Southeast Alaska Tribal Toxins (SEATT)

Central Council Tlingit and Haida Indian Tribes of Alaska

CRAIG TRIBAL ASSOCIATION

Sitka Tribe of Alaska

YAKUTAT TLINGIT TRIBE

Petersburg Indian Association

A Partnership to Monitor Harmful Algal Blooms

Klawock **Cooperative** Association

Organized Village of Kassan

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Overview

- How SEATT was formed and the commitment
- Background on Harmful Algal Blooms (HABs) and importance of subsistence harvest
- Toxins, their effects, and distribution
- Regulatory authority
- SEATT monitoring and the benefits
- Biotoxin Lab
- Funding

WHY A PARTNERSHIP?

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

→ No assistance from AK state agencies

↓

STA reached out to SE Tribes

↓ ↓

FY 15 EPA IGAP funds for baseline phytoplankton

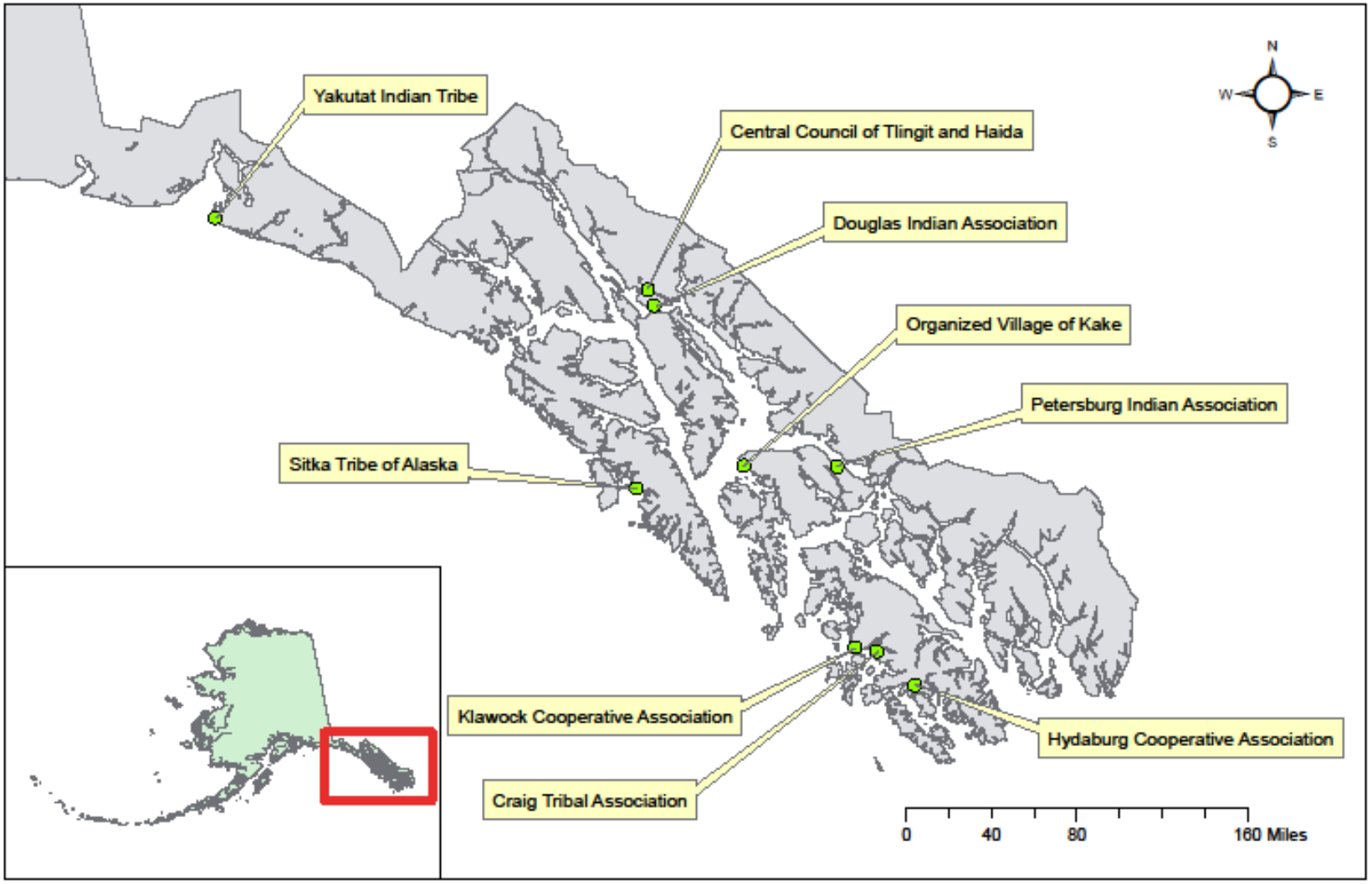
→ Create an early warning system

↓ ↓

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

November 2013

Southeast Alaska Tribal Toxins (SEATT) Partner Locations



Traditions and Culture

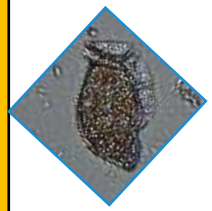
