

2021 “What’s Blooming?” Plankton Monitoring Final Report



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2021 Goals & Procedures

Stream Team partnered with Pacific Shellfish Institute (PSI) to perform its 10th year of the “What’s Blooming?” plankton monitoring program! The goal of this program is to offer engaging activities that educate the public about local water quality issues and encourage environmental stewardship. Monitoring connects the community to their watershed and inspires participants to take evidence-based actions that reduce stormwater pollution, particularly related to nutrients, bacteria and litter. Due to COVID-19, public participation was not explicitly advertised this year. However, the public was allowed to assist with water quality sampling and plankton viewing in a more limited capacity. For those individuals interested in participating, face masks and hand sanitizer were available, and equipment was sanitized between groups. Similar to 2020, no formal community events were held.



Olympia Yacht Club campers from the STEM Sailing program assist with SoundToxins sampling, July 28th.

2021 Task Summary	# events	People Reached (FB)*	Impressions (IG)*	In-person Contacts
Task				
What's Blooming in Olympia? Budd Inlet/Ward Lake	7	1583	469	56
What's Blooming in Lacey? Woodland Creek/Long Lake	2	256	230	40
What's Blooming in TC? Deep Lake/Munn Lake	2	494	186	12
2021 Summer Newsletter Article				Completed
	11	2333	885	108
* Facebook and Instagram analytics used in addition to limited In-person contacts				

During the summer, PSI conducted 6 “What’s Blooming in Budd?” events at the Port Plaza dock. Every other week, PSI also sampled at 5 fresh water lakes throughout Thurston County including Deep, Munn, Ward and Long Lakes, in addition to Longs Pond and Woodland Creek at Woodland Creek Park. PSI shared information about the weekly sampling events through enhanced “blog-style” entries (Appendix A) on [PSI’s website](#), [PSI’s Facebook](#) (Appendix B) and [PSI’s Instagram](#) pages. PSI completed a total of 11 sampling events reaching at least 3,326 individuals – 97% of those being contacts via social media sites such as Facebook & Instagram.

PSI posted 10 Facebook and 10 Instagram entries resulting in 2,333 People Reached (FB), 885 Impressions (IG) and 18 Shares further increasing educational viewing. The events resulted in 108 In-Person contacts on the dock and surrounding lakes.

For the “What’s Blooming?” monitoring events, PSI collected water quality and phytoplankton data between June 24th and August 26th. The phytoplankton were viewed under a field microscope and the results were displayed to the public using an A-frame board left on-site until dusk. Plankton samples were further analyzed in the lab to determine species diversity and harmful algal bloom (HAB) concentrations using SoundToxins protocols. SoundToxins is a monitoring program designed to provide early warning of HABs in order to minimize human health risk and losses to fisheries. Data was entered into NOAA’s [SoundToxins](#) phytoplankton monitoring database. Sampling at freshwater lakes was conducted similarly with a focus on water quality, plankton species composition and HABs. The connection between sources of stormwater pollution, downstream water quality, and stewardship was highlighted throughout the program.



Olympia HS intern, Shriya, collecting a plankton sample, July 22nd.

The “What’s Blooming?” program lends itself to supporting additional new partnerships and applications beyond the scope of this contract. For example, on 7/28 and 8/11, campers from Olympia Yacht Club’s STEM sailing program helped sample water quality, collect plankton samples, and screen samples for HAB species. On 8/25, “What’s Blooming in Budd?” plankton samples were shared with a Northwest Youth Corps crew at Capitol Land Trust’s Inspiring Kids Preserve. Students learned about stormwater pollution, plankton, HABs, and shellfish-related job opportunities.

PSI promoted the “What’s Blooming?” program at Deschutes Estuary Restoration Team’s (DERT’s) kayak patrol event at Boston Harbor on 8/21. Paddlers collected water quality data and plankton samples from 3 Boston Harbor locations and compared them to data and samples collected from Budd Inlet that same evening. And finally, “What’s Blooming?” events provided the perfect opportunity for student interns to learn about careers in marine science. Student interns from Olympia High School assisted with sampling on



NW Youth Corps crew viewing a “What’s Blooming?” sample at Capitol Land Trust’s Inspiring Kids Preserve.

6/24, 7/22 and 7/29. One intern, Shriya, has been assisting with the SoundToxins program since February 2021. Thank you, Shriya!

