

Modelling the effects of the temporal and spatial environmental variability on the energetics of the Pacific oyster in the baie des Veys ecosystem

PhD student: Karine GRANGERE (Karine.Grangere@ifremer.fr)

Abstract

Gain/loss/energy allocation in oysters is determined by ecosystem dynamics through biotic (i.e. trophic resources) and abiotic (i.e. temperature) processes. The aim of this work is to study variations of oyster physiological state (somatic growth, reserves, metabolic exertion) as a response to environmental factors by integrating physiological processes of oysters (i.e. energy allocation) with environmental processes which control oyster development.

The study site, the baie des Veys is an open estuary and intertidal ecosystem (37 km²) influenced by four rivers, with an important oyster farming activity (10 500 tons produced per year). At the bay scale, some spatial differences in the structure of phytoplanktonic and microphytobenthic communities and in the biological performances of cultivated oysters were observed. It is assumed that a trophic heterogeneity may exist, however the mechanisms controlling it remain unclear. In order to assess whether spatial interactions between oysters and the ecosystem may significantly affect phytoplankton availability and oyster growth, a three-dimensional (3D) hydrodynamic model was coupled to an ecosystem model. The ecosystem model simulates the Baie des Veys nutrient-phytoplankton-oyster food web. The method consists of coupling a primary production model that simulates trophic resources and an oyster ecophysiological model (Dynamic Energy Budget model). This coupled model will elucidate the influence of some factors such as trophic interactions, watershed supplies (freshwater, nutrients, suspended particulate matter...) or climate variations, on the seasonal and inter-annual variability of oyster physiological state (growth and reproduction). Furthermore, the integration of this coupled model in the hydrodynamic model will allow us to better understand the observed spatial differences in oyster biological performances in relation to the effect of water circulation on food production and availability for filter-feeders.