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## Multi-method approach combining isotopic tracers, anthropogenic contaminants and mapping to retrace socio-environmental trajectories of groundwater-dependent coastal hydrosystems

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Coastal lagoons are unique and complex ecosystems. Resulting from both terrestrial (fresh groundwater and surface water) and marine water influences, these ecosystems are often maintained by direct or indirect groundwater supplies and collectively known as groundwater dependent ecosystems (GDEs). Because they provide a wide range of ecosystem goods and services on which a large part of the human population depends, coastal GDEs are considered as complex socio-economic and ecological component worldwide. The increasing human development in coastal areas induces yet a strong pressure on water resources and the expected effects of climate change could exacerbate the pressures on these environments. To limit the risks of degradation and to ensure the sustainability of ecosystem services, the implementation of proper water resources management strategies is essential. This requires a strong knowledge of the environmental and socio-economic trajectories of hydrosystems, and particularly of the behavior and role of groundwater.

To this end, only the combined use of several tools allows a global understanding of the spatial and temporal dynamics of the system. The correlation between isotopic tracers ( $^{18}\text{O}$ ,  $^2\text{H}$ ,  $^3\text{H}$ ,  $^{15}\text{N}$ ,  $^{11}\text{B}$ ), anthropogenic contaminants (organic micro pollutants) and mapping approaches (land-use and vulnerability) allows a historical analyze of the hydrosystem. In addition, to better constraint the hydrosystem hydrological behavior, it is also possible to highlight the current status of water resources, the historical legacy of pollutants and the consequences of past developments and practices, which continue to jeopardize the current quality of the water resource. This methodology was applied to a Mediterranean hydrosystem, in connection with a coastal lagoon (Corsica Island, France). The identification of degradation processes and their chronology could then be traced back in time.

It appears that the current deterioration is mainly due to a legacy pollution resulting from the development of policies implemented 60 years earlier. In the case of coastal GDEs that are highly anthropized and subject to ever-increasing development, this methodology proposes new key elements for the establishment of relevant management strategies to ensure the future sustainability of water resources.