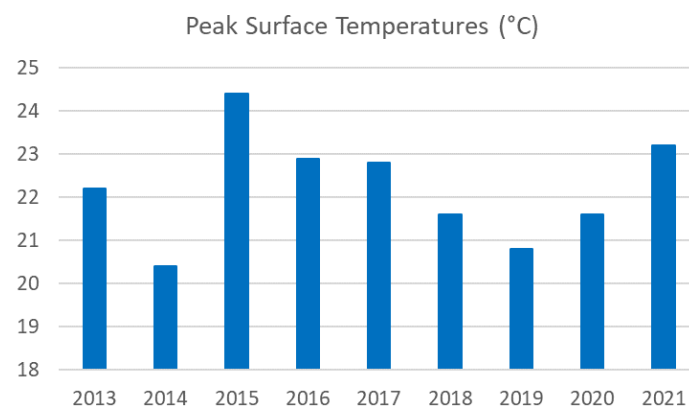
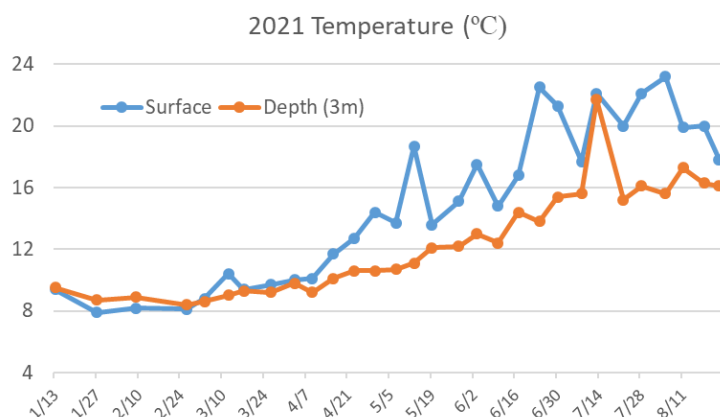
The “What’s Blooming?” program has contributed to a long term data set for Budd Inlet. This spring, PSI used this data to create a SoundToxins phytoplankton monitoring lesson for middle and high school students. This lesson includes a Power Point presentation, data analysis, and hands-on activities including using water quality equipment and identifying phytoplankton. The unit was piloted in Jenna Glock’s 9th grade Biology/STEM Physics class at North Thurston High School. The unit is currently being updated based on this summer’s important new findings related to *Dinophysis* blooms and DSP closures. We look forward to offering this unit to more classes in the future.



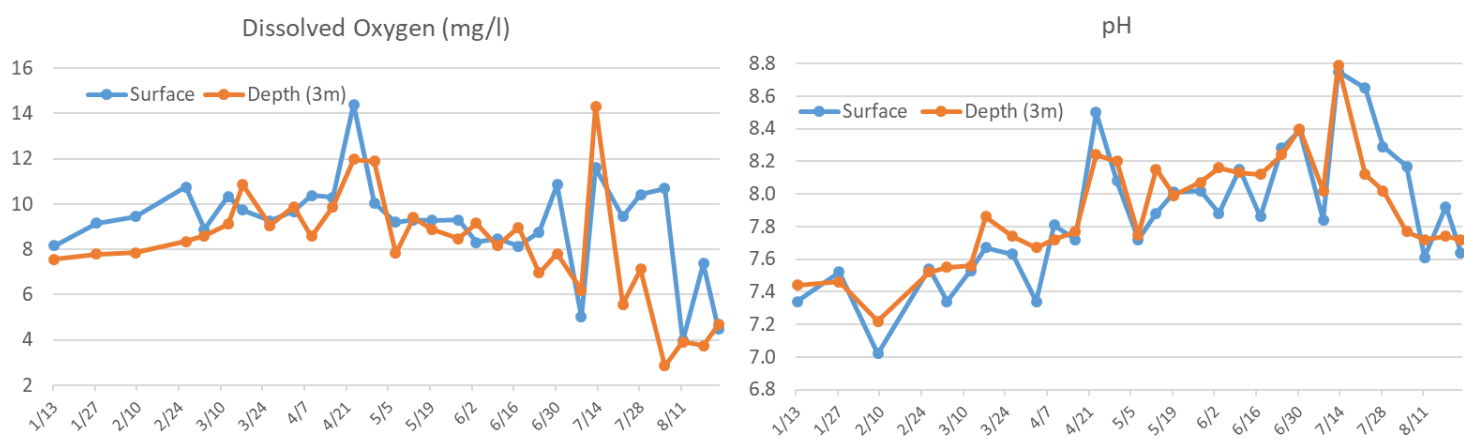
PSI's new SoundToxins Plankton Monitoring unit!

