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RESEARCH ARTICLE

ASSESSMENT OF THEROOR WETLAND, WATER QUALITY KANYAKUMARI DISTRICT, TAMILNADU, INDIA.

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Abstract

Wetland water quality assessment plays an important role in water protection and quality conservation its present use and also a potential source for future consumption. The study area selected was Theroor wetland of Agasteswaramtaluk popularly known as city of lakes'', Kanyakumaridistrict, South India. Present study is focused on the determination of hydrological parameters during different seasons in 2015-2016 at three stations of Theroor wetland. The limnological characteristic like rainfall, air and water temperature, pH, total hardness, dissolved oxygen, biological oxygen demand were studied to analyze the suitability of Theroor wetland water quality. Good and suitable water quality was observed in following seasonal order during the study period i.e. Post monsoon>Premonsoon>Monsoon> summer. Which were compared with standard values prescribed by WHO (2010); APHA(2005);BIS(1991);BIS (1991); ISI (1991). The fluctuation in values of physicochemical parameters of water obtained in the present study sites indicated that the Theroor wetland is slowly transforming to eutrophication status which is due to unplanned urbanization and ad hoc approach of letting untreated sewage in to this wetland water body. It is the prime necessary to lake immediate remedial action to prevent all anthropogenic activities in and around the study area or else the lake will become biologically barren and will be lost forever.

Introduction:-

Kanniyakumari, the smallest district in Tamilnaducomprises of four Taluks, vizVilavancode, Kalkulam, Agasteeswaram and Thovalaiwith an area of 1672Sq. Km. Among these taluks,Agastheswaramtaluk is the second largest in Kanniyakumari district with a wide spread area of 80 Km^2encompassing 12 villages. In which the study area Theroor, a panchayat town falls between the coordinate 33°10'N; 77°10"E, which has a very beautiful fresh water wetland that runs to 8Km and gives water for the Agasteeswaramtaluk and all nearby taluks. The important feature of this wetland is that it is not only an important source of precious freshwater but provide valuable habitats to plants and animals, moderate hydrological cycles, influence microclimate, enhance the aesthetic beauty of the landscape and extend man recreational opportunities to humankind. This wetland water is also used for drinking, irrigation, fishing and eco-tourism, etc.(Plate: 1). Apart from the above advantages it is also noted for the wide variety of migratory water birds.

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Plate 1:- Satellite image showing the study area.

Currently due to population explosion, industrialization, urbanization and developmental thrust of man have created problems to this aesthetic natural water resource which has threatened humanity and biodiversity, and if the human race is to continue this problem they will have to be tackled by one and all at a war footing. Due to all the above discussed issues during the recent years there has been increasingly greater concern for inland freshwater resources which are affected in different ways by all kinds of human activities. Therefore scientific study needs to review strategies for conservation and better utilization of wetlands resources due to ever increasing importance and long term sustainability globally and in India they have gained momentum in recent years. Here lays the relevance of the present study where a number of authors have studied the physical and chemical characteristics of some Indian water bodies (Tamot, S. and Sharma, (2006); Kumari*et al.*, 2007; Khare and Jadhav, 2008; Srivastava *et al.,* 2009; Patra*et al.*, 2010; Koli and Ranga, 2011; Parameswara*et al.*, 2012; Kulkarni and Tapase, 2012). So an attempt has been carried out to estimate the physicochemical analysis on the selected wetland with an aim to assess the deteriorated status water quality.

Materials and Method:-

Selection of Sites: The present investigation was carried out to study the Theroor wetland water physicochemical parameters. The sampling program was carried outfor four seasons namelysummer, Monsoon, Post monsoon and Pre monsoon. In order to determine the regional variation in different sites,three representative stations (S-I, S-II, S-III) located in different stretches of the water area covering all almost all directions of the lake was selected for collection of water samples. The selection of sites was mainly considered on the disturbance aspects (viz pollution load, pilgrims, human activities, sewage, idol immersion) on the water body, such that the samples may provide reasonably representative status water quality of the wetland.

