

The food web in the lower part of the Seine estuary

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The Seine estuary illustrates the alterations in estuaries due to man: strong inputs of pollutants of various origins and large changes of its morphology since the middle of the XIX century. The intertidal mudflats have been greatly reduced ($< 30\text{km}^2$) after management of the channels of the Seine River. It plays an important role in the dynamics of the eastern English Channel ecosystem; nevertheless, its biological compartment remains poorly known until the beginning of the '90. The objectives of the Seine Aval program were to identify the life resources of the Seine estuary: macrobenthos, zooplankton, suprabenthos, and fish populations and to define the main trophic links in the lower part of the estuary (i.e. from the polyhaline to the oligohaline zones). There is an impoverishment of the biological diversity from the polyhaline zone to the oligohaline zone. The benthic and pelagic fauna of the Seine estuary is similar to other north-eastern Atlantic estuaries, but there are great differences between the biological compartments with areas of very high abundance of organisms (benthos on the muddy intertidal zone and, zooplankton in the lower part of the estuary) and areas with very low abundance of organisms (macrobenthos in the channel). There is also a contrast between the high abundance of the first levels of the trophic chain in a contaminated environment and the low abundance of fish. The pelagic fauna, especially the copepod *Eurytemora affinis* and the shrimp *Palaemon longirostris* seemed to be more abundant in the Seine estuary than in other estuaries. Two macrobenthic communities occurred in the estuary: a diversified and abundant *Abra alba*-*Pectinaria koreni* community in the outer part of the estuary and a *Macoma balthica* community in the inner part. This latter was especially poor in specific richness, density and biomass, in all areas, except on tidal mud flats. Two trophic chains were identified. In the oligohaline zone corresponding to the maximum turbidity zone (high turbidity, low concentration of oxygen), the trophic chain was exclusively planktonic due to the dredging of the estuary which prevented permanent benthic fauna formation. In this zone, the number of fishes was relatively low in spite of high biomass of mesozooplankton and suprabenthos. In the outer part of the estuary, low turbidity and high concentration of oxygen are more favourable to fish populations which feed especially on benthic fauna. So, in spite of a high contamination and human modifications, the Seine estuary remains an European estuary with high abundances for young fish and birds especially the limicoles. Nevertheless, in the future, a global management of the Estuary would be necessary to ensure the actual functioning of the biological compartments and to propose measures to ensure the rehabilitation of migrating fish.