

# Paralytic Shellfish Poisoning

Ecology and Causes,  
Symptoms, and Testing

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# Ecology and Causes

What causes PSP, when does it occur,  
and why is it happening more often?



PSP is caused by  
Harmful Algal  
Blooms



# Harmful Algal Blooms

- Blooms occur when colonies of algae grow rapidly under certain environmental conditions.
- HABs are most often not visible but can sometimes cause red tides.
- Some algae species produce toxins
- Illness caused by these toxins can be fatal in humans and wildlife.

Three main species of concern in Alaska:

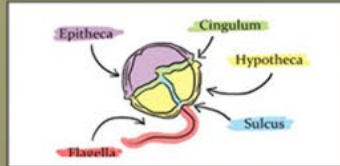
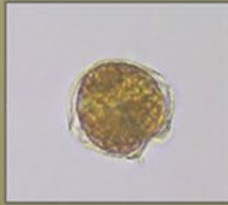
***Alexandrium spp.*, causing PSP**

*Dinophysis spp.*, causing ASP

*Pseudo-nitzschia spp.*, causing DSP

# HABs species summary

## Alexandrium spp.



Identified by three lobes and long flagella "tail".  
Found singular when not in bloom

**TOXIC!**

Toxin produced: Saxitoxin  
Causes: Paralytic Shellfish Poisoning (PSP)  
Symptoms: Neurological impairment such as temporarily paralysis or death in severe cases

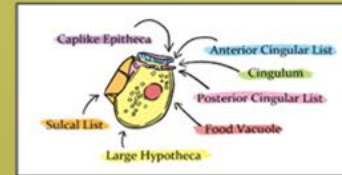
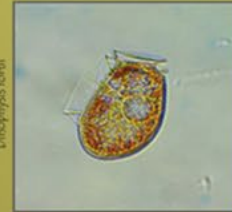
May also affect marine mammals.

Looks like:



A Pokéball or a Hamburger

## Dinophysis spp.



Identified by bulb shape with fish-like fin.  
Found singularly or with daughter cell

**TOXIC-**  
**but non-fatal**

Toxin produced: Okadaic Acid  
Causes: Diarrhetic Shellfish Poisoning (DSP)  
Symptoms: Severe gastrointestinal distress

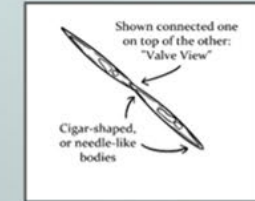
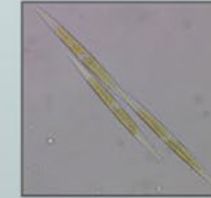
While not fatal, evidence suggests it could promote tumor growth.

Looks like:



A vase or Angry Kool-Aid man!

## Pseudo-nitzschia spp.



Found singularly or joined in chains  
Have a mucus trail to glide along, like slugs and

**TOXIC!**

Toxin Produced: Domoic acid  
Causes: Amnesic Shellfish Poisoning (ASP)

Symptoms: headaches, dizziness, confusion or in severe cases temporary or long term memory loss

Looks like:



