

Whales, trace metals, and phytoplankton: a nutrient nexus in the Southern Benguela Upwelling System

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The Benguela Upwelling System (BUS) is the most productive upwelling system globally in terms of primary production, as evidenced by frequent red tide events in St Helena Bay. Seasonally, this region also hosts large gathering of whale populations, whose feeding and defecation release nutrients into seawater, potentially impacting the bioavailability of nutrients for phytoplankton. Despite the ecological importance of whale faeces in the BUS, their role in nutrient cycling remains underexplored. This study investigated how nutrients from whale faeces impact local phytoplankton communities in the BUS. Five-day incubations were conducted using natural phytoplankton community of St Helena Bay under different treatments: control, humpback whale faeces, organic matter from dead zooplankton, and a combination of whale faeces and organic matter. Seawater and particulate matter were analysed at beginning and end of the incubation for macronutrient, metal concentrations, photosynthetic pigments, particulate carbon, and particulate nitrogen concentration. Preliminary results revealed strong macronutrient limitations, particularly for nitrates and silicates, which intensified over time. Key metals (iron, manganese, and copper) were found at relatively high concentrations in both particulate and dissolved fractions and remained stable during the incubation period. These findings suggest that while metal are enriched in whale faeces, their impact on phytoplankton growth was limited due to pre-existing high metal concentrations in ambient waters. However, the high concentration of nitrogen in the faeces could play a crucial role in this nitrogen-limited zone. Given the rapid environmental changes over the 21st century and the rebound of whale populations following the International Convention for the Regulation of Whaling, the role of whale faeces in nutrient cycling within the BUS may become increasingly significant in the future.