

Whatcom Marine Resources Committee (MRC) 2024 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 2023-September 2024



Northwest
Straits
INITIATIVE



PUGET SOUND
PARTNERSHIP



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 the Salish Sea, the Whatcom MRC added two HAB monitoring sites in Whatcom County including Birch Bay Village Marina and Drayton Harbor/Semiahmoo Marina. The MRC monitors these two sites for harmful phytoplankton weekly from March through November and biweekly from November through February. Monitoring and analysis protocols are conducted using existing protocols developed by the SoundToxins monitoring network. The HAB data is uploaded to the SoundToxins database, providing information to management agencies and scientists to 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 Salish Sea 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 Marina, both showed early signs of HABs, both in the water and as biotoxin concentrations in mussel tissues, as early as April of 2024. Biotoxin action levels were reached in May, and the shellfish beds in these areas were closed for recreation harvest by the Washington Department of Health (WA DOH). No other sites monitored by SoundToxins or WA DOH in the Puget Sound showed measurable HAB or biotoxin concentrations in the spring or summer. 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 is to fill a HABs 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. 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 better understand phytoplankton dynamics of the entire sound. Another goal of the project is to provide learning opportunities and scientific content to K-12 and higher education students.

Project Engagement

The HAB sampling team included community volunteers and student interns from Blaine High School and Western Washington University. 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 primary HAB sampling team attended a SoundToxins training in Seattle in February of 2024, collaborating with other sampling teams throughout the Puget Sound and learning more about HABs in our region. The HAB team also provided in class training opportunities at Blaine High School for AP Marine Biology classes and presented project findings at various community events including Whatcom Water Week, a Cherry Point Advisory Committee meeting, and a Northwest Straits Initiative Commission meeting. The team frequently communicated with WA DOH and Whatcom County Health and Community Services on marine toxins and shellfish closures.

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.
- **Garden of the Salish Sea Curriculum (GSSC):** Provided student interns to assist the HAB team. The HAB team provided teaching content and hands-on training to K-12 students through GSSC.
- **Whatcom County Health and Community Services:** Coordinated supplies for mussel collection and shipping to WA DOH and announced Whatcom County shellfish closures as necessary.

Participants

The primary HAB team that consistently sampled throughout the year included Rick Beauregard (MRC Project Lead), Steve Wilson, Patricia Lulu, Lora Crawford, Pat Gilmer, and Dana Flerchinger (MRC staff). A full volunteer list is included in Appendix A. Throughout the reporting period, 13 volunteers participated, contributing over 500 hours of volunteer time to the project



Volunteers assist with HAB sample collection. Photo credits: Top left, top right, and bottom right: Rick Beauregard, MRC project lead. Bottom left: Dana Flerchinger, MRC staff.

Project Methods

From October 2023 through September 2024, 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.

