

Responses of Molluscan Communities to Improved Water Quality in Long Island Sound

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Water quality in Long Island Sound (LIS) has improved since the adoption of a nitrogen Total Maximum Daily Load (TMDL) management strategy in 2000. However, no long-term monitoring data of benthic macroinvertebrate communities are available for evaluating the success of the management intervention. Time-averaged molluscan death assemblages (DAs) that readily preserve and accumulate in the sediment provide a unique opportunity to reconstruct past habitat conditions. Here we use the remains of dead mollusk shells retained in 10 benthic grab samples collected from LIS as part of the Environmental Protection Agency-led 2020 National Coastal Conditions Assessment (NCCA) to evaluate the response of benthic communities to the TMDL intervention. We hypothesized that habitat condition—measured using the NCCA-adopted Multivariate AZTI Marine Biotic Index—changed since the introduction of the TMDL, with the direction of change related to the direction of change in water quality (indexed as the frequency of summer hypoxic events at each sampling location). Radiocarbon dating results confirm that the molluscan DAs reflect pre-TMDL conditions. Overall, post-TMDL improvements in water quality led to increases in pollution-sensitive species relative to pollution-tolerant species from the DA to the living molluscan assemblage, although habitat conditions today remain moderately disturbed at some sites, potentially due to the persistence of high levels of heavy metals and other pollutants in the sediment. Our results illustrate how molluscan DAs that are collected using standard sampling protocols for the living benthic macroinvertebrate community can be used to provide a cost-effective and efficient means of retroactively acquiring data to assess the success of restoration actions in other estuarine and coastal waters lacking long-term monitoring data.

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