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Ecological Status and Fish Diversity in the MahendratanayaRiver Srikakulam-Andhra Pradesh-India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Mahendatanaya is the link river between the two states Andhra Pradesh and Odessa. It is origin from Rayagada hills (Eastern Ghats) and travel through Odessa to Andhra Pradesh, finally join with the Bay of Bengal at Baruvakotturu in Srikakulam. It is not only agricultural resource but also one of the high biodiversity spots in the Srikakulam Wetlands. I studied biodiversity of Mahendratanaya River by the survey method use of fish boats and fish gears along with fisher men and local people. I was collected the different water samples from the different areas and send to laboratory for indention to the values of ph, turbidity, Nitrates and Oxygen levels. Different Ichthyofauna was collected from the 34 sites with the help of fishermen by the use of the boats, fish gears, Fish traps

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and nets, the catching fishes are preserve in the bamboo traps and ice boxes and identified by IUCN the study time between 2023-2024. In the 30 water samples collected and set to the laboratory identifying for water elements. I was identified 10 orders, 19 families, 38 genus, 58 species of the total collected fishes count more or less 4300, fish conservation, anthropogenic and biodiversity of Ichthyofauna in the MahendratanayaRiver. I calculated the Environmental Tolerance Index (ETI) of the 10 species from the 9 sites of the river and beta diversity.

Graphical Abstract

Diagram1. Sample collection from MahendratanayaRiverat the four sites(site.1,2,3,4,)

Keywords: Fish diversity; distribution; environmental variability; ecological tolerance.

1. INTRODUCTION

Mahendratanaya is the one of the medium sized river and high biodiversity hub in the Srikakulam wetlands This river is entering in to the Andhra Pradesh from Odissa at Bathupuram village and finally joining in to the Bay of Bengal with large estuary at Baruvakotturu village. According to climatic changes water recourses are decrease day by day why because its depends upon rains for the water sources. It's made with marshy, semi sand soils along with shrubs and little bit plants. It's not only Ichthyofauna hub but also reserve place of the other animal that are living the Mahendrsgiri hills. Most of deer's population is increasing recent days, why because the eastern ghost deforestation is decreasing by the tribal people. Kalingadal dam was constructed on this river at Budarasing in Mandasamandal. This river is major water resource to the agricultural lands who are depends upon this for cultivation of different crops. This fertilizers and pesticides are major effect to the decreasing to the Ichthyofauna. Water sources mostly comes from the rains, when the cyclones will come than more water is enter in to the Bay of Bengal as floods I identified high variety of fresh water fishes and low amount of brackish water fishes along with biotic and a biotic factors in this river ecosystem. Studied the abundance impact on the fish distribution and verity in this ecosystem. It is not only biodiversity hot spot but also anthropogenic high diversified aquatic ecosystem.

It's one of the life resource to the fishermen who are living depends upon aqua resource, where is this river is entering in to the Bay of Bengal. Estuary was made between the where this river was entered in to the Bay of Bengal at Baruvakotturuvillage. The fisher men are only depends upon this as cultivation. The estuary is also occupying more than 50 hectare and biodiversity hub for the Ichthyofauna at the time of breeding season.

This is mostly moving besides the Mahendragirihills (Eastern Ghats), different fish species specifications, systemization was deeply studied in the publication literature. I observed in this lotic ecosystem the different fish species based on families, orders and species richness. The author considers the fish habitat and physic-chemical parameters in this ecosystem.

2. METHODS AND MATERIALS

2.1. Sampling and Study Area

The Mahendratanya is link River between the two states Odissa and Andhra Pradesh, it is majorly agricultural water Resource River. Kalingadal Dam was constructed on this river at upper place the site between the two Eastern Ghats 4 km from Budarsing village. I studied this river divide as three regions that is (Fig. 1) 1. Upper region: Its mostly occupying with forest climate with waterfalls water flowing canals. 2. Middle region: it's mostly water resource and kalingdhal reservoir also. Its around highly occupying agricultural lands and horticultural area.3. Lower region: it's mostly towards the costal line Bay of Bengal.