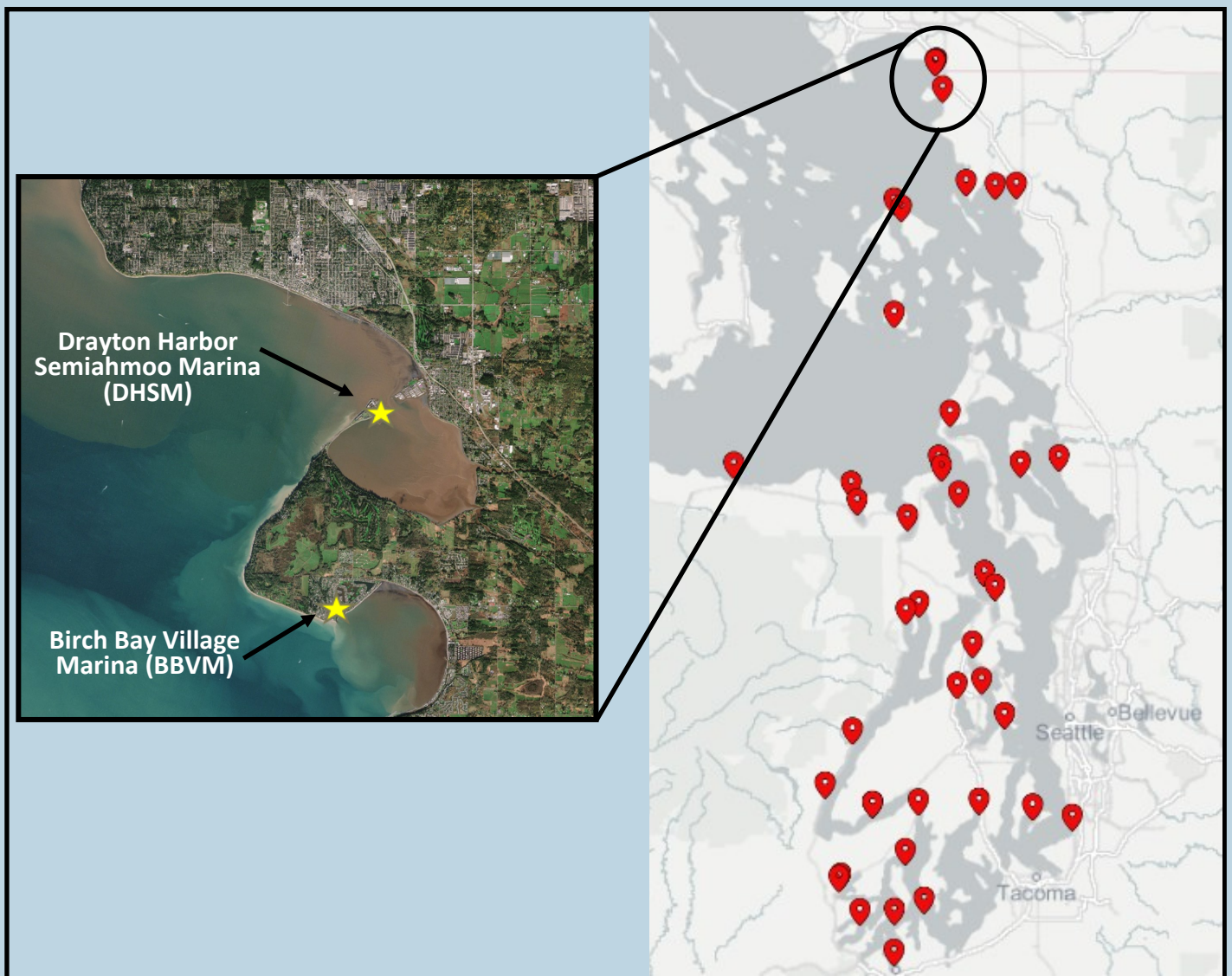
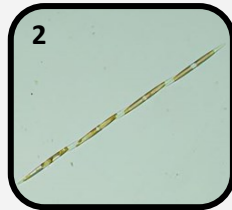


Figure 1: Map showing all of the SoundToxins HAB monitoring sites throughout the Puget Sound. The two northernmost sites, including Drayton Harbor/Semiahmoo Marina and Birch Bay Village Marina, are sampled by the Whatcom MRC.

Project Methods

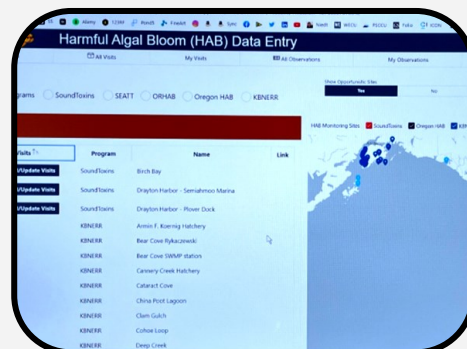
Sample Collection: Three types of plankton samples were taken per site: whole water samples, 10X concentrated whole water samples, and a vertical net tow of the water column (Left photo credit: Dana Flerchinger, MRC staff). For the vertical net tow, the cod end of the net concentrated the plankton sample (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 (left photo), with a focus on HAB species including (1) *Alexandrium* (associated with paralytic shellfish toxins), (2) *Pseudo-nitzschia* (associated with amnesic shellfish toxins), and (3) *Dinophysis* (associated with diarrhetic shellfish toxins).



Reporting: Results were uploaded to the SoundToxins Monitoring database (see photo). When present, HAB counts were also emailed to SoundToxins and WA DOH.



