RESEARCH ARTICLE

CONDITION OF *LABEO ROHITA* AND PRIMARY PRODUCTIVITY OF SURYA- POKHRA POND (MANPUR), GAYA, BIHAR

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ABSTRACT

It is a hard fact that condition factor in fishes (Rohu) which is studied, shows marked fluctiuations during the year, so much so that on the basis alone the year can be broadly divided into four important periods like, the winter (January to March), the pre-monsoon (April to June), the monsoon (July to September), and the post monsoon (October to December). The condition of fish productivity in general is good particularly during the winter and pre-monsoon months. The reason is that the food environment is favourable during the pre-monsoon period. The adult fishes are sexually matured. There are deposition of fats in the body. Various ecological conditions also play an important role for increase in the weight of fishes. Pond water is also observed as clear, transparent and less polluted. The slight degree of pollution is due to human activities. Abundance of phytoplanktons also provide the improved feeding condition as a number of phytoplanktons like Chlamydomonas, Oscillatoria etc. are observed. Dissolved oxygen also showed similar pattern of wide fluctuations with range between 6.8 to 13.8. The first peak was found during March' 2018 and other during September' 2018 . The lowest value was recorded as 6.8 ppm in June' 2018 . The high dissolved oxygen content in Aug-Sep can be attributed to the phenomenon of photosynthesis accentuated by high velocity of flow and presence of abundant quantities of macrophytes and cloud free sky, which cause good photosynthesis activities in the ecosystem. The collected data also shows there is decrease in D.O. with increase in temperature throughout the year.

INTRODUCTION

Gaya is one of the oldest cities of the world which is famous for its religious importance. The city of Gaya has a continental monsoon type of climate owing to its great distance from sea. Summers are very hot and winter cold. The temperature may rise to even 46^0c in summer and it may fall down to 3^0c in winter. Humidity is also fluctuating. During summer it is much lower than, during other months due to hot and dry westerly winds prevailing in the period. Due to fluctuation in temperature and other associated environmental factors, variation in the production of phytoplankton and macrophytes occur in ponds of Gaya town. This has been reflected in their biomass, rate of production, annual production turn over value and their efficiency of energy capture and its flow. In India, considerable work has been done on the productivity of forests and grassland ecosystems but comparatively few workers like Srinivasan (1964), Sitaramaiya (1967), Nasar and Munshi (1973), Hanifa and Pandaya (1978), Chakravorty (1980),

Rekha Kumari (2006) and some others have furnished data on the plankton biomass, their interaction and relationship with physico-chemical factors of soil and water, primary productivity and other related parameters of freshwater ecosystems. In the present investigation, it has been tried to undertake a study of freshwater pond, 'Suryapokhra' which is located at Manpur in Gaya district (Bihar). The ecological study of this pond is carried out regularly for 10 months from every point of view in order to know the comparative as well as general ecological picture of this pond. The present ecological investigation is mainly confined to lentic habitat. It consists of floristic and faunistic community structure including biomass and diversity, physico-chemicl factors of the medium (soil and water), effects of seasonal and diurnal variations, longitudinal and depth profile of these parameters, the productivity and nutrient conditions of the ecosystems, their interrelationship and condition factor of certain freshwater fishes, most commonly the *Labeo rohita*. Dissolved oxygen also showed similar pattern of wide fluctuatios with range between 6.8 to 13.8. The higher dissolved oxygen is observed during Aug. – Sep. period. The study indicated that the mean primary productivity (GPP) of the pond is found to be 0.50g cm^3h^{-1} in surface.

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On the basis of Mean Primary Prductivity, the fish production potential of the pond 'Suryapokhra' shows that there is considerable scope for the enhancement of present average production. The current research work is conducted to find out the phytoplankton diversity in relation to primary productivity of 'Surypokhra' pond. Attempt is made to assess the current water quality status and possibilities of fisheries development.

MATERIALS AND METHODS

For the present study, 'Suryapokhra' pond is selected which is located at Khanzahapur (Manpur), Gaya (Bihar), India Sampling of water is collected and analysed at fortnightly interval. The method of physical and chemical analysis is done by adopting standard methods APHA (2000). Planktons are collected by bolting silk plankton net (25) with 77 mesh per sq. cm and counted with the help of sedgwickrafter counter chamber by using microscope. Benthic macro – invertebrates are collected with the help of Ekman Dredge 22.5 × 22.5 cm size. For Estimation of Primary productivity, the magnitude of primary production is measured by classical bottle experiment adopted by Ganapati (1970).

