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THE MEASUREMENTS OF NUTRIENT FLUXES AT THE WATER-SEDIMENT INTERFACE : INCUBATION METHODS (IN LABORATORY AND *IN SITU*) ; GRADIENT METHOD (CALCULATED FLUXES) ; BENTHIC ECOSYSTEM TUNNEL

M. FEUILLET-GIRARD(1), D. GOULEAU(1), W. ZURBURG(2), A.C. SMAAL(3), N. DANKERS(4), M. HERAL(5)

(1) CNRS-IFREMER, Crema L'Houmeau B.P. 5, 17137 L'Houmeau (France).
(2) Delta Institute for hydrobiological Research, Vierstraat 28, 4401 EA Yerseke (Netherlands)
(3) Ministry of Transport and Public Works, Tidal Waters Division, P.O. Box 8039, 4330. EA Middelburg (Netherlands).
(4) IBN TEXEL (Netherlands).
(5) LABEIM-IFREMER, B.P. 133, 17390 La Tremblade (France).

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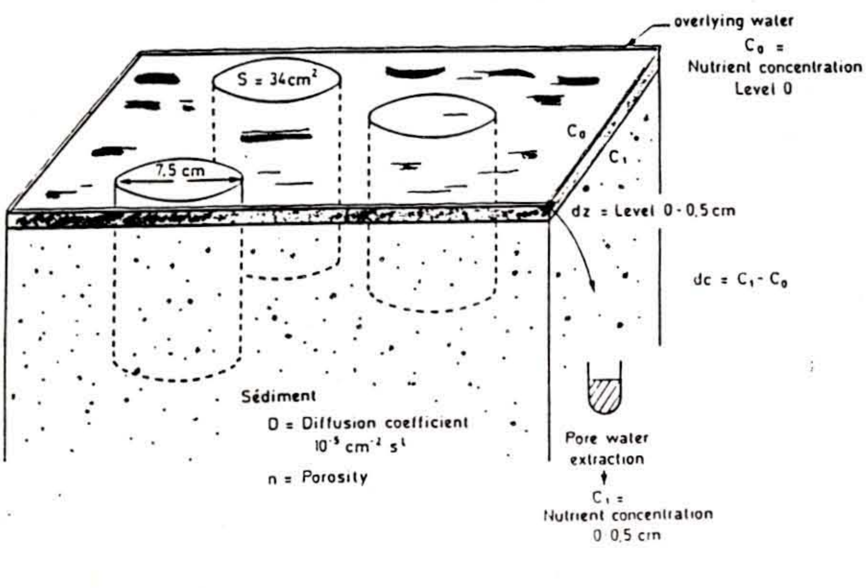
INTRODUCTION

Many flux measurements methods have been described in the literature. The purpose of our study was to compare results obtained by these different methods : Gradient Method, Incubation Method (Laboratory and In Situ), Benthic Ecosystem Tunnel. The field experiment has been performed in the Marennes Oléron Bay since May 1991 (contrat C.E.E . FAR).

DIAGRAM OF THE APPARATUS DESIGNED FOR MEASUREMENT OF FLUXES AT SEDIMENT-WATER INTERFACE

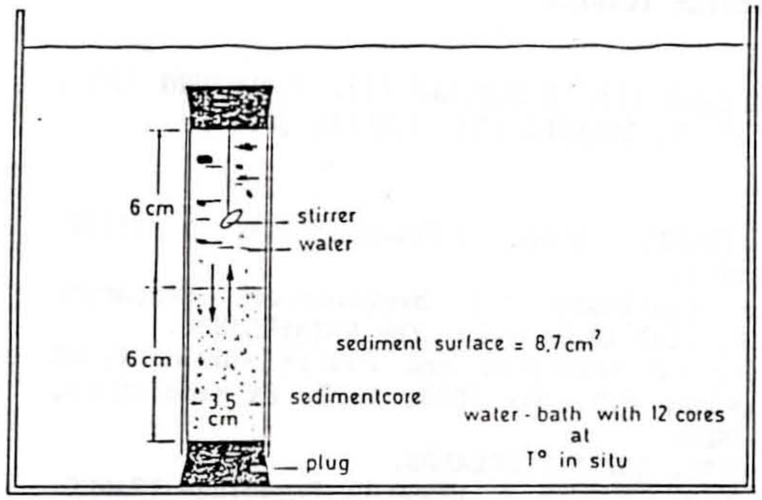
1.- GRADIENT METHODS : calculated fluxes with Fick' first law

