

SEASONAL VARIABILITY OF PHYTOPLANKTON IN EUTROPHIC AND OLIGOTROPHIC ENVIRONMENTS IN SARONIKOS GULF, GREECE, 1983-1985

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From June 1983 to December 1985 and several times a year, surface water samples were collected with a 1.3 l N.I.O. bottle at two locations in the western Saronikos Gulf. Station S1 (38°00.3' N - 23°26.9' E), located in Elefsis Bay, is typical of a strong eutrophic environment and station S2 (37°44.8' N - 23°22.1' E), located in the outer Saronikos, is characterized by almost oligotrophic conditions (FRILIGOS, 1985). Phytoplankton samples, after fixation with Lugol's solution, were examined under an inverted microscope. The aim of this study is to present the seasonal phytoplankton abundance and species composition in these two different environments. At station S1, diatoms, dinoflagellates and μ -flagellates (flagellates with cell diameter less than 5 μ m) were always present in large amounts (Table 1 and Fig. 1). Coccolithophores afforded very few species, but gave a bloom in July 1983 and July 1985. Silicoflagellates appeared only occasionally and always in very small quantities. On the average, the microplankton (total of all phytoplankton groups with cell diameter larger than 5 μ m) had the lowest cell density in February (2.7×10^4 cells.l⁻¹) and the highest in July (4.1×10^6 cells.l⁻¹). The μ -flagellates tended to have a minimum abundance in December (4.0×10^4 cells.l⁻¹) and a maximum in May (6.8×10^6 cells.l⁻¹). The number of species was by far more constant (average: 30 species per 10-ml sample). It did not display any pronounced seasonal trend or correlation with the number of individuals. Station S2 differs, as the phytoplankton density was at least one order of magnitude lower than it was at S1 (Table 1 and Fig. 1), with average values of microplankton and μ -flagellates 4.6×10^4 cells.l⁻¹ and 1.4×10^5 cells.l⁻¹, respectively. Also, the microplankton tended to have the normal seasonal cell variation, with a minimum in December-January and also in May, and a maximum in March. The abundance of μ -flagellates had a minimum in September and a maximum in spring months. Furthermore, the number of species displayed the usual trend of increasing with the number of individuals. The concentration of total dissolved inorganic nitrogen ON (nitrite, nitrate, ammonium) is higher at S1 (aver.: 2.94 μ M.l⁻¹) than at the S2 (aver.: 1.03 μ M.l⁻¹). Based on the species that were most important in abundance during the study period, five different assemblages were distinguished in phytoplankton community at station S1. The first assemblage, comprising the species *Coscinosira polychorda*, *Chaetoceros curvisetus*, *Thalassiosira rotula*, *Thalassiothrix mediterranea*, *Chaetoceros socialis* and *Chaetoceros didymus* was detected in December and February. From March to April, phytoplankton consisted of the species *Eucampia zodiacus*, *Scrippsiella trochoidea*, *Prorocentrum micans*, *Nitzschia seriata*, *C. curvisetus* and *Phalacrocoma pulchellum*. The third assemblage appeared in May-June and was made up of the algae *Gymnodinium* sp., *Leptocylindrus minimus*, *Nitzschia closterium*, *Leptocylindrus danicus* and *Skeletonema costatum*. In July 1983 and July 1985, a bloom of *Emiliana huxleyi* was observed, with densities of 2.1×10^6 cells.l⁻¹ and 3.1×10^6 cells.l⁻¹, constituting 70.5% and 76.4% of the whole microplankton population, respectively. By the end of August to November, phytoplankton mainly consisted of the species *N. closterium*, *L. minimus*, *Rhizosolenia fragilissima*, *C. curvisetus*, *Chaetoceros glandazii* and *E. huxleyi*. At station S2, for most of samplings, the species composition and succession resembled those at S1. Also, the variations in diversity were quite intensive at S1, where the lowest values were recorded during the Coccolithophore blooms, while at the outer station S2, the diversity values were relatively high, reaching values of 3.4 bits/indiv.

TAXONOMIC GROUP	STATION S1		STATION S2	
	RANGE	AVERAGE	RANGE	AVERAGE
DIATOMS	2.0×10^4 - 1.1×10^6	3.4×10^5	5.0×10^2 - 1.9×10^5	4.1×10^4
DINOFAGELLATES	1.8×10^3 - 3.8×10^5	1.0×10^5	2.0×10^2 - 1.4×10^4	3.8×10^3
COCCOLITHOPHORES	2.0×10^2 - 3.1×10^6	3.1×10^5	0 - 3.3×10^3	6.3×10^2
SILICOFLAGELLATES	0 - 1.2×10^3	1.2×10^2	0 - 1.0×10^3	1.4×10^2
MICROPLANKTON	2.7×10^4 - 4.1×10^6	7.6×10^5	8.0×10^2 - 2.0×10^5	4.6×10^4
μ -FLAGELLATES	4.0×10^4 - 6.8×10^6	1.4×10^6	4.8×10^3 - 4.7×10^5	1.4×10^5

Table 1. Ranges and average values of phytoplankton (cells.l⁻¹) at S1 and S2, from June 83 to Dec. 85.

In conclusion, the impact of human activity resulted in that the peak of microplankton abundance occurred in summer and not in March. Furthermore, pollution tended to reduce the number of species when the abundance soared, while, in natural conditions, the number of species increases with the number of individuals. In addition, *E. huxleyi* and *R. fragilissima*, predominating at S1, do not appear among the first five species at station S2, which presented about one tenth of diatoms and microplankton and about half the number of the species in comparison to S1, among which *N. closterium* and *L. danicus* predominated. This suggests that pollution causes the bloom of few species, which depend on the local conditions and are scanty in clean waters. The above mainly quantitative differences between the two stations, which are also qualitative in several cases, confirm the eutrophic character of the Elefsis area, but also the oligotrophic conditions which dominate at the western Saronikos. Similar results have been reported by MORAITOU-APOSTOLOPOULOU & IGNATIADES (1980), and PAGOU (1986) in similar studies of Saronikos Gulf.

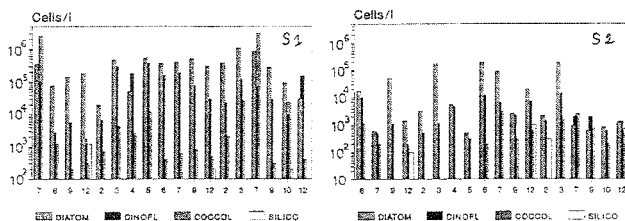


Fig. 1. Abundance variation of phytoplankton groups at the stations S1 and S2.

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