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The presence of ladderane lipids in the oxygen minimum zone of the Arabian Sea indicates nitrogen loss through anammox

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ABSTRACT: Distributions of ladderane lipids, which are characteristic of membranes of bacteria performing anaerobic ammonium oxidation (anammox), were determined in the northwestern Arabian Sea with respect to season, depth, and distance to the coast of Oman. Ladderane lipids were detected and quantified in suspended particulate matter (SPM) obtained from various water depths along a northwest-to-southeast transect during the spring intermonsoon period. Maximum concentrations of 5-8 $\mu\text{g L}^{-1}$ generally occurred at 500 m in the upper part of the oxygen minimum zone (OMZ). Fluxes of ladderane lipids obtained from sediment trap material sampled at 500-m water depth ~350 km off the coast reveal a strong seasonal pattern apparently related to the annual monsoon cycle in the northern Arabian Sea, with highest fluxes of 125 $\text{ng m}^{-2} \text{d}^{-1}$ observed during the southwest monsoon. This fourfold increase in flux during the SW monsoon compared the spring intermonsoon period may indicate higher anammox bacterial productivity or enhance export of ladderanes during a period of high particulate matter flux or both. Anammox, in addition to denitrification, seems to be responsible for a significant loss of nutrient nitrogen from OMZ waters in the Arabian Sea.

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