$$\Phi = -n D \frac{dc}{dz} \quad \mu M\ m^{-2}\ h^{-1}$$



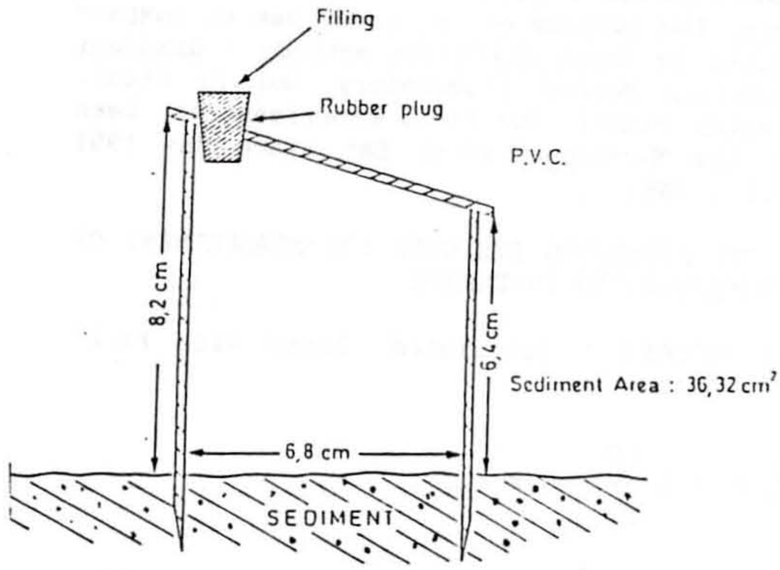
2.- INCUBATION METHODS

LABORATORY (in the dark)

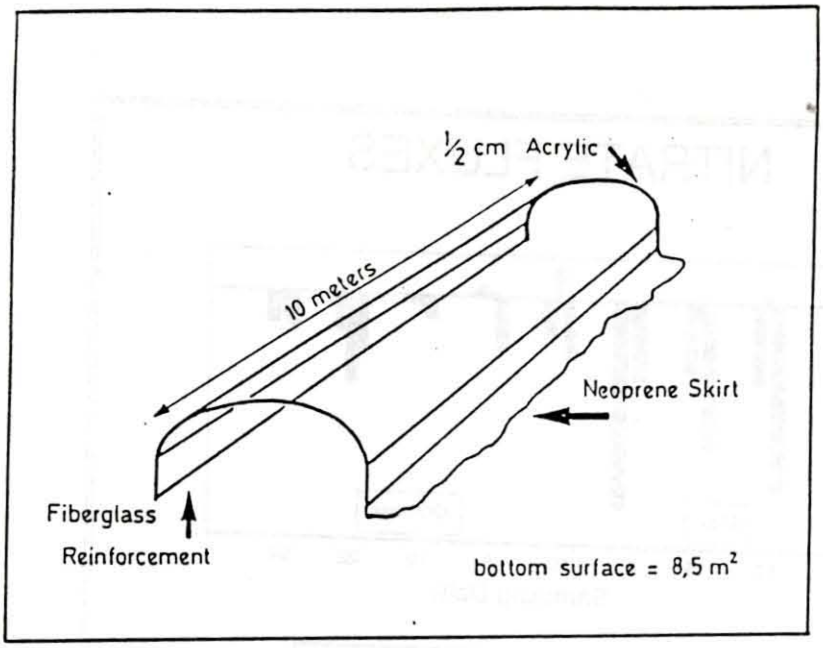


Short incubation : 4-6 h

in SITU (in the dark)



