What's Blooming in 2022?

This summer, PSI will sample weekly at Budd Inlet in addition to a handful of lakes throughout Thurston County. Thank you, Steam Team, for your continued support of this fun and important work!

After 2 years of limited community involvement – due to COVID restrictions – we now cordially invite you to join us on the dock!!! We will have water quality equipment, plankton nets, and microscopes available for plankton viewing and identifying harmful algal bloom (HAB) species for NOAA's SoundToxins program. Hand sanitizer and wipes are also available. As always, you may check here weekly to view data, photos, videos, and a commentary on our sampling experience.

Every week, plankton communities change. Every week, we see something new!

We would love to hear from you! Contact us anytime with your burning plankton questions, to request a sampling location, or arrange for a small group presentation.

Aimee Christy, aimee@pacshell.org

2022 Sampling Schedule 1:00-2:00 PM

- June 23 – Budd Inlet (Port Plaza)
- June 30 – Woodland Creek (Lacey)
- July 7 – Tumwater Falls Park (Tumwater)
- July 14 – Budd Inlet (Port Plaza)
- July 21 – Budd Inlet (Port Plaza)
- July 28 – Lake Lawrence (Yelm)
- August 4 – Long Lake (Lacey)
- August 11 – Budd Inlet (Port Plaza)
- August 18 – Pioneer Park (Tumwater)
- August 25 – Deep Lake (Thurston Co.)
- September 1 – Budd Inlet (Port Plaza)

September 1, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 3.8-meters

Total number of species observed: 43

Blooming Phytoplankton Species: *Akashiwo sanguinea, Pseudo-nitzschia*

Common Phytoplankton Species: *Dinophysis, Thalassiosira*

Zooplankton: rotifers, larvaceans, crustacean nauplii, copepods, tiarina, tintinnids, nematodes, polychaete larvae, marine cladocerans.

Harmful Algal Bloom (HAB) Species: *Dinophysis* (875 cells/L), *Protoceratium* (12 cells/L), *Akashiwo* (1167 cells/L), *Pseudo-nitzschia* (3149 cells/L)

	Surface	1.5m	3.0m
Temp (°C)	19.5	17.2	16.4
Salinity (ppt)	23.42	27.92	28.4
Oxygen (mg/l)	7.48	6.20	5.71
pH	8.02	7.95	7.94

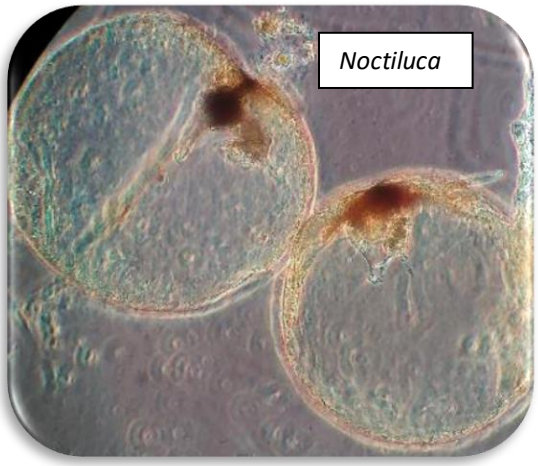
Nudibranch

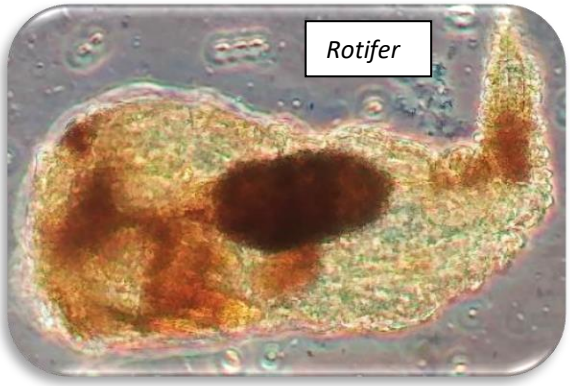
What a special grand finale to the season. We were on the dock for 4 hours (!) as groups passed through to talk about plankton, water quality, shellfish, and marine critters. The plankton samples may have been the best I've seen in my 20+ years looking at plankton. The diversity was astounding and full of diatoms, dinoflagellates and zooplankton. Harmful algal bloom species such as *Pseudo-nitzschia, Dinophysis* and *Akashiwo* were also blooming making for interesting conversation. The kids were even successful at scooping nudibranchs, jellies and sticklebacks out of the water for closer viewing – and a few cigarette butts, too.

Thank you to all the folks that stopped by to share stories, enjoy plankton, and connect with one another and Puget Sound. It's been a fun summer on the dock!

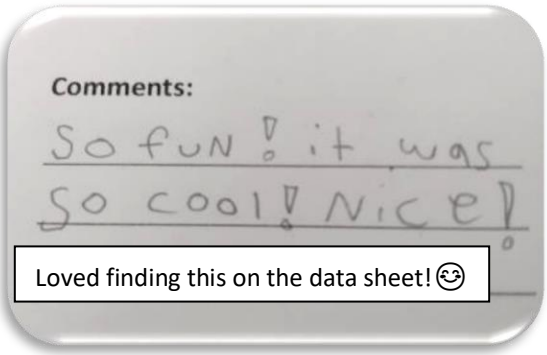
Thank you, Stream Team, for supporting the "What's Blooming?" summer program for well over a decade. PSI will continue to collect plankton samples at Port Plaza year-round for SoundToxins. If you, or your class, would like to join us, don't hesitate to reach out.

Olympia Community Sailing campers!





So excited to lend out the first Discover Plankton kit today! Two more are available to check out at the Olympia Timberland Library!



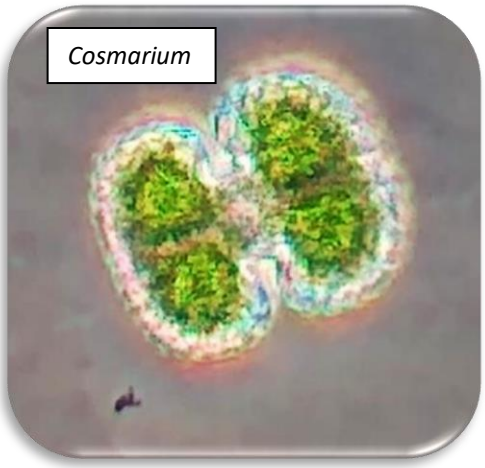
Loved finding this on the data sheet! 😊

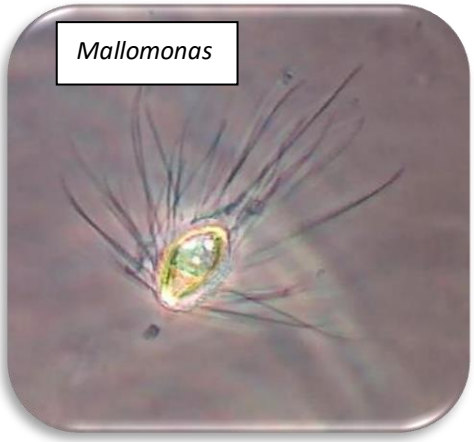
August 25, 2022 – Deep Lake, Millersylvania State Park

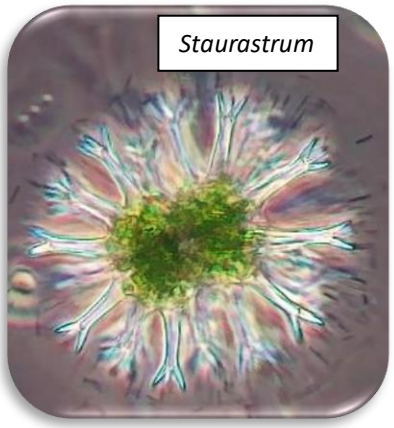
The lake was gorgeous today. Tons of people (and dogs) paddleboarding, swimming, fishing, canoeing and relaxing along the shady shoreline. We sampled from the dock near the boat launch where I was quickly joined by an enthusiastic group of kids fishing. They "fished" for plankton and loaded slides for over an hour! I think one girl caught and released about 10 fish while I was there. The fish were curious…gathering around and poking at the YSI as I jotted down data.

