A STUDY OF THE CHEMICAL PROPERTIES OF NEURA OX-BOW LAKE AT SARAN

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Abstract: **- A Study of the chemical properties of Neura an ox-bow lake, Saran District (Bihar) was reported. Certain physico-chemical parameters such as dissolved oxygen, free CO_2, and alkalinity were studied to know the aquatic health of the oxbow lake.**

Keywords: Neura, Ox-Bow lake, Chemical Properties, Saran, Bihar.

I.ITRODUCTION

In the present work, the different methodology and techniques have been studied for fish production. During the course of investigation, several parameters for fish nutrition has been considered in different chapters of the thesis. In Saran Division ponds and ox-bow lake reserve ware of Saran District. Limnology is the science of the interaction of fresh water organism with their environment. In such an environment, significant chemical factors from the view-points of organism are oxygen, carbon dioxide, nitrogen and phosphorus contents of the concerned body of water. On the other hand, the most important physical factors are light, intensity, temperature and flow rate, while the obviously important biological factors are the presence of the competition or predation of organisms which serve as nutrients. A population can exist only if the intensity of each specific environmental factor lies within certain critical limits. Organisms change the medium in which they live by their metabolic activity. Obvious examples of such changes are removal of dissolved organic substances (biological self-purification) and the decrease in flow rate of volume of water resulting from a biomass increase. The metabolic activities of the organisms, which are essential for water quality management, are primarily reactions of ecosystems. A given environmental factor e.g., light causes a specific response e.g., production of oxygen. It is impossible at present to identify all the constituents and individual reactions within an ecosystem, due to their large number and complexity. In the light of growing awareness of conservation of environment immunological investigation has gained tremendous importance and as such plenty of works are being done throughout the globe. With the changing need of the people, researchers and conservationists have also changed their priority area and as a result, presently hydro-biological investigations are generally aimed at furthering human welfare. In the topics, India assumes special status lentic (by standing water e.g. pond lake and swamp) and lotic (by running water, e.g. spring, streams or rivers). In nature, these two habitats are not sharply differentiated from each other and sometimes from intermediate habitats. It might be caused due to erosion of the soil and activities of organizations, resulting in the development of different graded habitats. In the meantime, to accelerate the pace of development many man-made water bodies viz., reservoirs and a network of canals also added to the system. Such waterbodies have become one of the major components of our environment and as such the present objective is to harmness these water resources including fisheries, for human welfare, while keeping the conservation of environment also in view. The study of water bodies in India has another point of importance also because there is an acute shortage of protein rich food on one hand, and population explosion on the other hand. Thus, we have to explore constantly the alternative source of food to each and every individual of the country. The well-established pisciculture and fisheries will not only remove the scarcity of food but also remove the cause of malnutrition and under-nutrition particularly in rural population of our country. All the organisms present in a particular area, have unique function and their own methods to play, and occupy the specific habitat. The space, where an organism lives or the place, where one would go to find the particular organisms is known as habitat of that organisms. The habitat of an organism actually represents a particular set of environmental conditions suitable for its successful growth. Thus, a word “ecological niche” was created which includes the physical space occupied by organisms, its fundamental role in the community and its position in the environmental gradient of the temperature, moisture, pH, soil etc. and condition of existence. Allen H. Benton and William E.Werner Jr.(1975) in the first chapter of their book “Field Biology and Ecology” Write “Ecology may will be the greatest challenge of the coming generation. If the changes is not made then the human survival will be in doubt. Our descendents survive, in spite of our failure to meet this challenge, they will live in a world dramatically different from ours.” In the preface of the book they write “The present era is the era of environmental revolution. The recognition that man is a part of nature, that man is a vulnerable end organism of many food chains; that man cannot forever go on increasing his own population and pollution of his environment; these are signs that recognition of the importance of ecology is in hand. German Ecology Earnst Haeckle first of all coined the term Ecology in 1869.The word Ecology is derived from the two Greek roots- “Oikos” meaning “house" and “logos" meaning “the science of “or “the study of". Hence, literally, ecology means study of the earth’s “households" including all living system. Development of fresh water aquaculture is one of the most important production oriented programmes of the country, being implemented by the state/union territory. Most of the aquaculture practices are practiced in ponds ox-bow lake in Bihar. Several aspects of management practices are being investigated of enhancing the fish productivity of pond which enclose broad stock

