Environmental control of phytoplankton cell size

Parsons and Takahashi (1974) claim that observations I made on net plankton and nannoplankton primary productivity in the California Current System (Malone 1971) support the generalization that there is a relationship between phytoplankton cell size and the ability to take up nitrate. While I do not disagree with this statement, my results do not necessarily support it; the relationship shown in figure 13 (Malone 1971, p. 815) between net plankton and nannoplankton productivity and nitrate could be explained entirely on the basis of variations in standing crop. Parsons and Takahashi failed to point out one of the major conclusions of my paper (Malone 1971, p. 816):

> The assimilation ratios of both fractions exhibited little variability, but on the average nannoplankton ratios were twice as great as those of the netplankton. Since this ratio is an index of growth rate . . ., the nannoplankton must have been limited primarily by "cropping" factors . . ., at least during those periods when netplankton productivity was increasing relative to nannoplankton productivity. . . . During upwelling, two processes could selectively remove nannoplankton cells from upwelling regions: (1) grazing and (2) horizontal advection.

One need not invoke size-dependent nutrient uptake kinetics to explain high levels of net plankton productivity. If nannoplankton cells were selectively removed from sites of upwelling by mass transport normal to the coast because of their low sinking rates, net plankton cells would have a greater tendency to remain closer to the region of upward water movement than nannoplankton cells. Since positive vertical advection is a major mechanism by which nitrate is returned to the photic zone, positive correlations between net plankton productivity and nitrate concentration may be circumstantial. It is quite conceivable that high levels of net plankton productivity reflect the selective effects of circulation rather than a growth response to nutrient enrichment.

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References

MALONE, T. C. 1971. The relative importance of nannoplankton and netplankton as primary producers in the California Current System. Fish. Bull. **69**: 799–820.

PARSONS, T. R., AND M. TAKAHASHI. 1974. A rebuttal to the comment by Hecky and Kilham. Limnol. Oceanogr. **19**: 366–368.

A response to the comment by Malone

This is a quite acceptable alternate explanation although not necessarily mutually exclusive of our interpretation. The reason for choosing the latter was that Eppley's laboratory data supported Malone's field observations. At present there are no similar experimental data to support the hypothesis given above by Malone—we shall look forward to hearing about a confirmation of these ideas.

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