

Robust segmentation of embayments to encompass changes in constituent loads and exposure to risk

Abstract

Nutrient and contaminant loads from the watershed, atmosphere, and seaward boundary to an embayment continually change due to human activities and alterations in the trends of natural forcing. Nevertheless, residence time (a measure of exposure) is always viewed as an unchanging character of the embayment. This concept has been adjusted to cope with such changes as they affect exposure of biological components in the system to risks. A method has been developed to facilitate cross-embayment comparisons of physical, chemical, and biological parameters. The process identifies areas within a selected group of systems that share the same predicted value of a spatially-variable virtual measure of concentration and exposure. This parameter depends on the constituent load as well as its transport behavior and mixing within each system, as reflected in the spatial distribution of local residence time. The procedure is illustrated using the impact of nitrogen loadings on benthic condition in a number of embayments in southern New England, USA. The favorable results of the method signify the robustness of this approach in cross-comparisons and classification of areas within embayments. The method addresses not only existing conditions but also conditions as changes take place, thus it can serve as an aid in strategically managing these systems.

Key words: embayment; segmentation; local residence time; exposure; virtual concentration