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SEASONAL VARIATION IN ZOOPLANKTON POPULATION IN RELATION TO PHYSICO-CHEMICAL CHARACTERISTICS OF WATER IN KAYAD LAKE NEAR AJMER, RAJASTHAN

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ABSTRACT

The paper highlights the studies of plankton composition in relation to physico-chemical characteristics of a freshwater lake at Kayad about 10 km away from Ajmer city. The biotic interference in the lake affects the water quality, bringing changes in the physico-chemical parameters, which directly influence the biotic composition of zooplankton. Water temperature showed minimum value of 18°C during winter and 35°C during monsoon. pH was minimum (7.2) during early summer and highest (8.7) during winter. Dissolved oxygen was maximum (10.87 mg/L) during winter and minimum (2.82 mg/L) during spring. The zooplankton of Kayad lake exhibited luxuriant growth in spring and monsoon, whereas, they were less abundant in summer season.

INTRODUCTION

An ecosystem has two major components, abiotic and biotic, which are interdependent. The chief abiotic factors are heat, light, pH value of water and basic inorganic and organic compounds. The biotic factors comprise of flora and fauna along with aquatic microbes such as algae, fungi, protozoans, benthos and bacteria etc. Since, both these components mutually influence and interact with each other, thorough understanding of an ecosystem is not possible without analysing these factors in detail. As regards the environment, it is well known that completion of life cycle of any organism entirely depends upon a favourable environment, and hence analysis of the environment is essential. The present paper deals with the variation of zooplankton in Kayad lake in relation to physico-chemical properties.

MATERIALS AND METHODS

Kayad is 10 km from Ajmer city, which is centrally situated in the state of Rajasthan. Kayad lake is about 1582 feet above the mean sea level, and is surrounded by three villages Kayad, Chhatri and Gagwana. The lake is situated at 26°36'30" north latitude and 74°42'0" east longitude. The capacity of the lake is 254.98 million cubic feet. Gross catchment area of lake is 55.17 square km.

Three different sites were selected for the purpose of sample collection. These sites differ in their characteristics, location, flora and fauna.

Site-1: This site is represented by a slanty wall which is made up of stones. It is used for bathing activities.

Site-2: This site is used mostly for animal bathing, and there is comparatively lesser human interference.

Site-3: This site is used as a grazing field for local cattle. There is more bird and fishing activity. It is also utilized for agriculture when the water is receded.

The samples were analysed chemically with the help of standard methods (APHA 1989) and

Trivedy & Goel (1986). The density of zooplankton was calculated for per litre, and they were identified with the help of standard works such as Tonapi (1980) and others.

RESULTS AND DISCUSSION

The results of the physico-chemical analysis of water are given in Table 1. Zooplankton collected from Kayad lake have been identified up to species level and the major groups are given in Table 2.

Water temperature: Water temperature showed lowest value (18°C) during winter and highest value (35°C) during summer. Low water temperature was accompanied with high dissolved oxygen due to the fact that as temperature increases the dissolved gases get released from the water. Water temperature specifies an important function in influencing the periodicity, occurrence and abundance of zooplankton.

Table 1: Physico-chemical characteristics at sites I, II and III.

Month	W. T. (°C)	pH (pH unit)	DO (mg/L)	Free CO_2 (mg/L)	Chloride (mg/L)	T.Alk. (mg/L)	T.S. (mg/L)	T.D.S (mg/L)
Site - I								
October	28.0	8.2	09.75	7.20	56.80	180	955	900
November	26.0	7.9	12.87	6.00	36.88	140	560	520
December	24.0	8.2	14.82	0.00	36.80	180	426	400
January	18.0	8.7	19.46	0.00	56.80	160	420	400
February	20.0	8.6	21.87	0.00	76.64	175	421	400
March	23.4	8.0	10.53	0.00	92.00	165	640	600
April	30.0	7.2	07.34	0.00	89.99	180	849	800
May	31.0	8.0	07.63	2.40	92.00	170	850	800
June	35.0	7.6	02.82	3.40	69.00	215	870	820
July	26.0	7.4	08.87	5.40	68.00	180	952	900
August	27.0	7.9	09.27	6.60	76.04	150	1460	1200
Site - 2								
October	27.9	8.0	09.74	6.00	68.00	180	950	880
November	26.0	7.4	10.92	5.90	65.24	185	600	550
December	24.2	8.0	14.24	3.20	59.62	160	520	500
January	18.1	8.2	15.00	0.00	56.80	150	560	520
February	20.0	8.6	14.82	0.00	34.05	110	800	760
March	23.0	8.0	08.87	0.00	42.56	120	820	786
April	29.8	7.4	10.14	0.00	84.80	165	900	860
May	31.2	7.9	10.53	1.90	78.00	130	870	828
June	35.0	7.4	09.75	2.60	82.60	210	950	882
July	26.0	7.2	08.45	4.50	98.00	195	900	860
August	27.2	7.6	09.75	7.10	78.00	170	1600	1300
Site - III								
October	28.0	8.0	9.75	6.00	68.00	180	920	855
November	26.0	7.9	9.70	6.00	64.00	170	610	562
December	24.2	8.0	10.92	0.00	58.79	160	570	535
January	18.0	8.6	11.92	0.00	56.80	150	540	500
February	20.1	8.6	11.70	0.00	34.08	125	600	560
March	23.4	8.0	11.70	0.00	42.56	160	760	722
April	30.0	7.3	10.20	0.00	84.80	160	800	760
May	31.0	7.7	10.44	1.70	84.80	150	870	824
June	35.0	7.6	9.84	2.60	78.60	170	900	850
July	26.0	7.0	8.74	3.20	86.70	165	900	850
August	27.2	7.7	8.24	5.40	98.00	160	1100	920

In the present study it was observed that the water temperature had a direct relationship with the total plankton. Arthropods showed positive correlation whereas *Euglena* and *Amoeba* showed an inverse relationship.

