availability, and with appropriate laboratory and field facilities for instrument preparation and deployment, and for analysis of samples. With concurrent deployment of devices of different designs and careful experimental planning with appropriate controls, comparative studies can be conducted and each of multiple approaches evaluated for a range of HAB species. Presentations and discussions will also be held on "best practices" for laboratory experiments that quantify germination using cultures and sediment samples. Some characteristics of resting stage formation and germination will only be possible to resolve in the laboratory.

The second workshop would focus on quantifying the formation and deposition of resting stages in field populations. The site for the workshop would again be a location where blooms of the target species are recurrent, predictable, and accessible. Multiple designs of sediment traps and collection methods can be evaluated, concurrent with methods for assessing levels of sexual induction and resting stage formation in the plankton. The latter would include traditional cytological methods, as well as novel optical and molecular approaches.

The third workshop in this series would involve modelers as well as biologists in an effort to refine methods to incorporate resting stage dynamics into HAB population dynamics models. In addition to defining the critical processes that need to be parameterized, the meeting would help to identify common approaches and computer code that can be shared among species and applications.

Potential funding sources for this project could include international agencies such as IOC-UNESCO, SCOR and national funding agencies such as the U.S. National Science Foundation (NSF) and the U.S. National Oceanic and Atmospheric Administration (NOAA).

Note also that this proposed workshop series covers an important but relatively narrow area of HAB population dynamics, and thus could be combined with other GEOHAB concept proposals related to life history transformations.

### HARMFUL ALGAL BLOOMS IN STRATIFIED SYSTEMS:
### THE NEXT DECADE OF DISCOVERY

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Since the establishment of the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB, SCOR and IOC/UNESCO) program in 1999, the scientific community has devoted important efforts to improve the comprehension of HABS in stratified systems. In August 2012, a workshop organized by the GEOHAB Core Research Program “HABs in Stratified Systems” and entitled “ADVANCES AND CHALLENGES FOR UNDERSTANDING PHYSICAL-BIOLOGICAL INTERACTIONS IN HABS IN STRATIFIED ENVIRONMENTS” was conducted at the Monterey Bay Aquarium Research Institute to review our current understanding of the processes governing the structure and dynamics of HABs in those systems - related in particular to “Thin Layers”. Engineers, physicists, biologists and modelers from all over the globe, working on the various aspects of phytoplankton dynamics in stratified systems, attended the meeting to provide an interdisciplinary understanding of this phenomenon.

The main advances attained in the recent decade, were identified from the presentations and the discussions during the workshop. In addition, participants highlighted gaps in knowledge and methodology and formulated open questions in order to orient future research for the improved modeling and prediction of HABs in these systems. These open questions and gaps were arranged into six overarching themes:
Theme 1) Physical structure
* Can organisms modify the physical microstructure in ways that influence Thin Layer ecology?

Theme 2) Biological structure: Rates and Interactions
* How are toxic phytoplankton and zooplankton distributed at fine spatial scales within the Thin Layer?
* How do these fine-scale spatial relationships influence trophic transfer of toxins?

Theme 3) Organism Behavior
* How do organisms behaviorally locate Thin Layers of HABs in stratified systems?
* How do organisms behave once they are within and in the vicinity of the Thin Layer?
* How does the fact that the environment is stratified favor the particular HAB organisms?

Theme 4) Nutrients
* How are the suites of nutrients distributed in space and with time within the layer over time?
* How do variations in nutrient gradients within the layer contribute to the development and persistence of the layer, as well as to the potential toxicity of the layer?

Theme 5) Temporal evolution of HABs in stratified systems and Thin Layers
* How does the physiological and viability status of the phytoplankton cells change over time with the Thin Layers?
* How do net growth and grazing rates in situ evolve within the Thin Layer?

Theme 6) Predictive modeling
* How can the latest advances in modeling help predict HABs in stratified systems?
* How will HAB distribution change with a changing climate?

The workshop revealed that some of the most recently developed instrumentation and modeling approaches can now provide responses to some of the ‘roadmap questions’ to address in the next 10 years of discovery, after the synthesis meeting of GEOHAB (Paris, April 2013). International collaboration and multidisciplinary field experiments will certainly favor to overcome challenges.

Proposed Activity

We propose to organize a 3-day International Proposal Writing Workshop at the University of Hawaii at Manoa. During this 3-day workshop, we propose to

1) Identify sources of funding for an international effort to answer these outstanding questions,
2) Outline one or two proposals which aim to answer these questions
3) Prepare a draft of one or two proposals
4) Develop a timeline, within which the proposals will be completed and submitted.

COMPARATIVE STUDIES OF CYANOBACTERIAL HABS (CHABS) TO IMPROVE PREDICTION, MANAGEMENT, AND MITIGATION

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GEOHAB aims to foster and promote the global study HABs. A key focus to date has been on marine and estuarine HABs. However, freshwater HABs are also a significant issue around the world. The main group responsible for these issues is cyanobacteria (CHABs). CHABs are an increasing phenomenon worldwide, with a suite of cyanotoxins being responsible for deaths and hospitalisation of many people