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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. Photoplankton were abundant as compared to zooplankton. Forty three phytoplankton genera were recorded. Among these nine were of *Cyanophyta*, seventeen of *Chlorophyta*, seven of *Euglenophyta* and ten of *Chrysophyta*. *Chlorophyta* were abundant in summer. *Chrysophyta* 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 (Dehadrai, 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 Saksena, 1992). The quality and quantity of phytoplankton is a good indicator of water quality. The high relative abundance of chlorophyta 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 characterized 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.

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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 (OSK 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:

Fritsch (1979), Tonapi (1980), Huet (1986), APHA (1989), Battish (1992).

The relative abundance of different phyla was also calculated.

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

Diversity index (H) = S-1/lnN (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 I and Figure 1.

Table I: Monthly distribution and relative abundance (%) of phytoplankton and zooplankton.

	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
No. of phyto-plankton	244	261	275	327	194	168	289	294
No. of zoo-plankton.	17	21	29	25	23	12	11	17
Total No. of organisms observed.	261	282	304	352	217	180	300	311
Relative abun-dance of phytoplankton	93.48	92.55	90.46	92.89	89.40	93.33	96.33	94.53

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.

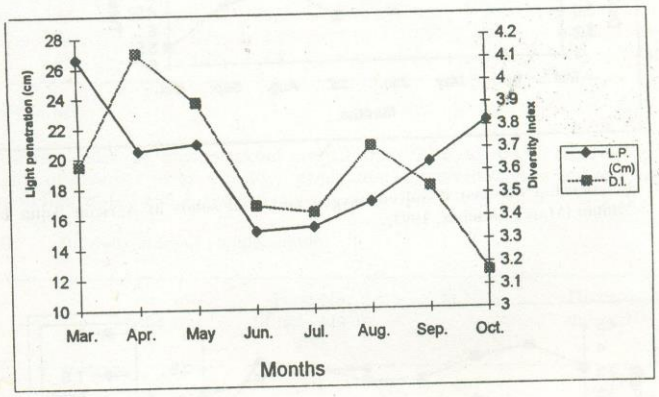

Fig. 1: Relationship between light penetration and diversity index in Agricon Aqua Farm, Multan (March-October, 1993).

Relative abundance

Phytoplankton were abundant as compared to zooplankton throughout the study period (Table I). *Chlorophyta* 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).

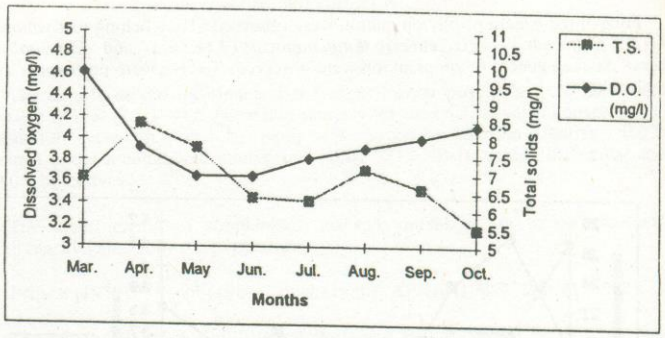

Fig. 2: Relationship between dissolved oxygen and total solids in Agricon Aqua Farm, Multan (March-October, 1993).

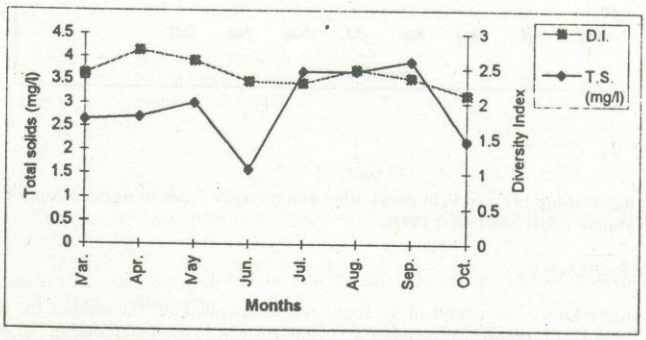

Fig. 3: Relationship between total solids and diversity index in Agricon Aqua Farm, Multan (March-October, 1993).

Cyanophyta 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 phyla during study period.**

	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Mean
Cyanophyta	23.75	40.42	23.68	33.80	20.27	23.30	18.33	26.36	26.73
Chlorophyta	32.56	34.02	60.19	57.67	64.51	63.88	65.00	49.51	53.05
Chrysophyta	32.56	17.02	5.59	1.13	3.68	4.44	7.66	12.86	10.55
Euglenophyta	4.59	1.06	0.98	0.28	0.92	1.66	5.33	5.78	2.62
Protozoa	3.83	4.96	5.26	2.27	4.14	2.77	2.02	4.50	3.48
Rotifera	2.68	2.48	4.27	4.82	6.45	3.88	1.66	0.96	3.30

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.**

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

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.

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