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Seasonal and long-term variations in the Salton Sea: an assessment of environmental and health risks

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The Salton Sea, California's largest body of inland water, is a hypersaline, eutrophic terminal lake experiencing rapid desiccation in the face of revised water management policies. Among the challenges are enrichments in potentially toxic levels of trace metals that will become exposed and transported as dust as lake level declines [1]. This situation will be exacerbated with intensification of seasonal water column anoxia linked to warming temperatures, higher salinity, and elevated levels of fertilizer-derived nutrients. Already, the sea frequently releases microbially produced hydrogen sulfide (H_2S) during wind-induced breakdown of summer stratification and associated upwelling. As a result, atmospheric H_2S locally exceeds state ambient air quality standards of 30 ppb during release events and spread into the greater Los Angeles region. As water level continues to decline at a rate of 0.3m/year[2], the ecological risks will increase—e.g., eutrophication, bottom water anoxia, and perturbations that include massive fish die off and associated impacts on the waterfowl populations. At the same time, public health challenges will increase via dust enriched in trace metals and pesticides.

With the goal of informing future mitigation strategies in the Salton Sea through baseline analysis and geochemical modeling, we will discuss the distributions and controls of trace metal and sulfide abundances in the water column and sediments. These results reveal that metal remobilization as related to shifting redox will occur through both oxidation during exposure and intensification of anoxia in the deeper waters. Critically, the sediments show a bullseye pattern with the highest metal enrichments in the basin center, suggesting that high fluxes of these materials as dust present a looming health threat not adequately considered. Further, we are assessing these processes in the context of atmospheric models that are illuminating the potential transport pathways and full environmental/health consequences of dust derived from the Salton Sea in light of predicted shifts in lake level, water column chemistry, and biogeochemical cycling. These details are essential going forward as the community seeks remedies that will minimize the deleterious consequences of the changing Salton Sea.

[1] Frie et al. (2019) Environmental Science and Technology, 53, 16. [2] USGS (2021).