PLANKTONIC DISTRIBUTION IN RESPONSE TO PHYSICOCHEMICAL PARAMETERS INVALKULAM POND, AGSTEESWARAM, KANYAKUMARI

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Abstract: ***Physiocochemical parameters play a vital role to determine the occurrence of planktons in aquatic ecosystem. Present study is to assess the distribution of planktonic population in response to physicochemical parameters in Valkulam pond, Agasteeswaram, Kanyakumari from October 2014 to September 2015. The result revealed that the phytoplankton population has three groups such as Cyanophyceae, Chlorophyceae and Bacillariophyceae. Zooplankton population shows five groups as Copepoda, Rotifera, Cladocera, Protozoa and Ostracoda. Physicochemical parameters (Calcium, Sulphates, Nitrates, Sodium and Phosphates) were high in monsoon and it was low premonsoon. Physicochemical parameters prevails in the selected study area was suitable for the production of plankton population. Therefore, it could be utilized for the aquaculture practices.***

Key words:Aquatic ecosystem,Plankton, Seasons, Aquaculture and Physicochemical parameters.

I. INTRODUCTION

Water is a precious natural and national resource, a basic human need hence its use needs appropriate planning, development and management. Biota in the water is governed entirely by various environmental factors (Kulshrestha et al., 2006). The scale of socioeconomic activities, urbanizations, industrial operations and agricultural production has a widespread impact on water resources (Kaushik et al., 1995). Aquatic biodiversity is one of the most essential characteristics of the aquatic ecosystem for maintaining its stability. Plankton has prime importance in the freshwater ecosystem as these are the basic source of energy with high nutritive value. Phytoplankton plays the role of primary producer in the aquatic ecosystem (Das et al., 2010 and Dabgar, 2012). They can convert inorganic material such as nitrate and phosphate in to organic compounds (protein and lipid) by photosynthesis. Zooplanktons occupy a central position between autotrophs and heterotrophs. They form important link in foodweb and also contribute significantly in the biological productivity of the freshwater ecosystem (Mukhopadhyay et al., 2000). The water quality assessment and planktonic study serve as important tool for assessment of productive nature of aquatic ecosystem (Pawar et al., 2005). Therefore the present investigation attempted to focus on distribution of planktonic population in response to physicochemical parameters in the Valkulam pond, Agasteeswaram, Kanyakumari.

II. MATERIALS AND METHODS

Sampling site

Valkulam Pond is located near Agasteeswaram at Kanyakumari District. The pond leads narrow extends in the south north direction, resembling a tail and hence the name Valkulam. This pond situated 500m away from Agasteeswaram and 2km away from Kanyakumari. The pond covers an area is about 25.86.5 hect which is used for irrigation of 70 acre agricultural area and aquaculture. The villagers used this pond for bathing, washing and domestic activities. Pond receives water from Pechipparai dam and supplies drinking water to 4 Panchayath such as Kovalam, Agasteeswaram, Kanyakumari and Thamaraikulam.

Field sampling and Analysis

Sample was collected fortnightly between 7:00 to 9:00 a.m., representing three seasons (Postmonsoon,Premonsoon and Monsoon). The physicochemical parameters like temperature, light penetration, dissolved oxygen, pH, alkalinity, calcium, sulphate, phosphates, sodium and nitrates were estimated by using standard methods (APHA, 2005). For plankton analysis, one liter of sample was collected and filtered through plankton net of bolting silk No.25. The sample was immediately preserved in opaque sample bottles containing 4% formalin and analyzed by Sedgwick Rafter counting cell. The identification of phytoplanktons was made with the help of Kumar et al., (2006) and Munshi et al., (2010). The zooplankton species were identified with the help of standardworks (Ward et al., 1959). Karl Pearson's correlation coefficient was used to study relationship between physicochemical parameters and plankton population.

III. RESULT AND DISCUSSION

Physicochemical parameters and planktonic populations of the study area have been presented in the table 1 and fig.1. Temperature plays a vital role in the occurrence and abundance of plankton. In the present study,temperature rangesin between 27-30^{0}C. Maximum temperature was recorded in premonsoon (30.75±1.30^{0}C) and it was minimum (27.75±1.30^{0}C) in monsoon. Increase in temperature enhanced the rate of decomposition by which water enriched with nutrient. This reflects higher productivity of planktons. Low temperature might be due to monsoonal rain, cloudy sky and humidity of air. It lowers the growth of zooplankton population. Temperature has positive correlation (r= 0.206) with pH (table: 2). Present finding was confirmed by Siddique et al.,(1980) from the primary production studies in a freshwater pond.

Dissolved oxygen (DO) is one of the most important parameter that reflects the physical and biological processes prevailed in water (Fakruzzamanet al., 1996). A maximum of 4 mg/lit of dissolved oxygen was recommended for healthy growth of fish and planktonic populations. Dissolved oxygen varied from 2.91±0.59mg/lit to 5.35±0.87 mg/lit. The narrow fluctuation and good DO was recorded in monsoon and

postmonsoon indicates the prevalence of higher plankton population and also favoured for the production of fishes in pond. The above finding was supported by Chindah, (2003) and Rahmanet al., (2008).

pH is the measure of hydrogen ionconcentration in water. The aquatic animals thrive well in water that has the pH value in the range of 7.2-9.0 (ELC, 2005). In this study, pH in the pond was slightly alkaline in nature (7.48±0.29 to 7.3±0.19) and fall within limit. It supports planktonic growth. This pH correlated with rise of temperature, increase in zooplankton population and also the production of freshwater fishes. The present finding was supported by Salam et al.,(2000) and Ntengwe, (2005).

Alkalinity values of 20-200 mg/l are common in fresh water ecosystems. Alkalinity is important for aquatic life because buffers against pH changes. High alkalinity (72±0.71mg/l) was reported in monsoon and it was minimum (71±1.58mg/l) in premonsoon. The result in this study is within the permissible limit. Presence of alkalinity might be due to high rate of decomposition where high rate of CO_2 was released. This CO_2 react with the water to form HCO-3 and thereby increasing the alkalinity which helps to maintain buffering capacity of water and favours zooplankton production. Present study is in agreement with the earlier findings of Huisman et al., (2005) and Manjare et al., (2010).

In the present study, concentration of calcium was Maximum (66.25±1.09 mg/l) in postmonsoon and it was low (63.25±1.30) in monsoon. Similar finding was reported from Haraz River, Iran (Jafariet al., 2011). Maximum concentration of phosphates and sodium were recorded (0.74±0.11mg/l and 7.81±0.38mg/l) in monsoon and minimum (0.48±0.06mg/1 and 6.34±0.37 mg/l) in premonsoon. Nitrogen is essential for organisms as an important constituent of proteins, including genetic material. Maximum concentration of nitrates and sulphates were observed in monsoon, when the pond was received high amount of debris from the watershed and agricultural runoffs which in turn disfavors zooplankton production. Nitrates and phosphates have negative correlation with Chlorophyceae and Bacillariophyceae. Similar findings were reported by Rani et al.,(2011) and Kushwaha et al.,(2014) from some aquatic ecosystem.

Phytoplankton population

Phytoplanktons are producers used as direct source of food by other aquatic life to maintain energy flow. In this study, we found 3 families of phytoplankton population i.e., Cyanophyceae, Chlorophyceae and Bacillariophyceae. Distribution is given as follows.

Cyanophyceae

Cyanophyceae is the blue green algae. It comprises unicellular to multicellular organism and provide chlorophyll to perform photosynthesis. Members of Cyanophyceae grows at any environment where ample moisture, temperature and light penetration. Cyanophyceae includes six species (42.86%) (*Anabaena ambigua*, *Nostoc commune*, *Phormidium sp.*, *Oscillatoriatenuis*, *Spirullina sp.*, and *Microcystisaeruginosa*). Maximum population of Cyanophyceae was found in premonsoon, which might be due to sufficient light penetration, temperature and oxidisable organic matter. But high Cyanophyceae population was observed in the summer by Sarwade et al., (2015) in the lake ecosystem.

Chlorophyceae

They are green algae have greater cellular organization as morphological structure and reproductive processes. Chlorophyceae showed 7 species with 35.71% (*Cladophora sp.*,*Hydrodictyon sp.*,*Microspora sp.*,*Spirogyra sp.*,*Volvoxaureus*, *Chlorella sp.*, and *Chlorococcum sp.*). They were found to be high in premonsoon and low in monsoon.Maximum phytoplankton in the premonsoon might be due to high water temperature. Similar observation was made by Kumar et al.,(2012) and Sarwade et al., (2015).

