

Volume 7 Issue 2 2021

ISSN 2454-3055

**INTERNATIONAL
JOURNAL OF
ZOOLOGICAL
INVESTIGATIONS**

***Forum for Biological and
Environmental Sciences***

Published by Saran Publications, India



Inland Ornamental Fish Diversity of Thrissur Kole - Part of Vembanad Kole Wetland, Kerala, India

Parvathy C.A.* and Vimala K. John

Department of Zoology, St. Thomas College (Autonomous), Thrissur, India

*Corresponding Author

Received: 3rd November, 2021; **Accepted:** 24th December, 2021; **Published online:** 31st December, 2021

<https://doi.org/10.33745/ijzi.2021.v07i02.094>

Abstract: Present work investigates the ornamental fishes in Thrissur kole wetlands, part of Vembanad wetland, Ramsar site in India. The ornamental fishes are the significant indicator of ecosystem. The kole wetland ecosystem harbours fish diversity and provide important water reserve and economic benefits to local people. This study also deals with the assessment of physico-chemical parameters of water samples of kole wetlands of Kerala, from sampling stations during 2017-2018 and statistical studies have been carried out by calculating correlation coefficients between different pairs of parameters. During the study 32 species of ornamental fishes belonging to 9 orders and 14 families were recorded. Among these we reported one species *Heteropneustes fossilis* as endangered (EN), 23 fish species as Least concerned (LC) and one species *Mystus montanus* as vulnerable (VU). It is found that from December 2017 to May 2018, the Atmosphere temperature (AT) has a fairly strong positive correlation with Water temperature (WT) and negative correlation between EC, DO, Calcium and Salinity. The physico-chemical parameters from June 2018-Nov 2018, showed a strong positive correlation in between acidity and WT, AT and BOD, calcium and pH, EC and BOD, turbidity and salinity, etc. The measured mean value ranges of magnesium, calcium, fluoride and iron were 4.66-80.83 (mg/l), 9.21-28.65 (mg/l), 0.098-2.82 (mg/l) and 0.19-0.79 (mg/l), respectively. All the physicochemical parameters of Kole wetlands are within the desirable limit set by WHO.

Keywords: Ornamental fishes, Statistical analysis, Physico-chemical parameters, Kole wetlands

Citation: Parvathy C.A. and Vimala K. John: Inland ornamental fish diversity of Thrissur Kole - Part of Vembanad Kole Wetland, Kerala, India. Intern. J. Zool. Invest. 7(2): 1028-1040, 2021.

<https://doi.org/10.33745/ijzi.2021.v07i02.094>

Introduction

Kole wetlands are the habitat for many aquatic and semi-aquatic organisms. They have many ecological importance and role in it. In Kole wetlands fishes are the main factor for the contribution of local economy. It harbours the excellent source of ornamental fishes. Documentation and characterization of ornamental fish diversity is the pivotal to assure the sustainable development and conservation of

the biodiversity. Fresh water fish diversity now faces serious threat by loss of habitat and urbanization. Also ornamental fish diversity indicate the health of the ecosystem. The inland fish diversity and physico-chemical parameters give important information about the ecosystem. The ornamental fishes are brightly coloured beautiful and well adapted to their natural habitat. In this study physico-chemical parameters like

Water Temperature (C), Air Temperature (C), pH, DO (mg/l), BOD, Turbidity (NTU), EC (μ S), Salinity (ppm), Acidity (mg/l), Alkalinity (mg/l), Total hardness (mg/l), Calcium (mg/l), Magnesium (mg/l), Chloride (mg/l), Fluoride (mg/l), Iron (mg/l), Nitrate (mg/l), Sulphate (mg/l) and TDS (mg/l) were tested along with fish diversity. Water quality parameters are major influencing factor in ornamental fish diversity.

Materials and Methods

An extensive fish survey has been conducted to record the ornamental fish diversity during the December 2017- November 2018, from five sites of Kole wetlands of Thrissur (Figs. 1, 2), part of Vembanad Kole wetland, Ramsar site (Vembanad-Kole Wetland, 19/08/2002, Kerala, 151,250 ha. 09°50'N 076°45'E). The largest brackish, humid tropical wetland ecosystem on the southwest coast of India, fed by 10 rivers and typical of large estuarine systems on the western coast, renowned for its clams and supporting the third largest waterfowl population in India during the winter months (Ramsar Site Information Service, 2002).

The fish samples were collected monthly from five stations along with the water samples for the analysis of the water quality parameters. The station 1 has latitude and longitude (from Mean Sea Level) 10.694897 and 75.995939, respectively. This Kole land is distributed over two districts, Thrissur and Malappuram. The location of Station 2 (10.489587, 76.129288), Station 3 (10.489587, 76.129288), Station 4 (10.489587, 76.129288) and Station 5 (10.489587, 76.129288) are in the Kole Wetlands of Thrissur, central Kerala. The water samples were collected at the depth 1 ft and the depth is measured using a marked wooden stick. In all stations the fishes were captured by vessel net (mesh size 6 mm X 6 mm), gill net (variable mesh sizes), and cast net (5 mm X 5 mm mesh size). The fishes were preserved in 10% formalin and identified according to Talwar and Jhingran (1991) and Jayaram (1999, 2006) and were confirmed from CMFRI, Cochi. The parameters like water temperature, air

temperature and dissolved oxygen were analyzed at spot. The pH was measured using pH meter, electrical conductivity and turbidity were measured by conductivity and turbidity meter. The DO and BOD were calculated using the portable DO meter. The chemical parameters like calcium, magnesium, chloride, sulphate, iron, nitrate and fluoride were calculated by standard titration method. Karl-Pearson correlation coefficient (r) was used for statistical significance.

