CHAPTER IX

SUSTAINABLE MANAGEMENT OF THE LAKE

In the global context water quality, climatic changes, interaction of aquatic environment with terrestrial environment, increased human population, introduction of species etc, are the main factors affecting the biodiversity of fresh water habitats.

Due to the increasing population, living aquatic resources of the world in general and that of India in particular are under constant pressure. One of the major groups of aquatic resources is the fresh water fishes, which contribute significantly to the commercial fisheries. Kerala State being in the tropical belt possess a very rich diversity of fresh water fishes occurring in streams, rivers, lakes, ponds, reservoirs, canals, estuaries etc. Several species of fishes occurring in such water bodies of Kerala are endangered or threatened. Of these several water bodies of Kerala fresh water lakes have received very little attention regarding documentation of their fish fauna. This has created difficulties in proper assessment of the fish fauna and their conservation. Only baseline studies will help in the assessment of the status and abundance of their fish fauna.


Except the report of Thomas et al. (1980), no detailed information regarding the fish fauna of Sasthamkotta lake is available. The available information on the fish fauna of this lake is meager (Thomas et al., (1980), Prakasam (1991)). This paucity of information made comparison or assessment of
the changes that have taken place during recent years to the ecological and fishery aspect almost impossible.

The lake supports fishery of a very negligible magnitude compared to its area. Since the lake is an enclosed water body, the fish fauna of the lake might have been completely isolated for all these years. The lake has a thin film of phytoplankton and zooplankton with a low rate of primary production. The existing low rate of production, in spite of leaching from the hills around, may be due to the complete isolation of the lake, and the very low fertility of the soil and unscientific agricultural practices in the catchment area. This may be the reason for the low fishery potential of the lake. Another reason may be the acidic nature of the lake reducing productivity.

During the present study, a total number of 26 species were obtained from Sasthamkotta lake. Thomas et al. (1980) and Prakasam (1991) reported 23 and 27 species respectively. The three species, Spratelloides malabaricus, Amlypharingodon melettinus and Danio devario reported by Thomas et al. and Tetradon cutcutia, Anguilla bicolor, Moringu raitaborua and two species of prawns reported by Prakasam (1991) were not observed in the present study. Another six species were newly reported in the present study. They are Dayella malabaricus, Puntius amphibius, Puntius dorsalis, Puntius vittatus, Puntius ticto and Ompok malabaricus. Regarding the Shannon-Wiener indices of the entire lake of Sasthamkotta, species diversity and Evenness was high during the post monsoon season. Species dominance was highest during monsoon and species richness during pre monsoon period.

The present fishing operation in Sasthamkotta lake consists mainly of gill nets of different mesh sizes. During the present study, a serious decline in the fishery especially Horabagrua brachysoma, Channa sp. and Heteropnustes fossilis were reported. Horabagrua brachysoma, once found in abundance was not a common fish now. Etroplus suratensis was also found in decreased number. Overfishing in the lake by local inhabitants and low productivity might have resulted in the reduction in fishery potential. The coliform count of the lake has become unlimited exceeding the prescribed ISI limits may also be one of the
reasons for the reduction of the fish. To replenish this fish scarcity and to conserve this biodiversity, fresh water fishery can be intensified by introducing native species which can be acclimatized to the lake. Care should be taken to maintain and monitor water quality parameters.

The catch per unit effort and the catch per day have shown that the fishery potential of the lake is negligible when compared to the area of the lake. The catch per unit effort and catch per day was high for gill net fishery and pre monsoon season was most suitable. The catch per unit effort for encircling net was higher than cast net but the catch per day was high for cast net due to the maximum number of operation. Monsoon was the suitable season for cast net fishery whereas post monsoon was the favorable season for encircling net fishery.