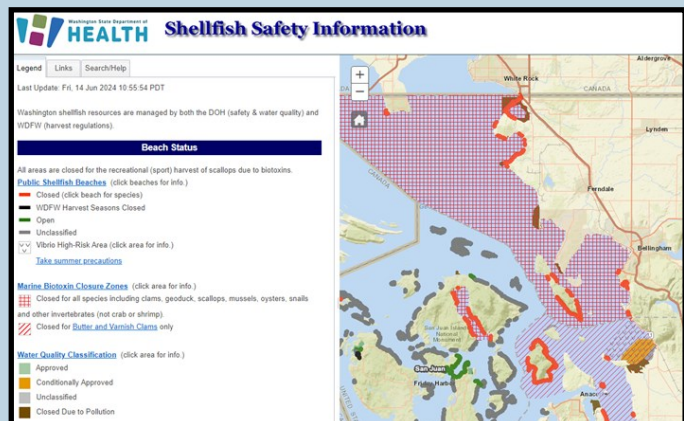
Additional Project Methods

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



Volunteers participate in microscope training to identify HABs species including (1) *Alexandrium*, (2) *Pseudo-nitzschia americana*, (3) *Akashiwo sanguinea*, (4) *Dinophysis acuminata* and (5) *Dinophysis acuta*. Photo credits: Left: Pat Gilmer, HAB volunteer, 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). Mussel sampling was conducted under a separate project with WA DOH, and thus 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 2023– September 2024, 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). Over 520 volunteer hours were contributed 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 the closure of recreational shellfish harvest in north Whatcom County by WA DOH. The closure went into effect on May 21, 2024 and remains closed as of September 20th, 2024.

Data Summary

Graphs summarizing the HAB data from October 2023-September 2024 from both sampling sites are shown on the following pages. All raw data is included in Appendix C.

Results: Drayton Harbor Semiahmoo Marina

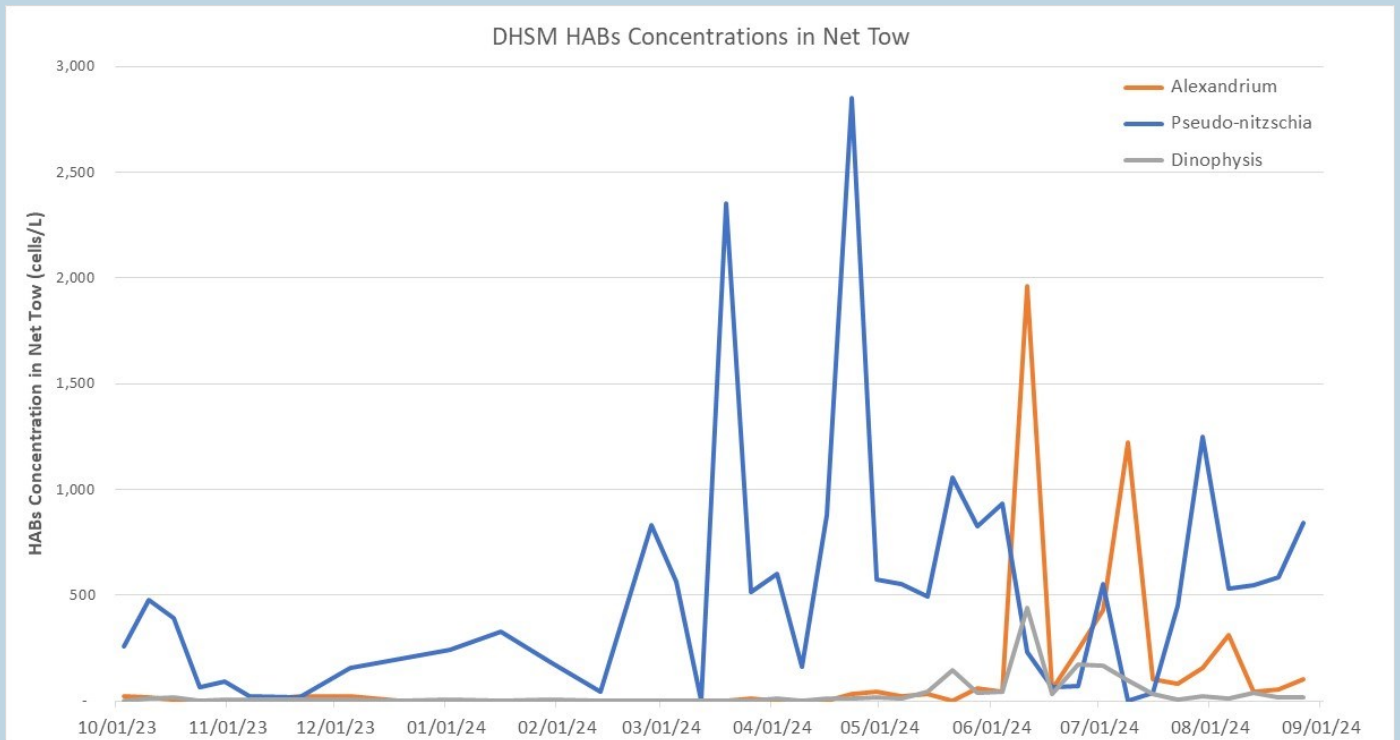


Figure 2: HABs concentrations from net tow samples at DHSM from October 2023–September 2024. The only HAB species that exceeded its SoundToxins action level was *Alexandrium*. *Alexandrium* concentrations exceeded the action level of any presence from October–December 2023 and from March–September 2024.