2.2 Data and Sampling Collection

The samples were collected the morning time between 6.0 am- 8.0am and evening 6.0-7.0 pm with the help of local fisher men using by the boats, through cast, drag nets, bamboo traps, and fish gears. The data was collected simultaneously monthly four times end of the week the time period between Jan-2023 to Oct-2024. Showed sampling sites in four different areas (Fig. 2) in the MahendratanayaRiver. The fishes were collected 36 sites from the four areas in the MahendratanayaRiver. The upstream forest region channels 22.2% (F1-F8) (A), Middle stream area along with kalingdal dam and agriculture area50%(F9-F26(B), The inter zone agriculture and city area connect to estuary25%(F23-F31((C), Downstream estuary connect to the Bay of Bengal27.7%(D). The 2-3 meters depth fishes were collected by the use of 25,30 size gill nets from the kalingdal Dam. The 30 water samples were collected according to fish distribution from the different sites in the three regions and send to laboratory identified the Nitrates, Nitrites, Phosphates, PH, etc. Water dissolved contents are measured from the collected water samples, they are dissolved oxygen (mg l_1) with an oxymeter WTW DIGI 330; pH and temperature (_C) with a pH-meter WTW-Ph 330 coupled with a thermometer. water turbidity (cm) measured with secchi disk depth (m) by the use of a ballasted rope; velocity (m s_1) by a propeller-driven current meter; electrical conductivity (IS cm_1), TDS (mg l_1) and salinity (&) were measured by the multi-parameter WTW-LF 340; Bushes, plants, Mud

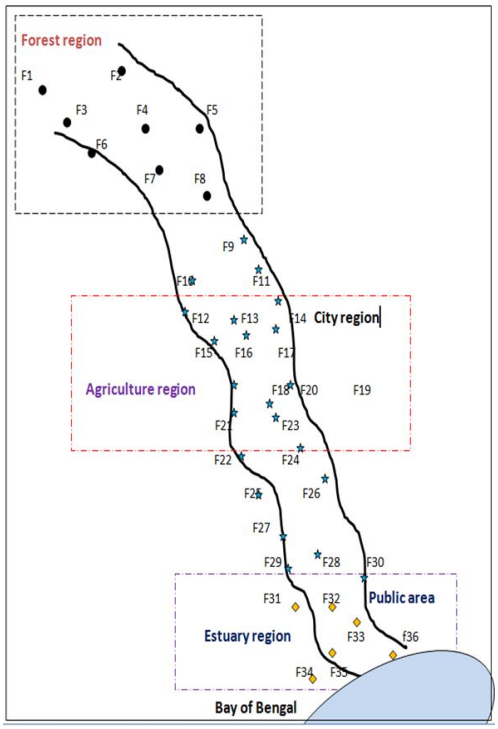

Fig. 1. Sampling sites position along with Mahendratanaya river,●Sampling collection by cast nets, ★Sampling collection by Drag nets& fish gears, ◆Sampling collection by Drag nets

soil. Gravel, leaf-stem-wood material measured based on the % mean value from bottom to surface.(Bhata, A. (2003). Environmental biology of fishes. *68*, 25–38).

2.3. Analytical Procedure

Physical and chemical parameters, collecting samples were evaluated as per three regions according to Principle Component Analysis's (PCA).

Differentiate the collecting samples from the different areas and diversity of the species from one environment to another environment by use of B_H-Diversity index the values 0-1, that is high beta diversity index to low level of species similarity and low beta diversity index to high level species similarity (Legendre & De Ca` ceres, 2013).

Beta diversity: $B_H=2C/S_1+S_2$(ðSrensen; 1948Þ)
S_1= Total number of first community species,
S_1= Total number of second community species,
C= Common species number of both communities

Identifying the species richness and variance between collecting samples, followed by the Mann–Whitney test to identify specific differences.

