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Manipulation of Zooplankton as Bio-Indicators of Water Quality at Borna [Chandapur] Dam Near Parli. V. Dist. Beed Maharashtra, India.

KEYWORDS: Borna [Chandapur] Dam, Bio-indicator Zooplankton species, water quality.

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ABSTRACT *The currentintellectdeal with assessment of vital Physico-chemical parameters and Zooplankton diversity correlated with the pollution status of Borna Prakalpa at Chandapur near Parli .v. town Dist. Beed resided between 180 – 51'-0" North latitude and 760 –27'-0" East longitude in Marathwada region [M.S] India [Asian continent]. The work was undertaken to investigate importantwater body near Parli .v. the imperative parameters were analyzed every month during February 2010 –January 2011. For this three different sampling stations were selected at Borna Prakapa as station CH1,CH2,CH3 .The results construed that in the different months showed fluctuations in physicochemical parameters imitate accordingly to the seasons, climate and the pollution load over the scrutinize water body. The present work was correlated with the zooplankton diversity and pollution indicator species used as bio-indicators to assess the water quality of the Borna dam. The Bio- indicator zooplanktonspeciesfrom three (3) stations of the dam were recorded, with the pollution indicator index species listed by IAAB , Bilgami K. S. and Sládecek pollution indicator species. A total of 22 genera were recorded out of 10 Rotifers 8 were Bio- indicaor, from 4 Cladocera 4 were Bio - indicator, out of 6 Copepods 6 were Bio- indicator, and 1 Ostracoda being the Bio- indicator. For knowing the quality of water samples the total score of stations were recorded 19 indicator species out of 22 were found which helped to know the high degree of organic pollution at the Borna dam. The species given by IAAB , Bilgami K. S. and Sládecek pollution indicator index.*

1] Introduction :

Increased interest in ecosystem health and integrity has created a need for new approaches in assessing ecosystem conditions. Traditional ecological indicators have focused on one of three distinct approaches (Landres *et al.*, 1988): detecting the presence and effects of environmental contaminants; tracking population trends of indicator species; and assessing physical habitat quality for species. The considerable success of contaminant biomonitoring programs in identifying and remedying pollution, particularly in aquatic systems, led to an early emphasis on chemical monitoring (Ellis, 1937; Hynes, 1960). An indicator species approach has been popular among biologists concerned with individual sport fisheries (e.g., Edwards *et al.*, 1990) and has also been used commonly in toxicity tests (Warren, 1971). More recently, physical habitat structure has received considerable attention (Platts *et al.*, 1983; Plafkin *et al.*, 1989) as water quality has improved following implementation of the Clean Water Act.

Fresh water zooplankton is an important biological component in aquatic ecosystems, whose main function is to act as a primary and secondary links in the food chain and they play a vital role in energy transfer of aquatic ecosystems (Altaff, 2004). Zooplanktons are the most valuable indicator of tropic status than generally has been realized, since they are larger and easier to identify than phytoplankton (Kovalev, et al., 1999). Zooplanktons can also be used as "bioindicators" for water pollution studies, because their occurance, vitality and responses, change under adverse environmental conditions (Oliver, 1996).

Water is liquid compound and descends from the cloud as rain. It covers 71 percent of the earth's surface in form of rivers, lake and seas (CIA, 2008 and MOFED, 2008) and is useful for life survival and existence of man, all animals and plants. Water is one of the most impotent available substances on the earth. The survival and quality of human life depends up on the availability of fresh water. The aquatic animal's life directly or indirectly depends on water quality status (A.Bajpai, 1993). (A.Mishra et.al.1993).(Sayeshwara,2010).

Maharashtra occupies main portion of the Indian Subcontinent. The geographical location of Maharashtra is bounded between latitude 16.4° to 22.1° N and longitude 72.6° to 80.9° E and has an area of 307.71 thousand sq km, which is about 9.4 percent of the total geographical area of India. In Marathwada region there are many dams on different rivers, but very less attention has been furnished towards presence of Zooplankton indicator species and water pollution. In the present investigation the pollution status of Chandapur Dam on Dhobighat river near Parli Vaijnath in Beed district of Marathwada region in Maharashtra State were checked with the help of Standard list of Zooplankton pollution indicator species list given by IAAB , Bilgami K. S. and Sládecek pollution indicator index.

