National Water Quality Monitoring Council

Working together for clean water

NWQMC Webinar Series

Being there - autonomous, in-situ detection of biotoxins associated with harmful algal blooms in marine and freshwater systems

Presented by

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Harmful algal blooms (HABs) are increasing in frequency, intensity, duration, and distribution in marine and freshwater systems, including across the marine-freshwater interface. HAB growth and toxicity can change rapidly over space and time, and are influenced by complex interactions with hydrographic processes and environmental factors that also exhibit variable spatio-temporal patterns. The application of powerful molecular analytical techniques to interrogate HAB populations has been largely restricted to laboratories and the time required for sample collection/processing/analysis limits their usefulness to support timely management decisions. Such impediments motivated development by the Monterey Bay Aquarium Research Institute of an instrument called the Environmental Sample Processor (ESP), which provides for the autonomous, in-situ molecular-level analysis of HABs as well as other microbial populations/processes.

The second-generation (2G) ESP, a robotic microbiology 'lab-in-a-can', is capable of filtering a water sample, processing the material captured, conducting molecular analytical-based measurements of target organisms or metabolites (e.g., toxins), and transmitting results to remote locations. The now commercially available 2G ESP is being incorporated into observing networks and coupled with observations from satellites, ships, profilers, and autonomous underwater vehicles (AUV) to permit the near-real time description of marine and freshwater HABs in the context of environmental and ecosystem variability. Although the 2G ESP is enhancing HAB research, monitoring/early warning, and forecasting capabilities, routine fixed-location deployments limit its ability to follow a coherent water mass and to assess fluctuations in bloom growth and toxicity over both space and time. This formidable challenge was addressed by re-engineering the 2G ESP for integration into a Tethys-class Long Range AUV. By coupling mobility with the means to track, sample intelligently, and characterize HABs and other microbes/processes at the molecular level 'on-the-fly', the 3G ESP will represent an unprecedented technological advancement in HAB detection and surveillance.

Our presentation will describe the ESP's development, highlight applications of this technology to marine and freshwater HAB research and management, and consider the potential for ESP data streams to improve forecasting of bloom development, trajectory, and toxicity.

The webinar is *free*; **pre-registration is required**. *Please login 10 minutes early.*

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