MICROBIAL READJUSTMENT TO NEW BALANCE AFTER
INFLUX CHANGE OF ORGANIC MATERIAL IN MARINE
DYSPHOTIC LAYER

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Abstract. Influences of energy and particulate matter were experimentally reduced by eliminating the upper part of the euphotic zone, using a large sediment-seawater enclosure (SSE) in situ in Saanich Inlet, B.C., Canada. The standing stock of heterotrophic microorganisms, as determined by ATP concentration, in the experimental dysphotic zone was not appreciably affected, although the decreased supply of organic material did reduce their rate of nutrient uptake from the environment. In the mesotrophic level of the natural dysphotic zone, the turnover rate of glutamic acid remained near the initial rate by readjusting into a new balance.

1. Introduction

Turnover time of each organic compound in a certain watermass of the natural environment has a certain amplitude in its steady-state oscillation. The turnover time has been shown to be divided by thresholds among oligotrophic, mesotrophic and eutrophic watermasses (Seki, 1981; Seki et al., 1972; 1974; 1975; 1980a, b and c). The steady-state oscillations are driven by a number of mechanisms. The mechanisms may be chiefly controlled by a series of negative feedback systems to maintain aquatic systems of the natural water within a certain trophic level of the flows of energy and material (Seki, 1981). However, the system may get into a higher trophic level irreversibly crossing over a threshold when the system receives too many disturbances. On the other hand, the system may get into a lower trophic level by irreversibly crossing over another side of the threshold, when the system receives the opposite kind of disturbances. Once an original system crossed over a certain threshold to the next system and crosses back over again the same threshold, the newly balanced system may be not the same as the original system. The integrated type of differential elements comprising the original and newly balanced systems will differ although the conspectus type may be the same in the both systems. This is because some of the differential elements are destroyed when the system is crossing over the threshold. For instance, the oligotrophic types of Lake Washington before and after the eutrophication may be not comprised of exactly the same differential elements.

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When natural water is enclosed in a container, the microbial population in the water usually decreases slightly followed by a rapid increase in the population and a decrease in the species number. Thereafter the population generally fluctuates in a steady-state oscillation (Seki, 1973). These fluctuations occur as a result of negative feedback systems in biological activities against the disturbance to readjust the enclosed ecosystem into a new balance. Thus, the amplitude of the oscillation becomes mostly minimized with time of storage to the direction of convergence. The magnitude of the changes is a function of a number of ecological parameters, such as the physicochemical or biological components of the water and the sample size (Parsons, 1980).

An experiment was undertaken to study the mechanism for readjustment to maintain the steady-state oscillation of uptake kinetics of an organic solute by marine microorganisms after a disturbance of reducing the influxes of energy and material \textit{in situ} in the sea.

### 2. Methods

Two different levels in the flow rates of energy and materials were performed by setting a large subsurface bag (SSE's enclosure bag; diameter 5 m, height from the sea-floor 17.5 m) \textit{in situ} in the sea of Patricia Bay, Saanich Inlet, B.C., Canada (Wong and Whitney, in preparation). This device (Figure 1) eliminates the active photosynthesis of phytoplankton inside the bag in the topmost layer of 2 or 5 m depth depending on the

![Fig. 1. SSE's enclosure bag launched \textit{in situ} in the sea of Patricia Bay at the approximately 20 m depth.](image-url)