

Woods Hole Sea Grant: 1996-1998 Projects

Tidal Flat Deposition: Processes and Rheology

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Pollutants often accumulate in fine sediments present along coastal and estuarine zones and along the open coast. Because the fate and transport of some pollutants follow that of fine sediments, it is important to understand the processes behind sediment movement. Unfortunately, fine sediment deposits are often difficult to sample. To address this problem, researchers have combined hydrodynamics with sediment characteristic information to develop a theoretical methodology for examination of fine sediment deposits in tidal flat areas. In continuation of a 1994-1996 Sea Grant-supported study, researchers will design a prototype instrument capable of making quick measurements of sediment characteristics in the field. Such data can then be used in models to improve our understanding of the fate of important coastal ecosystems. (R/G-21)

Quantifying Flushing Rates of Estuaries

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The severity of anthropogenically-induced problems (those caused by humans) such as nutrient loading (eutrophication) or contamination of shellfish beds by toxic dinoflagellates depends largely on the flushing rate of the system. In this comparative study, researchers will measure flushing rates of three, hydrodynamically different, estuaries. Following Rhodamine dye releases in three Massachusetts estuaries, the Parker River, Childs River, and Waquoit Bay, investigators can monitor residence times and three-dimensional spreading of the dye through measurements of forcing variables (winds, tides, and freshwater inflow) as well as currents and water properties. With methods of measuring flushing rates currently limited, this project seeks to improve the empirical, as well as the theoretical, understanding of flushing mechanisms in estuaries. (R/O-30)

Ecosystem Level Measurements of Denitrification in Estuaries

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Nutrients generated from sewage, agricultural or urban runoff commonly travel through watersheds, from rivers to coastal systems, resulting in nutrient overloading conditions such as algal blooms, oxygen depletions and, ultimately, fish kills. Currently, there is no reliable method to quantitatively measure an ecosystem response to nutrient overloading from human population and land use changes. Through collaboration with researchers from a National Science Foundation-funded project, investigators will determine the importance of nitrogen conversions (for example, denitrification) in three major estuarine zones of the Parker River/Plum Island Sound, Massachusetts, estuary. Through utilization of a "whole system" nitrogen addition tracer experiment, scientists will measure benthic breakdown of the labeled nitrogen and the loss of nitrogen as N₂ gas, a form unavailable to plants, including those which contribute to algal blooms. By studying three habitats in the highly productive, yet commonly eutrophied, low salinity zone, researchers hope to develop and expand models of water quality which will be useful for coastal community land use and nutrient discharge planning. (R/M-37)

A Stable Isotopic Approach for Early Detection of Wastewater N in Food Webs

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Another Sea Grant-funded nutrient loading study investigates the use of nitrogen stable isotopes for detecting and monitoring wastewater induced eutrophication. Nitrogen (N) inputs to estuaries from coastal watersheds are contributed by three major sources: wastewater atmospheric deposition, and fertilizers. N stable isotope ratios in groundwater-borne wastewater are elevated relative to the other N sources, so that wastewater acts as a N-15 enriched tracer introduced to estuaries. Changes at the molecular level with increased wastewater loading should be detectable before changes at the population and community level. To test the sensitivity of stable isotopes for detecting wastewater N in estuaries, investigators will measure N stable isotope signatures in groundwater and biota from seven estuaries entering into Waquoit Bay, Massachusetts, that receive low to high N loads. Isotopic changes across estuaries with increased wastewater loading will be compared with changes at the population and community level (monitored by the Waquoit Bay Land Margin Ecosystem Research program) that are traditionally used to assess eutrophication. Tracking wastewater N isotopically through estuarine food webs may provide a means for identifying wastewater induced eutrophication at an earlier stage than is presently possible. Early detection of eutrophication from wastewater is critical for making effective land use management decisions in coastal regions.

Dynamics of the Toxic Dinoflagellate Alexandrium in the Gulf of Maine: Source Populations and Downstream Impacts

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Toxic algal blooms or "red tides" can cause serious health and economic problems, including Paralytic Shellfish Poisoning (PSP), which occurs when shellfish, zooplankton, and other marine animals accumulate toxins while feeding on dinoflagellates of the genus *Alexandrium*. For humans, impacts of *Alexandrium* blooms range from the quarantine of shellfish beds to sickness or even death if the contaminated shellfish are eaten. For marine ecosystems, the impacts can be equally devastating, with mortalities or incapacitation occurring at multiple levels of the food web as toxins are passed from consumer to consumer. With evidence that toxic *Alexandrium* cells may be transported into Massachusetts coastal waters from the southwestern Gulf of Maine, researchers will investigate bloom dynamics before and after a new sewage outfall pipe begins to re-route waste from Boston Harbor to a site nine miles offshore into Massachusetts Bay [scheduled for April 1998]. This research will undoubtedly assist in future management decisions relating to this controversial project. (R/B-140)

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