3.- BENTHIC ECOSYSTEM TUNNEL



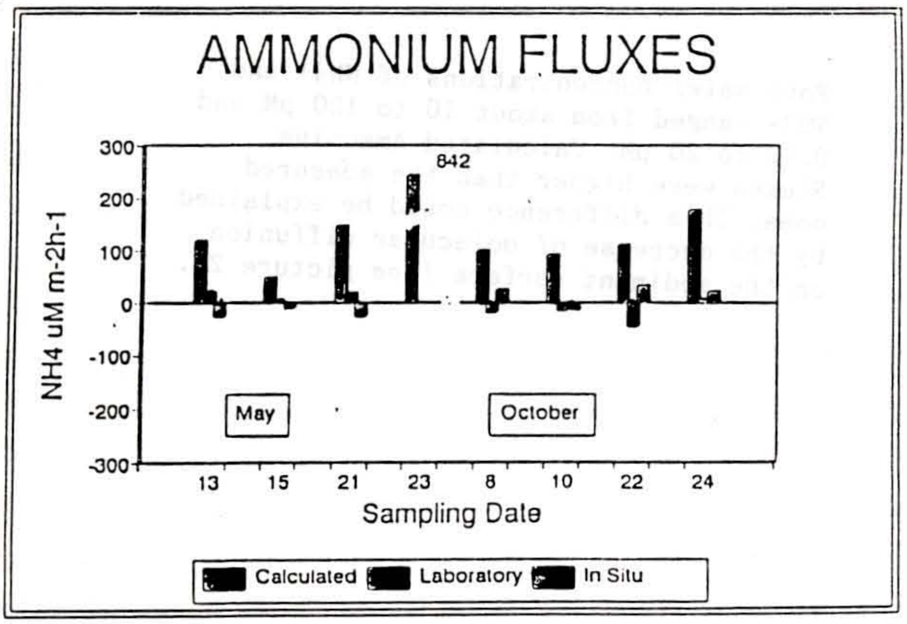
Benthic Ecosystem Tunnel

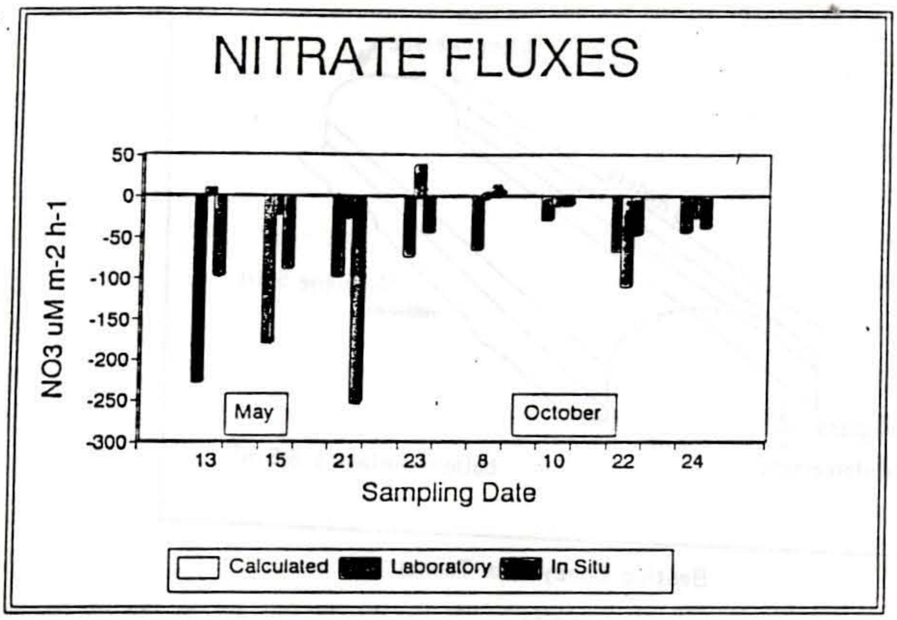
(BEST)

The BEST structure used to obtain fluxes of materials across an oyster reef.

