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POPULATION DYNAMICS AND SPECIES DIVERSITY OF PLANKTON IN RELATION TOHYDROBIOLOGICAL CHARACTERISTICS FROM MORNA DAM OF SANGLI DISTRICT

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ABSTRACT

River Morna is a tributary of river Warna in Krishna Basin. The water from the dam is utilised for irrigation, generation of electricity, drinking, aquaculture practices and recreation purposes. The present study companies with limnological parameters, plankton diversity and survey of resident fish species. The plankton and bird species are best biological parameters of water and enviromental quality and assecement of conservation value of any habitat. The complied data needs to be further strengthened for improving strategies that insure stability and sustainability of study area.

KEYWORDS: Hydrobiology, Morna dam, Sangli district.

INTRODUCTION

Water has unique property of dissolving and carrying suspension, a huge variety of chemicals has undesirable consequence that water can easily become contaminated. (Jindal and Singh, 2006; Jindal *et al*., 2010; Jindal and Sharma, 2011b) Water is the most important natural resource for the survival of human as well as plants. It is becoming scarce due to rapid population growth, urbanization and industrialization. Ward and Whipple (1959), Kudo (1986) and Pennak (1989).

In order to combat this scarcity condition, careful management of water resources is essential. Rainfall is the most important source of replenishment of ground water and surface water sources. (Singh and Ahluwalia, 2013, Thakur *et al.,* 2013).

Dams are major part of freshwater resources. Analysis of physico-chemical parameters of water are essential, to assess the quality of water (Saravanakumar *et al*., 2008).

A fresh water ecosystem is one of the most threatened ecosystems on earth and for the conservation of freshwater ecosystem a meaningful database is essential. The water resources store rain water received from adjoining catchment area during rainy season. The stored water is utilized for drinking, irrigation and fresh water aquaculture and also for industrial use.(Chopra *et al.,* 1990)

MATERIAL AND METHODS

The two sites of Morna dam from Sangli District were selected for the present study. During the investigation monthly collection of water sample was done at the two sampling sites. The first site (S1) is situated on the water collecting channels near the entrance of the reservoir. Second site (S2) lies near the dam line.

The Morna dam is an irrigation project on river Morna in Shirala Tehsil. River Morna is a tributary of river Warna in Krishna Basin. This reservoir is historical, ethno-cultural, and religious and irrigation important. It lies one Km West of Shirala. The reservoir occupies an area of about 85.5Km2 and has an irregular octagonal outline. Actual length is 1015m. Height 31.2m and nature is shallow and deep with original Catchment area of 85.5 sq.km. The capacity of lake at flood reserve level is 20-74 cu.m. The capacity of live storage is 16-53 Mcu.m. The capacity of dead storage is 4-21 Mcu.m.

The study area was visited regularly from November 2020 to october 2021. Water samples were collected in air tight prepolythene containers of 10 litre capacity from the two sites of each reservoir. The water sampling was carried out between 9.00 am to 12.00 noon every month and brought to the laboratory. The water samples were analyzed for various physico-chemical parameters such as temperature, pH, dissolved oxygen, carbon dioxide, total hardness, total dissolved solids, biological oxygen demand, Chemical oxygen demand, hydrogen sulphide, nitrogen, phosphates, potassium, planktons and bird were identified by standard methods as described by (More and Nandan, 2000; Nandan and Aher, 2005; Tas and Gonulal, 2007). Plankton samples were collected with plankton net and preserved by using 0.5 ml of formalin in 50 ml sample collected after filtration of 50 liters of water.

The objective of the present study is to study water quality, plankton and fish diversity of Morna dam. The main purpose of reservoir is to supply water for drinking, domestic purpose and irrigation as well as fishing practices.

RESULTS AND DISCUSSION

Physico-Chemical Parameters: The physico-chemical property of water clearly explains its geological profile, soil water interstices, pollution status as well as human and animal health problems and important to maintain the aquaculture practices. The various parameters analysed during the present work are discussed and correlated with relevant references. They are depicted in table.1.

Temperature: The all metabolic and physiological activities and life processes such as feeding, reproduction, movement and distribution of aquatic organisms are greatly influenced by water temperature. It varied at different sampling sites depending up on their locations and exposure to the sun. Morna reservoir shows average water temperature range between 18.50 ^{0}C to 30.70 ^{0}C from November 2020 to October 2021. The temperature of reservoir shows monthly variation. It varied at different sampling sites depending up on their locations, season and exposure to the sun. The high water temperature values in April and May and low values in June and july is a normal feature of the reservoirs.