Results and Discussion

The list of collected ornamental fishes, result of hydrological factors and correlation values are presented in Tables 1, 2, 3, 4 and 5. The ornamental fishes indicate the wealth of ecosystem, since it depends on the physico-chemical properties as well as biological characteristics.

A total of 32 species of ornamental fishes belonging to 9 orders and 14 families were recorded (Figs. 3, 4) from the five sites. Among these we found one species *Heteropneustes fossilis* as endangered (EN- IUCN Red List) category, 23 fish species as Least concerned (LC) and one species *Mystus montanus* as vulnerable (VU-IUCN Red List) category. The three species *Anguilla bengalensis*, *Ompok bimaculatus* and *Wallago attu* were categorised under Near Threatened (NT) and four species of fishes *Megalops cyprinoides*, *Anabas testudineus*, *Puntius mahecola* and *Puntius amphibiosus* were categorized as DD (Data Deficient). The order Cypriniformes (11 species) was dominant with several species namely *Amplypharyngodon melettinus*, *Rasbora dandia*, *Puntius parrah*, *Puntius filamentosus*, *Puntius amphibiosus*, *Puntius vittatus*, *Puntius sophore*, *Puntius mahecola*, *Esomus barbatus*, *Puntius dorsalis* and *Lepidocephalus thermalis*. The orders Siluriformes and Anabantiformes include 6 species each whereas order Synbranchiformes, Cichliformes and Beloniformes include 2 species each. The order Anguilliformes, Elopiformes and Gobiiformes include one species each. The most dominant family recorded was Cyprinidae which



Fig.1 : Vembanad Kole Wetlands, Kerala, India.

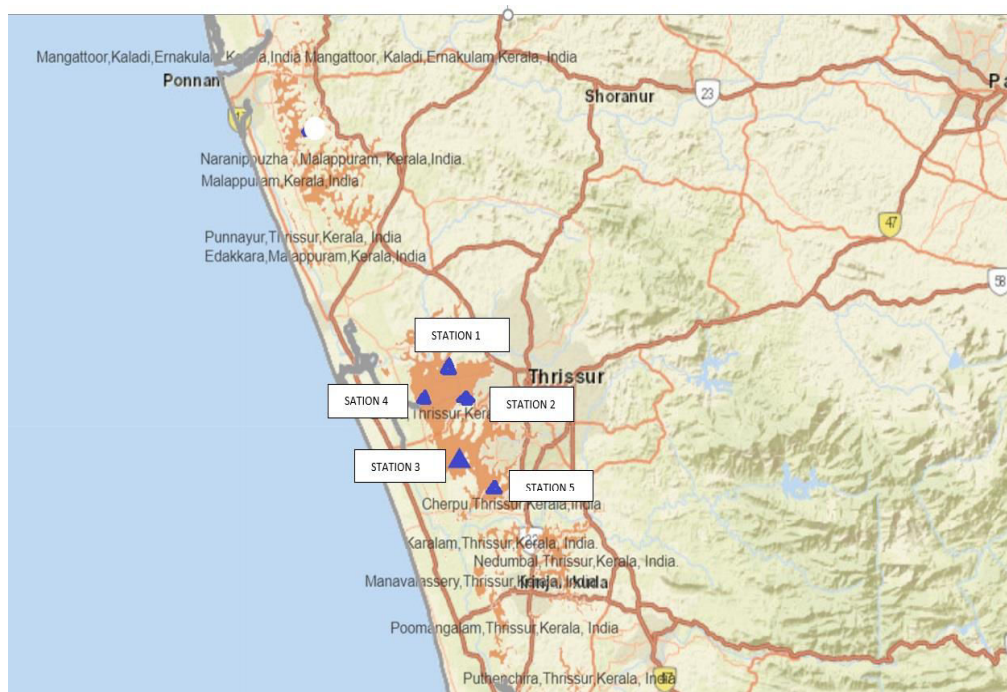


Fig. 2: Study sites of Kole Wetlands in Thrissur.

Table1: Collected ornamental fishes from Kole wetlands of Thrissur, Kerala -their status from all sampling stations

