SEASONAL VARIABILITY OF CHLOROPHYLL *A* CONCENTRATION IN THE WATER COLUMN OF MALIA BAY (SOUTH AEGEAN SEA)

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In order to study the seasonal variability of the chlorophyll *a* concentrations in the water column of the coastal system in Crete, five sampling cruises of the "R/V Philia" were conducted in Malia bay in November 1992 and March, May, August and November 1993. Samples were collected at three transects (MX2, MX4, MX7) perpendicular to the coast line (Fig.1) each one including three stations (A, B and C) at depths of 10, 30 and 70 m respectively. The number of samples per station ranged from two at the 10 m depth stations (at 0 and 10 m from the sea surface), to four at the 30 m depth stations (0, 10, 20 and 30 m from the surface), and five at the 70 m depth stations (0, 10, 20 30 and 50 m from the surface). Water samples, collected by 5 l Niskin bottles, were filtered on board through Whatman CF/F filters which were subsequently stored at -20°C, and analysed for chlorophyll *a* and phaeopigments with a Turner fluorometer (YENTSCH and MENZEL, 1963). Analyses for nutrients concentration were performed after STRICKLAND and PARSONS (1972). The vertical profile of temperature, salinity and dissolved oxygen at each sampling station was obtained by means of CTD measurements. The results of the chlorophyll *a* analysis revealed rather high concentrations in March 1993 (Fig.2) which exceeded by 10 times those measured at the same stations in all other seasons. The maximal and minimal values recorded per month respectively were: 0.05-0.57 µg/l in November 1992, 0.90-4.90 µg/l in March 1993, 0.08-1.13 µg/l in May, 0.06-0.72 µg/l in August and 0.09-0.53 µg/l in November 1993. The same holds true for phaeopigments which showed a more or less similar pattern.

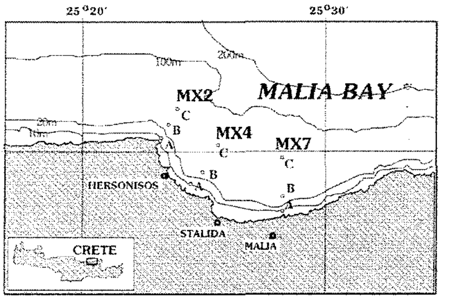

Fig. 1. Sampling stations in Malia Bay

As far as the vertical distribution is concerned, the highest concentrations during late spring and summer were found below the thermocline (30-40 m), while in November and March the distribution of phytoplankton in the water column was more or less uniform. In November 1993 however, the prolongation of the hot season resulted in a vertical distribution similar to that of the August. Phytoplankton biomasses seem to be influenced by the hydrodynamic pattern in the bay and the nutrients availability. The gradual development of the water stratification (late spring to autumn) inhibits photosynthesis due to nutrients depletion in the surface layer while during winter and early spring, mixing of the surface layers with deep, nutrients rich water masses, as well as the increase in precipitation influencing the coastal zone, form favourable conditions for the phytoplankton bloom. Figure 3 shows a considerably higher phosphate concentrations found in March at all depths. This is particularly important for Eastern Mediterranean marine ecosystems where phosphorus is a limiting factor for phytoplankton development.

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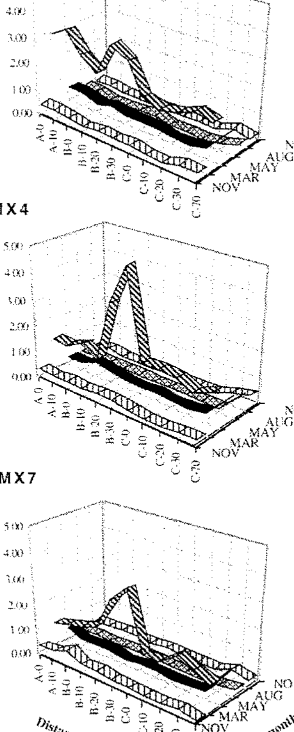

Fig. 2. Seasonal variability of chlorophyll a concentration in 3 transects, differents depths and distance from shore.

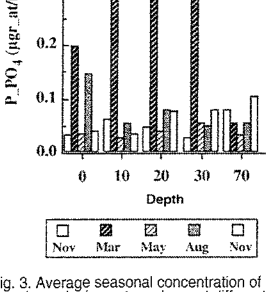

Fig. 3. Average seasonal concentration of phosphates in the water column at different depths.

