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Persistent Microbial Signatures Connect Latin America's Largest Environmental Disaster to the South Atlantic's Largest Coral Reef Complex

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The Fundão tailings dam collapse released about 55 million m³ of mining waste and is seen as Brazil's largest environmental disaster and a major event in global mining. Its impacts reached rivers, lagoons, coastal waters, and distant reefs such as Abrolhos Archipelago, the largest coral reef complex in the South Atlantic. However, its long-term biological effects, especially on environmental and coral microbiomes, remain poorly understood. Here, we analyzed sediment, water, and two coral species, *Millepora alcicornis* and *Mussismilia harttii*, via 16S rRNA gene sequencing. We assessed metals and biochemical markers of metal stress. From September 2018 to July 2024, with two campaigns per year, 4,391 samples were analyzed. Bacterial and archaeal groups associated with heavy metals and tailings were abundant in nearly all sample types, including Abrolhos corals. Although Abrolhos is 1,103 km from Fundão and 250 km from the Doce River mouth, coral microbiomes were more similar to Doce River sediments than to local Abrolhos sediment and water. During rainy seasons, metal- and tailings-associated taxa increased in the Doce River and were enriched in corals, sometimes dominating their microbiome. Coral communities also showed more microorganisms linked to environmental stress, suggesting dysbiosis. These results indicate that the Doce River plume may still influence riverine, coastal, and coral microbiomes, supporting a persistent "microbial bridge" between the disaster and Abrolhos.

Keywords

Bacteria, Archaea, Microbiome, 16S rRNA, *Millepora alcicornis* and *Mussismilia harttii*

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Yes, I am a Junior Scientist.

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