CROSS-SECTIONAL DIFFERENCES IN TROPHIC STRUCTURES OF BENTHIC COMMUNITIES IN KISO RIVER ESTUSRY WITH PARTICULAR REFERENCE TO BIVALVES, *Corbicula* spp.

Graduate School of Environmental Studies, Nagoya University ○Nannan LI, Takashi TASHIRO
OBAYASHI CORPORATION Daisuke YOSHIMOTO
Graduate School of Engineering, Nagoya University Fellow Tetsuro TSUJIMOTO

1. INTRODUCTION

The benthic organisms play important part in the estuary ecosystem, since they composes food web by connecting the primary producers such as phytoplankton and algae with predacious consumers such as fish and birds in higher trophic levels. Recently, carbon and nitrogen stable isotope analysis in organism are generally considered to be a useful tool to analyze food web / trophic structures. Conventionally, Kasai and Nakata (2005) and the other reserchers focused on variation of food web structures and habitat characteristics of benthic communities along riverine estuaries. However, there are few attempts regarding their cross sectional differences. Tashiro et al. (2010) clarified the diversification and characteristics of benthic communities along the transection in a wide river estuary. Hence, the purpose of our research is to clarify the food web / trophic structures in a specific transection by measuring the stable isotopes of carbon and nitrogen for major benthic species and particulate organic matters (POMs) in a wide riverine estuary.

2. MATERIALS AND METHOD

The study field is located at around 17 river km from the mouth, in the Kiso River estuary. The mainstem of Kiso River is roughly 193 km length，and its catchment area is 5.275km^2. Three station were set in this transection as follows: St.1 in the riparian subtidal embayment with groins; St.2 in the center of main river; St.3 in the riparian subtidal zone without groins. A series of field survey were carried out from September 27 to November 15, 2012.

In order to monitor the physical environment conditions, the chlorophyll a and salinity concentration were measured by the electric conductivity and turbidity loggers (COMPACT-CT and -CLW, JFE Advantech Co., Ltd.) in the riparian stations. The benthic POMs (BPOMs) and organisms were collected on the bed surface area of 0.0225 m^2 by Ekman-Birge grab in each station. The suspended POMs (SPOMs) were collected by plankton-net in each station. These POM samples were divided into the CPOMs (coarser particles than 1 mm) and the FPOMs (finer particles than 1 mm). all of the samples were processed to be dried fine powders for CN stable isotope analysis after evaluating their wet or dry mass.

Stable isotope ratios were measured by using continuous flow isotope ratio mass spectrometry (EA-IRMS, Thermo Fisher scientific Ltd.). The analytical results were evaluated in the delta notation as follows:

$$\delta^{13}\mathrm{C} \text{ or } \delta^{13}\mathrm{N} = (\mathrm{R}_{\mathrm{sample}}/\mathrm{R}_{\mathrm{standard}} - 1) \times 1000\,(‰) \qquad (1)$$

where R is the ^{13}C/^{12}C or ^{15}N/^{14}N ratio for δ^{13}C or δ^{15}N, and, PDB carbonate for δ^{13}C and air nitrogen for δ^{15}N were viewed as standard. Furthermore, the software *Iso Source* (e.g. Phillips and Glegg, 2003) was utilized for evaluating the compositions of food sources fed by the bivalves such as *Corbicula leana* and *Corbicula japonica*.

3. RESULTS AND DISCUSSIONS

The chlorophyll-a concentration is considerably higher in the St. 1 (15.83 μg/l as the average value) than that in the St. 3 (1.06 μg/l as the average value). It indicated that primary production is relatively higher in the embayment area.

Fig. 1 shows all of the analytical results of the stable isotope ratio of carbon and nitrogen (δ^{13}C and δ^{15}N). Regarding the data distributions of *Corbicula leana* and *Corbicula japonica,* St. 1 showed relatively higher values than the other stations. It was indicated that they depended on the food sources with higher carbon isotope values. Moreover, it was known that the organic particles from the seaward site showed higher values in carbonate isotope ratios than those from the terrestrial sites (e.g. Kasai and Nakata, 2005; Yamamoto et al., 2005). According to this finding, it could be explained that the seaward organic matters with higher carbon isotope ratios were brought by the tidal current were utilized as the major food sources of benthic species even in our field, around 17 km far from the mouth due to the topographic factor,.

Fig. 2 shows the compositions of food sources for *Corbicula leana* (a) and *Corbicula japonica* (b) which are evaluated as the analytical results of the Iso Source with the potential food sources listed in the legend of these figures.

