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Study of fish productivity in relation to physico-chemical properties of Rani Talab of Teaker, Rewa (M.P.)

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ABSTRACT

An experiment was carried out during the year 2011 and 2012 at the Research Centre, A.P.S. University, Rewa (M.P.) to study the fish productivity in relation to physico-chemical properties of Talab water of Teaker village, Rewa (M.P.) . The study was confined under the five sites of the pond. In both the years, there was great variation in the physical properties of pond water i.e. water level, ambient temperature transparency, electrical conductivity. Vast differences were also observed in chemical properties of Talab water i.e. turbidity, pH, dissolved O_2, free CO_2 chlorides, total hardness, calcium hardness, phosphate and total dissolved solids. During the year 2011 and 2012, the fish productivity was maximum (1146-1216 kg) in January and least 683-696 kg in October or August. The fish productivity was exactly in accordance with the quantity and quality (species) of fishes in the pond water.

Key words: Fish productivity, Rani Talab, physico-chemical properties

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INTRODUCTION

The requirement of water to all living organisms including fish culture is a serious challenge today because entire water resources are polluted due to human and animal activities in the vicinity of villages in a unhealthy manner. Human beings affect the welfare of fish through fisheries, aquaculture and other activities. Fishes are with the intimate contact with their pond water environment through the huge surface area of their gills so they are vulnerable to poor water quality and water-born pollutants. The physico-chemical characteristics of water-bodies affect the fish species composition, abundance, productivity of fish and physiological conditions of aquatic organisms. The pond's water is chemically polluted by many ways which may discourage the normal fish production. Looking to all these facts the present research was taken up to judge the fish productivity under the existing condition of the pond water of Teaker village.

MATERIALS AND METHODS

The experiment was carried during the year 2011 and 2012 at the Research Centre, A.P.S. University, Rewa (M.P.). The study site was Rani Talab of Teaker village. The pond contains several types fish species. Water sampling and fish collection was done month wise from five sites (4 suitable corners and 1 in the Centre) of the Talab. Among the physical properties of Talab, water level, ambient temperature, transparency and electrical conductivity were determined as per prescribed procedures (Ramteke and Moghe, 1988). Among the chemical properties, turbidity, pH, dissolved oxygen, free carbon dioxide, chlorides, total hardness of water, calcium hardness, phosphate, and total dissolved solids were estimated as per recommended procedures (Ramteke and Moghe (1988 and Watch (1952). The annual production of fishes was recorded from each of the sites. The fish productivity was estimated by the formula as given by Ricker (1946) and Allen (1950).

RESULTS AND DISCUSSION

Physical properties of pond water: The perusal of data in Table 1 reveal that during the year 2011 and 2012, the water level was varied from 2.67 to 6.05 meters. The water level was found minimum in June (2.48 m), whereas the October month exhibited the maximum water level (6.98 m). The average ambient temperature varied from 18.38°c to 33.4°c during year 2011 and 2012. The ambient temperature was found minimum in January whereas June month exhibited the maximum ambient temperature. The average transparency varied from 23.26 to 59.10 cm during year 2011 and 2012. The transparency was found to be minimum in September, whereas the January month exhibited the maximum transparency (59.8 cm). Similarly average electrical conductivity varied from 12.75 to 17.81 mmhos during the year 2011 and 2012. The electrical conductivity was found to be minimum in September, whereas the May month exhibited the maximum electrical conductivity. In fact the physical properties of pond water depends upon the men and animals nutrition enrichment, acidification and domestic wastes, sewage, addition of agricultural and industrial toxic substances (Laskar and Gupta, 2009).

Chemical properties of pond water : It was further observed that the average turbidity of pond water varied from 123.03 to 193.33 ppm during the year 2011 and 2012. The turbidity was found minimum in January, whereas the June month exhibited the maximum turbidity. The high or turbidity during summer months might be ascribed to the higher water temperature because suspended particles absorb heat from the sunlight making the water warm (Thirumala *et al*., 2006).

The average pH varied from 7.47 to 8.19 during year 2011 and 2012. The pH was found minimum in October (6.23), whereas the July month exhibited the maximum pH (9.59). The higher of pH recorded during winter months could be attributed to increased primary productivity, wherein carbonates, sulfate, nitrates and phosphates are converted to hydroxyl ions (Narayani, 1990).

