Phytoplankton blooming and zooplankton swarms in eutrophied zones of Aegean Sea (Izmir Bay) (1)

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The ecological importance of the phytoplankton blooming and zooplankton swarms have become little recognized in the Eastern Mediterranean and Aegean Seas. However, the effect of eutrophication on this events has been shown in the past decade (AUBERT et AUBERT, 1988; KORAY, 1990; STIRN, 1988), particularly on ciliated protozoans and micrometazoans (REVELANTE *et al.*, 1985) in the Mediterranean and Adriatic Seas. In the Eastern Aegean Sea and Izmir Bay which are under the effects of discharges of Izmir city, eutrophic increase in biomass of phyto-, protozooplankton and micrometazoans have been reported by JACQUES and SOURNIA (1980), KORAY (1988) and KORAY *et al.*, (1990).

The purposes of this study were to obtain an updated species list of blooming and/or swarming plankton for Eastern Aegean coasts and to quantify their basic ecological properties.

The samples which were evaluated in this study were collected from 1990 to 1992, with sampling concentrated in spring-summer with bi-weekly periods. Monthly or bi-monthly sampling was carried on during autumn and winter. Quantitative bottle and qualitative net samples were collected regularly. Species determinations were mainly realized with living specimens. However, formalin and lugol preserved material were used for enumeration of settled samples.

At the end of the observations, twenty nine species of marine plankton representing ten different classes were identified (Table I). Phytoplanktonic members of the list clearly showed a yearly succession and their total biomass increased from oligotrophic toward the eutrophic zones of the bay. During the pronounced and widespread blooms of dinoflagellates (*P. micans, N. scintillans, A. minutum, G. simplex, S. trochoidea*), seawater was strikingly discoloured red. Coccolithophorides, diatoms and euglenoids were also associated with different discoloration of seawater such as milky *(E. huxleyi)* or green (all the diatoms, euglenoids and prasinophytes).

The increases of tintinnid populations were closely related to the blooms of the same species of phytoplankton. Both *F. campanula* and *H. subulata* formed swarms during diatom *N. closterium* blooming in the inner eutrophied zone of the bay. The non-tintinnid ciliate *M. rubrum* exhibited its own characteristic periodicity and were observed during particular upwelling periods. The neustonic patches of the radiolarian *S. zanclea* were most pronounced in less eutrophied mixing zones. The swarms of the ctenophore *B. hydatina* were dependent on the wind direction during the late spring and were clearly associated with *N. scintillans*, also drifted by wind on the surface. However, a clear predator/prey relationship between the dinoflagellate and ctenophore could not be implied. The well-known grazers, *A. clausii, O. nana* and their nauplii, meta-nauplii formed huge swarms in the eutrophied zones of the bay in summer and middle autumn. The tintinnid *F. campanula* can compete efficiently with *A. clausii* and *O. nana* for similar phytoplanktonic food under eutrophied conditions. The planktonic swarms along the Eastern coasts of Aegean Sea and in Izmir Bay were mainly wind dependent when they located at surface waters and/or partly neustonic (e.g. *N. scintillans, S. zanclea* and *B. hydatina*). However, the gradual increase in phytoplankton, protozooplankton and micrometazoa blooms and/or swarms is probably related to the eutrophication, availability of nutrients and food size ot the prey crop.

Table I : Blooming and/or swarming species of plankton of the Eastern coast of Aegean Sea and in Izmir Bay during the years 1990-1991.

Species	Date (Months) 1990	1991	Temp. (°C)	Sal. (‰)
DINOPHYCEAE				
Alexandrium minutum	4,5	4	15.5-19.4	37.63-38.00
Gonyaulax polyedra	4,5	-	16.3-18.6	37.56-37.93
Gymnodinium simplex	3,4,5	4,6	15.5-16.3	37.51
Gyrodinium spirale	4,5	4	15.5-16.5	37.03-37.85
Noctiluca scintillans	3,4,5,6	3,4,5,6	15.5-20.8	37.51-39.25
Oxytoxum scolopax	4,5,6	4	15.5-25.6	37.63
Prorocentrum micans	2,3,4,5,6	4	10.2-25.6	36.20-39.25
P. minimum	3,4,5	-	15.5-22.3	37.56-38.28
P. triestinum	4,5,6	4,6	15.5-25.6	37.60-39.25
Protoperidinium steinii	4,5	4	15.5-22.6	37.63-38.05
Scripsiella trochoidea	3,4,5	4	15.5-22.6	37.51-38.00
PRYMNESIOPHYCEAE				
Emiliania huxleyi	5,6	5,6	22.5-25.6	36.88-37.60
CHRYSOPHYCEAE				
Bicoeca mediterranea	5,6	5,6	18.0-25.6	36.88-37.35
BACILLARIOPHYCEAE				
Nitzschia closterium	3,4,5	4,5	15.5-22.3	37.51-38.27
N. pungens	4,5	4,5	15.5-22.3	37.63-38.00
Thalassiosira allenii	5,6	4,5,6	18.0-25.6	36.88-37.43
T. anguste-lineata	3,4,5	4	15.5-22.3	37.51-38.05
EUGLENOPHYCEAE				
Eutreptiella cf. lanowii	6,7	-	18.0-22.3	36.88-37.43
E. gymnastica	5,6,7	4,6	15.5-22.3	36.88-37.05
PRASINOPHYCEAE				
Pyramimonas propulsum	5	5	20.8-21.0	36.00
RADIOLARIA				
Sticholonche zanclea	3,4	3,4	15.5-18.2	37.27-38.2
CILIATA				
Favella campanula	5,7	-	18.0-22.3	38.66
Helicostomella subulata	3	4,5	13.7	37.51-37.82
Tintinnopsis cylindrica	4	-	16.3	37.6
Mesodinium rubrum	4,10	4,10	15.5-20.2	37.4
CTENOPHORA				
Bolina hydatina	5,6	5,6	20.0-22.9	36.82-36.86
CRUSTACEA				
Acartia clausi	7,9	7,9	21.9-26.5	37.62-38.96
Centropages kröyeri	9	9	23.6	38.80
Oithona nana	7,9	7,9	21.9-26.5	37.62-37.96

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