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New Approaches for Responsible Management of Offshore Springs in Semi-arid Regions

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In arid and semi-arid regions, such as the Mediterranean and Gulf Region where water is scarce water demand has been exacerbated and become a major environmental challenge. Presently there is massive pressure to develop new water sources to alleviate existing water stress. In the quest for more freshwater even groundwater discharge into the sea in the form of “off-shore freshwater springs” (or submarine groundwater discharge) has been contemplated as a potential source of unconventional water in coastal zones. Offshore-springs are derived from aquifers with complex geological controls mainly in the form of faults and karst conduits. Representing a border-line discipline, they have been poorly studied with only few submarine groundwater monitoring sites existing worldwide. Recently, innovative techniques have been developed enabling springs to be detected via remote sensing such as airborne surveys or satellite images. “Thermal Anomalies” can be clearly identified as evidence for groundwater discharge into the marine environment. A diversity of groundwater routes along which off-shore springs are fed from land sources can be recognized and near-shore and offshore springs differentiated and classified according to their geometry. This is well pronounced along the coast of Lebanon and offshore of Oman. Offshore springs play an important role in the marine ecosystem as natural sources of mercury, metals, nutrients, dissolved carbon species and in cooling or warming ocean water. However, they are extremely sensitive to variations in qualitative and quantitative water inputs triggered by climate change and anthropogenic impacts especially in their recharge zones. Pollutants such as sewage, detergents, heavy metals or herbicides that negatively affect water quality of offshore springs can transit the groundwater rapidly. Recently these springs have also been severely affected by uncontrolled water abstraction from land aquifers. In Bahrain, overpumping combined with burial under land reclamation rubble has caused the disappearance of offshore springs inducing a drastic decline in the pearl oyster population. Climate change related precipitation decrease and temperature increase is likely to further decrease groundwater and surface water recharge, increase irrigation and domestic water demand, increase water extraction from aquifers and in turn decrease water availability for offshore springs.. Thus in future, continuous monitoring of water quantity and quality as well as new remote sensing approach in addition to observations by citizens such as fishermen and tourist guides are becoming essential to ensure responsible management of offshore freshwater springs.