

2018 “What’s Blooming?” Plankton Monitoring Final Report



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The Stream Team Collective partnered with Pacific Shellfish Institute (PSI) to perform its seventh year of the “What’s Blooming in Budd?” phytoplankton monitoring program in Budd Inlet, downtown Olympia. This year, in addition to sampling at Budd Inlet (9 events), PSI also hosted events at Long Lake Park in the City of Lacey (4 events) and at Pioneer Park in the City of Tumwater (1 event). The goal was to offer engaging hands-on activities that educate the public about local water quality issues and encourage environmental stewardship.

To meet this goal, volunteers met on Thursday afternoons between June and September 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 Long Lake Park, July 26, 2018.

After Budd Inlet 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 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 at PSI’s laboratory. 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 2013-2017. This year’s weekly web page entries are archived at the end of this report.

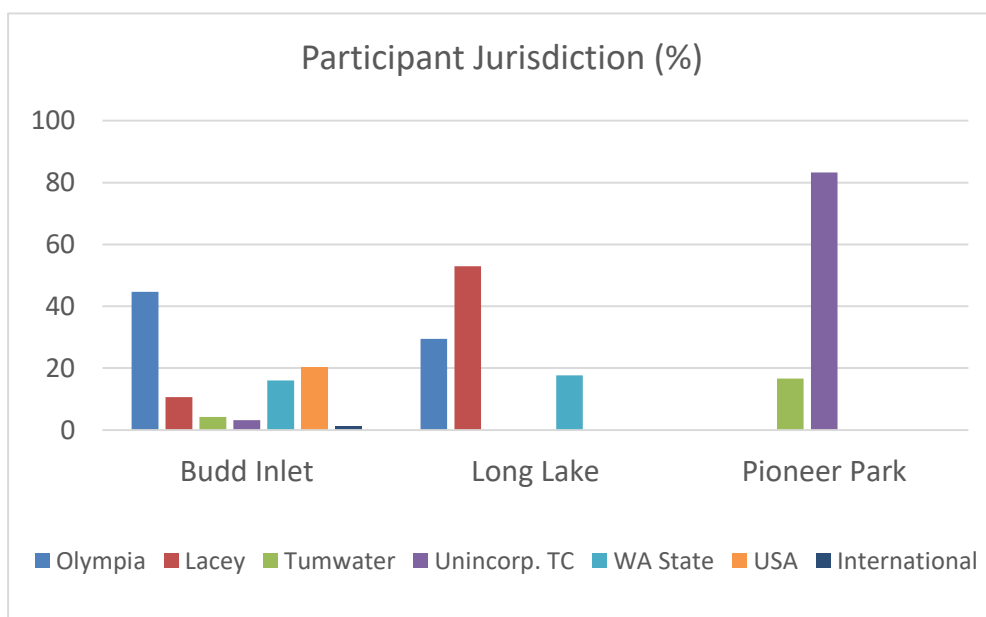
Results

A total of 14 sampling events were conducted between June 21st and September 15th totaling 243 contacts with the public. The average number of attendees was 23.5 per event at Budd Inlet, 6.25 per event at Long Lake, and 6 per event at Pioneer Park. Attendance was low during 2 Long Lake events because the swimming area was “Closed” due to poor visibility caused by blue-green algae. Otherwise, average attendance at Long Lake was 10 visitors per event. The highest attendance occurred at Budd Inlet on August 2nd with 21 individuals at the dock and 22 at LOTT. Overall, most of the Budd Inlet contacts were made at the dock (n=135), while a smaller, yet notable, number were encountered at LOTT’s WET Science Center (n=77).



“Sign In” information was collected from 117 individuals at Budd Lake (n=94), Long Lake (n=17) and Pioneer Park (n=6). Over 45% of attendees at the Budd Inlet events lived in Olympia, with 20% visiting from outside of Washington State. Fifty-three percent of Long Lake participants lived in the City of Lacey and all of the Pioneer Park participants lived in Unincorporated Thurston County or the City of Tumwater.

PSI also attended *Summer Splash!* at the Hands On Children’s Museum on July 20th. 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 200 contacts were made at this interactive event.

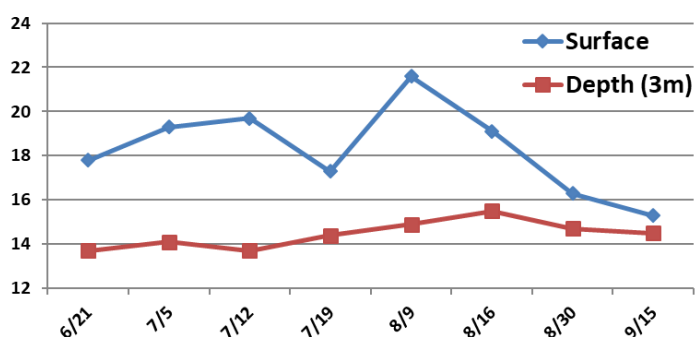


Budd Inlet

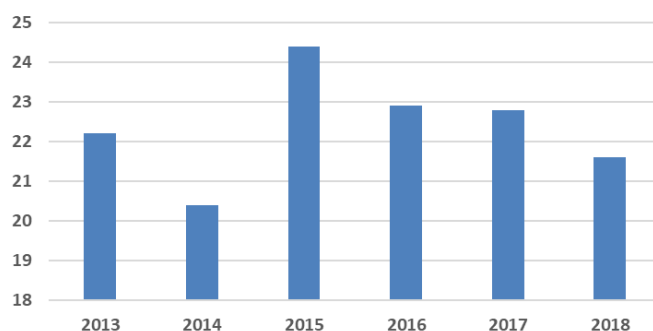
Temperature

Surface temperatures ranged from 17.3°C to 21.6°C (63°F to 71°F), peaking on August 9th and then decreasing during the transition to fall. Temperatures at 3-meters remained relatively constant between 13.7°C and 15.5°C. Surface temperatures exceeded 22°C every summer over the past 6 years except for in 2014 and this year, 2018. 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).