Porcupine Quills

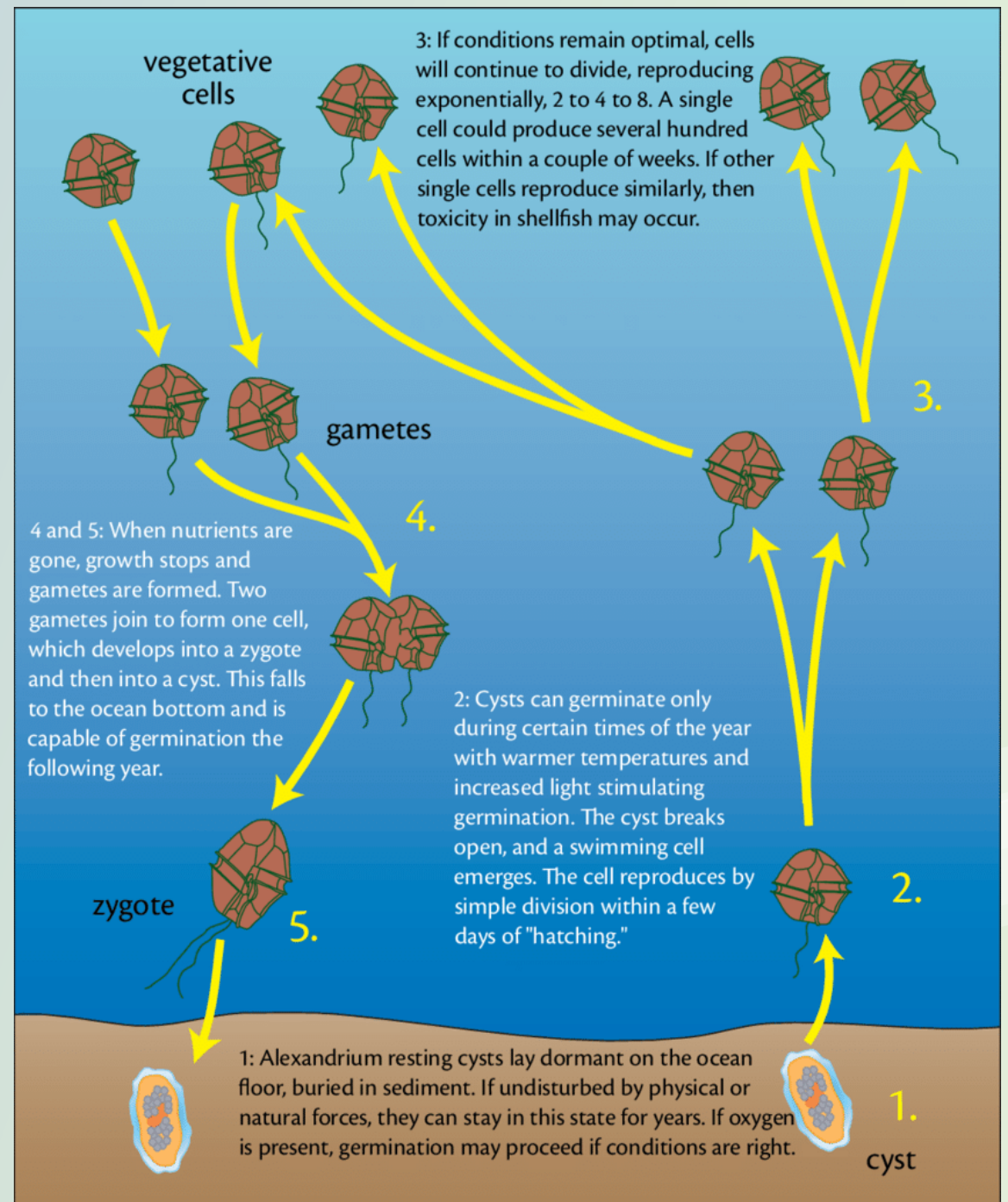


# How toxins enter the food chain

- Cysts are buried in sediments on the ocean floor
- Cysts can stay dormant for years until conditions are good for germination
- Increasing bottom water temperatures increase germination



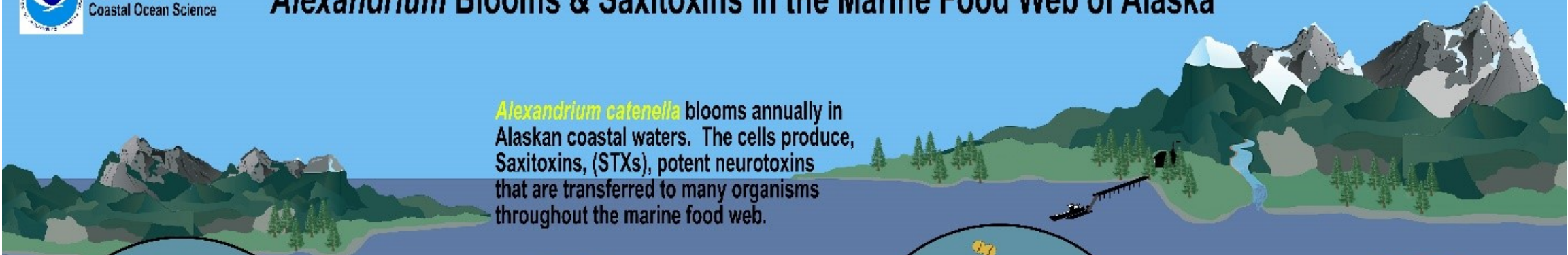
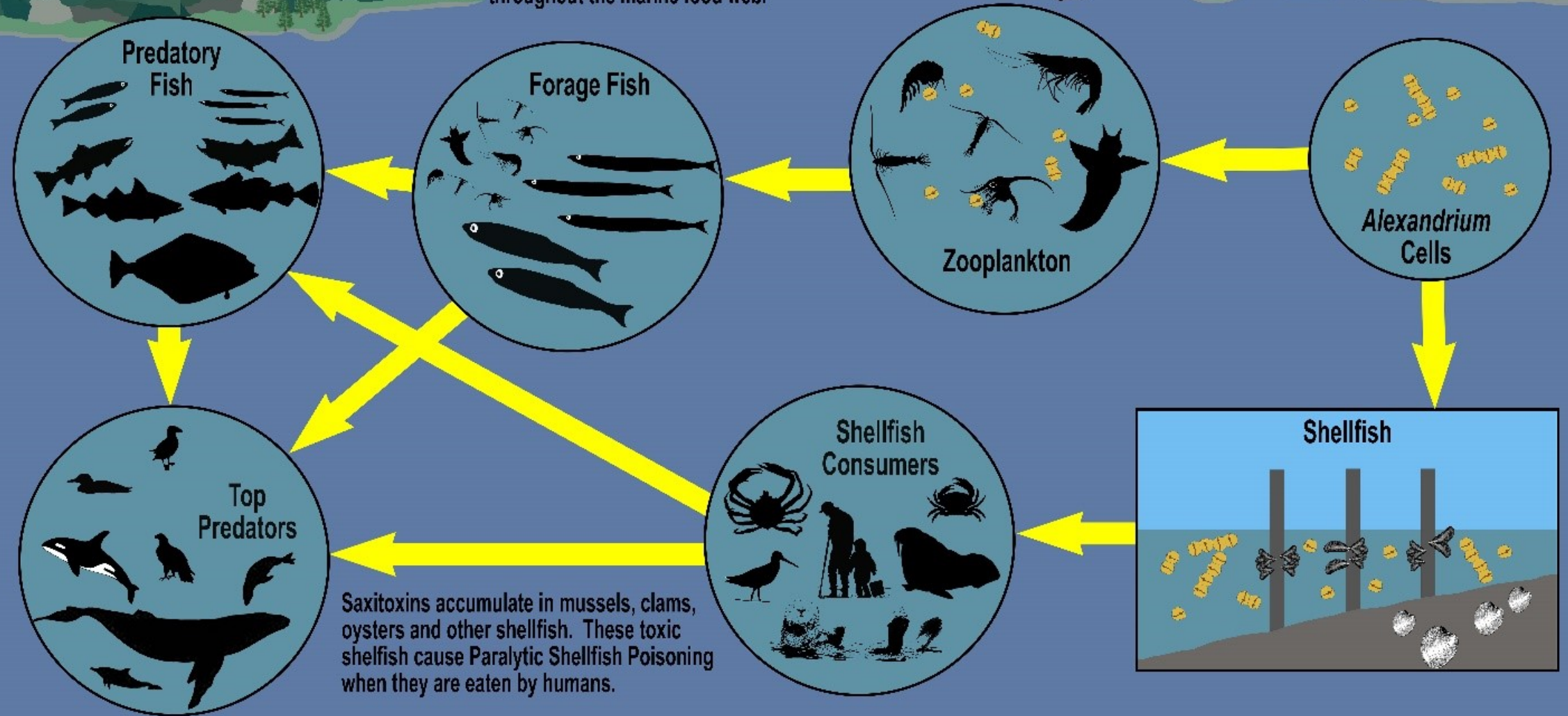
Don Anderson,  
Woods Hole  
Oceanographic  
Institute