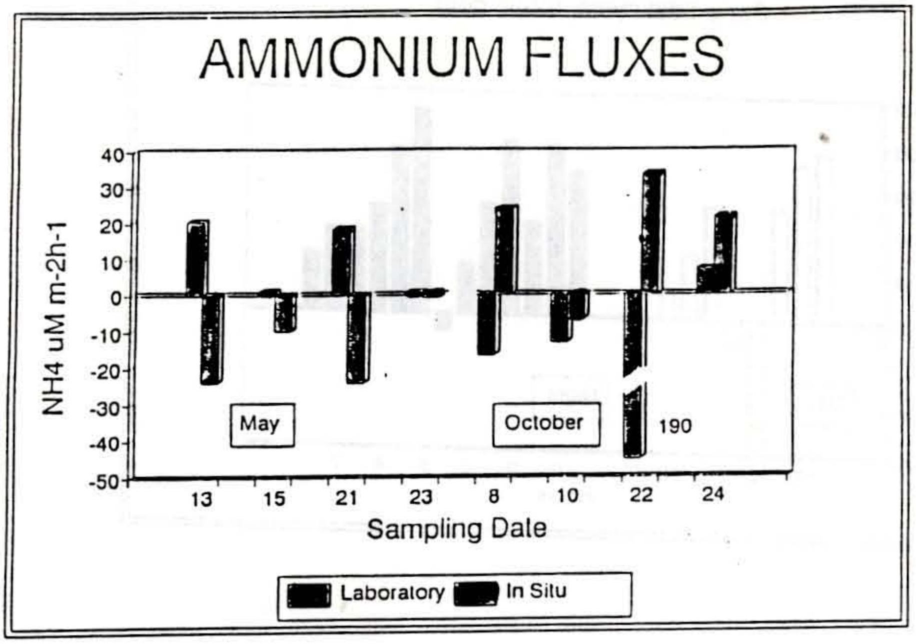
RESULTS

HOW MEASUREMENTS OF FLUXES ARE FUNCTION OF THE USED METHODS?

