The biomarkers approach as framework for understanding natural and anthropogenic impacts in a mid-altitude freshwater lake of NW Indian Himalaya

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The n-alkane distribution (n-C_{10} to n-C_{35}) and environmental pollutants (fecal stanols and polycyclic aromatic hydrocarbons (PAHs)) were investigated from the surface sediments of a mid-altitude freshwater lake (Rewalsar), NW Himalaya to understand the natural and anthropogenic organic matter (OM) sources. The dominance of odd numbered n-alkanes (n-C_{27}, n-C_{29} and n-C_{31}) and multiple n-alkane indices such as terrigenous/aquatic ratio, and carbon preference index suggest input of terrestrial higher plants, while the data obtained from average chain length and Proxy ratio P-aqueous indicate OM input from mixed sources. The analysis of PAHs and fecal stanols allowed the identification of locations that are mostly impacted by anthropogenic organic matter sources involving petrogenic, pyrogenic and/or sewage effluents. Moreover, the presence of pollutants resulting in eutrophication leads to anoxia in the Rewalsar Lake, that is also supported by low pristane/phytane ratio. Further, grain size and land use land cover changes were also evaluated in order understand the factors controlling spatial distribution of OM. To the best of our knowledge, this is the first integrated use of molecular markers so as to investigate the organic matter sources from an aquatic system in the Indian Himalaya. Further, the data obtained highlight the need for the formulation and implementation of lake monitoring strategies.