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Biodiversity of Kanher dam of Satara district MS, India

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Abstract

River Venna is a tributary of Krishna river and has its orgin in nearMahabaleshwar. It runs a distance 45 km before meets with river Krishna near Satara on which Kanher dam was constructed.The water from the dam is utilised for irrigation, generation of electricity, drinking, aquaculture practices and recreation purposes. The present study comparies with limnological parameters, plankton diversity and survey of migratory and resident bird 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 needss to be further strengthened for improving strategies that insure stability and sustainability of study area.

Keywords: Biodiversity, Kanher dam, Satara 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. 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. 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. Dams are major part of freshwater resources. Analysis of physico-chemical parameters of water are essential, to assess the quality of water. 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.

Material and Methods

The two sites of Kanher dam from Satara 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 distance between the two sites was approximately two km away from each other.

Kanher dam is artificial minor irrigation projects in Maharashtra State built on Venna river near Kanher. It is situated in Northern-West part of in Medha Tahsil of Satara district .It is about 15 km away from the city. The study area was visited regularly from April 2012 to March 2013. 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[1-6]. mbhar et al.,(2009). 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 bird diversity of Kanher dam. The main purpose of reservoir is to supply water for drinking, domestic purpose and irrigation as well as fishing practices (culture and capture fishery) are carried out under fishery development office Satara, (Kanher).

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 in the following pages and correlated with relevant references. They are summarized in table.1 to 4.

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. Kanher reservoir shows average water temperature range between 20.50 oC to 31.60 oC from April 2012 to March 2013. 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 July and August 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 21.03oC to 30.4 oC for reservoirs of North district of West Bengal[6].

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[7-9], pointed out that fluctuation in temperature was dependent on the types and concentration of polluted matter, especially during summer.

pH: pH of Kanher reservoir was recorded at the two sampling sites S1, S2, (table. 1 to 4) . Kanher reservoir shows average pH range between 6.15 to 7.67 from April 2012 to March 2013. The pH range 6.15 to 7.67 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[10, and11].

Electrical conductivity: During the present investigation electrical conductance of the Kanher reservoir was measured at two sampling sites S1, S2, (table. 1 to 4). Results show average range of electrical conductance between 0.11 µmhos to 0.18 µmhos from April 2012 to March 2013. 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 Kanher reservoir was recorded at three sampling sites S1, S2, (Table. 1 to 4). Results show average range of dissolved oxygen was between 3.43 mg/L to 8.09 mg/L for April 2012 to March 2013.

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[12].

Free Carbon dioxide: Free CO_2 of Kanher reservoir was recorded at two sampling sites S1, S2, and results are summarized in (table. 1 to 4). Results shows average range of free CO_2 between 4.80 mg/L to 10.79 mg/L from April 2012 to March 2013.

The lower values of free CO_2 observed during rainy and winter season is due to complete utilization of free CO_2 by the phytoplanktons. The inverse relationship of dissolved oxygen and free CO_2 was observed. Similar results were reported by[13].

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 Kanher reservoir was recorded at the two sampling sites S1, S2, (table. 1 to 4). Results show average range of total hardness between 49.9 mg/L to 91.67 mg/L from April 2012 to March 2013. 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 Kanher reservoir was recorded at the three sampling sites S1, S2, (table. 1 to 4). Results shows average the range of calcium between 6.25 mg/L to 18.63 mg/L and magnesium between 4.40 mg/L to 12.74 mg/L from April 2012 to March 2013.

The desirable limit of calcium and magnesium for drinking water are 75 mg/L and 30 mg/L respectively[14-17].

Total Solids: Total solids are the measure of the all kinds of solids (suspended, dissolved, volatile etc.) in water. Total solids of Kanher reservoir was recorded at the three sampling sites S1, S2, (table.1 to 4). Results show average range of total solids between 867 mg /L to 2954 mg /L , total dissolved solids between 299 mg /L to 1,329 mg /L, total suspended solids between 342 mg /L to 1,377 mg /L from April 2012 to March 2013[18,11].

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.11 The present investigation chlorides of Kanher reservoir were recorded at the two sampling sites S1, S2 (Table. 1 to 4). Results show average range of chlorides between[19.29] mg/L to 35.84 mg/L from April 2012 to March 2013.

