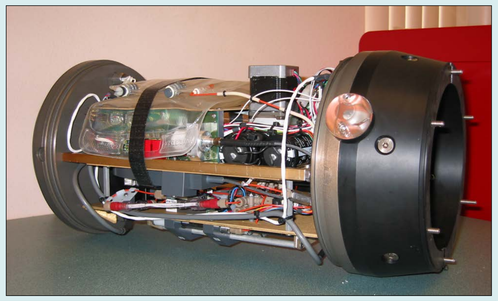
INTEGRATING 3-DIMENSIONAL PHYTOPLANKTON COMMUNITY STRUCTURE WITH HYDROGRAPHIC STRUCTURE UTILIZING AUTONOMOUS UNDERWATER VEHICLES

Gary J. Kirkpatrick[1], Barbara A. Kirkpatrick[1], and Oscar M. Schofield[2]

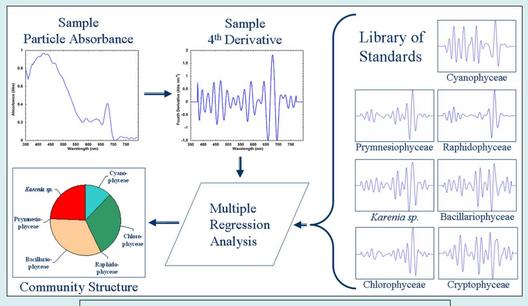
[1] Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236, USA
[2]Rutgers University, 71 Dudley Road, New Brunswick, NJ 08540, USA
Contact: gkirkpat@mote.org

Abstract

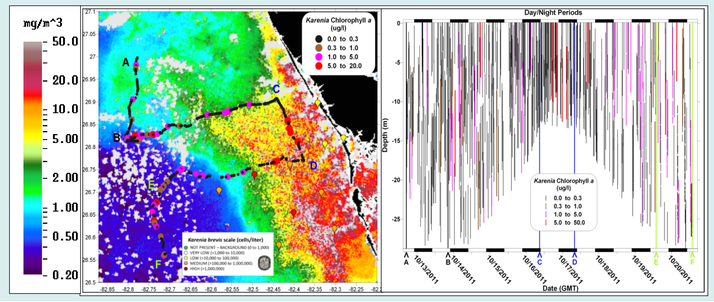
Consideration of phytoplankton taxonomic community structure is essential to the understanding of the function of food webs, the occurrence of hypoxia, and development of harmful algal blooms. Remote sensing can detect and map phytoplankton abundance over large areas of the surface of aquatic environments. However, remote sensing is limited in its ability to provide 3-dimesional distribution of taxonomic structure. Our approach provides phytoplankton community structure at a high sampling rate on mobile platforms to allow for adaptive sampling in 3-dimensions. We have deployed the Optical Phytoplankton Discriminator (OPD) in the payload bay of a Slocum glider since May 2003. We believe this approach greatly enhances the knowledge of the dynamic interchanges between phytoplankton species, shedding new light on issues that have, to date, been studied in situ from a target species approach or laboratory studies with simulated environmental conditions. We will present data from several OPD/glider missions that highlight the strength of this adaptive monitoring approach to relate phytoplankton community structure to hydrographic structure and remote sensing chlorophyll distribution.



Optical Phytoplankton Discriminator (OPD)

