

## 2017 Plankton Monitoring Summary



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The Stream Team Collective partnered with Pacific Shellfish Institute (PSI) to conduct its sixth year of the “What’s Blooming in Budd?” phytoplankton monitoring program in Budd Inlet, downtown Olympia. The goal was to offer engaging hands-on activities that educated the public about local water quality issues and encouraged environmental stewardship. To meet this goal, volunteers met on Thursday afternoons between June and September at the Port Plaza dock to collect information about weather, tides, water temperature, salinity, and water clarity. A phytoplankton sample was also collected by performing a vertical net tow from a depth of 3 meters. Participants viewed and identified plankton on the dock using battery powered AmScope field microscopes.



*Citizen scientists at Port Plaza dock, July 13, 2017.*

After the plankton samples were collected, they were transported to LOTT’s WET Science Center classroom and projected onto a large screen where volunteers generated a complete list of species present. A 20-ml sample was also preserved and quantitatively screened for phytoplankton species known to produce biotoxins using Sound Toxins protocols.

The data was entered directly into NOAA/Sea Grant’s Sound Toxins monitoring database. Sound Toxins is a volunteer monitoring program designed to provide early warning of harmful algal blooms (HABs) in order to minimize human health risk and economic losses to fisheries. Monitoring results were also updated weekly on PSI’s “What’s Blooming in Budd?” web page which included a summary of citizen monitoring highlights, photos (plankton and volunteers), raw data and Final Reports from 2013-2017.

The “What’s Blooming in Budd?” data was also utilized by Washington Department of Ecology’s Eyes Over Puget Sound Program and Washington Department of Health’s Shellfish Program (WDOH). PSI corresponded with Dr. Christopher Krembs at Ecology 3 times and Jerry Borchert at WDOH 4 times regarding phytoplankton blooms and HAB species over the course of the monitoring season.

In mid-July, the “What’s Blooming in Budd?” program was featured in the Eyes Over Puget Sound July 24<sup>th</sup> Surface Conditions Report. Dr. Krembs contacted PSI – after being alerted to significant orange blooms in lower Budd Inlet – to coordinate a simultaneous flyover survey in conjunction with on-the-ground field sampling. Sampling revealed a bloom of the dinoflagellate *Ceratium fusus*.

**Aerial photography 7-24-2017**

Field log | Climate | Water column | Aerial photos | Streams

**What's Blooming in Budd?**  
 Pacific Shellfish Institute  
 Aimee Christy collected a 3m net tow sample from 2 lower Budd Inlet locations during the bloom and observed a thick tangle of *Ceratium fusus* (100X magnification).

*Ceratium fusus* (A) and one *Noctiluca* (B), and *Hypophysis* (C) under the microscope

Large, very patchy orange-brown bloom.  
 Location: Budd Inlet (South Sound), 11:56 AM.

*On-the ground sampling confirmed a bloom of Ceratium fusus (A) in lower Budd Inlet on July 24<sup>th</sup>. Also featured are the dinoflagellates, Noctiluca (B), and Protoperidinium (C).*

The “What’s Blooming in Budd?” program also provided data to WDOH during HAB occurrences. For example, PSI notified WDOH when *Dinophysis* cell counts increased or decreased significantly throughout the summer. *Dinophysis* concentrations increased to over 1,600 cells/L on July 6<sup>th</sup> resulting in a steady increase in the amount of biotoxin measured in WDOH’s routinely sampled mussel tissues. *Dinophysis* concentrations increased again in late August resulting in a shellfish harvest closure for Budd Inlet by mid-September when biotoxins exceeded the regulatory limit of 16 µg/100g tissue. This closure remains in effect to date (mid-October).

In addition to notifying WDOH when HAB species were blooming or dissipating, the data also assisted WDOH by collecting species specific information. DSP is produced by a suite of biotoxins including Okadaic Acid (OA) and dinophysistoxins (DTX 1,2, and 3). According to J.

