Nychthemeral cycle of nutrients in a meromictic brackish-water lagoon (L. Lungo).

by

GIAN CARLO CARRADA and MARIA RIGILLO TRONCONE

Zoological Station of Naples (Italy)

Summary

Concentration and vertical distribution of nutrients during a day cycle in a meromictic brackish-water lagoon are given and briefly discussed.

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Lago Lungo is a littoral brackish-water lagoon of the Pontine region, about one hundred kilometers north of Naples.

It runs parallel to the coast and, on its southern side, is separated from the sea by a dune; the dune is crossed by a canal which connects the lagoon to the sea.

The lagoon has a max.length of 1750 m, a max. breadth of 437 m and a max. depth of 7 m; the length of the canal is 150 m. A detailed morphological description of Lago Lungo has been given by SOMMANI [1954].

On its northern shore the lagoon receives the outflow of the fresh-water lake S. Puoto. Along the same shore, a series of small ditches drain surrounding fields which are intensively cultivated around the year; their contribution of water to the lagoon, though small, is continuous in all seasons.

The lagoon is characterized by a condition of permanent meromixis, with a chemocline separating an oxygenated mixolimnion from a hydrogen sulfife rich monimolimnion.

At the chemocline level, a layer of bacterial " red water ", with a thickness of about 2 m [CARRADA & RIGILLO TRONCONE, 1974], is found.

Given the above peculiar hydrographical and ecological features, so different from those to be found in most Mediterranean lagoons, it appeared of some interest the study of nutrient distribution as a first step to the analysis of the trophic patterns of the lagoon.

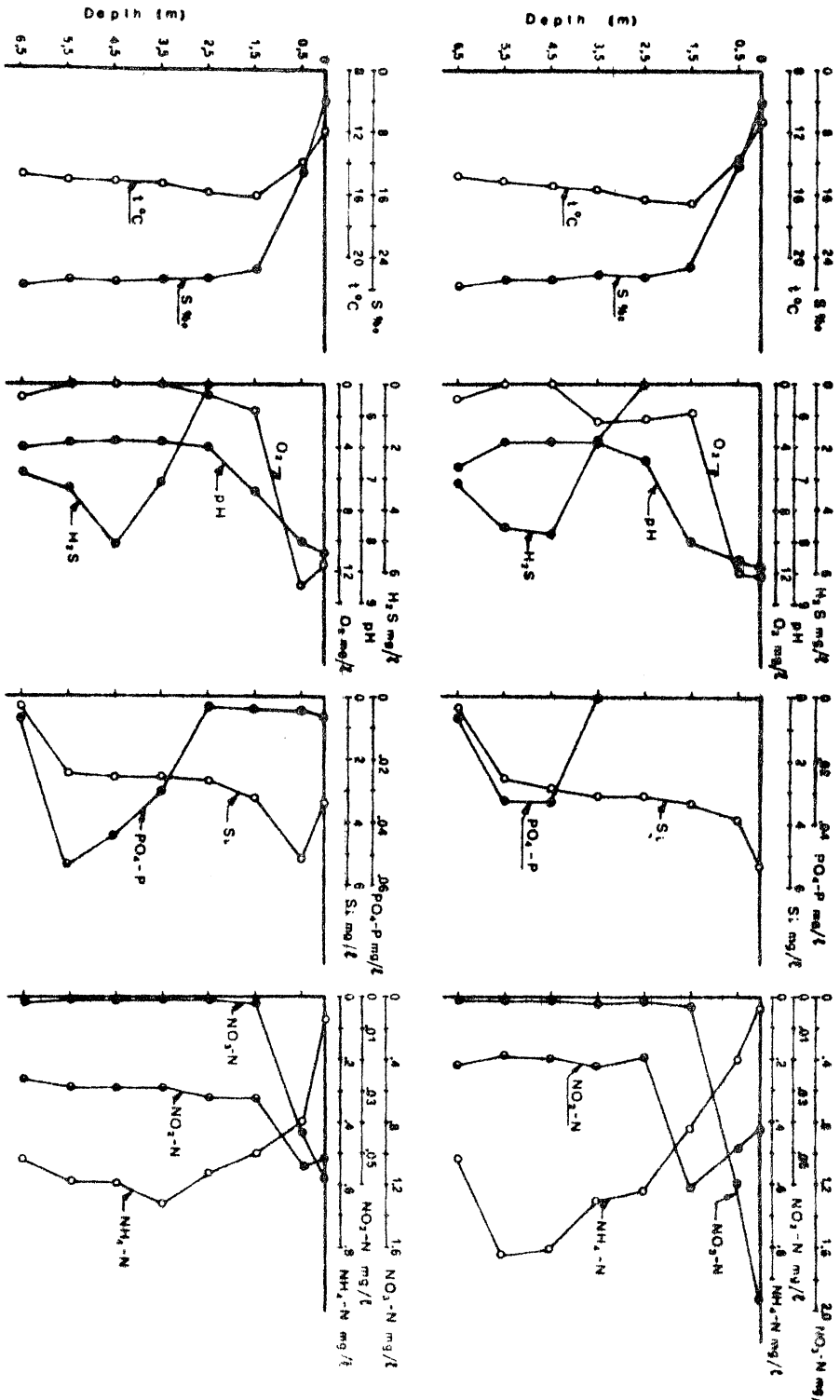
The following preliminary data are the result of two samplings made on March 7, 1973 at 2 p.m. and March 8 at 2 a.m., at a station located in the central and deepest part of the lagoon.

