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ICHTHYOFAUNAL DIVERSITY IN RELATION WITH FISH FARMING AND WATER QUALITY OF A NORTH INDIAN POND, *RAM TAAL VATIKA*

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ABSTRACT

We studied the ichthyofaunal diversity of Ram Taal Vatika, a pond situated in Meerut Cantonment area with an area of 18329.55m². This pond consisted of 12 commercially important fish species, belonging to 4 orders, 6 families, and 10 genera. The order Cypriniformes were dominant with 7 species, followed by Siluriformes with 3 species, Clupeiformes with 1 species, Osteoglossiformes with 1 species. The pond is for the fish farming in which they procure fish seed from outer stations and grow them in pond and sell them to the direct retailers as well as to the other pond owners. If we are talking about the physio-chemical parameters of pond water like temperature, pH, alkalinity, hardness, dissolved, oxygen, ammonia, nitrate, nitrite, were recorded and found appropriate for aquatic fauna, they work effectively for the growth and development of the fishes.

Key words: Ram taal vatika, Ichthyofaunal Diversity, Biological oxygen demand, Physiochemical parameters

INTRODUCTION

Ram Taal Vatika is the pond situated in Meerut Cantonment, Uttar Pradesh, India. It is a man-made water body expanding over an area of 18330 m^2. The landscape and terrain of the wetland is almost flat. This is an important pond of Meerut and has become the source of some villagers for their livelihood. The aquatic ecosystem is highly dependent on water quality and biological diversity. Physicochemical parameters of water play a significant role in the biology and physiology of fish (Arora and Pervez 2024). Fishes are the important indicator of aquatic ecosystem and occupy a remarkable position from a socioeconomic point of view. Ram Taal Vatika is situated in Meerut cantonment area and this fish farming runs under the army on a contractual basis over 50 years. Fish farming or pisciculture involves commercial breeding of fish, most often for food, in fish tanks or artificial enclosures such as fish ponds. The ichthyofaunal diversity is a good indicator of health of aquatic ecosystem. A good piscine diversity represents the balanced ecosystem.

Jain (2017) studied that the rivers and ponds of the western U.P hosts a number of fish species and inferred that the fish fauna in Western U.P. is at risk due to several anthropogenic activities like deforestation, overfishing, sand mining, recreational activities and organic and inorganic pollution. It was observed that anthropogenic activity altering the fine tune of the river ecosystem and established as a major cause of habitat alteration and fish stock depletion and thus many of the species were rare. Tripathi and Yadav (2020) stated that Seetadwar lake of Sharavasti, Uttar Pradesh is very rich in fish diversity and sustains high productivity, this water body is most suitable for fish culture. Singh (2023) concluded that Kohargaddi dam of District Balrampur, Uttar Pradesh State, is very rich in fish species diversity and sustains high productivity, this water body is most suitable for pisciculture. Wani and Gupta (2015) made a two-year extensive study and reported a total of 21 species of freshwater fishes belonging to 6 orders, 11 families and 17 genera were recorded from the study sites of the lake. Verma et al. (2018) concluded after whole year examine of Bakhira lake for ichthyofaunal diversity that this lake is wealthy in ichthyofaunal diversity but conservation measure is also required. A fluctuation of physicochemical parameters of this lake is directly or indirectly correlated with and biological productivity potential. Sharma (2014) studied that Icthyofaunal Diversity of Uttarakhand from Devprayag to Haridwar and inferred that owing to ever growing demand of water in this region, these bio resources are experiencing grave threats to mutually diversity and ecosystem firmness. Along with a number of fishes are vanishing due to several anthropogenic factors. Throughout the last few