management nutritional management, health of environmental management. Out of the above stated management environmental management is most essential in which hydrobiological factors are taken into consideration. This type of work would definitely add a lot of knowledge in fish production partially the edible and valuable IMC and Exotic carps from our fresh water inland fisheries resources particularly of Saran Division spl. Neura ox-bow lake. Organisms change the medium in which they live by their metabolic activity. Obvious examples of such changes are removal of dissolved organic substances (biological self-purification) and the decrease in flow rate of volume of water resulting from a biomass increase. The metabolic activities of the organisms, which are essential for water quality management, are primarily reactions of ecosystems. A given environmental factor e.g., light causes a specific response e.g., production of oxygen. It is impossible at present to identify all the constituents and individual reactions within an ecosystem, due to their large number and complexity.

Materials and Method

The aqua biotic condition, physio-chemical properties of'NEURA RESERVOIR (OX-BOW LAKE)' were studied forgetting the systemic position of Ichthyofauna and bio fauna including the planktons and bottom fauna. In the session, the extensive study includes the collection of bio-physical and bio-chemical examination of fishes, aquatic plants, planktons, water samples and soil samples in the laboratory and the results were recorded for further analysis.

Collection of sample and chemical analysis

The collection of the aquatic plants was made physically. All aquatic plants which were present in the water body were collected by the sitting on a boat. All the collected plants and weeds were kept in a plastic bucket. The bucket was half filled with water. By keeping the plants and weed in water filled bucket, they remain in normal condition. Thus, aquatic plants were collected and being brought in the laboratory for identification. Till the identification was completed the water of the bucket was changed at regular intervals. The fishes, thus collected were first kept in 8% formalin for 48 hours. After that the fishes were transferred in 5% formalin and preserved for detailed study and identification in the laboratory. The identification and classification of the fishes were made with the help of Day's "Fish Fauna of British India" and "The Classification of the fishes, Present and Extinct" of Leo S. Berg respectively.

Result and discussion

Physio chemical parameter of the lake

It is known that vital gift of nature to the living community. Life cannot be imagined without water, since water forms three quarter of weight of the living cell. Eugene P. Odum wrote that "The history of man has often been shaped by the rivers that provide water, transportation and a means of waste disposal''. The living organisms and their non-living environments are in-separable, inter-related and dependent fully upon each other and hence every animal is adapted to its environment. Aquatic animals living in different water bodies for their survival and growth are adapted to their environment. The environment includes biotic and abiotic factors both. Hence, adaptation to a particular environment needs adjustment to biotic and abiotic factors of the particular environments. Aquatic animals including fishes live in the water throughout their life and they get adapted according to the local climatic condition. As a result, there is morph physiological changes in the animals. The abiotic parameters of lake, ponds, reservoirs and other water bodies have a greater impact on the development of fishes in any water body. The inter-relation among various animals and other biotic factors are inseparable. As such change in any one factor may change the other factors with the result that there shall be an adverse effect on the productivity. Thus, the result of any water body is entirely dependent upon all the biotic and abiotic factors of that water body. During the course of present investigation of NEURA Reservoir (Ox-bow lake) in sonepur of saran District, the detailed study of biotic and abiotic parameters along with soil condition have been made and it has been clearly established that these factors interact among themselves and are interdependent. The study also speaks for the means for better productive capacity of the reservoir. The studied physio chemical parameters include air and water temperature, pH of water, dissolved oxygen (DO), free CO_2 and alkalinity of water. During the study period, air temperature was recorded maximum in June and minimum in January. Similarly, water temperature was noted high in summer and low in winter. As water temperature is dependent on-air temperature, therefore, air and water temperature show similar fluctuation during the year. The Hydrogen ion concentration or pH of water did not show much fluctuation throughout the year. pH of water show that water of the studied lake is near neutral (6.9-7.1) to slightly alkaline (7.3). pH range between 6.5-7.5 is an indicative of productive water. Dissolved oxygen (DO) is an important parameter as most of the aquatic organisms can breathe only that oxygen that is dissolved in water. DO was recorded maximum in February (5.98± 2.82mg/l) and minimum in December (2.63±1.58mg/l) in the studied area. The value of DO was highly variable. After a high value in February, a sudden drop in DO value was observed in March. This may be due to profuse vegetation growth in the surface of the water body. The free CO_2 was ranged between 1.75- 5.81mg/l. The lowest value was recorded in March and the highest value was recorded in February. From March onwards, Free CO_2 value increases. High aquatic vegetation may be the reason for such a high CO_2 value as most part of the water surface is covered with water hyacinth. The value of free CO_2 is also dependant on time and site of water. As sampling was done during morning hours, photosynthetic activities were reduced at that time and hence high value of free CO_2 is recorded. Near periphery also, free CO_2 is found to be more than centre. Alkalinity is the capacity of water to neutralise acids and an ability to absorb hydroxyl

