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A studies on Hydrobiological assessment of Pavana Dam water from Pune, Maharashtra

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Abstract

For survival of biotic factor an abiotic factor *i.e*. Water is most important natural resource. Nearly 0.3 to 0.4 % of fresh water is available for use to the men. An Aquatic organism requires sufficient and healthy water with nutrients for their survival .Water from Pavanadam is used for drinking by Pimpari-Chinchawad Muncipal Corporation, for agriculture in Maval , for industrial purpose and for domestic use. Pavana dam is located in Maval Tahasil of Pune district. Pavana dam is earth fill gravity dam constructed to fulfill need of drinking and irrigation. In this study the water quality of Pavana dam is assessed by using the physico-chemical parameters Also some zooplanktons were studied. The study was carried out from August 2017 to July 2018. The parameters like Temperature, TDS, Turbidity, P^H, Dissolved Oxygen, COD, BOD, Total Alkalinity, Total hardness, Chloride, Sulphates, Phosphates, Calcium and Magnesium has been studied. The mean and SD calculated for statistical analysis. The Physico-chemical analysis will help to assess water quality for utilization for drinking, irrigation, domestic and industrial purpose.

Water plays an important role in the life of every organism for carrying out all life activities. The main source of drinking water is dam beside this ponds rivers, lakes and streams *etc*. are also sources of fresh water. Therefore monitoring of water quality is essential to know health of water. The quality and health of water depends on physico-chemical parameters of water. The present study is revealed with Pavana dam. Pavana dam is located in Maval Tahsil on Pavana river, 50 Km away from Pune towards west direction. This dam is situated at 18.6794185^0 N, and 73.4752505^0 E in Pune district of Maharashtra. It was constructed in 1972. The length is 1,329 m and height is 42.37 mwith a gross storage capacity of 8.51 TMC. The backwaters of the Pavana Dam formed a reservoir; Pavana Lake's geographical location in the Western Ghats makes it a natural hot

spot for flora and fauna. The hydroelectric power is generated from water.

Nearly one third of drinking water requirement of the world is obtained from rivers, dams, lakes. The interactions of physical and chemical content of water play a significant role in composition, distribution and abundance of aquatic organisms Water quality is function of natural or human influences. Babu and Mohan[5] observed that water quality plays a role in the distribution of the fishes and distribution of zooplankton. If the water parameters show changes in temperature, transparency, DO, COD, nitrate and phosphate then adverse effect on the function and biodiversity of water body results. The limnological parameters of the aquatic environment have been found to influence yields and production of dam. Dam forms valuable aquatic ecosystem and provides economic benefits through fishery and tourism. Sarwade and Kamble[24] observed that physico-chemical parameters have effects on production of water resources, productivity & conservation of aquatic ecosystem..

Study Area: Pavana dam is the study area located in Maval Tahsil of pune district. Three sites of dam were selected; each site is away from one to two Km from each other. Water samples were collected in every month in the morning between 8:00 a.m. to 10:00 p.m. by immersing a clean wide mouthed one litre plastic container at the sub-surface level. The temperature was measured at the field with mercury thermometer. pH was measured by PH paper at site as well in laboratory by pH meter. For estimation of dissolved oxygen, oxygen was fixed at site by adding alkaline iodide and manganese sulphate. The transparency of water was measured by usingSacchi disc. The water samples from three different sites were collected and brought in the laboratory for further analysis. The water samples were also collected with plankton net for identification ofzooplaktons. The water parameters were analysed according to the methods described by APHA[4], Trivedi and Goel[26] and WHO[29] guidelines for drinking water ,titrimetric method for total alkalinity, EDTA titrimetric method for total hardness, DO by Winkler's method. For BOD water was incubated and Winkler's method used. The results were compared with WHO[29] and BIS[6].

The physico-chemical parameters of water samples from Pavana dam for one years from August 2017 to July 2018 are given in the table-1. The results were compared with WHO guidelines of drinking water.

