Managing Harmful Algal Blooms in Tribal Waters Webinar Series

Day 2: Monitoring for HABs and Creating Partnerships

March 16, 2021

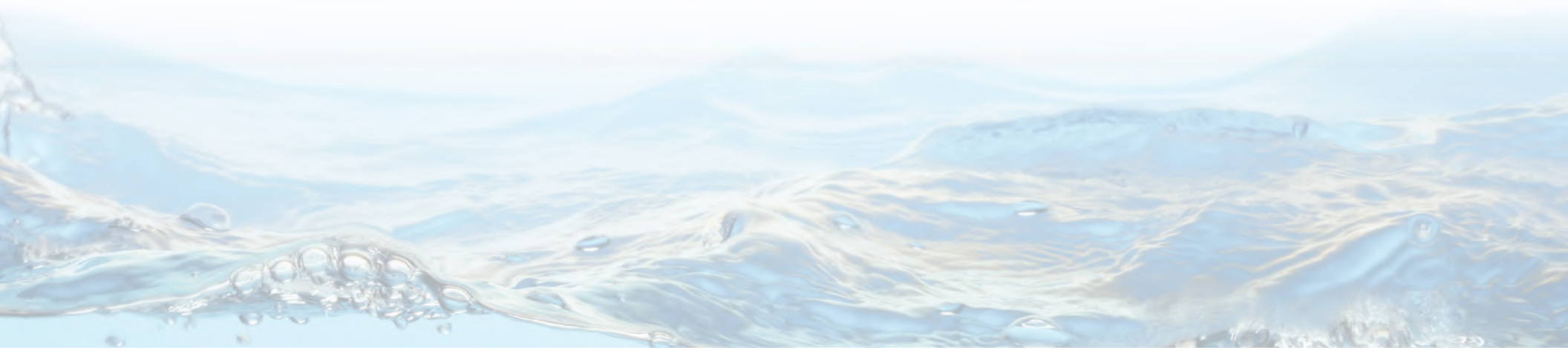
1:00 – 3:30 PM EST/10:00 AM – 12:30 PM PST

Reminders

- Slide presentations and speaker bios are downloadable as handouts
- If you are having technical difficulties, let us know in the chat box
- If you have a question for a speaker, type it in the chat box
  - Moderators will ask questions at the end of each session, time permitting
- During the webinar, participants on the phone can send questions to meetings@erg.com

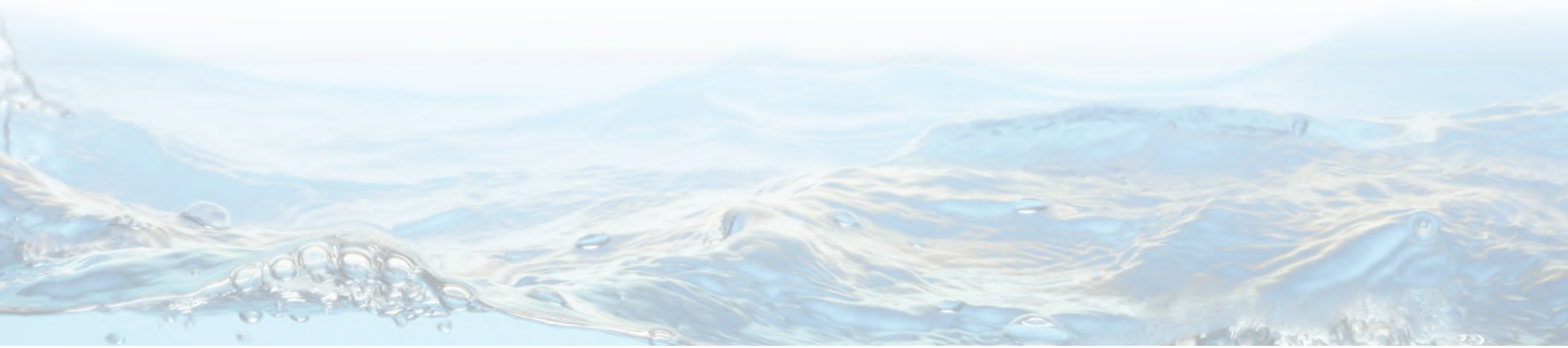
Welcome

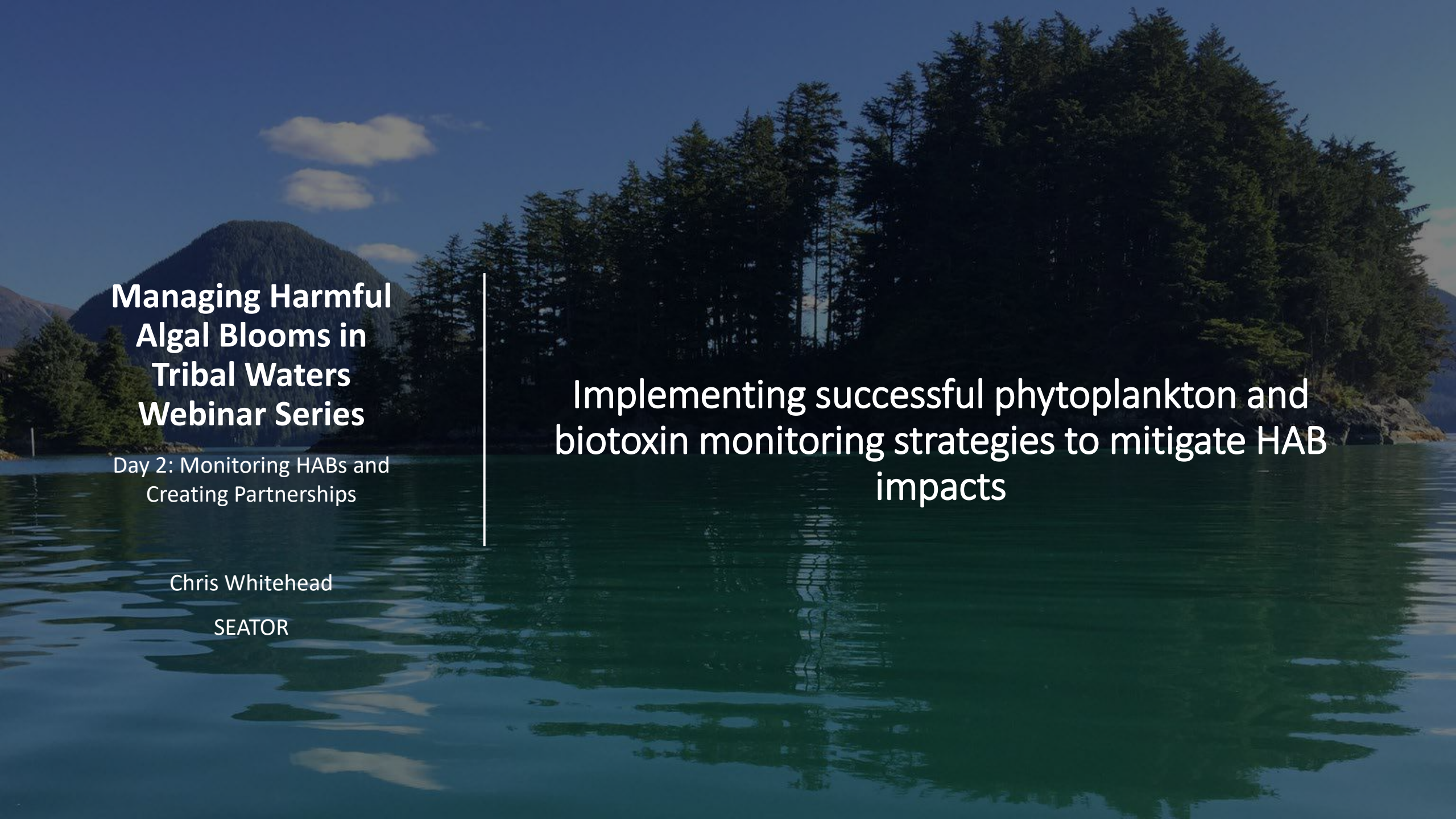
- Moderator: Tod Leighfield, NOAA



Session 1: Developing HABs Monitoring Programs

- Chris Whitehead, Southeast Alaska Tribal Ocean Research (SEATOR)





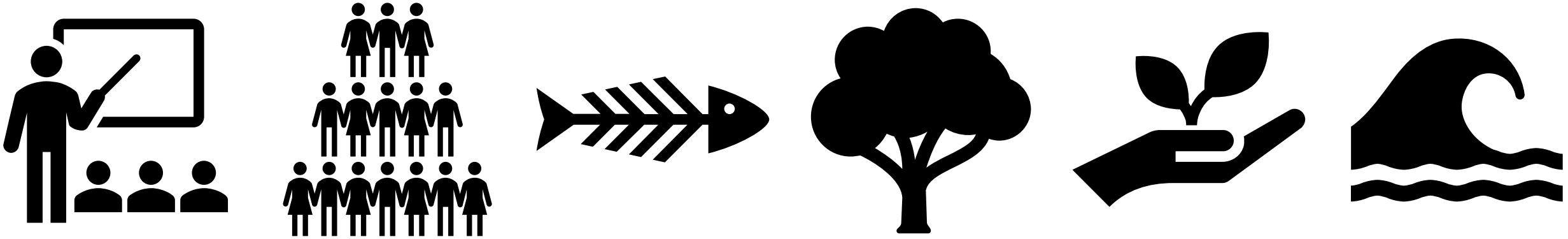
Managing Harmful Algal Blooms in Tribal Waters Webinar Series

Day 2: Monitoring HABs and Creating Partnerships

Implementing successful phytoplankton and biotoxin monitoring strategies to mitigate HAB impacts

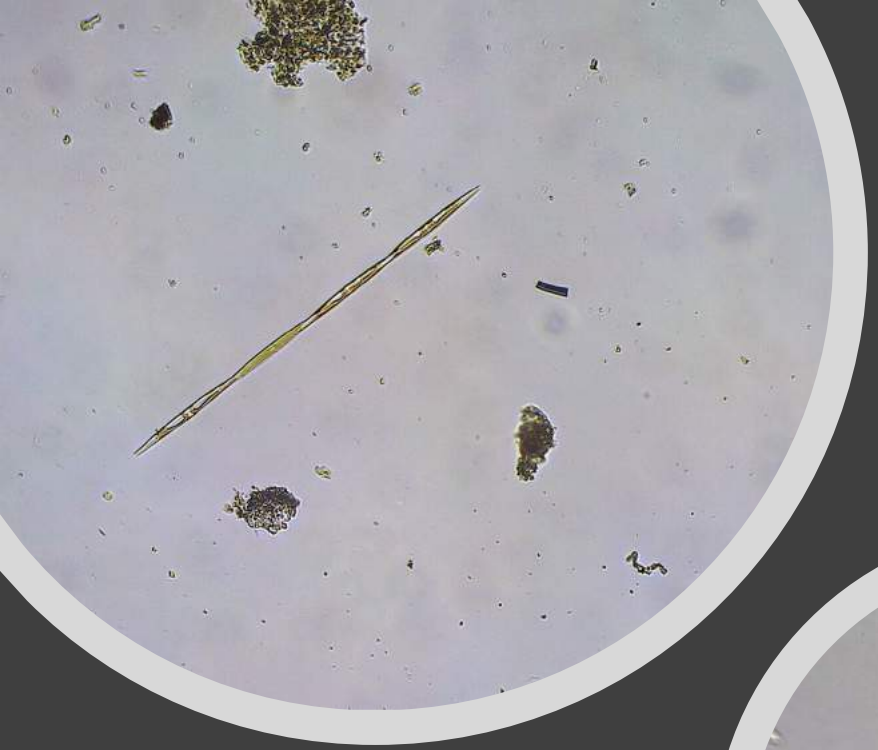
Chris Whitehead

SEATOR



Common Concern to Focus Regional Effort

Sustainable Access to Traditional Resources



HAB Toxins

- *Saxitoxin-Paralytic Shellfish Poisoning (PSP)*
- *Domoic Acid-Amnesic Shellfish Poisoning (ASP)*
- *Okadaic Acid-Diarrehetic Shellfish Poisoning (DSP)*

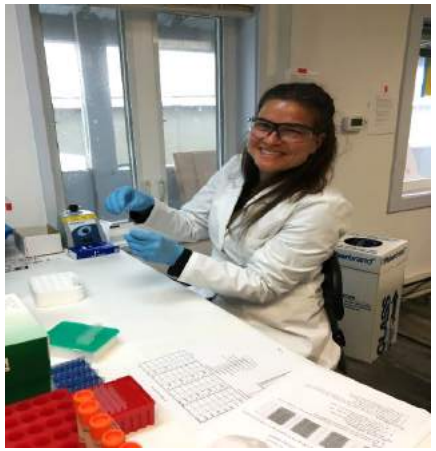
Who Regulates Toxins

FDA regulations for all commercially harvested shellfish in Alaska under the National Shellfish Sanitation Program

- Alaska Department of Environmental Conservation ---Alaska

- **Alaska has no long-term subsistence monitoring program
  - "Just don't harvest wild shellfish"

Tribal Organizations Take the Lead

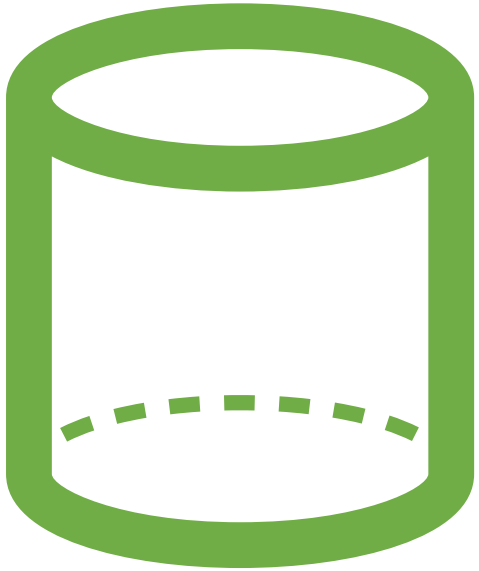


founded-1970 NSHC
NORTON SOUND HEALTH CORPORATION

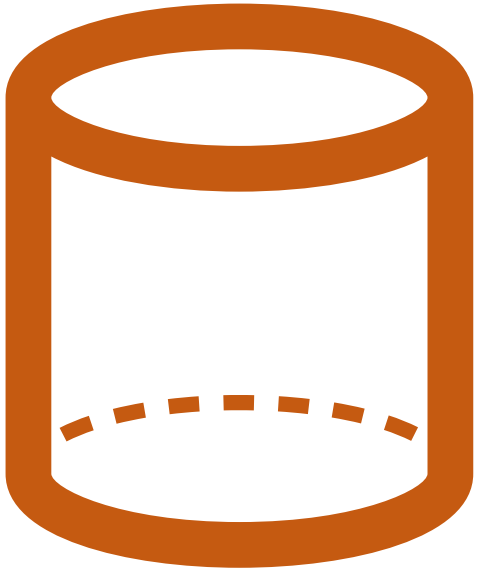
SEATOR
Culture Science Community
Southeast Alaska Tribal Ocean Research

Chugach Regional Resources Commission
Alutiiq Pride

OCEAN & EARTH ENVIRONMENTAL



Phytoplankton Observations
“early warning”

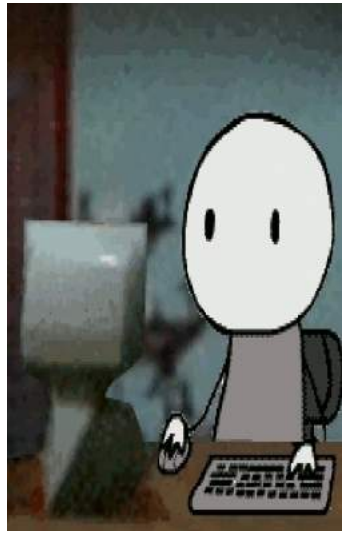


ToxinTesting:
Shellfish/Marine
Mammals/Water

Communicating Results

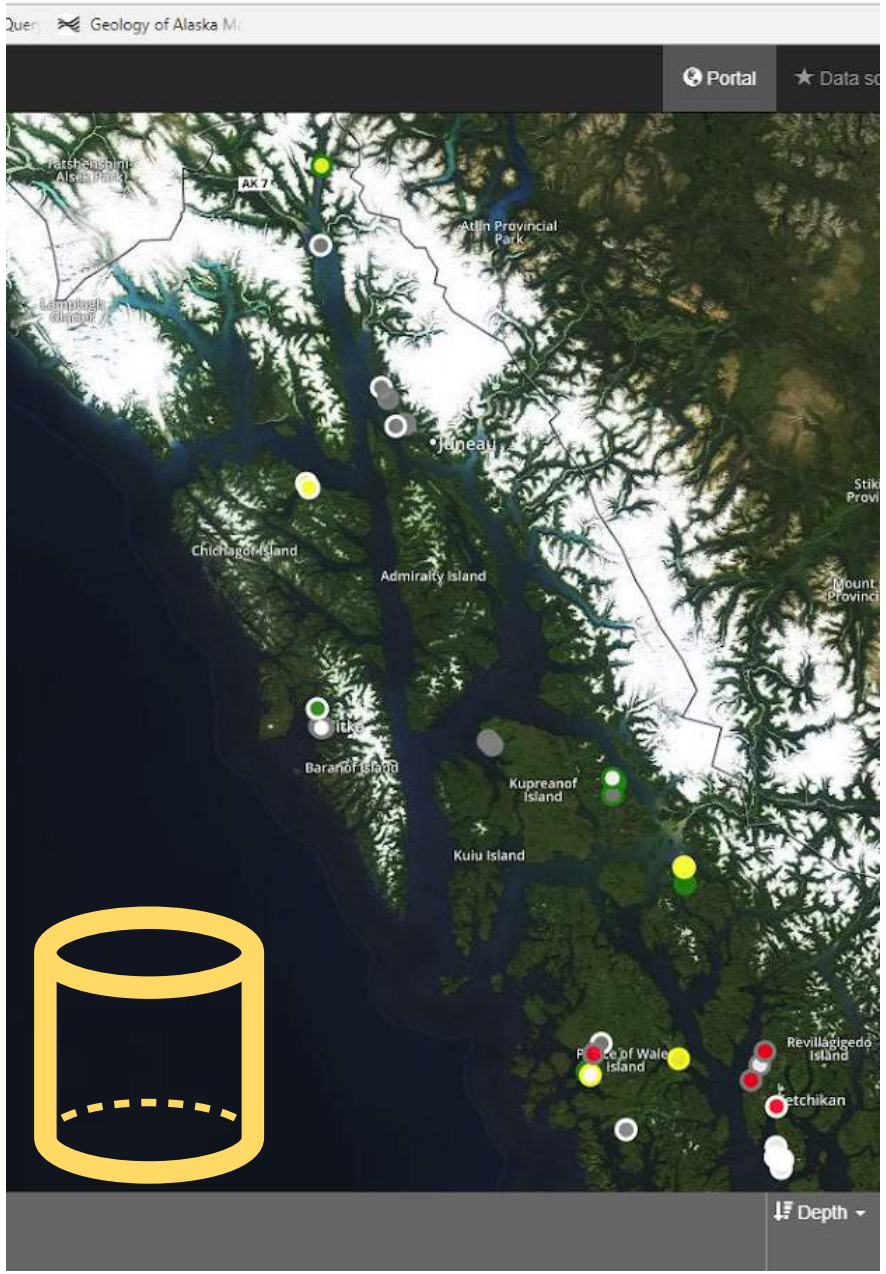
Program Elements

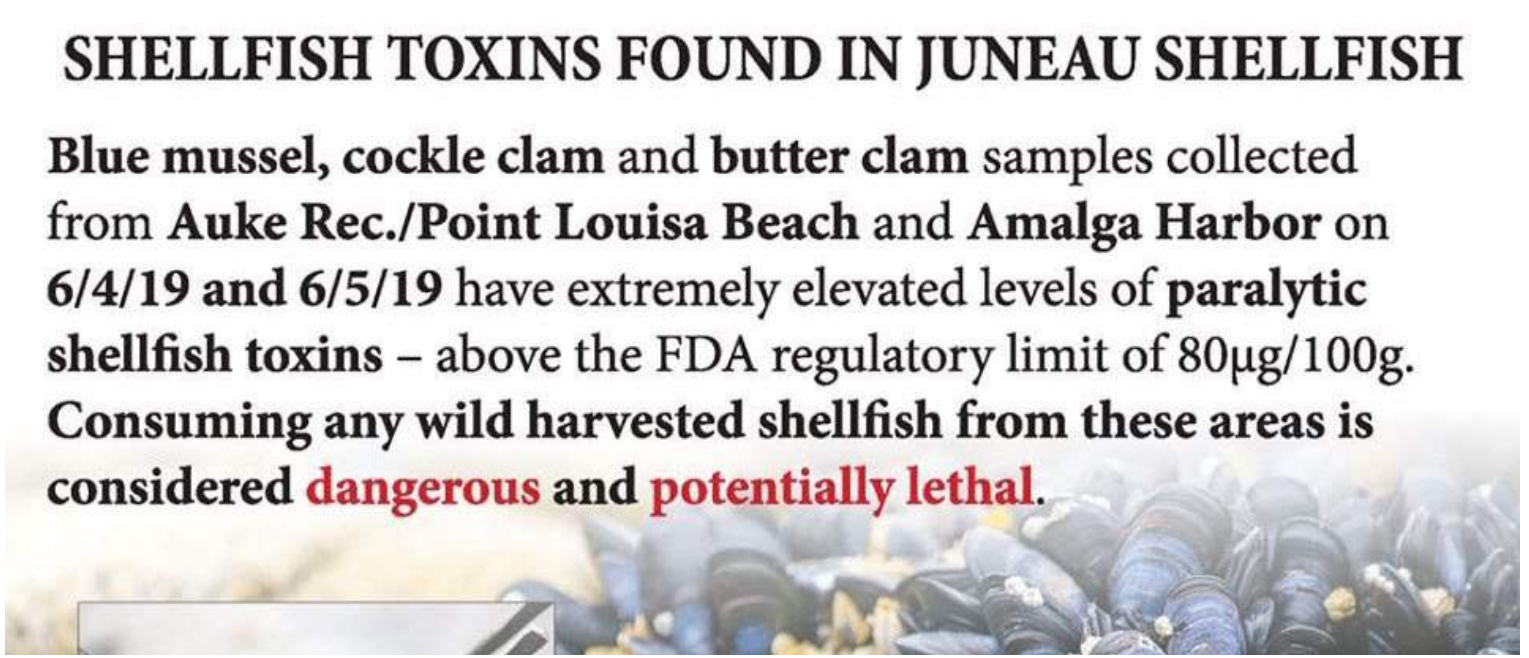
Collecting Baseline Data on Phytoplankton



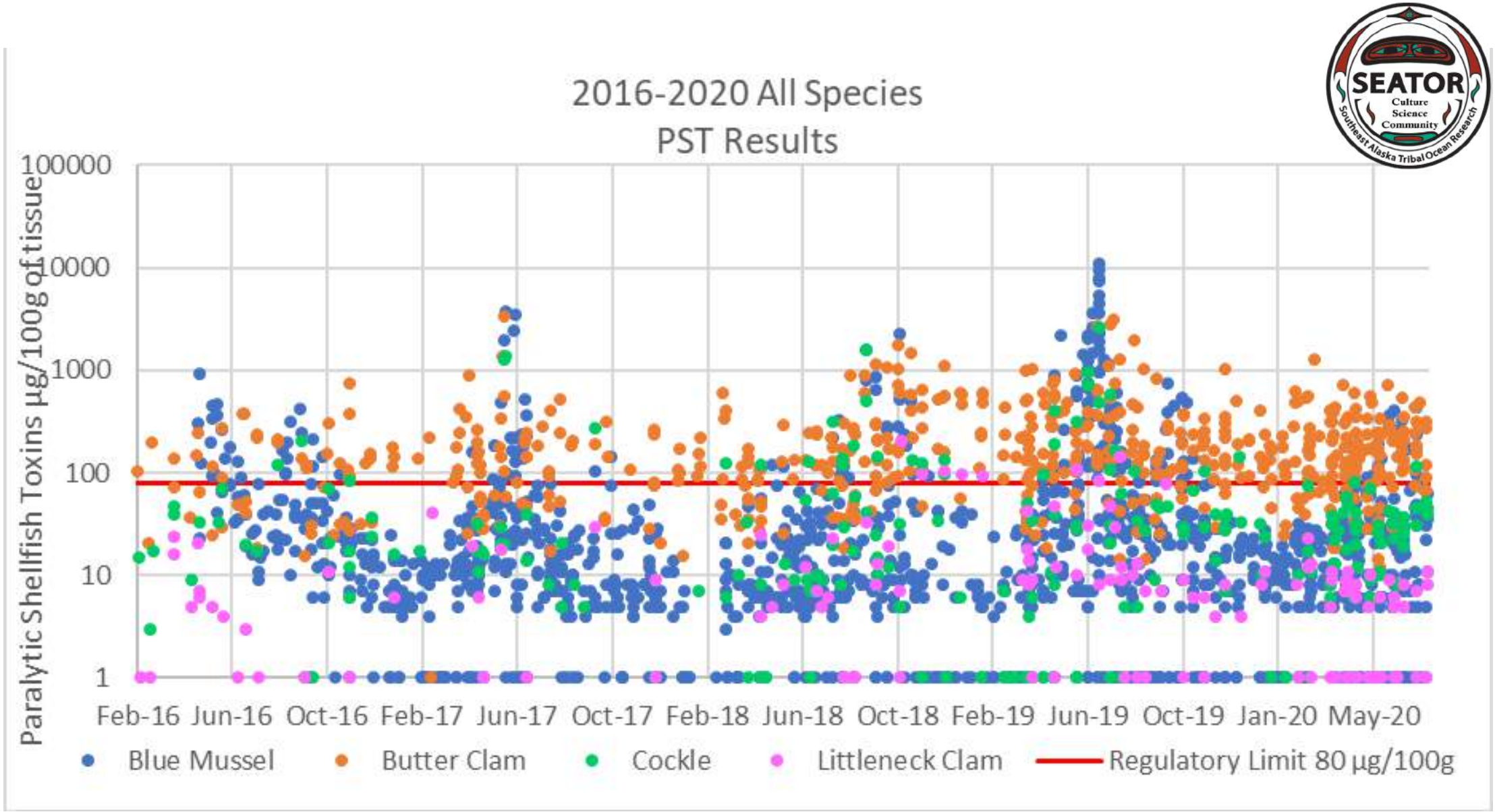
Key harvest locations (consistency)
Weekly net tow and phytoplankton ID
Salinity and Sea Surface Temperature
Whole water sampling
Data entry
Communicating results (early warning tool)

