Calusa Waterkeeper's ADAM: Aerosol Detector for (Harmful) Algae Monitoring

Human Health

Harmful Algal Blooms (HABs), both salt-water "red tide" and fresh water blue-green algae, are of increasing concern, particularly due to their negative effects on human respiratory, gastrointestinal, and neurological health. While such harmful effects are well documented in marine life and in humans who have been in direct contact with waterborne toxins, a growing body of research suggests that airborne toxins may also affect human health. Clearly of concern to beach goers, boaters, and those living near water even if not in the water, airborne toxins can spread up to 4 miles and possibly farther, potentially exposing residents even if far from water. Yet, the first Consensus Document of Florida's Harmful Algal Bloom Task Force states, "There is no routine monitoring for aerosolized toxins." Written in January 2020, this is still true. Calusa Waterkeeper (CWK) is working to fill this gap.

Aerosol Detection

CWK's Aerosol Detector for (Harmful) Algae Monitoring, named ADAM, will provide more data, analysis, and reporting of this growing likely health threat. Following the initiation of this project by our Waterkeeper, a team of engineering-oriented Volunteer Rangers designed an air sampling system to be portable, easy to use, easy to service, and scientifically sound, based on the recent but growing research literature on aerosolized toxins. CWK has already constructed two such systems and is deploying them to various locations. Blue-green algal blooms on the Caloosahatchee River are of first concern, but air sampling will expand to address future red tide blooms in our local bays and coast as well. For the analytic lab methods of toxin detection per se, CWK has partnered with another non-profit organization, Brain Chemistry Labs (BRL) under Dr. Paul Cox, for the lab analysis of any and all algal toxins found by ADAM.

Algae Monitoring

CWK and BCL, also working with others, intends to lead in the methodology of aerosolized algae collection and detection as well as how to objectively report to the public. A publicly accessible monitoring and alerting system is the second phase of this project, currently in research and design. However, there is one major issue for objective reporting: There are no human risk standards for airborne exposure as there are for waterborne algal toxins. For example, NOAA provides red tide beach warnings that include wind factors: however, warnings are based on water rather than air samples. Similarly, the Florida Department of Environmental Protection reports blue-green algae concentrations and risk levels, but again, these are based on water rather than air samples. With experience, success, and further support, CWK will fill this gap with more air samplers at more locations, also address the issues of objective reporting. In the end, government agencies are likely to adopt the mantle of such testing and reporting. In the meantime, CWK will help lead the way with others in similar pursuit, establishing a likely gamechanging effort for water quality and public health concerns, both near and long term.







To move from location to location as needed, ADAM is designed to be very portable, with all its components either in or on the field box. A telescoping monopole lifts the "nose" to the 4 to 6 foot "breathing zone" for collection, while the field box holds the battery-powered air sampling pump (blue device), extra filter cassettes, sampling bottles, ultrapure water, tools, etc. Extra stabilization is provided by bipods when need. Waterproof air vents and an AC connection for extended runs (not shown) are also included. The "nose" (detailed above) holds two collection methods: a filter pad held in a plastic cassette (on the right) followed by a water bubbler (on the left). While the filter/cassette is typical for air sampling, the addition of a water bubbler is increasingly being used in aerosolized HAB studies to improve detection. A strainer attached to the filter cassette keeps out debris. The air pump is run at 2 liters per minute for at least 4 hours although CWK will be experimenting with runs as long as 24 hours. Each 4-hour run at 2 liters per minute is equivalent to 1 hour of toxin exposure by inhalation, which is known to be 10X more toxic than by oral ingestion.