

EXECUTIVE SUMMARY

The Regional Harbor Monitoring Program (RHMP) was developed by the Port of San Diego, City of San Diego, City of Oceanside, and County of Orange to address questions regarding the general water quality and condition of aquatic life in the four harbors within Region 9 (San Diego) of the State Water Resources Control Board. The RHMP was developed to address the overall condition of the harbors through core monitoring and supplemental focused studies by answering the questions set forth by the San Diego Regional Water Quality Control Board (SDRWQCB) regarding the spatial distribution of pollutants and their impacts, the safety of the waters for human contact, the safety of fish for human consumption, the abilities of the waters and sediments to sustain healthy biota, and the long-term trends in harbor conditions. The core monitoring program assesses the conditions found in the harbors based on comparisons to historical reference values for the four harbors and comparisons of contaminant concentrations to known surface water and sediment thresholds using chemistry, bacterial, toxicology, and benthic infaunal community indicators.

Prior to the initiation of the RHMP in the summer of 2008, a Pilot Project was initiated to assess the effectiveness of the proposed study design, determine the level of sampling effort needed to increase the statistical power of the study, and refine the design as needed. Sampling for the Pilot Project was conducted from 2005 to 2007, once per year in the month of August. The Pilot Project is a scaled-down version of the RHMP that focuses on a limited number of indicator measurements sampled within two of the five identified strata. The strata sampled in the Pilot Project, marinas and freshwater influenced, were selected because the variability within these areas was anticipated to be greater than in the other three strata, and thus would provide a conservative estimate of the amount of sampling effort needed to detect statistically significant differences from historical conditions. Given that only two strata were surveyed, the results of the Pilot Project cannot be used to assess whether conditions have improved or deteriorated from historical conditions, since preset targets were determined using stations located within the shallow, deep, and port/industrial strata in addition to the marina and freshwater-influenced strata. Although the Pilot Project was specifically designed to assess the validity of the design, inferences can be made on whether conditions in the marina and freshwater-influenced strata are better or worse than the historical harbor-wide conditions.

Based on the results of the Pilot Project, the following statements can be made:

- Copper concentrations in marinas exceeded water quality objectives, while concentrations of other metals and polycyclic aromatic hydrocarbons were below water quality objectives.
- All bacterial concentrations were well below AB 411 levels.
- Physical water column measures largely occurred at levels that were suitable to support healthy biota.
- Sediment concentrations of copper in marinas and zinc in marina and freshwater-influenced strata occurred at levels likely to cause adverse biological effects
- Polycyclic aromatic hydrocarbons and all other sediment metals (except arsenic and mercury) primarily occurred at levels that were not likely to result in adverse biological effects.
- The majorities of the marina and freshwater-influenced strata contained sediments that were not toxic.

- Benthic infaunal communities in both strata occurred at intermediate levels of disturbance.
- In the marina stratum, the primary surface water, sediment, and benthic infaunal community indicators occurred at levels that were worse than harbor-wide historical conditions
- Toxicity levels in the marina sediments generally were better than harbor-wide historical conditions.
- In the freshwater-influenced stratum, primary surface water, sediment, and toxicity indicators were better than historical conditions, while only benthic infauna was worse.
- The marina stratum tended to have higher concentrations of surface water and sediment chemistry indicators than the freshwater-influenced stratum.
- Toxicity levels and benthic infaunal communities did not differ between the two strata.
- From 2005-2007, no negative short-term trends were evident for any indicator that would be indicative of a degrading condition.

The results of the Pilot Project validated the effectiveness of the RHMP study design in answering the SDRWQCB questions. The use of a stratified random design that was repeated among years allowed for the assessment of the spatial distributions of pollutants (i.e., differences between strata and among harbors), as well as changes in the levels of pollution through time (i.e., short-term trends from year to year). Additionally, the Pilot Project illustrated that the study design is appropriate for analysis of trends through comparisons of the percentages of stations below threshold values between present-day and historical conditions, as well as comparisons of changes in indicator values from year to year. Evidence for the effectiveness of the approaches is seen in the prevalence of statistically significant results in most cases where it was reasonable to assume that they would occur.

Since the initiation of the Pilot Project additional historical data for the harbors have been released, the Benthic Response Index (BRI) has been modified, and new sediment quality objectives (SQO) for bays and estuaries have been developed. Moreover, successful completion of the Pilot Project has provided valuable insights into the validity of the approach and how it can be enhanced. As a result of recent methodological innovations and analyses of the effectiveness of Pilot Project results, the following modifications to the RHMP study design are recommended:

- Increase the sample size in strata to 15.
- Integrate Bight 2003 data into historical distribution curves.
- Analyze sediment conditions with new SQOs.
- Revise benthic community assessment and BRI calculation.
- Include tributyltin as an analyte.

Based on Pilot Study findings, special studies are recommended to determine the spatial extent of copper pollution surrounding marinas, quantify the level of copper flux from marina sediments, assess the bioavailability of copper using bioaccumulation studies and the biotic ligand model, and identify the causes of high toxicity levels in areas where they occur through sediment toxicity identification evaluations.