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RESEARCH TRENDS IN AQUACULTURE AND FISHERIES

EDITORS:
DR. PARIMALA B.
DR. MANGAL KADAM
MR. GOWHAR IQBAL
MR. PRAKASH PATEKAR

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Editors

Dr. Parimala B.

Department of Zoology,

University College of Science,

Tumkur University, Tumakuru

Dr. Mangal Kadam

PG Department of Zoology,

Yeshwant College,

Nanded, Maharashtra

Mr. Gowhar Iqbal

Department of Fish Biotechnology,

ICAR- Central Institute of Fisheries

Education (CIFE), Mumbai

Mr. Prakash Patekar

Fish Nutrition, Physiology and

Biochemistry (FNBP) Division,

ICAR- Central Institute of Fisheries

Education (CIFE), Mumbai

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PREFACE

In the ever-evolving world of aquaculture and fisheries, where science meets the shimmering waters, this book serves as a compass guiding us through the currents of cutting-edge research. As we cast our nets into the sea of knowledge, we find a wealth of discoveries, innovations, and trends that shape the future of sustainable aquatic practices.

From the bustling activity of aquaculture farms to the serene depths of fisheries research, the chapters within this tome unravel the intricacies of aquatic ecosystems and the dynamic interplay between human endeavors and the underwater world. We explore the latest methodologies, technological advancements, and breakthroughs that redefine the landscape of aquaculture and fisheries science.

This compilation is a testament to the collaborative efforts of brilliant minds dedicated to unraveling the mysteries of marine life. As we flip through these pages, we navigate through a mosaic of studies, each contributing a brushstroke to the canvas of our understanding. The interdisciplinary nature of the research showcased here mirrors the complex web of relationships that sustain aquatic ecosystems.

In the spirit of curiosity, let us delve into the depths of these research trends, recognizing that the pursuit of knowledge is a journey without a final destination. Instead, it is an ongoing exploration, a continuous voyage into the uncharted territories of aquaculture and fisheries. So, fellow adventurers, fasten your intellectual seatbelts as we embark on this enlightening expedition through the currents of progress and innovation in the realm of aquatic research.

Editors

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ZOOPLANKTON COMMUNITY DYNAMICS AND TROPHIC INTERACTIONS IN TULASHI WATER RESERVOIR, KOLHAPUR DISTRICT, M.S., INDIA

Rahul S. Kamble*[1], Gajanan K. Sontakke[1] and Sagar A. Vhanalakar*[2]

[1]Department of Zoology, Vivekanand College, Kolhapur, Dist. – Kolhapur (M.S.) INDIA

[2]Department of Zoology, Karmaveer Hire Arts, Science, Commerce and Education College, Gargoti, Tal – Bhudargad, Dist – Kolhapur 416 209 (M.S.) INDIA

*Corresponding author E-mail: rahulkamble3470@gmail.com, sagarayan36@gmail.com

Introduction:

The dynamics of zooplankton communities in freshwater reservoirs are influenced by a range of factors, including water temperature, nutrient concentrations, and the presence of predators (Dmitrieva, 2011). These communities can serve as indicators of water quality and ecosystem processes (Picapedra, 2020). The spatial and temporal variability of zooplankton communities can be influenced by hydraulic and water quality factors (Descloux, 2016). In subtropical systems, nutrient recycling by zooplankton may play a more significant role than grazing impacts on phytoplankton growth (Hunt, 2005).

Tulashi Water Reservoir Dhamod is strategically located in the Dhamod Village, Radhanagari, Maharashtra state, India, serving as a crucial water body within this geographic area. The dam was constructed on 12 Feb. 1970. This expansive reservoir serves as a vital water resource within the region, contributing to various essential functions such as irrigation, hydroelectric power generation, and providing a reliable water source for local communities.

The dam's gross storage capacity is an impressive 10,429.00 km^3 (2,502.05 cu mi), ensuring a consistent and substantial water supply. The dam's height above its lowest foundation stands at 26 m (85 ft.), emphasizing the scale of its engineering and its role in managing water resources.