2018 Budd Inlet Water Temperature (°C)



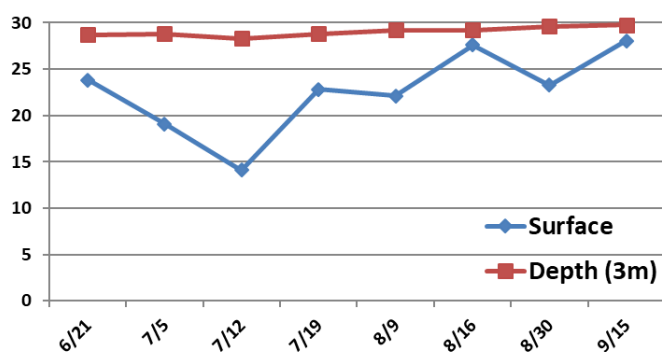
Peak Surface Water Temperatures (°C)



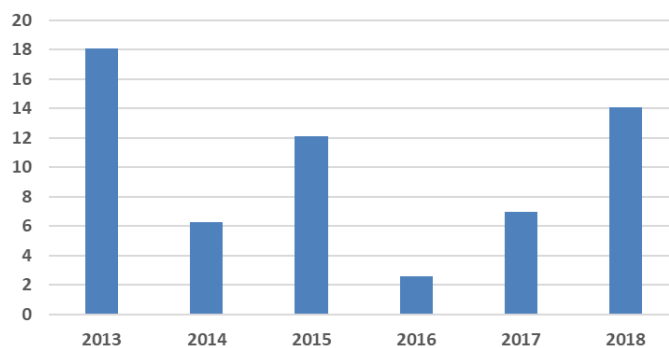
Salinity

Surface salinity values did not fluctuate as much as in previous years, likely due to the decreased amount of sampling performed at this site. Values ranged from 14.1 ppt to 29.2 ppt. The salinity at 3-meters was relatively constant remaining between 28.3 and 29.7 ppt. Surface salinity values dropped below 10 ppt on numerous occasions over the past 5 years due to a combination of rain events, outgoing tides, thermal stratification and Capitol Lake dam releases. Marine organisms living in lower Budd Inlet appear to be quite adapted to this dynamic environment.

2018 Budd Inlet Salinity (ppt)



Minimum Surface Salinity (ppt)



Water Clarity

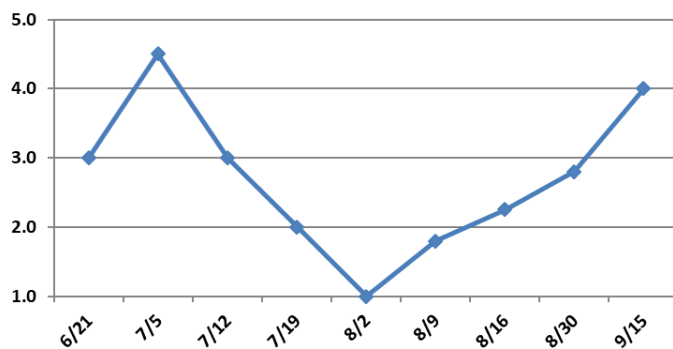
Water clarity, or visibility, ranged from 1.0 meter (3 feet) on August 2nd to over 4.0 meters (13-15 feet) in early July and mid-September. Water clarity was at its poorest in early August during a thick bloom of *Ceratium fusus* (dominant species), *Akashiwo sanguinea* and *Noctiluca scintillans* (sub-dominant).

According to prior data, water clarity appears to have decreased over the past 5 years. However, these values are weekly snapshots in time and may not be robust enough to ascertain trends over time.

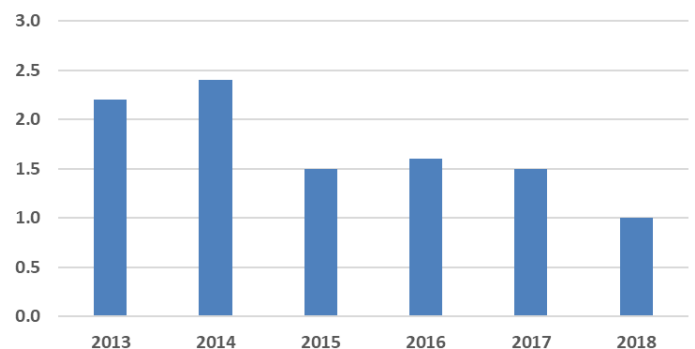


Water clarity in Budd Inlet plummets as *Ceratium fusus* starts to bloom, July 19th.

2018 Secchi Disk Depth (m)

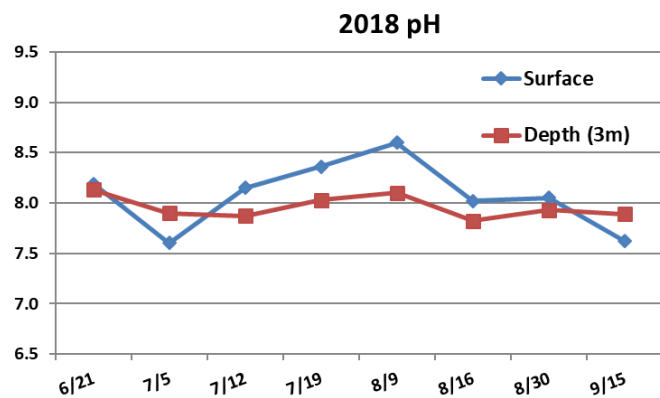
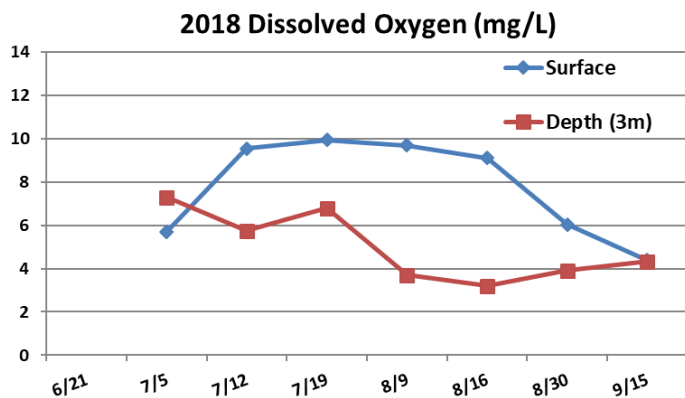


Minimum Secchi Disk Depth (m)



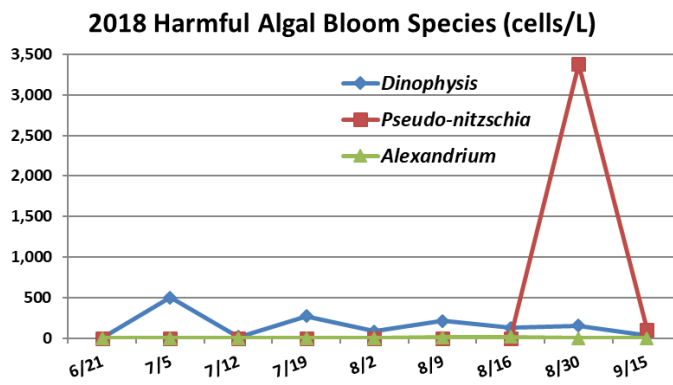
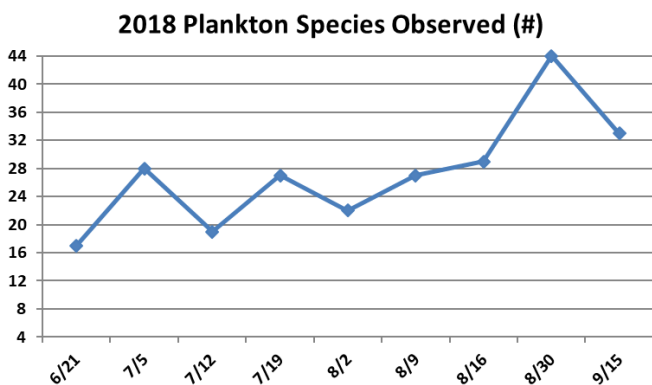
Dissolved Oxygen and pH

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. 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 surface DO levels ranging from 10.0 mg/L in mid-summer to 4.1 mg/l in early fall with corresponding pH values of 8.6 to 7.6 in surface waters. Dissolved oxygen levels at 3-meter depth dropped to as low as 3.1 mg/l during mid to late summer.