STAGE STRUCTURE OF CHAETOGNATHS IN UPPER PELAGIC WATERS OF THE EASTERN MEDITERRANEAN IN AUTUMN 1991 AND SPRING 1992 (POEM - BC CRUISES)

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Within the framework of the International POEM-BC programme zooplankton, samples were collected by the Greek POEM-BC group in autumn (late October to early November) 1991 and in spring (late March to early April) 1992. Samples were taken with a WP-3 closing net (mouth area 1m^2, mesh size 200 µm) towed vertically from 300 m to the surface, from fourteen stations in Eastern Mediterranean upper pelagic waters, situated along three transects, A : Cretan Sea, B: Cretan Passage and C: Rhodes Sea (Fig.1). All chaetognath specimens were sorted from the samples and identified to species and stage of development using a modification of GHIRARDELLI's (1961) system (KEHAYIAS *et al.*, 1992). The purpose of this study was to investigate differences in the stage structure, as (%) occurence of each stage of development, for each species between the two sampling periods. The abundance of the total chaetognaths was almost the same in autumn and spring (103.4 n/100 m^3 and 110.6 n/100 m^3 respectively). The chaetognath community comprised eight species (KEHAYIAS *et al.*, 1993). In autumn, diurnal vertical migration was not detected in any of the species nor in their developmental stages (KEHAYIAS *et al.*, 1994), while in spring it was only detected in *Sagitta serratodentata atlantica*. No differences in the stage structure of the species were found in the Cretan Sea, Cretan Passage and Rhodes Sea for both sampling periods tested separately (Kruskal–Wallis test, $p > 0.05$), i.e. each species was at the same phase of its reproductive cycle in the overall sampling area. The computations were performed on stage proportions using the counts of each stage within each sample. Differences in the stage structure between the two seasons were observed in all species except *S. minima* and *S. lyra* (one way anova, $p < 0.05$).

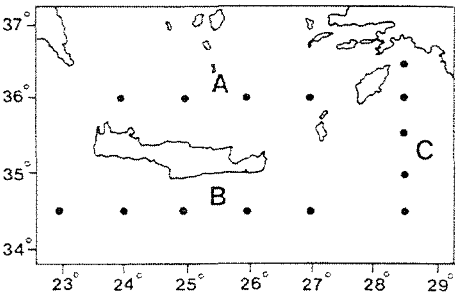

Fig. 1 Zooplankton sampling stations.

The epipelagic species *Sagitta serratodentata atlantica*, *S. bipunctata* and *S. minima* breed in autumn and spring; mature individuals were found in both seasons. For the former two species the same was found in Eastern Mediterranean neritic waters (KEHAYIAS *et al.*, 1992). The mesopelagic species *Krohnitta subtilis* and *S. hexaptera* breed in spring since mature individuals were found only in March–April, while for the remaining mesopelagic species *S. decipiens* and *S. lyra* mature specimens were not observed in our samples, possibly due to their deeper than 300m mode of distribution (KEHAYIAS *et al.*, 1994). Mature specimens were also not observed for the epipelagic *S. enflata* possibly due to its low abundance in our samples. Juvenile specimens (stage I) were observed in both seasons for all different species. This suggests that spawning may occur in autumn and spring while the sampling should be extended monthly since a year round spawning in subtropical waters of Eastern Mediterranean could be evident (ALVARINO, 1965; KEHAYIAS *et al.*, 1992). In general, the population of each species according to its stage structure showed a more mature phase of its reproductive cycle in spring rather than in autumn.

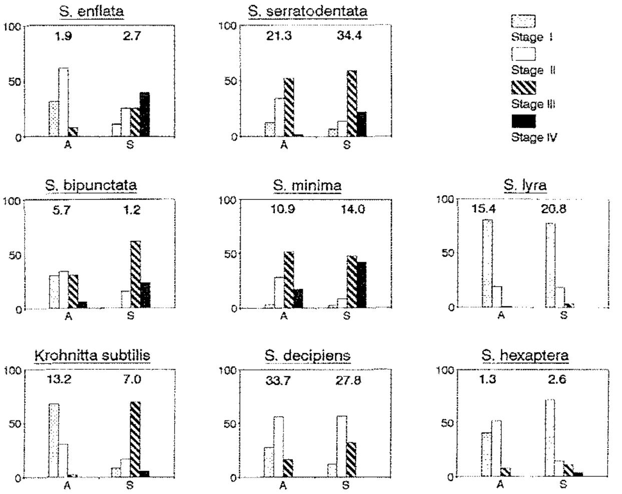

Fig. 2 Stage structure of eight chaetognath species (as % mean occurence of the different maturity stages of each species in Cretan Sea, Cretan Passage and Rhodes Sea) in autumn 1991 (A) and spring 1992 (S). Mean total abundance values (n/100m^3) are given for each species in each sampling period.

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