THE ABUNDANCE PATTERN OF DIATOMS AS AN INFICATOR OF EUTROPHICATION

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Abstract

The abundance patterns of the marine diatoms Nitzschia closterium and Nitzschia seriata in relation to the nutritional level of sea water were examined. Five-year data of abundance of both species fitted the truncated log-normal distribution model. The analysis of the abundance patterns showed that N.closterium was affected by the level of nutrition and could be used as an indicator of eutrophication whereas N. seriata was not sensitive to nutrient changes of sea water.

Introduction

An important consequence of eutrophication in the sea is the acceleration in abundance of certain species and the elimination in the size of populations of other species. In literature much emphasis has been placed on the relationships between eutrophication and community structure (HOOPER, 1971).

In this work the effects of eutrophication on the species level are examined by analysing the frequency distribution patterns of two diatoms which are common in eutrophic and oligotrophic waters.

Materials and Methods

Monthly measurements of cell concentrations of the diatoms Nitzschia closterium and Nitzschia seriata were made at station S_1 (eutrophic) and station S_3 (oligotrophic) of the Saronicos Gulf, Aegean Sea during the period 1977-81.

The data of cell abundance (cells/l) were transformed logarithmically and analysed by the truncated log-normal distribution procedure (SOKAL and ROHLF, 1969).

Results and Discussion

The frequency distribution of abundance of the species N. closterium and N. seriata at stations S_1 and stations S_3 are shown in Fig. 1 and Fig. 2. The examination of the frequency distribution of abundance of N. closterium indicates that the population of this species varied with station. The two curves differe in the height of the mode (higher at stations S_3) and the number of intervals covered (more at station S_1). Also, the calculated mean abundance of N. closterium at station S_1 ($\bar{x}$ = 4265 cells/l) differs significantly from the mean cell concentration of this species at station S_3 ($\bar{x}$ = 1042). It is obvious that the eutrophication conditions at station S_1 have affected the size of N. closterium population as well as the frequency distribution pattern of its abundance.

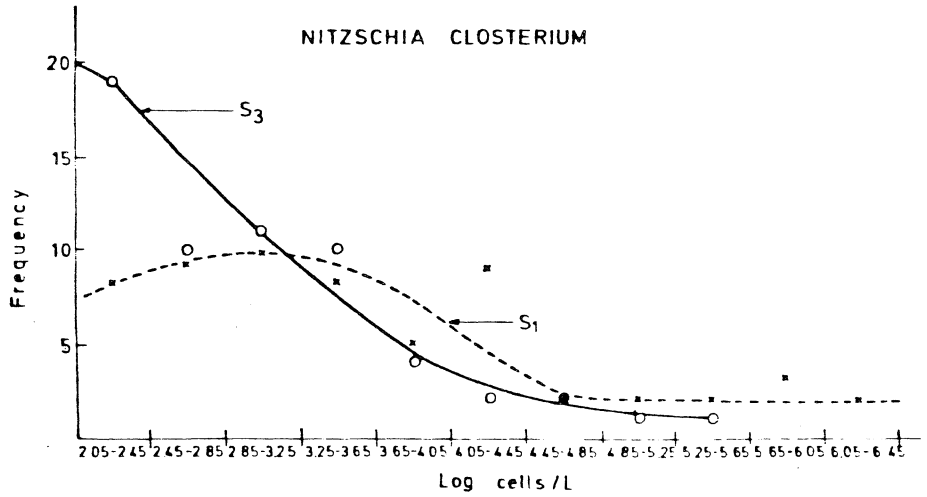

Fig. 1. The frequency distribution of abundance of N. closterium.

The frequency distribution of abundance N. seriata (Fig. 2) is similar at both stations and the calculated mean abundance of this species at station S_1 ($\bar{x}$ = 3548 cells/l) is very close to the mean value at station S_3 ($\bar{x}$ = 3263 cells/l). It would appear then that the eutrophication conditions as station S_1 do not significantly affect the abundance distribution and level of N. seriata.