- Subsistence user groups play toxin roulette when harvesting bivalves in Alaska.
- Coastal Alaskan Native populations are 12 times more likely to be affected by PSP than the Caucasian community because of the greater use of subsistence foods (Gessner and Schloss, 1996).

The Clam Diggers. REPRODUCED FROM THE COLLECTIONS OF THE LIBRARY OF CONGRESS

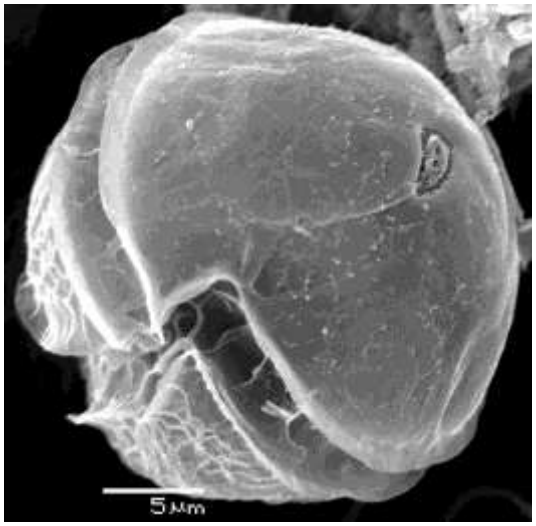
Background on HABs and the increase due to climate change.

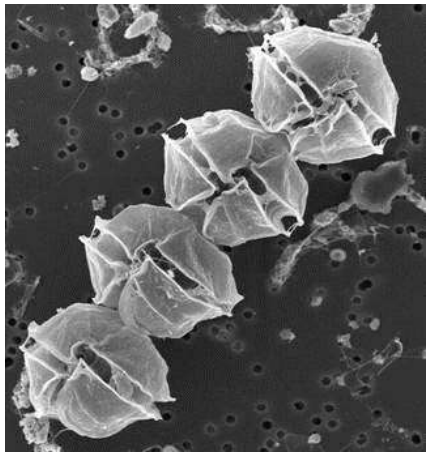
- PSP was first acknowledged as an environmental problem in 1799 when the crew of Alexander Baranof from the Russian American Trading Company ingested blue mussels containing high levels of PSP in southeast Alaska (Fortuine 1975).
- Paralytic shellfish poisoning **(PSP)** is caused by the saxatoxins released by *Alexandrium catanella*
- Amnesic shellfish poisoning **(ASP)** is caused by domoic acid released by *Pseudo-nitzchia*
- With rise in sea water temps due to climate change, HAB species will be more prevalent throughout the year.

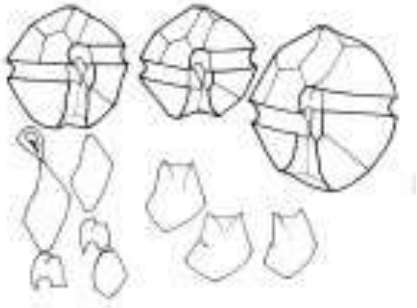
HUMAN HEALTH SYNDROMES – *Associated with Phytoplankton*

