

THE NITROGEN BUDGET OF THE NORTHERN ADRIATIC

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SUMMARY

The nitrogen budget of the Northern Adriatic is mainly controlled by the river nitrogen input and water mass transport. Minor contributions are also discussed. A first approximation to quantifying the assimilation-regeneration cycle of nitrogen is included.

RÉSUMÉ

Le bilan de l'azote dans la mer Adriatique septentrionale est principalement contrôlé par l'apport fluvial et le transport par les masses d'eau. Les contributions mineures seront aussi discutées. Une première approximation de la quantification du cycle assimilatio-régénérative de l'azote est inclusé.

INTRODUCTION

One of the first steps in understanding observed changes in the fertility of a sea is the computation of phytoplankton nutrient budgets. Very few nutrient data have been published for the Northern Adriatic, although it is a particularly interesting region because it accepts the discharge of the Po river, one of the three largest rivers flowing into Mediterranean, and displays relatively high primary production.

MATERIALS AND METHODS

During 1972 and 1973 a series of 21 oceanographic stations in the Northern Adriatic (Gilmartin et al, 1972) were occupied at approximately monthly intervals over a 12 month period. Standard oceanographic parameters were measured, and the concentration of ammonia, nitrite and nitrate determined. Additional data, from the literature, were used in the computation (river discharge, water mass exchange rate, nitrogen content in the sediments, dissolved and particulate organic nitrogen, rain data and others).

RESULTS AND DISCUSSION

The results highlight the importance of river nitrogen input (88% of the contributions) and water mass transport (up to 87% of the losses) as major processes dominating the nitrogen budget of the Northern Adriatic.

INPUTS	mg-at N x 10 ⁹	NITROGEN FORM
Po river	5,800	inorg: part. organic = 1,8:1
Minor rivers	1,200	inorganic
Rain	700	ammonia, nitrate
Sewage	400	organic
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Total	8,100	

LOSSES AND SINKS

Water transport	5,300-11,900	inorg. diss. & part.organic
Sediments	1,705	organic
Fish	150	organic
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Total	7,200-13,800	

Other processes, such as photochemical reactions, denitrification, nitrogen fixation, loss by evaporation and in aerosols were also evaluated, and it was concluded they are insignificant in the Northern Adriatic.

The nitrogen quantity involved in a yearly assimilation-regeneration cycle was calculated from the data using the relationship AOU:C:N=-276:106:16, using in situ measured primary production (Revelante, personal communication), zooplankton standing crop data and an average ammonia excretion rate of 1 ug-at/mg dry w./day. Despite the uncertainty of the data a relatively good correlation between assimilated (11,900 mg-at N x 10⁹) and regenerated (7,300 from organic matter and 5,200 from zooplankton excretion) nitrogen was obtained.

In order to increase the accuracy of the nutrient budgets more precise data on the water masses exchange rates are needed. In particular further investigations on nitrogen uptake by phytoplankton, regeneration rates from organic matter, and as zooplankton excretion rate, are needed to aid the development of models for the primary productivity of the Northern Adriatic.

R e f e r e n c e s

- GILMARTIN, M., KVEDER, S., DEGOBBIS, D., REVELANTE, N & SMODLAKA, N., 1972. - Hydrographic data collected during approximately bi-weekly cruises in the Northern Adriatic. July-December 1972. *Thalassia Jugosl.*, 8: 149-213.

DISCUSSION

Questions and comments:

1. Your nitrogen budget in the Northern Adriatic shows only the output of nitrogen to the sediment. I think the pathway of nitrogen to the sediments are two-ways: input from the sediment and output to the sediment. Does the figure presented represents net - loss of nitrogen to the sediments?
(R. FUKAI, Monaco)
 - This figure represents the nitrogen net-loss to the sediments, but might be probably overestimated. It is unlikely that only 50% of the sediment organic nitrogen, from which the loss is calculated, is remineralized in the Northern Adriatic, as has been assumed from a few papers on this subject for the oceans.
2. Can we consider the Adriatic to be, in general, an oligotrophic sea? (A. BALLESTER, Spain)
 - Generally, the Adriatic is an oligotrophic sea. In its northern part eutrophic phenomena are sporadic reflection of particular environmental conditions.
3. If we take the second figure in the part of losses and sinks of your nitrogen budget (13.000×10^9 mg-at), then the nitrogen balance will be negative? What is the input that can compensate this negative nitrogen balance?
(A. BALLESTER, Spain)
 - Much work remains to be done with regard to the water exchange problems before the establishing more precise data of the nitrogen losses by water masses transport from the Northern Adriatic. Generally speaking we suppose the balance might be achieved.

4. I have the feeling that the input data concerning the load of the industrial wastes could be underestimated.
(B. CESCO, Italy)
- We will take into consideration recent load input data and reestablish the nitrogen budget for the investigated area.