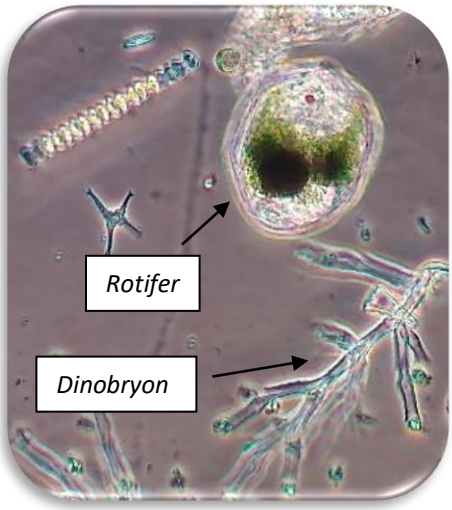
	1m
Temp (°C)	24.60
Salinity (ppt)	0.03
Oxygen (mg/l)	10.71
pH	8.30

The water was shallow and fairly clear (the secchi disk was visible when it hit bottom at 2m). The oxygen levels and pH looked great. While the water seemed warm (75°F), it was perfectly refreshing for a dip in the lake. The plankton were incredibly diverse – a nice mix of diatoms, dinoflagellates, green protists and zooplankton. This is the only lake that I consistently see my favorite freshwater species, *Micrasterias*! No harmful algal bloom species were observed. Not one!









Unknown at this point, but so cool!

August 24, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 2.2-meters

Total number of species observed: 36

Blooming Phytoplankton Species: Very small species of *Chaetoceros*

Common Phytoplankton Species: *Scrippsiella, Pseudo-nitzschia, Thalassiosira,*

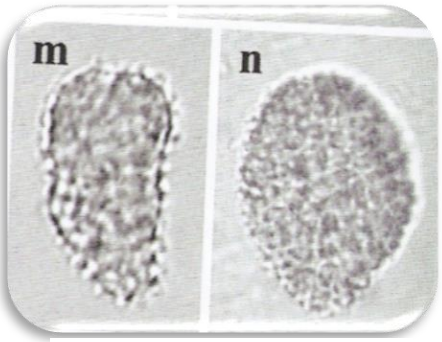
Zooplankton: crustacean nauplii, tintinnids, rotifers, larvaceans, copepods

Harmful Algal Bloom (HAB) Species: *Dinophysis* (36 cells/L), *Protoceratium* (18 cells/L), *Akashiwo* (375 cells/L), *Pseudo-nitzschia* (2,042 cells/L)

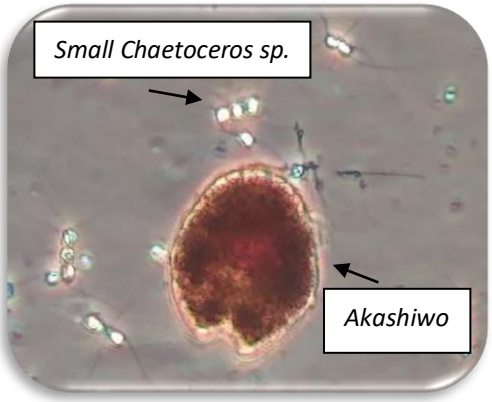
	Surface	1.5m	3.0m
Temp (°C)	21.00	18.80	16.00
Salinity (ppt)	15.93	26.51	28.24
Oxygen (mg/l)	9.05	8.84	3.98
pH	8.43	8.22	7.79

The entire week has been hot! *Pseudo-nitzschia*, the species responsible for Amnesic Shellfish Poisoning, is on the rise forming long, robust chains. Additional HAB species were also present, but at low concentrations.

This week, Brian Bill, NOAA, contacted Dr. Rita Horner (retired U.W. faculty) to inquire about this summer's mystery dinoflagellate in Budd Inlet. She referred us to the section of Dictyochophyceae (Silicoflagellates) in a book by Hoppenrath & Elbrachter. We believe the species might be *Verrucophora farcimen*. Mucocysts give these slow-moving flagellated cells their warty appearance.



Verrucophora farcimen; Hoppenrath & Elbrachter

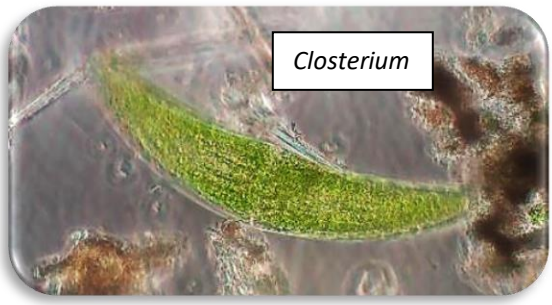


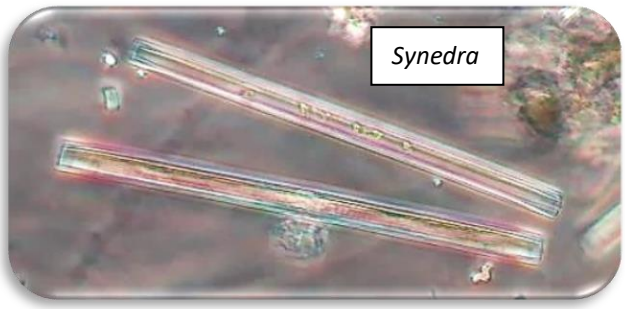
August 18, 2022 – Deschutes River, Pioneer Park

Pioneer Park was hopping today with temperatures soaring into the mid-90s and folks enjoying the nice, cool Deschutes River. The water temperature was the same as Budd Inlet's surface temperature at 18.9°C, or 66°F! Refreshing for a swim, but on the warm side for fish!

	Surface
Temp (°C)	18.9
Salinity (ppt)	0.07
Oxygen (mg/l)	10.36
pH	8.19

The plankton were a mix of diatoms, green protists and a few zooplankton – no dinoflagellates, but plenty of pennate (boat-shaped) diatoms, *Synedra, Melosira*, and rotifers. No harmful algal bloom species were observed. An entire soccer team ran over to the table to check out the plankton under the microscopes! Their enthusiasm was just as strong off the field as on! 😊 I love to hear, "Oh man, these plankton are sick!" and "I love science!" Couldn't agree more!





Who wants to swim in poop or trash? Not these kids! These four science stewards earned their Octopus Genius and Nudibranch Love stickers today as part of PSI's Sound Science Stewards (SSS) Sticker program. As a group, we picked up 85 pieces of trash, flagged (and scooped) 15 dog poop piles, and passed out Bags-on-Board to several dog owners. The kids even received a few thank you's from passersby.

Would you like to earn a Pink Polish Designs sticker?! Simply complete 3 surveys & 3 stewardship actions, send us your Final Report Form, and we will pop one in the mail for you! It's fun, easy and helps keep Puget Sound clean and healthy!

Oooooh....nice water bottle! ☺

August 17, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 2.5-meters

Total number of species observed: 33

Blooming Phytoplankton Species: Very small species of Chaetoceros

Common Phytoplankton Species: *Polykrikos, Ebria, Ditylum*

Zooplankton: tiarina, tintinnids, rotifer

Harmful Algal Bloom (HAB) Species: *Dinophysis* (30 cells/L), *Protoceratium* (6 cells/L), *Akashiwo* (36 cells/L)

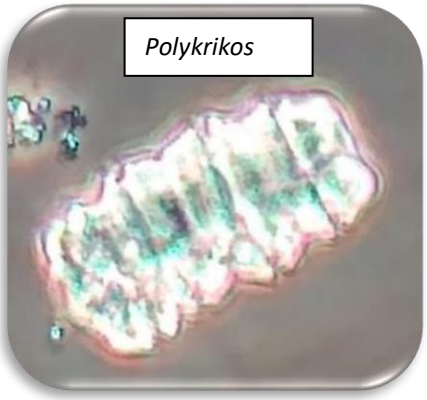
	Surface	1.5m	3.0m
Temp (°C)	19.0	18.0	15.9
Salinity (ppt)	21.11	26.97	28.3
Oxygen (mg/l)	7.82	6.53	5.17
pH	8.14	7.99	7.95

Today's plankton sample was fairly sparse. Water clarity has been uncharacteristically high – between 2.5 and 3.5 meters – for this time of year. And the plankton composition was a nice mix of diatoms, dinoflagelles, and zooplankton.

The dinoflagellate, *Polykrikos*, was common. This fun, interesting species consists of a colony of zooids – with every 2 zooids sharing one nucleus. They are mixotrophs meaning they can feed in a variety of ways. Studies have reported that *Polykrikos* are even capable of grazing down toxic *Alexandrium* cells, the species responsible for Paralytic Shellfish Poisoning.

The mystery flagellate that was captured in images from NOAA's Imaging FlowCytobot on August 4th was present again this week. I took a riveting 30-second video. Ha! If you know what it is, please let us know!

Look! A sunflower!