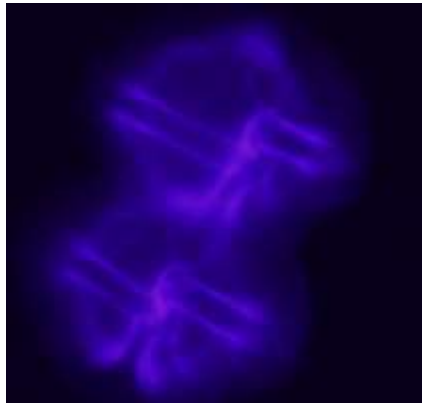
SYNDROME	SPECIES AND TOXIN	SYMPTOMS
Amnesic Shellfish Poisoning **(ASP)**	 *Pseudo-nitzschia* **Domoic acid**	Permanent short term memory loss
Ciguatera **Fish** Poisoning **(CFP)**	 *Gambierdiscus toxicus* **Ciguatoxin & Maitotoxin**	Temperature Sensation Reversal
Diarrhetic Shellfish Poisoning **(DSP)**	 *Dinophysis* **Okadaic acid**	Diarrhea Nausea Vomiting
Neurotoxic Shellfish Poisoning **(NSP)**	 *Karenia brevis* **Brevetoxin**	Gastrointestinal and Neurological Problems
Paralytic Shellfish Poisoning **(PSP)**	 *Alexandrium* **Saxitoxin**	Loss of motor control

Alaskan *Alexandrium* spp.





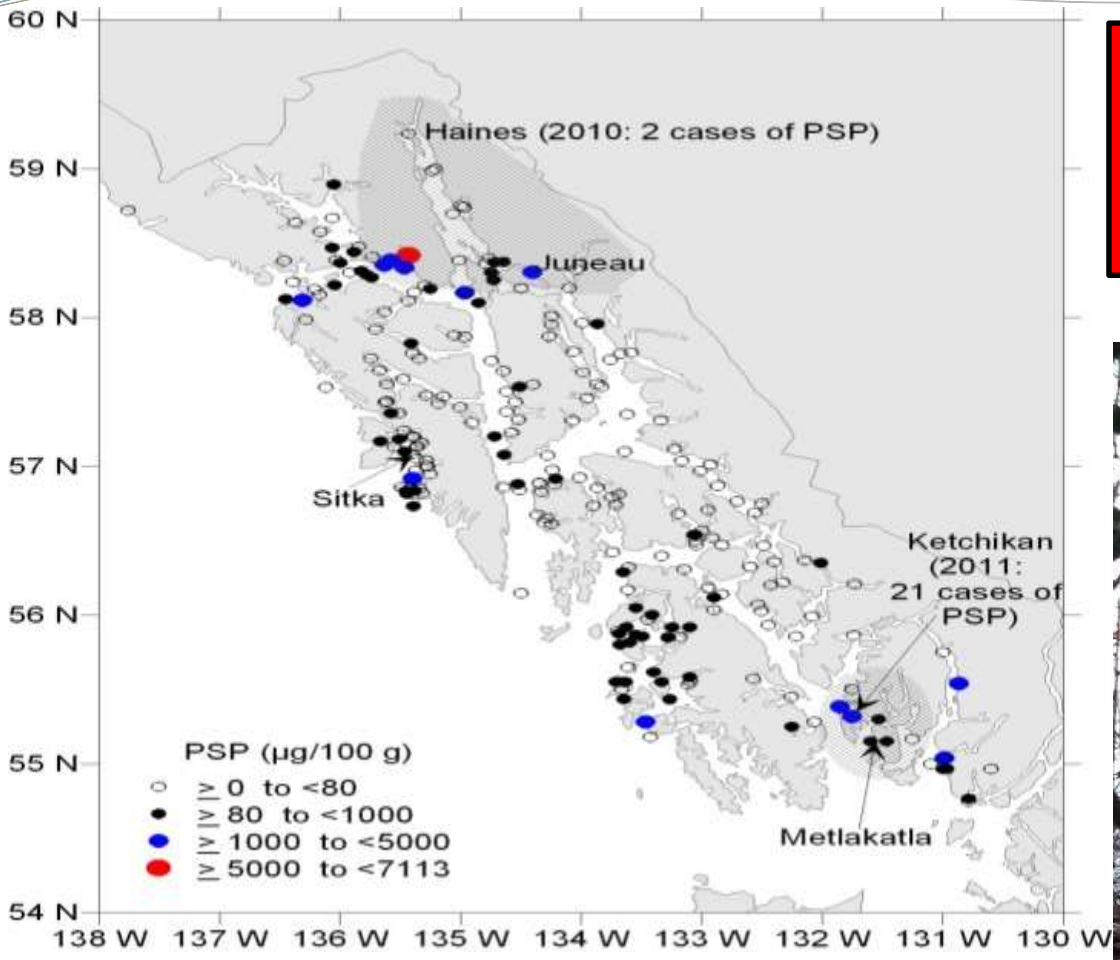




The dinoflagellate *Alexandrium catanella* (formerly *Gonyaulax catanella/catenatum*) produces saxitoxin, a highly potent neurotoxin, which, if consumed, causes paralytic shellfish poisoning (PSP).