Water Temperature : Water temperature plays important role in the life of aquatic flora and fauna. It affects distribution and physiological activities of aquatic organisms. At high temperature zooplanktons move in the deep water. The minimum average temperature was recorded as $23.33 \pm 0.15^{o}C$ in January 2018 and maximum average temperature $29.33 \pm 0.56^{o}C$ in May 2018. Trivedi and Goel[28] reported higher temperature in March and lower in November in Satara District. Ingole and Pawar[11] observed somewhat similar values in Majalgaon dam, Beed. The temperature increases due to more solar radiation in May.

Total Dissolved Solids: The minimum average TDS was recorded in August 2017 as 46.67 ± 1.15 mg/l and in July 2018 average maximum TDS was 83.33 ± 5.03 mg/l . Gupta[10]

Table-1. Monthly Variation In Physico-Chemical Parameters of Pawana Dam From August 2017 to July 2018.

Para-meters	WT OC	TDS mg/l	TURB NTU	WTr cm	P^H	DO mg/l	BOD mg/l	COD mg/l	CO2 mg/l	TH mg/l	TA mg/l	Cl mg/l	NO3 mg/l	SO4 mg/l	PO4 mg/l	BC mg/l	Ca mg/l	Mg mg/l
Aug-17	24.37	46.67	6.41	18.00	7.07	6.10	9.17	16.38	4.41	31.66	25.66	9.15	0.19	3.08	0.23	25.74	5.51	3.31
	±0.15	±1.15	±0.77	±0.60	±0.01	±0.26	±0.38	±0.73	±0.28	±2.02	±1.05	±0.33	±0.02	±0.22	±0.04	±1.03	±0.89	±1.10
SEP	25.10	50.33	4.90	21.07	7.63	4.80	6.57	13.51	11.93	27.39	21.08	9.32	0.20	2.38	0.62	23.06	6.25	1.96
	±0.10	±2.52	±0.44	±1.59	±0.25	±0.56	±0.38	±0.62	±0.63	±0.67	±0.88	±0.70	±0.03	±0.51	±0.01	±0.23	±0.38	±0.26
OCT	26.27	53.00	5.07	28.23	7.49	4.73	11.27	13.77	10.38	33.99	23.85	14.10	0.34	5.06	0.50	22.50	7.08	3.71
	±0.15	±1.41	±0.60	±2.01	±0.24	±0.15	±0.60	±1.29	±0.33	±0.75	±1.39	±0.73	±0.10	±0.23	±0.03	±0.79	±0.15	±0.35
NOV	26.77	53.67	4.57	39.40	7.52	5.63	7.33	15.39	8.88	33.47	24.94	10.92	0.52	3.58	0.10	23.80	5.70	3.61
