2019 “What’s Blooming?”
Plankton Monitoring Final Report

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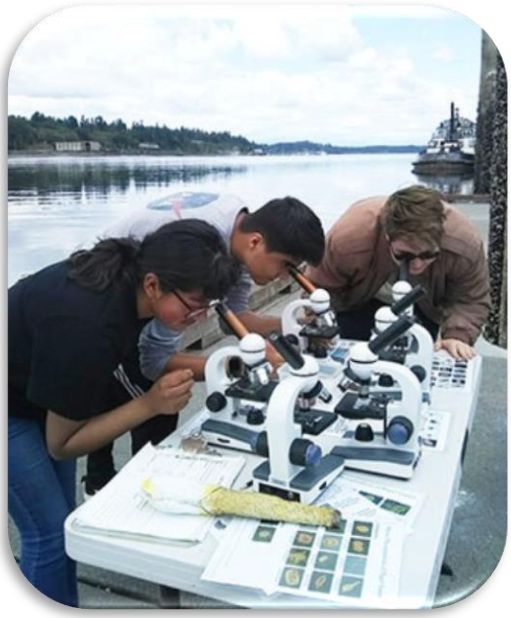
The Stream Team Collective partnered with Pacific Shellfish Institute (PSI) to perform its eighth year of the “What’s Blooming?” phytoplankton monitoring program. This year, in addition to sampling at Budd Inlet (7 events), PSI also hosted events at Long Lake Park in the City of Lacey (3 events). PSI also provided activities at community events including Lacey’s Family Fish-In, Tumwater’s World Ocean Day Celebration, and Tumwater’s Return of the Salmon Celebration. Finally, PSI delivered hands-on presentations to 100 students from River Ridge and North Thurston High Schools at the Nisqually Reach Nature Center. The overarching goal was to offer engaging hands-on activities that educate students and the public about local water quality issues and encourage environmental stewardship.



2019 Event Summary

Event	# Events	Location	Contacts
What's Blooming in Budd?	7	Olympia	114
What's Living in Long?	3	Lacey	31
Lacey Family Fish In	1	Lacey	50
River Ridge High School Field Trip	1	Lacey	58
North Thurston High School Field Trip	1	Lacey	41
World Ocean Day Celebration	1	Tumwater	50
Return of the Salmon Celebration	1	Tumwater	200
TOTAL			**544**

For the “What’s Blooming in Budd?” and “What’s Living in Long Lake?” events, participants met on Thursday afternoons between June and August to collect information about weather, tides, water temperature, salinity, water clarity, and phytoplankton assemblages. Phytoplankton samples were viewed using field microscopes and then transported to PSI where staff generated a complete list of species present. A 20-ml sample was preserved and quantitatively screened for phytoplankton species known to produce biotoxins using Sound Toxins protocols. Long Lake samples were screened for species abundance and the presence of blue-green algae. Volunteers also completed a WDOE Algae Sampling Data Supplemental Information form to record information about lake use (boats, swimmers, fishing, dogs), weather conditions, and surface scums.

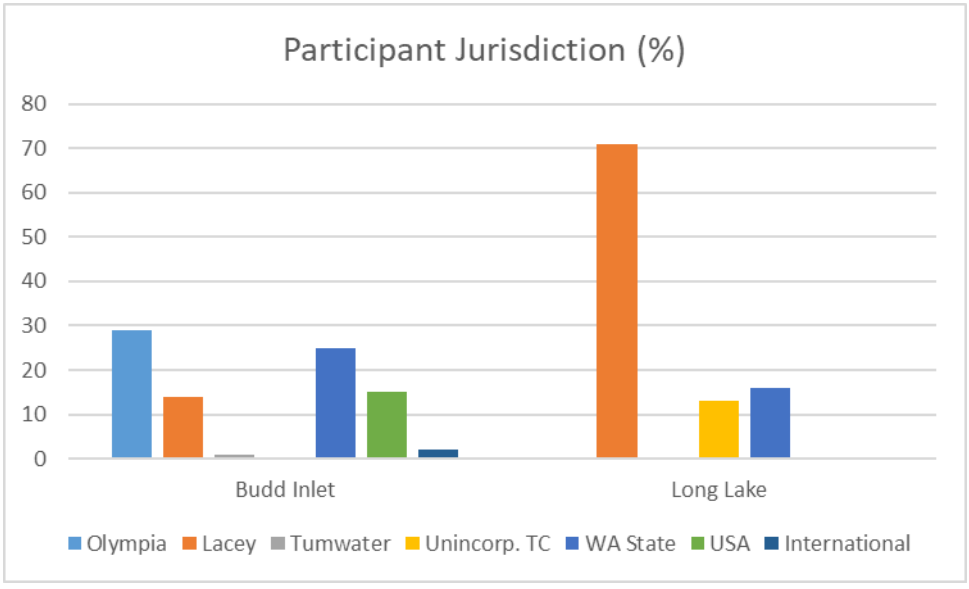
Budd Inlet data was entered directly into NOAA/Sea Grant’s Sound Toxins monitoring database. Sound Toxins is a volunteer monitoring program designed to provide early warning of harmful algal blooms (HABs) in order to minimize human health risk and economic losses to fisheries.

Monitoring results were also updated weekly on PSI's "What's Blooming in Budd?/What's Living in Long Lake?" web page which included a summary of citizen monitoring highlights, photos, raw data and Final Reports from 2013-2019. This year's weekly web page entries are archived at the end of this report.

Results

A total of 10 sampling events were completed between June 20th and August 29th totaling 145 contacts with the public. The average number of attendees was 16 per event at Budd Inlet and 10 per event at Long Lake. In 2018, average numbers were 15 and 10 respectively. The highest attendance occurred at Budd Inlet on June 20th with 25 individuals at the dock.

"Sign-In" information was collected from 145 individuals at Budd Lake (n=114), and Long Lake (n=31). Over 29% of attendees at the Budd Inlet events lived in Olympia, with 25% visiting from Washington State, 17% outside of WA, and 14% from Lacey. Seventy-one percent of Long Lake participants lived in the City of Lacey, 16% from WA State and 13% from Unincorporated Thurston County.



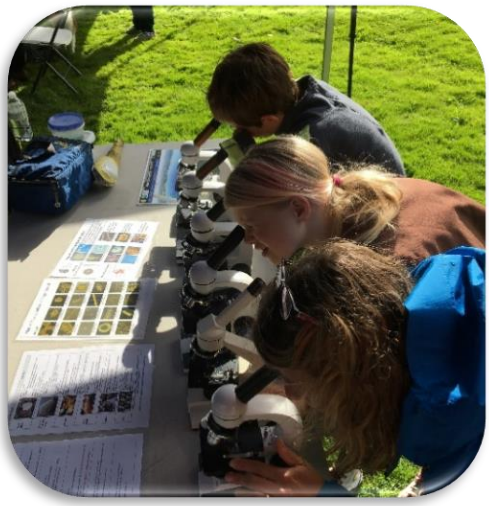
PSI also participated in 1) the Lacey Family Fish-In on 4/13/19; 2) field trips with students from River Ridge High School (58 students) and North Thurston High School (41 students) at the Nisqually Reach Nature Center on 5/30/19 and 5/31/19; 3) World Ocean Day Celebration at

Tumwater Falls Park on 6/10/19; and 4) the Tumwater Falls – Return of the Salmon event on 10/5/19. In all, PSI reached 544 individuals at 15 events, for an average of 36 contacts per event.

