SOUTHEAST ALASKA TRIBAL TOXINS

SEATOR

Culture
Science
Efficiency

Southeast Alaska Tribal Ocean Research

A Partnership to Monitor Harmful Algal Blooms

Projects and Programs

- Southeast Alaska Tribal Toxins (SEATT)
- Southeast Alaska Regional Ocean Acidification Monitoring (SEAROAM)
- Sitka Tribe of Alaska Environmental Research Lab (STAERL)
- Integrated *Alexandrium* Cyst bed Mapping in Southeast Alaska (IACSEA)

WHY DO WE NEED SEATOR

- Support SE partnered Tribes working on climate change related impacts on the marine environment
- Outreach, community access to data, training
- **UNIFIED CREDIBILITY**

SEATOR
Culture
Science
Efficiency
Southeast Alaska Tribal Ocean Research

WHY A PARTNERSHIP?

A ***Common Concern*** about subsistence clam resources

→ No assistance from AK state agencies

↓

STA reached out to SE Tribes

↓ ↓

EPA IGAP funds for baseline phytoplankton

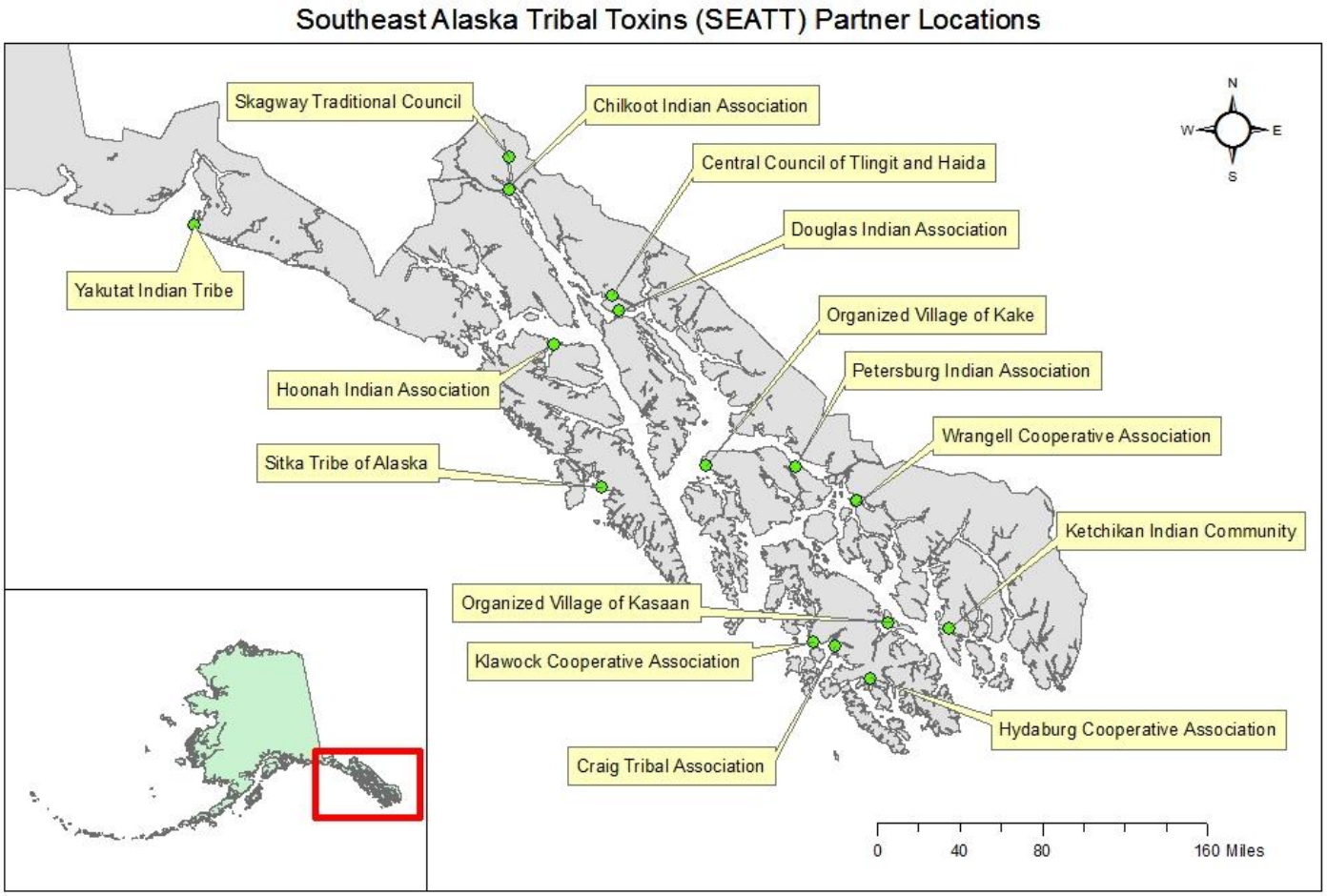
→ Create an early warning system

↓ ↓

South**E**ast **A**laska **T**ribal **T**oxins

November 2013

SOUTHEAST TRIBAL PARTNERS

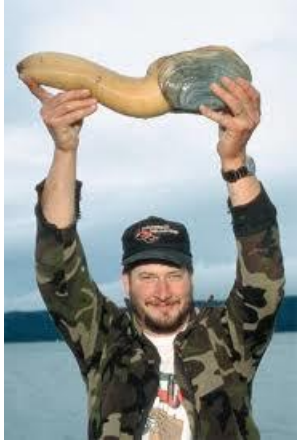


Who Regulates for PSP and toxins in Alaska?

- Alaska Department of Environmental Conservation follows FDA regulations for all commercially harvested shellfish in Alaska under the National Shellfish Sanitation Program

What about subsistence users?

- Alaska has **no long-term SUBSISTENCE OR RECREATIONAL** regulatory testing.



What does monitoring look like?

Equipment and Training

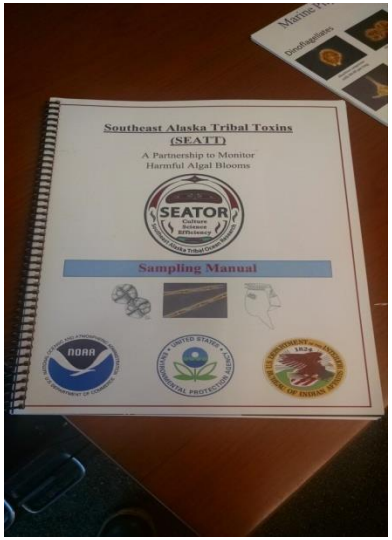
Equipment

- Digital Microscope with Camera
- Refractometer and Thermometer
- Phytoplankton Net
- Filtering apparatus
- Identification tools

Training

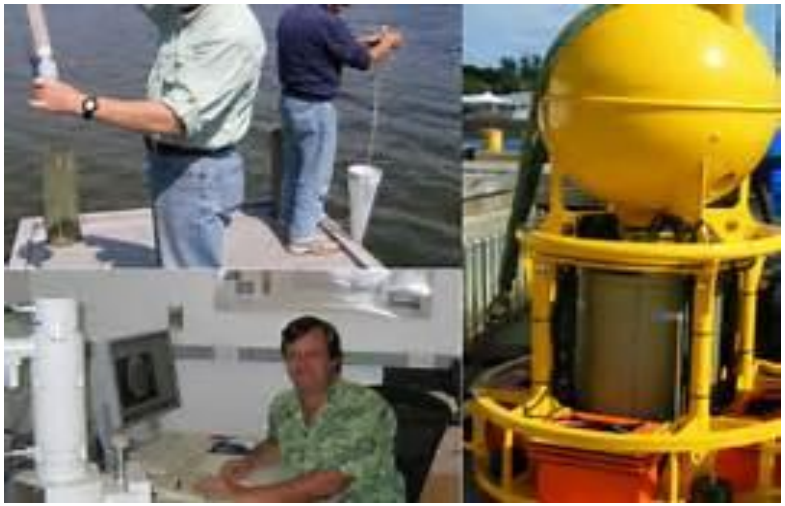
- Workshops in Sitka
- Sampling Manual
- Videos
- Site Visits

