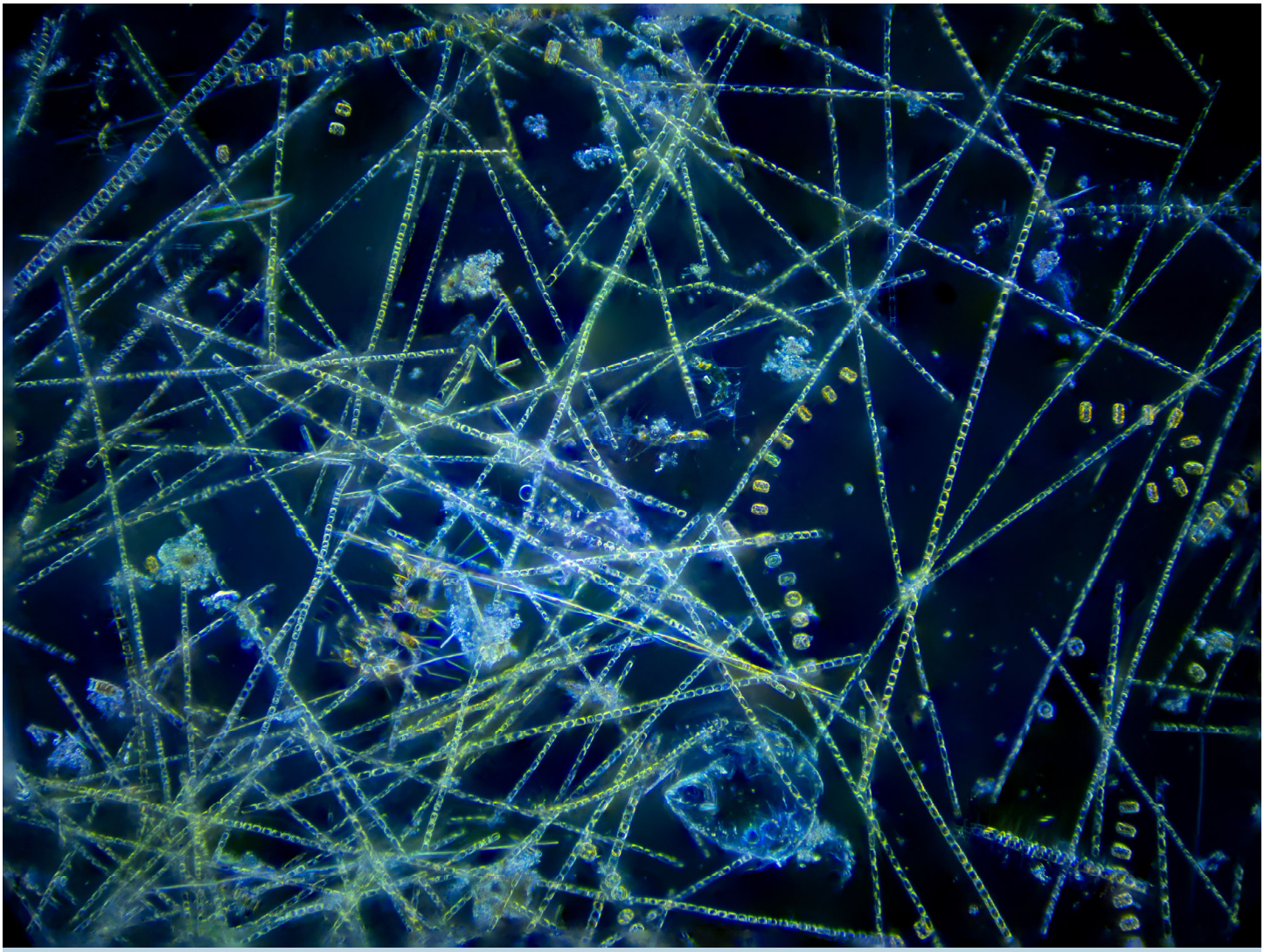

Whatcom Marine Resources Committee (MRC)
2025 Harmful Algal Bloom Monitoring Final Report

Prepared by: Austin Rose and Dana Flerchinger, Whatcom MRC Staff

Whatcom County Public Works—Natural Resources

Reporting Period: October 2024-September 2025

Grant Number: SEANWS-2023-WhCoPW-00002

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Abstract

The SoundToxins monitoring network, managed by Washington Sea Grant, monitors over 3 dozen sites for harmful algal blooms (HABs) throughout the Salish Sea. Due to a lack of HAB data from the north region of Washington State, the Whatcom MRC added two HAB monitoring sites in Whatcom County including Birch Bay Village Marina and Drayton Harbor/Semiahmoo Marina in October of 2023. The MRC monitors these two sites for harmful phytoplankton weekly from March through October and biweekly from November through February. The monitoring and analysis protocols that are used were developed by the SoundToxins monitoring network. The HAB data is uploaded to the SoundToxins database and the Washington State Department of Health (WA DOH) is notified when HAB action levels are reached. This data allows management agencies and scientists to more effectively manage shellfish closures for public safety. Adding regular monitoring at these sites in north Whatcom County fills data gaps in areas that have seen historically high levels of shellfish toxins. Drayton Harbor is also an important tribal, recreational, and commercial shellfish harvest area. The addition of these sites in the northern-most area of the Puget Sound also provides valuable data to better understand phytoplankton dynamics of the entire sound.

This year, our two sampling locations at Drayton Harbor/Semiahmoo Marina and Birch Bay Village Marina, showed decreased HAB impacts as compared to the spring and summer of 2024. Biotoxin action levels for paralytic shellfish toxins at both sites were reached in August of 2025 as compared to May of 2024. This resulted in shorter closures for recreational shellfish harvest in 2025 as compared to 2024 as issued by WA DOH. Recreational shellfish harvest was closed for the majority of the spring and summer of 2024, yet remained open in 2025 until August in Drayton Harbor and July in Birch Bay, demonstrating large variances in HAB abundance year to year.

Because phytoplankton blooms are highly variable in terms of where and when they initiate and proliferate, a large number of geographically dispersed sites must be monitored to get a complete picture and to best protect public health. The Whatcom MRC's citizen science monitoring of HABs helps to achieve this goal in Whatcom County.

Project Goals

Initiated by local citizen scientists, the goal of this work was to fill a HAB data gap in the northern region of the Puget Sound. This is particularly important considering the commercial oyster farm in Drayton Harbor, the historically elevated concentrations of HABs found in the area, and the influence of the Fraser River which contributes to high nutrient loading that can strongly impact blooms. This data provides information to management agencies and scientists to more effectively manage shellfish closures for public safety within Whatcom County and provides valuable data to improve our understanding of phytoplankton dynamics of the entire sound. Another goal of this project is to provide learning opportunities and scientific content to K-12 and higher education students.

