

{rokbox title=|Distribution of different methods used to measure ammonia oxidation (a) and nitrite oxidation (b) :: Image:

Authors|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-database-nitrification-nitrifiers-sintes-2023-thumb-et-al.jpg|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-database-nitrification-nitrifiers-sintes-2023-et-al.jpg{/rokbox}

Weiyi Tang, Bess B. Ward, Michael Beman, Laura Bristow, Darren Clark, Sarah Fawcett, Claudia Frey, François Fripiat, Gerhard J. Herndl, Mhlangabezi Mdutyana, Fabien Paulot, Xuefeng Peng, Alyson E. Santoro, Takuhei Shiozaki, **Eva Sintes**, Charles Stock, Xin Sun, Xianhui S. Wan, Min N. Xu, and Yao Zhang, 2023.

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Abstract: As a key biogeochemical pathway in the marine nitrogen cycle, nitrification (ammonia oxidation and nitrite oxidation) converts the most reduced form of nitrogen – ammonium–ammonia (NH_4^+ – NH_3) – into the oxidized species nitrite (NO_2^-) and nitrate (NO_3^-). In the ocean, these processes are mainly performed by ammonia-oxidizing archaea (AOA) and bacteria (AOB) and nitrite-oxidizing bacteria (NOB). By transforming nitrogen speciation and providing substrates for nitrogen removal, nitrification affects microbial community structure; marine productivity (including chemoautotrophic carbon fixation); and the production of a powerful greenhouse gas, nitrous oxide (N_2O). Nitrification is hypothesized to be regulated by temperature, oxygen, light, substrate concentration, substrate flux, pH and other environmental factors. Although the number of field observations from various oceanic regions has increased considerably over the last few decades, a global synthesis is lacking, and understanding how environmental factors control nitrification remains elusive. Therefore, we have compiled a database of nitrification rates and nitrifier abundance in the global ocean from published literature and unpublished datasets. This database includes 2393 and 1006 measurements of ammonia oxidation and nitrite oxidation rates and 2242 and 631 quantifications of ammonia oxidizers and nitrite oxidizers, respectively. This community effort confirms and enhances our understanding of the spatial distribution of nitrification and nitrifiers and their corresponding drivers such as the important role of substrate concentration in controlling nitrification rates and nitrifier abundance. Some conundrums are also revealed, including the inconsistent observations of light limitation and high rates of nitrite oxidation reported from anoxic waters. This database can be used to constrain the distribution of marine nitrification, to evaluate and improve biogeochemical models of nitrification, and to quantify the impact of nitrification on ecosystem functions like marine productivity and N_2O production. This database additionally sets a baseline for comparison with future observations and guides future exploration (e.g., measurements in the poorly sampled regions such as the Indian Ocean and method

comparison and/or standardization).

Keywords: