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A STUDY OF THE WATER RESORCE MANANGEMENT OF ARUVIKKARA RESERVOIR, THIRUVANTHAPURAM, KERALA

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Abstract: The present attempt is to analyze the water quality and to reveal the role of aquatic biodiversity ie. micro and macro flora in maintaining the status of the reservoir. Attempt has also been made to understand and predict the implications of impotent management of water resource. The samples were collected monthly wise for different types of analysis during the year 2012-13.The different physico chemical parameters analyzed; most of them were within the standard limits as suggested by WHO. From the water quality studies it is revealed that the water is nonpolluted. About 25 taxa of phytoplanktons and 35taxa of aquatic and wetland plants were observed during the study. The macro flora includes floating, submerged aquatic plants, aquatic weeds and the micro flora included phytoplankton of different types viz. Cyanophyceae, Chlorophyceae and Bacillariophyceae. The study revealed that water in the reservoir was managed ineffectively and most of the area was inhabited by aquatic weeds and noxious phytoplankton. If this condition prevails, these micro and macro flora can flourishes in the water body and can lead to Eutrophication and finally the death bell of the water body. The water body gets encroached by the neighboring peoples started unfair agricultural practices in the water body. More over silt and sand have been deposited in the reservoir in large quantities results formation of land masses which decreases the storage capacity and quality of the water in the reservoir. It is suggested to develop policies and legislations, monitoring, planning and efficient management in conserving the aquatic body from eutrophication and encroachment for a better future.

Key words: water quality, Aquatic plants, Phytoplanktons, Eutrophication, Encroachment, Sustainability

INTRODUCTION

Integrated Water Resources Management (IWRM) is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

Study area: Aruvikkara located in Kerala, India with coordinates 8.5677800°N 77.018890°E is a village in Thiruvananthapuram district in the state of Kerala, India. It is located on the banks of the Karamana River 15 km from Thiruvananthapuram, the capital of the state of Kerala in South India. Aruvikkara dam is the main source of water for distribution in the Thiruvanthapuram city. For study purpose, five sampling sites were selected to collect water samples. Site 1 (Vembanni) and Site 2 (Vembanni East) are on the southern side of the reservoir, Site 3 (Mundela) on the eastern side, Site 4 (Kalian kuzhi) on the northern of the reservoir and Site 5 (Temple side) downstream the reservoir. Sand mining was seen on Site 3 and

MATERIALS AND METHODS

Water samples, Plant samples and sediment samples have been collected once in a month for a period of one year from the selected stations (5) of the dam. Samples have brought to the laboratory for the following analysis. Different physico chemical parameters like Temperature, Alkalinity, pH, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Phosphate, Nitrate, Nitrite, Silicate, Sodium, Potassium, Calcium and Magnesium were analyzed using standard methods (APHA 1992).

RESULTS AND DISCUSSION

The results of various physico-chemical parameters are depicted in Table 1, 2 and 3.

Temperature of the water samples were analyzed at the sites with the help of a thermometer. Monthly values of temperature ranged between 30.9°C at the site 5 in the pre monsoon and 23.5°C at the site 3 in the monsoon. Fluctuations in water temperature experienced may be due to the timing of collection and the influence of season. pH of the water samples were analyzed at the sites with the help of a mobile pH meter. Monthly values of pH ranged between 6.2 at different sites in different seasons and 7.5 at site 5in the pre monsoon. The pH value was within the limits of standard values (ICMR, 1975 and WHO, 1985) that indicates the suitability of the water for all purposes. The maximum alkalinity was 22.7 at the site 5 in the pre monsoon and the minimum alkalinity was 9.5 at the site 2 in the post monsoon. The permissible value of Total Alkalinity ranges a maximum of 600mg/ L. Total hardness were analyzed using Total hardness method. The maximum total hardness was 34 at the site 1 in the pre monsoon and the minimum total hardness was 4 at different sites in the monsoon. The hardness of water observed at all sites were within the limits prescribed by WHO (1971) and ISI (1991) - 100mg L and 250mg L respectively. The silicate concentration in the water varied between 4.7mg/l at the site 4 in the pre monsoon and 2.1 mg/l at the site 5 in the monsoon. The concentrations of silicate detected in the reservoir were within the limits of worldwide average of silicate for rivers (13.1 mg L) suggested by Livingstone (1963). The phosphate concentration in the water varied between 0.060mg/l at the site 4 in the post monsoon and 0.030mg/l at the different sites and at different seasons. The amount of phosphate found in the sites was mostly lower than the prescribed level of USPH standard 0.1 mg/L (De, 1999) for unpolluted water at all sites. The DO concentration varied between 8.5 mg L at site 5 during September and 3.5 mg/L at the site 3 during January. These DO values were fairly above the required standard values prescribed by various authorities (5 and 6 mg/L by ICMR, 1975 and ISI 1991 respectively). Monthly values of BOD ranged between 0.5 mg/L at the site 3 in February and 5.3 mg/L at the site 5 in December. The annual and seasonal average values of BOD remained below the accepted stand standards of 3 mg/L recommended by ICMR (1975) and ISI (1991). COD values in Aruvikkara reservoir varied between 4mg/L at different sites during post monsoon and 200mg/L at site 3 during the month of December. The annual mean value, recorded at Aruvikkara reservoir, remained lower than the COD values published for Indian rivers by CPCB (1991).

