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Prospects of Fisheries development in Ox-Bow lakes of Eastern Uttar Pradesh specially in Ballia district

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ABSTRACT

The present article deals with the fisheries development of three important Ox-Bow Lakes of Ballia district of eastern Uttar Pradesh in relation to physico-chemical and biological conditions. The results were found conducive for Fisheries development. The results indicate clearly that potential fish yield is not being realized from the lakes and there is immense scope for increase in Fish production.

Figure : 00 References : 14 Tables : 04
KEY WORDS : Ox-Bow lakes, Productivity.

Introduction

The third world countries are facing acute problem of malnutrition owing to exponential acceleration of human population and not so commensurate nutritional food supply. Thus, there arises an immediate need of producing highly nutritive food to save humanity from hunger as well as from nutritional deficiencies. Fish constitutes an excellent source of protein and may be valuable supplement to human diet particularly for rural masses of India. Moreover, in the matter of feed conversion efficiency, no farm animals are comparable to fishes. Besides, it may play an important role in the developing economy of our nation by generating employment avenues as also for various commercial activities.

Eastern Uttar Pradesh is provided with plentiful inland waters in the form of large lakes, reservoirs, low lyingareas, ponds, pools and ditches which offer immense scope for fish culture operations to add to the fisheries wealth. All these water bodies were once teeming with fish but due to man made changes in their environment, shrinkage in size due to human encroachment for habitat, input of industrial and domestic sewage effluents, all these water bodies are facing one or the other problem thus adversely affecting the fisheries.

Ballia, the eastern most district of Uttar Pradesh is bordered by the Ganga River in the south and the Ghaghara River in the north and east. The district extends westwards from the confluence point of the Ganga and Ghaghara rivers. The loop and bends formed by meandering courses of rivers in time have resulted in the formation of a number of Ox-bow lakes, depressions and low-lying areas in the district which constitute potent fish resource of this region. Significant among them are Suraha lake, Lake Dah Muriyari and Lake Dah Reoti.

Suraha lake formed by the former channel of Ganga River, is one of the biggest lakes of the country covering an area of 2602.18 hectares of perennial water. During rainy season, it in undates large low-lying areas thus expanding to total area of 3642.25 hectares. The lake is connected with the Ganga River through Katehar Nullah which fills or drains the lake depending upon the water level of the lake in relation to that of the river. Lake Dah Muriyari covering an area of 287.69 hectares and Lake Dah Reoti covering an area of 436 hectares of perennial water are formed by the former channels of river Ghaghara whereas Lake Dah Muriyari gets connected with the river during rainy season. The lake Dah-Reoti rarely gets opportunity to establish continuity with the Ghaghra river. Inflow and outflow of water from all the lakes through connecting nullahs is controlled by flap-control regulators.

Methodology

The authors and the co-authors have made extensive observations on the water quality[3,9,12] qualitative and quantitative abundance of plankton in time and space[2,9,10,12]and phytoplankton primary production[4,10,11] on various lakes of this area. This communication is

TABLE-1 : Range of variation and yearly mean of physico-chemical factors of water of different lakes.

	Factor	Suraha lake	Lake Dah Muriyari	Lake Dah Reoti
1.	**Temperature (°C)**			
	Range of variation	17.5-31.6	17.5-31.5	17-31
	Mean	26.05	25.92	25.8
2.	**Transparency (cm)**			
	Range of variation	76.0-202.0	64.7-170.5	57-120
	Mean	128.15	108.72	87.21
3.	**pH**			
	Range of variation	7.4-8.9	7.6-9.2	7.57-9.62
	Mean	8.45	8.42	8.51
4.	**Dissolved oxygen (mg/L)**			
	Range of variation	7.2-20.0	7.5-14.5	7.65-13.15
	Mean	12.35	11.04	10.11
5.	**Free CO_2 (mg/L)**			
	Range of variation Mean	0-14.5	0-18.3	0.00-15.9
	3.35	3.96	4.9	
6.	**Alkalinity (mg/L)**			
	Range of variation	82.5-135.0	92-152	63.50-133.92
	Mean	106.45	114.66	98.71
7.	**BOD (mg/L)**	*	*	
	Range of variation	*	*	3.40-19.85
	Mean			9.35
8.	**COD (mg/L)**	*	*	
	Range of variation			8.4-25.2
	Mean			15.45
9.	**Chloride (mg/L)**			*
	Range of variation	4.0-12.3	3.7-8.5	
	Mean	0.725	5.76	
10.	**Nitrate(mg/L)**			*
	Range of variation	0.08-0.54	0.10-0.82	
	Mean	0.225	0.36	
11.	**Phosphate (mg/L)**			*
	Range of variation	0.02-0.15	0.02-0.30	
	Mean	0.075	0.5	
12.	**Calcium (mg/L)**			*
	Range of variation	118-207	108-168	
	Mean	163.8	128.83	
	*not estimated			

TABLE-2: Range of variation and yearly averages of Plankton (Number/Litre) in different lakes.