Toxin Testing- Methods and Uses





Data Accessibility and Communicating Results


2016-2020 All Species
PST Results
Paralytic Shellfish Toxins µg/100g of tissue
100000
10000
1000
100
10
1
Feb-16
Jun-16
Oct-16
Feb-17
Jun-17
Oct-17
Feb-18
Jun-18
Oct-18
Feb-19
Jun-19
Oct-19
Jan-20
May-20
Blue Mussel
Butter Clam
Cockle
Littleneck Clam
Regulatory Limit 80 µg/100g

Create an Entity

ONE VOICE

- Purchase all supplies needed for phytoplankton collection and analysis
- Build capacity by attending training on phytoplankton collection for baseline data
- Resolution joining the program
- Provide protocols for sampling method
- Collect weekly phytoplankton observations using microscopy and enter data into shared database
- Share information via quarterly calls with Project members, local health authorities, and managers
- Update community on HABs, human health effects, and phytoplankton sampling efforts

Tier 1: Phytoplankton Monitoring

- **Basic supplies (~$3,500-$4,000)**
  - **Digital Microscope**
  - **Plankton Net and bottles**
  - **Thermometer**
  - **Refractometer**
  - **Slides/covers/pipette**

- **Data entry (database costs)**

Momentum with Capacity

- Utilize YOUR NETWORK to tackle other common concerns
  - Climate Change Impacts
  - Contaminants
  - Water Quality

Ocean Acidification Laboratory

- Assess effects of changing ocean chemistry on marine resources
- National and regional dataset

Intertidal Shellfish Population Surveys

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Assessing Total Mercury in Halibut and Seal Tissue

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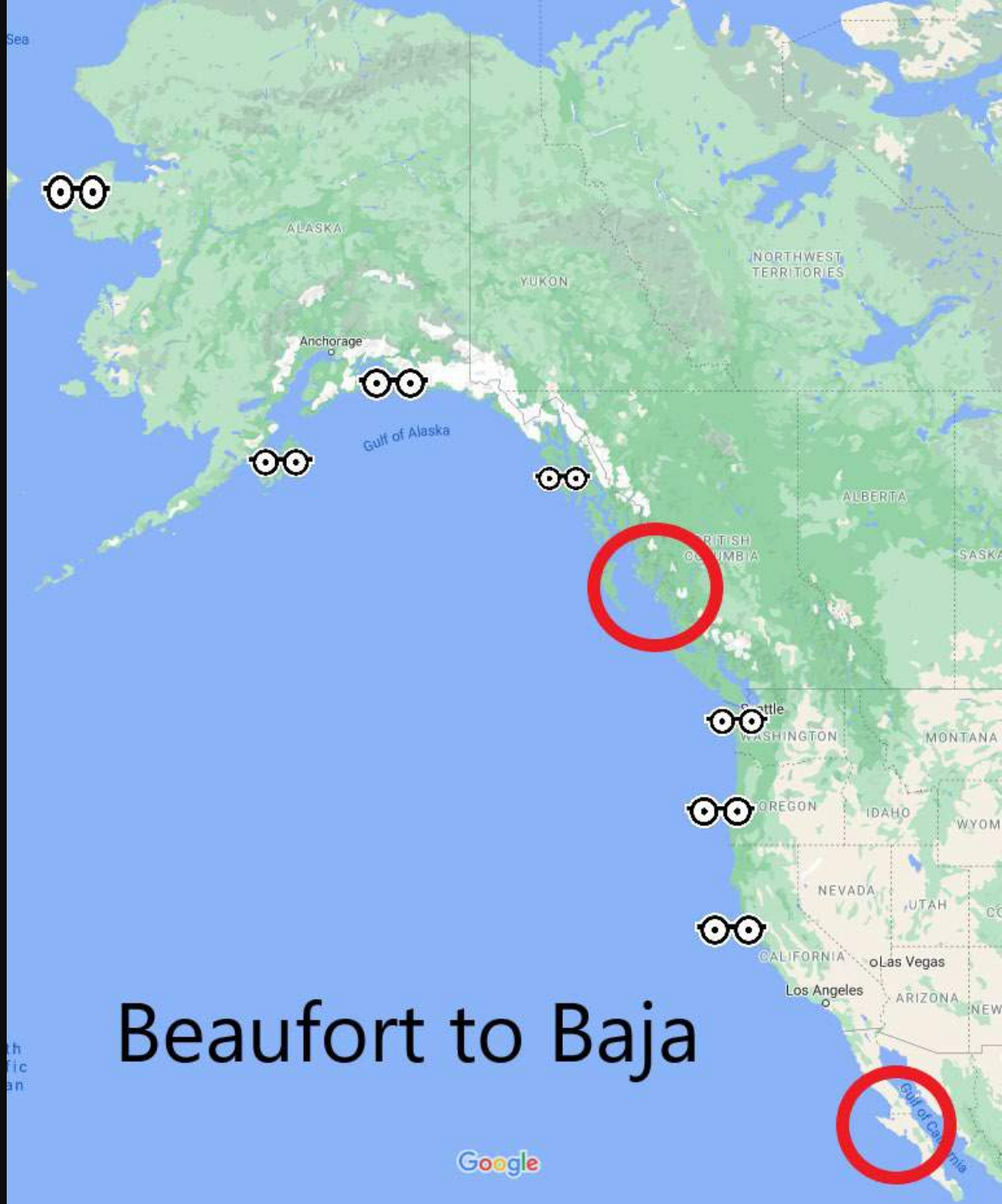
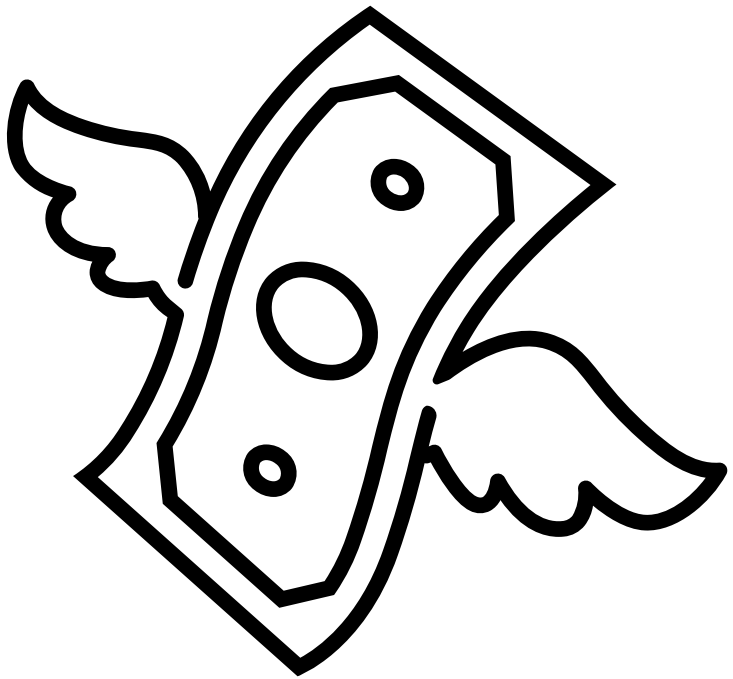
Tribal Youth and Community Programs

“Eyes on the water”

Linking Tribal Environmental Programs from Alaska to Mexico.





How to FUND a Network

- Webinar 3-March 18
  Session 1

Questions on how to get started?

Chris Whitehead

chris.whitehead@oceanearthenvironmental.com

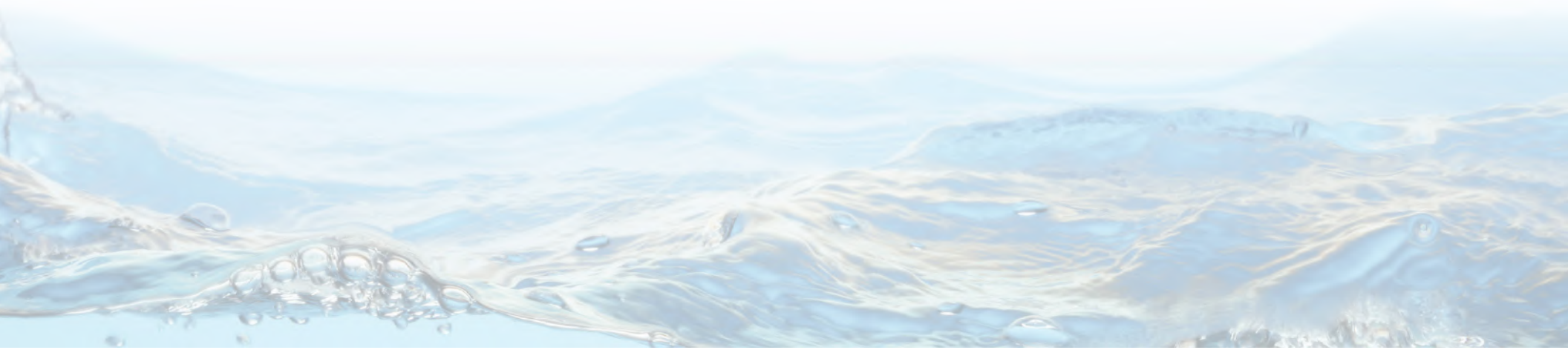
360-797-3152

Session 1: Developing HABs Monitoring Programs

QUESTIONS?

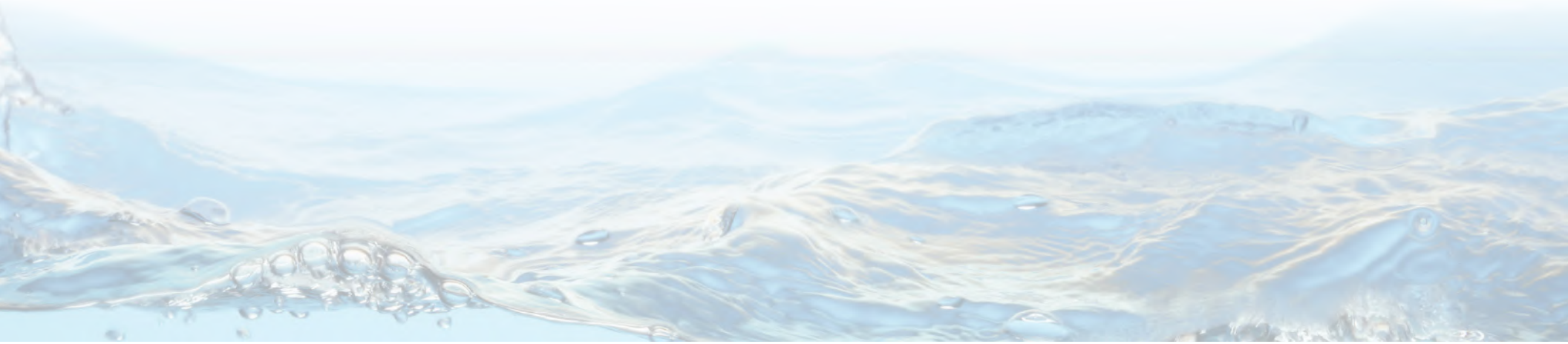
Session 2: Collecting and Analyzing Baseline Data

- Moderator: Chris Whitehead, SEATOR



Session 2: Collecting and Analyzing Baseline Data

- Jennifer Maucher, NOAA
- Laura Webb, U.S. EPA Region 7
- Karola Kennedy, Robinson Rancheria
- Seth Book, Skokomish



Phytoplankton Monitoring Network

Promoting a better understanding of Harmful Algal Blooms by way of volunteer monitoring.

Jen Maucher Fuquay, M.S. PMN Coordinator

What is PMN?

20th year!

PMN

Estab. 2001

Phytoplankton Monitoring Network (PMN) is a national volunteer organization that monitors for potential Harmful Algal Blooms

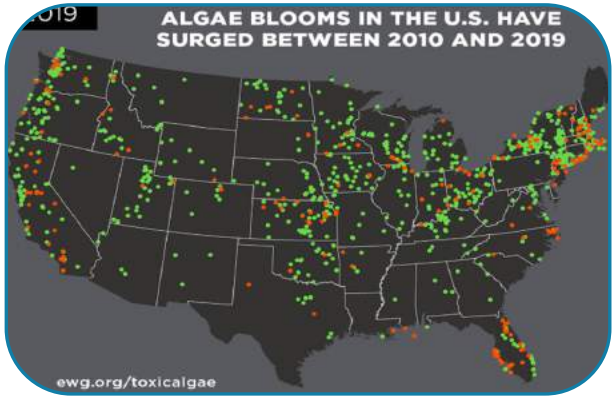
Train citizen scientists to:

- *Collect samples from **coastal** or **freshwater** environments*
- *Identify potentially harmful algal/cyanobacterial species*
- *Enter information into NOAA database*

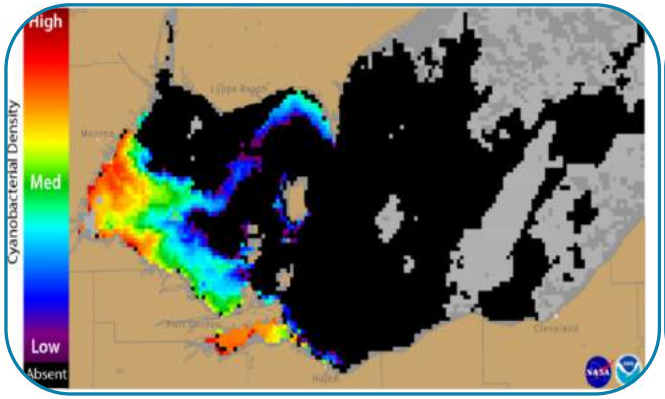
NOAA scientists can then:

- *Analyze water samples for HAB toxins on limited basis*
- *Alert state/local agencies to presence of bloom*
- *Identify temporal and geographic HAB trends with consistent long term data collection*

Why We Monitor HABs



HABs are increasing in duration, frequency, and geographical distribution



Data helps us understand, forecast, and prepare for harmful algal blooms

Monitoring can act as early warning system for potential toxin exposure

Why is this important?

Want to ensure sustainable access to traditional resources while protecting Tribal health.

This is especially true for Tribes that rely on subsistence harvesting.

Establishing **baseline data** for which HAB organisms are present is important first step.

Consistent monitoring for HAB organisms coupled with toxin detection can mitigate risk of human health impacts.

Field Sampling – Summary

10- 15 minutes total sample time

1. Tow 20 µm plankton net for 3 minutes

- *dunk net until bottle full of water (no air)*
- *drop net straight down a few feet below surface (vertical profile)*
- *bring net back to just below surface and begin **3 min** net tow*

2. Record Water & Air Temperatures

3. Record Salinity (coastal)

4. Collect 1L & live whole water samples

Lab Analysis – Summary

15- 60 minutes depending on skill level and sample density

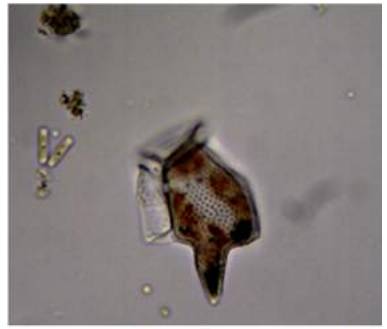
1. Prepare gridded slide

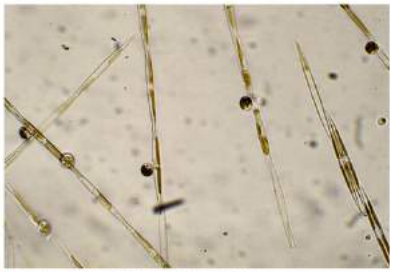
2. SCAN through slide one time

- *Observe relative abundance of targets*
- ***TAKE PHOTOS** if possible*

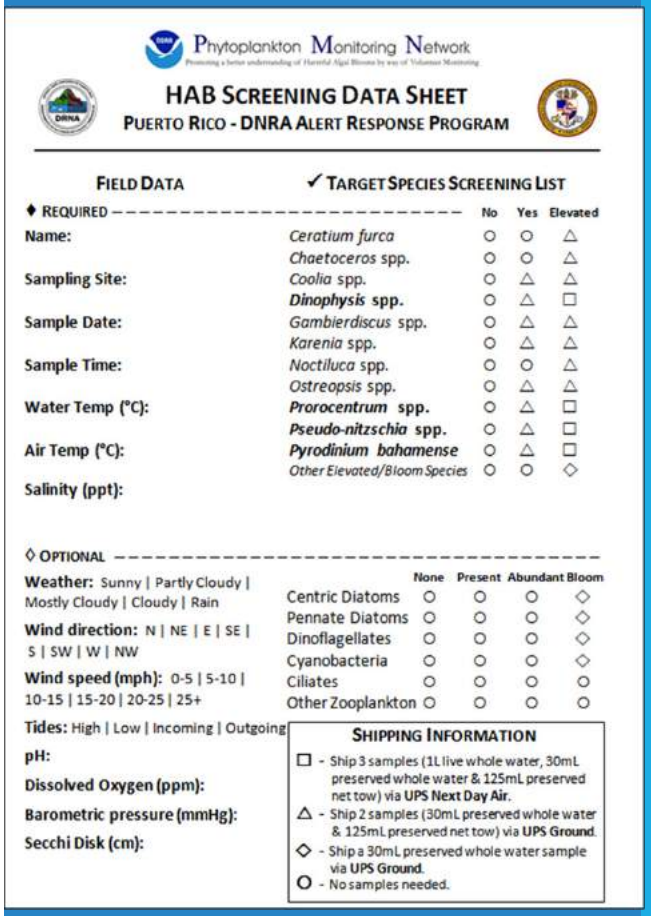
3. Enter data

4. [Filter 1 L whole water sample]





Data Collection



Phytoplankton Monitoring Network

HAB SCREENING DATA SHEET
PUERTO RICO - DNRA ALERT RESPONSE PROGRAM

FIELD DATA

♦ REQUIRED

Name:

Sampling Site:

Sample Date:

Sample Time:

Water Temp (°C):

Air Temp (°C):

Salinity (ppt):

✓ TARGET SPECIES SCREENING LIST

	No	Yes	Elevated
Ceratium furca	○	○	△
Chaetoceros spp.	○	○	△
Coolia spp.	○	△	△
***Dinophysis* spp.**	○	△	□
Gambierdiscus spp.	○	△	△
Karenia spp.	○	△	△
Noctiluca spp.	○	○	△
Ostreopsis spp.	○	△	△
***Prorocentrum* spp.**	○	△	□
***Pseudo-nitzschia* spp.**	○	△	□
Pyrodinium bahamense	○	△	□
Other Elevated/Bloom Species	○	○	◇

◊ OPTIONAL

Weather: Sunny | Partly Cloudy | Mostly Cloudy | Cloudy | Rain

Wind direction: N | NE | E | SE | S | SW | W | NW

Wind speed (mph): 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25+

Tides: High | Low | Incoming | Outgoing

pH:

Dissolved Oxygen (ppm):

Barometric pressure (mmHg):

Secchi Disk (cm):

	None	Present	Abundant	Bloom
Centric Diatoms	○	○	○	◇
Pennate Diatoms	○	○	○	◇
Dinoflagellates	○	○	○	◇
Cyanobacteria	○	○	○	◇
Ciliates	○	○	○	○
Other Zooplankton	○	○	○	○

SHIPPING INFORMATION

□ - Ship 3 samples (1L live whole water, 30mL preserved whole water & 125mL preserved net tow) via **UPS Next Day Air.**

△ - Ship 2 samples (30mL preserved whole water & 125mL preserved net tow) via **UPS Ground.**

◇ - Ship a 30mL preserved whole water sample via **UPS Ground.**

○ - No samples needed.

Environmental Parameters

- Collected to understand the conditions that are conducive for HABs
  - ***Water temperature**
  - ***Salinity**
  - *Air temperature
  - Tides
  - Weather/Winds

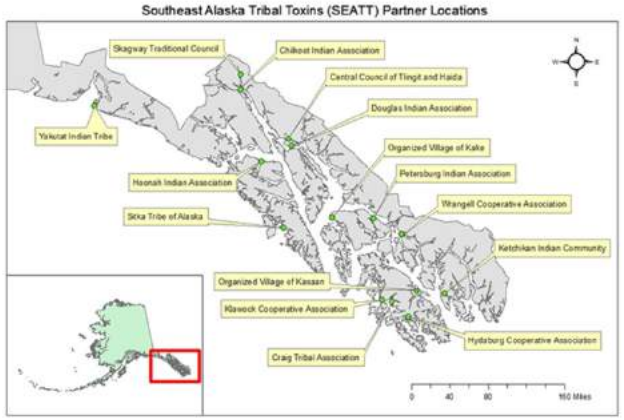
Whole Water Samples

- ***Use to ID phytoplankton present***
- Filter for toxin analysis
- Cell counts to get cell concentration

Shellfish Samples

- Use for toxin analysis

SE Alaska Tribal Ocean Research



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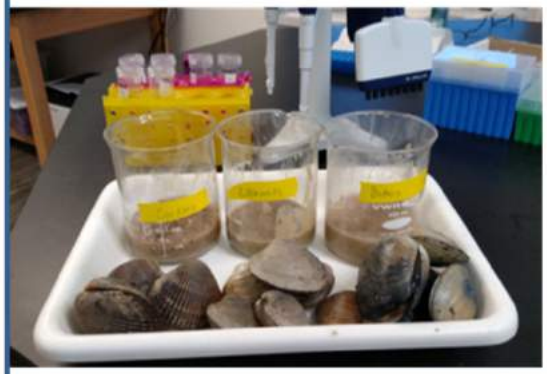
ID & Count Phytoplankton

Seawater filters to measure cellular toxins

Shellfish collection for toxin analysis



Utilization of PMN sampling and identification techniques was the first step in the creation of **SEATOR in 2014**. Tribal Environmental Specialists have been trained on phytoplankton collection and identification using the PMN model.

NORTON SOUND HEALTH CORPORATION

Chugach Regional Resources Commission

NSHC- NOME, AK

Supports the Inupiat, Siberian Yup'ik and Yu'pik people of the Bering Strait region

Ocean and Earth Environmental Services hosted training workshop in Feb 2021

PMN provided Phyto ID Training for marine and freshwater HAB ID

NSHC beginning with phytoplankton monitoring first, then will build capacity towards sampling for toxins as well

SEWARD, AK

7 Tribes in the Chugach region

Ocean and Earth Environmental Services to host upcoming training workshop in Seward May 2021

PMN to provide Phyto ID training

CRRC will expand to shellfish collection in the next year

Toxin analysis will occur at Alutiiq Pride Marine Institute.

Thank You!

Jennifer.Maucher@noaa.gov

Region 7 Science & Technology Center

Iowa, Kansas, Missouri and Nebraska

Aquavan

2008 Dodge Sprinter

Flexibility – cargo van to certified bacteria laboratory

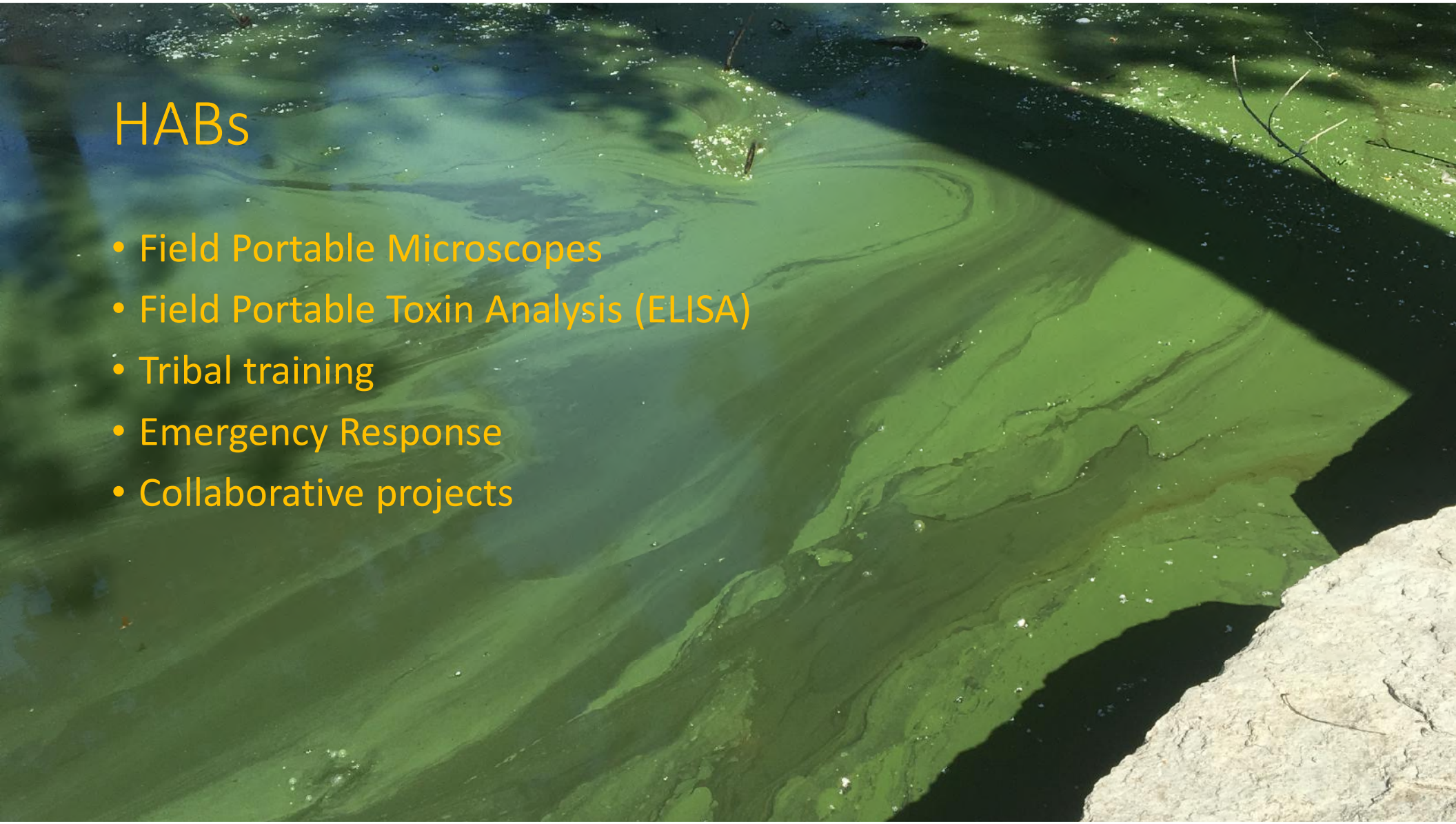
- Retractable SS bench top
- One permanent shelving unit
- 1 or more portable shelving unit
- Portable sink with hot water heater
- Refrigerator and/or freezer unit

Power – built in batteries/inverter with optional generator

HVAC – internal AC and heat, with portable AC/Heater unit used as needed

Taking the Lab to the Sample

- HABs monitoring and response
- ISO Accredited E coli laboratory
- National Aquatic Resource Surveys (NARS)
- Mobile classroom
- Superfund sample collection and processing



HABs

- Field Portable Microscopes
- Field Portable Toxin Analysis (ELISA)
- Tribal training
- Emergency Response
- Collaborative projects

qPCR filter processing

- Short holding time (8 hrs)
- Collaborative project with USGS and KDHE on Milford Lake - HABs
- Collaborative project with KU and MU at Kansas Biological Survey Field Station - HABs
- Tribal E. coli sampling – source tracking

Hurricane Laura Response

- 3 Certified analysts
- Able to use E.*coli* and chlorine data to pinpoint problem areas in system
- Used to identify water main breaks/leaks caused by heavy equipment

- **Results used to lift boil advisory for Lake Charles**

Tribal Training

- Hands-on training to Kickapoo Nation water quality technician
- Sampling for HABs and e coli
- ELISA training at R7 and once Tribe had ELISA reader
- Microscopy training for Cyanobacteria in R7 and in Tribal lab
- Assisted with Tribe purchasing E coli testing equipment and training
- Assisted with YSI sonde calibration and maintenance
- Building Tribal capacity

Thank you!

