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SoundToxins: a Puget Sound harmful algae monitoring partnership

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Introduction

SoundToxins is a monitoring program designed and implemented in 2006 to provide early warning of harmful algal bloom (HAB) events in order to minimize both human health risks and economic losses to Puget Sound fisheries. HABs are populations of toxic algae which can accumulate in shellfish, and transfer up the food chain to marine and terrestrial animals. High concentrations of some algal species can sicken or kill marine birds, mammals or humans and can cause fish to die in large numbers.

This project was conceived and implemented by NOAA Northwest Fisheries Science Center (NWFSC) after observing an apparent increase in HAB events, and is now co-directed by Washington Sea Grant (WSG).

SoundToxins has grown from four partners in 2006 to 28 partners in 2018, some of whom monitor multiple sites in Puget Sound, and is comprised of a diverse partnership of shellfish and finfish farmers, colleges, environmental learning centers, Native American tribes, and volunteers.



Monitoring Puget Sound

SoundToxins participants utilize microscopes to identify plankton (single-celled algae) at sampling sites around Puget Sound, and enter this information into a database. Samples are collected weekly from March to November and every other week throughout the winter season. The species currently being monitored by SoundToxins include:

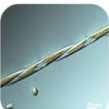
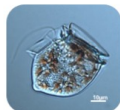


Alexandrium

A dinoflagellate known to produce a suite of toxins called paralytic shellfish toxins (PSTs) which cause paralytic shellfish poisoning (PSP) in humans.

Dinophysis

Some species are known to produce toxins such as okadaic acid and dinophysistoxin, which cause diarrhetic shellfish poisoning (DSP) in humans.

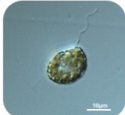


Pseudo-nitzschia

These pennate diatoms can produce a toxin called domoic acid. Domoic acid poisoning in humans is known as amnesic shellfish poisoning (ASP).

Heterosigma

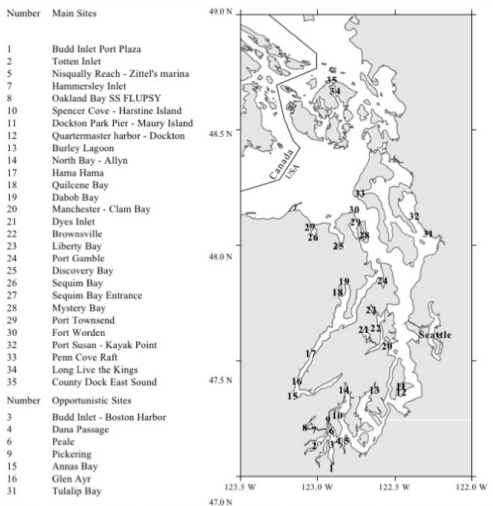
This organism can cause irritation of fish gills, creating an excess mucus and stopping fish from taking up oxygen from water, resulting in large scale fish deaths.



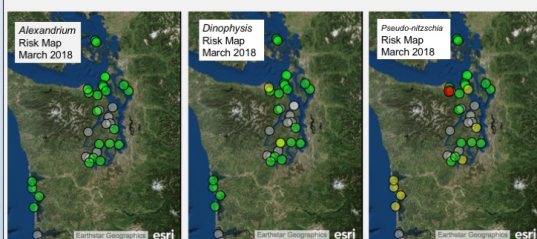
Azadinium

This small dinoflagellate species is known to produce toxins called azaspiracids. This organism has recently been identified in Puget Sound and is currently being studied.

Images by Gabriela Hannach, King County Environmental Laboratory



SoundToxins sampling sites 2018
www.soundtoxins.org



Harmful Algal Bloom Risk Levels showing current risks as high (red), medium (yellow), low (green), and no data (gray). This information is extrapolated from the database and is available in real time to state health officials and managers. These individuals are then able to make timely decisions—about which harvest sites need additional shellfish to be collected, or where shellfish can be harvested prior to impending closures—protecting human health and reducing economic loss. Considering Washington State is the largest producer of shellfish in the U.S. (valued at \$150 million) SoundToxins plays a critical role in maintaining seafood security for the entire nation.

Future Work

SoundToxins is supported, in part, by NOAA grant funding to NWFSC and Washington Sea Grant, with a mandate to study the risks of new toxins in Puget Sound. SoundToxins strives to include any species that may present threats to human health and economic losses. A new grant proposed features *Akashiwo sanguinea* and *Protoceratium reticulatum* as two new species to be included in weekly monitoring.

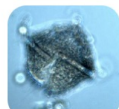


Akashiwo sanguinea

This organism can form massive blooms, and has been reported to kill shellfish but no toxins have been found. *Akashiwo* may be due to clogging of shellfish gills.

Protoceratium reticulatum

This dinoflagellate species creates yessotoxins (YTX), which can accumulate in shellfish and pose a risk to human health.

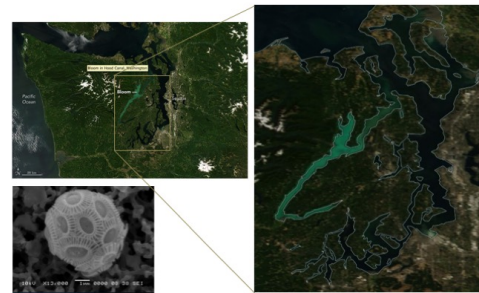


Images by Gabriela Hannach, King County Environmental Laboratory

Impacts

Observing change

In July of 2016 SoundToxins program manager Teri King caught a glimpse of the infamous Hood Canal bloom. The bloom was confirmed to be due to a species of armored plankton called coccolithophores, which are plated with calcium carbonate, turning the water a bright turquoise hue that can be observed from space (pictured below). When the bloom occurred again in 2017, samples were sent to NOAA for identification, and the species in question was recognized as *Emiliania huxleyi* (pictured below).



Images from space credited to Nasa's Aqua satellite, SEM photograph of *Emiliania huxleyi* by Brian Bill, NOAA Northwest Fisheries Science Center

Protecting public health

In spring 2015, a SoundToxins partner at Taylor Shellfish noted high numbers of *Alexandrium* in a water sample collected from Dabob Bay. When toxicity of a mussel sample from the area exceeded the safe harvest level, commercial and recreational shellfish growing areas in Hood Canal were immediately closed. Four semi-trucks bound for retail and wholesale markets, carrying hundreds of pounds of potentially toxic mussels, were recalled, preventing possible human illnesses. Without the identification and alert of *Alexandrium* by a SoundToxins partner, this shipment of shellfish would not have been tested, as it was outside of the routine testing by DOH. The early warning provided by SoundToxins very likely averted human illnesses from toxic shellfish.

Partners

Tribal partners: Jamestown S'Klallam Tribe, Nisqually Tribe, Port Gamble S'Klallam Tribe, Skokomish Tribe, Squaxin Island Tribe, Stillaguamish Tribe, Tulalip Tribes.

Educational institutions: The Evergreen State College, Pacific Shellfish Institute, Port Townsend Marine Science Center, University of Washington, Washington Sea Grant (WSG).

Fish aquaculture partners: Long Live the Kings.
Shellfish Growers: Clam Fresh Enterprises, Coast Seafoods, Hama Hama Oyster Company, Penn Cove Shellfish, Seattle Shellfish, Taylor Shellfish.

Government: King County Environmental Laboratory, Kitsap Public Health District, NOAA Northwest Fisheries Science Center (NWFSC), Pacific Northwest National Laboratory, Washington State Department of Health.

Private citizens: residents of Vashon and San Juan Islands.

Contact

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