Updates to www.seator.org



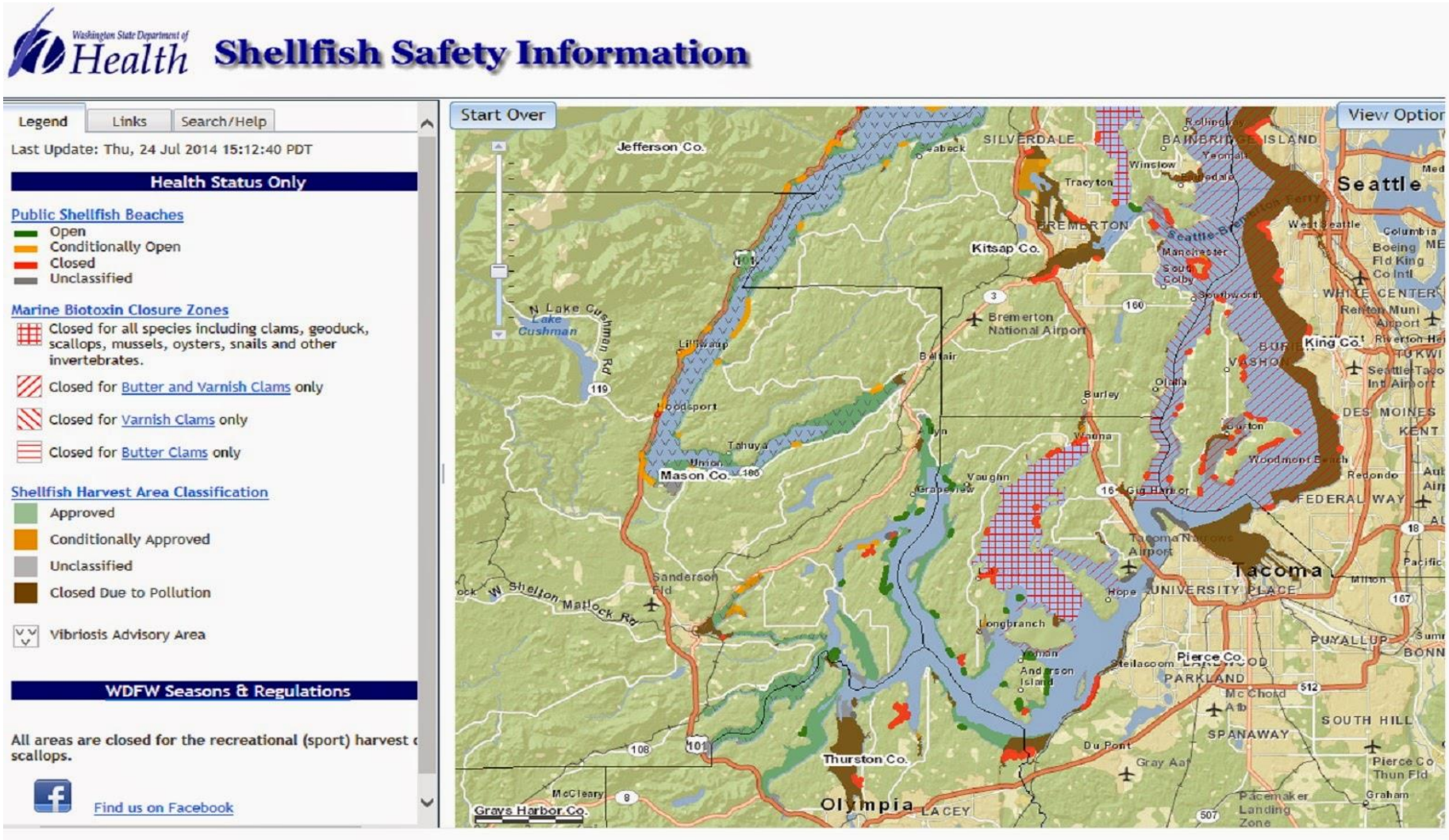
Where does all the data go?

- SoundToxin Database and Phytoplankton Monitoring Network (NOAA)
  - National database for all monitoring groups
  - Used by researchers, shellfish growers, and resource managers for early warning system