In terms of structure, Tulashi Water Reservoir Dhamod boasts a remarkable dam height of 26 m (85 ft.) above its lowest foundation, with a total length of 186 m (610 ft.). These specifications underscore the engineering prowess involved in the construction of the dam, highlighting its role not only in water management but also in providing stability to the surrounding ecosystem.

The vast surface area and impressive storage capacity of the reservoir contribute to its ecological significance. Understanding the dam's specifications is crucial for assessing its

environmental impact, as variations in water levels, controlled releases, and the overall hydrological balance influence the dynamics of the aquatic ecosystem within and around the reservoir. The extensive size and storage capacity of Tulashi Water Reservoir Dhamod have direct implications for the human population in the region. The reservoir caters to diverse needs, from agricultural irrigation to sustaining local communities, and its engineering specifications play a pivotal role in facilitating these various uses.

A diverse fish population and a balanced zooplankton community are indicative of a healthy and stable aquatic ecosystem. Understanding the temporal patterns in fish diversity and zooplankton composition provides critical insights into the overall health of Tulashi Water Reservoir Dhamod, enabling researchers to identify any disruptions or imbalances that may have occurred over time.

Zooplankton serves as a valuable indicator for assessing water quality, trophic status, and pollution levels in aquatic ecosystems. Various ecological aspects of zooplankton have been a subject of study in India by several workers [Somashekhar RK 1994, Siva Kumar K 2001].The physico-chemical parameters and nutrient status of water body play an important role in governing the production of plankton which is the natural food of many species of fishes, especially zooplankton constitute important food source of many omnivorous and carnivorous fishes and also support the necessary amount of protein for the rapid growth of larval carps [Rahman S,2008]. They respond quickly to aquatic environmental changes (e.g., water quality, such as pH, colour, odor and taste, etc.,) for their short life cycle, and are therefore used as indicators of overall health or condition of their habitats [Thorpe HJ, 2008]. The qualitative and quantitative abundance of zooplankton in a lake are of great importance for successful aquaculture management, as they vary from one geographical location to another and lake to lake within the same geographical location even within similar ecological conditions [Boyd CE,1982].

Material and Methods:

Study area

The Tulashi Water Reservoir is situated near Dhamod villages, with coordinates of approximately 16°31'43″ "N latitude and 74°02'31"″ E longitude. It is strategically located on the Tulashi River, covering the geographical expanse of Dhamod and its surrounding areas, including villages of Burambali, Keloshi Bk, kumbharwadi, and Keloshi Kh.etc. The reservoir encompasses a catchment area extending up to 20 square kilometers.

This catchment area plays a crucial role in regulating the inflow of water into the reservoir, thereby influencing the overall hydrological dynamics of the Tulashi Water Reservoir. The Tulashi Water Reservoir is defined by its impressive dam structure. The dam has a length of 4961 feet, and the total storage capacity of the reservoir is measured at 3.4 thousand Million Cubic feet (TMC), making it a significant water resource for local communities. Additionally, the dam reaches a depth of 960 ft, further enhancing its ability to effectively store and manage water resources.