	Suraha Lake		Lake Dah Muriyari		Lake Dah Reoti	
	Range of Variation	Yearly Average	Range of Variation	Yearly Average	Range of Variation	Yearly Average
Phytoplankton	672-45574	16336	1846-51712	18303	695-37223	9418
Cyanobacteria	208-43406	11408	1242-50228	17119	170-37023	8019
Bacillariophyceae	20-637	214	240-1572	835	20-510	158
Euglenophyceae	3-108	25	68-258	154	07-170	30
Chlorophyceae	26-234	108	92-182	152	04-110	78
Dinophyceae	0-45200	4582	22-85	43	0-8400	11333
Zooplankton	100-1108	441	1021-2056	1520	77-1034	405
Rotifera	36-490	216	500-1275	925	35-473	204
Copepoda	39-541	174	310-750	575	25-504	163
Cladocera	13-105	52	11-32	20	02-78	38

intended to review our present state of knowledge on the limnological conditions of different water bodies to evaluate the present state of fishery as also to suggest measures to obtain potential fish yield from water resources.

The potential yield of fish depends much on the efficiency with which the energy is trapped, accumulated and dissipated at the different tropic levels in an aquatic system. Accordingly, the actual yield of fish depends on two factors.

i. Capacity of the primary producers to manufacture food material which itself affect supply of nutrients, temperature, light penetration, other physical and chemical variables and the abundance and composition of phytoplankton.

ii. Transfer of food material after it is produced. It includes the number of trophic pathways between the phytoplankton and thefish.

In view of the above, the quality of water, quantitative abundance and composition of plankton as also the rate of primary production of various lakes have been estimated.

Results and Discussion

The results are reflected in Tables 1, 2 and 3 respectively. However, the following few notable features were observed.

Water quality

1. The lakes of this region are shallow in nature with an average depth varying from 2 to 5 M remain clear for most part of the year thus permitting light penetration up to deeper zones for photosynthetic activities. The lakes are exposed to substantial wind action leading to mixing of nutrients released in the hypolimnion and almost homogenous vertical distribution of plankton as also checking stratification of the water columns. Such a condition may be considered conducive for high biological productivity.

2. The water temperature remains above 20"C almost throughout the year suitable to activate the rate of bio-chemical, thermochemical and enzymatic reactions as also for release of stimuli for breeding mechanism in aquatic fauna.

TABLE-3: Primary production in different lakes

	Suraha Lake	Dah Muriyari	Dah-Reoti
Net Primary Production	640 gC/m^3/day to 1980 mgC/m^3/day	830 gC/m^3/day to 1940 mgC/m^3/day	770 gC/m^3/day to 1940 mgC/m^3/day
Gross Primary Production	930 gC/m^3/day to 2140 mgC/m^3/day	1140 gC/m^3/day to 2380 mgC/m^3/day	930 gC/m^3/day to 2310 mgC/m^3/day

3. The aquatic medium remains in slightly alkaline range congenial to high biological productivity. Acid waters reduce the appetite of the fish, their growth and tolerance to toxic substances and also render the fish to attack of parasites and diseases where as too much alkaline waters, the fish become sluggish and inactive,
4. Presence of rich oxygen contents, fairly high values of contents of calcium among cations and bicarbonates and chlorides among anions, presence of nitrate-nitrogen and phosphate in appreciable quantity, input of nutrients from agricultural run-off and mild domestic sewage provide favourable conditions for rich biological productivity.

Plankton

Planktons are essential links in food chain of aquatic system as also effective tools in environmental biomonitoring of aquatic systems. Phytoplankton play a phenomenal role in the biosynthesis of organic materials and virtually all the dynamic features of a water body such as colour,clarity, water taste. Zooplankton and fish production depend to a large extent on the phytoplankton. The zooplankton form a major link in the energy transfer at secondary level in aquatic biotopes.The plankters serve as food for fishes directly or indirectly and thus play a key role infishery.

All the water bodies in this region support rich plankton population composed of both Phyto and zooplankton.

The major groups of phytoplankton encountered in this region are Cyanobacteria, Dinophyceae, Bacillariophyceae, Chlorophyceae and Euglenophyceae whereas zooplankton includes members of Rotifera, Copepoda and Cladocera.

