

FIELD OBSERVATION ON WATER QUALITY IN A VERTICAL CROSS-SECTION OF A BRACKISH LAKE DOMINATED BY SUSPENSION-FEEDING BIVALVES

Kyushu University: Fatos Kerciku, Yoshiyuki Nakamura, Tetsunori Inoue

Shimane Prefectural Institute of Health and Environmental Science: Yu Ishitobi, Kenji Kato

Introduction

Due to the high biological activity of suspension-feeding bivalves (shijimi) populated densely in near shore, benthic region of Lake Shinji, water quality in the littoral region of the lake is quite distinguishable with that of pelagic region (Yamamuro and Koike, 1993). Previous experiment showed that nocturnal convection enhances food supply to bivalves so that chl. a concentration in littoral water decreases appreciably during nighttime. This fact implies that excreted nutrients by bivalves are available for phytoplankton during daytime, and makes feasible existence of an active coupling of benthic and pelagic processes. In order to investigate the benthic-pelagic coupling processes, we performed continuous experiments of water quality in the vertical cross-section of the lake.

Materials and Methods

Measurements were carried out from August 6 18:00 hr until August 8 12:00 hr in 1997 every six hours at 9 distinguishable stations located in a straight line transect the north-south shore of the Lake Shinji whose surface area is 80 km² and the mean depth 4.5 m (see Fig.1). Temperature and salinity were measured by STD (Alec Electricity, ASD100-PK) at 10 cm intervals, Chl.a and DO were measured by Turner Designs Model 10 and by YSI Model 58 at 50 cm intervals, respectively. Chlorophyll a was calibrated based on the standard analyses done for a reduced number of samples taken in the same time and place. Nutrients were analyzed by Autoanalyser Traacs 800 TM. Respiration, Net and Gross Product were measured using the light-dark bottle technique. The measurements started at station number one and proceeded to station 9 using a speed boat. Samples of water were kept into cooling boxes and transported to the laboratory within a short time.

Results and discussions

In Fig 2 are shown midnight, morning and noon pictures of temperature, chlorophyll a, dissolved oxygen and NH₄ distributions, respectively. Temperature field ranged from 25.5 to 28.5 °C, even though these values were quite low compared with values observed during typical summer time. Isotherms were to be almost vertical during the nighttime and horizontal during the daytime. The concentration of chl.a had a distribution with lowest value in littoral region and maximum in pelagic one. The lower values appeared during the nighttime, whereas relatively high concentration isopleths were developed around the depth 4 m near shore. Dissolved oxygen pattern followed that of temperature, the lower values looks to be near the sediment in littoral regions (as result of biological activity of bivalves) and in the deep pelagic regions due to. There is a significant increase of DO from early in the morning until noon as dissolved oxygen is affected by the rate of photosynthesis. From Fig.2 one can point out, that concentration of ammonium is higher in shallower water region.

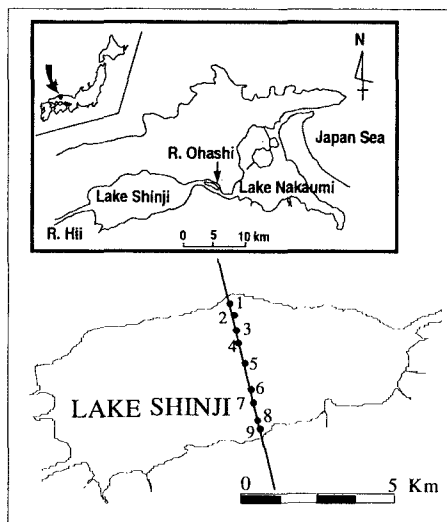


Fig. 1 Map of Lake Shinji and location of the measurements stations

The reverse pattern of chl.a and nutrients is a reflection of filtering and excretion activity of bivalves densely populated in the littoral region.

Primary production seems maximum in a region where littoral water mixes with pelagic water (see Fig 3). This implies that excreted nutrients by bivalves are available for phytoplankton during daytime, and suggests that bivalves not only reduce the plankton biomass by filtration but as well stimulate its growth by supplying nutrients by excretion. Therefore there exists a feed back loop between benthic and pelagic regions, where a relatively rich nutritive current of water gives an impact at relatively high chl.a concentration in intermediate regions at the depth of 4 m.

