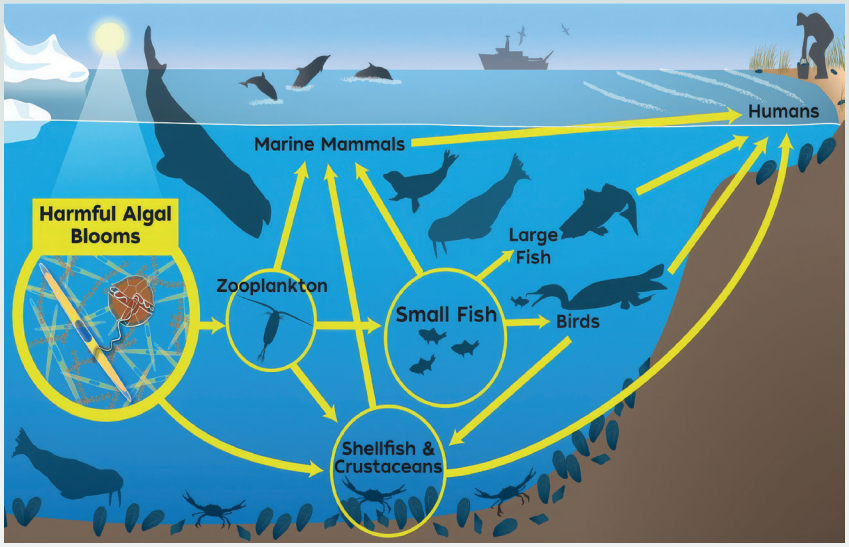
LISST-HAB

MARINE GRADE INSTRUMENTS USED TO DETECT, STUDY AND MITIGATE HARMFUL ALGAE BLOOMS

What are Harmful Algal Blooms?

Given proper circumstances (light, nutrients), all algae can bloom and a portion can become Harmful Algae Blooms (HABs) if the algae produces toxins. Most commonly cyanobacteria, dinoflagellates and diatoms will have this ability. Cyanobacteria are the most common reasons for HABs in freshwater, while dinoflagellates and diatoms are the most common reasons for HABs in salt water.

HAB's accumulate through the food web and are potentially lethal for animals and humans, so there are many good reasons to monitor, study and understand the origin, evolution, duration and behavior of HAB's.



Toxins from HABs accumulate via the food web, potentially affecting all aquatic organisms and humans consuming aquatic organisms. Figure from Anderson et al. (2022): https://doi.org/10.5670/oceanog.2022.121. Reproduced under reative Commons 4.0.

LISST products are in-use worldwide

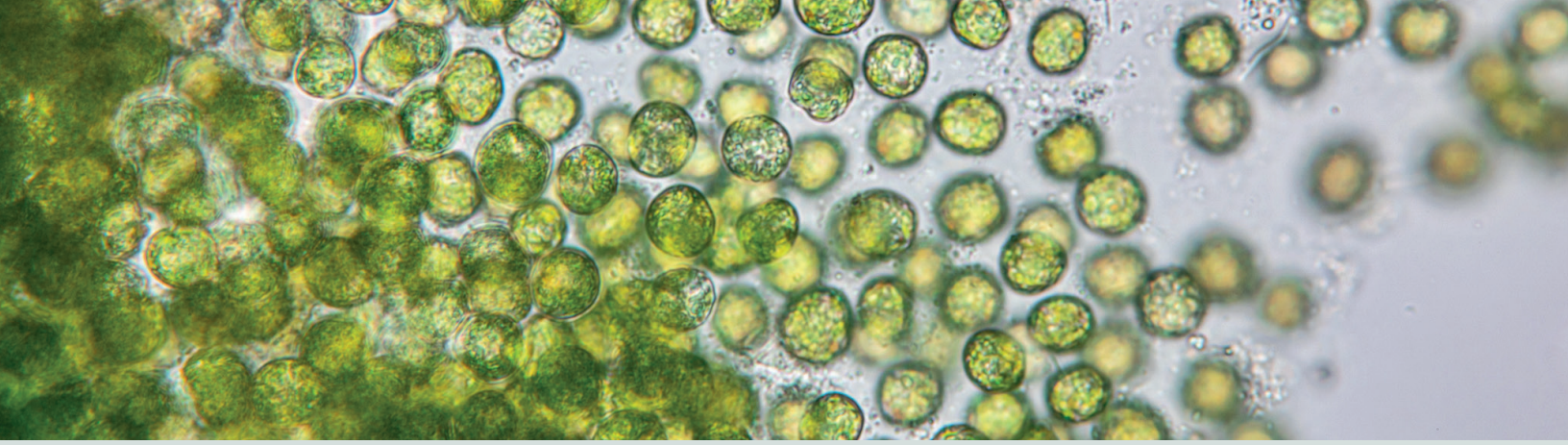
Sequoia's LISST-HAB system integrates three high-sensitivity fluorometers with the LISST-200X platform to enable simultaneous in-situ detection of Phycoerythrin, Phycocyanin, and Chlorophyll-a. This configuration supports pigment-specific discrimination of cyanobacteria and other phytoplankton groups, critical for HAB characterization.

