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RESEARCH ARTICLE

PRODUCTIVITY AND WATER QUALITY OF TUBE WELL WATER AND FISH POND IN KATHUA, JAMMU DIVISION, INDIA

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ABSTRACT

Introduction: Life on earth is not possible without water; one of the essential constituent of the environment. This study was designed to assess the quality of productivity and water quality of fish pond water in National Fish Farm Kathua and hand pump water of Kathua regions (Barnoti and Nihalpur). **Method:** Sample was collected in the month of April 2018. The water sample was analyzed for various physic-chemical characteristics like temperature, pH, total dissolved solids (TDS), dissolved oxygen (DO), electrical conductivity (EC), chlorides, carbonates, alkalinity, sulfate, nitrates, phosphate, and hardness. **Results:** Results showed the level (mean ± standard error) of pH (Fishpond-7.68 ± 0.93, Handpump-6.5 ± 0.22), TDS (Fishpond-136 ± 2.70 mg/L, Handpump-11.25 ± 0.96 mg/L), DO (Fishpond-17.60 ± 3.03mg/L, Handpump-12.71 ± 1.47mg/L), EC (Fishpond-1.9 ± 0.55 µS/cm^2, Handpump-1.5 ± 0.58 µS/cm^2), chloride (Fishpond-929.24 ± 20.77mg/L, Handpump-88.40 ± 52.21mg/L), carbonate (Fishpond-76.28 ± 27.86 mg/L, Handpump-84.00 ± 32.67 mg/L), and alkalinity (Fishpond-456.40 ± 124.04 mg/L, Handpump-528.00 ± 192.87 mg/L), respectively. But, the level of sulfate, nitrate, phosphate, and hardness was not detected. **Conclusion:** The suitability of the hand pump water and fish pond was assessed. With reference to this study, it can be concluded that the water quality of hand pump water was good and the productivity level was moderate in all the ponds.

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INTRODUCTION

Water plays an important role in the development of a healthy society. It is the most abundant and most useful compound in the world and hence it is called as 'Jeevan' in Sanskrit. Life is not possible without water. 70% surface of the earth is covered by water; the majority of water available on earth is saline in nature only 3% of existing as fresh water. Freshwater has become a limited due to overutilization and pollution (Ghosh and Basu, 1968; Gupta and Shukla, 2006; Patil *et al*., 2001; Singh and Mathur, 2005). Ponds have been used since time immemorial as a traditional source of water supply in India. A pond is referred to as a man-made or natural water body which is between 1m^2 and 2 ha in area, which held water for four months of the year or more. The water of ponds are polluted mainly due to discharged water waste, water from the residential area, sewage outlets, solid wastes, detergents, automobiles oil waste (Bhuyian and Gupta, 2006) Pollution of surface and groundwater is a great problem due to urbanization and industrialization.

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Contaminated drinking water can cause various diseases including cholera, typhoid, fever, dysentery and other intestinal diseases (Udoh, 1987; Adeyemi, 2004; Dixit and Shankar, 2009). In developing countries, about 1.8 million people mostly children die every year as a result of water-related disease (Onda *et al*., 2012; Wolf *et al*., 2013; WHO, 2006; WHO, 2011; WHO/UNICEF, 2013). A Fishpond is a controlled pond which is stocked with fish and is used for fish culture or is also used for recreational fishing or for ornamental purposes. Fishponds provide a source of food and income from the sale of fish for small farmers (Shava and Gunhidzirai, 2017). This study was conducted to assess the productivity and water quality of fish pond Kathua and their effect on fisheries. There was no studies have been done on the productivity and water quality of fish seed farm Kathua and water quality of hand pump water of Kathua. This study also considered the importance of water management in sustaining fish production in national fish seed farm.

MATERIALS AND METHODS

Study Area: The study area is National Fish Seed Farm Kathua town district Kathua, J&K, India. Total area of Kathua is 2,651 km^2.