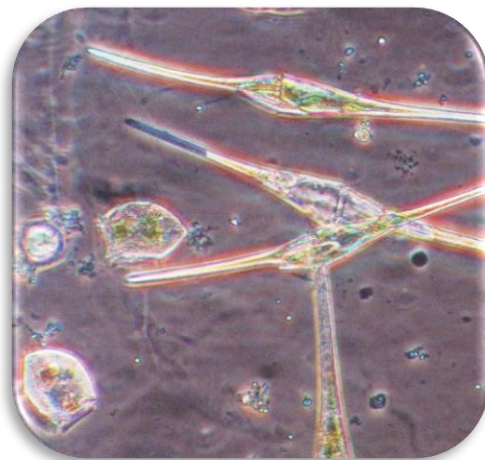


Plankton

The total number of species (phytoplankton and zooplankton) observed in samples ranged from 17 species in June to 44 species in late-August with an average of 27 ± 8 species. Diversity was highest in late August when surface temperatures declined and stratification dissipated, creating a more mixed, nutrient rich, diverse environment.

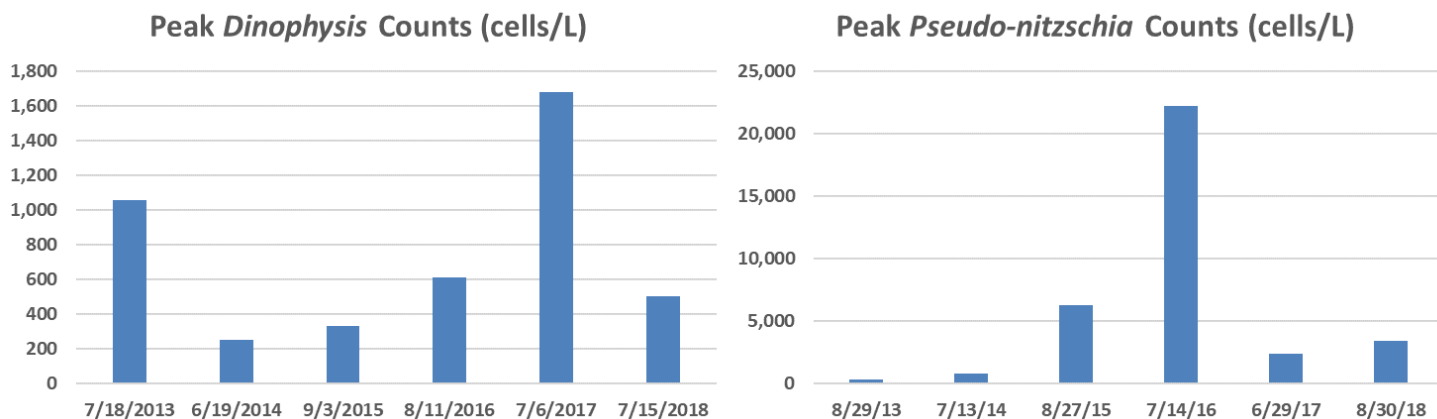


The monitoring season started in June with an early bloom of *Noctiluca* and *Dinophysis*. Similar to 2017, July was dominated by the dinoflagellate, *Ceratium fusus*. In August, *Ceratium fusus* persisted, but was also joined by *Akashiwo sanguinea* and *Noctiluca* – the combination of which kept visibility between 3 to 10 feet. The bloom initiation date for *Ceratium fusus* (7/5) and *Akashiwo sanguinea* (8/31) was surprisingly similar (± 1 day) in both 2017 and 2018.



Dinoflagellates *Ceratium fusus* and *Dinophysis* spp. dominate the Budd plankton community on 7/5/18

During the 2018 season, harmful algal bloom (HAB) species *Dinophysis* spp., *Pseudo-nitzschia* sp., and *Alexandrium* sp. were each observed. *Dinophysis*, the species responsible for Diarrhetic Shellfish Poisoning (DSP) was observed throughout the season, blooming in early to mid-July at moderate concentrations (500 cells/L). For comparison, *Dinophysis* exceeded 1,600 cells/L in 2017. *Pseudo-nitzschia*, the HAB species responsible for Amnesic Shellfish Poisoning (ASP) was absent throughout most of the season, but bloomed at low levels on 8/30 (3,381 cells/L). For comparison, this species exceeded 20,000 cells/L in 2016. Only 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* concentrations over the past 5 years.



Long Lake

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.

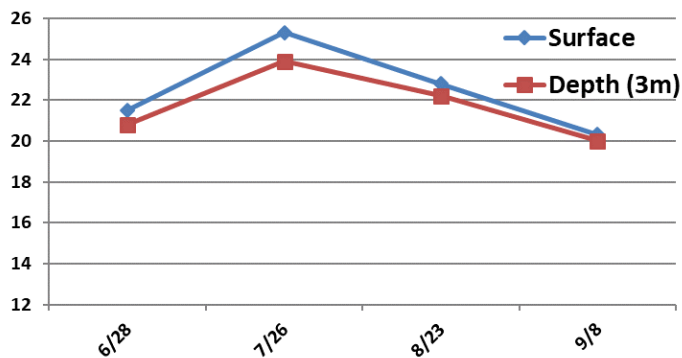


Lovely, overcast day at Long Lake, 6/28/18.

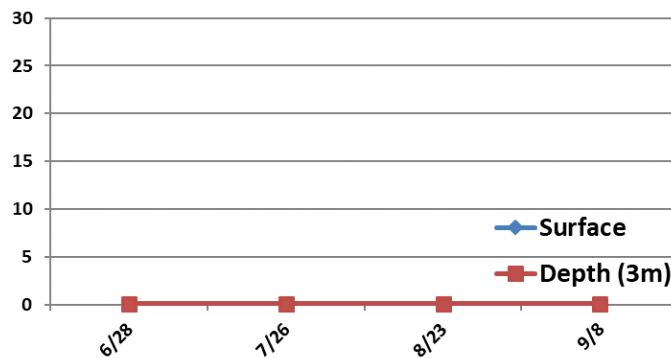
Temperature and Salinity

Surface water temperatures in Long Lake were much higher than Budd Inlet ranging from 21.5°C in June to 25.3°C (77.5°F) in July before falling to 20°C in September. While surface water was slightly warmer than at 3-meter depth, the difference was not as pronounced as Budd Inlet where stratification resulted in a temperature differential as great as 7°C. Long Lake salinity was measured at .07 ppt at each sampling event.

