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Primary productivity of Wardha river at Ballarpur in Chandrapur District of Maharashtra, India with reference to its fishery.

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ABSTRACT

The study of primary productivity is important for the assessment of productivity of any aquatic systems. The present investigation is carried out to understand the status of primary production of Wardha river at Ballarpur in Chandrapur District of Maharashtra. Light and Dark bottle method was followed for the estimation of primary productivity. It was carried out for the period of three months (December, 2018 to February, 2019) at monthly intervals. The value of Gross primary productivity was ranged between 71.5 – 113.16 ($mg.C.m^3.hr^{-1}$), Net primary productivity ranged as 29.8 – 70.2 ($mg.C.m^3.hr^{-1}$) and Community respiration was between 25.6 – 69.4 ($mg.C.m^3.hr^{-1}$). From this study, it may be concluded that, Wardha river is productive and suitable for stocking fish seed in post-monsoon period for the development of culture based capture fishery.

Key words: Primary productivity, Wardha river and Capture fishery.

INTRODUCTION

The Wardha river is also known as 'Varda river', is a major river in Vidarbha region of Maharashtra. It originates in the Satpuda range of mountains and flows into Wainganga river. The Wardha river is originates at an altitude of 777m (2549 ft) in the Satpuda range of mountains near Khairwani village in Multai Tahsil of Betul District in Madhya Pradesh State of India. From its origin, it flows for 32 Km (20 Miles) in Madhya Pradesh and then enters into Maharashtra. After travelling for another 528 Km. (Miles), it joins to the Wainganga river and forms the Pranhita river at Adilabad District of Telangana State which ultimately flows into Godavari river. The Kar, Wena, Jam and Erai are its 'Left-bank tributaries' while the Madhu, Bembala and Penganga are its 'Right-bank tributaries'. There are two dams on Wardha river, viz., 'Upper Wardha Dam' and 'Lower Wardha Dam'.

The 'Upper Wardha Dam' is located on the Wardha river near Morshi. It is considered as a lifetime of the Amravati City and the Morshi and Warud Taluka. The 'Lower Wardha Dam' is located near Warud Bagaji and Dhanoli in Amravati District. It caters to Wardha District. A dam on the Bembala river has been constructed near Babhulgaon in Yawatmal District and is considered as a lifetime for the part of Yawatmal.

The primary productivity, in Ecology, is the rate at which energy is converted into organic substances by photosynthetic producers (Photo-autotrophs) which obtain energy and nutrients by harnessing sunlight and chemosynthetic producers (Chemo-autotrophs), which obtain chemical energy through oxidation. Nearly all of earth's primary productivity is generated by photo-autotrophs.

The total amount of biological productivity in a region or ecosystem is called as 'Gross primary productivity'. A certain amount of organic material is used to sustain the life of producers (or autotrophs) in a food chain and what remains is the 'Net primary productivity' which can be used by consumers (or heterotrophs, which are made up of herbivores and carnivores in each environment). Primary productivity is usually determined by measuring the uptake of Carbon di-oxide or the output of Oxygen. Production rates are usually expressed as grams of organic carbon per unit area per unit time.

In marine environments, there are two principal categories of producers, viz., Pelagic phytoplanktons and Benthic algae. The pelagic phytoplanktons floats freely in the Ocean and the benthic algae are lives at or near the Ocean floor. In terrestrial environments, primary productivity is generated by trees and other land plants (including planted crops). Most primary producers requires nitrogen and phosphorus which are available as dissolved nutrient in soil, lakes and rivers and in the Ocean as nitrate, nitrite, ammonia and phosphorus. The abundance of these molecules and the intensity and the quality of light exerts a major influence on rates of production.

Primary productivity is an important hydrobiological aspect of any other water body. It shows the production capacity of that water body. Here we will discuss about the primary productivity of Wardha river near Ballarpur in Chandrapur District of Maharashtra, India with reference to its fisheries.

MATERIAL AND METHODS

For the study of primary productivity of Wardha river, Ballarpur site was choosen. Ballarpur is a Tahsil place in Chandrapur District. It is famous for Paper mill. Three sites were selected. These are: Site-1: Ballarpur Fort, Site-2: Ballarpur Paper mill and Site-3: Ballarpur Railway Station area. For primary productivity (Gross primary productivity, Net primary productivity and Community respiration), Dissolved oxygen bottles were used to follow the 'Light and Dark bottles technique' suggested by Gaarder and Gran (1927) and recommended by Vollenweider (1969). A standard method given in APHA's (1998) book was also followed. Gaarder and Gran (1927) was the first who proposed the technique of Light and Dark bottles of DO and Winkler's titration method to measure the production and consumption of oxygen. i.e., Primary productivity. The primary productivity has been expressed as Gross primary productivity, Net primary productivity and Community respiration.