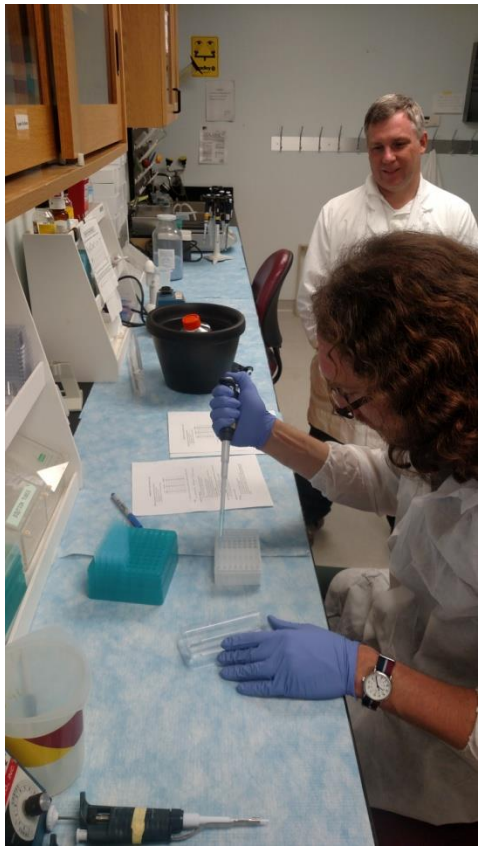
http://www.seator.org/

Interactive Mapping Tool

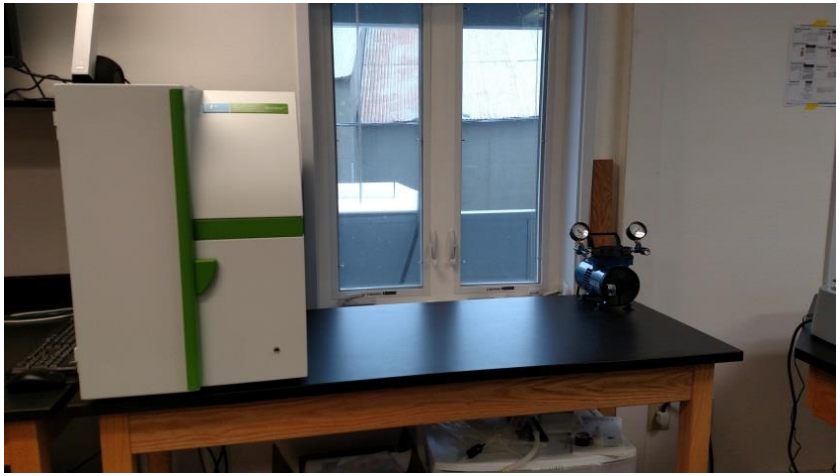

Washington State Department of Health
Shellfish Safety Information
Legend
Links
Search/Help
Last Update: Thu, 24 Jul 2014 15:12:40 PDT
Health Status Only
Public Shellfish Beaches
Open
Conditionally Open
Closed
Unclassified
Marine Biotoxin Closure Zones
Closed for all species including clams, geoduck, scallops, mussels, oysters, snails and other invertebrates.
Closed for Butter and Varnish Clams only
Closed for Varnish Clams only
Closed for Butter Clams only
Shellfish Harvest Area Classification
Approved
Conditionally Approved
Unclassified
Closed Due to Pollution
Vibriosis Advisory Area
WDFW Seasons & Regulations
All areas are closed for the recreational (sport) harvest
scallops.
Find us on Facebook
Start Over
View Optior
Jefferson Co.
Kitsap Co.
Mason Co.
King Co.
Pierce Co.
Thurston Co.
Grays Harbor Co.
Seattle
Tacoma
Olympia
Bremerton
Bremerton National Airport
Belfair
Lilliwaup
Hoodsport
Tahuya
Union
Lake Cushman
N Lake Cushman Rd
Sanderson Fld
W Shelton Matlock Rd
Longbranch
Vaughn
Grapeview
Burley
Olalla
Wauna
Gig Harbor
Hope
Steilacoom
Anderson Island
Du Pont
Gray Aaf
McChord
Tacoma Narrows Airport
Boeing Fld King Co Intl
Seattle-Tacoma Intl Airport
Renton Muni Airport
Pierce Co Thun Fld
Pacemaker Landing Zone
SILVERDALE
BAINBRIDGE ISLAND
Winslow
Tracyton
Manchester
South Colby
Southworth
West Seattle
WHITE CENTER
DES MOINES
KENT
FEDERAL WAY
UNIVERSITY PLACE
PUYALLUP
PARKLAND
SPANAWAY
SOUTH HILL
LACEY
McCleary
Graham
Redondo
Woodmont Beach
Pacific
Milton
Sumner
Bonney Lake
Tukwila
Burien
Vashon
Kingston
Belfair
Seabeck
Pleasant Beach
Manette
Bremerton Ferry
Seattle Ferry
Southworth Ferry
Vashon Ferry
Kingston Ferry
Mukilteo Ferry
Edmonds Ferry
Clinton Ferry
Fauntleroy Ferry
Point Defiance Ferry
Tacoma Narrows Ferry
Gig Harbor Ferry
Steilacoom Ferry
Anderson Island Ferry
Longbranch Ferry
Vaughn Ferry
Grapeview Ferry
Hoodsport Ferry
Lilliwaup Ferry
Tahuya Ferry
Belfair Ferry
Bremerton National Airport
Tacoma Narrows Airport
Boeing Fld King Co Intl
Seattle-Tacoma Intl Airport
Renton Muni Airport
Pierce Co Thun Fld
Pacemaker Landing Zone
McChord Afb
Gray Aaf
Du Pont
Sanderson Fld
Olympia
Tacoma
Seattle
Bremerton
Port Orchard
Poulsbo
Kingston
Belfair
Shelton
Hoodsport
Lilliwaup
Tahuya
Union
Longbranch
Vaughn
Grapeview
Burley
Olalla
Wauna
Gig Harbor
Hope
Steilacoom
Anderson Island
Du Pont
Gray Aaf
McChord
Tacoma Narrows Airport
Boeing Fld King Co Intl
Seattle-Tacoma Intl Airport
Renton Muni Airport
Pierce Co Thun Fld
Pacemaker Landing Zone

