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Diversity Study of Freshwater Fishes in Manimala River, Pathanamthitta, Kerala, India

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Abstract: The present study deals with the species diversity of fishes in Manimala River with reference to Eraviperoor region, Pathanamthitta, Kerala, India. The Manimala River forms the northern and north-western boundary and Varattar (a branch of river Pamba) forms the southern boundary of the study area. The wetlands (mainly paddy fields) consist of 18 small to medium-sized water bodies functioning as a water source for agriculture. A chain of canals connects many of them in the lower areas while the remaining ones get interconnected during monsoon floods during which the movement of fishes from rivers to other water bodies takes place. These small water bodies are extremely significant for the preservation and sustenance of the biodiversity of fishes. 24 species belonging to 12 families and 5 orders were collected and identified. This includes 10 species from the family Cyprinidae, 3 species from the family Channidae, 2 species from family Cichlidae, and 1 species each from families Hemiramphidae, Belontiidae, Anabantidae, Osphronemidae, Heteropneustidae, Claridae, Siluridae, Tetraodontidae, and Ambassidae.

Keywords: Manimala river, Fish biodiversity, Cypriniformes, Perciformes, Tetraodontiformes, Belontiiformes, Siluriformes,

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Introduction

Biodiversity is the degree of variation of life forms within a given ecosystem. Biodiversity is essential for stabilization of ecosystem, protection of overall environmental quality for understanding intrinsic worth of all species on the earth (Ehrlich and Wilson, 1991). India is very rich in Biodiversity. India supports about 10 % of the world's biological diversity with just 2% of the world's

land area. There is a global concern about the status of the bioresources on which human life depends and their loss affects food security, vulnerability to natural disasters, energy security, etc. Fish account for the highest species diversity among all vertebrates and they live in almost all conceivable aquatic habitats (Remadevi, 2003). The environmentally sustainable use of fish

resources is central to fisheries management, given the long-term importance of this sector in terms of nutrition and employment. But today's major concern relates to the unsustainable levels of exploiting fishes with such practices that lead to the depletion of fish stocks, disruption of ecological equilibrium, and reduction in diversity (Radhakrishnan and Sugumaran, 2012). Fisheries that exploit a range of species may have more stable catches than fisheries that exploit a single species. Conservation of biodiversity is important in environmental management programs (Turner and Gardner, 1991). Presently over 20,500 fish species are known throughout the world (Nelson, 1996); of these 40% are inhabitants of freshwater and inland water bodies. A majority of these fishes are found in tropical waters. It is estimated that about 2500 fish species are found in India, of which about 930 Species are freshwater fishes, belonging to 20 Orders, 100 Families and 300 Genera (Daniels, 2000). Fish diversity investigations in rivers of South India (Chandrashekhariah, 2000) showed that in Krishna river basin there is 101 fish Species belonging to 19 Families and 5 Orders. Majority of the fish species in this riverine system are endemic and 20 Species are under the threat of extinction. The Cauvery river basin has 96 fish species under 23 Families and 8 Orders. 60 fish species belonging to 13 Families and 4 Orders were recorded in Godavari basin. A study of fresh water fish diversity in Alralam Wild Life Sanctuary of Kerala (Shaji *et al.*, 1995) found 33 species belonging to 15 families. Whereas, river Periyar of Periyar Tiger Reserve has 35 species belonging to 21 genera and 11 Families. Studies carried out in Kalakad-Mundanthurai Tiger Reserve, and rivers in western ghats of Kerala (Johnsingh, 2001) reported 33 species belonging to 9 families. A study in River Pampa reported that out of the 60 species of fishes reported from the river, 26 species, belonging to 5 orders and 21 genera contributed to the exploited fishery (Renjithkumar *et al.*, 2011). One of the epoch-making Ichthyological works in the 18th century was that of Peter Artedi (1705- 1734) who has been aptly

