



# Concepts in Delaware Estuary Science and Management

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## **Testing the Waters: Toxicity Testing of Ambient Water in the Delaware Estuary**

**About this Series.** This is one in a series of short articles contributed to the Partnership for the Delaware Estuary (PDE) by scientists and managers living and working in the region. The purpose of web-publishing these articles is to provide introductory, “leading” information about natural resources, scientific concepts, management issues, and other science activities of current and emerging interest, for which little documented information exists elsewhere. In many cases, articles published to this forum will lead to more in-depth scientific publications or studies. **Please send suggestions and contributions** to the Delaware Estuary Science Coordinator at the Partnership.

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## Testing the Waters: Toxicity Testing of Ambient Water in the Delaware Estuary

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The Delaware River Basin Commission was formed in 1961 when President Kennedy and the governors of Delaware, New Jersey, Pennsylvania, and New York for the first time signed concurrent compact legislation into law creating a regional body with the force of law to oversee a unified approach to managing a river system without regard to political boundaries. Since its formation, the Commission has worked to protect water quality, resolve interstate water disputes without costly litigation, allocate and conserve water, manage river flow, and provide numerous other services to the signatory parties. The Commission serves as policy maker, regulator, planner, manager and mediator on behalf of the signatories to the Delaware River Basin Compact and the residents of the Basin. The 35,065 Km<sup>2</sup> (13,539 square miles) of the Delaware River Basin contain stretches of the National Wild and Scenic River System as well as highly urbanized and industrialized areas. The Basin provides water for nearly 15 million people or roughly five percent of the U.S. population. While the Delaware Bay is a principal breeding ground for American horseshoe crabs and is among the largest staging areas for shorebirds in North America, it is also home to many industries and one of the largest petroleum ports in North America. The Delaware River Port Complex (including docking facilities in Pennsylvania, New Jersey, and Delaware) is the largest freshwater port in the world. According to testimony submitted to a U.S. House of Representatives subcommittee in 2005, the port complex generates \$19 billion in annual economic activity. Nearly 42 million gallons of crude oil are moved on the Delaware River on a daily basis. A special session on the Delaware River and Bay at the SETAC-NA Annual Meeting in Baltimore will include studies conducted throughout the Basin. I encourage you to attend.

As an Environmental Toxicologist at the DRBC, I have participated in a number of activities. One that may be of interest to HDC-SETAC members is the DRBC Chronic Toxicity Workgroup. The Workgroup includes DRBC staff, EPA, state, municipal, and industry representatives as well as other interested parties working toward developing a scientifically sound sampling and analysis plan to determine if ambient toxicity occurs in the estuary. Potential sources of toxicity and water quality impairment in the Delaware Estuary include point and non-point sources, contaminated sites, tributaries, the Chesapeake and Delaware Canal, and atmospheric deposition (Delaware Estuary Program, 1996). However, the Clean Water Act mandates that there should be no toxic effects in ambient waters. Currently, toxicity in the estuary is determined with test species used to assess receiving (ambient) water (USEPA, 2002). Toxicity tests are run on composite water samples. The test organisms are exposed to water samples in the laboratory and any resulting effects are observed. Data on survival, growth and reproduction are collected as part of the tests. Physical-chemical data also are collected as specified in the respective test methods.

Figure 1 is a map of the Delaware Estuary with sample site locations marked for the year 2005 surveys. Within the sample area changes in salinity from 1 to 10 ppt occur due to river flow and tidal conditions. The selection of test species and appropriate controls for toxicity testing is complicated by this changing salinity gradient. Furthermore, efforts to study and characterize toxicity in the Delaware Estuary have

been hampered by the limited number of EPA-approved test species that are tolerant of low salinity levels present in the estuary (USEPA, 2002).



**Figure 1.** Delaware Estuary Sample Site Locations

In addition to the euryhaline fish *Menidia beryllina*, a number of test species are under consideration by the Chronic Toxicity Workgroup for use in testing ambient estuarine water. The mysid *Americamysis bahia* has been selected as a test species because mysids play an important role in the estuarine environment, *A. bahia* has a history of use in standardized tests, and the test organism is commercially available. However, based on data from long-term chronic toxicity tests, current EPA guidance is to conduct *A. bahia* tests at salinities between 20 to 30 ppt. This requires salinity adjustment in many samples from the estuary that may potentially alter the toxicity profile of the samples. If the test species can be acclimated to the salinity of the river water to be tested, salinity adjustment can be avoided or limited. This should make interpretation of the test results easier. In an effort to modify the standard test method, supportive data was generated for acclimating *A. bahia* to low salinities ( $\geq 10$  ppt) for use in 7-day tests by American Aquatic Testing Inc. Another example of a candidate organism that has a number of the desired criteria and is proposed for use is *Hyalella azteca*, an amphipod that is often used for sediment toxicity testing and is increasingly used for water column testing in a 10-day duration test. Importantly, *H. azteca* is recommended for testing in low salinities between 0 to 15 ppt. (USEPA, 2000). All three species (*M. beryllina*, *A. bahia*, and *H. azteca*) are scheduled for use in year 2005 surveys. The goal is to develop a scientifically defensible set of toxicity tests to aid in the assessment of water quality and facilitate environmental management of the estuary.

#### **Suggested Reading List for More Information**

Delaware Estuary Program. 1996. The Scientific Characterization of the Delaware Estuary.

U.S. Environmental Protection Agency. 2000. Section 11. Test Method 100.1. *Hyalella azteca* 10-d Survival and Growth Test for Sediments. EPA 600/R-99/064.

U.S. Environmental Protection Agency, October 2002. Short-Term Methods For Estimating The Chronic Toxicity Of Effluents And Receiving Waters To Marine & Estuarine Organisms, Third Edition EPA-821-R-02-014.