected from 15 different Streams in palani hills of the southern western Ghats India. Fish samples collected were *Devario malabaricus*(Devario), *Punitus denisonii* [1] *Punitus dorsalis* [2] *Horlabiosa joshuai* [3] Each fish sample was placed in aseptic small plastic box, labeled

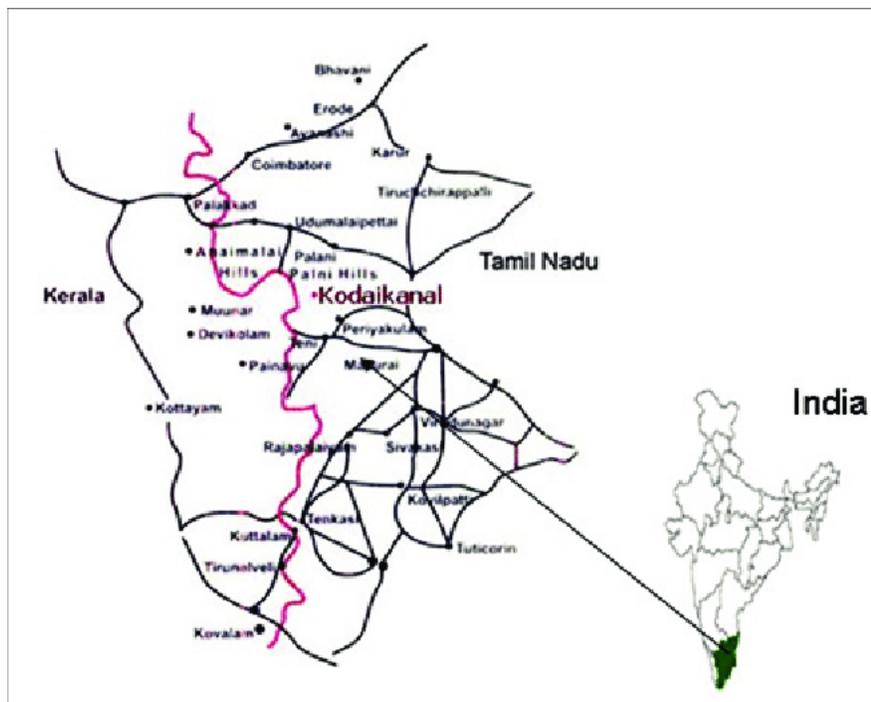
and sealed separately to avoid contamination. These fishes were brought to the laboratory and kept at 40°C.

2.3. PRESERVATION METHOD

Collection of sample 3 replica area between 1 meter distances. Sample collected month wise up to 1 year (July 2019 to July 2020) Collected Specimen preserved by 70% Ethanol or 95% Ethanol separately. In each site, three replicas were made between 1 m intervals. Month-wise sampling was carried out for a year. The physic-chemical parameters analysis of sampling site were measured the following latitude, longitude, and elevation of sampling sites were taken from GPS (global positioning system); temperature, ph, dissolved oxygen, velocity depth, substrates were measured. The field surveys and identifications have been carried out through non-destructive sampling by using sampling methods suited to the nature of river course, stream order, and flow, presence of aquatic flora and fauna, and local human disturbance of collection area. Collected information on threats to and ecology of species were also collected based on direct observation, bio-ecological measurements of streams and ecological survey with local key informants.

PALANI HILLS OF SOUTH INDIA

LOCATION MAP OF PALANI HILLS, WESTERN GHATES



Elevation: 2,533 m
Location: Tamil Nadu, India
Mountain range: Western Ghats
Country: India
Easiest route: Laws Ghats Road

Parent range: Western Ghats

TABLE 1: COLLECTION STREAMS WITH ELEVATION IN PALANI HILLS OF SOUTH INDIA.

S.NO	Low elevation(m)	S.NO	Mid elevation(m)	S.NO	High elevation (m)
1.	Poolathur (900)	6	Adukkam (1406)	11.	Fairy falls (2050)
2.	Kumbakarai (400)	7	Silver cascade (1256)	12.	Guntar (1990)
3.	Pachalur (296)	8.	Kurusedi (1213)	13.	Bear Shola falls (1980)
4.	Rat tail falls (290)	9.	Moolayar (1186)	14.	Samakadu (1538)
5.	Thallakuttu (250)	10.	Kozikottu (1182)	15.	Pillar rock stream (1534)

3. RESULT AND DISCUSSION

The fish fauna were surveyed from the streams and rivers of the Southern Western Ghats during one year period of seasonality wise analysis. The collection sites were selected based on the earlier fish faunal distribution in literature. Western Ghats is a mountain range that runs almost parallel to the Indian peninsula well known for its splendid biodiversity both in terms of richness and endemism. The physical and chemical climatic records of the selected study sites(Adukkam, Bear shoal falls, Fairy falls,Guntar, Kumbakarai, Kurusedi, Moolayar, Pachalur, Pillar rock,