2018 Long Lake Water Temperature (°C)



2018 Long Lake Salinity (ppt)



Water Clarity and Species Diversity

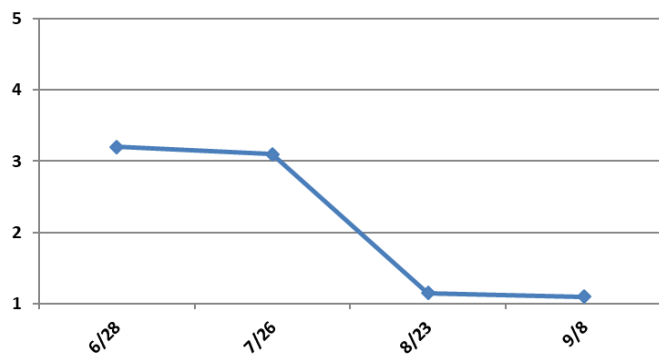
Water clarity was similar to Budd Inlet ranging from 3.2 meters in June and July to 1.1 meters during the algae bloom in September and August. Water clarity was poor enough during this time that Lake Managers and the Health Department roped off the swimming beach and posted signs indicating that the beach was closed due to inadequate lake visibility. Signs reading "Caution – Toxic algae may be present" were also added.



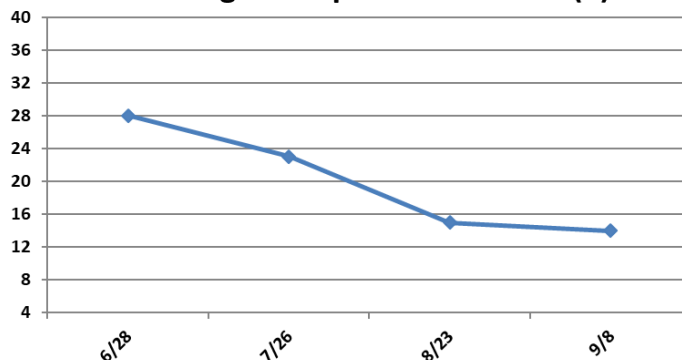
Swimming area closed at Long Lake on 8/23/18

Species diversity decreased from 28 species in June to 14 species during the blue green algae bloom.

2018 Long Lake Secchi Disk Depth (m)

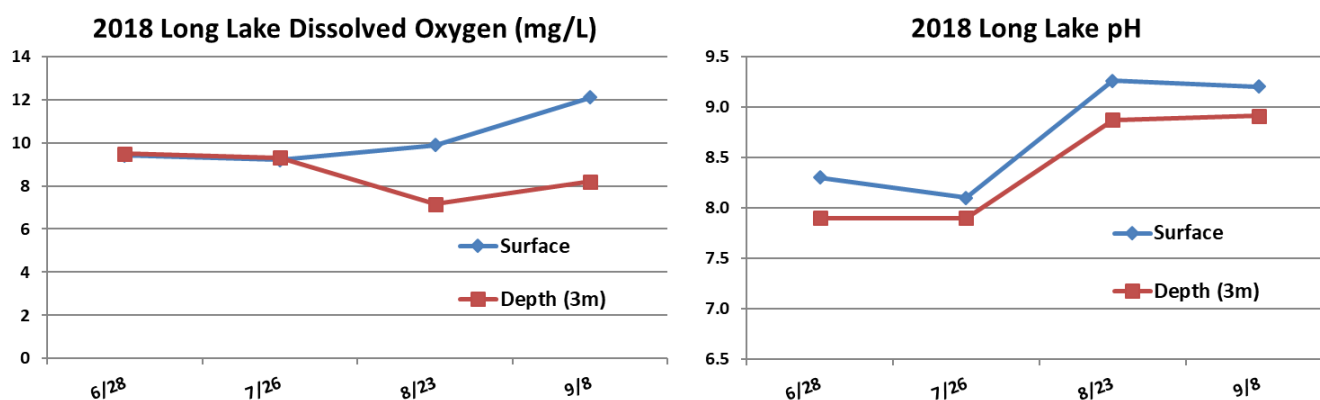


2018 Long Lake Species Observed (#)



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. Our data reflected active photosynthesis, particularly during the blue-green algae bloom, when surface DO increased from 9.3 mg/l to 12.1 mg/l. At the same time, pH increased from 8.1 to 9.2. At 3-meter depth, DO levels decreased throughout the season from 9.3 mg/l to 7.2 mg/l during bacterial decomposition. For comparison, Budd Inlet surface DO ranged from approximately 4 to 10 mg/l throughout the sampling season, with a minimum of 3.1 mg/l at 3-meters during decomposition. Budd Inlet's surface pH values ranged from 7.6 to 8.6.



Plankton

Long Lake experienced a variety of diatoms, dinoflagellates and zooplankton species, particularly in early summer. The most common species detected throughout the season included the diatoms *Asterionella*, *Fragellaria*, and *Melosira*; the dinoflagellate *Ceratium*; and an abundance of rotifers. Species known to produce biotoxins were also observed including *Microcystis*, *Oscillatoria*, *Lyngbya*, *Anabaena*, *Aphanizomenon*, and *Gloeotrichia*. During the blue-green algae bloom, *Anabaena*, a blue green algae responsible for producing Anatoxin-a, saxitoxins, and microcystins was common; as well as *Aphanizomenon* (at very low numbers) which can also produce anatoxin-a and saxitoxins. Other potential toxin producers observed

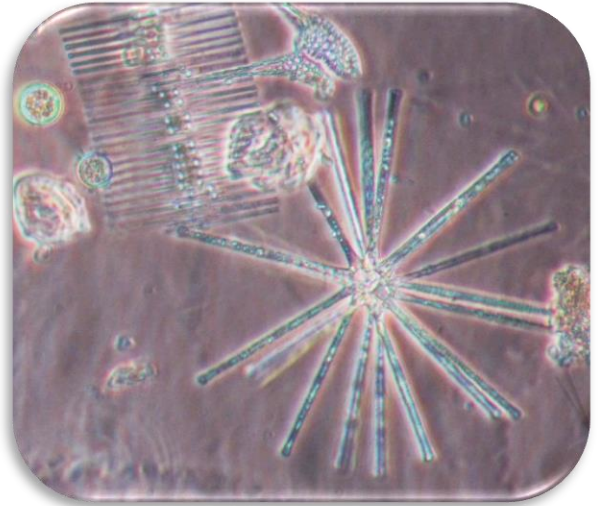
Site	Collection Date	Microcystin (µg/L)	Above State Guideline
Long Lake	8/22/18	0.43	No
Long Lake	8/28/18	0.16	No
Long Lake	8/30/18	0.17	No
Long Lake	9/18/18	0.37	No
Long Lake	9/25/18	1.95	No
Long Lake	10/23/18	2.70	No

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

at low levels were *Lyngbya* and *Microcystis*. Laboratory results from mid-August to mid-October indicated that Microcystin levels were between 0.16 and 2.70, but never exceeded the Health Advisory Level of 6.0 µg/L. Still, the swimming area remained closed for safety reasons due to poor visibility.