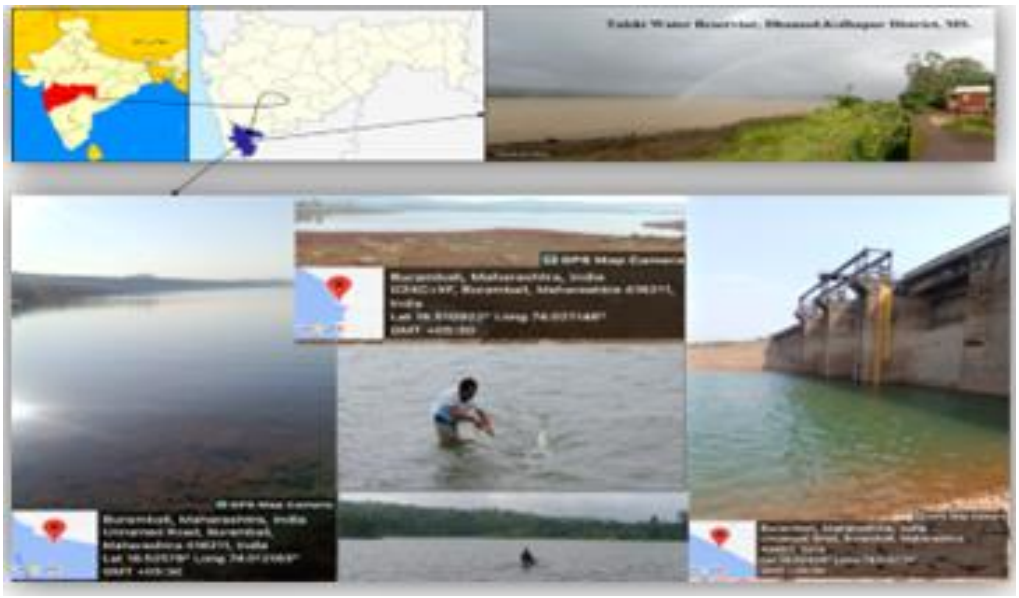

Figure 1: The Map showing in a study area in Tulashi Water reservoir (Dhamod), Kolhapur District, M.S., India

Sample collection

Water samples were collected randomly in different four selected sites of the water reservoir on monthly basis for a period of January 2023 to September 2023 (January 2022;2023, Feb. 2022; 2023, November 2022, December 2022 (Post-Monsoon); March, April, May 2022;2023 (Summer); June, July 2022;2023 (Pre-Monsoon); August 2022;2023, September 2022; 2023, October 2022; (Monsson).) Covering Post monsoon, summer, Pre monsoon, Monsoon. Water samples were collected during the early hours between 7.00 am to 10.00 am. The plankton samples were collected by filtering 50 litters of water through standard plankton net (77 mesh bolting silk) and the concentration samples were fixed in 4% of formalin.

Zooplankton sampling

Zooplankton distribution and abundance were assessed by straining 30 L of water through a 25 cm diameter zooplankton net with a 45 µm mesh size to a concentrated

volume of 30 ml. This was preserved in 4% formalin. Zooplankton species in 3 ml concentrate subsample were identified and counted under the scanning (x40) and low power (x100) magnifications. Identification was done using the descriptive keys of Adoni (1985), IAAB (1998), Michael and Sharma (1988), Krishnaswamy (1973), Edmondson (1959), Pennak (1968), Dhanpathi (2000) and APHA (1995). Community structure was assessed using the indices of species diversity, Simpson's dominance index (S),

Statistical analysis of diversity indices

The data was subjected to analysis the species individuals, Shannon and Weaner's diversity index, richness and evenness were calculated using the software PAST (Paleontological Statistics), ver. 4.03.

Results and Discussion:

Table 1: List of zooplankton recorded in Tulashi water reservoir Dhamod, Kolhapur district during January -2022 to September 2023

Sr. No.	Group	Family	Scientific Name
1.	Rotifera	Brachionidae	*Brachionus calyciflorus*
2.			*Brachionus angularis*
3.			*Brachionus caudatus*
4.			*Brachionus angularis*
5.			*Brachionus quadridentata*
6.			*Keratella species*
7.			*Notholca species*
8.			*Mytilina species*
9.			*Platiyas species*
10.			*Lepadella species*
11.			*Platyias*
12.		Lecanidae	*Lecane species*
13.		Notommntidae	*Cephalodella species*
14.			*Scaridium species*
15.		Trichocercidae	*Trichocerca species*
16.		Asplanchnidae	*Asplanchnopus species*
17.		Conochilidae	*Conochilus species*
18.		Gastropodidae	*Gastropus*
19.		Trichocercidae	*Trichocerca multicrinis*

