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# Hypersaline and hyperthermal tolerant benthic foraminifera from a desalination plant outflow in the Arabian Gulf

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We surveyed the benthic foraminiferal assemblages every 20 m along a 350 m linear transect from the proximal to distal parts of a desalination plant outflow in Bahrain. The objective of the study is to identify (if any) species of benthic foraminifera adapted to elevated water temperatures and concentrated brine solution from the desalination plant outfow conditions. The outflow water from the desalination plant is consistently 1.5 – 2oC degrees warmer and is about 13 PSU more saline than the ambient water conditions in the Arabian Gulf off Bahrain. Remarkably, we identified benthic foraminiferal species that were able to survive these extreme conditions. The temperature and salinity at the outflow recorded during the autumn (December 1, 2017) sampling event were 26.3oC and 60, respectively, compared with 23.9°C and 49 in the ambient sea water some 400 m from the outflow. Along the transect, the diversity is low, while the living benthic foraminiferal assemblage is dominated by a few species including Ammonia tepida, Peneroplis planatus, Peneroplis pertusus, and Coscinospira hemprichii. We tentatively identified the area as a kill zone due to the limited numbers of living specimens recovered from stations in the proximal part of the transect. Furthermore, the relative numbers of observed species among the living forms indicates a zone of decreased biodiversity compared with a nearby control site. We analyzed sediment and water samples for known trace metals and organic pollutants, and all the observed values are below the low pollution limits. Given the low levels of chemical environmental pollutants, the observations indicate that low microfaunal diversity and abundances are likely a response to environmental stress. We further speculate that benthic foraminifera living in the zone influenced by the outflow have developed metabolic strategies to cope with hypersalinity and elevated temperatures. This study will help to identify key bioindicator species that can be further explored for understanding adaptive strategies of microbenthos in the current scenario of rising sea temperatures and salinity.