POTENTIALLY TOXIC PHYTOPLANKTON SPECIES AND ITS RELATIONSHIP WITH THE ENVIRONMENTAL FACTORS IN THE GEMLIK GULF (MARMARA SEA, TURKEY)

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Abstract
This study was carried on the toxic phytoplankton species and its relationship with the environmental variables in the Gemlik Gulf. The toxic phytoplankton assemblages related to environmental factors were investigated monthly at totally 5 stations and 7 different depths (0.5-50 m) between June 2010 and May 2011. The surface nutrient concentrations increased especially at the stations located inside of the gulf. The limiting effect of silicate for diatoms was observed in early, mid-summer and early winter periods while the nitrogen is the limiting nutrient in the gulf during the whole sampling periods.

Keywords: Phytoplankton, Marmara Sea

Excessive growth of phytoplankton which is called as "red tides" and "harmful algal bloom" (HAB) in a particular marine habitat is seasonally observed as population blooms in relation to environmental variables such as water temperature, nutrient availability, etc. The Gemlik Gulf is located in the south-eastern part of the Marmara Sea which is occupied by two distinctly different water masses; Black Sea originated upper layer (10-15 m thick, 22-26 psu) and Mediterranean originated deeper layer (38.5-38.6 psu) which are separated from the former by a sharp interface (pycnocline) about 10-20 m thick [1] (Fig.1).

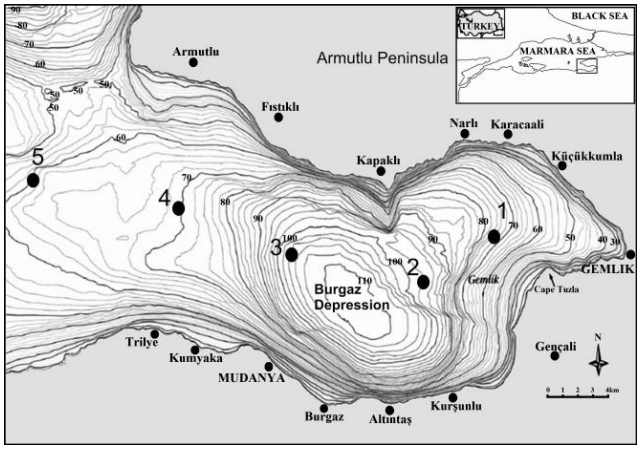

Fig. 1. Sampling stations in the Gemlik Gulf, Marmara Sea (bathymetric map by Kusçu et al. [2].

Twenty-one potentially toxic phytoplankton species were detected at the samples collected between June 2010 and May 2011 from 5 stations at the gulf. There are two highest potentially toxic phytoplankton abundances which were recorded as 233600 cell/L (*Prorocentrum micans*) and 73600 cell/L(*Pseudo-nitzschia pungens*) in the study. Canonical Correspondence Analysis (CCA) was computed in order to relate the change in potentially toxic phytoplankton species with environmental variability (Fig. 2).

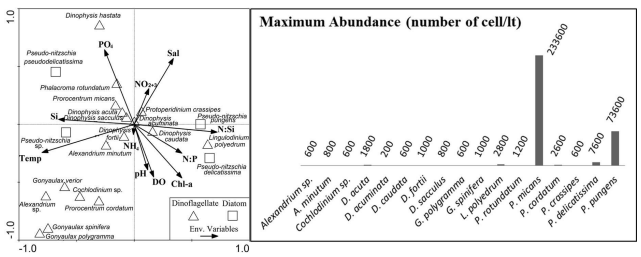

Fig. 2. Ordination of canonical correspondence analysis (CCA) of potentially toxic phytoplankton species in relation to the environmental variables (1) and its abundance (2).

The distribution pattern of the potentially toxic species indicated that most of species favored in high temperature (Temp), salinity, (Sal) PO_4-P, N:Si, SiO4-Si, N:P, Chlorophyll a (Chl-a), and Dissolved Oxygen (DO)i while favored in low pH, NO_{2+3}-N and NH_4 in the diagram. *D. hastata* and *P. rotundata* among dinoflagellates were highly associated with PO_4-P. *Pseudo-nitzschia* sp. *P. pseudodelicatissima* was associated with SiO_4-Si availability, while *P. pungens* with N:Si ratio. Dinoflagellates that belong to the genera Dinophysis spp. were scattered around the center of the CCA diagram. Balkis and Aktan [3] recorded 11 toxic phytoplankton species in the Sea of Marmara. Tas and Yilmaz [4] reported potentially 23 harmful and/or bloom-forming microalgae (14 dinoflagellates, 4 diatoms) and of which nine taxa have been confirmed to be toxic elsewhere in the world in the Golden Horn, a eutrophic estuary in the Sea of Marmara (Turkey). In the resent study [5] which carried on resting dinoflagellate cyst in the Gemlik Gulf, it was reported that the cyst abundance of potentially toxic dinoflagellates (74%–92% of total cysts cm^3) was higher than nontoxic species. The locally small patches of visible red tide events were detected especially in the gulf, although the phytoplankton bloom had not been observed. The current study which represented the presence of the toxic phytoplankton species could be used as reference for determining the changes that may occur in the region in future.

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