The Bioscan 6(1) : 89-92, 2011
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

OCCURRENCE OF MACRO-ZOO BENTHOS IN RELATION TO PHYSICO-CHEMICAL CHARACTERISTICS IN NAGARAM TANK OF WARANGAL, ANDHRA PRADESH

K. NARASIMHA RAMULU, K. SRIKANTH, B. RAVINDAR AND G. BENARJEE*
Fisheries Research Laboratory, Department of Zoology
Kakatiya University - 506 009
E-mail: gbgsss@yahoo.co.in

KEY WORDS
Benthic fauna
Species diversity
Fish production
Physico – chemical parameters

Received on :
28.10.2010

Accepted on :
19.01.2011

***Corresponding author**

ABSTRACT
Physico-chemical characteristics and macro-zoo benthos in the Nagaram tank during the year June 2007 – May 2009 have been studied. Water temperature (18 to 35ºC) of the tank was closely followed the atmospheric temperature (18 to 35ºC).The pH fluctuated between 7.1 and 9. Dissolved oxygen was within the moderate range of 0.25 to 6.90 mg/L. Alkalinity of the tank was also observed within the productive range (119 to 158 mg/L). The high value of alkalinity in the station - II might be due to presence of salts generated through the death and decay of the macrophytes and other aquatic organisms. The conductivity ranged between (119.50 to 600.20 mhos).The macro zoo benthic fauna of this tank belonged to gastropoda represented by 3 species belonging to *Indoplanarbis, Bellanya bengalensis,* (Lamarck), *Thiara tubereulata* (Muller); two species of bivalves belonging to *Lamellidens corrianus* (Lea), *Parreysia, rugossa* (Gmelin). Gastropods contributed 54% of the total zoo macro benthic population. The bivalves were available in lesser abundance compared to the Gastropods (46%).

INTRODUCTION

Macro invertebrates and macro benthic organisms can, therefore, serve as excellent diagnostic indicators for measuring the extent of pollution of aquatic ecosystem. Rich bottom coupled with micro conductive physico-chemical conditions encourage fast colonization of the benthic community. The low number of species and density of benthic life is attributed to low bottom oxygen (Moore, 1942). Welcome (1979) stressed on the combination of factors like temperature, dissolved oxygen, nature of substratum, grazing and predation etc., as major factors for the growth of benthic faunal structures.

The earlier studies on macro benthos have been made by Michael (1968) and Mandal and Moitra (1975). Similar studies were conducted on lakes in and around Hyderabad, Andhra Pradesh (Anitha *et al.,* 2004; 2005 and Rao, 2006). Several investigators have also studied the fresh water benthic community structure (Radheyshyam and Naik, 1990; Habib *et al.,* 1991; Radheyshyam *et al.,* 1993) and their seasonal fluctuations (Murugan *et al.,* 1980; Bazzanti and Seminara, 1985).

The distribution, composition and abundance of benthic community are biological indicators of water and sediment quality and trophic status at the soil – water interface (Pandey *et al.,* 1983, Victor and Onomivbori, 1996; Anthony, 2001). Benthic community plays an important link in the energy flow from primary producers to fish (Olah, 1976).

The aim of this study was to determine the biological richness of the tank with particular emphasis on the relationship between the structure of the macro zoo benthos community and their physico-chemical environments, and thereby to determine the water quality of the Nagaram tank.

MATERIALS AND METHODS

Study area

The study site is situated in Nagaram, Warangal District, Andhra Pradesh. The tank located at 79º34′00′′ W to 79º36′00 EL and 18º4′15′′ S to 18º5′45′′ NL. In order to cover the whole topography of the tank, four sampling sites viz., I, II, III and IV were selected.

The study was conducted during June 2007 to May 2009. Samples from the tank were collected at monthly intervals at fixed sampling stations. Water quality parameters were analysed as per standard methods (APHA, 1975). Soil samples were sorted out in the laboratory with the help of brush and preserved in 5% formalin. For qualitative analysis of macrozoo benthos standard keys were used (Subba Rao, 1989). They were identified following Ward and Whipple (1992), Needham and Needham (1962), Tonapi (1980), Adoni (1985) and Pennak (1989). The identification is based mainly on the shell characters described earlier (Blanford and Godwin-Austen, 1908; Gude, 1914; Preston, 1915; Satyamurthi, 1960).

For quantitative analysis number of benthos per unit area were calculated as follows.

