Mesozooplankton Biomass and Enzymatic Metabolic Activities Increases in the Boundaries of Island-Generated Eddies

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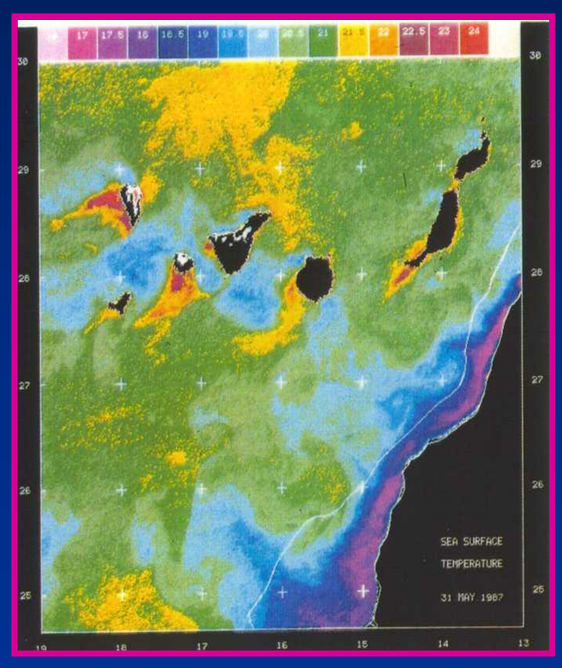
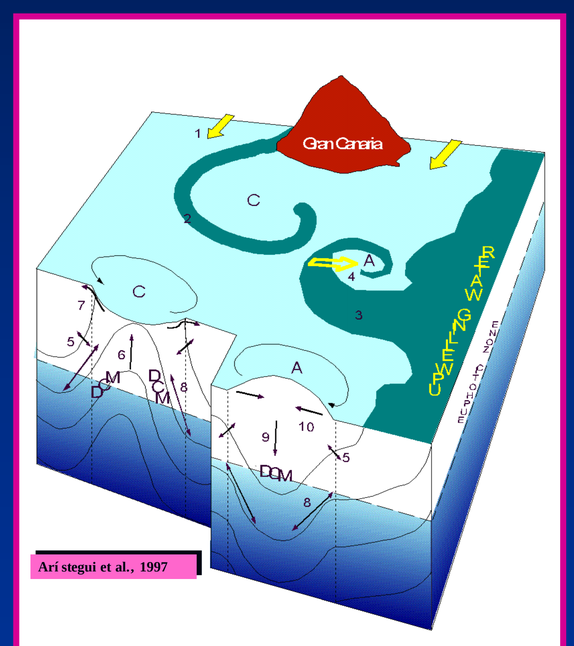
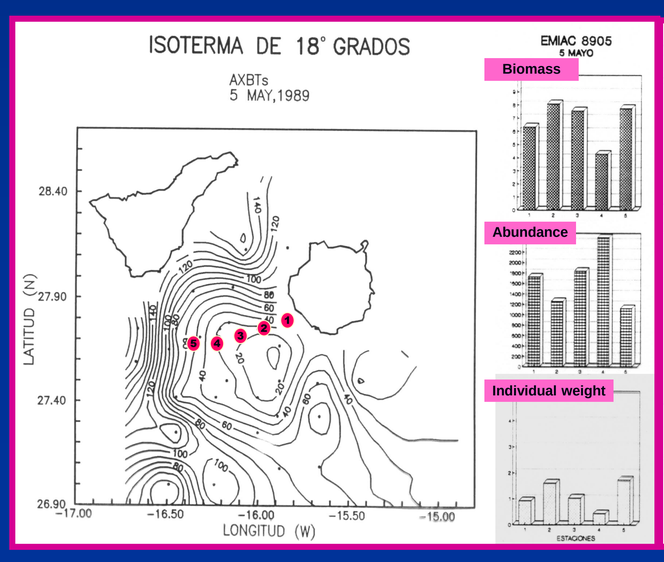
Antecedents:

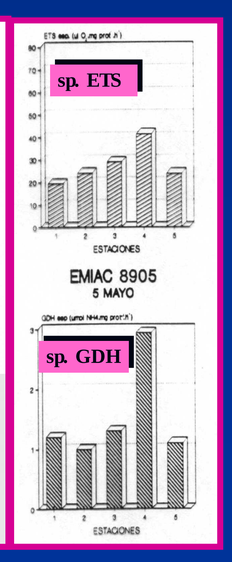
- The presence of a system of recurring eddies, generated by the Canary Islands, has been demonstrated (Arí stegui et al, 1994, 1997). This system is formed by a cyclonic eddy that injects nutrients in the photic layer, with a consequent increase of the primary production, and an anticyclonic eddy that acts occasionally, entraining rich chlorophyll waters and the Saharan upwelling filaments.