Borchert, data suggests that *D. fortii* is typically associated with the production of OA, albeit at fairly low concentrations. Whereas, *D. acuminata* tends to produce DTX1 - the most common and toxic form – and DTX2 which was only recently detected in Washington State and is typically found on the East Coast.

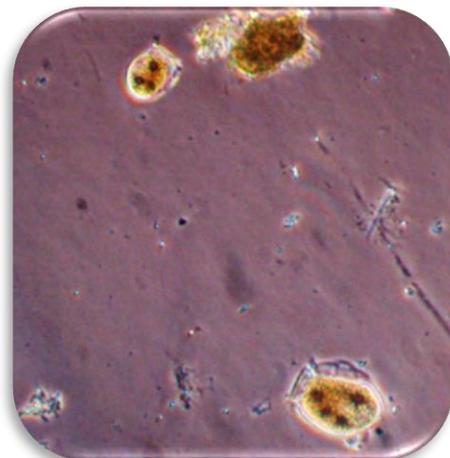
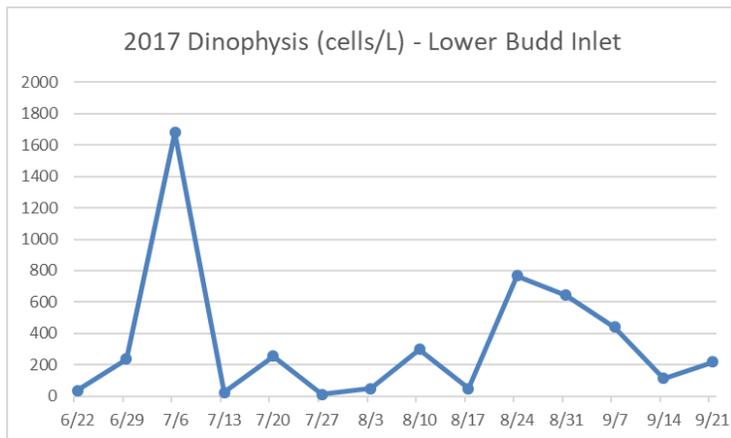


**Washington State Department of Health**  
Office of Environmental Health and Safety (360)236-3330

DSP Results  
Waterbody: Budd Inlet

Date Collected	Sample Site	Subsite	Species	DSP Result (µg/100g)	DSP Tissue	Collector
06/01/2017	Olympia	OYC	Blue Mussel	2	Whole	Department of Health
06/15/2017	Olympia	OYC		3	Whole	Department of Health
07/05/2017	Olympia	OYC		10	Whole	Department of Health
07/12/2017	Olympia	OYC		15	Whole	Department of Health

WDOH's July Biotoxin Report: DSP in blue mussels, Budd Inlet.



Plankton sample (Sept. 21) depicting *D. acuminata* (top left) and *D. fortii* (lower right). Note the small round shape of *D. acuminata* and larger lima bean shape of *D. fortii*.