Abundance and diversity of biotic communities are influenced by various physicochemical parameters. The potentialities of an aquatic ecosystem are influenced by nutrient dynamics, productivity, standing stock and energy transfer. The physicochemical parameters are interdependent and they vary with seasons. Rainfall was highest during the monsoon season in the study period. Water temperature was always positively correlated with atmospheric temperature and negatively related with rainfall. Annual mean showed that water of Sasthamkotta lake was acidic except station I, near the Vallakadavu which may be due to the indiscriminate use of soaps and detergents. Comparatively low conductivity and turbidity and high transparency values were observed. Dissolved oxygen was high at all stations especially during post monsoon and monsoon seasons. Carbon dioxide content registered an apparent increasing trend from pre monsoon to monsoon at all the stations. At all stations alkalinity showed a decreasing trend from monsoon to pre monsoon. Salinity values registered highest values at station IV, near the filter house which is due to the discharge of waste water with excess chlorine after purification from the filter house. Hardness of the lake was within the prescribed limit of BIS (1991). Biological oxygen demand and chemical oxygen demand was highest during pre monsoon. Total suspended solids and total organic carbon was highest during pre monsoon and showed a positive correlation with conductivity.
High level of potassium content correlated with the rainfall at all the stations is due to leaching and siltation. Irrespective of the seasons station I is the site having high phosphate concentration due to the indiscriminate use of soaps and detergents. Nitrite and nitrate concentration was high in the present study especially at station III near the concrete bund. These are due to the unscientific agricultural practices and hence discharge of fertilizers and pesticides from the nearby rubber and other plantations. As the lake water is a drinking water source, it should be free from microbes. All the stations under study were polluted with total coliforms, faecal coliforms, *Escherichia coli* and faecal streptococci. The results showed that the number of these bacteria is far beyond the prescribed limits of Indian standards, usable not for drinking but for bathing also. Station I is the highly polluted site for all these four types of microbes. The count was highest during the monsoon and post monsoon seasons.

Texture analysis of the sediment showed the silty clay nature with high percentage of clay. Nitrogen content was high in the bund region, Station III for sediment analysis also. The sediment is acidic in nature with an increase in electrical conductivity associated with seasonal rain. Low organic content and potassium in the lake sediment observed is due to the heavy sand deposition and diminished organic detritus.

Gross primary productivity exhibited a low rate at this lake. Comparatively high values were during the post monsoon season might be due to the addition of nutrients through surface run off from catchment. Chlorophyll 'a' which is an indicator of phytoplankton abundance was highest during post monsoon and observed a direct relationship with silicate. Potassium exhibited an inverse relationship with chlorophyll 'a' which limits the plankton growth.

Planktonic studies in the lake showed an inversion of chlorophyceae to Bacillariophyceae in the abundance and dominance. In the previous studies, Chlorophyceae dominated in the lake water which is an indication of the good quality of water. During the present study, Bacillariophyceae dominated in number and species. *Navicula* sp. and *Nitzschia* sp. are tolerant in polluted water and are indicators of pollution. *Cocconeis* sp., *Fragilaria* sp., *Melosira* sp., *Nitzschia* sp.,

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Navicula sp. and Synedra species were more abundant among the Bacillariophyceae in the lake. Presence of high number of Bacillariophyceae and reduction of Chlorophyceae may be considered as an indicator of increased water pollution of the lake. This can be well predicted due to the presence of macrophytes in the lake at certain pockets which were absent in sasthamkotta before. Nutrient concentration and phytoplankton abundance was high in the Station III near the bund region. Here macrophytes are seen in abundance also. Urgent management options in this direction are warranted.