Webb.laura@epa.gov

Clear Lake Public Water System Cyanotoxin Monitoring Program

Clear Lake is the largest freshwater lake in California

68 square miles of surface area

2.5 million years old, oldest lake in North America

Known as Bass Capitol of the West

Seven Federally Recognized Tribes in Lake County

Pomo Indians have occupied land near Clear Lake for at least 11,000 years

Program Goals

Protect Tribal beneficial Uses of Clear Lake through real-time data collection and education

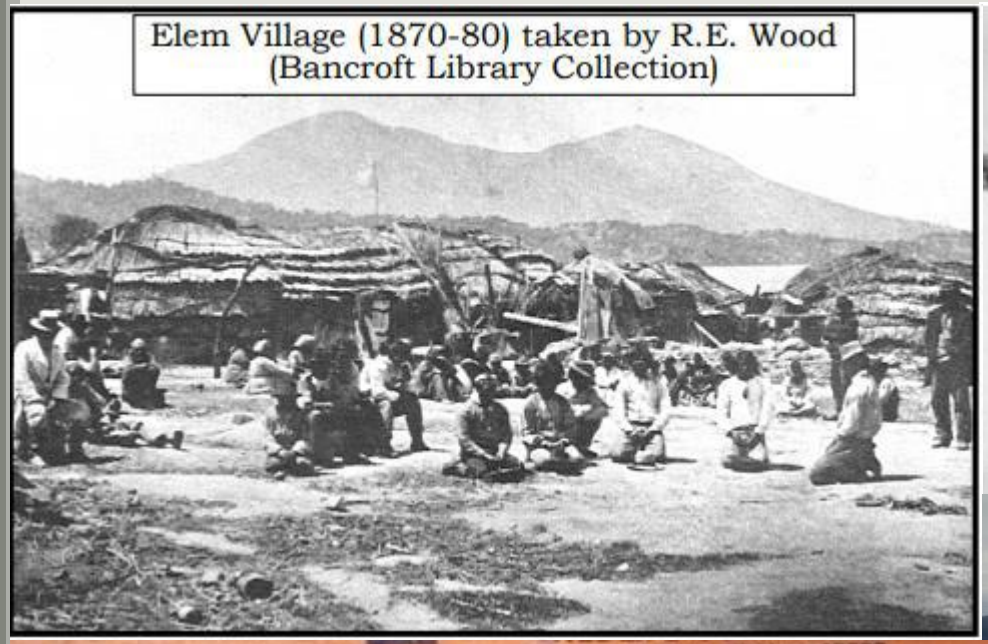
Share resources and information in collaborative approach for monitoring the lake

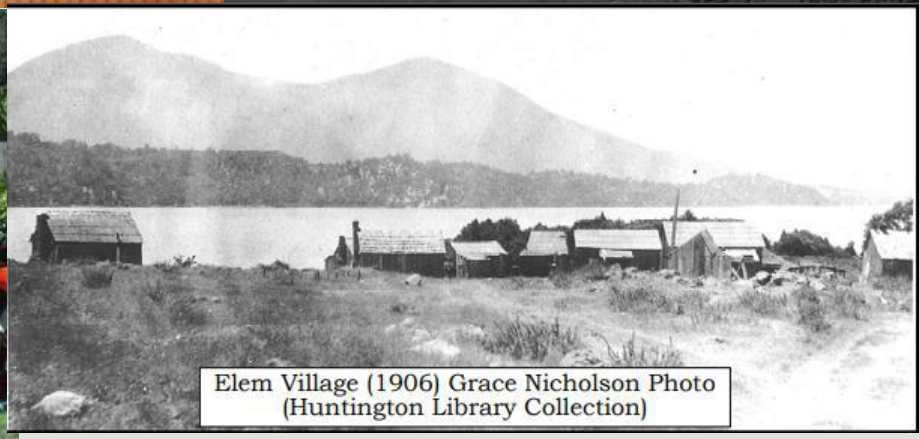
Determine seasonal water quality trends as related to occurrences of cyanobacteria blooms through collection of shoreline/recreational area water chemistry, bacteria and nutrient data

Provide data on cyanobacteria related toxins in a timely manner to support public health decisions

Advocated for signage that indicated safe thresholds for recreational use of Clear Lake

Formed Task Force to notify local, state and federal agencies of elevated cyanotoxin levels at the Clear Lake shoreline





Map of Clear Lake Drinking water intakes

- 18 Public Water Systems
- Serves a population of 39,800 people, 62% of Lake County (census 2017 - 64,246 people)
- 10 systems in the Lower Arm
- Serves a population of 22,070 people, 34% of Lake County
- Prior monitoring before my program began
- 2013 one sample event in Aug with 16 of the 17 systems participating for microcystin analysis
- 2014 two sampling events in July and September with 5 systems
- 2016 and currently every two weeks during bloom season 7 systems participate

Monitoring Design

Every other week collect an intake and finished water samples.

Off week is recreational sampling

Recreational monitoring samples for the four major cyanotoxins and are alerting water systems to other possible toxins in their intake area

EPA Method 546

Microcystin-ADDA ELISA Kit Procedure

Add 50 uL of sample then 50 uL of antibody solution, incubate for 90 minutes

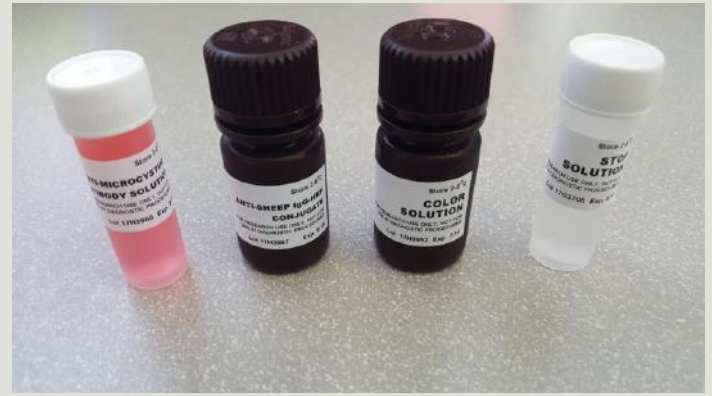
Wash out wells

Add 100uL of enzyme conjugate, incubate for 30 minutes

Wash out wells

Add 100 uL of substrate / color solution, incubate 20-30 minutes

Add 50 uL stopping solution



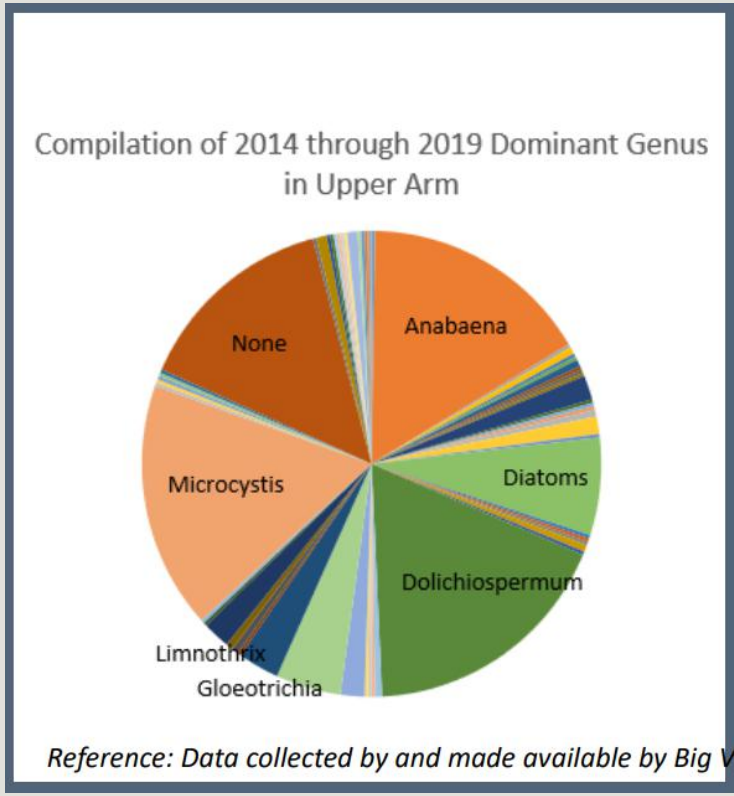
Partners

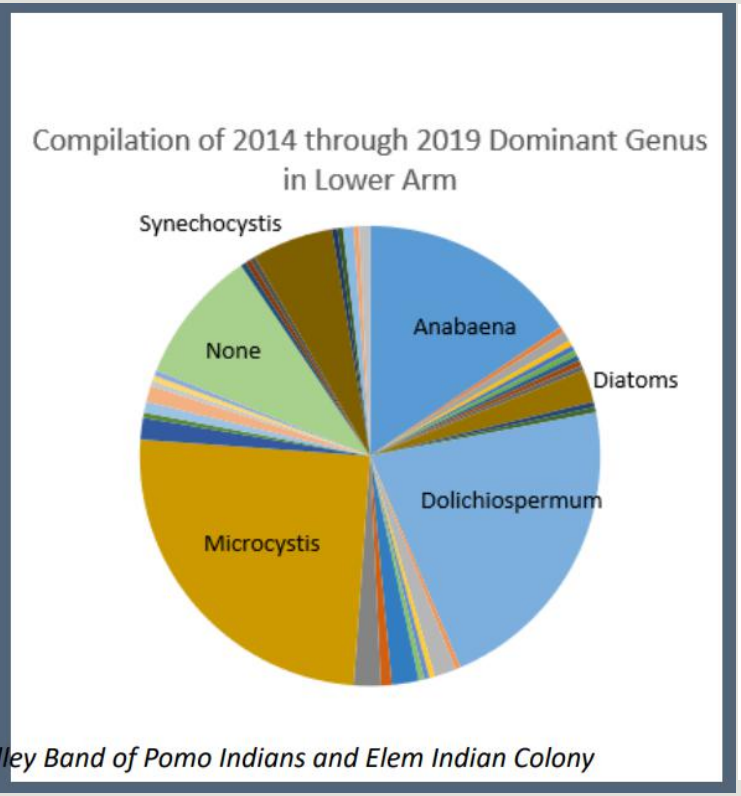
California State Water Control Board, Division of Drinking Water

Public Water Systems that use Clear Lake as source water

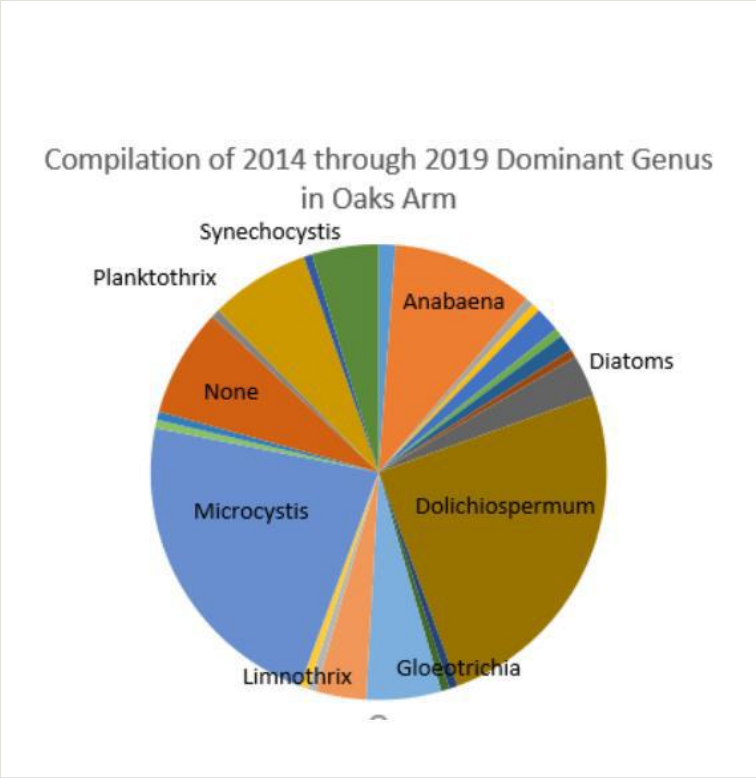
Lake County Public Health Officer

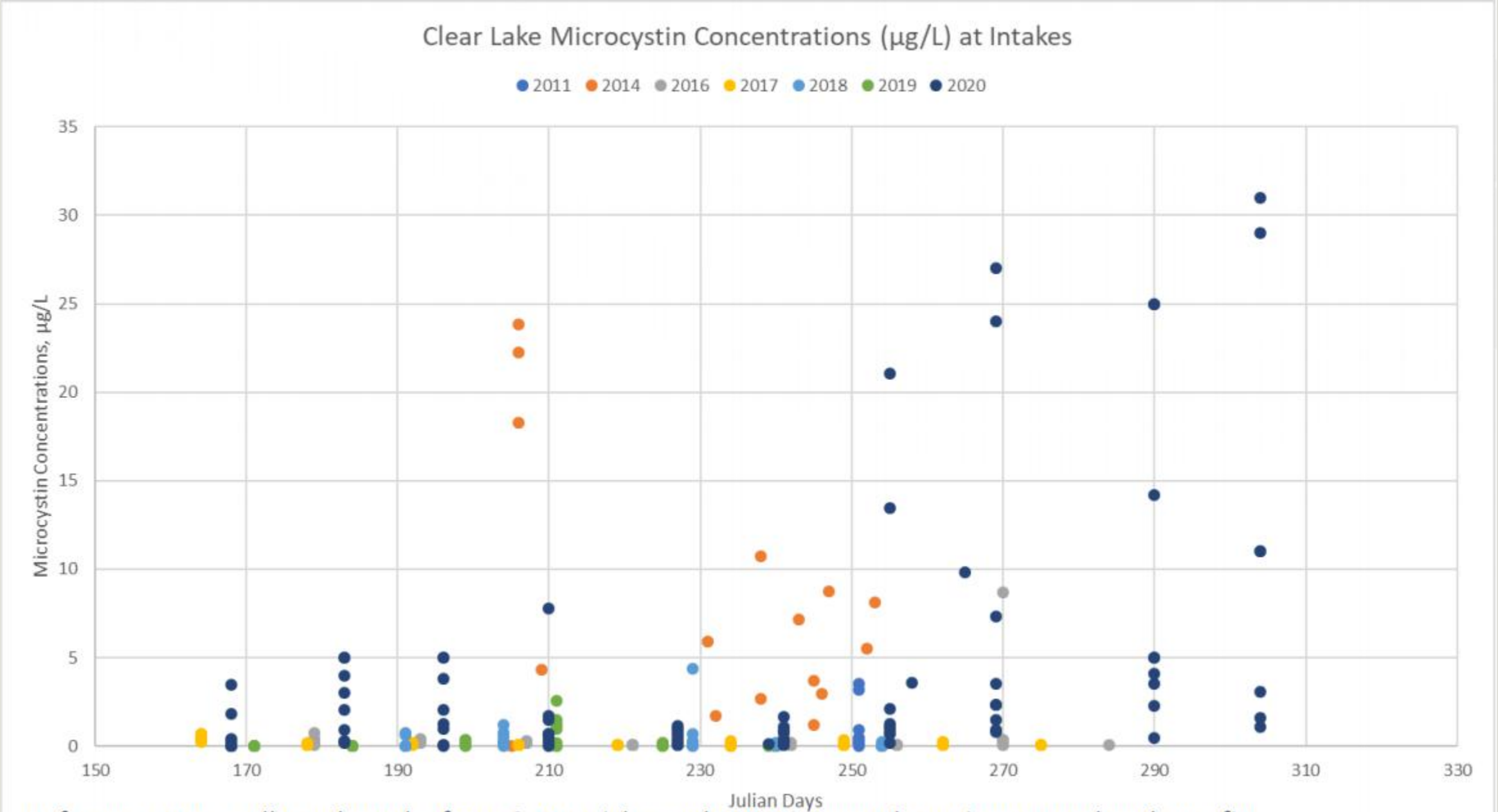
Big Valley Rancheria



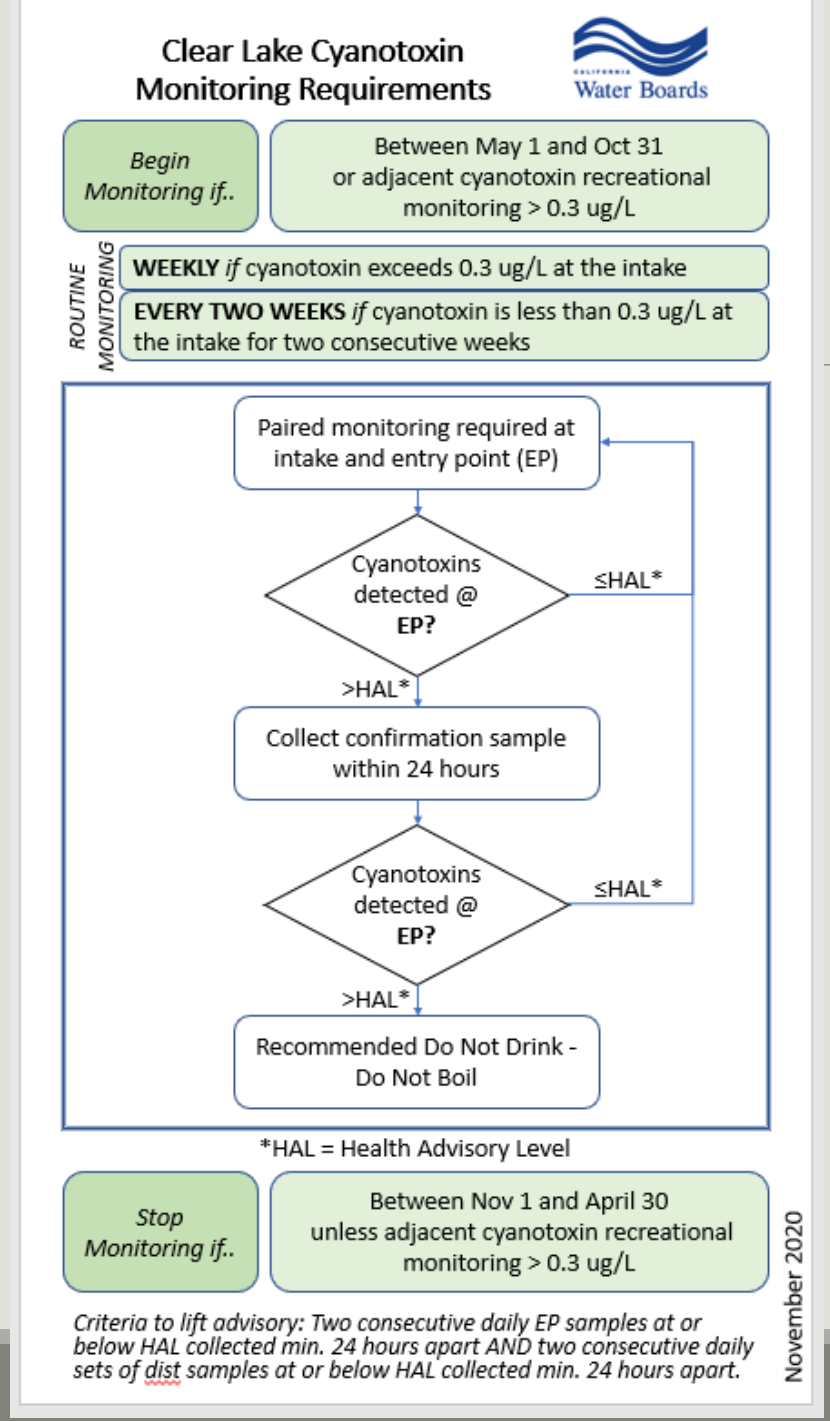


Reference: Data collected by and made available by Big Valley Band of Pomo Indians and Elem Indian Colony





Reference: Data collected results from CDPH Richmond DWRL, Kennedy Environmental and Eurofins



Order Elements - Sampling

- Each sampling event consists of one sample from the intake and one sample from the entry point
- EPA Method 546: ELISA or
- EPA Method 544: LC/MS/MS
- Choice of method is up to the PWS
- Samples must be reported within 10 days of receiving the result

Path Forward

Water systems are constructing interties with neighboring systems

Continued sampling and analyzing waters in various stages of treatment to optimize treatments and tools

More inclusion of the Public Water Systems in source water protection measures happening in the watershed

Mentorship programs with new operators

Karola Kennedy
Water Resources Manager
Robinson Rancheria
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Skokomish Water Quality Program

Skokomish Indian Tribe

Department of Natural Resources

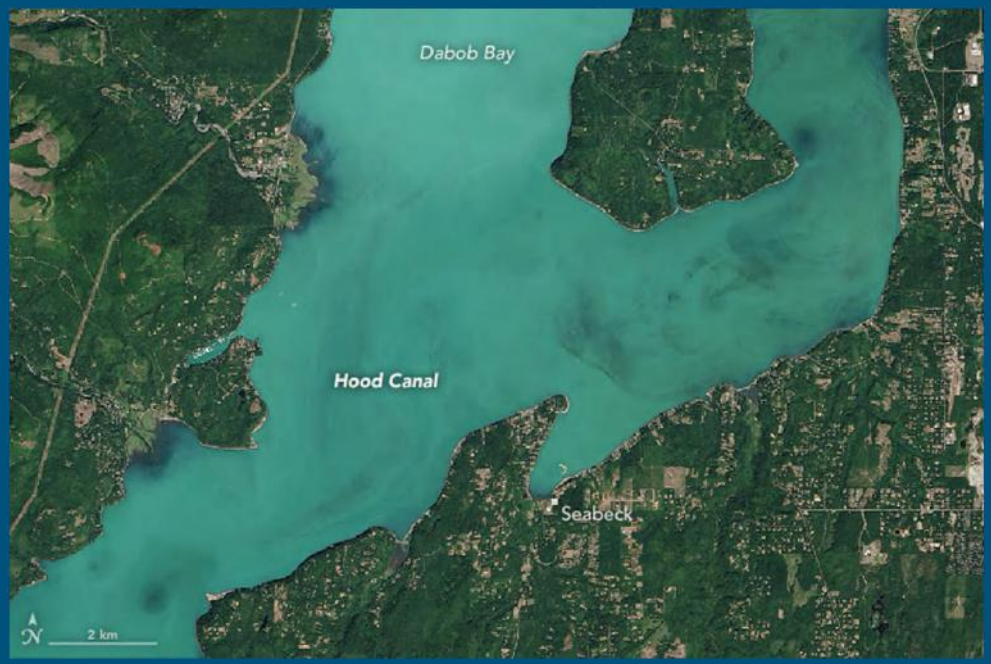
Seth Book, Blair Paul, Julian Sammons, Aaron Bentson-Royal, Damon Freitag, Maso Roqueni-Galbreath, Noami Estrada-Packer and Sang-Seon Yun

EPA Tribal HAB workshop

March 16th, 2021

Overview

- Harmful Algal Bloom Toxins
  - Methods
    - Chemical Analysis
    - Microscopy
  - Results
- Coccolithophore Blooms
  - Monitoring methods
  - Research questions
- Fish Kills/Dissolved Oxygen



Nasa Earth Observatory MODIS Satellite July 27, 2016
Coccolithophore Bloom in upper Hood Canal

Harmful Algal Blooms and tribal natural resources

- Shellfish bio-accumulate toxins
- HABs limit access to seafood resources:
  Treaty rights to resources
  (1855 Treaty of Point No Point)
- Both acute and chronic exposure need to be monitored
- Impacts public health

Concerns and actions for marine algal toxins

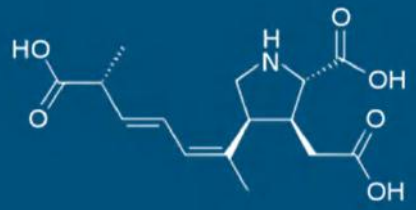
- Climate change and HABs in Hood Canal
  - Increasing surface water temperature
  - Increasing weather events
  - Increasing nutrient input
- PSP shellfish closure on Skokomish Reservation in 2016
- Develop early warning for marine algal toxins
  - Focusing on water and phytoplankton samples
- BIA-TRP funded algal toxin monitoring program launched
- Monitoring efforts in 2017-2020

Marine algal toxins: Hydrophilic toxins

Amnesiac Shellfish Poisoning (ASP)
Domoic acid (DA) - *Pseudo-Nitzschia sp.*

- Impact parts of the brain responsible for memory
- Damages nerves
- Can impact kidney function

Domoic Acid



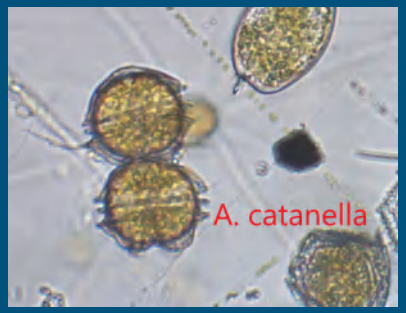
Pseudo-nitzschia sp.

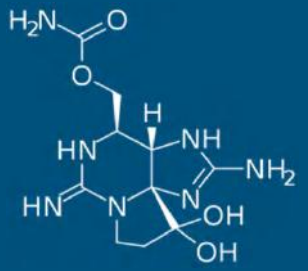
Paralytic Shellfish Poisoning (PSP)
Saxitoxin (STX) and Gonyautoxin (GTX) –

Alexandrium sp., Gymnodinium sp., & Pyrodinium sp.