Table 2: Number of zooplankton encountered in Kayad lake.

Phylum	Winter	Spring	Summer	Monsoon
Protozoans	25	28	20	26
Coelenterates	4	3	4	6
Rotifers	1	2	2	1
Nematodes	2	1	2	2
Annelids	1	2	2	1
Arthropods	8	10	7	12
Crustaceans	1	1	2	-
Total	42	47	39	48

pH: pH values ranged from 7.2 to 8.7. Minimum pH was recorded during early summer in the month of April, and maximum during winter. Higher pH value, observed during post winter, was also reported earlier (Blum 1957, Badge & Verma 1985). Maximum pH can be due to increase in photosynthesis. Monsoon decrease in pH may be attributed to inflow of rain water (Badge & Verma 1985). This trend is in accordance with other studies (Badge & Verma 1985, Sharma 1990, Parvateesam et al. 1991).

Among the Zooplankton, *Amoeba, Daphnia* and *Monia* showed positive correlation with pH. Interestingly, *Hydra* and *Mesocyclops* showed inverse relationship.

Dissolved oxygen: The dissolve oxygen was minimum (2.82 mg/L) during spring, and maximum (21.87 mg/L) during winter. The rising temperature reduces the oxygen carrying capacity of water which explains the lower dissolved oxygen values during summer. Lower values can be correlated with the high decomposition rates of organic matter (Sharma et al. 1978). Dissolved oxygen showed positive correlation with Chlorophyceae and *Daphnia* and negative with Euglenophyceae and Cyanophyceae. Similar results were obtained by Billore (1981) and Sankhla (1981).

Free carbon dioxide: There was irregular trend of free carbon dioxide. It was absent from all the three sites in the month of January, February and March, 1998. Highest free carbon dioxide (7.2 mg/L) was recorded during early winter. Low value of free carbon dioxide (2.4 mg/L) was recorded in the month of May. The free carbon dioxide in any water body varies somewhat rapidly due to biological activity. In the present study, free CO_2 showed negative relation with dissolved oxygen. Increase in free carbon dioxide during early winter can be attributed to the higher rate of decomposition during the season and the favourable temperature.

Chloride: Chloride were minimum during early winter (34.08 mg/L) and maximum during summer (92.00 mg/L). The value showed an increase from winter to summer. Decrease in the water level of the lake during spring, summer and pre-monsoon may be the reason for the increase of the chloride concentration. Run off water from the surrounding hills, agricultural fields and the ghat may be responsible for decrease in values during monsoon. The results obtained are in accordance with the finding of Tripathi & Pandey (1990), Sharma (1990) and Parvateesan et al. (1991).

Total alkalinity: Total alkalinity was minimum (140 mg/L) during winter, and maximum (215 mg/L) during summer. Sharma (1990) reported higher total alkalinity during monsoon. In the present investigation total alkalinity showed positive correlation with conductivity of the lake water.

Total dissolve solids: Total dissolve solids were maximum during the month of August and minimum in December, January and February. Tripathy & Pandey (1989) reported maximum concentration of total dissolved solids during summer.

Zooplankton

Zooplankton, collected and recorded during the present investigation from different sites, belong to

Protozoa, Nematoda, Coelentrata, Annelida and Arthropoda. In all, about 30 different species were collected from the lake water.

Zooplankton are the microscopic free swimming animals and act as a component of an aquatic ecosystem which is primary consumer of phytoplankton. They provide main food to fishes, and can be used as indicators of the trophic level of a water body. Zooplankton play an integrated role in transferring energy to consumers, hence, they make a higher trophic level in energy flow after phytoplankton.

The density and diversity of the zooplankton are controlled by several physico-chemical factors like water temperature. Dissolved oxygen and organic matter are the important factors which control the zooplankton growth.

Protozoans: Quantitatively Protozoan members were maximum at all the sites in spring followed by winter and monsoon, and minimum during summer. In all, 9 species of Protozoa were recorded. Of these, two species, *viz*., *Euglena spuaogyra, Amoeba proteus* and *Amoeba radisa* were present throughout the study period.

Coelenterates: These organisms were represented only by two species, *Hydra vulgaris* and *Pelmatohydra oligacts*. Both the species were maximum during monsoon, and minimum during spring. Moderate temperature, free CO_2 and dissolved organic matter favoured their growth.

Rotifers: Rotifers were reported to be minimum during winter season in all the three sites of the lake. This could be due to low water temperature and comparatively high water level than during summer, which minimised the density of organisms.

Nematodes: About 6 species of Nematodes were reported from different sites of the lake during different seasons.

Annelids: Only one species of Annelids was reported from the lake during spring and monsoon. This could be attributed to high temperature during which the multiplication, reproduction and metabolic activities are increased.

Arthropods: Seven species belonging to the order Cladocera and six species of Copepodes were reported from different sites of the lake. Both Cladocera and Copepoda were reported to be minimum during winter season due to low water temperature and comparatively high water level, which minimised the density of organisms, and due to dilution of water during rainy season.

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