2024 Analysis of *Alexandrium* Cysts in Bed Sediments of Bellingham Bay in Puget Sound, WA

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INTRODUCTION

Alexandrium catenella is a toxic dinoflagellate that produces saxitoxin, a potent neurotoxin that can bioaccumulate in filter-feeding shellfish. When said shellfish are consumed by mammals, including humans, this toxin blocks nerve signals and causes Paralytic Shellfish Poisoning (PSP), which can lead to severe paralysis and respiratory failure. The lifecycle of *A. catenella* alternates between active vegetative cells in the water column and dormant benthic cysts in the sediment (Fig. 1). Increases in light, temperature, and nutrient availability cause these resting cysts to germinate into vegetative cells, and can potentially generate vegetative blooms that drive toxin bioaccumulation. While both life stages of *A. catenella* produce saxitoxin, monitoring benthic cyst concentrations is critical for identifying potential bloom hotspots. Accordingly, the purpose of this study was to monitor the concentrations of *A. catenella* cysts in sediments in Bellingham Bay to alert stakeholders of future human and ecosystem health risks.

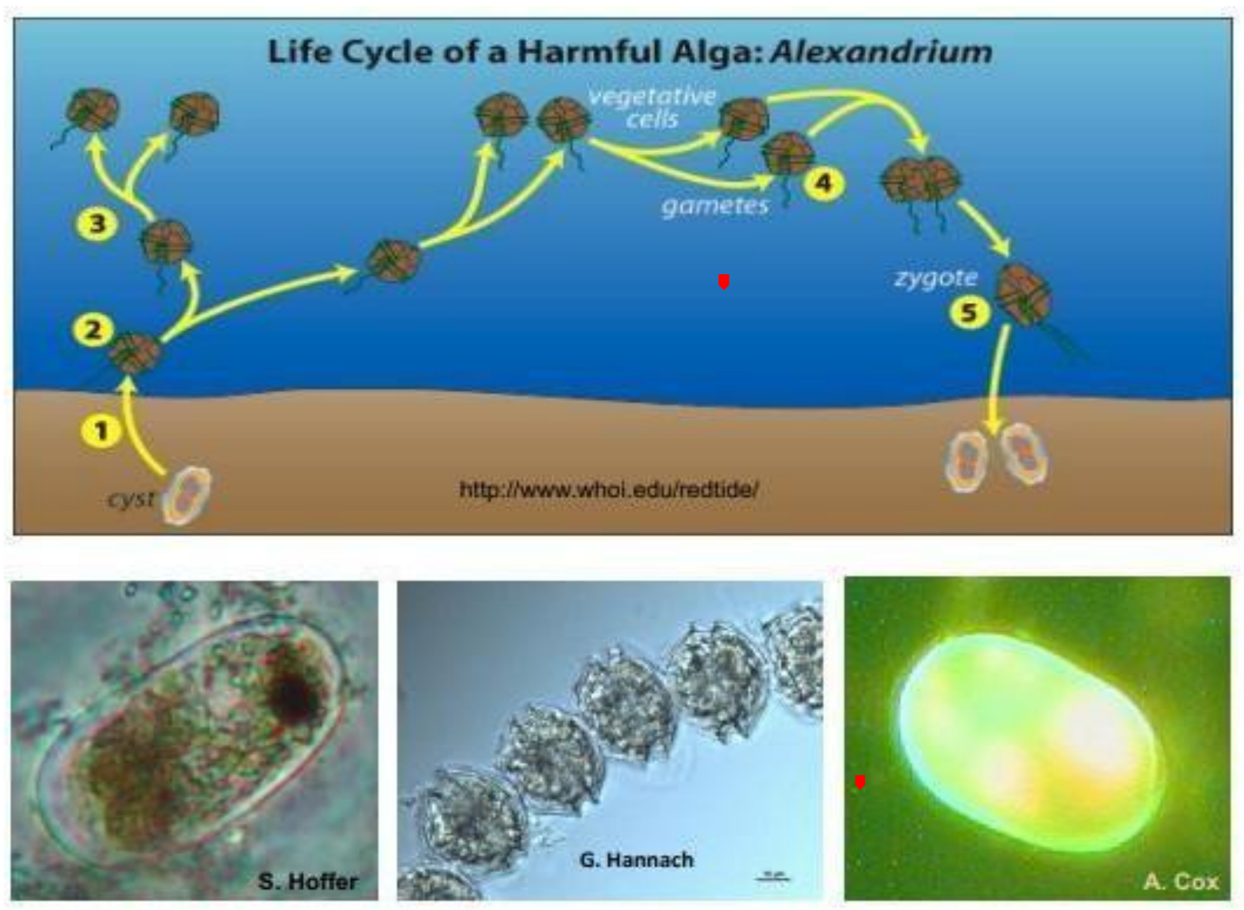


Fig. 1. Clockwise from top, life cycle of *Alexandrium catenella*, fluorescing cyst, vegetative cells in chain, and resting cyst.

