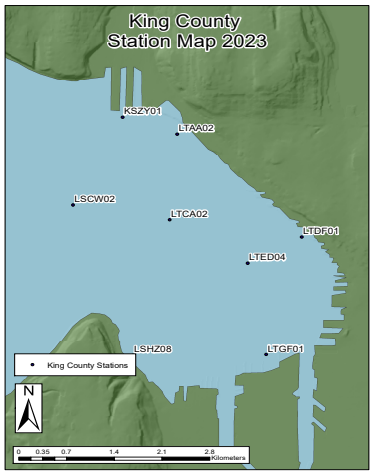
2023 Analysis of Particle Size and Total Organic Content in Bed Sediments of Elliott Bay near Seattle, WA

Michael Paszek, Mentor Julie Masura

Introduction

The Puget Sound ecosystem is home to an abundance of species that rely on its waters for food and sanctuary. The sound has many urban waterways and several expansive port cities on its borders. The proximity to large population and industrial centers has impacted this ecosystem in many ways. It is important to monitor conditions within the sound to track changes over time, and to inform the degree to which anthropogenic effects are responsible for these changes. Analysis of benthic sediment allows for comparison against decades of previously recorded data. The purpose of this study is to analyze total organic content and particle size of benthic sediment samples taken within Elliott Bay.



Field Methods

Samples were collected under the King County Marine Monitoring Program 2023 and sediment samples were analyzed by undergraduate researchers for grain-size distribution and total organic content. This information can be used to inform state agencies, local counties and municipalities, and local industries of the state the Puget Sound Ecosystem.

Lab Methods

Particle Size Analysis – Laser Diffraction

A subsample of well-mixed sediment was obtained and diluted with water.

The sample was stirred until uniform and added to a Beckman-Coulter LS 13 320 Laser Diffraction Particle Size Analyzer.

Laser diffraction provides statistical analysis of the particle size content of the sample.

All samples were analyzed in duplicate.

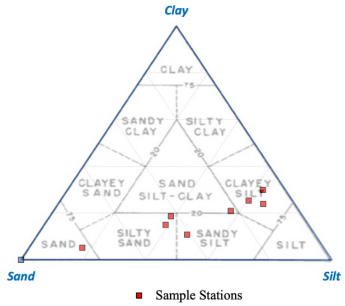


Figure 1. Particle size distribution of samples analyzed within Elliott Bay Summer 2023.

Total Organic Content – Loss on Ignition

The mass of a 5mL subsample was obtained and the sample deposited in a small crucible.

Sample was dried in an oven for five hours at 105°C and the mass of the dried sediment recorded.

Sample was then burned for eight hours at 650°C to eliminate carbon, and the resulting mass recorded.

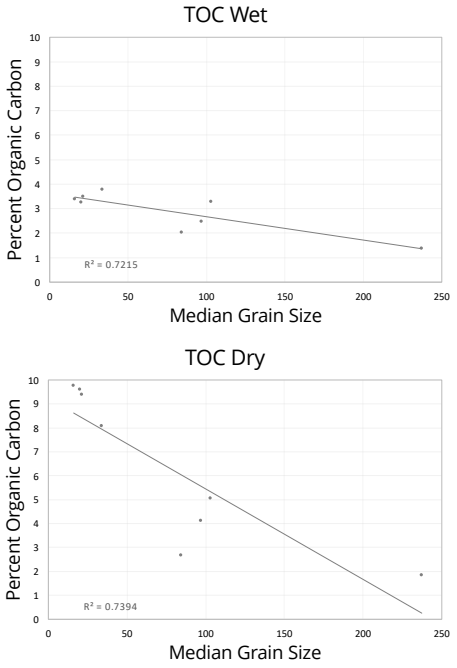


Figure 2. Total Organic Content vs Median Grain size correlations within Elliott Bay Summer 2023.

Elliott Bay Summary Results

- Particle size distribution ranged from sand to clayey silt.

- Median grain size ranged from 16 um to 237 µm.

- Total organic carbon (wet) ranged from 1.4% to 3.8%.

- Total organic carbon (dry) ranged from 1.9% to 9.8%.

- Percent organic carbon indicated a strong negative correlation to median grain size.

Research Significance

Particle size and total organic content are both important metrics that are relatively easy to monitor within urban portions of the Puget Sound. Particle size can inform the energy of an aquatic system and whether that energy is consistent or sporadic. Total organic carbon relates to the biologic content of an area, and in urban ecosystems this can be heavily influenced by anthropogenic activity.

Studies have frequently indicated a negative relationship between fine grain sediment and benthic microalgae, an important primary producer (Cahoon et al. 1999). Anthropogenic effects can result in abnormally high concentrations of fine sediment in estuarine ecosystems. This fine sediment can hold more organic material and greatly increase the nutrient content of a benthic community. If this is further influenced by activities such as dumping or sewage outflow, excess nutrients in the sediment could cause unfavorable conditions for naturally occurring species.

Our results do not indicate any trend between grain size and benthic microalgae that was analyzed by Marino 2023. Results do indicate a strong negative correlation between organic carbon and a larger median grain size.

Particle size and total organic content of sediment within Elliott Bay will be important to continue studying in order to assess long term trends and effects on this area of the Puget Sound Ecosystem.

Citations