The environmental tolerance index (ETI), ecological tolerance (tk) and optima (uk) values of collected 10 most dominant species eight or more sites. and caught by fish gears and calculated of variables. High ETI values were assigned for the highest environmental tolerance range of the individual species (Curry, 1999), while optima (uk) and tolerance (tk) estimates were used to understand the tolerance and optimum ranges of species (Ter Braak and Barendregt, 1986).

$$u_k = \frac{\sum_{i=1}^{n} y\,ik \cdot xi}{\sum_{n=1}^{n} y\,ik} \qquad t_k = \sqrt{\frac{\sum_{i=1}^{n} y\,ik(xi-uk)^2}{\sum_{n=1}^{n} y\,ik}}$$

ETI =a/A with a: variation range of a variable at stations where x species was found; A: variation range of a variable at all stations.

where yik and i are the abundance of each taxon (k), and the value of each environmental variable (x) in the sample irrespectively. A C2 computer program was used to find the tolerance and optimum estimates of individual species (Mookappa Naik, C. K., & Kousar, H. (2012) Statically analysis done with collected species from the eight or more sites.

Table 1. Fish diversity in MahendratanayaRiverin Srikakulam

Name of order & families	S.no	Scientific Name	Common Name	Feeding Habitat	Upper Region	Middle Region	Lower Region (Estuaries)
Anguilliformes	**I**						
1. Anguillidae (2)	1	Anguilla bicolor bicolor	Short fin eel	Demersal, fishes, crusta, mollu		+	+
	2	Anguilla bengalensis	Indian Long fin eel	Demersal, fishes, crusta, mollus		+	+
Beloiniformes	**II**						
2. Exocoetidae (1)	3	Xenentodoncancila	Freshwater garfish	Pelagic, voracious	+	+	+
Siluriformes	**III**						
3.Bagridae (4)	4	Mystusbleeker	Day's mystus	Demersal, Crusta, Algae,diatoms		+	+
	5	Spherataseenghala	Giant river catfish	Demersal, feed on Crusta, Algae	+	+	+
	6	Ompokbimaculatus	Butter Catfish	Demersal, Crusta, Algae'diatoms		+	
	7	Mystus vittatus	Striped dwarf catfish	Demersa, predatory	+	+	+
4. Heteropneustidae(1)	8	Heteropneustesfossilis	Stinging catfish	Demersal, Omnivorous	+	+	
5. Claridae(2)	9	Clarias gariepinus	African catfish	Demersal, Omnivorous		+	
	10	Clarias batrachus	Batchwavacha	Demersal, Omnivorous	+	+	+
6. Schibeidae(2)	11	Eutropiichthysvacha	Magur	Surface feeder, carnivorous	+	+	+
	12	Pseudeutropiusatherinoides	Indian potasi	Surface feeder, carnivorous		+	
7. Siluridae(2)	13	Wallago attu	Boal	Benthopelagic feeder, carnivorous		+	+
	14	Ompokbimaculatus	Ompokbimaculatus	Demersal, Crustacean, Algae		+	
Channiformes	**IV**						
8.Channidae (6)	15	Channa marulius	Spotted snakehead	Spotted snakehead	+	+	+
	16	Channa gachua	Dwarf snake head	Smallfishes, Insects, Crustceans	+	+	
	17	Channa striatus	Banded snakehead	Bottom, carnivorous	+	+	+
	18	Channa micropeltes	Giant snakehead	Crustaceans, small fishes, bottum	+	+	
	19	Channa punctata	Spotted snakehead	Insects, Molluscs, Fishes	+	+	+
	20	Channa orienali	Walking snakehead	Bottom, Voracious and predatory	+	+	+
Gobiiformes	**V**						
9.Gobiidae (2)	21	Glossogobiusgiuris	Tank/Bar-eyed goby	Benthopelagic, Omnivorous		+	+
	22	Awaousgrammepomus	Scribbled goby	Benthopelagic, Omnivorous	+	+	+
10.Anabantidae (2)	23	Trichogasterfaciatus	Banded gaurami	Surface, carnivorous		+	
	24	Colisa lalio	Dwarf gaurami	Surface, mosquito larvae		+	
11.Nandidae (1)	25	Nandus nandus	Mud perch	Benthopelagic, aquati insects,		+	+

