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Nitrate source apportionment in river Sondu Miriu, Lake Victoria catchment, Kenya

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Eutrophication of the waters of Lake Victoria has become a major environmental concern to the riparian East African countries due to the rapid proliferation of water hyacinth and a general decline in the Lake's water quality. While this could be linked to the increasing nitrate concentration observed in the Lake over the last five decades, information on the nitrate sources and discharge in the basin is scanty. A study was conducted in the Sondu Miriu river catchment which drains into the Lake Victoria to identify and quantify nitrate sources using stable isotope tracers, hydrochemistry and a Bayesian mixing model (mixSIAR). Data from the four-season study conducted between July/2016 and March/2017, show that the commercial tea and urban (TU) part of the catchment located near Kericho town had significantly high NO_{3-} concentration (p>0.05) ranging 4–8 mg L-1 compared to both the downstream area under mixed agriculture (MA) and the midstream area dominated by tea and forests (TF). δ15N–NO_3- values in the catchment ranged from 2.8–9.6‰ during the study period. However, MA gave significantly high δ15N–NO_3- (p>0.05) during the peak wet and dry seasons (7.0–9.6‰ indicating animal manure and domestic sewage as major sources of the river nitrate. δ18O–NO_3- on the other hand, ranged from 2.2–13.7‰ but the relatively higher δ18–NO_3- values obtained in TU during the study period indicates increased inorganic fertilizer input from the commercial tea estates. MixSIAR output indicated a spatiotemporal variation in the potential NO_3- source contribution. In the dry season, potential NO_3- sources followed the order; manure and sewage (25.2%), soil N (23.0%), nitrate fertilizer (19.4%), ammonium fertilizer and rain (18.8%) and nitrate in precipitation (13.8%). During the wet season, soil N was highest (24.5%), manure and sewage (24%), nitrate fertilizer (24%), ammonium fertilizer and rain (19.3%) and nitrate in precipitation (18.6%). MA showed manure & sewage and soil N as the dominant NO_3- sources while TU and TF showed nitrate fertilizers and soil N as the leading NO_3- sources. Findings in this study show that anthropogenic activities, namely sewage, and inorganic/organic fertilizers are key sources of NO_{3-} discharge in the Sondu Miriu river catchment. To mitigate these impacts, sewage treatment facilities should be upgraded in the area while commercial tea farm drains should be subjected to treatment procedures before releasing into rivers.