Eco. Env. & Cons. 31 (4) : 2025; pp. (1858-1865)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2025.v31i04.077
Website: www.envirobiotechjournals.com

Seasonal assessment of phytoplankton community of Kot Dam, Jhunjhunu district, Rajasthan, India

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(Received 20 August, 2025; Accepted 22 October, 2025)

ABSTRACT

Study was conducted at the Kot Dam (27R 39′2′′N latitude and 75R 25′10′′E longitude) in the Jhunjhunu district of Rajasthan to assess seasonal variations in species richness and diversity of phytoplankton from April 2021 to March 2023. A total of 28 phytoplankton species belonging to five families were observed at sampling stations I, II, and III of the Kot Dam. Out of these maximum numbers of species belongs to Chlorophyceae family (13) followed by Bacillariophyceae (7), Cyanophyceae (6) and lowest number of species were observed from families Xanthophyceae and Dinophyceae (single species from each). Simpson diversity index ranged between 0.9431 to 0.9558 for sampling station I, 0.9272 to 0.9559 for sampling station II, and 0.9477 to 0.9548 for sampling station III of Kot Dam. Seasonal variation in the Simpson diversity index was observed at all three sampling stations. Shannon diversity index values ranged from 2.996 to 3.201 for sampling station I, 2.828 to 3.21 for sampling station II, and 3.068 to 3.204 for sampling station III. Increased sunlight and warmer temperatures promote the growth of phytoplankton and decrease mixing in the water column, allowing nutrients to accumulate in the surface layer. In monsoon season, phytoplankton species are often reduced because of the dilution of water bodies, and high turbidity and excessive nutrient loads inhibit the growth of certain phytoplankton. Freshwater influx from rainfall and runoff disrupts water salinity and temperature, impacting phytoplankton communities, high turbidity caused by increased suspended solids, and reduced light penetration responsible for the decline rate of photosynthesis; therefore, the number of phytoplankton also declines.

Key words: *Phytoplankton, Kot dam, Seasonal variation, Chlorophyceae, Bacillariophyceae, Cyanophyceae, Photosynthesis, Turbidity.*

Introduction

Plankton are a diverse group of microscopic living plants and animals that float, drift freely, or swim feebly in the water column, independent of the shore and bottom (Sommer, 1994). They are located at the bottom of the food chain (autotrophs), leading to commercially important fisheries. They are also biological indicators of excellent water quality (Keller *et al.*, 2008). Phytoplankton is the major producers in wetland environments, fixing energy and transferring it to higher trophic levels (Wetzel, 1983; Jhakar, 2013). Phytoplankton's, which comprise approximately 90% of oxygen production, are of utmost significance among all species on Earth.

Additionally, it plays a role in interconnected food chains, the process of transferring nutrients, and first generation of organic matter in freshwater lake ecosystems (Attayde and Hansson, 1999; Jhakar, 2013).These organisms can thrive in a wide range of habitats and obtain nutrients from water or sediments while utilizing sunlight to produce oxygen. Major significance of phytoplankton in aquatic ecosystems arises from their biotic origin as microscopic aquatic algae that possess chlorophyll pigments and thrive through photosynthesis (Reynolds, 2006). Phytoplankton plays a crucial role as the main producers in aquatic ecosystems, controlling the transfer of energy and biomass to maintain ecosystem balance (Cantonati *et al.,* 2006). Availability of nutrients, volume of water, and morphology of the bottom substrate in tropical wetlands all influence the community structure, dominance and seasonal fluctuations of phytoplankton (Gopal and Zutshi, 1998; Delariva and Agostinho, 2005). Phytoplankton communities in various water bodies, such as lakes, reservoirs, rivers, and ponds, exhibit variations in cell organization, species composition, and degree of diversity (Padisak *et al.,* 2006; Xiao *et al.,* 2011; Bolgovics *et al.,* 2017). Sensitivity and alterations in species composition frequently serve as indicators of significant environmental changes in ecosystems (Devassy and Goes, 1988; Chishty and Choudhary, 2022a). An investigation into the ecology of plankton in a water body is extremely beneficial for understanding the general economy and fundamental characteristics of lakes and ponds (Devi *et al.,* 2016). Interactions between environmental factors and organisms are the cause of the qualitative and quantitative availability of plankton, including phytoplankton, in aquatic ecosystems. Parameters such as temperature, light, dissolved oxygen, pH, electrical conductivity, and nutrients influence the phytoplankton composition, biomass, and variety in tropical reservoirs (Padisak *et al.,* 2010; Stomp *et al.,* 2011; Dhar *et al.,* 2012). An analysis of present-day freshwater conditions is critical for the conservation, protection, and enhancement of natural ecosystems. Therefore, present study was conducted to assess seasonal variations in phytoplankton species richness and diversity at the Kot Dam in the Jhunjhunu district of Rajasthan.

