ESRI OCEAN GIS FORUM– November 2014

http://www.esri.com/events/oceans

A Water Quality Index for the Southern California Bight: Spatial integration of multiple pollutants and sources

Steven J. Steinberg, Rebecca A. Schaffner and Kenneth C. Schiff

Southern California Coastal Water Research Project Authority, Costa Mesa, CA, USA;

Abstract

Southern California marine ecosystems face a variety of direct and indirect threats to their integrity and health as a result of their proximity to urbanized areas, primarily from fishing and resource extraction, and exposure to anthropogenic pollutants. Two primary sources of anthropogenic pollutants are treated wastewater, released by publicly owned treatment works (POTWs) through ocean outfalls, and freshwater run-off contained in urban river plumes. We developed a geospatial tool in ArcGIS to calculate a Pollutant Exposure Index (PEI) for the Southern California Bight (SCB). The PEI quantifies long-term exposure to potentially harmful pollutants emanating from these two sources. Recent studies on the dispersal of plumes have resulted in high quality spatial datasets that predict plume occurrence frequencies as point grids around POTWs and river mouths throughout the region. We multiplied the plume frequency values with data on average annual discharge rates, initial dilution factors, and concentration of chemicals in discharges to calculate total exposure to pollutants at each location. Using this approach we developed maps of the distribution of three important plume constituents: dissolved inorganic nitrogen in the form of nitrate and nitrite (DIN), total suspended solids (TSS), and copper. Python scripts, Model Builder, and individual ArcGIS tools facilitated geoprocessing of the exposure data and calculation of the final PEI raster, including: 1) Creating exposure rasters for each pollutant and source using Inverse Distance Weighting; 2) Summing POTW and river plume exposure rasters for each pollutant and normalizing each raster to the maximum exposure value; 3) Creating the PEI by summing pollutant exposure rasters and normalizing again to provide values ranging from zero to one. The resulting georeferenced PEI raster may be used with other spatial data to examine relative pollution risk for any area of interest within the mapped region. The PEI will be incorporated into an ongoing study to examine relative risks posed to marine habitats by pollutants and fishing pressure.