

IMPACT OF THE GEOLOGICAL SETTING AND ANTHROPOGENIC ACTIVITIES ON GROUNDWATER SALINIZATION: A CASE STUDY ON SEMI-CONFINED COASTAL AQUIFER IN MAZANDARAN PROVINCE, NORTHERN IRAN

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Abstract

Hydrogeochemical data of the semi-confined coastal aquifer (~2300 km²) (SCCA) located in the terrain between Amol and Ghaemshahr townships in Northern Iran reveal salinization of fresh groundwater (FGW). The saline groundwater zone starting from the eastern half of the aquifer's coastal boundary extends inland for more than 40 km and is oriented at an angle (~45°) to the flow direction of FGW. Data pertaining to the location, depth of water sampling spots and imbalance between discharge and recharge indicate that salinization of FGW is caused due to (1) excessive withdrawal of groundwater from closely spaced bore wells in the eastern half of the coastal (northern) region of the SCCA, leading to both lateral seawater intrusion and upconing of the underlying palaeobrine interfaced with the FGW and (2) excessive withdrawal of groundwater from deep bore wells in the central region of the SCCA, leading to the upconing of the underlying palaeobrine into the FGW zone. While salinization of the FGW at two sampling locations in the northern unconfined region of the SCCA is due to irrigation return flow, one sampling location in the southern unconfined region of the SCCA is caused by the inflow of saline water from Garmroud river which, in turn, is getting continuously polluted at its origin by large quantities of highly saline water discharging from the Lalezar spring. Further, the SCCA is prone to periodical seawater intrusion associated with sea level rise of the land-locked Caspian Sea; one such documented recent event is the sea level rise of 2.4 m during a period of 17 years starting from 1977. Present-day practice of over exploitation under the existing geological setting with two natural saline water sources one, at the northern boundary and the other beneath the SCCA is mainly responsible for salinization of ~20 vol. % groundwater resource of the SCCA.

Keywords: Coastal aquifer, Salinization, seawater intrusion, palaeobrine, Mazandaran Province, Northern Iran