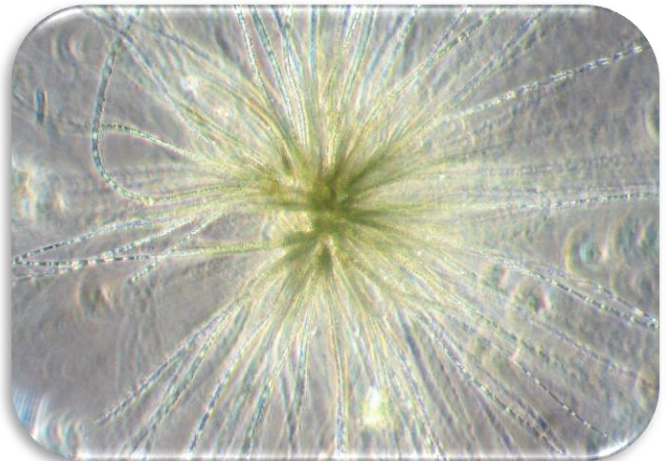
Participants view plankton under microscopes at Long Lake on 7/26/18.



Asterionella (right) and *Fragellaria* (upper left) were common at Long Lake on 7/26/18.



The rotifers, *Keratella*, and chains of *Anabaena* were common at Long Lake on 8/23/18.



The cyanobacteria, *Gloeotrichia*, was observed at Long Lake, 6/28/18

Conclusions

The 2018 “What’s Blooming?” events attracted an average of 23.5 volunteers per sampling event at Budd Inlet and reached over 240 individuals throughout the summer. Community members at Budd Inlet, Long Lake and Pioneer Park enjoyed connecting with their watershed and learning about water quality issues such as eutrophication, HABs, and bacteria 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 for supporting the “What’s Blooming?” program and the staff at LOTT for welcoming us into the WET Science Center to view plankton. Thank you to the Port of Olympia for granting us permission to use the Port Plaza dock and the lifeguards at Long Lake for accommodating water sampling on the swimming dock. Finally, a big “thank you” to all the citizen scientists that helped us collect our data and make every sampling event exciting, fun, and educational.



Participants view plankton samples collected from Ward Lake and the Deschutes River at Pioneer Park on 8/4/18.

2018 Weekly Plankton Summary Archive

Dock Date: June 21, 2018

Location: Budd Inlet Port Plaza

Vertical Net Tow Depth: 3 meters

Dominant Species: *Noctiluca*

Common Species: *Noctiluca*

of Species Observed: 17

Harmful Algal Bloom (HAB) species: None



Happy Summer! What a great way to spend the afternoon on summer solstice. It was cloudy and cooler today, so there weren't too many people around Port Plaza, but we had a great turnout at LOTT. Very low diversity with *Noctiluca* dominating. It may be a great night to see some bioluminescence! Also abundant were comb jellies, we caught lots in our plankton net. No HABs in the samples today.

Dock Date: June 28, 2018

Location: Long Lake, Lacey

Vertical Net Tow Depth: 3 meters

Dominant Species: *Dinobryon*

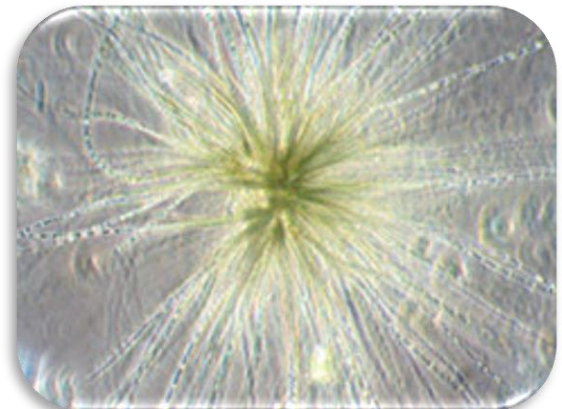
Common Species : *Rotifers*

of Species Observed: 29+

Harmful Algal Bloom (HAB) species:

Aphanizomenon, Microcystis

of HABs: not quantified



That's not Budd Inlet! No, we're shaking things up a bit and sampling at Long Lake this week. Lakes, similar to Puget Sound, are sensitive to nutrient inputs. Excess nutrients can lead to algae blooms that can decrease oxygen levels upon decomposition. Some types of algae produce toxins that can close lakes to swimming and other recreational uses. Today, we collected water quality data and a plankton sample and took a peek to see what was living in Long Lake. The water temperature was warm (21.5C),

oxygen levels super saturated (106%), and the water clarity was over 3 meters. The lake looks great. No blooms were present and the plankton was a diverse mix of diatoms, dinoflagellates, ciliates, protists, cyanobacteria, and zooplankton.

I'll admit, while I may be quite good at marine plankton ID, my fresh water ID skills are definitely not as strong. I've spent some time at the TC Environmental Lab learning a few species, but I've had my head in the books for hours today trying to learn more. I love it! So much microscopic diversity! The sample did contain a few species that can produce toxins including *Aphanizomenon* and *Microcystis*, but at very low concentrations. I also saw a nice *Gloeotrichia* (pictured above).

Thank you to the young scientists from Tacoma that helped collect data today. The life guards also did their part by measuring the depth along the length of the swimming dock with our depth gun. The depth is 8-12 feet around the dock if you're curious.

Come join us next week at Budd Inlet or July 26th at Long Lake to discover what's living in the water!

Dock Date: July 5, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

Dominant Species: *Noctiluca*, *Ceratium fusus*

Common Species: *Dinophysis* spp., *Scrippsiella*

of Species Observed: 28

Harmful Algal Bloom (HAB) species:

Dinophysis

of HABs: 500 cells/L



What a diverse mix of plankton in the water today! The water was much warmer: 19.1 degrees Celsius at the surface compared with 17.8 a few weeks ago. *Noctiluca* and *Ceratium fusus* were certainly blooming along with the toxin producer, *Dinophysis*. The plankton photo above depicts two of these species - *Ceratium fusus* (left) and *Dinophysis fortii* (right). WDOH's Shellfish Safety map indicates that the entire Inlet is still closed to all shellfish harvesting due to elevated levels of the Diarrhetic Shellfish Poisoning (DSP)

toxin found in routinely tested mussel tissue. I counted 84 *Dinophysis* cells in just one drop of water from our net tow.