The LISST-HAB additionally provides real-time measurements of particle size distribution (PSD), volume concentration, beam attenuation, temperature, and depth. This enables quantification of nano- and microplankton cell concentrations, size, and growth dynamics—helpful for modeling bloom development and succession.

Traditional fluorometry alone is often confounded by non-algal particles and pigment variability across taxa. By integrating fluorometry with LISST's laser diffraction-based PSD measurements, the LISST-HAB system mitigates false positives and improves accuracy in estimating algal biomass and growth rates. To resolve larger particle populations and morphological traits, Sequoia's LISST-Holo2 instrument employs digital inline holography to capture suspended particle imagery. This allows for identification and sizing of planktonic organisms, flocs, and aggregates.

SEQUOIA

Tools and Research for Particle Intelligence



Applications in the Field

HAB and algae researchers have used the data from the LISST-HAB and/or the LISST-200X/LISST-100X/LISST-100 in several ways:

- In-situ monitoring and vertical migration tracking of a cyanobacteria bloom[1]: The LISST-HAB efficiently measured volume concentration, Chlorophyll a, and cyanobacteria size distribution. Cell counts matched microscope results (R2 ≥ 0.99), but were obtained much faster. Bloom distribution—both horizontal and vertical—depended on wind speed and direction. Other researchers have reported similar LISST-HAB findings[2].
- The LISST-100, predecessor of the LISST-200X, accurately measured phytoplankton cell dimensions for various shapes and sizes, and tracked increasing particle concentrations during a red tide bloom[3].
- Nano- and microplankton cell counts from an inverted microscope match LISST data closely. The LISST was then used to monitor a bloom in detail across time and space[4].
- LISSTs have shown great potential for synoptic bloom monitoring and study of bloom dynamics, e.g. patchiness[5].
- Diatom PSD, growth and aggregation processes have successfully been studied and quantified using LISSTs[6].

LISST-HAB

LISST-Holo2

1. Zhang et al. (2024): https://doi.org/10.1016/j.watres.2024.121693
2. Choi et al. (2022): https://doi.org/10.4491/KSEE.2022.44.12.569
3. Rienecker et al. 2008: https://doi.org/10.4319/lom.2008.6.153
4. Angles et al. 2008: https://doi.org/10.1016/j.hal.2008.04.004
5. https://www.sequoiasci.com/about/news/florida-gulf-coast-university-takes-delivery-of-lisst-hab/
6. Rzadkowolski et al. 2012: https://doi.org/10.1080/09670262.2011.646314

Summary

LISST instruments produce datasets critical for the scientific community, allowing the creation of accurate in-situ details of the natural environment in order to access, study, mitigate and plan. The LISST-HAB quickly delivers accurate fluorescence and particle size data, making it effective for cell counting, concentration, aggregation studies, and monitoring HAB blooms. Quantifying these metrics aids rapid decisions and deeper HAB insights. The LISST-Holo2, provides particle images for identification, adding details to a successful HAB evaluation and monitoring plan.

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