Name of order & families	S.no	Scientific Name	Common Name	Feeding Habitat	Upper Region	Middle Region	Lower Region (Estuaries)
				fish			
12.Ambassidae (2)	26	Ambassisranga	Indian glassy fish	substratum's, mosquitos, Oar		+	
	27	Chanda nama	Elongate glass perchlet	substratum's, mosquito breeding		+	
13. Cichlidae (4)	28	Oreochromis variable	Tilapia	Surface dweller, omnivorous	+	+	
	29	Mastacembelus armatus	Zig zag spiny eel	Surface dweller, omnivorous		+	+
	30	Mastacembeluspancalus	Barred spiny eel	Bottom, crustaceans. larvas		+	+
	31	Oreochromis mossambicus	Mozambique Tilapia	Bottom, crustaceans. larvas		+	
Cichhlifomes	**VI**						
14. Cichilidae(1)	32	Etroplussuratensis	Cicchilid fish	Surface dweller, Insects, leaves		+	+
Cypriniformies	**VII**						
15.Cyprinidae (18)	33	Amblypharyngodon mola	Mola carplet	Surface feeder ' larvivorous fish		+	
	34	Amblypharyngodonmicrolepis	Indian carplet	Surface feeder, Phyto and zooplank		+	
	35	Labeofimbriatus	Gangetic latia	Benthopelagic, algae, insec, detritus		+	
	36	Catlacatla	Catla	Surface layer and zooplankton	+	+	
	37	Labeo bata	Bata labeo	Bottom dwellers, Crusta, insect	+	+	
	38	Puntius chola	Swamp barb	Benthopelagic, crusta, insects,	+	+	
	39	Puntius ticto	Ticto barb	Surface feeder, Algae, Crustaceans,	+	+	+
	40	Puntius saranasarana	Olive barb	Surface habitat &Ominivorous	+	+	
	41	Puntius sophore	Spot-fin swamp barb	Benthopelagic, phytoplank, zoopl			
	42	Rasbora daniconius	Slender rasbora	Surface feeder,algae,aquatic,insects		+	
	43	Labeorohita	Rohit	Middle layer, plant matters	+	+	
	44	Labeocalbasu	Black rohu	Bottom dweller & Scavenger		+	
	45	Cyprinus carpio	Common carp	Bottom dweller, plankton and detritus	+	+	+
	46	Salmostomaphulo	Fine scale razor	Surface feeder, larvivorous fish		+	
	47	Rasbora elanga	Bengala barb	Demersal, insects, algae, protozoans		+	
	48	Ctenopharyngodonidella	grass carp	vegetables, crustaceans and larvae	+	+	
	49	Cirrhinusreba	Reba carp	Demersal, vegetables, crusta,larvae		+	

Name of order & families	S.no	Scientific Name	Common Name	Feeding Habitat	Upper Region	Middle Region	Lower Region (Estuaries)
	50	Cirrhinusmrigala	Mrigal	Bottom dweller & detritus eater	+	+	+
	51	Labeo porcellus	Bombay Labeo	Benthopelagic, algae, plant, insects		+	+
Gonrynchiformes	**VIII**						
16. Chanidae (1)	52	chanoschanos	Milk fish	algae-benthic and filamentous			+
Mugiliformes	**IX**						
17. Mugilidae (5)	53	Osteomuglicunnesius	Long arm mullet	Organicmatter,detrius and mud		+	+
	54	Mugil cephalus	Flat head grey mullet	Detritus, Microalgae, Benthic			+
	55	Planilizaparsia	Goldspot mullet	Feed on algae, Diat, organic matter			+
	56	Mugilaplaniceps	Rock mullet	Small molluscs, crustaceans			+
	57	Mugil dussumieri	Green back mullet	Small algae, zoo pankton			+
Carangiformes	**X**						
Latidae(1)	58	Latis calcarifer	Barramundi	Omnivorous, cornivorous			+
Total number of fresh water fishes (Three regions)					**23**	**51**	**30**
Total number Brackish (marine) fishes(Three regions)					**0**	**5**	**11**
Total Fresh water fishes					**47**		
Total Brackish water fishes					**11**		