Materials and Methods

Study was conducted at the Kot Dam (27R 39′2′′N latitude and 75R 25′10′′E longitude) in the Jhunjhunu district of Rajasthan to assess seasonal variations in species richness and diversity of phytoplankton. Phytoplankton samples were collected monthly from April 2021 to March 2023 from three different sampling sites, SS-I, SS-II, and S-III, to assess phytoplankton diversity. Data obtained on a monthly basis were further classified into three notable seasons: summer (April to June), monsoon (July to September) and winter (October to March) to assess seasonal variation in species richness and diversity of the phytoplankton community of Kot Dam. Phytoplankton samples were collected using plankton net from different sampling sites of the Kot dam. Plankton samples were collected by filtering a substantial volume of water (usually 50 l) through specialized plankton net. Once samples were collected, the phytoplankton samples were immediately preserved in a 4% formalin solution at the sampling sites. Collected water samples were transported in the Department of Zoology, Vidhya Bhawan Rural Institute, Udaipur, for microscopic examination, taxonomic identification and counting of individuals of a particular species. The quantitative analysis of phytoplankton was carried out using a Sedgwick-Rafter plankton counting chamber. Plankton identification was completed within 24 hours of sample collection. Phytoplankton identified done by using standard field guides (Ward and Whipple, 1959; Sladecek, 1973; Battish, 1992; APHA, 2012). Taxonomic identification and photography of plankton specimens were conducted using a light microscope at a magnification of 40×10. Phytoplankton diversity was analyzed using two software programs: Microsoft Excel and PAST (Hammer *et al.,* 2001).

Results and Discussion

Plankton responds quickly to environmental changes due to their short lifespan. Phytoplanktons are found in water bodies and grow under average ecological conditions, and thus, they can be used as water quality indicators (Saha *et al.,* 2000).During study period, total 28 phytoplankton species belonging to five families were observed at sampling stations I, II and III of the Kot Dam. Out of these maximum numbers of species belongs to Chlorophyceae family (13) followed by Bacillariophyceae (7), Cyanophyceae (6) and lowest number of species were observed from families Xanthophyceae and Dinophyceae (single species from each) (Table 1).

Species richness: At sampling station I, the highest number of species was observed in summer 2022 (28 species) followed by summer 2021 and winter 2021-22 (27 species each season), winter 2022-23 (26 spe-

Table 1. List of Phytoplankton species observed in various seasons at different sampling stations of Kot Dam