Budd Inlet Water Quality Data

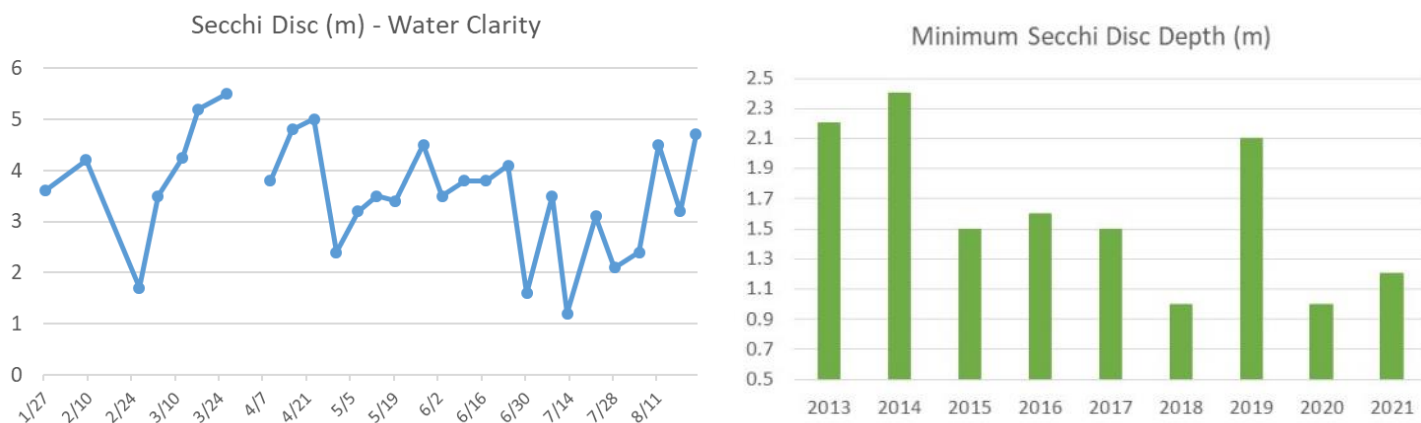
This summer, our region experienced unprecedented periods of extreme heat – reaching triple digit numbers in late June. These maximum temperatures occurred during peak low tides resulting in heat stress and mortality for many intertidal organisms including shellfish. This summer’s peak recorded water temperature was warmer than any other year (23.2°C) since 2013 (when we began collecting data), with the exception of 2015. In 2015, the highest temperature (>24°C) was recorded during the warm water event nicknamed “the Blob.” While the surface temperature reading was 22°C just prior to this year’s “heat dome” event in late June, no measurements were collected during the actual heat wave for safety reasons. Therefore, it is likely that surface temperatures were higher than reported. Regardless, water temperatures were warmer than normal this summer, particularly in June during the kick-off of the “What’s Blooming?” season.



This year, PSI monitored dissolved oxygen (DO) and pH levels throughout the entire year. In general, DO and pH tend to move in sync with one another and are highly influenced by phytoplankton concentrations. For example, when phytoplankton are blooming (spring and summer), oxygen and pH levels are elevated due to photosynthesis. When phytoplankton concentrations are low (winter), oxygen and pH levels decline. In Budd Inlet, DO and pH levels also decline at depth in mid-late summer due to the bacterial decomposition of settled phytoplankton at the bottom of the Inlet. Budd Inlet has long suffered from dangerously low oxygen levels in late-summer due to excess nutrients that fuel rich phytoplankton blooms. Preventing nutrient sources such as animal waste, fertilizer, grass clippings, and soaps from entering stormwater that reaches Budd Inlet is a key step in protecting water quality.



During the “What’s Blooming?” season, DO levels at 3m depth ranged from 14.3 mg/l on 7/13 to 2.86 mg/l on 8/5. Levels below 4 mg/l are stressful to marine life; below 2 mg/l have been shown to cause mortality. Fortunately, a bloom of *Euglenoids* and *Ceratium* increased DO levels to 9.2 mg/l on 9/2. Following a similar pattern, pH levels at 3m depth ranged from 8.8 on 7/13 to 7.7 on 8/11, bumping up to 8.2 during the bloom on 9/2. These ranges were fairly similar to 2020. Last year, summer DO values ranged from 16 mg/l to 3.9 mg/l and summer pH values ranged from 8.9 to 7.8.