3. RESULTS

We are identified 10 orders, 18 families, 35 genus and 58 species fish diversity in the Mahendratana river out of 3556 caught fishes use by the different type of nets, Fish gears and Bamboo traps. Above the fish diversity we are identified two type of water habitat fishes that is 11 type brackish water species are belongs to 5 orders, 6 families and 8 genus. The 47 type fresh water fishes are belongs to 4orders. 12families,27genus. The brackish water fishes are 11-*Anguilla bicolor* bicolor, *Anguilla bengalensis*, Xenentodoncancila, Etroplussuratensis, chanoschanos, Osteomuglicunnesius, Mugil cephalus, Planilizaparsia, Mugilaplaniceps, Mugil dussumieri, Latis calcarifer. We are studied and observed as a three regions in river upper region, middle region and lower region and fallowing the type of species number Upper-23, Middle-53 and Lower-30. (Table:2) out of them upper region no brackish water fishes but 23- fresh water, middle region 3- brackish water and 53 fresh water fishes, lower region 11- brackish water and 30- fresh water fishes types were identified. According to above collection and classification the middle region is high diversified region, the lower region is mostly occupying with migrated fishes, upper region is low diversify why because its mostly relation with the hill region (Fig:3).

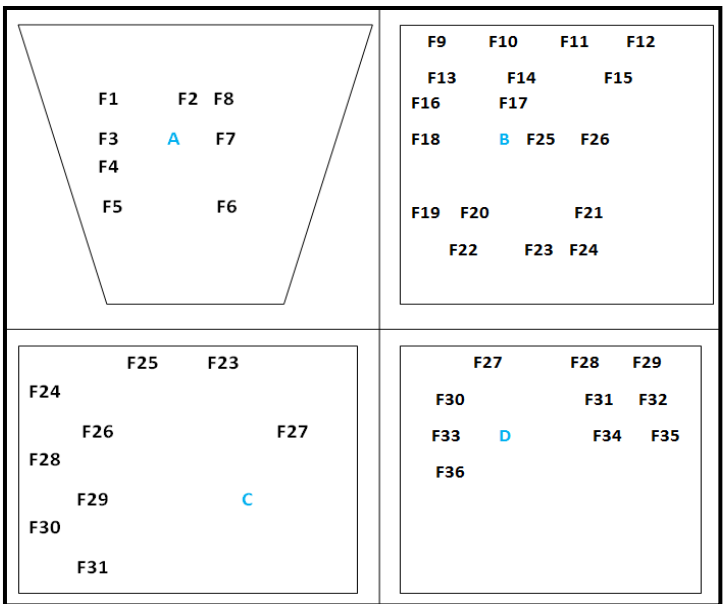

Fig. 2. Fish distribution in Three regions (Upper-A; Middle-B; Inter zone of middle& lower-C; Lower-D

Table 2. The percentage data between Families, Genus, Species diversity in Mahendrhratanaya River

S. No	Name of order	No.of families in order	No.of genus in order	No.of.spe. in order	% of families	% of genus	% of species
1	Anguilliformes	1	1	2	5.55%	2.85%	3.44%
2	Beloiniformes	1	1	1	5.55%	2.85%	1.72%
3	Siluriformes	5	8	11	27.77%	22.85%	18.96%
4	Channiformes	1	1	6	5.55%	2.85%	10.34%
5	Gobiiformes	5	9	11	27.77%	25.75%	18.96%
6	Cichhlifomes	1	1	1	5.55%	2.85%	1.72%
7	Cypriniformies	1	9	19	5.55%	25.75%	32.75%
8	Gonrynchiformes	1	1	1	5.55%	2.85%	1.72%
9	Mugiliformes	1	3	5	5.55%	2.85%	8.62%
10	Anabantiformes	1	1	1	5.55%	2.85%	1.72%
Total		**18**	**35**	**58**			

