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INVESTIGATION OF THE INTRUSION OF SALTWATER- FRESHWATER INTERFACE ALONG THE EASTERN COAST OF SRI LANKA

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Coastal aquifers are highly vulnerable to seawater intrusion due to natural and anthropogenic factors such as over-extraction, sea-level rise, and geological conditions. The shallow coastal aquifer along Sri Lanka's eastern coast faces salinization risks due to overexploitation. This study focused on a 50 km stretch from Kallady to Karaitivu, where 47 groundwater samples were collected from deep tube wells (25) and dug wells (21) along ten transects spaced at 5 km intervals. Each transect included at least five wells, with samples taken 300–500 meters apart. Groundwater chemistry was analyzed using pH, electrical conductivity (EC), total dissolved solids (TDS), salinity, and major ion concentrations, alongside hydrochemical classification methods such as Piper diagrams and saltwater intrusion indicators. pH values ranged from 6.37 to 7.44, with most samples exhibiting mildly acidic to neutral conditions. EC values varied significantly, with 72.34% of the samples surpassing the freshwater threshold, indicating potential seawater intrusion. TDS levels further confirmed this, with some samples exceeding the WHO drinking water limit of 1,000 mg/l. The dominant ions detected were sodium (Na^+), calcium (Ca^{2+}), and bicarbonates (HCO_3^-), reflecting geological influences and ion exchange processes. Piper diagram analysis classified 82.98% of the samples as Ca-Mg-HCO_3 type, characteristic of freshwater influenced by rock weathering and mineral dissolution. Saltwater intrusion indicators, including the chloride-bicarbonate ratio, sodium-chloride ratio, and base exchange indices (BEX), revealed that 91.49% of contamination was due to seawater intrusion, while 8.51% was linked to anthropogenic activities. BEX values showed that 87.23% of samples were undergoing a freshening process, although localized salinization persisted. Isolated saline intrusion zones were identified at 250 m, 300 m, and 500–600 m from the coastline in the highly populated areas of Koddaikallar South, Karaitivu, and Kalmunai respectively. The study underscores the need for continuous monitoring and groundwater management strategies to mitigate saltwater intrusion and ensure long-term water sustainability.

Keywords: Groundwater, Seawater Intrusion, Hydrogeochemical Processes, Groundwater Quality