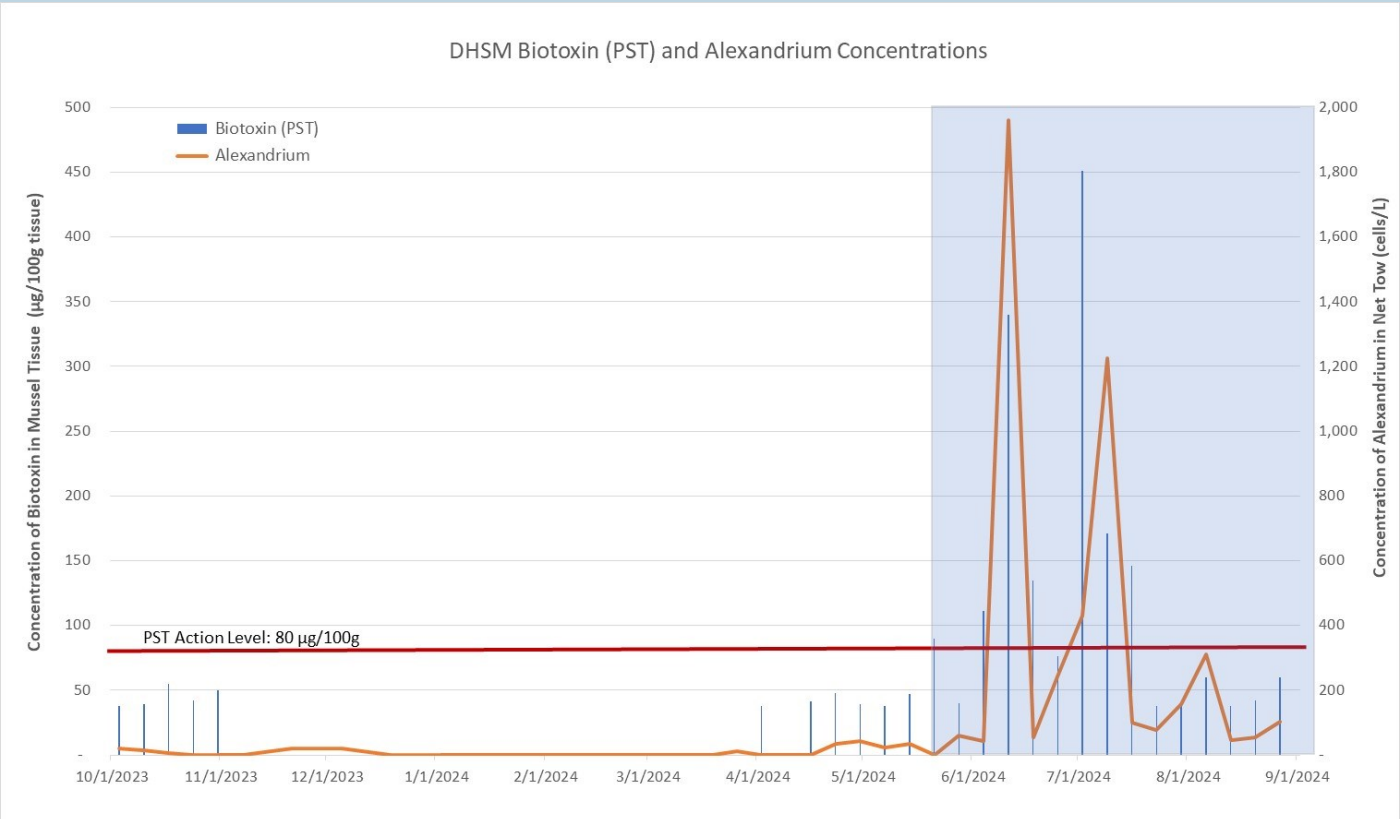


Figure 3: *Alexandrium* concentration from net tow and WA DOH biotoxin/PST data from the blue mussels collected concurrently at DHSM from October 2023–September 2024. Biotoxins detected in blue mussel tissues exceeded the USFDA action level of 80 µg/100g tissue from May 21, 2024 through July 16th, 2024. The blue box indicates when shellfish beds were closed for harvest due to PST exceeding the USFDA action levels or due to continued presence of *Alexandrium* in the water following closure events.

