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Patterns in the d13C and d15N signature of Ulva pertusa: Interaction between physical gradients and nutrient source pools

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ABSTRACT: Field surveys and laboratory experiments were used to investigate the influence of the physical environment on variability in $\delta^{13}C$ and $\delta^{15}N$ signatures of *Ulva pertusa*, an abundant macroalgae inhabiting the low salinity layer (LSL) of Doubtful Sound, a New Zealand fjord. Field surveys revealed significant spatial variability in $\delta^{13}C$ (-18‰ to -12‰) and $\delta^{15}N$ (0‰ to 6‰). $\delta^{13}C$ was enriched at high irradiance sites and depleted at the fjord[]s wave-exposed entrance. $\delta^{15}N$ signatures increased from 0‰ at the fjord head where freshwater influence is greatest to an oceanic signature of 6‰ at the fjord entrance. $\delta^{15}N$ also increased by up to 4‰ between 2-m depth and the LSL-seawater interface (4-m depth); this pattern was less pronounced near the ocean. During laboratory experiments, $\delta^{13}C$ of U. pertusa became significantly enriched under high levels of irradiance (>50 mmol quanta m^{-2} s^{-1}). When exposed to high irradiance, increases in water motion rapidly depleted $\delta^{13}C$ signatures by as much as 5‰. Variability in $\delta^{13}C$ of *U. pertusa* in Doubtful Sound is largely a function of the light regime, which influences rates of photosynthesis and in turn the algae[]s dependence on HCO_3^-, an enriched source of carbon. However, increased water motion at the fjord entrance counteracts the influence of irradiance, leading to enhanced flux of CO_2 and depleted $\delta^{13}C$ signatures. Variation in $\delta^{15}N$ of *U. pertusa* is less dependent on the physical environment and instead is driven by the source pool signature, which in turn varies between freshwater and marine sources of nitrogen.

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