A two-stage multivariate approach to identifying ocean outfall plumes based on temperature and salinity profiles

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ABSTRACT

Ocean outfall plumes are often mapped using CTD profiles, but the extent to which particulate plume parameters, such as bacteria, behave like the physical parameters measured by CTDs has not been well tested. Additionally, interpretation of CTD data for plume mapping is typically based on subjective judgment of where physical parameters differ from those of surrounding waters. Here, we present monitoring data spanning two years in which bacterial concentration and CTD profiles were collected simultaneously near a large treated wastewater outfall. These data were used to assess the effectiveness of temperature- salinity (T-S) plots for describing bacterial plume dilution and to test a statistical model for predicting bacterial concentration from T-S data. Elevated bacterial concentrations were found to be consistently associated with subsurface low salinity deviations. We also found that this deviation could be quantifiably defined using a two-stage multivariate approach based on cluster analysis followed by principal component analyses (PCA). Due to the considerable natural variability in T-S relationships, the extent to which this approach can be used as a plume tracer was dependent on the level of detection required. T-S relationships were reliable for identifying the plume when bacterial concentrations were several times water quality standards and were also effective at defining areas from which the plume was absent. The T-S relationships were inconsistent in defining those areas where plume dilution reduced bacterial concentrations to moderate levels, including those approximately equal to that of the water quality standard.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2005_06AnnualReport/AR0506_133-140.pdf