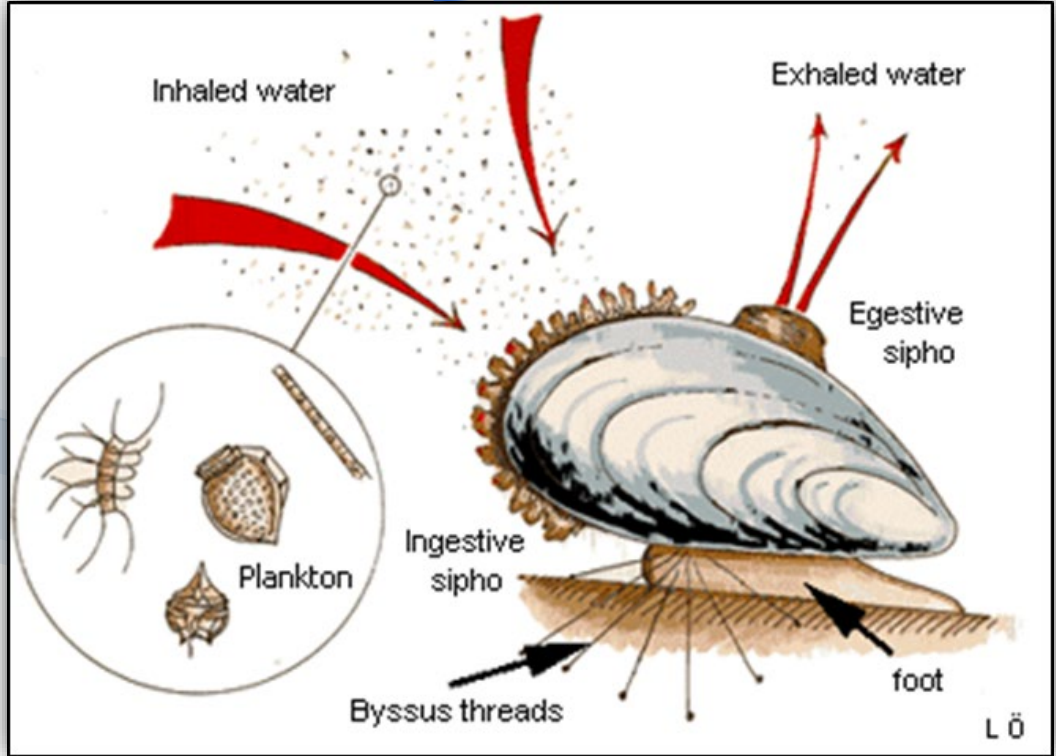
# Alexandrium Blooms & Saxitoxins in the Marine Food Web of Alaska

*Alexandrium catenella* blooms annually in Alaskan coastal waters. The cells produce, Saxitoxins, (STXs), potent neurotoxins that are transferred to many organisms throughout the marine food web.





