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RECIRCULATION PATHWAY OF NITRATE FROM AQUACULTURE DISCHARGE IN COASTAL AQUIFER

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This study aims to resolve the fate and transport of nitrate by evaluating whether seawater intrusion can recirculate aquaculture derived nitrate sources into the coastal aquifer. A total of 65 water samples were collected during two field campaigns in May 2024 and August 2024, including groundwater from public and agricultural wells across a coast to inland elevation gradient, coastal springs, fish farm effluent, and seawater stations within the bay. Major anions and cations were quantified by ion chromatography and ICP OES, and rare earth elements were measured by ICP-MS and normalized to Post Archean Australian Shale to calculate the cerium anomaly as Ce/Ce*. Major ion compositions showed Na and Cl dominated types for seawater, fish farm effluent, and springs, whereas groundwater plotted along a compositional trend away from Cl and nitrate dominance toward HCO_3^- enrichment, consistent with a progressive shift from seawater influence in coastal wells to inland freshwater signatures typical of basaltic aquifers. In seawater, Ce/Ce* ranged from 0.30 to 0.85 in the dry season and 0.42 to 0.91 in the wet season, while groundwater ranged from 0.38 to 0.86 in the dry season and 0.41 to 0.85 in the wet season, with springs below 0.64 and fish farm effluents below 0.40. Across all samples, Ce/Ce* decreases as nitrate increases with a stronger inverse correlation in groundwater and springs, and spatially Ce/Ce* shows the lowest values near the submarine groundwater discharge zone with a landward increase in groundwater up to about 6.8 km, supporting a recirculation pathway that can propagate landward to influence groundwater quality.