Poolathur, Rat tail falls, Samakkadu, Silver cascade & ThalakuThu falls) was given in Table:1. The following studied latitude(N), Longitude(e), Elevation(m), Width(m), Water depth(m), Current velocity(sec/m), Canopy cover(%), Local human distribution was tabulated (Table:2), and DO_2 (mg/l), CO_2 (mg/l), TDS(mg/l), Turbidity, t. alkalinity(mg/l), t. hardness(mg/l), calcium (mg/l), chloride(mg/l), chlorine(mg/l), ammonia(mg/l), nitrite(mg/l), nitrate(mg/l). Maximum water temperature ($25.5^{\circ}C$) was recorded at fairy falls and a minimum water temperature ($12.4^{\circ}C$) was noted at Poolathur (Table.3) Characteristic features of small streams such as stream width, water depth, current velocity and the percentage canopy cover, bedrock, boulder, pebbles, and sand in the study sites are provided in large scale studies performed in other areas, geo-morphologically variables such as climate and altitude have been considered as the major factors responsible for fish faunal distribution. The chemical parameters were collected there are, odor, temperature ($^{\circ}C$), and to statistical findings every collection area chemical and physical factors mean values the maximum in TDS values are 86.6 -57.88 and minimum mean value are 0.03-0.02 were studied this results indicate that large scale variables were responsible for determining the diversity of fresh water stream fish communities. Multivariate analysis suggests that physical and chemical variables significantly influence the distribution and abundance of fresh water stream fishes in streams of palani hills of Southern Western Ghats. Apart from these variables, elevation was an important factor. Identified some fish species in that collection area of palani hills and collect fish identification and fish morphological studies, feeding habit, biology studies, distribution, IUCN status, threat to human and its uses was tabulated (Table:3). Finally studied fish scientific name, common name, vernacular name, and fish classification was noted. My study were continue to analysis fish distributional status, biological study, feeding habit was studies my identified endemic fishes. Finally to analysis based on phylogenetic nature to collect their IUCN red list status information was collected and tabulated (Table: 4).

TABLE: 2. PHYSICAL PARAMETERS OF THE SAMPLING SITES

Area of collection	Latitude (n)	Longitude (e)	Elevation (m)	Temperature		Stream Width(m)	Water depth(m)	Current velocity	Canopy cover(%)	Local human distribution
				At	Water					

1.Poolathur	10.16152	77.331	900	17.2	12.4	2	12	0.09	90	YES
2.Kumbakarai	10.17739	77.545	400	17.2	15.8	9	7	11.7	80	YES
3.Pachalur	10.39085	77.677	296	17.3	15.2	4	7	2.1	80	YES
4.Rat tail falls	10.13133	77.383	290	22.7	17.5	9	5	0.08	60	YES
5.Thallakuttu falls	10.44181	77.696	250	19.7	18.7	5	39	0.07	50	YES
6.Adukkam	10.23677	77.543	1406	23.5	18.4	14	3.5	3.9	10	NO
7.Silver cascade	10.24537	77.516	1256	23.1	20.7	3	11	0.04	80	NO
8.Kurusedi	10.27633	77.559	1213	22.3	20.1	2	5	50.9	80	YES
9.Moolayar	10.26903	77.611	1186	23.4	20.2	5	6	10.06	50	YES
10.Kozikottu	10.23731	77.546	1182	28.3	20.5	2	12	3.3	50	YES
11.Fairy falls	10.13524	77.281	2050	24.4	25.5	2	17	0.09	40	YES
12.Guntar	10.10927	77.318	1990	28.1	22.7	5	12	0.11	60	YES
13.Bear shoal falls	10.13182	77.239	1980	24.6	23.1	2	24	0.05	60	YES
14.Samakadu	10.24044	77.564	1538	27.7	23.3	2	3	3.3	20	YES
15.Pillar rock	10.21018	77.466	1534	26.2	24.5	2	6	2.6	50	NO