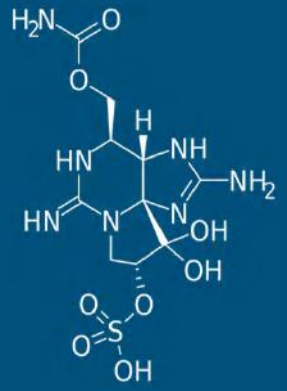
Mechanisms of Paralytic Shellfish Poisoning

- Attacks sodium voltage gated channels in nervous system
- Inhibits control of muscular system
- Lack of control leads to cardiac arrest





Saxitoxin



Gonyautoxin

Marine algal toxins: Lipophilic toxins

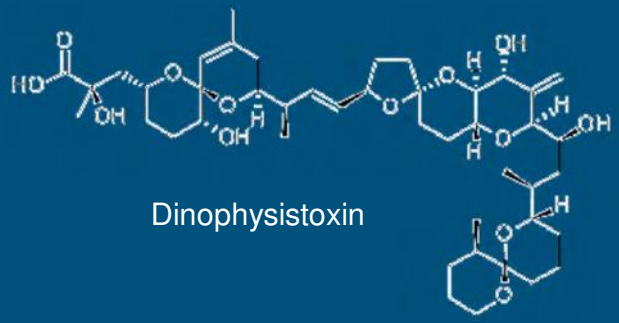
Diarrhetic Shellfish Poisoning (DSP)

Dinophysistoxin (DTX) – *Dinophysis sp.*

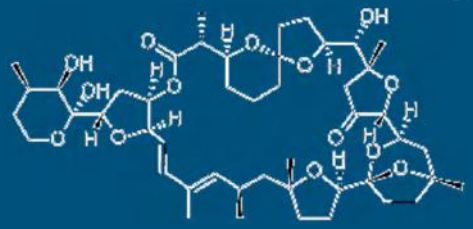
Pectenotoxin (PTX) – *Dinophysis sp.*

Okadaic Acid (OA) - *Dinophysis sp.* & *Prorocentrum lima*

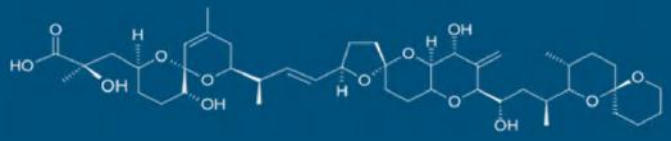
- DSPs produced by *Dinophysis* genus
- Disrupts and inhibits water regulation in the body
- DSPs inhibit protein phosphatases causing your intestines to lose your water
- DSPs cause diarrhea, vomiting, & nausea
- DSP symptoms can be lethal, toxin is non-lethal
- Different *Dinophysis* species can produce separate DSP toxins or congeners



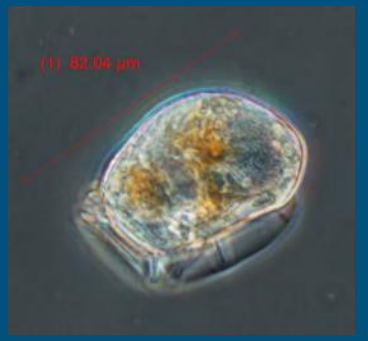
Dinophysistoxin



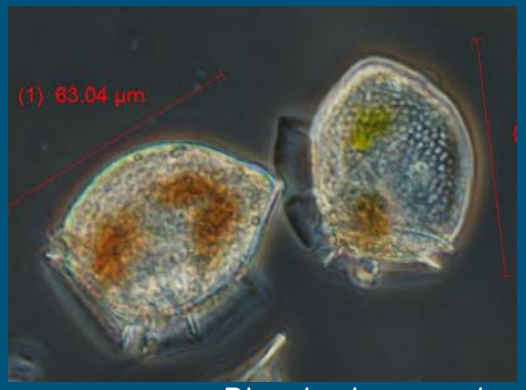
Pectenotoxins



Okadaic acid



Dinophysis fortii

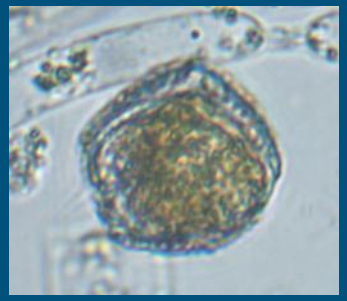


Dinophysis norvegica

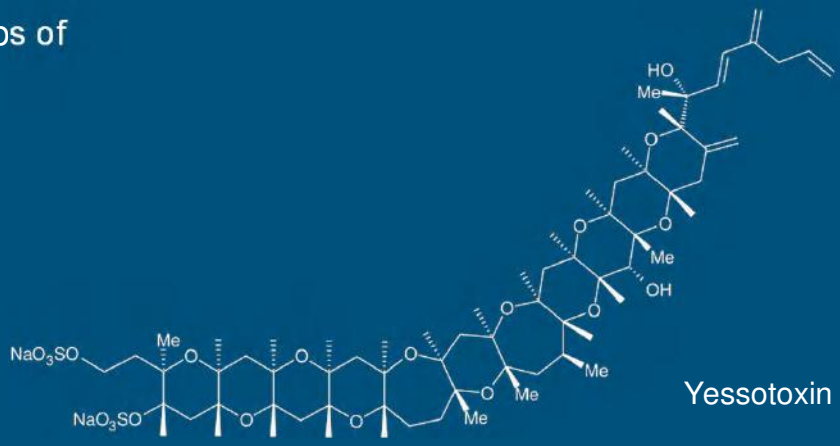
Marine algal toxins: Lipophilic toxins

Yessotoxin (YTX)- *Protoceratium reticulatum & Lingulodinium polyedrum*

- Shellfish Killer
- Humans effects unknown
- Shares chemical characteristics with other groups of toxins



Protoceratium reticulatum



Yessotoxin

Hood Canal monitoring sites

- Sampling sites
  - Sequim Bay (SB)-a reference point
  - Hood Canal Bridge (HC)
  - Quilcene (QC)
  - Point Whitney (PW)
  - Triton State Park (TS)
  - Ayock (AY)
  - Glen Ayr (GA)
  - Union Dock (UD)
  - Hoodsport (HS)
  - Port of Allyn (PA)
  - Lilliwaup (LI)
  - Dewatto (DW)
  - Rendsland (RL)

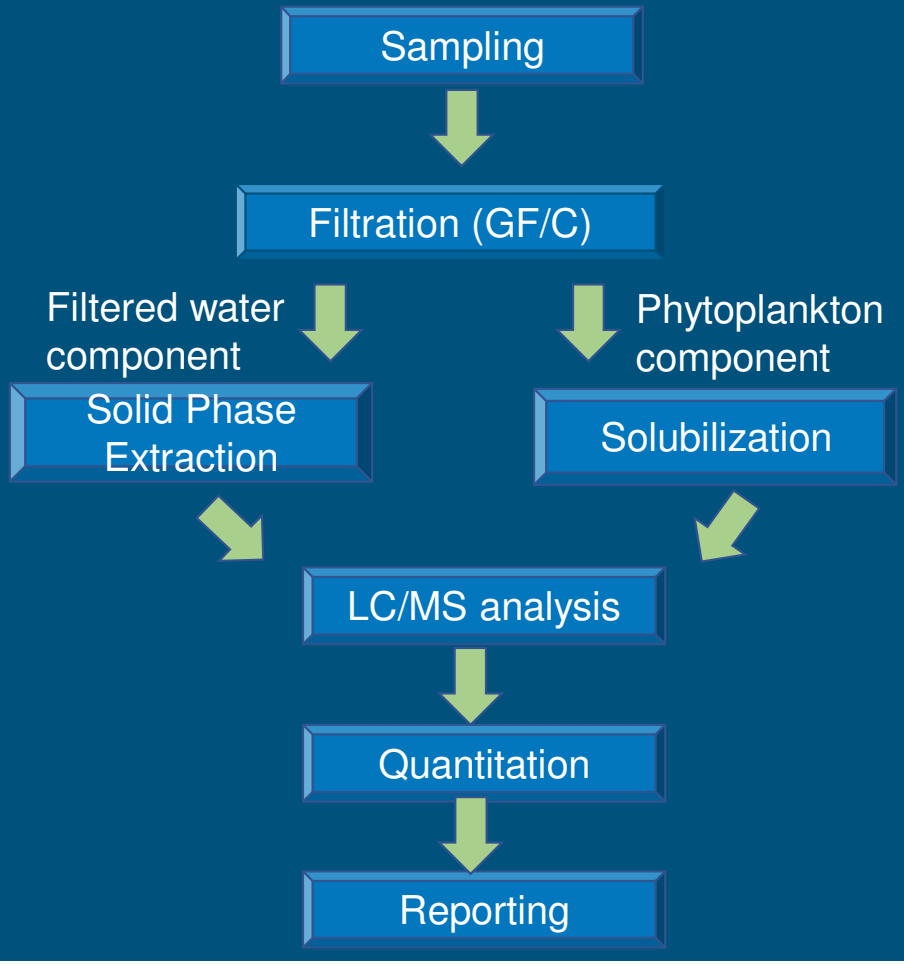
Sampling Methods

- Two 1 liter whole water samples
- Vertical Algal Tow
- Hydrolab w/ Chl-a
- Weather
- Visibility with Secchi Disk

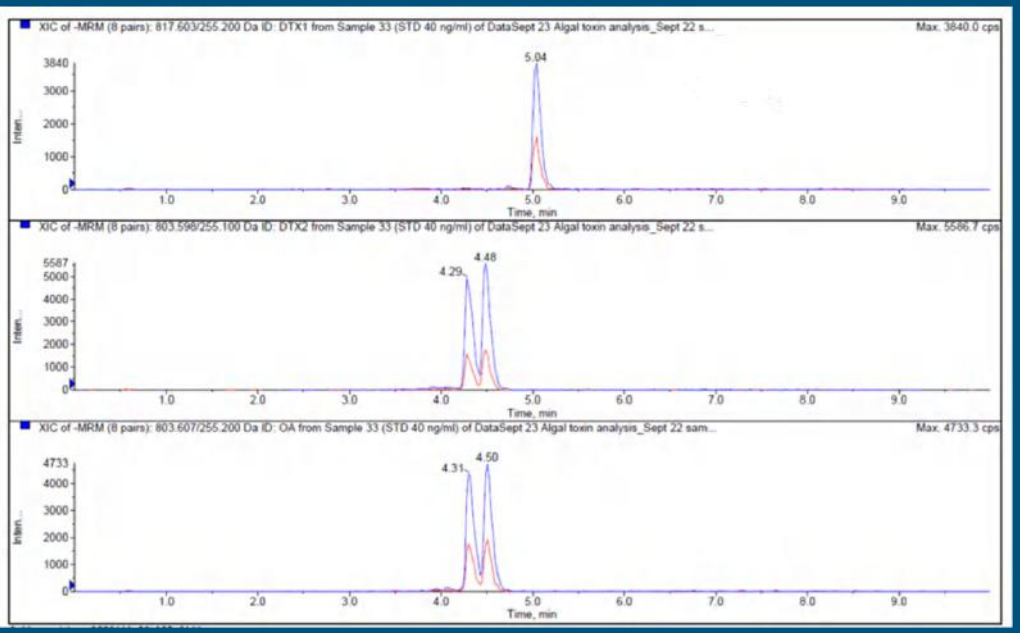
LC/MS analysis

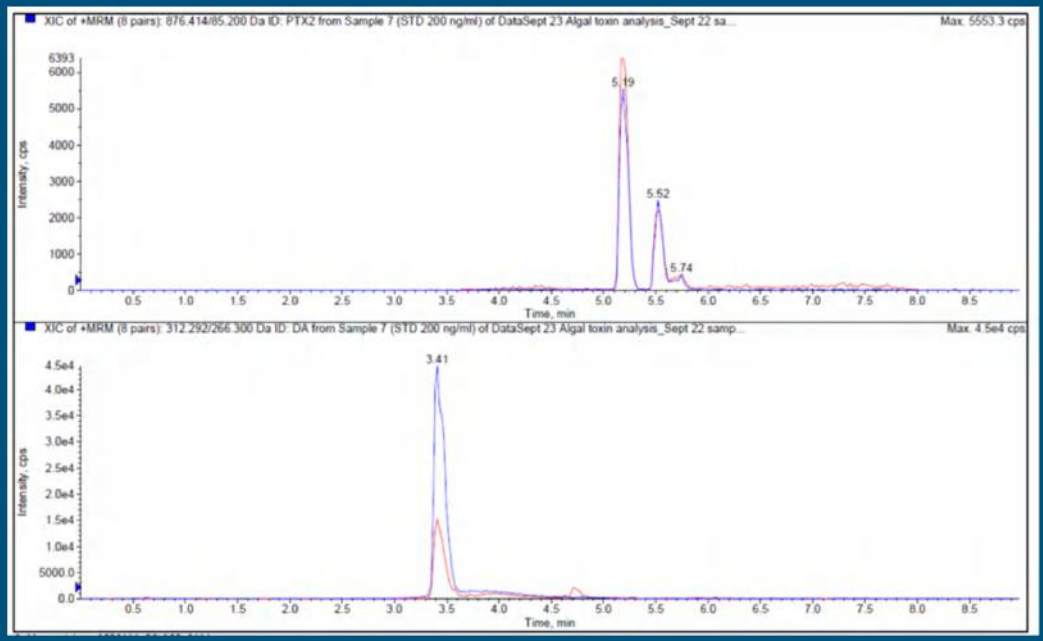
Liquid Chromatography/Mass Spectrometry

- Individual compounds can be identified and quantified
- Very low level detection
- Broad spectrum detection
- Requires analytical instruments



Results: Separation and Detection of toxins

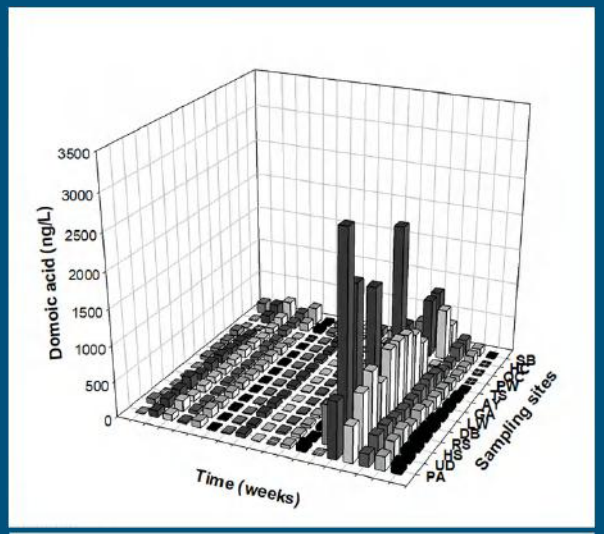




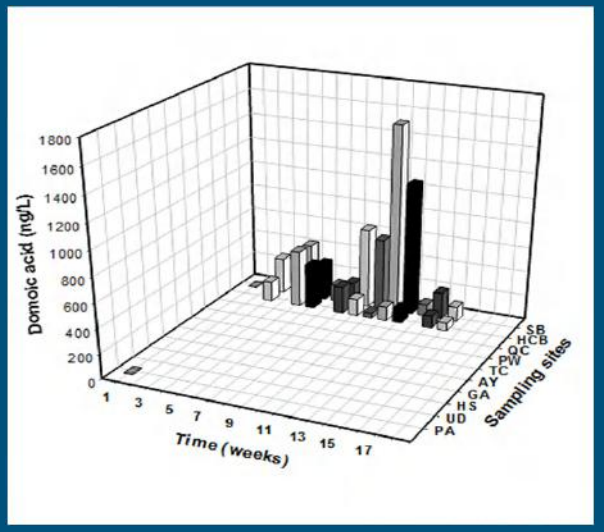
Negative mode detection
OA eluting at 4.29 min Detection limits: 10 ng/L
DTX-2 eluting at 4.50 min Detection limits: 10 ng/L
DTX-1 eluting at 5.04 min Detection limits: 10 ng/L

Positive mode detection
DA eluting at 3.41 min Detection limits: 50 ng/L
PTX-2 eluting at 5.19 min Detection limits: 10 ng/L

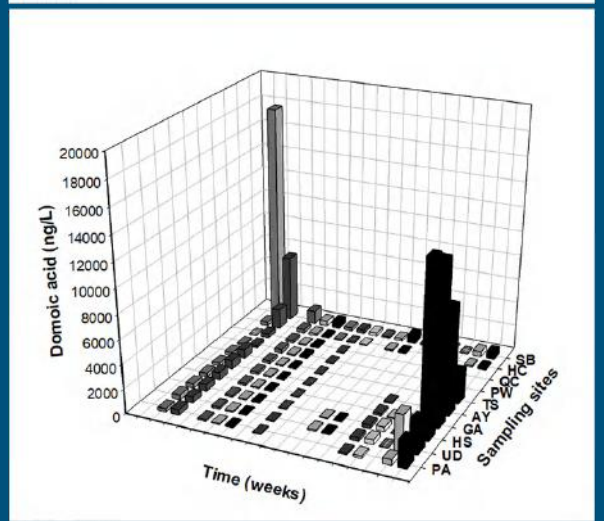
Results: Domoic acid



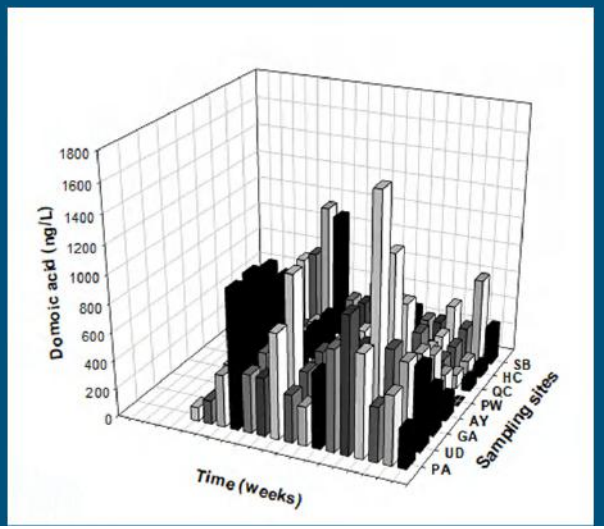
2017



2018

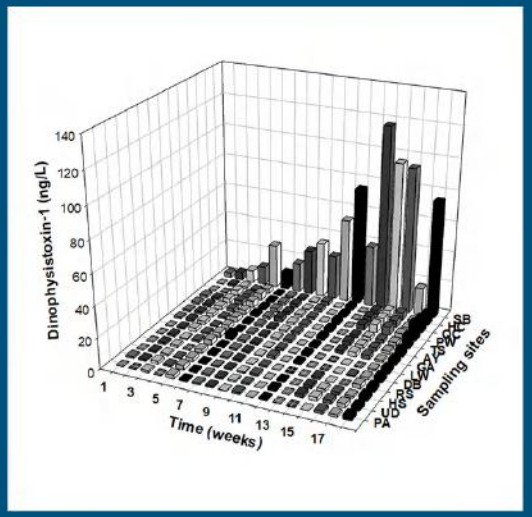


2019

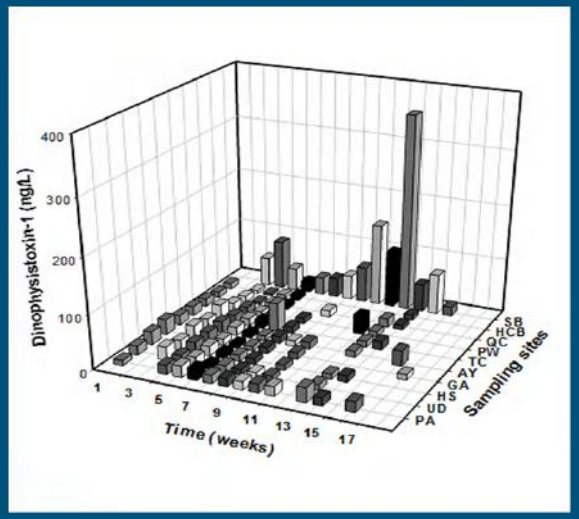


2020

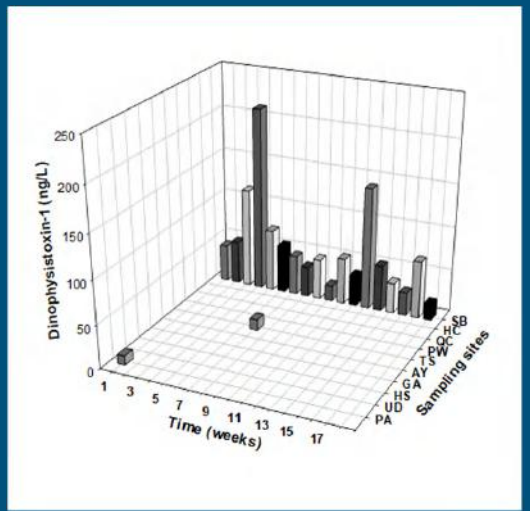
Results: Dinophysistoxin-1



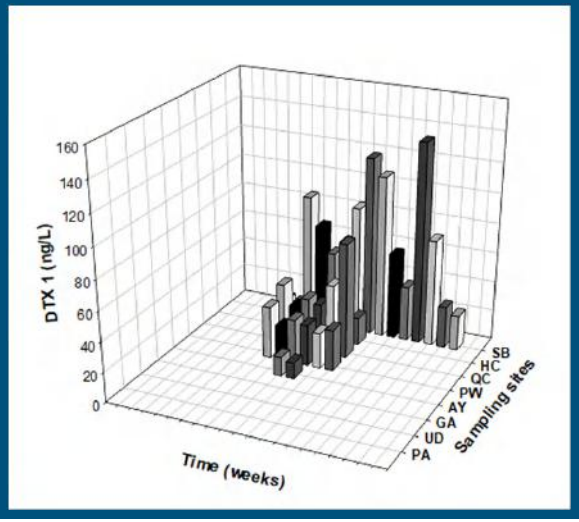
2017



2018

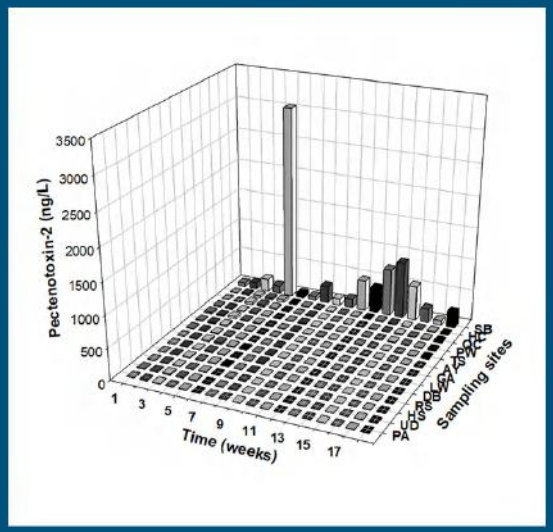


2019

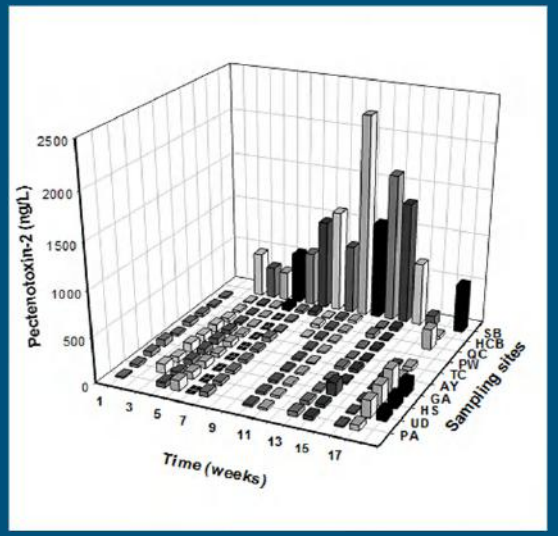


2020

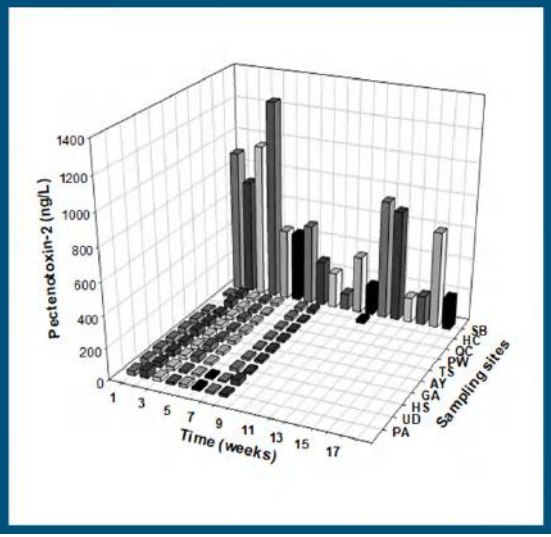
Results: Pectenotoxin-2



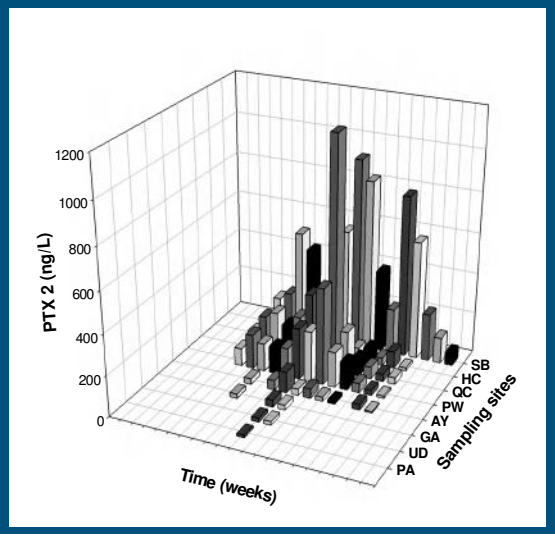
2017



2018



2019



2020

HAB Toxin Analysis Conclusions

- Sensitive, reliable analytical methods were developed to monitor HAB toxins in Hood Canal
- Domoic acid, dinophysistoxin 1, and pectenotoxin 2 are the toxin species of concern in Hood Canal
- Temporal and spatial variations observed
- Monitoring data can serve as baseline for future efforts

Microscopy

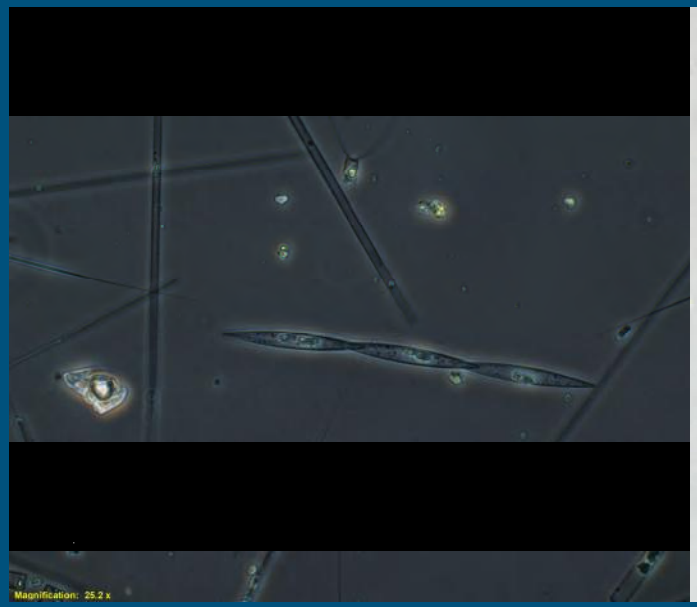
- Quantify relative phytoplankton species abundance
- Measure biodiversity in water column

