TEXTURAL AND COMPOSITIONAL CHARACTERISTICS OF SUSPENDED MATTER IN THE LIGNANO BASIN (MARANO LAGOON, NORTHERN ADRIATIC SEA)

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The aim of this study is the evaluation of the mean characteristics of the suspended matter of the Lignano basin (surface: 40 km^2; mean depth: 0.8 m), in the Marano Lagoon (Northern Adriatic Sea). Nine stations were sampled four times during 1991-1992 (October, February, April and July) along the channels of the basin, at lagoon inlet and at the Stella River mouth, which is the main spring-river, tributary of the lagoon (annual average discharge: 34 m^3/s). Surface and bottom samples were taken with a Niskin bottle, twice a day, during flood and ebb in spring tides without wind conditions.Temperature, salinity (CTD probe) and current speed measurements (NBA curremtmeter)were also collected.

The main parameters like total suspended matter (TSM), total carbonates andparticulate organic carbon (POC), C/N ratio, 5th percentile, modal and mean diameter are here presented. It was established their most frequent values so as their exceptional ones, showing the differences among the various lagoon environments: the basin, the inlet and the mouth of the Stella River.

For almost all the parameters a sistematic difference between the surface and the bottom was observed: concentration, mean diameter and carbonate percent values observed at surface are generally lower than those at the bottom. Likewise at the lagoon inlet (FANZUTTI *et al.*, 1992), this difference could be explained by the selective sedimentation within the water column of lagoon channels.

By observing the TSM frequency distribution, it can be established that the most frequent values are included in the band between 4 and 10 mg/dm^3 for the lagoon basin, those between 12 and 30 mg/dm^3 become less frequent, and those above 30mg/dm^3 should be considerated unusual. The last ones can be found mostly insurface during February and along the water column during July.

At each sampling, it was observed that the mean concentration values in the inlet are usually lower than those measured in the lagoon basin, whereas in the spring-river water values are similar to those of the lagoon. The only exception appears in October when the Stella River discharge was higher than the annual average and when at the inlet the resuspension phenomena due to the sea state areverified.

The frequency distribution of the POC in the lagoon basin shows a modal interval between 250 and 1000 µg/dm^3. Values lower than 250 µg/dm^3 are not found. The frequency of values higher than 1000 µg/dm^3 tend to decrease roughly, and likewise it is observed for the TSM, very high values at surface during February and along the water column during July are observed. At each sampling the lagoon inlet showed values equal or lower than those observed in the lagoon, while Stella River mouth (in normally discharge conditions) presents organic carbon values lower than those of the lagoon. In the lagoon, modal C/N ratio values range between 8 and 10.

The mean percent values of detrital carbonates in the basin are between 31.6% and 39.5%, while the range in the inlet is widely (29.5% in February and 42.5% inJuly). In the mouth of the Stella River the carbonate contents are slightly superior to those of the lagoon basin.

In the lagoon basin, the frequency distribution of grain-size parameters has allowed to establish that the most frequent values of the mean diameter are between 8 and 12 µm. As far as the modal diameter is concerned, values range from 10 to 12 µm, whereas for the 5th coarse percentile between 24 and 26 µm. Among all theseparameters, the mean diameter is the one that permits to differentiate the various environments. During ebb tide, the mean diameter in the inlet are higher with respect to the basin one, while during the flood the opposite phenomenon is observed.

The particulate matter brought from the Stella River is coarser (10 to 14 µm) than the lagoon one. This phenomenon is more evident in October sampling when the annual mean discharge was exceeded. Whether for the characteristics of the suspended matter or for the salinity distribution, the diffusion of the "plume" within the lagoon seems to be limited to a distance of about 2 km from the mouth (BELLI *et al.*, 1994).

BRAMBATI *et al.* (1990) recognized that a resuspension forced by the wind is one of the factors that mostly change the patterns of the TSM concentration in the Lignano basin. Since the data here presented are not influenced by wind resuspension, it was possible to indicate normal values during spring tides, while the exceptional values could be attributed to others phenomena below mentioned.

Anomalous values of POC found in February should be attributed to organic debris, as confirmed by the high values of C/N ratio and the low values of chlorophyll (FONDA UMANI, personal communication). The accumulation of organic debris within the basin could be due to the flood, typical of the late autumn season and to the degradation of the macro-algae that colonize the tidal flat. Its drastical removal is caused by the maximum (equinoctional) February tide excursions when wide zones of tidal flat emerge. The high concentrations of TSM found in July should be related to the resuspension caused by an intensive traffic of boats, which highly increases during the summer time in the resort area of Lignano.

