EFFECTS OF ANTHROPOGENIC ACTIVITIES ON THE GROWTH OF *LABEO ROHITA* IN MEDININAGAR, PALAMU, JHARKHAND.

By

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Abstract

The measurements for the quality of the water were made at three stations of Nawatoli pond, Bada Talab, Kacharwa dam located in Medininagar, Palamu district, Jharkhand. The study was conducted from January to December in 2021.The results received were analyzed for temperature, pH, EC, Cl⁻, , TDS, TH and SS aquaculture. The results of the analyses revealed that although the water pollution in the river showed variations throughout the year, in fact the samples obtained at various sites displayed different levels of pollutants. APHA 2012 was used to study the pollutants level in different waterbodies. These parameters were compared with the WHO Guidelines and TS-266. Among the three waterbodies that were included in the study, the best quality of water was measured in the Kacharwa dam, which gave the lowest values; and the levels were measured to be higher in the Nawatoli pond. The $p < 0.05$ level was accepted as being significant in the analyses. The distribution of the data was performed by using the Box-plot Graphs. Furthermore, the effects on fish species and the pollution in these waterbodies were examined in the study.

Keywords: *Nawatoli pond, Bada Talab, Kacharwa dam, Water Quality, Labeo rohita, Pollution, Medininagar,*

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INTRODUCTION

Anthropogenic activities cause several physical and chemical transformations in water of dams, reservoir and rivers that alter the quality of fish habitat. The health of an aquatic ecosystemis highly dependent on the physio-chemical and biological characteristics of water (Venkateshraju et al., 2010; Rameshkumar et al., 2019). Change in fish population can be indicator s of aquatic ecosystem health (Moyle, 1994) The existence and richness of fish species can be associated to the physical and chemical properties of

water (Deacon and Mize 1997).Reduced water quality is reported to affect fish communities by impacting habitat, food availability and dissolved oxygen level, which in turn influence their growth potential and reproductive abilities (Reynolds,2014; Shetty et al. 2015)T. he retention time of water in reservoirs is a major determinant of the degree of transformation of the water quality. The longer the time of retention of water in the reservoir, the higher the chance of water quality degradation and vice versa (Khatri and Tyagi, 2015).

MATERIAL AND METHODS

Three waterbodies were selected in Medininagar, Palamu district, Jharkhand for study -

1. Nawatoli pond
2. Bada talab
3. Charwa dam

In the present work, growth and behaviour of Labeo rohita (locally called "Rohu")was taken into account in all the three experimental waterbodies during different reproductive periods – prebreeding, breeding and postbreeding periods in experimental fishe*Labeo rohita* –

For determining the Physico-chemical characteristics of water like temperature, Turbidity, Hydrogen ion concentration, Dissolved oxygen, Free carbondioxide, Alkalinity, Phosphate, Nitratesurface water samples were collected in polythene bags from sampling sites of all the three waterbodies selected for the experiment. Air temperature, water temperature, pH, Dissolved oxygen and free CO2 were determined on the spot and rest were determined in laboratories. Using the methodologies of APHA (2005).

Three different seasons were considered for experiment to determine the effects of water conditions on growth and physiology of fishes taking growth index as measurement. For study purpose fish samples were captured in about 10 to 100 sq.m. area in all the three waterbodies.

Fish samples were collected from different selected localities during the study period from January to December (2021). Local fishermen were engaged to capture fishes in defined areas in different waterbodies. Gill nets, cast nets and dragnets were used to collect fish samples. Immediately weight, size of fishes were measured at the very site of collection. 10% formalin solution was used for preservation of fish collected.

Fish identification were done by using methodology evolved by Datta Munshi and Srivastava (1988) ; Talwar and Jhingran (1991) and Jayaram (1999).Species richness(denoted by R) was measured by Index of richness propounded by Margalef (1958). Species evenness was measured with Evenness index (denoted by E) using the methology of Hill(1973).