S. no.	Name of species	Sampling Station I						Sampling Station II						Sampling Station III					
		S 2021	M 2021	W 2021-22	S 2022	M 2022	W 2022-23	S 2021	M 2021	W 2021-22	S 2022	M 2022	W 2022-23	S 2021	M 2021	W 2021-22	S 2022	M 2022	W 2022-23
	Family I: Chlorophyceae																		
1	*Botryococcus sp.*	15	14	27	9	2	24	4	9	21	15	6	32	24	9	24	18	8	5
2	*Chlamydomonas sp.*	39	18	45	33	27	30	28	0	39	45	11	34	28	7	34	43	12	43
3	*Chlorella sp.*	39	27	36	2	8	36	24	5	24	28	9	36	17	24	9	45	24	39
4	*Cladophora sp.*	24	15	23	42	19	32	34	33	44	30	6	34	38	0	45	56	17	51
5	*Closterium sp.*	25	21	34	43	8	24	27	3	27	11	15	28	39	14	33	45	8	47
6	*Coelastrum sp.*	30	17	44	12	21	33	36	24	42	27	23	42	36	9	44	34	24	48
7	*Hydrodictyonreticulatur*	18	4	36	30	3	14	28	1	32	32	9	43	32	6	19	34	26	51
8	*Microspora sp.*	36	27	45	23	12	34	39	21	0	24	6	21	39	27	24	4	24	42
9	*Oedogonium sp.*	22	16	27	25	0	21	34	27	40	7	34	15	9	23	23	22	15	31
10	*Pleodorina sp.*	32	18	32	8	12	24	34	21	51	22	18	24	18	23	25	14	22	18
11	*Spirogyra sp.*	21	8	8	26	21	21	33	5	32	24	6	42	27	12	0	33	12	44
12	*Ulothrix sp.*	4	23	45	12	0	32	36	42	27	36	15	8	36	10	24	35	35	42
13	*Volvox sp.*	10	12	15	8	3	16	11	2	13	5	0	4	11	10	16	18	14	23
	Family II: Xanthophyceae																		
14	*Botrydiopsis sp.*	0	0	12	11	24	31	0	8	14	11	6	13	5	3	17	18	6	13
	Family III: Bacillariophyceae																		
15	*Cymbella sp.*	15	18	16	17	14	0	15	4	14	10	1	24	9	16	22	14	11	18
16	*Diatomaelongatum*	14	0	13	12	11	3	12	8	13	12	11	7	13	12	6	12	8	16
17	*Diatoma sp.*	18	14	20	11	9	16	10	13	14	10	6	14	17	0	22	15	6	0
18	*Diatoma vulgare*	11	14	23	13	7	13	0	0	0	9	6	11	0	11	0	12	3	23
19	*Gomphonema sp.*	14	4	13	17	4	15	13	6	16	6	0	12	19	15	18	15	11	14
20	*Navicula sp.*	27	21	26	32	30	17	38	29	31	20	9	23	11	10	6	14	16	26
21	*Synedra ulna*	8	5	14	32	16	21	15	7	24	21	0	5	18	7	23	17	21	4
	Family IV: Dinophyceae																		
22	*Ceratium*	26	7	14	29	13	2	18	12	23	30	13	5	36	16	10	22	0	13
	Family V: Cyanophyceae																		
23	*Anabaena sp.*	16	0	0	12	10	18	21	0	4	28	5	17	16	8	0	12	2	19
24	*Nostoc sp.*	23	3	17	28	0	7	18	1	15	20	0	3	7	3	11	26	6	21
25	*Oscillatoria rileyi*	40	11	23	21	6	16	18	4	10	19	0	24	24	14	35	25	13	12
26	*Oscilllatoria tenuis*	3	6	28	27	8	12	18	0	11	28	15	27	13	3	23	35	8	0
27	*Planktothrix*	36	14	20	18	12	0	29	7	22	14	16	31	24	0	32	21	12	17
28	*Spirulina sp.*	32	12	21	24	0	33	19	15	2	24	10	27	28	5	13	16	14	8

cies) and monsoon 2021 (25 species). The lowest number of phytoplankton species was observed during the monsoon 2022 (24 species) (Table 1 and 2). At sampling station II, the highest number of species was observed in winter 2022-23 and summer 2022 (28 species for each season) followed by summer 2021 and winter 2021-22 (26 species for each season) and the monsoon season 2022 consisted of 24 species. The lowest number of phytoplankton species is observed during the monsoon season 2021 (23) (Table 1 and 2). At sampling station III, the highest species richness was observed in summer 2022 (28 species) followed by summer 2021 and monsoon 2022 (27 species in each season), winter 2022-23 consisted of 26 species. The lowest number of species was observed during monsoon 2021 and winter 2021-22 (25 species in each season) (Table 1 and 2). Due to increased sunlight and warmer temperature promote growth of phytoplankton and decreased mixing in water column, which allows nutrients to accumulate in the surface layer (Bhat *et al.,* 2015; Vajravelu *et al.,* 2018; Srichandan *et al.,* 2019).

Simpson Diversity Index: At sampling station I, highest value of Simpson diversity index was observed in winter 2021-22 (0.9558) followed by summer 2022 (0.9551), summer 2021 (0.9544), winter 2022-23 (0.9537), monsoon 2021 (0.9506) and lowest value of Simpson diversity index was observed in monsoon 2022 (0.9431) (Table 2). At sampling station II, highest value of Simpson diversity index summer 2022 (0.9559) followed by summer 2021 (0.9548), winter 2022-23 (0.9530), winter2021-22 (0.9504), monsoon 2022 (0.9272) and lowest value of Simpson diversityindex was observed during the monsoon 2021 (0.9272) (Table 2). At sampling station III, highest value of Simpson diversity index was observed during the summer 2022 (0.9548) followed by summer 2021 (0.9544), monsoon 2022 (0.9515), winter 2021-22 (0.9514), winter 2022-23 (0.9493) and lowest value of Simpson diversity index was observed during monsoon 2021 (0.9477) (Table 2).