The phytoplankton play the major role contributing more that 95% of the total plankton whereas zooplankton contribute only a meagre share of even less than 5%. The most significant aspect of the plankton population is the dominance of Cyanobacteria both in number and individual form contributing more than 80% of the total phytoplankton. Interest attaches with the fact that a single blue green algal form *Micro cystisa eruginosa* contributes more than 95% of the cyano bacteria and almost more than 70% of the total plankton production in the lake This species forms bloom during rainy season and persists thoughout the year in significant number. *Adinofla gellate* species *Ceratium hirudinella* also forms bloom during January or February in some lakes but it disappears from the lake with the rise in temperature.

Phytoplankton Primary productivity

Primary productivity studies are aimed at the evaluation of the capacity of an ecosystem to build up at the expense of external energy, both radiant and also supplies electrons needed for all reducing reactions.

Primary production has been observed in lakes Suraha, Dah Muriyari and Dah-Reoti and the results are obtained

On the basis of average per day production of carbon, the total carbon produced in each lake is estimated. Assuming carbon/dry weight ratio of plankton biomassis 0.44 as suggested[14], the total dry mass of plankton in each water body has been estimated. Assuming that 100 kg dry plankton is roughly equivalent to 1 kg fish *i.e.,* roughly 1% conversion, the expected fish production has been worked out (Table-4):

In indicates clearly that potential fish yield is not being realized from these lakes and there is immense scope for increase in fish production.

Problems and suggestions for improvement of Fishery

The lakes support only a small population of low trophic feeders (plankton feeders- viz. *Labeo rohita*, *Cirrthinus mrigala* and *Catla*. The population of carps is neither sufficient enough to utilize all food items nor composed in proper ratio to feed at different niches of the lake water. Moreover, plankton community existing in the

TABLE-4: Production and conservation rates

	Expected Production	Actual Production	Present Conservation rate
Lake Suraha	597000 kg	455200 kg	0.66 %
Lake Dah Muriyari	405552 kg	24000 kg	0.59 %
Lake Dah Reoti	67646 kg	6000 kg	0.09 %

lake too, is not desirable and does not constitute preferential food items for plankton feeders.

The blue green algal form *Micro cystis aeruginosa* and dinoflagellate *Ceratium hirudinella* which form the bulk of phytoplankton are not the natural food items which the fish prefers under favourable conditions. In fry of carps these remain undigested in the gut and ejected intact along with the faecal matter[6]. Thus, the huge energy fixed by the autotrophs does not get converted into fish flesh and settles to the bottom after death in the form of detritus and organic mud. Spawn and fry of carps with a short and straight intestine are reported to digest rotifers and cladocerans fairly rapidly and thrive well on zooplankton[6] but the zooplankton in the lake water exhibits only a depressed population[1] of plankton community.

Carnivorous and predacious fishes which constitute a significant population of the fish fauna in the lake are obtained at the end of long food chain and that too, at the cost of carp fry, fingerlings and even the yearlings flourishing at lower trophic levels. Indiscriminate fishing is further detrimental to carp fishery. The carps are caught and sold at the very early stage without permitting them to attain marketable size. The intensive and indiscriminate fishing round the year without any control magnify the loss to a great extent and deprives the lake of a good percentage of carps at various stages of development.

1. (i) Central or State fisheries department should take over the control of fisheries management of the lake. However, if it is not possible, an effective cooperative society fisherman be constituted and be kept under the supervision of some appropriate authority. The fishermen should be trained with modern techniques involved in fish culture and be entrusted the job of procurement and introduction of seeds in adequate number and in proper ratio and composition, rearing of fingerlings and harvesting as also the marketing of catch at appropriate time. Culture of Indian major carps *viz. Catla catla*, (surface feeder), *Labeo rohita* (column feeder) and *Cirrthinus mrigala* (bottom feeder) has a great promise in this lake. They are known for their taste and nutritive value, rapid growth and compatibility with other fishes and close to the primary producer in food chain. More so, they are in high demand in the market and fetch high prices as compared to other fishes.

   (ii) To ensure high productivity ,construction of hatcheries at the lakes is suggested to raise finger lings of desirable fish to stock the lake.

   (iii) Huges hallow in undated low-lying areas may act as breeding grounds for the carps, if *Eichhornia crassipes* is completely eradicated from this region.

2 (i) Another constraint to the lake fishery is the presence of thick floating submerged and emerged vegetation. *Eichhornia crassipes* and *Pistia* stratiotes should be controlled mechanically whereas, the other macrophytes be controlled biologically through introduction of some known effective exotic carps.