Project Engagement

The MRC was responsible for project planning and coordination including sample collection, analysis of phytoplankton samples, and data entry. The MRC recruited and trained community volunteers to assist with sampling and analysis, and communicated findings to the project partners outlined on the next page.

The primary HAB sampling team included a dedicated group of community volunteers who consistently collected and analyzed samples. As the HAB team sampled, there was also constant engagement with the public about the project. These brief interactions often yielded interest in the project, resulting in several folks joining the team for sampling or microscopic analysis throughout the year. Additionally, members of the HAB sampling team attended a SoundToxins training in Seattle in February of 2025, collaborating with other sampling teams throughout the Puget Sound and learning more about HABs in our region.

Partners/ Organizations

- **SoundToxins**: Provided sampling protocols, equipment, training, HAB communication, and database management for HAB data throughout the Puget Sound.
- **Washington State Department of Health (WA DOH)**: Provided biotoxin testing for the mussels sampled by the HAB team. This information, along with the HAB team's findings, was used to update the WA DOH Recreational Shellfish Safety Map.
- **Whatcom County Health and Community Services**: Coordinated supplies for mussel collection and shipping to WA DOH and announced Whatcom County shellfish closures as necessary.
- **Garden of the Salish Sea Curriculum (GSSC)**: The HAB team provided teaching content and hands-on training to K-12 students through GSSC.

2025 Annual SoundToxins training in Seattle. Photo credit: Dana Flerchinger, MRC staff.

Participants

The primary HAB team that consistently sampled throughout the year is shown in the top left photo below and included (from left to right): Rick Beauregard (MRC project lead), Dana Flerchinger (MRC staff), Pat Gilmer, Patricia Lulu, Lora Crawford, and Steve Wilson. A full volunteer list with corresponding hours is included in Appendix A. Throughout the reporting period, 7 volunteers participated, contributing over 500 hours of volunteer time to the project.

Volunteers assist with HAB sample collection and analysis. Photo credits: Top left: Semiahmoo resident. Top right: Rick Beauregard, MRC project lead. Bottom row photos: Dana Flerchinger, MRC staff.

Project Methods

From October 2024 through September 2025, the Whatcom MRC sampled two sites for HABs using protocols developed by the SoundToxins monitoring network (see Appendix B). These protocols are also used by other HAB monitoring groups to maintain consistency throughout the Puget Sound. The two sites, including Drayton Harbor/Semiahmoo Marina (DHSM) and Birch Bay Village Marina (BBVM) were monitored weekly from March through October and biweekly from November through February.

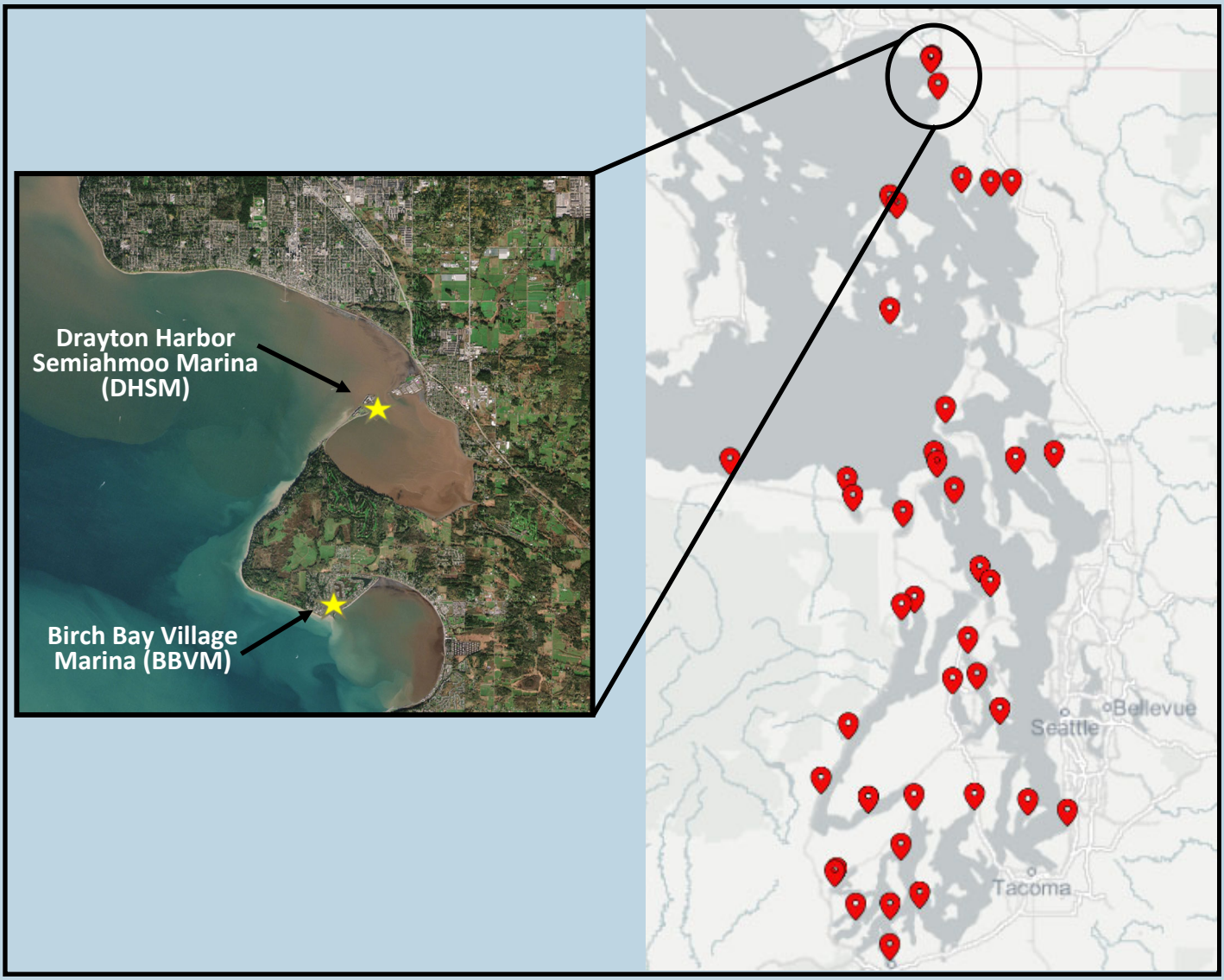
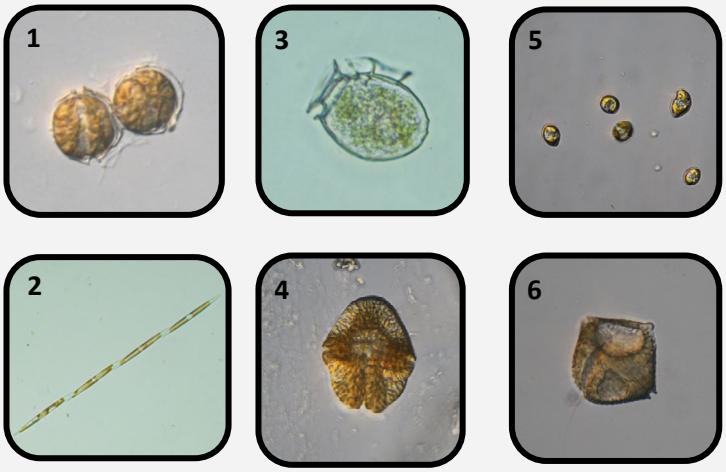


