

Isotope analysis aids monitoring of estuarine nitrogen

Bannon and Roman (2008) investigate the practicality of stable nitrogen (N) isotope analysis in monitoring salt-marsh ecosystems for changes in wastewater inputs. Different nitrogen sources are generally associated with different ranges of nitrogen-15 concentrations; therefore, analysis of N isotope ratios in plant and animal tissues reveals the relative contributions of nitrogen from the atmosphere and from human populations (e.g., sewer overflows and effluent from treated sewage and storm sewers).

The investigators sampled saltmarsh cordgrass (*Spartina alterniflora*), sea lettuce macroalgae (*Ulva lactuca*), mummichog killifish (*Fundulus heteroclitus*), and ribbed marsh mussel (*Geukensia demissa*) in marshes of Cape Cod National Seashore

(Massachusetts), Fire Island National Seashore (New York), and Gateway National Recreation Area (New York). Their goal was to identify which species are the most sensitive indicators of anthropogenic N and to evaluate the feasibility of incorporating stable N isotope sampling into long-term monitoring programs.

The study found that the mussel and fish species—consumers—“might be better indicators of nutrient source” than the plant species. It also found that human population, as opposed to residential development from land use data, is a better predictor of nitrogen derived from wastewater because most anthropogenic N in the study came from wastewater.

The investigators were also interested in determining the necessary sample sizes of each organism to detect significant changes in anthropogenic N loading over time. They found that 10 samples of cordgrass are needed to detect a change of one part per thousand in anthropogenic nitrogen. For sea lettuce the sample size jumps to 66, but would reveal changes of $\frac{1}{2}$ part per thousand. Only 9 or 10 samples of the killifish and mussel species would be needed to detect this same change.

The authors conclude with recommendations for incorporating this sampling and analysis technique into monitoring programs, stressing a balance between “the ability to detect change and the time, cost, and effort required for sample collection and analysis.” They suggest the best blend for characterizing an entire marsh-dominated estuarine system is to sample a small number of killifish and a larger number of cordgrass.

Reference

Bannon, R. O., and C. T. Roman. 2008. Using stable isotopes to monitor anthropogenic nitrogen inputs to estuaries. *Ecological Applications* 18(1):22–30.