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Constructing a spatial understanding of heavy and trace metal dynamics in reef ecosystems in Puerto Rico

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The biogeochemical cycling of trace and/or heavy metals (i.e. < 1 mg/kg; Fe, Cu, Zn, Cd, and Pb among others) in aquatic environments is both essential and potentially harmful for aquatic and marine ecosystems. At low concentrations, many of these metals are vital for the functioning of major metabolic processes for aquatic organisms. Above these thresholds, however, contamination and accumulation of these metals becomes toxic and disrupts ecosystem health, inclusive of detrimental impacts to local fishing and tourism industries. Marginal coral reef ecosystems are a junction for these biogeochemical cycles; their daily, seasonal, and (inter)annual metabolic processes modulate the distribution of trace and heavy metals in the ambient environment while also being sensitive to increased heavy metal loads due to human activities. As such, urban development, coastal pollution, and land use change pose additional to the health of marginal reef ecosystems facing global warming and ocean acidification. This project aims to characterize the spatial distribution of trace and heavy metals off the coast of Puerto Rico in an island-wide effort to understand the dynamics and ecotoxicological burden of human development on reef ecosystems. Seawater samples were collected (at surface and from deep waters) from 41 sites directly to adjacent to coastal coral reefs and distributed mainly around the eastern, western, and southern coasts. Additional riverine samples from the west coast add insight to possible point-source inputs of anthropogenically sourced heavy metals, alongside additional samples from sites in areas with heavy industrial activity, commercial ship traffic, and leisure boat traffic. All samples were chromatographically purified and analyzed for the concentrations of Fe, Cu, Zn, Cd, Pb, and other metabolically relevant trace elements via ICP-MS and ICP-OES. This project will synthesize this broad dataset into a coherent understanding of the spatial distribution of heavy metal loads in Puerto Rico's coastal coral reef ecosystems, with the added dimension of understanding potential (anthropogenic and natural) sources and sinks.