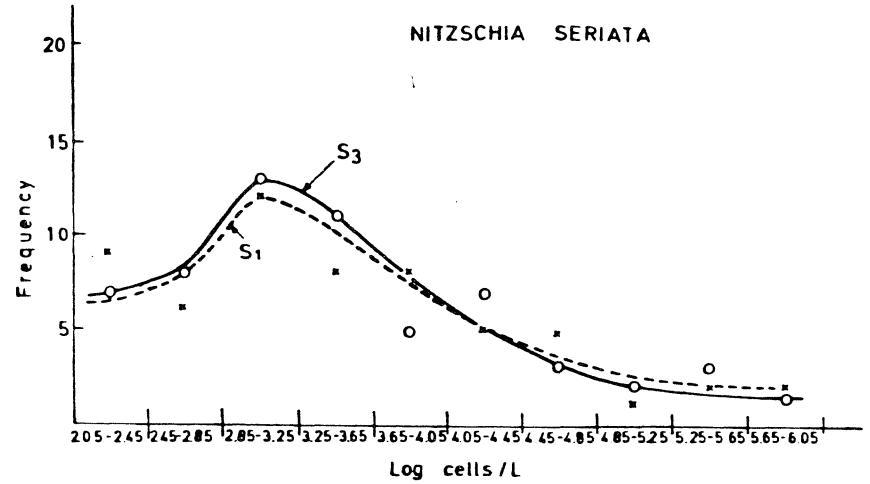

Fig. 2. The frequency distribution of abundance of N. seriata.

The following important points may be deduced from the analysis of the results obtained.

1. Changes in the nutritional state of the water do not necessarily affect the abundance pattern of all diatoms (example: N. seriata).

2. The frequency distribution of abundance of certain species are affected by eutrophication (example: N. closterium) and these species can be considered as indicators of eutrophication.

References

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The phytoplankton community of the deep chlorophyll maximum in the Western Mediterranean

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Summary. This communication deals with the distribution of chlorophyll concentration and phytoplankton composition, during the stratification period (July 1982 and 1983), along several transects from the Catalan coast to beyond the channel between Mallorca and Menorca.

Résumé. Dans cette communication on expose des résultats concernant la distribution de chlorophylle et des organismes du phytoplancton, pendant la période de stratification estivale, le long d'une série de transectes de la côte catalane jusqu'au delà du seuil entre Mallorca et Menorca.

Between 1982 and 1984, the Instituto de Investigaciones Pesqueras of Barcelona sponsored three cruises (July 1982, July 1983 and May 1984) to study the structure and function of the pelagic community during the stratification period in the Western Mediterranean. These surveys covered repeatedly a series of transects from the Catalan coast to beyond the channel between Mallorca and Menorca. Temperature and salinity profiles were recorded by means of a CTD system. Water for chemical and biological determinations was taken at depths between 0 and 400 or 500 m. Samples of 120 ml of water were fixed with Lugol's solution to study the composition of the phytoplankton with the inverted microscope technique. The results commented here will be those of the July 1982 (PEP-82) and July 1983 (PEP-83)

cruises for chlorophyll and of the July 1982 cruise for phytoplankton (Estrada, in press). The phytoplankton data of July 1983, still under elaboration, appeared to show similar patterns.

Both in the July 1982 and 1983 cruises, the chlorophyll a distribution showed a pronounced maximum at depths ranging from 40 to 90 m. This maximum was associated with elevated phytoplankton cell densities and higher contents of chlorophyll per cell and coincided with the nitracline and with a nitrite maximum. An oxygen maximum was also found approximately 30 m above the chlorophyll maximum. Primary production (estimates bases on ^{14}C uptake experiments) showed generally a peak at the level of the deep chlorophyll maximum (DCM), but productivity indices there were low compared with those of the surface layers.

The distribution of the phytoplankton during PEP-82 presented several consistent patterns. Diatoms dominated in the coastal stations and in several DCM samples. Flagellates and small dinoflagellates were distributed throughout the nutrient-poor euphotic zone, while several large dinoflagellates were typically found in the surface layers. Statistical analyses showed that the phytoplankton composition at the DCM differed qualitatively and quantitatively from that of the upper euphotic zone. The presence of diatoms and the localized high cell densities in some of the DCM samples suggested that *in situ* growth combined with reduced diffusion losses played an inportant role.

References

ESTRADA, M. In press, Deep phytoplankton and chlorophyll maxima in the Western Mediterranean. NATO Advanced Research Workshop on Mediterranean Marine Ecosystems. Heraklion, Creta (Greece), September 1983.