Methods

- Vertical Plankton Tow
- Enumeration with Sedgewick-Counting Slide
- Reverse calculated results to whole water

Microscopic images of HABs

Phase contrast

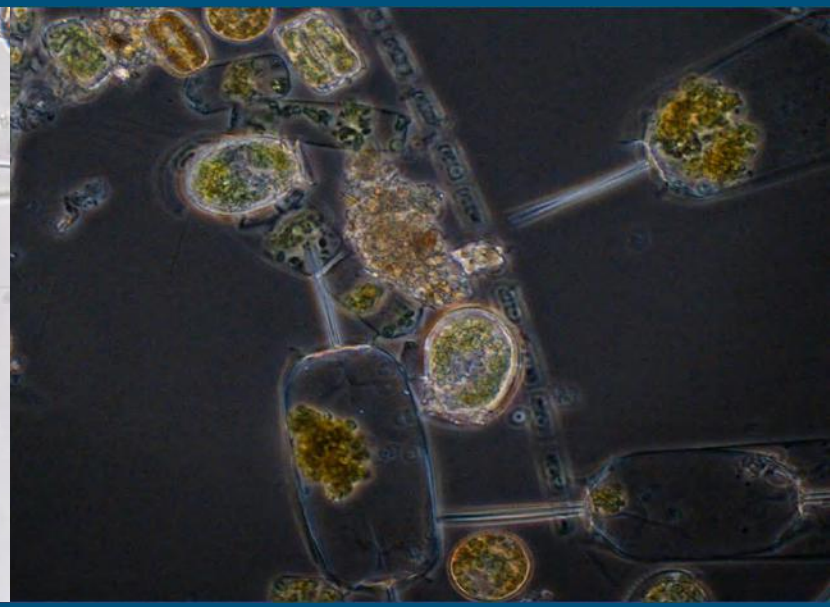


Pseudo-nitzschia

Brightfield

Akashiwo sanguinea

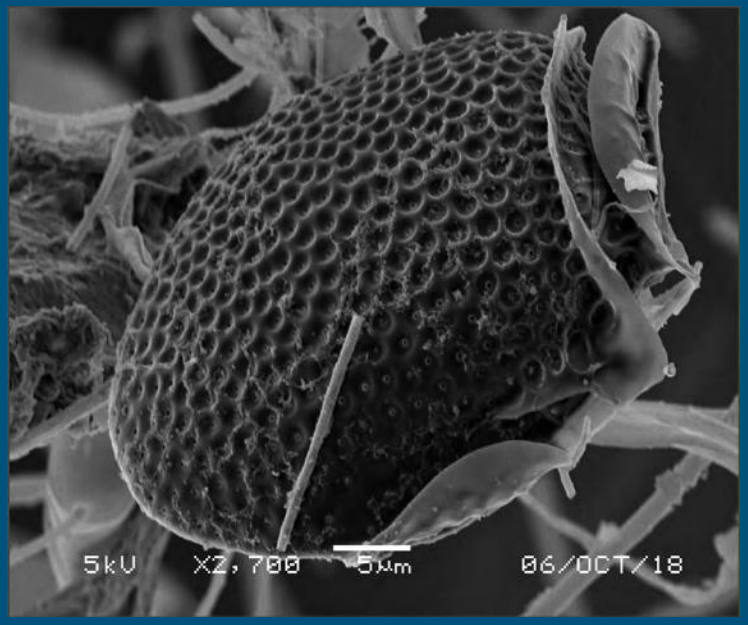
Phase contrast



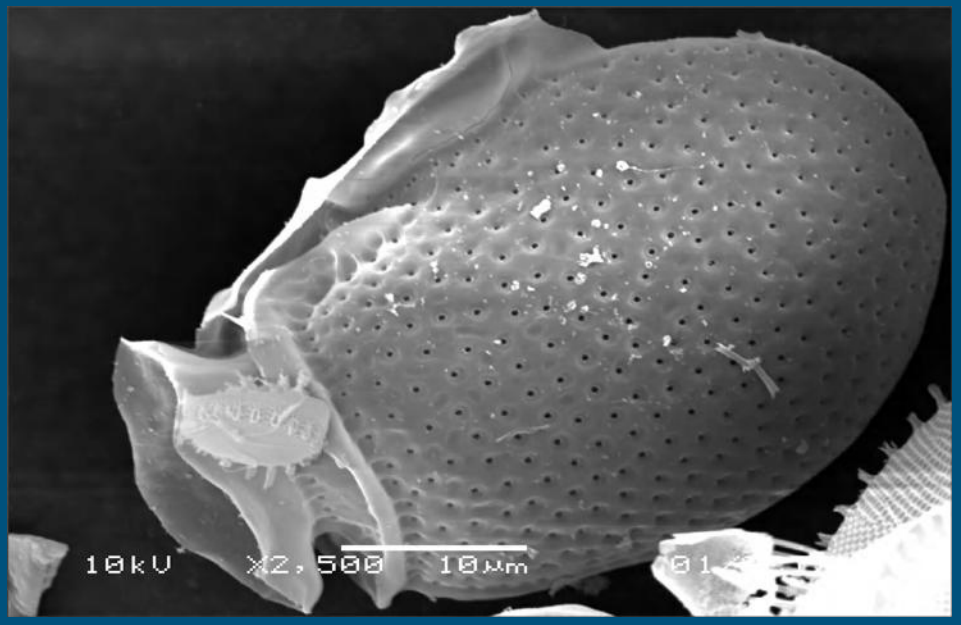
Ditylum brightwellii
Dinophysis acuminata
Thalassiosira spp.

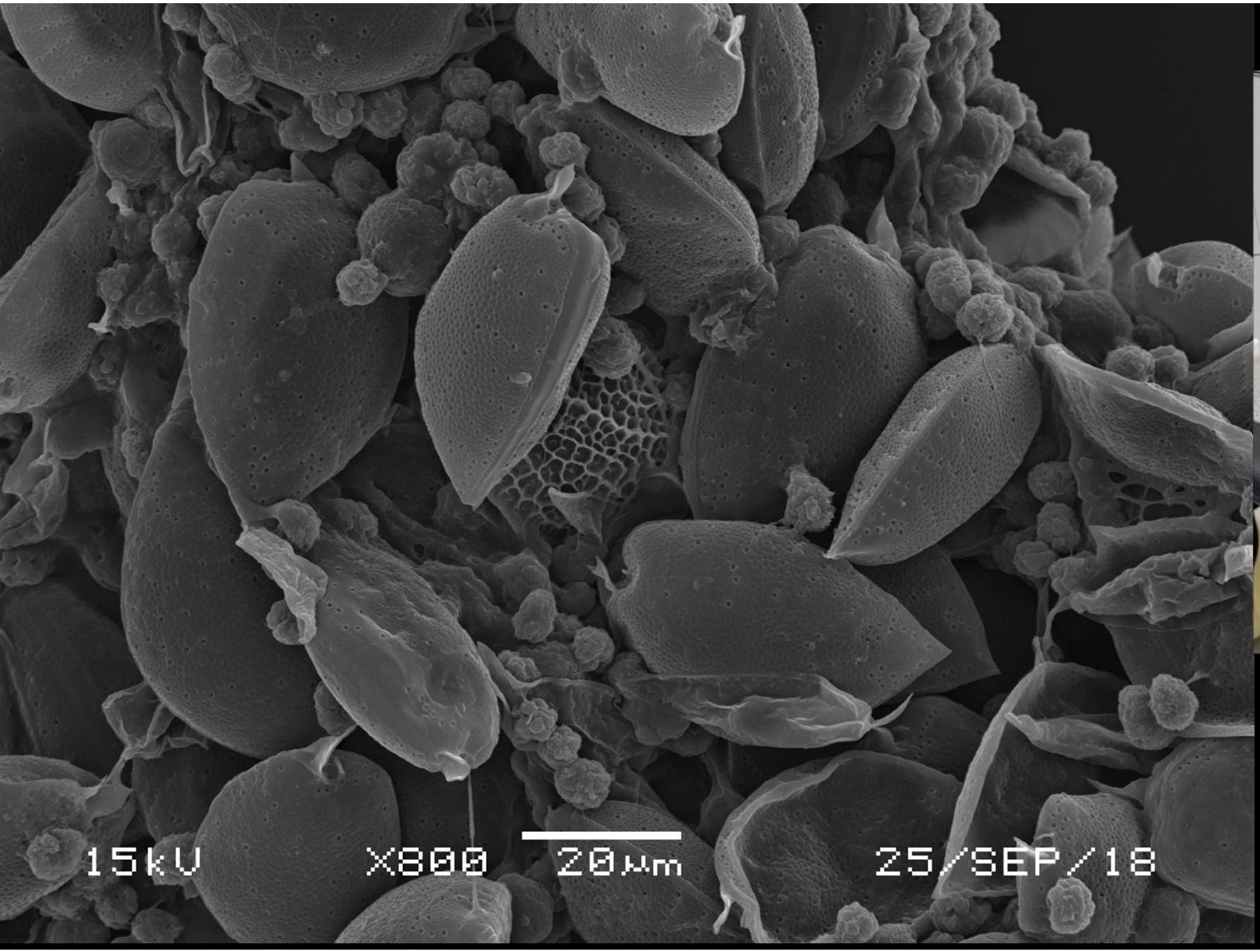
Microscopic images of HAB: SEM

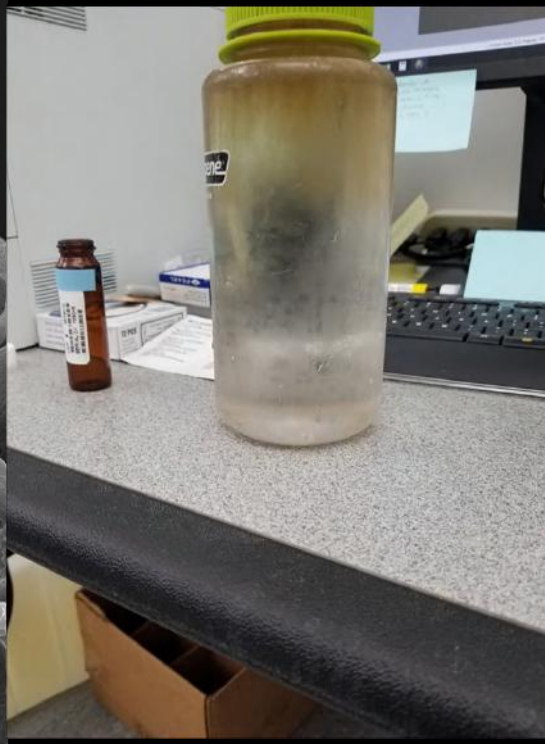
Dinophysis acuta



Dinophysis acuminata

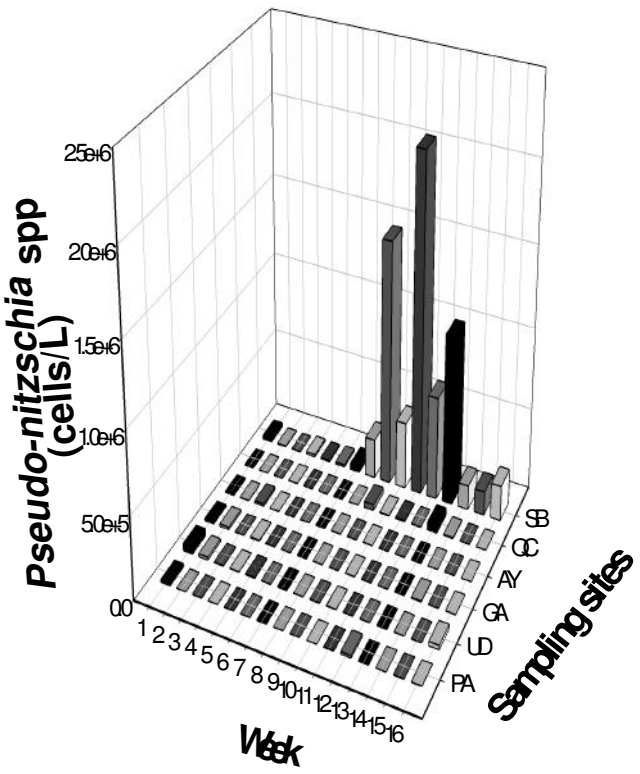


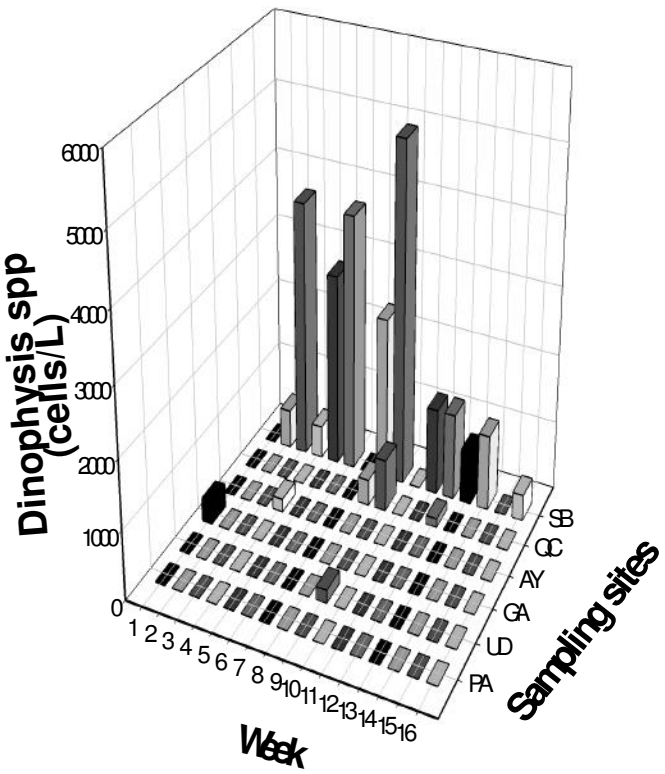


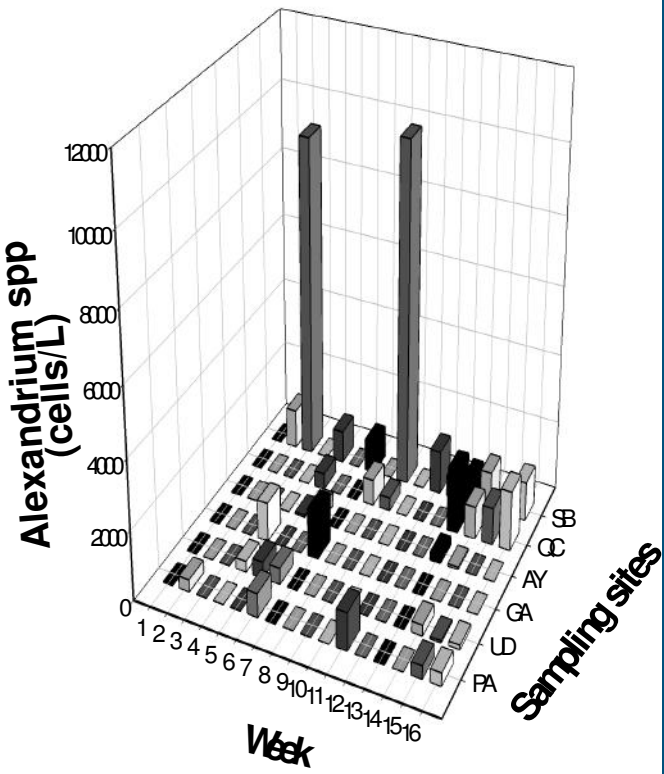


Bloom of *Prorocentrum micans*
Sequim Bay 9/21/2018

Phytoplankton enumeration (2020)

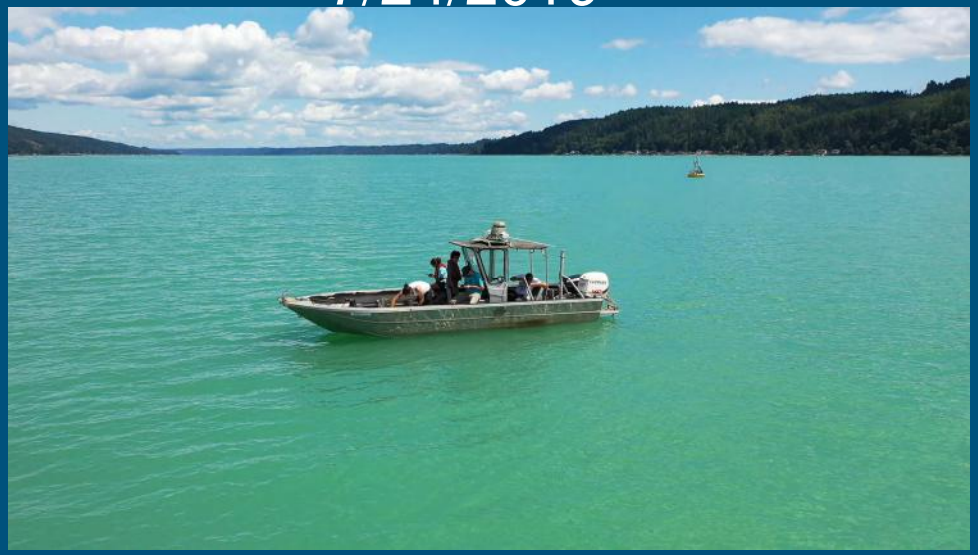






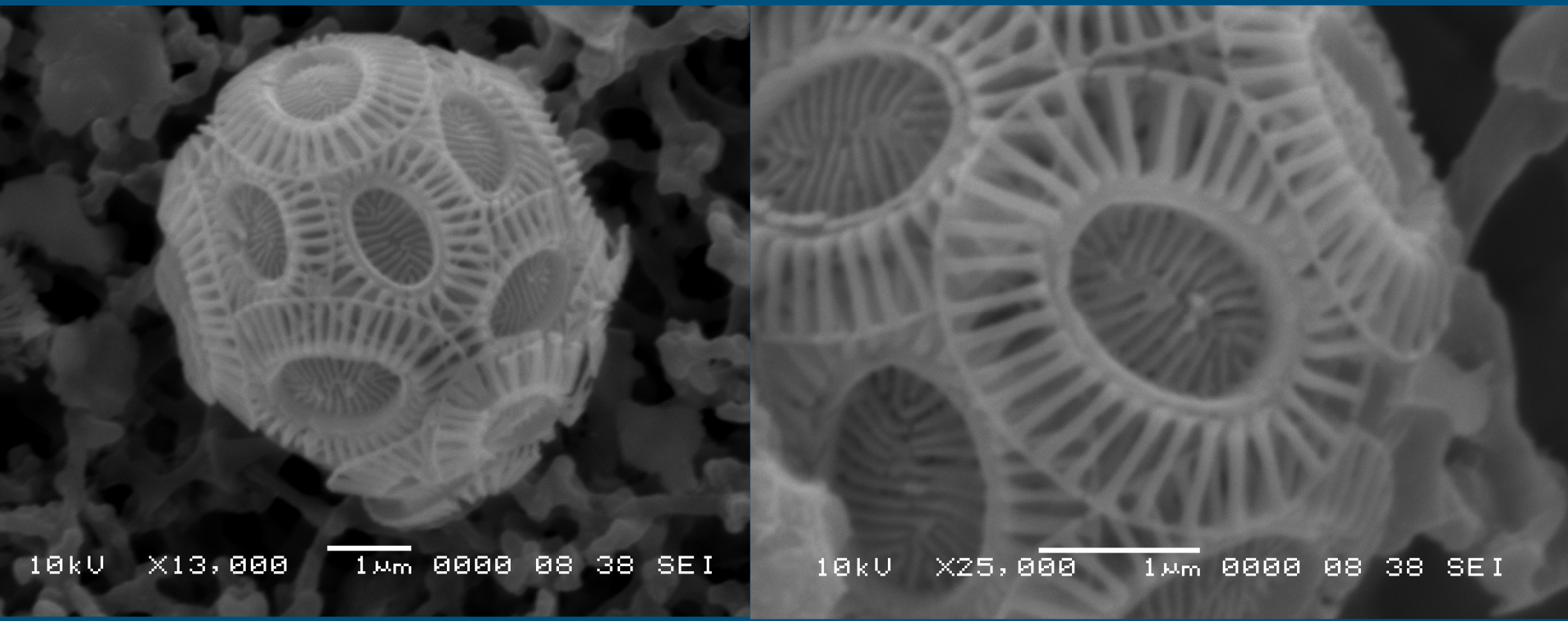
Coccolithophore bloom monitoring

UW Twanoh buoy
7/24/2019



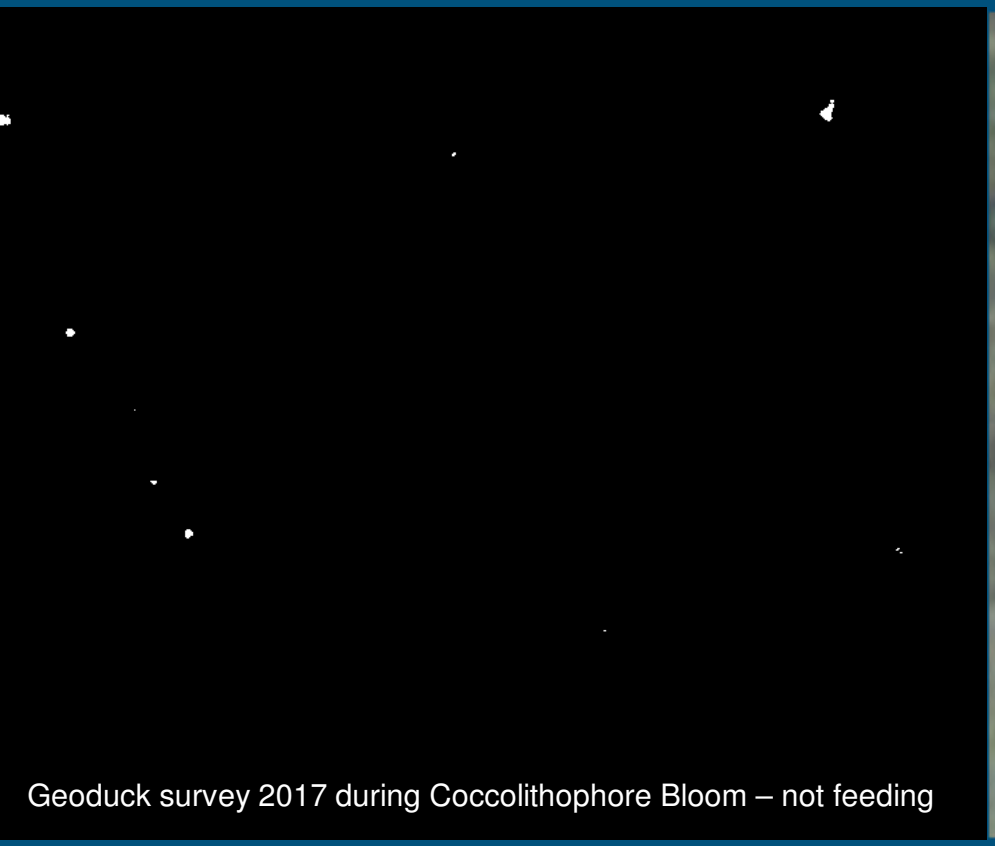
Lower Hood Canal
7/24/2019

Emiliania huxleyi: SEM image



Dr. Gerardo Chin-Leo, The Evergreen State College

What are the impact of Coccolithophore bloom to shellfish resources?