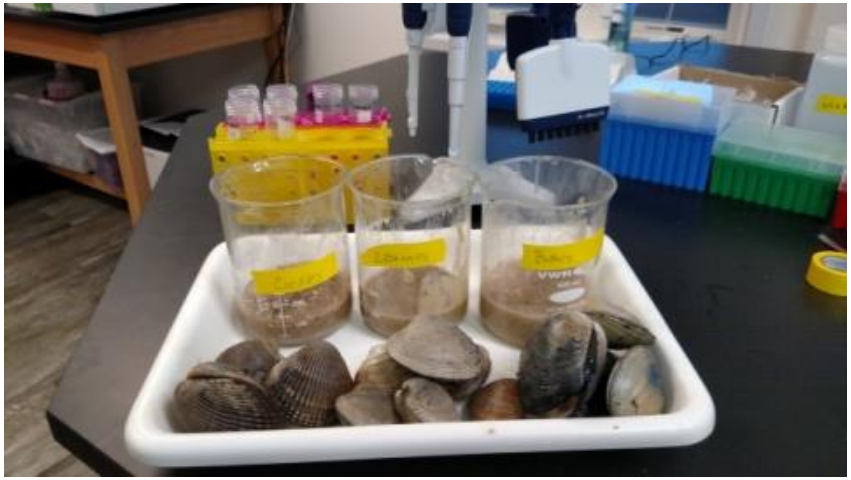
Sitka Tribe of Alaska Environmental Regulatory Lab (STAERL)

- Developed to support SE Tribes (SEATT) with shellfish toxin analysis.
- **Tribes can use STAERL to develop subsistence shellfish management plans**



RBA: receptor binding assay





- Provide **STX** data (OMA 2011.27)
- Lower detection limit (6.4 µg/100g)
- High throughput
  - Screen 23 samples/plate
- Research other species to amend AOAC

ELISA: enzymed linked imunoabsorbant assay

Domoic Acid

(OMA 2006.02)

Outreach and community

- Local subsistence harvesters can utilize Lab

Toxic Shellfish 101

How plankton can ruin your dinner plans

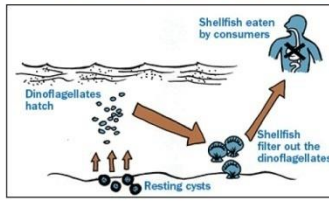
Step 1: Phytoplankton "Bloom"

When conditions are just right, one species or genus of plankton can multiply especially rapidly. If the plankton is toxin-producing, toxin levels can rapidly increase with the populations. The exact factors that lead to algal blooms and to toxin production are still not well-known.

A non-toxic *Noctiluca* bloom colors the water in Puget Sound a vivid orange. Photo: Don Paulson.

