Investigating Interannual Variability in Summertime Harmful Algal Blooms in Long Island Sound

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Long Island Sound has an extensive history of harmful algal blooms, which occur when algae grow out of control. These blooms are dangerous to the environment because they deplete oxygen following their demise and decay, creating hypoxic conditions, which kill surrounding benthic organisms. They are also hazardous to larger animals in the marine food chain and to humans because some blooms release toxins that can cause disease or death. The most intense peak of blooms appears during the summer to fall period; however, the composition, spatial extent, and intensity of the blooms vary considerably from year to year. Because of Long Island Sound's proximity to a major metropolitan area, it is important to investigate the temporal and spatial distribution of these blooms, as well as their potential drivers to better understand and predict the interannual variability of these blooms. The first part of the project tested the accuracy of a satellite ocean color-based Normalized Red Tide Index (NRTI) algorithm for detecting and assessing the spatial extent and intensity of harmful algal blooms by comparing it to the retrospective analysis of harmful algal species in water samples collected from the Sound. The second portion of the project investigated environmental conditions such as dissolved oxygen, pH, and precipitation as potential triggers for these blooms. The findings corroborated that the blooms peaked during the summer to fall transition and that the NRTI algorithm estimates were consistent with the collected algal cell counts in both 2020 and 2021. They also supported the notion that the harmful algal blooms followed a gradient of intensity from the Western to Central to Eastern Long Island Sound regions, with the most intense being in the Western Sound. Furthermore, the findings suggested that 2021 had more favorable conditions that support algal growth than 2020, which include lower pH, lower salinity, lower dissolved oxygen, and excess precipitation. Further work will include investigating the types of nutrients in the Sound to provide clarity on the role of anthropogenic fertilizers and runoff into the Sound on the bloom intensity.