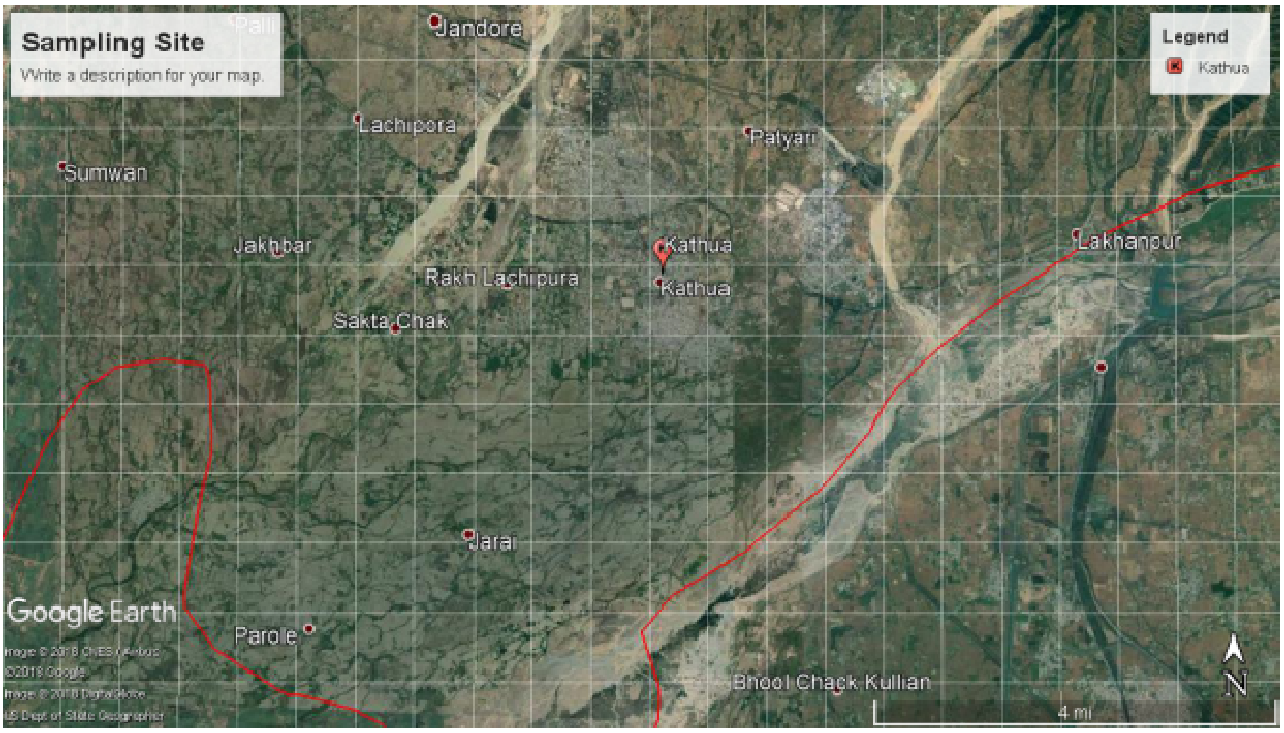

Figure 1. Water Sampling Map at Kathua, Jammu, India by Google 3D Earth Software

The Kathua town stretch between 32°37' North to 75° 52'Eeast longitude. The region from where, water samples were collected, GPS coordinates presented in the Table 1 and Figure 1.

Water Sampling and analysis: For analysis of productivity and physico-chemical parameters of water, sampling was done in the month of April 2018. Water samples were collected in plastic bottles. There were total 34 sample were collected from hand pump water and 30 samples were collected from fish ponds. To measure the productivity, the water sample was taken from the fish pond in three plastic bottles as the initial bottle, light bottle, and a dark bottle. The initial bottle was taken for the initial reading. The primary organic production of the river water was determined by 'light and dark bottle method' (Garder and Green, 1972). Water sample collects in three different bottles named as initial, light bottle (LB) and dark bottle (DB) having a 1-liter volume of each for productivity. Here, DB must be covered with dark cloth or polythene cover so sunlight not reached to water sample anymore and photosynthesis not occur in that sample.

