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Comparative Limno-Chemical Study of Brush Park (Katal) and Macrophyte Free Area in a Wetland of Assam

RANJAN K. MANNA AND MD. AFTABUDDIN

Regional Center, Central Inland Fisheries Research Institute (ICAR)
Dispur, Guwahati 781006, India

Abstract

Fishing using brush park (katal) is an age-old practice in wetlands of Assam. This fishing method uses water hyacinth as hiding place for fishes. A study was conducted in 46, Morakong beel, Morigaon, Assam during 2005-06 to examine the limno-chemical environment inside the brush park as compared to macrophyte area of the beel. A total of six parameters viz. temperature, pH, specific conductivity, dissolved oxygen, free carbon dioxide and total alkalinity were measured both inside and outside the brush park. Data revealed that brush park is not congenial for fish growth especially due to low dissolved oxygen, low pH and high carbon dioxide values. A scientific intervention for better fishing device by modifying the method is recommended.
Key words : Brush park, Katal/jeng fishing, Limno-chemical parameters, Dissolved oxygen, Carbon-di-oxide.

The state of Assam is blessed with about 1 lakh ha of floodplain wetlands having immense fisheries potential. These floodplain wetlands are locally known as *beel/anoa* in Assam. These water bodies are mostly underutilized as evidenced by their present average fish production of 172.9 kg/ha per year against estimated potential of about 1000 kg/ha per year (1). Rich nutrients and fewer disturbances in the closed and seasonally open wetlands provide scope for luxuriant growth of submerged and floating macrophytes in these wetlands. Dense canopy of macrophytes often creates difficulty in fish harvesting from the beels. Among various fishing methods used in beels (2, 3), brush park fishing (locally known as jeng/katal fishing) is told to be the most efficient methods. This fishing method uses water hyacinth *(Eichhornea crassipes)* as aggregating device for fishes. Various aspects of katal fishing were reported by many researchers from time to time (4—6). However, no study has been performed on limno-chemical environment inside brush parks in comparison to other areas of the beel. The present account is based on comparative limno-chemical studies performed inside and outside brush parks in 46, Morakong beel, Morigaon, Assam during 2005-06 in the light of various reported adverse effects of water hyacinth for deteriorating water quality (7, 8).

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Description of Katal Fishing

An area of the beel is marked and encircled with the help of bamboo poles. Branches of tree/bamboo are placed inside water within that area and floating water hyacinth are spreaded over them. The branches of bush forming tree like *sheora* (*Strebulus asper)* are used for this purpose. Bamboo strips are used to encircle the whole area to avoid escape of water hyacinth. The katal are set just after monsoon during the months of July—September and harvested after 2—3 months. The fishes used this area as hiding places to avoid intensive fishing outside the area. During harvesting,the whole brush park is encircled with small mesh nets. water hyacinth and tree branches are thrown outside the area and the nets are slowly advanced inwards to reduce the circumference of the

Table 1. Variation of average temperature (C) in 46, Morakolong beel, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophyte free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	31.9	30.3	35.9	30.7
Winter	21.6	21.9	21.9	23.1

Table 2. Variation of average water pH in 46, Morakolong beel, Morigaon, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophyte free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	6.0	5.8	7.4	6.2
Winter	7.1	6.7	7.0	7.1

katal. Cast nets are also operated in the cleared area to catch fishes. Finally, when the circle becomes small, foot ropes of the net brought together to form a bag and catch all the fishes. The whole operation takes many days depending upon the size of brush park. The circumference of the jeng/katal may vary from 200—350 m. The catch comprises all types of fishes including carps, air breathing fishes, catfishes, knife fishes. Fish catch composition from katal varies from one beel to another depending upon physical environment like depth etc.