OBSERVATION

Different types of morphological abnormalities were found in fishes. Similar has been reported by researchers (Abel, 2007; 2009; Adams, 2004; Kakulu, 1987; Kumar *et al.,* 2018: Kamboj *et al.,* 2020; Sharma *et al.,* 2018; 2019). These are:

- Scale disorientation
- Split fins
- Fin deformity
- Opercular deformity
- Hyperplasia of the surface of the mouth

• Protruding mouth or nose part depression
• Gill deformity
• Jaw deformity
• Eye deformity
• Muscle atrophy
• Skeleton deformity
• Outward protrusion of the lower lip
• Tumours and other swellings

Physio-chemical condition of water was found poor in Nawatoli pond followed by Bada Talab and Kachrwa dam. Reasonbehind deterioration of water quality in Nawatoli pond is as this pond is thickly surrounded by human inhabitation. Pond receives domestic wastewater effluents from nearby inhabitationof the surrounding that must be be the reason for detoriation in water quality that is evident from the physio-chemical analysis of water of the pond. Poor quality is affect the growth of fish as well as number of fish population (Abel, 2007; 2009; Adams, 2004; Kakulu, 1987; Kumar *et al.,* 2018: Kamboj *et al.,* 2020; Sharma *et al.,* 2018; 2019) Fish growth was found maximum in Kachrwa dam followed by Bada Talab and Nawatoli pond.

Table – 1
Physico-chemical conditions of water in Nawatoli Pond
(Month wise average Data of Year 2021

Parameters	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
Water temp	22.3	24.0	25.0	26.0	34.0	37.0	36.5	36.5	33.0	31.0	29.5	24.5
Turbidity mgl^{-1}	200.0	258.0	248.0	345.0	335.0	360.0	390.0	395.0	230.0	210.0	195.0	167.0
pH	7.9	8.2	7.9	7.9	7.9	8.2	8.5	8.5	8.7	8.6	8.6	8.5
$DO_2 mgl^{-1}$	4.6	4.5	4.5	4.0	4.6	4.4	4.0	4.0	4.4	4.5	4.8	4.0
DO_2Sat%	35	39	38	30	30	35	32	30	32	33	35	35
$FCO_2 mgl^{-1}$	2.6	3.5	5.0	4.0	6.0	6.5	6.5	5.0	5.5	6.5	6.0	6.0
CO_3 mgl^{-1}	0.0	0.0	3.0	3.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HCO_3 mgl^{-1}	84.05	60.0	65.0	66.0	76.0	76.5	75.0	78.0	79.0	79.0	78.0	79.0
Cl mgl^{-1}	1.30	1.40	1.35	1.40	1.30	1.35	1.35	1.30	1.40	1.45	1.45	1.35
SiO_2 mgl^{-1}	21.0	24.0	25.0	25.0	26.0	23.0	24.5	23.0	22.0	24.0	23.0	25.0
PO_4 mgl^{-1}	0.153	0.157	0.161	0.260	0.201	0.570	0.348	0.405	0.380	0.267	0.487	0.282
NO_3 mgl^{-1}	0.440	04256	0.442	0.465	0.425	0.435	0.495	0.486	0.495	0.465	0.476	0.475

Notation: DO_2= Dissolved oxygen; FCO_2 = Free Carbondioxide; CO_3 = Carbonate alkalinity; HCO_3= Bicarbonate alkalinity; Cl = Chloride; SiO_2 = silicate; PO ¾ = Phosphate; NO^{3-} = Nitrate

Table – 2

Physico-chemical conditions of water in Bada Talab (Month wise average Data of Year 2021