20.	Cladocera	Daphnidae	*Daphnia species*
21.			*Monia species*
22.		Sididae	*Diophonosoma species*
23.		Macrothricidae	*Macrothrix species*
24.		Bosminidae	*Bosmina species*
25.	Copepoda	Cyclopidae	*Cyclopoid copepod*
26.			*Calanoid copepod*
27.			*Cyclops*
28.			*Tropocyclops species*
29.		Diaptomidae	*Daiptomus*
30.	Oligochaeta	Lubriculidae	*Lumbriculus*
31.	Diptera	Culicidae	*Chaoborus*
32.	Diatoms' / Others	Anuracopsididae	*Anuracopsisa cochlearis*
33.		Astrociaidae	*Asteromphalus*
34.		Asterionellopsidaceae.	*Asterionellopsis*
35.		Chaetocerotaceae	*Chaetoceros*
36.		Coscinodiscaceae	*Coscinodiscus*
37.		Cylindraceae	*Cylindratheca*
38.			*Entomoneis species*
39.		Chydoridae	*Alona species*
40.		Mytilidae	*Mytilia species*
41.		Macrothricidae	*Macrothrix Baird*
42.			*Macrothrix agsensis*
43.			*Streblocerus*
44.		Naididae	*Chaetogaster species*
45.		Dinophysiaceae	*dinoflagellates oxyphysis*
46.		Gymnodiniaceae	*Amphidinium*
47.		Stenocaraidae	*Streblocerus serricaudatus*
48.		Didiniidae	*Didinium species*
49.			*Anabaena circinalis*
50.			*Microcystis species*
51.			*Prorocentrum species*

Table 2: Seasonal diversity indices of zooplankton in Tulashi water reservoir Dhamod, Kolhapur district during January -2022 to September 2023

Diversity Indices		Zooplankton diversity indices																			
		Post Monsoon						Summer						Pre Monsoon				Monsson			
		Jan-22	Jan-23	Feb-22	Feb-23	Nov-22	Dec-22	Mar-22	Apr-22	May-22	Mar-23	Apr-23	May-23	Jun-22	Jul-22	Jun-23	Jul-23	Sep-22	Oct-22	Sep-23	Jan-22
Rotifera	Density	860	880	930	1020	900	920	1250	1590	1810	1510	1670	1920	1540	1150	1400	1160	850	820	840	860
	Dominance_D	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Shannon_H	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
	Simpson_1-D	2.88	2.85	2.87	2.87	2.86	2.85	2.83	2.92	2.93	2.87	2.91	2.92	2.90	2.90	2.92	2.83	2.87	2.85	2.90	2.88
	Evenness_e^H/S	0.94	0.91	0.93	0.93	0.92	0.91	0.89	0.97	0.98	0.93	0.96	0.98	0.96	0.96	0.97	0.89	0.93	0.91	0.95	0.94
Cladocera	Density	350	450	430	460	370	350	520	540	580	520	540	560	370	300	310	270	230	240	250	350
	Dominance_D	0.21	0.21	0.20	0.20	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.23	0.23	0.24	0.22	0.25	0.21	0.21
	Shannon_H	0.79	0.79	0.80	0.80	0.79	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.77	0.77	0.76	0.78	0.75	0.79	0.79
	Simpson_1-D	1.57	1.58	1.60	1.61	1.59	1.60	1.61	1.61	1.61	1.61	1.61	1.61	1.60	1.54	1.54	1.51	1.57	1.49	1.58	1.57
	Evenness_e^H/S	0.96	0.97	0.99	1.00	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.93	0.93	0.91	0.96	0.89	0.97	0.96
Copepoda	Density	310	270	230	240	250	380	500	510	540	440	510	550	410	330	370	370	450	430	460	310
	Dominance_D	0.23	0.24	0.22	0.25	0.21	0.21	0.20	0.20	0.20	0.21	0.20	0.20	0.22	0.21	0.22	0.21	0.21	0.20	0.20	0.23
	Shannon_H	0.77	0.76	0.78	0.75	0.79	0.80	0.80	0.80	0.80	0.79	0.80	0.80	0.78	0.79	0.78	0.79	0.79	0.80	0.80	0.77
	Simpson_1-D	1.54	1.51	1.57	1.49	1.58	1.60	1.60	1.60	1.61	1.59	1.61	1.60	1.56	1.58	1.56	1.59	1.58	1.60	1.61	1.54
	Evenness_e^H/S	0.93	0.91	0.96	0.89	0.97	0.99	0.99	0.99	1.00	0.98	1.00	0.99	0.95	0.97	0.96	0.98	0.97	0.99	1.00	0.93

