

## Heavy metal pollution in the Damietta Estuary of the Nile

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At the downstream of the Damietta branch, Faraskour's Dam was constructed separating it from the Damietta Estuary, which receives very small amounts of the Nile water. The average depth of the Damietta Estuary is 7 m and its width at the mouth does not exceed 200 m. The water quality of this Estuary was deteriorated due to pollution, mainly from sewage and industrial wastes. The present study deals with regional and seasonal variations of heavy metals in the Damietta Estuary to illustrate the impact of man on this water body. Water sampling was carried out seasonally during 1979-80 from the surface, middle and bottom waters at five selected stations.

Suspended matter (SM), ranging from 2.3-110.4 mg/l, showed irregular vertical variations. The surface increase in SM content resulted from settling of air-born dust. The bottom increase, however, coincided mainly with stirring up of the sediments by water currents. Such increase was matched with the corresponding increase in the bottom values of particulate heavy metals. The maximum regional average SM value was found at location directly affected by pollution, where dissolved and particulate metals gave maximum or markedly high average concentrations. The maximum seasonal average SM value in winter reflects the effect of strong wind in stirring up the sediments and rainfall in increasing land runoff (ABBAS, 1980). This highest SM content increased obviously the values of particulate metals, giving maxima or markedly high seasonal averages (Table 1).

The concentrations of iron varied widely from 2.16-46.55 µg/l for dissolved form and from 1.80-406.8 µg/l for particulate form. The increase in the bottom dissolved iron coincided possibly with the increase in the rate of its release from sediments (SANDERS, 1970). Manganese concentrations varied considerably from 0.24-313.3 µg/l for dissolved form and from 1.6-191.1 µg/l for particulate form. Contrary to iron, the seasonal distribution of dissolved manganese reflects the role of phytoplankton uptake (Table 1). However, different pollutants could be considered as main sources for iron.

Copper concentrations varied markedly from 0.25-34.38 µg/l for dissolved form and from 0.56-52.1 µg/l for particulate form. The minimum seasonal average value of dissolved copper in December was matched with the maximum seasonal average value of particulate copper (Table 1). These extremes in December were correlated with the increase in pH values (ABDEL-MOATI, 1981). The values of zinc varied markedly from 1.68-91.88 µg/l for dissolved form and from 2.8-102.2 µg/l for particulate form. The increase in the bottom values of dissolved zinc may be attributed to sediment-water exchange of this metal (SONNEN, 1965). The highest regional average value of dissolved zinc matched with the lowest regional average value of particulate zinc was found at location, where reducing conditions prevailed (ABDEL-MOATI, 1981). Cadmium concentrations varied noticeably from 0.03-0.24 µg/l for dissolved form and from 0.04-1.93 µg/l for particulate form. The seasonal distribution of particulate cadmium was correlated with that of SM (Table 1). The increase in the mean values of SM and heavy metals calculated for the Damietta Estuary compared with the corresponding means of the comparatively clean Damietta branch reflects the influence of pollutants dumped in this Estuary.

		March 1	June 9	Sep. 7	Dec. 9	March 1980
SM		11.1	10.5	9.5	25.0	9.5
Fe	D	11.10	11.02	9.27	7.87	6.15
	P	183.2	96.4	106.0	147.2	109.7
Mn	D	16.36	8.64	23.27	55.14	14.6
	P	69.4	22.6	54.6	28.9	16.3
Cu	D	3.64	3.56	3.04	2.23	4.31
	P	8.5	9.2	8.5	11.8	10.3
Zn	D	17.24	6.87	14.99	15.39	13.35
	P	18.2	16.1	21.4	24.4	15.6
Cd	D	0.04	1.14	1.80	1.22	1.08
	P	0.26	0.19	0.16	0.36	0.16

D = Dissolved                      P = Particulate

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Table 1. Variations of the seasonal averages of SM (mg/l), dissolved and particulate heavy metals (µg/l) in the Damietta Estuary of the Nile