Journal of Aquatic Biology and Fisheries Vol. 2/No. 2/2014/ pp. 36 to 40

A PRELIMINARY STUDY OF THE PHYSICO CHEMICAL PARAMETERS OF THE POND IN THIRUVANANTHAPURAM ZOO, KERALA, INDIA WITH SPECIAL REFERENCE TO PHYTOPLANKTON DIVERSITY

Anila P. Ajayan and Ajit Kumar, K.G*.
Dept. of Post Graduate Studies and Research in Botany, Mahatma Gandhi College, Thiruvananthapuram
**Email: ajit.anchal@gmail.com*

Received on: 10 October 2013, accepted on: 12 December 2013

Abstract: Physico chemical analysis of the pond in Thiruvananthapuram Zoo has been carried out in Pre-Monsoon and Monsoon period of 2013. The present investigation is focused to assess the water quality of the Zoo pond with special reference to phytoplankton diversity. Water samples were collected monthly for the analysis of pH (pH meter),temperature (°Celsius thermometer),Dissolved oxygen and Biological Oxygen Demand (Winkler's titration method), Calcium, Magnesium, Phosphate, Total Alkalinity, Silicate, Sodium and Potassium (Flame Photometer). Water samples for algae was collected from the pond using phytoplankton net and fixed in 4% formaldehyde, with the help of relevant literatures they were identified. The dissolved oxygen concentration of the pond reached maximum of 26.5 mg/l during Pre-monsoon and remained low in Monsoon (2.9mg/l). Calcium remained low for Pre-monsoon and was at the acceptable range 5-100 mg/l for an aquaculture pond. Four algal groups were observed and the occurrence of distribution is in the decreasing order Chlorophyta> Cyanophyta> Bacillariophyta > Euglenophyta. Algae like Ankistrodesmus falcatus, Scenedesmus quadricauda, Closterium parvulum, Crucigenia tetrapedia, Kirchneriella lunaris, Merismopedia elegans, Oscillatoria subbervis, Phacas sp. and Trachelomonas sp. were reported as pollution indicators. Microbial quality of the water samples were also carried out. E. coli was found in two seasons. Pseudomonas sp. and Staphylococcus sp. were isolated in Monsoon period. Four algal groups were observed and the occurrence of distribution is in the decreasing order Chlorophyta> Cyanophyta> Bacillariophyta > Euglenophyta.

Key words: Zoo and Phytoplankton, Conductivity, Pseudomonas, Staphylococcus, Chlorophyta, Euglenophyta.

INTRODUCTION

The Zoo is an oldest form of wildlife tourism. The welfare of the animals reflects the development of zoo and zoo tourism. A water body inside the zoo has its own importance, as the quality of water may affect the animals when it is provided to them. Zoo should be aware of the necessary water quality standards for all species in their care. Regular monitoring and recording of water quality should be performed and water quality should be maintained to appropriate levels. The present investigation is focused to assess the water quality of the Zoo pond with special reference to phytoplankton diversity and the bacterial count in water for Pre Monsoon and Monsoon period. About 60 species of resident water birds like Pond Herons, Oriental Darter and Cormorant are some of them associated with the pond.

MATERIALS AND METHODS

Thiruvananthapuram Zoo, one of the oldest in the country, was established as an annexe to the Museum in 1857 by the erstwhile Maharaja of Travancore in order to attract more visitors. This Zoo was originally set up for recreational purpose only. But with more and more loss of forest and wildlife in the process of human development, the goal of the Zoo changed from recreation to conservation. Today Zoos are seen as the last resort for endangered animals and birds. The Central Zoo Authority established in 1992 under the Ministry of Environment and Forest of India, enforces uniform management code to all the Zoos in the country and provide financial and technical support for the Zoos. Thiruvananthapuram Zoo is one of the oldest in the country which is located at the heart of the city, extended over 7693.93 sq.m, is at

8.5117293°N 76.9550014°E and is often named as 'The lungs of the city'. The parameters studied are:

Physico-chemical parameters

Water samples were collected monthly for the analysis of pH (pH meter), temperature (° Celsius thermometer), Dissolved oxygen and BOD (Winkler's titration method), Calcium, Magnesium, Phosphate, Total Alkalinity, Silicate, (APHA, 1998), Sodium and Potassium (Flame Photometer).

Phytoplankton Analysis

Water samples from the pond was collected between using phytoplankton net (No. 25) and fixed in 4% formaldehyde, with the help of relevant literature they were identified (Prescott, 1978).

Identification of Bacteria

In order to identify bacteria, different methods which were used are Cultural characteristics, Morphology and Staining reaction, Biochemical reaction. The cultural characteristics such as colour and surface of colonies were observed along with any other peculiar feature of culture growth on three different agar plates Nutrient Agar, MacConkey Agar and EMB Agar. Morphology of these cultures was studied by gram staining technique. Bacterial colonies were identified on the basis of different biochemical test *viz*, H_2S production, Citrate utilization test, Catalase test, Oxidase test, Indole Production test, Voges-Proskauer test, Methyl Red test, Lactose reduction test and Motility. Morphological and biochemical tests were done for the identification of particular bacteria as per methods given in Central Diagnostic Laboratory Manual and Bergey's Manual 9th edition.

