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Impacts of an industrial and agricultural complex on organic matter and heavy metal dynamics in the sediment of the artificial Shihwa Lake, Korea

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To assess the impact of anthropogenic inputs on organic matter (OM) and heavy metal cycles in lake Shihwa, South Korea, sediment oxygen demand (SOD), benthic nutrient flux (BNF), and benthic heavy metal flux were estimated between June 9 and 14, 2022 at five stations, using in situ benthic chambers: four inshore and one offshore of the lake. The SODs ranged from 30.6 ± 0.0 to 83.3 ± 0.2 mmol m^{-2} d^{-1}, showing a high correlation with the organic carbon content (R^2 = 0.874) and vertical organic carbon flux (R^2 = 0.998). The combined analysis of sediment trap and SOD showed that excess OM input was an essential factor for organic carbon remineralization. The BNFs ranged from 8.70 ± 1.46 to 13.82 ± 3.90 mmol N m^{-2} d^{-1} and from 0.19 ± 0.02 to 1.18 ± 0.12 mmol P m^{-2} d^{-1}, respectively, accounting for 35 % – 144 % and 32 – 184 % of the N and P requirement for primary production in the water column. Due to the industrial complexes near the lake, the highest average benthic fluxes were those for Cr, Cd, Pb, and Cu (1.33 ± 0.86, 0.16 ± 0.1, 0.32 ± 0.6, and 7.7 ± 1.4 mmol m^{-2} d^{-1}, respectively). Conversely, contaminants of agricultural activities and water circulation through the tidal power plant could lead to the highest benthic fluxes of Mn, As, and Zn (5,488 ± 242, 3.7 ± 0.6, and 1631 ± 581 mmol m^{-2} d^{-1}, respectively) at the station near the water gate. Mn, Fe, Co, Pb, Ni, and Zn contributed more than 10 % of the sediment to the current standing stock in the lake, suggesting that the benthic metal flux might be a crucial source of several metals in the water column in this lake. The other sources are the continuous metal inputs from the industrial and agricultural complexes, resulting in metal contamination. Consequently, the endogenous release of heavy metals might be one of the primary heavy metal sources that pose a potential and continuous risk to the water column in Shihwa Lake.