Many workers have given different range of temperature of water and air for various water bodies in Maharashtra. It has recorded temperature range between 21.03^{0}C to 30.4 ^{0}C for reservoirs of North district of West Bengal.(Rai, 1978).

The high temperature during summer is due to clear atmosphere, greater solar radiation and low water level. The fluctuation in water temperature had relationship with air temperature which shows positive correlation with air temperature and negative correlation with dissolved oxygen, pointed out that fluctuation in temperature was dependent on the types and concentration of polluted matter, especially during summer.

pH: pH of Morna reservoir was recorded at the two sampling sites S1, S2, (table. 1 to 4). Morna reservoir shows average pH range between 6.10 to 7.80 from November 2020 to October 2021. The above pH range is used for fish culture. The present water bodies shows pH within ICMR standard (6.5-8.5) and ISI standard (6.5-9.2). pH increases due to consumption of oxygen and rapid release of carbon dioxide by aquatic animals. In biological

activity hydrolysis of carbonates must have occurred forming hydroxide leading to increase in pH.

Electrical conductivity: During the present investigation electrical conductance of the Morna reservoir was measured at two sampling sites S1, S2, (table. 1 to 4). Results show average range of electrical conductance between 0.10 µmhos to 0.20 µmhos from November 2020 to October 2021. However lowest values were recorded during winter season as compared to rainy and summer season. In the present study maximum EC was recorded in summer which may be due to fast evaporation of water and minimum EC was recorded in winter indicating dilution of water due to monsoon rain. The present values of electrical conductance indicate that water is suitable for drinking as well as aquaculture practices.

Dissolved Oxygen: The dissolved oxygen is the most important environmental factor influencing the health condition of aquatic ecosystem. It is the prime necessity for aquatic organisms. In the present investigation dissolved oxygen of Morna reservoir was recorded at two sampling sites S1, S2, (Table. 1 to 4). Results show average range of dissolved oxygen was between 2.90 mg/L to 9.08 mg/L for November 2020 to October 2021.

The 6 mg/L to 9 mg/L range of DO is supported for potability and aquaculture. The presence of oxygen demanding pollutants (like organic wastes) cause rapid depletion of dissolved oxygen from water. Dissolved oxygen shows inverse relationship with BOD and temperature.

Free Carbon dioxide: Free CO2 of Morna reservoir was recorded at two sampling sites S1, S2, and results are summarized in (table. 1 to 4). Results shows average range of free CO2 between 5.90 mg/L to 11.60 mg/L from November 2020 to October 2021.

The lower values of free CO2 observed during rainy and winter season is due to complete utilization of free CO2 by the phytoplanktons. The inverse relationship of dissolved oxygen and free CO2 was observed. Similar results were reported by (More and Nandan, 2000; Nandan and Aher, 2005; Tas and Gonulal, 2007).

Hardness of Water: Hardness is a property of water which prevents a foam formation with soap and increases the boiling point of water. The maximum permissible limit for total hardness in water according to WHO standard is 500 mg/L. Total hardness of Morna reservoir was recorded at the two sampling sites S1, S2, (table. 1 to 4). Results show average range of total hardness between 50.10 mg/L to 95.80 mg/L from November 2020 to October

2021. Hardness shows direct relationship with temperature, electrical conductivity and transparency.

Calcium and Magnesium: The calcium is one of the major ions of fresh water and is an absolute requirement for algae and plants. It regulates various physiological functions. Calcium of Morna reservoir was recorded at the two sampling sites S1, S2, (table. 1 to 4). Results shows average the range of calcium between 7.40 mg/L to 20.80 mg/L and magnesium between 5.60 mg/L to 14.90 mg/L from November 2020 to October 2021. The desirable limit of calcium and magnesium for drinking water are 75 mg/L and 30 mg/L respectively.

Total Solids: Total solids are the measure of the all kinds of solids (suspended, dissolved, volatile etc.) in water. Total solids of Morna reservoir was recorded at the two sampling sites S1, S2, (table.1 to 4). Results show average range of total solids between 980 mg /L to 3554mg /L, total dissolved solids between 310 mg /L to 1632 mg /L, total suspended solids between 362 mg /L to 1439 mg /L from November 2020 to October 2021.

Chlorides: Chloride occurs naturally in all types of water. In natural fresh water however its concentration remains quite low. It's very high concentration gives a salty taste to the water. It's lower concentration during rainy season is mainly due to dilution by rapid inflow of water. The present investigation chlorides of Morna reservoir were recorded at the two sampling sites S1, S2 (Table. 1 to 4). Results show average range of chlorides between 20.20 mg/L to 37.40 mg/L from November 2020 to October 2021. The potable water may contain small quantity of chloride without any harmful effects. The acceptable range for chloride is 200-600 mg/L.

