

## Stable isotope analysis of food-web system in subarctic to subtropical region of western North Pacific

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Carbon and nitrogen isotope ratios of biota are controlled by two factors, a metabolic system and a life style of predator and a regional variability of environmental parameters on food-web system. To evaluate the environmental factors (*i.e.*, nutrients and temperature) on the basic food-web in marine ecosystem, we studied the seasonal variation of nitrogen and carbon isotope ratios of zooplankton and ambient water in the subarctic site of K2 (47°N, 160°E) and the subtropical one of S1 (30°N, 145°E) in the western Pacific ocean, both of which are JAMSTEC observation site.

Biota were collected in eight depths (0-50, 50-100, 100-150, 150-200, 200-300, 300-500, 500-750, 750-1000m) at both sites using IONESS from February 2010 to July 2011. We also collected water samples from seasonal and vertical (~1,000m depth) profiles in  $\delta^{15}\text{N}$  ( $\text{NO}_3^+ + \text{NO}_2^-$ ) together with zooplankton  $\delta^{15}\text{N}$  at K2 and S1 in special reference to nitrogen cycles. Biota samples were freeze-dried on board immediately after the sampling, and dried one day and delipidated before the analysis. The  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values of zooplankton were determined at SI Science and Research Institute for Humanity and Nature, whereas the  $\delta^{15}\text{N}$  ratio of nitrate ions ( $\text{NO}_3^- + \text{NO}_2^-$ ) in the water was determined using denitrifying method (Casciotti et al., 2002; Sigman et al., 2001) at Tokyo University of Agriculture and Technology and the University of California, Davis.

The  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values of amphipods and copepod, omnivorous zooplankton in the surface ocean, showed a large seasonal variation. The  $\delta^{15}\text{N}$  values of zooplankton and nitrate ions in the water at the S1 site tended to be lower than those at the K1 site, indicating that the basic food-web is affected by nitrogen fixation. We further compared the trophic fractionation of carbon and nitrogen isotopes ( $\Delta\delta^{13}\text{C}$ ,  $\Delta\delta^{15}\text{N}$ ) at these two sites statistically with previously databases for food chains in four marine environments of the Antarctic Ocean, gulf of Alaska, Oyashio, and Kuroshio. It is observed that a simple relationship exists in the  $\Delta\delta^{15}\text{N}/\Delta\delta^{13}\text{C}$  regardless of species and ecosystems. This result demonstrates that the  $\Delta\delta^{15}\text{N}/\Delta\delta^{13}\text{C}$ , which is an isotope fractionation in the baiting process of food-web system, is determined by energy metabolism mainly driven by amino-acids and decarbonation. This contention suggests a unified regularity is maintained in the lower to higher trophic level in the marine ecosystem.

Keywords: nitrogen stable isotope, carbon stable isotope, food web, isotope fractionation