

Elucidating Trace Metals Aquatic Contamination Down-Wind from an Industrial Area to Remote Wetlands

IRIS ZOHAR¹, REVITAL BOOKMAN² AND EKATERINA FISHMAN³

¹Tel-Hai Academic College

²Charney School of Marine Sciences, University of Haifa, Mt. Carmel, Haifa 31905, Israel.

³University of Haifa

Industrial facilities and metropolitans are 'hotspots' that contribute pollutants down-wind influenced by emission rates, pollutant characteristics, and geographical and meteorological conditions. Among the airborne pollutants are heavy trace metals (TM), which are associated with human health threats. Haifa Bay Industrial Area (HBIA), Israel's primary industrial region for the past century, hosts petroleum refineries, extensive petrochemical facilities, numerous chemical and agrochemical factories, two large seaports, and significant traffic activity.

Our study aimed to determine the dispersion extent of airborne TMs from HBIA by examining aquatic sediments, which serve as efficient TM archives, along a downwind northwest-to-southeast transect based on the area's typical wind regime. We collected sediment cores from three ponds with different sedimentology and proximity to HBIA: Nesher, Shizaf, and Zaqum (the latter is about 60 Km downwind from HBIA).

Leach extract of TMs from Nesher sediment generally yielded concentrations below 20 ppm, except for V, which reached 37 ppm at a depth of 13 cm; Shizaf pond showed similar metal concentrations at layers ≥ 3 cm (including V peaking at that depth), but much lower concentrations at the top 2 cm and Zaqum, the farthest pond, yielded below one ppm TM Leach concentrations. Total concentrations of some TMs were higher at Nesher compared to downwind Zaqum (Cd, Co, Cu, Pb, Sb, Y), though not consistently across all TMs, as some didn't show any geographical gradient (Ni, V, Zn), and some were higher at Zaqum (Cr, Mo), indicating the impact of authigenic constituents or alternative proximate impacts (e.g., agriculture). Hence, spatial variation of TMs downwind gradient emerges from anthropogenic inputs (inferred by the Leach extract). Temporal variations were minimal in the Nesher sediment profile, possibly due to in-profile leaching, whereas Shizaf and Zaqum indicated past regional exposure to TMs. Vanadium, otherwise considered a nutrient, presented potential contamination levels (e.g., 160 mg kg⁻¹ Total concentration) together with other TMs (e.g., Cd, Ni, Y). The fractionation of TMs within the sediment's major chemical pools (organic compounds, reduced constituents, oxides) will be discussed in the context of sedimentary dynamics and environmental threats, including under extreme climatic conditions (e.g., heat events).