Comparative Lethality of Selected Toxins & Chemical Agents in Laboratory Mice

	AGENT	LD_{50} (μg/kg)	MOLECULAR WEIGHT	SOURCE
	Botulinum toxin	0.001	150,000	Bacterium
	Shiga toxin	0.002	55,000	Bacterium
	Tetanus toxin	0.002	150,000	Bacterium
	Abrin	0.04	65,000	Plant (Rosary Pea)
	Diphtheria toxin	0.10	62,000	Bacterium
#5	**Maitotoxin**	**0.10**	**3,400**	***Gambierdiscus***
#7	**Palytoxin**	**0.15**	**2,700**	***Ostreopsis***
#8	**Ciguatoxin**	**0.40**	**1,000**	***Gambierdiscus***
	Textilotoxin	0.60	80,000	Elapid Snake
	C. perfringens toxins	0.1 - 5.0	35-40,000	Bacterium
	Batrachotoxin	2.0	539	Arrow-Poison Frog
	Ricin	3.0	64,000	Plant (Castor Bean)
	alpha-Conotoxin	5.0	1,500	Cone Snail
	Taipoxin	5.0	46,000	Elapid Snake
	Tetrodotoxin	8.0	319	Puffer Fish
	alpha-Tityustoxin	9.0	8,000	Scorpion
#17	**Saxitoxin**	**10.0 (Inhal 2.0)**	**299**	***Alexandrium* & *Gymnodinium***
	VX	15.0	267	Chemical Agent
	SEB (Rhesus/Aerosol)	27.0 (ED_{50}~pg)	28,494	Bacterium
	Anatoxin-A(s)	50.0	500	Blue-Green Algae
	Microcystin	50.0	994	Blue-Green Algae
	Soman (GD)	64.0	182	Chemical Agent
	Sarin (GB)	100.0	140	Chemical Agent
	Aconitine	100.0	647	Plant (Monkshood)
	Brevetoxin	**180.0**	**1,000**	***Karenia brevis***



Maximum PSP toxins
(1991-2011)

2011 reported blue muscles at >50,000 ug/100g in Ketchikan

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

- 80 ug of toxin/ 100g of shellfish with mouse bioassay

What about subsistence users?

- Alaska has NO SUBSISTENCE OR RECREATIONAL regulatory testing.
- ADEC will not certify any intertidal harvest for subsistence use.

What does monitoring look like?

Net tow and WQ field sample

Microscopy for ID and cell count /abundance

Filter sample in lab and test for toxins

Shellfish collection, shipped to Sitka

Monitoring Components

- Collect & process seawater samples weekly
- Record oceanic parameters
- Identify presence of HAB species
- Enumerate target species
- Describe phytoplankton species diversity
- Measure toxins (cellular)
- Ship shellfish samples to Sitka Sentinel mussel cages (2016)

Equipment and Training

Equipment

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

Training

- Workshops in Sitka

•Developing Manuals/Training DVD (UAS)

- Site Visits

Cell counts & imaging training

Quarterly Newsletters and Updates to SEATOR.org

SEATT DATA ENTRY SHEET

Sample Location:
Collection Date and Time:
Field Data Collected by:
Data Entered by:
Comments:

Weather and Water
sunny partly cloudy mostly cloudy cloudy rain
Wind (none, light, moderate, strong):
Tide (incoming, outgoing, high, low):
Air Temperature (°C):
Water Temperature (°C): Salinity (ppm):