Shannon diversity index: At sampling station I, highest value of Shannon diversity index was observed in winter 2021-22 (3.201) followed by summer 2022 (3.197), summer 2021 (3.169), monsoon (2.996), monsoon 2021 (3.092) and lowest value of Shannon diversity index was observed during the monsoon 2022 (2.996) (Table 2). At sampling station II, highest value of Shannon diversity index was observed in summer 2022 (3.21) followed by summer 2021 (3.163), winter 2022-23(3.159), winter 2021-22 (3.106), monsoon 2022 (2.959) and lowest value of Shannon diversity index was observed in monsoon 2021 (2.828) (Table 2). At sampling station III, highest value of Shannon diversity index was observed in summer 2022 (3.204) followed by summer 2021 (3.175), monsoon 2022(3.141), winter 2021-22 (3.108), winter 2022-23 (3.091) and lowest value of Shannon diversity index was observed during the monsoon 2021 (3.068) (Table 2).

Devi and Antal (2013) conducted a study on diversity of phytoplankton in a tropical pond in Jammu andKashmir, focusing on its relationship with water quality. Physicochemical parameters exhibited pronounced seasonal fluctuations. During study they found, a total of 21 genera from three distinct families of phytoplankton (Bacillariophyceae, Chlorophyceae and Cyanophyceae) were documented. Bacillariophyceae was the dominant family both qualitatively and numerically followed by Chlorophyceae and Cyanophyceae families.

Ayaz *et al.* (2012) examined limnological param-

Table 2. Seasonal variation in composition of phytoplankton species richness and various diversity indices of different sampling stations of Kot Dam

S. No	Species and Diversity index		Sampling station			Different Seasons		
			S2021	M 2021	W 2021-22	S2022	M 2022	W2022-23
1	Phytoplankton species	SS I	27	25	27	28	24	26
		SS II	26	24	26	28	23	28
		SS III	27	25	25	28	27	26
2	SimpsonDiversity Index	SS I	0.9544	0.9506	0.9558	0.9551	0.9431	0.9537
		SS II	0.9548	0.9272	0.9504	0.9559	0.9394	0.953
		SS III	0.9544	0.9477	0.9514	0.9548	0.9515	0.9493
3	ShannonDiversity Index	SS I	3.169	3.092	3.201	3.197	2.996	3.139
		SS II	3.163	2.828	3.106	3.21	2.959	3.159
		SS III	3.175	3.068	3.108	3.204	3.141	3.091

eters in high mountain Lake Kailash; their study revealed that a total of 14 species of phytoplankton were recorded from the lake, of which Bacillariophyceae contributed the maximum number of seven species (50%) to the total phytoplankton, Chlorophyceae contributed five species (35.71%) and one species (7.14%) contributed by Cyanophyceae and Dyanophyceae to the total phytoplankton.

Kumari *et al.* (2014) investigated 45 different species of phytoplankton, which consisted of 21 Chlorophyceae, 14 Bacillariophyceae and 10 Cyanophyceae, in two reservoirs located in the Narmada River, Punasa and Omkareshwar in Madhya Pradesh, India. Rajyalaxmi and Aruna (2024) studied the composition, density and diversity of Phytoplankton in Rathi Cheruvu River in Telangana, India. They obtained 0.37 values of Simpson diversity and 1.11 Shannon's diversity.

In our study, Simpson diversity index ranged between 0.9431 to 0.9558 for sampling station I, 0.9272 to 0.9559 for sampling station II, and 0.9477 to 0.9548 for sampling station III of Kot Dam. Seasonal variation in Simpson diversity index was also observed across the all three sampling stations. Value of Shannon diversity index observed between 2.996 to 3.201 for sampling station I, 2.828 to 3.21 for sampling station II and 3.068 to 3.204 for sampling station III.

