STUDIES ON ICHTHYO-DIVERSITY OF MARUTHUR ANICUT, TIRUNELVELI DISTRICT, TAMIL NADU, INDIA.

[1]Joseph Antony Reneese.P, [2]Muthu Krishnan. S*,[3]Raja.P, 4Ronald.J.

[1]PG scholar, [2]Research scholar (Reg. No. 18111282191004), [3]Assistant professor, [4]Assistant professor

Department of Zoology, St. Xavier's College, (Autonomous)Palayamkottai, Tirunelveli -627 002

Affiliated to Manonmaniam Sundaranar University,

Abishekapatti, Tirunelveli- 627012, Tamilnadu, India.

Abstract

This study has been undertaken to investigate fish diversity in Maruthur Anicut of Tirunelveli district, TamilNadu for a period of six months (Dec.2017 to May 2018). In total, 49 fish species belonging to 14 families and 31 genera were recorded during the study period. Among them Cyprinidae was the most predominant family, which contribute 22 species (44.90%), followed by Cichlidae with (10.20%). *Lepidocephalus thermalis* (24.26%) and *Salmostoma clupeoides* (11.90%) were most abundant species in the study area. Among the 49 species 4 species were found to be endangered (EN), 2 were vulnerable (VU), 2 were lower risk near threatened (LRnt). This study reveals the present status of Ichthyo – Diversity of Maruthur Anicut, which would pave the way to future works related to management and conservation of fishery resources

Keywords: Ichthyo – Diversity, Species Richness, Diversity Indices, Abundance and Conservation

1.0 Introduction

Tirunelveli district is having a geographical area of 6,759 sq.km and lays between (8°.05' and 9°.30' N and 77°.05' and 78°.25'E) the South eastern portion of Tamil Nadu. Reservoir fisheries are an important component of the inland fisheries in South and South East India. The Western Ghats are the richest region of ecological communities in India with respect to endemic freshwater fishes. North- Eastern India, which has a very high diversity among freshwater fish, however, does not have many endemic species because of its jagged political boundary. Each habitat has its own unique community of fishes and other organisms which adapt to the various features of that habitat and major changes in landscapes by human activities (Armantrout, 1995). Conditions at any point in a basin are a summary of all activities upstream in the basin (Arthington and Welcomme, 1995). The Thamirabarani River is a perennial river that originates from the Agastyarkoodam peak of pothigai hills of the Western Ghats, above Papanasam in the Ambasamudram taluk and flows through Tirunelveli and Tuticorin Districts. Fish diversity is not only the wealth of Tamil Nadu and the India, but it also has serious implication on fishery. Thus there is an urgent need for proper inventorisation and documentation of this fish diversity in order to develop a fresh water fish diversity information system. Hence this study focused on freshwater icthyo-diversity and species richness in Maruthur Anicut, Tirunelveli District, Tamil Nadu.

2.0. Materials and Methods.

The study area is the Maruthur Anicut in Tirunelveli District lying between 8.7598°N latitude and 77.8183°E longitude in the Tamirabarani river basin. Icthyo-diversity assessment was done during December 2017- May 2018. Fishes were collected from different region of Maruthur Anicut with the help of fisherman using cast net, drag nets and fishing hooks/gears at 5m intervals. The collected fish samples were preserved with 10% formalin solution, labeled and brought to the laboratory. Fish identification was done using keys and manuals developed by Talwar and Jhingran (1991), Koumans (1953), Pethiyagoda (1991), Kottelat *et al.* (1993), Masuda *et al.* (1984), and Jayaram (1999). Identified fishes were confirmed by the taxonomic experts.

Fish species diversity was subjected to diversity analysis using different indices like Shannon – Weiner index (H), Simpson Dominance index (D), Simpson index of diversity (1-D) and Margalef's index.

2.1 Fish diversity analysis:

2.1.1 Shannon – Weiner index

Shannon – Weiner index (H) which depends on both the number of species present and the abundance of each species.

$$H = \sum P_i \, In P_i$$

Where, H = Shannon – Weiner index.

$$P_i = \frac{ni}{N}$$

$\sum$ = Sum

In = Naturallogrithm

ni = Number of individuals of each species in the sample.