Results: Birch Bay Village Marina

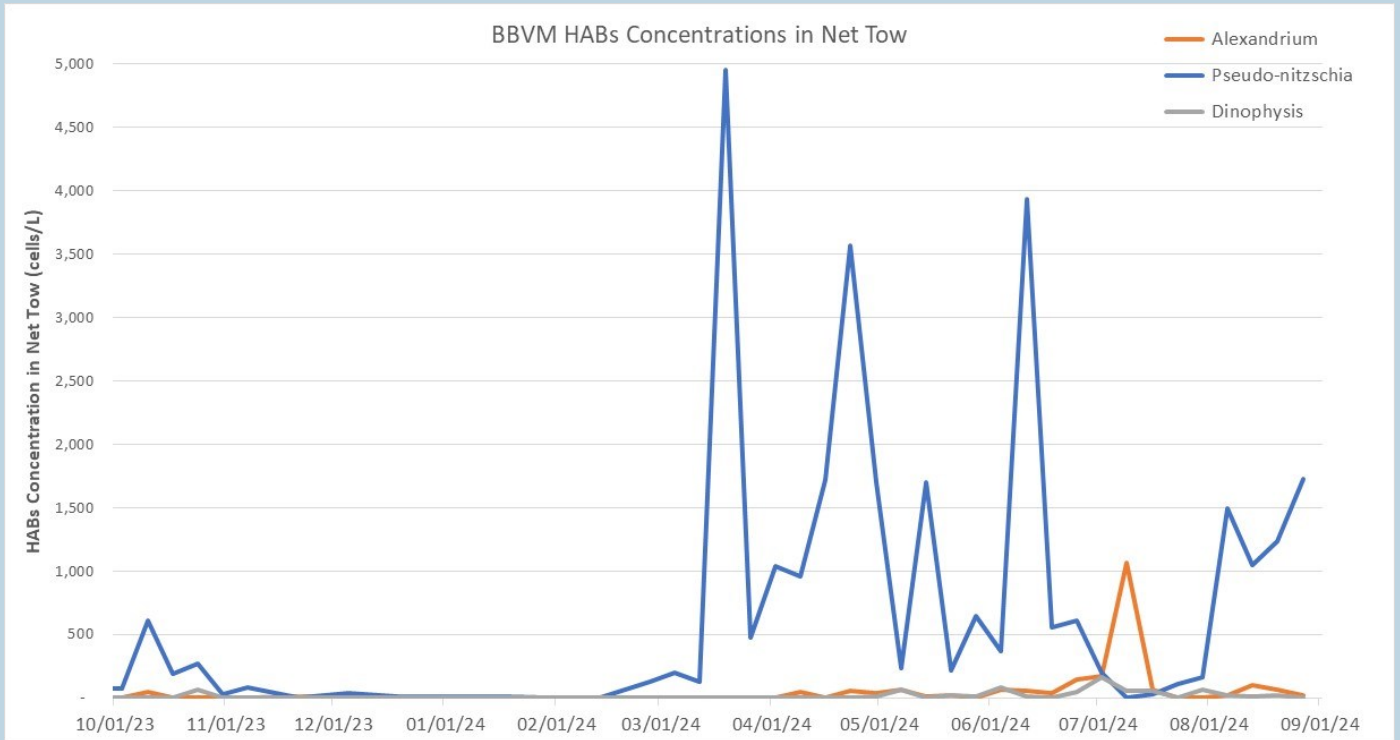


Figure 4: HABs concentrations from net tow samples at BBVM from October 2023–September 2024. The only HAB species that exceeded its SoundToxins action level was *Alexandrium*. *Alexandrium* concentrations exceeded the action level of any presence from October-December of 2023 and from April through September 2024.