Oligochaeta	Density	40	40	80	60	40	30	100	40	60	40	80	80	120	60	100	50	60	40	40	40
	Dominance_D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Shannon_H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Simpson_1-D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Evenness_e^H/S	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Diptera	Density	30	30	30	40	60	40	80	90	90	110	100	120	90	60	80	70	60	30	50	30
	Dominance_D	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Shannon_H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Simpson_1-D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Evenness_e^H/S	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Diatoms' / Others	Density	710	730	940	990	910	900	1100	1100	1150	1140	1200	1250	1040	960	970	980	820	790	850	710
	Dominance_D	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06
	Shannon_H	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.94	0.94	0.94	0.94	0.94	0.94
	Simpson_1-D	2.94	2.94	2.94	2.92	2.93	2.89	2.91	2.90	2.92	2.89	2.89	2.86	2.89	2.95	2.93	2.88	2.94	2.92	2.93	2.94
	Evenness_e^H/S	0.94	0.94	0.94	0.92	0.94	0.90	0.91	0.91	0.93	0.90	0.90	0.87	0.90	0.95	0.93	0.89	0.94	0.93	0.94	0.94

Zooplankton composition

Throughout the study period at Tulshi Water Reservoir in Dhamod, Kolhapur District, M.S. India, a comprehensive examination revealed the presence of 51 distinct zooplankton species. These species were systematically categorized into six orders: Rotifera (comprising 19 species), Cladocera (with 5 species), Copepoda (including 5 species), Oligochaeta (1 species), Diptera (1 species), and a miscellaneous group encompassing Diatoms and Others (totaling 20 species) as detailed in Table I. Zooplankton, a diverse assemblage of minute organisms suspended in natural water bodies, owes its mobility to the interplay of water currents and wave dynamics [Moss, 1982].

The study shed light on the multifaceted factors influencing the dynamics of zooplankton populations, encompassing elements such as light intensity, food availability, dissolved oxygen levels, and predation. The density and diversity of these populations can be significantly impacted by external factors such as excessive salinity or low pH [Horne *et al.*, 2002].

The observed order of zooplankton diversity in this investigation is delineated as follows: Rotifera > Cladocera > Copepoda > Oligochaeta > Diptera > Diatoms and Others. Notably, Rotifera emerged as the most dominant forms during the present investigation in the studied reservoir area. Expanding upon this, the study explored the intricate interplay of various environmental factors shaping the composition and prevalence of zooplankton species in the Tulshi Water Reservoir.

