RECONSTRUCTION OF POLLUTANT SOURCES IN SORSOGON BAY, PHILIPPINES USING SEDIMENTS BY STABLE ISOTOPE CHARACTERIZATION AND MIXING MODEL TECHNIQUES

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ABSTRACT

Sorsogon Bay is an area that has been experiencing deterioration in water quality, harmful algal blooms and shallowing water depth in the past years. Human settlements, farming, sewage, animal wastes, atmospheric deposition, industrial activities, groundwater inflow, as well as impacts of climate change all contribute to the increase in sediment and nutrient loading in Sorsogon Bay. These pollutants and excess nutrients are associated with suspended fine sediments which can be transported to water systems especially during typhoons and flood events. The application of sediment age dating coupled with carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotopes, carbon to nitrogen ratio (C:N), and mixing model techniques demonstrated a powerful tool in coastal and marine environment investigations on retrospective assessment of transport of sediment-associated nutrients, sedimentation and erosion and land use. ^{210}Pb age dating technique was applied to three sediment cores, CAS, CAD and SAM, that were collected in Sorsogon Bay, Philippines by Sta. Maria et al. (2019). Among the three age dating models employed in the three sediment cores, namely Constant Initial Concentration using linear regression (^{1}CIC) and exponential regression (^{2}CIC), Constant Flux - Constant Sedimentation Rate (CF:CS) and Constant Rate of Supply (CRS), the CF:CS dating model gave the best age estimate of the sediment profiles. The $\delta^{13}C$, $\delta^{15}N$ stable isotopes, C:N ratio, and calculated % terrestrial contributions were compared with population increase and land-based activities such as land use changes over two periods, pre- (before 1960) and post-disturbance (after 1960) in the last ten decades. Results of SAM and CAD sediment cores reveal that population growth and related anthropogenic activities such as conversion of forests to agricultural farms and construction of commercial and residential buildings lead to increased terrestrial or sediment inputs to Sorsogon Bay. The signatures of CAS sediment core, on the other hand, indicated the opposite trend of decreasing terrestrial input, from >60% before 1960 to 38% in 2009.

The information provided by this study could aid in drafting more effective management policies and sediment control strategies that will mitigate the impacts of land-based pollutants to the marine and coastal environment.

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