called the father of Ichthyology. During the later part of the 18th century, a number of other workers were engaged in studying the internal organizations of fishes. In this context, the work of Alexander Monero entitled 'The structure and physiology of fishes' explained and compared with those of man and other animals (1785) is worth mentioning. Jordan David Starr (1922), provided a classification of fishes including families and genera as far as known since then much of Ichthyological knowledge has accumulated in the scientific literature. Many Ichthyological studies definitely require detailed and valid information on various aspects viz. systematic, morphology, ecology, physiology etc. As early as 1822, Hamilton gave an excellent, illustrated taxonomic account of 'Fishes of Gangatic system' and removed various confusions caused by regional names of fishes. After Hamilton, there is, however, no work of greater importance on Indian Ichthyology, than the epoch making contribution of Francis Day's 'Fishes of India' (1878). The work included in the government of India's health bulletin no.12, 1937, entitled 'The table for identification of Indian fishes' with the description of certain families and observation of the relative utility of the probable Larvivorous fishes of India. Dutta Munshi and Srivastava (1988) brought out an exhaustive treatise on 'Natural History of fishes and systematics of freshwater fishes of India.

During the 1993-1995 survey of freshwater fishes in two east-flowing and three west-flowing rivers in Kerala part of the Nilgiri biosphere reserve, 92 species were recorded. Individually, Kabini river has 59 species and Kunthi river with 11 species. The interesting observation made in this study is the east-flowing rivers were more diverse than the west-flowing rivers. But almost all the species found in west-flowing rivers were endemic to Kerala.

Measuring biodiversity is one of the central issues in ecology because of its importance in devising conservation strategies. Moreover, the fisheries sector occupies a very important place in the socio-economic development of the country. It

has been recognized as a powerful income and employment generator as it stimulates the growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the source of livelihood for a large section of the economically backward population of the country. Therefore, there is a need to throw light on the sustainable use of small indigenous fish species and the conservation of biodiversity.

In this study an attempt has been made to collect and identify the available fish species of the Manimala River, Pathanamthitta, Kerala, India.

Materials and Methods

Area of Study:

The study area (Eraviperoor) covers an area of 18.64 km² (21° 24' latitude and 36°39' longitude) falling under the Eraviperoor Panchayat in Pathanamthitta, Kerala, India. The area receives an average of over 80 inches of rain per year. The vegetation can be generally described as agriculture-dominated but with very diverse fauna and flora. The wetlands (mainly paddy fields) consist of 18 small to medium water bodies functioning as water sources for the limited agricultural options that were available during the past century. A chain of small canals connects many of them in the lower area while the remaining ones get interconnected during monsoon floods. These small water bodies are extremely significant for the preservation and sustenance of biodiversity, especially the aquatic and water-dependent species. River Manimala forms the northern and north-western boundary whereas Kuttur village in the west, Puramattam and Koipuram villages in the east, and the Varattar River (a branch of River Pamba in the south) form the boundary.

Collection of fishes:

Fish species were collected for the study in a period of 4 months from December 2013 to April 2014. Following equipments were used for the capturing of fish:

Bamboo traps: It is a traditional device for capturing fish from small canals, streams, and paddy fields. In a bamboo trap, one end is closed and the other end is open with a very wide mouth. The closed-end is conical and sometimes with a flap at the end, where there is no flap, this will be tied up while in water. This device is known as 'Koodu' meaning cage in Malayalam. This cage is kept in running water at the narrowest portion of the canal. The remaining width of the channel after the head portion is covered with twigs, leaves of trees, and mud so that the fishes cannot escape.

Fishing nets: Fishing nets are of various types and are made of nylon, cotton, or combination. These are as follow:

Cast nets: This is the simplest type of net that can be operated by a single man by throwing it over the surface of the water. It is a long circular net with its periphery weighed down with lead beads. A cast net is operated from the boat. At the time of fishing, the net is swung over the head and dropped to the distance reachable by attached rope. After sometime it is slowly dragged in water with a rope. The fishes enter the net and are thus caught and collected.

Gill nets and drifts nets: Gill nets are wall-like and with mesh openings of varying sizes. For each type of fish, a particular type of mesh is used. Gill nets are prepared from synthetic impermeable fiber due to which it is not possible for the fishes to see the nets, so as fishes try to swim through the net wall and they get entangled by their operculum and caught.

Hooks and Lines: Hook and lines are the simplest and cheapest fishing gear. Though very ancient it is very popular among modern fishermen. From the simplest baited hooks used by primitive people, man invented the modern hand lines and long lines. Line fishing is the most effective method for catching large fish. Hooks are used for catching the smaller fishes.

