2021 South Sound Science Symposium Project Summary

Title: Same Faces, New Places: Examining Biotoxin Data Alerts Managers to Potential Biotoxin Vulnerabilities due to Climate Change

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Project Summary: In Washington, climate change is expected to bring warmer weather, altered weather patterns, and increased precipitation. These factors lead to variation in water temperature, pH and salinity, increased stratification, and increased nutrients, all of which influence marine algae and cyanobacterial growth (Griffith & Gobler 2020). With increased algal growth comes blooms, often characterized by high cell densities, visible accumulations or toxin production. Marine Harmful Algal Blooms (HABs) and Cyanobacteria Harmful Algal Blooms (CHABs), collectively termed HABs, negatively impact water quality in communities around the world. Research has yet to identify if HAB species will have a direct competitive advantage as climate change accelerates. However, Washington's HABs are impacting marine and freshwater environments earlier each year, with lake and shellfish closures lasting longer (Moore et al. 2011). The distributions of HABs are expected to expand with climate change as well, with new lakes, rivers, inlets, and bays within Puget Sound vulnerable to biotoxins. The Department of Health (DOH) is working to identify climate-sensitive health risks that will be exacerbated by a changing climate, and the populations vulnerable to those risks. A series of Climate Profiles, currently in development, will focus on climate-sensitive hazards at the county level, including HABs.

In 2015, a joint EPA/DOH project reported the first occurrence of microcystins (MCs), liver toxins, in waters from lakes discharged into Puget Sound and confirmed MCs in downstream estuarine caged mussels (Preece et al. 2015a, 2015b). These studies identified a new biotoxin threat to Washington's vital shellfish industry and served to emphasize the connection between fresh and marine environments that is expected to become a greater concern in our warmer, wetter future. In 2017, dead wildlife and pets were associated with an anatoxin-a (a freshwater neurotoxin) producing bloom in Summit Lake, Thurston County. Lake users were unable to have any contact with the lake's water, including those residents who used the lake as their water source. Summit Lake drains into Totten Inlet in southern Puget Sound, one of Washington's most productive commercial shellfish growing areas, consistently producing over 1 million dozen oysters annually. Though no shellfish were contaminated during this event, this case illustrates the potential damage caused by transfer of freshwater toxins into estuaries and the importance of collaboratively monitoring the freshwater to marine continuum.

DOH routinely tests for three marine biotoxins, Diarrhetic Shellfish Poisoning (DSP), Amnesic Shellfish Poisoning (ASP) and Paralytic Shellfish Poisoning (PSP), with monitoring supported by Local Health Jurisdictions (LHJs), Tribal Nations and volunteers. DSP and PSP toxins in shellfish tissues have been detected above closure levels in many areas of the South Sound in the last 30

years (figure). Synergistic effects due to cooccurring toxins pose additional risks and may become a more frequent issue. LHJs and other lake managers sample waterbodies for four CHAB toxins: microcystins, cylindrospermopsins, anatoxin-a(s) and saxitoxins. Routine monitoring and opportunistic sampling of HABs combined with historical data analysis, allows managers to protect public health from marine and freshwater resource contamination, while preparing for emergent biotoxin threats.

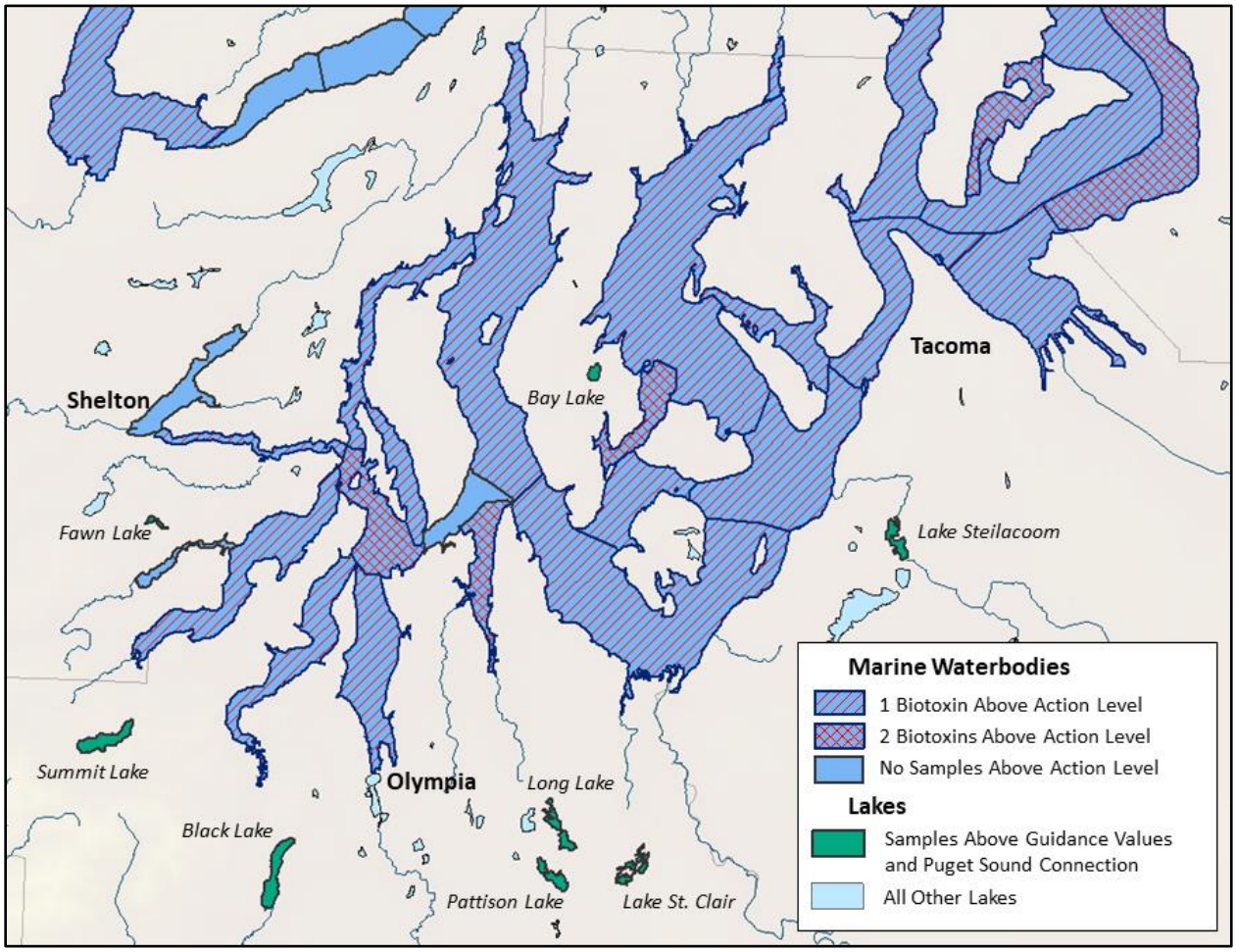

Figure. South Sound waterbodies with marine biotoxin samples above the action level from 1990 to 2020 and lakes with cyanotoxin levels exceeding recreational guidance values, from 2007 to 2020 (nwtoxicalgae.org), that have the potential to introduce cyanotoxins into southern Puget Sound. No samples above the action level have been found in Southern Hood Canal (top) and Oakland Bay (near Shelton). Dana Passage (center) is not sampled directly and has been closed due to the detection of biotoxins at nearby sites.

References:

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