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Do Halogenated Natural Products Bioaccumulate in Narragansett Bay?

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Honors Project Summary

In recent decades, halogenated natural products (HNPs) have garnered increased research attention. These chemicals are produced by algae, bacteria, worms, and sponges. Many HNPs are structurally similar to harmful man-made compounds, including polychlorinated biphenyls (PCBs) and brominated flame retardants such as polybrominated diphenyl ethers (PBDEs), which are known to cause cancer, endocrine disruption, and even death. While HNPs are produced naturally, they are still considered contaminants because of their bioaccumulative behavior and apparent toxicity.

Currently, there is limited research on their presence and effects, with few studies from Europe and the Pacific highlighting their importance and promoting the need for further research. Additionally, recent research has suggested that HNP dynamics could be changing due to climate change and eutrophication. To date, HNPs have never been studied in Narragansett Bay; this project sought to identify HNPs in biota from the Bay, in an initial effort to document the presence of these compounds in the Southern New England region.

Diverse flora and fauna, including red algae (*Ceramium virgatum*), green algae (*Cladophora sericea*), blue mussels (*Mytilus edulis*), summer flounder (*Paralichthys dentatus*), and hake (*Urophycis regia*), were collected from different salinity regimes throughout the Bay in the fall of 2016. Tissue samples were processed using accelerated solvent extraction, further purified using manual gel permeation chromatography and silica column chromatography, and analyzed using gas chromatography/mass spectrometry, using surrogate standards to determine recoveries. Halogenated natural products were identified within all five of the samples; the identification of these compounds in higher organisms provides qualitative evidence for the bioaccumulation of these HNPs in Narragansett Bay biota. HNP compounds identified include Br₃Cl₃ DBP, TriBHD, 2,4,6-TBA, 2,4,6-TBP, and MeO-BDEs. In addition, several man-made PCB compounds were found in four of the five samples.

These findings provide valuable insight for not only the health of Narragansett Bay and its fisheries, but also for further research to describe the distribution and possible impacts of these pollutants within temperate Atlantic estuarine environments, especially when faced with continued anthropogenic impacts.