Kumari *et al.* (2014) investigated a total of 45 different species of phytoplankton, which consisted of 21 Chlorophyceae, 14 Bacillariophyceae and 10 Cyanophyceae in two reservoirs located in the Narmada River, Punasa and Omkareshwar in Madhya Pradesh, India. Summarwar (2012) conducted a study on plankton diversity in the Bisalpur Reservoir (Rajasthan). This study documented 51 and 12 species of phytoplankton and zooplankton, respectively. Janagal and Khatri (2015) identified Chlorophyceae, Bacillariophyceae and Cyanophyceae in a desert village pond in Bikaner.

During monsoon season, phytoplankton species are often reduced because of the dilution of water bodies, and high turbidity and excessive nutrient load inhibit the growth of certain phytoplankton (Patil and Anil, 2011and 2015; Tripathy *et al.*, 2020). Freshwater influx from rainfall and runoff disrupts

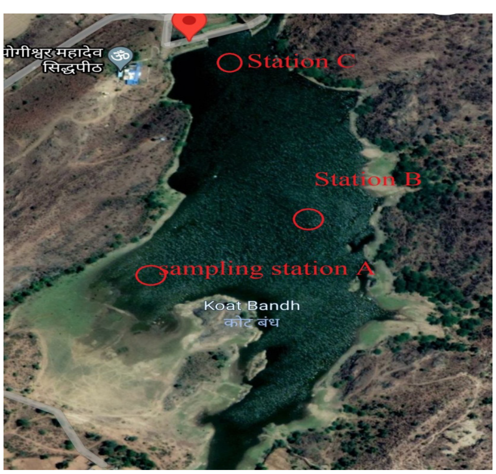

Fig. A. Overy of Study Site: Kot Dam, Jhunjhunu District

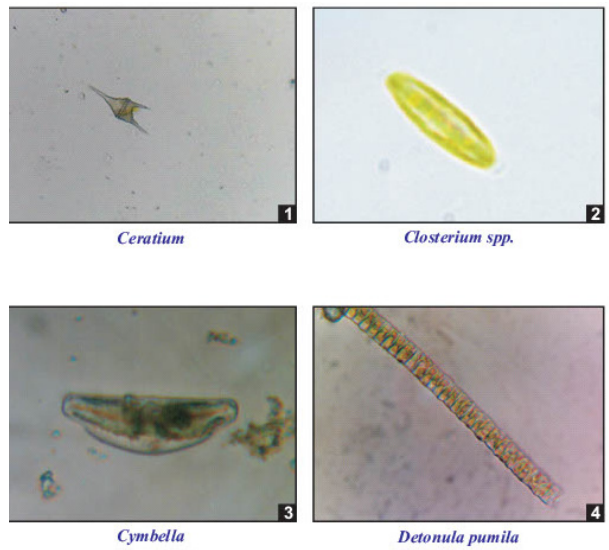

Fig. B. 1. *Ceratium*, 2. *Closterium spp.*, 3. *Cymbella* and 4. *Detonula pumila*

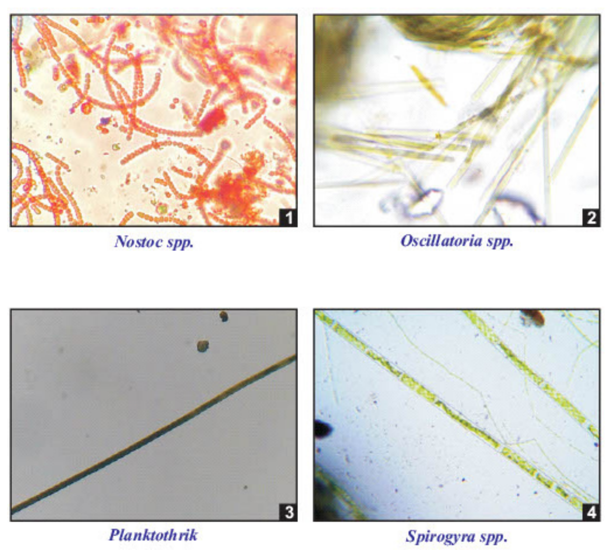

Fig. C. 1. *Nostoc spp.*, 2. *Oscillatoria spp.*, 3. *Planktothrik*, 4. *Spirogyra spp.*

water salinity and temperature, impacting phytoplankton communities, high turbidity caused by increased suspended solids, and reduced light penetration responsible for the decline rate of photosynthesis; therefore, the number of phytoplankton also declines (Bharathi and Sarma, 2019; Chowdhury and Biswas, 2023).