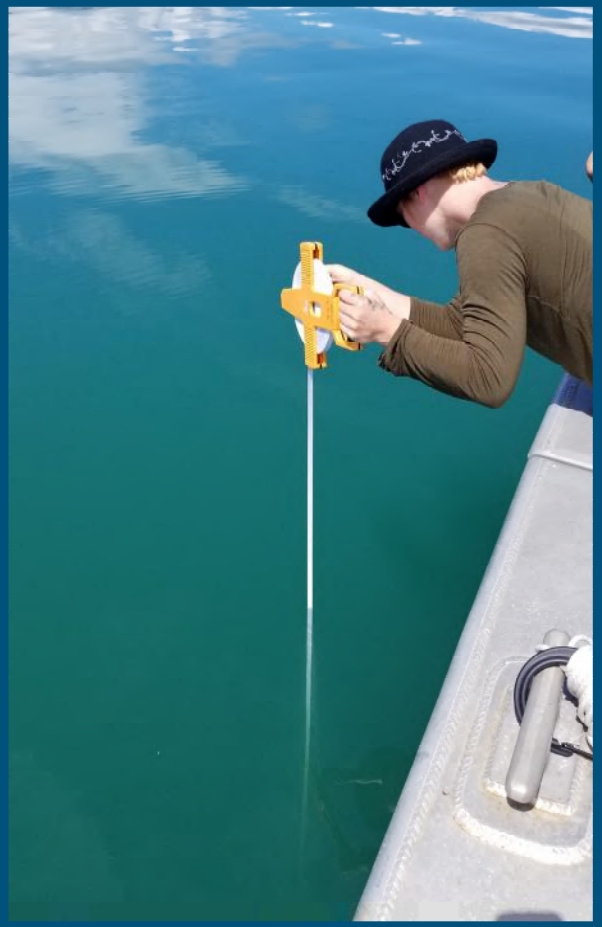
Geoduck survey 2017 during Coccolithophore Bloom – not feeding

Normal Geoduck feeding behavior before Coccolithophore bloom

Geoduck cease feeding during Coccolithophore bloom

Blair Paul (2017), Skokomish Tribe Shellfish Program

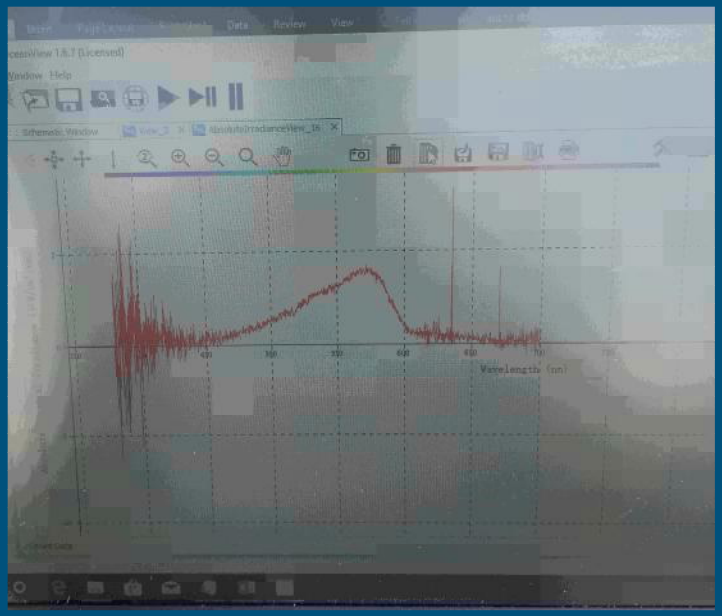
Coccolithophore bloom monitoring



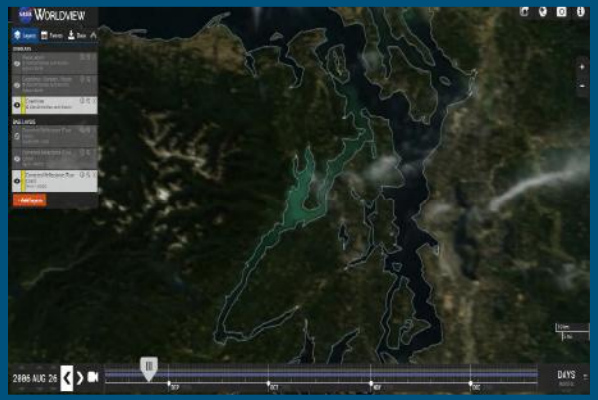
- Secchi depth for light attenuation measurement

Coccolithophore bloom monitoring

VIS-NIR Spectroradiometer to assess spectral attenuation

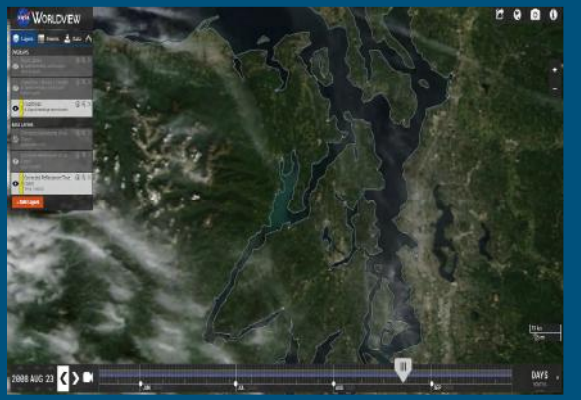


NASA MODIS- Coccolithophore bloom duration monitoring



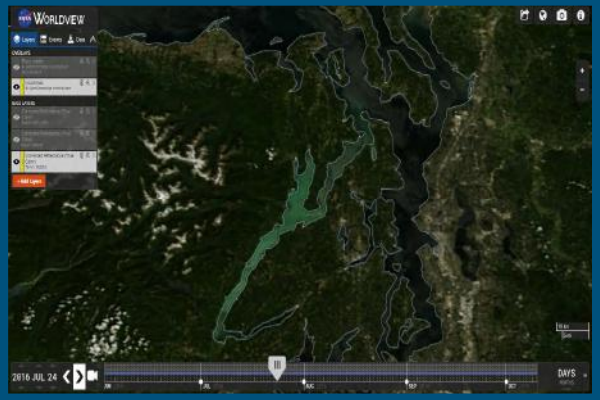
Aug 18, 2006-19 days

Jul 24, 2007-25 days

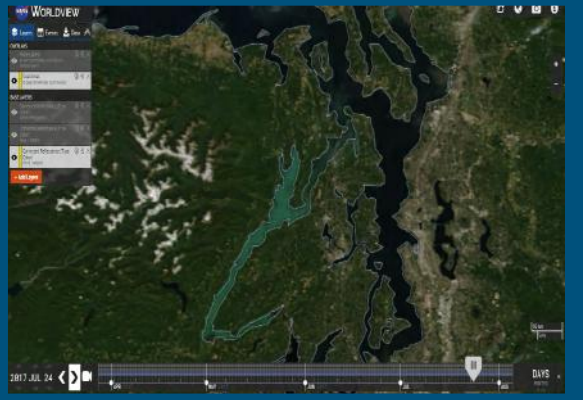


Aug 19, 2008-4 days

Jul 12, 2012-11 days

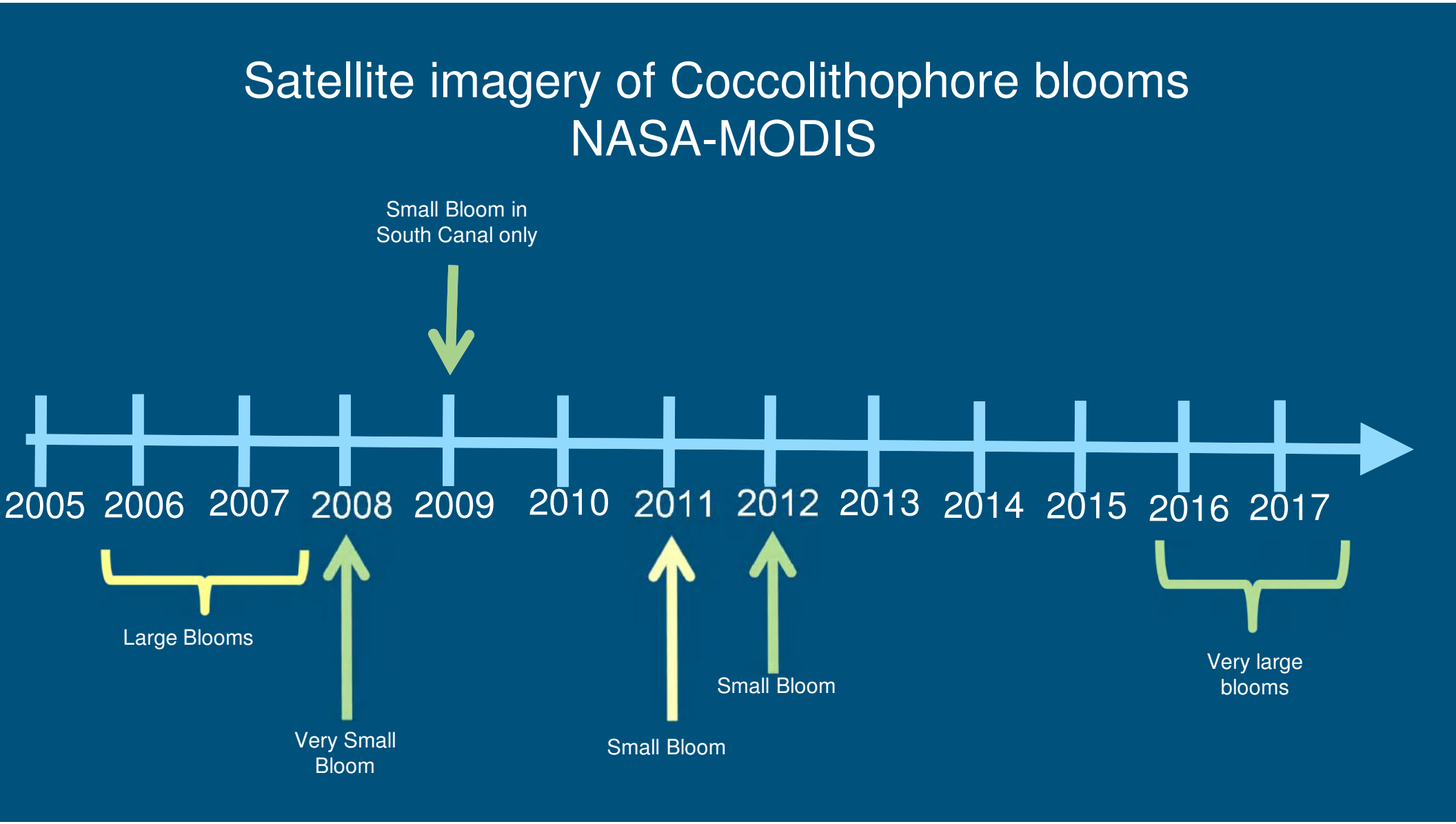


Jul 17, 2016-40 days



Jul 12, 2017-34 days

Satellite imagery of Coccolithophore blooms NASA-MODIS



Hood Canal Hypoxia–Low Dissolved Oxygen

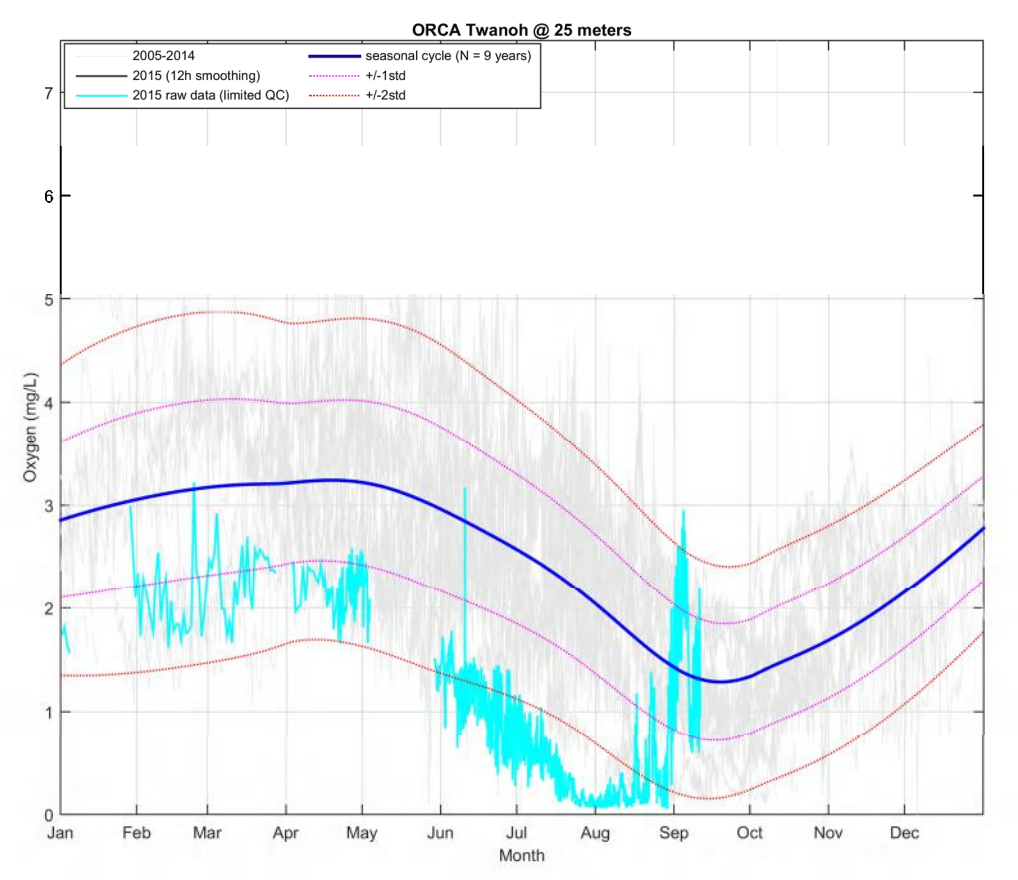
- Low DO at depth in Southern Hood Canal
  - Summer algal blooms – High primary productivity
  - Stratified water column
  - Low circulation - Long residence time
    - Fjord with shallow sill
- Fall southerly wind event upwells Low DO to surface potentially causing fish kills

Fish Kill September 20, 2006

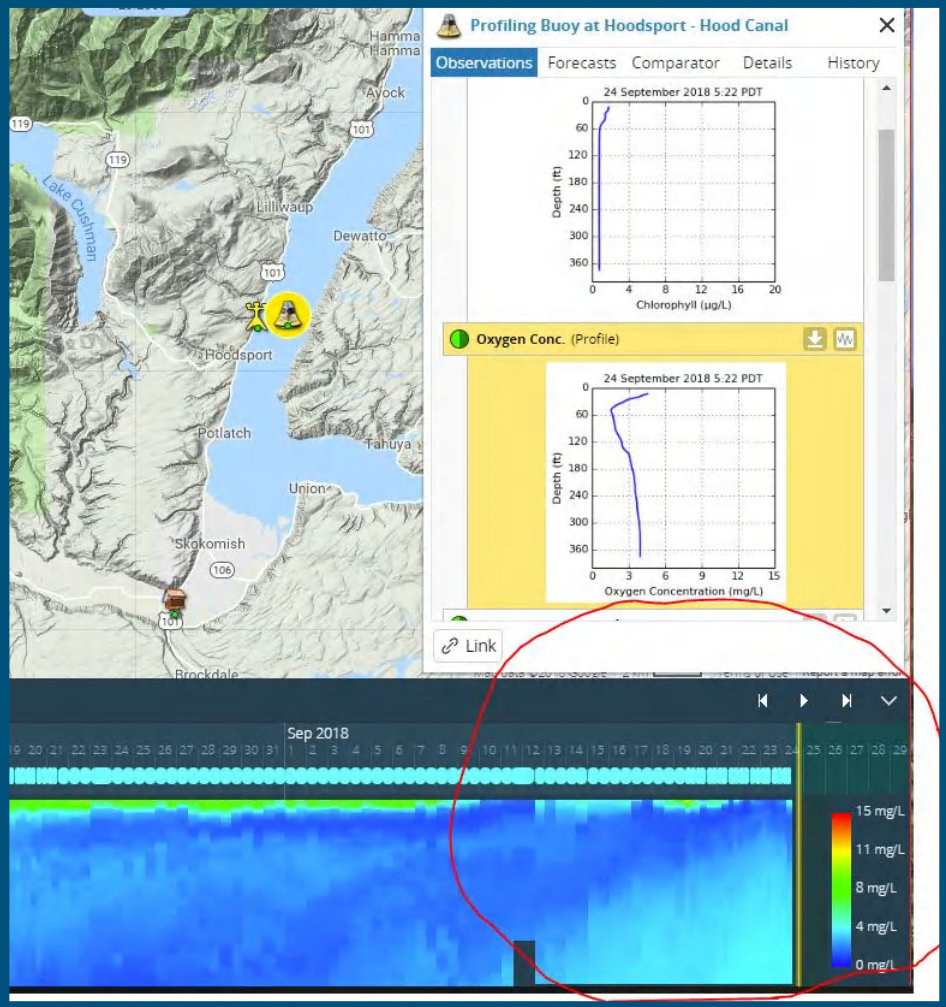
Seth Book, Southern Hood Canal, September 20, 2006

Fish Kill - August, 2015

NANOOS UW ORCA

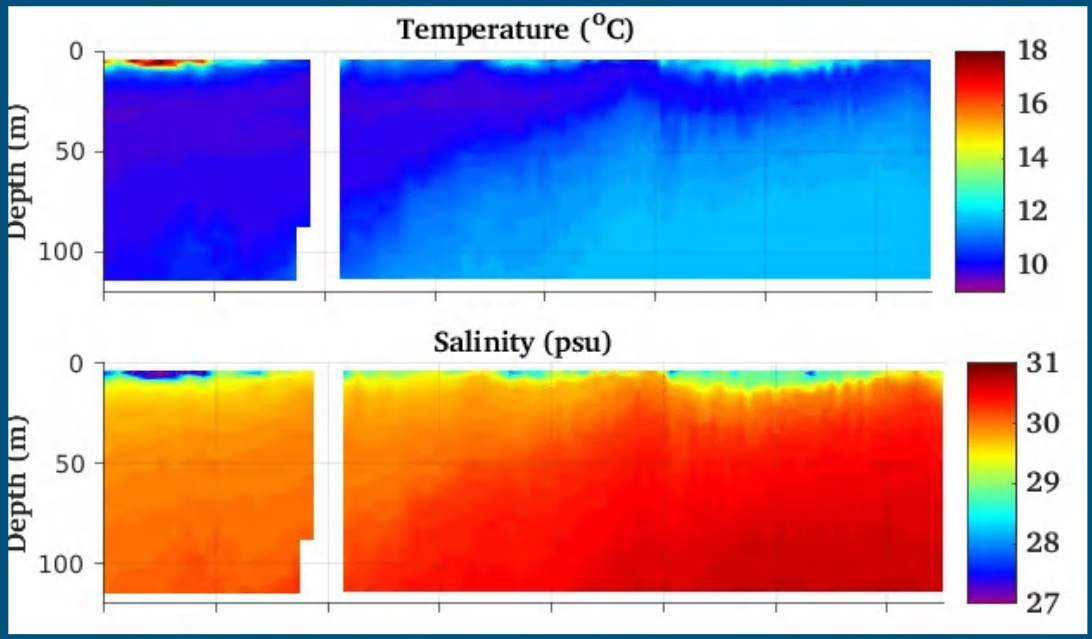


UW ORCA Twanoh 2015 – Climatology plot

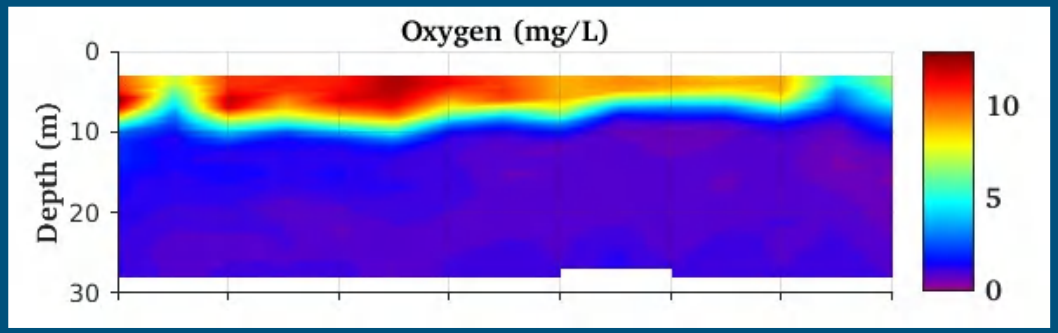


NANOOS Hoodsport ORCA 2018

NANOOS
Time series



Hoodsport October, 4 2018
(30 day Salinity, Temperature)



Twanoh, August 27, 2018 (7 day Oxygen)

Acknowledgements

- Skokomish Indian Tribal Council for their support
- EPA for their support of the Skokomish Tribe's Environmental laboratory.
- BIA Tribal Resilience Program for funding projects
- The Evergreen State College for use of SEM equipment and student interns
- University of Washington ORCA Hoodsport/Twanoh Buoys
- NANOOS
- Skokomish Shellfish Program

Seth Book
Skokomish Natural Resources
sbook@skokomish.org
360.463.1889

Session 2: Collecting and Analyzing Baseline Data

QUESTIONS?

BREAK AND AUDIENCE POLL

What actions are you taking to monitor for and manage HABs in your community/program? Select all that apply.

- Have a management plan for managing HABs
- Have a monitoring program for HABs
- Collaborating with other programs/partners to manage HABs
- Building awareness in the community about HABs issues
- Other (write response in the chat box)

The webinar will resume at 2:35 p.m.

Session 3: Creating Partnerships and Building Networks to Manage HABs

- Moderator: Lesley D'Anglada, U.S. EPA Office of Science and Technology

HAB early warning - phytoplankton monitoring
SoundToxins and ORHAB in Washington State

• Weekly phytoplankton monitoring (~30 sites)
• Additional shellfish and seawater toxin analysis during blooms.

Olympic Region HAB (ORHAB) Partnership

1
2
3
4
5
6
7

Canada
USA

35
34
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2
1

48.5 N
48.0 N
47.5 N
47.0 N
123.5 W
123.0 W
122.5 W
122.0 W

SoundToxins

Creating partnerships & building networks

Vera L. Trainer

NOAA Northwest Fisheries Science Center Seattle, WA

vera.l.trainer@noaa.gov

HAB early warning - phytoplankton monitoring
SoundToxins and ORHAB in Washington State

• Weekly phytoplankton monitoring (~30 sites)
• Additional shellfish and seawater toxin analysis during blooms.

Olympic Region HAB (ORHAB) Partnership

1
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Canada
USA

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48.5 N
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123.5 W
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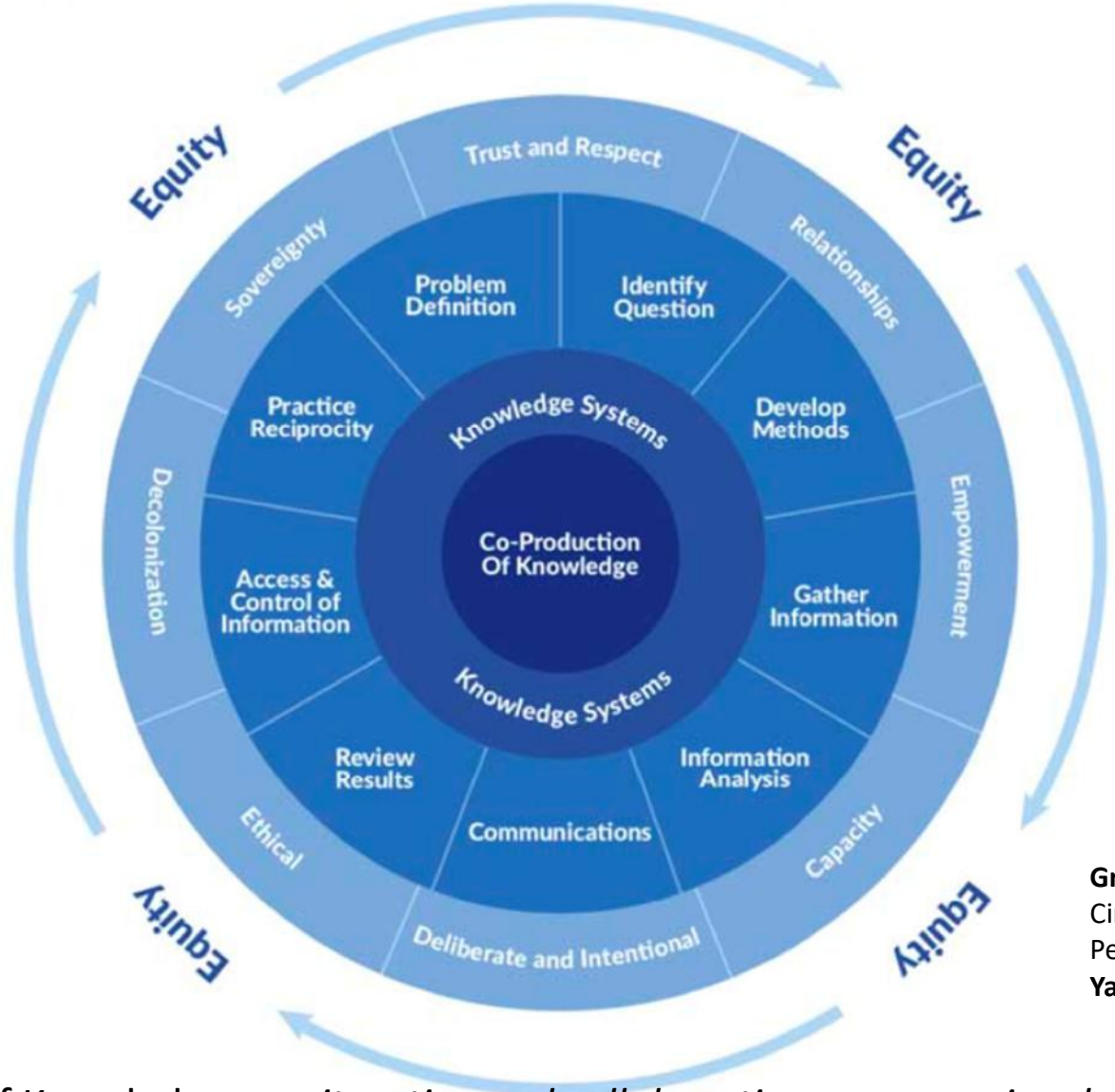
122.5 W
122.0 W

SoundToxins

Understanding the Arctic through a Co-Production of Knowledge



"we fight about a lot of things, but this is something we can agree on"

Graphic: Carolina Behe, Inuit Circumpolar Council & **Raychelle Daniel**, Pew Charitable Trusts & **Julie Raymond-Yakoubian**, Kawerak

Co-Production of Knowledge - *an iterative and collaborative processes involving diverse types of expertise, knowledge and actors to produce context-specific knowledge and pathways towards a sustainable future.*

SoundToxins Analysis

Transaction Costs

- ✧ Lack of clearly established communication channels
- ✧ Volunteer Coordination is time-consuming
- ✧ Information deficiencies exist

Institutional Performance

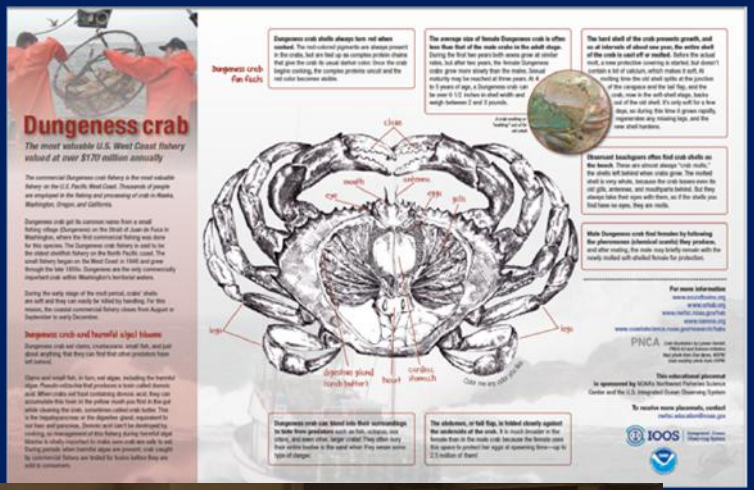
- ✧ **Efficiency -** could be improved
- ✧ **Accountability -** low in lieu of formalized agreements
- ✧ **Adaptability** - medium to high (detect new species)

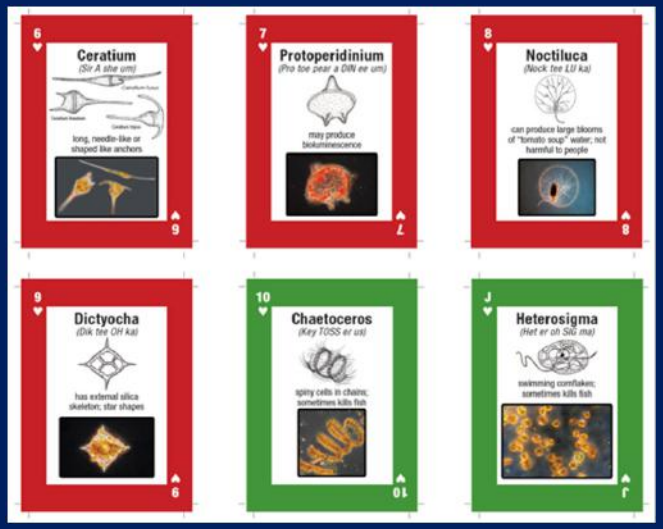
Andy Gregory (University of Washington), 2011 M.S. Thesis study

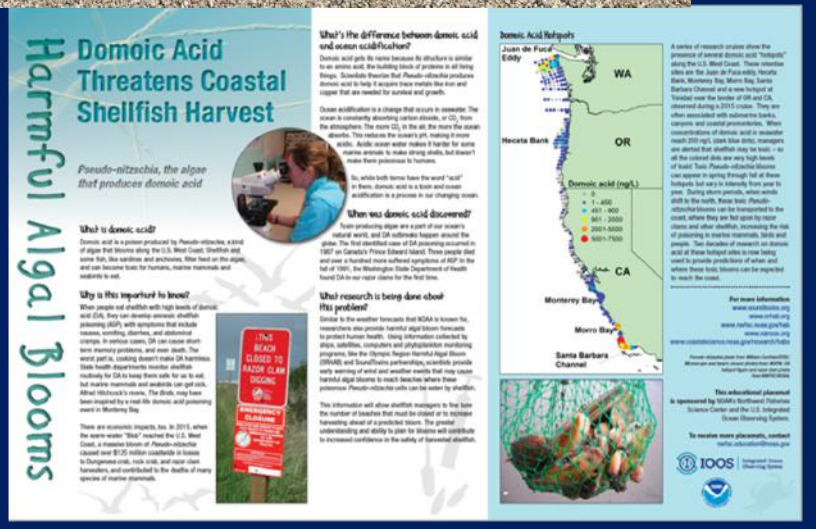
How did we develop a Community of Practice?