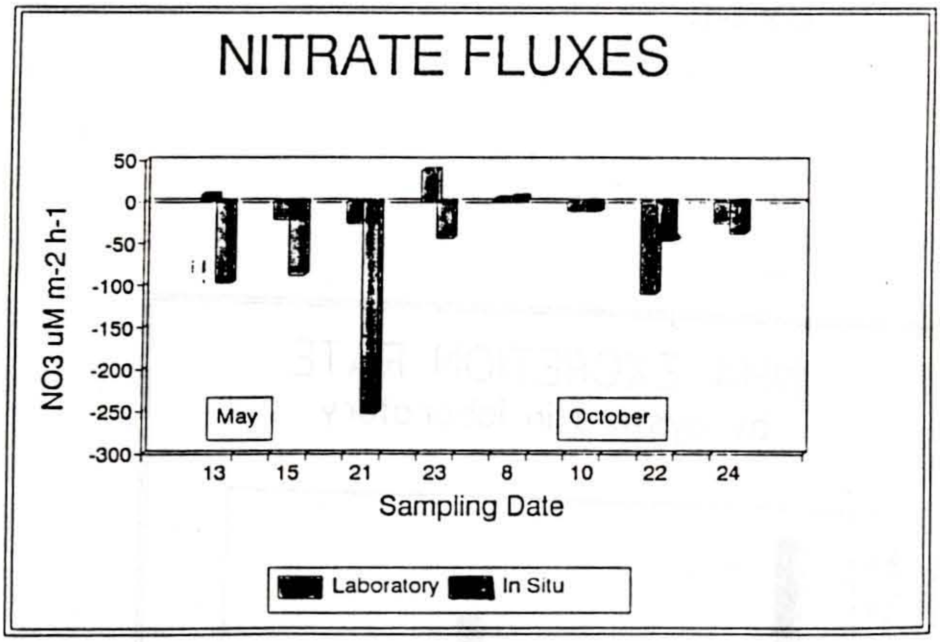




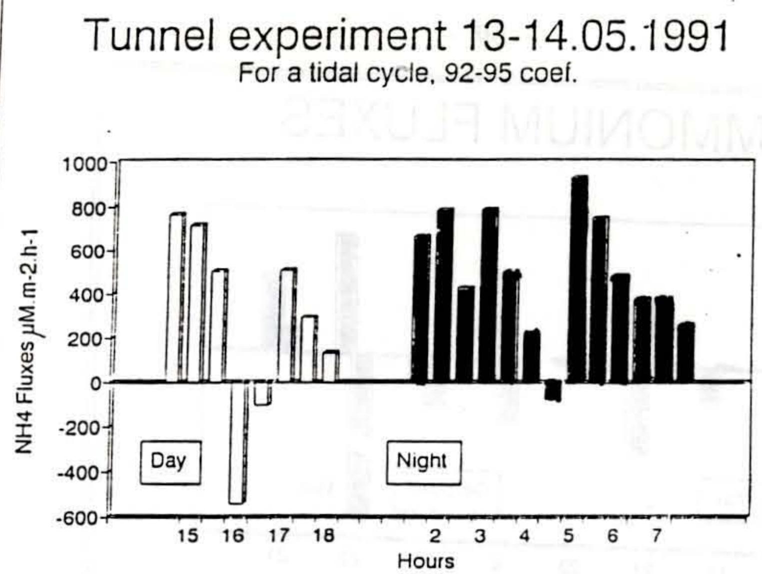
Pore water concentrations of NH4+ and NO3- ranged from about 10 to 120 µM and 0.42 to 20 µM. Calculated Ammonium Fluxes were higher than the measured ones. This difference could be explained by the decrease of molecular diffusion on the sediment surface (see picture 2).



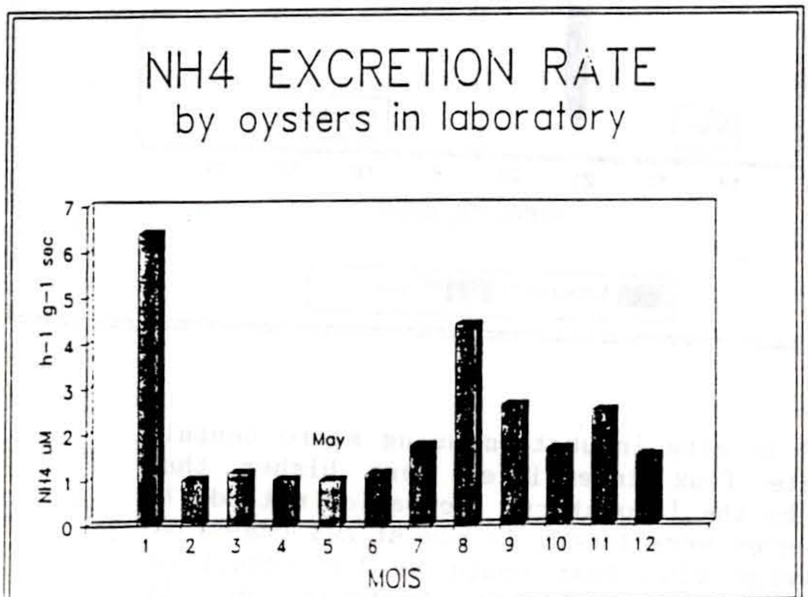
Both measurements, in laboratory and in situ gave weak flux intensities compared with previous measurements. Short incubations in laboratory (4h) showed that ammonium fluxes were dominated by a weak release in May. Reverse fluxes were observed in October. In the case of in situ incubation, we found reverse fluxes in May, and releases in October. Differences in sampling might account for the discrepancies between the results of both techniques.



In the case of in situ incubation using micro benthic chambers Nitrate flux intensities were higher than those obtained by the laboratory incubation method. In October differences were lower. In almost all cases, we observed a reverse flux that could be the result of nutrient uptake by nitrifying bacteria or by denitrification.



Here we only show results obtained in spring tide over an oyster bed, we could not obtain either uptake or release with the control tunnel. By another way Ammonium flux calculated with Ammonium excretion rate found in May in laboratory, agreed with fluxes found in the tunnel and reached 400 µM m-2 h-1.



CONCLUSION

The non-agreement between fluxes estimated from pore water profiles and exchange measurements is apparent for Ammonium fluxes. This disagreement could be explained by the presence of a biofilm on the sediment surface which hides the diffusion. The fluxes measured by the BEST permitted us to measure an Ammonium release from oyster bed and the mussel bed, but the control tunnel did not take into account the flux coming from the sediment, because the resident time was too short.