The effect of water velocity on stable carbon and nitrogen isotope signatures of periphyton

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Limnol. Oceanogr., 48(6), 2003, 2194-2199 | DOI: 10.4319/lo.2003.48.6.2194

ABSTRACT: Water movement affects carbon and nitrogen isotopic signatures of algae, possibly through effects on boundarylayer thickness. We describe a laboratory experiment carried out in artificial streams, which supports this hypothesis. Periphyton δ'³C and δ'⁵N signatures were significantly depleted in '³C and '⁵N when grown at higher water velocity over the range of 5-62 cm s⁻', the normal range found in small streams. δ'³C signatures ranged between -16.7‰ and -28.1‰ from the lowest to the highest water velocity, respectively. Similarly, δ'⁵N signatures ranged between 7.2‰ and 2.3‰ from the lowest to the highest water velocity, respectively. This pattern was found for algal communities growing on glass (mainly diatoms) as well as for those growing on rock (mainly filamentous green algae). For both C and N, the slopes of the responses were not different between the periphyton communities growing on each substrate, although the effect was statistically weaker for the communities on rocks. The intercept for δ'³C was significantly higher for the communities on rocks, but not different for δ'⁵N. Thus, while both isotopes are fractionated to a greater extent as velocity increases, the diatom communities growing on glass appeared to fractionate C isotopes more than the filamentous green algae growing on rock. This relationship between the stable isotopic signatures of aquatic plants and water velocity will hopefully allow a better understanding of the differences in isotopic signatures of fish in different habitats.

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