Bacillariophyceae

Most of the Bacillariophyceae were unicellular although they can exist as colonies having filamentous, ribbons or star shaped. Bacillariophyceae showed 6 species which includes *Diatoma vulgaris*, *Fragilariapinnata*, *F.arcus*, *Naviculaconfervacea*, *N. radiosa* and *Pinnularia sp*. Bacillariophyceae was found to be high in premonsoon. It may be due to high temperature and light which is suitable for the growth of Bacillariophyceae species. Density of Bacillariophyceae has positive correlation with temperature (r=0.281).Similar findings were reported by Suresh et al.,(2013) and Sarwade et al., (2015) in the Lake ecosystem.

Table 1:Physiochemical and Planktonic Population in Valkulam Pond

Parameters	**Post monsoon**	**Premonsoon**	**Monsoon**
	Mean±SD	***Mean±SD***	***Mean±SD***
Temperature	29.75±1.79	30.75±1.30	27.75±1.30
Do	4.22±1.06	2.91±0.59	5.35±0.87
pH	7.3±0.19	7.48±0.29	7.4±0.10
Alkalinity	71.5±1.12	71±1.58	72±0.71
Calcium	66.25±1.09	63.5±1.12	63.25±1.30
Posphates	0.48±0.06	0.61±0.02	0.74±0.11
Sulphates	0.6±0.12	0.53±0.11	0.65±0.11
Sodium	6.34±0.37	6.41±0.58	7.81±0.38
Nitrates	0.03±0.00	0.03±0.02	0.03±0.01
Cyanophyceae	32±21.25	42.5±17.64	33.75±9.23
Bacillariophyceae	4.25±1.30	2.75±1.79	2.5±1.80
Chlorophyceae	22.25±7.15	21.5±6.34	12±3.08
Rotifera	25±2.74	21.25±4.32	12.75±0.83
Copepoda	17±1.63	23.25±5.76	12.25±1.48
Cladocera	14.75±1.92	15.75±3.11	12±1.87
Protozoa	12.25±1.48	16.25±2.17	7.5±1.80
Ostracoda	7.75±1.09	8.5±1.12	6.75±1.92

Figure 1: Physiochemical and Planktonic Population in Valkulam Pond

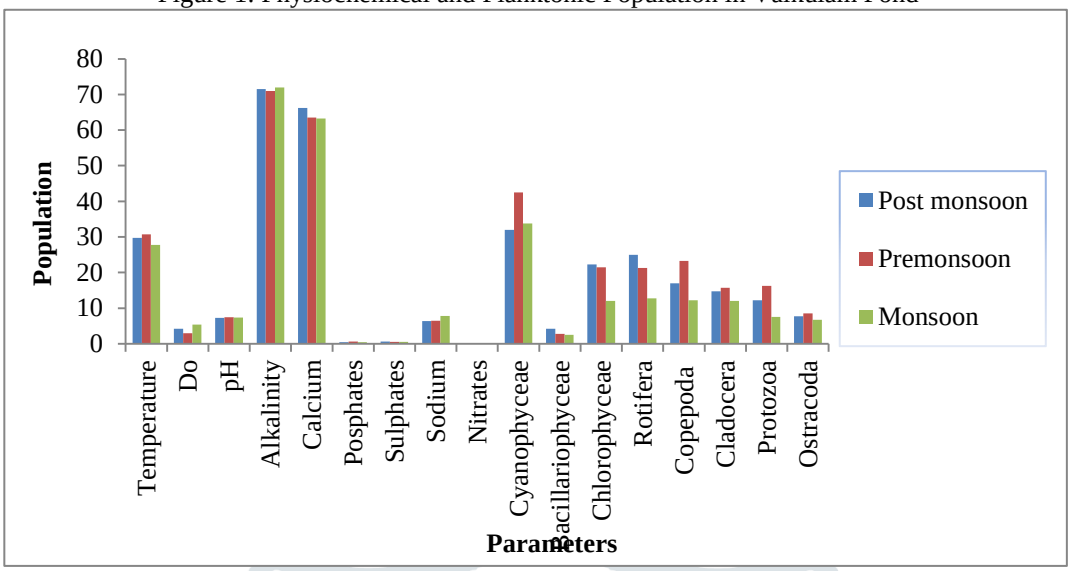

Table : 2Correlation inter-matrix between Physiochemical and Planktonic Population in Valkulam Pond