Water sampling: The sampling was carried out every month, from Mar 2015 to Feb 2016about 4 - 6m away from the bund and 20 -30 cm of depth. Water samples werecollected in the morning between 8:00 am to 10:00a.mand analyzed at the study spot.

Methodology: Data on rainfall of Kanniyakumari district with reference to Agatheswaramtaluk was obtained from Department of Meteorology. During each sampling events air and water temperature, transparency,pH was measured in the field immediately with the help of glass thermometer, secchi disc and portable pH meter.Total hardness, Dissolved oxygen and Biological oxygen demand were monitored at the sampling sites adopting the procedures outlined by standard methods of (ICMR, 1975; APHA, 2004; Gupta, 2007; Kodarkar*etal*.,2008).

Results and Discussion:-

The results of physicochemical parameters of Theroor wetland is summarized and presented in the form of Table:1 and Table:2. The aesthetic beauty and quality of any water body depends on the water and itsquality which is a vital concern for mankind because it directly linked with human health. The maintenance of healthy aquatic ecosystem is dependent on the water quality (physicochemical) properties and biodiversity (Venkatesharaju*etal*., 2010).

Rain fall: Hydrological analysis was carried out to evaluate the water level characteristics of the water body as well as the drainage system. Theroor Lakewas recorded 36.1cm in monsoon season while lowest rainfall 23.4cm in summer season in 2015-2016.

Air and Water Temperature:-

Temperature, the most important physical factors in aquatic environment,that air temperature ranged between (25.9°C to 36.1°C) at S-I, (25.3°C to 35.6°C) in S-II, (24.9°C to 34.9°C) at S-III during winter and summer seasons and the minimum water temperature recorded were (25◦C, 24.4◦C, 24.2◦C) winter seasonand maximum water temperature was noted to be summer season (34.2◦C, 33.7◦C, 33.1◦C) at S-I, S-II, S-III). Maximum temperature was recorded during summer season which may be due to high solar radiation, increase in pollution load due to water evaporation and low water level, while minimum air temperature was recorded during winter seasonwhich may be due to cloudy sky, rainfall change in temperature greatly influences the aquatic life. The difference in temperature range may be due different in sampling timing and seasonal influence. The similar kind of observation with similar trends on different water bodies was reported by several workers like (Dwivedi and Pandey, (2002); Singh and Mathur, (2005); Jayabhaye*etal.*, (2006), Salve and Hiware, 2008), Basavaraja and Deshmukh (2008) Simpi*etal.*, (2011);Shinde Ra ullah Khan *etal*., (2012); El Badaoui*etal*., (2015) Priyatharsini and Dhanalakshmi (2016).

Transparency:-

In any water body reduction of light penetration will be due to dissolved and suspended materials. The average value of transparency, noted in the study area were 121cm-64cm, 118-61cm, 112-58cm at S-I, S-II, S-III. Maximum transparency was recorded during summer seasonwhich seemed to be related to greater amount of sunshine, better penetration of light, moderate velocity of wind and hence stillness and minimum during monsoon season due to evaporation process, low airtemperature and reduced relative humidity anddue to high planktonic population whichsubsequently decreased transparency of water. (Chaurasia and Adoni, (1985); Sinha *etal*., (2002); Kadam*etal.*, (2007); Sharma Riddhi*etal*(2011);Shah and Pandit, (2012).

pH:-

pH of any water body either fresh water and marine water, either lenic or lotic is considered a very important water quality parameter since pH affects other chemical reactions such as solubility and metal toxicity (Fakayode, 2005). It also serves as index to denote the degree of pollution by acidic and alkaline waste.The pH of the water sample at S-I ranged between (5.7-8.20), at S-II (5.1-7.32), and S-III (4.8-7.18). WHOpermissible limit of pH is 6.5-8.5. Maximum pH was noted in summer season followed by pre monsoon, post monsoon season andwhile monsoon season minimum pH was recorded. All the pH value at all the sites was noted to bebelow the permissible limit. pH (S-I- (8.20), S-II- (7.32), S-III- (7.18)) was observed during summer which may be due to presence of carbonates and bicarbonates. The fluctuation in pH values observed among the selected sites may be due to changes in biotic and abiotic factors, which may be attributed to the dilution on account of the inflow of the runoff and macrophytes cover.(Raveen*etal*., (2008), Parine*etal.*, (2004), Tiwari *etal.*, (2009) Rahashyamani Mishra (2011).