Conclusions

Simultaneous and continuous measurements of temperature, chl.a, DO, respiration, net and gross production and analyses of basic nutrients in a cross section of Lake Shinji a brackish lake, dominated by suspension-feeding bivalves, enables us to have a clear view of variation of water quality.

Suspension feeding bivalves not only reduce the phytoplankton biomass by filtration but also enhance it through their excretion .

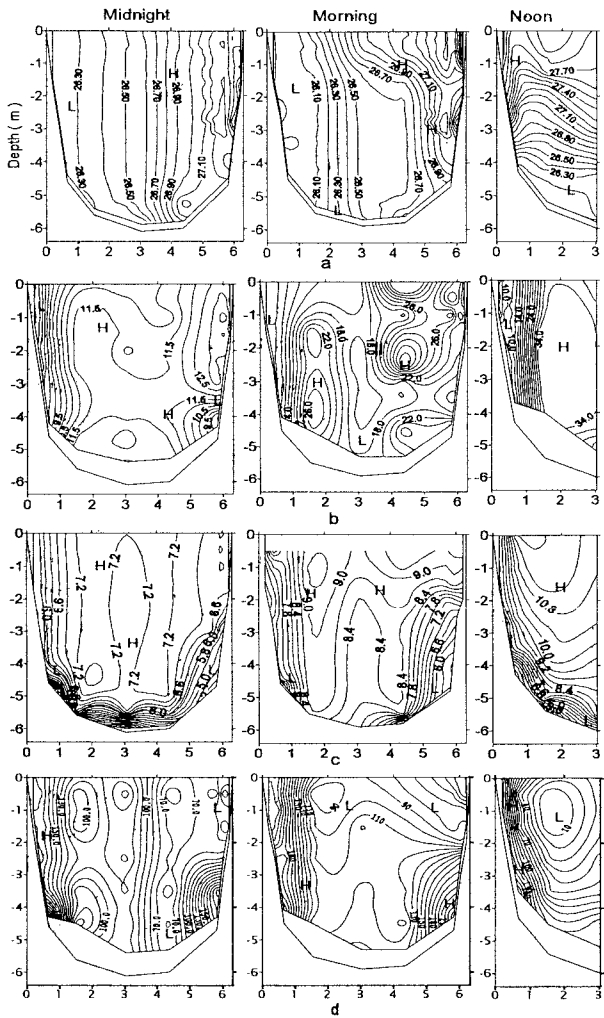


Fig. 2 Distribution of a) Temperature (°C), b) Chl.a (µg/l), c) DO (mg/l), d) NH4 (µg/l). August 8, 1997,000 hr, 600hr, and 1200 hr

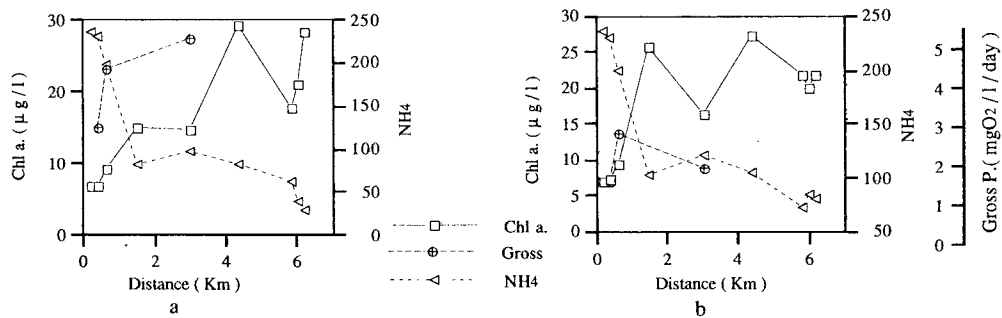


Fig. 3 Variation of NH4, Chl.a and Gross Production. August 8, 1997. 600 hr. a) depth 0.5 m and b) depth 1.5 m

References

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