	±0.06	±2.52	±0.25	±0.66	±0.30	±0.15	±0.74	±0.84	±0.20	±0.85	±1.39	±0.27	±0.02	±0.75	±0.04	±0.27	±0.41	±0.50
DEC	24.17	51.00	5.83	45.97	7.52	3.87	9.70	17.51	10.59	36.19	24.62	15.30	0.28	4.58	0.15	24.09	6.62	4.00
	±0.06	±1.0	±0.10	±1.45	±0.63	±0.12	±0.70	±0.92	±0.90	±0.63	±0.65	±0.81	±0.01	±0.47	±0.02	±1.18	±0.23	±0.14
JAN	23.33	51.00	6.25	44.83	7.38	6.43	7.00	15.24	5.70	35.10	30.46	17.90	0.23	2.20	0.15	24.25	5.40	2.75
	±0.15	±4.24	±0.23	±2.18	±0.04	±0.25	±0.20	±0.37	±0.47	±0.35	±0.52	±1.25	±0.02	±0.21	±0.03	±0.37	±0.43	±0.18
FEB	27.07	70.00	2.01	43.90	7.52	4.87	9.47	16.65	2.27	32.67	32.01	13.91	0.22	1.64	0.12	32.00	5.89	2.31
	±0.12	±2.0	±0.43	±0.46	±0.32	±0.35	±0.50	±0.59	±1.48	±0.99	±1.99	±2.44	±0.01	±0.30	±0.01	±2.00	±0.47	±0.14
MAR	27.63	72.00	2.20	43.83	7.86	3.80	7.63	23.37	3.57	33.03	35.55	11.38	0.36	2.43	0.06	32.93	7.00	3.08
	±0.06	±2.0	±0.66	±1.35	±0.31	±0.10	±0.57	±0.53	±0.23	±0.37	±0.57	±0.86	±0.03	±0.47	±0.02	±0.39	±1.00	±0.07
APRIL	28.03	74.00	2.12	47.93	7.30	6.00	7.60	23.14	2.56	35.27	19.49	11.01	3.00	2.67	0.83	23.56	7.92	3.49
	±0.06	±1.0	±0.69	±0.83	±0.31	±0.10	±0.44	±3.70	±0.51	±0.38	±2.78	±0.88	±0.10	±0.58	±0.03	±0.70	±0.93	±0.56
MAY	29.33	72.33	4.04	49.03	7.23	5.30	3.00	11.28	4.43	30.19	31.42	7.17	2.28	1.51	0.07	31.59	8.70	2.87
	±0.58	±2.52	±0.12	±1.46	±0.51	±0.46	±0.50	±2.68	±0.21	±2.02	±1.10	±0.97	±0.20	±0.25	±0.00	±1.10	±0.97	±0.07
JUN	27.20	82.00	4.91	34.20	7.14	4.73	6.60	19.21	6.75	31.12	27.47	11.01	3.72	3.67	0.16	20.39	9.01	4.31
	±0.10	±2.0	±0.07	±1.67	±0.23	±0.15	±0.56	±0.59	±0.31	±0.73	±0.56	±0.04	±0.11	±0.28	±0.04	±0.63	±0.81	±0.37
JUL.	24.53	83.33	7.28	24.20	7.41	6.73	6.17	19.51	7.22	35.46	26.66	12.25	4.57	3.40	0.51	22.22	10.39	5.33
	±0.06	±5.03	±0.16	±1.11	±0.55	±0.35	±0.35	±0.51	±0.40	±0.78	±0.45	±0.25	±0.25	±021	±0.03	±0.61	±0.34	±0.34