At LOTT's WET Science Center, we were "Wow"ed by the number of rotifers, tiarina, copepods, bivalve larvae, polychaete larvae, and crustacean nauplii that we saw darting across the screen. Thank you to the scientists that helped collect today's data. I enjoyed your enthusiasm and hope you'll all come back in the weeks to come. You never know what you're going to find in next week's drop of water.

Dock Date: July 12, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

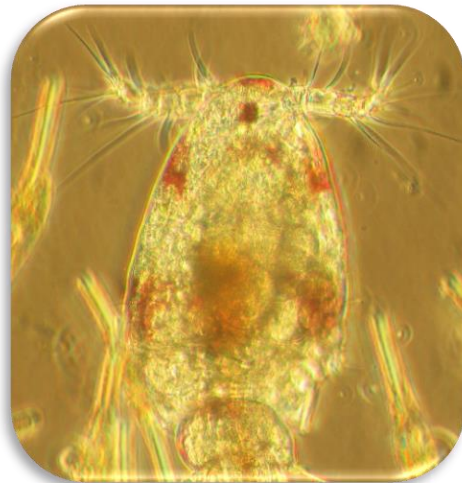
Dominant Species: *Ceratium fusus*

Common Species: *Dinophysis* spp.

of Species Observed: 19

Harmful Algal Bloom (HAB) species: *Dinophysis*

of HABs: 15 cells/L



The weather was hot today warming the surface water temperature to 19.7 degrees Celsius. Water clarity (3 meters) was less than last week indicating more plankton in the water. Correspondingly, the oxygen levels were high at 9.54 mg/L as the phytoplankton photosynthesized – taking in carbon dioxide and releasing oxygen into the surrounding water. *Ceratium fusus* was blooming and *Dinophysis* remained common. We also observed many comb jellies.

Dock Date: July 19, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

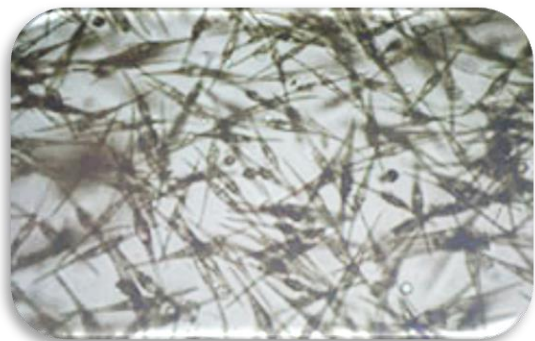
Dominant Species: *Ceratium fusus*

Common Species: *Noctiluca*

of Species Observed: 27

Harmful Algal Bloom (HAB) species: *Dinophysis*

of HABs: 268 cells/L





The weather was much cooler today. The water was very brown today due to a very dense bloom of *Ceratium fusus*. Despite the density of *Ceratium*, there was more diversity this week than last week with 27 different species observed. Lots of zooplankton in our sample, especially Rotifers. There were more *Dinophysis* present in our sample today than last week, 45 cells/drop, or 268 cells per liter.

Thank you to the scientists that helped collect today's data. I enjoyed your enthusiasm and hope you'll all come back in the weeks to come. You never know what you're going to find in next week's drop of water.

Dock Date: July 26, 2018

Location: Long Lake, Lacey

Vertical Net Tow Depth: 3 meters

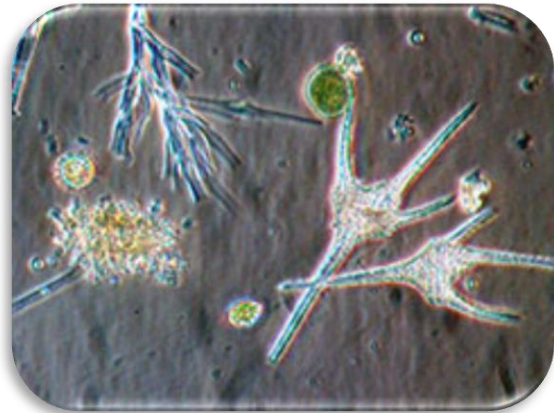
Dominant Species: *Ceratium*, *Asterionella*

Common Species: *Fragellaria*, rotifers

of Species Observed: 23

Harmful Algal Bloom (HAB) species: *Anabaena*

of HABs: not quantified



We returned to Long Lake today for our monthly sampling event. The weather was in the upper 80's and we counted 30 people wading and 25 swimming and jumping off of the dock. The water was 25.3 C, or 77.5 F! That's hot! Water clarity was similar to last month with a secchi disk reading of 3.1 meters. Plankton diversity was high with lots of interesting diatoms, dinoflagellates, ciliates and zooplankton. Pictured are two *Ceratium* (the common *Ceratium* in Budd Inlet only has one horn, not 3!) and a branching *Dinobryon*.

As far as toxin producing species, we only saw a tiny bit of *Anabaena* in our sample. The most recent Algae Toxicity Test Results for Long Lake (7/16-7/18) performed by Washington Department

of Ecology indicate that lake water was below the Minimum Detection Level (MDL) for Microcystin and Anatoxin-a.

Thank you to the volunteers that came to the lake today to collect data and look at the plankton samples under the microscopes. I enjoyed your enthusiasm! Come join us next week to see if the *Ceratium* are still blooming in Budd Inlet!

Dock Date: August 2, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

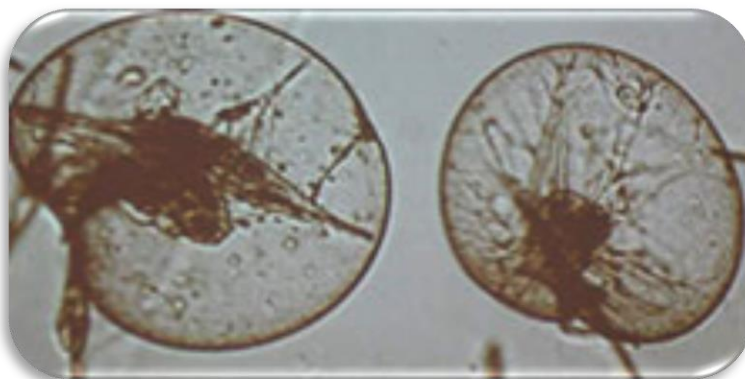
Dominant Species: *Ceratium fusus*

Common Species: *Noctiluca*, *Akashiwo sanguinea*

of Species Observed: 22

Harmful Algal Bloom (HAB) species: *Dinophysis*

of HABs: 83 cells/L



Much cooler on the dock today, but the bloom of *Ceratium fusus* persists. The water was very dark today, the secchi disk reading was only 1 meter. The toxin producing species, *Dinophysis*, was still present today with a concentration of 83 cells/L. Thank you to all the volunteers that came out today to check out what's blooming in Budd! We also had a great turnout at Lott with 22 visitors. See you next week!