Total hardness:-

Total hardness is imported by calcium and magnesium ions and is considered very important parameter in decreasing the toxic effect of poisonous element. The hardness of the selected sites of Theroor wetlandwas found to be in the range of 80.4 mg/l to 212.4 mg/lit at S-I ; 78.0mg/l to 214.8 mg/l at S-II and 76.8mg/l to 212.4 mg/l during monsoon season and summer season. Maximum hardness recorded during summer may be due to decrement in water volume and increment in evaporation of wetland water. The hardness values in selected sites were well under the permissible limit (300-600 mg/lit (BIS).MahimaChaurasia and Pandy (2007).

Dissolved Oxygen:-

It isa good water quality indicator parameter. It is related to the water quality, distribution and abundance of (maximum and minimum population) species in any wetland land ecosystem. The minimum dissolved oxygen recorded during summer season at S-I, S-II and S-III were 4.9 mg/l, 4.3 mg/l, and 4.1mg/l followed by post monsoon season was 6.9mg/l, 62mg/l and 5.7mg/l; pre monsoon season (9mg/l, 85mg/l, 8.1mg/l) and monsoon season (7.9mg/l, 7.3mg/l, 6.9mg/l) during the year 2014-2015. The minimum concentration of dissolved oxygen at all the study sites I, II, III may be attributed by addition of effluents containing oxidizable organic matter, decay of vegetation at higher temperature and consumption of O_2 from water by producers and consumers.

Maximum dissolved oxygen recorded during monsoon season (8.7mg/l, 82mg/l, and 7.8mg/l) which started declining gradually during post monsoon (7.4mg/, 6.8mg/, and 6.2) winter and during summer. It reached the lowest concentration (4.9mg/l, 4.3mg/l,,and 4.1mg/l,). Maximum amount dissolved oxygen may be due to diffusion from atmosphere, low temperature and high aeration and photosynthetic activity of autotrophs. Patra*et al.*, (2010); Rahashyamani Mishra, (2011);NarasimhaRamuluandBenarje, (2013).

Biological oxygen demand:-

Biological oxygen demand is an indicative measurethat determines the quantum of oxygen required for biological oxidation of organic matter by microorganisms. The minimum biological oxygen demand at site-I ranged between (1.09 mg/l) at site-II (1.05 mg/l) and at site-III (1.01 mg/l) were noted by premonsoon season. The maximum BOD (2.50mg/l, 2.39mg/l, and 2.21 mg/l) at S-I, S-II, S-III was noted during summer followed monsoon. The BOD demand shows the positive correlation with dissolved oxygen. Maximum dissolved oxygen demand during summer due to poor photosynthesis, stagnation of water. But during the wet season the large volume of fresh water diluted the organic matter resulting in decrease of the BOD values. (Kumar and Sharma, (2005),Rahashyamani Mishra (2011).

Table 1:- Data on the seasonal variation of physical parameters Rain fall, Air Temperature, Water Temperature, Transparency, in Theroor Lake for a period of one year [2014-2015]