Abbreviations: WT- Water temperature; TDS- Total Dissolved Solid ; TURB-Turbidity ; WTr- Water transparency; pH- Potential of hydrogen ion; DO- Dissolved oxygen; BOD-Biochemical Oxygen Demand ;COD-Chemical Oxygen Demand;CO_2 – Carbon Dioxide; TH- Total hardness; TA- Total alkalinity ; Cl^-- Chloride; NO_3^-- Nitrate; SO_4- Sulphate, PO4-Phosphate ; BC-Bicarbonate ; Ca- Calcium ; Mg- Magnesium

noted more TDS in July is due to runoff water with mud or sand. The more TDS affects the clarity of water and light rays poorly reach to the bottom. Water is not suitable when TDS is more than 500 mg/l.

Turbidity: Natural water becomes turbid because of clay, phytoplankton or organic matter as said by Sarwade and Kamble[24] In February 2018 average minimum turbidity was 2.01± 0.43 NTU and in July 2018 maximum average turbidity was 7.28± 0.16 NTU. Albadali *et. al*.,[1] noted the highest value as 206.7 NTU. It indicates turbidity increases in monsoon due to silt, suspended particles *etc*. Less number of zooplnaktons observed in more turbid water by Jaya Pawar[22].

Water Transparency: Water transparency and turbidity correlated to each other. If water is more turbid, less is transparency. It affects penetration of light to bottom of lentic water system. And turbidity affect trophic level of aquatic ecosystem .The minimum average transparency observed in August 2017 as 18.00± 0.60 cm. The average maximum transparency observed in May 2018 as 49.03 ±1.46.cm by Manjare and Muley[16].

pH: pH is measure of H^+ ion concentration, Acceptable values of drinking water ranges from 6.5 to 8.5.(WHO). In August 2017 average minimum pH was 7.07± 0.01 and average maximum was 7.86± 0.31 in March 2018. Jannat[13] noted that pH affects biological activities While Chergui[7] observed alkaline values in Chiffa river of Algeria. The above values indicate water of Pavana dam has acceptable pH.

Dissolved Oxygen : DO released by photosynthetic activity of aquatic vegetation. DO is required for metabolism of aquatic organisms and affect productivity. The limit of DO for fresh water is 5 to 6 mg/l. The average minimum DO values of Pavana dam water was 3.80± 0.10 mg/l in March 2018. And average maximum value was 6.90± 0.26 mg/l in 6.73± 0.35 mg/l in July 2018. High DO was recorded by Anita[3]. in March 2016 in Nagaral dam Chincholli , Karnataka More DO quantity indicates good quality of water while low quantity indicates water pollution. And this less DO adversely affects life in the water. Similar low values of DO observed by Cox[8].

Biochemical Oxygen Demand: This is amount of oxygen used by microbes to decompose organic matter in the water. The average minimum BOD was 3.00± 0.50 mg/ l in May 2018.While average maximum BOD was 11.27± 0.60 mg/l in October 2018. Maximum BOD was observed in October. According to Sirsat and Kamble[27] the higher quantity of BOD is harmful to aquatic life because oxygen level depletes rapidly.

Chemical Oxygen Demand: Amount of DO required for oxidation of non-organic material. COD correlated with pollution level. The average minimum COD was 11.28± 2.68 mg/l in May 2018. The average maximum COD 23.37± 0.53 mg/l in March 2018. The organic waste pollution is indicated by COD. Jadhav[12] observed the readings are below Indian standard (BIS)[6] *i. e*. 250mg/l.

Free Carbon Dioxide : Low amount of CO_2 is essential for photosynthesis of flora. Pollution load increases with increase in CO_2.

During present study the average minimum amount of CO_2 was noted as 2.27± .48 mg/l in February 2018. While average maximum amount of CO_2 noted as 11.93± 0.63 mg/l September 2017. Niroula[18] recorded 73.92 mg/l of CO_2. This value is slightly increased but all other values were below acceptable level *i.e.* 10 mg/l.

Total Hardness : According to Jadhav[12] dissolved minerals in the water, Calcium and Magnesium cause hardness of water. Water having hardness 0-60 mg/l is considered as soft water, hardness above 120 mg/l is considered as hard water. The average minimum value was 27.39± 0.67 mg/l in September 2017. And average maximum value was recorded as 36.19± 0.63 mg/l in December 2017. All values are below normal level therefore water is soft water.

Total Alkalinity: Alkalinity is capacity of water to neutralize strong acid. According to Patil[20] the alkalinity is due to presence of salts of carbonates, bicarbonates and hydroxide compound of calcium, sodium and potassium. The average minimum alkalinity of Pavana dam water was 19.49± 2.78 mg/l in April 2018. And average maximum alkalinity was 35.55± 0.57 mg/l in March 2018. Sitaram[26] observed lowest 110 mg/l during month of Oct. and highest 160 mg/l during the month of March in Osmanabad. The values of Pavana dam were within acceptable limits.

Chloride: In the water chloride arises from sewage effluent. High quantity of chloride (< 200mg/l) indicate pollution and makes water salty. Theaverage minimum amount of Chloride was noted as 7.17± 0,97 mg/l in May 2018. While average maximum Chloride value noted as 17.90± 1.25 mg/l in January 2018. The maximum value (32.5 mg/l) was recorded in the month of May by Simpi[25]. The chloride value of Pavana dam water are below acceptable level (250 mg/l). Therefore this water is not salty and polluted.

