Stable carbon and nitrogen isotope composition of aquatic and terrestrial plants of the San Francisco Bay estuarine system

Cloern, James E., Elizabeth A. Canuel, David Harris

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ABSTRACT: We report measurements of seasonal variability in the C-N stable isotope ratios of plants collected across the habitat mosaic of San Francisco Bay, its marshes, and its tributary river system. Analyses of 868 plant samples were binned into 10 groups (e.g., terrestrial riparian, freshwater phytoplankton, salt marsh) to determine whether C-N isotopes can be used as biomarkers for tracing the origins of organic matter in this river-marsh-estuary complex. Variability of $\delta^{13}C$ and $\delta^{15}N$ was high (~5-10‰) within each plant group, and we identified three modes of variability: (1) between species and their microhabitats, (2) over annual cycles of plant growth and senescence, and (3) between living and decomposing biomass. These modes of within-group variability obscure any source specific isotopic signatures, confounding the application of C-N isotopes for identifying the origins of organic matter. A second confounding factor was large dissimilarity between the $\delta^{13}C$- $\delta^{15}N$ of primary producers and the organic matter pools in the seston and sediments. Both confounding factors impede the application of C-N isotopes to reveal the food supply to primary consumers in ecosystems supporting diverse autotrophs and where the isotopic composition of organic matter has been transformed and become distinct from that of its parent plant sources. Our results support the advice of others: variability of C-N stable isotopes within all organic-matter pools is high and must be considered in applications of these isotopes to trace trophic linkages from primary producers to primary consumers. Isotope-based approaches are perhaps most powerful when used to complement other tools, such as molecular biomarkers, bioassays, direct measures of production, and compilations of organic-matter budgets.

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