



## Enhanced methane oxidation in an estuarine turbidity maximum

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Limnol. Oceanogr., 52(1), 2007, 470-475 | DOI: 10.4319/lo.2007.52.1.0470

**ABSTRACT:** Methane and suspended particulate matter (SPM) concentrations, monitored bimonthly during one hydrological year (2003-2004) along 70 km transects in the tidal regions of the Garonne and Dordogne rivers (SW France), showed a significant negative correlation, both spatially and temporally. During spring in clear waters ( $SPM < 50 \text{ mg L}^{-1}$ ), methane production was first evidenced by a net increase in methane concentrations, in parallel with temperature and a decrease in river flow. In summer, as soon as the estuarine turbidity maximum (ETM) appeared and SPM concentrations exceeded  $100 \text{ mg L}^{-1}$ , methane concentrations decreased from  $\sim 600$  to  $\sim 30 \text{ nmol L}^{-1}$  in one month. More downstream in the turbid Gironde estuary, methane concentrations were occasionally below atmospheric equilibrium. In dark microcosms, high methane consumption was observed in samples from the ETM with SPM concentrations  $> 2,000 \text{ mg L}^{-1}$ , but not after removing the SPM by settling ( $SPM = 16 \text{ mg L}^{-1}$ ), nor in a sample collected few kilometers upstream, with  $SPM = 3 \text{ mg L}^{-1}$ . Methane oxidation was also able to draw down methane concentrations below half the atmospheric equilibrium value in an ETM sample. Suspended clays in the ETM enhance methane oxidation and strongly reduce methane fluxes to the atmosphere.

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