1.1] Need behind the aspiration

- To provide the data of qualitative, quantitative abundance of zooplankton highlighting Bio -indicator species as the base for further research, control of pollution and rehabilitation.
- This work is one step in the direction to minimize the Problem of water pollution due to domestic, industrial and agricultural activity.
- To help for the solution of pollution from end to end with Gram Panchyat Chandapur and 12 other villages and Municipal Corporation at parli v, Irrigation Dept. , Pollution control board, Govt. Officials and NGO's etc.

1.2] Need behind this work.

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- ❖ The present water body is important in parli region but no attention has been given to it.
- ❖ The main cause behind this work is to focus on pollution status and inhibit the all domestic

  activities to reinstate the usual status of this Borna Prakalpa or Chandapur Dam .
- ❖ This work may be a little effort to focus and minimize Pollution stress on this Dam.

2] Materials and Methods

The influence of pollution on the abundance of major zooplanktons like Rotifera, Cladocera and Copepod were investigated at polluted and non polluted regions at Chandapur near Parli v. The water samples were collected for physicochemical analysis from 3 stations CH_1,CH_2,CH_3 of Chandapur dam for one year (Feb 2010 to Jan 2011).

The water samples were collected in the acid washed five-liter plastic containers, at early Morning 10 a.m to 12 a.m in the fourth week of every month. Separate samples were collected for DO in 250 ml. BOD bottles. The Physico-chemical variations of dam water like DO, Temperature,

pH , conductivity and total hardness were recorded. DO was fixed at the stations itself water and air temperatures were recorded with thermometer; pH was examined with the help digital pH meter in laboratory. The conductivity was recorded with the help of digital conductivity meter. The standard methods used for water analysis were according to APHA (1998) in the Laboratory/ Dept. of Zoology at Late. Laxmibai Deshmukh Mahila College Parli.V.Dist Beed .The subsurface water was sieved through plankton net no.25 and was transferred to 200 ml plastic containers for preservation in 4% formalin solution. The formalin fixed plankton samples were centrifuged at 1500 to 2000 rpm for 8-12 min. The zooplanktons were settled at bottom, the upper water was siphoned out and diluted to concentration in such a way that they could be easily counted individually under compound binocular microscope and zooplanktons were measured and multiplied with dilution factors using Sedgwick rafter cell Edmonson, (1963) ,Battish (1992) and APHA (2005).

Species diversity index was obtained by following Shannon Weaver methodology (Nath, 1997).After further taxonomic investigations' the pollution tolerant genera and species were recorded from three (3), stations of one dam. The Zooplankton samples were collected every month at the present dam from 3 different sampling stations. For one year from Feb 2010 to Jan 2011. The analysis was done with the help of Sedgwick's rafter cell. The supernant water was siphoned out and the settled planktons were enumerated by 'Sedgwick-Rafter Cell' method. Identification of zooplanktons species was performed under microscope by using keys and monographs of IAAB, Bilgami K. S. and Sládecek pollution indicator index ,standard References; Pennak (1978) and Adoni *et al*. (1985). The pollution indicator species were identified according to the standard list of pollution tolerant zooplankton index by IAAB , Bilgami K. S. and Sládecek pollution indicator index.

Table no.1 Details of Borna[Chandapur] Prakalpa near Parli v.Town .

Name of Prakalpa	Borna Prakalpa/Chandapur Dam
Geographical coordination	**18⁰_51'-0"** North latitude and **76⁰_27'-0"** East longitude.
River impounded.	Dhobi ghat
Type of Dam	Earthen type
Year of Construction.	1969
Catchment area	22.53 sq.kms
Submergence area	71.28 hectors
Length of dam [Length of earthen wall]	258 meters
Height of Dam[Height of earthen wall]	23.90 meters.
Reservoir irrigated area	----------
Gross storage capacity	3.01 million Cubic meters.
The average rain fall	676 mm
Distance from Parli v. Town	5 kms away from East direction.
Water supplied for Drinking to	12 Nearby villages.