Kids observe the base of the food chain after fishing at Woodland Creek Community Park during the Family Fish-In.

After learning about salmon and water quality, contestants compete to toss the doggie doo in the can during World Ocean Day, Tumwater Falls Historic Park.

High school students collect water quality data to compare and track plankton assemblages, oxygen levels, and pH in Budd Inlet and Nisqually Reach, Nisqually Reach Nature Center.

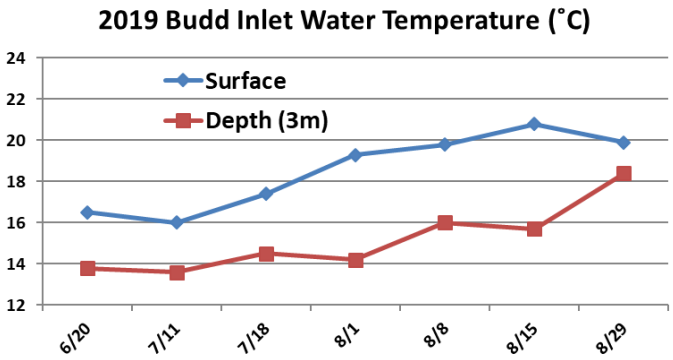


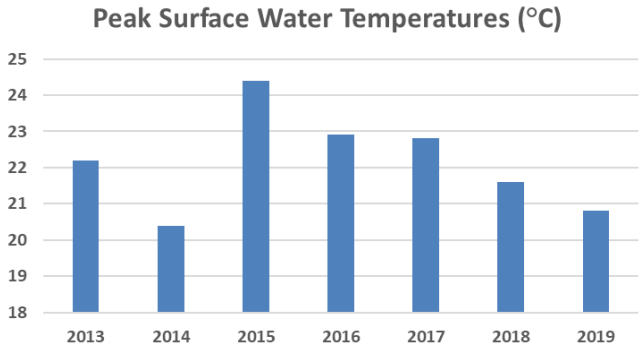
Young scientists learn about salmon and observe the Fall plankton bloom during the Return of the Salmon event at Tumwater Falls Historic Park.

Budd Inlet

Temperature

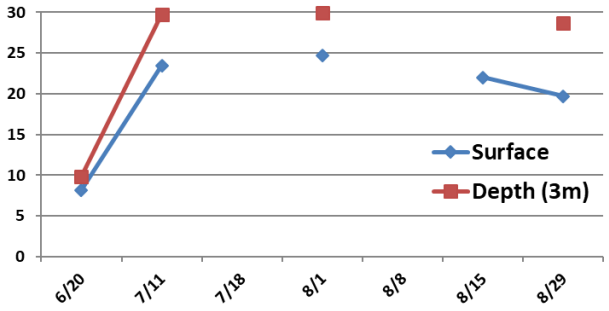
Surface temperatures ranged from 16.0°C in July to 20.8°C during mid- August. Temperatures at 3 meters were cooler ranging between 14.0°C and 18.0°C. Overall, this year's water temperatures were quite mild - similar to 2014. In 2015, temperatures exceeded 24°C (75°F) due to the unusually warm water mass in the North Pacific nicknamed "the blob."

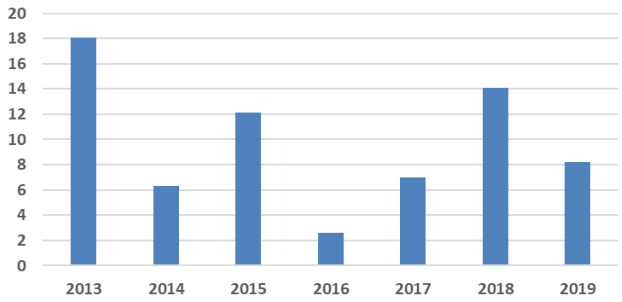




Salinity

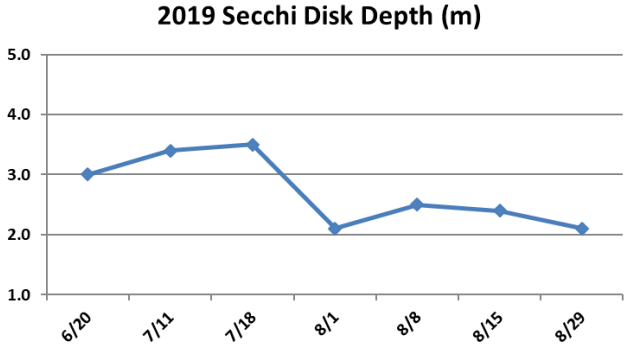
The salinity probe worked intermittently throughout the season and ultimately needed to be replaced in late August. Several surface values were generating using a handheld refractometer. From the data collected, surface waters contained more fresh water than the higher density, saltier waters (29 ppt) at 3-meters depth. On June 20th, the outgoing low tide may have carried fresh water from the Deschutes River and Capitol Lake past Port Plaza during sampling. Marine species in lower Budd Inlet prove to be quite resilient to salinity fluctuations.

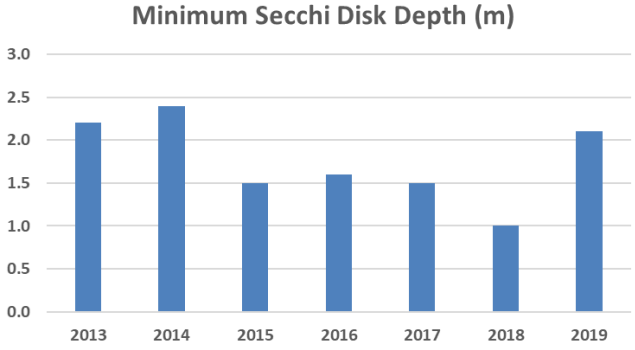




Water Clarity

Water clarity, or visibility, ranged from 3.5 meters in July to 2.1 meters in August. Over the past 4 years, water clarity had been declining, dropping to as low as 1-meter in 2018! This year,

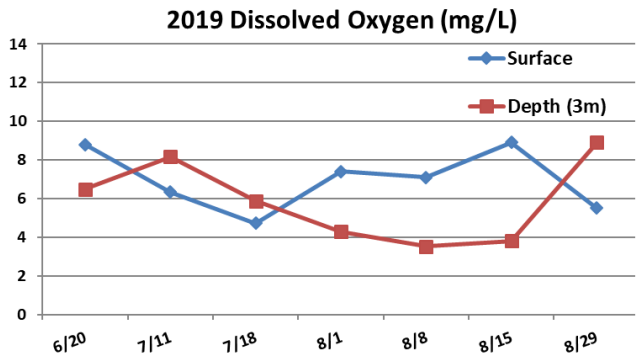


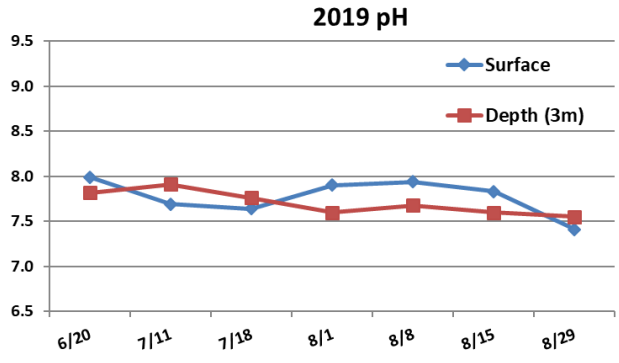


while blooms of *Ceratium fusus*, *Akashiwo sanguinea* and *Noctiluca scintillans* were still present, visibility remained much higher.

