

Continuous modifications of river discharge by dam constructions and its impact on estuarine environment of the Nakdong Estuary, Korea

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The river discharge of the Eulsuk channels, the main waterway of the Nakdong Estuary, has been modified significantly by dam constructions for the last century. In addition to dam constructions, other anthropogenic alterations would also have changed the estuarine environment. ES-A, a well-dated sediment core, was collected at the Eulsuk tidal flat of the Nakdong Estuary in 2015. Grain size, total organic carbon(TOC), total nitrogen(TN), carbon and nitrogen stable isotope($\delta^{13}\text{C}$, $\delta^{15}\text{N}$), and biogenic silica(BSi) of ES-A were analyzed to estimate environmental changes by anthropogenic alterations. Mud, TOC, TN, and BSi content of ES-A increased after each dam installation. These damming effects on ES-A were temporary and the damming effect of Noksan Dam was the largest due to main channel shift from the West Nakdong river to the Eulsuk channels. Though river discharge of the Eulsuk channels significantly modified by Noksan Dam and Nakdong Estuary Dam, TOC/TN ratio(C/N) and $\delta^{13}\text{C}$ have been in the range of estuarine POM. Moreover, there was no correlation between BSi and $\delta^{13}\text{C}$, suggesting changes in freshwater discharge was not a major determinant of diatom production in the Nakdong Estuary. The marine organic carbon proportion in bulk TOC($\text{TOC}_{\text{marine}}/\text{TOC}_{\text{bulk}}$), C/N and $\delta^{13}\text{C}$ were correlated one another indicating that organic matter has been well preserved. $\text{BSi}/\text{TOC}_{\text{bulk}}$ and $\text{BSi}/\text{TOC}_{\text{marine}}$ were calculated to estimate diatom dominance change. $\delta^{13}\text{C}$ correlated with $\text{BSi}/\text{TOC}_{\text{bulk}}$, but not with $\text{BSi}/\text{TOC}_{\text{marine}}$ which would be more suitable for *in-situ* diatom dominance by excluding external TOC. This finding suggested that the river discharge has been a controlling factor for $\text{TOC}_{\text{terrestrial}}$ input to the estuary but not for diatom production and its dominance, so BSi/TOC of ES-A is not a suitable indicator for diatom dominance. Therefore, the Nakdong Estuary has been maintained estuarine condition along with the positive linear correlation between $\text{BSi}/\text{TOC}_{\text{bulk}}$ and $\delta^{13}\text{C}$ though river discharge has modified by damming. However, after the West gate opening in 2012, there were outliers on $\text{BSi}/\text{TOC}_{\text{bulk}}-\delta^{13}\text{C}$ correlation due to increased non-diatom bloom in 2013~2015. This suggested that the $\text{BSi}/\text{TOC}_{\text{bulk}}-\delta^{13}\text{C}$ correlation could indicate environmental changes such as harmful algal blooms.