GRAPH: 1

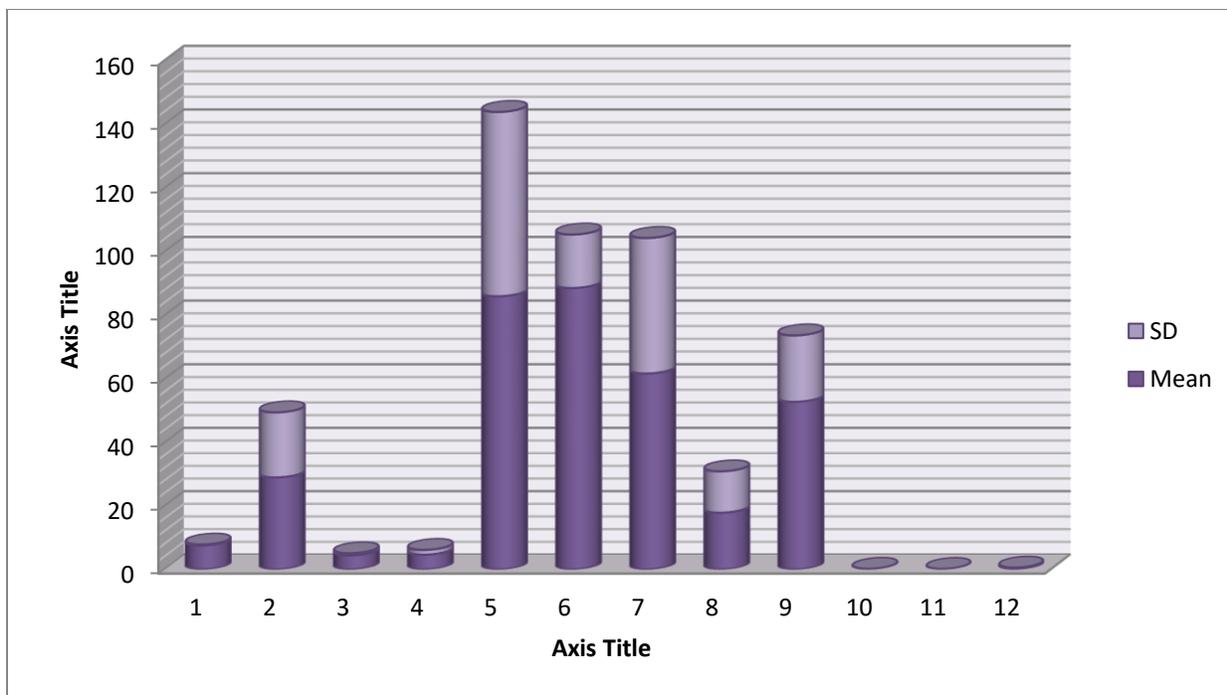


TABLE NO. 4: ENDEMISM, LOCALIZATION, ABUNDANCE AND IUCN STATUS OF THE FISHES RECORDED IN THE STUDY SITES

<i>Puntius sophore</i>	Non-endemic	Common	Abundance	LC	India, Pakistan, Nepal, Bangladesh, Burma, China
<i>Pethia ticto</i>	Non-endemic	Common	Abundance	LC	India, Nepal, Pakistan, Srilanka, Bangladesh, Burma
<i>Puntius denisoni</i>	Non-endemic	ENWG	Very rare	EN	Mundakayam, Travancore, Aralam, Kannur, Nilgris
<i>Puntius dorsalis</i>	Non-endemic	ENWG	Very rare	EN	Tamilnadu, Kerala, Karnataka, Andhra, Orissa, Srilanka
<i>Devarimalabaricus</i>	Non-endemic	ENWG	Very rare	LC	Western Ghats, Tamilnadu, Kerala,

					Karnataka
<i>Nemaceilus guentheri</i>	Non-endemic	ENWG	Very rare	VU	Western Ghats, Tamilnadu, Kerala, Karnataka
<i>Nemacheilus keralensis</i>	Non-endemic	ENWG	Very rare	VU	Western Ghats, Tamilnadu, Kerala, Karnataka

4. CONCLUSION:

This study depicted the status of the distributions of climatic changes during monsoon seasons in sampling area of south India region. The changes of physic-chemical factors during monsoon or seasonal variations were represented all the factors changed in habited fishes in this study area. The clear the understanding of bio ecological condition in particular inhabited area of palani hills based on seasonality, distributional status, diversity of fresh water stream fishes has been made through this research encompassing the different fishes endangered and the responsibility of parameter analysis in that area was based on the frequent climatic changes in the palani hills. The findings were made based on the analysis of water quality and the local human population activity on the freshwater of streams and rivers that affect the living of endemic freshwater fishes and its bio-ecological condition. The attentions during different Seasonality, Distributional analysis given in this research would be useful to understand the conservation status of freshwater streams fishes of Palani hills, and its endemic freshwater fishes. This biology study clearly proven the evidence of their fish fauna diversities collected through fish base. The fish identification was tabulated and presented. It is concluded through this study about the fish biographical distributional pattern of fish species based on their habitat seasonality and water parameters of living habitat and thus this study would be an input for further researches relating to phylogenetic.

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