EFFECT OF SEASONAL VARIATIONS ON BIOLOGICAL PARAMETERS OF AN AQUA FARM, AGRICON, MULTAN

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Abstract: Density and diversity of plankton was used as a measure of water quality. Phytoplankton were abundant as compared to zooplankton. Forty three phytoplankton genera were recorded. Among these four were of Cyclotella, seventeen of Chlorophyta, seven of Euglenophyta and ten of Chrysophyta. Chrysophyta were abundant in summer. Chrysophytes showed an inverse correlation with temperature. Euglenophyta was rarely observed. Sixteen genera of zooplankton were observed including twelve of protozoans and four of rotifers. Diversity index ranged from 3.16 to 4.13 which indicates unpolluted water.

Key words: Seasonal variations, water quality, Biological parameters, Fish farm.

INTRODUCTION

In recent years, aquaculture is being projected as a possible solution to the food problems faced by the masses. It gives higher productivity per unit as compared to agriculture and animal husbandry. Water quality studies are important and have been taken up because these play a key role in aquaculture (Pillay, 1990). The water quality determines the survival and growth of the cultured animals and plants (Dehoun, 1992). The actual harvest of the fish from a piece of water is the ultimate terminal link between a chain of successive biological events within the watermass (Mishra and Sakshena, 1992). The quality and quantity of phytoplankton is a good indicator of water quality. The high relative abundance of chlorophyll a is indicative of productive water. Blue green algal blooms secrete toxic substances and cause phytoplankton die-off (Shepherd and Bromage, 1992). Diversity indices are used to measure stress in the environment and describe how the individuals are distributed among the species. Unpolluted environments are characterize by a large number of species occurring in relatively low numbers in a community thus having a maximum diversity (Mason, 1988). The present study deals with the effect of seasonal variations on biological parameters of a commercial fish farm.
MATERIALS AND METHODS

The details of the location and the experimental protocols have been described elsewhere (Ali et al., 1994). The water samples for the qualitative and quantitative study of plankton were preserved by using 4% formaline solution (Battish, 1992) and examined under a compound microscope (OEM 9715-HB-I), using 10X ocular and 10X and 40X objectives.

The identification of zooplankton and phytoplankton up to generic level was carried out by using following literature:


The relative abundance of different phyla was also calculated.

Diversity index of phytoplankton during each month was calculated by using the following formula:

\[
\text{Diversity index (H)} = \frac{S}{\ln N} \quad \text{(Boyd, 1981)}
\]

where

- \( S \) = No. of phytoplankton genera
- \( N \) = No. of total phytoplankton.
- \( \ln \) = Natural logarithm.

RESULTS

The monthly distribution of phytoplankton and zooplankton is given in Table 1 and Figure 1.

| Table 1: Monthly distribution and relative abundance (%) of phytoplankton and zooplankton. |
|---------------------------------|-------|-------|-------|-------|-------|-------|-----|
| No. of zooplankton              | 244   | 261   | 275   | 327   | 194   | 168   | 289  | 294  |
| Total No. of organisms observed | 17    | 21    | 29    | 25    | 23    | 12    | 11   | 17   |
| Relative abundance of phytoplankton | 93.48 | 92.55 | 90.46 | 92.89 | 89.40 | 93.33 | 96.33 | 94.53 |
SEASONAL BIOPARAMETRIC VARIATIONS IN AQUA FARM

Forty three genera of phytoplankton were observed. They belong to Cyanophyta (9 genera), Chlorophyta (17 genera), Euglenophyta (7 genera) and Chrysophyta (10 genera). Sixteen genera of zooplankton were observed. Twelve were protozoans and four were rotifers.

Fig. 1: Relationship between light penetration and diversity index in Agricon Aqua Farm, Multan (March-October, 1993).

Relative abundance

Phytoplankton were abundant as compared to zooplankton throughout the study period (Table I). Cyanophyta was relatively abundant when considered during the whole study period (Table II).

During March, Chlorophyta and Chrysophyta both were relatively abundant followed by Cyanophyta and Euglenophyta. During April, Cyanophyta was relatively abundant followed by Chlorophyta, Chrysophyta and Euglenophyta. From May to September, Chlorophyta was most abundant followed by Cyanophyta, Chrysophyta and Euglenophyta. During October, Chlorophyta was relatively less abundant followed by Cyanophyta, Chrysophyta and Euglenophyta (Table II).
Fig. 2: Relationship between dissolved oxygen and total solids in Agricon Aqua Farm, Multan (March-October, 1993).

Fig. 3: Relationship between total solids and diversity index in Agricon Aqua Farm, Multan (March-October, 1993).