The chloride level is directly related with the pollution level. The maximum values of chloride were recorded during summer season because of scanty rain, high rate of evaporation. It has significant positive correlation with water temperature and electrical conductance. It was also observed that high level of chloride is an indication of higher degree of pollution and low level chloride content indicates absence of any substantial pollution.

Hydrogen Sulphide: Hydrogen sulphide of Morna reservoir was recorded at the sampling sites S1, S2 (Table No.1 to 4). Results show average range of hydrogen sulphide between1.45mg/L to 5.55 mg/L from November 2020 to October 2021. Hydrogen sulphide is

inversely proportional to dissolved oxygen. It may be due to the decreased DO level, which might have led to reduction of sulphates to hydrogen sulphide to increase its concentration by sulphur bacteria.

Acidity: APHA regards acidity of water as it's quantitative capacity to react with strong bases to a designated pH. Acidity of Morna reservoir was recorded at three sampling sites S1, S2 (Table. 1 to 4). Results show average range of acidity from 2.60 mg/L to 36.40 mg/L from November 2020 to October 2021.

Total Alkalinity: Total alkalinity of Morna reservoir was recorded at the sampling sites S1, S2 (Table.1 to 4). Results show average range of total alkalinity between 24.46 mg/L to 88.22 mg/L from November 2020 to October 2021. Kar *et al.* (1987) has reported alkalinity ranging from 78 to 230 mg/L in river Godavari.

Biological oxygen demand: The BOD test is widely used to determine the degree of pollution. Biological oxygen demand of Morna reservoir was measured at the sampling sites S1, S2 (Table. 1 to 4). Results show average range of biological oxygen demand between 6.20 mg /L to 26.34 mg /L from November 2020 to October 2021. The BOD values shows negative relationship with dissolved oxygen similar relationship has also been reported by (Davis, 1995, Kumar, 1997; Mukhopadhysay *et al*., 2000; Jindal and Singh, 2006).

Chemical oxygen demand: Chemical oxygen demand of Morna reservoir was measured at sampling sites S1, S2 (Table. 1 to 4). Results show average range of chemical oxygen demand between 5.32 mg /L to 20.60 mg /L from November 2020 to October 2021. Similar findings are recorded by (Jindal and Vasisht, 1981; Gurumayum *et al.*, 2002).

Nitrate: The high amount of nitrates as pollution indicator. It's average high values could be attributed anthropiogenic activities. Nitrate values of Morna reservoir was measured at two sampling sites S1, S2 (Table. 1 to 4). Results show average range of nitrate between 9.80 mg /L to 20.40 mg /L November 2020 to October 2021. In the present study lower values of nitrate recorded in rainy season and higher in summer season. The tolerance limit of nitrates in drinking water source is 45 mg /L. The determination of nitrate in drinking water is of prime importance because the excessive nitrate indicates high degree of organic pollution and leads to cyanosis in infants and methamoglobonemia, (blue baby syndrome), gastric cancer. Research conducted by British nutrition foundation and cancer research campaign in UK

have shown the direct relationship between high incidences of stomach cancer and the prolonged intake of nitrate rich drinking water. (More and Nandan, 2000; Nandan and Aher, 2005; Tas and Gonulal, 2007).

Phosphate: In fresh water phosphorus is present in very small quantities. Phosphate level of Morna reservoir was measured at the two sampling sites S1, S2 (Table. 1 to 4). Results show average range of phosphate level between 0.013 mg /L to 0.037 mg /L from November 2020 to October 2021. The values recorded in the present investigation in were closely corroborated with findings of earlier workers.

Sodium and Potassium: These sodium and potassium were estimated by flame photometer. Sodium values were measured at two sampling sites of Morna dam S1, S2 (Table.1 to 4). Results show average range of sodium between 8.10 mg/L to 15.90 mg/L from November 2020 to October 2021 has given range of 16.17 mg/L to 23.00 mg/L range of sodium values at Upper lake water in Bhopal. Potassium level of Morna dam was measured at two sampling sites S1, S2 (Table. 1 to 4). Results show average range of potassium between 0.84 mg/L to 3.70 mg/L from November 2020 to October 2021.

Table 1: Physico- Chemical Parameters of Morna dam from November 2020 to October 2021.

