ROLE OF CLAMS IN REGULATING BIOGEOCHEMICAL PROCESSES OF ASHTAMUDI LAKE

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Need for the Study

Among bivalve molluscs, clams form an important resource as meat for human consumption and for shells in the cement industry. The Ashtamudi Lake Ecosystem in Kerala (southwest coast of India) is well known for its clam resources. This estuarine system between latitude 8˚45' - 9˚28' N and 76˚28' - 77˚17' E contributes approximately 80% of the overall clam export trade in India, providing livelihoods for at least 3,000 local people.

As part of eco-labelling the scientifically managed clam fisheries of Ashtamudi Lake, the Central Marine Fisheries Research Institute (CMFRI) in collaboration with, World Wide Fund for Nature (WWF), in 2014, probed into the ecosystem benefits coming out of the management initiatives. Accordingly, a rapid appraisal of selected biogeochemical processes was carried out analyzing two scenarios *viz*. a) Clam bed with fishery and b) Non clam zone in Ashtamudi Lake.

Methods

Samples of water, sediment, plankton and benthos were examined using standard methods. Water quality (in terms of nutrients, particulate organic matter, particulate inorganic matter, chlorophyll, TSS, BOD etc.) and sediment quality (in terms of organic carbon, oxidation reduction potential, available nutrients, texture etc.) were assessed using standard procedures.

Results

Table1. Selected Biological Characteristics

Scenario	Clam with fishery	No Clam
Clam (numbers)	85	-
Clam weight (g)	196	-
Ratio of Clam Weight to Nos.	2.3	-
Diatom count, millions ml^{-1}	3.51	3.11
Benthos (Biomass), g m^{-2}	48.44	95.16

Table 2 . Sediment Quality

Scenario	Clam with fishery	No Clam	Optimum range
Organic carbon, %	1.77	0.9	1.5 – 2.5
Eh, mV	-44	-97	> -200
Salinity, PSU	11.49	7.15	> 2.2
Ammonia – N, ppm	3.23	1.85	Together as available N, 250-750ppm
Nitrite- N, ppm	0.05	0.02	
Nitrate-N, ppm	0.36	0.33	
Available P, ppm	77.35	60.29	> 60
pH	7.22	7.65	6.5 – 7.5
Sand, %	68.6	82.1	40
Silt, %	17.0	10.9	30
Clay, %	14.1	6.8	30

