Trophic discrimination of $^{15}N/^{14}N$ for amino acids illustrates energy consumption in organisms

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Animals eat and metabolize diets to extract energy for their activities in ecosystems. The metabolism starts from the deamination for 'trophic' amino acids (e.g., alanine and glutamic acid) and from other reactions for 'source' amino acids (e.g., phenylalanine), resulting in large (3-8‰) and little (0-1‰) trophic discrimination of $^{15}N/^{14}N$ for the former and latter, respectively, in the animal bodies. During the last decade, we have applied this finding as a powerful tool to evaluate the trophic position of organisms and the basal resources (i.e., primary producers) for organisms in food webs.

However, the validity of this tool is dependent on consistency of the size of trophic discrimination. More specifically in the physiological end, the size of trophic discrimination principally varies because it should be related to the deamination flux of amino acids in the energy consumption of animals, e.g., the energy consumption is significantly reduced in the dormancy. In this study, marine fish are reared in a condition with distinct osmotic pressure caused by low-salinity or natural seawater, to confirm whether or not the size of energy consumption is a factor for determining the trophic discrimination of amino acids.

Because marine fish are forced to use much energy against high osmotic pressure of natural seawater, they can grow largely or fastly due to less energy requirement in low-salinity seawater. Moreover, the compression of trophic discrimination (by ~3‰) is observed in the fish under low-salinity. These results indicates that the size of trophic discrimination certainly correlates with energy consumption of animals.

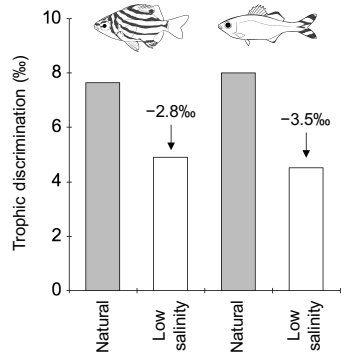

Fig. 1.
Trophic discrimination of $^{15}N/^{14}N$ for glutamic acid vs. phenylalanine in the fish *Girella punctata* and *Microcanthus strigatus*, which are reared in natural or low-salinity seawater.