The average dissolved O_2 (DO) varied from 6.10 to 9.08 mg/lit. during year 2011 and 2012. The DO was found to be minimum in February (5.49 mg/lit.) whereas the June month exhibited the maximum DO (9.12 mg/lit.) The presence of dissolved oxygen in water may be due to direct diffusion from the air and photosynthetic activity of autotrophs (Arya *et al.*, 2011).

Similarly the free CO_2 varied from 1.05 to 2.12 mg/ lit. during the year 2011 and 2012. The free CO_2 was found to be minimum in October (1.00 mg/ lit), whereas the December month exhibited the maximum free CO_2 (4.52 mg/ lit). The increased CO_2 level may be due to the sequence of processes like uptake from the autotrophs, assimilation by algae, and decay of aerobic bacteria also add CO_2 (Mohapatra, 1987).

The chloride content was at its peak in summer and lowered down during winter season during both the years. The chloride value varied from 48.19 to 73.29 mg/ lit. during the year 2011 and 2012. The chloride was found to be minimum in December, whereas the May month exhibited the maximum chloride. The higher concentration of Chloride is considered to be an indicator of higher pollution due to higher organic waste of animal origin (Arya *et al*., 2011).

The total hardness of pond water was in the range of 231.6 mg/ lit. to 307.2 mg/ lit. in the year 2011 and 2012. The month of September exhibited the maximum total hardness (244 mg/ lit.) and the month of June exhibited the minimum total hardness (310 mg/ lit.). The total hardness was found high during the summer season which may be due to evaporation of water and addition of calcium and magnesium salts (Nargis and Pramanik *et al.*, 2008 and Arya *et al.*, 2011).

The average calcium hardness of pond water varied between 29.00 mg/ lit. to 90.02 mg/lit. during the year 2011 and 2012. The maximum values of calcium hardness were obtained during June (90.61 mg/lit.) and minimum value in September (28.00 mg/lit.).

The average phosphate in pond water was in the range of 0.11 to 0.234 mg/ lit. in the year 2011 and 2012. The month of August exhibited the maximum phosphate content (0.25 mg/ lit.) and the month of December exhibited minimum P-content (0.12 mg/lit.).

The phosphate concentration was found low during winter which may be attributed to locking up of phosphate in dense phytoplankton and macrophytic vegetation (Wani and Suble, 1990). During plankton multiplication, the phosphate concentration is automatically decreased (Moss and Ball, 1989).

The total solids of pond water varied between 262 to 336 mg/ lit. during the year 2011 and 2012. It was reported minimum during January (261 mg/ lit.), whereas it was maximum during October (339 mg/ lit.) The amount of total solids are influenced by the activity of plankton and organic materials. According to Trivedi *et al*. (1987), the total solids, mostly, are organic and also inorganic in nature which pose serious problems of pollution.

Productivity of pond fishes : During both the years, the fish productivity was found highest (1146 to 1216 kg) in January (Table 1). Whereas the productivity was lowest (383 and 696 kg) in October or in August. The higher or lower fish productivity was exactly in accordance with the qualities and quantities of fishes in the pond water in those months.

Protz *et al*. (2006) reported that water quality is one of the most important contributors to fish health and stress level. Fish may be able to tolerate adverse water quality conditions; however, when combined with other stressors, fish may be quickly overcome by the resulting physiological challenges. Stress assoicated with short-term holding of fishes can have negative effects on overall health and well-being.

CONCLUSION

Temperature, dissolved oxygen, ammonia, nitrite, nitrate, salinity, pH, carbon dioxide, alkalinity, and hardness are the most common water quality parameters affecting physiological stress. Jolley *et al*. (2010) indicated that food availability may regulate fish recruitment, both directly and indirectly. The availability of zooplankton, especially to newly hatched larvae, is thought to be crucial to their early growth and survival.

Conflict of interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

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REFERENCES

Allen, K.R. (1950). The computation of production in fish populations. *N.Z. Sci. Rev*, **8**: 89.

Arya, S, Kumar, V, Raikwar, M, Dhaka, A and Minakshi (2011). Physico-chemical Analysis of Selected Surface Water Samples of Laxmi Tal (Pond) in Jhansi City, UP, Bundelkhand Region, Central India *Journal of Experimental Sciences,* **2**(8): 01-06.

Jolley, J. C., Willis, D. W. and Holland R. S. (2010). Match–Mismatch Regulation for Bluegill and Yellow Perch Larvae and Their Prey in Sandhill Lakes. *Journal of Fish and Wildlife Management,* **1**,(2): 73-85.