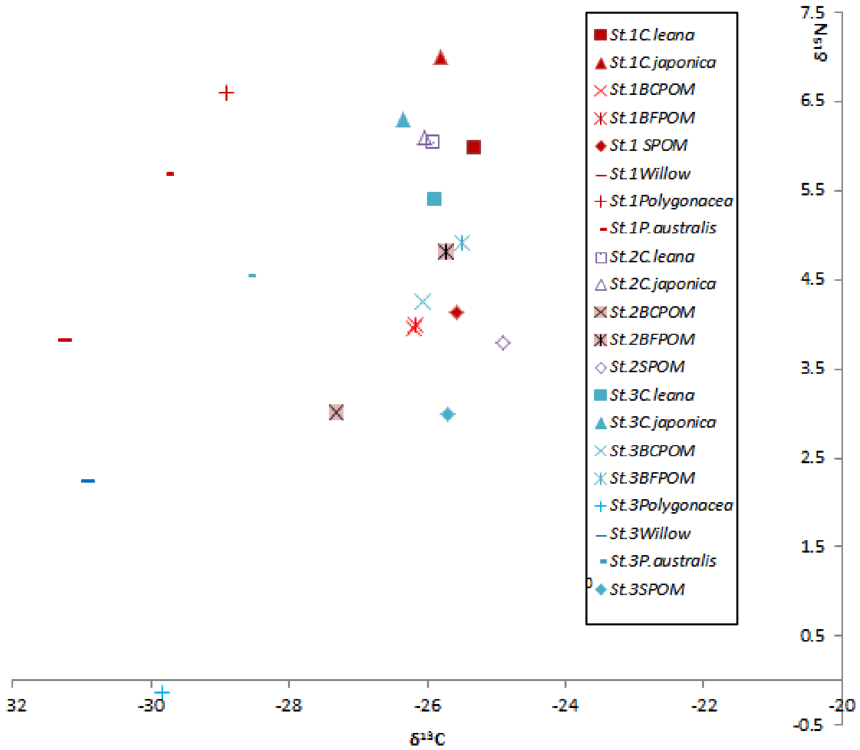

Fig. 1 δ^{13}C *and* δ^{15}N plot of *Corbicula leana, Corbicula japonica* and their food sources in all of the stations

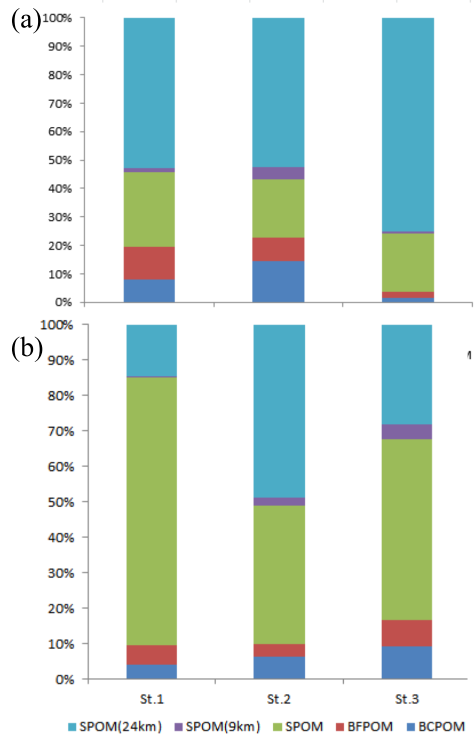

Fig. 2 Compositions of food sources of *C. leana* (upper (a)) and *C. japonica* (lower (b))

The contribution of SPOM for *C.leana* in each station is more than 78%, whereas the terrestrial SPOM accounts for more than 66% (see Fig.2(a)). It denoted that the food sources for *C.leana* could be mostly dependent on suspended materials. The compositions of food sources were quite similar between St.1 and St.2 stations. It indicated that *C.leana* mainly depends on the terrestrial SPOM, even in the relatively high autochthonous production area (like embayment). In St. 3, the ratios of the terrestrial SPOM (collected at 24 river km from the mouth) show larger than those in St. 1 and 2. It can be explained that in the left riparian area, the water exchanged frequently, promotes to provide much more terrestrial POM from the upstream (collected at 9 river km from the mouth).

The contribution of SPOM to *C.japonica's* food sources is 83%~90% (see Fig.2(b)). Althogh both *C.japonica* and *C.leana* depend on the SPOM, the sources are quite different as follows: for *C.leana*, the mainly food sources is terrestrial SPOM, whereas for *C. japonica,* the mainly food source varied according to the different habitat. In other words, the autochthonous phytoplankton was the mainly food source because of a large amount of autochthonous phytoplankton in St. 1, whereas the terrestrial SPOM was brought from upstream and assimilated as the largest fractional food sources in St. 2 located in the central of river. However, the autochthonous POM ratio in St. 3 is not as large as that in St. 1, and terrestrial SPOM ratio in St .3 is also less than that in St. 2. Considering these results in St. 3， it might be explained by the following environmental conditions as: the chlorophyll-a concentration is less than St. 1, and water exchanging is not so frequently as St. 2. Although Kasai and Nakata (2005) concluded that *C.japonica* use the marine POM as the food sources in lower estuary, and terrestrial POM in upper estuary, we could get something different results that *C.corbicul*a could unselectively assimilate the SPOM in their habitat environments where phytoplankton was viewed as impossible food sources..

REFERENCES

Kasai, A. and Nakata, A, K. (2005): Utilization Of Terrestrial Organic Matter By The Bivalve *Corbicula Japonica* Estimited From Stable Isotope Analysis, Fisheries Science 71：151-158.
Phillips, D.J. and Gregg, J.W. (2003): Sorce partitioning using stable isotopes: coping with too many sources, Oecologia 136: 261-269.
Tashiro, T., Furuhata, H. and Tsujimoto, T. (2010): Benthic animal community in a tidal embayment of the Kiso River, Japan, Limnology in Tokai Region of Japan 43: 61-69. (in Japanese)
Yamamoto, N., Watanabe, K., Kusano, H., and Omura, T. (2005): Carbon And Nitrogen Stable Isotope Analysis On Trophic Structure Of Benthic Faunal Communities In Hirose River Basin, Journal Of Japan Society On Water Environment, 28(6): 385-392. (in Japanese)