Figure 1: Map showing all of the SoundToxins HAB monitoring sites throughout the Puget Sound. The two northernmost sites, including Drayton Harbor/Semiahmoo Marina and Birch Bay Village Marina, are sampled by the Whatcom MRC.

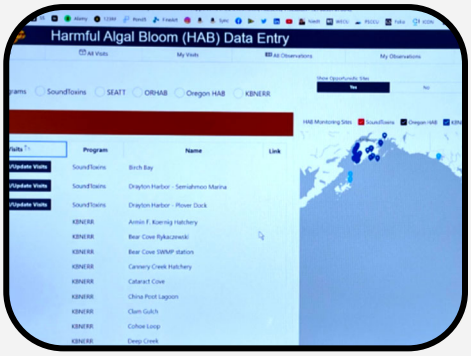
Project Methods

Sample Collection: Three types of plankton samples were taken per site: whole water samples, 10X concentrated whole water samples, and a vertical net tow of the water column (Left photo credit: Dana Flerchinger, MRC staff). For the vertical net tow, the cod end of the net concentrates the plankton sample (Right photo credit: Rick Beauregard, MRC project lead). Environmental conditions, including air and water temperature, salinity, wind speed and direction, and tide height and stage, were also recorded.



Sample Analysis: Plankton samples were analyzed microscopically with a focus on HAB species including (1) *Alexandrium*, (2) *Pseudo-nitzschia*, (3) *Dinophysis*, (4) *Akashiwo sanguinea*, (5) *Heterosigma akashiwo*, and (6) *Protoceratium reticulatum*. HAB species and their corresponding action levels established by SoundToxins and the U.S Food and Drug Administration (US FDA), as well as toxicity information, are listed on the next page. Photo credits: Steve Wilson and Rick Beauregard.

Reporting: Results were uploaded to the SoundToxins monitoring database (see photo). When present above their respective action levels, HAB species concentrations were also directly reported to SoundToxins and WA DOH.



Project Methods

Plankton Species	Sample	SoundToxins Action Level*	Toxicology	Toxin	US FDA Action Level*
Diatoms					
Pseudo-nitzschia (small complex)	10X, WW	1,000,000 cells/L	Amnesic Shellfish Poisoning (ASP)	Domoic Acid (DA)	20 ppm
Pseudo-nitzschia (large complex)	10X, WW	50,000 cells/L	Amnesic Shellfish Poisoning (ASP)	Domoic Acid (DA)	20 ppm
Chaetoceros concavicornus	Net Tow	"Common", "Bloom" or › 5,000 cells/L	Fish mortality	NA; causes physical irritation	NA
Dinoflagellates					
Alexandrium spp.	Net Tow	Initial sighting; increase from	Paralytic Shellfish Poisoning (PSP)	Paralytic Shellfish	80 µg/100 g shellfish tissue
Dinophysis spp.	Net Tow	Initial sighting; increase from previous sample	Diarrhetic Shellfish Poisoning (DSP)	Diarrhetic Shellfish Toxin	16 µg/100 g shellfish tissue
Akashiwo sanguinea	Net Tow	"Common" or "Bloom"	Bird, fish and shellfish mortality	Photosensitive hemolytic toxins	NA
Azadinium spp.	Net Tow	Initial sighting; increase from previous sample	Human health impacts	Azaspiracids	NA
Karenia mikimotoi	Net Tow	Initial sighting; increase from previous sample	Human and marine life health impacts	Gymnocin polyether toxins	NA
Protoceratium reticulatum	Net Tow	"Common" or "Bloom"	Shellfish mortality	Yessotoxin	NA
Other					
Phaeocystis globosa	Net Tow	"Common" or "Bloom"	Bird, fish and shellfish mortality	Hemolytic toxins	NA
Heterosigma akashiwo	WW	"Common" or "Bloom"	Fish and shellfish mortality	Several	NA

Table 1: HAB species action levels and toxicity information. WW indicates that the whole water sample is used for analysis. "Common" or "Bloom" conditions are relative to the abundances in the rest of the sample.

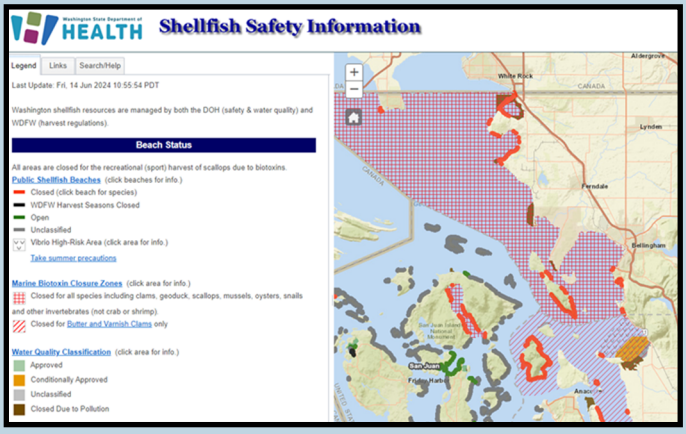
*While the US FDA sets mandatory, nationwide action levels that trigger commercial shellfish harvesting closures, SoundToxins uses lower, species-specific action levels to alert authorities of a potential threat before toxin levels become dangerous.

Additional Project Methods

HAB Identification Training: To train volunteers on plankton identification, counting, and microscope procedures, the HAB team hosted several "scope school" sessions following sample collection, focusing on proper identification of HAB species.