Primary Productivity: Primary Productivity is measured following light and dark bottles method. For this prupose, glass stopped black and white BOD bottles of 250ml are used. The 2bottles were suspended about 15cm below the water line. The incubation period was kept three hours. O_2 estimations in the BOD bottles were made following usual winkler's method.

The calculation is done as under

Gross Oxygen Production (GOP) mgl^{-1} = LB – DB
Net Oxygen Production (NOP) $mg1^{-1}$ = LB – IB
Community Respiration (CR) $Mg1^{-1}$ = IB – DB

The value of gross and net primary productivity are calculated as follows

Gross Primary Productivity ($gcm^{-3}h^{-1}$) = GOP × 0.375/1.2×h
Net Primary Productivity ($gcm^{-3}h^{-1}$) = NOP × 0.375/1.2×h

Where :-

LB = Dissolved Oxygen in light bottle
DB = Dissolved Oxygen in dark bottle
IB = Dissolved Oxygen in initial bottle
H = Duration of incubation or exposure
1.2 = A constant
0.375 = A factor value (1g of oxygen is equal to 0.375g carbon)

Plankton Analysis

For this, 50 litres of water is filtered through bolting silk no. 25 (mesh size 77 per sq.cm) and plankton thus obtained is preserved in Lugol's solution for further quantitative and qualitative analysis. The identification of phytoplanktons are restricted only major groups i.e. Chlorophyceae, Cyanophyceac, Bacillariophyceal and Englinophyceae

Phytoplanktons

The phytoplanktons constitute bulk of primary producers and are the base of food chains in any waterbody.

The phytoplanktonic community of Suryapokhara pond during the present is represented by four major groups stated as above. Overall 27 genera of algae are identified. Out of the total 27 genra, 9 are from chlorophyceae, 9 are from cyanophyceae (Green algae), 6 from bacillariophyceae and 3 belonged to euglenopyceae. The most prominent phytoplanktons during the study are Chlamydomonas, Volvox, Anabaena, Nostoc and Microcystis. Chlorophycean dominance has been observed followed by Cyanophyceae, Bacillariophyceae and Euglenophyceae.

Chlorophycean population were minimum in June as 1900 speimens L^{-1}. Bacillaniphycean population were minimum in july as 1100 specimen L^{-1} and maximum as 2700 specimen L^{-1} in Jan. Euglenophycean population as minimum as 900 specimens L^{-1} in June and as maximum as 1700 in October. Considering the average phytoplanktonic biomass, Chlorophyceae was the most dominant (85.54 cells ml^{-1}) followed by cyanophyceae (75.62 cells ml^{-1}), Baclillariophyceae (66 cels ml^{-1}) and Euglenophyneae 30 (cells ml^{-1}). The statistical correlation of phytoplankton is found positive with GPP and NPP. However there is a negative relationship with community respiration.

Physico-chemical Parameters
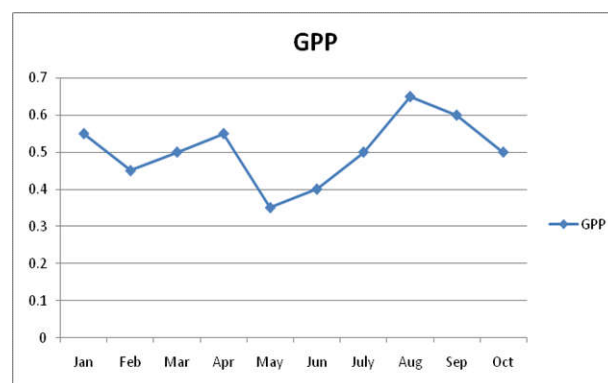
Graph 1. GPP fluctuations

Monthly Variation of GPP ($gcm^{-3}h^{-1}$) in Surya pokhra Pond.
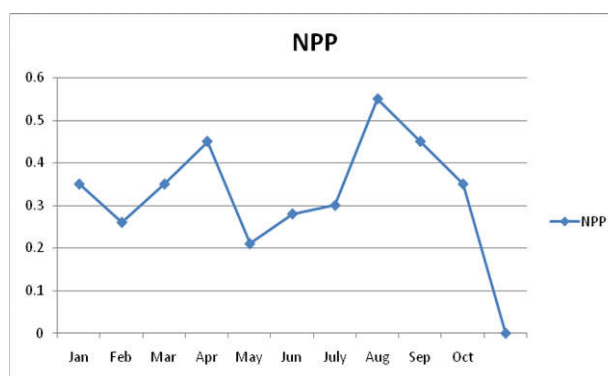
Graph 2. NPP fluctuations

Monthly Variation of NPP ($gcm^{-3}h^{-1}$) in Surya pokhra Pond.