ion without significant pH change (Koliyar and Rokade, 2008). The range of alkalinity 40-90 mg/l is considered as highly productive. The calculated alkalinity is ranged between 46-106 mg/l of the studied lake. Alkalinity is maximum in December and minimum in August. Similar observation about alkalinity was made by Saud *et al.* (2012).

Table 1: Monthly variation in the physio chemical parameter of the oxbow lake

Month	Air Temp ^{0}C	Water Temp ^{0}C	pH	DO (mg/l)	Free CO_2 (mg/l)	Alkalinity (mg/l)
January	21.35±1.63	17.7±0.42	7.3±0.23	4.42±1.06	4.78±1.32	100±12.91
February	23.9±1.56	20.75±2.47	7.32±0.12	5.98±1.82	5.81±1.53	89.5±7.98
March	29.75±1.06	23.75±1.06	7.14±0.35	2.91±0.14	1.75±0.39	69.5±7.62
April	30.65±0.49	25.9±1.55	7.16±0.42	3.64±1.62	2.31±1.27	71.5±17.3
May	32.5±2.12	30±1.41	7.1±0.23	5.22±3.76	2.02±1.31	77±12.95
June	33.1±1.56	30.5±0.71	6.9±0.34	4.48±1.74	2.95±1.39	62±2.82
July	31±1.41	30.25±1.77	7.13±0.67	5.33±3.72	3.02±1.53	46±6.99
August	32.5±0.71	31.15±0.21	7.2±0.78	5.47±2.63	3.85±1.44	58±8.56
September	29.5±0.71	28.75±0.35	6.9±0.41	4.52±2.21	5.17±2.28	52±9.78
October	26.25±0.35	24.5±0.71	7.15±0.56	3.42±1.73	5.27±2.26	64±5.16
November	25.35±0.92	24.4±0.57	7.23±0.63	2.93±1.49	4.80±1.04	85±6.67
December	23.5±0.70	22.75±2.47	7.26±0.26	2.63±1.58	5.63±0.95	106.5±14.35

Neura diversity

During the study, a large number of fish species belonging to different families were identified. List of fishes with common names, conservation status based on the report of Conservation Assessment and Management Plan (CAMP) for freshwater fishes of India by Molur and Walker and IUCN Red List of Threatened Species are given in Table 1. Of these, Cyprinidae family with 14 fish species dominating the lake followed by Channidae family with 5 species. Bagridae, Belontiidae, Chandidae and Siluridae family are represented by 3 species each. Notopteridae and Mastacembelidae family are reported from the lake each with 2 species.

Among the reported fishes, *Labeo rohita* is a very common fish for the fishermen. They are usually caught by hook and line and it is a popular fishing gear for the villagers. Other commonly found fishes are *Amblypharyngodon mola* and *Notopterus notopterus.* They are abundant species. Fourteen species are commonly found and twenty-one are occasionally found from the lake. *Mastacembelus armatus, M. pancalus* and *Nandus nandus* are generally not common for the fishermen. Villagers also use cast net, gill net, bamboo made traps etc. for fishing. Fishing is continuous throughout the year. However, peak fishing season is winter (Dec-Feb). Local villagers employed *Phasi jal* in night and in early morning they collect their catch from the net. Different nets are used to catch different sized fishes.

During monsoon, fishes like *Wallago attu, Channa sp, Puntius sp* breed in the beel. But carps like *Catla catla, Labeo rohita, Labeo gonius* etc. breed in running water of main river Gandak. They migrate from the lake to river through the connecting channel.