Hand dredging for clams in Ashtamudi Lake

Sorting clams

Map of Ashtamudi Lake showing clam sampling zones

Water sampling

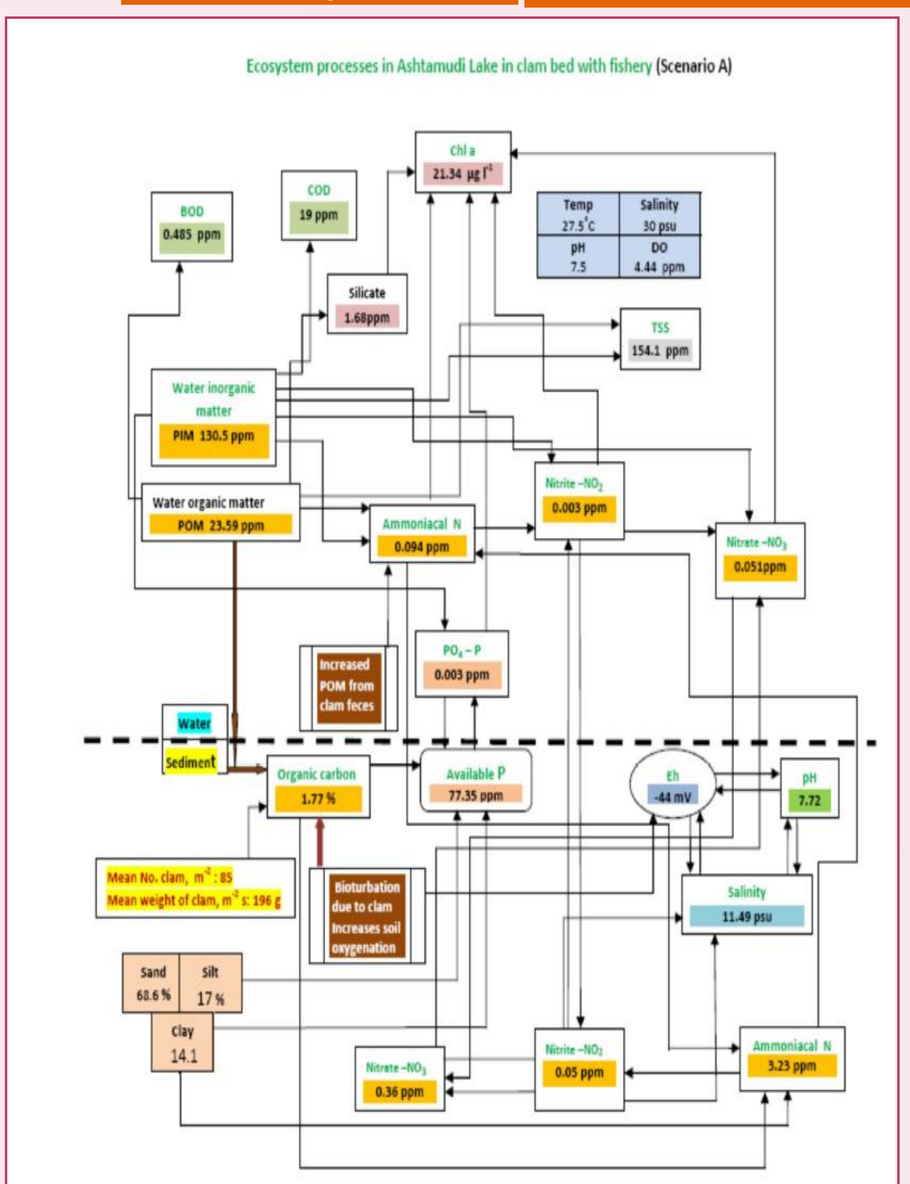
Sediment sampling

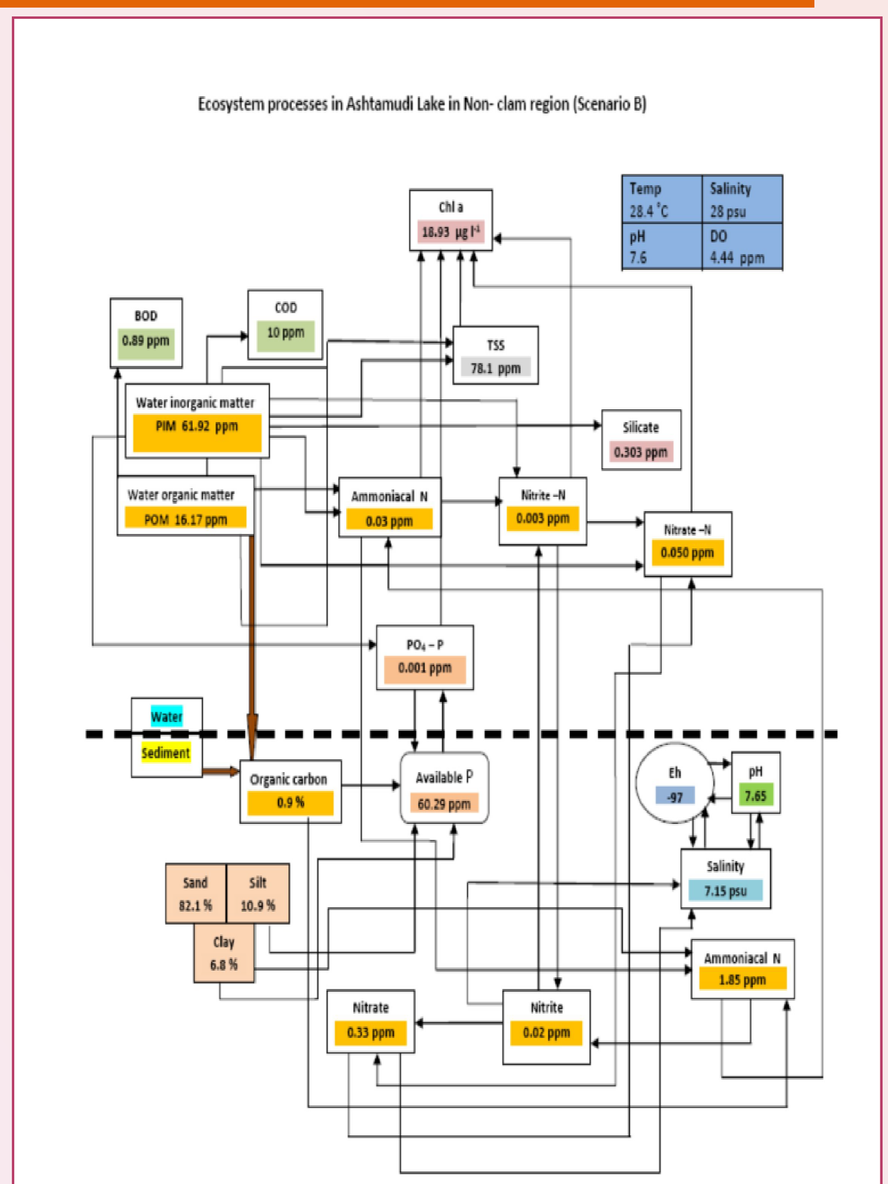
Table 3. Selected Water Characteristics

Scenario	Clam with fishery	No Clam	Optimum range
Chlorophyll a, µg l^{-1}	21.34	18.93	17-40
Temperature, ˚C	27.5	28.4	25-32
Salinity, PSU	30	28	2 - 48
DO, , mg l^{-1}	4.44	4.44	5 -10
TSS, mg l^{-1}	154.1	78.1	25-200
BOD, mg l^{-1}	0.49	0.89	<15
COD, mg l^{-1}	19	10	<70
P O M, mg l^{-1}	23.59	16.17	
P I M, mg l^{-1}	130.5	61.92	
pH	7.5	7.6	7.0-8.7
Total ammonia – N, mg l^{-1}	0.094	0.03	0-0.1
Nitrite – N, mg l^{-1}	0.003	0.003	0-0.5
Nitrate – N, mg l^{-1}	0.051	0.05	0.1-3
PO_4 –P, mg l^{-1}	0.003	0.001	<0.01
Silicate, mg l^{-1}	1.68	0.303	> 5

Analysis

COMPARING ECOLOGY OF CLAM AND NON CLAM ZONES OF ASHTAMUDI LAKE





Discussion

TABLE OF DISCUSSION

Scenario	Clam with fishery	No Clam	Probable reason
Diatoms	More ↑		More nutrient release
Chlorophyll	≈1.13 times ↑		More nutrient release
Water temp	≈Same		
TSS	≈2 times ↑		May be due to clam fishing
Water salinity	≈Same		
DO	≈Same		
BOD		≈2 times ↑	Less bio-oxidation in non clam region
COD	≈1.9 times ↑		More oxidation due to clam bioturbation
Water pH	≈Same		
Ammonia-N (water)	≈3 times ↑		From clam faeces
Nitrite-N (water)	≈Same		
Nitrate-N (water)	≈Same		
PO_4- P (water)	≈3 times ↑		From clam faeces
