

Relationship of fouling diatom number and chlorophyll-a value from Zuari estuary, Goa (West coast of India)

P.D. REDEKAR¹ AND A.B. WAGH²

MCMRD, National Institute of Oceanography, Dona Paula,
Goa - 403 004 India

ABSTRACT

The diatom cell biomass is expressed in terms of diatom number and chlorophyll -a value on panel of glass slide. The Chlorophyll value in a water body is indicative of the productivity. The present study was conducted to find out the relationship of cell biomass of fouling diatoms and the chlorophyll -a value observed over a period of 4 days of immersion of glass slide panel in 1 m depth in the estuarine environment in Zuari estuary. Generally, diatom number showed increasing trend from 1st to 4th day. Diatom number showed low values during monsoon and high during pre and post-monsoon months, highest number being shown during post-monsoon. Chlorophyll -a value was low during monsoon and pre-monsoon. High values of chlorophyll -a were recorded, although the diatom number was low, which may be due to the heavy deposition of *Chlorella* on glass slide. No direct relationship could be established between diatom number and chlorophyll-a value.

Introduction

Primary productivity of the coastal waters of Indian seas has been always an important topic of research since it not only sustains the marine life but also the fisheries of the country. Phytoplankton biomass and chlorophyll-a concentration are the indicators of the productivity. The impact of growing industrialisation, increase in human population, oil terminal operatives etc. is borne by the coastal waters which are treated

as dumping grounds. Thus even in present day scenario such study is carried out by several workers like Sarupria and Bhargava (1998), Ramaiah and Ramaiah (1998), Tiwari and Nair (1998), Nair *et. al* (1998) and Ram *et- al.* (1998). Among the phytoplankton, the diatoms are the most predominant and contribute the major part. Various workers have used the measures like cell count and chlorophyll pigment concentration for expressing diatom cell biomass (Sawant and Wagh, 1994; Targett and Stochaj, 1994;

¹ College of Fisheries, Shirgaon, Ratnagiri - 415 629. Maharashtra

² Flat No. D-9, Kanchanganga Housing Society Behind Mahatma Society,
Kothrud, Pune - 411 029, Maharashtra

Sawant *et al.* 1995). In the present investigations on fouling diatoms from Zuari estuary, both cell count and chlorophyll -a concentration have been used to express diatom cell biomass from glass slides to study if there is any relationship between diatom number and chlorophyll -a value.

Material and Methods

The Zuari estuary (Goa State) is located at lat. 15° 25' N and long. 73° 59' E of the central west coast of India. Dona Paula station was selected in this estuary for carrying out the present study. Station Dona Paula is located at the mouth of the estuary and depth of water is about 2 to 4.5 m. In the present work, fouling diatoms were studied by exposing the glass slides in 1 m depth at Dona Paula in the Zuari estuary, Goa during June 1993 to October 1994. Sampling was done on monthly basis. Every day two slides were removed for four consecutive days. After bringing the slides from the field to the laboratory, they were put into petridishes with filtered seawater and then studied under phase contrast inverted microscope and the diatom cell number was counted individually on both sides of the slide. Then the slides were put in 90% acetone for overnight and were used for studying chlorophyll-a content using fluorescence Spectrophotometer as described by Parsons *et. al.* (1984).

The environmental parameters studied were temperature, salinity pH, dissolved oxygen and nutrients such as nitrite, nitrate, phosphate and silicate. Standard methodology given by Strickland and Parsons (1968) and Parsons *et. al* (1984) was used for estimation of these parameters.

Results (Fig. 1 to 15)

Generally, diatom number showed minimum values on the first day and maximum on the fourth day. Regarding abundance, diatoms showed low number

during monsoon (3/dm² to 1079/dm²) and high during pre-monsoon (6/dm² to 1676/dm²) and post-monsoon (66/dm² to 3730/dm²), The highest number was observed during post-monsoon. Likewise, values of chlorophyll -a were low during monsoon (14.46ng/dm² to 877.22ng/dm²) and pre-monsoon (1.56ng/dm² to 305.28ng/dm²) but high during post-monsoon (22.51ng/dm² to 1126.55ng/dm²). This trend of low and high was observed in both number of diatoms and chlorophyll -a values. Sometimes though the number of diatoms was low, high values of chlorophyll -a were recorded due to heavy deposition of *Chlorella* on the glass slide.

The ranges of environmental parameters are as follows: Temperature (25°C to 32°C), Salinity (7.24‰ to 35.7‰), pH (7.3 to 8.3), Dissolved oxygen (4.2123 ml/l to 6.3280 ml/l), Nitrite (undetectable level to 4.7 µg/l), Nitrate (0.138µg/l to 19.136 µg/l), Phosphate (undetectable level to 2.8 µg/l) and Silicate (0.700 µg/l to -90.25 µg/l). It was observed that during low salinities minimum number of diatoms was recorded and maximum number during higher salinities.