Water productivity calculation: Gross Primary productivity (GPP), the Net Primary Productivity (NPP) and Respiration were calculated in the following manner:

$$\text{Gross Primary Productivity} = \frac{LB-DB}{T} \times \frac{0.375}{PQ} \times 1000\ \text{mg/L/h}$$

$$\text{Net Primary Productivity} = \frac{LB-IB}{T} \times \frac{0.375}{PQ} \times 1000\ \text{mg/L/h}$$

$$\text{Respiration} = \frac{IB-DB}{T} \times \frac{0.375}{RQ} \times 1000\ \text{mg/L/h}$$

Where: LB = Light bottle, DB = Dark bottle, IB = Initial bottle, T = Time of incubation, PQ = Photosynthesis Quotient = 1.25, RQ = Respiratory Quotient =1 and the value 0.375 represents a constant to convert Oxygen value to Carbon Value (Thomas *et al.,* 1980).

For physico-chemical parameters: For physico-chemical parameter analysis, water samples were collected from three different sites of the pond. Samples were collected in plastic bottles which were previously washed with detergents and later rinse with sample water several times. pH of the water was measured at the spot then 1mL toluene was added to the 1Lwater samples and the samples were kept in refrigerator maintained at 4ºC and all rest of the parameters were analyzed in the laboratory as per the standard methods (Table 2).

RESULTS AND DISCUSSION

All the samples were analyzed for pH, TDS, EC, DO, alkalinity, hardness, chloride, sulfate, phosphate, nitrate, carbonate and bicarbonate and productivity. Among all these parameters hardness, phosphate, sulfate, and bicarbonates were analyzed but not detected. Hardness was also not detected in pond water. pH of pond water 7.68±0.93 was slightly alkaline and the pH of handpump water 6.50±0.22 was slightly acidic.

Electric conductivity of pond water is slightly higher than handpump water 1.90±0.55 µS/cm^2 and 1.50±058 µS/cm^2. TDS of pond water is higher than handpump water 136.00±2.70mg/L and 11.25±0.96 mg/L. Dissolved oxygen of pond water was analyzed as higher than the handpump water 17.60±27.86 mg/L and 12.71±1.47 mg/L. Handpump water shows higher level of alkalinity 528.00±192.87 mg/L than the pond water 456.40±124.04 mg/L (Figure 3). Chloride level of pond water 929.24±20.77 mg/L higher than the handpump water 880.40±52.20 mg/L (Figure 3). Carbonate level of handpump water 84.00±32.67 mg/L higher than pond water 76.28±27.86 mg/L (Table 3, Figure 2).

Table 1. GPS Reading of different sampling sites

Sr. No.	Source of Water	Latitude	Longitude
01.	Hand pump 1	32.44751	75.44751
02.	Hand pump 2	32.41431	75.44592
03.	Hand pump 3	32.42085	75.45369
04.	Hand pump 4	32.42841	75.43694
05.	Rearing pond -5	32.37877	75.50486
06.	Rearing pond - 4	32.37906	75.50496
07.	Nursing pond - 2	32.38011	75.50538
08.	Stocking pond - 4	32.37957	75.50544
09.	Stocking pond -1	32.37834	75.50502

Table 2. Analytical techniques used for analysis of different physico-chemical parameters (Adapted from Giri *et al*., 2017)

Sl. No.	Parameter	Abbreviation	Unit	Method/Equipment used	Reference
01.	Temperature	TEMP	^{0}C	HACH Instrumental method	APHA, 1998
02.	pH	pH	--------	HACH Ion selective instrumental method	APHA, 1998
03.	Electrical Conductivity	EC	µS/cm^2	HACH Ion selective instrumental method	APHA, 1998
04.	Total Dissolved Solids	TDS	mg/L	HACH Ion selective instrumental method	APHA, 1998
07.	Total & Calcium Hardness	ToHard & CaHard	mg/L	EDTA Titrimetric Method	APHA, 2012
08.	Chloride	Cl^-	mg/L	Mohr's Method	APHA, 2012
09.	Dissolve Oxygen	DO	mg/L	HACH Ion selective instrumental method	Manivasakam, 1997
10.	Carbonate & Bicarbonate	CO_3, HCO_3	mg/L	Titrimetric method	Singh *et al.,* 2005
11.	Alkalinity	ALK	mg/L	Titrimetric method	APHA, 2012
12.	Sulfate	SO_4	mg/L	U.V. visible spectro-photometric method	APHA, 2012
13.	Nitrate	NO_3	mg/L	U.V. visible spectro-photometric method	APHA, 2012
14.	Phosphate	PO_4	mg/L	U.V. visible spectro-photometric method	APHA, 2012

