

SCCWRP #874

A GIS Tool to Compute a Pollutant Exposure Index for the Southern California Bight

RA Schaffner, SJ Steinberg, and KC Schiff

Southern California Coastal Water Research Project Authority, Costa Mesa, CA, 92626, United States

ABSTRACT

Southern California marine ecosystems face a variety of threats to their integrity and health as a result of their proximity to urbanized areas. These threats may be direct, through fishing and resource extraction, or indirect, through exposure to anthropogenic pollutants. Two primary sources of anthropogenic pollutants are treated wastewater, released by publicly owned treatment works through ocean outfalls, and freshwater runoff contained in urban river plumes. We developed a geospatial tool using ArcGIS software to calculate a pollutant exposure index for the Southern California Bight. The pollutant exposure index 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 publicly owned treatment works 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, total suspended solids, and copper. A series of Python scripts was created to facilitate geoprocessing of the exposure data and calculate the final pollutant exposure index raster, including (1) creating exposure rasters for each pollutant and source using inverse distance weighting, (2) summing publicly owned treatment works and river plume exposure rasters for each pollutant and normalizing each raster to the maximum exposure value, and (3) creating the pollutant exposure index by summing pollutant exposure rasters and normalizing again to provide values ranging from zero to one. The resulting georeferenced pollutant exposure index raster may be used with other spatial data to examine relative pollution risk for any area of interest within the mapped region. The pollutant exposure index will be incorporated into an ongoing study to examine relative risks posed to marine habitats by pollutants and pressure from fishing.

Due to distribution restrictions, the full-text version of this article is available by request only.

Please contact pubrequest@sccwrp.org to request a copy.