Table no.2 Physicochemical data of Borna Dam Near Parli V. Dist.Beed. Feb 2010-Jan 2011

Months/ Parameters	Jan 2011	Feb 2010	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec 2010
Atm. Temp.	23	25	29	34	36	34	30	28	27	29	25	20
Water temp.	18	20	24	29	30.5	32	25.4	23	22	21	18.5	16
PH	8	8.12	8.33	8.52	8.61	8.4	8.3	8.21	7.99	7.64	7.43	7.25
Conductivity	910	1100	1245	1478	1677	1890	2109	2132	1854	1643	1276	1080
D. Oxygen	9.1	8.4	7.30	6.5	6.3	6.8	7.01	7.8	8.3	8.55	8.7	8.9
T.Hardness	144	108	100	96	90	116	118	120	124	128	134	138

Table no.3 Mean Seasonal data of Borna dam near Parli V. Dist.Beed. Feb 2010-Jan 2011

Sr.No	Parameters	Summer[mean values]	Monsoon[mean values]	Winter[mean values].
1	Air temperature	31°C	29.75 °C	24.25 °C
2	Wat.Temperature	25.87 °C	25.6 °C	18.37 °C
3	PH	8.4	8.22	7.64
4	Conductivity	1375	1996.25	1227.25

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5	D.Oxygen	7.12	7.47	8.81
6	Total hardness	98.5	119.5	136

Table no.4 Zooplankton groups recorded with their respective genera Borna Prakalpa at Chandapur during Feb 2010 to Jan 2011.

1)Rotifera(10 genera) i) *Brachionus sp.*[5diff species] ii) *Cephalodella sp.* iii) *Trichocerca sp.* iv) *Keratella sp.[2]* v) *Anuraeopsis fissa*	**Frequency** +++++ xxxx – – – +++++ ---	**2) Cladocera (4 genera)** i) *Daphnia sp.* ii) *Bosmania sp.* iii) *cerodaphnia sp.* iv) *Chydorous sp* v)*Moina Sp.,*	**Frequency** +++++ xxxx xxxx 00 +++++
3) Copepoda (6 genera) i) *Cyclops sp.* ii) *Diaptomous sp.* iii) *Eucyclops sp.* *iv) Mesocyclops sp.* v) *Microcyclops sp* *vi) Macrocyclops sp.*	**Frequency** +++++ – – – xxxx xxxx xxxx 00 +++++	**4) Ostracoda (1 genera)** *i) Cypris sp.*	**Frequency** xxxx

frequency symbols 1] Abundant= +++++ 2] Moderate= xxxx 3] Frequent= 00 4]Rare= ---

Table no. 5 [a,b,c,d]:- Bio - indicator Zooplankton species from different groups at Borna Prakalpa Chandapur Dam During Feb 2010 to Jan 2011 Table no.5a

Sr.No	**Rotifera[10]**	Potency Bio - indication
1	Anuraeopsis fissa	*
2	Brachinous calciflorus	****$ b+xx
3	Brachinous calciflorus.b	****$ b+xx
4	*Brachinous* quadridentata	***$
5	Brachinous angularis	***$
6	Kartella sp.	**
7	Kartella quadranta .sp	**
8	Brachionus havanaensis	***$
9	Trichocerca	**
10	Caphalodella.	%

Table no.5b

Sr.no	Cladocera [4]	Potency Bio -indication
1	Chydorous Species	**#
2	Bosmina. Sp	**a+
3	Cerodaphnia sp.	#
4	Daphnia sp.	**

Table no.5c

Sr.No	Copepoda[6]	Potency Bio indication
1	Diaptomus Sp	***
2	Cyclops Sp.,	*xx
3	Mesocyclops Sp.	***
4	Microcyclops Sp.	***
5	Macrocyclops sp.	*
6	Eucyclops sp	*

Bio-indication Potency :- 1] Nil pollution status *
2] Mild pollution status **
3]Moderate Pollution status *** 4
] High Pollution status ****
5] Acid stress indicator a+
6] Euthrophication indicator #
7] Thermal stress indicator $
8] Heavy metal stress indicator xx
9] Alkaline stress indicator b+
10] Sludge and Detrioration indicator %