decades, the fish biodiversity of the country is declining swiftly due to anthropogenic activity environmental degradation like urbanization, damming, abstraction of water for irrigation, power generation and pollution, which have subjected our natural water bodies in general and rivers, in particular to severe stress with disturbing effects on fresh water fish diversity. Jitendra et al. (2013) reported that the freshwater fisheries resources of Faizabad consisted exclusively of culture fishery from seasonal, perennial and culture ponds and capture fishery from rivers, nullas and irrigation canals. Present fish biodiversity in the river originate mainly from natural reproduction and/ or escape from the numerous water bodies of the district. Sakhare (2001) focussed on piscine diversity in the wetlands of Coimbatore District, because it is considered as a good indicator of balanced and healthy ecosystem. This study showed that selected sampling site (Perur, Muthanankulam and Kurichi) wetlands supported 40 species of fishes belonging to 4 orders 07 family and 21 species during the study. Kumar and Singh (2013) found that Kararia lake is an important lake of east Champaran district which provides a wide variety of icthyofauna with good economic potential. Patil et al. (2012) inferred that the availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physicochemical parameters such as colour, temperature, acidity, hardness, pH, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality. Heavy metals such as Pb, Cr, Fe, Hg etc. are of special concern because they produce water or chronic poisoning in aquatic animals. Jain et al. (2014) observed that urbanization; industrialization and farming activities around the pond were the factors that are probably responsible for low fish production and diversity. However, the fish fauna in Mawana is at risk due to several anthropogenic activities like deforestation, overfishing, sand mining, recreational activities and organic and inorganic pollution.

This present study focuses on ichthyofaunal diversity of Ram Taal Vatika and gives attention to process of fish farming over there. Moreover, it also gives attention to water quality and its impact on ichthyofaunal diversity and process of fish farming. Pisces are the major group of vertebrates which show an enormous diversity in shape, size, biology and ecology. The aquatic ecosystem is important and it has large number of economically viable fish which is an important source of food. Fishes are the important vertebrate group of animal kingdom in the world contributing to the biodiversity of fauna. Primarily fishes are used as a food source for majority communities. Many vital vitamins and fatty acids are found in fishes so less often it is referred by doctors as a source of nutrient food. Hence, the aim of the study is to (i) identify the ichthyofaunal diversity, (ii) understand the process of fish farming, and (iii) the impact of water quality on ichthyofaunal diversity of Ram Taal Vatika. This study will help better understand the diversity of fishes in the pond along with the consideration of water quality in relation with fish health.

MATERIALS AND METHODS

The present study was conducted for identifying the fish species and testing of water quality in the local pond namely Ram Taal Vatika in Meerut Cantonment area, during May, 2024.

1. **Survey of the area**

Ram Taal Vatika situated in Meerut cantonment (latitude 28.983158 and longitude 77.688189) near historically famous Augarnath temple (Fig. 1&2).

Table 1: Morphometric characters of Ram Taal Vatika

Parameters	Ram Taal Vatika
Longitude	77°41’17.5” E
Latitude	28°58'59" N
Area (m²)	18329.55m²
Maximum depth (m)	5.8
Annual rainfall (mm)	800

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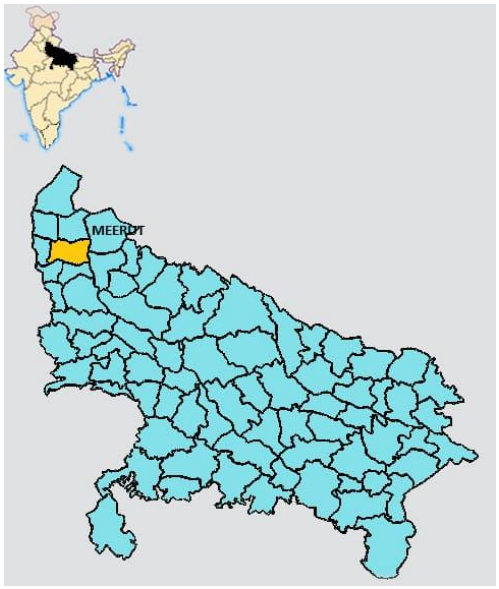

Fig.1: Location of Uttar Pradesh in India and location of Meerut in Uttar Pradesh

Selection of the site

At Ram Taal Vatika two sampling sites were selected for present investigation (Fig. 2).

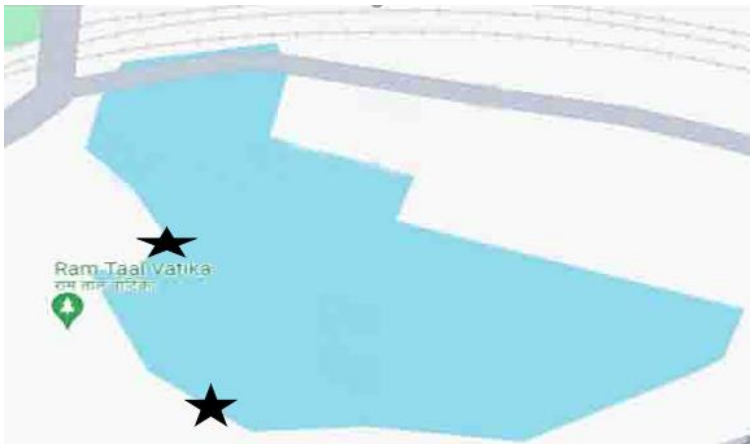

Fig. 2: Satellite image of Ram Taal Vatika with 2 sampling sites.