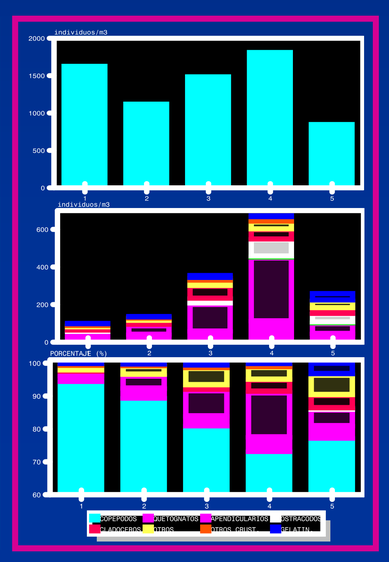




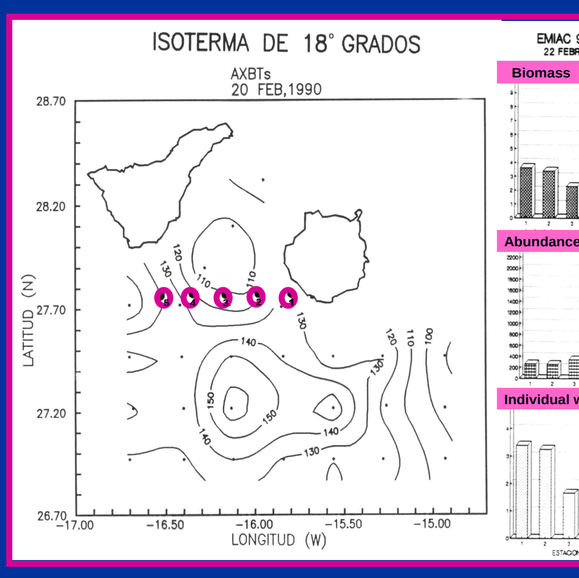
Preliminary studies : 8905 transect. Taxonomic Studies and Enzymatic Activities

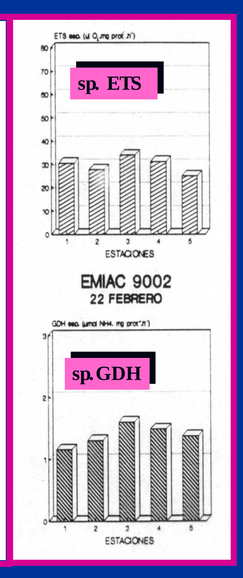


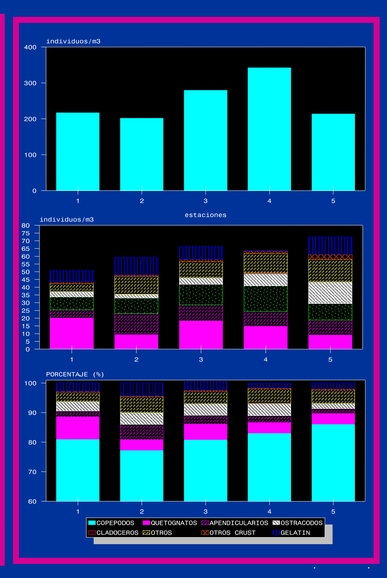




Preliminary studies: 9002 transect. Taxonomic Studies and Enzymatic Activities,







Preliminary studies : 8905 and 9002 transects

Two sampling transects were performed across the cyclonic eddy: The first in May, with higher biomass values, and the second in February, a period with a stratified water column previous to the development of the phytoplankton bloom. The zooplankton distribution is clearly influenced by the presence of this eddy. In May, lower biomass values were obtained in the outer boundaries of the vortex. Precisely in these stations we found an increase in the number of organisms with lowest individual weight. Metabolic enzymatic activities as indexes of respiration (sp ETS) and nitrogen excretion (sp GDH) showed a tendency to increase from the center to the boundaries, coinciding with the station of highest abundance of organisms with the lowest individual weight.

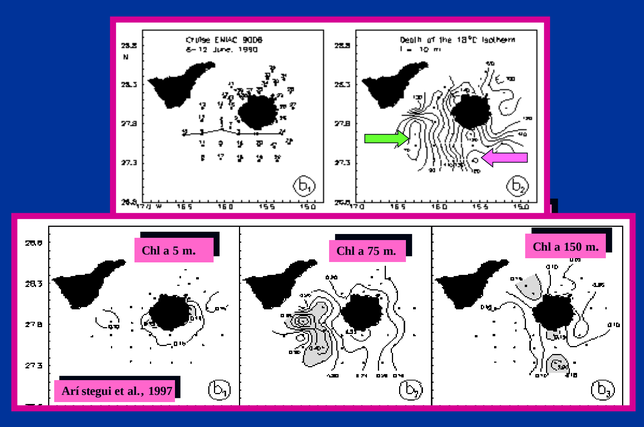
In February we found a different oceanographic situation, depicted by a lower energy in the cyclonic vortex suggested by the deeper distribution of the 18° isotherm. The total biomass and abundance of mesozooplankton were half the values reported in May, but were composed of organisms with significantly higher individual weight. The specific ETS and GDH distribution was homogeneous in the area suggesting that there is no association with the occurence of this phenomena.

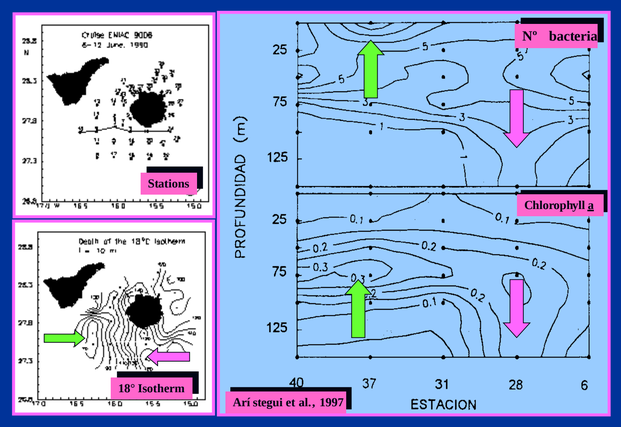
The analysis of major groups of zooplancton showed a high percentage of copepods in the center of the eddy decreasing towards the borders, that is partially replaced by a sharp increase in the abundance of appendicularians, a very active filter-feeding zooplankter, in coincidence with the highest chlorophyll values. In the oceanic stations, less influenced by the island shelf and the eddy, we found a significant increase of gelatinous organisms that were more abundant in February than in May.

EMIAC 9006 Cruise

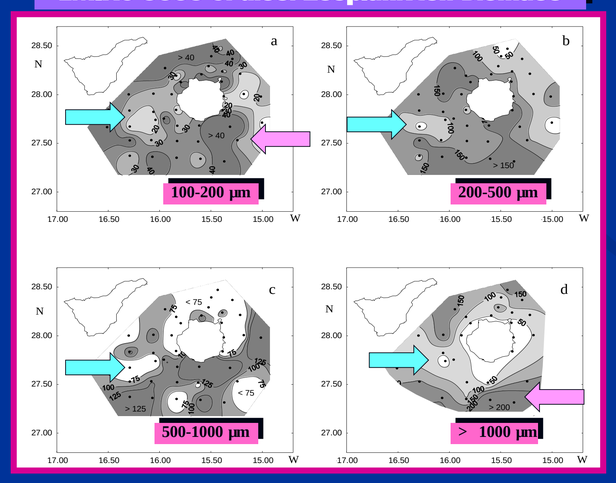
In June, shipboard data were collected on cruise EMIAC 9006. Isothermal surfaces were elevated in the center of cyclonic eddy, and depressed in the center of anticyclonic ones. We studied the chlorophyll "a" concentration at 5, 75 and 150 meters of depth and found that the maximum values of chlorophyll in surface were related to the edges of the island. At 75 meters of depth, the maximum values of chlorophyll were related to the edges of the cyclonic eddy, whereas at 150 meters the maximum values of chlorophyll were related to the anticyclonic eddy. Low values for mesozooplankton biomass were observed for all the size-classes related to the center of the cyclonic eddy. Metabolic activities, ETS and GDH, were high for the smallest size (100-200 microns) related to the sides of the island where we found the maximum of chlorophyll at surface. In larger size classes, we observed high activity related to the anticyclonic eddy where the chlorophyll can be found deeper.