# Example pathway for toxins – out of the ocean and into a meal

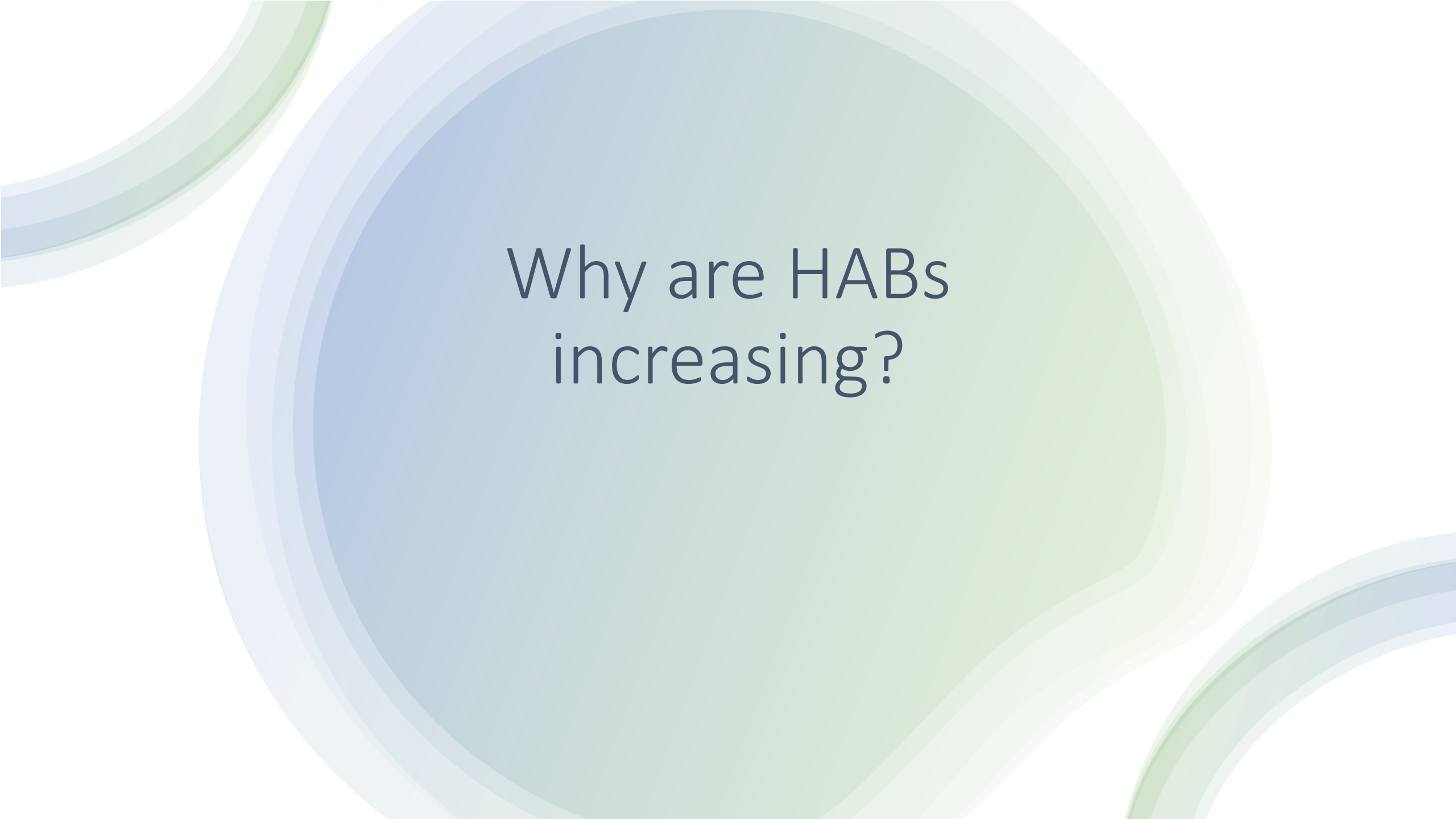


<http://molluscs.at/bivalvia/index.html?/bivalvia/main.html>

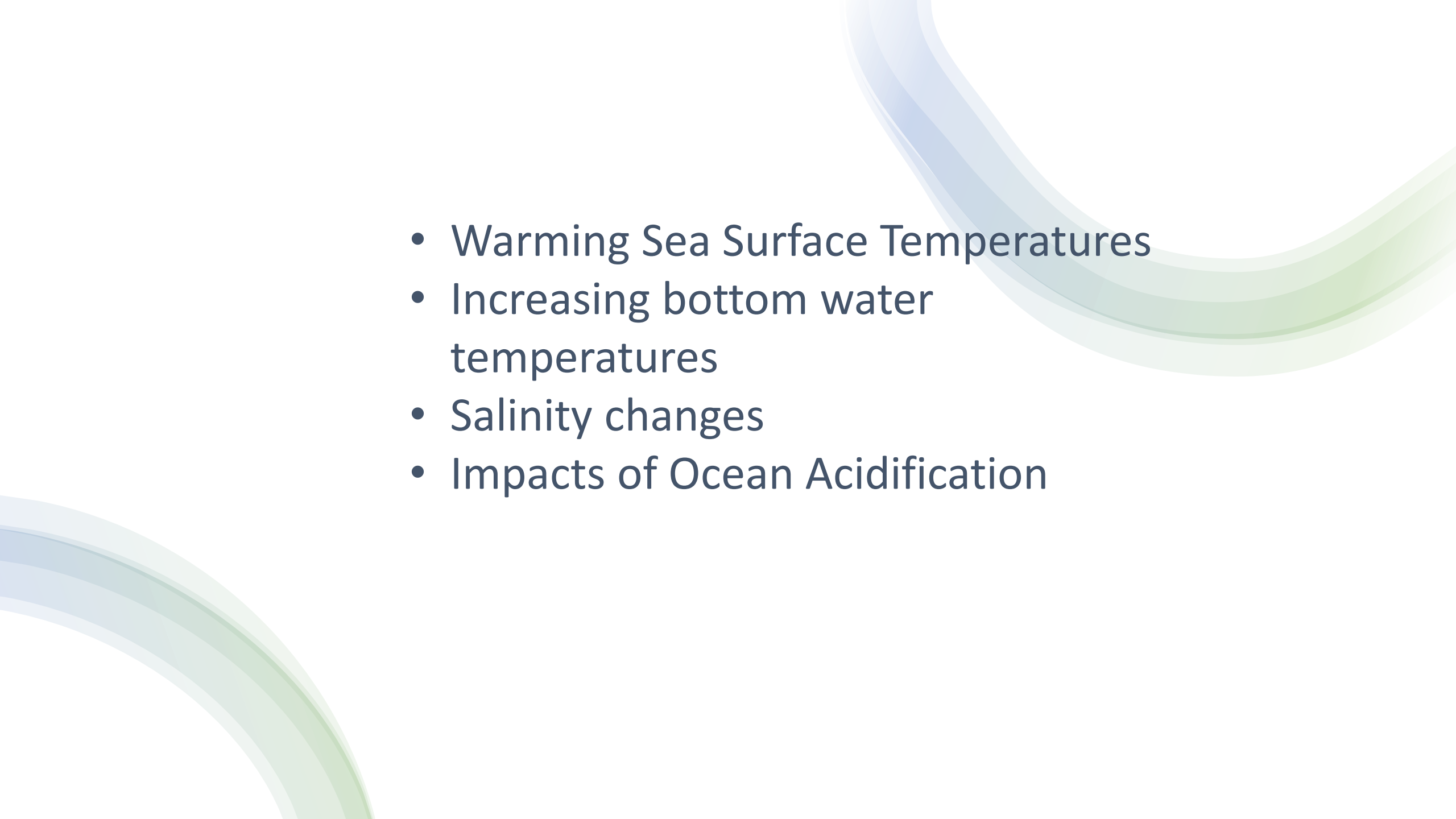


Photo credit: Lisa Tran





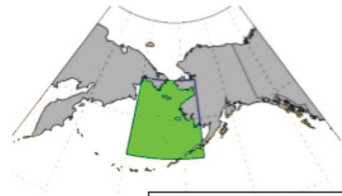
Why are HABs  
increasing?

- 
- The background features decorative curved lines in shades of blue and green, sweeping across the top and bottom of the slide.
- Warming Sea Surface Temperatures
  - Increasing bottom water temperatures
  - Salinity changes
  - Impacts of Ocean Acidification

