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REASEARCH DISCOVERING THE EVOLUTION OF AN ESTUARY

Temporal patterns and changes in Charleston Harbor's benthic microalgae community may show how the harbor is changing.

How often do you think about the food you eat and the air you breathe? If you eat seafood or live near Charleston Harbor benthic microalgae have been important to your lifestyle, likely without you even knowing it. Benthic microalgae, or BMA, are small, sediment-dwelling organisms responsible for up to 50% of primary production in estuarine systems through photosynthesis.

BMA are also important for monitoring ecosystem changes. By forming the foundation of estuarine energy, they provide a snapshot of how the estuary is functioning as a whole. If changes occur in BMA patterns, this may indicate changes in the overall ecosystem. BMA are also easily "characterized and compared using modern molecular approaches," says microbial ecologist, Dr. Craig Plante. These qualities make BMA living indicators, or bioindicators, which is important in monitoring future ecosystem health.

Christine Hart is an intern with NSF's REU program at the College of Charleston. Since BMA are essential to estuaries and serve a role in monitoring ecosystem changes, she worked to detect temporal and tidal stage patterns in BMA dynamics.

At low tide, BMA density, or biomass, increases in the upper layers of sediment. Until now researchers did not know the mechanisms for the visible change in BMA biomass.

The study focused on two possible mechanisms of biomass change. One mechanism was the vertical migration of BMA from deeper layers to the top layer of sediment. The other suggested mechanism for biomass increase was growth among BMA species due to sunlight exposure. The change in biomass was measured by the sediment's chlorophyll *a* concentration during three hours of exposed sediment.

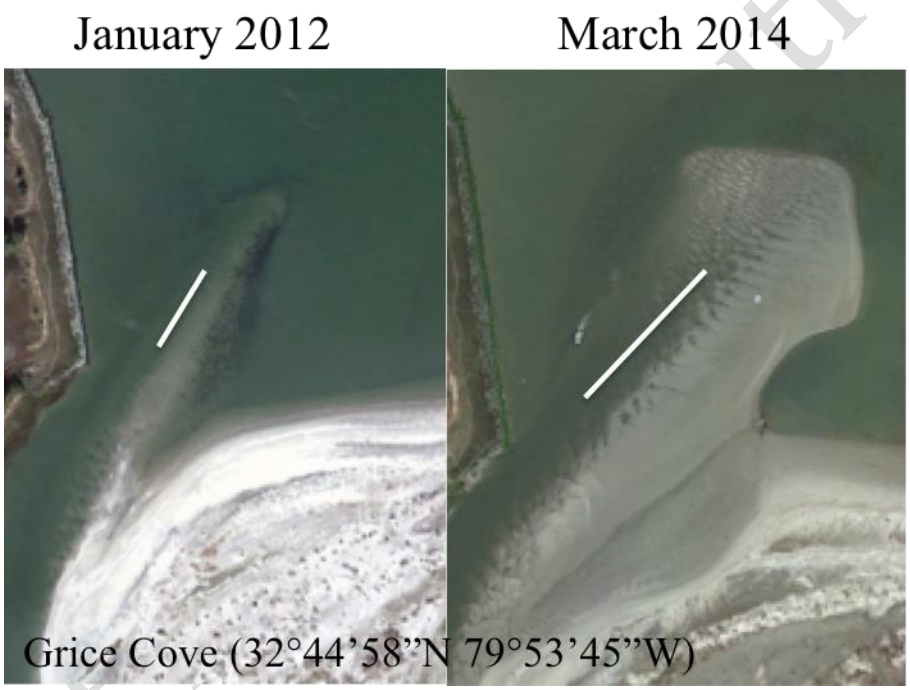
Results suggested that both vertical migration and growth by sunlight are responsible for the visible increase in biomass. Previous studies have not emphasized growth as a contributing factor to BMA biomass; therefore, this study establishes a new pattern in BMA dynamics.

In addition to the unknown mechanism of biomass increase, there is a lack of information on the particular BMA species of Charleston Harbor. To better use BMA as bioindicators, we characterized the type of BMA contributing to the visible biomass changes.

"BMA are difficult to tell apart using visual observations because there are so few distinctive characteristics between species. So, we are using molecular techniques," says Kristina Hill-Spanik at College of Charleston, co-advisor to this study. We extracted DNA from the sediment and identified BMA species by analyzing the results of DNA sequencing.

Results show that BMA diversity is changing over larger time scales, rather than hourly or within our week of sampling. This may be due to geological changes at the sampling site, as shown below. The changes in BMA populations in correspondence with geographical changes may be an example of the importance of BMA as bioindicators.

In summary, the study has identified that growth and vertical migration are important to BMA increase during low tide. The study also identified the long-term changes in the type of BMA in Grice Cove. These results contribute to our knowledge about an essential source of energy in Charleston Harbor. Dr. Craig Plante says these results will direct future studies of the lab "to better understand natural temporal and spatial patterns of BMA." Gathering more information on BMA dynamics may allow us to use BMA as an effective indicator of the evolution of Charleston's estuaries.



Aerial view of Grice Cove sampling site over time. The approximate location of the sampling site is shown by the white line. Sampling sandbar has changed over time, possibly contributing to community changes. Source: "Grice Cove" 32°44'58"N 79°53'45"W. **Google Earth**. January 2012 to March 2014. June 20, 2017.