Nitrate: Biodegradation of nitrogenous compounds is source of nitrates. Nitrite is oxidized form of nitrogen which is one of the sources of plant nutrients. The average minimum amount of Nitrate was recorded 0.19± 0.02 mg/l in August 2017. And average maximum values recorded as 4.57± 0.21 mg/l in July 2018. The observed values are very low as Indian standard value *i.e.* is 45 mg/l. According to Pawar[21] Nitrite level varied between 0.002 (May) and 0.093 mg/1 (June), suitable for fish. Therefore in Pavana dam water trace amount of nitrite is present.

Sulfate: The sulfate arises from rock erosion due to water flow. The average minimum value was 1.51± 0.25 mg/l in May 2018. While maximum average values was 5.06± 0.23 october 2017. The Sulfate values varies from 3mg/l to 15.3mg/l in Panner reservoir, Kashmir recorded by Farooq[9] The maximum values were observed in winter season. These values do not exceed the permissible limit.

Phosphate : Phosphate is one of the nutrient factor for plants and phytoplanktons. Because of agricultural runoff phosphate is added in water. Pavana dam water shows minimum average quantity of phosphate as 0.06± 0.02 mg/l in March 2018. The average maximum values as 0.83± 0.03 mg/l in April 2018. Mishra[17] observed phosphate values as

2mg/l to 7 mg/l . The maximum values in Pavana dam observed in the summer season.

Bicarbonate : The average minimum amount of bicarbonate was 20.39± 0.63 mg/l in June 2018. While average maximum amount of bicarbonate were found in March 2018 *i.e.* 32.93 ± 0.39 mg/l. The minimum amount was recorded in the monsoon while maximum amount in the summer season. Kamble[14] noted values of bicarbonate in July 80.08 mg/l and in September 5.62 mg/l in Khadakwasala dam, Pune. Bicarbonate values of Pavana dam water were less than these values.

Calcium: Calcium is released in the water from mineral rock weathering and from organic matter. Calcium is one of micronutrient for many organisms. During present study the average minimum amount of calcium was 5.40± 0.43 mg/l in January 2018, and average maximum amount was 10.39± 0,34 mg/l in July 2018. Pimple[23] recorded Calcium value in Pashan lake from 19 mg/l to 34 mg/l. The minimum amount were observed in winter season and maximum amount in rainy season because water run off with minerals.

Magnesium : Magnesium is important element for growth of chlorophyll and hence growth of phytoplankton. According to Chergui[7] Magnesium is present with calcium in all types of water. The average minimum values were noted as 1.96± 0.26 mg/l in September 2017. The average maximum value of Mg++ noted as 5.33± 0.34 mg/l in July 2018. The minimum amount recorded in August and September while maximum amount recorded in July. Patil[19] noted values of Magnesium higher in summer 22.4 mg/l, followed by rainy season and decreased during winter 17.3 mg/l. in Birnal reservoir, Sangali. But all the values of Pavana dam water were below WHO standard (50 mg/l).

Zooplanktons : The following zooplanktons were noted in Pavana dam.The zooplankton were identified by Altaff [2] manual of zooplankton.

Rotifera: *Branchionus forticulata, Keratella tropica, Lecane pyriformis, Asplanchna* sp.
Cladocera : *Alona rustica, Daphnia magna, Ceriodaphnia* sp. *Moina micrura.*
Copepoda : *Cyclus magnus, Mesocyclops, Naplius* larva.
Ostracoda : *Condonajeaneli, Cyprinotus.*

The main objective was to assess water quality of Pavana dam by using different physico-chemical parameters in the year August 2017 to July 2018. The second objective was to note zooplankton distribution in Pavana dam. The analyzed physico-chemical parameters were compared with WHO standard limits and it was observed that all physic-chemical parameters are within a range of the permissible limits. It is found that the water of Pavana dam is non-polluted is suitable for drinking after boiling or filtering , irrigation and for other uses. In this non-polluted water growth of phytoplankton, zooplankton, fishes, algae *etc.* may takes place without any harmful effects of water.