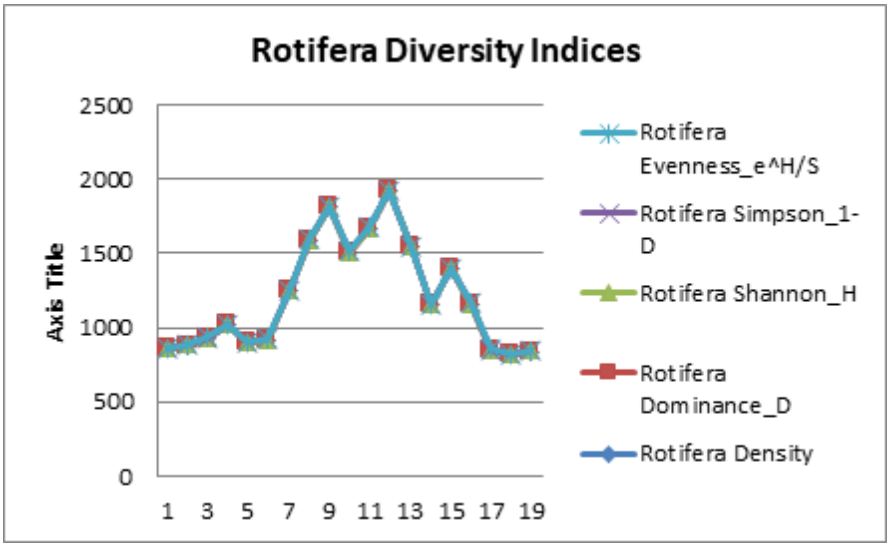

Figure 2: Graphical representation of Group Rotiera diversity indices

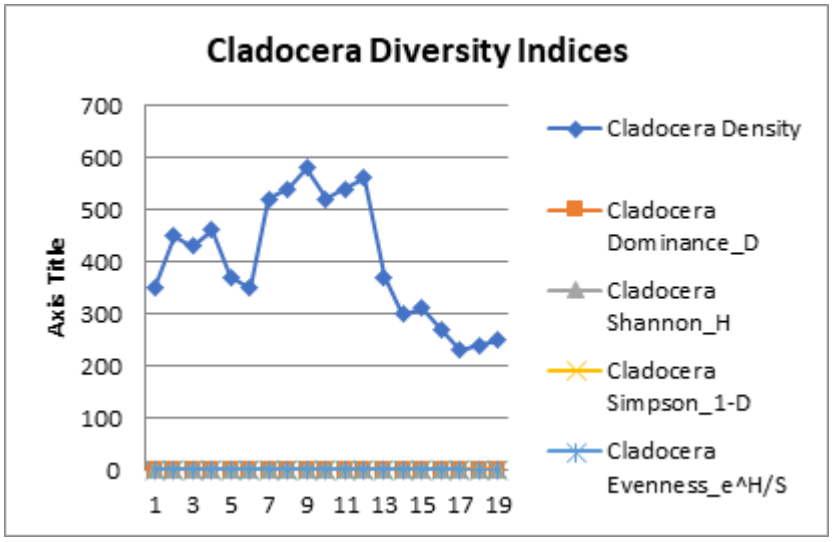

Figure 3: Graphical representation of Group Cladocera diversity indice

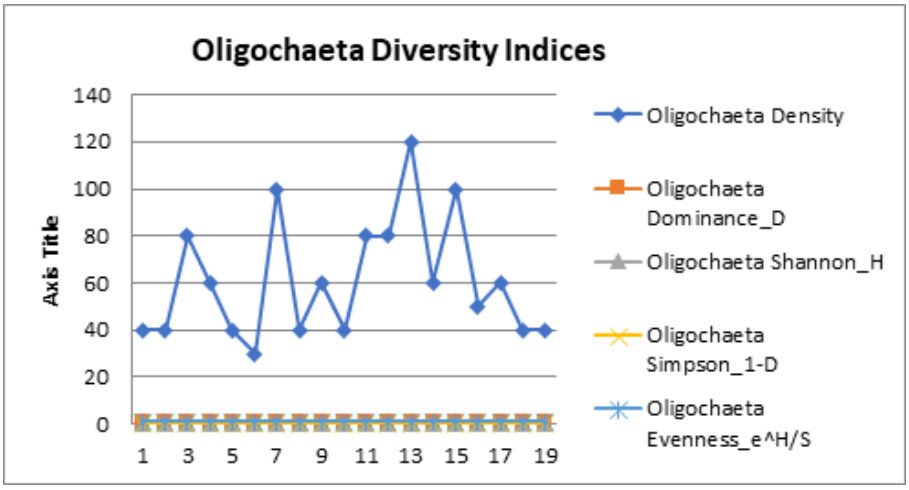

Figure 4: Graphical representation of Group Oligochaeta diversity indice

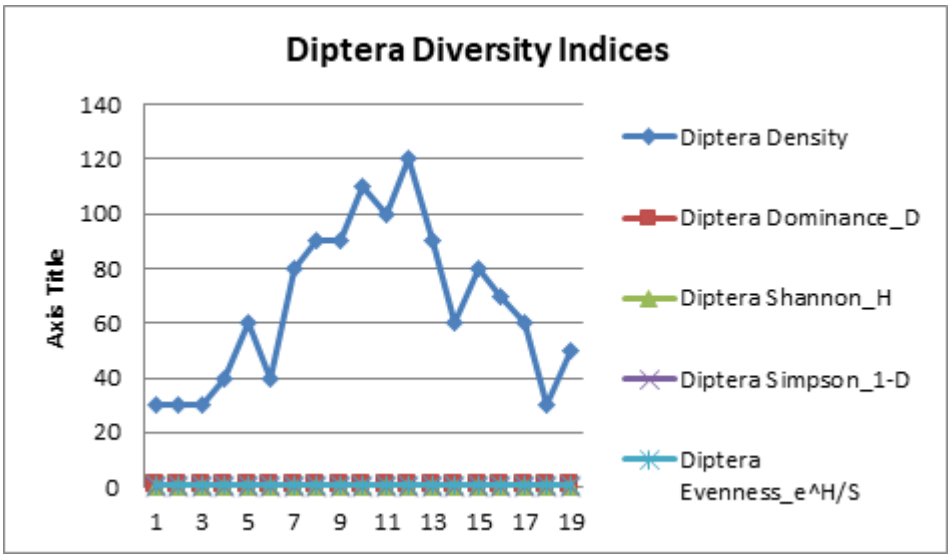

Figure 5: Graphical representation of Group Diptera diversity indice

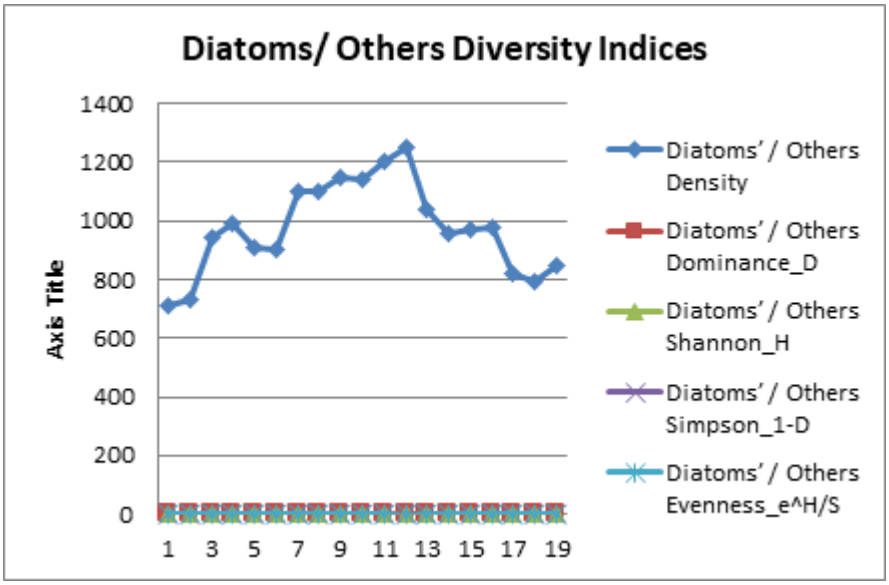

Figure 6: Graphical representation of Group Diatoms/ Other's diversity indice

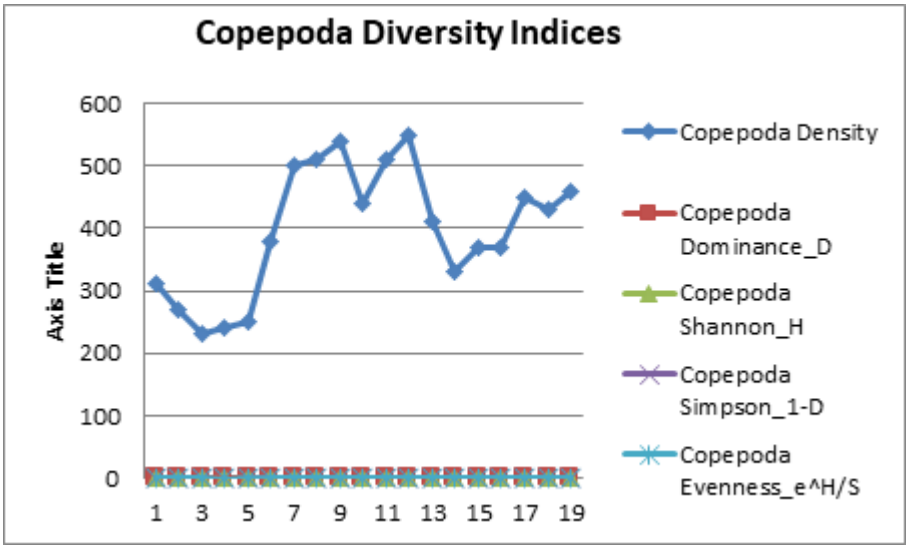

Figure 7: Graphical representation of Group Copepoda diversity indice

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About Editors

Dr. Parimala B. started her career as a school teacher. She has successfully been conferred with the Senior Scientist Award 2021 from ESDA, Delhi. SBER Outstanding Scientist Award. -2022, NESA Scientist of the Year -2022, ESDA Academic Excellence Award-2022. Currently, she is working as an Associate Professor at the Department of Zoology of University College of Science, Tumkur University, Tumakuru. She is widely acknowledged by innumerable students for her dedication and enthusiasm in teaching. She stands tall in providing all the necessary support and guidance to the student's multidimensionality through her vast professional networks. Being an able and promising administrator, she has successfully led the Department of Zoology as the head and has proved her potential by being efficient personnel in various academic and college developmental committees. She holds Ph.D. in Zoology, M.Phil. in Environmental Studies, Master in Applied Zoology along with B.Ed. has built her multidisciplinary a strong resource and made her 16 years of professional life fruitful. Being an expert in the field of Biodiversity, Toxicology, and Ornithology she has made a