N = Total number of individuals of all species in the sample.

2.1.2 Simpson's diversity indices

Simpson's diversity index is a measure of diversity. It takes into account the number of species present, as well as the abundance of each species.

(a) Simpson's index of dominance

$$D = \sum \frac{ni(ni-1)}{N(N-1)}$$

ni = Number of individuals of each species in the sample.

N = Total number of individuals of all species in the sample.

(b) Simpson's index of diversity

$$1 - D$$

D = Simpson's index of dominance

2.1.3 Margalef index

The Number of species per sample is a measure of richness. The more species present in a sample, the 'richer' the sample. Species richness as a measure on its own takes no account of the number of individuals of each species present. It gives as much weight of those species which have many individuals.

$$Ma = \frac{S-1}{In\ N}$$

S = Number of species

N = Number of individuals in the sample.

2.1.4 Correlation:

The Pearson correlation coefficient, often referred to as the Pearson 'r' test, is a statistical formula that measures the strength between variables and relationships. To determine how strong the relationship is between two variables, you need to find the coefficient value, which can range between -1.00 and 1.00.

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{\left[N\sum x^2 - (\sum x)^2\right]\left[N\sum y^2 - (\sum y)^2\right]}}$$

N = Number of pairs of scores

$\sum xy$ = Sum of the products of paired scores

$\sum x$ = Sum of x scores

$\sum y$ = Sum of y scores

$\sum x^2$ = Sum of squared x scores

$\sum y^2$ = Sum of squared y scores.

2.2 Statistics package:

Shannon-Weiner diversity index, Simpson's index of dominance, Simpson's index of diversity and Margalef index was performed manually and checked with PAST software (Version 3.19) for confirmation. Correlation and Standard deviation (S.D) were also done manually and Microsoft Office Excel was used for confirmation.

3.0 RESULTS AND DISCUSSION

3.1 ICTHYO-DIVERSITY

The present study shows the record of 49 fish species (Table 1) belonging to 14 families and 31 genera from the selected site of Maruthur Anicut of Tirunelveli District, Tamilnadu (Figure 1). The Cyprinidae was the most predominant family, contributing 44.90% of total fish species. The dominant nature of cyprinids and their occurrence in the water bodies of Tamil Nadu is a common phenomenon (Arunachalam and Sankaranarayanan, 1999 ; Arunachalam *et al.*, 2000) which is followed with Cichlidae with 10.20%, Bagridae with 8.16%, Belontiidae with 6.12%. We observed Channidae, Anguillidae, Clariidae, Mastacembelidae, Ambassidae with 4.08% and Osmeridae, Mugilidae, Gobiidae, Zenarchopteridae Cobitidae with only 2.04%. In a similar study Anbalagan and Sivakami (2017) reported same pattern of fish diversity in a fresh water lake in Tamil Nadu and identified 22 species belonging to 12 different families in which Cyprinidae recorded the highest species richness. Similarly, another one study revealed that 18 fish species belonging to 14 genera and 8 families in the Suthamalli pond, Tirunelveli district and recorded dominant cyprinidae family which comprises of higher level of major and minor carps which were found to be numerically abundant and also showed high species richness (Xavier Innocent *et al.,* 2012) but it was comparatively lower than the present study carried out in Maruthur Anicut. This species diversity variation is due to the vast area, presence of natural resources, climate and seasonal variation. The disturbed and undisturbed streams are characterized on the basis of utilization of different habitats by fish assemblage group (Scott and Hall, 1997). The low species richness was recorded during the December month can be attributed to a lot of physical barriers like big log inside the river site, fallen trees and biological factors such as habitat destruction, anthropogenic pressure, water quality, siltation as physical movement is considered very important for fish diversity.

In the present study, out of 49 collected fishes 4 species are endangered (EN), 2 are vulnerable (VU), 2 are lower risk near threatened (LRnt), 34 species are low risk least concern (LRIc), 3 species are data deficient (DD) and 1 are not evaluated (NE) in the workshop (CAMP 1998). Conservation status of 3 species is unknown (Table 2).