PROBLEMS THE LAKE FACES

Sasthamkotta lake is the largest fresh water lake of Kerala, is one among the nineteen wetlands identified for intensive conservation and management by the Ministry of Environment and Forests under the national wetland programme. This wetland was declared as Ramsar site since 2002. This wetland has several values and attributes. This is the main source of drinking water to the lakhs of people at Kollam District, pondage for ground water recharge, receptacle for flood waters, sink for flood waters, sink for pollutants and an ideal habitat for fresh water flora and fauna. This wetland system is subjected to considerable pressure, especially due to disturbances in the catchment. The changes in land use and subsequent soil erosion have been a threat to this wetland ecosystem. The catchment area, is thickly populated; hence domestic or community waste water is indiscriminately discharged into the lake. Several house holds near the lake do not have proper sanitation facilities; local inhabitants in the catchment bathe and wash clothes and domestic animals in the lake using soaps and detergents. Human faeces in the catchment area make the water highly unfit for human use. The coliform count of the lake is exceeding the ISI limits making the water unfit for drinking and bathing. Part of the agrochemicals used in the catchment also finds their way into the lake. Because of the unscientific land use pattern in the catchment, sediment load entering into the lake has considerably increased, causing a reduction in the capacity of the water body. Macrophytes began to appear in certain pockets of the lake. All such activities, if continued without a check, would lead to the eutrophication of the lake.
Being a major source of protected water supply, the condition of the lake has reached a critical stage from the ecological point of view and if proper conservation measures are not taken, the lake is likely to deteriorate further.

CONSERVATION STRATEGIES

There is an urgent need to adopt long term conservation measures based on plans with sound ecological approach. Considering the above problems facing the wetland some mitigation measures are suggested.

1. Reduction in the lake volume is a major threat which may mostly be due to reclamation activity and siltation. Siltation diminishes the quantum of water flow; destruct the breeding grounds of fishes, habitat destruction of the fishes affect the benthic population and overall productivity of the lake. Afforestation in the catchment with indigenous species will help to prevent sedimentation of the lake. Quarrying in the catchment area is to be banned by law.

2. Resurvey of the lake should be conducted and strong measures should be taken to arrest further encroachment. At least an area of 200 meter from the boundary of the lake should be declared as the ‘land regulation zone’ and all human interference should be prohibited by suitable management programmes. Terracing on slopes to reduce erosion and reforestation of the ‘LRZ’ to check seepage should be practiced.

3. As there is no well planned drainage system in the watershed, wastewater from households, streets, market and other public places in the lake catchment are let out indiscriminately on to land which would ultimately reach the lake contaminating it. Providing facilities for recycling of domestic and other waste water and biodegradable solid wastes as fertilizers for plants could be considered.

4. Several inhabitants do not have sanitation facilities which are the main reason for the increased coliform count in the lake. Scientific sanitation facilities with reduction of the waste water flow to the lake should be
practiced at the catchments as well as by the pilgrims to the Sasthamkotta Temple.

5. Make alternate sources for bathing, washing clothes and cattle.

6. The waste water after purification process from the filter house is being continuously discharging into the same lake and to prevent this separate earth tanks are to be built for discharging and processing this waste water before it is discharged into the lake.

7. Regular and proper monthly monitoring of the water quality of the lake is to be implemented.

8. Tourism in the name of ‘Ecotourism’ is not at all suggested in this lake.

9. Awareness should be created among the students of the nearby schools and other educational institutions, farmers and the public in the catchment area about this valuable water source, ecological implications of the indiscriminate activities which adversely affect the lake ecosystem.

10. Creating awareness through interaction programmes and mass communication media. Functional literacy on the lake conservation should be introduced in a regional manner highlighting the importance of the lake with special reference to the significance as a drinking water source.

11. Display Boards’ are to be placed along the catchment area of the lake with attractive captions indicating the importance of the lake and ‘DON’TS and DOS’ in the lake.


13. Changes in the productivity and plankton should be monitored to maintain adequate measure for the maintenance of the lake more productive which in turn replenishes the water quality of the lake along with fishery potential.

14. A scientific monitoring unit should be constituted for the effective management of the lake water quality. A wet land management
committee would be formed with representatives of self help groups, Kollam Corporation, adjoining panchayats, NGOs, concerned government organizations and participating institutions.

15. Point source of the pollution should be identified and mitigation measures should be implemented at the same place itself.

In all attempts, we should exercise control on catchment activities which tend to increase pollution and degrade the ecosystem. Judicious utilization of the natural resource is to be planned.