Development and Evaluation of Chemical Indicators for Monitoring Ecological Risk

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Project Summary:

Our **overall goal** is to identify and validate effective contaminant indicators of adverse impacts on estuarine ecosystem health. Indicators will be developed in the Great Lakes, but will also be applicable to both marine and freshwater ecosystems. These contaminant indicators will be used to evaluate ecological condition. Specifically we will focus on the evaluation of two indicators: 1) indicator PAHs of photoactivated toxicity to fish and benthic organisms; and 2) organic chemical indicators of xenoestrogenic compound exposure to fishes.

The assessment of ecological condition in an effective manner is best accomplished using integrative indicators of condition. These indicators should be cost-effective, be applicable across multiple scales, and provide useful information for environmental managers. Within the Omnibus Proposal, this Contaminants Subproposal focuses on contaminant indicators that will provide a measure of condition of the estuarine ecosystem. These indicators will also serve as diagnostic indicators that will identify the primary stressors affecting the specific ecological endpoint of concern. We have focused on PAH compounds and xenoestrogens since they are widespread in the environment and have existing sources, and thus are of current concern.

The **specific hypotheses** we are testing are: 1) Specific PAHs in combination with UV penetration are indicators of potential loss of vulnerable species within coastal fish and or benthic communities; and 2) specific chemicals are indicators of endocrine disruption in fish via the estrogen receptor. Data collected to test these hypotheses will be used to demonstrate the degree of usefulness of these two groups of indicator compounds as diagnostic indictors for estuarine ecosystems. Our overall approach to this project is as follows. For both indicators, we will compare contaminant concentrations to a biological endpoint or condition across a gradient of non-degraded to highly degraded sites in 2-3 watersheds being studied by the other indicator project groups in the program. For indicator PAHs of photoactivated toxicity, we will compare both photoactive toxic and non-photoactive toxic PAH concentrations in sediments, fish, and fish larvae to the fish species compositional changes across the gradient (being done by another subproposal). Using correlative statistical techniques, we will identify specific indicator PAHs that are associated with the decline or loss of vulnerable species (those that are exposed to light during early life cycle stages), UV dose, and photoactive toxic potency of the site. While photoactivated toxicity has been extensively studied and its acute toxicity demonstrated in the laboratory, this will be the first field test of such an indicator. The xenoestrogen indicators will be identified in an analogous manner. A suite of potential xenoestrogens will be measured in fish tissue, sediment, and/or water and compared to vitellogenin induction in male fish (a bioindicator of individual estrogen exposure) at the same gradient of sites. Using correlative statistical techniques, we will identify specific indicator xenoestrogens that are associated with vitellogenin induction. This would represent the first link of vitellogenin induction and chemical exposure in field sites other than near sewage treatment plants.