Meteorological modulation of the Exchange Between Raritan Bay and the Coastal Ocean - R/6010-0013

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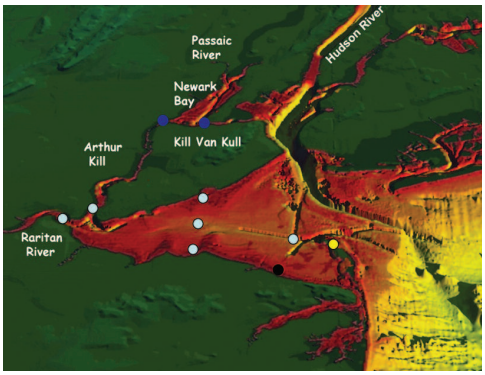
Research Summary

Estuarine residence time is the average time water particles take to escape or leave an estuary. It is perhaps the most important quantity water quality managers need to know in order to determine Total Maximum Daily Loads (TMDL) for a water body. It also plays a central role in determining the character of material that an estuary discharges into the coastal ocean. For example, in estuaries with short residence times (less than one week), such as the Hudson River estuary, inorganic nitrogen from the watershed is exported unassimilated into the coastal ocean where it may fuel large plankton blooms that lead to anoxic conditions in the coastal ocean. In contrast, in estuarine systems with long residence times (many months), such as the Chesapeake Bay and Long Island Sound, inorganic nitrogen is assimilated within the estuary which ultimately fuels the chronic anoxia found within these estuaries. Raritan Bay lies somewhere between these two extremes.

Reliable estimates of estuarine flushing time require detailed hydrographic observations of velocity and salinity at both long time and spatial scales. In Raritan Bay, there are no such observations that enable us to characterize the bay's circulation, to quantify the relative importance of tides, winds and river discharge on the bay's flow structure, or provide reliable estimates of the bay's flushing time. Nevertheless, water quality remains a major concern in the bay. Indeed, parts of the bay exhibit chronic hypoxia that appears to be related to low wind events and times of strong vertical stratification. This research project will release year-long mooring deployments throughout the bay together with targeted shipboard surveys to provide the first detailed investigation of circulation processes in Raritan Bay. In addition to providing critical information to managers the data will also provide insights to fundamental processes that drive estuarine exchange. Particular emphasis will be placed on seasonal scale variability in circulation and dispersive processes associated with variable wind and river discharge.

The mooring array used for this project includes four elements in Raritan Bay, one at the mouth of the Raritan River and one at the southern edge of the Arthur Kill. Each mooring element will contain a profiling Doppler current meter and a surface and bottom conductivity and temperature sensor for measuring salinity. In addition the two moorings where recurrent low dissolved oxygen occurs will include dissolved oxygen sensors. Shipboard surveys will provide higher spatial scale resolution of flow parameters and include measurements of current velocity, salinity, temperature nitrate, chlorophyll-a and dissolved oxygen. This will represent by far the most comprehensive data set in this highly urbanized estuary and will provide managers with information and insights into the processes that determine water quality.



This fact sheet is the result of work sponsored by New Jersey Sea Grant with funds from the National Oceanic and Atmospheric Administration (NOAA) Office of Sea Grant, U.S. Department of Commerce, under NOAA grant number NA060AR4170086 and New Jersey Marine Sciences Consortium/New Jersey Sea Grant with funds appropriated by the State of New Jersey. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of New Jersey Sea Grant or the U.S Department of Commerce. NJSG-10-766