Forty fishes recorded in the studied beel indicate rich diversity of fishes in the lake. According to IUCN status, major fishes of this lake are of least concern (LC) category. Four species are nearly threatened (NT) and categories of five species are not evaluated (NE). According to CAMP status, a major part of the fishes is lower risk near threatened (LRlc) type. Six species are vulnerable and three are endangered species.

Table 2: Checklist of fishes found in the oxbow lake with occurrence, IUCN and CAMP status

Family	*Scientific Name*	Common Name	IUCN status	CAMP Status	Occurrence
Family: Cyprinidae	*1. Amblypharyngodon mola (Ham. -Buch.)*	Brass fish	LC	LRlc	A
	2. Aspidoparia jaya (Ham. -Buch.)	Aspidoparia	LC	VU	C
	3. A. morar (Ham. -Buch.)	Aspidoparia	LC	LRnt	C
	4. Catla catla (Ham. -Buch.)	Common carp	NE	VU	O
	5. Cirrhinus mrigala (Ham. -Buch.)	Mrigal	LC	LRnt	O
	6. Esomus danricus (Ham. -Buch.)	Flying barb	LC	LRlc	C
	7. Labeo bata (Ham. -Buch.)	Minor carp	LC	LRnt	O
	8. L. gonius (Ham. -Buch.)	Kuria labeo	LC	LRnt	O
	9. L. rohita (Ham. -Buch.)	Rohu	LC	LRnt	C
	10. Puntius conchonius (Ham. -Buch.)	Rosy barb	LC	LRlc	C
	11. P. sophore (Ham. -Buch.)	Spot fin swamp barb	LC	LRnt	C
	12. P. ticto (Ham. -Buch.)	Two spot barb	LC	LRnt	C
	13. Rasbora daniconius (Ham. -Buch.)	Black line rasbora	NE	LRnt	C
	14. R. rasbora (Ham. -Buch.)	Yellow tail black tip	LC	LRnt	O
Family: Notopteridae	*15. Chitala chitala* (Ham. -Buch.)	Feather back	NT	EN	O
	16. Notopterus notopterus (Pallas)	Bronze feather back	LC	LRnt	A
Family: Channidae	*17. Channa barca* (Ham. -Buch.)	Violet snakehead	DD	NE	O
	18. C.gachua (Schneider)	Dwarf snakehead	LC	VU	O
	19. C. marulius (Ham. -Buch.)	Peacock snakehead	LC	LRnt	O
	20. C. punctatus (Bloch)	Spotted snakehead	LC	LRnt	C
Family: Anabantidae	*21. Anabas testudineus* (Bloch)	Climbing perch	DD	VU	O
	22. P. ranga (Ham. -Buch.)	Indian glassy fish	LC	NE	O
Family: Heteropneustidae	23. *Heteropneustes fossilis* (Bloch)	Stinging catfish	LC	VU	O
Family: Nandidae	*24. Nandus nandus* (Ham. -Buch.)	Leaf fish	LC	LRnt	R
Family: Schilbeidae	*25. Pseudotropus atherinoides* (Bloch)	Indian potashi	NE	EN	O

Conclusion

The rich Neura of the lake indicates the high productivity of the lake. However, fish diversity is declining due to anthropogenic stress on water such as washing clothes, washing different containers etc. by the local people. Fishing nets with small mesh size is also responsible for degradation of fish diversity. To conserve diversity, people awareness is must and they will learn to use resources without causing any damage to those resources. Along with the capture fishery, culture fishery can also be adopted for higher production from the lake. Proper regulation of fishing gears and their mesh size and their fishing intensity should also be monitored. Weed management is another important matter for consideration. Eugene P. Odum in his book "Ecology" writes "The history of man has often been shaped by the rivers that provide water, transportation and a means of waste disposal." It is necessary for the people today from the experiments and the conservations during the present work it can be concluded that this virgin NEURA Reservoir (Ox-bow lake) though with his productive capacity needs special care. According to Banerjee (1967), the necessary conditions for high productive capacity of any water body in relation to fishes are as follows: -

1. Phosphorus content in soil – 60
2. pH of soil – 6.5 to 7.5
3. depth-more than 5 meters
4. Range of water temperature – 20^0C
5. Maximum temperature for India carp–37.8 ^{0}C
6. Organic carbon in soil – 1.5 to 2.5% optimal
7. pH of water – 6.5 to 7.5 most favorable 7.5 to 8.5 average production.
9. Dissolved oxygen – 7 ppm
10. Presence of mud deposits of organic matter derived from the decay and decomposition of animals and plants.