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PHYSICO-CHEMICAL FEATURES AND NUTRIENTS DISTRIBUTION IN THE MARSALA LAGOON (ITALY)

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The Marsala lagoon (Stagnone di Marsala) extends over 20 km^2 along the western coast of Sicily. The average depth is about 1 m, the northern part is shallower (< 0.5 m) whereas the southern part reaches depths of more than three meters. Two mouths on the west and northern sides, wide 2.5 km and 0.4 km respectively, connect the lagoon to the sea. No river flows directly into the lagoon, whose waters are saline or hyperaline. Salt production basins are active along the eastern shore of the central part. The biocenosis of the lagoon are mostly those typical of marine environments and present some peculiarities as free-living forms of phyto- and zoobenthic species and sponge gigantism (CORRIERO, 1989). Water circulation driven by winds and tides acts in the north-south direction slowing down in the corridor between the three major islets and Isola Grande favored by the *Posidonia oceanica* mattes (RIGGIO *et al.*, 1983). Two surveys were carried out during May 1991 and February 1992. Temperature and salinity ranged from: 12.51°C and 35.87 PSU in February, to 21.67°C and 41.98 PSU, in May. The formation of a dense water core ($\gamma t > 29$ kg m^{-3}) in the central part of the lagoon during the spring survey was evident. The lagoon can be divided in three different parts on the basis of the temperature and salinity seasonal variations (considering our data and the former studies of CALVO *et al.*, 1986 and of CORRIERO *et al.*, 1989): a southern part with the lowest temperature and salinity variation, due to a high exchange with the sea, a central part where the highest temperature and salinity variations take place, due to a less intense water mass circulation and to the high evaporation during spring and summer and freshwater runoff during rain periods (limited to the east side); and a northern part subject to occasional riverine inputs and exchanges with the sea through the northern mouth. The differences in the physico-chemical features reflects on the biocenosis distributions, *Posidonia oceanica* is absent in the northern and central east part; the sponges which are abundant in the southern and central part are almost absent in the northern part (CEFALI & ANDALORO, 1979). The oligotrophy of the lagoon was confirmed during the February and May surveys but an increase of ammonium and chlorophyll *a* concentrations (up to 2-3 mg m-3) and oxygen oversaturation was observed mainly near the northern mouth of the lagoon (fig. 1). The nutrients concentrations are summarized in table 1. Dissolved inorganic nitrogen (DIN) constitutes about half of total dissolved nitrogen and ammonium constitutes 56% (in February) and 68 % (in May) of DIN. Ammonium concentrations resulted more elevated in February in the northern part near the acquaculture plant water discharges whereas elevated silicates, nitrates and nitrites were found in the central part in connection with minimum salinities values (fig.1). The north-west zone of the lagoon, once colonized by *Cymodocea nodosa* and *Caulerpa prolifera* (CALVO *et al.*, 1980), now is being covered by *Ulva* spp., which is colonizing the southern part of the lagoon near the town of Marsala, too. The distribution of this nitrophilic algae was reported previously in the southern part only (CALVO *et al.*, 1980, 1986). Though the surveys were carried out only during two seasonal periods the signs of a variation in the trophic condition in the northern part of the lagoon was noticed. Water outflows from the acquaculture plant, settled near the northern mouth at the beginning of the eighties, and the progressive burying of the mouth caused by southwards displacement of the Birgi creek mouth (RIGGIO *et al.*, 1983) seem to be the cause of the outspreading of dystrophic conditions which may endanger the Marsala lagoon ecosystems, particularly in the northern and central parts.

Tab. 1. Nutrients (µmol dm^{-3}) and chl *a* (µg dm^{-3}).

	Si(OH)4	NH3	NO3	NO2	Ntot	Chl a
MAY'91						
min.	0,60	0,21	0,04	0,02	2,33	0,01
max.	1,95	3,16	0,93	1,16	10,14	2,88
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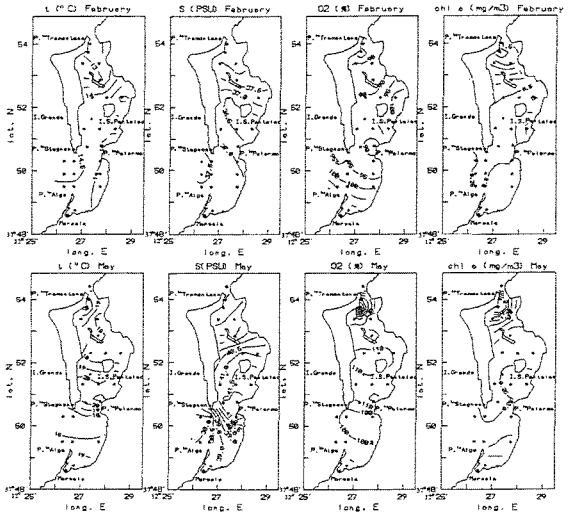
min.	0,46	0,04	0,05	0,19	5,28	< 0,01
max.	3,70	4,38	94,25	2,39	17,15	2,10

Fig. 1. Surficial distribution of temperature, salinity, oxygen (% of saturation), chlorophyll a in February and May.



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