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**ORIGINAL ARTICLE**

**Study of algae from lakes of Vasai Region, District Palghar,  
Maharashtra**

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**ABSTRACT**

*Algae are bio-indicators of pollution. The presence or absence of certain species indicates the ecological condition of the area. Vasai region has witnessed fast infrastructural development causing changes in the algal diversity of water bodies in the area. In the study we observe the biodiversity of algae by Shannon-Weiner and Simpson diversity index and assess the water eutrophication condition by Nygaard's algal index.*

**Key Words :** *Vasai Region, Fresh water Lakes, Algal Diversity, Eutrophication, Shannon-Weiner Diversity Index, Simpson Diversity index, Nygaard's Algal Index*

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**INTRODUCTION**

Vasai region is in Palghar district about 45 Km from Mumbai Central , the core part of the Mumbai City. Its coordinates are 19°23'36.0420" N and 72°51'44.7372"E. Vasai region is part of Vasai- Virar Municipal Corporation (VVCMC), the largest Municipal Corporation in Palghar District with total area of 311 sq. kms and population of 12.22 lakhs as per 2011 census (VVCMC 2019). The region has witnessed very rapid infrastructure and city development after formation of Vasai-Virar Municipal Corporation. This has caused depletion of lakes in the region [13].

The region has Chakreshwar, Nirmal, Achole and Gass fresh water bodies. Nirmal is bigger lake compared to other lakes. It shows two water bodies alongside the Nirmal-Vasai Road [5]. The micro-algae and macro-algae were visibly observed in these water bodies. Hence the study was conducted to assess diversity of algae and evaluate the status of water pollution. The samples were collected during March 2019 to October 2019 which includes Pre and Post monsoon season [4].

**MATERIAL AND METHODS**

The water samples were collected from Chakreshwar, Nirmal I and II, Achole and Gass fresh water bodies. The collection was done in March-April 2019 as pre-monsoon samples and September-October 2019 as post-monsoon samples. 10 samples were collected from each one of above lakes. The sample sites were taken from center to the periphery from all the sides. All the samples were collected and stored in air tight plastic container at 15°C to prevent the damage to the samples. The algae were observed under light compound microscope and counting was done by Lackey's Drop Method [4].The identification was done with the help of monographs.



Map 1 : Vasai region map with circled area as study site; source Google Maps

**Statistical Analysis:** The observed data was statistically analysed with various indices. Shannon-Weiner index [9] and Simpson Diversity Index [10] were derived to study algal biodiversity. To evaluate water pollution and eutrophication conditions Nygaard's algal index [7] were calculated.

**Simpson's Diversity index**

$$D = N(N - 1) \sum n(n - 1)$$

Where D stands for Diversity Index  
 N for total number of organisms in the community  
 n number of for individuals in each species

➤ **Shanon-wiever Diversity index**

$$H = \sum [(pi) \times \ln(pi)]$$

Where H= Shanon-weiner Diversity Index  
 Pi = proportion of total sample represented by species i

**Nygaard's Algal Index (Compound Coefficient)**

$$\frac{Myxophycean + Chlorophycean + Bacillariophycean + Euglenophycean}{Desmidacean}$$

$$MyxophyceanIndex = \frac{Myxophycean}{Desmidacean}$$

$$Chlorophycean Index = \frac{Chlorococcales}{Desmidacean}$$

$$Euglenophycean Index = \frac{Euglenophycean}{Myxophycean + Chlorophycean}$$

**RESULTS AND DISCUSSION**

Nirmallake in Vasai region is rich in algae as reported by Singh *et al* [11]. We have observed the algal diversity of 23 genus distributed in 5 Classes in these lakes. Class Chlorophyceae shows species of 10 genus, Cyanophyceae 5, Bacillariophyceae 5, Euglenophyceae 2 and Desmidophyceae 1 genus. Similar results were also reported in fresh water bodies in and around Mumbai region [12, 1, 3].

