Sources of organic matter in Chilika lagoon, India: Inferences from stable isotope compositions

M. AMIR[1]*, D. PAUL[1], R. N. SAMAL[2]

[1]Department of Earth Sciences, Indian Institute of Technology Kanpur, Kanpur, India (* mamir@iitk.ac.in)
[2]Wetland Research and Training Centre, Chilika Development Authority, Odisha, India

Coastal lagoons are one of the most dynamic and productive aquatic ecosystems and act as both source and sink for organic matter (OM). Here, we used elemental C/N ratios, and stable isotope compositions ($\delta^{13}C$ and $\delta^{15}N$) of particulate organic matter (POM) collected during monsoon, winter and summer seasons, and surface sediment organic matter (SOM) collected during monsoon season from Chilika lagoon, India to understand the spatial and seasonal variability in POM and SOM sources. An AMS radiocarbon-dated Holocene sediment core was also analyzed for $\delta^{13}C$ and $\delta^{15}N$ to understand the temporal variability of OM in the Holocene. The POM composition of monsoon season that is characterized with the highest river discharge, is dominated by terrestrial inputs. Whereas phytoplanktons are the main contributor to POM in the summer/dry season, marked by significantly reduced freshwater discharge. The winter season POM comprises both terrestrial OM and phytoplanktons. Spatially, $\delta^{13}C_{POM}$ and $\delta^{15}N_{POM}$ values in the northern sector show dominance of terrestrial OM, while the central and southern sectors receive increased contribution from phytoplanktons. The SOM composition indicates major contribution from terrestrial and macrophyte sources along with minor input of phytoplanktons. Higher $\delta^{13}C$ and $\delta^{15}N$ values in both POM (–23.4 ± 1.0‰ and 4.4 ± 1.3‰, respectively) and SOM (–22.2 ± 0.1‰ and 6.4 ± 0.2‰, respectively) towards outer channel suggest dominance of marine inputs. The $\delta^{15}N$, which is a good indicator of pollution, suggests that northern sector is heavily influenced by urban/industrial wastewater input (4.9 ± 1.4‰), while the western part of central sector is significantly influenced by untreated domestic sewage (2.7 ± 1.3‰) discharged from nearby townships/villages. Low $\delta^{13}C$ and $\delta^{15}N$, and high C/N values in core sediments during early to middle Holocene suggest dominance of terrestrial OM. Whereas high $\delta^{13}C$ and $\delta^{15}N$, and low C/N values from ~4.2–2.3 ka indicate increased contribution from marine OM source. After that isotopic compositions continuously decreased towards present-day but C/N ratios remained constant, which is due to increased anthropogenic nitrogen input into the lagoon.