Table 1: Fish species recorded in the study

Order	Family	Scientific name
Cypriniformes	Cyprinidae	<i>Puntius ticto</i> , <i>Puntius vittatus</i> , <i>Puntius tetrazona</i> , <i>Puntius sarana</i> , <i>Puntius sophore</i> , <i>Puntius fasciatus</i> , <i>Labeo dussumieri</i> , <i>Aplocheilus lineatus</i> , <i>Ctenopharyngodon idella</i> , <i>Parluciosoma daniconius</i>
Perciformes	Anabantidae; Ambassidae; Osphronemidae; Cichlidae; Channidae	<i>Anbas tetudineus</i> , <i>Parambassis ranga</i> , <i>Macropus cupanus</i> , <i>Etroplus maculatus</i> , <i>Etroplus suratensis</i> , <i>Channa maruloides</i> , <i>Channa orientalis</i> , <i>Channa straita</i>
Beloniforms	Belonidae; Hemiramphidae	<i>Xenentodon cancila</i> , <i>Hyporhamphus limbatus</i>
Siluriformes	Claridae; Heteropneutidae; Siluridae	<i>Clarias batractus</i> , <i>Heteropneustes fossilis</i> , <i>Wallago attu</i>
Tetraodontiformes	Tetraodontidae	<i>Tetraodon travancoricus</i>

directly placed in a 10% formalin solution, while large fishes were given an incision on their abdomen and preserved.

Identification:

The fishes were identified up to the species level with the help of standard keys and books (Day, 1889; Jayaram, 1999). Photographs of the collected specimens were taken with the help of a camera.

Results and Discussion

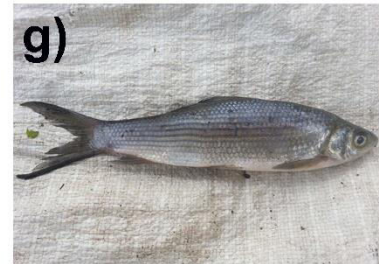
In this study a total of 24 species were identified which include 12 families and 5 orders. This showed that the study area is qualitatively rich in the diversity of fishes. The collected fish species have been depicted in Figure 1 and listed in Table 1.

During the study highest number of fish species were recorded from the family Cyprinidae with a total of 10 species, that is 42% of the total

species collected. They are *Puntius ticto*, *Puntius vittatus*, *Puntius tetrazona*, *Puntius sarana*, *Puntius sophore*, *Puntius fasciatus*, *Labeo dussumieri*, *Aplocheilus lineatus*, *Ctenopharyngodon idella*, *Parluciosoma daniconius*. All of them are omnivorous. The second-highest number of species were obtained from the family Channidae with 3 species, which is 13% and includes *Channa maruloides*, *Channa orientalis* and *Channa straita*. They all are carnivores and predatory which feeds on small fishes, frogs, snakes, insects, earthworms and tadpoles, etc. They possess an additional respiratory organ called the accessory bronchial chamber. The third highest species number was obtained from family Cichlidae with 2 species, that is 9% of the collection. They are *Etroplus maculatus* and *Etroplus suratensis*. These are omnivorous.

One species (4%) each were collected from the following families:

Family Belonidae includes the species *Xenontodon cancila*. It is a predator fish species. It is voracious