Volunteers participate in microscope training to identify HAB species including (1) *Alexandrium*, (2) *Pseudo-nitzschia americana*, (3) *Akashiwo sanguinea*, (4) *Dinophysis acuminata* and (5) *Dinophysis acuta*. Photo credits: Left: Dana Flerchinger, MRC staff. All plankton photos: Steve Wilson, HAB volunteer.

Mussel Sampling: While collecting plankton samples, the volunteer team concurrently sampled blue mussels to be tested for paralytic shellfish toxins (PST or biotoxins) by WA DOH. Mussel sampling was conducted under a separate project with WA DOH, and thus was not within the scope of this MRC project. This biotoxin information, along with the findings of the HABs team, were used to inform recreational shellfish harvest closures in these areas to protect public health (right photo below).



HAB volunteers collect blue mussels from Birch Bay Marina. Photo credit: Dana Flerchinger, MRC staff.

Results

From October 2024-September 2025, 40 sampling events occurred, yielding a total of 240 samples collected for HAB analysis (including whole water samples, 10X concentrated whole water samples, and net tow samples from the two sites). Volunteers contributed over 500 hours for sampling and analysis. At both DHSM and BBVM, the presence of PST in the sampled mussels and the presence of HAB species in the water (specifically *Alexandrium*, the phytoplankton that produces PST), triggered recreational shellfish harvest closures in August and September of 2025.

Data Summary

Graphs summarizing the HAB data from October 2024-September 2025 from both sampling sites are shown on the following pages. All raw data, which includes sampling results from the net tow, whole water samples, 10X concentrated whole water samples, environmental conditions, and corresponding biotoxin numbers from WA DOH's mussel testing from each site, are included in Appendix C.

This years' samples had relatively low *Alexandrium* and biotoxin concentrations as compared to previous years. In 2025, recreational shellfish closures at Birch Bay and Drayton Harbor were shorter in length (one event in July at Birch Bay and August–September of 2025 at both sites) and occurred much later in the year as compared to 2023 (closures began in May and periodically opened/closed through September) and 2024 (closure occurred from May through September). Other HAB causing species were also reported above their SoundToxins action levels throughout the sampling period, so WA DOH was notified, but no negative impacts were reported.

Results: DHSM HAB Species Concentrations

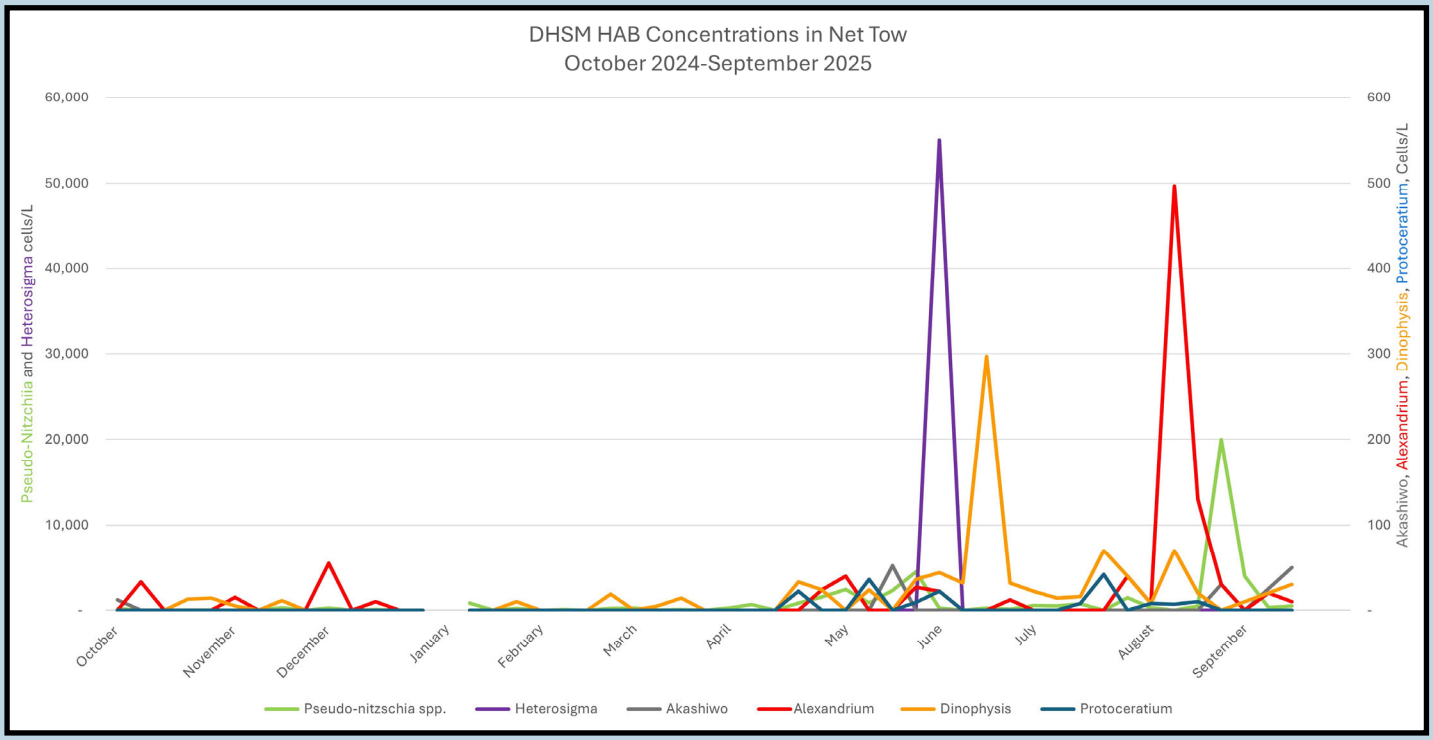


Figure 2: HABs concentrations from net tow samples at DHSM from October 2024–September 2025.

Alexandrium (see red line) was present from October-December 2024 and from May-September 2025, but biotoxins were only detected in blue mussel tissues above the US FDA action level from August-September of 2025, triggering the closure of recreational shellfish harvest by WA DOH.

There was a large bloom of *Heterosigma akashiwo* during June (see purple line) that was only present for one sampling event. Other HAB species were also detected during this sampling period including: *Akashiwo sanguinea* (see gray line), *Dinophysis* (see yellow line), *Protoceratium reticulatum* (see blue line), and *Pseudo-nitzschia* (see green line; never exceeded its SoundToxins action level, but was present several times throughout the year). WA DOH was notified of the presence of these species in the water at DHSM, but no negative impacts were reported.

