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Distribution of Macroplankton and marine circulation in the Ligurian Sea

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During two cruises conducted respectively in April and August 1986, by the GRO-G (Oceanological Research Group-Genoa) and the Institute of Marine Environmental Science of the University of Genoa, macroplankton samples were collected in the northeastern sector of the Ligurian Sea, over a grid of offshore stations; three stations (45, 46, 47), however, were located at the eastermost end of the basin, parallel to the coastline, near the edge of the continental shelf.

The sampling was carried out from April 24th to 27th and from August 25th to 27th, using a 1 mt ORI net of 1 mm mesh, equipped with a flowmeter and towed on the surface at 1,5 knot speed during day time. The average volume of filtered water was 1,444 cubic meters. In the laboratory the organisms were counted and sorted into the main taxa and the biomass of each taxon was evaluated (dry weight, 60°C).

Temperature and salinity recordings from 0 to 100 db were made at the same time using a Neil Brown CTD onboard the O/V "Minerva", the purpose being to acquire information on the physical and dynamic conditions of the water masses at the sampling time. In order to obtain a general view of the marine circulation pattern, the mean temperature and salinity of the layer comprised between 0 and 100 db were calculated, and the average isotherms and isohalines were plotted.

A cyclonic circulation is a permanent feature of the Ligurian Sea, flowing along the coast at variable speed in relation to the stresses brought about by atmospheric circulation. Deep masses show an upwelling tendency at the centre of the circuit (central divergence), as against the downwelling tendency of surface masses at its periphery (convergence). The divergence axis, therefore, is identified by minimal mean temperatures, as well as by highest mean salinities (HELA 1963, ASTRALDI & GASPARINI 1986, HECQ et al. 1987).

a) Dynamic conditions of water masses. APRIL 24-27, 1986. The isothermal pattern showed an absolute temperature minimum (13.13°C) in the central and deepest area of the basin (St. 27): the central divergence appeared to follow two directions, corresponding to stations 25, 31 and 27, 34, 40. The main displacement of surface masses was at the periphery of this area.

AUGUST 25-27, 1986. The pattern of mean isotherms and isohalines pointed to the presence of a divergence area at stations 34 and 41; stations 32, 33, 34, 40 and 41 were all within an area characterized by prevailing vertical motions. The cyclonic motion at the periphery of this area was almost parallel to the coastline.

b) Composition and distribution of macroplankton. APRIL 24-27, 1986. Gelatinous specimens were prevailing in most of the samples. On the average 74% of the plankton biomass (dry weight) were Siphonophora, the other taxa in the examined area being : Tunicata (9%), Pteropoda (7%), Crustacea (6%), Polychaeta (2%) and Medusae (1%). The average proportion of Chaetognatha and Pisces larvae in the whole biomass was less than 1% dry weight.

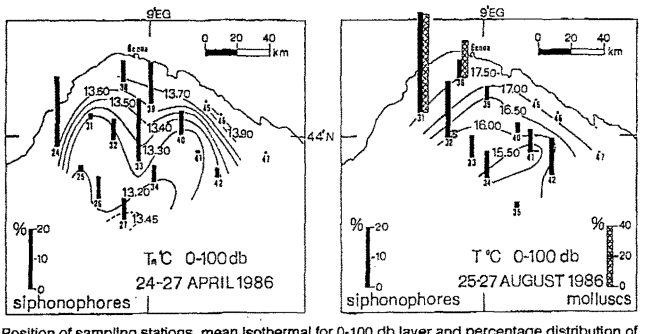
Zooplankton density was highest into inshore stations (46, 47). In offshore waters Siphonophora showed a very heterogeneous distribution, concentrating at three stations (24, 33, 39) located outside the central divergence zone, mainly in station 24 which was characterized by particularly intense temperature and salinity gradients. In the said three stations, moreover, there were specimens of all the taxa inhabiting the surface waters at the time of sampling. On the other hand, stations 25, 26, 27, 31 and 34, located in the area of greatest divergence, were characterized by a less diversified population and a general impoverishment of the whole biomass. However, in some of these stations, the concentration of Copepoda (*E.rostrata, A.patersoni*) and Euphausids larvae appeared to be rather high.

AUGUST 25-27, 1986. Mollusca or Siphonophora were dominant by weight in individual samples. On the average Mollusca were prevailing contributing to 54% of dry biomass, followed by Siphonophora (25%), Chaetognatha (11%), Crustacea (5%) and Medusae (4%). The Tunicata and Pisces larvae were less than 1%.

The divergence area at the center of the basin (33, 34, 35, 39, 40) was very poorly populated, Siphonophora being almost the exclusive presence. In offshore waters the biomass was mainly concentrated in two stations (31, 38) along the cyclonic circuit, where Mollusca, Chaetognatha (31, 38), Siphonophora, Medusae (31), *Doliolum*, Stomatopods larvae, Pisces larvae (38) were present in highest density.

Concluding remarks. The large-scale macroplankton sampling carried out in a large area of the Ligurian Sea in the shortest possible time, and the contemporary observation of the physical and dynamic conditions of the waters, enabled us to evidence the influence exerted by the basin dynamic conditions on the macroplankton distribution.

The data show that in the basin area characterized by vertically moving components of water masses, the macroplankton biomass is subject to an overall decrease and the macroplanktonic population is poorly diversified. Altogether, the macroplankton appears to be richer along the cyclonic circuit flowing by the Ligurian coast, and to concentrate mostly in the peripheral areas where temperature and salinity gradients are highest. Major biomass densities are due mainly to Siphonophora and Mollusca, i.e. to the largest populations encountered in the diurnal surface macroplankton at the time of the surveys. Taxa other than Copepods contribute in a lesser amount to the highest biomass concentrations in these areas. Hydrodynamical conditions coupled with behavioral patterns (vertical migration, reproduction) may aggregate zooplankton. The predominant role of biological factors in the small-scale spatial distribution of Copepods was shown by Boucher (1984) in the Ligurian front facing the French coast.



Position of sampling stations, mean isothermal for 0-100 db layer and percentage distribution of biomass (mgDW/100cm) for offshore stations.

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