Phytoplankton has a crucial role as the main producer in aquatic ecosystems, controlling the transfer of energy and biomass to maintain the balance of ecosystem (Cantonati *et al.,* 2006). Algae are a subgroup of organisms that inhabit aquatic or moist environments and possess thalloid bodies and photosynthetic capabilities (Douglas *et al.,* 2003; Bajpai, 2018). The group of algae known as diatoms (Bacillariophyceae) is predominantly microscopic and possesses a distinctive cell wall composed of silica. They are a significant source of energy-rich molecules that sustain the entire food web, including fish, aquatic invertebrates and zooplankton (Hansson, 1992; Guo *et al.,* 2016). Diatoms can function as biological indicators of water quality, enabling the determination of past water quality and its trends over time (Juttner *et al.,* 1996; Ragueneau *et al.*, 2006; Lobo *et al.*, 2016). Amount of water, nutrients, and shape of the bottom substrate in tropical wetlands all affect the phytoplankton community structure, which is in charge of how the community changes with the seasons (Gopal and Zutshi, 1998; Delariva and Agostinho, 2005). An investigation into the ecology of plankton in a water body is extremely beneficial for understanding the general economy and fundamental character of the lake or pond (Devi *et al.,* 2016). Interactions between environmental factors and organisms are the cause of the qualitative and quantitative availability of plankton, including phytoplankton (Sharma *et al.,* 2009; Vajravelu *et al.,* 2018; Chishty and Choudhary, 2022 a and b). They are a significant source of energy-rich molecules that sustain the entire food web, including fish, aquatic invertebrates and zooplankton (Lebour, 1992; Pachiappan *et al.,* 2018).

Conflict of Interest- None

References

Attayde, J. L. and Hansson, L. A. 1999. Effects of nutrient recycling by zooplankton and fish on phytoplankton communities. *Oecologia*. 121(1): 47-54.

A.P.H.A. 2012. *Standard Methods for the Examination of Water and Wastewater*. 22nd Ed. American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF), Washington D.C., U.S.A.

Ayaz, N.A. Wanganeo, A. Ishaq, A. and Bhat, N.A. 2012. Summer Limnology of a high mountain Lake "Kailash Lake" Bhaderwah, Jammu and Kashmir. *International Journal of Environmental Sciences*. 3(3):931-939.

Bajpai, P. 2018. Characteristics of algae. In: *Third Generation Biofuels* (pp. 11-15). Singapore: Springer Singapore.

Battish, S.K. 1992. *Freshwater Zooplankton of India*. Oxford and IBH Publishing Co., Pvt. Ltd. New Delhi.

Bharathi, M.D. and Sarma, V.V.S.S. 2019. Impact of monsoon- induced discharge on phytoplankton community structure in the tropical Indian estuaries. *Regional Studies in Marine Science.* 31 (100795): 1-29.

Bhat, N.A. Wanganeo, A. and Raina, R. 2015. Seasonal dynamics of phytoplankton community in a tropical wetland. *Environmental Monitoring and Assessment.* 187: 1-12.

Bolgovics, A. Varbiro, G. Acs, E. Trabert, Z. Kiss, K.T. Pozderka, V. Gorgenyi, J. Boda, P. Lukacs, B.A. Nagy-Laszlo, Z. Abonyi, A. and Borics, G. 2017. Phytoplankton of Rhithral Rivers: its origin, diversity and possible use for quality-assessment. *Ecological Indicators*. 81: 587- 596.

Stomp, M. Huisman, J. Mittelbach, G.G. Litchman, E. and Klausmeier, C.A. 2011. Large scale biodiversity patterns in freshwater phytoplankton.

Cantonati, M. Gerecke, R. and Bertuzzi, E. 2006. Springs of the Alps, sensitive ecosystems to environmental change: from biodiversity assessments to longterm studies, In: Lami A., Boggero A., (Eds.), Ecology of high altitude aquatic systems in the Alps. *Hydrobiologia*. 562:59-96.