Table 2 Conservation Status of each species

Family	Species	Conservation Status (IUCN)
Cyprinidae	*Cyprinus carpio*	Vulnerable
	Labeo rohita	Least Concern
	Cirrhinus mrigala	Least Concern
	Devario aequipinnatus	Least Concern
	Devario malabaricus	Least Concern
	Puntius vittatus	Least Concern
	Dawkinsia filamentosa	Least Concern
	Labeo boggut	Least Concern
	Esomus lineatus	Least Concern
	Barbonymus altus	Least Concern
	Ctenopharyngodon idella	Unknown
	Catla catla	Least Concern
	Mylopharyngodon piceus	Data Deficient
	Puntius amphibious	Data Deficient
	Puntius parrah	Least Concern
	Hypselobarbus curmuca	Endangered
	Hypselobarbus dubius	Endangered
	Hypselobarbus jerdoni	Least Concern
	Hypselobarbus dobsoni	Data Deficient
	Barbodes carnaticus	Least Concern
	Salmostoma clupeoides	Least Concern
	Labeo calbasu	Least Concern
Channidae	*Channa striatus*	Least Concern
	Channa punctatus	Least Concern

Cobitidae	*Lepidocephalus thermalis*	Least Concern
Cichlidae	*Etroplus suratensis*	Least Concern
	Etroplus maculatus	Least Concern
	Oreochromis niloticus	Unknown
	Pelmatolapia mariae	Least Concern
	Oreochromis mossambicus	Near Threatened
Bagridae	*Mystus gulio*	Least Concern
	Mystus keletius	Least Concern
	Mystus vitatus	Least Concern
	Mystus cavasius	Least Concern
Mastacembelidae	*Mastacembelus armatus*	Least Concern
	Mastacembelus malabaricus	Least Concern
Mugilidae	*Liza richardsonii*	Unknown
Osmeridae	*Hypomesus transpacificus*	Critically Endangered
Belontiidae	*Pseudosphromenus cupanus*	Least Concern
	Pseudosphromenus dayi	Vulnerable
	Xenentodon cancila	Least Concern
Ambassidae	*Ambassis thomassi*	Least Concern
	Ambassis dayi	Least Concern
Gobiidae	*Glossogobius giuris*	Least Concern
Anguillidae	*Anguilla anguilla*	Critically Endangered
	Anguilla bicolour	Near Threatened
Clariidae	*Clarias batrachus*	Least Concern
	Clarias gariepinus	Least Concern
Zenarchopteridae	*Dermogenys siamensis*	Population Info unavailable

3.2 Fish diversity analysis

The Shannon Weiner fish diversity index of different months ranged from 1.954 to 3.108. Maximum fish diversity index was recorded in April (3.108). The Simpson's diversity indexes of dominance in different sites varied from 0.06181 to 0.3468. The highest was recorded in the month of February (0.3468). The Simpson's index of diversity ranged between 0.6532 and 0.9382. Generally Simpson's index of diversity value ranges between 0 – 1. Values near to 1 are considered as good diversity (Table 3).

The Margalef Index ranged from 6.033 to 7.223, March and February showed highest (7.223) and lowest value (6.033) respectively. Higher the calculated value higher the species richness. Total abundance of Ichthyo species throughout the study period are as follows *Lepidocephalus thermalis* (24.26%), *Salmostoma clupeoides* (11.90%), *Puntius amphibious* (7.14%), *Pelmatolapia mariae* (6.41%), *Devario aequipinnatus* (5.46%), *Devario malabaricus* (3.90%), *Etroplus maculatus* (3.65%) *Pseudosphromenus cupanus* (2.46%), *Esomus lineatus* (3.05%), *Ambassis thomassi* (2.79%), *Dawkinsia filamentosa* (2.76%), *Xenentodon cancila* (2.62%), *Puntiua vittatus* (2.60) *Mystus gulio* (1.35%) and *Anguilla bicolour* (0.03%). Abiotic and biotic factors have an important role in supporting fish diversity in lake ecosystems (Prasad *et al*., 2009). This study clearly illustrates that the Maruthur Anicut consist of rich icthyo-diversity and abundance and is need to be conserved and protected for future development in aquaculture, ornamental fish production and ecotourism.

