Proceedings of Coastal Zone 09
Boston, Massachusetts
July 19 to 23, 2009

MONITORING TOXIC ALGAE IN THE PUGET SOUND USING QUANTITATIVE PCR

Sonya T. Dyhrman Woods Hole Oceanographic Institution
Sheean T. Haley Woods Hole Oceanographic Institution
Jerry A. Borchert Shellfish Program, Washington State Department of Health
Bob Lona Marine Biotoxin Unit, Washington State Department
Deana L. Erdner University of Texas at Austin, Marine Science Institute

KEYWORDS: harmful algae, *Alexandrium catenella*, qPCR, monitoring, management, shellfisheries

Dinoflagellates of the genus *Alexandrium* can produce a suite of potent neurotoxins that cause paralytic shellfish poisoning (PSP) in humans, and can have serious deleterious impacts on public health and economic resources. *Alexandrium* and related PSP-toxicity is a problem of global scale. Within this genus, *Alexandrium catenella* is widespread in the northwestern part of North America, including the Puget Sound, and is responsible for seasonal harmful algal blooms (HAB) in these regions. Even at low cell densities, *A. catenella* toxins can accumulate in shellfish and result in PSP. As a result, accurate measurements of *A. catenella* distributions, particularly at low cell density, are critical to continued PSP monitoring and mitigation efforts. For example, detection of low, but increasing cell densities may trigger increased PSP monitoring, or help to target PSP monitoring to specific locations or time-periods. Towards this end a specific, sensitive, and high throughput real-time quantitative PCR (qPCR) method has been developed to assay the abundance of *A. catenella*.

In this study, Puget Sound surface water samples for qPCR analyses, microscope cell counts, and shellfish for PSP analyses (typically *Mytilus edulis*) were collected every two weeks from April through October in 2006 and 2007 by community volunteers and local public health organizations from 41 Sentinel Sites distributed throughout the Puget Sound. qPCR amplification of DNA extracted from field samples and standards was performed with a SYBR Green detection system. With the qPCR assay, low water column abundances of *A. catenella* of less than 10 cells per liter were measured. The detection of low cell numbers by qPCR resulted in the ability to report cells at all Sentinel Sites before these sites reached the USDA's regulatory PSP limit. Monitoring cell abundance by qPCR predicted, at times, an increase in PSP toxicity. In 2006, this was seen for roughly half of the sampled Sentinel Sites. Often the increase in cell abundance occurred a week or two in advance of the increase in PSP toxicity. However, given the variability associated with the sites, qPCR cell counts were unable to define an absolute, or threshold cell number, necessary to predict PSP toxicity. There is a clear seasonality to *A. catenella* bloom dynamics in Puget Sound, as cell numbers increased substantially in nearly all Sentinel Sites from May to October. Data from the 2007 field season resulted in low cell numbers relative to 2006 with low to no shellfish toxicity in the majority of cases. These data have begun to establish the utility of qPCR in providing data regarding the presence of toxic *A. cantenella* in the water column and may help guide management

practices as bloom patterns are elucidated. Early warning of PSP toxicity may be possible at sites where cell numbers increase prior to shellfish toxicity.

Sonya T. Dyhrman
Woods Hole Oceanographic Institution
Biology Department
Woods Hole, MA 02543
sdyhrman@whoi.edu
(508) 289-3086