remarkable contribution to the conversation of avifauna. Now she guiding several Ph.D. students in her specialization. With her active involvement in the research field, she got the position in the A.D. Scientific Index Scientist ranking. Dr. Parimala holds a strong scientific network with which she has done several collaborative research and here, she continues to endeavour energetically and enjoyably.

Dr. M. S. Kadam (Professor) obtained M.Sc. Zoology (Fishery Science), Department of Zoology, Shri Shivaji Mahavidyalaya, Parbhani in 1998. She was awarded Ph. D. in January, 2006. She is currently associated with the P. G Department of Zoology, Yeshwant Mahavidyalaya, Nanded (M.S) India as Professor. She has completed one minor Research Project. Dr. (Mrs) M. S. Kadam has published more than 105 research papers in the field of Limnology and Fishery science in various national and international journals. She also attended and presented research papers in more than 91 conferences. She has Recipient of 05 (Five) different awards at National & International Level for outstanding Research contribution in Fishery Science. She has achieved several recognitions in academic career, as a P.G Teacher, Research Guide in Zoology, S.R.T.M University, Nanded. She is Fellow of Society of Life Sciences (F.S.L.Sc.) and IAZ UP. She is a life Member of various national level research societies. She has Authored Four reference book and one U.G.C patterns book published by Educational Publisher and Distribution, Aurangabad.

Mr. Gowhar Iqbal is a dedicated Ph.D. Scholar in the prestigious Fish Biotechnology Department at ICAR-Central Institute of Fisheries Education (CIFE), Mumbai. He has completed his Master's in Fish Biotechnology at ICAR-Central Institute of Fisheries Education (CIFE), Mumbai. He has completed his under-graduation (B.F.Sc) from the College of Fisheries, SKUAST-Kashmir. He has recently been honoured