

Periodic Research

A Study on Benthic Community in Pushkar Lake (Ajmer)



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Abstract

The diversity of benthic community acts as sensitive indicators of lake health. These play a critical role in the natural flow of energy and nutrients in the ecosystem more over they play a vital role in purifying water bodies since they are saprophytic but some may be harmful. Their abundance, diversity and short life cycle make them ideal subject for the assessment of wetland's ecological conditions. Making a fringe between two diverge land ecosystems, the Indian desert in the north-west and relatively fertile plains in the south-east the Aravalli Range, acts as an ecotone representing a blend of flora and fauna of both the regions. As of land, the community of aquatic ecosystems in the Aravalli range is supposed to be characteristic, demonstrating the edge effect. The present study was undertaken from October 2012 to March 2013 to explore the benthic fauna and its ecology in Pushkar lake (Ajmer).

Physical-chemical limnology revealed that the pond was shallow with turbid, alkaline, hard, slightly saline and well oxygenated. Annelida was represented by *Aeolosoma hemprichi*, *Alboglossiphonia weberi*, *Hirudinaria globosa* and *Tubifex tubifex*. Molluscan population was dominated by *Bellamya bengalensis* followed by *Lymnea acuminata*, *Diagnostoma pulchella*, *Thiara tuberculata*, *Indoplanorbis exustus*, *Gabbia orcula* and *Gyraulus rotula*. Insects were represented by adult as well as larval forms. The adult insect fauna belonged to only two orders namely Coleoptera (beetles) and Hemiptera (bugs). Apart from these orders Diptera (Mosquitoes, Flies, and Midges), Odonata (Dragonflies), Ephemeroptera (Mayflies) and Plecoptera (Stoneflies) were represented only by larval forms.

Keywords: Benthic Fauna, Physical-Chemical Limnology, Ecotone, Diversity
Introduction

Aquatic macro-benthic forms have been identified as excellent tool for bio monitoring studies as they respond rapidly to the environmental changes. Some Benthic forms are often considered to be best indicators of organic pollution because of their constant presence, relatively long life span, sedentary habits, and different tolerance to stress habitat (Webber et al., 1989). Benthic population is an essential part of lake ecosystems, exerting a considerable impact upon their functioning. The diversity of benthic fauna acts as sensitive indicators of lake health. The benthic population consumes organic matter that sinks from surface production. These benthic invertebrates become food for the other aquatic invertebrates and vertebrates, hence play a critical role in the natural flow of energy and nutrients in the ecosystem more over they play a vital role in purifying water bodies since they are saprophytic but some may be harmful as some gastropods are intermediate hosts of infectious trematodes and other parasites of animals and human beings (Brown, 1994). Biological monitoring is considered to provide an integrated approach to assess water and overall environmental quality (Hynes, 1960). Additionally, snails are ideal bio-indicators not only for paleoenvironments and water quality (Harman, 1974; Clarke, 1979), but for lotic and lentic aquatic ecosystems as well (Choubisa, 1992).

The Aravalli Range, which runs through the state from south west to the north east for about 850 kms, adds diversity to the landscape of Rajasthan. The region north west to the Aravalli range constitutes the major part of the Indian desert while the south-east plains are relatively fertile lands. Making a fringe between two diverge land ecosystems, it acts as an ecotone representing a blend of flora and fauna of both the regions (Saxena, 1997). As of land, the community of aquatic ecosystems in the Aravalli range is supposed to be characteristic, demonstrating the edge effect. The present study was undertaken from October 2012 to March 2013 to explore the benthic fauna and its ecology in Pushkar lake (Ajmer).

Study Area

Pushkar is situated 14kms on the North west of Ajmer. The geographical coordinates are 26°30'0" North 74°33'0" East. The lake Pushkar posses scenic beauty with hills on three sides and sand drafting from the plains of Marwar. The Pushkar lake draws catchment of the Aravalli hills covering an area of 22 Sq. Kilometers. The lake has water surface of 22 hectares.

Material and Method

1. Both water and sediment samples were collected from three study stations. A quadrat was used to collect the samples of sandy sediment. Benthic forms were collected by sieving the mud samples.
2. Benthic forms were studied under binocular microscope and bull lens. The forms were identified and counted. The results are expressed in the No./m²
3. Water was examined for major ecological variables including temperature, pH, electrical conductance, total dissolved solids, dissolved gases (oxygen, carbon dioxide), alkalinity and hardness. The sediment samples were examined for pH, electrical conductance, total dissolved solids and organic matter. The analysis was made following APHA-AWWA-WPCF (1981). For parameters like temperature, pH, electrical conductance and total dissolved solids, respective meters were used.
4. Benthic fauna were identified following Daghli (1952), Borner & DeLong (1957), Baid (1958), Vazirani (1964), Edmondson (1966), Needham & Needham (1978), Tonapi (1980), Mc Cafferty (1981) and Subbarao (1989).