Month and Parameters	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	Jun 2021	July 2021	Aug 2021	Sep 2021	Oct 2021
Temperature	26.4	28.3	25.7	24.54	29.30	28.35	30.02	21.3	18.70	26.30	30.4	26.40
pH	6.20	6.40	6.30	7.40	6.40	7.30	7.80	6.70	7.20	6.90	7.10	7.50
E.C.	0.12	0.14	0.10	0.10	0.18	0.19	0.17	0.14	0.18	0.20	0.16	0.14
Dissolved Oxygen	3.20	2.90	3.70	5.70	8.40	5.50	8.40	6.80	7.20	9.08	5.30	7.40
Free CO2	6.30	6.20	5.90	7.40	8.90	6.30	9.50	10.30	11.60	8.30	7.50	10.50
Total Hardness	60.40	66.48	55.30	50.10	70.40	85.40	70.45	80.50	90.50	95.80	75.40	80.40
Calcium	7.50	8.50	7.40	8.90	12.30	16.40	18.30	20.80	16.50	18.40	14.20	12.30
Magnesium	5.90	5.60	7.80	8.60	9.50	10.30	12.30	13.40	14.90	11.40	6.70	9.50
Total Solids	1112	1456	1837	2350	3500	3200	3554	2800	2490	980	1290	1110
Total Dissolved Solids	560	730	950	1439	1260	1360	1146	856	978	362	490	980
Chloride	24.50	22.50	20.20	26.60	30.40	36.60	32.30	22.40	30.78	37.40	28.80	27.80
Hydrogen Sulphide	2.40	2.80	1.70	1.45	2.70	3.80	3.60	4.80	5.55	5.30	4.90	3.70
Acidity	5.70	4.80	2.60	7.90	16.90	27.80	32.40	35.90	25.90	34.90	36.40	26.90
Alkalinity	28.30	24.46	30.50	44.80	50.30	68.90	88.22	80.34	72.90	66.30	30.90	45.70
BOD	10.78	8.90	12.90	6.20	16.90	22.80	23.70	26.34	24.90	12.90	10.30	12.50
COD	8.30	11.60	14.60	5.32	6.40	9.50	17.80	15.50	20.60	9.30	12.50	14.80
Sodium	11.30	12.60	9.30	8.10	13.30	12.80	13.85	14.90	15.90	12.20	11.50	10.20

Potassium	1.46	2.20	2.60	1.30	0.84	0.98	2.30	1.90	2.20	2.90	3.70	3.10
Nitrate	9.90	9.80	11.50	10.90	12.30	14.90	16.90	17.60	18.90	19.40	20.40	18.80
Phosphate	0.019	0.013	0.021	0.019	0.027	0.028	0.030	0.029	0.035	0.020	0.034	0.037

Phytoplankton: The phytoplankton community on which whole aquatic population depends is largely influenced by the interaction of number of physico-chemical factors.

The phytoplankton members represent the families viz. Chlorophyceae, Cyanophyceae, Bacillariophyceae and Dinophyceae. The Chlorophyceae members are found to be dominant through out the study period.

Table 2: Diversity of phytoplankton in Morna dam.

Sr.no.	Phytoplankton recorded	Sr.no	Phytoplankton recorded
1	*Sperocystis spp.*	12	*Pediastrum biradiatum*
2	*Pediastrum duplex*	13	*Cosmarium tetraphtalmun*
3	*Zygnema spp.*	14	*Pediastrum simplex*
4	*Dictyosphaerium pulchellum*	15	*Dinobryon sociale*
5	*Chlorella ellipsoidae*	16	*Scenedesmus quadricauda*
6	*Chlorococcum hunicola*	17	*Ankistrodesmus spiralis*
7	*Chlorella vulgaris*	18	*Ceratium cornutum*
8	*Ankistrodesmus falcatus*	19	*Tetraspora gelatinosa*
9	*Asterococcus superbus*	20	*Haematococcus lacustris*
10	*Spirogyra spp.*	21	*Anabaena spp*
11	*Cosmarium depressum*	22	*Melosira granulata*

Table 3: Diversity of fishes in Morna dam.

Sr.no	Local name	Scientific name
1	Rohu	*Labeo rohita*
2	Catla	*Catla catla*
3	Mrigal	*Cirrhinus mrigala*
4	Cyprinus	*Cyprinus carpio*
5	Silver carp	*Hypoplithalimichthys molitrix*
6	Tambir	*Labeo fimbricatus*
7	Kanas	*Labeo calbasu*
8	Khaprya	*Ompok bimaculatus*
9	Putia	*Glossogbius girris*
10	Dokrya	*Chana gachua*

Diversity of phytoplankton in Morna dam

Sperocystis spp.

Zygnema

Cosmarium depressum

CONCLUSION

The physico-chemical properties of Morna dam were within tolerance limits, no excessive values were recorded during the study period. Hence water is suitable for irrigation, power generation and for drinking purpose after purification. The present study also shows rich diversity of phytoplankton and fishes in the vicinity of reservoir.

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