Nitrification in Mono Lake, California: Activity and community composition during contrasting hydrological regimes

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ABSTRACT: Rates of nitrification, geochemical variables, and the associated ammonia oxidizer microbial community were investigated in the water column of Mono Lake, California, between August 2002 and August 2003. Ammonia oxidation rates were measured using a ^{15}N isotope tracer technique. 16S ribosomal deoxyribonucleic acid, functional gene, and fluorescence in situ hybridization (FISH) analyses were used to characterize the ammonia oxidizer population. Peak ammonia oxidation activity occurred consistently between 12 and 14 m; the maximum integrated rate was observed in November 2002. The ammonia-oxidizing bacterial (AOB) community exhibited sequences most closely related to halo and/or alkaline tolerant *Nitrosomonas*-like sequences. The observed phylogeny represented a significant shift from previously documented AOB community composition and was coincident with Mono Lake[]s transition from monomixis to meromixis. Samples were also analyzed for ammoniaoxidizing archaea (AOA). FISH analysis revealed a substantial population of Crenarchaeota, the phylum encompassing all known AOA; however, no archaeal ammonia monooxygenase (*amoA*) sequences were detected. Unrealistic AOB cell-specific nitrification rates strongly indicate the possibility of a missing nitrification source, and correlations between nitrification rates, geochemical variables, and crenarchaeal and AOB abundance also indicate a significant AOA contribution to nitrification. However, the lack of verifiable archaeal amoA genes leaves open the question of whether AOA contribute to nitrification in Mono Lake.