Parameters	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
Water temp	19.5	21.0	23.0	29.0	32.0	31.0	30.5	31.5	29.0	29.0	26.5	21.5
Turbidity mgl^{-1}	80.0	58.0	48.0	45.0	35.0	360.0	290.0	250.0	130.0	110.0	95.0	67.0
pH	7.7	8.2	7.7	7.9	7.9	7.6	7.7	7.5	7.7	7.6	7.6	7.5
$DO_2 mgl^{-1}$	7.6	8.5	7.5	7.0	6.6	6.4	7.0	6.0	6.4	6.5	7.8	8.0
DO_2Sat%	85	95	98	90	90	85	92	80	82	83	95	95
$FCO_2 mgl^{-1}$	1.6	1.5	0.0	0.0	0.0	2.5	2.5	1.0	1.5	1.5	1.0	1.0
CO_3 mgl^{-1}	0.0	0.0	3.0	3.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HCO_3 mgl^{-1}	74.0	70.0	74.0	75.0	76.0	70.5	68.0	68.0	69.0	69.0	68.0	69.0
Cl mgl^{-1}	0.30	0.40	0.35	0.40	0.30	0.35	0.35	0.30	0.40	0.45	0.45	0.35
SiO_2 mgl^{-1}	18.0	20.0	21.0	18.0	15.0	13.0	21.5	21.0	22.0	20.0	20.0	20.0
PO_4 mgl^{-1}	0.053	0.107	0.141	0.260	0.201	0.570	0.348	0.605	0.080	0.067	0.187	0.082
NO_3 mgl^{-1}	0.240	0.256	0.342	0.365	0.401	0.400	0.510	0.540	0.445	0.310	0.310	0.340

Notation: DO_2= Dissolved oxygen; FCO_2 = Free Carbondioxide; CO_3 = Carbonate alkalinity; HCO_3= Bicarbonate alkalinity; Cl = Chloride; SiO_2 = silicate; PO_4^{3-} = Phosphate; NO^{3-} = Nitrate

Table – 3
Physico-chemical conditions of water in Kachrwa Dam
(Month wise average Data of Year 2021

Parameters	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
Water temp	20.5	21.0	23.0	29.0	12.0	31.0	30.5	31.5	29.0	29.0	26.5	21.5
Turbidity mgl^{-1}	65.0	58.0	48.0	45.0	35.0	260.0	290.0	250.0	130.0	110.0	95.0	67.0
pH	8.0	8.2	7.7	7.9	7.9	7.6	7.7	7.5	7.7	7.6	7.6	7.5
$DO_2 mgl^{-1}$	7.6	8.5	7.5	7.0	6.6	6.4	7.0	6.0	6.4	6.5	7.8	8.0
DO_2Sat%	85	95	98	90	90	85	92	80	82	83	95	95
$FCO_2 mgl^{-1}$	2.0	1.5	0.0	0.0	0.0	2.5	2.5	1.0	1.5	1.5	1.0	1.0
CO_3 mgl^{-1}	0.0	0.0	3.0	3.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HCO_3 mgl^{-1}	74.0	70.0	74.0	75.0	76.0	70.5	68.0	68.0	69.0	69.0	68.0	69.0
Cl mgl^{-1}	0.30	0.40	0.35	0.40	0.30	0.35	0.35	0.30	0.40	0.45	0.45	0.35
SiO_2 mgl^{-1}	18.0	20.0	21.0	18.0	15.0	13.0	21.5	21.0	22.0	20.0	20.0	20.0
PO_4 mgl^{-1}	0.053	0.107	0.141	0.260	0.201	0.570	0.348	0.605	0.080	0.067	0.187	0.82
NO_3 mgl^{-1}	0.290	0.256	0.342	0.365	0.401	0.400	0.510	0.540	0.445	0.310	0.310	0.340

Notation: DO_2= Dissolved oxygen; FCO_2 = Free Carbondioxide; CO_3 = Carbonate alkalinity; HCO_3= Bicarbonate alkalinity; Cl = Chloride; SiO_2 = silicate; PO_4^{3} = Phosphate;