with several awards, including the Best M.F.Sc Thesis Award, Best Student Award, Young Achiever Award – 2023, Best Speaker Award, Best Poster Presentation Award and Best Researcher Award. He has authored various research articles, more than 10 review articles, more than 15 popular articles and more than 15 book chapters. Mr Gowhar Iqbal has also attended more than 02 National and 04 International Conferences, Training, Workshops and many Symposiums. He also worked as an editor of 2 books. His research focuses on Cell culture, Proteomics, Genomics, Barcoding, Bioinformatics, Parasitology studies, etc. He is passionate about exploring the intricacies of Fish Biotechnology. He is a reviewer board member of the journals "Chronicle of Aquatic Science" and "Acta Scientific Veterinary Sciences Journal." His work has the potential to have a lasting impact on Fisheries sciences and Fish Biotechnology

Mr. Prakash Goraksha Patekar, B.F.Sc from College of Fisheries, Ratnagiri, and M.F.Sc in Fish Nutrition, Physiology and Biochemistry (FNBP) Division, ICAR- Central Institute of Fisheries Education (CIFE), Versova, Mumbai and currently doing PhD in the same department at ICAR-CIFE, Mumbai. He is passionate about exploring the intricacies of Fish Nutrition, Physiology, and Biochemistry. His research focuses on understanding aquatic organism's dietary requirements and metabolic processes and nutrition-related aspects as well as larval nutrition-related aspects. He is a dedicated researcher with a deep commitment to advancing our understanding of fish nutrition and physiology and its use in the improvement of aquaculture. He has authored research articles related to larval nutrition in peer-reviewed journal. He has qualified the ASRB-NET in 2022. Mr. Patekar also worked as an Editor for edited some books published by national and international publishers.

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