

# The Domoic Acid Story

*Pseudo-nitzschia*, the alga that produces domoic acid.



Washington Department of Fish & Wildlife



NOAA Fisheries

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## What is domoic acid?

Domoic acid is a biotoxin produced by *Pseudo-nitzschia*, a kind of alga that often blooms along the Washington coast.

## Why is this important to know?

When people eat shellfish containing domoic acid, they may suffer amnesic shellfish poisoning (ASP) and even die. Domoic acid concentrates in the edible tissue (foot, siphon, and mantle) as well as the digestive tract. Cooking does not make domoic acid harmless. Domoic acid crosses into the brain and locks onto neurons. It can result in long-term problems with a person's short-term memory. In less serious cases, symptoms include vomiting, nausea, diarrhea and abdominal cramps.

## Is red tide the same as domoic acid?

Scientists do not like to use the term "red tide." They prefer the term "harmful algal blooms (HAB)," because HAB's are often invisible. *Pseudo-nitzschia* blooms that produce domoic acid outbreaks along our coast may be colorless. The red-colored water seen on Washington beaches is usually caused by non-toxic organisms.

## When did all this start?

Toxin-producing algae are a part of our ocean's natural world and domoic acid events occur in other areas around the world in addition to the Pacific Northwest. The first reported outbreak of domoic acid occurred in 1987 on Canada's Prince Edward Island. Three people died and over a hundred people suffered symptoms of domoic acid poisoning. Various impairments, including the loss of short term memory, are linked to domoic acid poisoning. In the fall of 1991, the Washington State Department of Health found domoic acid in our razor clams.

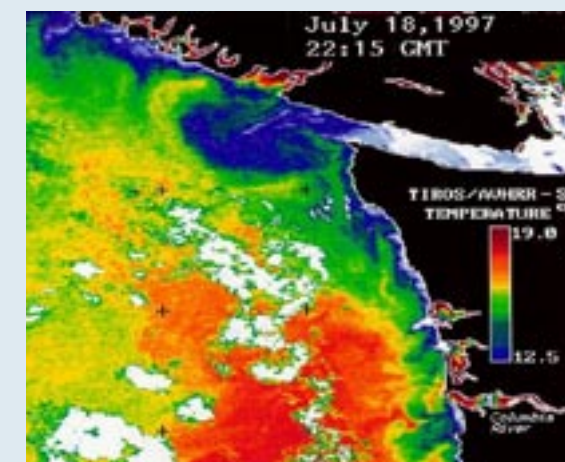
## What research is being done to address this problem?

In 1998, federal, state, local, tribal, and private scientists and managers joined together to form the Olympic Region Harmful Algal Bloom (ORHAB) partnership. With support from the National Oceanic and Atmospheric Administration (NOAA), ORHAB partners have monitored physical conditions, plankton abundance, and domoic acid levels along the coast. To build on this effort, the National Science Foundation and NOAA's Center for Sponsored Coastal Ocean Research awarded funds through 2007 to ECOHAB Pacific Northwest—an in-depth study of the underlying ocean dynamics and biological processes that give rise to domoic acid outbreaks. Scientists will continue to study domoic acid events along our coast for years to come.

## What does the research show so far?

HAB researchers have proposed a theory to explain the seemingly random occurrences of domoic acid outbreaks. According to this theory, during summer months, an enormous eddy or circular current pattern forms to the west of Cape Flattery at the entrance of the Strait of Juan de Fuca. The satellite image below shows the Juan de Fuca Eddy as a blue circular patch of cold water.

## Satellite image: Temperature of the Juan de Fuca Eddy

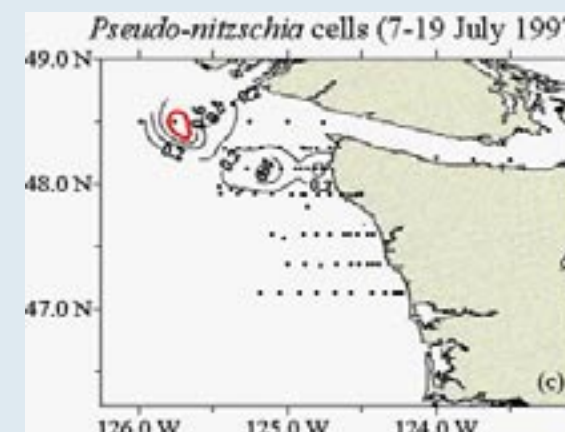


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Left: The Juan de Fuca Eddy, shown in the color blue, is a mass of colder waters. Nearshore waters are also cold, displayed as blue, an indication that deep water has upwelled along the coast.

The Juan de Fuca Eddy is a unique place having many unusual features and conditions. Algal cells tend to concentrate there.

## *Pseudo-nitzschia* in the Juan de Fuca Eddy

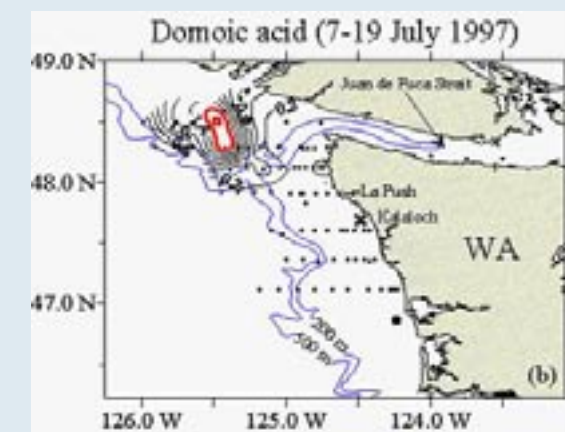


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Left: The data from a research cruise in 1997 showed a high concentration of *Pseudo-nitzschia* cells (illustrated with the red circle) in the Juan de Fuca Eddy.

For reasons as yet unknown, *Pseudo-nitzschia* residing in this eddy sometimes produce domoic acid.

## Domoic Acid in the Juan de Fuca Eddy



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Left: The 1997 data also showed a high concentration of domoic acid (illustrated with the red circle) within the Juan de Fuca Eddy.

Scientists believe that algal patches break off from the eddy and move southward along the Washington coast as upwelling progresses. Dense pools of algae may stay offshore or move towards the coast with the onshore flow pushed by early fall storms. If the storm patterns persist and domoic acid levels in the water are high enough, razor clams may consume sufficient toxic algae to become contaminated. New evidence suggests the low salinity plume of freshwater coming out from the Columbia River might also play a role in domoic acid events on the coast. When the Columbia River flows north, as it does each time there is a storm off the coast, its waters may provide a protective buffer, preventing the toxic algae from reaching Washington's southern beaches. Hickey, B. M., S. Geier, N. Kachel and A. MacFadyen (2005). A Bi-directional River Plume: The Columbia in Summer. *Continental Shelf Research*. Figures above published in Trainer, V.L., Hickey, B. M., and Horner, R.A. (2002). Biological and Physical Dynamics of Domoic Acid Production Off the Washington U.S.A. Coast. *Limnology and Oceanography*, 47(5),1438-1446.

