ZOOPLANKTON COMMUNITY STRUCTURE AND DISTRIBUTION IN THE BAY OF VILLEFRANCHE-SUR-MER USING THE ZOOSCAN DIGITAL IMAGING SYSTEM

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Abstract

The mesozooplankton (>200 µm) abundances and biomass spectra were studied in a 8-years time-series in the coastal zone of the North Ligurian Sea using a new image analysis system. Preliminary results show a clear seasonal cycle of both abundance and biomass structure of the zooplankton community. These are related to changes in zooplankton biodiversity and phytoplankton biomass.

Keywords : zooplankton, biomass spectrum, image analysis

Zooplankton plays a central role in aquatic ecosystems relative to phytoplankton and higher trophic levels (1). It is a biological indicator of environmental changes (2) or human impacts on marine systems. Within the french program SOMLIT, we have followed the temporal variability of coastal mesozooplankton with environmental changes in a 8-years time-series. Weekly samples of zooplankton collected by a WPII net (200 µm of mesh size) between 1995 and 2003 in the bay of Villefranche-sur-Mer (North-western Mediterranean) were analysed by the ZOOSCAN. This new system is a low-cost imaging device which allows rapid, exhaustive and non-destructive enumeration and measurements of mesozooplankton and micronekton (3). It permits to describe the biodiversity and size of the zooplankton community by measuring 38 morphometric attributes for each individual with an automated identification. In our study, slopes of the biomass spectra (4) are calculated for the mesozooplankton community (450 to 1550 µm in Equivalent Spherical Diameter) on 273 samples (more than 300 000 individuals measured).

The zooplankton abundance shows a seasonal cycle over the eight years (Fig. 1). Abundances are higher in winter-spring period (500-7000 ind.m^{-3}) than during the summer-autumn period (35-2500 ind.m^{-3}). The results show a high inter-annual variability with the highest abundances between 1999 and 2001. The zooplankton seasonal cycle generally follows the chlorophyll *a* cycle. The slope of the biomass spectrum provides an informative measure of the structure of the plankton community. The temporal distribution of the calculated slopes (Fig. 2) also exhibits a seasonal pattern : 1) a steep spectrum characterized by a high negative slope (in winter and spring) indicates the dominance of organisms with a low biomass, 2) a flat spectrum with a less negative slope (in summer and fall) implies a higher proportion of larger organisms. During the year 2002, the Shannon diversity index (calculated only on the abundance of copepods manually identificated) shows that copepods' biodiversity was lower in winter-spring during the phytoplankton bloom than during the rest of the year (Fig. 3). This suggests a relationship between the biomass structure and the biodiversity. In November 2002, the spatial structure of the zooplankton community was also analysed on a transect from the South French coast to the central Ligurian Sea. The slopes of the biomass spectra are steeper in the open sea than in the coastal area. At that time of the year, chlorophyll *a* concentrations are higher in the open sea as a result of well established upwelling (5).

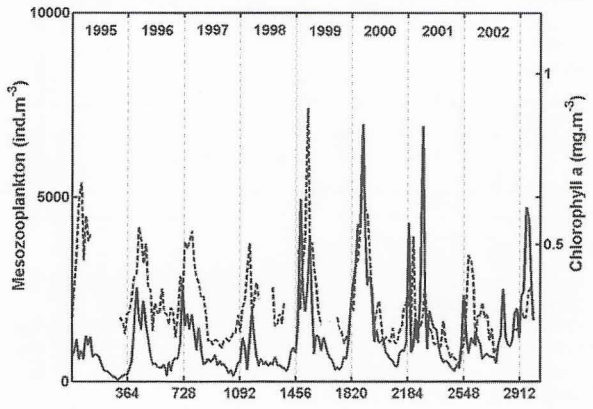

Fig. 1. Temporal distributions of the biweekly mesozooplankton abundance (continuous line) and chlorophyll *a* (dashed line).

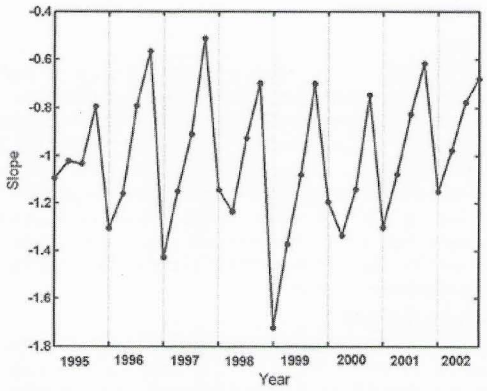

Fig. 2. Temporal distribution of biomass spectra slope from 1995-2002.

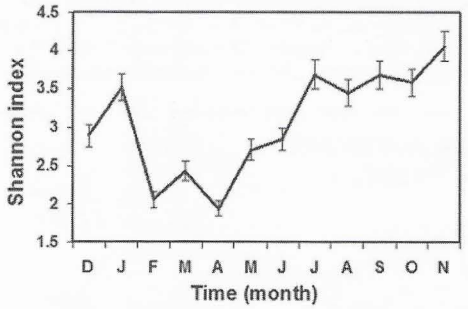

Fig. 3. Monthly variation of the copepods Shannon index during the year 2002.

These preliminary results obtained by the ZOOSCAN reveal some temporal and spatial patterns of the zooplankton community structure which can be associated with changes in zooplankton diversity and phytoplankton biomass. The next step will be the taxonomic identification of all organisms by the ZOOSCAN, in order (1) to evaluate the link between biodiversity and biomass spectra, (2) to describe the relationship between zooplankton (biodiversity and biomass) and environmental factors (phytoplankton, nutrients, detritic particles, temperature, salinity).

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