From comparison of the data obtained during this project and the data of Banerjee, it is evident that this "NEURA Reservoir (Ox-bow lake)" although has good potentiality for pisciculture but the fish production is much poor. It has failed to fetch high yield due to mismanaged handling of this water body. The low yield and gradual decrease in fish catch is due to following reasons: -

(1) Auto stocking of fish fries from the nearby rivers has practically been stopped.
(2) Sufficient numbers of fish fries are not introduced regularly. Commonly the fries are introduced only at the beginning of the least period.
(3) At the end of the lease period the contractor fish out even the youngest fish from the reservoir.
(4) Fishes of all sizes are netted out.
(5) Aquatic plants are not under controlled conditions.
(6) Water and soil of the reservoir are never analyzed.
(7) Annual severe flood badly affects all the factors.
(8) One of the reasons for low fish production can be attributed to large numbers of predacious fishes which might take a good tall of the carps reducing the fish productions.
(9) Group rivalry among fishermen sometimes, is also responsible for low production.

Related Problem

The present research project had a limited scope. Several related problems of aquaculture which we faced during this investigation must be studied and solved for a well-organized aquaculture. Therefore, following related topics must be undertaken for future investigation: -

a. Histophysiological investigation under extreme variations of abiotic and biotic.
b. Scope of induced breeding in this water body.
c. Optimal and lethal doses of various physiochemical factors responsible for better growth of fish and planktons should be determined.
d. Effect of domestic sewage on plankton and their histo-chemical studies.

SUGGESTION: -

In order to enhance the fish production of this virgin "NEURA Reservoir (Ox-bow lake)" by maintaining and monitoring the reservoir on scientific basis following suggestion for the improvement of the water body must be followed up: -

(1) In both the years of investigation annual flood were observed. This can be averted by making earthen or cemented embankment. This will also check the water entry during rainy season from the catchment area.
(2) A sluice gate should be constructed so that water inflow and outflow should be controlled.
(3) Due to ploughing for cultivation on the different sides of the reservoir, it has several broken embankment points. During rainy season when the reservoir is over flooded fish escape is increased. Hence embankment on all the sides of the reservoir should be raised to avoid exit or entry of water.
(4) Fish catching should be suspended for atleast one to two years and only controlled fishing should be done so that fishes may get sufficient time for growth.
(5) Unauthorized fishing and theft of fish should be stopped.
(6) Over shading of plants should be stopped.
(7) Fishermen should be given adequate training for fish culture.
(8) Fishermen should be given financial co-operation in order to manage their own co-operative societies.
(9) A separate Agency should be set up for reservoir management and for doing all sorts of research work for an increase in the fish production.
(10) There should be certain scientific application at regular intervals so that any deficiency, it can be compensated by proper means by as follows: -
(a) Fishermen should be trained on the scientific basis and modern nets should be provided to them from time to time.
(b) Diseased fishes should be sorted out regularly form the reservoir at different sites.
(c) Additional species of commercially important fishes should be introduced into the reservoir.
(d) After rainy months unnecessary growth of aquatic weeds should be controlled.
(e) Soil and water of the reservoir should be regularly analyzed, and the deficiency found should be removed by proper means.
(f) Attached nursery and stocking tanks should be constructed so that fries and fingerlings may be reared properly. This may develop an ideal fish farm.
(g) Fish food should be regularly supplemented into the reservoir
(h) Insects attacking fries, fingerlings and small fishes should be removed regularly, so that damage caused by them must be minimized.

The above suggestion when adopted and followed in letter and spirit, then "NEURA Reservoir (Ox-bow lake)" will improve and the fish yield will naturally increase to an ideal stage. As a result, the socio-economic condition of the fishermen of the area will also be improved. It will also open the avenues of more employment opportunities since, large number of people skilled- unskilled; will be required to handle such a large quantity of fish. It will develop on one hand, the national economy and on the other hand will solve the problem of protein rich food to a large extent and it will help to solve the unemployment.

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