August 11, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 3.3-meters

Total number of species observed: 25

Blooming Phytoplankton Species: Nothing blooming, but *Scrippsiella* were common

Common Phytoplankton Species: *Noctiluca, Akashiwo* and *Dinophysis* present

Zooplankton: crustacean nauplii, tiarina, larvacean, cladocera, tintinnids

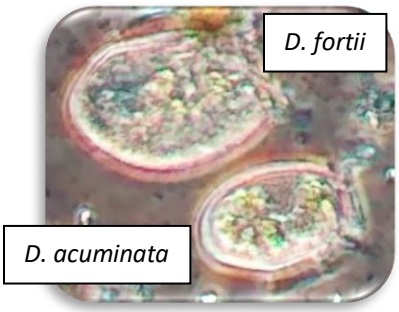
Harmful Algal Bloom (HAB) Species: *Dinophysis* (184 cells/L), *Protoceratium* (24 cells/L), *Akashiwo* (226 cells/L)

Photo credit: Michele Burton

	Surface	1.5m	3.0m
Temp (°C)	19.8	19.7	15.8
Salinity (ppt)	22.43	25.20	28.1
Oxygen (mg/l)	5.9	5.8	4.3
pH	7.9	7.9	7.8

Thank you, Evie Fagergren, for hosting What's Blooming this week! We were also fortunate to have Michele Burton, photographer for Stream Team, attending and taking such wonderful pictures. And thank you to the fun group of community scientists that stopped by to help sample. Madeline, August and Olivia…and even a family from France (!) – the YSI data, secchi reading, and plankton samples looked great.

The plankton composition was very similar to last week. While no specific species were blooming, the dinoflagellates, *Noctiluca* and *Scrippsiella*, were common. A handful of HAB species were present, but not at alarming numbers. *Protoceratium* and *Akashiwo* were still present as well as *Dinophysis*. The *Dinophysis* composition was consistent this week with *D. acuminata* (19%) and *D. fortii* (75%) being the most common. However, I did see a few *D. rotundata* (6%) which were fun to see as they are a bit more infrequent.



On Friday, Jerry Borchert from WDOH forwarded DSP toxicity data from 7/8/22 – 8/12/22 for four Thurston County locations. The DSP closure level was reached at the Olympia Yacht Club site on 8/2/22 before subsiding the following week. According to our data, *Dinophysis* doubled on July 26th to 423 cells/L with *D. acuminata (34%)* and *D. fortii* (61%) being the common species.

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

Marine Biotoxin by County
DSP Results Date 7/8/2022 - 8/12/2022

County: Thurston

Date Collected	Waterbody	SiteName	Subsite	Species	DSP Tissue	DSP Results ***(µg/100g)	Collector
07/12/2022	Squaxin Passage	Boston Harbor Marina		Blue Mussel	Whole	<1	Thurston County Health Department
07/19/2022	Squaxin Passage	Boston Harbor Marina		Blue Mussel	Whole	2	Thurston County Health Department
07/26/2022	Squaxin Passage	Boston Harbor Marina		Blue Mussel	Whole	3	Thurston County Health Department
08/09/2022	Squaxin Passage	Boston Harbor Marina		Blue Mussel	Whole	2	Thurston County Health Department
07/12/2022	Budd Inlet	Olympia	Olympia Yacht Club	Blue Mussel	Whole	8	Department of Health
07/20/2022	Budd Inlet	Olympia	Olympia Yacht Club	Blue Mussel	Whole	8	Department of Health
08/02/2022	Budd Inlet	Olympia	Olympia Yacht Club	Blue Mussel	Whole	**16**	Department of Health
08/10/2022	Budd Inlet	Olympia	Olympia Yacht Club	Blue Mussel	Whole	8	Department of Health
07/18/2022	Totten Inlet	Totten Inlet/Sandy Point		Blue Mussel	Whole	3	Taylor Shellfish Company
08/01/2022	Totten Inlet	Totten Inlet/Sandy Point		Blue Mussel	Whole	10	Taylor Shellfish Company
08/10/2022	Totten Inlet	Totten Inlet/Sandy Point	Deepwater Point	Blue Mussel	Whole	7	Taylor Shellfish Company
08/10/2022	Totten Inlet	Totten Inlet/Sandy Point	North Totten	Blue Mussel	Whole	3	Taylor Shellfish Company
07/20/2022	Nisqually Reach	Zittel's Marina		Blue Mussel	Whole	6	Department of Health
08/02/2022	Nisqually Reach	Zittel's Marina		Blue Mussel	Whole	1	Department of Health

NTD: No Toxin Detected
* Action Level: 80µg/100g
** Action Level: 20ppm
*** Action Level: 16µg/100g

TDD Relay Services 1-800-833-6399
http://www.doh.wa.gov/shellfishsafety.htm

Photo credit: Michele Burton

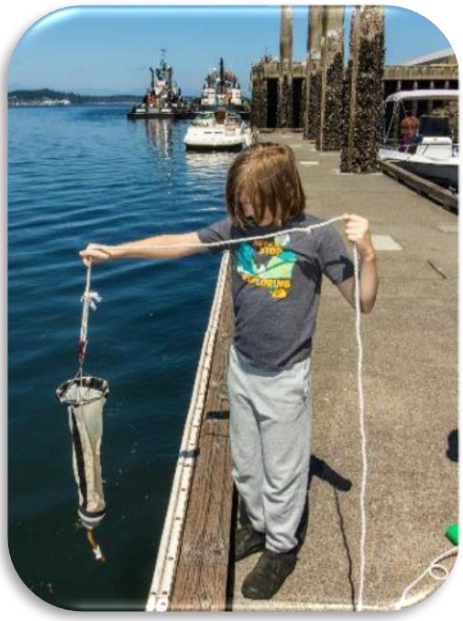


Photo credit: Michele Burton

August 4, 2022 – Long Lake Swimming Beach, Lacey

Secchi disk (water clarity): no dock

Total number of species observed: 21+

Blooming Phytoplankton Species: *Ceratium, Melosira, Dolichospermum*

Common Phytoplankton Species: *Dinobryon, Fragilaria*

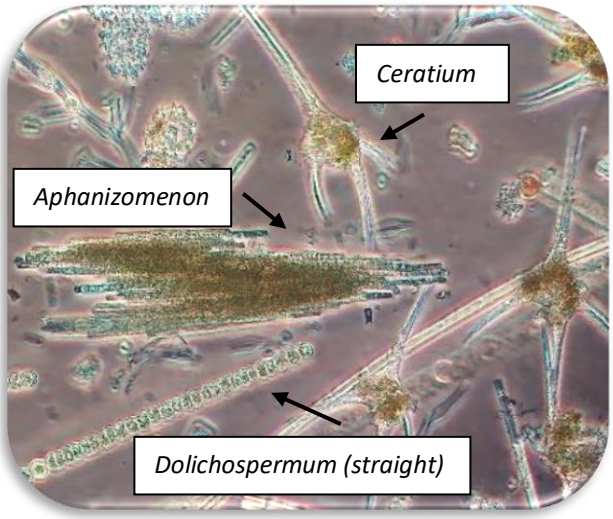
Zooplankton: rotifers – 3 species

Harmful Algal Bloom (HAB) Species: *Dolichospermum* (common) and *Aphanizomenon* (present)

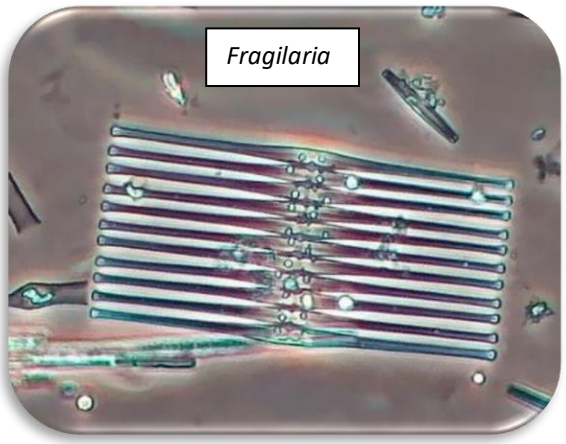
All was quiet at Long Lake today. The cool weather seemed to keep folks at home despite the super warm water temperatures - 78°F! Perfect for swimming! A handful of inquisitive folks ran over to see what was blooming under the microscopes (the plankton were amazing!) and talk about HABs. This week (8/1), Lake Pattison was closed to swimming after microcystin levels (24 ug/L) exceeded the closure limit of 8 ug/L.

