

## **Relationships between benthic community condition, water quality, sediment quality, nutrient loads, and land use patterns in Chesapeake Bay**

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### **ABSTRACT**

Associations between microbenthic communities, measures of water column and sediment exposure, and measures of anthropogenic activities throughout the watershed were examined for the Chesapeake Bay, U.S. The condition of the microbenthic communities was indicated by a multimetric benthic index of biotic integrity (B-IBI) that compares deviation of community metrics from values at reference sites assumed to be minimally altered by anthropogenic sources of stress. Correlation analysis was used to examine associations between sites with poor benthic condition and measures of pollution exposure in the water column and sediment. Low dissolved oxygen events were spatially extensive and strongly correlated with benthic community condition, explaining 42% of the variation in the B-IBI. Sediment contamination was spatially limited to a few specific locations including Baltimore Harbor and the Southern Branch of the Elizabeth River and explained about 10% of the variation in the B-IBI. After removing the effects of low dissolved oxygen events, the residual variation in benthic community condition was weakly correlated with surrogates for eutrophication—water column concentrations of total nitrogen, total phosphorus, and chlorophyll *a*. Associations between benthic condition and anthropogenic inputs and activities in the watershed were also studied by correlation analysis. Benthic condition was negatively correlated with watershed. At the tributary level, the frequency of low dissolved oxygen event and levels of sediment contaminants were positively correlated with population density and percent of urban land use. Sediment contaminants were also positively correlated with nonpoint nutrient loadings and agricultural land use while total phosphorus concentrations were not correlated with land use or nutrient loadings. Chlorophyll *a* concentrations were positively correlated with nitrogen and phosphorus concentrations in the water column and with agricultural land use but were not correlated with nutrient loads.

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