This Week's Citation Classic

Riley G A. Organic aggregates in seawater and the dynamics of their formation and utilization. *Limnol. Oceanogr.* 8:372-81, 1963.
[Bingham Oceanographic Laboratory, Yale University, New Haven, CT]

Organic detritus and dissolved organic matter in seawater have been regarded traditionally as a simple, one-way transition from the living to the inorganic state via bacterial degradation. Evidence is presented that these reactions are reversible in ways that are ecologically significant. [The *SCI*® indicates that this paper has been cited in over 130 publications since 1963.]

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"This paper perhaps gained attention mainly because of a catchy title. Everyone knew there was a lot of organic detritus in seawater. So what? It was just gunk. However, I pulled together two disparate observations of others, did some further investigations, and pointed up their possible ecological significance.

"I was at Yale University, studying Long Island Sound, and a young visiting fellow named Satoshi Nishizawa was working with me for awhile. He had observed and photographed detritus from a diving sphere.[1] Some of the particles were larger than anything I had seen and must have been produced by aggregation of smaller particles. He showed me that they were quite fragile and were easily broken up by normal sampling methods and so were seldom seen in their natural state. I mounted some carefully collected samples on slides for microscopic examination. Most of them were of a size readily eaten by zooplankton and contained numerous bacteria and other small organisms. Although the food value of the detritus itself was uncertain, the aggregates served to package these tiny organisms into bite-sized food for animals. I began a two-year study of the aggregates.

"Then I learned from a friend, William Sutcliffe, that he and an associate had produced particles from the dissolved fraction by adsorption on bubbles. They later showed that these particles would support the growth of young brine shrimp.[2] I repeated the bubbling experiments. The particles were thin, almost transparent flakes, similar to flakes on my slide collections, which I had not recognized before as being organic particles. They were particularly abundant in winter, when wave action during stormy weather might be expected to inject numerous bubbles into the surface water.

"Further laboratory experiments showed that extracellular organics released by growing phytoplankton could be converted readily to particles by bubbling air through the filtered culture medium. This was regarded as ecologically significant because although much of the dissolved matter in seawater is refractory and has been around for a long time, there can be additions of fresh and usable food material to this fraction.

"In short, the particulate and dissolved organic matter was not merely a bacterial substrate in a terminal process of dissolution but could be reorganized and could reenter the main food web, often at times when other food was scarce.

"In retrospect, this paper was speculatory and pushed some of its conclusions too far. Nevertheless, it clearly demonstrated the existence of some ecological problems that had not been recognized before. Hence, the paper stimulated further work on various aspects of the subject and of course was cited in some of these later publications. I published a review of this field in *Advances in Marine Biology* in 1970."[3]

1. **Nishizawa S, Fukuda M & Inoue N.** Photographic study of suspended matter and plankton in the sea. *Bull. Fac. Fish. Hokkaido Univ.* 5:36-40, 1954.
2. **Baylor E R & Sutcliffe W H.** Dissolved organic matter in seawater as a source of particulate food. *Limnol. Oceanogr.* 8:369-71, 1963.
3. **Riley G A.** Particulate organic matter in seawater. *Advan. Mar. Biol.* 8:1-118, 1970.

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