Order /Family/ Species	Common name	Local name	IUCN Status
Order : Synbranchiformes Family : Mastacembelidae 1. <i>Mastacembelus armatus</i> (Lacepede, 1800) 2. <i>Macrognathus guentheri</i> (F.Day, 1865)	Marble spiny eel Spiny Eel	Aral Kallaral	LC LC
Order : Anguilliformes Family : Anguillidae 3. <i>Anguilla bengalensis</i> (Grey and Hardwicke, 1844)	Long fin eel	Malinghal	NT
Order : Siluriformes Family : Heteropneustidae 4. <i>Heteropneustes fossilis</i> (Bloch, 1794) 5. <i>Ompak bimaculatus</i> (Bloch, 1794) 6. <i>Wallago attu</i> (Schnider, 1801) 7. <i>Danio malabaricus</i> (Jerdon, 1849) Family : Bagridae 8. <i>Mystus armatus</i> (Day, 1865) 9. <i>Mystus montanus</i> (Jerdon, 1849)	Stinging catfish Indian Butter-catfish Freshwater shark Malabar danio Kerala mystus Jerdon's mystus	Kadu Vala Vala Thupalam kothi Koori Kallenkooori	EN NT NT LC LC VU
Order : Cypriniformes Family : Cyprinidae 10. <i>Amplypharyngodon melettinus</i> (Valenciennes,1844) 11. <i>Rasbora dandia</i> (Valenciennes,1844) 12. <i>Puntius parrah</i> (Day, 1865) 13. <i>Puntius filamentosus</i> (Valenciennes,1844) 14. <i>Puntius amphibiosus</i> (Valenciennes) 15. <i>Puntius vittatus</i> (Day,1865) 16. <i>Puntius sophore</i> (Hamilton, 1822) 17. <i>Puntius mahecola</i> (Valenciennes,1844)	Attentive Carplet Black line fish Parrah barb Olive barb Scarlet barb Stripped barb Pool barb Wayanad barb	Vayambu -- Paral Poovaliparal Urulan paral Paral Paral Paral	LC LC LC LC DD LC LC DD

18. <i>Esomus barbatus</i> (Jerdon,1849)	Flying barb	Paral	LC
19. <i>Puntius dorsalis</i> (Jerdon,1849) Family: Cobitidae	Long snouted Barb	Paral	LC
20. <i>Lepidocephalus thermalis</i> (Valenciennes, 1846)	Malabar loach	Koima	LC
Order : Anabantiformes			
Family : Channidae			
21. <i>Channa marulius</i> (Hamilton, 1822)	Snake Head	Cholan bral	LC
22. <i>Channa gachua</i> (Hamilton 1822)	Brown snake head	Vatton	LC
23. <i>Channa puntatus</i> (Day,1865)	Spotted snake head	Kadi bral	LC
24. <i>Channa striatus</i> (Bloch,1793)	Snake head	Varal	LC
Family : Anabantidae			
25. <i>Anabas testudineus</i> (Bloch,1792)	Climbing perch	Karipidi	DD
Family : Nandidae			
26. <i>Nandus nandus</i> (Hamilton,1822)	Leaf fish	Porik	LC
Order : Elopiformes			
Family : Elopidae			
27. <i>Megalops cyprinoides</i> (Broussonet,1782)	Tarpon	Valathan	DD
Order : Cichiliformes			
Family : Cichilidae			
28. <i>Etoplus suratensis</i> (Bloch)	Orange Chromidae	Pallathy	LC
29. <i>Etoplus maculatus</i> (Bloch)	Peal spot	--	LC
Order : Gobiiformes			
Family : Gobiidae			
30. <i>Glossogobius aureus</i>	Golden tank gopi	--	LC
Order : Beloniformes			
Family : Hemiramphidae			
31. <i>Hyporaphus limbatus</i> (Valenciennes,1844)	Needle fish	Koolan	LC
32. <i>Xenentodon cancila</i> (Hamilton,1822)	Long nosed needle fish	Koolan	LC

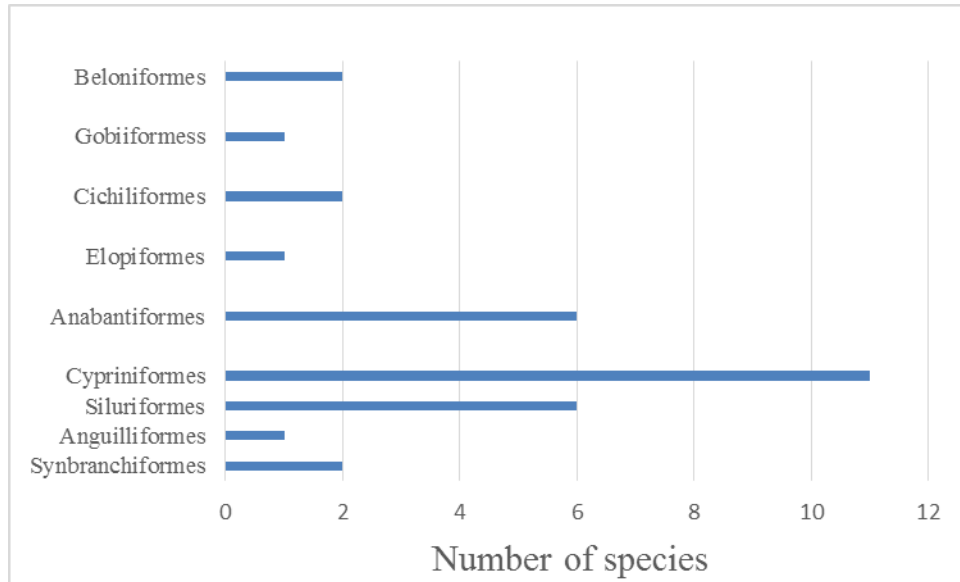


Fig. 3: Population of ornamental fish diversity under different orders.