Step 2: Shellfish Pick Up Toxins

Shellfish like clams, mussels, and scallops eat plankton that they filter out of the water. During a harmful bloom, a shellfish's daily meal is almost entirely made of toxic plankton. Since a single shellfish can filter up to 20 gallons of water a day, even low toxin levels can become highly concentrated. Most shellfish are unaffected by planktonic toxins and continue feeding as usual throughout the bloom.



Step 3: Shellfish Are Eaten

There is no visual way to tell if a shellfish is safe or not. The water can be clear or colored, the shellfish can be eaten or shunned by local wildlife, the time since the last bloom could be recent or extensive, but it would still be impossible to say whether wild shellfish were safe to harvest. As a result, people are hospitalized every year in Alaska after eating unsafe shellfish.

Getting sick could require as many as thirty shellfish or as few as one and could take only minutes or up to 48 hours depending on the toxin type and the amount present.

Which Animals Should You Be Most Concerned About?

Filter feeding bivalves are especially prone to accumulating dangerous levels of toxin. These include mussels, clams, oysters, and scallops. Carnivorous scavengers like crabs can pick up toxins in their viscera (the crab's "butter") from eating contaminated shellfish. Plankton-eating forage fish like herring and sand lance are also susceptible to planktonic toxins.

Since chitons, limpets, and sea urchins are primarily herbivorous, they are generally not at risk for accumulating planktonic toxins.

Step 4: The Threat Dissipates

After as little as a few days or as long as a few months, the bloom fades away. As shellfish stop eating toxic food, their toxin levels also decrease. Some species like blue mussels clear their toxins relatively quickly, while others, like butter clams, can take months to return to safe levels.

Get your shellfish tested!
Contact STA's Environmental Lab for testing information and protocols. 907-747-7356
Email: seator@sitkatribe-nsn.gov

Harmful Alaskan Algal Species

***Alexandrium* spp.**

- TOXIC. *Alexandrium* species can produce saxitoxins that accumulate in shellfish. These toxins cause Paralytic Shellfish Poisoning and cannot be neutralized by freezing or cooking.
- *Alexandrium* causes commercial shellfishery closures almost every year. Recreational shellfish harvesters are also sickened every year.
- *Alexandrium* has a cyst phase that allows cells to remain dormant for long periods of time (even years!). Cysts are also toxic and can contaminate shellfish.
- Some *Alexandrium* species can create a reddish tinge in the water, hence the name "red tide". Many blooms are not visible, however.
- Blooms of *Alexandrium* do not have consistent triggers, but they tend to be most common in mid-summer, after large rain events, or after a cyst bed has been disturbed.

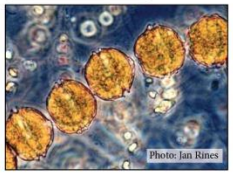


Photo: Jan Rines

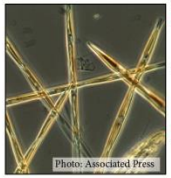


Photo: Associated Press

***Pseudo-nitzschia* spp.**

- TOXIC. *Pseudo-nitzschia* species can release domoic acid. Like saxitoxins, domoic acid accumulates in shellfish and cannot be neutralized by freezing or cooking. Domoic acid can lead to Amnesic Shellfish Poisoning.
- In July 2015, a *Pseudo-nitzschia* bloom stretched from southern California into Southeast Alaska. The southern portion of this bloom produced enough domoic acid to shut down shellfisheries along the coast and to sicken hundreds of sea lions.
- Colorless! Blooms of *Pseudo-nitzschia* are not visible without a microscope.
- *Pseudo-nitzschia* is one of the earliest harmful algal species to bloom in Southeast Alaska. In 2015, the bloom season stretched from May to September.

***Dinophysis* spp.**

- TOXIC, but non-fatal. *Dinophysis* species can produce okadaic acid, which can accumulate in shellfish and cause severe gastrointestinal distress, or Diarrhetic Shellfish Poisoning. These toxins also cannot be neutralized by cooking or freezing.
- While okadaic acid exposure is not fatal, evidence from Europe suggests that it could promote tumor growth.
- *Dinophysis* blooms in warm conditions with stable salinity.

