SERDP
Strategic Environmental Research and Development Program

An Integrated Approach to Understand Relationships between Shallow Water Benthic Community Structure and Ecosystem Function

Conservation
CS-1335

Background:

Diffuse sources of pollution, associated primarily with groundwater discharge and surface water runoff, are responsible for most of the deterioration of water-quality in U.S. coastal regions. Section 101 of the Clean Water Act requires federal and state agencies to restore and maintain the chemical, physical, and biological integrity of these coastal areas. Biocriteria-based methods, such as the multimetric Benthic Index of Biotic Integrity (B-IBI), have been successfully applied to elucidate regional and local water- and sediment-quality impairments and physical habitat disturbance in the Chesapeake Bay. Although such methods serve as good indicators of anthropogenic disturbance, their relationship to key functional attributes of aquatic ecosystems is not known.

Objective:

The overall objective is to couple the B-IBI approach with detailed investigations of benthic community structure and function in order to better understand relationships among military activities, integrity of benthic communities, and ecosystem function within the shallow waters of the Chesapeake Bay estuarine system. Specific objectives are to: (1) use the B-IBI to assess benthic community health at military installations spanning a range of salinities and stressor types; and (2) identify relationships among B-IBI metrics, food web structure, primary production, respiration, and nitrogen cycling along gradients of impairment in the Chesapeake Bay, at both military and non-military sites.

Summary of Process/Technology:

Field data will be collected in shallow water habitats adjacent to selected military installations and other areas influenced by human activities in the watershed and at paired control sites in relatively undeveloped areas. These sites will range from the tidal freshwater upper Chesapeake Bay and Potomac River estuary to nearly marine regimes of the lower Chesapeake Bay. Sampling stations will be established within pre-determined strata delineated on the basis of potential impacts from adjacent watershed activities and at paired control sites of comparable habitat type. Macrofaunal invertebrate community composition and abundance will be used to compute B-IBIs for each station sampled and average values for stations at each study site. For comparison with the B-IBI results, other measures of structure and function will be made at the same stations.

The results of the study will be modeled using univariate and multivariate statistical methods to relate B-IBIs and component metrics (e.g., biodiversity) with measures of ecosystem function.

Benefit:

This project will improve and expand existing tools to help scientists and Department of Defense installation managers better understand how to manage and restore estuarine ecosystems. Biocriteria-based approaches increasingly will play a central role in water-quality management.

Multi-Angle Imaging SpectroRadiometer (MISR) image of the Chesapeake Bay estuary and the surrounding watershed, March 2000.
(source: NASA/GSFC/JPL, MISR Science Team)

Accomplishments:

This project began in FY 2003. Accomplishments will be noted upon completion of the project.

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