The most notable spike in DO and pH occurred on 7/13. According to field notes, this particular day was hot and the water was “warm and gross” with thick brown scum and vegetation hugging the dock and dead jellyfish floating near the surface. The secchi disc reading (water clarity or turbidity) was at its lowest – 1.2 meters – and the water was thick with a bloom of *Chaetoceros*, dinoflagellate species, and euglenoids. Secchi disc readings can fluctuate weekly reflecting blooms as they quickly come and go. Secchi readings as low as 1.0 meters were detected in both 2018 and 2020.

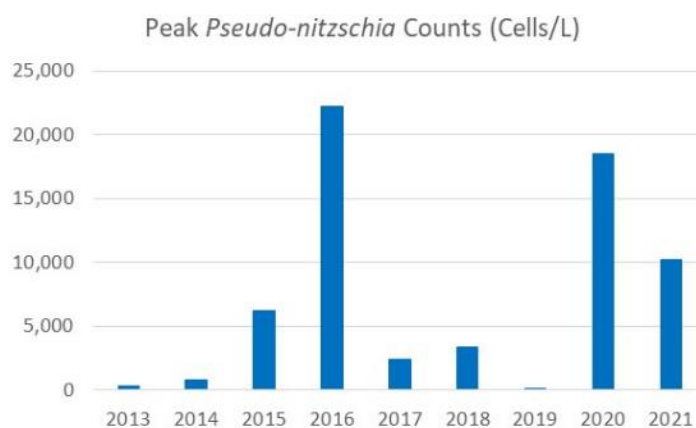
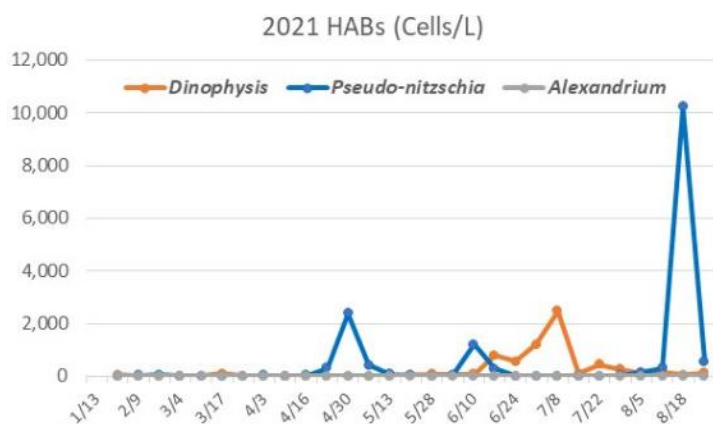
Harmful Algal Blooms (HABs)

Plankton samples were screened for HAB species including *Dinophysis*, *Pseudo-nitzschia*, and *Alexandrium*. This year, *Akashiwo sanguinea*, *Protoceratium reticulatum* and *Mesodinium* were also screened as “Species of Concern” or “Interest.” *Akashiwo sanguinea* and *Protoceratium reticulatum* have been associated with shellfish mortality events, and *Mesodinium rubrum* is an important food source for *Dinophysis*.

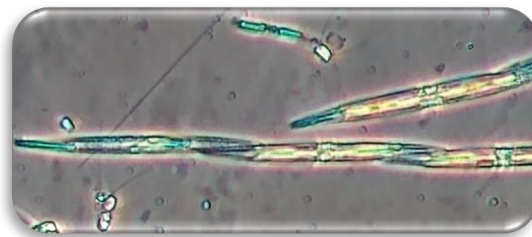
Pseudo-nitzschia, the species responsible for Amnesic Shellfish Poisoning (ASP) bloomed mid-August peaking at a concentration of 10,000 cells/L. Concentrations were higher in both 2020 and 2016 (22,000 cells/L). While it is not uncommon for *Pseudo-nitzschia* to bloom in Budd, ASP closures are rare in South Sound. In fact, while cells are often present, or even common, they remain non-toxic in this region.



Thick surface scum and floating vegetative debris (Sago Pondweed), Budd Inlet, July 13th.