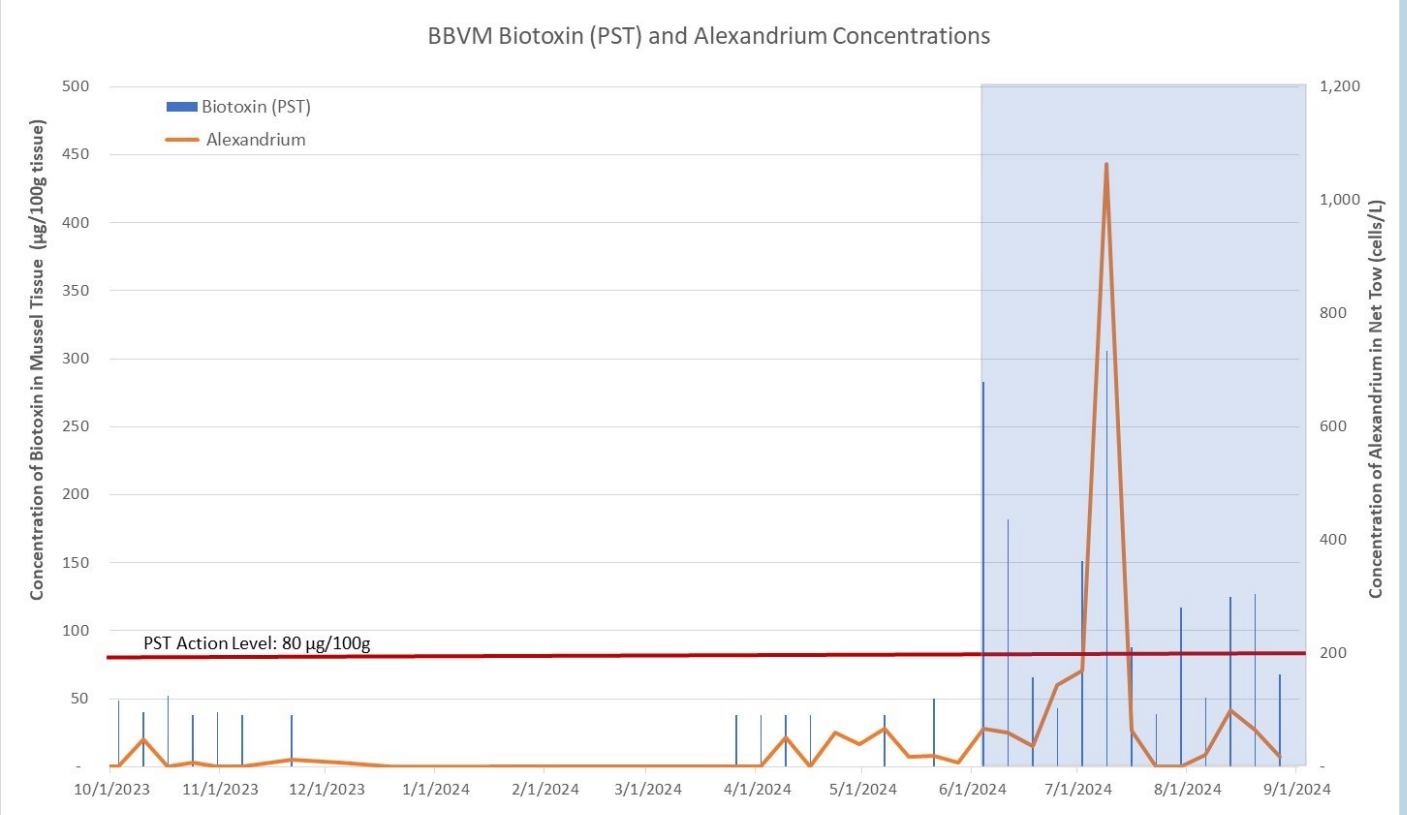


Figure 5: *Alexandrium* concentration from net tow and WA DOH biotoxin/PST data from the blue mussels collected concurrently at BBVM from October 2023–September 2024. Biotoxins detected in blue mussel tissues exceeded the USFDA action level of 80 µg/100g tissue from June 4, 2024 to August 20th, 2024. The blue box indicates when shellfish beds were closed for harvest due to PST exceeding the USFDA action levels or due to continued presence of *Alexandrium* in the water following closure events.

