

Team Science in a Summer Undergraduate Fellowship: Field Sampling for Metal Contamination in the Raritan River

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Summer internships provide undergraduate students with intensive one-on-one training experiences in the laboratory. At Rutgers University, we sought to extend this training to promote scientific collaboration and networking through team-based field sampling. During the 2019 Summer Undergraduate Research Fellowship (SURF) Program, twelve undergraduate students collected surface water from the Raritan River aboard the R/V Rutgers following completion of interactive classroom sessions on heavy metal contamination. The river has a history of extensive pollution from industrial facilities and includes multiple Superfund sites along its shore. In collaboration with the Marine and Coastal Sciences program, surface water was collected in duplicate at 6 sites between New Brunswick, NJ and the Raritan Bay. Students kept field notes on sample characteristics as well as weather and water conditions. ICP-MS analysis revealed a large range of metals concentrations in the sampled surface water. Lithium (mean: 33.0 ppb), barium (mean: 20.8 ppb), and arsenic (mean: 16.2 ppb) were the most abundant metals analyzed, while lead (mean: 0.06), cadmium (mean: 0.02 ppb), and cobalt (mean: 0.48 ppb) were the least abundant. Notable changes in metal concentrations were observed in relation to whether samples were collected near and away from industrial and landfill sites, and may provide clues on the primary sources of contamination. Concentrations of lithium, vanadium, chromium, cobalt, nickel, copper, arsenic, cadmium, cesium, and uranium increased up to 14-fold in samples collected between the Edison landfill and Sayreville brownfield, with an overall trend of increasing concentrations toward the Raritan Bay. By comparison, barium decreased toward the Raritan Bay, while lead was highest upstream from the major contamination sites, but remained constant throughout the remaining the stretch of river. Participants rated the surface water sampling activity highly (mean rating = 4.6, SD 0.5) on a Likert scale of 1-5. The students' overall impression of fieldwork was that it was fun to perform research outside, and that the experience provided tangible relevance of toxicology to their lives. *Supported by the SOT Intern Program, R25ES020721, P30ES005022, and T32ES007148.*