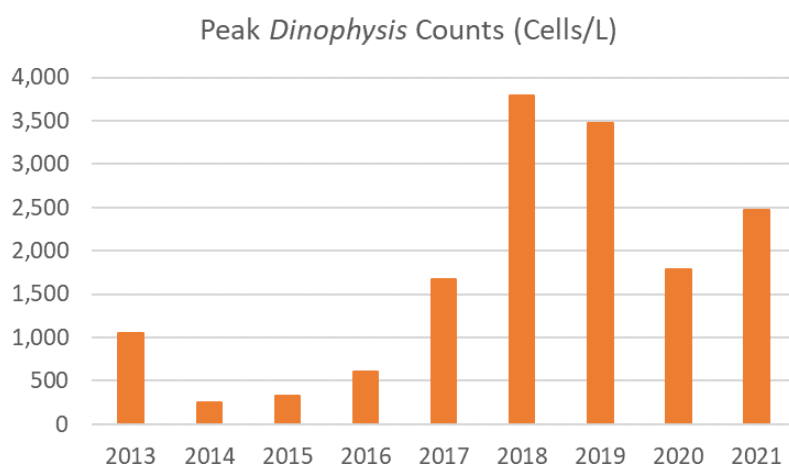
Dinophysis, the species responsible for Diarrhetic Shellfish Poisoning (DSP), was found in every sample collected this summer, blooming in late June and early July with a maximum concentration of 2,476 cells/L. WDOH closed Budd Inlet to shellfish harvesting on July 12th due to elevated levels of DSTs (Diarrhetic Shellfish Toxins) in blue mussels.



Pseudo-nitzschia bloom, August 18th.

Shellfish measured 28 $\mu\text{g}/100\text{ g}$ tissue, exceeding the closure limit of 16. Budd Inlet remained closed throughout the summer.

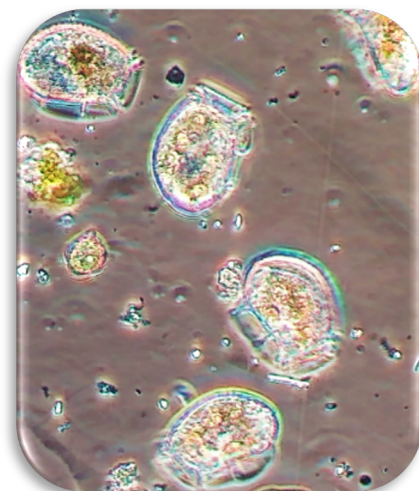
As we continue to collect information from Budd Inlet, this long-term data provides clues to help answer important questions. For example, 1) When are DSP closures most likely to occur and 2) What species of *Dinophysis* are responsible for toxin production? This summer's *Dinophysis* data provided valuable clues to address these questions.



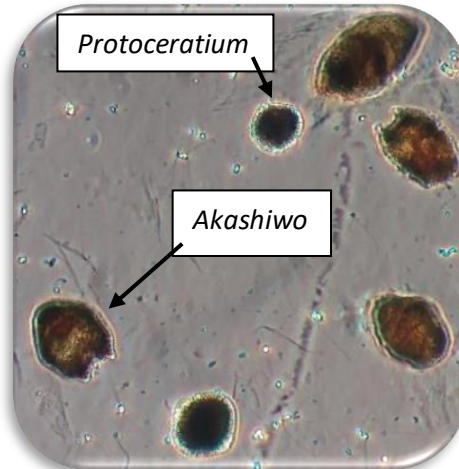
Since 2015, almost all DSP closures have been initiated in late summer or early fall. Some – like during fall of 2015 – persisted until mid-summer of the following year. In fact, in June 2016, lower Budd Inlet set a national record for the highest level of DSP toxins (DSTs) measured in mussels – 250 $\mu\text{g}/100\text{ g}$ tissue! During all of these closures, *Dinophysis fortii* and *D. acuminata* (particularly the former) have been blooming. In 2018 and 2019, extremely high cell counts (~3,500 cells/L) were detected in June/July, but did not result in shellfish toxicity. In those two instances, *D. norvegica* was blooming. This year, *D. fortii* was blooming in June/July resulting in a DSP closure. Closures, therefore, appear to occur when *D. fortii* (and possibly *D. acuminata*) are blooming regardless of the season.

Alexandrium, the species responsible for Paralytic Shellfish Poisoning (PSP) was not found in notable concentrations throughout the entire summer. This finding is consistent with previous years.