Fig. 3. A view of Ram Taal Vatika

After talking with pond management people, we selected two sampling sites from where sample of fish and water.

Sample of fish were collected with the help of local fishermen with the tools like hand nets, gill nets, cast nets, hook and dragnets with the help of local people and fisherman mainly during the time of fishing. For analysis of water quality parameters of using the standard methods. Samples were transported to the laboratory for analysis of other parameters, under standard ideal conditions. Through experimental fishing at all sampling sites of Ram Taal Vatika alive fish samples were collected for identification at that place (Shrivastava 2006). All the specimens collected from this pond were identified with the help of standard literature of Day (1975-78, 1986), FAO (1974), Talwar and Jhingran (1991), and Jayaram, (1999, 2010) and identification keys; using various morphometric and meristic characters.

Some important Physiochemical Parameters

Water must be tested with different physicochemical parameters. Selection of parameters for testing of water is solely depends upon for what purpose we going to use that water and what extent we need its quality and purity. Water does content different types of floating, dissolved, suspended and microbiological as well as bacteriological impurities. Some physical test should be performed for testing of its physical appearance such as temperature, colour, odour, pH, turbidity, TDS, *etc*. while chemical tests should be performed for its BOD, COD, dissolved oxygen, alkalinity, hardness and other characters. The important parameters are stated below:

Temperature

In an established system the water temperature controls the rate of all chemical reactions, and affects fish growth, reproduction and immunity. Drastic temperature changes can be fatal to fish.

pH

pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. pH was positively correlated with electrical conductance and total alkalinity (Gupta et al. 2009). The reduced rate of photosynthetic activity the assimilation of carbon dioxide and bicarbonates which are ultimately responsible for increase in pH, the low oxygen values coincided with high temperature during the summer month. Various factors bring about changes the pH of water. The higher pH values observed suggests that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physicochemical condition (Karanth 1987).

Alkalinity

It is Composed primarily of carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-), alkalinity acts as a stabilizer for pH. Alkalinity, pH and hardness affect the toxicity of many substances in the water. It is determined by simple dilute

HCl titration in presence of phenolphthalein and methyl orange indicators.

Dissolved Oxygen

D.O. is one of the most important parameters. Its correlation with water body gives direct and indirect information, *e.g.* bacterial activity, photosynthesis, availability of nutrients, stratification, *etc*. (PremlataVikal 2009). In the progress of summer, dissolved oxygen decreased due to increase in temperature and also due to increased microbial Morrissette 1978.

Biochemical Oxygen Demand (BOD)

BOD is a measure of organic material contamination in water, specified in mg/L. BOD is the amount of dissolved oxygen required for the biochemical decomposition of organic compounds and the oxidation of certain inorganic materials (e.g., iron, sulphites). Typically, the test for BOD is conducted over a five-day period (Milacron Marketing Co.).

Chemical Oxygen Demand (COD)

COD is another measure of organic material contamination in water specified in mg/L. COD is the amount of dissolved oxygen required to cause chemical oxidation of the organic material in water. Both BOD and COD are key indicators of the environmental health of a surface water supply. They are commonly used in waste water treatment but rarely in general water treatment. (Milacron Marketing Co.).

Ammonia (Nitrogen)

It is measured spectroscopically at 425 nm radiation by making a colour complex with Nessler's reagent. The conditions of reaction are alkaline and cause severe interference from hardness in water.

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Calcium

It is measured by complexometric titration with standard solution of ETDA using Patton's and Reeder's indicator under the pH conditions of more than 12.0. These conditions are achieved by adding a fixed volume of 4N Sodium Hydroxide. The volume of titre (EDTA solution) against the known volume of sample gives the concentration of calcium in the sample.

Magnesium

It is also measured by complexometric titration with standard solution of EDTA using Eriochrome black T as indicator under the buffer conditions of pH 10.0. The buffer solution is made from Ammonium Chloride and Ammonium Hydroxide. The solution resists the pH variations during titration.

