

# SoundToxins

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## SoundToxins Monitoring Program

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### What is SoundToxins?

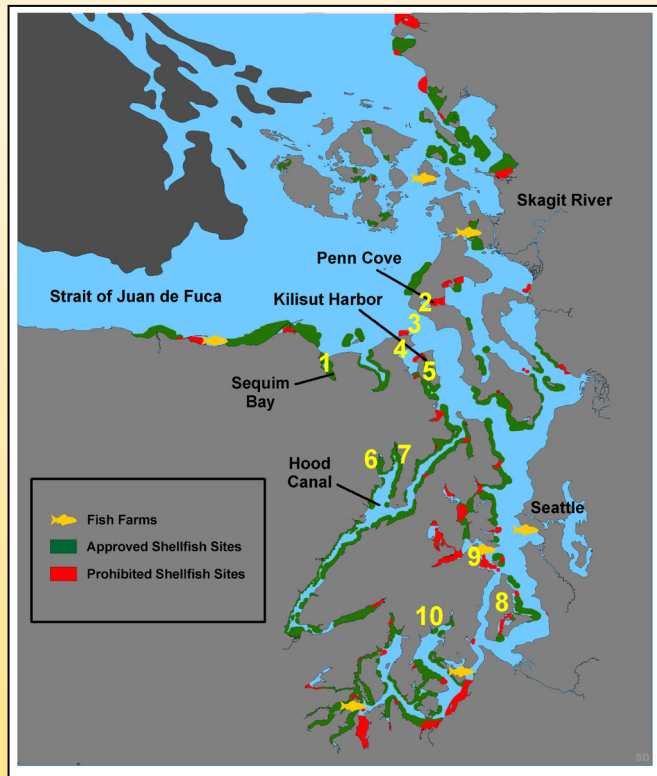
In the Pacific Northwest there are several genera of algae and some bacteria that can cause harm when populations reach high enough numbers. During harmful algal blooms (HABs), the algal species and their toxins can accumulate in shellfish and can also be transferred up the food chain to humans. Disease outbreaks and closure of shellfish harvesting has also resulted from high concentrations of the bacterium *Vibrio parahaemolyticus* in oysters. In addition, high concentrations of some algal species can cause fish mortality. An outbreak of the toxic species of the diatom *Pseudo-nitzschia* led to the first closures of shellfish harvesting due to the toxin produced by the diatom in Puget Sound in 2003 and 2005. Shellfish closures due to the toxin produced by the species of the dinoflagellate, *Alexandrium*, have occurred throughout Puget Sound since the 1950s. Closures due to the bacterium *Vibrio parahaemolyticus* first occurred in 1997-1998 and again in 2006 and 2007. Due to the apparent increase in these HAB and *Vibrio* occurrences during the last decade, the Partnership for Enhanced Monitoring and Emergency Response to HABs in Puget Sound (SoundToxins) was formed.

### Program Goals

The goal of the SoundToxins program is to provide sufficient warning of HAB and “Vibrio” events to enable early or selective harvesting of shellfish and to enable fish farmers to reduce the detrimental effects of the HABs on fish, thereby minimizing risks to both human and fish health and reducing economic loss to Puget Sound fisheries. To best accomplish this goal, the program objectives are: 1) to determine which environmental conditions promote the onset and flourishing of HABs and increased concentrations of *Vibrio parahaemolyticus*; and 2) to determine which combination of environmental factors can be used for early warning of HABs and *Vibrio parahaemolyticus* in Puget Sound.

### The Monitoring Program

SoundToxins participants currently sample at nine locations (see map) in Puget Sound. Seawater is collected and tested for salinity, temperature, and nutrients as well as toxins and chlorophyll. A duplicate sample of seawater will be analyzed for the presence of total and potentially pathogenic *V. parahaemolyticus*. Phytoplankton species diversity in each sample is described and the target harmful species of *Pseudo-nitzschia*, *Alexandrium*, *Dinophysis* and *Heterosigma* are counted for abundance. This information is used to gain an understanding of bloom dynamics, to assess which environmental factors are conducive to HAB formation, and which predictive factors may be used to forecast outbreaks.