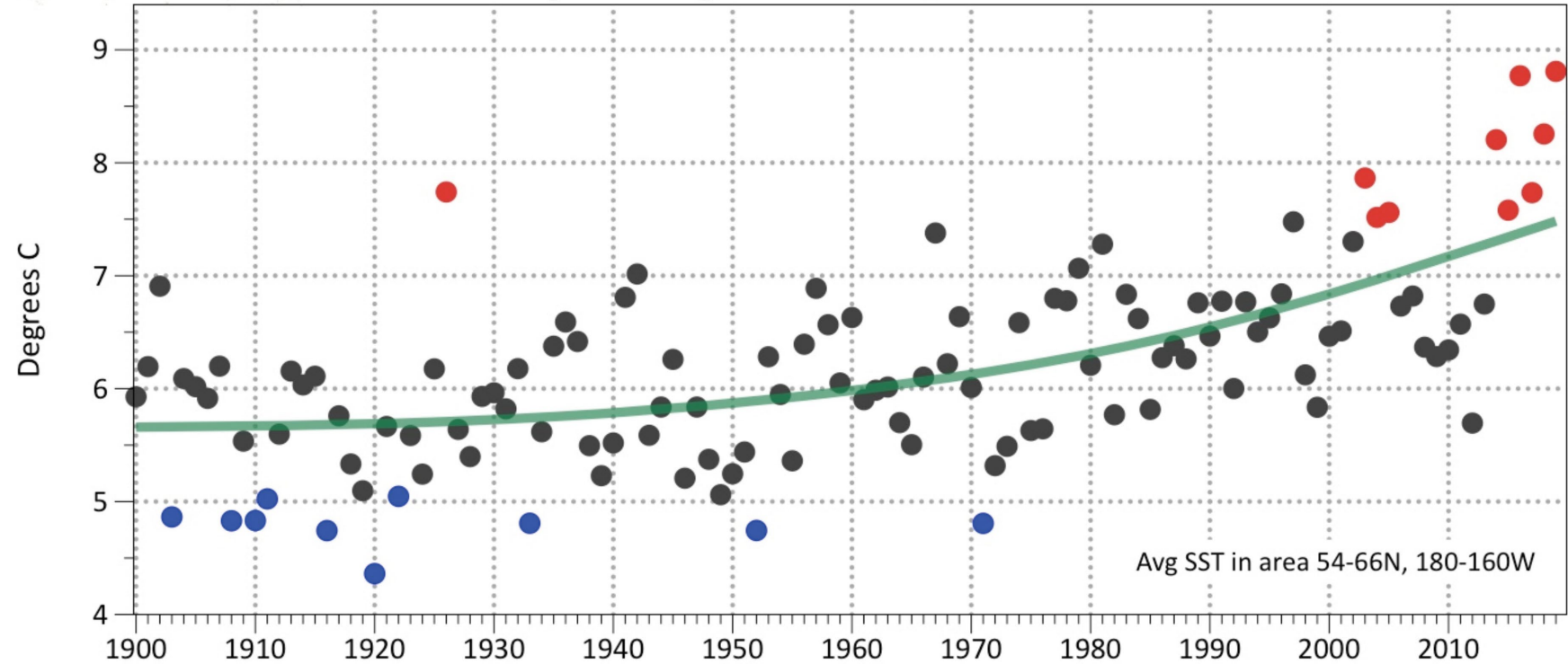
Local knowledge of harvesting shellfish is built on generations of experience - but does not account for extremely rapid climate change.



Rick Thoman  
Alaska Center for Climate  
Assessment & Policy



## Bering Sea (east of 180W) Average Sea Surface Temperature May through October, 1900 to 2019



- Ten Warmest
- Ten Coldest
- Smoothed Average

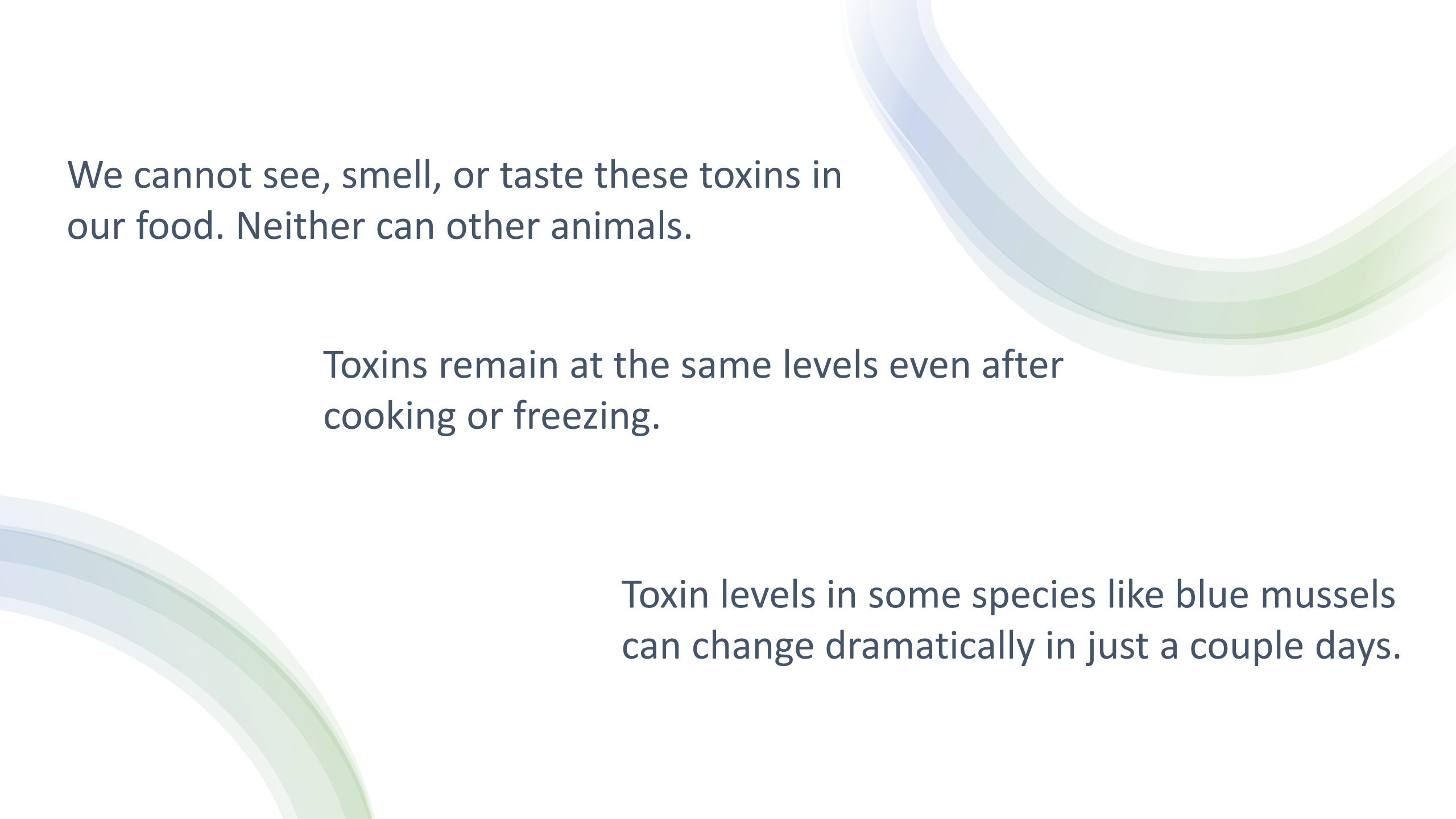
Data sources: NOAA/ERSSTv5  
UAF/B. Brettschneider

