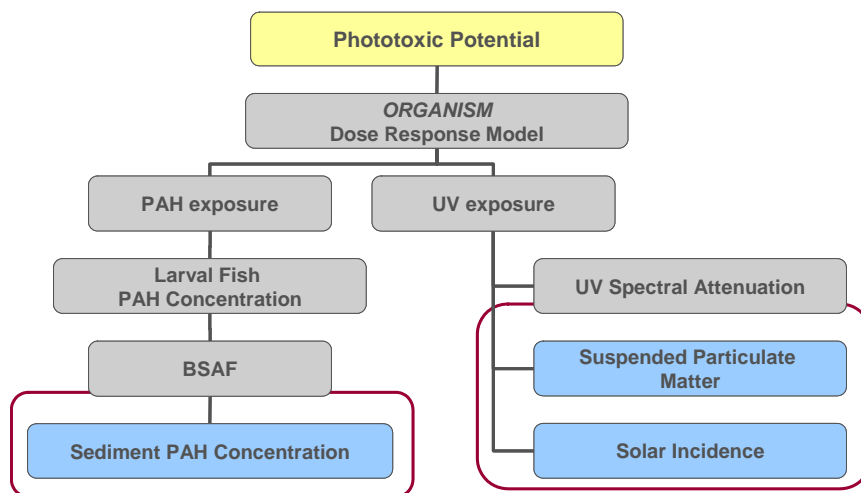




Indicator for Fish Health: Assessing Risk of Photo-Enhanced Toxicity of PAHs to Larval Fish in the Coastal Great Lakes

Background

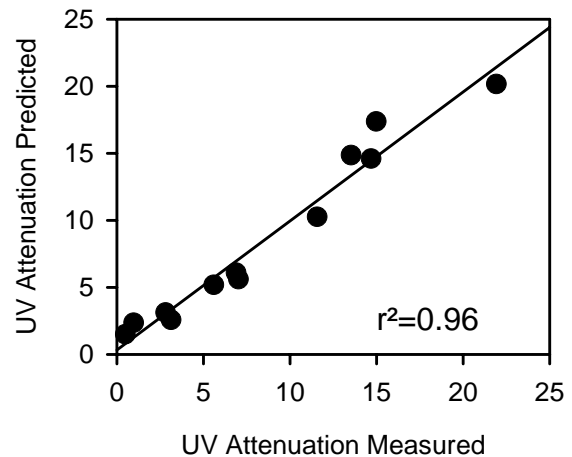
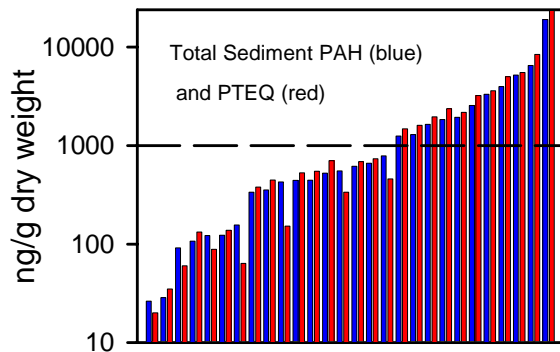
Polycyclic aromatic hydrocarbons (PAHs) are toxic by-products of combustion and are present in uncombusted petroleum. The toxicity of these compounds is greatly increased with the addition of ultraviolet (UV) light from the sun. The electronically excited molecules can cause oxidative damage to cells in which they are present, eventually leading to death. Larval fish are thought to be especially vulnerable because of their high lipid content, translucency and habitat. Because they are high in lipid, larval fish can accumulate high levels of lipophilic PAHs. Because they are translucent, UV penetration of their bodies is greater than for adult fish with pigmentation. The habitat of larval fish, nearshore areas, increases their propensity for photo-enhanced toxicity: 1) they are in close proximity to sediments where PAH concentrations may be high; 2) the shallow water creates the potential for higher UV doses.



Managers of the coastal Great Lakes need only take a water sample, filter it for SPM and measure the spectral attenuation on a spectrophotometer to obtain UV dose at a specific site and time. At the same time a sediment gram sample may be taken and analyzed for total PAHs to obtain PAH dose in larval fish through our bio0sediment accumulation factors (BSAFs). This information can be put into our model and a phototoxic potential at a site will be estimated.

Results

Total sediment PAHs measured at random sites throughout the Great Lakes are similar in concentration to the photo-toxic equivalents (PTEQ), and many of the sites are above the threshold believed to be ecologically relevant. UV attenuation in the water column is well modeled using our multiple linear regression model including spectral attenuation and total suspended particulate matter (SPM).



Further Information

Please contact Deborah Swackhamer (email: dswack@umn.edu) or Matt Simcik (email: msimcik@umn.edu) with questions regarding this indicator.