Combined impacts of ocean acidification and desalination: culture experiments on the coastal species *Ammonia* sp. and *Elphidium crispum*

*Laurie Marie Charrieau[1], Helena L. Filipsson[2], Yukiko Nagai[1], Sachiko Kawada[1], Karl Ljung[2], Emma Kritzberg[3], Takashi Toyofuku[1,4]

1. Japan Agency for Marine-Earth Science and Technology, 2. Department of Geology, Lund University, Sweden, 3. Department of Biology, Lund University, Sweden, 4. Tokyo University of Marine Science and Technology (TUMSAT), Japan

Coastal areas display natural large environmental variability such as frequent changes in salinity, pH, and carbonate chemistry. Anthropogenic impacts –especially ocean acidification –increase this variability, which may affect the living conditions of coastal species, particularly, calcifiers, such as foraminifera.

The purpose of this study was to evaluate the combined effect of two typical environmental stressors on the coast - salinity and pH –on calcifying organisms. We performed culture experiments on living benthic foraminifera to study the combined effects of lowered pH and salinity on the calcification abilities and survival of the coastal, calcitic species Ammonia sp. and *Elphidium crispum*.

We found that these two species could tolerate low pH and low salinity, which reflects the environmental variations in their natural habitats. However, in open ocean conditions (salinity ~35) and lower pH treatment, the species displayed resistance to test dissolution for a longer time than in brackish conditions (salinity ~5 to 20). Moreover, the response of foraminifera to the different treatments was species-specific, and *Ammonia* sp. appeared more resistant than *E. crispum* when placed in the same conditions of pH and salinity. We also observed living dissolved specimens of juveniles *Ammonia* sp. under the combined effect of low pH and very low salinity, and we showed that desalination is one cause for the decalcification. However, they were not able to recalcify when returned to higher salinities, probably due to a sensitive balance in environmental parameters. Finally, we highlight the ability of foraminifera to survive under $\Omega calc < 1$, and that high salinity and $[Ca^{2+}]$ as building blocks are crucial for the foraminiferal calcification process.

We conclude that coastal benthic foraminifera will not immediately be affected by ocean acidification, but rather by a combination of decreasing salinity and lowered pH.

Keywords: Coastal ocean acidification, Desalination, Culture experiment, Benthic foraminifera, Calcification process