Table 3. Water physico-chemical parametric values of Pond Water and Hand Pump Water

Source of Water	pH	TDS (mg/L)	EC (µS/cm)	DO (mg/L)	Carbonate (mg/L)	Alkalinity (mg/L)	Chloride (mg/L)
Pond	7.68 ± 0.93	13.6 ± 2.70	1.9 ± 0.55	17.6 ± 3.03	76.28± 27.86	456.40± 124.04	929.24± 20.77
Hand Pump	6.5 ± 0.22	11.25± 0.96	1.5 ± 0.58	12.71± 1.47	84.00± 32.67	528.00± 192.87	880.40± 52.21

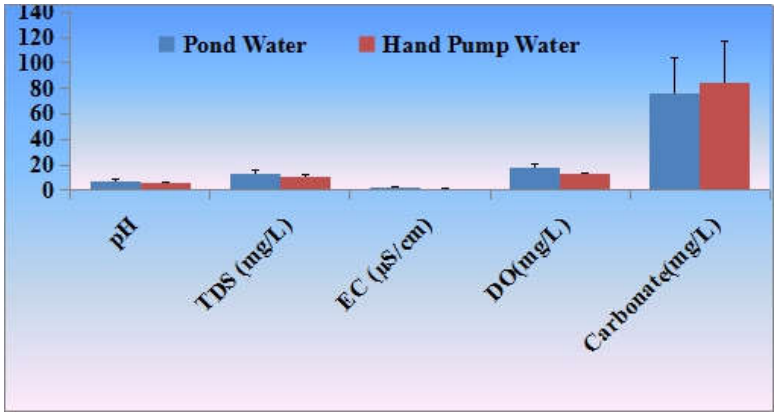

Figure 2. Bar diagram of different levels of parameters in Pond water and Hand Pump Water

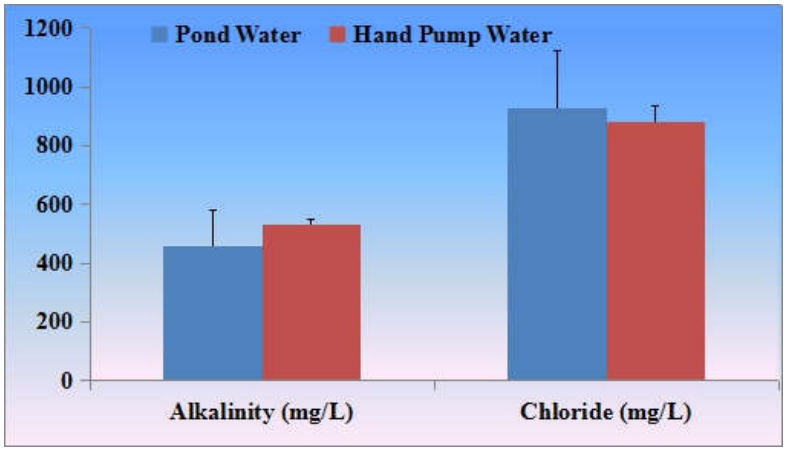

Figure 3. Bar diagram of alkalinity and chloride levels in Pond water and Hand Pump Water

Productivity of water of Stocking pond -1, Rearing pond -4, Stocking pond-4 and Nursing pond -4 comes under oligotropic and productivity of water of Rearing pond -5 comes under mesotropic. All the parameters shows the lower level than the permissible guideline of WHO except alkalinity and chloride level of both pond water and handpump was high and also the pH of pond water was slightly alkaline. This result may be due to the wastage from the civil population and contamination of handpump water may be due to the sanitary system or human wastage disposed near the handpump (Kuberan *et al*., 2015; Hutton and Chase, 2016; Ersel, 2015).

Conclusion: The suitability of the hand pump water and fish pond was assessed. With reference to this study, it can be concluded that the water quality of hand pump water was good and the productivity level was moderate in all the ponds.

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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