The potable water may contain small quantity of chloride without any harmful effects. The acceptable range for chloride is 200-600 mg/L.19 The chloride level is directly related with the pollution level[20, 21].

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 Kanher reservoir was recorded at the sampling sites S1, S2 (Table No.1 to 4). Results show average range of hydrogen sulphide between 1.35 mg/L to 4.45 mg/L from April 2012 to March 2013.

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 Kanher reservoir was recorded at three sampling sites S1, S2 (Table. 1 to 4). Results show average range of acidity from 2.53 mg/L to 34.81 mg/L from April 2012 to March 2013.

Total Alkalinity: Total alkalinity of Kanher reservoir was recorded at the sampling sites S1, S2 (Table.1 to 4). Results show average range of total alkalinity between 23.41 mg/L to 85.17 mg/L from April 2012 to March 2013.[22] 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 Kanher reservoir was measured at the sampling sites S1, S2 (Table. 1 to 4). Results show average range of biological oxygen demand between 5.18 mg /L to 22.21 mg /L from April 2012 to March 2013.

The BOD values shows negative relationship with dissolved oxygen similar relationship has also been reported by[23].

Chemical oxygen demand: Chemical oxygen demand of Kanher reservoir was measured at sampling sites S1, S2 (Table. 1 to 4). Results show average range of chemical oxygen demand between 4.31 mg /L to 17.63 mg /L from April 2012 to March 2013. Similar findings are recorded by 9.

Nitrate: 24 reported that the high amount of nitrates as pollution indicator. It's average high values could be attributed anthropiogenic activities.

Nitrate values of Kanher reservoir was measured at two sampling sites S1, S2 (Table. 1 to 4). Results show average range of nitrate between 9.89 mg /L to 19.30 mg /L April 2012 to March 2013. 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. [24, 25]. 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.

Phosphate: In fresh water phosphorus is present in very small quantities. Phosphate level of Kanher reservoir was measured at the two sampling sites S1, S2 (Table. 1 to 4). Results show average range of phosphate level between 0.011 mg /L to 0.038 mg /L from April 2012 to March 2013.

The values recorded in the present investigation in were closely corroborated with findings of earlier workers[26].

Sodium and Potassium: These sodium and potassium were estimated by flame photometer. Sodium values were measured at two sampling sites of Kanher dam S1, S2 (Table.1 to 4). Results show average range of sodium between 6.10 mg/L to 14.81 mg/L from April 2012 to March 2013.[27] 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 Kanher dam was measured at two sampling sites S1, S2 (Table. 1 to 4). Results show average range of potassium between 0.81 mg/L to 2.67 mg/L from April 2012 to March 2013.

Table-1
Physico- Chemical Parameters of Kanher dam from April to March 2013

Monthand parameter	April 12	May 12	June-12	July-12	Aug-12	Sept-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13
Temperature	28.8	30.4	21.33	21.03	23.93	23.54	24.67	25.46	26.31	27.37	28.02	29
pH	6.36	6.15	6.24	6.31	6.4	6.44	6.581	6.86	6.27	7.331	7.45	7.67
	±0.39	±0.1	±0.06	±0.03	±0.24	±0.12	±0.10	±0.09	±1.34	±0.07	±0.10	±0.06
E.C.	0.14	0.13	0.13	0.12	0.1	0.11	0.116	0.13	0.13	0.161	0.18	0.16
	±0.00	±0.0	±0.00	±0.00	±0.00	±0.00	±0.04	±0.00	±0.03	±0.02	±0.00	±0.01
Dissolved Oxygen	4.22	4.72	5.51	6.67	5.5	6.38	7.143	8.01	3.99	5.333	4.68	3.43
	±0.24	±0.5	±0.30	±0.63	±0.63	±0.22	±0.26	±0.38	±0.90	±0.50	±0.64	±0.29
Free CO2	6.17	6.06	4.80	5.23	5.9	6.74	7.516	8.09	7.42	9.355	10.20	10.79
	±0.06	±0.5	±0.46	±0.09	±0.18	±0.32	±0.12	±0.60	±1.48	±0.49	±0.30	±0.40
Total Hardness	66.17	62.3	54.89	53.44	49.9	58.00	62.94	66.17	61.92	77.06	83.73	91.67
	±3.82	±4.1	±2.87	±4.07	±6.04	±5.69	±2.91	±5.30	±12.62	±5.04	±6.08	±0.58
Calcium	8.82	7.38	6.75	7.01	10.0	11.74	10.90	8.60	8.29	11.84	16.42	18.63
	±0.92	±0.5	±0.37	±0.32	±1.12	±0.90	±4.03	±2.33	±1.80	±1.16	±2.05	±1.82
Magnesium	12.40	6.76	7.27	9.29	8.1	9.61	7.915	10.90	11.77	12.15	10.20	9.42
	±1.89	±1.4	±1.29	±0.82	±1.05	±1.2	±1.8	±2.92	±2.35	±1.77	±1.75	±2.81
Total Solids	2061	2684	2422	2313	2954.9	2045	1728.	1723.	1458.2	1421	945.3	867.78
	±93.7	±31.	±221.2	±112.5	±171.4	±240.	±170.	±103.	±300.8	±52.2	±40.8	±29.53
Total Dissolved Solids	916	1760	1478	1246	1329.0	1156.	1007.	706.3	725.80	645.8	346.0	299.89
	±134.	±88.	±291.0	±91.51	±67.16	±82.8	±38.5	±84.2	±141.9	±85.5	±21.2	±16.95
Chloride	27.36	19.2	24.11	28.01	28.7	29.74	30.56	30.82	30.46	33.81	34.30	35.84
	±0.91	±0.5	±1.30	±1.86	±2.01	±1.51	±0.84	±1.13	±6.35	±1.59	±1.24	±0.74

