15. A Study of Physico-Chemical Parameters for Determining Fish Culture Potential in Latur District Water Bodies

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Abstract

Water environment in Latur district's water bodies including river Manjara and others having seasonal variation in physico-chemical parameters. These parameters affect on fish growth and development as well as overall fish population. Nutrition availability determines the overall growth in fishes. Water bodies in this region are seasonal in nature. Most of the inland fish culture in this area depends on water availability. Water in the water bodies having P^H in between 6.4 to 8.00, Tempeature seasonally vary from 33.5^0C in summer and around 18^0C in winter. Other parameters including dissolved oxygen, turbidity, availability of planktons also fluctuates with seasonal variations. Overall study indicates that water bodies having potential of fish culture with artificial feeding and present natural food availability.

Key Words – Water, Physico-Chemical parameters, fish growth, Fish culture

Introduction

To understand the ecology of fishes, knowledge about the properties of the water in which fish live required. Water is the most important abiotic factor in the nature. It occurs in three states including solid, liquid and gaseous on the earth. Water is an universal solvent because it acts as a solvent for a variety of inorganic, organic and gaseous substances. Water quality changes with land and soil type. Physico-chemical properties of water changes with change in environmental conditions.

The density of fresh water is a maximum at about 4^oC.Density of water decreases with rise in temperature. Fishes can experience different temperatures in different layers of water

because of differences in densities. When water bodies differ in salinity also differ in density. The temperature at which water has its maximum density decreases as salinity increases.So, water quality determines biomass density and diversity.

Fishes are aerobic organisms. They require a supply of oxygen and produce carbon di-oxide as a by-product of respiration. Fishes also produce ammonia as an excretory product. The solubility of gaseous in water is affected by temperature, salinity and pressure. Oxygen dissolves poorly in water. Oxygen solubility decreases with increase in both temperature and salinity. High temperature results in decrease in pressure as well as oxygen solubility. Both carbon dioxide and ammonia are much more soluble than oxygen in water. Fresh water has a negligible osmotic concentration with bicarbonate ions. Fresh water bodies depend on local conditions including the composition of local rocks, soils and environmental conditions for their salinity.

Materials and Methods

All water samples were collected to the laboratory of Department of Zoology and Fishery Science,Rajarshri Shahu Mahavidyalaya (Autonomous) Latur (18.43^{O} N, 76.73 ^{O} E), Maharashtra .India.

Water samples analysed for their physico-chemical characters by using methods from the manual 'standards of water and waste water analysis' published by APHA in 1998.And also used manual, which is published by Indian Association of Aquatic biologists(IAAB),Publication No.2;Methodology for Water Analysis(Third Edition-2006).

Sample Survey

Samples were taken from two water bodies Dhanegaon dam and Gharani reservoir in two months intervals each year 2012 and 2013.The water quality of river and reservoir determined by calculating the basic parameters like colour,temperature, P^{H} ,D.O.(in mg/l),BOD(in mg/lit),total hardness etc.All precautions are taken during the sampling.For further analysis samples were brought to laboratory.

Colour

Visual observations of water for colour in different seasons of the year.

Temperature

Record the temperature of the water with the help of standard calibrated thermometer in ^{o}C.Take the sample in container from water body and measure the temperature immediately. Diwan, A.D., Misra, S.M.,& et.al. (2006).

P^H

P^H is the value expressed as the negative logarithm of the hydrogen ion concentration. The p^H range is given between 0 to 14.When p^H value is 7, it becomes neutral, value above 7 is alkaline and below 7 is acidic according to std. p^H scale. On field p^H is measured by digital pen p^H meter and in laboratory p^H is measured by calibrated digital p^H meter. Diwan, A.D., Misra, S.M.,& et.al. (2006).