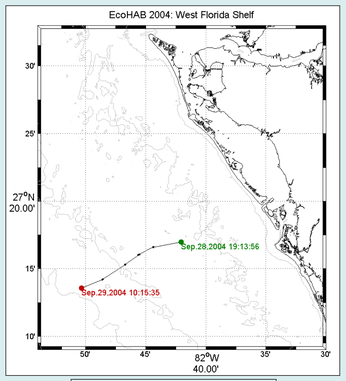


OPD Taxa Classification Scheme

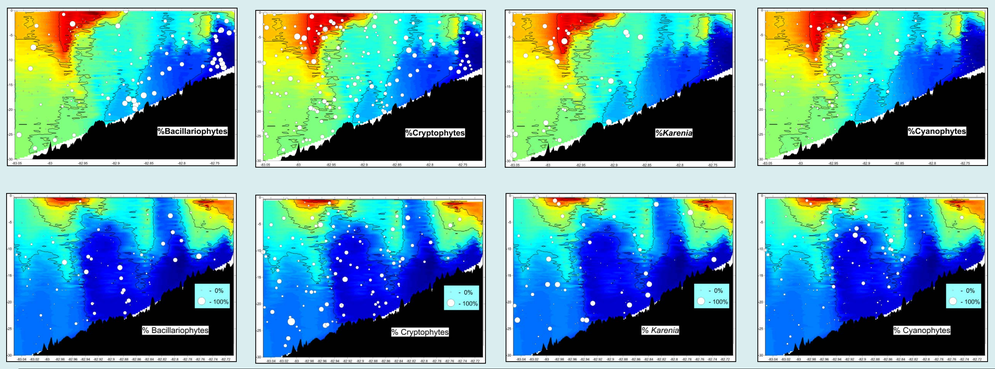


AUV/OPD Deployment from 10/13/2001 to 10/20/2001
(On left the AUV/OPD track off Charlotte Harbor, Florida is overlaid on a remote sensing chlorophyll *a* map (courtesy USF/CMS). On right are the OPD estimates of *Karenia sp*. chlorophyll biomass over the depth range of each sampling.)

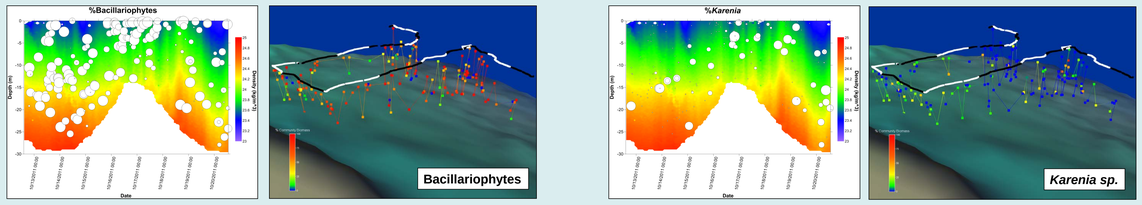
Launching AUV/OPD



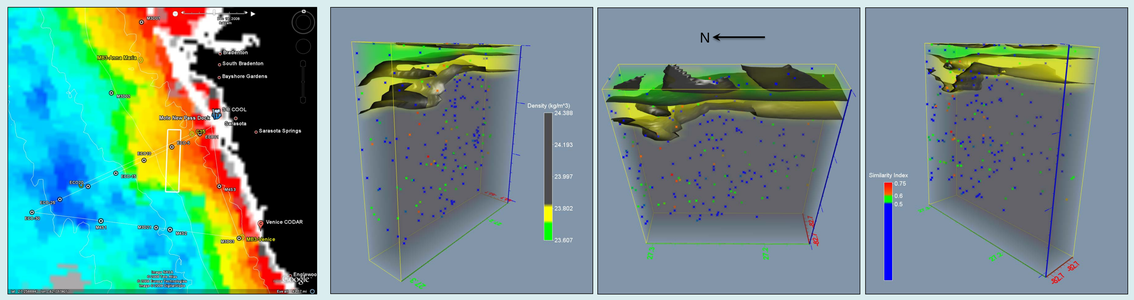
AUV/OPD Track 9/28 – 9/30, 2004



Distribution of Four (of eight) Taxa Classified by the OPD Overlaid on Water Temperature
(Each transit took approximately two days. Note the apparent upwelling of cooler water in the middle of the inbound transit.)



Distributions of OPD Estimates of Percent and Quantitative Biomass for Two Taxa, 10/13-10/20, 2011
(The left panel for each taxon shows % biomass overlaid on the water column density structure. The right panel is a 3-D projection of longitudinal, latitudinal and depth distributions of the quantitative biomass (mg/l chlorophyll *a*).)



3-D Distribution of *Karenia sp*. Observed During AUV/OPD Deployment 9/28-10/6, 2008
(Left panel shows AUV operations area off of Sarasota, Florida overlaid on remote sensing chlorophyll *a* map (courtesy USF/CMS). Right three panels present perspectives of the volume rendering of water column density structure and *Karenia sp*. similarity index (values above 0.6 indicate presence of the target organism).)

Acknowledgements

This work was supported over the past 20 years by a variety of funding sources. These include: the Florida Fish and Wildlife Conservation Commission (FWCC), NOAA, NSF, ONR, NASA, EPA and private foundations and benefactors