An Observation on the Occurence of Near-Anoxia Conditions in the Sea of Marmara

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The Sea of Marmara is a relatively small, inter-continental basin with a surface area of 11,500 km^2 and a volume of 3378 km^3 (Özsoy, *et al.*, 1986). It shows a transitory character between two semi-enclosed basins, the Black Sea and the Aegean Sea (Figure 1). The existence of less saline (22-24 ppt) Black Sea origin waters over the more saline (38.5 ppt) Mediterranean origin waters forms a strong salinity stratification at about 30m. Subhalocline waters of the Sea of Marmara recieve particulate organic matter, not only trough its own primary production, but also particulate organic matter originated from Black Sea and waste discharges around the İstanbul Metropolitan Area.

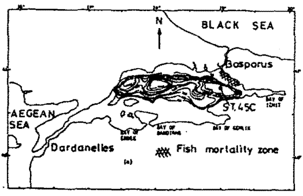

Figure 1. The Bathmetry of the Sea of Marmara (depths in meters) and location of Sta.45C

The stability of the halocline is further increased by thermal stratification developed during summer. The existence of a strong pycnocline prevents aeration of sub-halocline layer. The only possible route for the reaeration of subhalocline layer of the Sea of Marmara is the influx of oxygen rich waters through the Dardanelles lower layer flow. However, oxygen influx by this route is not sufficient to compensate the utilizations by sinking particulate organic matter from euphotic zone, thus the deep basins of the Sea of Marmara contain water with highly depleted oxygen content (1.0-1.5 mg O_2/l). Partial reaeration of the subhalocline waters by wind-induced vertical mixing was observed during late winter of

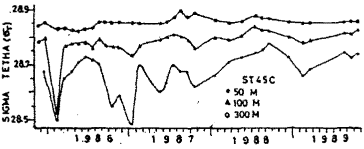

Figure 2. Time-variation of σ_T at Sta.45C for Nov.,1985-Oct., 1989 period

1986 and early spring of 1987 (Figure 2). However, a similar mixing was not seen during 1988-1989, probably due to a milder winter. Increased influx of relatively dense waters of Mediterranean origin (Fig.2) into deep basin of the Marmara during the summer of 1987 increased the stability. This, in turn, increased the AOU (Appearant Oxygen Utilization) levels of sub-halocline waters from about 5.0-5.5 mg O_2/l in 1986 to 6.0-6.5 mg O_2/l in mid-summer of 1987; the AOU, thereafter, increased gradually up to 7.0 mg

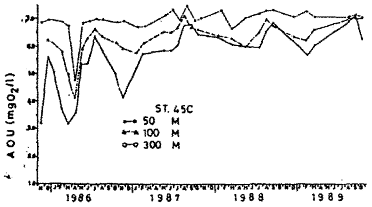

Figure 3. Time-variation of AOU at Sta.45C for Nov.,1985-Oct., 1989 period

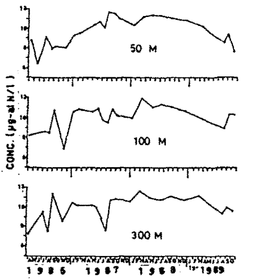

Figure 4. Time-variation of TO_xN at Sta.45C for April,1986-Oct., 1989 period

O_2/l in 1989 (Figure 3). A parallel increase was observed in the level of total oxidized nitrogen ($TO_xN=NO_3+NO_2$) which increased gradually to 11 µM through mid 1988 (Figure 4) and then indicated a decrease towards the end of the year, during which the AOU levels continued to increase. Increased oxygen depletion within the sub-halocline waters and episodic strong northeasterly winds in August, 1989 moved the interface upwards. The oxygen below the halocline was 0.3 mg/l. Mass mortalities of benthic and demersal fish in the region adjacent to the Anatolian coast of the BMJ region (Fig.1) were recorded following the observation.

REFERENCES

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