3.1. Fish Community Abundance

Based on the percentage Cypriniformies 6 species, Mugiliformes 3 species Channiformes 4 (Table 2) species were highly represented in the Mahendratana river. Out of 10 orders the species percentage under the families Anguilliformes order percentage of families, genus, species are (5.55%, 2.85% 3.44%), fallowing to the orders Beloiniformes (5.55%, 2.85%, 1.72%), Siluriformes(27.77%,22.85%,18.96%), Channiformes (5.55%, 2.85%, 10.34%), Gobiiformes (27.77%, 25.75%,18.96%) Cichhlifomes (5.55%,2.85%,1.72%), Cypriniformies (5.55%, 25.75%,32.75%), Gonrynchiformes (5.55%,2.85%,1.72%), Mugiliformes (5.55%, 2.85%, 8.62%), Anabantiformes (5.55%,2.85%,1.72%) above the families Cyprinidae (18) high percentage species second Channidae (6) .

3.2 Community Distribution in Upper, Middle, Lower Regions

According to ecological features The principal component analysis (PCA), showed three different regions of the Mahendratanaya River (IUCN Red List of threatened species, version 2013.2. (2013).)upper region and middle region common fishes are 23 species and middle region and lower region common species are 24. Above 58 species (Table 1) middle regions highly represented that is 51 species the percentage is (91.37%), fallowing upper region is 23 percentage is (39.65%), lower region is 31 species percentage is (51.72%). At the time of collection from the 35-40 sites 75% is common the remaining 25% only occupying the unique sites. In the lower region mostly brackish fishes were represented, that is highly distribute more than 82% three species (Mugil cephalus, chanoschanos, Latis calcarifer) but low number fresh water fishes also identified4% (Channa striatus, Catlacatla). Middle and upper region mostly diversified the fresh water fishes 94%. But middle region 6% (Latis calcarifer, *Anguilla bengalensis*) brackish water fishes also identified (Fig. 3) (The beta diversity index measured, Longitudinal gradient, is very high of the middle and lower area (0.68). but upper course is low diversity index(0.04) identified that is between lower and upper diversity index is lesser than middle region. The Mann–Whitney test revealed no significant difference ($p > 0.05$) between the species richness of the sampling area (upper region, middle and lower region).

3.3 Environmental Factors Effect on the Fish Diversity

We were collected different water samples from the different sites of the diversified three regions along with fishes measured the values in the given below of the collected 10 species sites. (Fig. 4) (Jayaram, 2011). Above 10 species(Table:3) PH minimum value fish is Labeorohita(5.18), maximum PH value fish is Mugil cephalus (6.68) and mean values is(5.93),Oxygen minimum value fish is Amblypharyngodonmicrolepis (2.04),maximum