Results: Temperature and *Alexandrium*

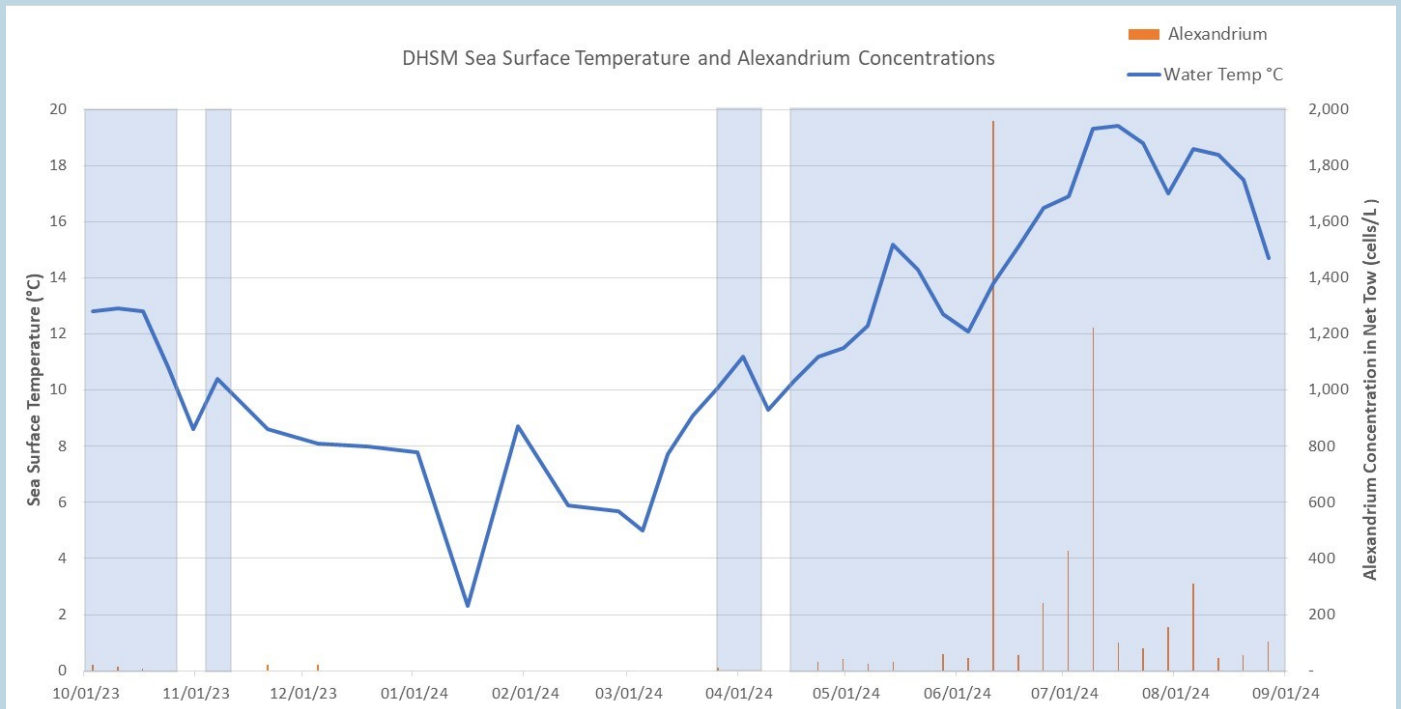


Figure 6: Sea surface temperature and *Alexandrium* concentration from net tow samples at DHSM from October 2023–September 2024. *Alexandrium* was often present in the water at temperatures of 10°C or greater (shown by blue boxes).*

