

ECOHAB Pacific Northwest

Towards improved understanding and prediction of harmful algal blooms

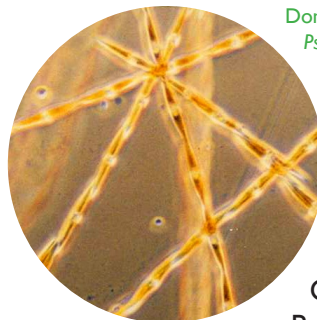


“Partly cloudy with a chance of afternoon showers,” reads the local weather forecast. Our ability to predict and track weather and storm events has advanced tremendously over the last several decades and is critical to our safety and economy. In the Pacific Northwest, and around the United States and world, there is another type of event where predictive capabilities could protect human health and save millions of dollars. These events are harmful algal blooms.

While invisible to the naked eye, there are thousands of species of microscopic algae in the oceans, a few dozen of which produce potent toxins. Harmful algal blooms (HABs) occur when a particular species of toxic algae proliferates. Through feeding, these toxins can be transferred through the food web where they affect, and sometimes even kill, other organisms, like zooplankton, shellfish, fish, birds, marine mammals, and humans.



Razor clams are important economically and serve as a subsistence food for many tribes. During a typical year, 2.4 million razor clams are harvested along the Washington coast, bringing in approximately \$5-8 million to the coastal economy. High levels of domoic acid off the Pacific Coast can result in coastwide closure of Washington’s razor clam fishery for a year at a time, as happened in 1991 and 1998.



Domoic acid is produced by several species of *Pseudo-nitzschia* algal genus. Shellfish, such as razor clams and mussels, filter phytoplankton (algae) from the water. When they filter toxic *Pseudo-nitzschia* they can accumulate domoic acid to levels that are potentially lethal to humans or other consumers.

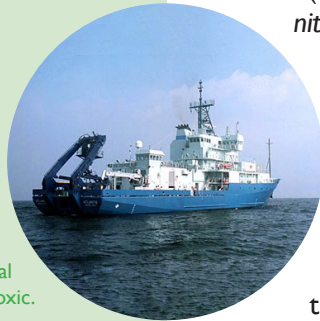
One of the toxins heavily impacting the Pacific Northwest is domoic acid, which is produced by the diatom *Pseudo-nitzschia*.

Domoic acid poisoning’s most serious symptom is short-term memory loss that can be permanent. Beach and harvest closures resulting from *Pseudo-nitzschia* blooms have had severe social and economic impacts on both coastal and tribal communities. In 1991, the closure of Washington State beaches to recreational and commercial shellfish harvesting resulted in a \$15-20 million revenue loss to local fishing communities. In order to mitigate these negative impacts, we must understand the ecology and oceanography of *Pseudo-nitzschia* blooms.

The Ecology and Oceanography of Harmful Algal Blooms program in the Pacific Northwest (ECOHAB PNW) was created to develop an understanding of when and where toxic blooms occur and whether these blooms will be transported to the coast. With sufficient warning, like weather forecasts, managers will be better able to schedule beach closures and minimize public health and economic impacts.

Main Objectives:

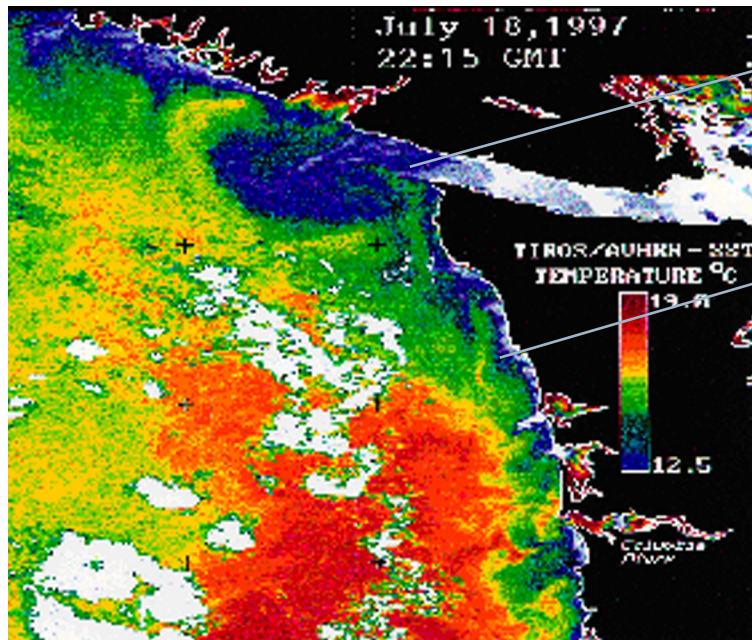
- To determine the physical/biological/chemical factors that make the Juan de Fuca eddy region more viable for growth and sustenance of toxic *Pseudo-nitzschia* than the nearshore upwelling zone.
- To determine the combination of factors that regulate the production, accumulation, and/or release of domoic acid from *Pseudo-nitzschia* cells in the field.
- To determine possible transport pathways between domoic acid initiation sites and shellfish beds on the nearby coast.



Research vessel Atlantis: Field sampling helps us understand what environmental conditions make cells toxic.

Investigators:

- Co-lead Investigators: Barbara Hickey (University of Washington) and Vera Trainer (NOAA Northwest Fisheries Science Center)
- Co-Principal Investigators: William Cochlan (San Francisco State University); Mike Foreman, Angelica Pena, Rick Thomson (Department of Fisheries & Oceans, Canada); Evelyn Lessard (University of Washington); Mark Wells and Laurie Connell (University of Maine); Charles Trick (University of Western Ontario, Canada)



Juan de Fuca eddy

nearshore upwelling zone

Satellite-derived sea surface temperature (July 1997) shows the colder offshore water indicative of the Juan de Fuca eddy. Satellite imagery can be used to determine transport pathways or sea surface temperature, but currently cannot be used to detect *Pseudo-nitzschia* cell presence.

ECO HAB PNW is a collaborative, state-of-the-art project that involves scientists from government and academic institutions in both the U.S. and Canada. Scientists are working together to solve an important ecosystem problem: they are investigating why a highly productive region offshore of the Strait of Juan de Fuca (the Juan de Fuca eddy) is a “hot spot” for development of toxic *Pseudo-nitzschia* blooms and how and when these blooms are transported to the Washington Coast. Scientists have found that under certain conditions, domoic acid generated in the eddy drifts southward, then moves toward shore during the first major fall storm. Unfortunately this coincides with the traditional start of the recreational razor clam season.

Scientists are studying *Pseudo-nitzschia* and the Juan de Fuca eddy through field and laboratory studies during summer and fall research cruises, as well as through moored sensors, GPS-tracked drifters, and circulation and biophysical models. Scientists are investigating what makes the eddy so hospitable for toxic algae, what causes the production and release of domoic acid, and how that toxin is transported from the eddy to shellfish beds.

ECO HAB PNW is helping to ensure that our region is healthy and productive. Scientists are improving our understanding and ability to predict *Pseudo-nitzschia* bloom events. Research results will help guide management of coastal resources to reduce HAB development, impacts, and future threats.



Scientists deploying a mooring during a research cruise. Equipment secured to moorings measures current direction and speed, water temperature and salinity and collects seawater for toxin and cell analysis.

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For more information, visit www.ecohabpnw.org or contact ECO HAB co-leads Barbara Hickey (206)543-4737 or Vera Trainer (206)860-6788.