Dissolved oxygen (DO)

Dissolved oxygen is a major parameter, which affects prominently on life within water. Oxygen is depleted in water bodies due to biochemical oxidation and respiration by water animals and zooplanktons. Generally those water ecosystems free from pollution contains high DO as compared to polluted water bodies. Polluted water bodies having depleted dissolved oxygen level, adversely affect on biological productivity of rivers and reservoirs.

Dissolved oxygen enters in water through direct diffusion from atmosphere and as a byproduct of photosynthesis carried out by algae and water plants. Algal bloom and pollution causes deficiency of oxygen in water bodies.So,gradually concentration of dissolved oxygen declines causes problem concerned with respiration in water animals like fish. Fish need at least3-5 mg/l of dissolved oxygen for survival.

Winkler's titrometric method for measurement of dissolved oxygen in mg/l is used to calculate dissolved oxygen variation in different water bodies concerned with Manjra river Dhanegaon dam and Gharani reservoir. Diwan, A.D., Misra, S.M.,& et.al. (2006).

Biological oxygen demand (BOD)

BOD indicates the magnitude of water pollution by the oxidisable organic matter. When a system receives excessive pollution load, its carrying capacity is exceeded and due to less oxygen available for oxidation, a net oxygen demand rises.Thus, BOD means quantity of DO in ppm required under test condition for complete oxidation(by aerobic bacteria)of the organic matter in representative sample. To measure BOD,dissolved oxygen is supplied by diluting the sample with oxygen enriched distilled water and ideal conditions are created for aerobic bacteria by maintaining constant temperature 25 ^{o}C and duration for bacterial action (5 days).The oxygen consumed in this process is estimated by Winkler's method and then BOD calculated. Diwan, A.D., Misra, S.M.,& et.al. (2006).

Total Hardness

Hardness of water is mainly imparted by alkaline earth metallic cations, mainly calcium and magnesium present in it. Total hardness of water from different water bodies ranges from 0 to several hundred mg/l.Temparary hardness caused due to carbonates(co_3) and bicarbonates(Hco_3).

Ecologically, temporary hardness plays a key role in buffering capacity thus neutralizing an off set in p^H due to addition of acidic products or pollutants. This has a great effect on biotic diversity and biomass in an ecosystem. To measure the total hardness of water titrometric EDTA method had been used .Total hardness calculated in mg/l. Diwan, A.D., Misra, S.M.,& et.al. (2006).

Statistical Methods

Using Matlab 7 software 3D graphs of various water parameter analysis and other statistical calculations are carried out during research work.

Results

According to study of physico-chemical characters of two fresh water bodies, Dhanegaon reservoir and Gharani reservoir from Dec.-2011-Nov.-2012 and Dec.2012-Nov.2013 following data calculated for each parameters represented in Table 1 and Table 2.Graphical analysis to correlate these also represented below with four different 3D graphs. Each graph shows correlation between Temperature(on x-axis),P^H(on y-axis) and Dissolved oxygen(on z-axis).According to graphical data temperature when rises in summer p^H slightly declines below neutral p^H in between 6.8-6.9,but when temperature declines in winter p^H rises above 7.8-8.6.When temperature correlated with dissolved oxygen in summer it ranges between 4.7-5.9 mg/lit and in winter between 6.0 to 6.6 mg/lit.In mansoon season Temperature ranges for 26.5-29.1 ^oC, P^H ranges from 7.0-7.4 and dissolved oxygen ranges from 5.2 to 5.6 mg/lit.Aevarage values of temperatures of both reservoirs are 26.40 ^oC and26.55 ^oC in year Dec.2011-Nov.2012 and Dec.2012 to Nov.2013,respectively.Aevarage values of P^H of both reservoirs are 7.5 and 7.6 in year Dec.2011-Nov.2012 and Dec.2012 to Nov.2013,respectively.Aevarage value of dissolved oxygen of both reservoirs are 5.6 mg/lit in year Dec.2011-Nov.2012 and Dec.2012 to Nov.2013,respectively.When BOD calculated after different time intervals from Dec.2011-Nov.2013 ,it ranges from 4.2 mg/lit to 7.1mg/lit.