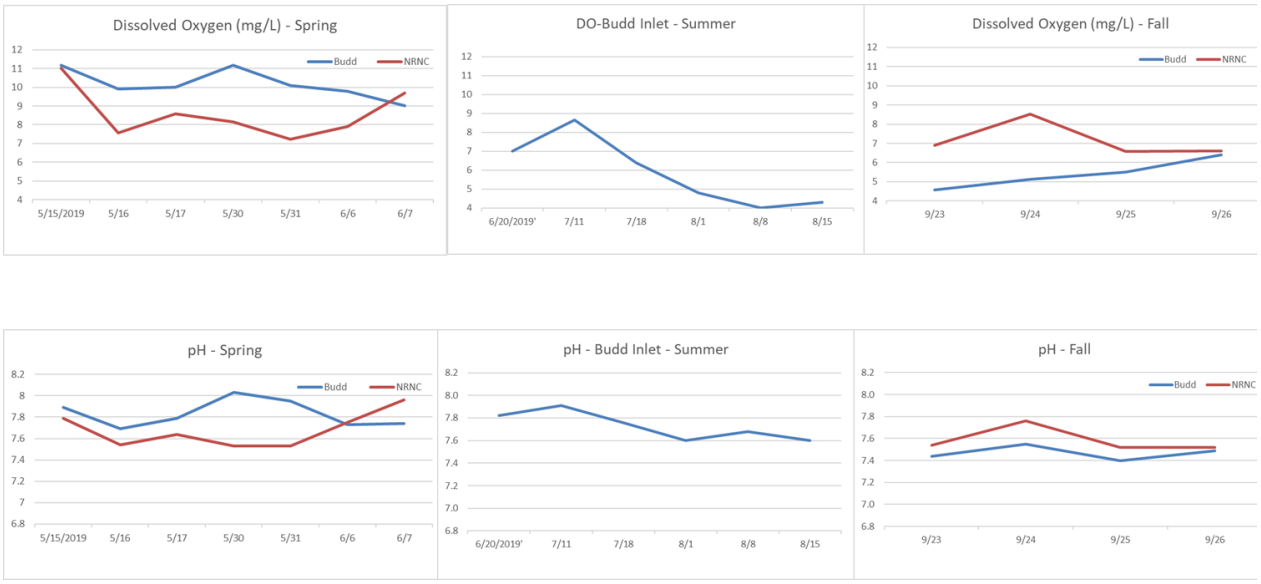
Dissolved Oxygen and pH

Phytoplankton concentrations are important drivers behind dissolved oxygen (DO) levels and pH throughout the water column. As surface phytoplankton concentrations increase, their photosynthetic activity utilizes dissolved carbon dioxide and releases dissolved oxygen. As carbon dioxide is removed from the water, the pH becomes less acidic, or increases. At depth, DO levels and pH respond more to phytoplankton decomposition. As plankton cells settle to the bottom of the Inlet, the process of bacterial decomposition utilizes DO and releases carbon dioxide into the water column decreasing both oxygen and pH levels. Therefore, DO and pH levels at depth tend to be lowest in late summer and early fall. This seasonal pattern was represented in Budd Inlet with DO levels at depth decreasing from 8 mg/L in early July to 3.5 mg/L in August. pH values decreased from 7.9 to 7.5 during this same timeframe.





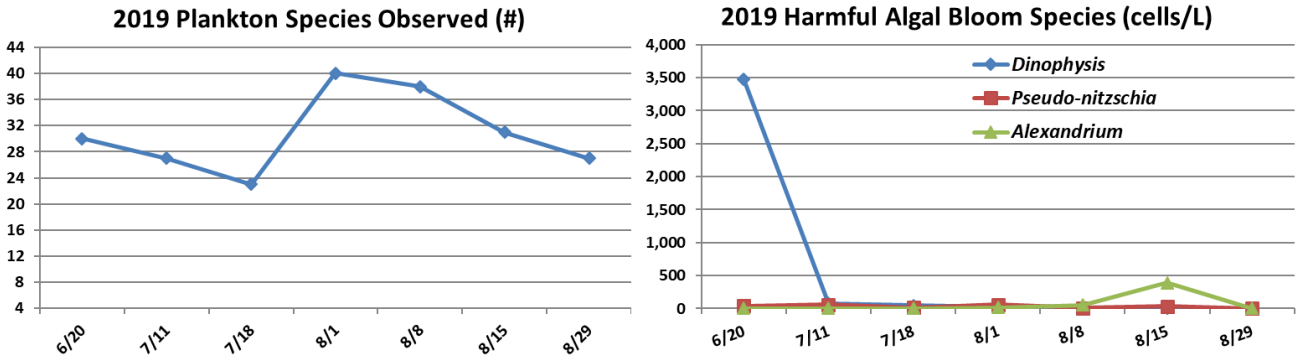
During Spring and Fall of 2019, PSI partnered with South Sound GREEN and the Nisqually River Education Project to conduct middle school and high school field trips to hundreds of students at the Nisqually Reach Nature Center. Stream Team covered PSI's time for two of these trips. During the events, students compared phytoplankton concentrations, DO, pH, and water clarity between Budd Inlet and Nisqually Reach. Students observed the influence of phytoplankton on DO and pH - both seasonally and over the course of the day. For example, data collected during the spring indicated that DO and pH were higher at Budd Inlet (11 mg/L, 8 pH) due to dense phytoplankton concentrations. However, when students measured DO and pH in the fall, levels were lower at Budd Inlet (4.5 mg/L, 7.4 pH), despite consistently denser phytoplankton concentrations. Why is this? While it is true that phytoplankton produce oxygen during photosynthesis, bacterial decomposition of plankton at depth during late summer/early fall carries a stronger signature. When PSI added summer data collected from the "What's Blooming in Budd?" program, it connected the spring and fall data sets seamlessly! This data was shared with all of the teachers that participated in the field trips.



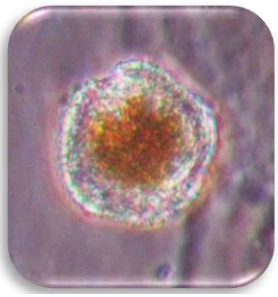
Student collected oxygen and pH data from Budd Inlet and Nisqually Reach (NRNC) during Spring (left) and Fall (right). Budd Inlet's "What's Blooming?" data (center) completes the gap - illustrating what happens in Budd during the Summer.

Plankton

The total number of species (phytoplankton and zooplankton) observed in samples ranged from 23 species in July to 43 species in early-August with an average of 31 species. Diversity declined throughout August as the composition transitioned to a handful of dinoflagellate species.