Table 3 Analysis of Icthyo Diversity using Different Indices

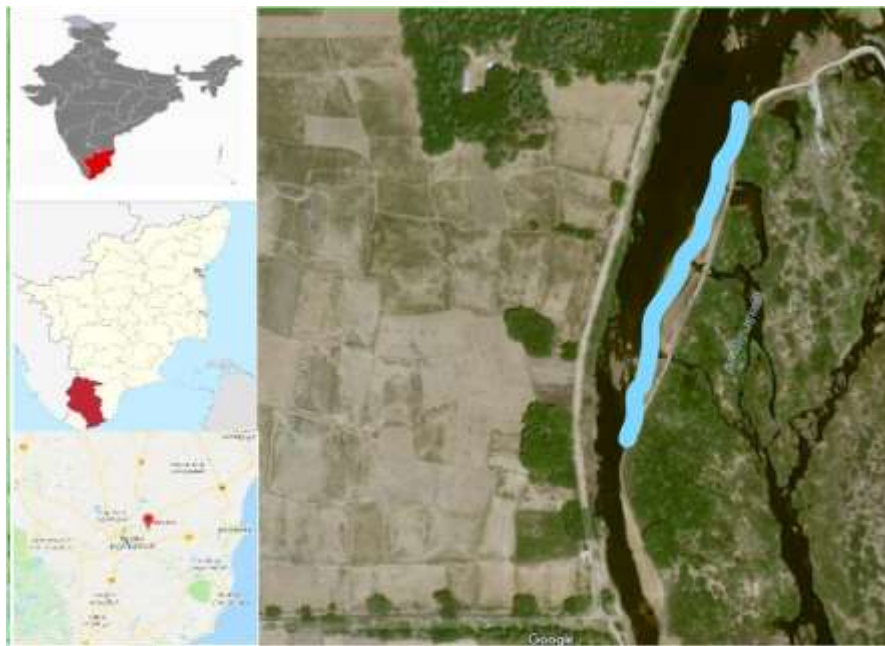| Diversity Indices	Dec	Jan	Feb	Mar	April	May
No. Of Individuals	463	656	1246	508	529	295
Dominance D	0.08291	0.09258	0.3468	0.06494	0.06438	0.06181
Simpson 1-D	0.9171	0.9074	0.6532	0.9351	0.9356	0.9382
Shannon H	2.998	2.959	1.974	3.085	3.108	3.069
Margalef index	6.354	6.629	6.033	7.223	7.176	6.33