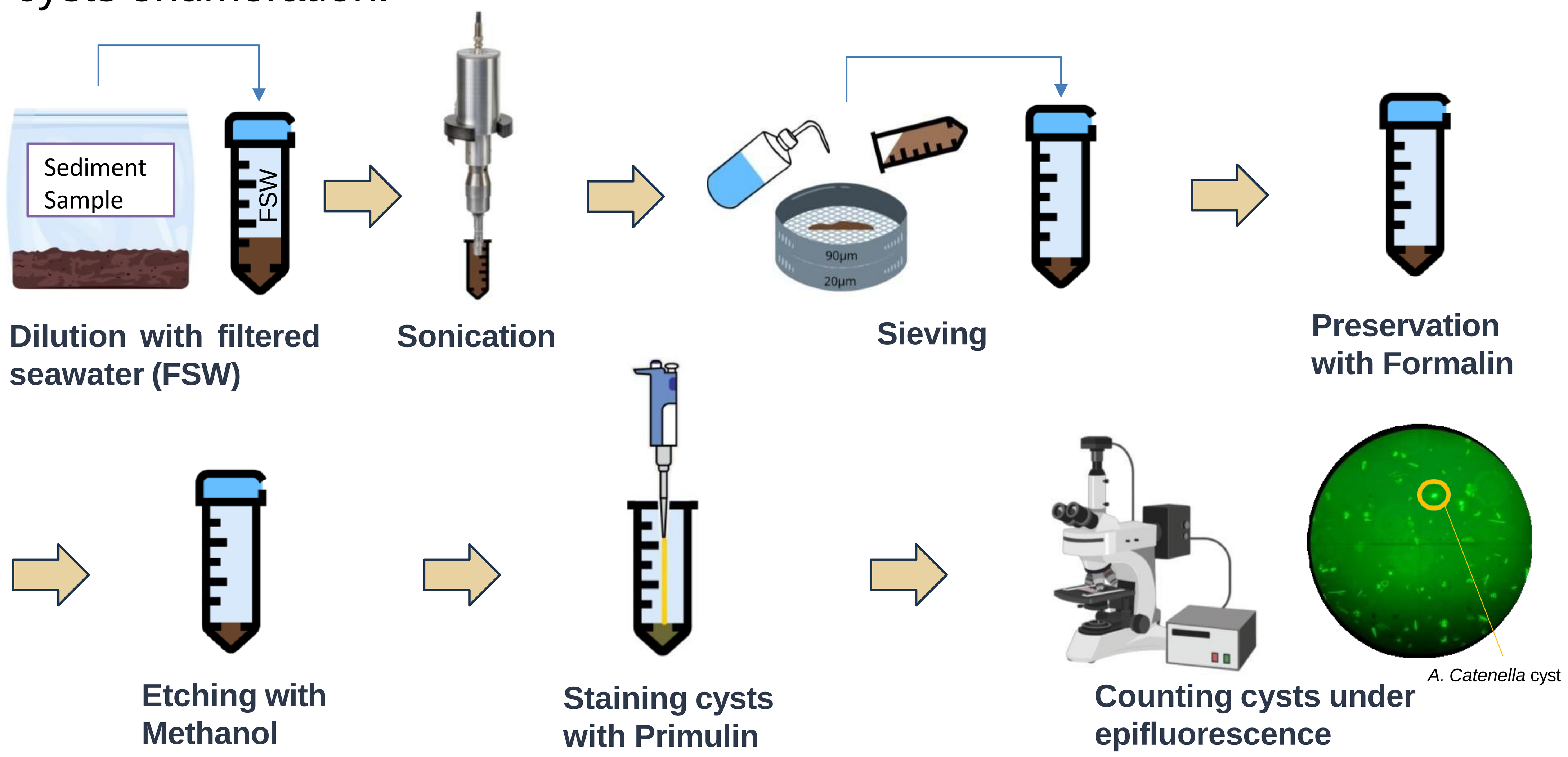
METHODS

FIELD SAMPLING

Washington State Department of Ecology's Marine Sediment Monitoring Team provided 30 sediment samples from Bellingham Bay in 2024. A 0.1 m^2 stainless steel van Veen grab sampler was used to recover benthic sediment from water depths ranging from 1 to 30 meters.