RESULTS

The results of monthly variation of pH, temperature, TDS, Conductivity, DO, BOD, Silicate, PO_4, Ca, and Mg, TA, Na and K are shown in Table 1 compared with the Water Quality of Pond Aquaculture (Boyd, 1998). The occurrence and abundance of Algae recorded during the study period are shown in Table 2.

List of Pollution Indicators observed

Algae are frequently found in polluted and un-polluted water and due to this behaviour they are generally considered useful to determine the quality of water. Algae are used for assessing the degree of pollution or as indicator of water pollution of different water bodies (Dwivedi and Pandey, 2002).

Chorophyta

Ankistrodesmus falcatus, *Closterium parvulum*, *Kirchneriella lunaris*, *Scenedesmus quadricauda*.

Table 1. Monthly variation of Physico chemical parameters compared with Water Quality of Aquaculture Pond

Parameters	February	March	April	May	June	Std. Conc.
Temperature	27	28	28	26	26	<30° C
PH	6.7	6.5	7.5	7	7.06	7 – 9
DO	26.5	2.9	5.16	11	10.3	>5
BOD	23.9	1.95	3.2	11	6.8	< 2
SiO_4	6.6	1.96	0.4	9.85	5.1	2-20
PO_4	3.8	9.46	4.28	3.2	5.3	0.005-0.2
Ca	4.2	5.4	3.2	0.32	6.6	5 – 100
Mg	3.7	3.1	1.5	4.8	4.63	5-100
TA	21.5	18.5	24	24	19	10-20
Na	6	7.5	2	6	4	2-100
K	3	5.5	12	4	3	1-10
TDS	93.1	98	85.2	79.3	76.5	70-150
Conductivity	186.2	192	179.6	164.2	140.1	140-300

(DO BOD, SiO_4, PO_4, Ca, Mg, TA, Na, and K in mg/l). (TDS & Conductivity in m mho)

Table 2. Occurrence and abundance of Algae recorded

Name of the Algae	February	March	April	May	June
Chlorophyta					
Ankistrodesmus sp	+	+	-	+	+
Arthrodesmus sp	-	+	-	+	-
Chlorococcum sp	-	+	+	-	-
Chlorogonium sp	+	+	+	-	-
Closterium sp	++	++	+	+++	+
Cosmarium sp	+	-	-	-	-
Crucigenia sp	-	+	+	++	+++
Dactylococcopsis sp	-	-	+	-	-
Dictyosphaerium sp	-	+	-	-	-
Euastrum sp	-	-	+	+	++
Eudorina sp	-	+	+	-	-
Kirchneriella sp	+	+	++	-	-
Microsterias sp	+	-	-	-	-
Nannochloris sp	+	-	-	-	-
Onychonema sp	-	+	-	+	-
Oocystis sp	-	+	-	+	-
Ourococcus sp	+	+	-	-	-
Pandorina sp	-	+	-	+	+
Pediastrum sp	++	+++	++	+++	++
Planktosphaeria sp	+	+	+	-	+
Scenedesmus sp	+++	+++	+	+	++
Schroederia sp	+	+	-	-	-
Staurastrum sp	-	+	-	+	-
Tetradesmus sp	+	-	-	+	-
Tetraedron sp	+	+	-	-	-
Tetrallantos sp	-	-	+	-	-
Cyanophyta					
Anabaena sp	-	-	+	-	-
Aphanocapsa sp	-	-	+	-	-
Chrococcus sp	+	+	-	+	-
Merismopedia sp	-	+	+	+	+
Microcystis sp	++	+	+	-	-
Oscillatoria sp	+	++	-	+++	-
Bacillariophyta					
Achnanthes sp	+	-	-	+	-
Caloneis sp	+	-	-	-	-
Chaetoceros sp	-	+	-	+	+
Coscinodiscus sp	-	-	+	-	-
Cyclotella sp	-	+	-	+	-
Fragillaria sp	-	+	+	+	-
Gomphonema sp	-	+	+	+	-
Navicula sp	++	++	+	+++	+
Nitzchia sp	-	+	-	+	-
Pinnularia sp	++	+	+	++	+
Rhizosolenia sp	+	+	-	++	+
Rhopalodia sp	-	+	-	+++	-
Synedra sp	++	-	+	++	-
Euglenophyta					
Euglena sp	-	-	+	+	++
Lepocinclis sp	+	+	+	-	++
Phacus sp	++	++	+	+++	++
T*rachelomonas* sp	+	-	+	+	+

+++ = Abundant; ++ = Dominant; + = Rare; - Absent

Cyanophyta

Euglenophyta

Phacus sp., *Trachelomonas* sp.