The monitoring season started in June with an early bloom of the dinoflagellates *Ceratium fusus*, *Akashiwo sanguinea* and *Dinophysis spp.* In July, the assemblages looked more typical of early summer as the diatom *Thalassiosira* spp. bloomed. In August, the diatoms *Thalassiosira* and *Leptocylindrus* continued to bloom and were joined by *Akashiwo*, *Ceratium*, *Noctiluca, and Protoperidinium*. The dinoflagellate, *Protoceratium reticulatum* was also common during August – noteworthy in that it is known to produce Yessotoxin and has been observed more frequently in south Puget Sound in recent years. This year, *Dinophysis*, the species responsible for Diarrhetic Shellfish Poisoning (DSP) was detected at a high concentration on June 20th (3,476 cells/L) – higher than

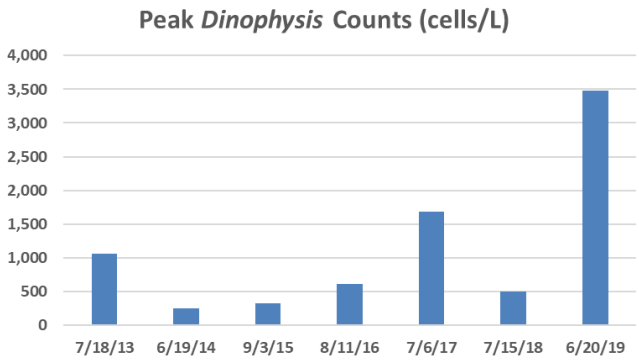


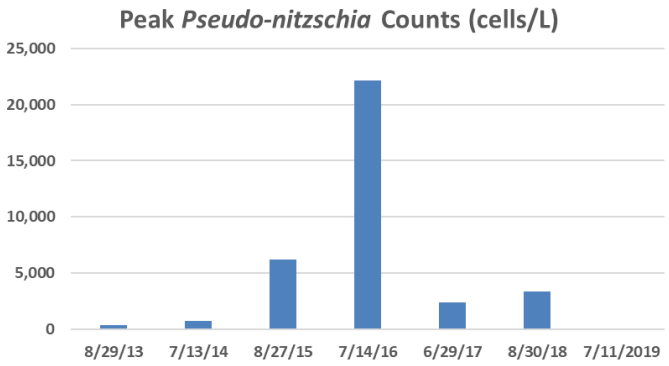
Protoceratium reticulatum - common in Budd Inlet during August.

observed during the last 6 years of the "What's Blooming" program. The DSP toxin levels in mussel tissue was 3-4 µg/100 mls on 6/11 and 6/26 according to Washington Department of Health. These levels never exceeded the shellfish bed closure limit of 16 µg /100 mls. Interestingly, on November 19th, PSI detected *Dinophysis* concentrations above 2,000 cells/L. DSP toxin levels climbed to 136 µg /100ml closing Budd Inlet to shellfish harvesting.

Two species of Dinophysis (left), Ceratium fusus (center) and Akashiwo sanguinea (right).

Pseudo-nitzschia, the HAB species responsible for Amnesic Shellfish Poisoning (ASP) was absent throughout most of the season. A few solitary cells of *Alexandrium spp.* were observed in Budd Inlet during August. *Alexandrium cantenella* is the species responsible for Paralytic Shellfish Poisoning (PSP). The following charts depict peak *Dinophysis* and *Pseudo-nitzschia* levels over the past 7 years.





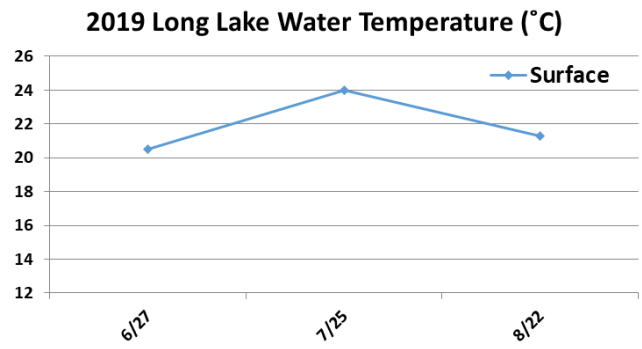
Long Lake

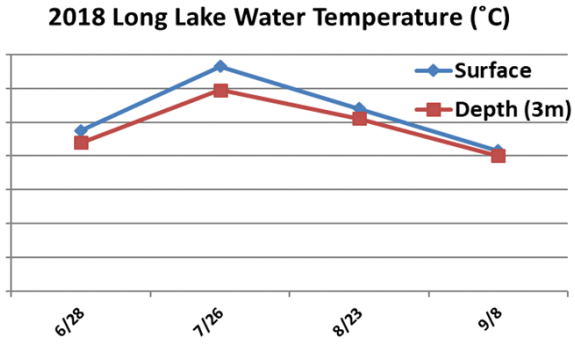
In 2019, PSI hosted 3 water sampling events at Long Lake. This year, the dock was removed, so data was collected from shore and surface/depth comparisons were not possible. Water quality in Long Lake is comparable to Puget Sound in many ways. The lake is sensitive to nutrients, increased light and water temperature which – similar to Budd Inlet – can stimulate algae blooms that influence water clarity, dissolved oxygen, pH, and HAB species. Lakes are especially susceptible to blooms of cyanobacteria, or blue-green algae; some of which produce toxins that can close lakes to swimming and other recreational uses. Swimmers, wildlife and dogs can become ill after contacting water during toxic blue-green algae blooms. In rare cases, humans may

experience stomach pain, vomiting, diarrhea or develop allergic reactions to the skin, eyes, and throat. Lakes are cooperatively monitored for biotoxins by Thurston County Environmental Health and Washington Department of Ecology's freshwater algae monitoring programs. Water samples are collected monthly – with increased sampling during bloom events – and tested for anatoxin-a, microcystin, saxitoxin and cylindrospermopsin. For more information about blue-green algae, refer to Thurston County Environmental Health's web page: www.co.thurston.wa.us/health/ehadm/swimming/blue_green_algae.html.

Temperature and Salinity

Surface water temperatures in Long Lake were much higher than Budd Inlet ranging from 20.0°C in June to 24.0°C in July before falling to 21°C in August. Temperatures were slightly warmer last summer, but the overall pattern was similar. Long Lake salinity measured between .07 and .13 ppt.