When this data compared with standards given by ICMR and WHO about fresh water fish culture, all the parameters are in favorable range for growth and cultivation of fishes. Overall data analysis suggests that each parameter fluctuates in average optimum range in each season, provides favorable conditions for aquatic biota to grow and develop including fishes. Data also

Suggest that pollution of these reservoirs are very less and do not affect on fish growth and survival. Water is light green in colour observed during summer and winter and turbid during mansoon.

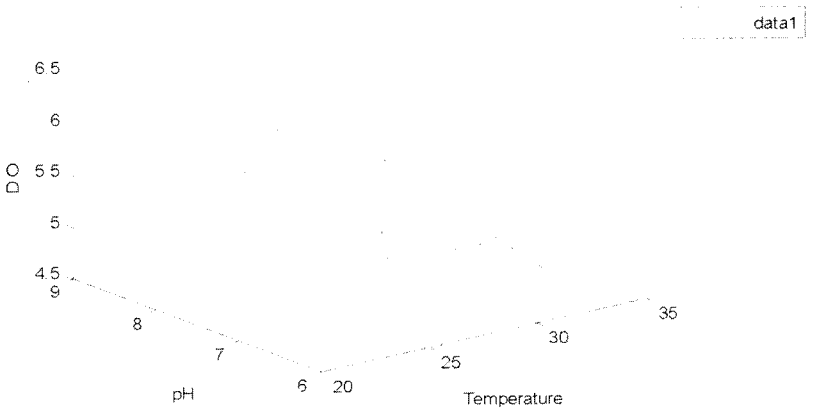
Table1-Physico-chemical standards of fresh water for fish culture by ICMR and WHO (Dinesh Kumar G., Karthik M. & Rajakumar R.(2017)).

Sr.no.	parameters		ICMR standards	WHO standards
1	Temperature in °C		28-37	28-35
2	P^H		7.0-8.5	6.5-8.5
3	Dissolved oxygen in mg/lit		-	5
4	Hardness in mg/dl	calcium	75-200	75-200
		magnesium	148	150
5	Alkalinity in mg/lit		100	75
6	BOD in mg/lit		12	10

Table 2:-physico-chemical character analysis of Dhanegaon dam and Gharani reservoir(From Dec.2011-Nov.2012 and Dec.2012-Nov.2013)

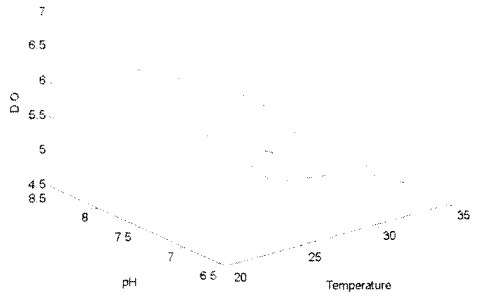
Sr.No.	Name of reservoir	Month	Temperature in °C		P^H		Dissolved oxygen(mg/lit)		Total hardness (mg/lit)	
			2011-2012	2012-2013	2011-2012	2012-2013	2011-2012	2012-2013	2011-2012	2012-2013
1	D.R.	Dec.	22	21.8	8.6	8.4	6.4	6.6	105	125
	G. R.		22.5	22	8.4	8.3	6.3	6.4	98	104
2	D.R.	Jan.	23.2	23.3	8.2	8.2	6.2	6.2	110	123
	G. R.		23.4	24	8.1	7.9	6.3	6.5	105	110
3	D.R.	Feb.	25.6	24.8	7.9	8.1	6.0	6.1	130	134
	G. R.		25.2	25.8	7.8	7.6	6.1	6.0	112	117
4	D.R.	Mar.	28.1	27.8	7.4	7.5	5.8	5.9	132	134
	G. R.		28.4	28.2	7.5	7.5	5.8	5.8	114	118
5	D.R.	Apr.	29.2	29.4	7.3	7,3	5.5	5.4	135	133
	G. R.		29.4	29.9	7.2	7.0	5.5	5.2	119	122
6	D.R.	May	33.5	33.8	6.8	6.8	4.6	4.7	152	161

