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A preliminary study on the pollutional qualities of the Aegean deltaic zones of some Turkish Rivers*

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Study areas take place at the eastern coast of the Aegean Sea (Figure a) on the Turkish territorial waters. Study period covers the years 1983-1987 with regular seasonal visits to the river mouths and a number of marine stations located nearby Study cruises are carried out by R/V K.Piri Reis ship of the Institute. During the study visits standard oceanographic parameters such as salinity, temperature, dissolved oxygen, conductivity, pH, turbidity, redox potential recordings with depth are automatically recorded. A simultaneous sampling program is carried out with due care to precondition and preserve the aliquots as necessary. After the analytical results are obtained they are statistically treated to get the seasonal averages. Oil slicks and floatable material observations are made whenever possible. Study conditions such as meteorological factors during the sampling and in situ measurements are also recorded.

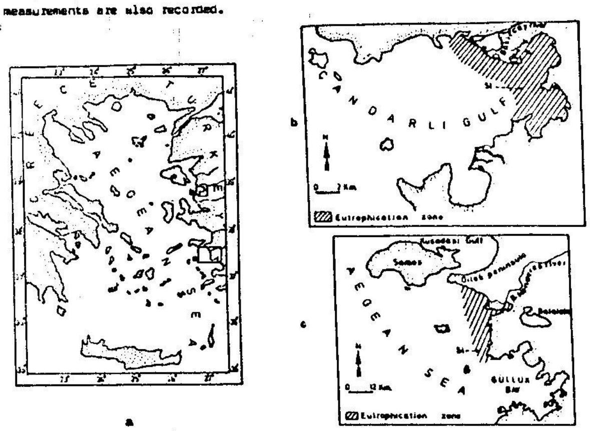

Figure a) Location map of the study areas, b) Deltaic zone of Bakırçay River
c) Deltaic zone of Büyük Menderes River

The study zones are shown in Figure b and c. Data generated from these two zones are treated wor discussion here by using the averaged values over 20 stations in Çandarlı (Fig.b) and 15 stations in B.Menderes delta (Fig.a). In Çandarlı the studyarea is wider than 20 in fact, there are 45 stations to cover all of the Bay. But the shaded area which covers the high eutrophication zone (shaded in figure) includes 20 stations only. In both figures b and c shaded eutrofied zones exhibit chlorophyl a concentrations of more than 1 mg/l in summer periods.

Study areas / Characteristics	ÇANDARLI BAY (Bakırçay River)	BÜYÜK MENDERES River
River (incl. seasonal variability)		
Flow rate, m3/sec	0.5 - 50	1 - 50
BOD5, tons/day	0.03 - 13.5	35
TSS, tons/day	0.3 - 764	5 - 450
Chlorophyl a, mg/l	4.60 - 13.02	-
Total Inorganic Nitrogen, tons/day	1 - 3	0.1 - 40
Sea (surface waters)		
Temperature, C	16.50 - 17.10	15.50 - 25.00
Salinity, ‰	38.60 - 38.70	36.00 - 39.60
Conductivity, mmho (avg)	47	48.5
Turbidity, TU	88.3 - 95.0	82.0 (avg)
Redox potential, mV	266 - 380	383 (avg)
Dissolved oxygen, mg/l	7.2 - 8.2	6.2 - 8.2
pH	8.50 - 8.70	7.92 - 8.50
Total Inorganic Nitrogen, mg/l	0.66 - 2.22	0.121 - 1.403
Total phosphorus, mg/l	0.016 - 0.159	0.012 - 0.450
Chlorophyl a mg/l	2.87 ∓ 0.82	0.10 - 1.38
Fecal coliforms per 100 ml	6 ∓ 5 (autumn)	0 - 53
Total petroleum mg/l	0.35 - 6.48	1.36 (avg)

Table 1 summarizes the river characteristics as well as the monitored sea water (surface) parameters. These quantities indicate that both zones have higher chlorophyl a values in comparison to the other zones at the Aegean Sea. According to the most recent measurements in summer 1987 which will be published soon, these values are in the range of 0.0145 to 1.0088 mg/l of pigment concentrations. This contrast is attributable to better nutritional conditions in the study regions. This conclusion is in parallel with the appreciably high total inorganic nitrogen, total orthophosphate phosphorus and turbidity values in these regions. These nutritional factors show rather sharp seasonal changes at the same stations which might be related with the seasonal changes in river water carry over of these substances and probably the discharging of surface runoff from the land. These seasonal variability has been notable during this study covering the period of 1983-1987.