Table-2
Physico- Chemical Parameters of Kanher dam from April to March 2013

Monthand parameter	April 12	May 12	June-12	July-12	Aug-12	Sept-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13
Hydrogen Sulphide	1.53	1.35	2.35	2.68	3.2	3.37	3.8067	2.98	2.95	3.633	4.24	4.45
	±0.22	±0.3	±0.21	±0.20	±0.20	±0.27	±0.116	±0.30	±0.58	±0.23	±0.17	±0.24
Acidity	23.94	2.53	3.75	5.00	6.3	7.34	8.2589	11.61	13.11	18.38	27.92	34.81
	±1.54	±0.2	±0.49	±0.28	±0.20	±0.42	±0.178	±1.02	±2.64	±0.97	±0.46	±1.96
Alkalinity	30.33	23.41	27.19	29.94	31.3	35.11	36.167	44.28	52.40	64.88	71.00	85.17
	±3.71	±0.5	±1.12	±0.92	±2.41	±3.02	±3.218	±2.30	±11.10	±3.67	±2.46	±1.74
BOD	5.18	5.39	6.22	6.85	7.9	9.41	11.033	12.78	12.40	15.41	17.47	22.21
	±0.13	±0.2	±0.22	±0.56	±0.53	±0.93	±0.698	±0.84	±2.53	±1.03	±1.78	±1.91
COD	4.31	4.51	5.23	6.47	7.6	9.10	9.3778	9.72	9.62	12.52	15.73	17.63
	±0.20	±0.3	±0.26	±0.05	±0.32	±0.67	±0.488	±0.33	±2.09	±0.50	±1.78	±1.95
Sodium	7.71	6.69	9.08	8.29	6.1	7.43	8.0333	8.84	7.89	13.34	14.81	11.72
	±0.44	±0.7	±0.52	±0.24	±0.23	±0.23	±0.600	±0.59	±1.69	±0.89	±3.13	±1.17
Potassium	0.81	0.94	0.90	1.36	0.9	0.94	0.9389	1.05	2.05	2.675	1.72	1.56
	±0.01	±0.1	±0.18	±0.00	±0.00	±0.00	±0.052	±0.12	±0.42	±0.11	±0.22	±0.19
Nitrate	12.89	9.98	9.89	12.98	11.8	14.38	14.967	12.40	10.97	13.70	13.94	19.30
	±1.84	±1.9	±2.01	±0.19	±0.14	±0.02	±1.761	±1.43	±2.13	±1.39	±0.57	±0.55
Phosphate	Trace	Trace	0.033	0.01	0.01	0.011	0.018	0.02	0.02	0.024	0.02	0.02
	Trace	Trace	±0.01	±1.178	±0.907	±0.00	±0.001	±0.00	±0.00	±0.00	±0.00	±0.003

All values are expressed in mg/L except pH and E.C.