Results: BBVM HAB Species Concentrations

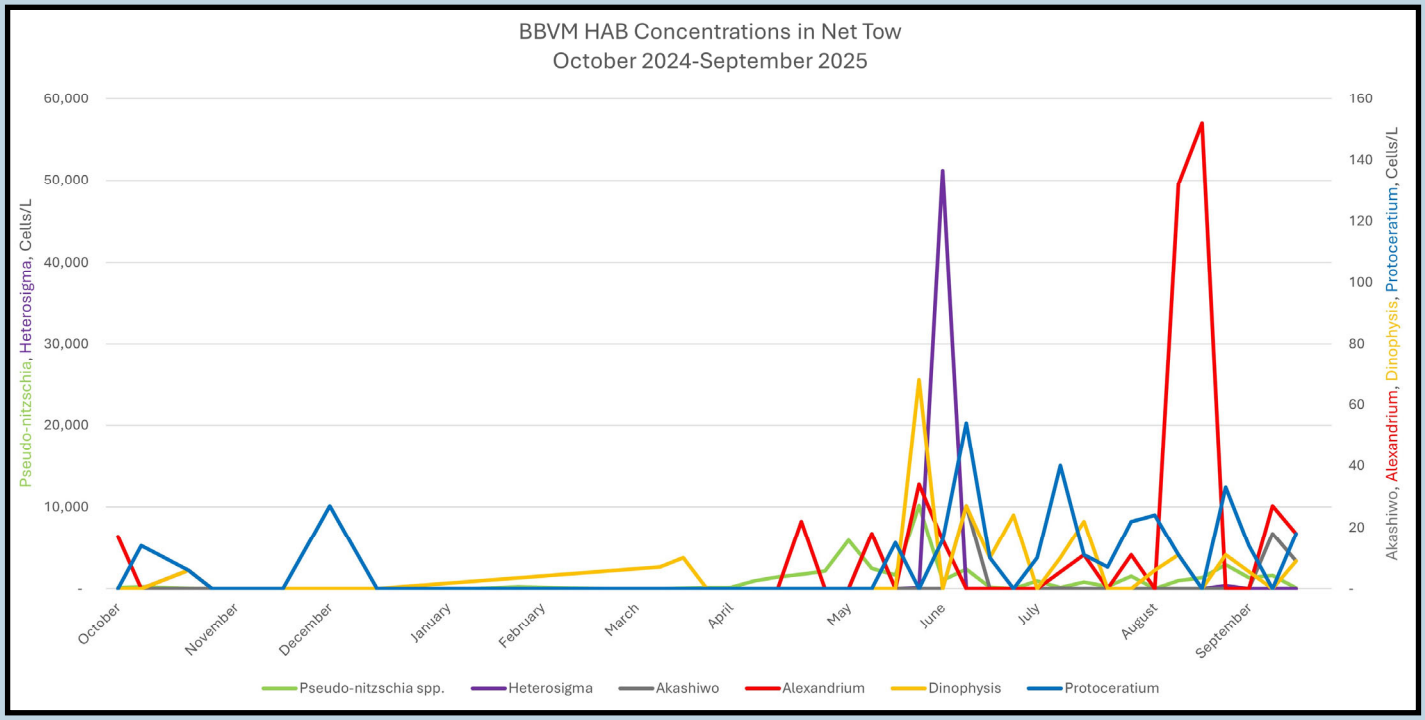


Figure 3: HABs concentrations from net tow samples at BBVM from October 2024–September 2025.

Alexandrium (see red line) was present in October of 2024 and from April-September of 2025, but biotoxins were only detected in blue mussel tissues above the US FDA action level from July-September of 2025, triggering the closure of recreational shellfish harvest by WA DOH.

There was a large bloom of *Heterosigma akashiwo* during June (see purple line) that lasted one week. Other HAB species were also detected during this sampling period including: *Akashiwo sanguinea* (see gray line), *Dinophysis* (see yellow line), *Protoceratium reticulatum* (see blue line), and *Pseudo-nitzschia* (see green line; never exceeded its SoundToxins' action level, but was present several times throughout the year). WA DOH was notified of the presence of these species in the water at BBVM, but no negative impacts were reported.