Benthos No. /m^2 = N/AX10^4

Where N = Number of organisms per sample

A = Biting area of sampler (15 x 5 cm)

RESULTS AND DISCUSSION

Physico – chemical parameters

In the present study the water temperature (18 to 35ºC) of the tank was closely fallowed the atmosphere temperature (18 to 35ºC). Bhowmik (1988) reported the minimum temperature in monsoon and maximum in summer respectively. The pH fluctuated between 7.1 and 9 The Dissolved oxygen was within the moderate range of 0.25 to 6.90 mg/L (Kumar 1985). The alkalinity of the tank was observed to be within the productive range (119 to 158 mg/L Table 1). The high value of alkalinity in the station - II was due to presence of salts generated through the death and decay of the macrophytes and other aquatic organisms, (Sugunan *et al.,* 2000). The eco system maintained moderate to high specific conductivity of water (119.50 to 600.20 μmhos) during May, where as comparatively lower values were recorded during October. This is in agreement with the study conducted by Benerjea (1967). All the physico-chemical parameters determined in the Nagaram tank are similar to Tuzen *et al.,* (2002) and Duran *et al.,* (2003).

Macro zoo benthos

Benthic organisms can be used as barometer of overall biodiversity of an aquatic ecosystem. The diversity and seasonal variation in macro-zoo benthic fauna of Nagaram tank have been studied on the basis of the collections obtained from monthly survey for a period of two years (June 2007 to May 2009). The organisms were identified species-wise and their abundance was calculated as number of organisms per square meter following Jhingran *et al.,* (1969). The identification is based mainly on the shell characters as described earlier (Blanford and Godwin-Austen, 1908; Satyamurthi, 1960).

Molluscs

Molluscs exhibited a larger share of the macro benthic fauna in the tank. A composite population of gastropods and bivalves contributed to the molluscan population in the eco system. *Indoplanarbis, Bellanya bengalensis,* (Lamark), *Thiara* (Melonoides) *tubereulata* (Muller) were the representative species of gastropod in the tank. Gastropods contributed 54% (Fig. 3) of the total zoo macro benthic population. *Bellamiya bengalinsis* belongs to family viviparidae was encountered in all the seasons (Table 2). A sizable population of *Indoplanbis exustus* under the family planarbidae was observed to be available. Seasonally these species was more dominant during winter than in summer and rainy seasons. However, the influence of winter environment on the benthic diversity was conspicuous for the tank. Rainy values though not very significance, but were observed to be lower compared to the other seasons. Sugunan (1989). The seasonal variation in the quantum of benthic fauna depends up on the inter play of various environmental factors such as temperature and dissolved oxygen. It is well known that the solubility of dissolved oxygen increased with lowering of the temperature.

Table 1: Analysis of Physico – Chemical parameters of Nagaram Tank

Parameter	Unit	Station - I		Mean	Station - II		Mean	Station - III		Mean	Station - IV		Mean
		Range of Variation		± SD	Range of Variation		± SD	Range of Variation		± SD	Range of Variation		± SD
		Min.	Max.		Min.	Max.		Min.	Max.		Min.	Max.	
Water Temperature	ºC	18	35	25.25 ± 9.75	17.6	34.51	25.91 ± 8.60	17	32.1	25.39 ± 8.39	18	32.5	25.62 ± 7.62
pH	-	7.1	9	8.08 ± 0.98	7.9	8.51	8.13 ± 0.23	7.52	8.3	7.94 ± 0.42	7	8	7.44 ± 0.44
Total Alkalinity	Mgl^{-1}	119	158	125.08 ± 6.08	130	160	139.25 ± 9.25	125	153	133.41 ± 8.41	140	152	148.08 ± 8.08
Free CO_2	Mgl^{-1}	4.09	10.9	7.95 ± 3.86	4.9	11.2	8.46 ± 3.56	4	17.6	8.5 ± 4.5	6.2	18.8	11.21 ± 5.01
Dissolved Oxygen	Mgl^{-1}	0.25	6.9	5.02 ± 4.77	2.5	4.91	3.81 ± 1.31	2	5.23	4.03 ± 2.03	0.25	4.1	2.43 ± 2.18
Biological Oxgyen Demand	Mgl^{-1}	4	12.3	5.34 ± 1.34	0.25	10	7.91 ± 7.66	6.1	10.86	7.9 ± 1.80	9.1	12.3	10.35 ± 1.25
Hardness	Mgl^{-1}	101	214	177.25 ± 76.25	162	227	207.16 ± 45.16	197	250	213.66 ± 16.66	201	350	245.91 ± 44.91
Electric Conductivity	?Scm^{-1}	137	390	296.95 ± 159.95	160	600.1	408.54 ± 248.54	119.5	590	349.58 ± 230.08	117	600.2	416.58 ± 239.58
Total Dissolved Solids	Mgl^{-1}	251	382	304.58 ± 53.58	261	410	327.75 ± 66.75	273	523	366.16 ± 93.16	280	550	387.66 ± 107.66
Chlorides	Mgl^{-1}	102.2	270.2	176.72 ± 74.52	110.25	350	206.32 ± 96.07	108.1	368.5	225 ± 116.00	120	390	228.89 ±108.89