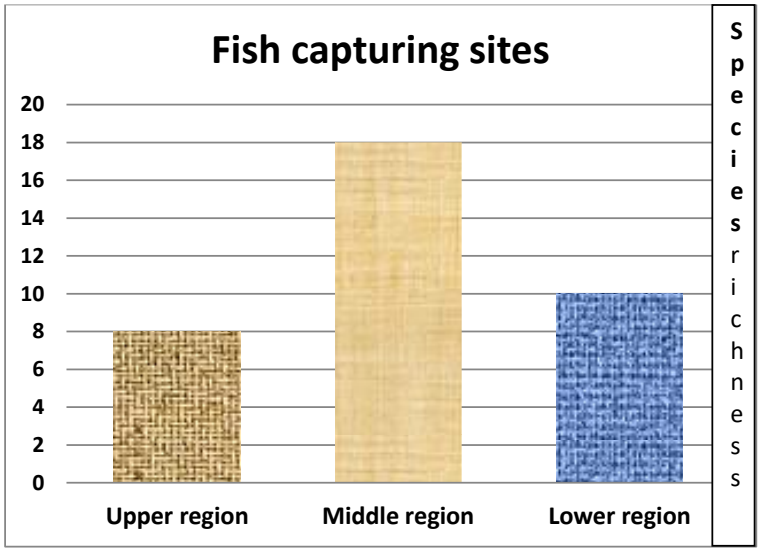

Fig. 3. Fish community distribution from Up-Down stream in Mahendratanaya River

Table 3. Tolerance (tk), optimum (uk), mean, maximum, minimum 10 fishes values of the 10 variable environment sits in MahendratanayaRiver

S.no	Species	Ecological status	PH	Oxygen	Nitrites	Mud	DwLR	Width	TDS
1	**Channa striatus**	uk	6.45	3.22	0.062	38.56	18.64	2.24	49.43
		tk	6.49	3.34	0.084	48.49	20.22	2.32	53.34
2	***Anguilla bengalensis***	uk	5.68	2.88	0.062	24.22	16.45	2.46	56.54
		tk	5.89	3.02	0.076	32.46	19.43	2.98	57.23
3	**Catlacatla**	uk	6.24	3.98	0.056	30.42	22.43	4.32	42.34
		tk	6.58	4.22	0.068	38.24	24.26	5.12	45.32
4	**Labeorohita**	uk	6.22	5.02	0.048	32.34	25.28	5.12	62.23
		tk	6.42	5.12	0.065	40.24	26.12	5.24	64.32
5	**Cyprinus carpio**	uk	5.18	5.28	0.034	29.45	23.42	3.82	61.29
		tk	5.42	5.46	0.043	36.32	24.98	4.28	63.9
6	**Cirrhinusmrigala**	uk	5.82	2.34	0.086	34.22	19.64	2.56	68.1
		tk	5.94	2.64	0.092	38.22	21.34	2.98	70.21
7	**Mugil cephalus**	uk	6.54	4.45	0.036	30.22	14.66	1.12	54.42
		tk	6.68	4.69	0.042	37.22	16.64	1.42	56.32
8	**Colisa lalio**	uk	6.22	3.24	0.078	28.22	12.22	3.24	44.46
		tk	6.34	3.64	0.082	34.22	13.46	3.89	47.21
9	**Amblypharyngodonmicrolepis**	uk	5.89	2.04	0.056	12.22	10.64	3.21	49.64
		tk	6.02	2.48	0.062	18.34	12.46	3.32	52.12
10	**Oreochromis variable**	uk	6.04	4.84	0.045	9.88	18.29	2.48	51.32
		tk	6.16	5.32	0.049	14.22	21.72	3.32	53.22
Mean			**5.93**	**3.75**	**0.064**	**29.18**	**18.38**	**3.18**	**56.27**
minimum			**5.18**	**2.04**	**0.036**	**9.88**	**10.64**	**1.12**	**42.34**
Maximum			**6.68**	**5.46**	**0.092**	**48.49**	**26.12**	**5.24**	**70.21**

DwLR, dead wood, leaves and roots; TDS, dissolved solids; Width, basin width; Oxy, oxygen;