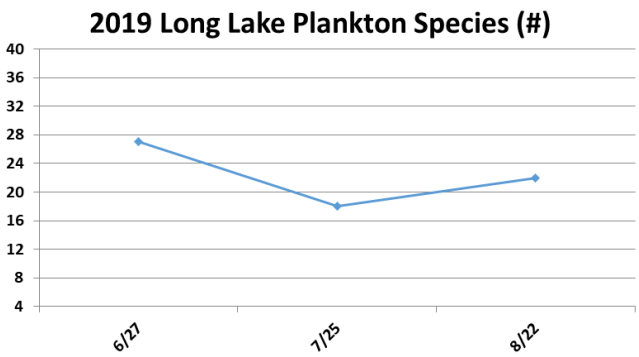


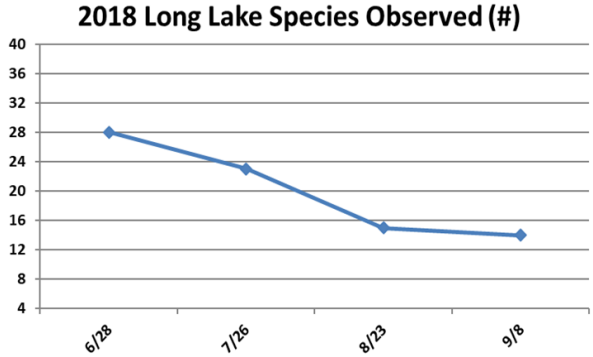


Water Clarity and Species Diversity

With the absence of the dock, water clarity could not be measured using a secchi disk. However, the lake was closed at the time of the August 22nd event due to the visibility being less than 4-feet. Last year, water clarity was also poor enough to close the lake to swimming during late-August and early-September.

Species diversity was highest during June in both 2018 and 2019.



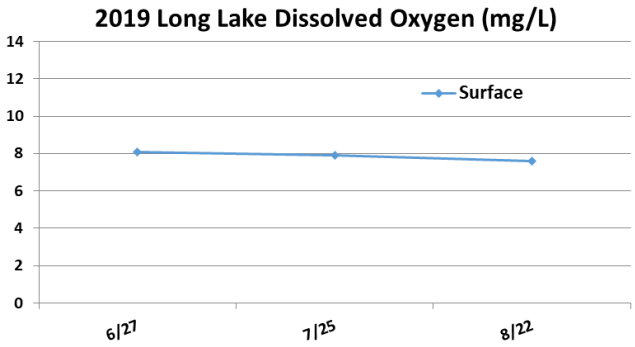


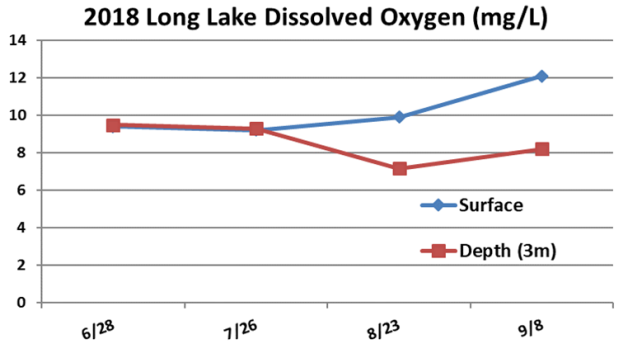
Dissolved Oxygen and pH

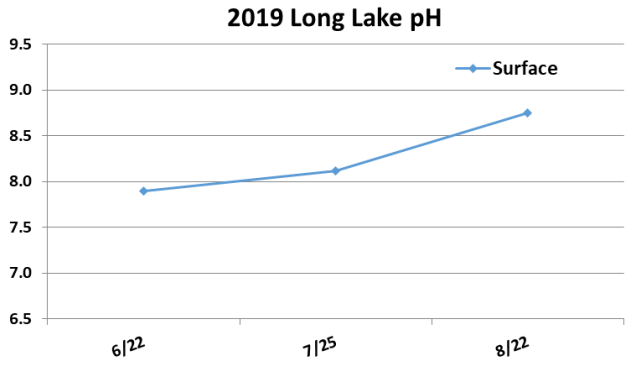
Cyanobacteria are like typical bacteria in that they lack a nucleus, but similar to green plants in that they make their own food by photosynthesis. In surface waters, photosynthesis by microscopic algae results in the removal of carbon dioxide from the water and production of oxygen, thus increasing pH and DO levels. At depth, algae are decomposed by bacteria resulting in decreased DO and pH.

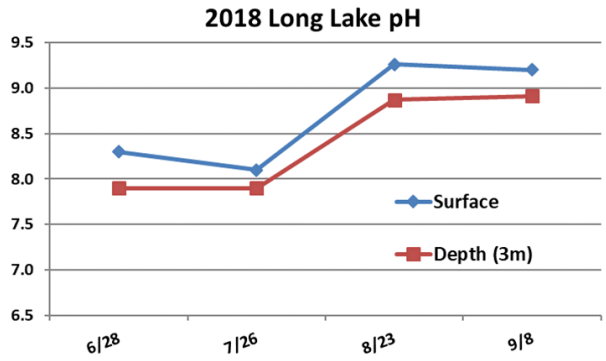
Swimming area closed at Long Lake on 8/23/18

This summer, the DO at the shore remained consistent around 8 mg/L. Unlike last year, DO levels did not increase during the late summer cyano-bacteria bloom. During the same time period, pH increased from 7.9 to 8.7 following a similar trend to last year with pH values increasing during the bloom.









Plankton

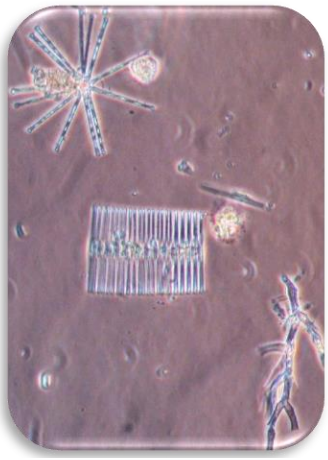
Long Lake experienced a variety of diatoms, dinoflagellates and zooplankton species, particularly in early summer. In June, *Dinobryon*, *Asterionella* and *Fragilaria* were blooming. In July, *Tabellaria* was blooming, and *Asterionella*, *Fragilaria* and the cyano-bacteria,

Aphanizomenon, were common. By August, the sample was dominated by not only *Aphanizomenon*, but also, *Anabaena*, recently renamed *Dolichospermum. Dolichospermum* can produce the toxin microcystin. *Aphanizomenon* can produce a suite of toxins including anatoxin-a, saxitoxin and cylindrospermopsin.

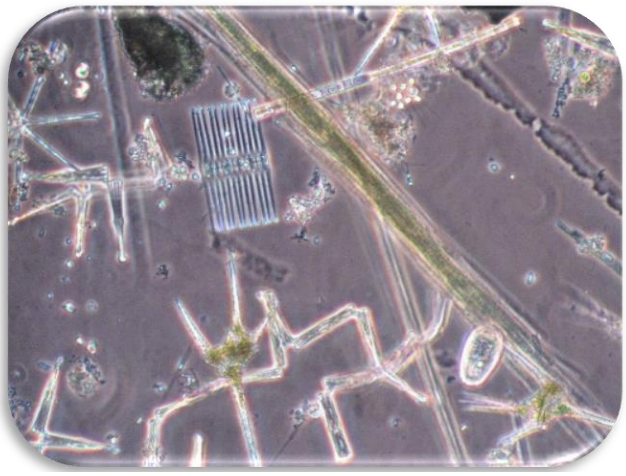
The lake was closed to swimming in August due to poor visibility. State laboratory results from June to late-October indicated that microcystin levels never exceeded the Health Advisory Level of 6.0 µg/L. Anatoxin-a, saxitoxin, and cylindrospermopsin were also sampled on 6/17, 8/29 and 9/25, but remained below the Method Detection Limit (MDL). Regardless, the swimming area was closed for safety between late August and October due to poor visibility and increasing levels of microsystin.