Table 2: Seasonal Quantitative analysis of benthos (No./m²) of Nagaram tank during June 2007 to May 2009

Sl.No.	Species	Rainy Seasonal range	Avg.	Winter Seasonal range	Avg.	Summer Seasonal range	Avg.	Average Density
	Gastropoda							
1	*Indoplanarbis*	11-17	13.25	18-32	24.37	10-20	15.50	18
2	*Bellanya bengalensis*	100-180	146-25	180-255	211.25	110-190	157.5	172
3	*Thiara tuberculata*	07-15	9.75	20-25	19.00	10-22	14.25	14
	Bivalve							
1	*Lamellidens corrianus*	15-25	20.62	130-190	162.12	160-191	180.25	121
2	*Parreysia rugossa*	05-10	7.25	80-90	83.75	80-100	89.37	60

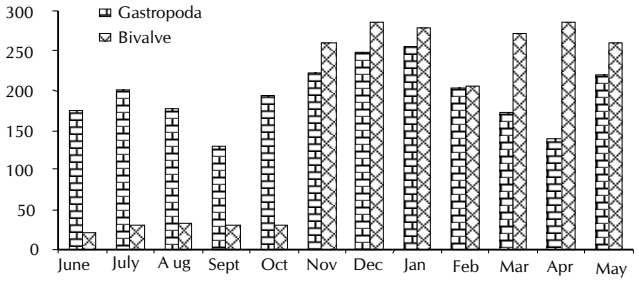

Figure 1: Monthly variation in abundance of Macrozoobenthos in Nagaram Tank during June 2007 – May 2008

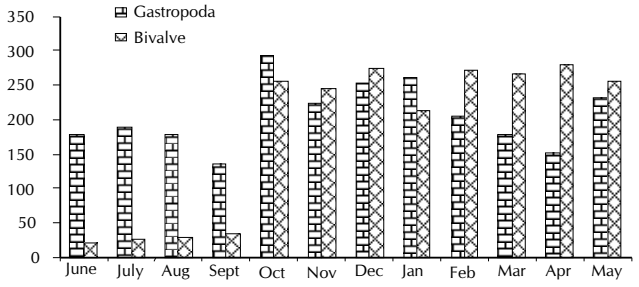

Figure 2: Monthly variation in abundance of Macrozoobenthos in Nagaram Tank during June 2008 – May 2009

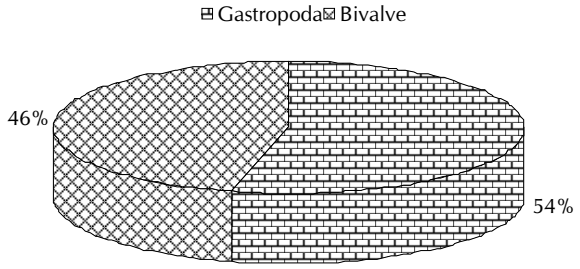

Figure 3: Relative abundance of the Zoo benthos in Nagaram tank during June 2007-May 2009

The present results on Nagaram tank, also supports the same (Mathew, 1978)

Bivalves

The bivalves were available in lesser abundance compared to Gastropods. They exhibited only 46% of the total macrozoobenthic population (Fig. 3). However, it was observed that bivalves were more abundant during summer season. The abundance of *Lamelldens carrianus* and *Parreysia rugosa* were encountered during the entire period of the investigation. Interms of % composition, molluscan gastropods were the dominant group at all the sampling stations, followed by bivalves. Seasonal fluctuations in water column were conspicuous. A mixed and balanced population of diversified fauna constituted the benthic population of investigated ecosystem. The abundance of benthic fauna greatly depends on physico-chemical properties of the substratum (Paul and Nandi, 2003).

