Submarine groundwater discharge and nutrient fluxes in a natural mangrove versus an artificial canal estate

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Artificially constructed canals can function differently than the coastal wetlands they replace. Here, we assess the impact of canal estate development on tidally driven submarine groundwater discharge (SGD) and associated nutrient dynamics. Time series observations of radium isotopes and dissolved nutrients were performed in a canal estate and a nearby mangrove creek in subtropical Australia. Our radium isotope mass balance model revealed SGD rates were ~2 fold higher in the canal. The lateral fluxes of total dissolved nitrogen (TDN) fluxes from the canal estate were slightly higher than the mangrove creek (8.4 and 9.1 mmol m⁻² day⁻¹ for mangrove and canal, respectively). However, NH₄⁺ fluxes were 1.5 fold higher in mangroves. SGD in the canal released ~3 fold more TDN than the mangrove (20 and 68 mmol m⁻² day⁻¹ in mangrove and canal, respectively). As expected, mangroves appear to be more efficient at retaining nitrogen than vegetation-striped, sandy canals. Overall, this study demonstrates land reclamation for canal estate development not only drives losses of estuarine ecosystem services, but also modifies SGD and related nutrient exports to the coastal ocean.