Trophic Static Index: Trophic level is the indicator of water quality for limnetic ecosystem. It shows the productivity of the system and biomass availability in that water body. The degree of nutrient enrichment is also classically indicated as trophic state of water bodies. It could vary between oligotrophic to hyper-eutrophic states. These equations were originally based on Carlson trophic static indices. Water bodies with TSI values less than 40 are usually classified as oligotrophic. TSI values greater than 50 are generally defined as eutrophic. Mesotrophic

Table 1. Physico chemical parameters of Aruvikkara reservoir (Monsoon season)

Parameter	Site 1	Site 2	Site 3	Site 4	Site 5
Temperature	24	22	25	24	25
pH	7.3	7.6	7.4	7.2	6.8
Total Alkalinity, (mg/l)	17.6	15.1	15.7	17.3	15.4
Total hardness, (mg/l)	15.3	13.4	12.7	18.7	14.0
Nitrate, (mg/l)	0.36	0.25	0.33	0.30	0.30
Nitrite, (mg/l)	0.036	0.060	0.092	0.1	0.069
Phosphate, (mg/l)	0.035	0.041	0.045	0.035	0.030
Silicate, (mg/l)	2.1	3.0	4.0	3.4	3.2
Dissolved oxygen, (mg/l)	5.9	7.6	6.3	5.1	6.9
Biological oxygen demand, (mg/l)	3.2	2.6	2.3	2.2	3.0
Chemical oxygen demand, (mg/l)	9	4	20	35	9

Table 2 Physico chemical parameters of Aruvikkara reservoir (Post-monsoon season)

Parameter	Site 1	Site 2	Site 3	Site 4	Site 5
Temperature	26	24	25	25	26
pH	6.7	6.2	6.5	6.1	6.1
Total Alkalinity, (mg/l)	17.0	12.7	16.3	17.6	13.5
Total hardness, (mg/l)	12.0	11.1	10.3	14.0	12.0
Nitrate, (mg/l)	0.54	0.45	0.47	0.40	0.50
Nitrite, (mg/l)	0.047	0.049	0.059	0.063	0.033
Phosphate, (mg/l)	0.050	0.045	0.055	0.040	0.045
Silicate, (mg/l)	3.0	2.7	3.6	3.8	3.3
Dissolved oxygen, (mg/l)	6.65	7.4	6.2	6.9	8.0
Biological oxygen demand, (mg/l)	2.4	2.3	2.1	1.9	2.4
Chemical oxygen demand, (mg/l)	41	36	45	55	22

Table 3. Physico chemical parameters of Aruvikkara reservoir (Pre-monsoon season)

Parameter	Site 1	Site 2	Site 3	Site 4	Site 5
Temperature	24	23	25	24	25
pH	6.7	6.6	6.7	6.5	6.7
Total Alkalinity, (mg/l)	19.8	14.1	15.1	18.9	13.2
Total hardness, (mg/l)	14.7	10.3	10.1	16.0	9.7
Nitrate, (mg/l)	0.40	0.50	0.55	0.65	0.60
Nitrite, (mg/l)	0.036	0.039	0.033	0.062	0.045
Phosphate, (mg/l)	0.050	0.030	0.045	0.050	0.035
Silicate, (mg/l)	4.5	3.4	3.9	4.2	3.8
Dissolved oxygen, (mg/l)	6.2	7.1	6.2	6.9	7.9
Biological oxygen demand, (mg/l)	2.7	3.2	3.3	2.9	2.5
Chemical oxygen demand, (mg/l)	48.5	45	55	35	33.2