Results: Drayton Harbor Semiahmoo Marina

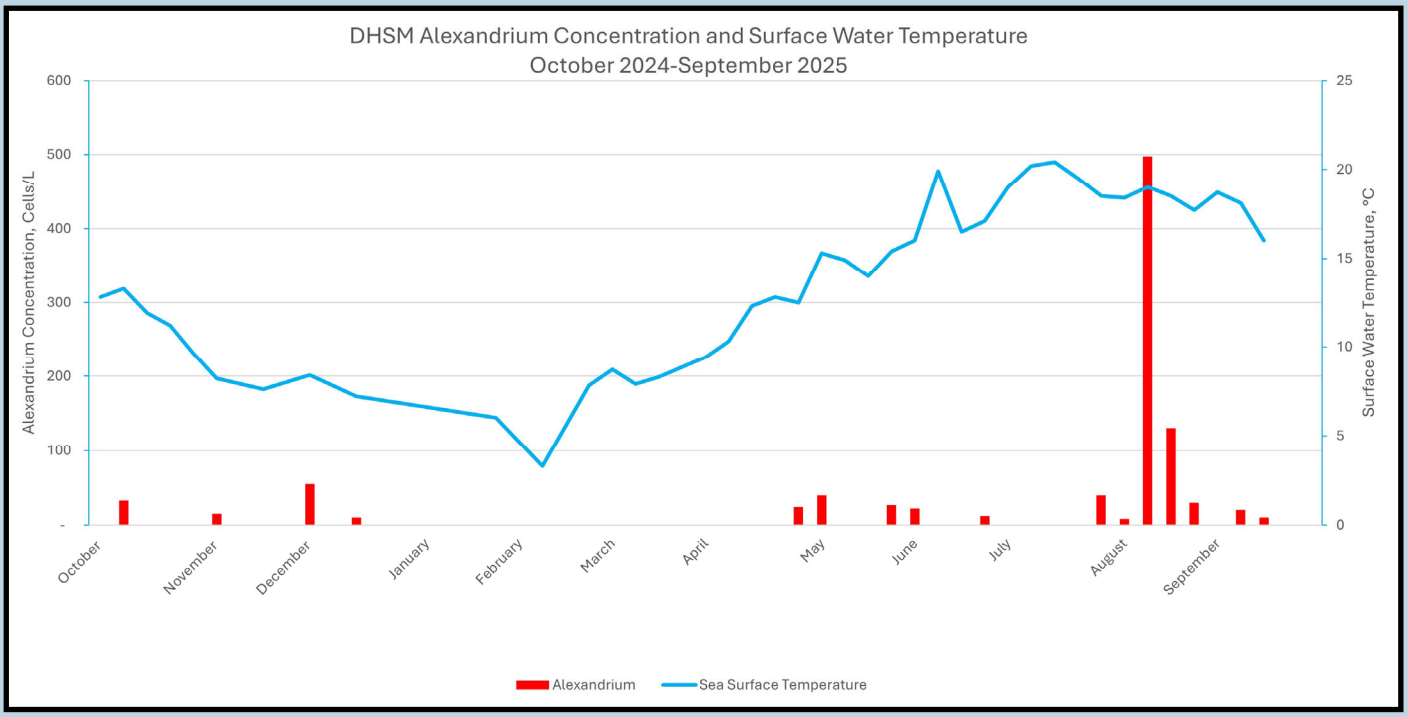


Figure 4: *Alexandrium* concentrations (red bars, left axis) from net tow samples at DHSM and sea surface temperatures (blue line, right axis) from October 2024–September 2025. *Alexandrium* concentrations tended to increase with increasing sea surface temperature, and was often present in the water at temperatures of 10°C or greater.*

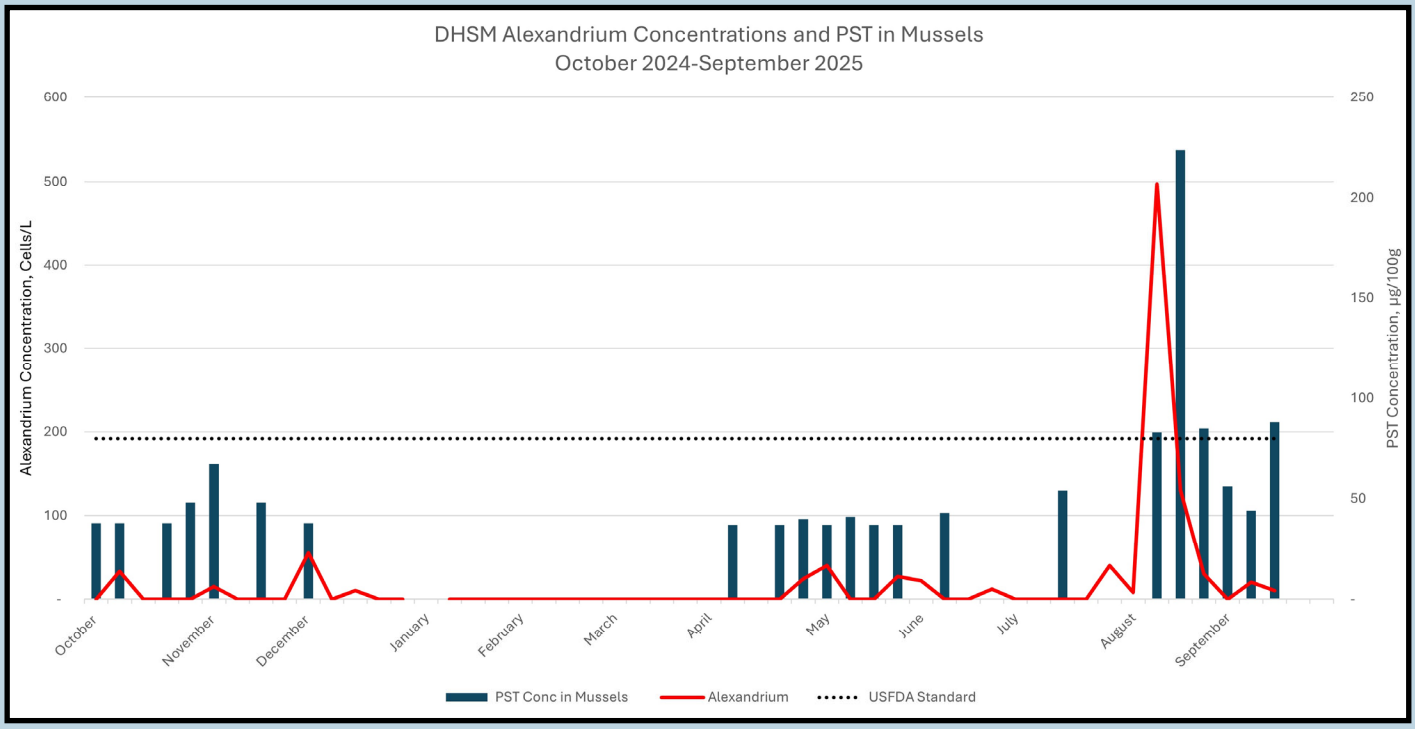


Figure 5: *Alexandrium* concentrations from net tow (red line, left axis) and WA DOH biotoxin/PST data from the blue mussels (navy bars, right axis) collected concurrently at DHSM from October 2024–September 2025. Biotoxins/PST detected in blue mussel tissues only exceeded the US FDA action level of 80 µg/100g tissue during August and September of 2025, so recreational shellfish beds were closed from August 12th through the present (mid September).

*In laboratory settings, the optimal temperature range for *Alexandrium* growth was 13-17 °C (Norris and Chew 1975 and Nisdhitani and Chew 1984), while empirical growth models utilizing in situ data from the Salish Sea showed a wider optimal temperature range of 10-24°C (Bill et. al 2016).