Discussion

Sarupria and Bhargava (1998) have reported on the seasonal distribution of chlorophyll -a of the Exclusive Economic Zone of India. They observed the seasonal variation in values of chlorophyll -a i.e. maximum average during pre-monsoon (14.2 mg/m²), followed by southwest monsoon (12.8 mg/m²) and post-monsoon (7.4 mg/m²), the annual average being 12 mg/m². Tiwari and Nair (1998) have studied the Dharmatar creek adjoining Bombay harbour and observed high concentration of chlorophyll -a (0.53 - 6.4mg/m³), average value being 1.94 mg/m³. According to them correlation between chlorophyll -a to phytoplankton count and nutrient was not significant Variation in phytoplankton cell count was enormous (17 - 5980 x 10³/l).

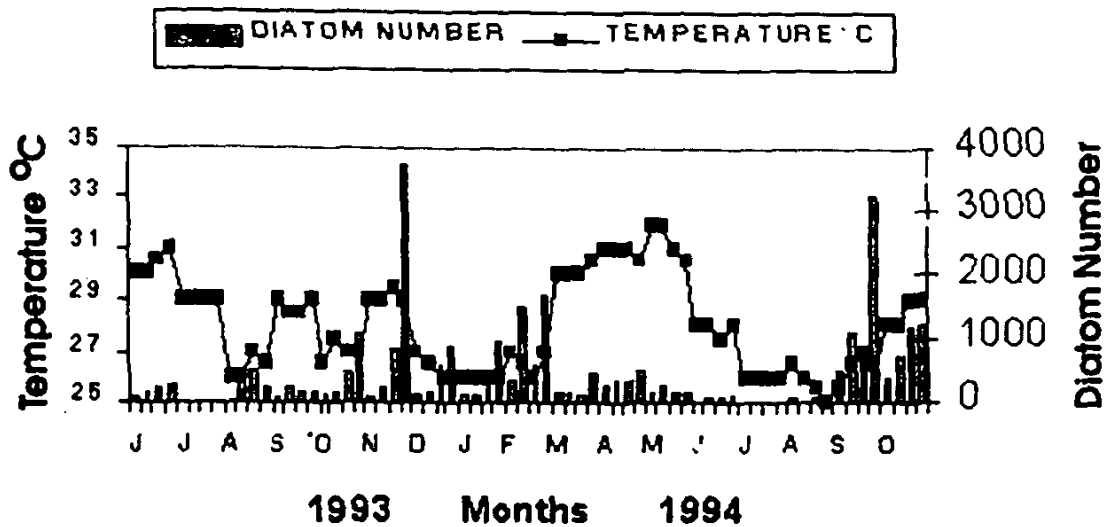


Fig. 1. Correlation of temperature & diatom number (chlorophyll studies) - Dona Paula.

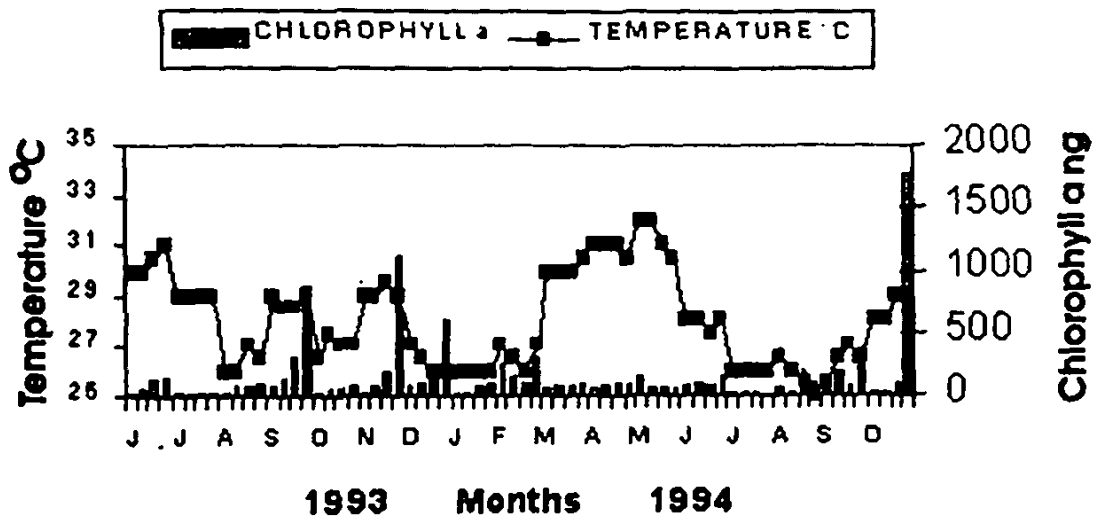


Fig. 2. Correlation of temperature & chlorophyll -a on glass slide - Dona Paula.