Results and Discussions

Physical-chemical limnology revealed that the pond was shallow with turbid, alkaline, hard, slightly saline and well oxygenated. The average values (ranges) of important abiotic variables of water were observed as Temperature (17.8 – 24.4 °C), Transparency (0.45 - 0.5m), pH (7.3 – 7.6), EC (0.34 - 0.42 mmho/ cm), DO (8.53 – 15.45 mg/l), Free CO₂ (2 - 46 mg/l), TDS (340 – 420 mg/l), Hardness (126-184mg/l) and Total Alkalinity (38 - 76 mg/l). Sediment analysis revealed the average values (ranges) as pH (9.2 – 9.8), EC (0.26 - 0.41 mmho/ cm), TDS (260 – 410 mg/g) and Organic matter (17.38 - 69.26 mg/g) (Table 1).

The benthic fauna displayed a diversity of 21 species belonging to Phylum Annelida (Class Oligochaeta and Hirudinea), Phylum Arthropoda (Class Insecta) and Phylum Mollusca (Class

Gastropoda) (Table 2). Annelids were represented by two Oligochaets namely *Aelosoma hemprichi*, *Tubifex tubifex* and two Hirudinian *Alboglossiphonia weberi* and *Hirudineria globosa*. Roonwal (1982) in his review of the fauna of the Indian desert also reported Oligochaeta and Hirudinea from the Indian desert. Saxena (2008) also recorded oligochaete *Tubifex tubifex* among aquatic invertebrates of Rajasthan while Srivastava (2009) recorded *Aelosoma hemprichi* probably for the first time in the region.

Arthropods were represented only by Insects. The adult insect fauna belonged to only two orders namely Coleoptera (Beetles) and Hemiptera (Bugs) belonging to 3 families each. Order Coleoptera was represented by family Dytiscidae (3 Sp.), Hydraenidae (1) and Hydrophilidae (2) whereas order Hemiptera was represented by Corixidae (1), Nepidae (2) and Notonectidae (1). *Tropisternus lateralis*, *Captotomus interrogatus*, *Laccophilus anticatus* (Beetles) and *Nepa cineria* (Bug) along with the Dytiscid *Agabus* larvae were present regularly during the present study. Apart from these orders Diptera (Mosquitoes, Flies, and Midges), Odonata (Dragonflies), Ephemeroptera (Mayflies) and Plecoptera (Stoneflies) were represented only by larval forms. *Chironomus* larvae were reported every time. The present study shows similarity with the findings of Srivastava (2009) who recorded 18 genera besides larval forms of many others in some village ponds of Bikaner.

Mollusc fauna was represented by seven Gastropods. Molluscan population was dominated by *Bellamya bengalensis* followed by *Lymnea acuminata*, *Diagnostoma pulchella*, *Thiara tuberculata*, *Gabbia orcula*, *Indoplanorbis exustus* and *Gyraulus rotula*. Perennial supply of ecologically safe water with good amount of aquatic vegetation and natural refuges ensures the population density and species diversity of the snails

Benthic fauna was dominated by Molluscs throughout the period of study except in January and February where Arthropods dominate. This was mainly due to the contribution of *Hydraticus fabricii*, *Hydraena quadricollis* and *Tropisternus lateralis*. Considerable number of Annelids were recorded only when the water temperature was above the average i.e. 21.75°C (Fig.1).

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Table 1
Physical – Chemical Variables At Pushkar Lake, Ajmer During October, 2012 – March 2013.
 Values are Averages of Three Study Stations and are Expressed in Mg/L in Water and Mg/G in Sediment Except Otherwise Mentioned.

VARIABLE	Oct. 2012	Nov. 2012	Dec. 2012	Jan. 2013	Feb. 2013	Mar. 2013	Average
WATER							
Tempemprature(°C)	24.4	23.2	22.1	17.8	20.4	22.6	21.75
Transparency(m)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
pH	7.4	7.6	7.5	7.4	7.3	7.4	7.43
EC(mmho/cm)	0.34	0.41	0.42	0.36	0.39	0.34	0.37
DO	9.76	12.60	8.53	8.94	12.60	15.45	11.31
Free CO ₂	12	2	4	38	46	12	19.00
TDS	340	410	420	360	390	340	376.60
Hardness	126	136	144	184	158	126	145.66
Total Alkalinity	38	66	42	76	62	38	53.66
SEDIMENTS							
pH	9.4	9.2	8.8	9.8	9.3	9.7	9.36
EC(mmho/cm)	0.38	0.39	0.41	0.34	0.26	0.38	0.36
TDS	380	390	410	340	260	380	360
Organic matter	22.27	29.87	17.38	22.27	66.81	69.26	37.97

Table 2
Diversity and Population Density of Benthic Fauna At Pushkar Lake, Ajmer During October, 2012 – March 2013. Values are Averages of Three Study Stations and are Expressed As No. /M².