Pseudo-nitzchia spp. size classification	% Small	% Large

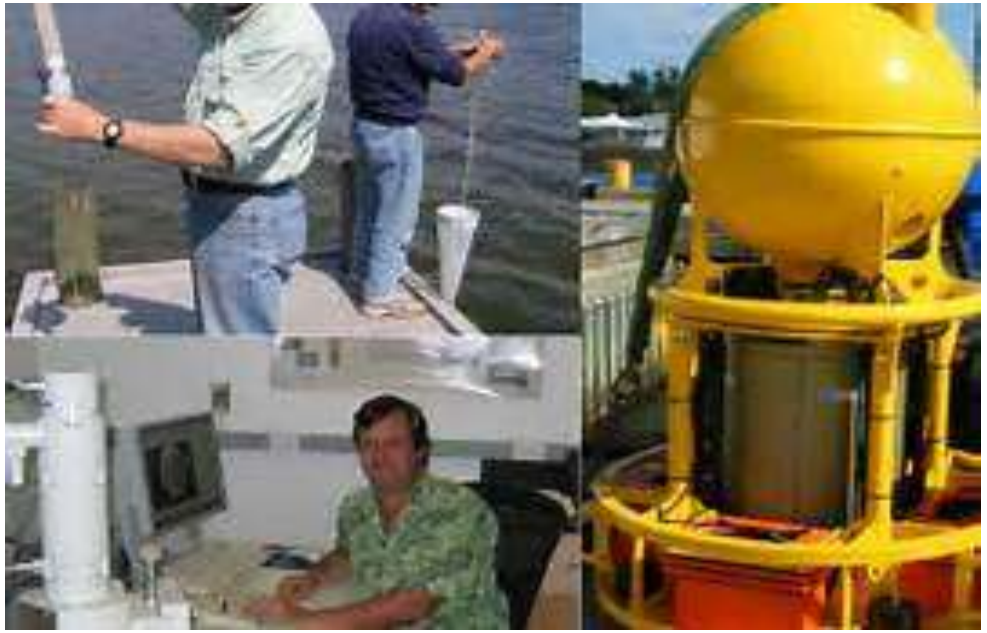
Cell Abundance

Genus	Species (if known)	Net Tow Relative Abundance N, P,C, B (none, present,common, bloom)
Pseudo-nitzschia		
Alexandrium		
Dinophysis		
Diatoms:		
Aterionellopsis		
Bacteriastrum		
Bacterosira		
Chaetoceros		
Corethron		
Coscinodiscus		
Cylindrotheca		
Dactyliosolen		
Ditylum		
Eucampia		
Fragilariopsis		
Guinardia		
Hemiaulus		
Leptocylindrus		
Licmophora		

Genus	Species	Abundance (N, P,C, B)
Diatoms (cont):		
Navicula		
Nitzschia		
Pleurosigma		
Rhizosolenia		
Skeletonema		
Stephanopyxsis		
Striatella		
Thalassionema		
Thalassiosira		
Dinoflagellates:		
Ceratium		
Cochlodinium		
Heterocapsa		
Noctiluca		
Prorocentrum		
Protoperidinium		
Haptophytes:		

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



Other Partnerships doing HAB monitoring

Olympic Region Harmful Algal Bloom **(ORHAB)** Partnership

- Tribes
- NOAA
- Volunteers
- Non-Profits
- Shellfish Growers

SoundToxins Partnership

- Tribes
- NOAA
- Volunteers
- Non-Profits
- Shellfish Growers

www.orhab.org

www.soundtoxins.org

Benefits for REAL Time monitoring

- EARLY WARNING system
- Develop forecasting tools
- Provide outreach to Tribal Citizens about the potential for health risk related to subsistence harvest.
- Coordinate with local and state health departments
- Provide the SEATT partners with a unified baseline data set.

  - **Credibility**

Ketchikan *noctiluca* bloom 2009

STA Toxin Analysis Lab

- Lab can be used to conduct regulatory sampling for SEATT partners for PSP and other toxins using RBA techniques

- **Ability for Tribes to establish their own subsistence shellfish management plans based on sampling data**

- Possibility to incorporate other needs that Tribes may have: OA, traditional foods, etc.

Icing on the cake

Looking to the Future

- Funding
  - EPA IGAP funds ($30K/SEATT partner/year: $270K/year)
  - STA and CCTHIA EPA unmet needs for technical training and workshops ($150/year)
  - STA-EPA unmet needs for cellular toxin analysis ($75K OCT 2014)
  - STA -BIA funding for technical standard operating procedure manual ($48K NOV, 2014)
  - STA-ANA Environmental Regulatory Enhancement for FDA certified regulatory lab($600K 2015)

TRAINING WORKSHOPS IN SITKA

- **May 11-15 2015, November 2015**
- Current SEATT partners are funded for travel, lodging, per diem.
- Possibility for additional interested Tribes to attend.
- NOAA, WDOH, UAS
  - Dr. Vera Trainer
  - Dr. Steve Morton
  - Kate Sullivan
  - Jerry Borchert

Questions or Comments?

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