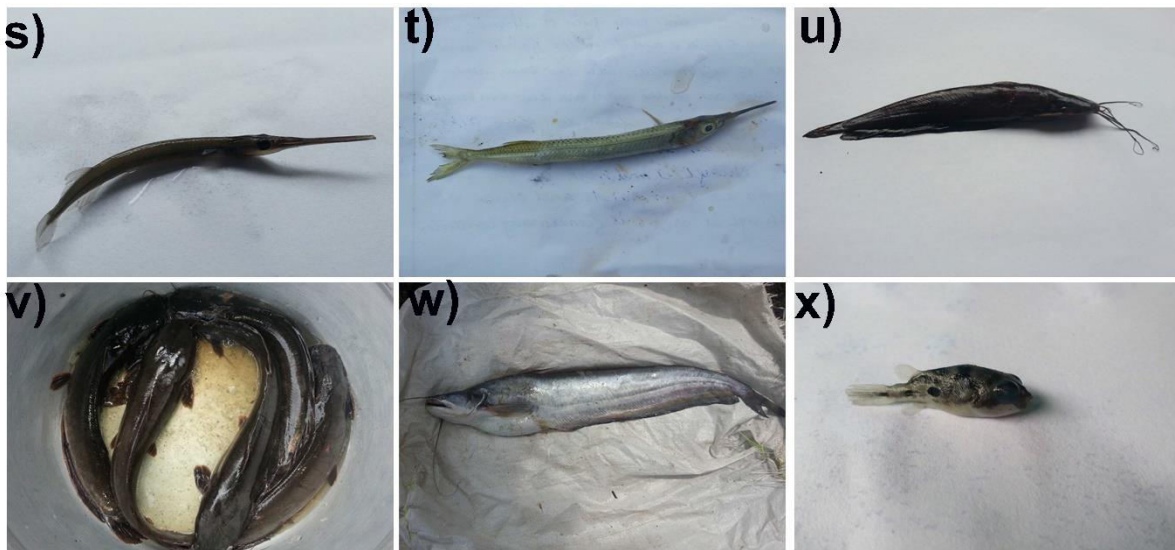


Fig. 1: (a) *Puntius ticto*, (b) *Puntius vittatus*, (c) *Puntius tetrazona*, (d) *Puntius sarana*, (e) *Puntius sophore*, (f) *Puntius fasciatus*, (g) *Labeo dussumieri*, (h) *Aplocheilichthys lineatus*, (i) *Ctenopharyngodon idella*, (j) *Paraluciosoma daniconius*, (k) *Anabas tetudineus*, (l) *Channa maruloides*, (m) *Channa striata*, (n) *Channa orientalis*, (o) *Macropodus cupanus*, (p) *Etroplus maculatus*, (q) *Etroplus suratensis*, (r) *Parambassis ranga*, (s) *Xenentodon cancila*, (t) *Hyporhamphus limbatus*, (u) *Heteropneustes fossilis*, (v) *Clarias batrachus*, (w) *Wallago attu*, (x) *Tetraodon travancoricus*.

and feeds on small fishes and frogs, its natural diet appears to consist almost entirely of crustaceans. Family Hemiramphidae includes the species *Hyporhamphus limbatus*, which is a predatory species. Family Anabantidae includes the species *Anabas tetudineus* which is bottom-dweller omnivore and plays an important ecological role. They possess a labyrinth organ, a structure in the head that allows them to breathe atmospheric oxygen. Family Osphronemidae consists of the species *Macropodus cupanus* and they feed on insects and zooplankton and are Larvivorous. Family Heteropneustidae includes a species *Heteropneustes fossilis*. They are predatory and carnivore. Family Clariidae consist of a species *Clarias batrachus* and they are omnivorous, fingerlings take insects, crustaceans, and debris and adults take smaller and larger crustaceans, worms, insects, small fish, decaying organic matter, etc. and also feeds on algae and higher plants at the bottom of water. They possess an accessory respiratory organ called an aborescent organ. Family Siluridae consists of a species *Wallago attu*. It is voracious, carnivorous, and predatory. It cannot be stocked in ponds with

other fishes. It is also called a freshwater shark on account of its vicious biting and feeding habits. Another family is Ambassidae which is represented by the species *Parambassis ranga*, It feeds on larvae and pupae of mosquitoes. It also feeds on crustaceans, annelid worms, and other invertebrates and can be used for mosquito control. The last family is Tetraodontidae which is represented by *Tetraodon travancoricus* which is a carnivorous fish. They can inflate their stomachs with water or air, and become 2 or 3 times of their normal size so can easily scare away many potential predators.

Conclusion

The present study revealed that the fish fauna in the study area is qualitatively rich. The wetlands (mainly paddy fields) consist of 18 small to medium-sized water bodies functioning as a water source for agriculture. A chain of canals connects many of them in the lower areas while the remaining ones get interconnected during monsoon floods. These small water bodies are extremely significant for the preservation and sustenance of the biodiversity of fishes.

The study identified 24 species of fishes distributed in 12 families and 5 orders. The diversity of the fishes mainly depends upon the biotic and abiotic factors and type of the ecosystem, age of the water body, mean depth, water level fluctuations, etc. The hydro-biological features of the collection centers also play an effective role in fisheries output to a greater extent. The distribution of fish species is quite variable because of environmental conditions.

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