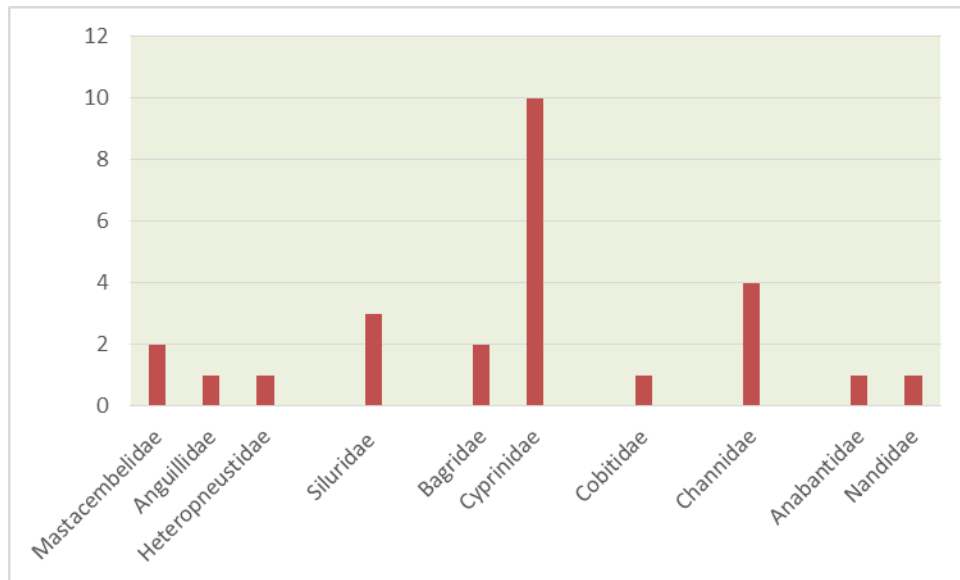


Fig 4: Population of ornamental fish diversity under different family

Table 2: The Physico-chemical parameters from Dec 2017- May 2018 (Pre- monsoon) from all stations

Physico-chemical parameters	Site 1	Site 2	Site 3	Site 4	Site 5
Water Temperature (C)	31	29	30	30	30
Air Temperature (C)	33	31	32	31	31
pH	6.85	7.11	6.56	6.9	7.7
DO (mg/l)	6.2	6.9	5.6	6.6	6.0
BOD	0.92	2.2	2.2	2.1	2.3
Turbidity (NTU)	95.65	108.26	85.4	65.7	103.03
EC (μ S)	.3	.4	.2	.3	.3
Salinity(ppm)	.066	0.097	0.146	0.058	0.069
Acidity (mg/l)	16.33	18.5	15.1	11.85	17.16
Alkalinity(mg/l)	27.5	43.66	33.33	30.83	26.66
Total hardness (mg/l)	86.5	76.33	75.33	65.66	61
Calcium (mg/l)	17.68	28.32	28.65	18.55	16.20
Magnesium (mg/l)	4.66	5.06	7.66	7.12	5.20
Chloride (mg/l)	36.66	53.83	80.83	32.4	38.5
Fluoride (mg/l)	0.23	0.213	0.391	0.268	0.27
Iron (mg/l)	0.79	0.626	1.133	0.54	0.543
Nitrate (mg/l)	1.89	3.59	2.47	3.15	2.54
Sulphate (mg/l)	99.58	85.6	123.61	56.06	62.67
TDS (mg/l)	166.3	155.83	154.3	184.3	186.5

Table 3: The Physico-chemical parameters from June 2018-Nov 2018 (Monsoon and Post- Monsoon)

Physico-chemical parameters	Site 1	Site 2	Site 3	Site 4	Site 5
Water Temperature (C)	27	26	28	26	26
Air Temperature (C)	29	28	30	29	29
pH	7.53	7.21	7.06	7.03	6.95
DO (mg/l)	7.2	5.9	6.8	7.5	8.1
BOD	1.76	0.95	2.56	2.30	1.6
Turbidity (NTU)	4	1.96	2.48	10.2	6.51
EC (μ S)	.2	.1	.3	.2	.2
Salinity(ppm)	0.059	0.054	0.052	0.095	0.056
Acidity (mg/l)	17.16	17	18.5	15.16	15.5
Alkalinity(mg/l)	28.66	30	37.16	30.84	33.33
Total hardness (mg/l)	59	38.1	53	49.83	56.16
Calcium (mg/l)	23.7	12.78	15.2	13.98	9.21
Magnesium (mg/l)	5.81	5.51	5.9	8.38	7.86
Chloride (mg/l)	32.83	30.33	31.16	53	31.33
Fluoride (mg/l)	0.215	0.096	0.184	2.82	0.186
Iron (mg/l)	0.55	0.19	0.19	0.66	0.466
Nitrate (mg/l)	3.96	4.93	3.84	4.17	4.03
Sulphate (mg/l)	30.51	32.06	44.43	28.05	13.9
TDS (mg/l)	122.5	98.83	119.16	145.3	134.6

Table 4: Correlation coefficient values among Physico-chemical parameters from Dec 2017 to May 2018.