The background features a series of concentric, overlapping circles in shades of light blue and green, creating a ripple effect. The overall color palette transitions from a light blue on the left to a light green on the right.

# Shellfish Toxin Facts

Myth-busting to save lives

HABs and toxins can be present  
in the water and animals any  
month of the year.



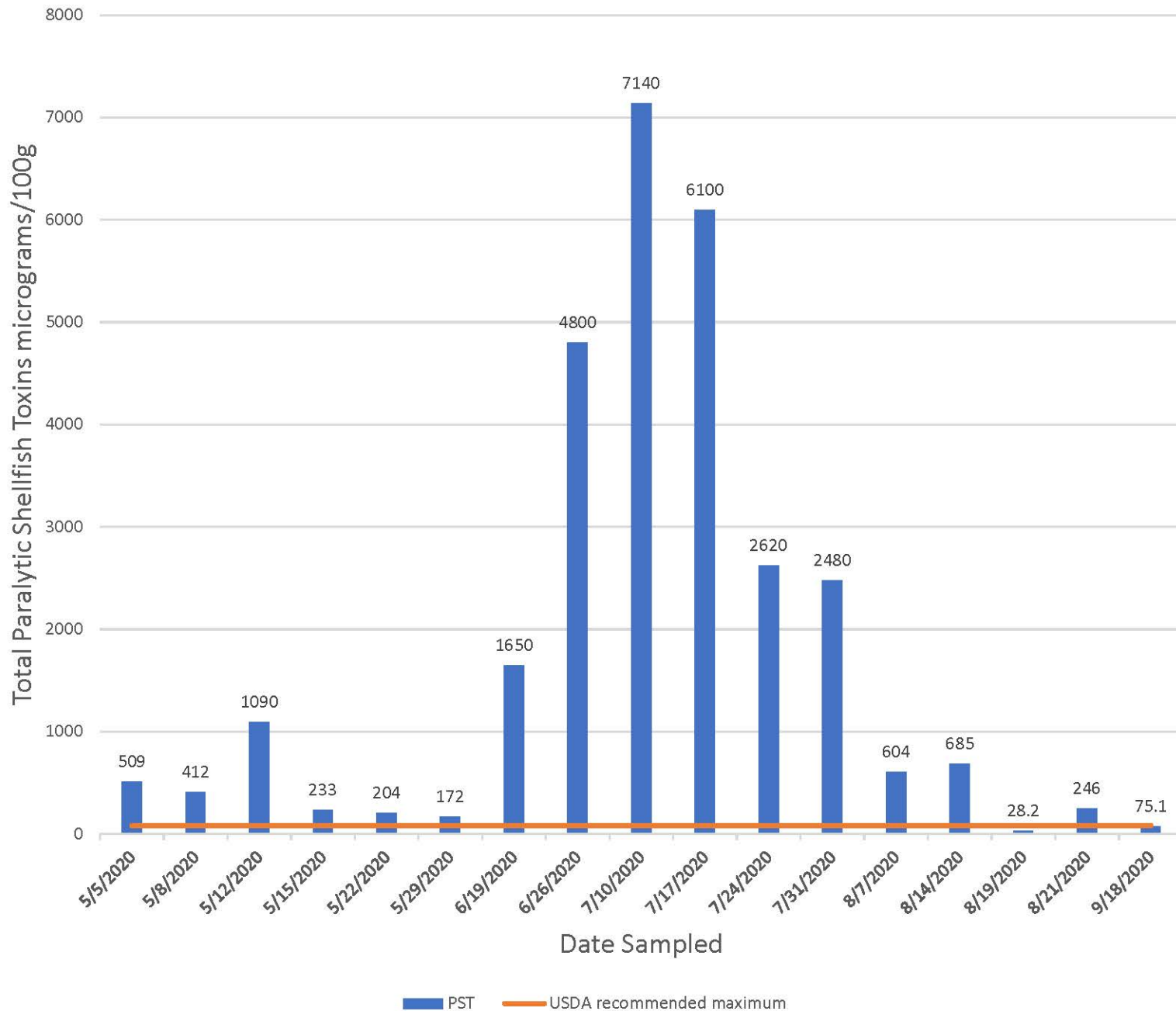
We cannot see, smell, or taste these toxins in our food. Neither can other animals.

Toxins remain at the same levels even after cooking or freezing.