Description of the Study Area

The study was undertaken in monsoon and winter season in 46, Morakolong beel, Morigaon, Assam (26°14′N, 92°19′ E) in 2005-06. This seasonally open wetland is shallow in nature having an area of 61.9 ha. It establishes link with the parent river Kolong, a southern tributary of River Brahmaputra during monsoon. Average depth of the wetland during post-monsoon is 1.5 m which increases to 3.5 m in monsoon due to intrusion of flood water from parent river. The connection of beel with the river is generally established during last week of May or first week of June depending upon arrival of monsoon. Water remained lentic in winter, whereas mild flow was observed during monsoon sampling due to entry of flood water. Submerged macrophytes start growing during November and remained till May end when turbid flood water kills all the submerged macrophytes. Floating macrophyte (water hyacinth) remained throughout the year, but mostly confined inside brush parks. Sometimes, fishermen bring water hyacinth from nearby water body to establish katal inside the wetland. About 11 numbers of big katal are set each year in this beel. Location of those katals mostly remained fixed inside the wetland.

Methods

The water sampling was performed from inside and outside the brush parks. Bottom water was collected using bottom sampler. For sampling inside brush parks, a slim country boat was inserted through water hyacinth with minimum disturbance possible. Outside sampling was performed from the relatively clear zone devoid of submerged and floating macrophytes. All the six parameters viz. temperature, pH, specific conductivity, dissolved oxygen, free carbon dioxide and total alkalinity were determined in the field using standard procedure (9).

Results and Discussion

Limno-chemical parameters of water depend on physical, chemical and biological processes influencing the system. All the six parameters viz. temperature, pH, specific conductivity, dissolved oxygen, free carbon dioxide and total alkalinity varied from one zone to another. Parameter wise results and discussions are given below.

Temperature

Temperature is one of the major controlling factors for growth of aquatic organisms especially fishes. Warm water fishes grow much faster than coldwater fishes. During our sampling in the wetland water temperature ranging between 21.6 to 35.9 C were recorded with lower temperatures during winter season (Table 1). During monsoon, surface temperature was higher than bottom temperature, whereas the trend is reverse during winter season. Surface water inside brush

Table 3. Variation of average specific conductivity (μS/cm) in 46, Morakolong beel, Morigaon, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophyte free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	94	102	86	108
Winter	239	232	241	249

Table 4. Variation of average dissolved oxygen (mg/I) in 46, Morakolong beel, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophytes free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	0.79	1.50	10.24	1.32
Winter	3.67	2.88	7.05	6.76

parks (31.9 C) did not get heated like clear zone (35.9 C) due to shading by dense water hyacinth canopy. Clear zone, on the other hand, heated fast due to direct sunlight exposure and scattering of heat by silt particles of turbid monsoon inflow. Clear bottom zone (23.1 C) will be more favorable to fishes as compared to bottom of water hyacinth covered brush park (21.9 C) in winter.

Water pH

Water pH in the range of 7.0—8.0 is reported to be ideal for fish growth. Winter sampling of our study observed near neutral pH in all the zones except floating bottom with pH of 6.7 (Table 2). Monsoon sampling, on the other hand, recorded acidic pH except at the surface of the clear zone with pH 7.4. The acidic pH in monsoon may be attributed to rapid microbial decomposition of dead submerged macrophytes throughout the beel. This large scale mortality of macrophytes was triggered by sudden rise of water level with highly turbid water inflow. The increase in pH in clear surface zone is due to increase in carbonate ion (and ultimately hydroxyl ion) when free carbon dioxide is not available in the system for photosynthesis.

Specific Conductivity

Specific conductivity indicates amount of soluble salts in water. So, it reflects the state of mineralization inside water. Soluble salts may be harmful to aquatic organism due to changes in osmotic pressure. Much higher specific conductance in winter as compared to monsoon is mainly due to concentration of ions by evaporation. In monsoon, bottom water showed higher amount of ions as reflected by higher specific conductance (Table 3). This is due to release of ions by higher rate of decomposition of bottom settled decaying submerged macrophytes. In winter, reverse trends are observed inside and outside brush parks. As euphotic zone reached up to bottom in winter, clear surface may facilitate higher rate of decomposition at bottom resulting in higher conductivity during winter. Shading inside brush parks may be responsible for the opposite trend.

