Activities: An interdisciplinary study was initiated to investigate the fundamental physical and biological processes in the Estuarine Turbidity Maximum (ETM) region of Chesapeake Bay. ETMs are features located in the upper reaches of estuaries throughout the world, but their role in sediment and organism dynamics is little understood. Earlier observations indicated that the ETM region is located near the toe of the salt front in upper Chesapeake Bay and suggested that the ETM played a significant role in entrapment of sediments, and both entrapment and production of planktonic organisms and fish. The project is conducted by five Co-Principal investigators from the University of Maryland Center for Environmental Sciencs and a single Principal Investigator from the Virginia Institute of Marine Science (collaborative proposal, NSF Grant No. 0002529). Summary information on this project can be found under the 'Research' banner at *http://www.cbl.umces.edu/etm/*. A more detailed description of the project, participants, activities and findings is provided at the under-development website *http://edh3-pc.cbl.umces.edu/*.

Participating scientists have hypothesized that the ETM entraps sediment particles and planktonic organisms which in turn support enhanced zooplankton production and both growth and survival of young fish. The objective of the research is to characterize constituents and evaluate processes operating in the Chesapeake ETM to understand its role in enhancement of trophic transfers that lead to production of key plankton organisms such as the copepod, *Eurytemora affinis*, and recruitment of anadromous fishes such as shads and striped bass.

A multidisciplinary approach is underway that includes observational science based on research cruises, shipboard experiments, and numerical modeling. The overall goal of the research is to determine which processes and mechanisms in the ETM region can explain observed distributions of sediments, zooplankton and fish. A corollary, of course, is to determine the degree of enhancement to production of zooplankton and fish that are consequences of the processes in the ETM.

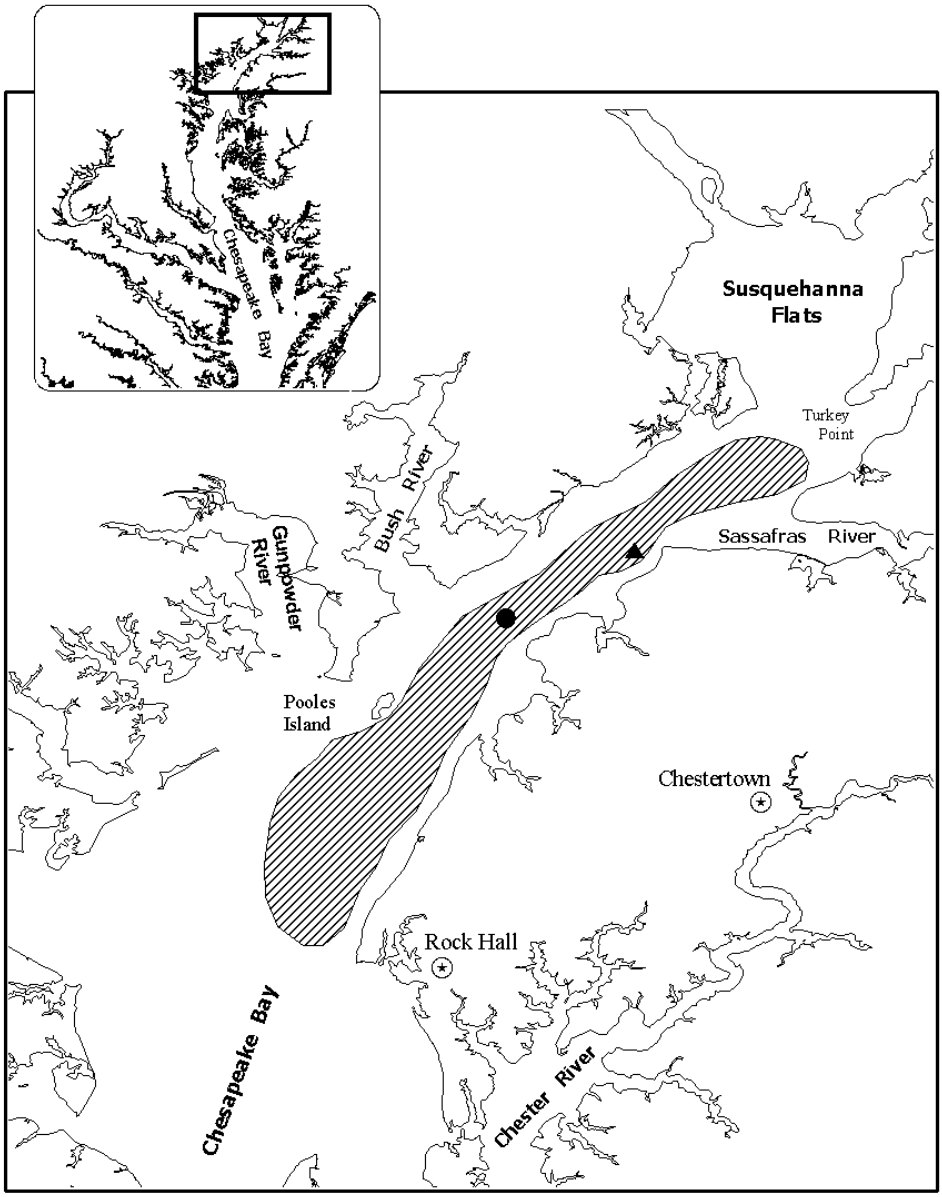
Two major research cruises were completed during the periods 5-13 May and 5-14 July 2001. The research vessels RV Henlopen, RV Coot, and RV Orion have been used to survey biology and physics of the ETM region(see appended figure). In addition, moorings were set near the ETM location to continuously record information on physics and sediments during each of the cruise surveys. A full suite of physical observations was made on hydrographic and sediment variables (CTD, DO, TSS, ADCP, ADV, LISST) during each cruise to characterize them and to track movements of the ETM in response to changes in winds, tides, and freshwater-flow events.