**Results**

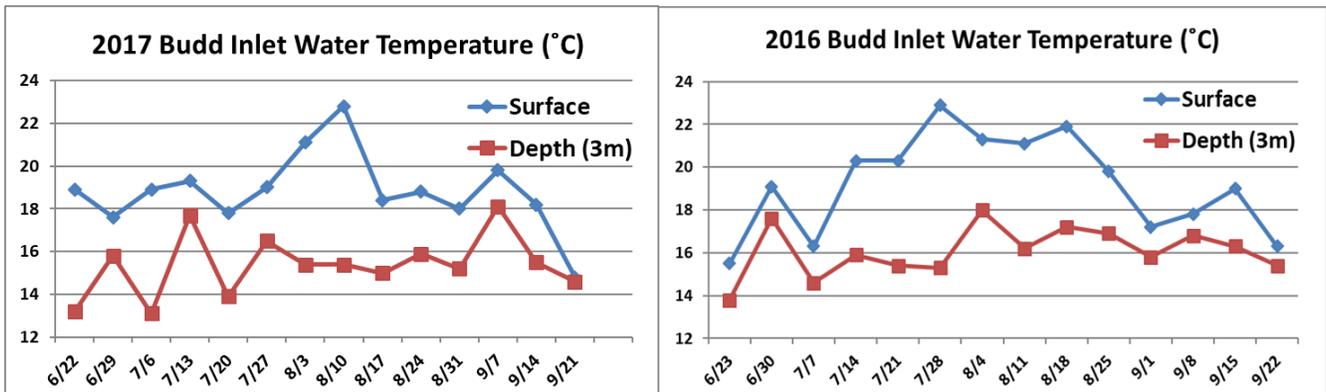
A total of 14 sampling events were conducted at Port Plaza between June 22<sup>nd</sup> and September 21<sup>st</sup> totaling 343 contacts with the public – a 23% increase from 2016. The average number of visitors was 24.5 (dock and LOTT combined), with the highest attendance on August 10<sup>th</sup> (n=69) with 38 individuals at the dock and 31 at LOTT. For this particular day, young scientists from Sequoia’s Treehouse Summer Camp were in attendance as well as adult students from the Saint Martin’s University Teaching program. Overall, a majority of the contacts (n=229) were made at the dock, while a smaller, yet significant number, occurred at the LOTT WET Center (n=114). Of the 82 parties that completed the “Sign-In” sheet, 46% were residents of Olympia, 16% were U.S. non-WA residents, 11% were WA residents living outside Thurston County, 10% were from

Lacey, 9% were from un-incorporated Thurston County, 6% from Tumwater, and 2% from outside the U.S.

PSI also attended the Summer Splash at the Hands On Children’s Museum on July 28<sup>th</sup>. For this event, PSI provided live plankton and macro-invertebrates for viewing under microscopes, a mussel filtration demonstration, and information about the “What’s Blooming in Budd?” and Sound Toxins phytoplankton monitoring programs. A total of 215 contacts were made.

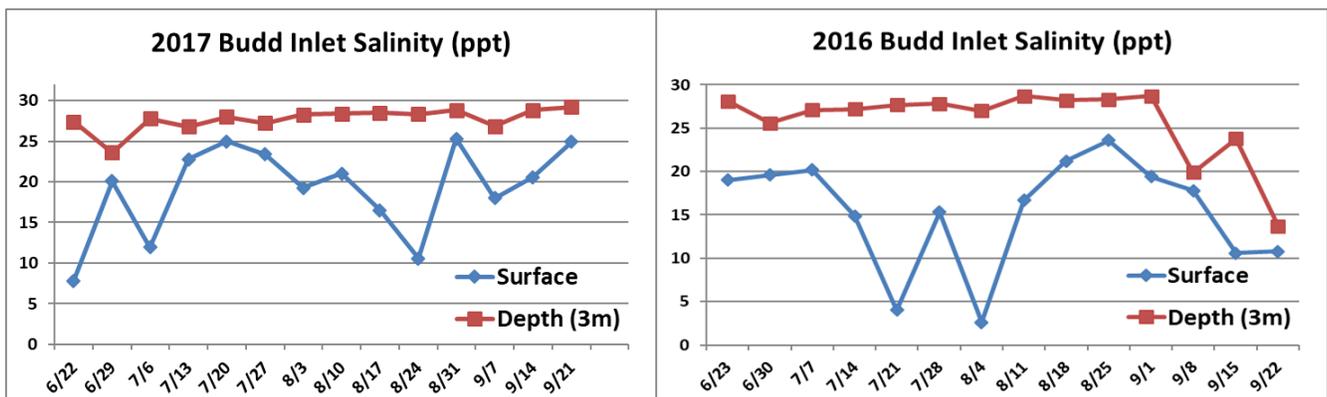
**Temperature**

Surface seawater temperatures ranged from 14.6°C to 22.8°C (58°F to 73°F), peaking on August 10<sup>th</sup> and then decreasing during the transition to fall. Surface temperatures exceeded 22°C every summer over the past 5 years except for in 2014. In 2015, temperatures exceeded 24°C (75°F) due to the unusually warm water mass in the North Pacific nicknamed “the blob.” (Refer to Stream Team’s 2015 Fall Edition newsletter for more information on the blob).



