

Nutrients (Organic C, P, N, Si) in the Eutrophic River Loire (France) and its Estuary

M. Meybeck^a, G. Cauwet^b, S. Dessery^a, M. Somville^c,
D. Gouleau^d and G. Billen^c

^aInstitut de Biogéochimie Marine, Ecole Normale Supérieure, rue Maurice Annoux, 92120 Montrouge, France; ^bLaboratoire de Sédimentologie et Géochimie Marine, Avenue de Villeneuve, 66025 Perpignan, France; ^cGroupe de microbiologie des milieux aquatiques, Université Libre de Bruxelles, 221 Boulevard du Triomphe, 1050 Bruxelles, Belgium; and ^dLaboratoire de Géologie Marine, Université de Nantes, Chemin de la Houssinière, 44072 Nantes, France

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The Loire estuary has been surveyed from 1982 to 1985 by 13 isochronous longitudinal profiles realized at low tide. Nutrient (SiO_2 , NO_3^- , NH_4^+ , PO_4^{3-} , particulate organic carbon or POC) patterns are very variable depending on the season, the estuarine section [river, upper-inner estuary, upstream of the fresh-water–saline-water interphase FSI, the lower-inner estuary characterized by the high turbidity zone (HTZ), the outer estuary] and the river discharge. Biological processes are dominant. In the eutrophied River Loire (summer pigment $> 100 \mu\text{g l}^{-1}$), the high algal productivity (algal POC $> 3 \text{ mg l}^{-1}$) results in severe depletion of SiO_2 , PO_4^{3-} , NO_3^- . The enormous biomass (55 000 ton algal POC/year) is degraded in the HTZ where bacterial activity is intense. As a result, there is generally a regeneration of dissolved SiO_2 and PO_4^{3-} , a marked NH_4^+ maximum, while NO_3^- is conservative or depleted when the HTZ is nearly anoxic. Other processes can be considered including pollution from fertilizer plans (PO_4^{3-} , NH_4^+) and from a hydrothermal power plant (NH_4^+). In the less turbid outer estuary, nutrients are generally conservative. Major variations of concentrations are observed in the lowest chlorinity section ($\text{Cl}^- < 1 \text{ g kg}^{-1}$) and also upstream the FSI, defined here as a 100% increase in Cl^- . Nutrient inputs to the ocean are not significantly modified for SiO_2 and NO_3^- , but are increased by 70% and 180% for PO_4^{3-} and NH_4^+ and depleted by 60% for POC. Odd hydrological events, especially some floods, may perturbate or even mask the usual seasonal pattern observed in profiles.

L'estuaire de la Loire a été suivi de 1982 à 1985 par 13 profils longitudinaux synoptiques effectués marée basse. Les éléments nutritifs (SiO_2 , NO_3^- , NH_4^+ , PO_4^{3-} , carbone organique particulaire ou COP) présentent des profils très divers dans les sections étudiées (rivière, zone fluvio-estuarienne en amont du front de salinité, zone du bouchon vaseux, estuaire externe) qui dépendent de l'élément étudié, de la section, de la saison, et de l'hydrodynamique fluvio-estuarienne. Les processus biologiques semblent ici dominants. La