LABORATORY PREPARATION

A modified version of the Yamaguchi et al. (1995) method was used for cysts enumeration.



RESULTS

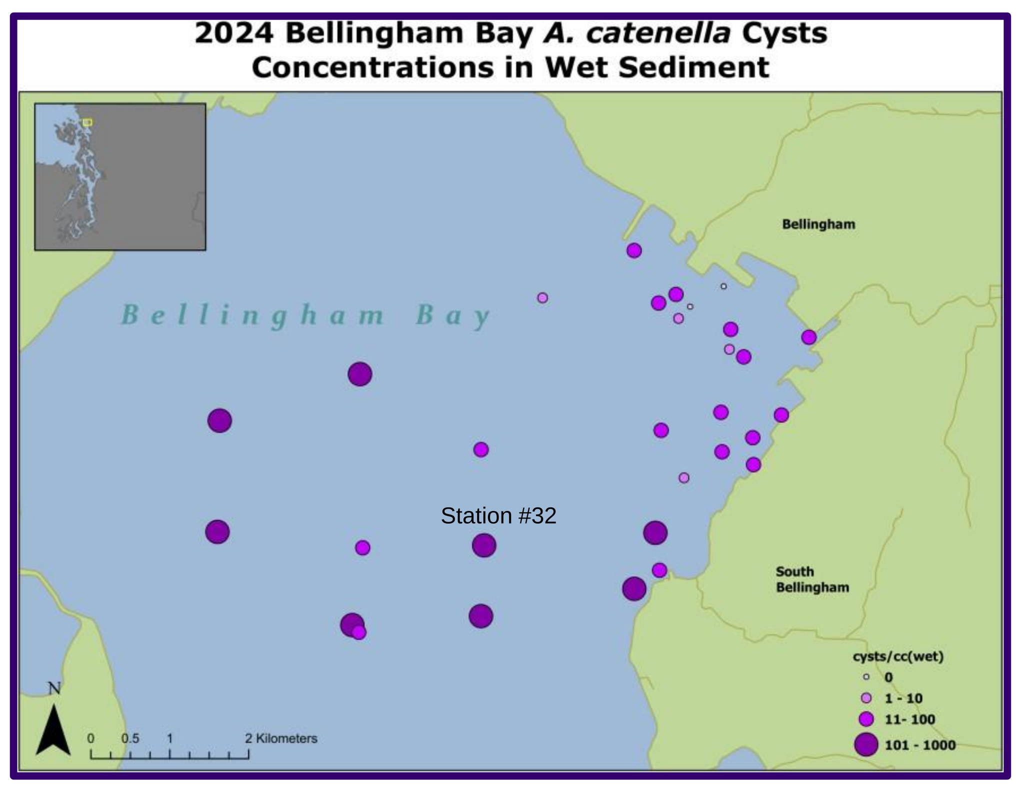


Fig. 2. 2024 cysts distribution in wet sediment sampled from around Bellingham Bay. Station #32 is particularly noted as it was the station with the highest cyst concentration.

