Microbially-driven biogeochemical cycling in coastal sediments is closely coupled with pelagic primary production and can be significantly enhanced by the burrowing and irrigation activity of macrofaunal bioturbators. Currently, a key question is whether ocean acidification (the increased oceanic uptake of atmospheric carbon dioxide and subsequent changes in seawater carbon chemistry) will affect the structure and function of those microbial communities responsible for nitrogen cycling. In particular, nitrification has been shown to be reduced when seawater samples are exposed to elevated levels of CO$_2$. However, it was not clear whether this effect extends to nitrification occurring either at the sediment surface or in macrofaunal burrow walls, where nitrification rates can be orders of magnitude higher than in overlying water. In a 14-week mesocosm experiment the impact of ocean acidification (pH levels: 8.10; 7.90; 7.70; 7.35; 6.80) on the structure and function of microbial communities inhabiting burrows of the mud shrimp *Upogebia deltaura* was investigated. With decreasing pH, there was a marked inhibition of nitrification in burrow wall sediment, whereas no effect was seen at the sediment surface. The potential for ocean acidification to significantly affect nitrogen cycling within bioturbated sediments will be discussed.