References :

1. Al-Badaii Fawaz, O. Mohammad and B. G. Muhd (2013). Hindawi Publishing Corporation Journal of Chemistry Volume Article ID 871056, 1-10.
2. Altaff K. (2004). A manual of Zooplankton.

UGC, New Delhi. 1-145.
3. Anita S.M., S.S. Hatti and S. Majagi (2018). *Indian. Research Journalof Life Science, Bioinformatics, Pharmaceutical and Chemical Sciences, 4*(6): 524-530.
4. APHA, (2005). Standard Methods for Examination of Water and Waste Water
5. Babu Y.S. and M.R. Mohan (2018). *Int. Journal of Sci. Reas,* 401-402.
6. BIS, (2012). (Bureau of Indian Standards). Indian Standard Institute, New Delhi, 1-5.
7. Chergui Fella Hamaidi (2013). *Journal of Ecosystem,* 1-9.
8. Cox B.A. (2003), *Sci; Total Environ,* 314-316, 335-377.
9. Farooq Humaira (2019). J. *Himalayan Ecol. Sustain. Dev. 14:* 1-18.
10. Gupta B.K. and R.R. Gupta (1999). *Poll. Res. 18*(4): 724-728.
11. Ingole, S.B., R.G. Pawale, P. N. Wavde (2009) *Journal of Aquatic Biol. 24*(1): 71-76.
12. Jadhav, S.D., M.S. Jadhav (2020). *IJTSRD, 1*(6): 250-256.
13. Jannat, Nure (2019). *HSOA Journal of Environmental Science: Current Research 2*(3): 1-6.
14. Kamble P.N., H.R. Aher and S.R. Kuchekar (2008). *Int. J. Chem. Sci., 6*(1): 325-332.
15. Kumar, S., V. Jain and S.K. Raghuvanshi (2021). *Int. J. Adv. Res. Biol. Sci. 8*(3): 30-36.
16. Manjare S. A., S. A. Vhanalakar and D.V. Muley (2010). *International Journal of Advanced Biotechnology and Research, 1*(2): 115-119.
17. Mishra Sachin, Asha Lata Singh and Dhanesh Tiwary (2014). *International Journal of Environmental Research and Development, 4:* 261-268.
18. Niroula B., K.L.B. Singh, G.B. Thapa and J. Pal (2010). *Our Nature 8*: 212-218.
19. Patil Alaka A. (2014). *Int. Res. J. Environment Sci. 3*(9): 43-49.
20. Patil V.A., S.G. Sontakke, M.C. Nagtilak, S.N. Labade (2014) *Pelagia Research Library, 5*(1): 144-147.
21. Pawar, B. A. (2009). *J. Indian Fish Assoc., 36:* 93-100.
22. Pawar Jaya (2016). Ph.D. Thesis, 85-94.
23. Pimple N.S. and P.S. Amrujkar (2015). *World Journal of Pharmaceutical Research, 4 :* 582-588.
24. Sarwade A.B. and N.A. Kamble (2014). *Octa Journal of Environmental Research 2:* 247-254.
25. Simpi Basavaraja, S.M. Hiremath, KNS Murthy, K.N. Chandrashekarappa, Anil N Patel, E.T. Puttiah (2011). *Global Journal of Science Frontier Research, 1*(3): 31-34.
26. Sitaram Khaire Bapu (2015), Final report of UGC Minor Research Project. 1-61.
27. Sirsat P.B. and A.H. Kamble (2020). *International Journal of Fisheries and Aquatic Studies, 8*(4): 193-195.
28. Trivedi R.K. and Goel P.K. (1986). Environmental Publication, Karad.
29. World Health Organisation(WHO) (1993) Guidelines for drinking water quality, Geneva Switzerland.