"share a concern or a passion for something they do and learn how to do it better as they interact regularly"

- Formalized agreement
- Feedback – monthly summaries
- 24/7 volunteer coordinator
- Annual meetings







International Journal of
Environmental Research and Public Health

Commentary

Taking the Long View for Oceans and Human Health Connection through Community Driven Science

Usha Varanasi [1,*], Vera L. Trainer [2] and Ervin Joe Schumacker [3]

Citation: Varanasi, U.; Trainer, V.L.; Schumacker, E.J. Taking the Long View for Oceans and Human Health Connection through Community Driven Science. *Int. J. Environ. Res. Public Health* **2021**, *18*, 2662. https://doi.org/10.3390/ijerph18052662

1. Share knowledge
2. Listen
3. Foster collaborative and equitable relationships from the inception of an idea
4. Conduct science as a collective action
5. Cultivate mutual respect

Creating Partnerships/Building Networks to Manage HABs: Clear Lake Cyanotoxin Monitoring Program

U.S. EPA: Managing Harmful Algal Blooms in Tribal Waters Webinar Series - March 16, 2021

Sarah Ryan, Environmental Director,
Big Valley Band of Pomo Indians

Overview

- The impacts of Clear Lake cyanobacteria blooms
- The ongoing uses of the water in Clear Lake
- The concerns about cyanotoxins
- The development of the Tribes' Clear Lake Cyanotoxin Monitoring Program
- The development of a multi-jurisdictional approach
- Collaboration and communication

Themes:

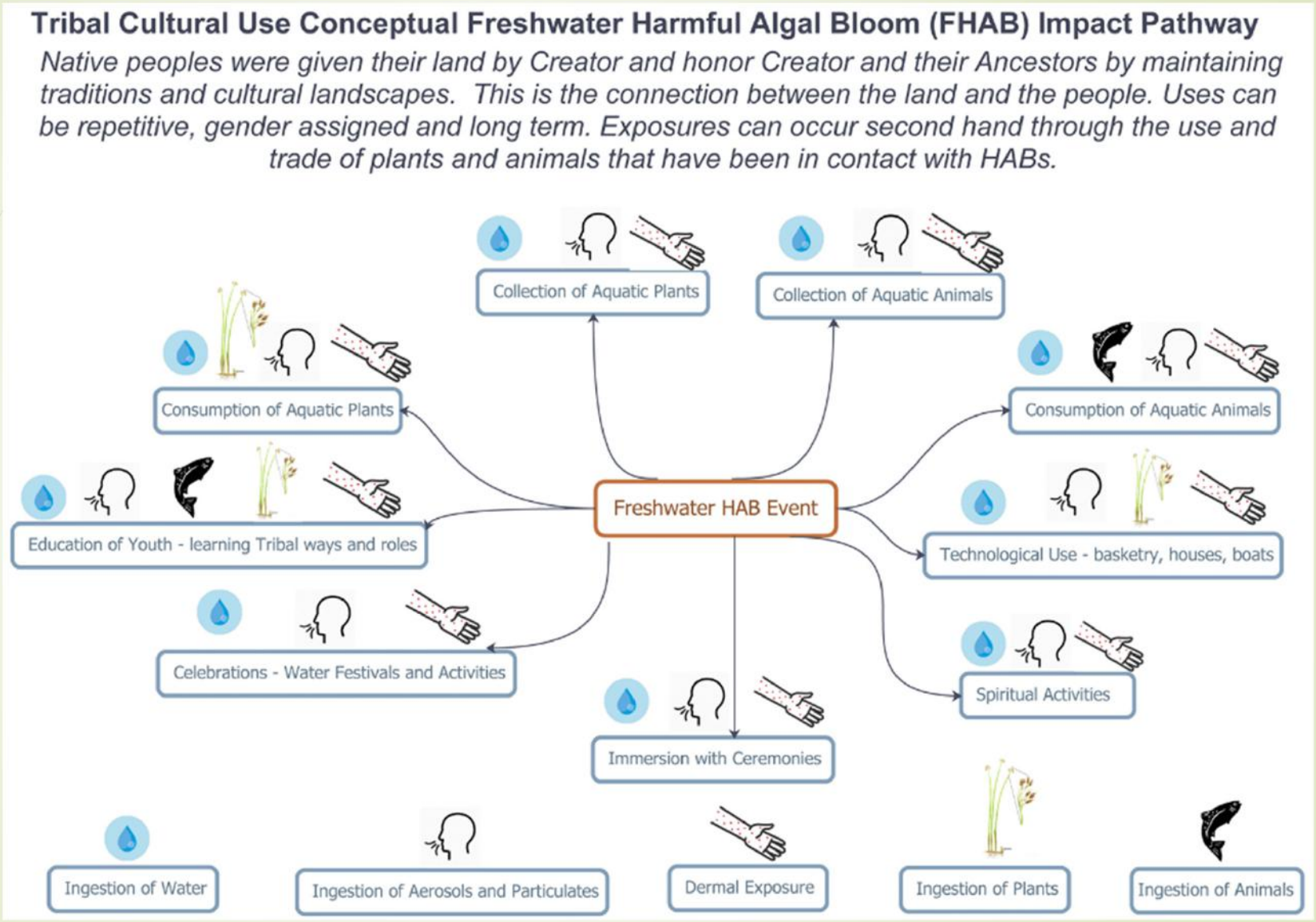
- PARTNERSHIP
- BUILDING OF NETWORK
- COMMON ISSUES/CONCERNS
- KEY LESSONS

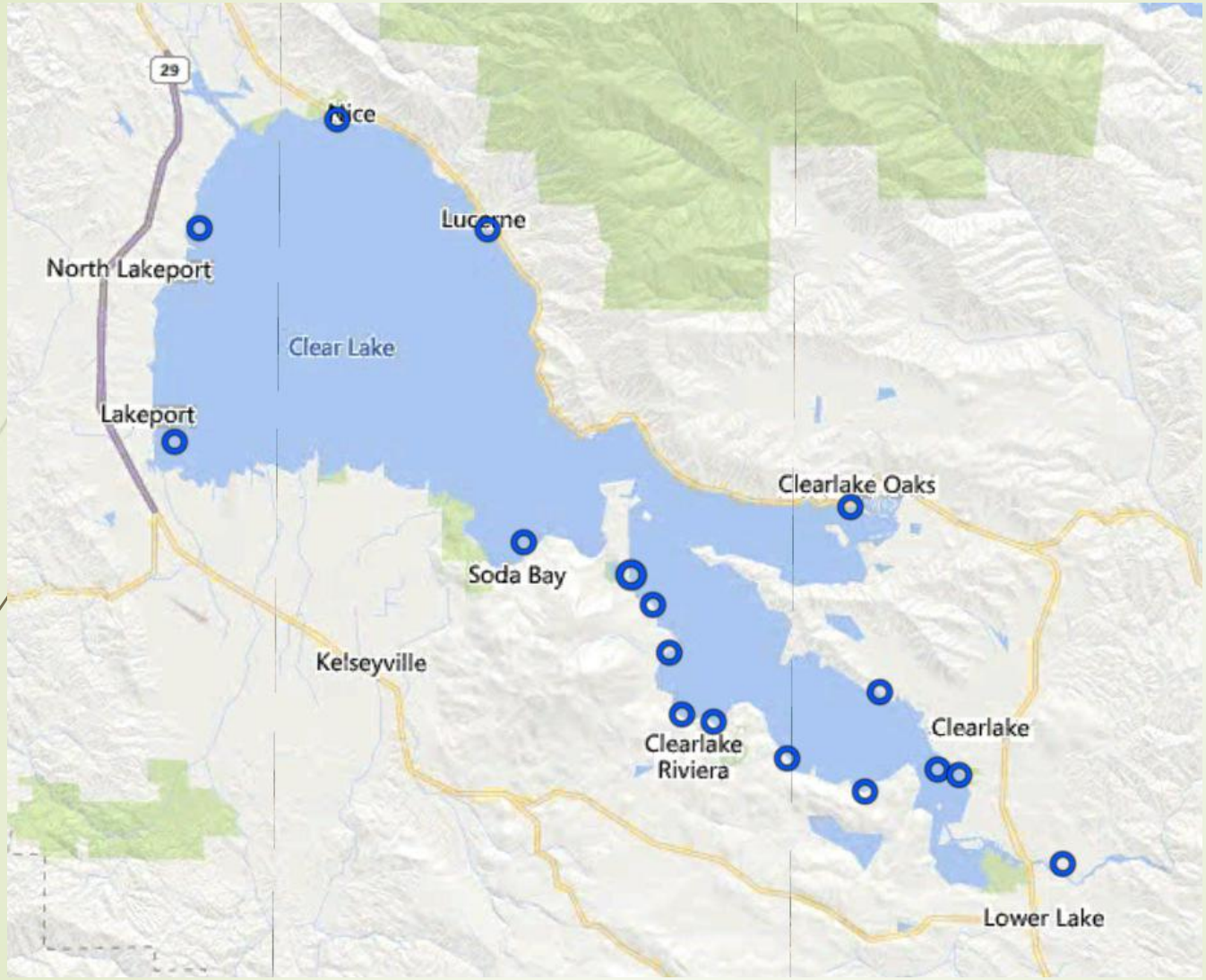
Clear Lake, California

Clear Lake's "Nuisance Algal Blooms"

2009 on…

Meanwhile, Native peoples continue to use the lake





And about 40,000 people (60 percent of the county's population) get their drinking water from 18 Clear Lake public water systems

Animals' uses of Clear Lake

And people continued to fish and live and be active on the lake

Concern about Cyanotoxins Grew as the Years Went By…

NOAA Fisheries mobilizes to gauge unprecedented West Coast toxic algal bloom

Offshore survey will measure extent and severity of largest harmful algal bloom in more than a decade

June 2015

Contributed by Michael Milstein

NATIONAL GEOGRAPHIC

New Diseases, Toxins Harming Marine Life

Dolphins, other marine mammals weakened by pollution, scientists say.

LOCAL NEWS

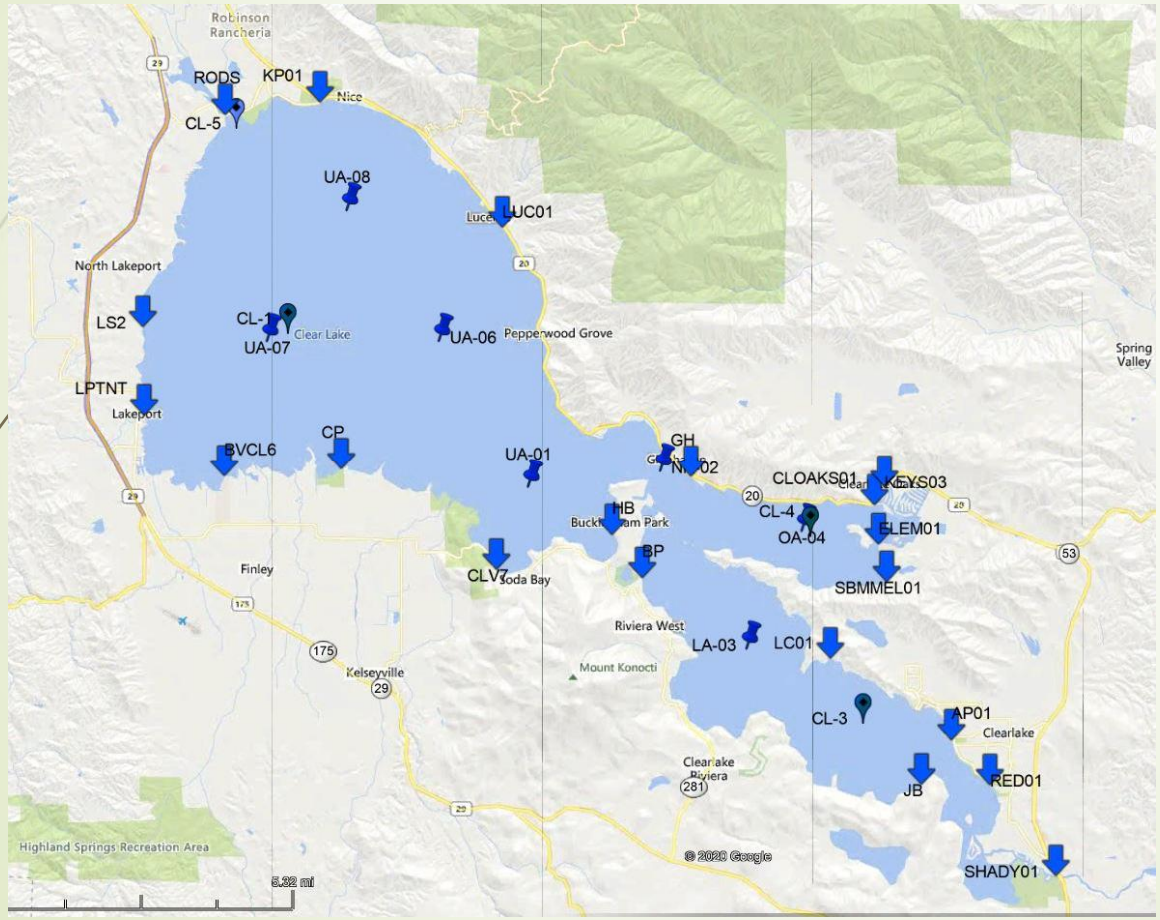
Toxin known to kill dogs within 30 minutes found in several California lakes, rivers

HOME / SCIENCE / EARTH/ENVIRONMENT

Clear Lake contaminated by algae in potentially hazardous bloom

7 September 2014, 10:12 am EDT By James Maynard Tech Times

So the Tribes developed the Clear Lake Cyanotoxin Monitoring Program in 2014



- Sampling locations include Tribal activity sites
- Discussed locations with county and other agencies, got feedback
- Locations were chosen in all jurisdictions of the area (cities, county, Tribal)

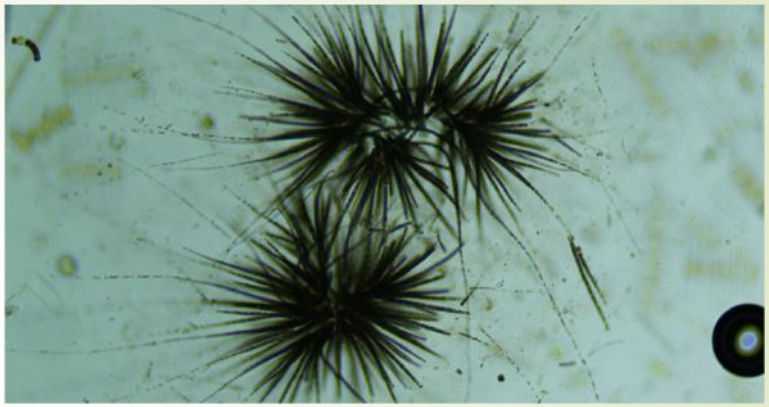
A Continually Developing Program

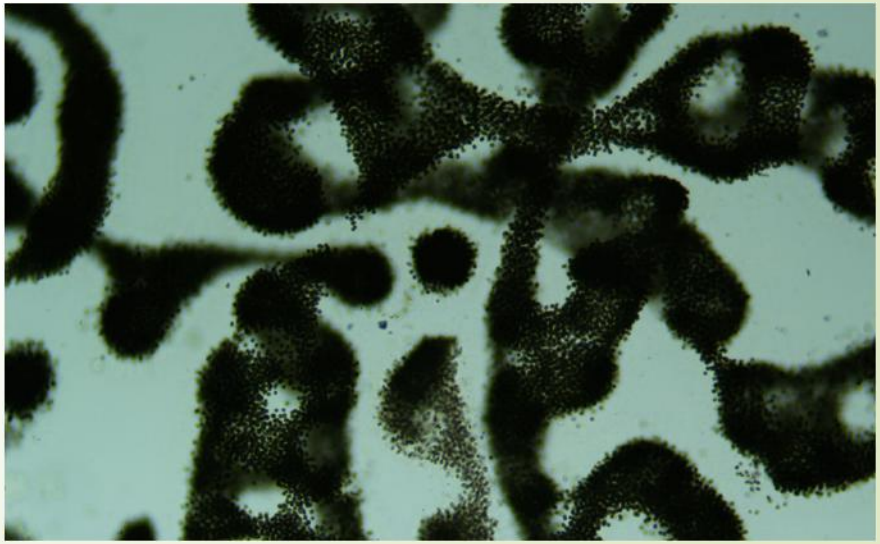
2014

- Formed Clear Lake Cyanobacteria Task Force, has continued to meet quarterly
- Uses Abraxis field strips and lab analysis of Microcystin

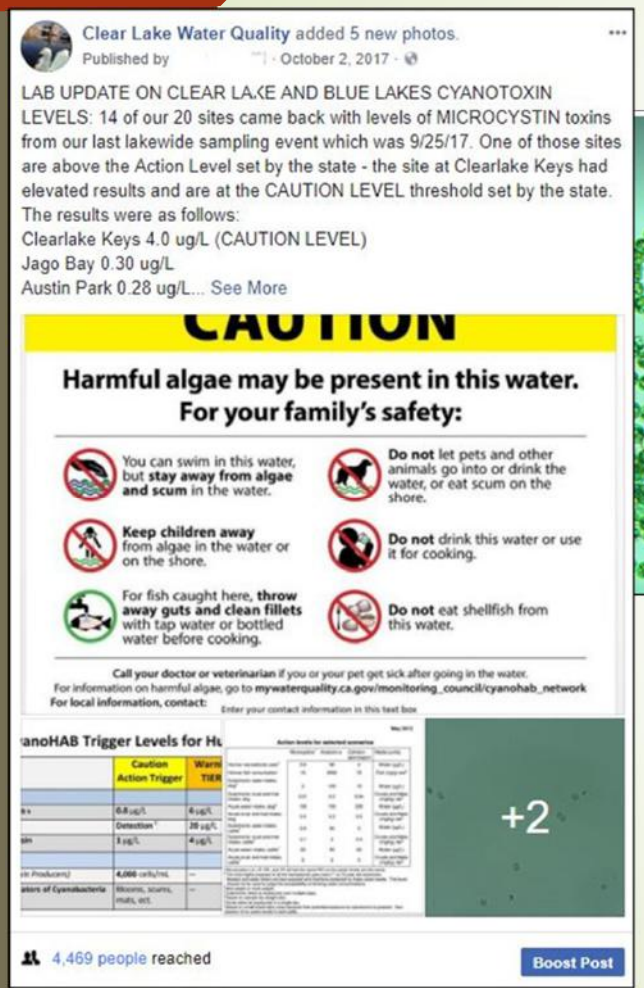
2015

- Added more sampling locations with input from stakeholders
- In house cyanobacteria cell identification
- Increased lab analysis to 4 cyanotoxins





A Continually Developing Program



2016

- Monitoring toxins in drinking water systems
- Chlorophyll-a and phycocyanin for TMDL
- Microcystin analysis at every site

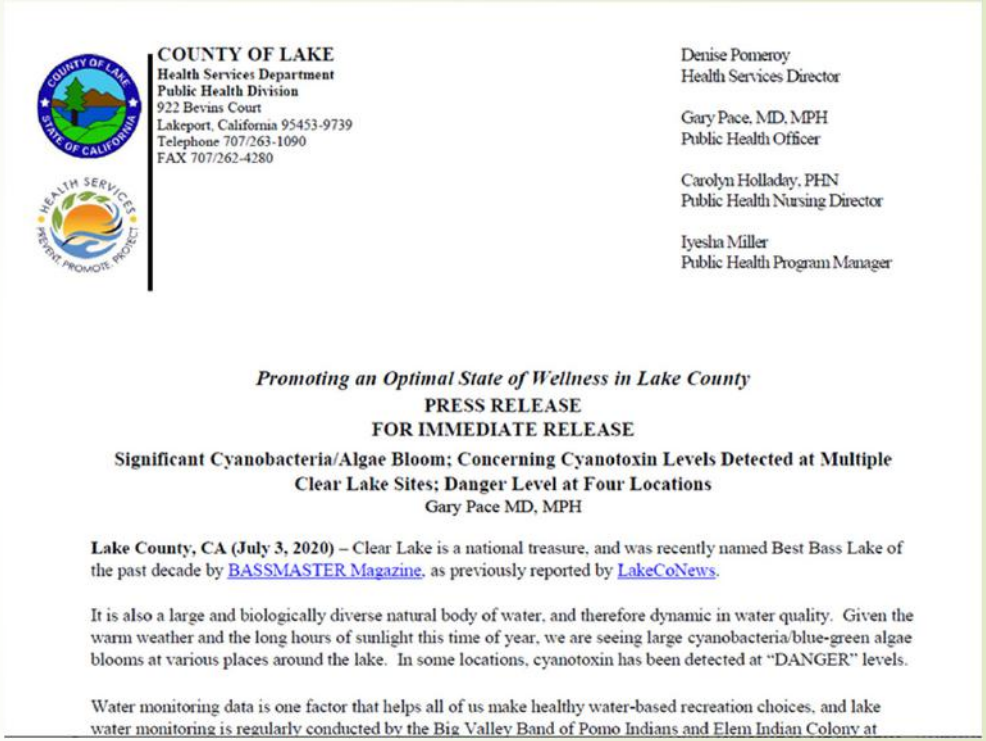
2017

- Other waterbodies in County
- qPCR analysis (toxin producing genes)
- Clear Lake Water Quality Website and transparency of data

Continually Developing Program

2018

- Analysis of fish and shellfish for Microcystin
- Began collaboration with CA DWR to get water samples from interior of lake
- Tribal data URL is installed on county signs, county press releases



COUNTY OF LAKE
Health Services Department
Public Health Division
922 Bevins Court
Lakeport, California 95453-9739
Telephone 707/263-1090
FAX 707/262-4280

Denise Pomeroy
Health Services Director

Gary Pace, MD, MPH
Public Health Officer

Carolyn Holladay, PHN
Public Health Nursing Director

Iyesha Miller
Public Health Program Manager

Promoting an Optimal State of Wellness in Lake County

PRESS RELEASE
FOR IMMEDIATE RELEASE

Significant Cyanobacteria/Algae Bloom; Concerning Cyanotoxin Levels Detected at Multiple Clear Lake Sites; Danger Level at Four Locations

Gary Pace MD, MPH

Lake County, CA (July 3, 2020) – Clear Lake is a national treasure, and was recently named Best Bass Lake of the past decade by BASSMASTER Magazine, as previously reported by LakeCoNews.

It is also a large and biologically diverse natural body of water, and therefore dynamic in water quality. Given the warm weather and the long hours of sunlight this time of year, we are seeing large cyanobacteria/blue-green algae blooms at various places around the lake. In some locations, cyanotoxin has been detected at "DANGER" levels.

Water monitoring data is one factor that helps all of us make healthy water-based recreation choices, and lake water monitoring is regularly conducted by the Big Valley Band of Pomo Indians and Elem Indian Colony at

www.bvrancheria.com/clearlakecyanotoxins

www.bvrancheria.com/clearlakecyanotoxins

Can Be Impacted by a HAB Event

Clear Lake Cyanotoxin Monitoring Program

Clear Lake Fish Cyanotoxin Study

Animal Vet Cyanotoxin Illness Fact Sheet

Physician Cyanotoxin Illness Fact Sheet

OEHHA ACTION LEVELS FOR CYANOTOXIN EXPOSURE

2014-2018 Clear Lake HAB Data Comparison

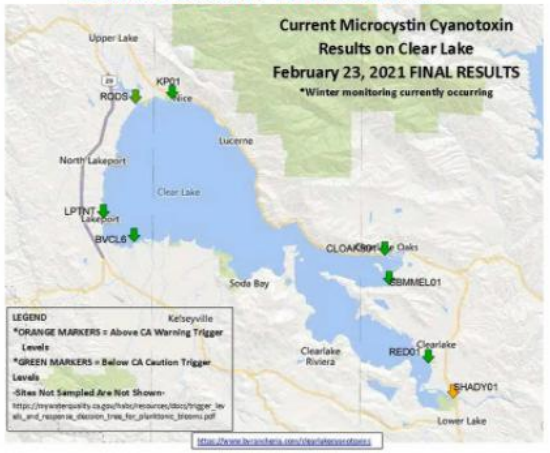
Presentations on the Cyanotoxin Monitoring Program:
Cyanobacteria Impacts to Tribal Water Uses

Tribal Water Quality and Cyanotoxins: Leading a Multi-Jurisdictional Monitoring Program

Clear Lake Drinking Water Leaflet

2012, and for which the World Health Organization provided guidance regarding exposure in the 1990's. OEHHA's Report

CURRENT RESULTS - 2021 SAMPLING



UPDATE ON CLEAR LAKE CYANOTOXIN LEVELS:

At our last sampling event on 2/23/21, we collected water samples from 8 sites on the lake. No blooms were noted, however we used Abraxis field strips to measure microcystin and determined that one site SHADY01 should be sent for lab analysis.

