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CONTINUOUS MEASUREMENTS OF WATER QUALITY INA CROSS SECTION OF LAKE SHINJI

Kyushu University: Fatos Kerciku, Yoshiyuki Nakamura, Tetsunori Inoue
Shimane Prefectural Institute of Health and Environmental Science: Yu Ishitobi, Kenji Kato
Kjansangbuk-do, Prov. Govern. Res. Ins. Health &Env: Lee Jeong Ja

Introduction

Lake Shiji, is one of the most productive lake in Japan with the highest yeild of a kind of filter feeder (shijimi) . These suspension feeders are densely populated in the littoral benthic region. A combination between localized distribution and high filtration activity of suspension-feeding bivalves is responsible for apparently existence of two regions with distinguishable water quality. (Yamamuro and Koike, 1993). Previously we have figured out that due to nocturnal convective motion which enhances food supply to bivalves, chl. a concentration in littoral water decreases appreciably and water clarity increases during nighttime as a consequence of 'top down' control caused by grazing and filtration. We also implied the hint that excreted nutrients by bivalves are available for phytoplankton during daytime, and so makes feasible existence of an active coupling of benthic and pelagic processes. For further investigation on the benthic-pelagic coupling processes, we conducted continuous and simultaneous measurements of water quality including main nutrients and primary production in a vertical cross-section of the lake.

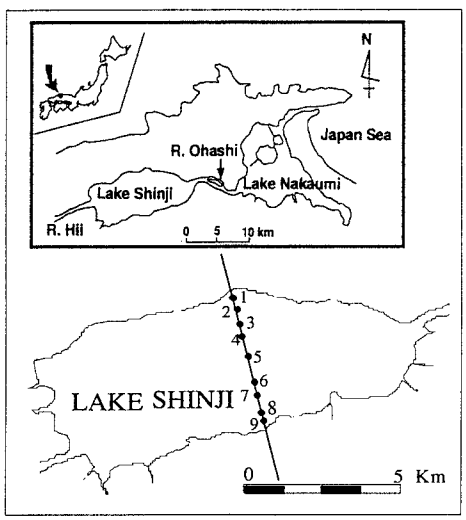

Fig. 1 Map of Lake Shinji and location of the measurements stations

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 on 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. The calibration for chl. a was done based on the standard analyses of 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 speedboat. 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 NH4 and PO4 distributions, respectively. Temperature field ranged from 25.5 to 28.5 (C, although these values are 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 4m 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 the lack of light penetration. There is a significant increase of DO from early in the morning until noon as DO is affected by the rate of photosynthesis. From Fig. 2, one can point out, that concentration of NH4 and PO4 is higher in shallower water region. The reverse pattern of chl.a and nutrients is a reflection of intensive filtering and excretion

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Address: Fukuoka-Shi, Hakata-Ku, Chiyo Machi 1-21-16- 726; tel 092-642-32-82, Fax 092-642-3279

activity of bivalves densely populated in the littoral region. Primary production seemsmaximum 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 do not only reduce the plankton biomass by filtration but alsow stimulate its growth by supplyingnutrients 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

We have conducted 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

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

Bivalves excrition is the main factor responsible for the increase in primary production in intermediate region

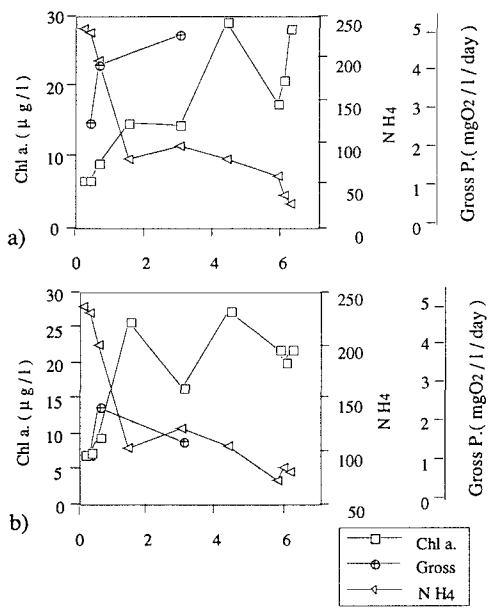

Fig.3 Variation of NH_4, Chl.a, and Gross Production. August 8. 1997.600 hr, a) 0.5 m and b) 1.5 m

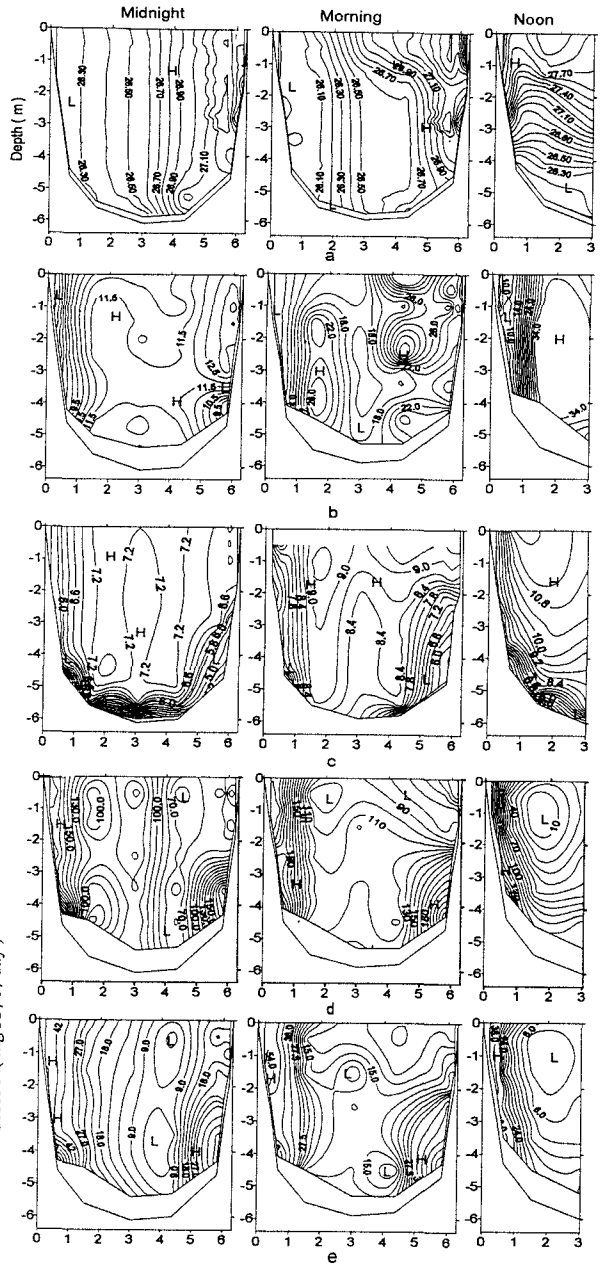

Fig. 2 Distribution of a) Temperature (°C), b) Chl.a (μg/l), c) DO (mg/l), d) NH4 (μg/l), e) PO4 (μg/l). August 8. 1997,000 hr, 600hr, and 1200 hr

References

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