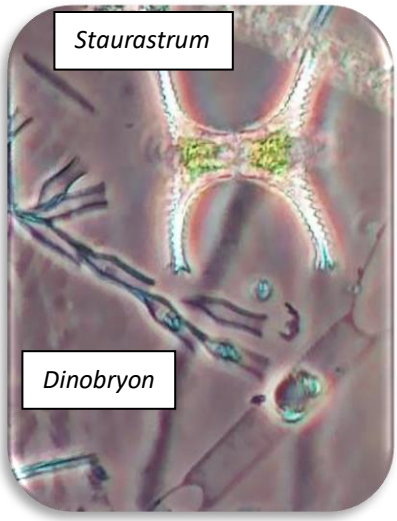
	Surface
Temp (°C)	25.4
Salinity (ppt)	0.1
Oxygen (mg/l)	9.15
pH	8.7

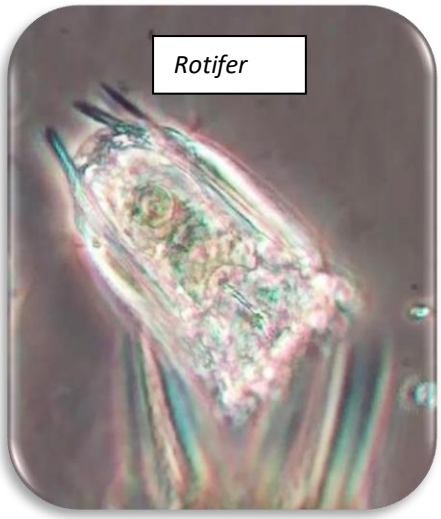
The Long Lake plankton sample was rich with *Ceratium, Dinobryon, Dolichospermum* and *Aphanizomenon*. The former two species being blue-green cyanobacteria. The *Dolichospermum* were observed in both straight and spiral forms. The oxygen level and pH were nice and high with so many photosynthesizers floating and swimming in the lake. Zooplankton were plentiful with at least 3 species of rotifers zipping across the slides.

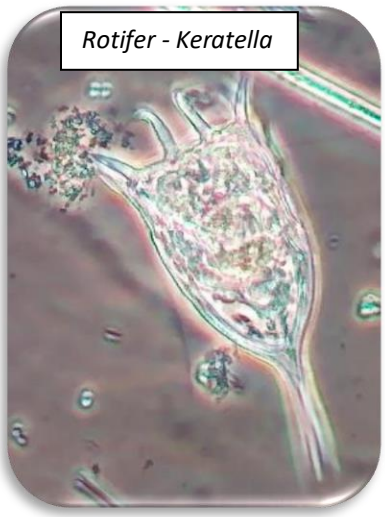


PSI's newly created Freshwater Plankton ID Guide!









August 4, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 3-meters

Total number of species observed: 34

Blooming Phytoplankton Species: nothing blooming, but *Scrippsiella* were common

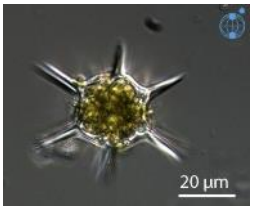
Common Phytoplankton Species: *Ceratium*, *Noctiluca, Akashiwo* and *Dinophysis* present

Zooplankton: crustacean nauplii, copepod, tiarina, larvacean.

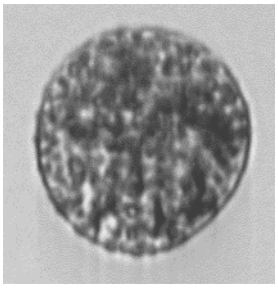
Harmful Algal Bloom (HAB) Species: *Pseudo-nitzschia* (36 cells/L), *Dinophysis* (202 cells/L), *Protoceratium* (42 cells/L), *Akashiwo* (220 cells/L)

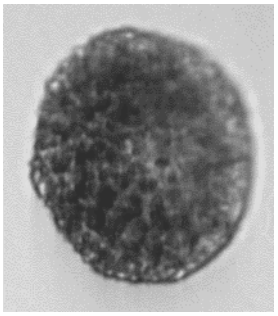
Coming in for a landing! The Olympia Community Sailing campers joined PSI Research Scientist, Katie Houle, and intern, Shriya, to collect this week's SoundToxins sample. Thanks for your help!!As we move into August, we continue to keep tabs on *Dinophysis* which have been slowly on the rise over the last few weeks. Also of interest is the appearance of a mysterious flagellate that was captured on NOAA's Imaging FlowCytobot instrument this week. We found a couple that look similar. Anyone have ID suggestions? *Dictyocha* perhaps? Sometimes, *Dictyocha* can have a membrane that covers the entire internal skeleton. Brian Bill will view under SEM (scanning electron microscope) to determine if this is the case.

	Surface	1.5m	3.0m
Temp (°C)	17.5	15.1	14.8
Salinity (ppt)	24.29	28.13	28.15
Oxygen (mg/l)	6.20	4.58	5.01
pH	8.0	7.8	7.9

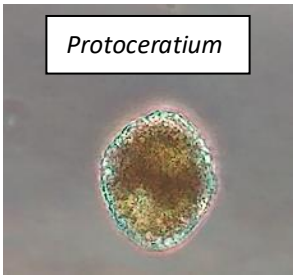


Typical Dictyocha w/skeleton showing





Dinophysis are still lingering in Budd with the main types being *D. acuminata* (53%) and *D. fortii* (35%). Also appearing this week are *Akashiwo sanguinea* (although very sad looking cells) and a few *Protoceratium reticulatum*. Both have been associated with shellfish mortality at higher concentrations. Still, we'll be watching these two species throughout the month!



IFCB Images, Brian Bill, NOAA

July 28, 2022 – Lake Lawrence Public Boat Ramp, Yelm

Secchi disk (water clarity): 1.8 meters

Total number of species observed: 20

Blooming Phytoplankton Species: *Dictyosphaerium, Lyngbya*

Common Phytoplankton Species: *Aphanocapsa, Fragilaria, Ceratium*

Zooplankton: rotifers (*Keratella* and *Filinia*), Cladocera

Harmful Algal Bloom (HAB) Species: *Dolichospermum* and *Aphanizomenon* were present – not quantified.

Lake Lawrence is a 330-acre, groundwater fed lake located just outside of Rainer and Yelm. It is a popular fishing spot that is home to a variety of warmwater fish including largemouth bass, yellow perch, bluegill and pumpkinseed sunfish, brown bullhead catfish and rainbow trout (stocked). The lake is named after Lindley and Sam Lawrence, businesspeople in the logging industry. You can read a wonderful piece about the lake's history from Lake Lawrence Community Club's website. Lake Lawrence is shallow (average depth = 13 feet), classified as eutrophic and experiences both nuisance aquatic vegetation and harmful algal blooms. You can read Thurston County Environmental Health's 2018 Lake Lawrence Water Quality Report here.

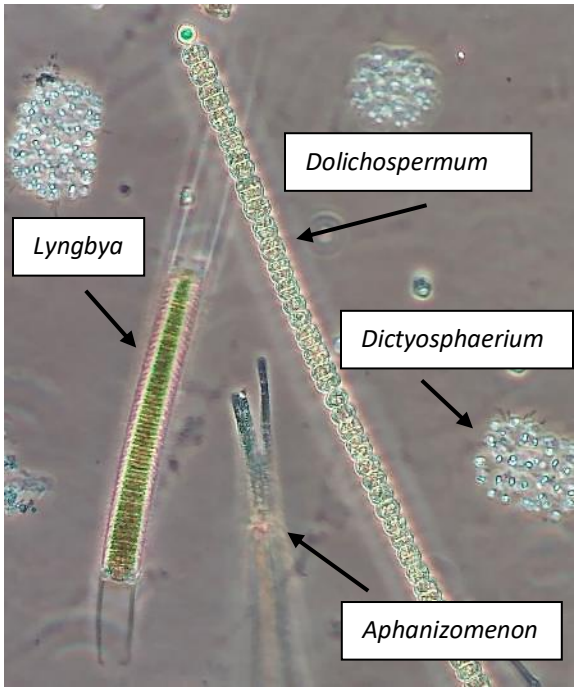
What a lovely lake! During my visit, dragonflies zipped along the shore and I could hear a Bald Eagle calling from not far away. The public boat launch was well maintained and offered a nice side trail for fishing. The weather was scorching – in the lower 90s – and only a few groups ventured down the trail to find a

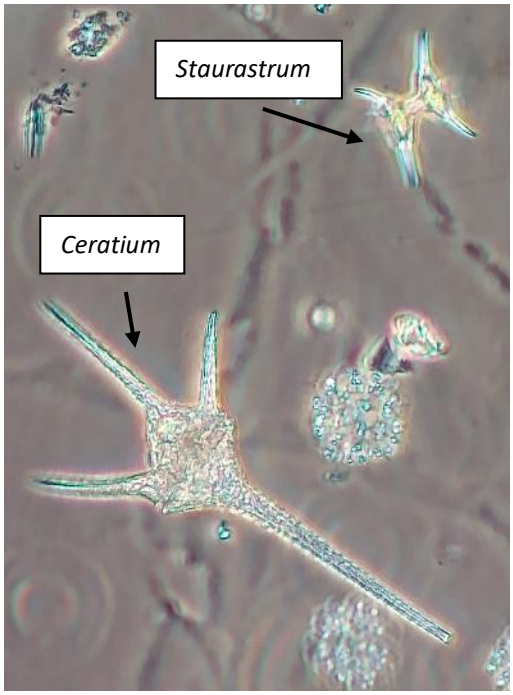
	Surface	1.5m	3.0m
Temp (°C)	28.3	27.0	
Salinity (ppt)	0.05	0.05	
Oxygen (mg/l)	11.3	11.5	
pH	9.6	9.6	

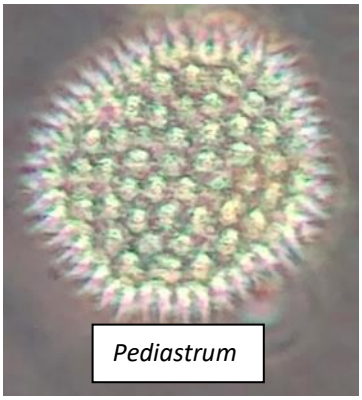
shady spot to fish. I set up a table under the trees to view plankton under microscopes and spent a bit of time picking up cigarette butts (over 150) and fishing line.