Zooplankton collections are made with pumps, nets and Niskin bottles, as well as on fine scales by high-frequency acoustic measurements taken on each CTD cast (the TAPS instrument). Egg production estimates and variability in key plankton constituents in the ETM region, especially the copepod *Eurytemora affinis,* are being conducted. Zooplankton collections have been made for stable isotope analysis (C and N) to determine primary sources of nutrition for plankton in the ETM. In addition, particulate matter has been collected for future analysis of lipids, proteins, carbohydrates, carbon, nitrogen, bacteria and protozoa.

Larval and juvenile fishes are collected in plankton nets and midwater trawls in the ETM and surrounding regions to determine distributions, abundances, growth rates and trophic relationships with respect to plankton distributions and ETM physics.

A prototype numerical model of hydrodynamics and sediment transport, based on the Princeton Ocean Model (of G. Mellor) is being developed that is responsive to river flow, winds

and tides. A particle advection component and coupled biophysical model is in planning stages for development and linkage to the hydrodynamic model.




Upper Chesapeake Bay. Hatched area represents region of the Estuarine Turbidity Maximum. The two highlighted sites are instrument mooring locations for the May ( ▲ ) and July ( ● ) 2001 cruises, respectivley.

Findings: It is too early in the project to reach conclusions on mechanisms and processes that support the ETM in Chesapeake Bay. However, it is apparent that there is a consistent association of the ETM with the toe of the salt front (1-3 psu) in the upper Bay, supporting observations made during the earlier NSF-LMER cruises in 1996. The ETM has remained reasonably stable in its location during CY2001, moving with tides and responsive to winds and freshwater inflow, but mostly confined to a zone <10 km in length in the upper Bay. Observations on the shoals adjacent to the dredged channel in the upper Chesapeake Bay and preliminary results of a hydrodynamic model indicate that the shoal areas play an important role in flux of sediments and organisms in the ETM region, and must be considered in describing, modeling, and evaluating processes that lead to retention or dispersal of sediments and planktonic organisms. Observations made during the first two cruises have produced along-channel and cross-Bay suspended sediment maps superimposed on the salinity structure (included figure), and have indicated distinct location and depth distributions of plankton and fish relative to the ETM location. The observations suggest that the retention hypothesis that guides the research may be supported, although little analysis has been done at this early stage of the project.

***(Please find the attached figure following this page)***

Attached Figure: