SIZE STRUCTURE OF PHYTOPLANKTON BIOMASS IN THE EQUATORIAL ATLANTIC OCEAN-RELATION WITH ENVIRONMENTAL FACTORS

BY

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Abstract :

The size structure of chlorophyll a (Chla) and phaeophytin a (Phea); total, < 3µm, <1 µm, has been studied on three transects (4°W, 23°W and 35°W) covering the entire equatorial Atlantic ocean (from 6°N to 5°S, see the enclosed map).

We confirm the now classical result, i.e. the extreme smallness of the photoautotrophs of the euphotic zone. Vertical and geographical gradients in the size structure are pointed out and can be connected to the nutrient status of the water column. In the nitrate depleted mixed layer of the western Atlantic (35°W) the <1 µm Chla averaged 73 % of the total Chla and the <1 µm Phea averaged 83 % of the total Phea. As soon as the nitrate is measurable (NO_3^- > 0.1 µg at.l^{-1}) in the bottom of the euphotic zone, the <1 µm Chla increased (x2 approximately) but its relative value decreased : the isoline 0.1 µg at NO_3^- l^{-1} and the ratio <1 µm Chla : total Chla = 0.5 are astoninshingly superimposable at 35°W. Such a correlation does not appear with the <3 µm Chla (at 23°W), suggesting that a dominant population of photoautotrophs smaller than 1 µm exists in the nitrate depleted waters.

In the eastern Atlantic (4°W), nitrate reached the surface (it was the season of the equatorial upwelling) and the percent of <1 µm and <3 µm Chla decreased with the increasing total Chla. No geographical distinction can be observed between east and the west in the both <1 µm Chla vs $[NO_3^-]$ and <1 µm Chla vs total Chla relationships. Since the nitrate is deep in the west (80-100 m) and shallow in the east (surface) it is suggested that it is more the nutrient status than the available light which controls the size structure of the phytoplankton in the equatorial Atlantic ocean.

The main conclusion is there is a strong need for identification, culture, nutrients requierements and kinetic studies of "picoplanktonic" organisms, since preliminary measurements of photosynthetic activity indicate they play the dominant role in the capture of energy entering the ecosystem, when nitrate is exhausted.