The water was greenish-brown, super warm (82.9°F!) and well oxygenated (must be plankton photosynthesizing!). Lots of tiny fish darted along the shoreline. Sure enough, the plankton sample was full of life. Two species of rotifers and water fleas darted across the slide. The most common phytoplankton observed were *Dictyosphaerium*, *Aphanocapsa*, *Fragilaria*, *Ceratium*, and long green strands of *Lyngbya* with their prominent sheaths. Also found were cyanobacteria including *Gloetrichia*, *Aphanizomenon*, and *Dolichospermum*.

Next Thursday, we'll be exploring Long Lake in Lacey. The weather will be a bit cooler – perfect for swimming with those plankton! Hope to see you!







July 26, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 1.8 meters

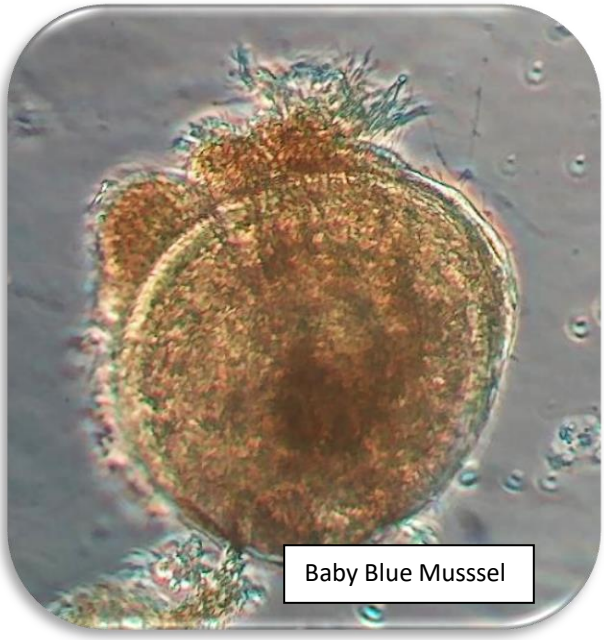
Total number of species observed: 41!!

Blooming Phytoplankton Species: *small unidentified dinoflagellates, small Chaetoceros sp.*

Common Phytoplankton Species: *Dinophysis, Ebria, Ceratium, Noctiluca, Thalassiosira, Scrippsiella*

Zooplankton: rotifers, tiarina, crustacean nauplii, nematode, mussels, tintinnids, copepod, larvacean, fish larvae

Harmful Algal Bloom (HAB) Species: *Dinophysis*: 423 cells/L, 34% *D. acuminata*, 61% *D. fortii*, 4% *D. norvegica*, 1% *D. parva*



	Surface	1.5m	3.0m
Temp (°C)	22.0	16.9	15.1
Salinity (ppt)	10.9	26.3	28.0
Oxygen (mg/l)	9.0	7.6	5.4
pH	8.2	8.0	7.8

Port Plaza was deserted – the heat was a bit sweltering at 4 PM (92°F). Only the Arctic terns were making themselves heard with their loud calls. The water looked clear. Visibility was 1.8 meters. Surface temperatures were hot (22°C, 71.6°F), but cooled quickly with depth. The water was definitely stratified with a layer of warm, fresh water sitting on top of the cooler salty water below. Oxygen and pH levels looked good, but we're starting to see a bit of oxygen depletion with depth.

The plankton composition was extremely diverse (41 species observed) with a nice mix of zooplankton, diatoms and dinoflagellates. The mysterious small unidentified dinoflagellates were still present, but replaced by an increase in *Scrippsiella* and *Protoperidinium*. *Dinophysis* numbers almost doubled this week from 244 to 423 cells/L.

Note: DSP toxin levels reached the closure limit of 16 µg/100g mussel tissue on 8/2/22, but dropped the following week.

July 21, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 2.5 meters

Total number of species observed: 30

Blooming Phytoplankton Species: *small unidentified dinoflagellate*

Common Phytoplankton Species: *Noctiluca, Dinophysis, Ceratium*

Zooplankton: rotifers, tiarina, polychaete, barnacles, mussels, marine cladocera

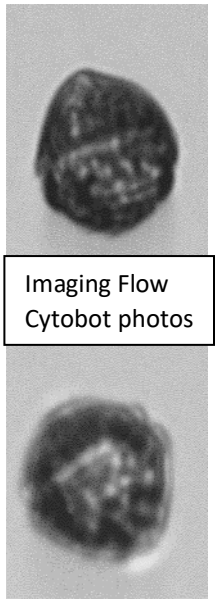
Harmful Algal Bloom (HAB) Species: *Dinophysis*: 244 cells/L, 20% *D. acuminata*, 76% *D. fortii*, 2% *D. norvegica*, 2% *D. parva*

	Surface	1.5m	3.0m
Temp (°C)	20.2	15.8	14.1
Salinity (ppt)	19.42	27.56	28.02
Oxygen (mg/l)	7.16	4.70	4.17
pH	8.0	7.8	7.8

It was a busy day at the dock! We kicked off our sampling with the Olympia Community Sailing campers. And then groups – both local and national – stopped by to learn about plankton. Thank you to everyone for your plankton enthusiasm and for making the afternoon so fun!

This is why we attach floats! 😊

Last week's thick *Heterosigma* bloom was completely gone! Not a single cell remained! Instead, the sample was dominated by small roundish dinoflagellates. While I've seen this species before, it's never been dominant. I sent photos to NOAA for identification help. They returned photos of the same dinoflagellate that they captured using their Imaging Flow Cytobot instrument (located in lower Budd) a couple days ago. NOAA is unsure of the species name as well. We also observed marine *Cladocera* (or water fleas) in the sample. We find *Cladocera* frequently in lakes, but never Puget Sound. So, we've witnessed some very unusual characters in the plankton this week. This is the reason I love studying plankton. The diversity is incredible.



In other exciting news….

PSI is partnering with the downtown Timberland Library to offer **Discover Plankton Lendable Kits!** The plankton kits will become part of TRL's Library of Things collection. Soon, you will be able to check out a bucket full of plankton sampling equipment: a plankton net, microscope, secchi disk, thermometer, hydrometer, scientific journal, and plankton identification sheets!!! These kits were made possible through Keta Legacy (formerly Mountaineers) funding. Thank you, Keta!!!

Discover Plankton Lendable Kits should be available in mid-August! I'm so excited!

This week, we have a guest contributor!!!! Brooke and her kids, Charlotte, Thomas, and Benjamin, had such a fun time exploring marine life at Marine Creature Monday, they decided to join us for What's Blooming, too! Charlotte sent a couple of photos and this amazing summary report about her experience. It certainly was a plankton party! Thank you, Charlotte!

Plankton Party!

By: Charlotte Freestone

Plankton is a really really small creature that lives in water. They're so small our eyes can't even see them. We have to use a microscope. If you look into the water, you can't see the bottom. That's because there's so much plankton. They're so many they block the bottom.

Some plankton look like: little shrimp, lima beans, little chubby worms, sticks, stars, crescent moons, and many more. Some plankton can harm you. Certain types of plankton get in shellfish. Then if you eat it causes harm like: short term memory lost, sickness, and getting paralyzed.

There is a type of plankton that can eat other plankton. It's shaped like a lima bean. If you see red dots in it, that means it ate another plankton.

To catch plankton, you: get a special net, put it in the water, pull it out, put some water in a cup, get a dropper, squeeze some water, put a drop on a slide, put another slide on top, put it under a microscope, adjust the slide to see different plankton.

When there is a bloom of plankton and if you put something in the water, sometimes there's so much plankton you can't even see it after a couple inches down! PLANKTON IS SO COOL!!!