Chishty, N. and Choudhary, N.L. 2022a. Seasonal Dynamic in Primary Productivity and Phytoplankton Diversity in Berach River System of Udaipur District, Rajasthan. *Asian Journal of Biological and Life Sciences*. 11(1): 82-92.

Chishty, N. and Choudhary, N.L. 2022b. Seasonal Dynamic of Physicochemical Parameters of Berach River system in Udaipur district, Rajasthan. *Toxicology International*. 29(3): 379-391.

Chowdhury, M. and Biswas, H. 2023. A coherent status of summer monsoon phytoplankton communities (2017–2018) along the Western Indian continental shelf: Implications for fisheries. *Science of the Total Environment*. 878:162963.doi:10.1016/j.scitotenv.2023.162963

Delariva, R.L. and Agostinho, A.A. 2005. Relationship between morphology and diets of six Neotropical loricariids. *Journal of Fish Biology*. 58: 832- 847.

Devassy, V.P. and Goes, J.I. 1988. Phytoplankton community structure and succession in a tropical estuarine complex (central west coast of India). *Estuarine, Coastal Shelf Science*. 27: 671-685.

Devi, A. and Antal, N. 2013. Zooplankton diversity and physicochemical condition of a tropical pond in Birpur, J and K, India. *International Research Journal of Environmental Science*. 2(5): 25-30.

Devi, M.B. Gupta, S. and Das, T. 2016. Phyto-plankton community of Lake Baskandianua, Cachar District, Assam, North East India-An ecological study. *Knowledge and Management of Aquatic Eco-systems*. 417: 2.

Dhar, J. Baghel, R.S. and Sharma, A.K. 2012. Role of instant nutrient replenishment on plankton dynamics with diffusion in a closed system: a pattern formation. *Applied Mathematics and Computation*. 218(17):8925-8936.

Douglas, S. E. Raven, J. A. and Larkum, A. W. 2003. The algae and their general characteristics. In Photosynthesis in Algae (pp. 1-10). *Dordrecht: Springer Netherlands*. *Ecology*. 92(11): 2096-2107.

Gopal, B. and Zutshi, D.P. 1998. Fifty years of hydrobiological research in India. *Hydrobiologia*. 384:267-290.

Guo, F. Kainz, M. J. Sheldon, F. and Bunn, S. E. 2016. The importance of highquality algal food sources in stream food webs–current status and future perspectives. *Freshwater Biology*. 61(6): 815-831.

Hammer, O. David A.T.H. and Ryan, P.D. 2001. Past: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica*. 4(1): 1-9.

Hansson, L.A. 1992. The role of food chain composition and nutrient availability in shaping algal biomass development. *Ecology*. 73(1): 241-247.

Jakhar, P. 2013. Role of phytoplankton and zooplankton as health indicators of aquatic ecosystem: A review. *International Journal of Innovation Research Study*. 2(12): 489-500.

Janagal, B. and Khatri, A.K. 2015. Phytoplankton diversity of a desert village pond in Bikaner, Rajasthan, India. *International Research Journal of Environment Science*. 4(12): 43-45.

Juttner, I. Rothfritz, H. and Ormerod, S.J. 1996. Diatoms as indicators of river quality in the Nepalese Middle Hills with consideration of the effects of habitat-specific sampling. *Freshwater Biology*. 36(2): 475-486.

Keller, B. Wolinska, J. Manka, M. and Spaak, P. 2008. Spatial, environmental and anthropogenic effects on the taxon composition of hybridizing Daphnia. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 363: 2943-2952.

Kumari, M., Mudgal, L.K. Patidar, K.C. and Singh, A.K. 2014. Comparative Phytoplankton studies of two reservoirs Punasa and Omkareshwar of Narmada River, MP, India. *International Journal of Advanced Research*. 2(3): 773- 779.

Lebour, M. V. 1922. The food of plankton organisms. *Journal of the Marine Biological Association of the United Kingdom,* 12(4): 644-677.

Lobo, E.A. Heinrich, C.G. Schuch, M. Wetzel, C.E. and Ector, L. 2016. Diatoms as bioindicators in Rivers. In: J. R. O. Necchi (Ed.), *River Algae*. Pp: 245-271.

Pachiappan, P. Santhanam, P. Begum, A. and Balaji Prasath, B. 2018. An introduction to plankton. In Basic and applied phytoplankton biology (pp. 1-24). Singapore: Springer Singapore.

