

## ***Interactive comment on* “Technical Note: Artificial coral reef mesocosms for ocean acidification investigations” by J. Leblud et al.**

### **Anonymous Referee #2**

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#### General comments

This technical note describes methods used to set up and maintain simplified reconstructed coral reef communities, in closed-circuit aquariums (i.e., with reduced water changes), during several years, under conditions that mimic those, which prevail in a natural reef. Part of the control of the chemistry is biologically mediated.

The manuscript is interesting because it shows that a technique of reef tank husbandry can be used to investigate the impact of OA on a coral reef.

Nevertheless, the method is not highly novel. Indeed, the experimental set up combines a series of well-known processes and systems such as interconnected tanks that reef hobbyists and aquarists have been using for many years to replicate and keep

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coral reefs away from the ocean. And the authors' statement that their mesocosm is an established ecosystem may be erroneous.

### Specific comments

P 15464: I 4-5: Why "water changes from the reef"? Water changes can be made using artificial seawater or natural water taken in a sea devoid of coral reefs.

P 15464: I 5-6: At this stage, without definitions of mesocosms and microcosms it's difficult if not impossible to understand the meaning of the sentence "with a more realistic physico-chemical environment than microcosms".

P 15465: I 1-2: To make things more understandable the authors should explain what they have in mind when they use the word "aquarium" and place here the definitions of microcosm and mesocosm they give later in the text.

P 15465: I 14: This sentence deserves explanations.

P 15465: I 24-29 and P 15466: I 1-4: These considerations are relevant. However they might be too long and the authors' arguments perhaps not at the right time and in the right place in the text so that one tends to lose the sense of the reasoning.

P 15466: I 22: At this stage one doesn't understand why the authors introduce a space-time scale in their definition of a mesocosm.

P 15466: I 24-25: The experimental set up described in this paper doesn't correspond to the Odum's (1984) definition of mesocosm: "bounded and partially enclosed outdoor experimental setups".

P 15467: I 3-4: All of the lab experimental set ups of this kind are artificial by essence but there are devices, which are less artificial than others. See for example Hazan Y., Wangensteen O. S., Fine M., 2014. Tough as a rock—boring urchin: adult Echinometra sp. EE from the Red Sea show high resistance to ocean acidification over long-term exposures. Marine Biology. 61 (11): 2531-2545.

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P 15467: I 7-26: These considerations are relevant. However they might be too long and the authors' arguments perhaps not at the right time and in the right place in the text so that one tends to lose the sense of the reasoning. This comment applies to the whole introduction.

P 15471: I 19-25: The technique, which consists in connecting a tank to one or several sumps or refugia harboring photosynthetic organisms kept under reverse photoperiod, is well known. Reef hobbyists have been using it for many years to minimize the daily variations of pH and pO<sub>2</sub>. One can find on the market especially designed timers (<http://reefbuilders.com/2010/11/16/nature-aquarium-control-timer-compact-package-features>) and aquariums equipped with refugia illuminated with a system called Reverse Daylight Photosynthesis (RDP™).

P 15472: I 6-8: One might wish to understand how “enough anaerobic zones” could lead to stabilized concentrations of orthophosphates. References?

P 15472: I 18-19: The two years of tuning by trial and error needed to obtain the requested experimental conditions is the major inconvenience of this method.

P 15474: I 4-5: The authors forget to mention that, in a mesocosm: -Nitrification, which releases protons, is a major cause of alkalinity consumption, and -Bioerosion (bacteria, cyanobacteria, boring sponges etc.), which dissolves CaCO<sub>3</sub>, is a major source of alkalinity. These processes deserve better developments.

15481: I 14-15: One wonders why the pO<sub>2</sub> was monitored only during 5 days at the end of the experiment.

15482: I 1-6: The differences between laboratory based artificial mesocosms and microcosms are not enough clear.

15482: I 9-15: The authors utilize many artificial means to control the chemistry of their experimental tanks. Hence, one can think that an ecosystem, which is so much artificially constrained, might not behave similarly to a natural one.

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15482: I 22-23: “small technical input”. The technical input is artificial and big, not small!

15483: I 11: “dead fishes”. It would be interesting to know what was the biomass and composition of the fish populations.

15483: I 23: The experimental set up includes a mechanical perlon filter and a protein skimmer, which removes particulate and dissolved matters. In this respect, the claim that artificial filtration is limited to a strict minimum is questionable.

15485: I 10-12: “the simplified ecosystems (...) had the opportunity to follow their own “evolution”. Reef hobbyists know very well this phenomenon, which (I think) casts doubt over the ability of the experimental set up to reproduce the long-term evolution of a natural ecosystem. Yes, it is hard to consider that both mesocosms are true replicates at the end of the experiment.

15487: I 1-8: These considerations give the feeling that the method includes a large part of empiricism, which cast doubt over its interest as a scientific tool.

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