Parameters		Rainfall (cm)		Air Temperature ◦C			Water Temperature ◦C			Transparency (cm)		
Seasons	Months	Stations										
		Max	Min	SI	SII	SIII	SI	SII	SIII	SI	SII	SIII
Summer	Mar	33.2	36.1	34.5	33.2	31.3	34.2	33.7	33.1	121	118	112
	Apr	32.3	26.1	36.1	35.6	34.9	33.9	32.8	32.2	120	116	111
	May	34.2	26.2	35.6	33.2	32.3	34.2	33.1	32.3	110	104	98
monsoon	June	3.5	24.5	32.1	31.7	30.5	30.2	29.6	29.1	64	61	58
	July	30.3	24	31.7	31.2	30.2	29.8	29.1	28.7	68	65	59
	Aug	30.4	23.9	30.7	30.1	29.6	28.9	28.1	27.8	69	64	59
Post monsoon	Sep	30.6	24.3	29.9	29.3	28.9	28	27.4	27.1	86	82	79
	Oct	30.5	24.3	28.7	28.1	27..7	27.3	26.8	26.2	81	74	69
	Nov	30.2	24	27.3	26.9	26.2	26.9	26.1	25.7	79	73	68
Pre monsoon	Dec	30.2	23.7	27.1	26.8	26.1	26.4	25.9	25.3	98	93	91
	Jan	30.8	23.4	26.4	25.8	25.4	25.8	25.1	24.3	93	89	83
	Feb	31.6	23.8	25.9	25.3	24.9	25	24.4	24.2	89	81	78

*The values are mean±SD of three replicates

*SI- station I; S-II- station –II S-III- station-III

Table 2:- Data on the seasonal variation of chemical parameters, pH, Total hardness,Dissolved oxygen, Biological oxygen demand, in Theroor Lake for a period of one year [2014-2015]

Parameters		pH			Total Hardness (mg/l)			Dissolved Oxygen (mg/l)			Biological Oxygen Demand (mg/l)		
Seasons	Months	S-I	S-II	S-III	SI	SII	SIII	SI	SII	SIII	SI	SII	SIII
Summer	Mar	7.79	7.5	7.1	199.2	196.8	194.4	5.9	5.3	4.9	2.50	2.39	2.21
	Apr	7.39	7.32	7.18	212.4	210	207	5.2	4.7	4.2	2.23	2.17	2.06
	May	8.2	7.8	7.3	216	214.8	212.4	4.9	4.3	4.1	2.19	1.98	1.86
monsoon	June	5.9	5.2	4.9	96	94.8	92.4	8.7	8.2	7.8	1.87	1.81	1.75
	July	5.7	5.1	4.8	126	124.8	122	8.1	7.6	7.1	1.72	1.67	1.53
	Aug	6	5.5	5.1	139.2	133	130.8	7.9	7.3	6.9	1.48	1.37	1.29
Post monsoon	Sep	6.4	6	5.7	80.4	78	76.8	7.4	6.8	6.2	1.35	1.27	1.20
	Oct	6.2	5.8	5.2	110.44	108	98.4	7.0	6.5	6.1	1.29	1.24	1.19
	Nov	6.5	5.5	5.1	102	99.6	97.2	6.9	6.2	5.7	1.20	1.12	1.09

Pre monsoon	Dec	7.8	7.1	6.8	86.4	84	82.8	10.9	10.4	9.8	1.11	1.09	1.05
	Jan	7.3	6.5	6.1	818	79.2	76.8	9.9	9.3	8.9	1.14	1.11	1.08
	Feb	6.9	6.3	5.9	86.4	84	82.8	9	8.5	8.1	1.09	1.05	1.01

*The values are mean±SD of three replicates
*SI- station I; S-II- station –II S-III- station-III

Conclusion:-

The present field analysis laboratory analysis of various physicochemical parameters of Theroor wetland water reveals that during summer when the temperature is very high other parameters like DO,BOD and total hardness fluctuated accordingly. Based on the foresaid reasons the following measures like seepage and leakage of runoff should be diverted, desiltationand deweedingof the wetland should be done at regular intervals, awareness among the public should be created byimparting environmental education and farmers are encouraged to use biodegradablemanures should be taken for the restoration of the Theroor wetland water quality and biodiversity. Finally the water quality of analyzed samples revealed that rapid urbanization coupled with inadequate monitoring are responsible for the pollution Theroor wetland of Agasteswaramtaluk. If the same trend continues and if it is not abated, in future consumption of Theroor wetland water for domestic and irrigation purposes will pose a serious health hazarded to the residents of Agastheswarampanchayat. In the interim, regular monitoring and prompt use of wetland should be followed for future water and biodiversity conservation.

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