Temperature and Salinity (Fig. 1 : 1,5)

Values and variation patterns for both parameters change very little during the 24 hours cycle. This has been confirmed by samplings made in previous years in the same season.

Temperature and salinity increase progressively with depth down to 1.5 m and then remain constant until the bottom. Constant low salinity values in surface waters are due to the fresh-water flow from lake S. Puoto; the lack of variation between day and night surface temperatures may be similarly attributed to the same cause.

Rapp. Comm. int. Mer Médit., **23**, 3, pp. 81-84, 1 fig. (1975).


Depth (m)
t °C
S ‰
pH
O_2 mg/l
H_2S mg/l
Si mg/l
PO_4-P mg/l
NO_3-N mg/l
NO_2-N mg/l
NH_4-N mg/l
1
2
3
4
5
6
7
8

Oxygen, Hydrogen sulfide and pH (Fig. 1 : 2,6)

These parameters clearly show the meromictic character of the lagoon.

Oxygen oversaturation values are found in the upper 0,5 m layer (113,23 % at 0 m and 121,40 % at 0,5 m during day time; 117,25 % at 0 m and 137,02 % at 0,5 m during the night); undersaturation values are attained at 1.5 m and increase progressively with depth.

Hydrogen sulfide can be detected at 2,5 m. Its concentration increases with depth, reaching a maximum between 4,5 and 5,5 m. Near the bottom, a slight increase in oxygen and a parallel decrease of hydrogen sulfide are observed.

pH variations further emphasize the schematic distribution of oxygen and hydrogen sulfide.

Furthermore, the distribution pattern of these parameters does not change during the diurnal cycle.

Nitrate, Nitrite and Ammonia (Fig. 1 : 4,8)

Nitrate is always present in high concentrations in surface layers but drops to very low values by 1,5 m; these values are constant throughout the monimolimnion; at the surface, a marked decrease is observed at night.

Nitrite distribution is clearly related to that of nitrate and to oxygen availability, both in the mixolimnion and in the monimolimnion.

Concentration of ammonia is low at the surface and increases progressively with depth. The decrease observed near the bottom appears to be correlated, as for hydrogen sulfide, with a slight increase in oxygen.

Phosphate (Fig. 1 : 3,7)

The absence of phosphate in the mixolimnion during day time has been confirmed also in previous samplings; at night phosphate is present in very low quantities.

A steep increase in concentration is observed in the intermediate layer of the monimolimnion, where maximum values are attained. Phosphate concentrations are again very low at the bottom.

Silicate (Fig. 1 : 3,7)

The distribution of this nutrient does not seem to be affected by the meromictic character of the lagoon. High concentration are found throughout the whole column of water, with hight values at the surface. Only in bottom waters is a strong reduction in concentration found.

It is worth noting that lake S. Puoto is very rich in silicate (the following values were found in March : 4.49 mg/l Si at 0 m; 3,93 mg/l at 5 m; 3,93 mg/l at 10 m) and its waters could be the main source of this nutrient for the lagoon.

The nutrient content of Lago Lungo is higher than the verage found in the litterature for most Mediterranean lagoons.

The vertical distribution of nutrients, particularly of phosphate, follows paterns already described for similar meromictic environments [GENOVESE, 1965].

Waters reaching the lagoon from lake S. Puoto and from surrounding fields can be considered the main source of the nutrients.

The meromictic character of the lagoon prevents recycling of nutrients trapped in the monimolimnion.

The constancy of distribution patterns during the nychthemeral cycle, even in the mixolimnion, is an evidence of the insufficient role played by the tide in securing a good exchange of water between the lagoon and the sea.

Tidal action is in fact a basic requirement to prevent the establishment of temporary or permanent meromictic conditions in such environments.

Sometime, strong winds can be responsible of a complete mixing of the waters, but, even in this case, the chemocline is rapidly restablished within a few days, at increasing depths, until it reaches its tipical level for the lagoon.

References

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