* This presentation has been summarized from the final reports of two scientific projects [illegible] TUR/8-H and TUR/9-K being carried out by the Institute.

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Decline in tar pollution in the Mediterranean Sea

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The Mediterranean Sea is considered to be one of the most tar polluted seas in in the world. Horn et al. (1970) reported concentrations of floating tar of up to 500,000 $\mu g/m^2$ in the Ionian Sea in 1969, and Golik (1982) reported on values of beach-stranded tar of up to 14 kg per frontal meter of beach in Israel in 1975. The reason for this high concentration of tar in the Mediterranean Sea was attributed to the fact that the Mediterranean is a land-locked sea, limited in its water exchange with other oceans. Though covering only 0.82% of the world ocean area, 21.4% of the global oil transport was carried on that sea in 1985.

In a recent investigation which was carried out in August-September 1987, by vessels and personnel from Cyprus, Germany, Israel and Turkey, pelagic tar was sampled from the surface water by means of neuston nets at 101 stations in the Mediterranean. Of these, 93 stations were east of the Straits of Sicily and 8 west of it. The distribution of the tar content indicates that the most tar contaminated areas in the Mediterranean are in the northeast between Cyprus and Turkey and in the Gulf of Sirte off the coast of Libya, where the mean tar content was 1847 and 6859 $\mu g/m^2$, respectively. The least polluted areas were the southwestern Mediterranean and the northern Ionian Sea as far east as halfway between Crete and Cyprus, with mean tar concentrations of 236 and 154 $\mu g/m^2$, respectively. Intermediate mean values of 1347 and 876 $\mu g/m^2$ were found in the Levantine Basin west and south of Cyprus, respectively.

With a few exceptions of coastal waters, pelagic tar was never measured in the eastern Mediterranean, so it is impossible to compare directly these findings to the past. However, several studies on tar pollution were conducted in the western and central Mediterranean in the past. A comparison between pelagic tar data collected in 1969 by Horn et al. (1970), in 1974 by Morris et al. (1975) and our data shows a sharp decline in tar concentration with time:

year	1969	1974	1987
mean tar concentration ($\mu g/m^2$)	37,000	9,700	1,175

A rank sum test which was conducted on the 1974 and 1987 data yielded $p<0.001$, indicating that there is a significant difference between the two. As the difference between the old and new data is so sharp, it is reasonable to assume that it represents a difference in time and not in space. These results agree with other investigations which show that during the last decade a significant reduction in tar pollution occurred at some of the Mediterranean coastlines such as that of Paphos, Cyprus, where beach-stranded tar quantity declined from a mean of 268 g/m^2 in 1976-1978 (UNEP, 1980) to 67 g/m^2 in 1983 (Demetropoulos, 1985). A similar reduction in tar quantity on the beach was found in Israel: 3625 g/m in 1975-76 (Golik, 1982) in comparison to 12 g/m in 1984 (Golik,1985). Image processing of air photographs from the Israeli coastline also shows a continuous decline in tar quantity between 1975 and 1985 (Golik and Rosenberg, 1987).

From the data at hand, it is proposed that the sharp decline during the last decade in the activity of most of the oil terminals in Israel, Lebanon and Syria in the eastern coast of the Mediterranean has caused a reduction in tar pollution in the Levantine Basin. The construction of an oil terminal in Iskenderun Bay, Turkey, and its increasing activity of oil loading from 14 million tons/year in 1977 to 75 million tons/year in 1987 caused concentration of tar pollution in that part of the Mediterranean Sea. In the same way, high tar pollution is found in the Gulf of Sirte off Libya, where oil loading is very active. However, except for local foci of tar pollution, the Mediterranean Sea as a whole has undergone a process of reduction in its tar pollution. The reasons for that must be the adoption of international conventions on prevention of oil pollution in the Mediterranean, the harsh steps undertaken by various Mediterranean countries to administer anti pollution laws, the technological developments in the shipping industry that reduce oil leakage, and the installation of coastal facilities for reception of oil wastes.

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