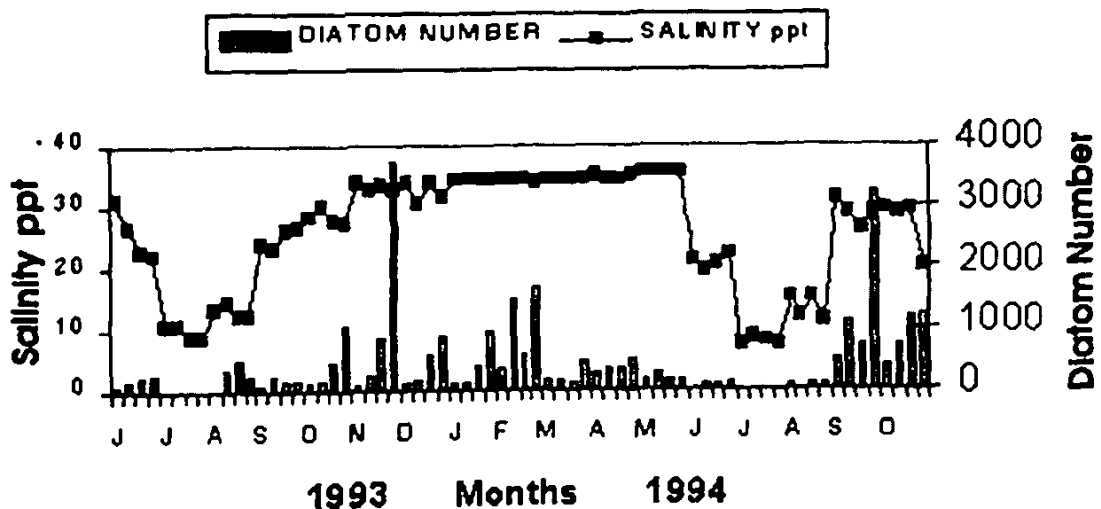


Fig. 3. Correlation of salinity & diatom number (chlorophyll studies) - Dona Paula.