The benthic population depicted a bimodal pattern of fluctuation during the period of investigation with two distinct peaks, the primary maxima in winter (October-January) and the secondary maxima in summer (February-May - Figs. 2 and 3). The present findings supports the view of Kaushal and Tyagi (1989) on Gobindsagar reservoir. However, the minimum observed were in rainy season. The period of maximum rainfall adversely affected the abundance of benthic organisms as was evident by their minimum population in rainy season. It could be due to dislodging of the benthic organisms as a result of turbulent inflow of waters. Further, the tank level had an inverse relation with the density of benthos which is similar to the observations of Marshal (1978) and Kaushal (2008). An edaphic factor like inflow and out flow affects the benthos. Fluctuations in population density and species composition become prominent in the tank depending on the existing ecological conditions. Mostly winter exhibits as favourable season for the growth of benthic organisms. Benthos represents an important link in the fish production process.

REFERENCES

Adoni, A. D. 1985. Work book on limnology, Pratibha publishers, C-10, Gour Nagar, Sagar – 470 003, India. 216

APHA, 1975. Standard methods for the examination of water and waste water, 12th Amer. Publ. Hlth. Assoc. Inc., New York.

Anthony, E. O. 2001. Composition and diversity of Diptera in temporary pond in Southern Nigeria. *Tropical Ecology*. **42(2):** 259-268.

Anitha, G., Kodarkar, M. S., Chandrasekhar, S. V. A. and Nalini 2004. Studies on Macrobenthos in Mirala lake, Hyderabad, Andhra Pradesh. *J. Aquatic Biology*. **19:** 61-68.

Anitha, G., Chandrasekhar, S. V. A. and Kodarkar, M. S. 2005. Hydrography in relation to Macro invertebrates in Mir. Alam lake, Hyderabad, Andhra Pradesh *Res. Zool. Surv. India. Occ Paper No.*: **235:** 1-148.

Bazzanti, M. and Seminara, M. 1985. Seasonal changes of the profundal Macrobenthic community in a polluted lake. *Scheweiz, Z. Hydrobiol*. **47:** 57-63.

Benerjea, S. M. 1967. Water quality and soil condition of fish ponds in some states of India in relation to fish production. *Indian J. Fish.* **14(1 and 2):** 115-144.

Bhowmik, M. L. 1988. Enviromental factors affecting fish food in fresh water fisheries, Kalyani, West Bengal, India, Ph.D thesis, (un published) University of Kalyani. p. 238.

Blanford, W. T. and Godwin – Austen, H. H. 1908. Fauna of British India Series, I. (Mollusca – Testacellidae and Zonitidae).

Duran, M., Tuzen, M. and Kayyam, M. 2003. Exploration of biological richness and water quality of stream Kelkit, Tokat region, Turkey. *Fresenius Environ. Bull.* **12(4):** 368-375.

Gude, G. K. 1914. Fauna of British India Series, II (Mollusca – Trochamorphidae Jonellidae).

Habib, M. B., Haque, I. and Ali, M. M. 1991. Multiple regression analysis of some bottom soil properties on the growth of benthos in nursery ponds. *Indian J. Fish.* **38(4):** 237-241.

Jhingran, V. G., Natrarajan, A. V., Benerjee, S. M. and David, A. 1969. Methodology on reservoir fisheries investigation in India. *Central Islands Fisheries Research Institute; Bulletin* No. **12:** 109.

Kaushal, D. K. and Tyagi, A. P. 1989. Observations on the bathymetric distribution of benthos in Gobindsagar reservoir, Himachal Pradesh. *J. Inland Fish. Soc. India.* **21(1):** 241-249.

Kaushal, D. K. 2008. Benthic macro fauna of Pong reservoir, Himachal Pradesh. *J. Inland Fish. Soc. India.* **40(1):** 65-68.

Kumar, K. 1985. Hydrobiological investigations of a fresh water beel with special reference to its fish production. Ph.D Thesis, (unpublished), Bhagalpur University, Bihar, India.

Mandal, B. K. and Moitra, S. K. 1975. Studies on the bottom fauna of fresh water fish pond at Burdwan. *J. Inland, Fish. Soc. India.* ***VII*:** 43-48.

Marshal, B. E. 1978. Aspects of the ecology of bethos fauna in lake MCII waine, Rhodesia. *Fresh water Biol.* **8(3):** 241-249.