Table – 4

Variation in 't' –test value in the Weight of *Labeo rohita* among different experimental ponds during different reproductive periods

Experimental conditions	Pre-breeding									Breeding			Post-breeding		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
Site 1 Vs Site 2	0.000	0.000	0.596	-0.599	-0.644	-0.977	-1.032	2.128	1.044	0.000	0.000	0.000	0.000	0.000	0.000
Site 1 Vs Site 3	0.000	0.000	0.734	0.047	-0.188	-0.188	-3.874	1.440	-0.068	0.000	0.000	0.000	0.000	0.000	0.000
Site 2 Vs Site 3	0.000	0.000	0.178	0.600	0.397	0.818	-2.987	-0.674	1.147	0.000	0.000	0.000	0.000	0.000	0.000

DISCUSSION

A high quantity of suspended water pollutants can interrupt the normal behaviour of fish population. Various fish species rely on sight to catch their prey quickly e.g. perch, brown trout, etc. are most susceptible to the high quantity of suspended solids and shows very strong avoidance behaviour. In some cases where the fish species survive in turbid water habitat, suspended solids can clog/harm gills aperture and reduced the resistance towards various disease and parasites (EPA, 2012). Fish species may also consume these suspended solids, results in illness by exposing to potential toxins or pathogens on the sediment. If the fish species do not die by consuming the suspended solids it can alter the blood profile and also damage its growth (EPA, 2012). Water pollutants can diminish the egg, embryo by reducing DO. Pollutants interfere various physiological processes without causing certain death. Lethal constituents and suspended dregs covers all the mucous membrane of fish gills which affect the respiration process. Mainly, mercury and lead hinder the activities of digestive enzymes

Pollutants effects directly and indirectly on the behaviour of aquatic organisms (Zala and Penn, 2004; Saaristo *et al.,* 2018), particularly in fish species (Robinson, 2009; Sloman and McNeil, 2012). Inorganic and organic pollutants also effect on various behavioural activities i.e. feeding, sexual and sociability D.S. Malik *et al.* (2020)

Abdullah *et al.* (2008) reported various histological changes in the liver of *Tilapia nilotica* which was reared in polluted water with heavy metals showing cloudy swelling, vacuolar and hydropic variations of the hepatocytes and also prominent coagulative necrosis. Velcheva *et al.* (2010) studied the pathological fluctuations in both gills and liver of *Alburnus alburnus.T*he skin of Tilapia species was adversely impacted by heavy metals pollution showing hyperactivation of goblet cells and dermal melanosis and dermal granuloma.

CONCLUSION

The productivity of a pond depends on the presence of several chemical substances of which dissolved gases like oxygen, carbon dioxide, inorganic salts and nutrients are more important variations in temperature has an important influence on all the organisms including fishes. Feeding, breeding, respiration and all other activities are influenced by temperature and the oxygen content of water is reducedwith rise in temperature. According to Swingle (1967) pond water having pH value from 6.5 to 9.0 is most suitable for fish culture and 15ppm hardness of water is considered suitable for the growth of fish, while less than 5 ppm causes slow growth and eventual death of fish happen. Growth of fish depends on the population density and availability of food. It is concern with a change in its size (length and weight) over a period of time.

Pond water is considered good for sufficient fish production for society if pond water is not polluted the pH value of water has 7.5-8.5, a sufficient amount of dissolved oxygen, carbon dioxide, phosphates, nitrates, carbonates, organic compounds, aquatic plants and plankton is essential. Thus, physical, chemical, biological conditions of the water is necessary for fish culture. However, the effect of water quality on the growth of freshwater fishes to be harmful to the fishery either directly or indirectly. The information gathered from thesetwo years studies may provide insight into the ways and means of conservation and propagation of certain commercially important fishes and other organisms from pond to augment regular supply of raw materials for food and others commercial purposes so that cottage industries may run properly contributing sustainable economic wealth and giving employment to thousands of people of this region.

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