July 13 & July 14, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 0.60 meters; 0.25 meters on July 14th at 8:00 AM

Total number of species observed: 28

Blooming Phytoplankton Species: *Heterosigma*!

Common Phytoplankton Species: *Ebria, Dictyocha, Noctiluca*

Zooplankton: rotifers, tintinnids, tiarina, polychaete, barnacles

Harmful Algal Bloom (HAB) Species: *Heterosigma*: too many to count! *Dinophysis*: 155 cells/L, 62% *D. acuminata*, 15% *D. fortii*, 15% *D. norvegica*, 8% *D. parva*

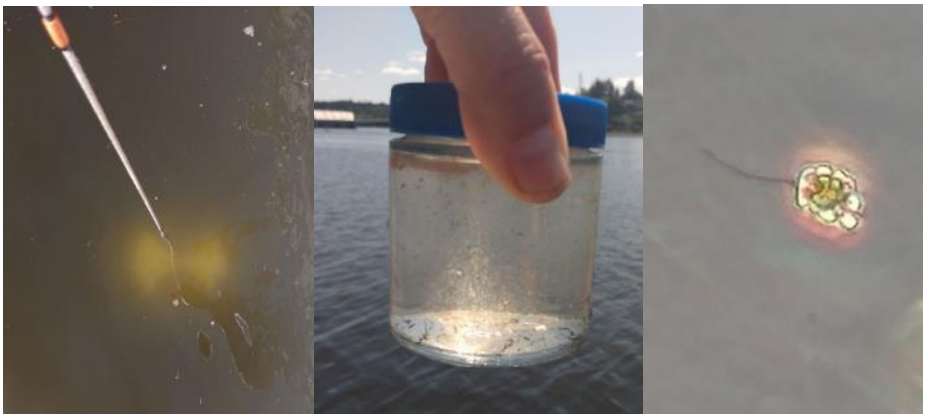
	Surface	1.5m	3.0m
Temp (°C)	21.7	15.6	13.7
Salinity (ppt)	16.00	27.08	27.83
Oxygen (mg/l)	16.91	6.40	3.93
pH	8.89	7.83	7.61

This week, we collected a SoundToxins sample on Wednesday, a day early, to investigate a red bloom that had been reported by a homeowner north of West Bay Marina. The bloom was reported to Greg Dunbar, a Spill Responder with WDOE, who forwarded the inquiry to NOAA, SoundToxins, PSI and WDOH to find out what's blooming in Budd. PSI, as well as Brian Bill and Emilie from NOAA, sampled on Wednesday and discovered a thick ***Heterosigma akashiwo*** bloom. These tiny flagellates can form extensive blooms in mid-summer when water temperatures heat up. *Heterosigma* are toxic to fish and the killing mechanism is rather mysterious and unknown.

Red bloom photo reported by a homeowner north of West Bay Marina.

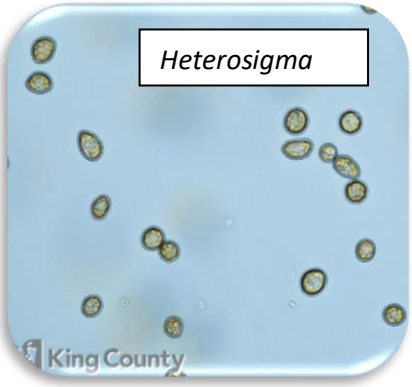
Emilie (NOAA) with a jug of Heterosigma!

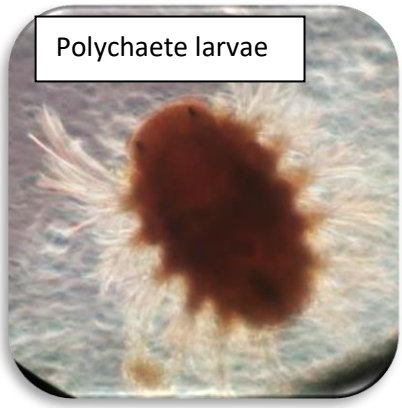
Water clarity was extremely low (0.6 meters) and I expected the net to be streaked in red when I pulled it up. Instead, the plankton sample was almost completely clear – not red at all! These tiny cells can slip right through the net's 20-micron mesh size. *Heterosigma* are less than 25-microns and many passed right through. Another interesting feature about *Heterosigma* is that the cells shrivel up into small little raspberries when preserved in Lugol's iodine solution. Otherwise, when unpreserved, they appear as rapidly swimming cornflakes that quickly rotate and change directions.



The secchi disk disappeared at 0.6 meters! (left), net tow sample (middle), Heterosigma preserved in Lugols solution (right).

On Thursday, Evie (PSI) hosted our regular What's Blooming event. She was joined by a family of young scientists – J, Phoenix, Houston and Lincoln – who spent the hour collecting plankton samples, scooping up tiny fish, and exploring microscopic and macroscopic marine life! Thank you for your help! Harbor Patrol and a few kayakers also stopped by to find out what's turning Budd Inlet a thick reddish brown! How long will the *Heterosigma* stick around? Visit us next week and find out!

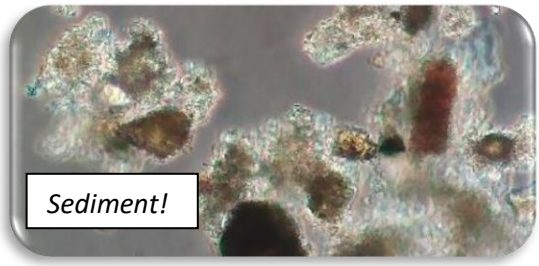




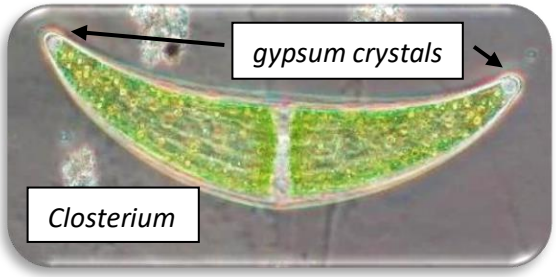
July 7, 2022 – Tumwater Falls Park (Brewery Park)

I struggled a bit to find a place to collect a plankton sample and the YSI data. The water was flowing really fast along the fish ladder and I certainly didn't want to strain or lose the plankton net. I found a nice calm pool that allowed me to toss the net out safely and also collect water quality data. Unfortunately, the most common item found in the sample was sediment! Not surprising given the tossing and turning of the water over the series of falls. The churning made for some nice oxygen concentrations though!

	Surface
Temp (°C)	16.5
Salinity (ppt)	0.06
Oxygen (mg/l)	9.93
pH	8.4

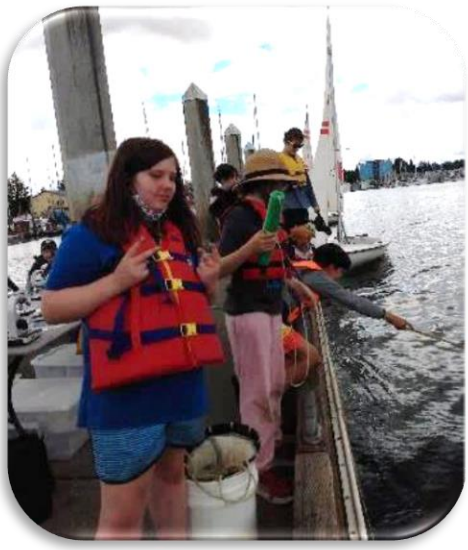


Among the sediment, we were still able to find one of my favorite freshwater species, *Closterium* (the green banana!). *Closterium* have cell vacuoles filled with gypsum crystals at each end that can be seen "dancing" when viewed under a microscope! Also found were long filaments (likely *Melosira*), rolling balls (*Synura*), euglenoids, a few large centric diatoms (*Stephanodiscus*) and a squirming nematode. Fortunately, the Budd Inlet samples were full of entertaining, zippy zooplankton to look at!



Thank you to all that stopped by to check out the plankton today! Come join us next week at the Port Plaza dock. We'll continue to keep tabs on *Dinophysis* levels and see how the plankton community has changed. Every week is different!