### The Partners

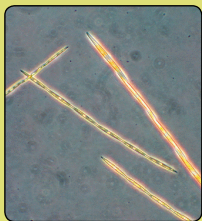
SoundToxins is a diverse partnership of shellfish farmers, fish farmers, environmental learning centers, volunteers and Native American Tribes. Only through collaboration can our efforts to mitigate the effects of HABs through early warning of these events be achieved.

Site	Agency
1. Sequim Bay.....	Jamestown S'Klallam tribe
2. Penn Cove.....	Penn Cove Mussels LLC.
3. Fort Worden	Port Townsend Marine Science Center (PTMSC)
4. Port Townsend.....	PTMSC
5. Kilisut Harbor.....	PTMSC
6. Quilcene Bay.....	Coast Seafoods Company
7. Dabob Bay.....	Taylor Shellfish
8. QuarterMaster.....	Vashon Island resident Harbor
9. Manchester.....	Northwest Fisheries Science Center
10. Henderson Bay.....	Minterbrook Oyster Company

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Fish Farms American Gold Seafood and others

## The Harmful Species

***Pseudo-nitzschia***, a needle-shaped pennate diatom. Some species of *Pseudo-nitzschia* are known



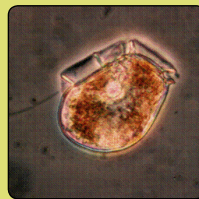
to produce the toxin, domoic acid, which when concentrated in shellfish and transferred up the food chain, can cause neurological damage and in severe cases, death in marine birds, marine mammals, and humans. Domoic acid poisoning in humans, also known as amnesic shellfish poisoning (ASP), can cause temporary and in more severe cases, permanent short-term memory loss. Domoic acid closures have occurred since 1991 on the outer Washington coast, but have only recently caused shellfish closures within Puget Sound.

***Alexandrium***, a dinoflagellate, as its name implies, has two flagella and can therefore move up and down through the water column. It is known for the suite of toxins that it produces (saxitoxin and gonyautoxin derivatives) referred to



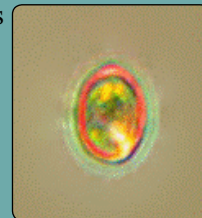
as paralytic shellfish toxins (PSTs). PSTs are responsible for the human illness called paralytic shellfish poisoning (PSP) which can cause tingling of the lips, tongue, short term paralysis and even death. PSTs have been responsible for shellfish closures in the Puget Sound area for decades with an increase in closure locations and frequency in recent years.

***Dinophysis***, a dinoflagellate, includes some species that are known to produce toxins such



as okadaic acid, *Dinophysis* toxins and pectenotoxins, which are responsible for the human syndrome called diarrhetic shellfish poisoning (DSP). Diarrhetic shellfish poisoning includes gastrointestinal symptoms such as diarrhea, nausea, vomiting and abdominal cramping. Several species of *Dinophysis* are present in Puget Sound and these cells have been observed in high numbers. Shellfish closures have occurred in the adjacent waters of British Columbia. Currently, there is no formal testing program in Washington State for toxins associated with DSP.

***Heterosigma***, a raphidophyte, has no cell wall and has two flagella. When it reaches high enough concentrations, *Heterosigma* can have deleterious effects on fish (especially net-penned fish). It has not yet been determined if *Heterosigma* produces a toxin, but cells are known to cause irritation of the fish gills, creating excess mucus, and thereby preventing fish from taking up sufficient oxygen from the water. *Heterosigma* blooms can kill large numbers of fish causing heavy economic impacts on the aquaculture industry as occurred in Puget Sound in 2006.



***Vibrio parahaemolyticus*** is a naturally occurring marine bacterium that can concentrate in shellfish, such as oysters. The bacterium is responsible for severe but self-limiting gastroenteritis linked to the consumption of raw oysters. In the past decade, there has been a significant increase in *V. parahaemolyticus*-related illnesses contracted from raw oysters harvested in the Pacific Northwest. Such illnesses/outbreaks pose a threat to public health and result in severe economic losses to the shellfish growers

### Training, Analysis, and Outreach

Dr. Rita Horner from the University of Washington provides phytoplankton species identification and training and sampling design. The Northwest Fisheries Science Center Marine Biotoxins and Microbiology Programs provide training courses, site visits, analysis of samples for cellular and dissolved toxin, *Vibrio* numbers, chlorophyll, and nutrients as well as overall project management including database administration, information management, outreach and method development.

### Funding Provided By

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