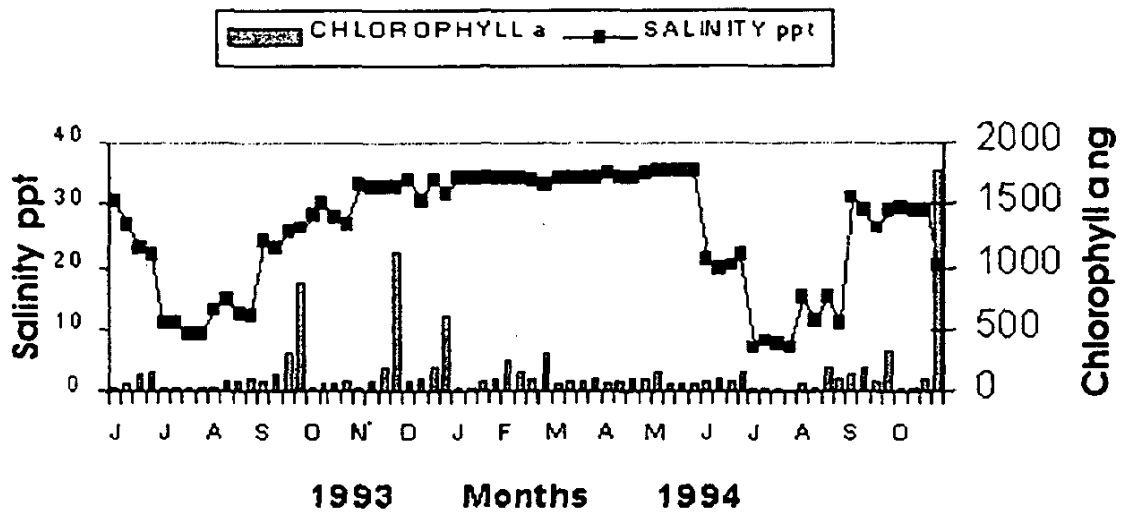


Fig. 4. Correlation of salinity & chlorophyll -a on glass slide - Dona Paula

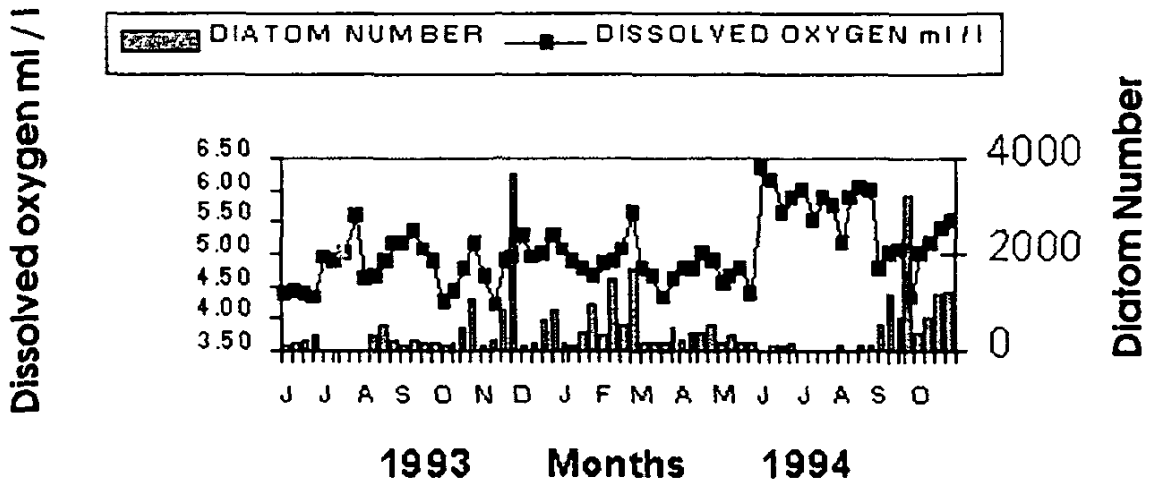


Fig. 5. Correlation of dissolved oxygen & diatom number (chlorophyll studies) - Dona Paula

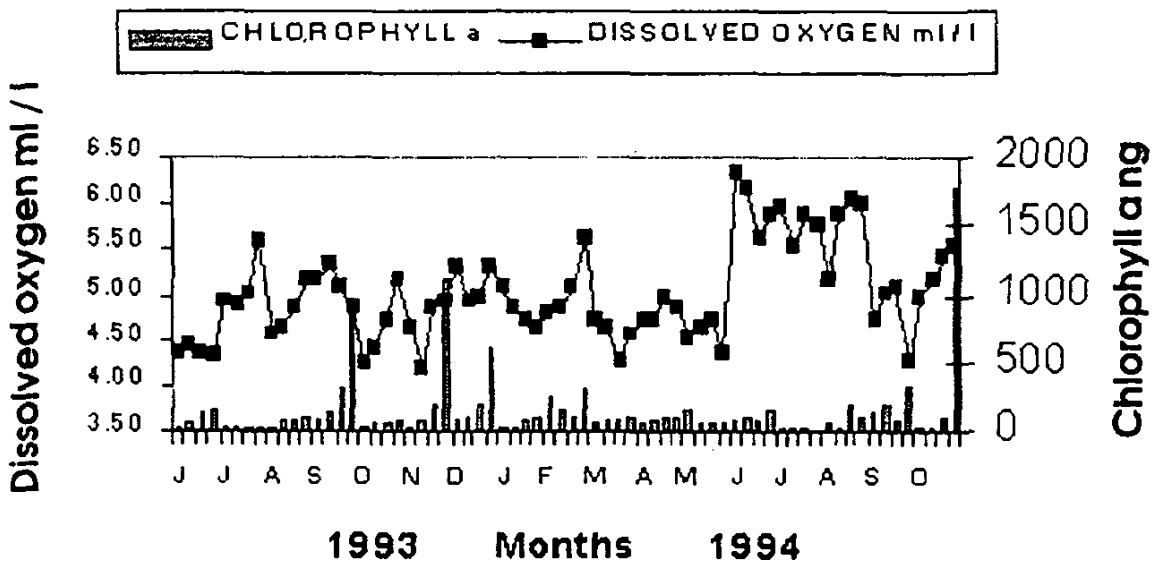


Fig. 6. Correlation of dissolved oxygen & chlorophyll -a on glass slide - Dona Paula

