EVALUATION OF CERTAIN ASPECTS OF RECENT MODELS OF PHYTOPLANKTON GROWTH AND ADAPTATION

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ABSTRACT

Recent numerical models proposed by Laws and Bannister (1980), Shuter (1979; Laws et. al. 1983), Kiefer and Mitchell (1983) and Laws et. al. (1985) concern the physiological adaptation of phytoplankton to the simultaneous variations of light, temperature and inorganic nutrient concentration. An experimental evaluation of some of the predictions of these models was performed using Pavlova lutheri grown in nitrate-limited steady state cultures at a series of growth rates at each of two constant culture irradiances. At each growth rate the short-term photosynthesis versus incident irradiance relationship (P vs. I_o), cellular nitrogen to carbon (N:C) ratio, chlorophyll a to carbon (Chla:C) ratio and the algal chlorophyll a-normalized integrated optical absorption coefficient ($\overline{k_c}$) were measured. The quantum yield of photosynthesis at the culture irradiance and the maximum quantum yield were then calculated. The P vs. I_o relationship, $\overline{k_c}$, quantum yields and N:C and Chla:C ratios were all found to vary with both growth rate and culture irradiance under nitrogen-limited conditions. The fact that these results failed to substantiate some of the models' predictions indicated the need for their revision. However, the importance of simultaneously accounting for both nitrate-limited growth rate and culture irradiance when determining phytoplankton physiological adaptation was

validated. Alterations of algal morphology and photosynthetic processes provided a possible explaination for many of the adaptations observed.