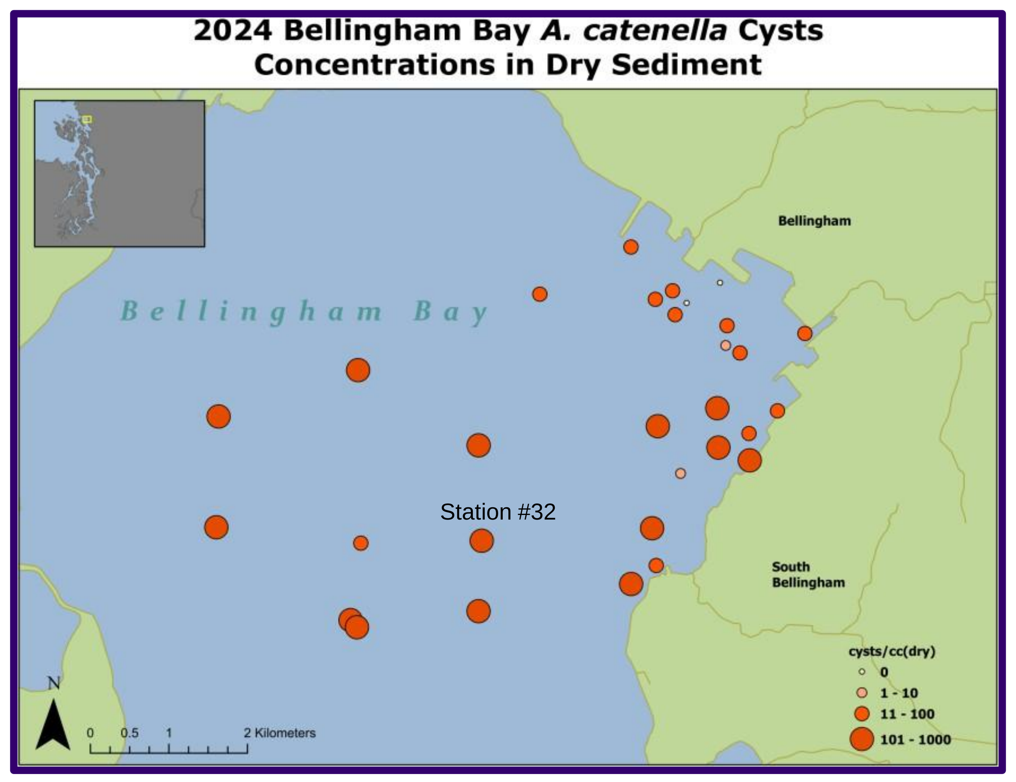


Fig. 3. 2024 cysts distribution in dry sediment sampled from around Bellingham Bay. Again, Station #32 is highlighted for its magnitude.

DISCUSSION

June sampling captured warmer temperatures and high nutrient levels, which triggered cyst germination into vegetative cells and lowered overall cyst concentrations. Station 32, the most abundant station for both 2024 (Fig 2 and 4) and 2017, maintained high baseline abundance, but dropped by 423 cysts/cc (wet) and 1,145 cysts/cc (dry) compared to 2017. This shift is likely influenced by localized circulation patterns rather than sediment properties. The emergence of cysts at previously vacant stations suggests spatial expansion, potentially fueled by the resuspension of historical banks or new deposits from recent blooms. Future research can integrate historical cyst abundance with sea surface temperatures to clarify environmental relationships critical to predicting *A. catenella* population shifts and bloom events within the Salish Sea and a warming climate.

CONCLUSION

Since 2005, cyst concentrations have been consistently high in Bellingham Bay, indicating the need for continued monitoring to inform stakeholders of potential human and ecosystem health risks.

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REFERENCES