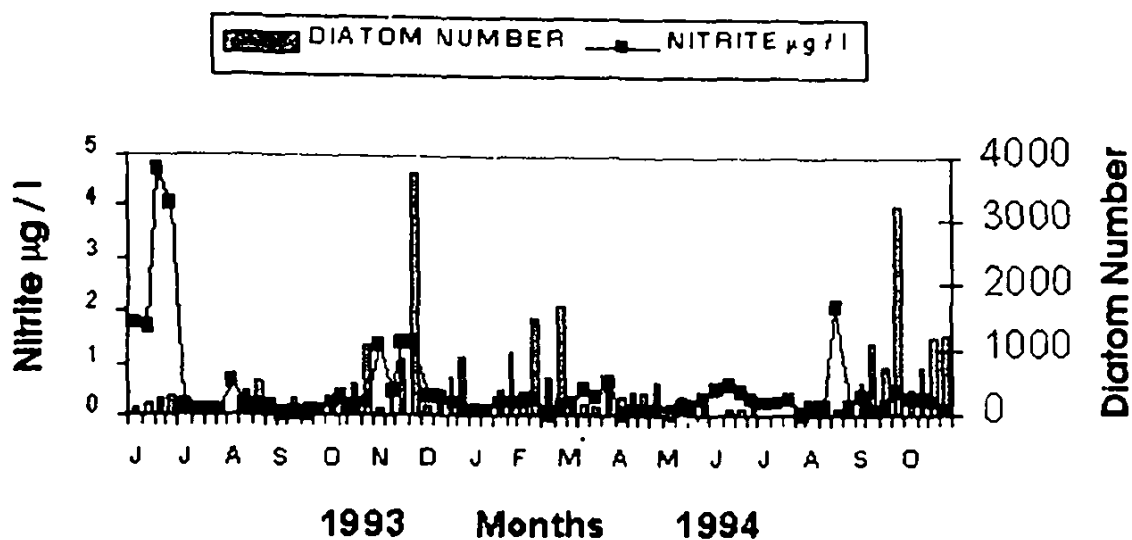


Fig. 7. Correlation of nitrite & diatom number (chlorophyll studies) - Dona Paula

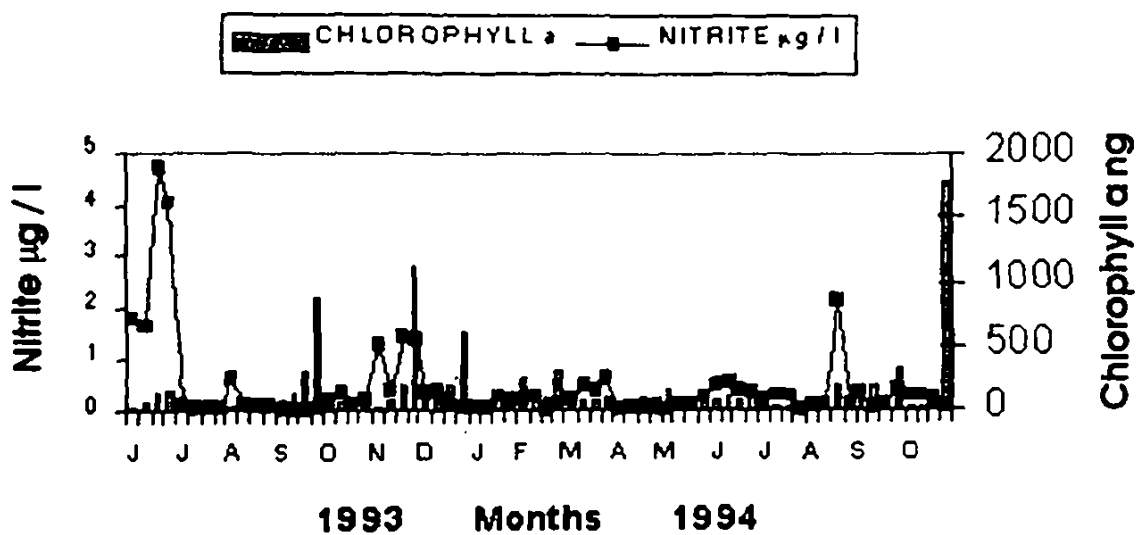


Fig. 8. Correlation of nitrite & chlorophyll -a on glass slide - Dona Paula

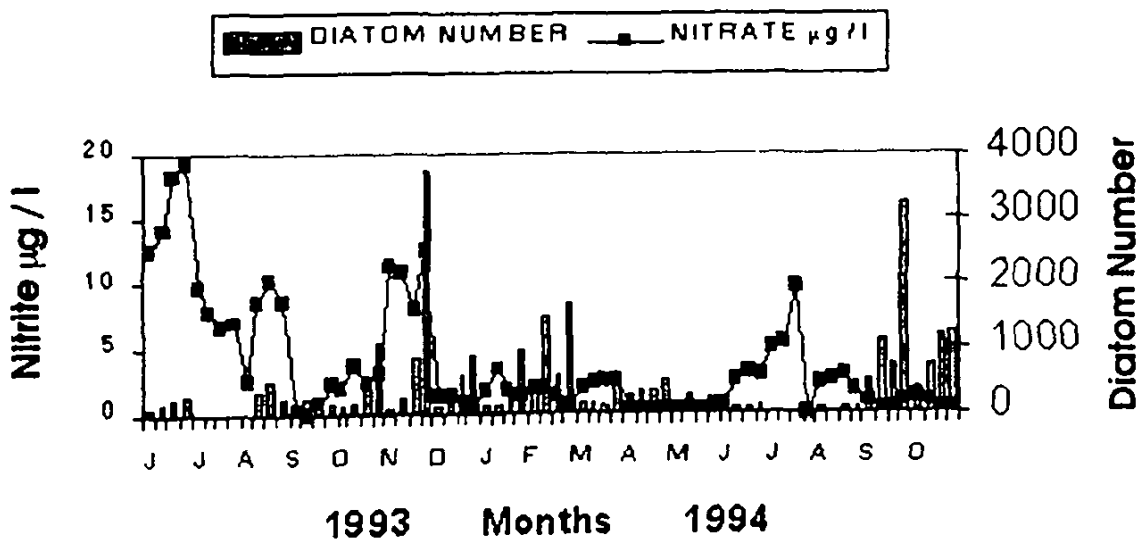


Fig. 9. Correlation of nitrate & diatom number (chlorophyll studies) - Dona Paula

