THE SPECIMED PROJECT : STRUCTURES OF PLANKTONIC ECOSYSTEMS IN THE NORTH-WESTERN MEDITERRANEAN

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Abstract
As a step towards operational management of marine ecosystems SPECiMed will develop a predictive understanding of how marine biogeochemical cycles and ecosystems respond to changing forcings, including how large-scale climatic variations impact regional ecosystem functioning through the changing physical dynamics and the alteration of biogeochemical cycles. SPECiMed relies on the joint expertise of oceanographers from the fields of physics, chemistry and biology to comprehend the ecosystem response to forcing. The 3-yearproject relies on the existing SOMLIT coastal stations of Marseille (SOFCOM) and Banyuls/mer (SOLA) and will implement the two shelf stations JULIO (SE entrance of the GoL) and MOLA (SW exit).
Keywords: Phytoplankton, Zooplankton , Nutrients, Mesoscale Phenomena, Monitoring

SPECiMed was designed as a component of the INSU-CNRS "Chantier Méditerranée" under the framework of the MERMEX project in its medium-term strategy of Enhanced Observing Periods (EOPs). In comparison with Long Observation Periods (LOPs) implemented in the framework of MOOSE (Mediterranean Ocean Observation multi-Sites on Environment), SPECiMed positions itself as an EOP designed to meet its specific scientific goals. Within MERMEX, SPECiMed will be more focused on the studies of ecological processes (biogeochemistry and food-web interactions).

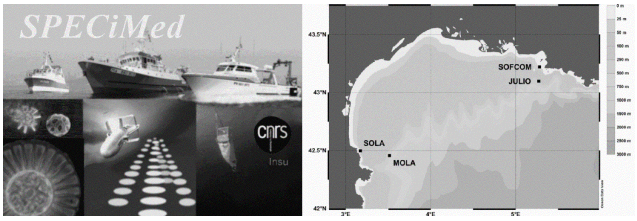

Fig. 1. SPECiMed will combine the classical methodologies and the new investigation tools for exploring the pelagic ecosystem of the Gulf of Lions.

The rapid development of the Mediterranean basin had significant positive impacts on living standards of people but it was largely achieved at the expense of environmental balances essential to human well-being. With increasing anthropogenic pressure, the Mediterranean basin has now become an endangered environment both in terms of its ecological balance and exploitable resources and of the water systems that sustain human activities. Regarding the marine environment, despite the intensive research efforts undertaken in the Mediterranean Sea for over a century, an integrated vision of how its ecosystems function is still lacking. Yet this knowledge is indispensable to meet the expectations of the Mediterranean basin development and sustainable management issues it raises.

In the northwestern Mediterranean (NWM), studies on the impact of climate on plankton communities are limited by the small number of long-term series. Nevertheless, few studies have addressed the question of the long-term drift in composition and dynamics of plankton. A long-term evolution of phytoplankton communities has been at least detected in several places of the French NWM coast, e.g. at DYFAMED station and especially in the Gulf of Lions (GoL), during the research projects EC2CO/GolPhyZ and the ongoing EU/SESAME partly devoted to plankton series data mining. The decadal variability of coastal phytoplankton in the Bay of Marseille from 1994 to 2006 suggests a close link to the North Atlantic Oscillation (via processes that still need to be assessed at the mechanistic level), a possible regime shift in the years around 1999, as well as signs of biodiversity loss.

The Mediterranean Sea is often compared to the world ocean given its thermohaline anti-estuarine circulation. It is also characterized by an eastward gradient of oligotrophy associated with a succession of different plankton communities. Therefore it is difficult to observe the evolution of the Mediterranean as a whole. Even if trends can be predicted using numerical models, these must be validated continuously in view of ongoing climate change. Therefore, the regional level appears appropriate. At first glance, the NWM basin is a mosaic of nested ecosystems offering similarities with the general situation of the World Ocean: An estuary at the mouth of a great river, the Rhône River, which brings locally large nutrient loads on a continental shelf, the GoL, and a coastal current, the Northern Current (NC), which separates the land-to-ocean aquatic continuum from an oligotrophic gyre. SPECiMed aims at establishing a three-year observation platform of plankton communities incl. bacteria, phyto-, microzoo- and mesozooplankton, associated biogeochemical cycles of major elements (C, N, P, and Si), as well as monitoring the physical environment impacting the pelagic communities.

Planktonic organisms generally are classified on the basis of size, nutritional, and physiological characteristics or phylogeny. Regardless of the criterion used, broad diversity is revealed, as illustrated in Figure 2. Thus, the planktonic organisms include several size-classes, from < 1 µm to several cm, so that sampling as well as quantitative observation of SPECiMED will take advantage of the use of several complementary means of investigation, each appropriate to one part of the size spectrum. SPECiMED will also develop the parallel use of *in situ* sensors like Lase Optical Plankton Counter (LOPC), Laser In Situ Scaterrometer and Transmissiometer (LISST) mounted on tracted Moving Vessel Profilers (MVP) in conjunction with hull-mounted ADCP to explore the mesoscale field of phyto- and zooplankton. While continuous measurements of currents will be performed by bottom ADCP moorings, integration between biology, geochemistry and physics will be provided by the coupled physical-biogeochemical multi-element multi-species model *Eco3M*.

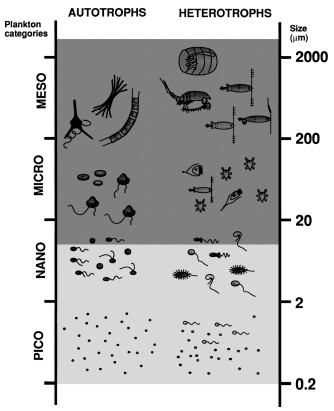

Fig. 2. Representative classification of planktonic organisms by size showing the diversity of various autotrophic and heterotrophic groups (modified from Karl, 1999). The dark area corresponds to the compartments for which historical time-series data are available in the Gulf of Lions, the light grey area corresponds to the compartments for which detailed information is lacking.

References
1 - Karl D.M., Bidigare R.R., Letelier R.M., 2001. Long-term changes in plankton community structure and productivity in the North Pacific Subtropical Gyre: The domain shift hypothesis. *Deep Sea Research* Part II: Topical Studies in Oceanography, 48:1449-1470.