July 7, 2022 – Budd Inlet, Port Plaza



Secchi disk (water clarity): 3.0 meters

Total number of species observed: 29

Blooming Phytoplankton Species: *Scrippsiella*

Common Phytoplankton Species: *Dinophysis, Dictyocha, Noctiluca*

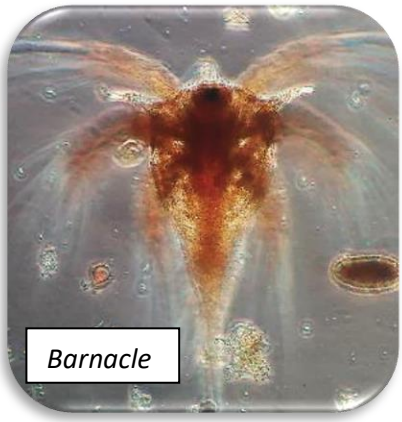
Zooplankton*:* Barnacle larvae, tintinnids, copepods, larvaceans, bivalve larvae, crustacean nauplii, gastropods, rotifers, and tiarina

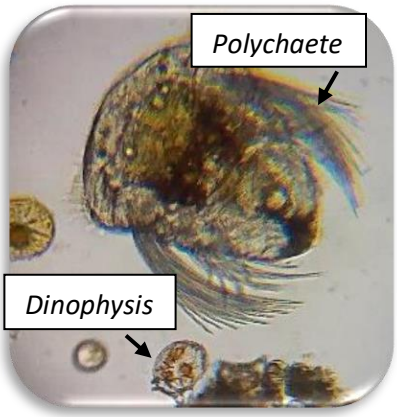
Harmful Algal Bloom (HAB) Species: *Dinophysis*: 375 cells/L, *30% D. acuminata, 41% D. fortii, 25% D. norvegica, 2% D. parva, 2% D. rotundata.*

	Surface	1.5m	3.0m
Temp (°C)	16.1	14.6	13.7
Salinity (ppt)	23.6	27.65	27.87
Oxygen (mg/l)	7.81	9.02	6.59
pH	7.9	8.1	7.9

Today we were joined by Olympia Community Sailing camp. The campers helped us collect plankton samples and figure out how to use our new hydrometer (a.k.a salinity gauge).

The sample was FULL of zooplankton. So much!!!! Barnacles, rotifers, mussel larvae, copepods and more! A thick band of Noctiluca rose to the surface of the jar so there should be nice bioluminescence at night. Plankton concentrations weren't as high as last week – perhaps due to the cooler temperatures. *Dinophysis* concentrations decreased from over 9,000 cells/L to 375 cells/L. No other harmful algal bloom species were observed.





June 30, 2022 – Longs Pond & Woodland Creek, Lacey

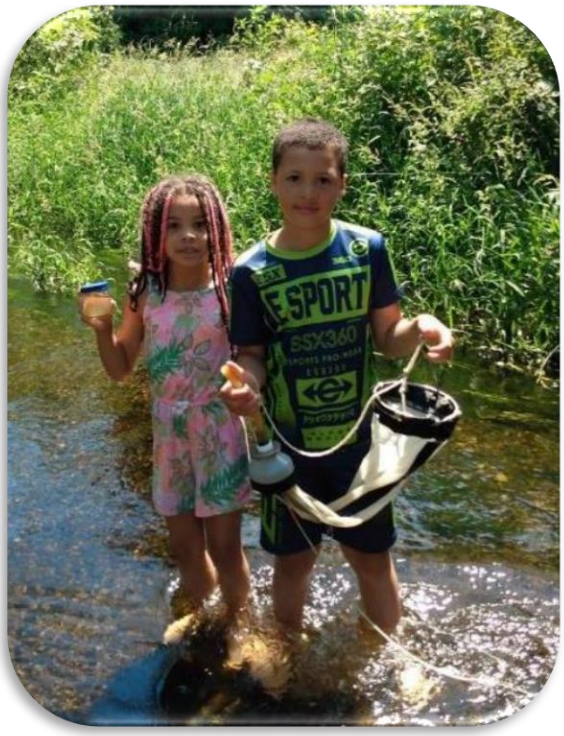
As soon as I dipped my net into Longs Pond, Alijah and Aaliyah quickly offered to help. Thank you (!!) to these amazing young scientists (and Grandma) who spent almost an hour and a half collecting and viewing water samples from both Longs Pond and Woodland Creek. They were pretty amazed at the incredible amount of life found in a few drops of water.

Visibility at Longs Pond was 1.5 meters. This was clearer than last year when we sampled in August and the visibility was only 0.25 meters!! The sample was greenish and full of many species from the Chlorococcales, an Order of green algae. Similar to last year, there was a huge difference in dissolved oxygen (DO) concentrations between the 2 sites. Oxygen levels were nice and high in Longs Pond due to the photosynthesizing algae (9.3 mg/L). In contrast, oxygen levels were remarkably low in Woodland Creek (2.8 mg/L). Last year, DO was 1.6 mg/L in Woodland Creek. Alijah was able to find slightly higher oxygen levels by placing the YSI probe within the mats of green algae (~4 mg/L).

	Longs Pond		Woodland Creek
	mid		mid
Temp (°C)	20.9		19.3
Salinity (ppt)	0.05		0.05
Oxygen (mg/l)	9.3		2.8
pH	7.9		7.2

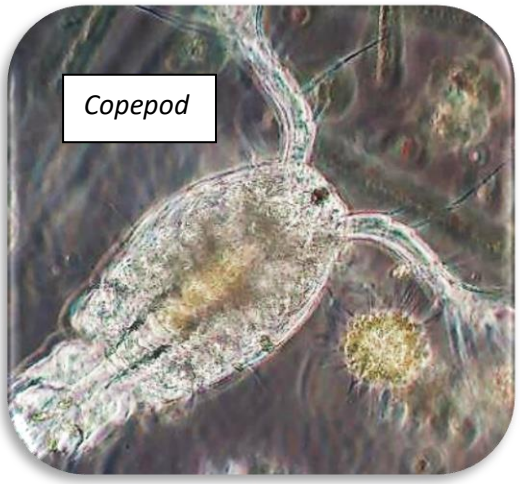
Alijah and Aaliyah performing a net tow and collecting YSI water quality data.

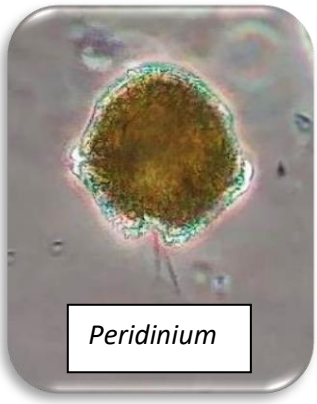
The kids were both disturbed and fascinated with the organisms found in their water samples.

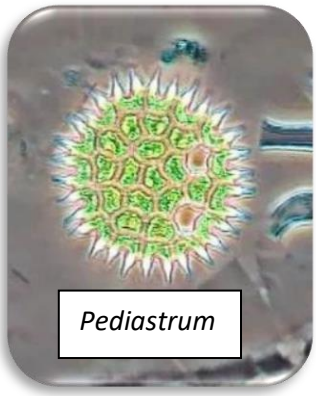


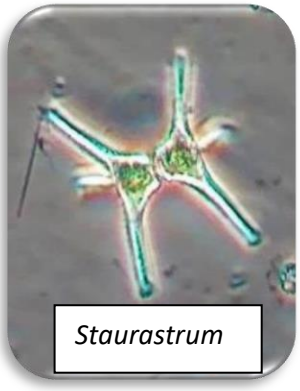
The Longs Pond sample was full of a mixture of zooplankton, diatoms, and dinoflagellates. The zooplankton zipping around on the slides included copepods, crustacean nauplii (probably early life stage of copepods), cladocerans (water fleas), and rotifers (at least 3 different species). The dinoflagellates included both the 3-pronged *Ceratium* and *Peridinium*. The green protists *Pediastrium*, *Scenedesmus, Cosmarium, Staurastrum, Phacus, Synura, Woronichinia*, and *Dinobryon* were present. The diatoms *Asterionella, Fragilaria, Tabellaria, Melosira* and *Navicula* were observed.

The bluegreen algae responsible for producing biotoxins were also present including *Aphanizomenon* and *Anabaena*, renamed *Dolichospermum*.









