# AN ASSESSMENT OF THE STATE OF MARINE ECOSYSTEMS AROUND TURKEY DURING SESAME (BLACK SEA, TURKISH STRAITS SYSTEM AND THE LEVANTINE BASIN)

Z. Uysal [1], S. Tugrul [1], N. Yücel [1], F. Sert [1], A. Gazihan [1], Y. Ak örek [1], T. Terbiyik [1], H. Örek [1] and E. Özsoy [1]*
[1] Institute of Marine Sciences, METU - ozsoy@ims.metu.edu.tr

## Abstract

Deeply contrasting coastal / open ocean ecosystems have been investigated in the April and October 2008 cruises of the R/V BILIM during the SESAME project, covering the Cilician Basin, a north-south transect of the Levantine Basin, the Aegean coast of Turkey, the Turkish Straits System (TSS), and finally a transect arching over the mid-section of the Black Sea starting from the Bosphorus and extending east. Earlier work in April 2007 in the Turkish Straits and a repeated earlier cruises in the Cilician Basin since 2005 have provided additional data. Physical, chemical and biological oceanographic measurements and satellite data provide a basic description of the state of the different ecosystems, ranging from oligotrophic open waters to eutrophicated coastal / shelf areas supplied with water and nutrients from the large rivers.

*Keywords: Circulation, Straits And Channels*

The Black Sea, a land-locked deep basin occupied with brackish waters, possesses distinctly different biochemical properties due to the presence of oxygenated in the upper layer and sulfide-bearing waters below a depth of 100-150 m and a transition zone in between (1). Comparison of the new and historical data sets indicates long-term changes in Black Sea upper layer chemistry. In this period, the nitrate stock of the upper layer has increased by 2-3 times as silicate stock displayed an opposite trend in the upper layer down to onoxic intreface since the 60's [2-3]. Thus, nitrate/silicate ratio decreased drastically in the upper layer throughout the basin [4]. However, there has been a slow increasing trend in the surface silicate values in the last decade, suggesting progressive changes in the Black Sea ecosystem. The suboxic zone, having distict chemical features, remained enlarged since 80's. Present results demonstrate that regionally variable vertical features of nutrients and dissolved oxygen remained similar in the western cyclonic gyre since 80's. However, lateral intrusion of oxygenated and nutient rich Bosphorus plume into the intermediate depths of SW shelf zone appears to modify basic features that appear in the westen cyclone. Depth integrated primary production rates ranged between 16 and 45 mgC.m-2h-1 in the eastern and western Black Sea stations in April and September 2008. A highly significant correlation exists (P = 0.001 n = 59 r= 0.59) between total chlorophyll and primary production rates. In-situ chlorophyll values were higher in spring than in fall. Concentrations ranged between up to 5 µg/L in spring-08, and 1.6 µg/L in autumn-08.

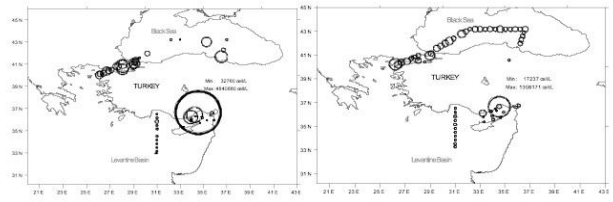


Fig. 1. Surface distribution of phytoplankton abundance (cells/l) in April and September 2008

In the Cilician basin of NE mediterranean, river discharges with large nutrient loads make eutrophic nearshorewaters of Mersin Bay. Upper layer of the Levantine Sea are depleted in nitrate and phosphate during the year, excluding the Rhodes cyclonic gyre in winter months. Nitrate/PO4 molar ratio has remained almost constant at levels of 25-28 during the last two decades, implying P-limited primary productivity in the euphotic zone as experienced in recent studies in the region. However, present POM data show that C/N ratio in the oligotrphic sea is very similar to the classical Redfield ratio, but lower than the those estimated for the more productive Black Sea ecosyetm during SESAME surveys. Primary Production (PP) rates ranged from 3.5 in the offshore to 40 mgC.m-2h-1 in nearshore waters of Mersin Bay enriched by river and domestic discharges. Phytoplankters were found overhelmingly abundant in shallow shelf waters under direct influence of river discharges in the Cilician basin and least in highly oligotrophic offshore waters in the Levantine basin. The mesozooplankton biomass and abundance decreased with inceasing depth (down to 200 m) in the Levantine Basin during study periods.

With the onset of stratification in fall, bacteria dominated the upper layers more efficiently compared to the spring period.

In the two-layer Marmara Sea ecosystem, the productive upper layer water is depleted in nitrate and phosphate; however, an enrichment is recorded in the Marmara-Bosphorus Junction due to intensive mixing of counterflows with different nutrient properties. Therefore, the euphotic zone is more productive and has higher algal biomass and POM than Black Sea open waters. Its lower layer are hypoxic levels of DO (between 30-100 µM), enriched in nutrients but with much lower N/P ratios (8-10) than in the oxygenated NE Mediterranean deep layer, due to denitrification in oxygen-depleted bottom waters of Marmara basin. Peak values of chlorophyll were measured in the Sea of Marmara. Phytoplankton standing stock reflections from the Sea of Marmara and the Black Sea were also significantly high.

Maximum heterotrophic bacterial and cyanobacterial abundance and biomass were observed in the sea of Marmara during fall with values ranging between 2.6x10^6 cells/ml and 14.4 µgC/l for heterotrophic bacteria and 2.1x10^5 cells/ml and 25.3 µgC/l for cyanobacteria. In contrast lowest levels were attained during fall in the Levantine Basin with values ranging between 1.5x10^2 cells/ml and 0.02 µgC/l for heterotrophic bacteria and 1.5x10^2 cells/ml and 0.02 µgC/l for cyanobacteria. Sea of Marmara held the highest bacterial population in both seasons and it was followed by the Black Sea and the Eastern Mediterranean. Both the surface bacterial and cyanobacterial abundance and biomass averages peaked in fall compared to spring at all regions except the apparent decrease in heterotrophic bacterial abundance and biomass in the sea of Marmara.

## References

1 - Sorokin Yu. I., 1983. The Black Sea. In: Estuaries and Enclosed Seas. Ecosystem of the World, B. H. Ketchum, editor. Elsevier, Amsterdam, pp. 253-291.

2 - Tugrul, S., Bastürk, Ö., Saydam, C. and Yilmaz, A., 1992. Changes in the hydrochemistry of the Black Sea inferred from water density profiles. *Nature*, 359: 137-139.

3 - Konovalov S. K. and Murray J. W., 2001. Variations in the chemistry of the Black Sea on a time scale of decades (1960-1995). *Journal of Marine Systems*, 31: 217-243.