Isolated Bacteria

During the study period, a total of 3 isolates were obtained for pure culture and Gram's staining, one was Gram-positive cocci and 2 were Gram-negative Bacilli. Gram-positive cocci were identified as *Staphylococcus* sp. Gram-negative rod was identified as *Escherichia* sp., and *Pseudomonas* sp. A list of 3 identified bacteria given in Table 3 and the Total Viable Count and *E. coli* count for the two seasons are given in Table 4.

CONCLUSIONS

Phytoplanktons were recorded throughout the study period. Phosphate is a major nutrient regarding the growth and production of phytoplankton and its concentration can be used to predict the total biomass of phytoplankton. The dissolved oxygen concentration of the pond reached maximum of 26.5 mg/l during February and remained low in March (2.9 mg/l). This may be due to increasing organic matter like the presence of leaf litter from the Rain tree *Samanea saman*, (jacq) Merr. located near the pond and it needs further study. Plastic bottles thrown carelessly into the pond can deteriorate

Table 3. Bacteria Identified

Characters Studied	1	2	3
Cultural Characteristics	Thin White	Golden Yellow	Green Metallic sheen
Culture Media	MacConkey Agar	Nutrient Agar	EMB Agar
Gram's Reaction	-	+	-
Morphology	Rod	Cocci	Rod
Catalase	+	+	+
Oxidse	+	-	-
Citrate	+	-	+
Lactose	-	+	+
H_2S	+	-	-
Motility	-	-	-
Indole	-	-	+
MR	-	+	+
VP	-	-	-
Identified Organisms	*Pseudomonas* sp	*Staphylococcus* sp	*E. coli*

(+ Positive; - Negative; MR Methyl Red; VP Voges Proskauer)

Table 4. Total coliform count and *E.coli* count

Study Period	*E. coli* Count	Total Viable Count
Pre- Monsoon	90 CFU/ml	854 CFU/ml
Monsoon	335 CFU/ml	2301 CFU/ml

(CFU - Coliform Unit)

the quality of the water. The increased BOD level in the water (23.9 mg/l) indicates the degradation of inorganic matters by the microbes thereby reducing the oxygen content in the lake and the same was previously observed by Jacob *et al*. (2008) in the Veli Lake. The phytoplankton was maximum throughout the study period and the pond looks dark green. Bacterial results hint towards the pollution status of the water body. Bacterial count studies showed a higher number of bacterial colonies present in the water during the Monsoon Period. Different bacterial genera which were identified are indicators of organic pollution. The faecal coliform bacteria *Escherichia coli* in water are a recommended indicator of faecal contamination for water. *E. coli* is present in the gastro- intestinal tracts of warm- blooded birds and animals. The permissible level of *E. coli* in recreational water is 400 CFU/ml and is Nil for drinking water. Although not necessarily agents of diseases, faecal coliform bacteria may indicate the potential presence of disease carrying organism. From the study it is concluded that the Pond is polluted and luxuriously blessed with Chlorophycean members and it needs more care in quality parameters to check pollution for a healthy environment of the Zoo animals and to enjoy the zoo tourism. Therefore, the pond has to be preserved for its intended use, a sustainable and aesthetic management planning is necessary for the conservation of this pond.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to Dr. Meera Unwin Antony and Director of Chief Disease Investigation Office, Palode, for their support and valuable guidance. I am also very thankful to the Director of Museums and Zoo, Thiruvananthapuram for providing necessary facilities for water sample collection.

REFERENCES

APHA. 1998. Standard method for the examination of water and waste water, (19th Ed.). New York: American Public Health Association, Inc.

Boyd. C.E. 1998. Water Quality for Pond Aquaculture. Research and Development Series No. 43.International Center for Aquaculture and Aquatic Environments, Alabama Agricultural Experiment Station, Auburn University.

Dwivedi, B.K. and Pandey, G.C. 2002. Physico-chemical factors and algal diversity of two ponds Faizabad, India. *Poll. Res.*, 21(3): 361-369.

Jacob. 2008. Seasonal variation of hydrographic parameters and distribution of nutrients in the Veli - Akkulam Lake Complex. *Indian Hydrobiology*, 11(2): 281-288.

Rajesh Rathore. 2013. Manual of Bacterial Disease Investigation 6th ed. Central Disease Diagnostic Laboratory, Centre for Animal Disease Research and Diagnosis, Indian Veterinary Research Institute, Izatnagar, Bareilly, UP.

Robert S. Breed. 1957. Bergey's Manual of Determinative Bacteriology. 7th ed. The William & Wilkins Co. Baltimore.

Prescott, G.W. 1978. How to know freshwater algae. 3rd ed., Wes. C. Brown Company Publishers Dubugue, IOWA, 280p.