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Interpretations of the ^{14}C Method of Measuring the Total Annual Production of Phytoplankton in a South Carolina Estuary*)

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The ^{14}C primary production technique for the estimation of total phytoplanktonic primary production has been applied to an estuary in South Carolina. Total phytoplanktonic production generally followed the annual temperature cycle and ranged from a low of $6.4 \text{ mgC/m}^2 \cdot \text{hr}$ in November to a high of $234 \text{ mgC/m}^2 \cdot \text{hr}$ in August. Total annual production of phytoplankton was calculated to be 346 gC/m^2 . Over a year, the proportion of the release of dissolved organic carbon (DOC) from estuarine phytoplankton ranged from 3 to 55 % of the total daily primary production. Inconsistencies in the amount of DOC measured are discussed relative to the experimental methods that were employed.

Introduction

The application of the ^{14}C method (Steemann-Nielsen 1952) for the measurement of phytoplanktonic primary production rates is routine in laboratories and field studies globally. However, criticisms of the method are numerous (Fogg 1969, Morris *et al.* 1971, Strickland 1965). In recent years, measurements of the carbon content of the medium in which the cells are suspended have enhanced the confusion already associated with the ^{14}C technique (Anderson and Zeutschel 1970, Arthur and Rigler 1967, Nalewajko and Lean 1972, Schindler 1971, Schindler and Holmgren 1971, Thomas 1971, Williams *et al.* 1972).

Large amounts of carbon have been observed in the filtrates of ^{14}C -labelled natural samples (Table 1). Inshore,

productive areas generally have high production rates with low percentages of fixed carbon released to the surrounding medium, while oligotrophic areas are characterized by low total fixation rates with high percentages of extracellular carbon (Anderson and Zeutschel 1970, Fogg *et al.* 1965, Thomas 1971, Watt 1966). Further, annual differences in the release of organic matter from phytoplankton have also been found, with higher release rates in post-bloom and senescent cells and lower rates found at most other times of the year (Hellebust 1965).

Productivity measurements in estuaries should further the understanding of the production technique and energetics of the inshore environment. Production rates are usually high and one would expect considerable concentrations of organic matter to be released in these eutrophic regions. To determine the actual amounts of carbon fixed and released by phytoplankton, a year long biweekly survey was undertaken in a high salinity, well-mixed estuary east of Georgetown, S. C. during 1972–73.

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