Sodium

It is measured with the help of flame photometer. The instrument is standardized with the known concentration of sodium ion (1 to 100 mg/litre). The samples having higher concentration are suitably diluted with distilled water and the dilution factor is applied to the observed values.

Chloride

It is measured by titrating a known volume of sample with standardized silver nitrate solution using potassium chromate solution in water or eosin/fluorescein solution in alcohol as indicator. The latter indicator is an adsorption indicator while the former makes a red coloured compound with silver as soon as the chlorides are precipitated from solution.

RESULTS AND DISCUSSION

Ram Taal Vatika is a habitat of 12 species of fishes, who grow and develop there for commercial purpose of food (Fig. 3). Physiochemical parameters like sulphate, calcium, dissolved oxygen sodium, potassium, nitrite, chloride, magnesium, chemical oxygen demand (COD), TDS, Turbidity, hardness, are all under the limits (Tables 2).

Table-2: Physiochemical parameters of the Ram Taal Vatika

Parameters	Unit	Limit	Values	Test Method
Colour	Hazen	15	<5	IS 3025 (Pt-4)
Odour	-	Agreeable	Agreeable	IS 3025 (Pt-5)
TDS	mg/ l	2000	458	IS 3025 (Pt-16)
Temperature	-	-	26.5	IS 3025 (Pt-8)
Turbidity	NTU	5	<1	IS 3025 (Pt-10)
pH	-	No Relaxation	7.11	IS 3025 (Pt-11)
Total Hardness	mg/ l	600	210	IS 3025 (Pt-21)
Alkalinity as $CaCO_3$	mg/ l	600	47.5	IS 3025 (Pt-23)
Acidity	mg/ l	-	Absent	IS 3025 (Pt-22)
Ammonia (as NH_3-N)	mg/ l	No Relaxation	<0.1	4500-NH_3-B&C, APHA 23rd
Biochemical Oxygen Demand	mg/ l	30	34	IS 3025 (Pt-44)
Chemical Oxygen Demand (as O2)	mg/ l	250	196	IS 3025 (Pt-58)
Magnesium (Mg^{2+})	mg/ l	1000	13.7	3500-MgB, APHA 23rd Ed2017
Chloride (as Cl)	mg/ l	500	140	IS 3025 (Pt-32)
Nitrate (as NO_3)	mg/ l	No Relaxation	8.2	IS 3025 (Pt-34)
Nitrite	mg/l	-	0.05	IS 3025 (Pt-09)
Potassium	mg/l	-	28.5	IS 3025 (Pt-45)
Sodium	mg/l	-	34.6	IS 3025 (Pt-45)
Dissolve Oxygen	mg/l	1.0 max	0.21	IS 3025 (Pt-63)
Calcium (as Ca^{2+})	mg/l	200	62.4	IS 3025 (Pt-40)
Sulphate	mg/l	400	13.5	IS 3025 (Pt-24)

BOD (Biological oxygen demand in on the higher side and it may have an adverse effect on the fauna present in the pond. Highest percentage shared by order Cypriniformes 58.33% comprising fish species are *Labeo gonius, Cyprinus carpio communis, Hypophthalmichthys molitrix, Labeo rohita, Cirrhinus reba, Catla catla, Cirrhinus mrigala* Second largest shared by order Siluriformes having 25% comprising fish species are *Sperata seenghala, Silonia silondia and Heteropneustes fossilis* (Table-3; Figs 4-12).

Mechanism of fish farming in Ram Taal Vatika

Pond management personnel provide information that they purchase the fish seed from Kolkata and Bareilly, grow them in the pond and sell it to the direct retailers or sell it to the other pond owners in any other city for food purpose. They also covered the pond from large thin nets, so that fishes got protected from predator birds. They also concluded that to protect fishes from diseases they use certain medicines time to time.

Icthyofaunal diversity in Ram Taal Vatika

Ram Taal Vatika consist of 12 commercially important fish species, belonging to 4 orders, 6 families, and 10 genera. The order Cypriniformes were dominant with 7 species, followed by Siluriformes with 3 species, Clupeiformes with 1 species, Osteoglossiformes with 1 species (Table-4).