	WT	AT	PH	DO	BOD	TB	EC	SA	AC	AL	TH	Ca	Mg	Cl	Fl	Fe	Nit	Sul
WT																		
AT	0.7905																	
PH	-0.2158	-0.5329																
DO	-0.4872	-0.4292	0.1777															
BOD	-0.7846	-0.8684	0.3081	0.0143														
TB	-0.264	0.0311	0.5071	0.0799	-0.0370													
EC	-0.5	-0.3952	0.4566	0.9048	8.59	0.4800												
SA	-0.3043	0.1273	-0.5124	-0.4983	0.3398	0.1076	-0.4811											
AC	-0.3037	0.0438	0.4356	0.0899	-0.0279	0.9955	0.4759	0.1777										
Al	-0.8354	-0.3620	-0.1971	0.5646	0.3707	0.2975	0.5340	0.4255	0.3698									
TH	0.3610	0.8263	-0.6099	0.0201	-0.7744	0.2216	0.0355	0.2204	0.2702	0.1979								
Ca	-0.6178	-0.0748	-0.5094	0.0202	0.3659	0.1698	-0.0191	0.8561	0.2577	0.8238	0.3015							
Mg	-0.104	-0.1736	-0.5634	-0.3742	0.4637	-0.7636	-0.6799	0.5066	-0.7267	0.0096	-0.2968	0.3531						
Cl	-0.3061	0.1242	-0.5105	-0.4986	0.3430	0.1071	-0.4813	0.9999	0.1770	0.4254	0.217	0.8558	0.5079					
Fl	0.0863	0.1115	-0.4538	-0.8101	0.3549	-0.3859	-0.9037	0.744	-0.3577	-0.1732	-0.1558	0.3695	0.8155	0.7449				
Fe	0.2329	0.5994	-0.7293	-0.6962	-0.1412	-0.0718	-0.7201	0.8467	-0.0139	0.0413	0.5084	0.5775	0.4621	0.8454	0.7608			
Nit	-0.915	-0.8231	0.1432	0.7229	0.6676	-0.0115	-0.6029	0.0226	0.0212	0.7786	-0.3778	0.4368	0.1428	0.0242	-0.2606	-0.4416		
Sul	0.17933	0.67194	-0.6796	-0.5358	-0.2729	0.1745	-0.4875	0.8107	0.2381	0.1921	0.7007	0.6364	0.1985	0.8087	0.5342	0.9494	-0.4098	
TDS	0.24197	-0.39168	0.6175	0.0671	0.1203	-0.3256	0.0353	-0.7721	-0.4096	-0.6528	-0.7167	-0.8678	-0.0620	-0.7702	-0.2253	-0.7148	-0.0530	-0.859

AT = Air temperature, WT = Water temperature, TB = Turbidity, TDS = Total dissolved solid, EC = Electrical Conductivity, DO = Dissolved oxygen, BOD = Biological oxygen demand, Cl = Chloride, AL = Alkalinity, TH=Total hardness, Ca= Calcium, Mg= Magnesium, Fl= Fluoride, Fe= Iron, Nit= Nitrate, Sul= Sulphate, SA= Salinity, AC= Acidity

Table 5: Correlation coefficient values among physico-chemical parameters from June 2018-Nov 2018

	WT	AT	PH	DO	BOD	TB	EC	SA	AC	AL	TH	Ca	Mg	Cl	Fl	Fe	Nit	Sul
WT																		
AT	0.7905																	
PH	0.2285	-0.2312																
DO	-0.1701	0.3873	-0.3383															
BOD	0.6116	0.904	-0.2694	0.3808														
TB	-0.5057	0.0542	-0.4063	0.7090	0.3517													
EC	0.7905	1	-0.2312	0.3873	0.904	0.0542												
SA	-0.4138	-0.0393	-0.2133	0.3303	0.3716	0.8827	-0.0393											
AC	0.8596	0.3913	0.3673	-0.5994	0.1672	-0.8561	0.3913	-0.6693										
AL	0.5828	0.7556	-0.6444	0.1257	0.5818	-0.1675	0.7556	-0.2983	0.4042									
TH	0.3917	0.6507	0.1599	0.7657	0.5154	0.2538	0.6507	-0.0200	-0.0214	0.1624								
Ca	0.47798	0.15942	0.90113	-0.15444	0.1733	-0.2268	0.1594	-0.0236	0.4196	-0.4185	0.4026							
Mg	-0.5204	0.1041	-0.6346	0.7837	0.31432	0.9479	0.1041	0.7221	-0.8617	0.0461	0.2485	-0.4815						
Cl	-0.3470	0.0302	-0.2481	0.3159	0.4400	0.8675	0.0302	0.9959	-0.6182	-0.2230	-0.0178	-0.0302	0.712					
Fl	-0.3577	0.0262	-0.2994	0.2989	0.436	0.8630	0.0262	0.9915	-0.6192	-0.1873	-0.0586	-0.0851	0.7208	0.9979				
Fe	-0.3977	0	0.0948	0.7132	0.2378	0.8536	8.14E-	0.7467	-0.7346	-0.4821	0.5085	0.2365	0.7063	0.7080	0.6717			
Nit	-0.5929	-0.890	0.0580	-0.6849	-0.7919	-0.2528	-0.8906	-0.0452	-0.1243	-0.4669	-0.9194	-0.2979	-0.2684	-0.0816	-0.0560	-0.3573		
Sul	0.7690	0.4011	0.2478	-0.6594	0.4179	-0.5249	0.4011	-0.1644	0.8309	0.3386	-0.2101	0.4183	-0.6303	-0.0978	-0.0927	-0.5314	-0.0547	
TDS	-0.1822	0.4106	-0.3938	0.8802	0.5964	0.9148	0.4106	0.7101	-0.6583	0.0842	0.5870	-0.1097	0.8978	0.7124	0.7002	0.8243	-0.6175	-0.4383