**Salinity**

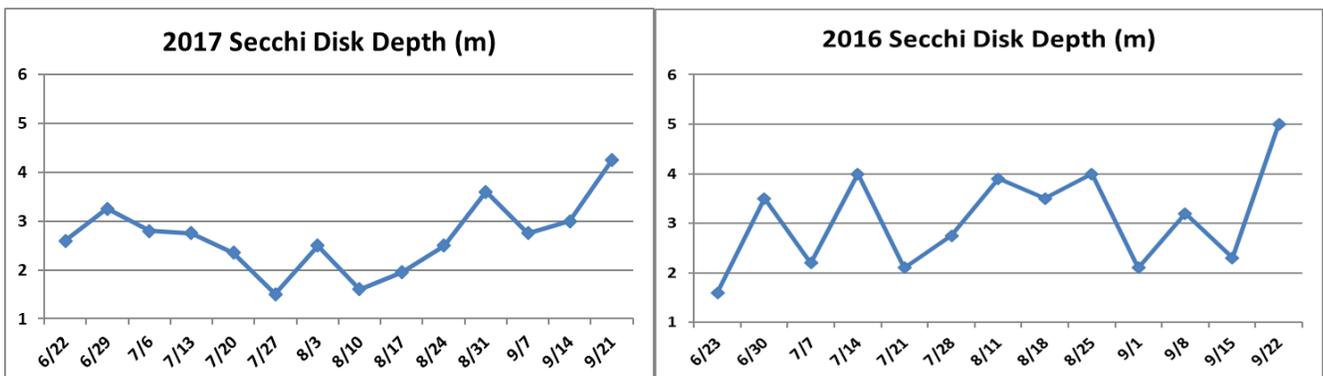
Salinity values fluctuated in surface waters this season, dropping below 10 ppt during two sampling events, June 22<sup>nd</sup> (8 ppt) and August 24<sup>th</sup> (10 ppt). The August drop in salinity was measured during low tide when the fresh water surface lens was most pronounced from the



Deschutes River. Similar to previous years, the salinity at 3 meters fluctuated little and was typically between 24 and 29 ppt.

### **Water Clarity**

Water clarity, or visibility, ranged from 1.5 meters (5 feet) on July 27<sup>th</sup> to 4.25 meters (13.9 feet) in late September. Overall, water clarity was approximately 10-14 feet both early and late in the sampling season when the water column was cooler and less stratified. As water temperatures and stratification increased, plankton blooms developed and water clarity declined. In late July and early August, a thick bloom of *Ceratium fusus* turned the water a dark reddish-brown color. Visibility dramatically increased on our last sampling event on September 21<sup>st</sup>, when *Ceratium fusus* and *Akashiwo sanguinea* were detected, but at much lower levels.