Mathew, P. M. 1978. Limnological investigations on the plankton of Govindsagar lake and its correlation with physico-chemical factors. *Proceedings of seminar on Economic Fisheries Fresh water Reservoir.* pp 37-46.

Michael, R. G. 1968. Studies on bottom fauna in a trophical fresh water fish pond. *Hydrobiologia.* **31:** 203 – 230.

Murugan, T., Diuvakaran, O., Nair, N. B. and Padmanabham, K. G. 1980. Distribution and seasonal variation of benthic fauna of Veli Lake, South – West Coast of India. *Indian J. Mar. Sci.* **9:** 184 – 188.

Moore, W. G. 1942. Field Studies on oxygen requirements of freshwater fishes. *Ecology.* **23:** 317 – 324.

Needham, J. G. and Needham, P. R. 1962. Freshwater biology. Holder Day Inc. San. Francisco.

Olah, J. 1976. Energy transoformation by *Tanypus punctipennis Meigh*, (Chironomidae) inlake Balaton. *Annal. Biol. Tihany.* **43:** 88-92.

Pandey, K., Radheyshyam, Prasad, S. and Chaudhury, H. S. 1983. A study on the macrozoo benthos and the physico – chemical characteristics of the bottom of Bakhira lake, Uttarpradesh, *India, Int. Rev. Ges. Hydrobiol.* **68(4):** 591-597.

Paul, S. and Nandi, N. C. 2003. Studies on intertidal macro zoobenthos of hugli river in and around Calcutta in relation to water and soil conditions, Rec. 2001. Surv. India. Oce. Paper No. 213 : 1-135.

Pennak, R. W. 1989. Freshwater invertebrates of the United States (Protozoa – Mollusca) 3rd Edition. A Wiley Inter Science Publication. John Wiley and Sons, Inc. 628.

Preston, H. B. 1915. Fauna of British India Series. (Freshwater Gastropoda and Pelcypoda).

Radheyshyam and Naik, D. R. 1990. Comparative studies on the macrobenthic fauna of a tropical fresh water swamp and newly constructed ponds in swampy area. *J. Aqua. Trop.* **5:** 57-61.

Radheyshyam, Sharma, B. K. Sarkar, S. K. and Satapathy, B. B. 1993. Observations on the dynamics of sediment detritus and macrobenthic fauna as influenced by *Cirrhunus mrigala* (L) and *Labeo rohita* (Ham). In monoculture fish ponds. *The third Indian fisheries forum proceedings, pantnagar*. pp.167-170.

Rao, R. S. 2006. Studies on Benthic macro invertebrates in Banjara lake, Hyderabad, Andhra Pradesh, India. Ph.D. Thesis, Osmania University, Hyderabad.

Satyamurthi, S. T. 1960. The land and Freshwater Molluscs in the collection of the Madras Government Museum. *Bull Madr. Govt. Mus. (Nat. Hist. Series)* **6(4):** 1-174 with 24 plates.

Subba Rao, N. V. 1989. Hand book of freshwater molluscs of India, ZSI. Calcutta, p. 289.

Sugunan, V. V. 1989. Limnological features of *beels* biotic factors**.** Training in management of beel (oxbow lake) fisheries. *Central Inland Fisheries Research Institute Bull. No.* **63:** 128-135.

Sugunan, V. V., Vinei, G. K., Bhattacharya, B. K. and Hassan, M. A. 2000. Ecology and fisheries of *beels* in West Bengal. Bull. No. **103:** Cent. Island Fish. Res. Inst. p.53.

Tonapi, G. T. 1980. Freshwater animals of India (an ecological approach) Oxford and IBH Co., New Delhi, pp.319+XVII.

Tuzen, M., Ayedemir, E. and Sari, H. 2002. Investigation of some physical and chemical parameters on the river Yesilirmak in Tokat region, Turkey. *Fresenius Environ. Bull.* **11(4):** 202-207.

Victor, R. and Onomivbori, O. 1996. The effects of urban pertubations on the benthic macro invertebrates of a *Southern Nigerian Stream*., pp. 223-238. Inf. Schiomer and Biland, K.T. (Eds). *Perspectives in Tropical Limology*. SPB Academic publishing by Amsterdam. The Netherland.

Ward, H. B. and Whipple, G. C. 1992. Freshwater biology (2nd Ed.). Indian reprint, *International Books and Periodically supply Service*, New Delhi. p.1247.

Welcome, R. I. 1979. Fisheries ecology of flood plain rivers, *Longman Ltd.* p. 317.