June 30, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 2.1 meters

Total number of species observed: 28

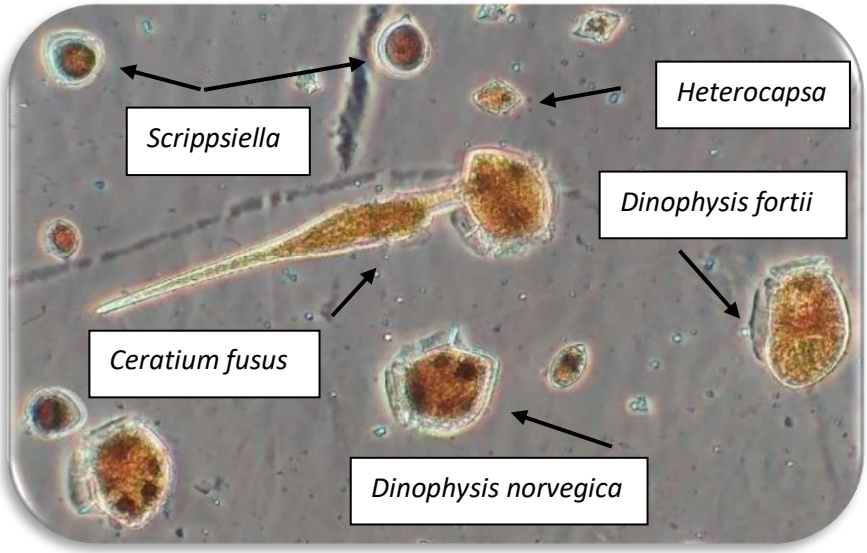
Blooming Phytoplankton Species: *Scrippsiella, Dinophysis*

Common Phytoplankton Species: *Heterocapsa, Ebria*

Zooplankton*:* Barnacle larvae, tintinnids, copepods, larvaceans, bivalve larvae, crustacean nauplii, and tiarina

Harmful Algal Bloom (HAB) Species: *Dinophysis*: 9,780 cells/L, *13% D. acuminata, 68% D. fortii, 14% D. norvegica, 4% D. parva, 1% D. rotundata. Pseudo-nitzschia: 12 cells/L. Akashiwo sanguinea: 185 cells/L.*

	Surface	1.5m	3.0m
Temp (°C)	14.4	14	13.8
Salinity (ppt)	25.13	26.97	27.25
Oxygen (mg/l)	7.99	10.36	9.95
pH	7.9	8.2	8.2



Dinophysis are blooming!!! Almost all of the diatoms are gone and have been replaced by dinoflagellates - mostly *Hetersigma, Scrippsiella, Protoperidinium* and *Dinophysis*. *Akashiwo* are also starting to increase in number. Diversity has declined from 36 to 28 species.

Dinophysis concentrations increased from 42 cells/L to 9,780 cells/L in one week – definitely worthy of an Alert notice to SoundToxins and WA Department of Health (WDOH)!!! *Dinophysis* is the species responsible for Diarrhetic Shellfish Poisoning. Last summer, the Inlet closed due to DSP in mid-July.

June 23, 2022 – Budd Inlet, Port Plaza

Secchi disk (water clarity): 3.5 meters

Total number of species observed: 36

Blooming Phytoplankton Species: *Heterocapsa, Scrippsiella*

Common Phytoplankton Species: *Noctiluca*

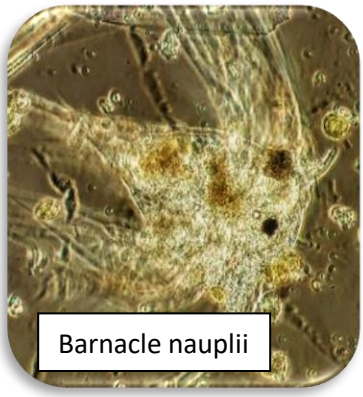
Zooplankton*:* So many!! Barnacle larvae, tintinnids, copepods, larvaceans, bivalve larvae, crustacean nauplii, tiarina, polychaete larvae plus 2 additional types of worms.

Harmful Algal Bloom (HAB) Species: *Dinophysis*: 42 cells/L, 43% *D. acuminata*, 28% *D. fortii*, 29% *D. norvegica*.

	Surface	1.5m	3.0m
Temp (°C)	17.4	13.8	12.6
Salinity (ppt)	17.61	27.1	27.76
Oxygen (mg/l)	8.8	8.6	6.8
pH	8.0	8.0	7.9

What an amazing kick-off to the "What's Blooming?" season!! The sun was shining and the Farmers Market was hopping. Many folks ventured down to Port Plaza and checked out plankton under the microscopes. The plankton community was incredible (!) – rich with zooplankton, especially barnacle larvae and tintinnids. *Noctiluca* were also very common, floating to the top of the glass sample jar; visible as a band of teeny-tiny circles to the naked eye. When *Noctiluca* are common, we should experience amazing bioluminescence at night! Dinoflagellates were also common – both *Heterocapsa* and *Scrippsiella*. These could be seen rolling slowly across the microscope slide.

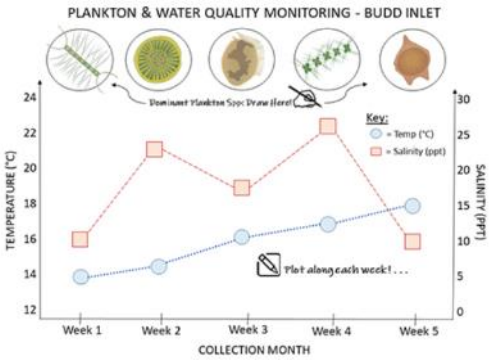
As far as harmful algal bloom (HAB) species, *Dinophysis* concentrations have fallen from 637 cells/L (last week) to 42 cells/L. *Pseudo-nitzschia*, which were blooming at high concentrations in early June (12,702 cells/L), are almost entirely absent. Thanks to all who shared in the plankton excitement today, especially Maitreya who pronounced, "there is an entire village of plankton" on her slide. She even named a tintinnid after herself, the Maitreya Tintinnid.



Join us next week as we explore freshwater plankton at Woodland Creek Community Park in Lacey!

Plot-Along-At-Home

Do you have a burning plankton question that you would like to investigate? Help identify trends and patterns by starting your own **"Plot-Along-At-Home"** graph! Use one of our templates or create your own graph depending on your individual research question. For example, are you curious what plankton are blooming when oxygen levels are at their lowest? What water quality is like during biotoxin closures? Start graphing and find out!



1. Print a Plot-Along-At-Home template. You can select a blank template or one that is already designed to track temperature/salinity or oxygen/pH. If you don't have a printer, sketch your own template or pick one up at the Port Plaza dock.
2. Plot your data.
3. Finally, sketch plankton species that are blooming each week. You can find pictures of most of these species by clicking on the Phytoplankton ID Guide and the Zooplankton ID Guide. Do you notice anything unusual or any trends?

2022 Budd Inlet Data

	8/4/22	8/11/22	8/17/22	8/24/22	9/1/22
Secchi (m) visibility	3.0	3.3	2.5	2.2	3.8
Water Temp (°C)					
Surface	17.5	19.8	19.0	21.0	19.5
Depth (3m)	14.8	15.8	15.9	16.0	16.4
Water Salinity (ppt)					
Surface	24.29	22.43	21.11	15.93	23.42
Depth (3m)	28.15	28.08	28.34	28.24	28.37
Oxygen (mg/l)					
Surface (1m)	6.20	5.92	7.82	9.05	7.48
Depth (3m)	5.01	4.33	5.17	3.98	5.71
pH					
Surface (1m)	7.95	7.89	8.14	8.43	8.02
Depth (3m)	7.85	7.83	7.95	7.79	7.94
HABS					
Dinophysis	202	184	30	36	875
Pseudo-nitzschia (PN)	36	0	77	2042	3149
Alexandrium	0	0	0	0	0
Blooming &	*Scrippsiella*	*Protoperidinium*	*sm Chaeoceros*	*sm Chaetoceros*	*Akashiwo*
Common Species		*Scrippsiella, Akashiwo*	*Polykrikos*	*Scrippsiella, P/N*	*Pseudo-nitzschia*

2022 Budd Inlet Data

	6/30/22	7/7/22	7/13/22	7/20/22	7/26/22
Secchi (m) visibility	2.1	3.0	0.6	3.6	1.8
Water Temp (°C)					
Surface	14.4	16.1	21.7	19.2	22.0
Depth (3m)	13.8	13.7	13.7	15.2	15.1
Water Salinity (ppt)					
Surface	25.13	23.60	16.00	15.50	10.91
Depth (3m)	27.25	27.87	27.83	27.85	28.02
Oxygen (mg/l)					
Surface (1m)	7.99	7.81	16.90	5.61	8.95
Depth (3m)	9.95	6.59	3.93	5.03	5.42
pH					
Surface (1m)	7.89	7.89	8.89	7.56	8.22
Depth (3m)	8.15	7.91	7.61	7.70	7.79
HABS					
Dinophysis	9780	375	155	244	423
Pseudo-nitzschia (PN)	12	0	0	0	0
Alexandrium	0	0	0	0	0
Blooming &	*Dinophysis, Scrippsie*	*Scrippsiella*	*Heterosigma!!!*	*sm unidentified dinos*	*sm unidentified dinos*
Common Species	*Heterocapsa, Ebria*	*Dinophysis, Noctiluca*			*sm Chaetoceros sp.*

6/30 *Dinophysis* bloom! 7/13 *Heterosigma* bloom! Caused low visibility and super high oxygen and pH levels (at surface where *Heterosigma* formed a surface band). Temperature values depict how hot and stratified the water column was.