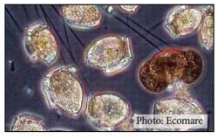


Photo: Ecomare

Heterosigma akashiwo

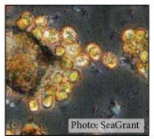


Photo: SeaGrant

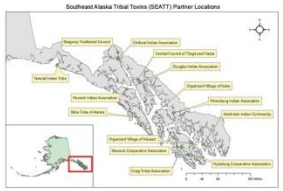
- NOT TOXIC to humans. *Heterosigma* can be toxic to fish, however, and has caused millions of dollars in damage to farmed fish in Puget Sound over the past few years. It has also been documented to kill wild salmon and crustaceans.
- *Heterosigma akashiwo*'s mechanism to fish and crustaceans is unknown. It could be producing an unstable neurotoxin, acting in concert with an unknown virus, or be producing radical oxides.
- Blooms are most likely when the water is warm and slighly brackish, as after a large summer rainstorm.

More questions? Find out more about harmful algal blooms, shellfish toxins, and available shellfish tests by contacting the Sitka Tribe's Environmental Lab. Phone: 907-747-7356. Email: seator@sitkatribe-nsn.gov.

Southeast Alaska Tribal Toxins

The Southeast Alaska Tribal Toxins (SEATT) partnership a network of Southeast Alaskan Tribes, university searchers, non-profit organizations, and commercial ver fisthermen. Together, the network monitors mmunities across Southeast for harmful algal blooms d toxic shellfish.

Every year, Alaskans are hospitalized for Paralytic Shellfish oisoning (PSP), a life-threatening illness caused by eating ntaminated shellfish. SEATT members are working to duce the risks of PSP and related illnesses from wild ellfish by monitoring local plankton and collecting ellfish samples. As the partnership has grown, SEATT embers have also started to monitor a wider range of ean conditions, map out algal cyst beds, and to improve ar ability to communicate results to the public.



Phytoplankton Monitoring

Unsafe shellfish are generally caused by a large increase of toxic plankton, or harmful algal bloom. To catch these blooms early, SEATT members collect a plankton sample from one or more sites in their communities. SEATT members then analyze the sample under a microscope, looking for potentially harmful species and quantifying their abundance. If target species are present, members then filter a water sample and mail the filters to the Sitka Tribe's lab (STAERL). Phytoplankton monitoring takes place every week of the year at every SEATT sites. All relevant data is uploaded to a database, then shared with the public.

tka Tribe of Alaska Environmental Regulatory Lab

In November 2015, the Sitka Tribe of Alaska unpacked the last box equipment for its new lab. This lab allows the SEATT partnership test both water samples and shellfish for toxins in the event of a rmful algal bloom. The lab is also available to recreational shellfish rvesters. Harvesters can get results on a sample of their collection thin 24 hours, allowing them to easily keep the rest of their shellfish ive while waiting to ensure that they're safe.

Currently, the lab uses an enzyme-based test to look for saxitoxin domoic acid that is fast, cheap, and effective. In March of 2016, TAERL will also add a new technique for saxitoxin testing called e Receptor Binding Assay. This technique has been approved for mmercial samples and will allow STAERL to test Southeast dive roducts by early 2017.

fore questions?

ontact us for testing information and protocols. Call 907-747-7356 email seator@sitkatribe-nsn.gov. Find us on the web at seator.org.

FUNDING

- **SEATT**: EPA IGAP -$20K/Tribe/year (~$250/yr)
- **SEATT:** EPA IGAP workshops-$150K (STA)
- **SEAROAM**: BIA Climate Change Program-$210K (STA)
- **SEATOR** site/SEATT training: BIA Climate Change Program-$50K (STA)
- **STAERL**:ANA Environmental Regulatory Enhancement Program-$580K (STA)
- ***Integrated Shellfish Map**: BLaST program-$200K (pending)

$1.5 million as of FY16

Other Partners

- NOAA –Northwest Fisheries Science Center and Charleston Marine Biotoxin Program NOS/PMN
- University of Alaska Fairbanks School of Fisheries and Ocean Science
- Southeast Alaska Regional Dive Fisheries Association (SARDFA)
- Washington State Department of Health Marine Biotoxin Program
- Alaska Department of Environmental Conservation (EHL)

Questions or Comments?

Chris Whitehead
Environmental Program Manager
Sitka Tribe of Alaska
Resource Protection Department
907-747-7395
chris.whitehead@sitkatribe-nsn.gov
www.seator.org