Dissolved Oxygen

Dissolved oxygen (DO) is necessary for survival of aquatic plants and animals as molecular oxygen is the electron acceptor in aerobic metabolism. For better growth of fishes,dissolved oxygen concentration higher than 5.0 mg/liter is necessary (10). Among all the parameters, difference in DO is much more pronounced across different zones. Both surface and bottom water inside brush park contained much less oxygen (0.79–3.67 mg/liter) in both the seasons which is not congenial for fish growth (Table 4). During monsoon, all the zones except clear surface showed low dissolved oxygen. This is due to rapid utilization of dissolved oxygen by microbial respiration for decomposing decaying submerged macrophyte at bottom. In winter also, much less dissolved oxygen at brush park zone was observed. This is due to obstructed equilibration with the atmospheric oxygen caused by dense canopy of water hyacinth inside brush parks. Photosynthetic oxygen production by plankton and by nearby submerged macrophyte somewhat compensated the scarcity of oxygen in clear zone during winter.

Free Carbon Dioxide

Free carbon dioxide is required by aquatic plants

Table 5. Variation of average free carbon dioxide (mg/l) in 46, Morakolong beel, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophyte free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	8.32	10.88	0	13.44
Winter	4.72	6.29	0	0

Table 6. Variation of average total alkalinity (mg/I) in 46, Morakolong beel, Assam.

	Inside brush parks (water hyacinth covered area)		Outside brush parks (macrophyte free area)	
	Surface water	Bottom water	Surface water	Bottom water
Monsoon	40.59	40.59	32.67	41.58
Winter	84.66	84.66	89.64	88.64

for photosynthetic primary production. Plants can use CO_2 better than any other carbon source like bicarbonate or carbonate for photosynthesis (11). Aquatic system derives free carbon dioxide from respiration of aquatic organism including microbes. Free carbon dioxide in water follows reverse trend of dissolved oxygen as observed in our study also. Monsoon sampling showed free carbon dioxide in all the zones except clear surface (Table 5). Microbial decomposition of decaying macrophyte at bottom releases enough free carbon dioxide, which is utilized by plankton in the clear surface in monsoon. Winter sampling, on the other hand, recorded free CO_2 only in floating zone, but there is no free carbon dioxide available in clear zone both at surface and bottom.

Total Alkalinity

Carbon availability for photosynthesis depends upon total alkalinity of water. Water with low total alkalinity of 0—50 mg/liter is usually less productive as compared to water with total alkalinity of 50—200 mg/liter. Again,at higher alkalinity, productivity tends to decrease. Higher total alkalinity in winter as compared to monsoon may be attributed to concentration of bicarbonate by evaporation (Table 6). During monsoon, lower total alkalinity at clear surface may be due to utilization of bicarbonate by plankton due to absence of free CO_2. Little lower total alkalinity was observed inside brush park with respect to clear zone in winter.

Conclusion

It is clear from this study that brush parks are not much suitable for good fish growth because the area was lacking of sufficient oxygen concentration necessary for it. Acidic pH inside katal has not been compensated by planktonic photosynthesis as observed outside the katal. Available free carbon dioxide is the reflection of poor phytoplankton concentration inside brush parks. So, brush park is not at all congenial for providing both limno-chemical environment and food source. Hence, scientific intervention is required to improve this age-old method of fish catching. An improved method where water hyacinth may be replaced with some artificial cover providing proper gaseous exchange may be compared with the method in practice. Success will discourage the people to keep water hyacinth in wetland as it is already known as nuisance. Better fish growth will be observed in water hyacinth free environment as fishes will get better environment to grow thereby increased fish productivity from wetlands of Assam.

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