Padisak, J. Borics, G. Grigorszky, I. and Soroczki-Pinter, E. 2006. Use of phytoplankton assemblages for monitoring ecological status of lakes within the water framework directive: the assemblage index. *Hydrobiologia*. 553: 1–14.

Padisak, J. Hajnal, E. Naselli-Flores, L. Martin, T.D. Noges, P. and Zohry, T. 2010. Convergence and divergence in organization of phytoplankton communities under various regimes of physical and biological control. *Hydrobiologia*. 639:205-220.

Patil, J. S. and Anil, A. C. 2011. Variations in phytoplankton community in a monsoon-influenced tropical estuary. *Environmental Monitoring and Assessment*. 182(1): 291-300.

Patil, J. S. and Anil, A. C. 2015. Effect of monsoonal perturbations on the occurrence of phytoplankton blooms in a tropical bay. *Marine Ecology Progress Series*. 530: 77-92.

Ragueneau, O. Conley, D. J. Leynaert, A. Longphuirt, S. N. andSlomp, C. P. 2006. Role of diatoms in silicon cycling and coastal marine food webs. *The Silicon Cycle: Human Perturbations And Impacts On Aquatic Systems*. 66: 163-195.

Rajyalaxmi, K. and Aruna, M. 2024. Composition, Density and Diversity of Phytoplankton in Rathi Cheruvu, BhadradriKothagudem, Telangana, India. *Asian Journal of Environment and Ecology*: 23(6): 12-20.

Reynolds, C. 2006. *Ecology of phytoplankton.* Cambridge University Press.

Saha, S.B. Battacharya, S. and Choudhary, A. 2000. Diversity of phytoplankton of a sewage polluted brackish water ecosystem. *Journal of Environmental Biology* 21(1): 9-14.

Sharma, N.K. Mohan, D. and Rai, A. K. 2009. Predicting phytoplankton growth and dynamics in relation to physico-chemical characteristics of water body. *Water, air, and soil pollution*. 202(1): 325-333.

Sladecek, V. 1973. System of Water Quality. Archiv für Hydrobiologie - Beiheft: Ergebnisse der Limnologie 7. Stuttgart. 218 S., 70 Abb., 64 Tab., 502 Lit.

Sommer, U. 1994. *Planktologie*. Springer. 1-274pp.

Srichandan, S. Baliarsingh, S. K. Prakash, S. Lotliker, A. A. Parida, C. and Sahu, K. C. 2019. Seasonal dynamics of phytoplankton in response to environmental variables in contrasting coastal ecosystems. *Environmental Science and Pollution Research*. 26: 12025-12041.

Summarwar, S. 2012. Studies on plankton diversity in

Bisalpur. *International Journal of Life Sciences Botany and Pharmaceutical Research*. 1(4):65-72.

Suthers, I. M. Richardson, A. J. and Rissik, D. 2019. The importance of plankton. *Plankton: a Guide to Their Ecology and Monitoring for Water Quality*. 1: 256.

Tripathy, S.C. Sabu, P. Patra, S. Naik, R.K. Sarkar, A. Venkataramana, V. and Sudarsanarao, P. 2020. Bio-physical control on variability in phytoplankton production and composition in the south-western tropical Indian Ocean during monsoon 2014. *Frontiers in Marine Science.* 7(515): 1-18.

Vajravelu, M. Martin, Y. Ayyappan, S. and Mayakrishnan, M. 2018. Seasonal influence of physico-chemical parameters on phytoplankton diversity, community structure and abundance at Parangipettai coastal waters, Bay of Bengal, South East Coast of India. *Oceanologia*. 60(2): 114-127.

Ward and Whipple 1959. *Fresh-water Biology*, 2nd Edition., W.T.Edmondson, Ed., xx + 1248 pages, Johan Wiley and Sons, New York.

Wetzel, R.G. 1983. *Limnology*. 2nd edition. W.B. Saunders Coll. Pub. pp. 267.

Xiao, L.J. Wang, T. Hu, R. Han, B.P. Wang, S. Qian, X. and Padisak, J. 2011. Succession of phytoplankton functional groups regulated by monsoonal hydrology in a large canyon-shaped reservoir. *Water Research*. 45: 5099- 5109.