Table no.5[d]

Ostracoda	Potency Bio -indication
Cypris	***

Result and Discussion

The zooplanktons from major link in the energy transfer at secondary level in aquatic biotopes. The occupy an intermediate position in aquatic food webs between autotrophs and heterotrophs. The distribution and diversity of zooplankton in aquatic ecosystems terms depends mainly on the physico-chemical proportion of water. Pollution of water bodies by different sources will result in drastic changes in zooplankton potential of the ecosystem. Zooplanktons are known to accumulate chemicals by direct absorption from water and through food intake.

Zooplankton constitutes the food source of organisms. It plays an important role in aquaculture, including being an indicator that determines water quality, pollution, and the state of eutrophication (SALER, 2009).

The present work was undertaken to study the pollution status of the Borna [Chandapur] Dam with zooplankton diversity. This dam water is used for drinking purpose of by 13 nearby village residents. After recording the zooplanktons for one year pollution statuses during the present work total of 22 genera of zooplankton were recorded the groups with the genera composition are as Rotifera (10 genera- 8 pollution indicator) Cladocera (4genera -4poll.ind), Copepoda (6 genera- 6 poll.ind) and Ostracoda (1genera- 1 poll.ind).Out of 22 found genera 19 were pollution indicator . From this it becomes clear that Borna[Chandapur] Dam is Polluted due to different domestic, agricultural and industrial activities as the water of Dhobi ghat river is saddened to construct the Dam for wellbeing of the people nearby Parli v. of Beed District of

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Maharashtra India.

For understanding the health of water bodies, zooplanktons are useful as these are very sensitive to pollutants and as they act as bio indicator of water bodies. The utility of zooplankton in accessing the water quality at population level was done by several workers The role of zooplankton in assessing water quality at population level had been reported by (Trivedi, 2000); Reddy (2002); (Altaf and Muthupriya, 2002); (Hiware and Ugale, 2003); (Sharma, 2004); (Raut et al., 2006); (Pandit et al., 2007); (Bhagat and Meshram, 2007); (Patil et al., 2008); (Mulani et al., 2009); (Rajgopal et al., 2010); (Verma et al., 2011) (Rankhamb and Raut, 2012); (Sivalingam et al., 2013); (Shailendra Sharma et, al. 2013) .

In the present investigation in biotic assemblages bioindicators from rotifers were recorded in the bulk other groups were as Cladocera, Copepoda and Ostracoda were recorded as in table no. 4 and 5[a,b,c,d.]which indicates that the Borna or Chandapur Dam At Chandapur is moderately polluted with 19 pollution indicator species from standard pollution indicator index. After outcome the results of the polluted status of the present water body Municipal Corporation, Maharashtra Pollution Control board, and NGO's can use this data for further action.

Physicochemical parameters

Water pollution is a phenomenon that is characterized by the deterioration of its quality as a result of various human activities. Rapid industrialization and indiscriminate use of chemical fertilizers and pesticides in agriculture are causing heavy and varied pollution in aquatic environment leading to deterioration of water quality and hence depletion of aquatic biota (Khan et al., 2012). Surface water quality depends not only on natural processes like precipitation inputs, erosion, and weathering of crustal material, etc., but also on anthropogenic influences like urban, industrial, and agricultural activities (Ravikumar et al., 2013). Therefore, scientific study needs to review strategies for conservation and better utilization of lakes (Nikitaraj, 2012).

1 and 2] Air and WaterTemperature.

In the present investigation maximum air temperature value recorded in Summer was 36^0 c in May with seasonal mean value as 31°C and minimum temperature value recorded in winter in October was 20 ^{0} c in December with seasonal mean temperature value as 24.25^0 C.

