{rokbox title=|Aquaria system of the experimental set-up placed on the modular shelves :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-aquaria-set-up-long-term-multiple-stressor-marine-organisms-gutierrez-et-al-2025-thumb.jpg|}images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-aquaria-set-up-long-term-multiple-stressor-marine-organisms-gutierrez-et-al-2025.jpg{/rokbox}

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An aquaria set-up for long-term, multiple-stressor research in marine organisms.
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Abstract: Multiple stressor research in aquaria is a useful approach to better understand the ecophysiology of marine species under different environmental conditions, including global change scenarios. Long-term experiments are helpful to detect the response of sustained exposure to selected environmental conditions. Here, we present an experimental set-up suitable to run long-term experiments, composed of a life support system, a cost-effective aquaria set-up and an open-source controller based on the use of a Raspberry Pi. In this set-up, temperature, pH and dissolved oxygen (DO) are individually manipulated and simultaneously controlled in eight different treatments. To prove the efficacy of the set-up, we provide an assessment over a nine-month experiment on a deep-sea coral species, combining values from current in situ and IPCC AR5 RCP 8.5 scenarios for the aforementioned parameters. Recorded data from the controllers and independent measurements (e.g. cross-checking with portable multiparameter devices and laboratory analyses) throughout the experimental time have been analysed and results have been discussed. Overall, the experimental set-up performed well, proving the stability of the parameters over time, both individually and in combination. On average, low and high-temperature treatments varied ~0.4 and 0.3°C, respectively. Low pH treatments were maintained within 0.05 pH units, whereas ambient pH treatments varied ~0.04 pH units. Low DO treatments had a variation of ~0.3 mg L–1, and ambient DO treatments varied ~0.2 mg L–1. No significant differences between scenarios for any parameter were detected (p minor then 0.05). The resulting programming code to read, control and register the values for these parameters is provided to contribute to its replicability across institutions. The set-up performed well over extensive periods while providing a customisable controller as a cost-effective alternative. The versatility of the system, allowing to work with different species, environments and scenarios makes it valuable for aquaria experiments where interactions of multiple environmental factors need to be tested.

Keywords: aquaria set-up, cold-water corals, cost-effective controller, flow-through system, global change, marine organisms, multiple stressors, open source controller