Results: Birch Bay Village Marina

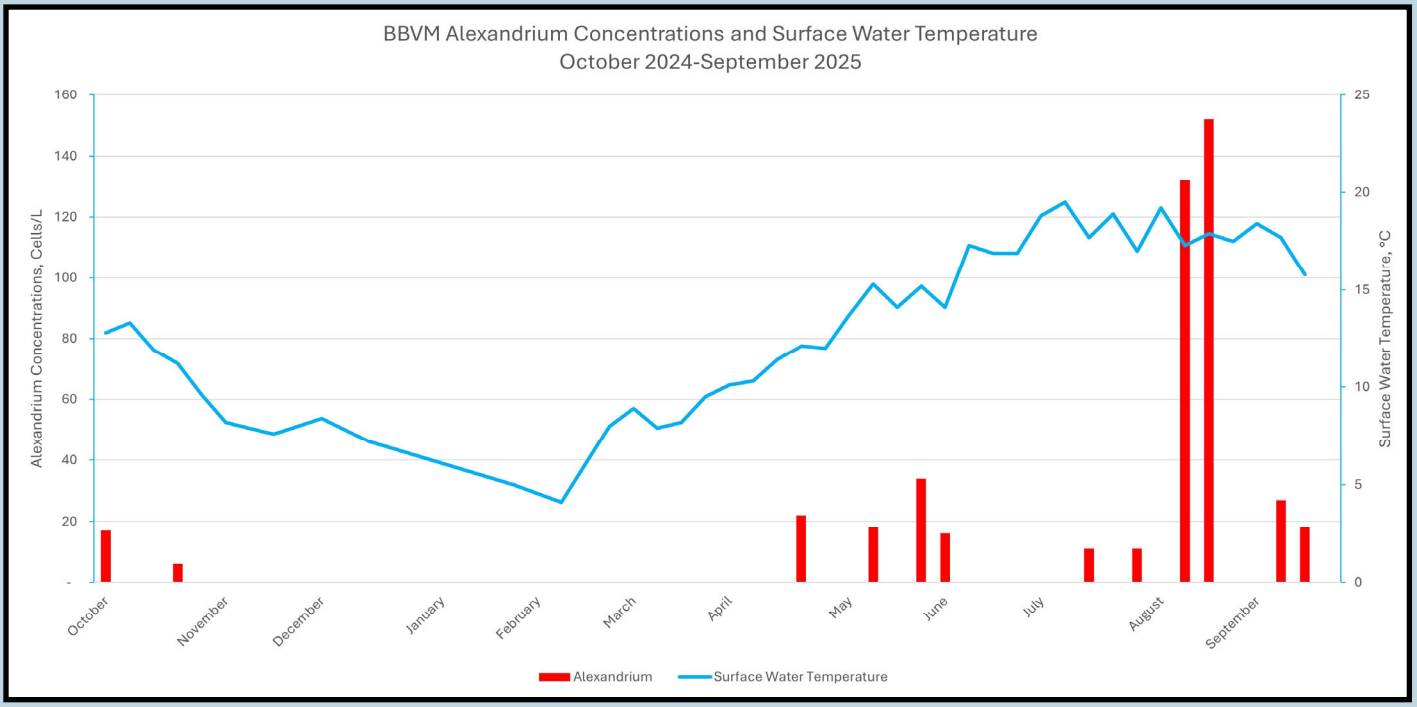


Figure 6: *Alexandrium* concentrations (red bars, left axis) from net tow samples at BBVM and sea surface temperatures (blue line, right axis) from October 2024–September 2025. *Alexandrium* concentrations tended to increase with increasing sea surface temperature, and was often present in the water at temperatures of 10°C or greater.*

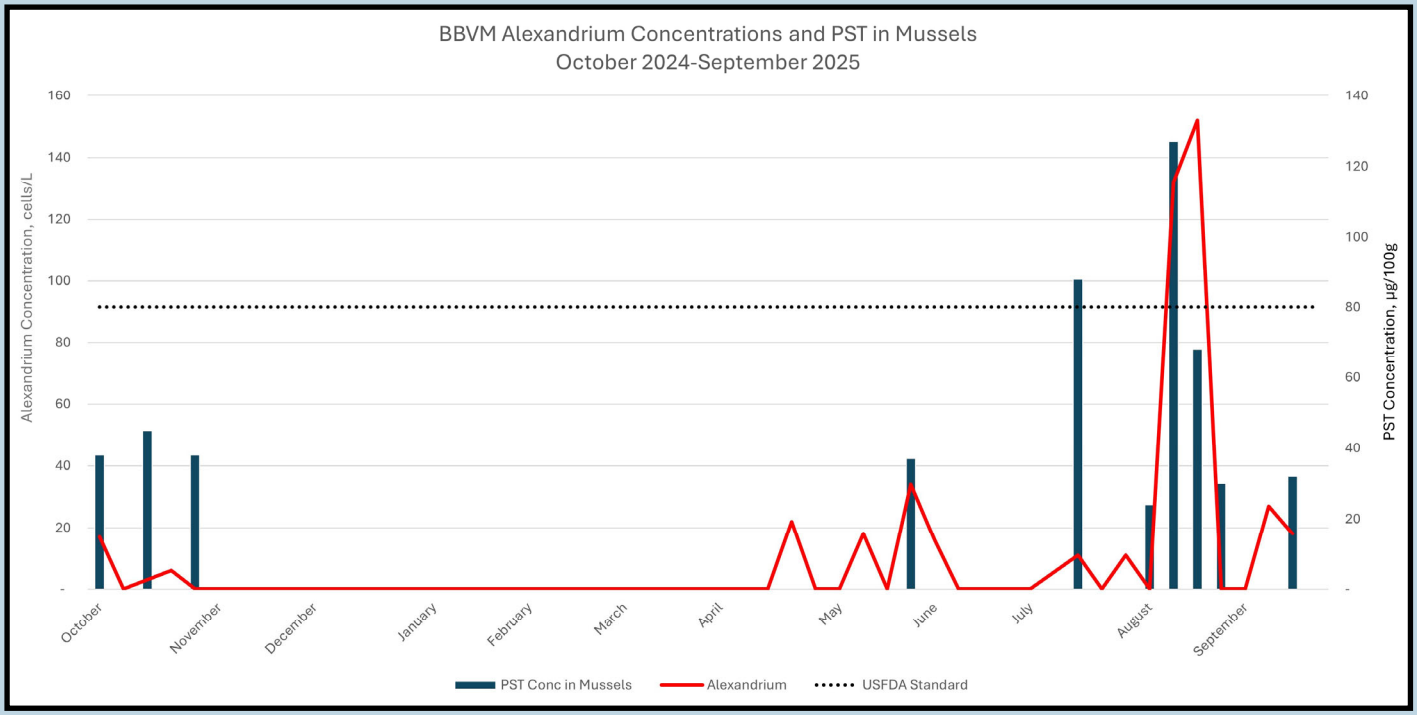


Figure 7: *Alexandrium* concentrations from net tow (red line, left axis) and WA DOH biotoxin/PST data from the blue mussels (navy bars, right axis) collected concurrently at BBVM from October 2024–September 2025. Biotoxins/PST detected in blue mussel tissues only exceeded the US FDA action level of 80 µg/100g tissue once in July, then from August- September of 2025, leading to a closure of the recreational shellfish beds.

*In laboratory settings, the optimal temperature range for *Alexandrium* growth was 13-17 °C (Norris and Chew 1975 and Nisdhitani and Chew 1984), while empirical growth models utilizing in situ data from the Salish Sea showed a wider optimal temperature range of 10-24°C (Bill et. al 2016).

Outcomes

The HAB monitoring data from Drayton Harbor/Semiahmoo Marina and Birch Bay Village Marina achieved the goal of filling the HAB data gap for the north Puget Sound. Phytoplankton monitoring data, in addition to biotoxin analysis by WA DOH, allowed for the effective management of shellfish resources within Whatcom County to better protect public health and the shellfish economy. Based on the monitoring data gathered for this project, northern Whatcom County beaches were closed for recreational shellfish harvest periodically from July through September of 2025.

