



A DECADE ON: THE TAILINGS LEGACY IN RIO DOCE WATER QUALITY

Luciana Pena Mello Brandão¹, Bianca Loureiro do Valle¹, Renata Cristina Henedino Amancio, Winnícius Muniz dos Santos Sá¹, Arielli Giachini Zavaski¹, Estevão Emerick de Oliveira Eller ¹, Leticia Malta Costa², José Fernandes Bezerra-Neto¹

¹ Federal University of Minas Gerais, Departament of Genetic, Ecology and Evolution, LIMNEA laboratory, Belo Horizonte, Minas Gerais, Brazil

² Federal University of Minas Gerais, Departament of Chemistry, Belo Horizonte, Minas Gerais, Brazil

E-mail: lucianabrandao.ufmg@gmail.com

In 2015, the collapse of the Fundão tailings dam released millions of cubic meters of mine waste into the Rio Doce Basin, causing profound and lasting environmental impacts. In this context, we aimed to assess three years of seasonal variation in water quality and metal concentrations in two sub-basins of the middle Doce River, one impacted by mine tailings (Doce River) and one unimpacted reference (Santo Antônio River), and to identify differences in parameters associated with the historical tailings impact. We hypothesized that tailings-associated variables (e.g., turbidity, Mn, As, Fe, Al) would differ in concentration and seasonality between the sub-basins, reflecting altered ecological responses nearly a decade after the collapse. Multivariate analyses (PCA, PERMANOVA) and mixed-effects models revealed significant spatial and temporal differences, with the impacted sub-basin showing persistently higher turbidity and metal loads, especially during the rainy season. Cluster analysis identified spatial groups corresponding to contamination gradients relative to the tailings source and confluence zones. Overall, our results demonstrate that the legacy of the tailings continues to shape water-quality dynamics and suspended particulate matter in the Rio Doce system, highlighting the need for ongoing, spatially explicit monitoring to support ecosystem recovery and management.

Palavras-chave: Long-term monitoring; mining tailings; Rio Doce; water pollution