Table 4. Calculated Trophic State Index values of Aruvikkara reservoir during the Study Period

TSI	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5
TSI (SD)	45.8	47.3	47.2	54.7	51.7
TSI (TN)	33.9	37.2	40.7	55.5	39.0
TSI (TP)	40.8	43.0	39.6	41.9	43.7
Average	40.2	42.5	42.5	50.7	44.8
Trophic Status	Mesotrophic	Mesotrophic	Mesotrophic	Eutrophic	Mesotrophic

water bodies have TSI values between 40 and 50. Trophic Static Index studies revealed that the 5 sites analyzed in the Aruvikkara reservoir were in the mesotrophic state and the site 4 in the eutrophic state (Table 4).

By this study, a total of 35 plants including aquatic and wetland belongs to different families were collected periodically. The collected plant specimens were identified with standard references. The dominant aquatic species include *Nymphaea nouchali* Burm.f., *Cabomba furcata* Schult. & Schult.f., *Nymphoides indica* (L.) Kuntze, *Salvinia adnata* Desv. and some wetland plant species like *Curculigo orchioides*, Gaertn., *Monochoria vaginalis* (Burm.f.) C.Presl, *Colocasia esculenta*, (L.) Schott., *Eriocaulon aquaticum* (Hill) Druce were spread throughout

the reservoir. Some regions were seen in the reservoir as islands with bushy grasses, plants and other organisms. The aquatic and wetland plants identified from the study area possess potentiality in the accumulation of water damaging compounds like trace metals and plays a keen role in maintaining the water quality status. At the water same time noxious weeds which are restricted flourishes in the water body and leaded to the destruction of balance of the ecosystem and deterioration of the water quality. The water quality studies revealed the suitability of the water for different purposes after proper filtration and other treatments. But the trophic index studies revealed that the water body is at the verge of eutrophication as many of its sites are in mesotrophic condition and also one site in eutrophic state. Hence the water body demands immediate attention in controlling the aquatic weeds and also in limiting its nutrient status.

Phytoplankton species were also studied during the study. In this study, a total of 25 phytoplankton species were recorded in which 9 species belonged to Chlorophyceae, 11 species belong to Bacillariophyceae. Out of 3 classes, Bacillariophyceae was found to be dominant. The Palmers Algal Genus Index revealed that of the analyzed sites, the site 4 has high organic pollution when compared to other sites which also have less organic pollution (Fig. 1).

The study revealed that water in the reservoir was managed ineffectively and most of the area was inhabited by aquatic weeds and noxious phytoplanktons. The study revealed that most of the sites in the Aruvikkara reservoir were in Mesotrophic condition. If this condition prevails, these micro and macro flora can flourishes in the water body and can lead to Eutrophication and finally leads to the death of the water body. The water body gets encroached by the neighboring peoples by starting unfair agricultural practices in the water body. More over silt and sand have been deposited in the reservoir in large quantities results formation of land masses which decreases the storage capacity and quality of the water in the reservoir. It is suggested to develop policies and legislations, monitoring, planning and efficient management in conserving the aquatic body from eutrophication and encroachment for a better future.

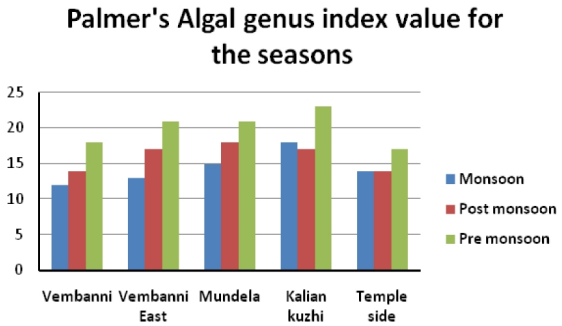

Fig. 1. Palmer Pollution Index for Aruvikkara reservoir

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