Groundwater-ocean interaction and its effects on coastal ecological processes – are there groundwater-dependant ecosystems in the coastal zone?

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Hydrological land-ocean connectivity is an important driver of coastal ecosystems. Rivers are obvious and visible pathways for terrestrial runoff, and the critical role of surface water discharge from rivers to coastal ecosystems has been well documented. Hidden from view, 'downstream' effects of coastal (supra-tidal, intertidal and submarine) groundwater discharge are far less well understood. Whilst hydrological and geochemical processes associated with coastal groundwater discharge have received an increasing amount of scientific attention over the past decade or so, the effects of groundwater flow on productivity, composition, diversity and functioning of coastal ecosystems along the world's shorelines have received little attention to date.

Coastal groundwater discharge includes both terrestrial (fresh) groundwater fluxes and the recirculation of seawater through sediments, analogous to hyporheic flow in rivers. I will present an overview over relevant coastal hydrological processes, and will illustrate their ecological effects on examples from diverse tropical coastal ecosystems, e.g. (1) perennial fresh groundwater discharge from coastal sand dune systems permitting growth of freshwater-dependent vegetation in the intertidal zone of the Great Barrier Reef (Australia), (2) recirculation of seawater through mangrove forest floors directly affecting tree health and providing a pathway for carbon export from these ecosystems, (3) the local hydrology of groundwater-fed coastal inlets on Mexico's Yucatan peninsula affecting the movement behaviour of and habitat use by the queen conch Strombus gigas, an economically important species in the Caribbean region. These examples for hydrological-ecological coupling in the coastal zone invite the question if we should not consider these coastal ecosystems to be groundwater-dependent, in analogy to groundwater-dependency in freshwater aquatic systems.