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Assessment and Management of Coastal Aquifer System

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Coastal aquifer systems have been playing an increasingly critical role in the coastal region development. Anthropogenic interventions supplemented by agricultural and industrial growth have been causing unprecedented more stress on the coastal eco-systems, more so in developing nations. The increasing water demand of the ever increasing coastal population is imposing an irrecoverable damage by way of seawater intrusion into coastal ground waters.

A number of investigations carried out by Vengosh and Rosenthal(1994), Todd (1959), Bear et al.(1999), Jones et al (1999), Barker(2000), Metcalf & Eddy (2000), Appelo and Postma (2005), El Moujabber et al.(2006), Panno et al.,(2006), Allen and Liteanu (2008), Mondal et al.(2010), Korfali and Jurdi (2010), Kennedy (2012) etc have resulted in arriving at specific ionic ratios as indicators of seawater intrusion. Ratios like Mg/Ca> 5.2, Na/Cl=0.86, Br/Cl=0.0015, Cl/(CO_3+HCO_3)=2 etc when reach an optimum value proved to reflect groundwater contamination due to seawater intrusion. Though qualitatively these rations proved to be highly useful, quantitative estimates of seawater intrusion can trigger more effective measures even at user end.

An effort considering the average groundwater quality, in conjunction with the sea water quality in the region and the ionic ratios of individual samples as well as those of samples developed in the laboratory models studies have provided scope not only to identify seawater intrusion more precisely but also resulted in derivation of empirical relationships to quantify the degree of contamination of seawater intrusion.
Further the hydrogeology, geomorphology, hydraulic gradient vis-à-vis the electrical conductivity and ionic rations of coastal ground waters are observed to play a significant role in the development of region specific empirical relations to assess and quantify the seawater intrusion.

The results obtained in this direction along a 27 km coastal strip of East coast of India, from Visakhapatnam to Bhimunipatnam, characterised with varied geohydrological and geomophological characteristics showed simple relationship like Electrical conductivity, Mg/Ca having values 6300 μs/cm, 5.2 can be assessed to be contaminated with 6% of contamination with sea water. A simple linear equation like Y= mX+c, with varying parameters like ionic ratios and characteristic parameters like EC, TDS etc have proved to be useful to quantify the levels of contamination. Similar other relations are also discussed in this paper.