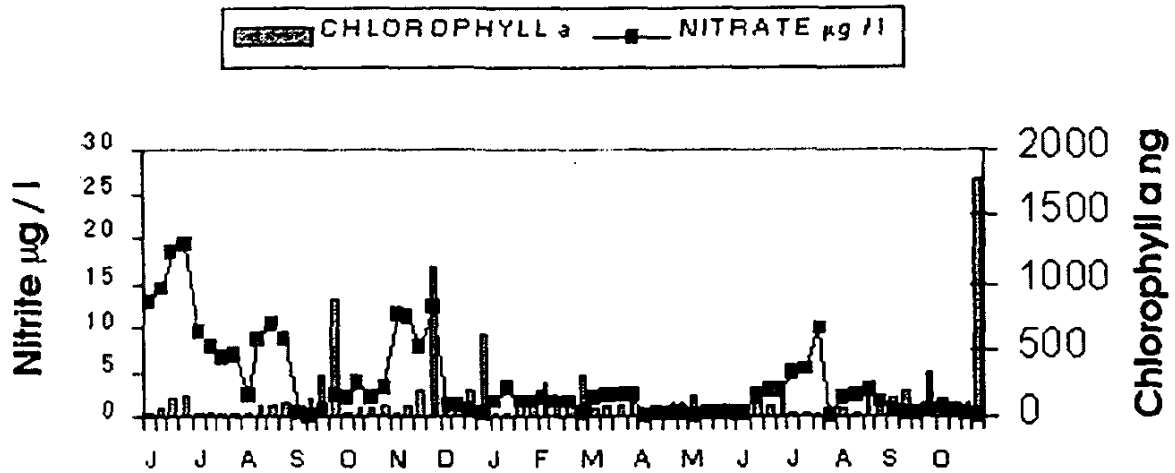


Fig. 10. Correlation of nitrate & chlorophyll -a on glass slide - Dona Paula

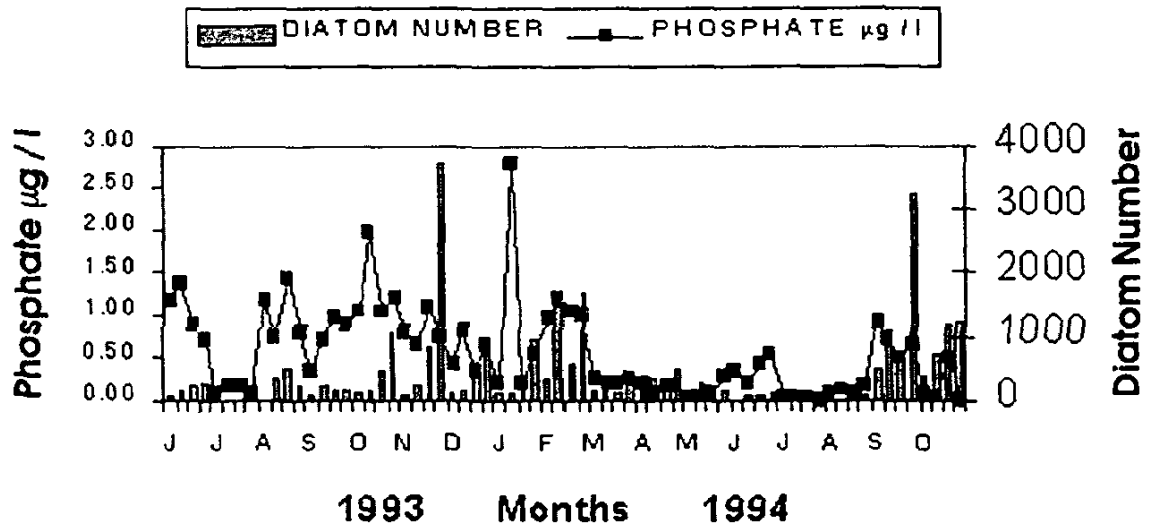


Fig. 11. Correlation of phosphate & diatom number (chlorophyll studies) Dona Paula