Faunal Species	Oct. 12	Nov.12	Dec.12	Jan.13	Feb.13	Mar.13	Average
P-ANNELIDA							
C-OLIGOCHAETA							
<i>Aeolosoma hemprichi</i>	80	00	00	00	00	40	20.00
<i>Tubifex tubifex</i>	60	80	40	40	60	100	63.33
C-HIRUDINEA							
<i>Alboglossiphonia weberi</i>	60	40	20	00	80	00	33.33
<i>Hirudineria globosa</i>	80	00	00	40	00	40	26.66
Total Annelids	280	120	60	80	140	180	143.33
P-ARTHROPODA							
C_INSECTA							
O-COLEOPTERA							
F- DYTISCIDAE							
<i>Captotomus interrogatus</i>	100	80	100	100	140	140	110.00
<i>Hydaticus fabricii</i>	00	380	560	480	540	480	406.66
<i>Laccophilus anticatus</i>	60	80	80	100	140	80	90.00
F-HYDRAENIDAE							
<i>Hydraena quadricollis</i>	00	00	00	800	580	280	276.66
F- HYDROPHILIDAE							
<i>Hydrophilus olivaceous</i>	00	60	00	00	00	00	10.00
<i>Tropisternus lateralis</i>	80	60	40	240	180	80	113.33
O-HEMIPTERA							
F- CORIXIDAE							
<i>Corixa lima</i>	00	00	60	00	00	00	10.00
F- NEPIDAE							
<i>Laccotrepes maculatus</i>	00	80	40	100	120	00	56.66
<i>Nepa cineria</i>	20	40	60	80	60	20	46.66
F-NOTONECTIDAE							
<i>Notonecta glauca</i>	00	00	00	80	40	00	20.00
Total Arthropods	260	780	940	1980	1800	1080	1140
P-MOLLUSCA C-Gastropoda							
<i>Bellamya bengalensis</i>	380	340	300	320	280	320	323.33
<i>Diagnostoma pulchella</i>	200	220	180	180	240	260	213.33
<i>Gabbia orcula</i>	240	100	160	140	120	120	146.66

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<i>Gyraulus rotula</i>	100	80	40	60	40	80	66.66
<i>Indoplanorbis exustus</i>	140	180	120	100	80	140	126.66
<i>Lymnaea acuminata</i>	340	280	260	240	220	260	266.66
<i>Thiara tuberculata</i>	200	220	160	140	120	220	176.66
Total Molluscs	1600	1420	1220	1180	1100	1400	1320
Total Benthic Fauna	2140	2320	2220	3240	3040	2660	2603.33

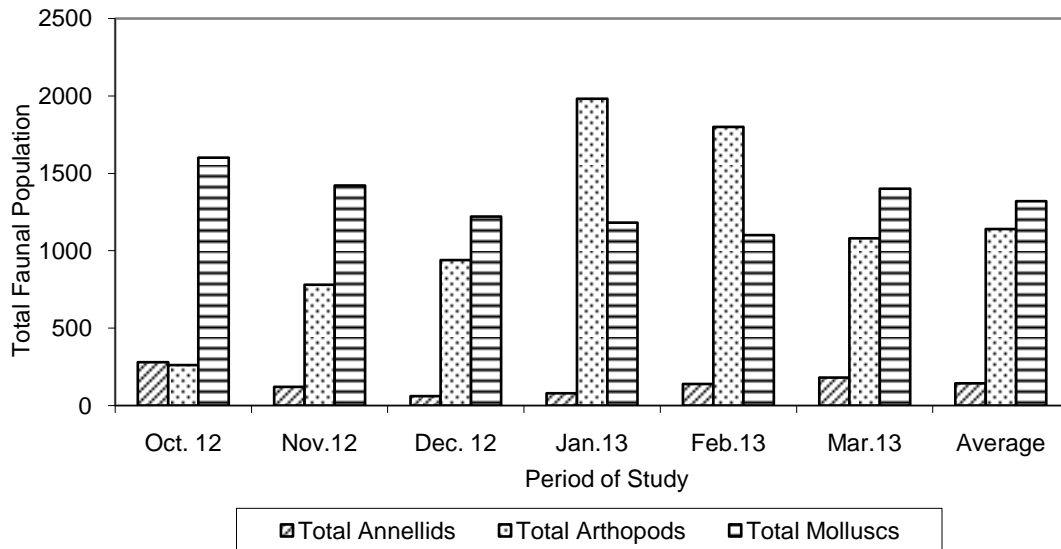


Fig. 1: Total Faunal Population at Pushkar lake, Ajmer

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