MEDCOAST 99 – EMECS 99 Joint Conference, Land-Ocean Interactions: Managing Coastal Ecosystems
9 – 13 November 1999; Antalya, Turkey, E. Özhan (Editor)

Coastal Development Impacts on Land-Coastal Waters

F.J. Vernberg[1,4], W.B. Vernberg[2], D.E. Porter[1,2], G.T. Chandler[1,2], H.N. McKellar[1,2], G. Scott[2,3], T. Siewicki[2,3], M. Fulton[2,3], D. Bushek[1], D. Tufford[2] and M. Wahl[2]

[1] Belle W. Baruch Institute for Marine Biology and Coastal Research
[2] School of Public Health, University of South Carolina, Columbia, SC 29208 USA
Tel +1-803-777 0177 Fax +1-803-777 1373
e-mail: vernberg@biol.sc.edu
[3] Center for Coastal Ecosystem Health and Biomolecular Research, National Ocean Service, National Oceanic and Atmospheric Administration, Charleston, SC 29422 USA

Abstract

If left unmanaged, anthropogenic activities threaten the environmental health and economic vitality of coastal waters. Historically, the dynamic and complex nature of critical coastal ecosystems inhibited the successful development of models that could effectively be used by coastal zone and fisheries managers. In response to these concerns, a long-term study was initiated in 1990 to define, measure and model the impacts of urbanization on coastal estuaries of the southeastern United States, a project entitled "Urbanization and Southeastern Estuarine Systems (USES)".

This study has focused on comparing the short-term and long-term variability in ecosystem responses of two neighboring estuaries in South Carolina, USA: Murrells Inlet (MI), a developed estuary, and the North Inlet – Winyah Bay National Estuarine Research Reserve (NI), a relatively pristine estuary. Although the USES study involves a multidisciplinary research team focusing on six major research topics (microbiology; toxicology; watershed analysis; phycology and water column processes; geographic information processing and risk assessment modeling; and public outreach and information dissemination), only microbiology, watershed analysis, and geographic information processing will be emphasized in the paper.

Microbiology: Typically in the early stages of coastal development, human waste disposal needs were met by the use of septic tank based technology or discharge of effluents into coastal waters, frequently resulting in contamination of shellfish and biotic resources due to pathogenic bacterial / viral pollution. New techniques were used to differentiate between human and animal pollution sources of fecal coliform bacteria. 1.) Pulsed Field Gel Electrophoresis (PFGE) clearly indicated differential DNA profiling between human and animal sources. Pollution sources in a mixed land use area showed a lack of PFGE match in surface water samples and samples from an adjacent sewage treatment plant. In other areas, septic tank sources were the likely

source of elevated fecal coliform bacteria. 2.) Multiple Antibiotic Resistance (MAR) testing, which is based on the fact that *E. coli* from wildlife species are lacking in antibiotic resistance while strains from humans exhibit resistance, indicated a higher MAR in urban versus pristine watersheds. 3.) Fatty Acid Profiling (FAP) is based on observed differences in bacterial composition among isolates from different host species. Results, agreeing with those of other investigations, suggest that this method may provide an effective tool for pollution source identification.

Watershed analysis: The empirical relationships for watershed hydrology, nutrient runoff and land use in MI and NI were developed. To simulate anthropogenic effects on the nutrient fluxes in an area experiencing rapid population and tourism growth, the Agricultural Nonpoint Source model was used. Comparison of our data with similar work on the northeastern US coast suggests that nutrient flow paths and fluxes may differ due to greater influence of seasonal storage in vegetation along the southeastern US coast.

Geographic information processing and risk assessment: The objectives of this component are to 1.) provide for database development and management, 2.) provide GIS, geostatistical, and integrated spatial modeling assistance to all project components, and 3.) perform applied modeling research applicable to coastal zone management. We will focus on the third objective and describe modeling efforts to identify spatial and temporal trends in the prevalence of the oyster pathogen *P. marinus*, and to compare responses of our two study sites to contaminants.