

## The Human Footprint on Long Island Sound, an Urban Estuary

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Long Island Sound (LIS), east of New York City, has seen dramatic environmental changes since European settlement in the 1600s, which is reflected in sediment cores. Pollen records show the effects of clear cutting by European colonists, which increased the sediment flux. Hypoxia (proxied by carbon isotope values in benthic foraminifera) started in the early 1800s, and the bottom water salinity of western LIS (proxied by oxygen isotope values in benthic foraminifera) dropped by several psu, due to enhanced run-off through land use changes and fresh water influx from waste-water treatment plants. N-isotope records indicate influx of sewage-derived N through an increase in  $\delta^{15}\text{N}$  around the mid-19<sup>th</sup> century. Enhanced nitrogen fluxes led to increased marine productivity, reflected in strongly increased mass accumulation rates of marine organic carbon (by a factor 5-8) and biogenic silica. The ratio of planktic to benthic diatom species increased, probably a result of increased water column turbidity, and relative abundance of heterotroph dinocysts increased. With the increased productivity came higher benthic foraminiferal accumulation rates, and an increase in relative abundance of the diatom-consuming species *Elphidium excavatum*. In the 1960s-1970s *E. excavatum* was largely replaced in abundance in western LIS by the omnivorous foraminifer *Ammonia parkinsoniana*. This dramatic change may reflect a switch from N-limitation to Si-limitation for primary productivity, seen in decreasing mass accumulation rates of biogenic silica, and changes in the dominant primary producers may have reverberated through the ecosystem. With the advance of industrial society and increasing population density around LIS came metal pollution (Hg, Cu, Zn, Cd, and Cr), sourced from waste water treatment plants and metal industries (brass foundries). For Hg, local sources include the hat making industry. These industries have now largely left Connecticut but strongly polluted sediments on land are eroded and transported into the Sound, especially during flood events. Multi proxy records from estuarine cores thus document the human influence on coastal environments and ecosystems.