Natural distinction of carbon and nitrogen isotopic niches in common fish species for diverse marine biotopes off the Yellow River estuary and adjacent sea areas

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Abstract

Stable isotope analysis is a universally recognized and efficient method of indicating trophic relationships that is widely applied in research. However, variations in natural isotopic abundance may lead to inaccuracies due to the effects of complex environmental conditions. This research compared the carbon and nitrogen isotopic niches of fish communities between diverse biotopes around the Yellow River estuary and adjacent sea areas, with the aim of revealing distinctions in stable isotopic niche metrics, trophic positions, and feeding preferences. Stable isotopic niche results indicated that the communities of estuarine habitants were compatible in most study biotopes, and may provide a corridor for energy and material transportation between Laizhou Bay and the open water. Local biocoenosis was embodied in the wider isotopic niche corresponding to frequent environmental changes and abiotic gradients. This implied that they used various food sources to adapt to the fickle environment, including marine-terrestrial boundaries and the estuary. Our analysis of the food source contribution indicated that allochthonous sources were considered major energy sources in estuarine areas directly affected by Yellow River-diluted water, while autochthonous benthic and pelagic producers dominated carbon input into the food web in Laizhou Bay and the open water. A significant variation in the fish δ^{15}N characteristic was found within estuarine adjacent regions, so, together with the results from previous studies, we deemed the local high concentration of dissolved inorganic nitrogen as the original trigger of the abnormal δ^{15}N characteristic in fishes via a transport process along food chains. These results provide a new perspective on the natural distinction of carbon and nitrogen isotopic niches. The detailed data reported here enhance our understanding of variations in fish communities in estuarine ecosystems.

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