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ABSTRACT

TITLE: Local, regional and global biogeochemical linkages to the Physiological ecology of macroalgae on coral reef communities near Green Turtle Cay, Abaco Cays, Bahamas.

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All of the earth's ecosystems are now impacted by human alteration of the global nitrogen cycle. In particular, ecosystems remote from major anthropogenic nitrogen sources are now showing evidence of nitrogen contamination. I report the consequences of nitrogen enrichment to the biochemistry, physiology, and taxonomic composition of marine macroalgal communities near Green Turtle Cay (GTC) in the eastern Bahamas. Water column dissolved inorganic nitrogen (DIN) concentrations at all sites were near the 1µM DIN concentration threshold noted for the demise of coral reef ecosystems globally. Macroalgae at sites with the highest anthropogenic nitrogen enrichment generally had higher biomass of fleshy species, higher net productivity, higher tissue % nitrogen (N) and phosphorus (P), higher alkaline phosphatase activity, lower N:P, C:N, C:P ratios, and higher stable nitrogen isotope (ä15N) values. Elevated ä15N values (4-10ppm) of macroalgae on inshore reefs suggest the importance of sewage and fertilizer as locally important nitrogen sources. Nitrogen enrichment associated with wet season rainfall at GTC resulted in changes in the nutrient biochemistry of macroalgae on the Abaco barrier reef.

I also report the first evidence of increased productivity of macroalgae as stimulated by nitrogen enriched rainfall on a coral reef ecosystem. Laurencia microcladia, a bloom species on the barrier reef of the Abaco island archipelago showed significantly higher dark respiration over control treatments with Sargasso Sea surfacewater when treated with a 5% rainwater solution. Lower net production in rainfall treatments may be indicative of light induced nitrate uptake, creating a "transient effect" of increased nutrient uptake by N-limited reef macroalgae. Significant wet deposition values of atmospheric nitrogen coupled with climatalogical forcing from Florida suggest a source-sink relationship with the northern Bahamas that may supply 50% of the "new" nitrogen to Bahamian coral reefs.

Lastly, Aplysia califonica fed the Rhodophyte Gracilaria ferox cultured in high, medium, and low nitrogen conditions responded by preferential feeding choice, and increased growth response when offered macroalgae with the highest %N and soluble protein. Organic chemistry assays indicated a difference of primary metabolite production between nitrogen replete and deprived G. ferox cultures. Thin-layer chromatography showed a lower incidence of nitrogen containing metabolites in N deprived cultures.