In the present investigation maximum water temperature value recorded in Summer was 30.5^0 c in May with seasonal mean value as 25.87 ^{0}C and minimum water temperature value recorded in winter in was 16 ^{0} c in December with seasonal mean water temperature value as 24.25 °C. Maximum values of air and water temperatures were recordedin summer and minimum values of temperature were recorded in winter Similar types results were attributed by few workers at different water bodies are as ., Mahajan C.L.,Singh J.J.,(1973). Trivedi, (2000); Reddy (2002); (Altaf and Muthupriya, 2002); Hiware and Ugale, (2003); Sharma, (2004); Pawar S, (2005) ., (Raut et al., 2006); Salve (2006)., Pandit et al., (2007); Bhagat and Meshram, (2007); Patil et al., (2008); Mulani et al., (2009); Dirican., (2009). Rajgopal et al., (2010); Sanyogita (2011) ., Verma et al., (2011) ., Shinde (2011)., Rankhamb and Raut, (2012); Sivalingam et al., (2013).

3] P^H

In the present investigation maximum pH value recorded in Summer was 8.61 with seasonal mean value as 8.4 and minimum pH value recorded in winter in October was 7.25 with seasonal mean value as7.64 . Similar types results were attributed by Mahajan C.L.,Singh J.J.,(1973). Trivedi, (2000); Reddy (2002); Altaf and Muthupriya, (2002); Hiware and Ugale, (2003); Raut et al., (2006); Pandit et al., (2007); Bhagat and Meshram, (2007); Patil et al., (2008); Verma et al., 2011)., Rankhamb and Raut, (2012).

4]Conductivity

In the present investigation maximum conductivity recorded in Monsoon was 2132 µm in August 2010 with seasonal mean value was 1996.25 µm value and minimum conductivity recorded in winter in December was 1080 µm with seasonal mean value 1227.25 µm. Electric conductivity showed high significant positive relationship with water temperature. Similar types of results were recorded by few workers as ., Rajgopal et al., (2010); Sanyogita (2011) ., Verma et al., (2011) ., Shinde (2011)., Sivalingam et al., (2013).

5] Dissolved oxygen:

Dissolved oxygen (DO) is one of the most important and limiting parameter of water quality assessment which maintains aquatic life. It regulates the metabolic processes of aquatic organisms. In the present investigation maximum D.O value recorded in winter was 9.1 mg/l in Jan.2011with easonal mean 8.81 mg/l as and minimum D.O value recorded in summer in May was 6.3 mg/l with seasonal mean value 7.12 mg/l.as7.64 . Similar types results were attributed by Lower DO in summer may be due to high temperature and low solubility of oxygen in water consequently affecting the BOD Singh et al., (1991). With the progress of winter, DO increased to its highest value which may be due to circulation by cooling and draw down of DO in water Hunnan, (1979).

6] Total Hardness

Water hardness is commonly defined as the sum of the polyvalent cat ions dissolved inwater. The most common cat ions are calcium and magnesium; although iron and manganese may contribute.

In present investigation maximum T.hardness value recorded in winter was 144 mg/l in Jan. 2011with seasonal mean 136 mg/l as and minimum T.hardness value recorded in summer in May was 90mg/l with seasonal mean value 98.5 mg/l. In the present work Maximum values of TH were recorded in winter and minimum were recordedin summer. Salve and Hiwre (2006), S.E Shinde *et.al* 2011) reported that TH high in winter low in summer and monsoon season.

Conclusion :-

After the present investigation it is very clear that 1] The present water body is polluted as from the zooplankton analysis out of 22 recorded species 19 are Bio- indicator.2] Different zooplankton pollution indicator species groups from Cladocera,

copepod and Ostracoda were found as shown in table no. 5[a,b,c,d]it points to polluted condition of Borna Dam at Chandapur. 3] This Borna Dam at Chandapur shows domination of rotifers which can be attributed with the high degree of pollution.

4] The zooplankton found in, high pollution stress, acid stess ,heavy metal stress, euthrophication stress, thermal

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stress, alkaline stress conditions etc clearly indicates that water body shows moderately polluted condition.

Recommendations

[1] The domestic activities around the reservoir must be prohibited to minimize the pollution load.

2] Municipal corporation can have facilities there Creation Park with Ornamental plants, Fish Aquarium house, boating facility, swimming pool etc.

3] There must be separate system run by Municipal Corporation for the management of Borna Dam at Chandapur as the water from dam is supplied to 13 nearby villages.

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