Calculation:

Gross primary productivity (mg.C.m^3.hr^{-1}) of DO = Light bottle DO - Dark bottle DO….A

Net primary productivity (mg.C.m^3.hr^{-1}) of DO = Light bottle DO - Initial DO……B

Community respiration (mg.C.m^3.hr^{-1}) of DO = Initial DO - Dark bottle DO……C

Gross primary productivity (mg.C.m^3.hr^{-1}) = A X 0.375/PQ X h

Net primary productivity (mg.C.m^3.hr^{-1}) = B X 0.375/PQ X h

Community respiration (mg.C.m^3.hr^{-1}) = C X 0.375/PQ X h

Where, PQ = Photosynthetic Quotient (Normally a PQ value of 1.2 is considered for field oriented primary production experiments.)
DO = Dissolved Oxygen
h = Incubation period in hours (6 hr.)

RESULT AND DISCUSSION

Three months data after analysis shows the variation in Gross primary productivity, Net primary productivity and Community respiration. The range of variation, mean values and standard deviation are given in Table 1.

Table 1: Range of variation, Mean values and Standard Deviation of Gross primary productivity, Net primary productivity and Community respiration of Wardha river.

Sr. No.	Parameters	Range of variation	Mean ± SD
1	Gross primary productivity ($mg.C.m^3.hr^{-1}$)	71.5 – 113.16	96.73 ± 10.75
2	Net primary productivity ($mg.C.m^3.hr^{-1}$)	29.8 – 70.2	48.08 ± 8.05
3	Community respiration ($mg.C.m^3.hr^{-1}$)	25.6 – 69.4	46.20 ± 8.07

The primary productivity is influenced by many environmental factors. According to Wetzel (1966), the high rate of primary productivity is correspond to an increase in solar radiation and is always more during the middle of the day (1:30 to 2:30 p.m.). In the present investigation, the Gross primary production, Net primary production and Community respiration shows variation in their range. The value of Gross primary productivity (GPP) was ranged between 71.5 – 113.16 ($mg.C.m^3.hr^{-1}$), Net primary productivity (NPP) ranged as 29.8 – 70.2 ($mg.C.m^3.hr^{-1}$) and Community Respiration (CR) was between 25.6 – 69.4 ($mg.C.m^3.hr^{-1}$). Gaidhane *et al.* (2020) was studied the primary productivity of Erai river in Chandrapur District of Maharashtra. They found nearly similar results in his study. Lokhande and Indulkar (2017) had made studies on primary productivity of Khaire reservoir in Raigad District of Maharashtra. The results of their study revealed that, the primary peak of productivity was observed during pre-monsoon season and the secondary peak was noticed during post-monsoon season. However, during the monsoon season low productivity values were recorded from the reservoir. Rathod *et al.* (2016) was observed the primary productivity of Kadwai reservoir in Ratnagiri, Maharashtra and they found that the primary productivity was increased during the post-monsoon period. Their result indicates that Kadwai reservoir is more productive during the post-monsoon season and suitable for stocking the fish seed. Baber and Raje (2015) was observed the primary productivity of Morwane dam in Ratnagiri District of Maharashtra. According to him, the study of primary productivity of dam or lake is fundamental aspect to understand the water quality and fishery potentials. The positive increase in dissolved oxygen level indicated that the Morwane dam is moderately productive having adequate penetration of light. From his study, it is concluded that the Khaire reservoir is productive in nature. Gaidhane *et al.* (2007) had studied the primary productivity of some Kharland (Saline) ponds of Ratnagiri, Maharashtra in order to understand their potential for prawn culture and concluded that the Kharland (Saline) ponds are productive and can be used for culture of prawns like marine prawns *Peneus merguensis* and *Peneus monodon* and freshwater prawns *Macrobrachium rosenbergii*) alone or along with fishes.

CONCLUSION

From the present investigation, it may be concluded that the Wardha river is productive during the post-monsoon season and is suitable for the stocking of fish seed for the development of culture based capture fishery.

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Conflicts of Interest: The authors declare no conflict of interest.

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