EMIAC 9006 Cruise: Temperature and Chlorophyll





EMIAC 9006 Cruise: Zooplankton Biomass

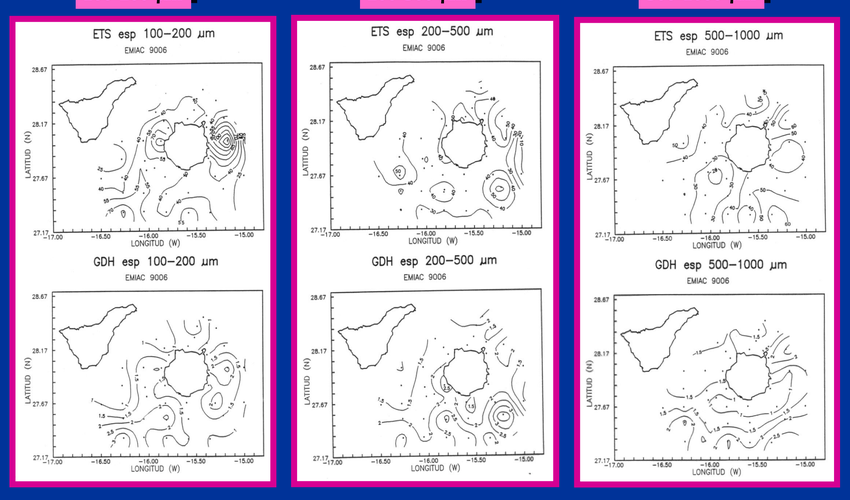


Discussion:

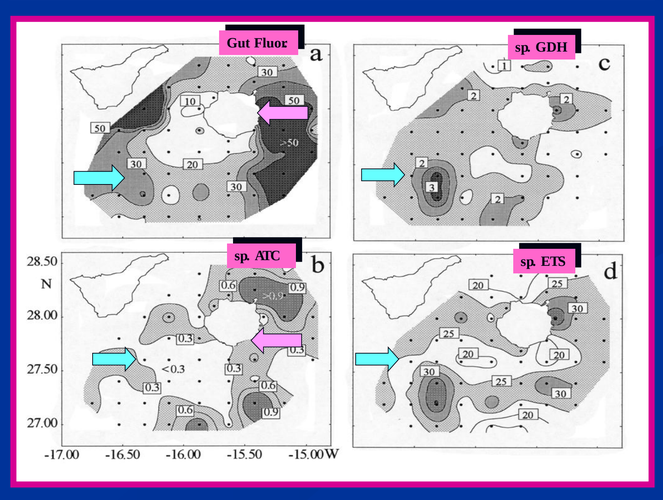
The biological effect of the eddy field on zooplankton biomass and activity is suggested to be the result of a slight increase of metabolism at the core of the cyclonic structure due to the enhancement of primary production. This increase of metabolism includes an increase in the growth of the organisms that is reflected in an increase of the biomass of the zooplankton that, by advection, is moved towards the edges of the eddy. Near the island the phytoplankton (expressed as chlorophyll "a") is observed at surface, where the zooplankton of small sizes shows maximum values of biomass and activities.

As the cyclonic eddy moves southwards, the phytoplankton is observed deeper and the biomass of zooplankton is then due to larger organisms. This biomass of large zooplankton coming from the cyclonic eddy, as well as from the upwelling filament, is trapped in the anticyclonic eddy where great accumulations of zooplankton and fish larvae are generated. For this reason it is very important in the dynamics of the fishing area.

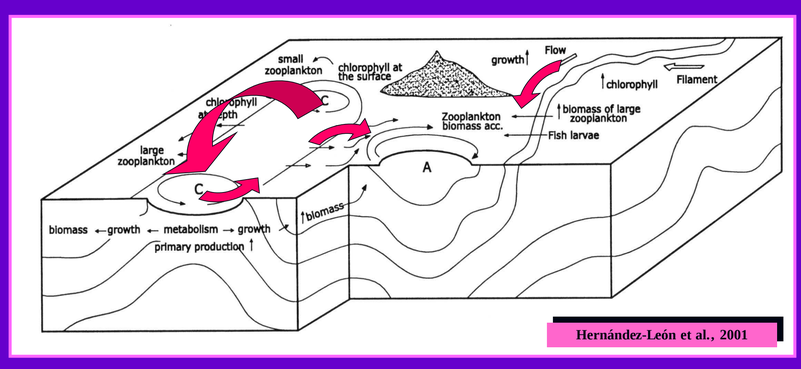
EMIAC 9006 Cruise: Enzymatic Activities ETS and GDH



Gut Fluorescence and Mean Enzymatic Activities ETS, GDH and ATC.



Model of Biological Operation of the System



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