Potential effects of nutrient reduction on the variability of plankton abundance and composition

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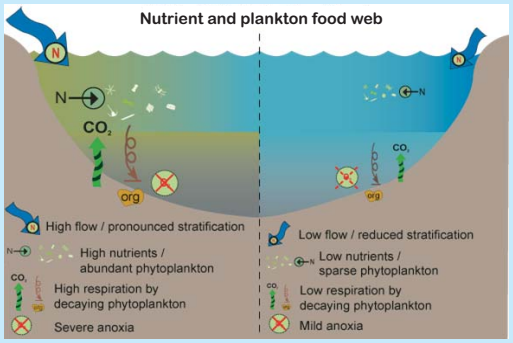
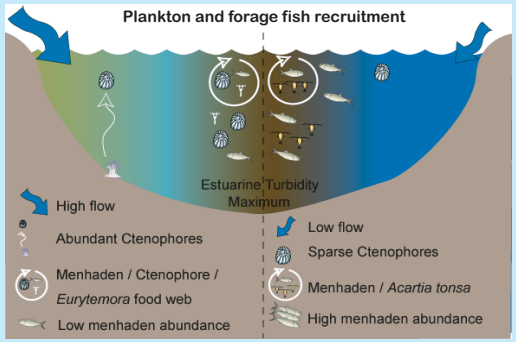
Ecosystem assessment and ecological forecasting project
A NOAA-UMCES Partnership
Cooperative Oxford Laboratory, Oxford MD

Objectives

Synthesize a variety of Chesapeake Bay data to support Chesapeake Bay Program in:

1. Assessing and forecasting effects of nutrient loading reduction on plankton abundance and composition, and forage fish recruitment.
2. Evaluating roles of climate and freshwater discharge on nutrient loading and living resources.
3. Providing useful diagnostic and predictive tools for environmental and fisheries managers.
4. Communicating findings through current and newly developing venues.





Ecosystem assessment and ecological forecasting project

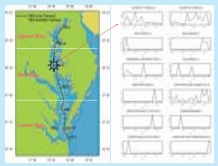
Vision:
Provide scientific assessment and ecological forecasts to guide ecosystem management, with the goal of Chesapeake Bay restoration.

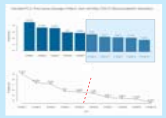
Goals:

1. Develop spatial explicit ecosystem health assessments.
2. Develop quantitative ecological forecasts supporting management decisions.
3. Build community (public, managers and scientists) consensus through scientific communication.

Very large data set

A large number of plankton abundance and composition time series data from Chesapeake Bay monitoring program.

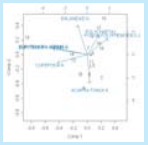


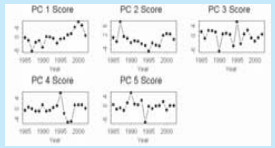


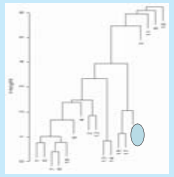
PCA

Data reduction

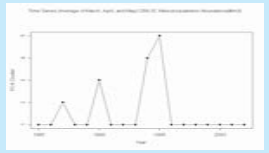
Using Principal Components Analysis (PAC) and Cluster Analysis to reduce the complexity of multivariate data and categorize dominant patterns.







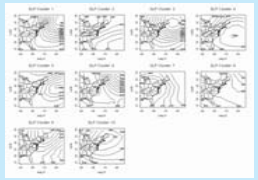
Cluster analysis



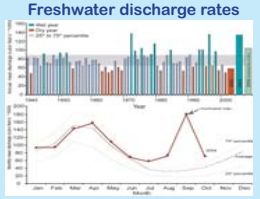
Model & forecast

Model and forecast changes in the plankton food web structure and function related to both nutreints and hydro-climatic forcing.

Sea level pressure patterns



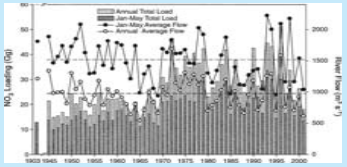
Freshwater discharge rates



Statistical & numerical techniques

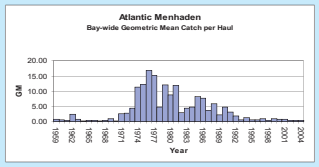
1. Time series models
2. Singular and multiple linear regression
3. Classification and Regression Tree (CART)
4. Bioenergic model
5. Numerical simulation

Nutrient loading and river flow



Hagy et al. 2004

Forage fish recruitment



Communication

Develop communication strategy to deliver timely, synthetic products.

1. Utilize historical data to demonstrate expected outcomes /benefits of nutrient reductions.
2. Focus on food web structure & function.
3. Differentiate hydro-climate forcing from management actions.
4. Newsletters, Bay Journal, indicators, and peer review publications.

Products

Progress report and working plan

We have chosen zooplankton data from CB 2.2 (oligohaline) and CB4.3C (mesohaline) stations in the main stem of the Bay as test data sets. We explored analysis procedures based on these data sets. The preliminary results showed that the criteria used to include/exclude measured variables in the data analysis and the data transformation techniques used to normalize data affect the plankton patterns derived from PCA and cluster analysis. However, the derived plankton patterns are not significantly different between spring (March, April, and May) and annual average. The derived plankton patterns are significantly different between the selected oligohaline and mesohaline stations. We will apply the standardized analysis procedures developed from these test data sets to other stations in the main stem and tributaries.

Acknowledgments

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