THE OCEANOGRAPHIC CONDITIONS NEAR THE CATALAN COAST DURING THE ANOMALOUSLY HOT SUMMER 2003. PRELIMINARY RESULTS OF TWO SUMMER CRUISES.

Emelianov M.*, Salat J., Sabatés A.

Institut de Ciencies del Mar CMIMA CSIC, Passeig maritim de la Barceloneta, 37-49, 08003 Barcelona , Spain - * mikhail@icm.csic.es

Abstract

The spatial distributions of temperature, salinity, density, zooplankton and ichtyoplankton were analysed on the basis of CTD sampling and plankton hauls performed during two oceanographic cruises in July and September 2003 along the Catalan coast. This summer season was anomalously long, hot and dry. The comparison of preliminary results with the data obtained in the same area in 1983 show higher temperatures and salinities at surface in July but not in September, while similar spatial distributions of the oceanographic parameters were found in both cases.

Keywords: temperature, salinity, surface layer, NW Mediterranean

Introduction

During the last 25 years it has been detected in the NW Mediterranean Sea an increment of the temperature, aproximately 0.7°C at sea surface, 0.4°C at 80 m depth [1], and 0.12°C between the years 1959 and 1989 at about 400 m depth [2]. Some authors [3, 4, 5] attributed the expansion of distribution ranges of fishes and benthos from the south Mediterranean to the warming process. They noted that they are more and more frequent in the NW Mediterranean Sea. At the same time some typical northern species abundances have decreased from the eighties until now [6]. These variations in the species distributions should reflect changes in the oceanographic conditions and they can be a first indication of the effect of the environmental changes in the mediterranean marine communities.

This study was designed to ascertain whether the observed changes, both in the species distribution and in the recurrent blooms of gelatinous zooplankton, are indicators of a trend in the long term, consequence of the global change, or, on the contrary, it is a response to the interannual variability in the physical characteristics. The present paper is a preliminary comparison between the hydrographic "normal" situation in 1983 and the anomalously "hot" summer 2003.

Materials and Methods

Two oceanographic cruises were performed in the summer season 2003 (July and September) in the shelf area extended along the Catalan coast, from the Ebro river Delta in the south to the Cape Creus in the north. The sampling stations, separated by 5 nautical miles, were located in 18 lines perpendicular to th coast, untils the shelf-break. Each station was sampled with CTD/Rosette equipped with a fluorometer. Current profiles in the first 300 m were continuosly registered with shipboard thermosalinograph and ADCP respectively. The sampling of fish larvae and zooplankton were carried out with a Bongo net from a maximum depth of 200 m until the surface. Also, in each station a neuston skate fishing was made.

Results

The comparison of the spatial distributions of temperature, salinity and specific density in the surface and 20 m depth obtained in July an September in 1983 and 2003 in the Catalan coastal area show that:

– In July 2003 the surface temperature was 1°C higher in the south and 0.5°C higher in the North than in 1983. In the 20 metres it was the opposite situation. Thus in July 2003 the first 20 m were 1 degree warmer than in July 1983. In the northern and southern areas, typically influenced by Rhone and Ebro rivers, salinity values at surface layer were 0.3 higher than in 1983.

– In September 2003 the spatial distributions of temperature, in the surface and at 20 m depth were similar to that obtained in September 1983. Salinities were again around 0.3 higher than in 1983 in the mentioned areas.

– The general trends of the physical distributions were similar. A N-S gradient of temperature in July and a surface intrusion of open sea waters, above the pycnoline, in September.

– In general, ichtyoplankton abundances were lower, especially in September. A quick survey of abundances of certain warm water species (*e.g. Sardinella aurita*) indicates a relative increment from 1983 in July. It is however a qualitative impression because samples are not still deeply analysed.

Discussion

Summer 2003 was anomalously long, hot and dry. Air temperatures were more than 2°C higher than usually and this situation started early June and lasted up to 20 August.

The comparison of phyisical data obtained in the same area in July and September 1983 and 2003 reflects the same oceanographyc patterns but surface layer temperature was higher in July 2003 as expected. The higher salinity values found in 2003 can also be explained by the lower precipitation over the main river basins. In September however while surface salinities were clearly higher in 2003, the surface layer temperature and pattern of distribution were similar to 1983. This situation would be explained if a cold air intrusion came before the cruise in September 2003. If this were the case, heavy precipitation and deepening of surface mixed layer would occur, but this was not the case. What was then causing the loss of heath in the surface layer of coastal water in September 2003? Was this related to the notable decrease of fish larvae abundance, relative to the same period in 1983?

The surface layer above the pycnoline near the coast in September is occupied by an intrusion of open sea waters and coastal lower salinity waters, colder, sink to the pycnocline. This is due to the lack of continental runoff in summer. A very preliminary explanation for the apparent heat loss of surface layer with respect to 1983 could be due to the relatively higher salinities of coastal waters in 2003. They should sink faster and in a thicker layer. In any case further work has to be done with data to verify this possibility or find out other alternatives.

References

1 - Salat J., and Pascual J. 2002. The oceanographic and meteorological station at L'Estartit (NWMediterranean) In: Tracking long-term hydrological change in the Mediterranean sea. *CIESM Workshop Series*, 16: 29-32.

2 - Bethoux J.P., Gentili B., Raunet J., and Tailliez D., 1990. Warming trend in the western Mediterranean deep water. *Nature,* 347: 660-662.

3 - Francour P., Boudouresque C. F., Harmelin J.G., Harmelin-Vivien M., and Quignard J.P., 1994. Are the Mediterranean waters becoming warmer ? Information from biological indicators. *Mar. Poll. Bull.*, 28: 523-626.

4 - Astraldi M., Bianchi C. N., Gasparini G.P., and Morri C., 1995. Climatic fluctuations, current variability and marine species distribution : a case study in the Ligurian Sea (north-west Mediterranean). *Oceanologica Acta,* 18: 139-149

5 - Bianchi, C.N., and Morri C., 2000. Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Mar. Poll. Bull.*, 40: 367-376

6 - Quignard, J. P., and Raibaut, A., 1993. Ichthyofaune de la côte languedocienne (Golfe du Lion). Modifications faunistiques et démographiques. *Vie et Milieu,* 43: 191-195.