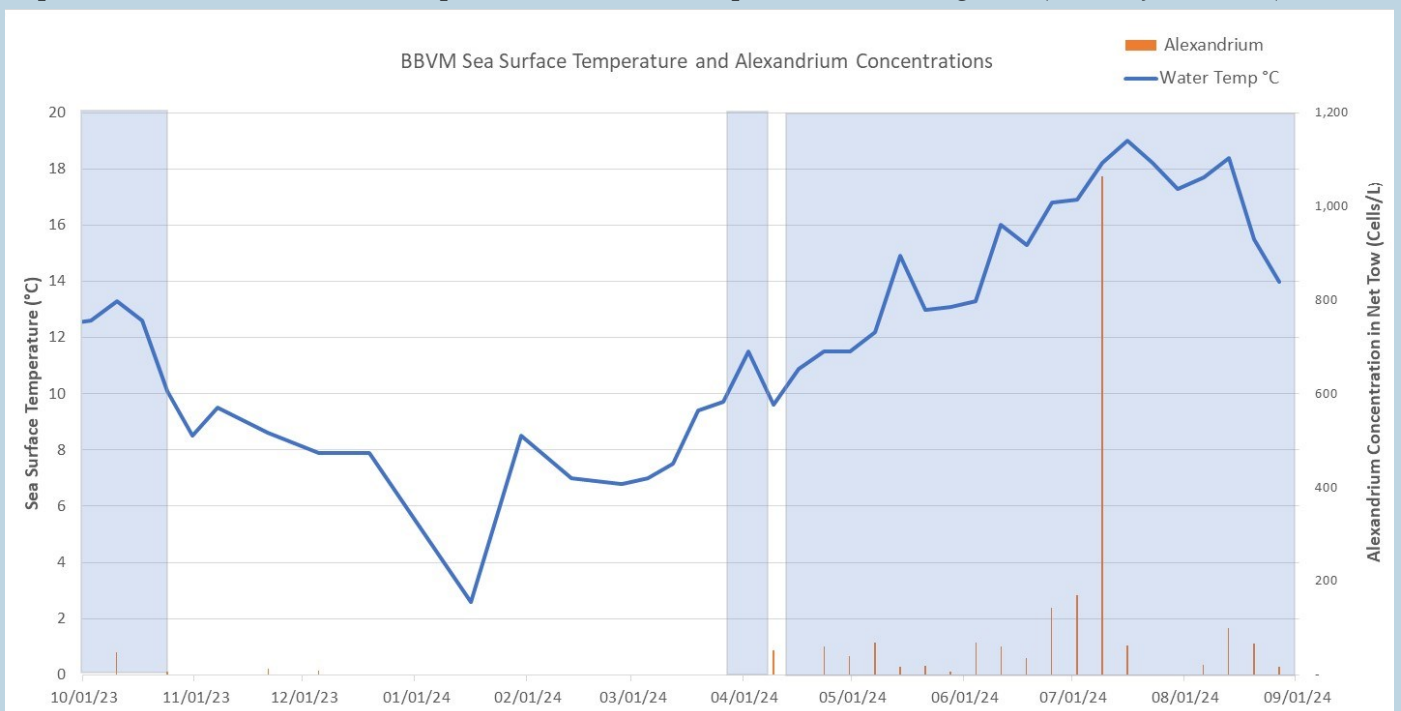


Figure 7: Sea surface temperature and *Alexandrium* concentrations from net tow samples at BBVM from October 2023–September 2024. *Alexandrium* was often present in the water at temperatures of 10°C or greater (shown by blue boxes).*

*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). In our data, increased sea surface temperatures (above 10°C) showed increases in *Alexandrium* concentrations in the water. The relationship between these two variables isn't clear for all HAB species and even with *Alexandrium*, we saw an upper threshold where presence started to decline once sea surface temperatures exceeded about 18°C.

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. Based on the monitoring data gathered for this project, Whatcom County beaches were closed for recreational shellfish harvest from late May through the present (September 20th, 2024).

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
- 13 volunteers participated
- 520 volunteer hours were contributed
- 15 “scope school” training events for phytoplankton identification and counting methods occurred

Results in Context

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 will be essential to effectively manage shellfish resources within 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. About a dozen different volunteers and one staff assisted with the HAB sampling. About 520 hours of total sampling, analysis, and data management time were invested by the team during the project year.

Data from the HAB counts was entered into the SoundToxin’s data base. Biotoxin data from the mussel samples were reported by the WA DOH and used to inform shellfish safety mapping. This year, our results proved why this MRC project to add these two sites in northern Whatcom county is important to the SoundToxins and WA DOH biotoxin monitoring program. Our two sampling sites, Semiahmoo Marina in Drayton Harbor, and Birch Bay Marina, both showed early signs of HABs both in the water and as biotoxin concentrations in the mussels, as early as April 2024. Levels of biotoxin increased along with increased concentrations of HAB species to the point where action levels were reached in May, and the shellfish beds were closed by WA DOH. No other sites monitored by SoundToxins or WA DOH in the Puget Sound showed measurable HABs or biotoxin concentrations in the spring or through the summer. Meanwhile, blooms of biotoxin causing organisms caused one of the largest shellfish recalls in history on the coasts of Oregon and Washington. 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 Department of Health

“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

Project Highlights—SoundToxins

“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 a wonderful addition to 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, engaging with local news outlets, and working with K-12 schools.”

-Michelle Lepori-Bui, SoundToxins Program Manager

Lessons Learned

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: List of Volunteers
- Appendix C: Raw HABs Data