Zooplankton diversity: Freshwater zooplankton is an important component in an aquatic ecosystem ad plays a critical role not only for primary consumers by serve as source of food for higher organisms. They are primary food for finished and shell fishes and can be used as indicators of tropic status of water body. Their flucations in occurrence and abundance can be used to estimate the fishery potential of a water body.3

Bird diversity of Kanher dam: Avian fauna occupies a special position in an aquatic ecosystem. They not only have an aesthetic role but also occupy a very important position in food chain. This region has biologically potential and rich in flora and fauna. The marshy places forms natural habitat for feeding, breeding and nesting grounds. The present study shows check list of different species of bird.

Table-3
Diversity of zooplankton in Kanher dam

Sr.no	Plankton recorded	Sr.no	Plankton recorded
1	Brachionus angularis	23	Lecane luna
2	Brachionus bidentata	24	Nauplius larva
3	Brachionus caudatus	25	Phyllodiaptomus blanci
4	Brachionus calafertus	26	Alona sp.,
5	Brachionus clayciforus	27	Alona pulchella
6	Brachionus diversicornis	28	Bosminia sp.,
7	Brachionus durgae	29	Bosminia deiteri
8	Brachionus falcatus	30	Bosminia longirostris
9	Brachionus forficula	31	Daphnia longirimis
10	Brachionus pallas	32	Daphnia lumholtzi
11	Brachionus quadridentata	33	Daphnia vosea
12	Brachionus rubens	34	Diaphnasama excisum
13	Filinia terminales	35	Indialona ganapati
14	Filinia longistea	36	Monia sp.,
15	Keratella cochleraris	37	Monia brachiata jurine
16	Keratella quadrata	38	Cypris sp.,
17	Keratella tropica	39	Cyclocypris globosa
18	Mesocyclops.sp,	40	Amoeba radiosa
19	Mesocyclops leukartii	41	Arcella sp.,
20	Microcyclops sp.,	42	Diffugia sp.
21	Lecane closterocerca	43	Paramecium sp.,
22	Lecane hamata	44	Vorticella sp.,

Table-4
Birds recorded in vicinity of reservoirs

Family- Ardeidae	**Family- Upupidae**
Indian pond Heron, *Ardeola grayii*	Common Hoopoe, *upupa epops*
Chestnut Bittern , *Ixobrychus cinnamoneus*	**Family- Bucerotidae**
Cattle Egret, *Bubulcus ibis*	Indian grey Hornbill, *Oclyceros birostri*
Little Egret, Egretta garzetta	**Family- Psittacidae**
Family- Podicipitidae	Plumheaded Parakeet, *Psittacula cyanocephala*
Little Grebe Tachybaptus ruficollis Pallas	Roseringed Parakeet, *Psittacula krameri* (scopoli)
Family- Rallidae	Indian Lorikeet , *Loriculus vernalis*
Bluebreasted Rail , *Rallus striatus*	**Family- Striginae**
Whitebreasted Waterhen , *Amaurornis phoenicurus*	Spotted owlet, *Athene brama*
Purple Moorhen, *porphyrio porphyrio*	**Family- Alcedinidae**
Common Coot , *Fulica atra*	Lesser Pied Kingfisher, *Ceryle rudis*
Family-Phasianidae	Small Blue Kingfisher, *Alcedo atthis*
Common Quail, *Coturnix coturnix*	Whitebreasted Kingfisher, *Halcyon coromanda*
Rain Quail, *Corturnix coromandelica*	Blackcapped Kingfisher *Halcyon pileata*
Bluebreasted Quail, *Cortunnix chinesis*	**Family-Muscicapinae**
Rock Bush Quail , *Perdicula argoondah*	Tickell's Blue , *flycatcher cyornis tickelliae*
Indian peafowl , *Pavo cristatus*	Jungle prinia, *Prinia sylvactica*
Family- Anatidae	Eurasian Blackbird , *Turdus merula*
Spotbilled Duck, *Anas poecilorhynha*	**Family- Motacillidae**
Mallard, *Anas platyrhynchos*	Yellow Wagtail , *Motacilla flava*
Northern shoveller, *Anas clypeata*	Grey Wagtail , *Motacilla cinere*

Conclusion

The physico-chemical properties of Kanher 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 zooplankton and avifauna in the vicinity of reservoir.

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