Vasai lakes show highest, 44 % Chlorophyceae members, the highest percentage of Chlorophyceae was observed in Nirmallake in pre-monsoon collection that is 58.77 %. Cyanophyceae was present 22.86 %, Desmidophyceae 19.27 %, Bacillariophyceae 8.1 % and Euglenophyceae was only 5.7 %. Similar results were reported by Palaniveil [8] in Chennai, Hosmani [2] in Mysore and Noel [6] in Madurai.

**Table no. 1 : Species composition of Different Algal Classes of Vasai Lakes**

Class	Genera	Nirmal Lake I		Nirmal lake II		Chakreshwar		Aachole		Gass		Total no. of
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Organisms
<b>Cyanophyceae</b>	<i>Anabaena</i>	6	4	4	4	5	8	1	2	6	8	<b>48</b>
	<i>Microcystis</i>	10	15	8	13	11	17	11	13	3	6	<b>107</b>
	<i>Nostoc</i>	4	8	0	0	6	9	3	8	2	2	<b>42</b>
	<i>Ocillatoria</i>	4	4	2	5	5	7	6	8	3	8	<b>52</b>
	<i>Spirulina</i>	3	8	6	7	4	5	2	7	6	8	<b>56</b>
<b>Chlorophyceae</b>	<i>Chlorella</i>	20	28	11	7	12	9	3	2	2	8	<b>102</b>
	<i>Closterium</i>	4	9	5	8	3	5	3	6	6	10	<b>59</b>
	<i>Kirchneriella</i>	1	0	4	1	3	1	2	3	4	6	<b>25</b>
	<i>Mougeotia</i>	6	2	5	3	0	0	7	3	4	1	<b>31</b>
	<i>Oedogonium</i>	6		4	8	3	3	4	9	4	2	<b>43</b>
	<i>Pediastrum</i>	2	5	1	6	4	8	2	6	3	5	<b>42</b>
	<i>Scenedesmus</i>	12	22	14	18	11	18	3	10	12	20	<b>140</b>
	<i>Spirogyra</i>	4	11	5	13	4	8	1	7	3	7	<b>63</b>
	<i>Ulothrix</i>	7	4	5	4	0	0	0	0	1	3	<b>24</b>
	<i>Zygnema</i>	5	9	6	8	3	5	2	6	6	9	<b>59</b>
<b>Euglenophyceae</b>	<i>Phacus</i>	4	6	5	9	4	9	0	0	7	10	<b>54</b>
	<i>Strombomonas</i>	0	0	4	1	3	1	0	3	4	6	<b>22</b>
<b>Desmidophyceae</b>	<i>Peridinium</i>	10	30	42	25	27	21	25	24	27	26	<b>257</b>
<b>Bacillariphyceae</b>	<i>Navicula</i>	3	5	1	5	4	8	2	6	3	6	<b>43</b>
	<i>Nitzschia</i>	2	5	3	6	2	6	4	8	1	5	<b>42</b>
	<i>Melosira</i>	1	1	2	1	0	0	5	2	0	0	<b>12</b>
	<i>Synedra</i>	0	0	0	0	0	1	0	2	1	1	<b>5</b>
	<i>Thalassiosira</i>	0	1	0	0	1	1	0	0	2	1	<b>6</b>
		6	12	6	12	7	16	11	18	7	13	<b>108</b>
<b>Total No. of Species</b>		<b>114</b>	<b>177</b>	<b>137</b>	<b>152</b>	<b>115</b>	<b>150</b>	<b>86</b>	<b>135</b>	<b>110</b>	<b>158</b>	<b>1334</b>

