

This Week's Citation Classic

Eppley R W, Rogers J N & McCarthy J J. Half-saturation constants for uptake of nitrate and ammonium by marine phytoplankton. *Limnol. Oceanogr.* **14**:912-20, 1969. [Institute of Marine Resources, University of California, La Jolla, CA]

This paper provided laboratory measurements of nitrate and ammonia uptake kinetic parameters for a suite of species of marine phytoplankton. It went on to speculate about the possible ecological significance of these properties for phytoplankton in the real ocean. [The SC[®] indicates that this paper has been cited over 155 times since 1969.]

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February 12, 1979

"That primary production in the oceans is related to inorganic nutrients has been known since the turn of the century. This work came about in order to find out if the kinetic parameters of nitrate and ammonium uptake by marine phytoplankton could help explain why some species live in the nutrient-impoverished central oceans while others live in richer coastal regions; why there is often a succession of species over the seasons in coastal waters; and why some species live in rock pools at the ocean's edge but not in the ocean itself. The paper also touched upon variations in the kinetic parameters with cell size and temperature.

"The methods and/or kinetic concepts were already extant in plant physiology, microbiology, and sanitary engineering. What was new was the application of these concepts to marine phytoplankton. Jane Rogers and I made the measurements. The three of us fit the uptake data to the Michaelis-Menten equation of enzyme kinetics and Jim McCarthy was instrumental in

interpreting the data in an ecological context.

"As our paper was in review, R.C. Dugdale published a conceptual review of phytoplankton-nutrient relationships in the ocean,¹ setting the stage nicely for our results and interpretation. These two papers proved seminal in encouraging work on both marine and freshwater phytoplankton. They were timely in being published at the height of interest in eutrophication of lakes and the coastal ocean, nitrogen having been identified as a principal limiting nutrient for phytoplankton growth in the sea, phosphorus in lakes. Work on the relation between the growth of aquatic plants and nutrient levels and input rates continues. Much of the current activity concerns seaweeds and the seasonal changes in their production.

"The research setting and how it came about may be of interest with respect to the sociology of science.

"The events that led to this work may be of some interest as they belong to the glory days of generous research funding in the 1960s. In 1963, a new group dedicated to plankton was set up by Milner B. Schaefer,² director of the Institute of Marine Resources at Scripps Institution of Oceanography, with AEC support. The late J.D.H. Strickland² had attained the stature of an intellectual and experimentalist leader in biological oceanography and was seduced to leave Canada and form the group. He had the courage and freedom to hire outsiders for his junior staff, such as a plant physiologist like me, as well as young people properly trained in oceanography.

"This particular study was possible because of the availability of such oceanographically-naive but enthusiastic experimenters, the recent availability of a culture collection at Scripps of ecologically significant ocean phytoplankton, and new methods of measuring ammonium and nitrate in seawater."

1. Dugdale R C. Nutrient limitation in the sea: dynamics, identification, and significance. *Limnol. Oceanogr.* **12**:685-95, 1967.

2. Behrman D. *The new world of the oceans—men and oceanography*. Boston and Toronto: Little Brown & Co., 1969. 436 p.