Date: August 4, 2018

Location: Pioneer Park, City of Tumwater

This summer, we hosted one outreach event at Pioneer Park in the City of Tumwater. Plankton samples were collected from both Ward Lake and the Deschutes River for viewing under microscopes. We observed a couple of dog walkers and distributed "Bags on Board" dispensers to make cleaning up after your dog that much easier. Several kids did a fabulous job modeling proper scooping techniques using the head of our mascot, Scoopy Doo.



Dock Date: August 9, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

Dominant Species: *Ceratium fusus*

Common Species: *Noctiluca*, *Akashiwo sanguinea*

of Species Observed: 27

Harmful Algal Bloom (HAB) species:
Dinophysis, *Alexandrium*

of HABs: D = 214 cells/L, A = 6 cells/L



The water was a rich orange brown color during the incoming low tide today. We dropped our plankton net to a 3 meter depth and pulled it up to reveal the super concentrated "plankton soup" that you see in the photo. The dinoflagellate, *Ceratium fusus*, was blooming, and to a lesser extent *Akashiwo sanguinea*. As the plankton jar sat on the table for 15 minutes, the buoyant *Noctiluca* rose to the surface forming a thick layer. What does this mean? It's a great time to check out the bioluminescence at night! Swim, kayak, splash around and enjoy the show!

Surface temperatures were warm (21.6C, 70F) dropping considerably at a 3 meter depth (14.9C, 59F). Dissolved oxygen levels were supersaturated at the surface (>100%) and much lower at 3 meters (40%). Visibility was 1.8 meters, a bit clearer than last week's remarkable 1 meter reading.

Thank you to the young scientists that came from near (Olympia) and far (Switzerland) to help collect our data. Come back next Thursday to discover What's Blooming in Budd!

Dock Date: August 16, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

Dominant Species: *Ceratium fusus*

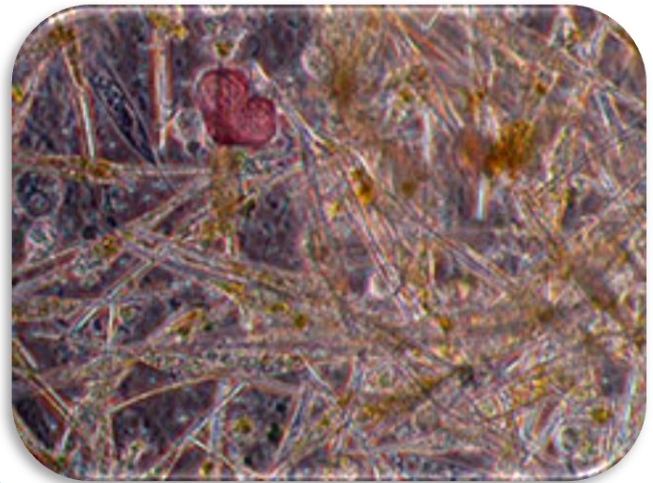
Common Species: *Akashiwo*, *Noctiluca*, *Protoperidinium*

of Species Observed: 29

Harmful Algal Bloom (HAB) species:

Dinophysis, *Alexandrium*

of HABs: D = 125 cells/L, A = 12 cells/L



Another beautiful day in Olympia. The moon jellies, ctenophores, and a curious seal kept us company while we collected our data. Helping us sample was a gentleman from the Long Lake's Lake Management District, a handful of enthusiastic young scientists returning from last year, and a few new faces! The water was thick with the dinoflagellates *Ceratium fusus* and to a lesser degree *Akashiwo sanguinea*, *Noctiluca*, and

Protoperidinium. We saw *Polykrikos* cells dividing (cool!), *Protoceratium reticulatum* (very reticulated), and zooplankton such as rotifers, larvaceans, copepods and polychaete worms. *Dinophysis*, one of the biotoxin producing dinoflagellates, was present, but the Inlet remains open for shellfish harvesting north of Burfoot Park.

Come join us next week to find out What's Living in Long Lake. We will record water quality data, collect a plankton sample, view plankton under field microscopes, and then perhaps jump in for a swim!

Dock Date: August 23, 2018

Location: Long Lake

Vertical Net Tow Depth: 3 meters

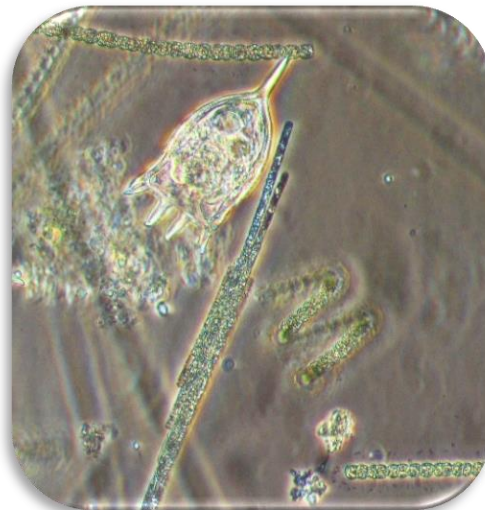
Dominant Species: Rotifers, *Anabaena*

Common Species: *Melosira*, *Ceratium*, *Fragellaria*

of Species Observed: 15

Harmful Algal Bloom (HAB) species: *Anabaena*,
Aphanizomenon, *Microcystis*

of HABs: not quantified



A lonely day at Long Lake – not a single swimmer or boater to be seen. The swimming beach was “caution taped” off with signs indicating that the beach was closed due to poor lake visibility. Over the next hour, the lifeguards replaced the signs with ones reading, “Caution – Toxic algae may be present.” Eric, from the Lake’s Lake Management District, walked to the dock with me to collect samples from the murky green water. Unlike our typical > 3-meter visibility,

the visibility had dropped to 1.15 meters. Oxygen levels and pH were high in surface waters reflecting the active photosynthesis taking place by microscopic plants and cyanobacteria (blue green algae). Cyanobacteria are like typical bacteria in that they lack a nucleus, but similar to green plants they make their own food by photosynthesis. During this process, they remove carbon dioxide from the water and produce oxygen. Our YSI probe reflected this process indicating an increase in surface pH (9.26) and dissolved oxygen (109% - supersaturated).

