RECENT DATA OF NITROGEN AND PHOSPHORUS INPUTS INTO MEDITERRANEAN SEA BY THE RHONE RIVER

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Abstract

Since the damming of the Nile, the Rhone River is the main freshwater supplier to the Mediterranean Sea playing a major role in the productivity of the western basin. Recent data seem to confirm a significant increase of nitrate input, while phosphate concentrations tend to decrease. This opposite pattern leads to a strong evolution of the N/P ratio in the inorganic nutrient available for primary producers.

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Since the damming of the Nile, the Rhone River is the main freshwater and sediment supplier to the Mediterranean Sea. Freshwater inputs play a major role in the balance of the water inputs through the Strait of Gibraltar and enhance significantly the primary production of the western basin. It has been seen by remote sensing observations of the river plume that the Rhone input of nutrients could be responsible for 46% of the excess production in the Gulf of Lions, compared with the Western basin. A good knowledge of this flux and of its variability is therefore essential for understanding of the primary production as well as the biogeochemistry of the Mediterranean Sea. An increase in the input may cause a corresponding increase of primary production leading to changes in the functioning of the Mediterranean ecosystem.

Here we report historical data from 1968, completed by recent data obtained during a long term program of high frequency sampling supported by the Agence de l'Eau Rhone-Méditerranée. With the help of an automated sampling system, suspended materials and inorganic, as well as organic, nutrients have analyzed daily, or 6 times per day during floods higher than $3000 m^{-3}.s^{-1}$.

Nitrate is the main nitrogen source (68%), while dissolved inorganic phosphorus (DIP) represented only 48% of phosphorus concentration, indicating the necessity to take into account organic forms in estimating nutrient budget. High frequency sampling confirms the high seasonal variability of nitrate with higher concentration in winter, while phosphate concentrations remain more or less constant over the year. Mean annual concentration of nitrate was more or less constant from 1968 to 1980 around $1 mg.l^{-1}$. Between 1985 and 1990, nitrate concentration has increased by about 50%, but during the last 15 years, concentrations remain around 2 $mg.l^{-1.}$ In opposite, DIP concentration tends to continuously decrease since 1985 from 0.2 to 0.08 $mg.l^{-1}$. We can compute the nutrients inputs ($tonne.year^{-1}$) from the values of the flow and those of the nutrient concentrations. It shows that:

1) In spite of some interannual variability, annual nitrate inputs have significantly increased during the last two decades, ranging from 50 to 100 metric Tons, confirming some previous results [1].

2) In the same time, DIP discharges have considerably decreased (more than 50%).

3) Consequently, the atomic N/P ratio of inorganic matter supply has considerably increased, from 20 to 40-60.

But recent measurements of organic forms of nitrogen and phosphorus show that these compounds can represent 20% to 100% of the inorganic forms, with a higher fraction of phosphorus. Then taking into account all nitrogen and phosphorus, atomic N/P ratio appear lower, ranging from 30 to 40.

These results show that it would be of great interest 1) to keep high frequency measurements, 2) to study mores particularly the relationships between river flow and nutrients concentrations and 3) to measure simultaneously organic and inorganic forms of the nutritive elements.

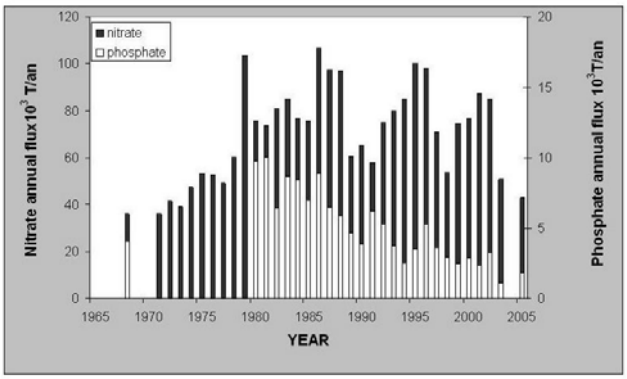

Fig. 1. Annual input of nitrate and phosphate by the Rhone River into the Mediteranean Sea since 1968.

Reference

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