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Eddies control oxygen availability and denitrifying potential in the north west Arabian Sea.

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Ocean oxygen concentrations regulate chemical and biological processes, with subtle thresholds leading to shifts in ecosystem functioning; limited deoxygenation and small changes in oxygen distribution can lead to dramatic shifts in ecosystem functioning as systems flip from one oxic state to another. Mixing of an oxygenated source within an oxygen minimum zone (OMZ) defines the chemical and biological state of water masses transported. Here we show, using a combination of glider observations and a 2km nested ROMS model, that local "peddies" govern the mixing of Persian Gulf water in the Gulf of Oman and define the extent of the suboxic zone as it travels along the 26.5 σ isopycnal layer. The glider observations show drastic deoxygenation of the now persistently suboxic Gulf of Oman OMZ (from 6 μM to < 2μM in 50 years). The seasonal variability in eddy energy then defines the oxygen concentration of export watermasses. In summer, this causes a four-fold reduction in denitrifying potential along 26.5 σ. We conclude that highly dynamic marginal regions such as the Gulf of Oman play a critical and underestimated role in defining vertical habitat space, regional denitrification budgets and ventilation across the western Indian Ocean.