Cryptophyta showed irregular fluctuations. Chlorophyta showed increasing trend during study period with a peak in September. Chrysophyta showed a decreasing trend from March to June and then increasing trend from June to October. Euglenophyta was rarely observed. It showed irregular behaviour.
Table II: Relative abundance (%) of phyta during study period.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyanophyta</td>
<td>25.75</td>
<td>40.42</td>
<td>23.68</td>
<td>33.80</td>
<td>20.27</td>
<td>21.30</td>
<td>18.33</td>
<td>20.36</td>
</tr>
<tr>
<td>Chlorophyta</td>
<td>32.56</td>
<td>34.02</td>
<td>60.19</td>
<td>57.67</td>
<td>64.51</td>
<td>63.88</td>
<td>65.80</td>
<td>40.51</td>
</tr>
<tr>
<td>Euglenophyta</td>
<td>32.56</td>
<td>17.02</td>
<td>5.59</td>
<td>1.13</td>
<td>3.68</td>
<td>4.44</td>
<td>7.66</td>
<td>12.86</td>
</tr>
<tr>
<td>Phaeophyta</td>
<td>4.59</td>
<td>1.98</td>
<td>0.98</td>
<td>0.28</td>
<td>0.92</td>
<td>1.06</td>
<td>1.16</td>
<td>5.23</td>
</tr>
<tr>
<td>Rhodophyta</td>
<td>3.65</td>
<td>4.96</td>
<td>5.26</td>
<td>2.27</td>
<td>4.14</td>
<td>2.77</td>
<td>2.62</td>
<td>4.50</td>
</tr>
</tbody>
</table>

Diversity index

Diversity index of phytoplankton ranged from 3.16 to 4.13 (Table III). The relationship of diversity index with light penetration, dissolved oxygen and total solids is shown in figures 1, 2 and 3, respectively.

Table III: Diversity index of phytoplankton.

<table>
<thead>
<tr>
<th>Month</th>
<th>No. of genera(s)</th>
<th>Total No. of individuals (N)</th>
<th>ln N</th>
<th>Diversity index (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>21</td>
<td>244</td>
<td>5.497</td>
<td>3.63</td>
</tr>
<tr>
<td>April</td>
<td>24</td>
<td>261</td>
<td>5.564</td>
<td>4.13</td>
</tr>
<tr>
<td>May</td>
<td>23</td>
<td>275</td>
<td>5.616</td>
<td>3.91</td>
</tr>
<tr>
<td>June</td>
<td>21</td>
<td>327</td>
<td>5.789</td>
<td>3.45</td>
</tr>
<tr>
<td>July</td>
<td>19</td>
<td>194</td>
<td>5.267</td>
<td>3.42</td>
</tr>
<tr>
<td>August</td>
<td>20</td>
<td>168</td>
<td>5.123</td>
<td>3.71</td>
</tr>
<tr>
<td>September</td>
<td>21</td>
<td>289</td>
<td>5.666</td>
<td>3.53</td>
</tr>
<tr>
<td>October</td>
<td>19</td>
<td>294</td>
<td>5.583</td>
<td>3.16</td>
</tr>
</tbody>
</table>

DISCUSSION

Chlorophyta was relatively abundant in March to April and highly abundant from May to September. Salam and Parveen (1997) reported similar trend in relative abundance of Chlorophyta from February to July indicating the productivity of water. In the present study, Cyanophyta was rarely present except in April. This observation was in contrast to the study by Salam and Parveen (1997) who reported that Cyanophyta was highly abundant during August and September indicating water pollution in that body of water which was mainly fed by seepage water while in the present study, water was regularly replenished. These results also show interlocking fluctuations of Chlorophyta and Cyanophyta. When Chlorophyta population is at its peak, Cyanophyta are at minimum level. When Cyanophyta population is at its peak, Chlorophyta are at minimum level. Boyd (1981), Shepherd and Bromage (1992) reported that Cyanophyta secrete toxic substances and results in massive phytoplankton die-offs, favouring blue green algae.
Our results indicated a negative correlation between Chrysophyta and temperature. Similarly, Munawar et al. (1991) also showed a negative correlation between Chrysophyta and temperature. Euglenophyta were rarely observed throughout the study period which followed irregular distribution pattern.

In the present study, diversity index remained above 3. Diversity index greater than 3 is an indicator of clean water while values in the range of 1-3 are characteristic of moderately polluted conditions and values less than 1 characterize heavy pollution (Mason, 1988). Therefore, in the present study, it can be concluded that water was productive and unpolluted as indicated by diversity index.

REFERENCES


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