Site	Collection Date	Microcystin (ug/L)	Above State Guideline
Long Lake	6/17/19	<MDL	No
Long Lake	8/29/19	<MDL	No
Long Lake	9/25/19	3.2	No
Long Lake	10/1/19	3.8	No
Long Lake	10/16/19	5.2	No
Long Lake	12/23/19	1.5	No
Long Lake	10/28/19	2.1	No

Source: Washington State Toxic Algae Program: https://www.nwtoxicalgae.org/FindLakes.aspx



Asterionella (left), Fragilaria (center), Dinobryon (right), June 27.



Tabellaria (throughout), Ceratium (3-horned dinoflagellate), Aphanizomenon (green filamentous), July 25.

Keratella (left), Dolichospermum (lower spiral), Aphanizomenon (green filamentous), August 22.

Conclusions

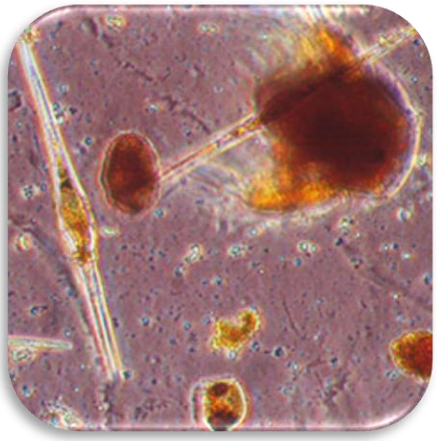
The 2019 “What’s Blooming?” events engaged many community members at Budd Inlet, Long Lake Park and Tumwater Falls Park. Participants enjoyed connecting with their watershed and learning about water quality issues such as eutrophication, HABs, and even bacteria and plastics pollution. Participants’ data contributed to the Sound Toxins database allowing the community, scientists, and resource managers to better understand HAB trends over time and protect human health. We look forward to continuing this program in the future to provide the community with educational citizen science monitoring opportunities that enrich our understanding of Puget Sound.

Acknowledgements

Thank you to the Stream Team Collective – interns and staff! - for supporting and participating in the “What’s Blooming?” program. Thank you to the Port of Olympia for granting permission to use the Port Plaza dock for educational activities. And finally, a big “Thank You” to all the citizen scientists that helped collect data and make every sampling event exciting, fun, and educational.

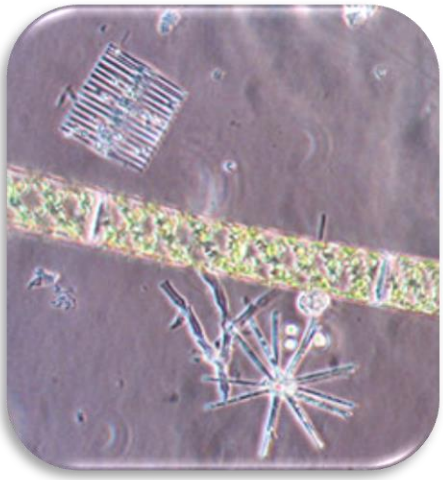
2019 Weekly Plankton Summary Archive

Location: Budd Inlet Port Plaza
Dock Date: June 20, 2019
Vertical Net Tow Depth: 3 meters
Dominant Species: *Ceratium, Akashiwo, Dinophysis*
Common Species: *Cylindrotheca, Protoperidinium*
# of Species Observed: 30
Harmful Algal Bloom (HAB) species: *Pseudo-nitzschia, Dinophysis (blooming!)*
# of HABs per drop: *Pseudo-nitzschia: 7, Dinophysis: 584*



Happy Summer!
What a beautiful day to kick off the plankton sampling season at Budd! We had many locals as well as out-of-state guests from Arizona, Oregon and Colorado. The tide was very low and many were amazed that the water would rise 16+ feet within the next 8 hours! The water was thick with dinoflagellates. Blooming species included *Akashiwo sanguinea*, *Ceratium fusus*, and *Noctiluca* (the bioluminescing one!). The harmful algal bloom species, *Dinophysis*, continues to bloom! PSI has been collecting samples all spring and this species has been blooming since late May. We also saw zooplankton such as copepods, crustacean nauplii, tintinnids, tiarina, and rotifers. Oh my! Next week, we'll start our sampling at Long Lake Park. Come join us!

Location: Long Lake
Dock Date: June 27, 2019
Vertical Net Tow Depth: surface
Dominant Species: *Dinobryon, Asterionella*, and *Fragilaria*
Common Species: *Ceratium*, rotifers
# of Species Observed: 27
Harmful Algal Bloom (HAB) species: *Anabaena (renamed Dolichospermum), Aphanizomenon*
# of HABs per drop: not quantified

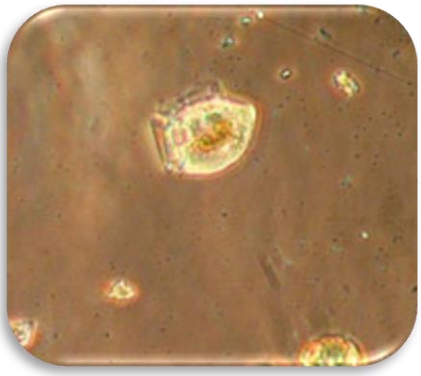


This week, PSI and City of Lacey StreamTeam kicked off the plankton sampling season at Long Lake Park. The weather forecast was for heavy rain and possible thunder showers, but it was sunny and muggy instead. We were entertained with hula hoopers (!), great music, and baby ducklings! The lake was warm (20.5°C) and dissolved oxygen and pH were looking good at 8.09 mg/L and 7.9 respectively.

In the microscopic world, the lake was blooming with phytoplankton such as *Dinobryon, Asterionella*, and *Fragilaria*. Also common was the dinoflagellate, *Ceratium*, and rotifers (zooplankton). The bluegreen algae species (*Anabaena* and *Aphanizomenon* – referred to as Annie and Fannie for short) were in the water at very low numbers. These two can sometimes produce biotoxins that make the lake unsafe for swimming. Overall, the water looked great and we noted at least 27 different planktonic species swimming in our samples.

Be sure to come on down to the lake on August 22 to find out What's Living in Long Lake!

Location: Budd Inlet Port Plaza
Dock Date: July 11, 2019
Vertical Net Tow Depth: 3 m
Dominant Species: *Ceratium,Thalassiosira*
Common Species: *Dinophysis, Protoperidinium*
# of Species Observed: 27
Harmful Algal Bloom (HAB) species: *Dinophysis*, *Psuedo-nitzschia*
# of HABs per drop: *Dinophysis*: 13; *Psuedo-nitzschia*: 10



This was our second "What's Blooming in Budd?" event for the summer season. The farmers market was in full swing and the dock at Percival landing was busy with boats, families, and even one brave diver! Children and adults alike stopped in to check out the several species of phytoplankton and zooplankton under the microscopes. One of the microscopes had a larval barnacle, and the visiting families learned

that barnacles have a microscopic free swimming stage before settling down onto rocks or pilings. There was also a lot of *Ceratium* present. This phytoplankton species is responsible for the rust-colored tint to the water that you may see from the dock.