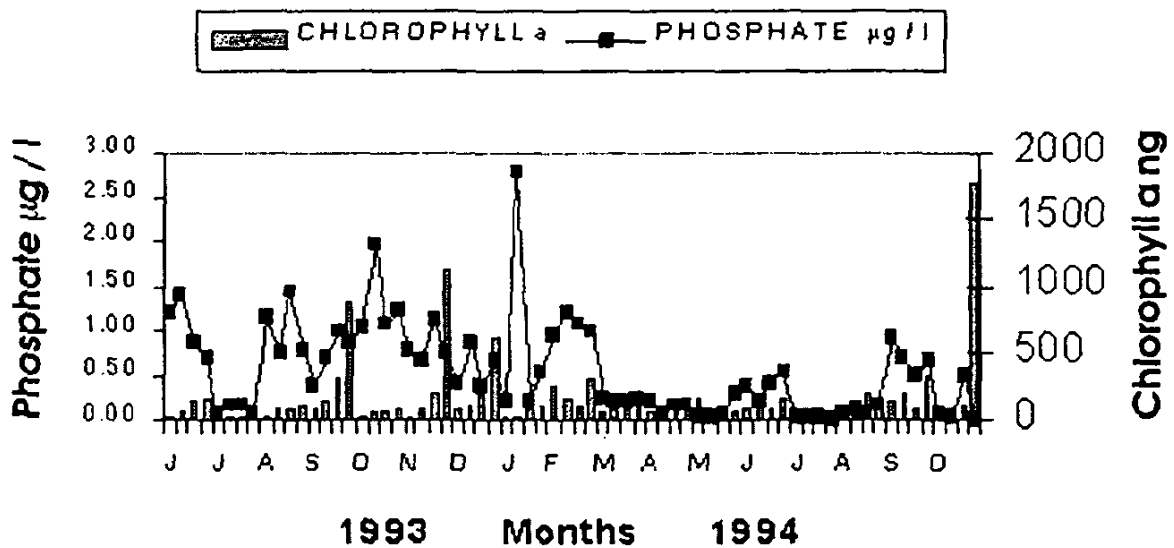


Fig. 12. Correlation of phosphate & chlorophyll -a on glass slide - Dona Paula

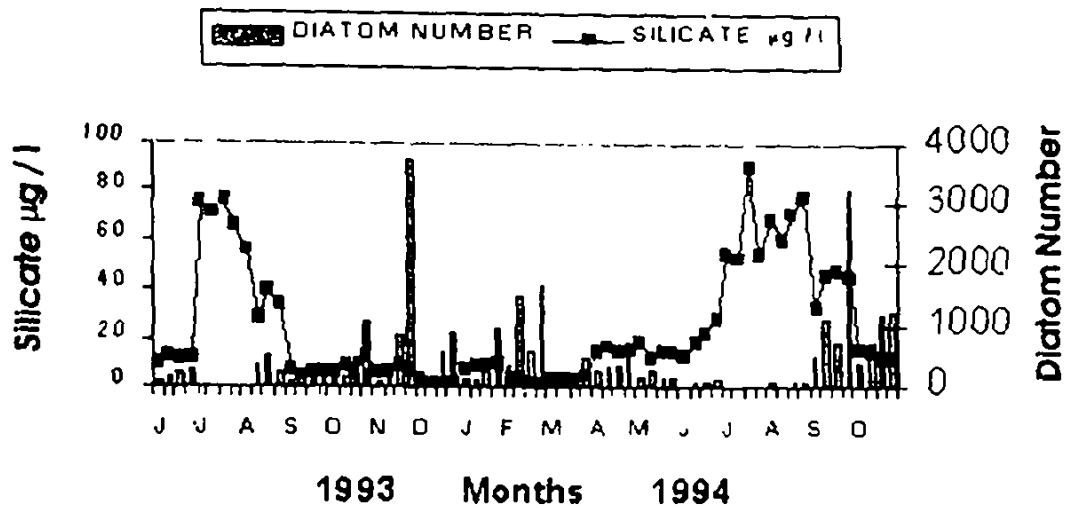


Fig. 13. Correlation of silicate & diatom number (chlorophyll studies) - Dona Paula

