

A combined multidisciplinary kinetic modeling approach for determination of coastal ecosystem contaminant fluxes

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The historical operation of manufacturing, chemical and other industries in the Sydney Harbour catchment over many decades has left a legacy of high chemical contamination in the surrounding catchment. These contaminants are now seriously impacting on incident commercial fisheries and public utilisation of estuarine resources. Elucidation of environmental processes is the key to effective ecosystem management, however few tools are available to predict their inter-relationships, rates and directions. This work seeks to combine GIS, contaminant transport, ecological, and bioaccumulation models to improve the accuracy and specificity of a probabilistic ecological risk assessment strategy.

This study has four components: (1) determination of chemical linkages between high trophic order species and different habitats resources using stable isotopic analyses of carbon and nitrogen. These studies identify trophic cascades forming the basis for selection of biota for contaminant transfer experiments; (2) short-term (weeks – months) chronology and geochemistry of sediment cores and traps in Homebush Bay to determine rates of sedimentation and resuspension (using environmental/cosmogenic ⁷-Be). Models derived from these studies provide the contaminants levels against which risk is assessed; (3) biokinetic studies using proxy radiotracer isotopes (eg. ⁷⁵-Se & ¹⁰⁹-Cd for analogous stable metals) of the uptake and trophic transfer of contaminants by specific estuarine biota. Here we identify the rates and extent to which contaminants accumulated and transferred to predators/seafoods; and (4) application of a probabilistic ecological risk assessment model (AQUARISK) set to criteria determined by stakeholder consensus.

Here we report initial results of the distribution of natural isotopes and redistribution of artificial isotopes injected into ecological compartments to determine the key trophic linkages, contaminant pathways and their rates in temperate estuarine systems of Sydney Harbour & Botany Bay (Australia).