AT = Air temperature, WT = Water temperature, TB = Turbidity, TDS = Total dissolved solid, EC = Electrical Conductivity, DO = Dissolved oxygen, BOD = Biological oxygen demand, Cl = Chloride, AL = Alkalinity, TH=Total hardness, Ca= Calcium, Mg= Magnesium, Fl= Fluoride, Fe= Iron, Nit= Nitrate, Sul= Sulphate, SA= Salinity, AC= Acidity

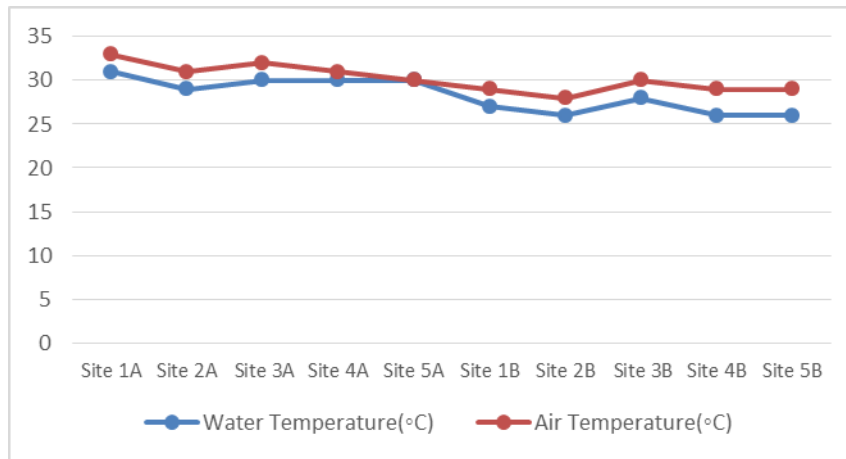


Fig. 5: Seasonal mean variations of Water temperature and Air temperature in Kole wetlands.

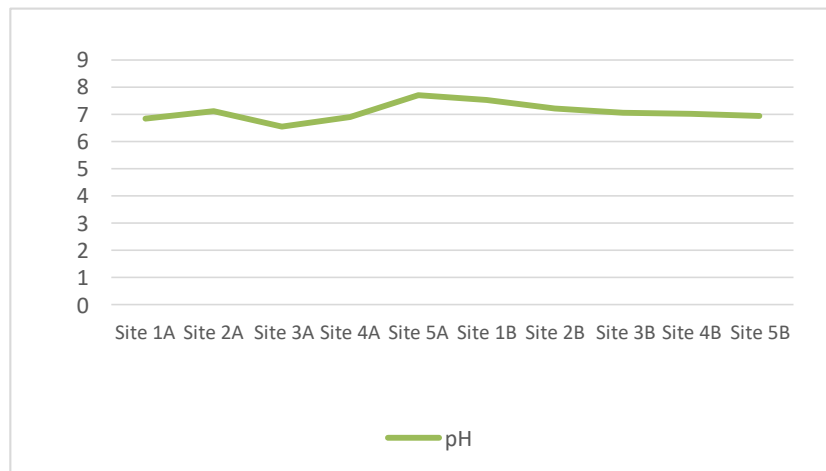


Fig. 6: Seasonal mean variations of pH in Kole wetlands.

includes 10 species of fishes. The second most dominant family was Channidae. From family Siluridae, three species were recorded. The families of Elopidae, Gobiidae, Nandidae, Anabantidae, Cobitidae, Anguillidae include one species each. The other reported fish families were Hemiramphidae, Cichilidae, Bagridae, Mastacembelidae which include two species each.

Seasonal variations of various physico-chemical parameters have been shown in Figures 5, 6, 7, 8 and 9. In the present study the water temperature ranged from 26-30 C (Tables 2, 3). The maximum temperature was 30 C recorded in the month of March and May, 2018. The minimum

water temperature was recorded in the months of July and December. Water temperature plays an important role which influences the chemical, biochemical and biological characteristics of aquatic ecosystem.

The pH values of the water samples collected during the study ranged from 6.5 to 7.7. This indicated that the Kole water was moderate towards acidic values and within the desirable limit (6.5–8.5) of the Indian drinking water standard (BIS, 1991).

The value of dissolved oxygen varied from 6.9-8.8 mg/l at all stations. The EC value ranged from

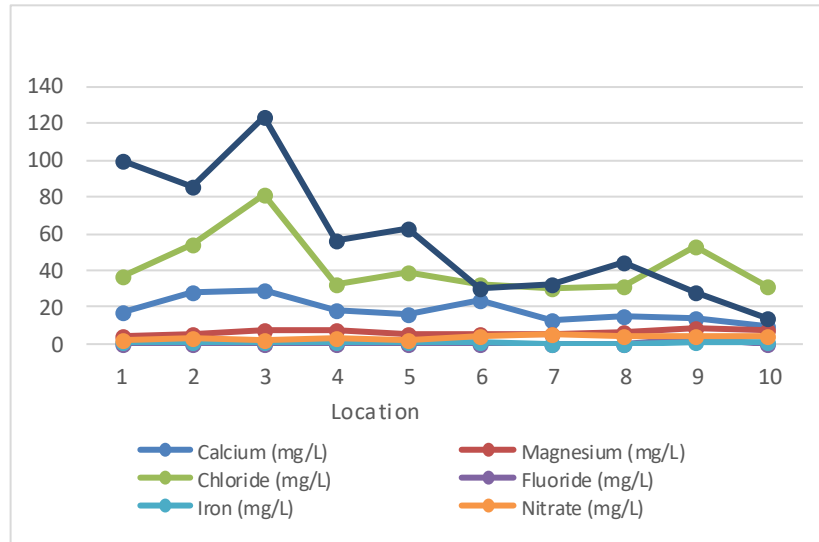


Fig. 7: Seasonal mean variations of Calcium, Chloride, Iron, Magnesium, Fluoride and Nitrate in Kole wetlands.