RESULTS AND DISCUSSION

After going through TABLE 1,2,3 & Graph 1 & 2 it is clear that the results pertaining to gross and net primary productivities of Suryapokhra Pond during the study period (Jan 2018 to Oct. 2018) is given.

Table 1. Biological characteristics of pond water

S.No.	Parameters	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Avg.	S.D.	Min.	Max	C.V. (%)
1	Primary productivity (g Cm^{-3}h^1)																	
2.	Gross primary productivity	0.60	0.50	0.35	0.60	0.60	0.65	0.60	0.45	0.55	0.40	0.65	0.40	0.52	0.10	0.35	0.65	19.23
3.	Net primary productivity	0.45	0.35	0.15	0.45	0.40	0.50	0.40	0.35	0.45	0.25	0.50	0.25	0.37	0.10	0.15	0.50	27.02
4.	Community respiration	0.15	0.15	0.20	0.15	0.20	0.15	0.20	0.10	0.10	0.15	0.15	0.15	0.15	0.03	0.10	0.20	20.00

Table 2. Physico-chemical characteristics

	Jan	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.
Air temp(^{0}C)	18	27	35	35.5	35	36	34	34	33	32
Water temp (^{0}C)	19	25	33	34	41	34	33	31	33	28
pH	7.8	7.6	8.2	7.9	7.5	7.2	8	7.8	7.6	8.2
Depth (feet)	12 feet	12	12	10	9	8	10	11	12	12
Dissolved oxygen (ppm)	10	12	13.8	9	8	6.8	7.6	9	9.5	8.5
Free CO_2 (ppm)	5	8	Nil	Nil	Nil	2	3	10	5	8
HCO_3	280	285	260	260	205	190	85	90	22	110
Transparency (mm)	102	135	105	120	150	65	55	90	65	120
GPP (gcm^{-3}h^{-1})	0.55	0.45	0.50	0.55	0.35	0.40	0.50	0.65	0.60	0.50
NPP (gcm^{-3}h^{-1})	0.35	.26	0.35	0.45	.21	0.28	0.30	0.55	0.45	0.35
CR (gcm^{-3}h^{-1})	0.20	0.19	0.15	0.10	0.14	0.12	0.20	0.10	0.15	0.15

Table 3. GPP, NPP AND CR

Month	GPP (gcm^{-3}h^{-1})	NPP(gcm^{-3}h^{-1})	CR (gcm^{-3}h^{-1})
Jan	0.55	0.35	0.2
Feb	0.45	0.26	0.19
Mar	0.5	0.35	0.15
Apr	0.55	0.45	0.1
May	0.35	0.21	0.14
June	0.4	0.28	0.12
July	0.5	0.3	0.2
Aug	0.65	0.55	0.1
Sep	0.6	0.45	0.15
Oct.	0.5	0.35	0.15
Average	0.5	0.35	0.15
SD	0.0866	0.0974	0.1122

In general the GPP ranged between 0.35 to 0.65. $gc^{-m-3} h^{-1}$. The average value of GPP is 0.50. The statistical relationship of GPP is found positive with NPP, community respiration (CR) and total phytoplanktons. The respective values of NPP ranged from 0.15 to 0.50 $gcm^{-3}h^{-1}$. The average value of NPP is 0.37. The statistical relationship of NPP is found positive with GPP and total phytoplanktons. The respective values of CR ranged from 0.10 to 0.20 $gcm^{-3}h^{-1}$. The average value of CR is 0.15. The statistical correlation of CR is found positive GPP. However there is a negative relationship with NPP and total Phytoplanktons.

Conclusion

Physico-Chemical parameters and Phytoplanktonic diversity show a favourable condition for fishery. Except few man made factors for pollution, the pond water is in good condition for growth and development of fish *Labeo rohita.*

We should develop the awareness plan to minimize the degree of pollution. These steps are as follows

- Using less polluting materials in the pond,
- Improvement in training facility to provide awareness to local people.

- Reducing the use of chemical inputs.
- Adoption of less environmentally harmful pesticides.
- Preventing harmful activities created by human beings.

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