Laskar, Hafsa Sultana and Susmita, Gupta (2009). Phytoplankton diversity and dynamics of Chatla floodplain lake, Barak Valley, Assam, North East India - A seasonal study. *J. Environ. Biol.,* **30**(1), 1007-1012.

Mohapatra, S.P., (1987). Heavy metal concentrations in the industrial effluents changed to the Thana Creek. *Indian J. Environ. Protn*., **7**(4): 284-286.

Moss, B. and H. Balls, (1989). Phytoplankton distribution in a flood plain lake and river system II. Seasonal changes in the phytoplankton communities and their control by hydrology and nutrient availability. *J. Plankton Res*., **11**(4): 839-867.

Narayani, Nishi (1990). Seasonal changes in abiotic parameters of eutrophic wetlands (lower lake, Bhopal). In: Advances in Environmental Biopollution. (Ed.) Shula, A.C.; Vandana, A., Trivedi, P.S. and Pandey, S.N. A.P.H. publishing Corporation, New Delhi, 155-163.

Nargis, A. and Pramanik, S. H. (2008). Physico-Chemical Parameters in Relation to Meteorological and Climatic Conditions in a Fish Pond *Bangladesh J. Sci. Ind. Res*, **43**(3), 405-410.

Portz, D. E., Woodley C. M. and Cech, J. J. (2006). Stress-associated impacts of short-term holding on fishes, *Reviews in Fish Biology and Fisheries,* **16(**2):125-170.

Ramteke, D. S. and Moghe, C. A., (1988). Manual on Water and Waste water Analysis National Environmental Engineering Research Institute, Nagpur.

Ricker, W.E. (1946). Production and utilization of fish populations. *Ecol. Monogr*, **16**(1): 373-391.

Thirumala, S., P.R. Kiran, V.T. Puttaiah, V. Kumara and T.R. Shashi Shekhar, (2006). Hydrochemical characteristics of Ayyanakere Lake near Western Ghats of Chikmagalore, *Karnataka. J. Aqua. Biol.,* **21**(1): 111-117.

Trivedi, R.K., Goel, P.K., and Trisal, C.L., (1987). Practical methods in Ecology and Environmental Sciences. *Environ. Publi.,* Karad, (India), 336.

Wani, I.A. and B.A. Subla, (1990). Physico-chemical features of two shallow Himalayan lakes. *Bull. Environ. Sci.,* **8**(2): 33-49.

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Table 1 Physico-chemical properties of pond-water and fish productivity from five sites

	Properties of pond water	Year 2011			Year 2012		
		Value	Mini.	Max.	Value	Mini.	Max.
	Physical properties						
1.	Water level (m)	2.64-5-98	June	Oct.	2.72-6.05	June	Oct.
2.	Ambient Temperature (°c)	18.24-33.02	Jan.	June	18.38-33.10	Jan.	June
3.	Transparency (cm)	23.26-58.98	Sept.	Jan	23.54-59.10	Sep.	Jan.
4.	Electrical conductivity mmhors	12.75-17.17	Stpt.	May	12.79-17-81	Spt.	May
	Chemical properties						
1	Turbidity _ppm)	126-193.05	Jan.	June	123.03-193.33	Nov.	June
2.	pH	7.51-8.18	July	July	7.47-8.19	Oct.	April
3.	Dissolved O_2 (mg/lit)	6.05-8.95	June	June	6.10-9.08	Feb.	June
4.	Free CO_2 (mg/lit)	1.01-2.04	Dec.	Dec.	1.05-2.12	Oct.	Dec.
5.	Chlorides (mg/lit)	48.19-72.09	May	May	48.64-72.38	Dec.	May
6.	Total hardness of pond water (mg/lit)	231.6-306.8	June	June	251.6-307.2	July	June
7	Calcium hardness (mg/lit)	29.00-89.83	June	June	30.00-90.02	Sept.	June
8.	Phosphate (mg/ lit)	0.11-0.23	Aug.	Aug.	0.12-0.23	Jan.	July
9.	Total dissolved solids (mg/lit)	264.327	Oct.	Oct.	262-336	Jan.	Oct.
	Productivity of fishes (kg)	**683.1146**	**Jan**	**Jan.**	**696-1216**	**Aug.**	**Jan.**