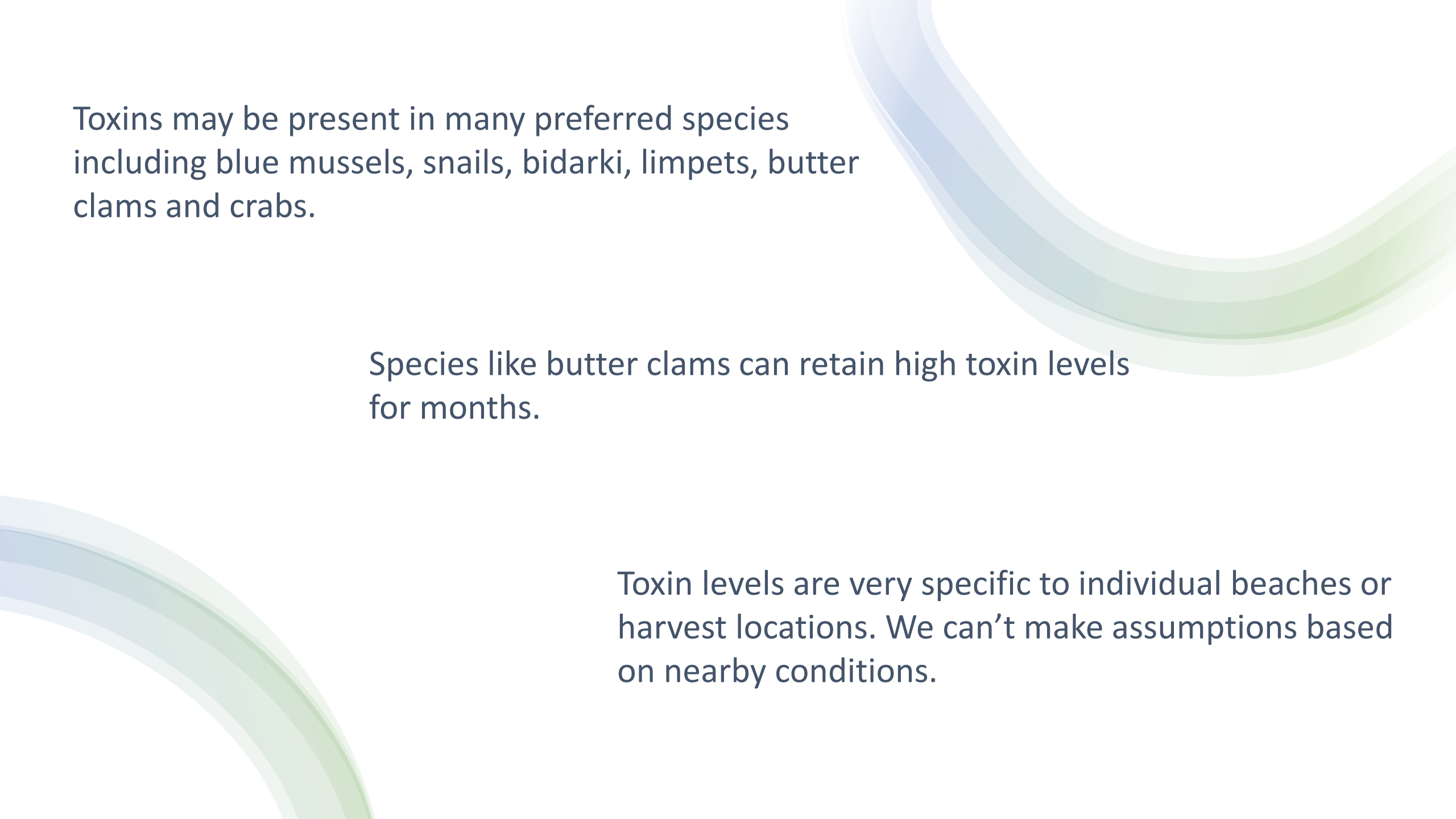
Toxin levels in some species like blue mussels can change dramatically in just a couple days.



Total Paralytic Shellfish Toxins micrograms/100g  
Blue mussels sampled from Little Priest Rock, Unalaska 5/5/2020 – 9/18/2020



Test results are available  
online:  
[www.Qawalangin.com/psp](http://www.Qawalangin.com/psp)



Toxins may be present in many preferred species including blue mussels, snails, bidarki, limpets, butter clams and crabs.

Species like butter clams can retain high toxin levels for months.

Toxin levels are very specific to individual beaches or harvest locations. We can't make assumptions based on nearby conditions.

# PSP Symptoms

# Paralytic Shellfish Poisoning Symptoms

- Tingling and numbness that spreads from the lips and mouth to the face, neck, and extremities
- Dizziness
- Weakness in the legs and arms
- Headache
- Nausea
- Sense of floating
- Confused or slurred speech
- Vomiting
- Paralysis
- Shortness of breath and respiratory failure

Source: Alaska Sea Grant  
<https://alaskaseagrant.org/our-work/harmful-algal-blooms/>

# Paralytic Shellfish Poisoning Symptoms

- Symptoms can start within minutes or may not appear until hours after consumption
- Median time of symptom onset is one hour after eating toxic shellfish
- First symptom is usually numbness and tingling in the mouth
- Muscles of the chest and abdomen may become paralyzed in severe cases, leading to respiratory failure if breathing assistance is not provided
- Death can occur within two hours, depending on the levels of toxin consumed and the individual's response.

Source: Alaska Sea Grant  
<https://alaskaseagrant.org/our-work/harmful-algal-blooms/>

PSP levels in the region were so high in 2020 that people harvesting them for scientific sampling experienced redness, irritation and tingling on their hands.

The background features a series of concentric, semi-transparent circles in shades of light blue and green, creating a layered, ripple effect. The overall color palette transitions from a soft blue on the left to a light green on the right.

# Treatment and Reporting



There is no antidote for PSP. Supportive measures are the only means of treatment.