To control submerged weeds, some selective varieties of herbivorus exotic fishes like grass carp (*Ctenopharyngodon idella*) common carp (*Cyprinus carpio*) and tawes (*Puntius javanicus*) should be introduced into the lake. They consume a wide variety of weeds as their food and to a large extent do not biologically interfere with other fishes and are also economical to maintain.

(ii) The blue green algal form *Micro cystis aeruginosa* which forms bloom during post monsoon period and persists round the year in the lake in significant number is the most noxious consuming most of the dissolved nutrients and serving no use to the fish as food. An effective control at this algal form would permit desired plankters to grow in the lakes.

3. The low yield of fish besides being consequence of other factors, is also partly attributable to the unrestricted growth and abundance of carnivorous/ predacious and trash fishes in the lake. While the former is obtained at the end of a long food chain and that too, at the cost of fry and fingerlings of carps beside others, the latter at some stages of

their life history compete for food with major carps[8]. Contribution of trashes in lowering fish yield is well recognised and the importance of control of these fishes has been emphasized[1,7]. In addition, these weed fishes provide forage base for the development of predatory cat fish population which in turn affect the recruitment potential of economic carps[8].

In such shallow lakes, large fraction of trash fishes can be effectively removed by using close meshed dragnets.

Conclusion

The results obtained during this investigation suggest that if scientifically managed, exploited and developed, these lakes would not only cater to the needs of fish- eating population of this region but would also help solve the poor economy to a great extent. In addition, it would be a good centre for picnic, recreational fishery, angling and rowing as also a decoration of this remote area.

References

1. Bennet GW. Management of artificial lakes and ponds. Reinhold Publishing Corporation, New York. 1962.
2. Jha AK, Singh SP, Singh SR. Population kinetics and seasonal fluctuation of phytoplankton of Dah-Reoti (Ballia) - an ox-bow lake..*J. Appl. Biosci.* 2007; **33** (2) : 174-179.
3. Jha AK, Singh SR. On the water quality of an Ox-bow lake- Dah Reoti (Ballia, mata) and its suitability for fish production. *Eco Env. & Cons*. 2008; **14** (1) : 191-198.
4. Jha AK, Singh SP, Singh SR. Observations on Phytoplankton, primary production and fish yield of an ox-bow lake dah Reoti'- Ballia UP India. *Flora & Fauna.* 2016; **22** (1) : 237.251
5. Jha AK, Singh SR. Population kinetics and Seasonal fluctuation of Zooplankton of Dah-Reoti Ballia) - an ox bow lake. *Flora & Fauna.* 2017; **23** (1) : 155-164.
6. Jhingran VG. Fish and fisheries of India *Hindustan Publishing Corporation.* 1982.
7. Natrajan AV. Problems of fisheries development in reservoir. *Proc. First workshop on all India co-ord. Ras. Proj. on ecology and fisheries of fresh water reservoir Central Inland Fisheries Research Institute Barrackpore, August.* 1971; 30.
8. Natrajan AV, Ramkrishnaiah M, Khan MA. The food spectrum of trash fishes in relation to major carps in Kolar and Tilaiya Reservoir(Bihar)*J.Inland.Fish.Sco.India.* 1975; **7** : 65-75
9. Singh SR. Observation on the seasonal variation in the water quality of Dah lake (Ballia) *Proc. Nat. Acad. Sci. India.* 1983; **53**(B) II: 142-149
10. Singh SR. Observations on the phytoplankton primary production in an ox-bow lake. *Proc. Nat. Acad. sci. India.* 1987; **57** (B) IV : 328-336.
11. Singh SR, Swarup K. Studies on the primary production of phytoplankton in Suraha Lake (Ballia, India). *Int. Revueges Hydrobiol.* 1980; **65**(5): 709-717.
12. Singh SR, Swarup K. Limnological studies of Suraha lake (Ballia) II Periodicity of phytoplankton. *J. Indian Bot. Soc*. 1979; (**58**): 319-329.
13. Singh SR, Swarup K. Limnology and productivity of Suraha Lake (Ballia) Madras. *J. Fish.* 1987; **IX** : 27-37
13. Swarup K, and Singh SR. Limnological studies of Suraha Lake (Ballia) 1. Variation in the water Quality. *J. Ind. Fish Soc. India.* 1979; **11** : 22-33.
14. Waldickuk M. Basic productivity of Trevor channel and Alberni inlet from chemical measurement. *J. Fish. Res. Bd. Can.* 1958; **13**: 7-20.