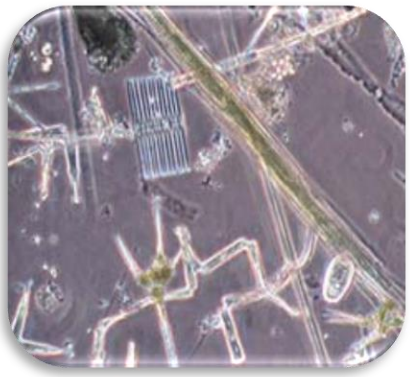
It was a cloudy day, but 70° Fahrenheit and humid on the dock. The water temperature was significantly cooler: about 56° Fahrenheit three meters below the surface. As it was high tide, the salinity was elevated at 29.74 parts per thousand (lots of ocean influence!) Read more about this week's water quality data as well as archived data from past summers by clicking on the "Raw Data" link.

Location: Budd Inlet
Dock Date: July 18, 2019
Vertical Net Tow Depth: 3 m
Dominant Species: *Ceratium,Thallassiosira*
Common Species: *Akashiwo, Protoperidinium*
# of Species Observed: 23
Harmful Algal Bloom (HAB) species: *Dinophysis*, *Psuedo-nitzschia*
# of HABs per drop: *Dinophysis*: 2; *Psuedo-nitzschia*: 8

Welcome back sunshine! We are happy to see you, and so are the many blooming species of phytoplankton and zooplankton in Budd Inlet. Photosynthesizing phytoplankton need sun and nutrients, just like the plants here on land. Of course, when there are abundant microscopic plants to eat, there are plenty of microscopic animals (zooplankton) ready to graze! Today we saw lots of *Thalassiosira, Ceratium*, and *Akashiwo* in our sample. *Dinophysis* (the plankton that causes diarrhetic shellfish poisoning) is still declining.

It's fascinating to witness the microscopic world come to life right in the heart of Olympia! Today lots of out-of-state visitors came to check out the event. The local Harbor patrol also stopped in for a quick look at the microscopes! Regardless of where you live, if you've visited us at Percival Landing, hopefully you have a new appreciation for each drop of water in the Puget Sound. For more fun with plankton stop by and see us for "What's living in Long Lake" next week!

Location: Long Lake
Dock Date: July 25, 2019
Vertical Net Tow Depth: surface tow
Dominant Species: *Tabellaria, Asterionella, Fragilaria*
Common Species: *Aphanizomenon, Melosira*
# of Species Observed: 18
Harmful Algal Bloom (HAB) species: *Aphanizomenon, Anabaena*
# of HABs per drop: *not quantified*



What a gorgeous day to be at Long Lake! Surface waters measured at 75°F and many folks were enjoying a nice swim in the lake. What were they swimming in? Phytoplankton of course! Dissolved oxygen levels were at 96% as these microscopic plants were actively photosynthesizing and converting carbon dioxide into oxygen and the simple sugars that sustain life at the base of the food chain.

We observed over 18 different species in our plankton sample including diatoms such as *Fragilaria, Asterionella*, and *Tabellaria*; the dinoflagellate *Ceratium*; and zooplankton such as rotifers and copepods. *Aphanizomenon* was quite common as well. This species is a blue-green algae, or cyanobacteria, that is monitored by Thurston County Environmental Health and Washington Department of Ecology. To keep tabs on Thurston County Toxic Blue-Green Algae Advisories, visit: https://www.co.thurston.wa.us/health/ehadm/swimming/blue_green_algae.html

Thanks to all the young scientists that helped us collect our data today! Next Thursday, we will be back at Budd Inlet sampling from the dock at Port Plaza by the Farmers Market. Hope to see you there!

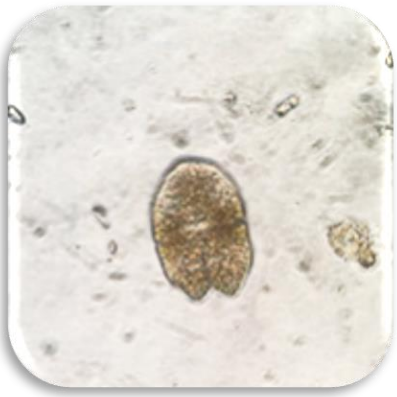
Location: Budd Inlet Port Plaza
Dock Date: August 1, 2019
Vertical Net Tow Depth: 3m
Dominant Species: *Thalassiosira*
Common Species: *Akashiwo, Ceratium, Noctiluca*
# of Species Observed: 40
Harmful Algal Bloom (HAB) species: *Pseudo-nitzschia, Dinophysis, Alexandrium*
# of HABs per drop: *PN = 10 cells, Dinophysis = 5 cells, Alex = 2 cells*

Another beautiful day in paradise! The Farmers Market was hopping and lots of folks were enjoying the waterfront. A couple of harbor seals even popped their heads up to check us out. It was a -3.4 foot low tide at 1:00 and the ramp down to the dock was very steep! In fact, our young scientists measured the water depth at only 9 feet using a depth gauge. The water was warm (19.3°C) and the water was a bit murky from not just phytoplankton, but a bit of sediment/organic detrital matter kicked up from the low tide.

The phytoplankton water sample was teaming with a mix of diatoms (lots of round *Thalassiosira*), dinoflagellates (a combination of *Ceratium fusus, Akashiwo sanguinea, Noctiluca, Protoperidinium*, and *Protoceratium*) and zooplankton (polychaete larvae, copepods, rotifers, crustacean nauplii, tintinnids). Back in the lab, I observed over 40 different plankton species. All of the 3 harmful algal bloom species were present (*Pseudo-nitzschia, Dinophysis, Alexandrium*), but in very low numbers. Also common was *Protoceratium reticulatum*, a species of interest due to its correlated with shellfish mortality events. All of these species and more in a single drop of water!

Thank you to all the lovely people that visited the dock this afternoon. It was fun to have so many helping hands for our weekly sampling. Come visit us next Thursday to see What's Blooming in Budd?!

Location: Budd Inlet Port Plaza
Dock Date: August 8, 2019
Vertical Net Tow Depth: 3m
Dominant Species: *Thalassiosira, Akashiwo, Leptocylindrus*
Common Species: *Ceratium, Noctiluca, Protoperidinium, Protoceratium*
# of Species Observed: 38
Harmful Algal Bloom (HAB) species: *Pseudo-nitzschia, Dinophysis, Alexandrium*
# of HABs per drop: *PN = 1 cell, Dinophysis = 1 cells, Alex = 9 cells*



It was another cool Pacific Northwest summer day, but in the spirit of the PNW, folks were out exploring the sound on boats and at the dock at Percival Landing. Families, couples, boaters, a photographer from Olympia Stream Team, and our friends from the Pacific Education Institute stopped by to check out what was blooming in Budd. Turns out: *Akashiwo sanguinea*- and lots of it! When visitors discover that we are looking for harmful algal bloom species, they are curious to know if the cells they see under the microscope can cause illness. In the case of *Akashiwo*, high cell densities do cause illness, but in shellfish (this one doesn't affect humans). Mussel farmers in particular are weary of large *Akashiwo* blooms, as mussels will starve and fall off their lines when it is present at high levels.