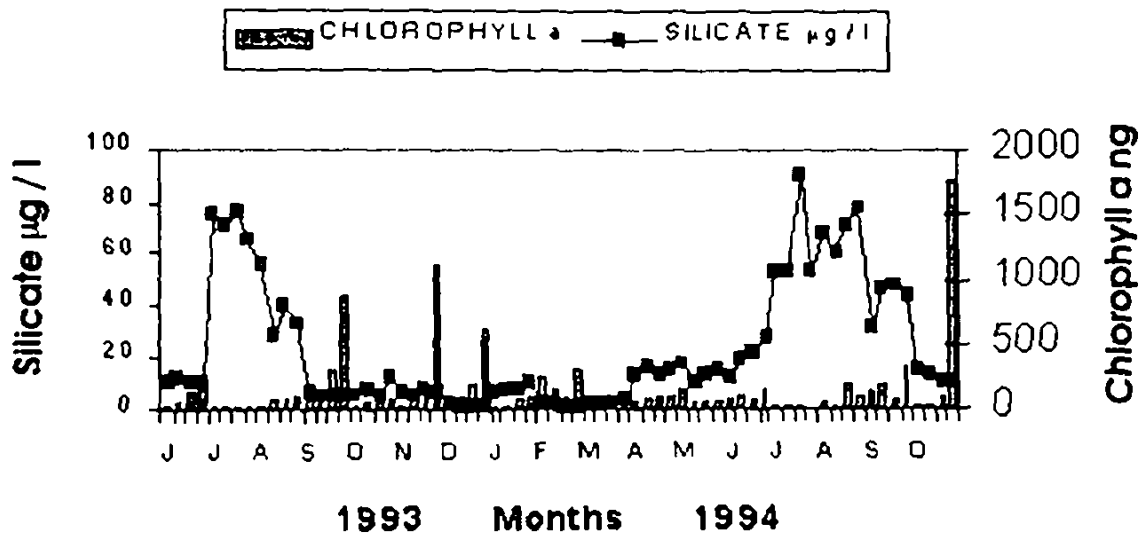


Fig. 14. Correlation of silicate & chlorophyll -a on glass slide - Dona Paula

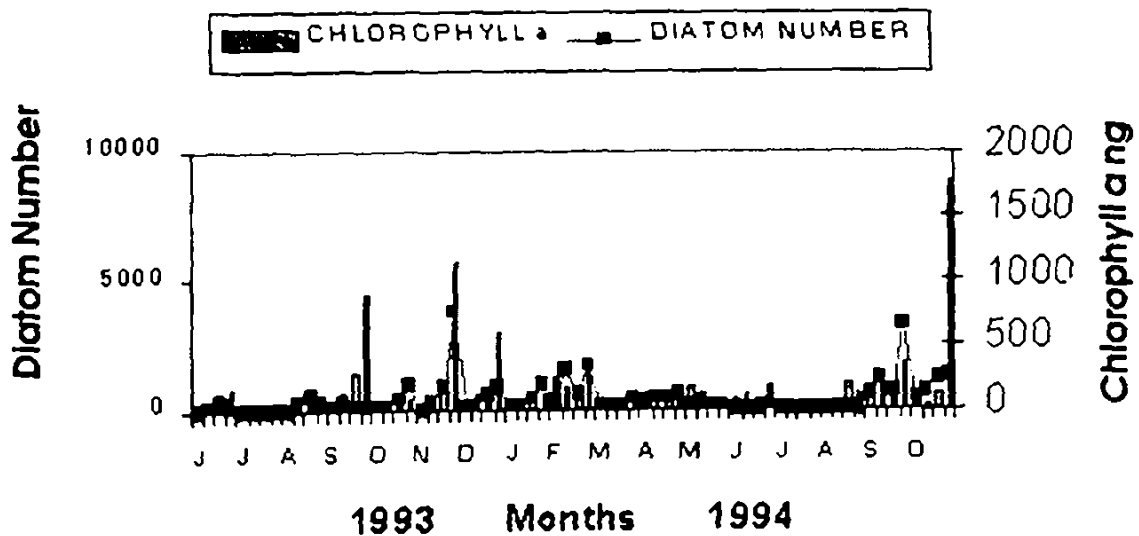


Fig. 15 Correlation of diatom number & chlorophyll -a on glass slide - Dona Paula

Average cell count was found to be 266×10^3 /l. Maximum phytoplankton population coincided with peak values of chlorophyll-a. Thus positive correlation between phytoplankton population and chlorophyll -a was observed. Nair *et. al.* (1998) studied the Vashisti estuary (Konkan, Maharashtra). They recorded high concentration of chlorophyll -a and average value of chlorophyll -a was found to be 3.1mg/m^3 . There were wide fluctuations in chlorophyll-a values during November and high values were confined to some segments. Chlorophyll -a values were found to be higher in subsurface water than at surface water. Ram *et al.* (1998) dealt with phytoplankton pigment and macrobenthos in nearshore waters of an oil terminal in Uran, Maharashtra. They observed wide fluctuations in chlorophyll -a concentrations ($2.1 - 11.8 \text{mg/m}^3$) in nearshore coastal waters of Uran and a definite trend of distribution of chlorophyll -a being always around two times lower during ebb tide than that during flood tide. There was significant decrease in phytoplankton biomass especially during ebb than flood tide in the study area.

In the present investigation diatom number was low during monsoon ($3/\text{dm}^2$ to $1079/\text{dm}^2$) and high during pre-monsoon ($6/\text{dm}^2$ to $1676/\text{dm}^2$) and post-monsoon ($66/\text{dm}^2$ to $3730/\text{dm}^2$). Chlorophyll-a values were low during monsoon ($14.46 \text{ng}/\text{dm}^2$ to $877.22 \text{ng}/\text{dm}^2$) and pre-monsoon ($1.56 \text{ng}/\text{dm}^2$ to $305.28 \text{ng}/\text{dm}^2$) but high during post-monsoon ($22.51 \text{ng}/\text{dm}^2$ to $1126.55 \text{ng}/\text{dm}^2$). No direct relation could be established between the number of diatoms and chlorophyll-a value on the glass slide.

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