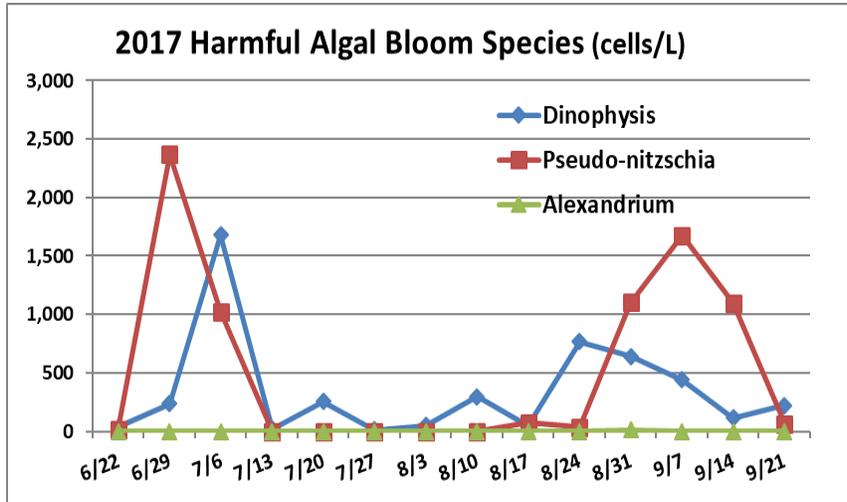
### **Plankton**

The total number of species (phytoplankton and zooplankton) observed in samples ranged from 11 species on August 3<sup>rd</sup> to 39 species on August 31<sup>st</sup>. The dinoflagellate, *Ceratium fusus*, dominated the samples throughout most of the season from mid-July to late September. *Akashiwo sanguinea* joined *C. fusus* as a co-dominant species from August 31<sup>st</sup> to the end of the sampling season. Notable blooms of less typical dinoflagellates included a *Protoceratium reticulatum* bloom

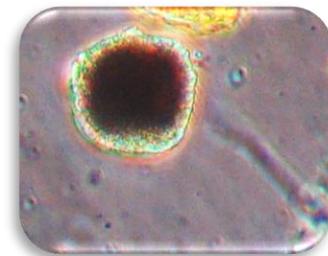


Phytoplankton sample (Aug. 31) displaying- from top to bottom - a chain of *Pseudo-nitzschia*, *Dinophysis fortii*, *Akashiwo sanguinea* (on its side) and *Ceratium fusus*.

on August 31<sup>st</sup> and *Prorocentrum spp.* bloom on September 14<sup>th</sup>. *Protocertium* is highly reticulated (meaning its plates display a net-like pattern), and is known to produce a biotoxin called yessotoxin. The threat posed by this toxin to human health, however, is poorly understood.



*Prorocentrum gracile* (top) overlying *Ceratium fusus*



*Protoceratium reticulatum*

During the 2017 season, harmful algal bloom (HAB) species *Dinophysis spp.*, *Pseudo-nitzschia sp.*, and *Alexandrium sp.* were observed. *Dinophysis*, the species responsible for Diarrhetic Shellfish Poisoning (DSP) was observed throughout the season blooming in early July and also late August. *Pseudo-nitzschia*, the HAB species responsible for Amnesic Shellfish Poisoning (ASP) was also detected in samples, particularly on 6/29 (2,369 cells/L) and 9/7 (1,673 cells/L). However, this species is frequently detected in south Puget Sound and, unlike when encountered on the outer Washington coast, rarely produces biotoxin. Only one solitary cell of *Alexandrium spp.* was observed in Budd Inlet on 8/31. *Alexandrium cantenella* is the species responsible for Paralytic Shellfish Poisoning (PSP).

### Conclusions

The 2017 “What’s Blooming in Budd?” events attracted an average of 24.5 volunteers per sampling event— an increase from 2016’s average of 20 individuals per event. Community members enjoyed learning about water quality issues in Budd Inlet such as



eutrophication and HABs while collecting useful data for the Sound Toxins monitoring program. Information about the plankton monitoring events, including up-to-date water quality and plankton data, were available to the public by visiting the “What’s Blooming in Budd?” web page hosted on PSI’s web site.

### Acknowledgements

Thank you to the Stream Team Collective for supporting the “What’s Blooming in Budd?” program and the staff at LOTT for welcoming us into the WET Center to view plankton. Thank you to the Port of Olympia for granting us permission to use the Port Plaza dock. The program attracted many enthusiastic participants and has generated six years of water quality and phytoplankton data for lower Budd Inlet.

A big thank you to all of the volunteers that helped collect data this season. And a special “shout out” to Roberta Woods, an extraordinary volunteer that participated in every phytoplankton monitoring event over the past couple of summers. PSI appreciates your time and dedication to the program – it is a pleasure having you!