Outputs

Over the course of the monitoring season:

- 240 samples were collected for HAB analysis over 40 sampling events at 2 sites in Whatcom County
- 7 volunteers participated
- 500 volunteer hours were contributed
- 7 "scope school" training events for phytoplankton identification and counting methods occurred

Left: HAB volunteers observe *Alexndrium* during "scope school". Photo credit: Rick Beauregard, MRC project lead. Right: MRC volunteer collects the net tow sample from Birch Bay Marina. Photo credit: Dana Flerchinger, MRC staff.

Results in Context

During this reporting period, we saw an unusually large bloom of *Heterosigma akashiwo* in June that only occurred for one sampling event, which is something we have not seen in previous years of monitoring. High concentrations of this species are linked to mass fish kills, although nothing was reported during this time. We also had an unusually large bloom of the diatom *Rhizosolenia/Sundstromia* that persisted for about 5 weeks during the summer, which may have depressed or outcompeted *Alexandrium* during this timeframe.

Across the SoundToxins monitoring sites throughout the Puget Sound, *Alexandrium* concentrations were relatively low during this reporting period as compared to previous years. The *Heterosigma akashiwo* and *Rhizosolenia* blooms were unique to our sites and were not observed at other SoundToxins sites.

As sea surface temperatures continue to rise and the impacts of climate change become more prevalent, monitoring for HAB species and events will become increasingly important to better protect public health throughout the Salish Sea. Continuing to collect this data for northern Whatcom County provides early warning information to management agencies to more effectively manage shellfish resources in our region.

Semiahmoo Marina. Photo credit: Dana Flerchinger, MRC staff.

Project Highlights from MRC Project Lead, Rick Beauregard

During this project year, the HAB sampling team sampled two northern Whatcom County sites for harmful algae. They also collected mussel samples for analysis by the WA DOH state lab for shellfish toxins. HAB samples were analyzed by 4 of our members trained in phytoplankton counting and identification methods. Other members of the team were also trained in microscopic techniques used to quantify the presence of HABs and other phytoplankton species through periodic "scope schools." One key outcome of our project is that we've proven the ability to train others in the methods for identifying and counting HAB species. Several volunteers and one staff assisted with the HAB sampling. Over 500 hours of total sampling, analysis, and data management time were invested by the team during the project year.

This year, the HABs team also completed a 4 year review of the results from 2020-2024, highlighting the significance of citizen scientists in supplementing traditional monitoring methods to provide early warnings of HAB events.

Data from the HAB counts was entered into the SoundToxins data base and biotoxin data from the mussel samples was reported by WA DOH and used to inform shellfish safety mapping. The data collected this year showed great variation from previous years, with much lower HAB concentrations and biotoxin levels as compared to past years. There was also a later and lower peak spring diatom bloom as compared to past years, and a large *Heterosigma* bloom that only lasted one sampling event and was only seen at the Whatcom County sites. Additionally, there was an large and persistent bloom of the diatom *Rhizosolenia/Sundstroemia* that lasted several weeks through the summer. We saw relatively low *Alexandrium* cell counts through mid September and low biotoxin concentrations for most of the spring and summer.

Phytoplankton blooms are highly variable in terms of where and when they can initiate and proliferate. A large geographically dispersed number of sites must be monitored to get a complete picture and best protect the public health. Projects like the MRC citizen science monitoring of HABs in Whatcom County, and others that make up the SoundToxins program, are the most cost effective way to achieve this sampling effort.

Project Highlights—WA DOH and SoundsToxins

"In times of ever-increasing costs to provide important public health protection for consumers of shellfish, the information that citizen science-based volunteers provide by collecting and reporting phytoplankton data is critical for the WA Department of Health (WA DOH) in the decision process when closing/opening shellfish harvest. In Whatcom County, there have been several occasions when WA DOH was considering upgrading an area closed to shellfish harvest based on declining toxin levels in shellfish, but the early warning phytoplankton data suggested the toxic bloom was not over. In these cases, we kept the closure in place and the next shellfish sample was over the closure level once again. Opening and closing an area to shellfish harvest has a significant cost to the commercial shellfish companies, tribes, local health jurisdictions, and recreational shellfish harvesters. WA DOH relies on the early warning phytoplankton data that the Whatcom County phytoplankton samplers provide to make the most confident public health changes in shellfish harvesting opportunities and to minimize the economic burden to all shellfish harvesters."

-Jerry Borchert, Marine Biotoxin Lead, Washington State Department of Health

"The SoundToxins partnership relies on the dedicated participation of community scientists to collect early warning data on HABs in critical shellfish growing areas across the state's coastal waters. The Drayton Harbor HAB Hunters have been invaluable members of our network. In addition to filling important data gaps, they have increased education and outreach efforts in the community through collaborating with other monitors across the network, training new volunteers, engaging with local news outlets, and working with K-12 schools. The work of Drayton Harbor HAB Hunters has been essential in providing early detection of HABs in Whatcom County's marine waters and helps improve shellfish safety and the resilience of the shellfish industry in Washington State."

-Michelle Lepori-Bui and Melissa Petrich, SoundToxins Program Managers

Lessons Learned/ Next Steps

The HAB team has learned what it takes to train and field a HAB team by gaining skills in microscopy, taxonomic identification, careful and meticulous counting, reliable and accurate field sampling and data collection in all weather conditions, data management, data analysis, and interpretation and presentation of results. If other MRCs are interested in participating in the HAB program within their own counties, the Whatcom MRC could help get these programs running.

References

Bill, B. D., Moore, S. K., Hay, L. R., Anderson, D. M., & Trainer, V. L. (2016). Effects of temperature and salinity on the growth of *Alexandrium* (Dinophyceae) isolates from the Salish Sea. *Journal of Phycology*, 52(2), 230–238. https://doi.org/10.1111/jpy.12386.

Nishitani L, Chew KK. (1984). Recent developments in paralytic shellfish poisoning research. *Aquaculture*, 39:317–329.

Norris L, Chew KK. (1975). Effect of environmental factors on growth of *Gonyaulax catenella*. In: LoCicero VR, editor. *Proceedings of the First International Conference on Toxic Dinoflagellate Blooms.* Boston: Massachusetts Science and Technology Foundation; 143–152.

Appendices

- **Appendix A**: SoundToxins Monitoring Manual
- **Appendix B**: Volunteer Hours
- **Appendix C**: Raw HABs Data