Identified map signage recommending restricted activity is based on CalOEHHA toxin trigger levels. Developed signage:

CAUTION / WARNING / DANGER SIGNAGE

02/23/21 RESULTS:
1 site above the California WARNING Trigger Level:
SHADY01 9.01 µg/L

7 sites not sent off for analysis because no bloom seen and no

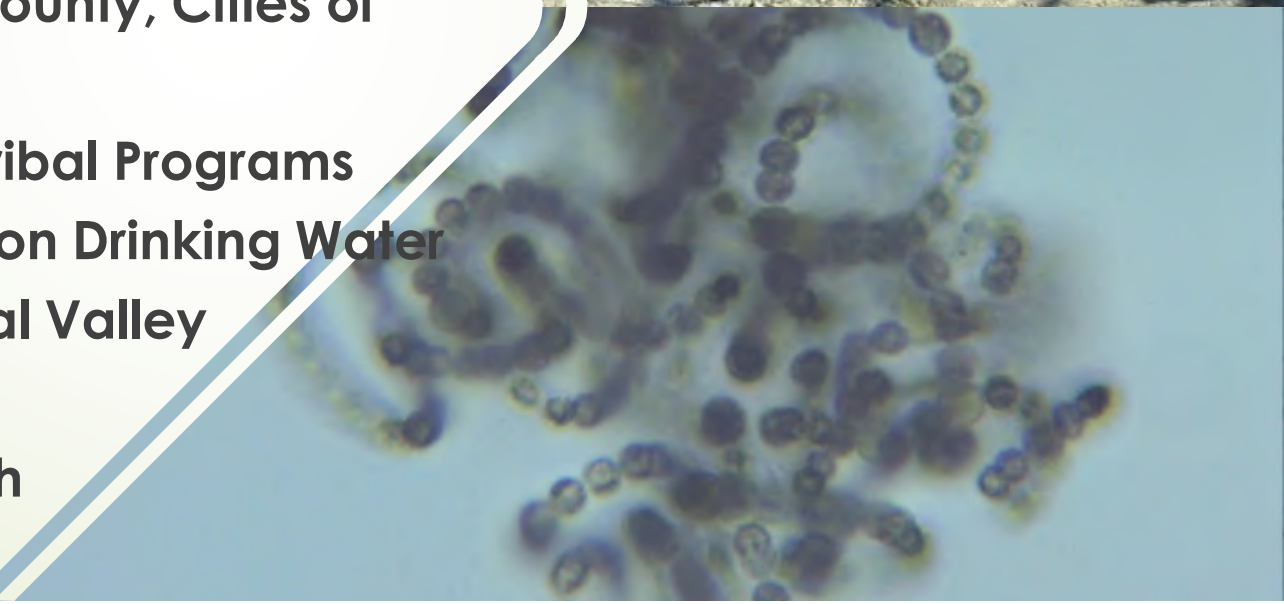
SITE ID	LOCATION
AP01	AUSTIN PARK BEACH, CLEARLAKE
BF	BUCKINGHAM PARK
BVCL6	BIG VALLEY SHORELINE
CL-1*	UPPER ARM, INTERIOR OF LAKE
CL-3*	LOWER ARM, INTERIOR OF LAKE
CL-4*	OAKS ARM, INTERIOR OF LAKE
CL-5*	MOUTH OF RODMAN SLOUGH, UPPER ARM
CLOAKS01	CLEARLAKE OAKS NEXT TO WATER TREATMENT
CLV7	SODA BAY COVE
CP	LAKESIDE COUNTY PARK, SODA BAY ROAD
ELEMO1	ELEM SHORELINE
GH	GLENHAVEN BEACH
HB	HORSESHOE BEND
JG	JAGO BAY
KEYS01	CLEARLAKE KEYS, EAST SIDE
KEYS03	CLEARLAKE KEYS, WEST SIDE
KP01	KELLING PARK
LA-03*	LOWER ARM, INTERIOR OF LAKE
LCD1	LILY COVE, CLEARLAKE
LPTNT	1ST ST. BOAT RAMP, LAKEPORT
LS2	LAKESHORE DRIVE, NORTH OF LAKEPORT
LUCD1	LUCERNE HARBOR PARK
NR-02*	NARROWS, INTERIOR OF LAKE
OA-04*	OAKS ARM, INTERIOR OF LAKE
REDO1	REDBUD PARK, CLEARLAKE
RODS	RODMAN SLOUGH
SBMMEL01	SULPHUR BANK MERCURY MINE SUPERFUND SITE
SCD1	CLEARLAKE KEYS, MOUTH OF SCHINDLER CREEK
SHADY 01	SHADY ACRES (CACHE CREEK)
UA-01*	UPPER ARM, INTERIOR OF LAKE
UA-06*	UPPER ARM, INTERIOR OF LAKE
UA-07*	UPPER ARM, INTERIOR OF LAKE
UA-08*	UPPER ARM, INTERIOR OF LAKE

Clear Lake Multi Jurisdictional Response Approach

- Task Force and Messaging Group Meetings
- Proposed cyanotoxin decision tree – press releases
- Posting information
- Communicating information – fb, website, press releases
- Drinking water response – alternating weeks with recreational monitoring
- Sampling response – during public/agency reports, fish kills
- Signage response

Clear Lake Cyanobacteria Task Force

- Tribes: Big Valley, Elem, Scotts Valley, Upper Lake, Robinson
- County agencies: Water Resources, Environmental Health, Public Health
- City agencies: Lakeport, Clearlake
- Local elected officials: Lake County, Cities of Lakeport and Clearlake
- US EPA: Region 9 Water and Tribal Programs
- CalEPA: SWRCB, OEHHA, Division Drinking Water
- Regional Water Quality: Central Valley Waterboards
- California Dept of Public Health
- California State Parks



Clear Lake Cyanobacteria Messaging Group

- Big Valley Band of Pomo Indians
- Elem Indian Colony
- Lake County Public Health
- Lake County Water Resources
- Lake County Environmental Health
- Lake County Administration Office
- City of Clearlake
- City of Lakeport

Seek professional advice to make water safe for drinking and cooking by having an effective pump, filter, and disinfection system.

Step 1

Ask a professional to advise you when installing or maintaining your home's pump, filter, or disinfection system because local conditions can vary.

- Rural Community Assistance Corporation – Call (916) 447-2854 and ask for the "specialist in small water filtration systems."
- California Rural Water – Call (916) 553-4900 and ask for technical assistance.

Step 2

Confirm treatment works by taking your water to a lab for testing multiple times a year. Ask your local health department for a list of certified labs.

Consider getting four or more neighbors to share equipment and the cost of taking Steps 1 and 2. To talk with a professional or find out about a loan, contact:

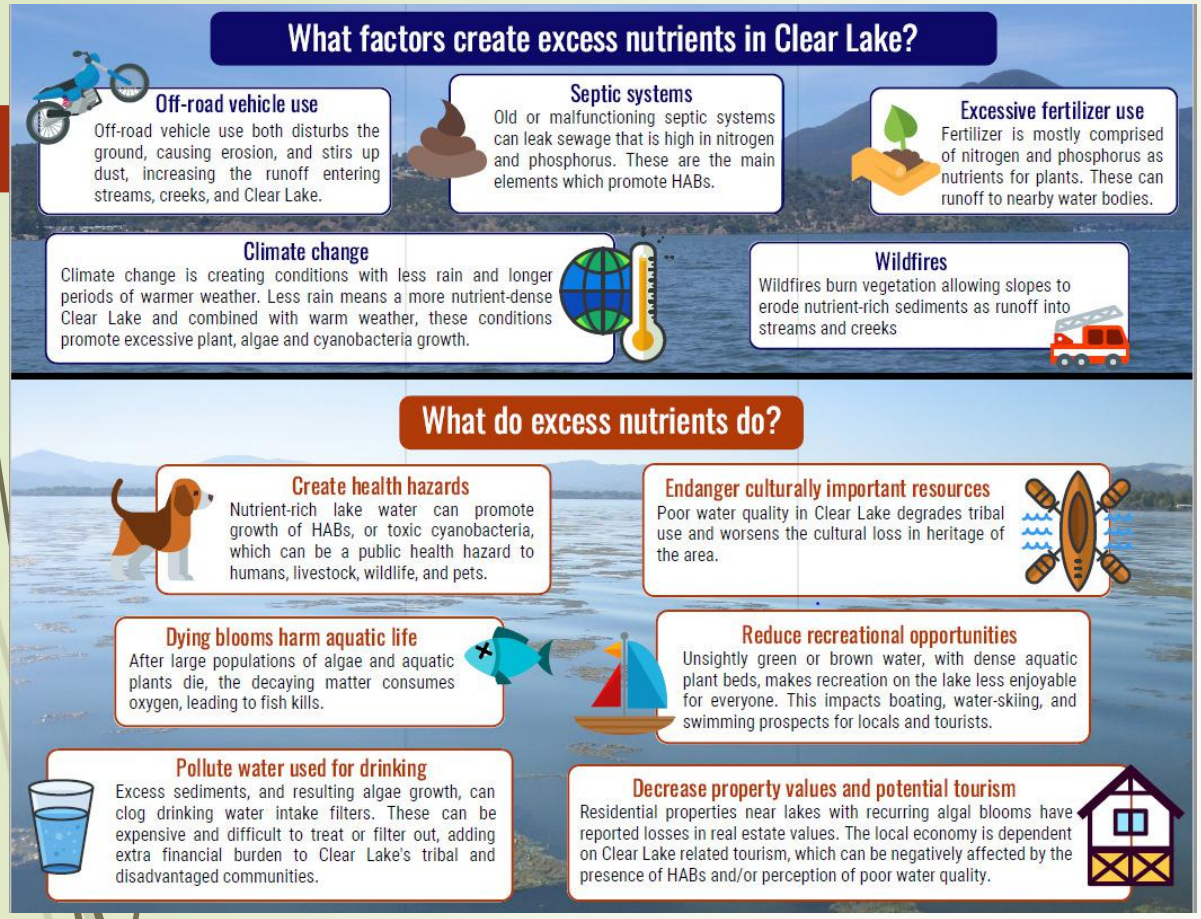
- Rural Community Assistance Corporation – Call (530) 692-9625 and ask for a loan officer.
- California Rural Water – Call (916) 553-4900 and request training.
- If there are 5 connections to 14 connections, please contact the Lake County Environmental Health Division for a State Small Water Permit at (707) 263-1164.

For more information contact:
Public Health (707) 263-1090
Special Districts (707) 263-0119

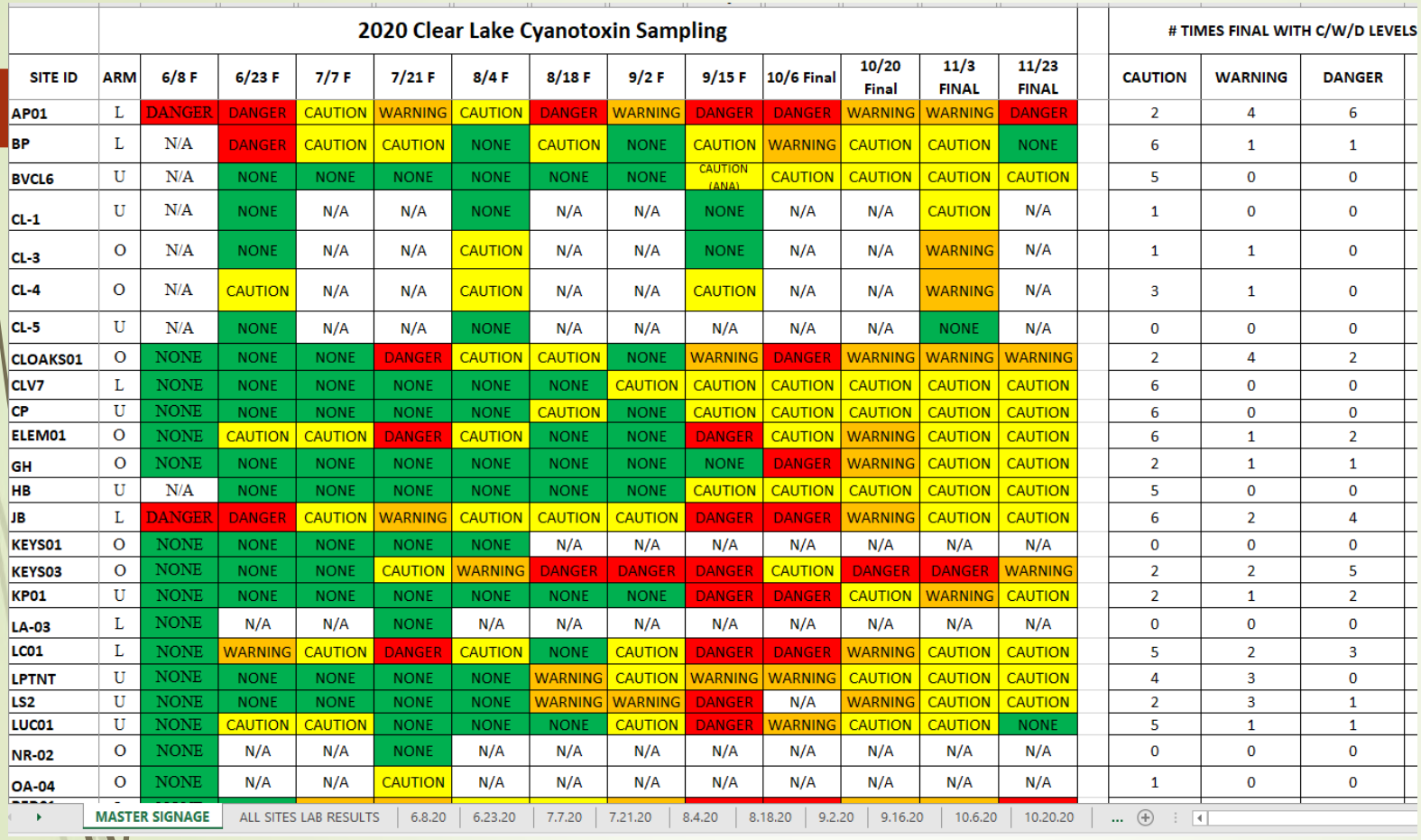
The California Department of Public Health, Environmental Health Investigations Branch provided technical assistance for this material

SWRCB Graphics 1K-2020

Some of our collaborative outreach to public: – drinking water



Outreach to Public – nutrient management, joint discussions on local radio



2020 Clear Lake Cyanotoxin Sampling

SITE ID	ARM	6/8 F	6/23 F	7/7 F	7/21 F	8/4 F	8/18 F	9/2 F	9/15 F	10/6 Final	10/20 Final	11/3 FINAL	11/23 FINAL	# TIMES FINAL WITH C/W/D LEVELS: CAUTION	WARNING	DANGER
AP01	L	DANGER	DANGER	CAUTION	WARNING	CAUTION	DANGER	WARNING	DANGER	DANGER	WARNING	WARNING	DANGER	2	4	6
BP	L	N/A	DANGER	CAUTION	CAUTION	NONE	CAUTION	NONE	CAUTION	WARNING	CAUTION	CAUTION	NONE	6	1	1
BVCL6	U	N/A	NONE	NONE	NONE	NONE	NONE	NONE	CAUTION (ANA)	CAUTION	CAUTION	CAUTION	CAUTION	5	0	0
CL-1	U	N/A	NONE	N/A	N/A	NONE	N/A	N/A	NONE	N/A	N/A	CAUTION	N/A	1	0	0
CL-3	O	N/A	NONE	N/A	N/A	CAUTION	N/A	N/A	NONE	N/A	N/A	WARNING	N/A	1	1	0
CL-4	O	N/A	CAUTION	N/A	N/A	CAUTION	N/A	N/A	CAUTION	N/A	N/A	WARNING	N/A	3	1	0
CL-5	U	N/A	NONE	N/A	N/A	NONE	N/A	N/A	N/A	N/A	N/A	NONE	N/A	0	0	0
CLOAKS01	O	NONE	NONE	NONE	DANGER	CAUTION	CAUTION	NONE	WARNING	DANGER	WARNING	WARNING	WARNING	2	4	2
CLV7	L	NONE	NONE	NONE	NONE	NONE	NONE	CAUTION	CAUTION	CAUTION	CAUTION	CAUTION	CAUTION	6	0	0
CP	U	NONE	NONE	NONE	NONE	NONE	CAUTION	NONE	CAUTION	CAUTION	CAUTION	CAUTION	CAUTION	6	0	0
ELEM01	O	NONE	CAUTION	CAUTION	DANGER	CAUTION	NONE	NONE	DANGER	CAUTION	WARNING	CAUTION	CAUTION	6	1	2
GH	O	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	DANGER	WARNING	CAUTION	CAUTION	2	1	1
HB	U	N/A	NONE	NONE	NONE	NONE	NONE	NONE	CAUTION	CAUTION	CAUTION	CAUTION	CAUTION	5	0	0
JB	L	DANGER	DANGER	CAUTION	WARNING	CAUTION	CAUTION	CAUTION	DANGER	DANGER	WARNING	CAUTION	CAUTION	6	2	4
KEYS01	O	NONE	NONE	NONE	NONE	NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0
KEYS03	O	NONE	NONE	NONE	CAUTION	WARNING	DANGER	DANGER	DANGER	CAUTION	DANGER	DANGER	WARNING	2	2	5
KP01	U	NONE	NONE	NONE	NONE	NONE	NONE	NONE	DANGER	DANGER	CAUTION	WARNING	CAUTION	2	1	2
LA-03	L	NONE	N/A	N/A	NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0
LC01	L	NONE	WARNING	CAUTION	DANGER	CAUTION	NONE	CAUTION	DANGER	DANGER	WARNING	CAUTION	CAUTION	5	2	3
LPTNT	U	NONE	NONE	NONE	NONE	NONE	WARNING	CAUTION	WARNING	WARNING	CAUTION	CAUTION	CAUTION	4	3	0
LS2	U	NONE	NONE	NONE	NONE	NONE	WARNING	WARNING	DANGER	N/A	WARNING	CAUTION	CAUTION	2	3	1
LUC01	U	NONE	CAUTION	CAUTION	NONE	NONE	NONE	CAUTION	DANGER	WARNING	CAUTION	CAUTION	NONE	5	1	1
NR-02	O	NONE	N/A	N/A	NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0
OA-04	O	NONE	N/A	N/A	CAUTION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	0	0

MASTER SIGNAGE | ALL SITES LAB RESULTS | 6.8.20 | 6.23.20 | 7.7.20 | 7.21.20 | 8.4.20 | 8.18.20 | 9.2.20 | 9.16.20 | 10.6.20 | 10.20.20 | ...

Communicating with the county and state about results, recommended signage

Summary Collaboration

- PARTNERSHIP
  - Determining sampling locations
  - Sharing information to improve programs
- BUILDING OF NETWORK
  - Communication about blooms amongst various agencies/governments
  - Decisions about sampling, posting
- COMMON ISSUES/CONCERNS
  - Transparency of results finally started occurring after illnesses/bad press
- KEY LESSONS
  - Communication with the public is worth it
  - Working together creates a more proficient outcome
  - We might not always have the same goals or agree with the way to get there but stay persistent to protect Tribal Traditional Uses.

Sarah Ryan
Big Valley Band of Pomo Indians
sryan@big-valley.net
707-263-3924 x132

Managing Harmful Algal Blooms in Tribal Waters Webinar Series

Day 2: Monitoring HABs and Creating Partnerships

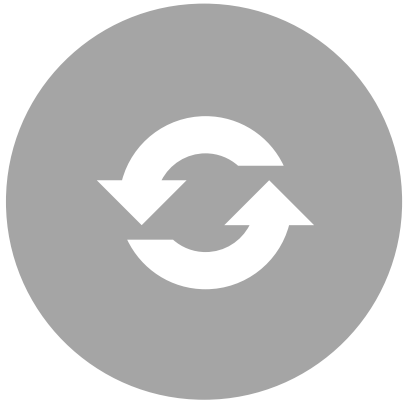
Session 3

Chris Whitehead

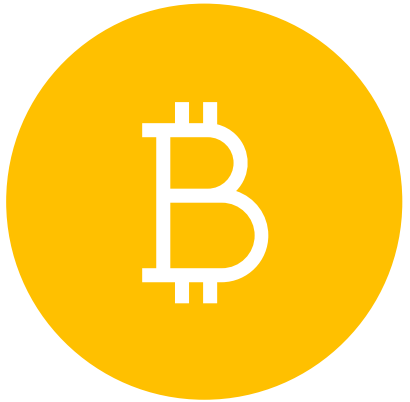
SEATOR

3 Easy Steps to Building a Network

FIND THE COMMON CONCERN



COMMIT TO TIER 1: BASELINE PHYTOPLANKTON



SECURE MILLIONS OF DOLLARS TO DO THE REST…

Designate a Network Leader

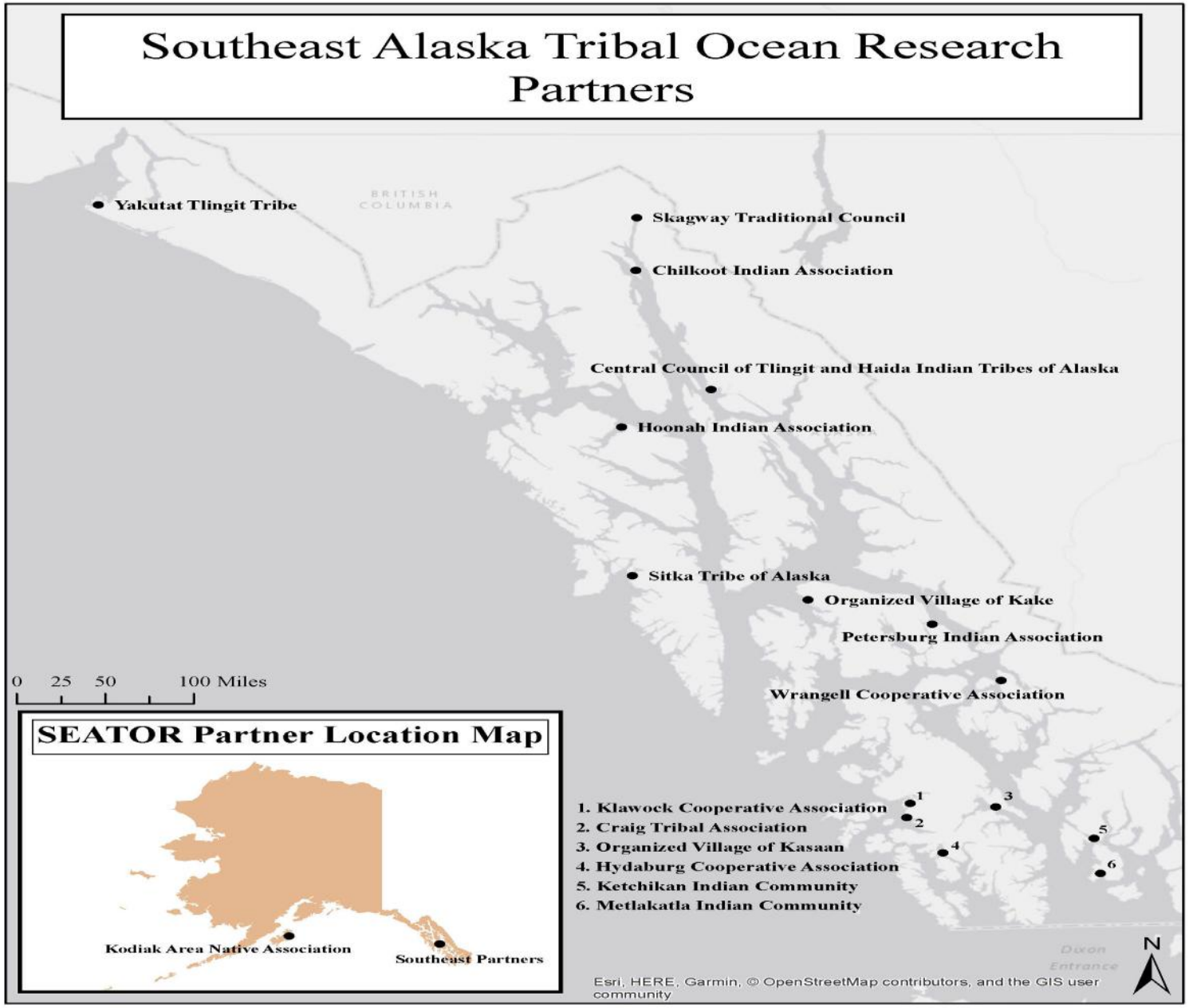
- Reach out to project partners
- Engages with stakeholders
- Link in University, state, and federal agencies ---technical support
- Coordinate Tier 1
  - Trainings
  - Data entry

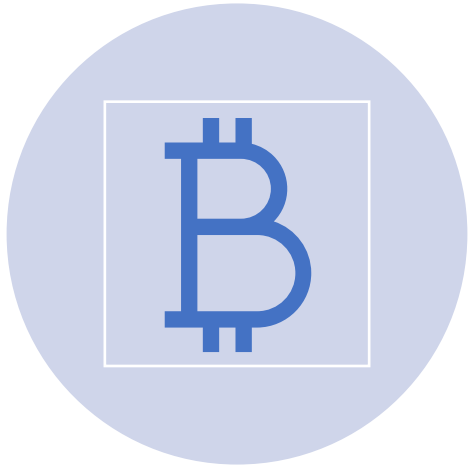
* Don’t recreate the wheel

Network >1

PARTNERS

- NOAA
- AK DEC
- Washington DOH
- AK SeaGrant
- UAF
- AOOS
- SARDFA
- AHAB
- HAKAI
- AK Shellfish Growers





SECURE MILLIONS OF DOLLARS TO DO THE REST…

MARCH 18 WEBINAR 3

Chris Whitehead

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Partners & Networks for Managing HABs

- State Environmental Agencies
- Federal Agencies
- Tribal Nations
- Public Water Purveyors
- State/Local BOH
- University Researchers
- Private industry
- Lake & Watershed Associations
- Waterboards
- Private citizens
- Others…

How and why did you build your network?

The Why

- Identified Need
  - Initial Request by State Environmental Agencies
  - Education & Outreach
  - Opportunity for Consistent Approach

The How

- Structure
  - Core central group/Hub
    - Website/Listserv/Blogs/Twitter/Facebook/etc.
  - Decentralized Collaborative
  - Occupational diversity
  - Scalability
  - Standardized baseline methods
  - Standardized training
  - Tiered participation levels
  - Open technology & data sharing
  - Open networking

How did you find and agree on common issues/concerns in order to build the network?

What advice would you give to others trying to build partnerships and networks?

- Provide organized baseline structure
- Invite Disputation
- Seek a diverse core
- Provide opportunities through an ongoing iterative process

what key lessons did you learn developing yours?

- It’s Everyone’s Program
- Provide Utility
- Have Structure
- Keep it loose…be flexible
- Welcome Occupational Diversity

Session 3: Creating Partnerships and Building Networks to Manage HABs

QUESTIONS?

Wrap-up

- Day 3: Funding HABs Management and Communicating Risks
  - Thursday, March 18, 1:00-3:30 PM EDT/10:00 AM-12:30 PM PDT
- Use the same Gotowebinar link for Webinar 3
- Please complete the attendee survey after the webinar ends

Questions? Send an email to epacyanohabs@epa.gov

THANK YOU FOR ATTENDING