Our samples included *Protoperidinium*, *Noctiluca* ("night light"), *Ceratium*, *Thalassiosira,* and smaller sized *Leptocylindrus*. The water was a bit murky red due to the large *Akashiwo* bloom. The high cell density may have also been amplified by the incoming high tide, which brings all types of microscopic plankton (and jellyfish) into the inlet. When the tide goes out, just the opposite happens, and lots of the drifting species we see get pulled out by the force of the tide.

Come visit us at the dock to learn more about what's in our water and how the dynamics of the sound shape what we see!

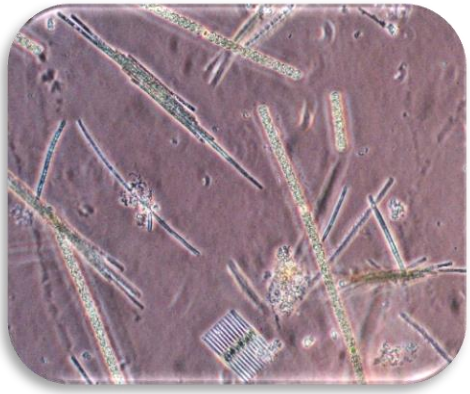
Location: Budd Inlet Port Plaza
Dock Date: August 15, 2019
Vertical Net Tow Depth: 3m
Dominant Species: *Akashiwo*
Common Species: *Protoceratium, Ceratium, Noctiluca*
# of Species Observed: 31
Harmful Algal Bloom (HAB) species: *Pseudo-nitzschia, Dinophysis, Alexandrium*
# of HABs per drop: *PN = 6 cell, Dinophysis = 1 cell, Alex = 65 cells*

What a gorgeous day! So many lovely folks wandered down to the dock to help collect data and find out what was blooming in Budd. The water depth was only 12 feet since it was peak low tide. Surface water temperatures were quite warm – 20.8°C (or 69 °F), cooling to 15.7°C (or 60 °F) at 3-meter depth. Dissolved oxygen levels were moderate near the surface (8.9 mg/l), but dropped considerably at 3-meters (3.8 mg/l). At this time of the year, phytoplankton that have settled to the bottom of the inlet are decomposing, depleting oxygen levels in the process. Hopefully, temperatures will cool soon and the water will become less stratified – more mixed – returning oxygen concentrations to a more acceptable level.

Our net tow resulted in a thick, orange jar of "plankton soup." The dominant species were dinoflagellates *Akashiwo sanguinea, Ceratium fusus*, and bioluminescing *Noctiluca scintillans*. Back in the lab, we were able to detect over 30 species including zooplankton such as copepods, larvaceans, tintinnids, and crustacean nauplii. The sample was screened for biotoxin producing species and entered into the SoundToxins database. A few cells of *Pseudo-nitzschia* and *Dinophysis* were detected, but in very small numbers. However, a solitary form of *Alexandrium* was observed at a higher concentration. We noted a few cells last week, but they seem to be picking up in concentration (387 cells/L). This species is different than the chain forming *Alexandrium catenella* that can close areas to shellfish harvesting due to PSP, or Paralytic Shellfish Poisoning. Based on previous years, we suspect that it is *A. tamarense* which has both toxic and nontoxic strains. Also common was *Protoceratium reticulatum* – a species that can produce a yessotoxin. An interesting mix of species, indeed!

Next Thursday, we will be sampling at Long Lake. Come take a dip and see what you're swimming among! Hope to see you there.

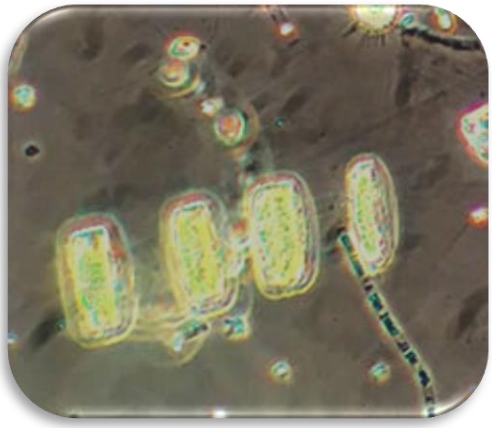
Location: Long Lake
Dock Date: August 22, 2019
Vertical Net Tow Depth: sampled from shore
Dominant Species: *Anabaena, Aphanizomenon*
Common Species: *rotifers, Trachelomonas, Ceratium*
# of Species Observed: 22
Harmful Algal Bloom (HAB) species: *Anabaena (renamed Dolichospermum), Aphanizomenon*
# of HABs per drop: not quantified



The air was cool and the sky was overcast, but that didn't keep our enthusiastic scientists away! Water visibility at Long Lake was a meager 3 feet (!) keeping the deeper swimming area closed for safety. What was making the water a thick murky green? It was our mission to find out! We pulled a plankton net through the water, loaded our slides and took a magnified peek under the microscopes. The water came to life with at least 3 different rotifers zooming across the field of view. The blue green algae species *Aphanizomenon* and *Anabaena* dominated the sample. Other species found were *Fragilaria, Tabellaria, Lyngbya, Staurastrum, Trachelomonas* and the 3-horned dinoflagellate, *Ceratium*.

Ceratium was also blooming a few miles across town in lower Budd Inlet where we collected a water sample an hour prior. The water was a thick orangish brown and FULL of dinoflagellates such as *Ceratium fusus, Akashiwo, Noctiluca* and *Protoperidinium*. The zooplankton were plentiful including copepods, barnacle nauplii, larvaceans, and the most beautiful polychaete worm. All in all, a lot of plankton. The combination of nutrients from recent rainfall plus sunshine provided the perfect ingredients for the rich "plankton soup" observed in both Budd Inlet and Long Lake.

Next week is our last “What’s Blooming?” event of the season. Hard to believe summer’s almost over. Come join us a Budd Inlet next Thursday to take a final peek at the magical world of plankton!



Location: Budd Inlet
Dock Date: August 29, 2019
Vertical Net Tow Depth: 3m
Dominant Species: *Thalassiosira, Leptocylindrus, Chaetoceros*
Common Species: *Noctiluca, Skeletonema*
# of Species Observed: 27
Harmful Algal Bloom (HAB) species: None
# of HABs per drop: N/A

It was an exciting end to the “What’s Blooming” season today. The event took place between rainstorms, but we could hear thunder in the distance! Folks learning to sail and seals fishing for salmon were in plain view from the dock. Also, the famous Lady Washington ship was tied near our station, so visitors could check out Washington’s history and phytoplankton all at once!

Thalassiosira was in full bloom and forming chains. There was also a bloom of *Chaetoceros* and *Leptocylindrus*. Certain species of *Chaetoceros* are known to irritate the gills of fish. There were no harmful algal species observed today, but lots of questions from young sailors on the health hazards of common harmful species in the region. In fact, many people asked great questions about plankton, shellfish farming, invertebrate ID, and oceanography. “What’s blooming” is a great place to bring all your marine biology questions- we love talking science!

Looking forward to another fun and informative season on the dock with you-all next summer!