

## **Use of the USEPA Estuary Nitrogen Model to estimate concentrations of total nitrogen in estuaries using loads calculated by watershed models and monitoring data**

Edward H. Dettmann<sup>1</sup>, Joel S. Steward<sup>2</sup>, and Henry A. Walker<sup>1</sup>

<sup>1</sup>U.S. Environmental Protection Agency, Office of Research and Development, NHEERL, Atlantic Ecology Division, 27 Tarzwell Dr., Narragansett, RI 02882.

<sup>2</sup>St. Johns River Water Management District, P.O. Box 1429, Palatka, FL 32178.

We use USEPA's Estuary Nitrogen Model (ENM) to calculate annual average concentrations of total nitrogen (TN) in ten estuaries or sub-estuaries along the Atlantic coast from New Hampshire to Florida. These include a variety of systems, ranging from strongly-flushed bays to weakly-flushed, microtidal lagoons. The ENM is a box model that calculates annual spatially-averaged concentrations in an estuary using the estuary flushing time and the sum of TN loadings from the watershed (modeled or measured), atmosphere, discharges directly to the estuary, and inputs across the seaward boundary. Input from the seaward boundary is estimated from nitrogen concentration and salinity at this boundary and mean salinity in the estuary. The model assumes first-order kinetics for loss of nitrogen to denitrification and long-term burial in sediment within the estuary. Surface-water loads of TN were calculated using the USGS SPARROW model, or (for most Florida estuaries) the St. Johns River Water Management District's Pollutant Load Screening Model (PLSM). Comparison of calculated and measured in-estuary TN concentrations shows good agreement. We also demonstrate use of the ENM to estimate throughput to the seaward boundary of TN from individual sources, the relative contributions of loading from individual sources (the watershed, direct discharges to the estuary, and input across the seaward boundary) to the TN content of the estuary, and to determine the sensitivity of in-estuary concentrations to changes in loading from the watershed. These results demonstrate the utility of linking watershed models with box models to assess the nitrogen content of estuaries and their sensitivity to changes in loading. The ENM has been used by state and regional agencies to assess TN concentrations and sources in estuaries.