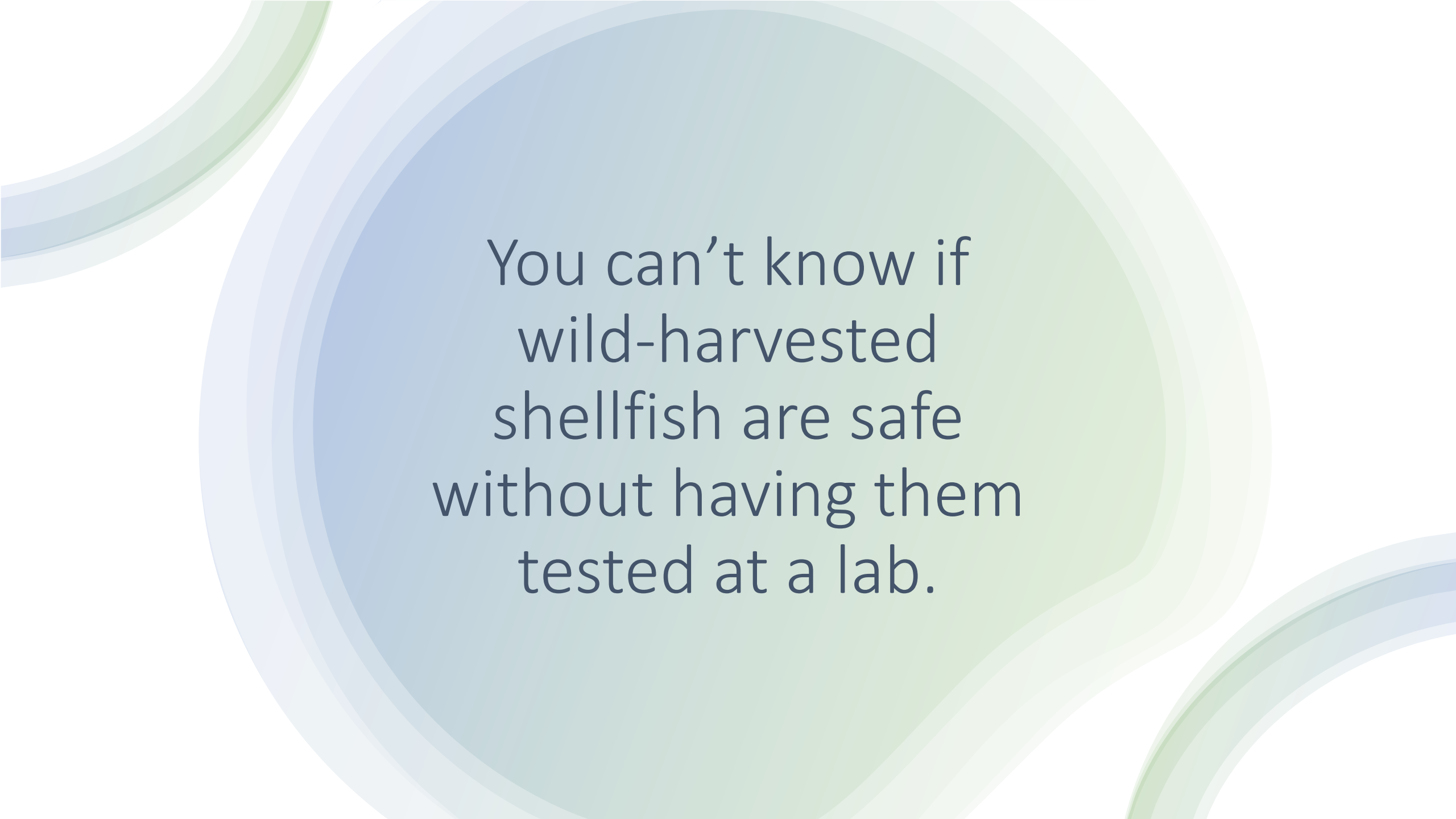
- Highly recommended that a medical assessment be made as soon as possible after symptoms appear.
- Symptoms can become more severe over time.
- The amount of PSP toxins consumed is often unknown, and progression of the illness is unpredictable
- If the level of toxin is high enough, the victim may suffer respiratory paralysis and will need to be put on a mechanical respirator and give oxygen
- Symptoms can resolve completely within hours to days after consuming infected shellfish

Source: Alaska Sea Grant  
<https://alaskaseagrant.org/our-work/harmful-algal-blooms/>

# Reporting any potential or confirmed cases

- Health care providers and citizens should report any suspected case of PSP immediately to the Alaska Section of Epidemiology.
- To report, call 907-269-8000 (Monday–Friday, 8 am–5 pm) or 1-800-478-0084 (after hours).
- Reporting even mild cases may save another person's life

Source: Alaska Sea Grant  
<https://alaskaseagrant.org/our-work/harmful-algal-blooms/>



You can't know if  
wild-harvested  
shellfish are safe  
without having them  
tested at a lab.

# Testing Shellfish

- Local testing is not available
- Samples may be sent to Anchorage, to the Environmental Health Lab
- Chandra can help coordinate, or
- Contact Matthew Forester at [matthew.forester@alaska.gov](mailto:matthew.forester@alaska.gov), 907.375.8200
- Samples must be shucked and drained, and must be at least 100 g (about 4 oz)
- Samples must be frozen and remain frozen
- Each test will cost \$125, plus shipping

**QAWALANGIN TRIBE OF UNALASKA**

PROJECT UPDATE:  
**BLUE MUSSEL TOXIN STUDY**  
SEPT. 2020 - SEPT. 2021

The Qawalangin Tribe is collecting mussels for PSP toxin level analysis to understand ongoing algal blooms and their impact on shellfish.

Samples will be collected at multiple sites and sent out every month.

When available, results will be shared on our website at [www.qawalangin.com](http://www.qawalangin.com)

This project will not determine if mussels are safe to harvest at specific areas.

**THE ONLY WAY TO BE CERTAIN THAT SHELLFISH ARE SAFE TO EAT IS TO BUY THEM FROM A COMMERCIAL SOURCE.**

This work is funded by NOAA's National Centers for Coastal Ocean Science Harmful Algal Bloom Event Response program.



# Online Resources to learn more

- Alaska Harmful Algal Bloom Network: <https://legacy.aaos.org/alaska-hab-network/>
- Southeast Alaska Tribal Ocean Research home page: <http://www.seator.org/>
- Sea Grant Alaska: <https://alaskaseagrant.org/our-work/harmful-algal-blooms/>
- U.S. National Office for Harmful Algal Blooms (Woods Hole Oceanographic Institute): <https://hab.whoi.edu/>
- NOAA Ocean Acidification home page (not directly addressing HABs or PSP, but interesting related ecology): <https://oceanacidification.noaa.gov/>
- NOAA National Centers for Coastal Ocean Science page with a lot of links to different HABs-related resources and projects: <https://coastalscience.noaa.gov/research/stressor-impacts-mitigation/>
- Link to research in the Gulf of Alaska: <https://coastalscience.noaa.gov/project/prevalence-of-paralytic-shellfish-toxins-in-marine-food-webs-of-prince-william-sound-and-kachemak-bay-alaska/>