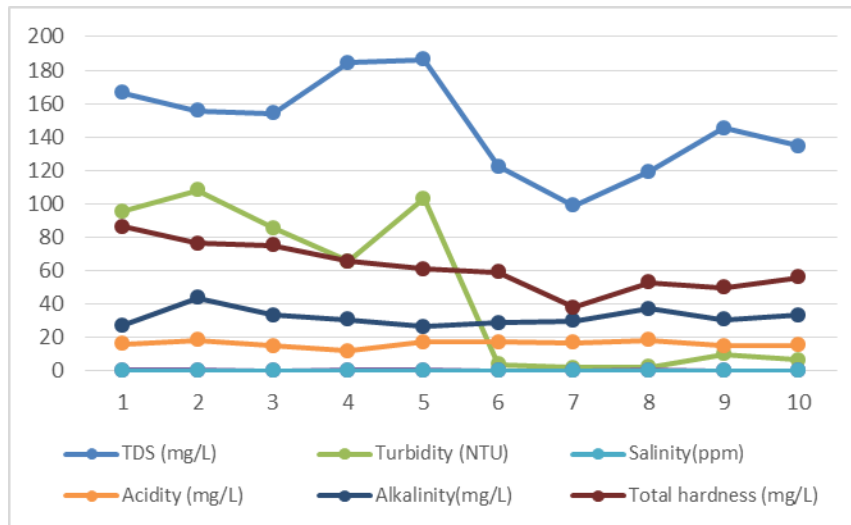


Fig. 8: Seasonal mean variations of TDS, Turbidity, Salinity, Acidity, Alkalinity and Total Hardness in Kole wetlands.

0.4 - 0.1 μ S. TDS value ranged from 98-186.5 mg/l. The value of BOD ranges from 0.92-2.56 mg/l. The value of other parameters like salinity, alkalinity, acidity and turbidity ranged from 0.052-0.146 ppm, 27.5-43.66 mg/l, 11.85-18.5 mg/l and 4-108.26 NTU, respectively. The value of turbidity is very low and below 10 NTU in August, but in March the value of turbidity was higher above 100 NTU. The measured ranges of magnesium, calcium, fluoride and iron were 4.66-80.83 mg/l, 9.21-28.65 mg/l, 0.098-2.82 mg/l and 0.19-0.79

mg/l, respectively. The value of nitrate and phosphate ranged from 1.89-4.93 mg/l and 13.9-123.6 mg/l, respectively. The value of these parameters from all stations were found to be normal and desirable as recommended by WHO (2004).

The present study from Dec 2017 to May 2018 (Tables 4, 5) indicated that atmosphere temperature (AT) has a fairly strong positive correlation with water temperature and negative

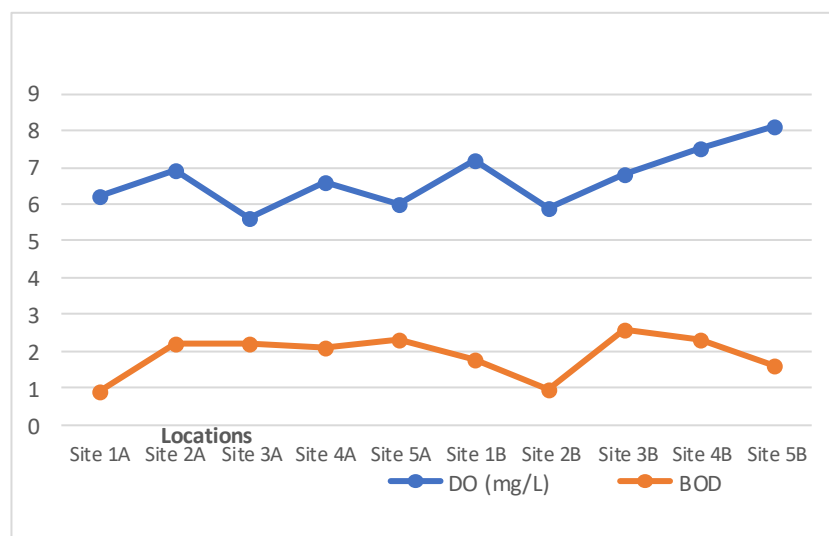


Fig. 9: Seasonal mean variations of DO and BOD in Kole wetlands.