The plankton tow revealed a microscopic world of bustling activity with rotifers zipping across our slides. *Anabaena*, a blue green algae responsible for producing Anatoxin-a, saxitoxins, and microcystins was common; as well as *Aphanizomenon* (at very low numbers) which can also produce anatoxin-a and saxitoxins (both pictured with the rotifer, *Keratella*). Other potential toxin producers observed at low levels were *Lyngbya* and *Microcystis*. A quick phone call to Thurston County revealed that prior water testing results were **below** the Health Advisory Level, but results are pending for the most recent samples collected on 8/22. Long Lake currently has a Caution Advisory for algae and swimming is prohibited at Long Lake Park. For more information about blue-green algae, check out:

www.co.thurston.wa.us/health/ehadm/swimming/blue_green_algae.html

Next Thursday, we will return to Budd Inlet to discover “What’s Blooming in Budd?” Is the dense *Ceratium fusus* bloom still underway. Join us to find out!

Dock Date: August 30, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

Dominant Species: *Akashiwo sanguinea*

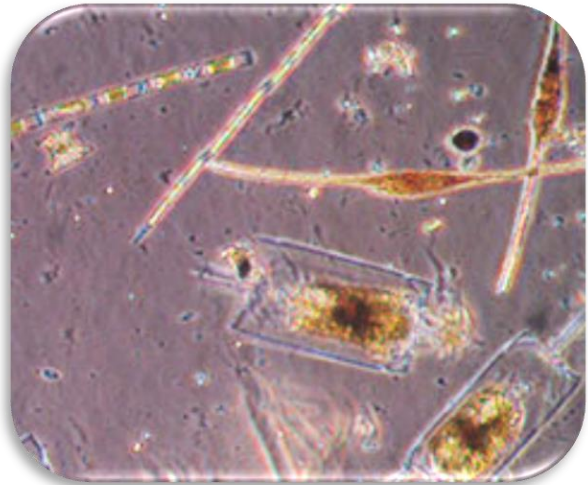
Common Species: *Ditylum*, *Skeletonema*

of Species Observed: 44

Harmful Algal Bloom (HAB) species:

Dinophysis, *Pseudo-nitzschia*

of HABs: D = 155 cells/L, PN = 3381 cells/L



The weather changed and so did the plankton community. What amazing biodiversity in the sample today - 44 species, a new record! The dense *Ceratium fusus* bloom has dissipated and been replaced with a bloom of *Akashiwo sanguinea* and *Ditylum*. Also very common were chain forming diatoms like *Skeletonema*, *Chaetoceros*, and *Eucampia*. Another chain former, *Pseudo-nitzschia*, was also common and is the species responsible for amnesic shellfish poisoning. This is the first time that it has bloomed this summer in Budd, but last year we had small blooms in June (2,369 cells/L) and September (1,673 cells/L) and over 22,000 cells/L in July of 2016. For whatever reason, *Pseudo-nitzschia* - despite its presence - does not often produce the biotoxin in south Puget Sound. More typically, this species is associated with razor clam fishery closures on the outer coast.

Species diversity was not only high among the diatoms and dinoflagellates, but also the zooplankton community. We observed larvaceans, copepods, crustacean nauplii, barnacle nauplii, tintinnids, rotifers, tiarina, polychaete larvae and even echinoderm larvae! It was a very active sample, indeed.

Thanks to all of the families that stopped by today to peek in the microscopes on the way to visit the beautiful Hawaiian Chieftain that was docked nearby. Only 2 more plankton sampling

days remain this summer and they will occur on Saturdays now that school is starting back up. Come visit us at Long Lake on September 8th and Budd Inlet on September 15th to find out What's Blooming!

Dock Date: September 8, 2018

Location: Long Lake

Vertical Net Tow Depth: 3 meters

Dominant Species: *Anabaena*

Common Species: *Fragellaria*, *Melosira*

of Species Observed: 14

Harmful Algal Bloom (HAB) species:

Anabaena, *Aphanizomenon*

of HABs: not quantified



The swimming area at Long Lake was “roped off” and quiet today as the Caution Advisory remained indicating that toxic algae may be present. The water was green and thick with very poor visibility – only 1.1 meters. A handful of individuals were fishing off the dock and were reminded to clean their fish well and remove the guts. Also please note that fishing off of the swimming dock is not permitted.

Our water sample was pure green as we poured the contents out of the plankton

net into our sample jars. *Anabaena*, a blue green algae responsible for producing Anatoxin-a, saxitoxins, and microcystins was common; as well as *Aphanizomenon* (at very low numbers) which can also produce anatoxin-a and saxitoxins. A third potential toxin producers observed at low levels were *Lyngbya*.

Department of Ecology testing from 8/31/18 indicated that Microcystin toxins were measured at 0.2 µg/L. The level for closing the lake is ≥ 6 µg/l. Levels of Anatoxin-a were below the Minimum Detection Level. For more information about blue-green algae, please check out: www.co.thurston.wa.us/health/ehadm/swimming/blue_green_algae.html

Next Saturday will be our last sampling day of the year. We will be at the Port Plaza to discover “What’s Blooming in Budd?” Come join us!

Dock Date: September 15, 2018

Location: Budd Inlet

Vertical Net Tow Depth: 3 meters

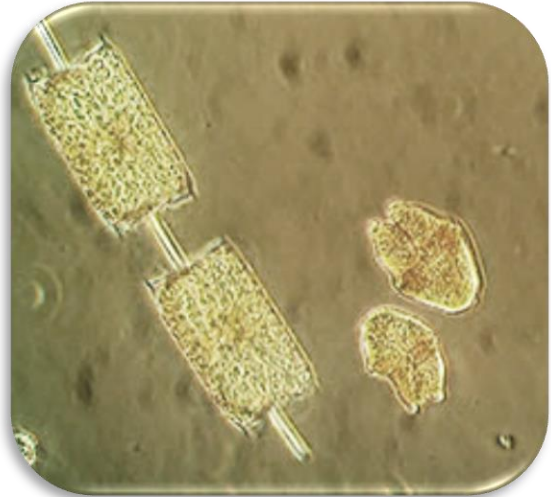
Dominant Species: *Akashiwo*

Common Species: *Ditylum*

of Species Observed: 33

Harmful Algal Bloom (HAB) species: *Dinophysis* & *Pseudo-nitzschia*

of HABs: *D* = 30 cells/L, *PN* = 107 cells/L



We had a surprisingly good turnout for our last “What’s Blooming” event of the season. The tall ships, Hawaiian Chieftain and Lady Washington were still docked, so this helped draw people down to the port. Luckily the rain held off for us as well, so we were able to keep the scopes out until the very end. The water has cleared up a lot over the past few weeks, our Secchi Disk reading was 4 meters. Plankton diversity was pretty high this week, 33 different species seen. These included a variety of diatoms, dinoflagellates, and zooplankton.

There was a small concentration of HAB species present, 30 cells per liter of *Dinophysis* and 107 cells per liter of *Pseudo-nitzschia*. This was a great way to end the season, thanks volunteers for joining me! We hope to see you next year.