Figure 1 Study Area

Table 1 List of species observed from Maruthur Anicut and it's abundance

Family	Species	December		January		February		March		April		May		Total
Cyprinidae	*Cyprinus carpio*	5	4	2	3	4	3	3	7	5	2	3	-	41
	Labeo rohita	3	2	5	6	1	2	-	1	1	1	-	-	22
	Cirrhinus mrigala	1	-	2	1	2	1	10	-	4	1	1	-	23
	Devario aequipinnatus	3	15	10	13	15	25	40	23	20	17	10	11	202
	Devario malabaricus	5	10	13	17	10	11	16	17	15	12	10	8	144
	Puntius vittatus	-	1	-	-	2	3	7	15	17	20	18	13	96
	Dawkinsia filamentosa	18	11	-	7	11	13	9	8	10	7	5	3	102
	Labeo boggut	-	-	3	2	2	1	-	1	-	1	-	-	10
	Esomus lineatus	11	12	13	15	11	9	10	6	8	8	7	2	112
	Barbonymus altus	1	-	-	-	1	-	-	1	1	-	-	-	4
	Ctenopharyngodon idella	-	1	-	-	1	-	1	-	1	-	-	-	4
	Catla catla	3	4	2	-	1	-	2	-	3	1	2	-	18
	Mylopharyngodon piceus	3	4	2	3	2	1	1	2	2	1	2	2	25
	Puntius amphibious	15	19	21	29	12	37	14	32	28	30	15	12	264
	Puntius parrah	1	-	-	-	2	-	-	1	-	1	-	-	5
	Hypselobarbus curmuca	1	6	2	-	2	-	4	3	3	2	2	1	26
	Hypselobarbus dubius	2	4	3	9	15	2	11	6	9	6	3	1	71
	Hypselobarbus jerdoni	1	-	-	3	-	4	1	-	-	1	1	-	11
	Hypselobarbus dobsoni	6	2	4	7	-	-	1	-	2	-	1	-	23
	Barbodes carnaticus	2	9	3	7	5	-	1	1	2	1	1	-	32
	Salmostoma clupeoides	54	49	36	48	23	73	16	43	40	29	18	11	440
	Labeo calbasu	-	-	4	-	12	-	-	2	2	1	1	1	23
Channidae	*Channa straitus*	3	-	4	3	2	4	2	-	1	2	2	1	24
	Channa punctataus	2	2	-	2	-	2	1	1	1	1	-	-	12
Cobitidae	*Lepidocephalus thermalis*	6	14	16	137	453	267	3	1	-	-	-	-	897
Cichlidae	*Etroplus suratensis*	1	2	-	1	5	3	-	6	3	5	2	1	29
	Etroplus maculates	2	3	7	21	10	9	6	19	20	17	13	8	135
	Oreochromis niloticus	1	3	8	1	-	3	7	-	10	6	8	3	50
	Pelmatolapia mariae	26	14	16	3	23	27	19	28	27	25	18	11	237
	Oreochromis mossambicus	2	4	3	3	2	1	6	3	5	3	3	3	38
Bagridae	*Mystus gulio*	2	3	3	5	7	6	5	3	5	4	4	3	50
	Mystus keletius	1	1	-	2	1	-	5	2	-	2	1	-	15
	Mystus vitatus	-	-	1	2	1	1	2	-	-	2	1	-	10

	Mystus cavasius	-	-	1	-	-	-	-	1	-	-	-	-	2
Mastacembelidae	*Mastacembelus armatus*	7	1	-	6	2	2	3	1	8	2	5	4	41
	Mastacembelus malabaricus	-	-	1	2	1	-	-	-	2	-	-	1	7
Mugilidae	*Liza richardsonii*	3	1	11	9	7	3	1	-	2	1	1	-	39
Osmeridae	*Hypomesus transpacificus*	-	-	3	-	-	2	-	1	-	-	-	-	6
Belontiidae	*Pseudosphromenus cupanus*	11	17	19	21	11	8	-	2	1	-	1	-	91
	Pseudosphromenus dayi	2	-	3	-	5	4	-	1	2	1	1	2	21
	Xenentodon cancila	1	1	5	7	3	14	9	21	12	11	8	5	97
Ambassidae	*Ambassis thomassi*	12	3	9	8	11	17	11	9	9	6	6	2	103
	Ambassis dayi	10	9	7	3	-	4	-	3	2	2	2	1	43
Gobiidae	*Glossogobius giuris*	1	2	-	1	2	-	-	1	1	-	-	-	8
Anguillidae	*Anguilla anguilla*	-	-	1	-	-	-	1	-	2	-	1	-	5
	Anguilla bicolour	-	-	-	1	-	-	-	-	-	-	-	-	1
Clariidae	*Clarias batrachus*	-	1	1	3	2	-	1	3	3	2	2	2	20
	Clarias gariepinus	1	-	-	1	1	1	2	2	3	1	2	2	16
Zenarchopteridae	*Dermogenys siamensis*	-	-	-	-	-	-	-	1	-	1	-	-	2

4.0 Conclusion

Aquaculture is most promising sector in Tamil Nadu and serves as an indicator of almost all aquatic ecosystems health. Aquaculture research must be practiced to fulfil the future holds on aquatic resources. We can clearly see lots of species were extinct in the previous years due to climate changes, human activities and natural harassment. Our study reveals that the Maruthur Anicut has rich fish diversity with 49 species indicates that conservation steps should be practiced to protect all those species for our future sustainability and survival. Cyprinidae was the dominant family and it has been a good habitat for *Channa* species and Claridae species. This work will also provide a path for future research.

5.0 Acknowledgement

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