Table 3: Ichthyofaunal diversity of Ram Taal Vatika

S.NO	LOCAL NAME	ZOOLOGICAL NAME	FAMILY	ORDER
1	Bhakur/ *Catla*	*Catla catla*	Cyprinidae	Cypriniformes
2	Nain	*Cirrhinus mrigala*	Cyprinidae	Cypriniformes
3	Nain	*Cirrhinus reba*	Cyprinidae	Cypriniformes
4	Rohu	*Labeo rohita*	Cyprinidae	Cypriniformes
5	Singhi	*Heteropneustes fossilis*	Saccobranchidae	Siluriformes
6	Silver carp	*Hypophthalmichthys molitrix*	Cyprinidae	Cypriniformes
7	Common carp	*Cyprinus carpio communis*	Cyprinidae	Cypriniformes
8	Siland	*Silonia silondia*	Schilbeidae	Siluriformes
9	Moi/ knifefish	*Chitala chitala*	Notopteridae	Osteoglossiformes
10.	Hilsa/ Hilsa shad	*Tenualosa ilisha*	Clupeidae	Clupeiformes
11.	Kursa	*Labeo gonius*	Cyprinidae	Cypriniformes
12.	Singhara	*Sperata seenghala*	Bagridae	Siluriformes

Fig. 4. *Cirrhinus mrigala*

Fig 5. *Labeo rohita*

Fig. 6. *Sperata seenghala*

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Fig. 7. ***Catla catla***

Fig. 8. ***Silonia silondia***

Fig. 9. ***Cyprinus carpio communis***

Fig. 10. ***Cirrhinus reba***

Fig. 11. ***Hypophthalmichthys molitrix***

Fig. 12. ***Heteropneustes fossilis***

Fig. 13. Savita Pal collecting water sample from Ram Taal Vatika

Table 4: Composition of fish community by family.

S. No.	Taxa	No. of species	Percentage (%)
1	Family Cyprinidae	7 species	58.38
2	Family Clupeidae	1 species	8.33
3	Family Notopteridae	1 species	8.33
4.	Family Bagridae	1 species	8.33
5.	Family Schilbeidae	1 species	8.33
6.	Family Saccobranchidae	1 species	8.33

CONCLUSION

We conclude that after examining three whole months and through collected data it is observed that Ram Taal Vatika is a wealthy pond with a number of species of fishes (Fig. 13). Physiochemical parameters of pond are pretty controlled except BOD which is little on higher side according to the limits. Fluctuation of some physio-chemical parameter of this pond is definitely affecting the good health of the fauna present in the pond. Anthropogenic activities, habitat degradation are some reasons that adversely affecting the fauna. Proper management of Ram Taal Vatika may help to boost the fish production for commercial purpose.

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Appendix

FORMULATION OF BOD

Formulation for BOD - (Biological oxygen demand) Initial Burette reading - Initial Blank) - final Burette reading - final DO blank × Dilution / sample volume

1 ml 0.025 sodium Thiosulphate = 1 mg/*l* of dissolve oxygen

Initial DO of sample (mg 1*l*) (Before Incubation = 9.5

Initial DO of sample (mg/*l*) After Incubation = 3.2

= 9.5 - 3.2 = (6.30)

DO of seed control (before incubation) mg/*l* = 9.1

DO of seed control (after incubation) mg/*l*

or

Final DO blank = 4.5

9.1 – 4.5= 4.6

Dilution = 200

Sample volume = 10

$6.3\ 0 - 4.6 = \frac{1.7 \times 200}{10} = 34$ mg/*l*

FORMULATION OF COD

$$\text{COD (mg/l)} = \frac{\text{V1-V2) NX8000}}{\text{Vo}}$$

Where

V_1 = volume of fe $(NH_3)_2\ (SO_4)^2$ required for litration against the blank in ml.

V2 = volume of $Fe(NH_4)_2\ (SO_4)_2$ required for titration against the sample in ml.

N = Normality of $Fe(NH_4)_2\ (SO_4)_2$ and

V_0 = volume of sample taken for testing in ml.

Sample value = 25 ml = V_0

Blank value = 13.6 ml = V_1

Sample volume = 7.6 = V_2

$$\frac{(13.6 - 7.6) \times 0.1021 \times 8000}{25} = 196 \text{ mg/l}$$

FORMULATION OF HARDENESS OF WATER

$$\frac{10.5 \text{ x } 0.01 \text{ x } 100 \text{ x } 1000}{50} = 210$$

10.5 = titration value

.01 = reagent molecular weight

50ml = sample