Comparison of Alexandrium spp. surface sediment cyst maps from Quartermaster Harbor in 2007 and 2017

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The Spatial and Temporal Distribution of *Alexandrium* Cysts in Quartermaster Harbor

Cheryl Greengrove
Julie Masura
Thanh-Thuy Nguyen
Mitch Schatz
& a host of other UWT Students
Life Cycle of a Harmful Alga: *Alexandrium*

1. **cyst**
2. **vegetative cells**
3. **gametes**
4. **zygote**

Harmful Algal Bloom (HAB)

*http://www.whoi.edu/redtide/*

Dinoflagellate

Paralytic Shellfish Toxin (PST) Producer

*G. Hannach*

*A. Cox*
The Puget Sound *Alexandrium* Harmful Algal Bloom (PS-AHAB) project laboratory experiments found:

**Factors controlling cyst germination**
- Prefers light and warmer conditions

Puget Sound *Alexandrium* growth rates

Puget Sound *Alexandrium* are euryhaline (20-35 psu) with a broad optimal temperature range (13-24°C)

Why do we care?

What are the ways we can detect *Alexandrium* and Paralytic Shellfish Toxins (PSTs)?

- Cysts in the sediment
- Vegetative cells in the water column
- PSTs in shellfish
Alexandrium outbreaks, shellfish toxicity, & human illnesses have plagued Puget Sound for decades

Native American Stories & Ship Logs

HMS Discovery

1793

Captain George Vancouver
http://www.vancouvermaritimemuseum.com

PSP More Recently:
• 1942 – 3 deaths
• 2012 – 9 reported PSP illnesses
• Most years – shellfish bed closures

Shellfish Bed closures due to PST

Shellfish harvesting closures due to PST by decade in Puget Sound based on Washington State Department of Health (WDOH) monitoring data. Trainer et al. (2003)
Where are cysts located?

*2005 data from Horner et al. (2011): Harmful Algae
Maximum PST Levels in Shellfish
(ug/100 g shellfish tissue)

80 ug/100 g is the closure limit

Data courtesy of Washington State Department of Health
Quartermaster Harbor
*Alexandrium* in water column & PST in shellfish

80 ug/100 g is the closure limit
Comparison of *Alexandrium* cyst distribution in the surface sediments of Quartermaster Harbor

2007 Quartermaster Harbor Cyst Abundance

2017 Quartermaster Harbor Cyst Abundance

Vashon Island

Maury Island

Alexandrium spp. cysts/cc wet sediment

- 0
- 1 - 10
- 11 - 100
- 101 - 1000
- 1001 - 10000

Regression: $y = 0.4951x + 238.98$

$R^2 = 0.6486$
**Alexandrium cysts, grain size and TOC down core in Quartermaster Harbor**

**METHODS**


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**Diagram details:**

- **Piston Core** vs **Kasten Core**
- **Cysts/cc**
- **Clay %**, **Silt %**, **Sand %**
- **TOC**

**Dates:**

- 2005
- 2010
- 1950
- Close portage 1925
- 1900
WHY?

- Shallow incubator bay (light)
- The right water properties (temperature & stratification)
- Long residence time

Figure 19. Predicted flushing times for the inner bay based on e-folding time of flushed dye tracer after being initialized uniformly throughout the model (October 2009 shown).

Summary

- Quartermaster Harbor is a hotspot for *Alexandrium* cysts in the sediment, vegetative cells in the water column & PST in shellfish.

- Cyst distribution pattern in the bay remains fairly constant, but the absolute abundance of cysts varies from year to year.

- Factors contributing to making this bay *Alexandrium* heaven are that it is a shallow incubator bay with the right water properties and long residence time.
Questions?

Thanks

- PS-AHAB
- Washington State Department of Health
- A variety of funding agencies
- Captains & Crews of multiple vessels
- Many, many UWT Students