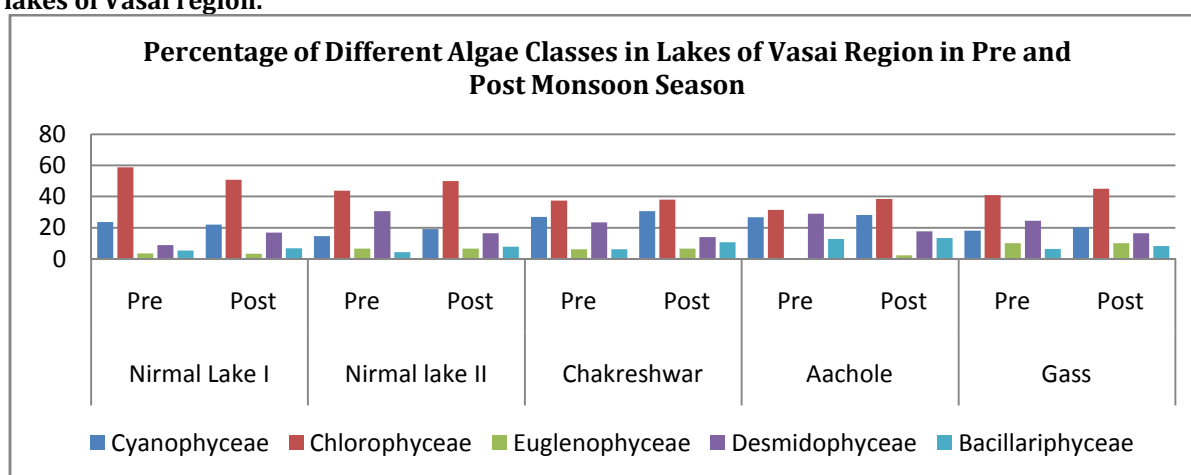
**Table no. 2 : Class composition of Different Algal Classes of Vasai Lakes**

Class	Nirmal Lake I		Nirmal lake II		Chakreshwar		Aachole		Gass		Total no. of Organism
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Cyanophyceae	27	39	20	29	31	46	23	38	20	32	305
Chlorophyceae	67	90	60	76	43	57	27	52	45	71	588
Euglenophyceae	4	6	9	10	7	10	0	3	11	16	76
Desmidophyceae	10	30	42	25	27	21	25	24	27	26	257
Bacillariphyceae	6	12	6	12	7	16	11	18	7	13	108

**Table No. 3 : Diversity and Pollution Indices of all lakes of Vasai Region**

Indices	Chakreshwar		Nirmal I		Nirmal II		Achole		Gass	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<b>Shanon Diversity Index (H)</b>	1.15	1.27	1.32	1.34	1.4	1.44	1.34	1.39	1.43	1.4
<b>Shanon Diversity Index (Evenness)</b>	0.71	0.79	0.82	0.77	0.87	0.89	0.97	0.86	0.89	0.87
<b>Simpson-Weiver Diversity Index</b>	0.53	0.57	0.58	0.59	0.65	0.67	0.66	0.65	0.67	0.65
<b>Nygaard's Algal Index Compound</b>	10.4	4.9	2.26	5.08	3.26	6.14	2.44	4.63	3.07	5.08
<b>Myxophycean Index</b>	2.7	1.3	0.48	1.16	1.15	2.19	0.92	1.58	0.74	1.23
<b>Chlorophycean Index</b>	6.7	3	1.43	3.04	1.59	2.71	1.08	2.17	1.67	2.73
<b>Euglenophycean Index</b>	0.04	0.05	0.11	0.1	0.09	0.1	0	0.03	0.17	0.16

**Fig 1 : Seasonal variation of Algal Classes in pre and post monsoon samples collected from various lakes of Vasai region.**



The Shannon diversity evenness index shows very low diversity at Chakreshwarlake in pre-monsoon samples, while highest evenness was observed in pre-monsoon samples in Achole lake.

In post-monsoon collection in Nirmal-II lake and pre-monsoon collection of Gass lake shows highest algal Diversity according to the Simpson-Weiner Diversity Index, whereas pre-monsoon collection from Chakreshwar lake has minimum algal diversity.

**CONCLUSION**

Algae are very important in determining water pollution. The trophic status of lakes was determined based on Nygaard’s Algal Index. It is also known as Species-diversity index. All the lakes shows very high eutrophication. Chakreshwarlake shows highest eutrophication among all the lakes studied. As a result we can conclude that some immediate steps need to be undertaken to improve the quality of water. Further study is required to confirm the quality index of Vasai region Lakes.

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