An environmental evaluation of species-specific offsets in coral tissue & skeletal-bound $\delta^{15}N$ with consideration for proxy use

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In an effort to reconstruct changes in the nitrogen cycle, the $\delta^{15}N$ of coral skeleton-bound organic matter (CS-$\delta^{15}N$) is being pursued as a proxy for the $\delta^{15}N$ of the nitrate supply to surface waters at sites of complete nitrate consumption, and for the degree of nitrate consumption where surface nutrient concentrations are high. However, species-specific offsets have been measured between coral tissue $\delta^{15}N$ and CS-$\delta^{15}N$, raising concerns about records compiled from multiple coral species [1]. Further, food availability has been hypothesized to affect coral $\delta^{15}N$ independently from the $\delta^{15}N$ of its N source due to changes in host-symbiont internal N cycling, which may compromise the ability of even individual corals to faithfully capture the $\delta^{15}N$ of its environment through time [2]. Investigation of these effects in the modern ocean is important for robust interpretation of CS-$\delta^{15}N$ records. The coral reefs across the Bermuda pedestal exhibit a gradient in the $\delta^{15}N$ of inorganic and organic N pools due to anthropogenic N inputs and/or reef N cycling processes. We measured coral tissue $\delta^{15}N$ and CS-$\delta^{15}N$ in four species collected from five sites across the pedestal and compared them to the $\delta^{15}N$ of potential N sources. We also measured the $\delta^{15}N$ of sessile asymbiotic filter feeders (feather duster worms) and benthic assimilators of dissolved inorganic N (macroalgae) to constrain coral N sources and test for changes in coral host-symbiont N cycling. The data show no evidence of a feeding effect on coral $\delta^{15}N$ for the examined range, with asymbiotic filter feeders and coral species both exhibiting a near 1:1 relationship with heterotrophic N sources. This argues that $\delta^{15}N$ change over time within an individual coral species reflects $\delta^{15}N$ change in the ecosystem. Species-specific offsets of -0.5 to 2.5‰ are observed between soft tissue and skeletal-bound $\delta^{15}N$, confirming previous findings and indicating that multi-species reconstructions must be pursued with caution. Possible mechanisms for these offsets will be discussed.

[1] Erler *et al.* (2015) *Coral Reefs* **34**, 329-338. [2] Wang *et al.* (2015) *GCA* **148**, 179-190.