Silicate in water	≈5.6 times ↑		From clam faeces
Particulate organic matter	≈1.5 times ↑		From clam faeces
Particulate inorganic matter	≈2 times ↑		From clam faeces
Sediment organic carbon	≈2 times ↑		From clam faeces
Sediment salinity	≈1.6 times ↑		More nutrient release
Ammoniacal N (sediment)	≈1.8 times ↑		From clam faeces
Nitrite N in sediment	≈2.5 times ↑		From clam faeces
Nitrate in sediment	≈1.09 times ↑		More oxidation due to clam bioturbation
Oxidation – Reduction Potential in sediment	≈2.2 times more oxidative ↑		More oxidation due to clam bioturbation
Available P in sediment	≈1.3 times ↑		More oxidation due to clam bioturbation
Sediment pH	≈Same		
Sand in sediment	≈1.2 times less ↓		From clam faeces
Silt in sediment	≈2 times ↑		From clam faeces
Clay in sediment	≈1.6 times ↑		From clam faeces

Summary

In clam bed with fishery, oxidation reduction potential of surface sediment was twice due to bioturbation of clams and the amount of nutrients released to water was thrice, compared to the non clam zone. Beneficial effects on bio-geo-chemical are indicated in the presence of clam with fishery. The environmental quality indicators remained well within permissible levels in clam bed with fishery, improving the ecosystem processes simultaneously. Sustainable maintenance of clam beds with optimum fishery is necessary for the general ecological health of the Ashtamudi Lake.

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