	G. R.		33.6	33.7	6.9	6.9	4.6	4.7	130	138
7	D.R.	Jun.	32.1	32.4	7.0	7.1	4.9	4.8	145	148
	G. R.		29.1	29.4	7.2	7.3	5.2	5.2	120	124
8	D.R.	July.	28	28.4	7.3	7.4	4.8	4.7	105	100
	G. R.		27.9	27.5	7.4	7.2	4.7	4.6	98	102
9	D.R.	Aug.	27.5	26	7.1	7.6	5.0	5.3	80	79
	G. R.		27.2	27	7.2	7.2	5.5	5.4	76	78
10	D.R.	Sept.	26.9	27.4	7.4	7.2	5.6	5.3	82	80
	G. R.		26.5	27.5	7.3	7.4	5.6	5.4	79	77
11	D.R.	Oct.	21.8	22.6	7.6	7.8	5.9	5.7	82	86
	G. R.		22	22.8	7.5	7.4	5.8	5.6	85	84
12	D.R.	Nov.	20	20.8	8.0	8.2	6.2	6.4	88	91
	G. R.		20.6	21	8.4	8.5	6.3	6.2	82	87

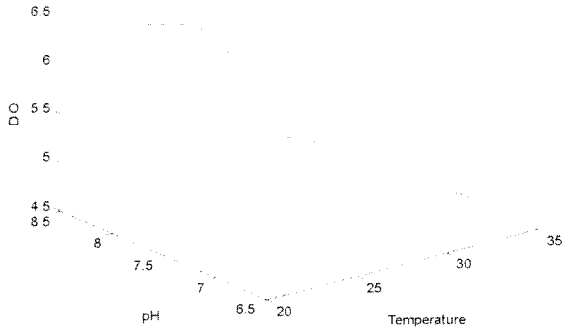


Graph1:Comparative analysis of physico-chemical parameters Temperature,pH and Dissolved oxygen of Dhanegaon reservoir in Latur district.(from Dec.2011-Nov.2012)

Graph2:Comparative analysis of physico-chemical parameters Temperature,pH and Dissolved oxygen of Gharani reservoir in Latur district.(from Dec.2011-Nov.2012)



Graph3: Comparative analysis of physico-chemical parameters Temperature,pH and Dissolved oxygen of Dhanegaon reservoir in Latur district.(from Dec.2012-Nov.2013)



Graph4: Comparative analysis of physico-chemical parameters Temperature,pH and Dissolved oxygen of Gharani reservoir in Latur district.(from Dec.2012-Nov.2013)

Discussion

Above results suggest that selected reservoirs for studies are favorable environmental conditions for natural growth of fishes as well as cultivation of fishes .According to report from central pollution control board of India and Maharashtra state pollution control board Report

From (2007-2011) Manjra river and its different tributaries are unpolluted due better water quality index (WQI) report for five subsequent years(water quality status of water bodies of Maharashtra with recourse to analytical/statistical tools (2007-2011))Data of water standards from ICMR and WHO ,also suggests that above analysis of water bodies have favorable water quality environment for the growth, culture of fishes and flourishing biotic life in the water

bodies. According to Dinesh Kumar G., Karthik M. and Rajakumar R. in 2017 seasonal variation can affect the water parameters with other some anthropogenic factor ,hence continuous monitoring is required for keeping watch on water quality .Altimately it helps in sustainance of healthy water bodies who supports water life or biota including fishes.In the above study ,after continuous monitoring for water quality in every season confirms that up to the 2011-2013 water quality of reservoirs are fit for fish growth and fish culture in reservoirs.

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