Urban Underwater Noise Pollution: The Soundscape of the Seattle, Washington I-5 Bridge
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Growing human population in coastal areas within the last century has intensified the level of underwater sound pollution globally and consequently its impact on marine habitats. The increased complexity in the ambient underwater soundscape of the urbanized shoreline is due to the convoluted use of nearshore and coastal waters for marine related activities such as recreational and commercial boating, shoreline roads, and industrial and residential development. These uses impose stress on the ecological quality of nearshore habitats for Pacific Northwest fish during transit through urbanized waters. This study examined the characteristics of ambient underwater sound at varying distances from the bridge using two built hydrophones utilizing piezo elements and three professional grade hydrophones, in effort to prototype the built hydrophones and ensure quality data collection. The propagation and attenuation of sound from the I-5 Bridge characterized the potential for this point source of sound pollution to impact fish during transit. The variation in the acoustic spectrum at multiple distances from the bridge identified the spatial extent of preferential attenuation of frequencies and intensity of sound as a contributor to noise pollution. Fish utilize the canals connecting the Puget Sound to Lake Union and Lake Washington, where bridge noise pollution could be affecting their behavior during migration.
Linking Surficial Geomorphology with Vertical Structure in High and Low Energy Marine Environments
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The inland waters of the Puget Sound, Washington, USA, and Georgia Basin, British Columbia, Canada, is a complex system of high energy river inputs to lower energy large basins with direct connection to the open ocean through the Straits of Juan de Fuca. High energy systems acting as transport mechanisms for coarse sediment interact with low energy regions with transport deposition of finer sediments to create the vertical stratigraphy of the seafloor. In regions of high energy the seafloor expression is dominated by a rougher seafloor with more geomorphic features of coarser material, while low energy regions are expressed in a seafloor of uniform lamination. This research investigates the link between the surface expression of seafloor roughness and the underlying vertical structure of sediment deposition. Using a high resolution bathymetric surface derived from multibeam sonar synchronized with low frequency sub-bottom acoustic profiles, the depth of acoustic penetration is correlated with a focal calculation of seafloor roughness. Areas of lower acoustic impedance have a larger range in penetration, with lower ranges of penetration persisting in areas of high acoustic impedance. High acoustic impedance is indicative of harder sediments, such as sand, and low acoustic impedance indicates softer sediments, such as mud. The research is a comparative study between a high energy system adjacent to the mouth of the Elwha River and the low energy protected region of South Possession Sound. The research illustrates the strong link between seafloor geomorphology and the terrestrial sources of sediment input and mitigation of sediment transport energy.