The dinoflagellate, *Protoceratium reticulatum* was present throughout most of the summer and common on August 5th – noteworthy in that it is known to produce yessotoxin and has been observed more frequently in South Puget Sound in recent years. *Akashiwo sanguinea* bloomed between late July and August 5th, tapering off during August. *Mesodinium rubrum*, a ciliated prey species of *Dinophysis*, was not observed as frequently this year when compared to 2020.



Dinophysis fortii, July 8th sample prior to the closure on July 12th.



Akashiwo and *Protoceratium*, 8/5/21

Fresh Water Lakes

PSI sampled at popular fresh water lakes throughout Thurston County including Deep, Munn, Ward and Long Lakes, in addition to Longs Pond and Woodland Creek at Woodland Creek Community Park. Similar to Budd Inlet, stormwater runoff, particularly related to nutrients, can foster algal blooms, poor visibility, lake closures, and oxygen depletion at depth. Monitoring allows the community to track water quality changes and recognize the importance of lake stewardship. The species composition at each of these locations was rich and diverse, consistently changing from week-to-week and from lake-to-lake. Similar to Budd Inlet, water samples were screened for HAB species including *Dolichospermum* (formerly named *Anabaena*), *Aphanizomenon* & *Microcystis*.

On August 27th, Long Lake was closed due to unsafe levels of toxic blue-green algae. Last year, the lake closed on August 20th. According to testing, microcystin levels were 17 µg/L, exceeding the State Advisory Level of 8 µg/L. Microcystin is a liver toxin and possible human carcinogen. While the blue-green algae, *Dolichospermum*, was observed in the sample, *Microcystis* was common. Both species are known to produce the toxin microcystin.

On August 17th, PSI surveyed water quality and pet waste at Woodland Creek Community Park, distributing Bags-On-Board to dog walkers and educating the public about the importance of cleaning up after pets to prevent bacteria and nutrient pollution. The amount of un-scooped dog waste has dramatically improved over the decade, decreasing from 143 piles in 2011 to only 33 in 2021. In Woodland Creek, the water temperature was warm (20.7°C) and DO was low (1.6 mg/l).

On July 29th, PSI sampled at Ward Lake. Water quality was very good with low algae concentrations, high visibility, and healthy oxygen and pH levels. Numerous open water swimmers were observed during sampling prompting PSI to also post the “What’s Blooming?” write-up on the Olympia Wild Swimming Facebook group.



Water quality sampling at Long Lake, a day prior to the 8/20 closure.



Plankton samples from Longs Pond (left) and Woodland Creek (right), 8/17/21.

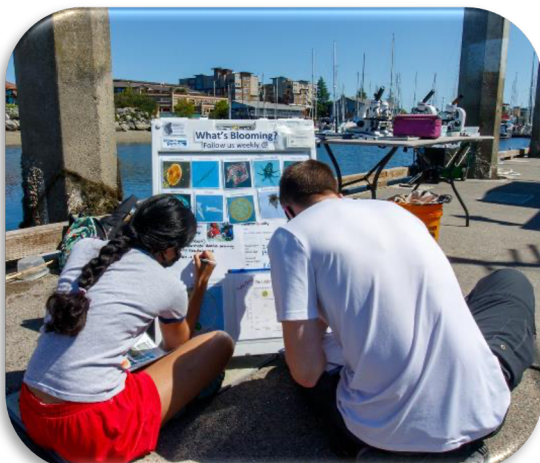
Please refer to Appendices A (Blog posts) and B (Facebook entries) for photos and a detailed description of each week's sampling adventures.

Acknowledgements

PSI is incredibly grateful to Stream Team for financially supporting the "What's Blooming?" program over the past 10 years! This ever growing data set is now revealing its true colors and being used by researchers and students to better understand water quality and HABs in our local region and promote environmental stewardship. Thank you to the Port of Olympia for supporting research and education at Port Plaza and to Washington SeaGrant for managing the SoundToxins program. Thank you to our student interns and to all of the plankton enthusiasts that follow along each year. See you on the dock next year!



Junior scientists assisting with Budd Inlet plankton identification, 8/5/21.



Interns, Shriya and Colton, assembling the "What's Blooming?" display board.



Biologists from WDOE, WDNR, WDFW & TCD worked together to ID this plant which had been a nuisance to Budd Inlet boaters all summer: Sago



Samantha collecting water quality data and a plankton sample from Woodland Creek, 8/17/21.