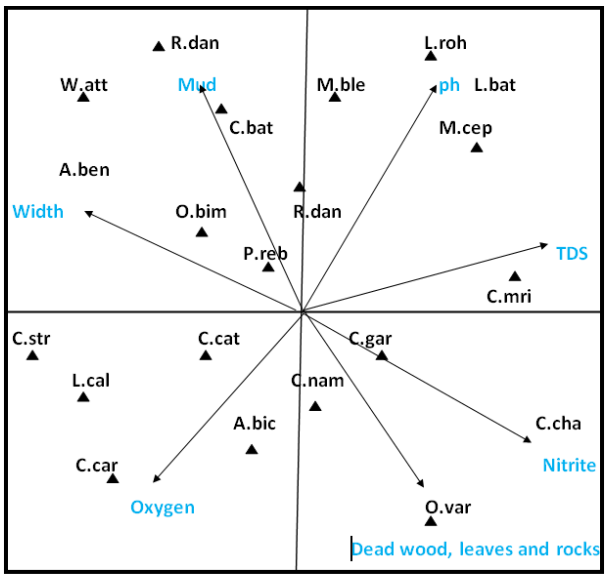

Fig. 4. CCA diagram environmental variables of species in Mahendratanaya River (Table.1)

Oxygen value fish is Cyprinus carpio(5.46)and mean values is(3.75),Nitrites minimum value fish is Mugil cephalus (0.036), maximum Nitrites value fish is Cirrhinusmrigala (0.092)and mean values is(0.064),Mud minimum value fish is Oreochromis variable (9.88), maximum Mud value fish is Channa striatus(48.49) and mean values is(29.18), DwLR minimum value fish is Amblypharyngodonmicrolepis (10.64), maximum DwLR value fish is Labeorohita (26.12)and mean values is(18.18),Width minimum value fish is Mugil cephalus (1.12), maximum Width value fish is Labeorohita (5.24) and mean values is(3.18),TDS minimum value fish is Catlacatla (42.34), maximum TDS Cirrhinusmrigala value fish is(70.21) and mean values is(56.27).According to above information the ecological elements distribution is random as per the pollutants involvement and agricultural distributed area.

4. DISCUSSIONS

We are mainly discussed of fish diversity based on the species Beta diversity index and species richness(Molur, S., Smith, K. G., Daniel, B. A., &Darwall, W. R. T. (2011).) (Fig. 3). Mhendratanya fish assemblage on compass mostly cyprinids and chanids are dominatedSpecies richness randomly increase from upstream to middle stream and slowly decrease and stably sustained to the downstream, why because the upstream mostly related to the rocks and forest region but middle stream is mostly present with planktons, water reservoirs and water storage places. The lower region is mostly affected to the indiscriminate hunting. In my study Labio rohita, Catlacatla, Cyprinus carpio, Cirrhinusmrigala are mostly abundant species in the south India region rivers not only the Mahendratanaya. In this ecosystem widely spread most of large species are found in the low and middle depth pool habitat, smaller are mostly shallow(Aboua, et al., 2012)habitat. Migrated are not only competent to spawning, feeding, nursery, growth by the avoid from predators but also (Brackish water fishes) they should maintained the good role in the food chain, food web, balance of biome with the fresh water fishes in the fresh water ecosystem (Carol & Michael, 1999, Rama, 2014a). Fish diversity is no more differentiation and maintains the homogenous. Not only the distribution and diversity of Ichthyofauna but also consider the effect and influence of the ecological factors in the biological communities, why because ecological factors are most influenced o the fish community breeding and life cycles of the Ichthyofauna. Cat fishes mostly prefer to the low dissolved oxygen and high nitrites, why because they should live in the mud habitat. and less resistant who are high sensitive they are high dissolved oxygen and low nitrites preferring. High tolerance(Goure`ne& Ouattara, 2010) are identified in the sand soil areas. The forestation area high in tolerance to nitrates, refuse to many fish species. In the agricultural area around of the river is polluted with agricultural inorganic components. I under strand the improvement to pollutants regulate the policies.

5. CONCLUSION

Above my study explained the different fish distribution and diversity of Mahendratanaya River Ichthyofauna. Conceder in this basin studied 58 species, species richness and high nitrates concentrations. It is use full to the good information further research of this unique area. It should indirectly explain the water pollution impacts and tolerable ranges in the different ranges in this Mahendratanaya River. According to my final opinion on this basin fish catching is indiscriminate, not based on breeding or non breeding season, the government should concentrate on this and support to the fishermen at the time of breeding season, the estuary region fish diversity will increase and its use to the ecosystem balance.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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