Parameters	T^0C	Do	pH	Alk	Ca	Ph	SO_2	Na	Ni	Cya	Ba	Chlo	Roti	Cope	Cla	Pro
T^0C	0.000															
Do	-0.771															
pH	0.206	-0.171														
Alk	0.120	0.092	0.380													
Ca	0.296	0.066	-0.441	0.000												
pH	0.242	-0.590	0.033	-0.239	-0.333											
SO_2	0.148	-0.236	-0.271	0.139	0.300	-0.050										
Na	-0.461	0.454	-0.253	-0.015	-0.293	-0.369	0.205									
Ni	0.000	-0.014	0.442	0.450	-0.356	0.019	-0.128	0.072								
Cya	0.251	0.315	-0.690	-0.687	-0.643	-0.146	-0.815	-0.051	-0.044							
Ba	0.281	0.156	-0.594	-0.200	-0.183	-0.287	-0.369	-0.317	-0.409	0.302						
Chlo	0.469	0.205	-0.785	-0.780	-0.439	-0.110	-0.831	-0.458	-0.291	0.794	0.702					
Roti	0.606	0.727	0.284	-0.485	0.504	0.311	0.343	-0.525	-0.420	-0.511	-0.403	-0.090				
Cope	0.719	-0.679	-0.171	-0.061	0.345	0.222	0.284	-0.279	-0.374	-0.074	0.435	0.244	0.786			
Cla	0.760	-0.792	0.129	-0.196	0.067	0.479	-0.004	-0.506	-0.158	-0.090	0.408	0.281	0.734	0.867		
Pro	0.021	-0.012	-0.448	-0.307	0.182	-0.168	0.320	0.305	-0.158	-0.360	-0.419	-0.589	0.332	0.214	0.067	
Ost	0.603	-0.757	0.182	-0.197	0.065	0.589	0.015	-0.678	-0.390	-0.338	0.393	0.162	0.790	0.744	0.931	-0.04

T^0C : Temperature	Do : Dissolved Oxygen	Alk : Alkalinity	Ca : Calcium	pH : Phosphate	
SO_2 : Sulphate	Na : Sodium	Ni: Nitrate	Cya :Cyanophyceae	Chlo : Chlorophyceae	
Ba : Bacillariophyceae	Roti : Rotifera	Cope : Copepoda	Cla : Cladocera	Pro : Protozoa	Ost : Ostracoda

Copepoda

Copepoda was the dominant group which includes *Nauplii*, *Microcyclops varicans*, *Eucyclops serrulatus*, *Paracyclops fimbriatus*, *Calanusfinmarchicus*, *Eucalanusbungii*, *Diaptomasdenticornis* and *Mysis*. Copepods made positive correlation with temperature (r = 0.719), Ca (r = 0.345) and Bacillariophyceae (r = 0.435) while made negative correlation with oxygen, alkalinity and nitrogen. Positive correlation with temperature coincides with the investigation of Koli et al., (2012) in Tulsi Reservoir, Maharastra.

Cladocera

In the present study, Cladocera group were represented by 3 species which includes *Daphnia sp*., *Ceriodaphnia* and *Bosmina sp*.,. This species showed positive correlation with temperature and Bacillariophyceae and negative correlation with oxygen. Negative correlation with phosphate had also been reported by Sharma (2009) in Loktak Lake.

Protozoa

Members of the Protozoa were *Amoeba sp*., and *Paramecium sp*. This group set up strongly positive correlation with temperature, pH, calcium, nitrate and negative correlation with oxygen.Similar results were suggested by Kedaret al., (2008) in Rishi Lake.

Ostracoda

Cypris sp., and *Cyprinotus sp*.,comes under Ostracoda group. This group showed positive correlation with temperature, phosphates and negative correlation with oxygen and alkalinity. But positive correlation with alkalinity was found by Shah and Pandit (2013) in Wular Lake.

IV. CONCLUSION

The selected Valkulam pond in our place is highly useful for domestic, agriculture and fishing and for creating natural environment.T he present study concluded that the planktonic population was found increasing trend during postmonsoon to premonsoon. Furthermore sedimentis not so much abundant because the selected pond is periodically desilted by local people. The successful development and maintenance of biological population depend upon the harmonious ecological balance between environmental conditions and tolerance of organism to variations in one or more of these factors. The pond should be properly maintains by public and government authorities.

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