Location = site 1A- site 5A (Dec 2017- May 2018: Pre- monsoon) and site 1B- site 5B (June 2018-Nov 2018: Monsoon and Post Monsoon)

correlation between EC, DO, calcium and salinity. Total hardness has negative correlation with atmosphere temperature (AT). AT has negative correlation with BOD, nitrate and positive correlation with total hardness. pH has negative correlation with salinity, alkalinity, total hardness (TH), calcium, Mg, chloride, fluoride, iron, sulphate etc., and also has positive correlation with turbidity (TB), EC and acidity. The parameter DO has a positive correlation with EC and negative correlation with alkalinity, iron, chloride, fluoride and sulphate. During this study, the physico-chemical parameters recorded a strong positive correlation between DO and EC, TB and AC, calcium and salinity, chloride and salinity. Also TDS showed strong negative correlation with calcium and nitrate. The total hardness showed positive correlation with the AT (Value=1). During this study the parameters recorded a strong positive correlation between AC and WT, AT and BOD, calcium and pH, EC and BOD, TB and salinity, TB and Mg, TB and Cl, TB and Fl, TB and TDS, salinity and Fl, salinity and Cl, alkalinity (Al) and TDS, TH and nitrate, Mg and Cl, Mg and TDS etc.

Conclusion

The Kole wetland aquatic system contain high faunal diversity and productivity. The present

anthropogenic activities seriously threat the ecosystem, will affect the fish diversity. In the present investigation, we recorded 32 species of ornamental fishes belonging to 9 orders and 14 families from all stations. We reported one species *Heteropneustes fossilis* as endangered (EN-IUCN Red List) category, 23 fish species as Least concerned (LC) and one species *Mystus montanus* as vulnerable (VU-IUCN Red List) category. The three species *Anguilla bengalensis*, *Ompak bimaculatus* and *Wallago attu* were categorised under Near Threatened (NT) and four species of fishes *Megalops cyprinoides*, *Anabas testudineus*, *Puntius mahecola* and *Puntius amphibiosus* were categorized as DD (Data Deficient). The domestic sewage dumping, leaching of fertilizers and pesticides from rice cultivation and use of ichthyotoxic substances for fish capture seriously harms the diversity of ornamental fishes and the water quality. The result obtained in the present investigation would be helpful for the pure ichthyofaunal studies and effective management of the Kole wetlands of mid-Kerala. Till date it is unfortunate that the Kole wetlands of mid-Kerala has not received much attention from the ichthyological aspects. The documentation of the diversity of fishes is one of the need for adopting

the proper conservation strategies of fish fauna. Also the regular monitoring of wetland water by analysis of physico-chemical parameters are appropriate for the conservation of ichthyofauna and management of water quality by corrective actions in the Kole wetlands.

Acknowledgements

We express sincere appreciation for the facilities provided by the Principal, St. Thomas' College, Thrissur. We thank to University Grants Commission for providing financial support and CMFRI, Kochi for providing species identification facility.

References

- APHA (1985) Standard Methods for Examination of Water and Wastewater, 20th Edition, American Public Health Association, Washington D. C.
- Barman RP. (2007) A review of the fresh water fish fauna of West Bengal, India with suggestions for conservation of the threatened and endemic species. Records Zoological Survey India, Occasional Paper, 263: 1-48.
- Bureau of Indian Standards (BIS) (1991) IS:10500. Indian standards of drinking water specification, New Delhi, India.
- Bhandari N S and Pande RK. (1991) Solute dynamics of River Sarju in the Central Himalayas, India. In: Ecology of the Mountain Waters, (eds.) Bhatt S.D. and Pande R.K., Ashish Pub. New Delhi, pp. 104-124.
- Day F. (1958) The fishes of India, A Natural History of the Fishes known to inhabit the seas and freshwaters of India, Burma and Ceylon, Vol. 1, Willam Dawson and Sons Ltd. London.
- Hamilton-Buchanan F. (1822) An Account of the Fishes of River Ganges and its Branches. George Ramsay and Co, London, vii: pp. 405.
- Hujare MS. (2008) Seasonal variation of physico-chemical parameters in the perennial tank of Talsande, Maharashtra. Ecotoxicol Environ Monitor. 18(3): 233-242.
- Jayaram KC. (1981) The Freshwater Fishes of India. Hand Book, Zoological Survey of India, Calcutta.
- Kamble SM, Kamble AH and Narke SY. (2009) Study of physico-chemical parameters of Ruti dam, Tq. Ashti, dist. Beed, Maharashtra. J Aqua Biol. 24(2): 86-89.
- Janjua MY, Ahmad T and Akhtar N. (2009) Limnology and trophic status of Shahpur dam reservoir, Pakistan. J Anim Plant Sci. 19(4): 224-273.
- McClelland J. (1839) Indian Cyprinidae. Asiatic Researches 19(II): 167.
- Ramachandran A. (2002) Freshwater indigenous ornamental fishes in Kerala and their prospects for international marketing. In: Riverine and Reservoir Fisheries of India, (eds.) Boopendranath M.R., Meenakumari B., Joseph J., Sankar T.V., Pravin P. and Edwin L., Central Institute of Fisheries Technology and Society of Fisheries Technologists, India.
- Ramsar Site Information Service (2002), <https://rsis Ramsar.org>.
- Talwar PK and Jhingran AG. (1991) Inland Fishes of India and Adjacent Countries. Oxford-IBH Publishing Co. Pvt. Ltd., New Delhi, p. 1158
- WHO (2004) Guidelines for Drinking-water Quality. World Health Organization, Geneva, Switzerland.