

Interactive comment on “Functional spatial contextualisation of the effects of multiple stressors in marine bivalves” by Antonio Giacoletti and Gianluca Sarà

Anonymous Referee #1

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This paper explores the implications of environmental stress (OA and hypoxia), as determined in lab experiments, on the growth and reproductive potential of mussels in two locations of the Mediterranean with simulations based on a dynamic energy budget model. The study capitalizes on the potential of DEB models to integrate the impacts of multiple environmental drivers on organismal level outcomes, including growth, reproduction, time to maturity, rates of feeding and respiration, and so on. This approach is powerful in potential and the application is new. However, there are some important shortcomings, especially in the way the model is parameterized. Also, I find the lack of some form of quality assessment problematic.

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It is very annoying that all sections consist of a single paragraph. Did something go wrong with the formatting of the manuscript?

The author's use of respiration measurements as a proxy for DEB maintenance costs is problematic. In the DEB framework, respiration is emphatically not the same as maintenance, but also include energetic overheads, such that of growth. Respiration is a function of the commitment rate in DEB, of which maintenance could be a minor part, depending on size and nutritional status of the animal. In addition, oxygen deprived mussels, and possibly mussels enduring stress of hypercarnia, are able to use anaerobic metabolic pathways to fulfill their maintenance requirements. If stress increases maintenance requirements, one would expect respiration rates to increase with increasing stress intensity. However, we see the opposite happen (see Fig 2). I think this is likely due to the fact that stressed mussels have their shells closed more often than unstressed conspecifics (see Fig. 1), and thus ingest less food. Less food leads to a lower energy reserve buffer and therefore a lower rate at which reserves are committed. I suggest the authors change the maximum assimilation rate parameter of their model based on their behavioral observations and leave the maintenance rate parameter unchanged.

The simulations suggest that unstressed mussels only grow to 3 cm in length and do not reproduce in Palermo. This seems implausible. How long do real mussels get in Palermo? Do they reproduce? How sensitive are the simulation results to the particular choices of parameter values? The authors do not reflect at all on the reliability of their assessments, which I find troublesome, especially given the politicized context of the subject matter.

Title. Functional spatial contextualization sounds impressive but I've no clue what it could mean. Also, the manuscript deals with only a single species; the title is too general.

L27-33 Split up sentence.

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L35 (and elsewhere) Put reference in the proper place of the sentence

L40 'lager'?

L68-70. This is a strong statement and should be substantiated with references. BTW, the only 2 papers using DEB in a OA context I'm aware of are 10.1111/gcb.12547 and 10.1016/j.jembe.2015.09.016

L72 the DEB [p_M] parameter does not relate to assimilation

L83 articulated → consisted of

Section 2.4 contains material that should go in 2.3 (or combine the sections).

I didn't get how the authors calculate the assimilation efficiency.

Section 3.1 belongs in the Materials and Methods Section. There is no need for a statistical analysis. Delete Table 2.

Combine Sections 3.2-4. There is no need to duplicate in the text what is already presented in the figures. The percentage of closed valves is simply 100 – percentage opened valves, so don't mention the former. I don't understand why the error measures differ so much, though.

Section 3.7 is incomprehensible for people without DEB modeling background. Include a figure and references to overview texts (e.g. Kooijman's book, Nisbet et al JAE, Sousa et al, and/or most recently Jusup et al Physics of Life Reviews 20:1-39).

L263 addictive → additive. The way the authors use 'additive' is confusing. Additive refers to impacts that can be summed, like $1+1=2$, an unlikely situation with nonlinear models, such as DEB.

What are the initial conditions of the simulation runs?

What is the rationale for the choices for the frequency of events?

From Table 5 remove data that are already presented in Figure 3. Round off # of eggs

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to 6.74e6. Units of frequency should be 1/time

Figure 3 label y axis 'Change relative to control'

L294 delete 'formally'

L295 delete 'compensatory' and change contrast to compensate

L299 suppressed feeding activity

L304 what is crossing effect?

L306 on → over. 'that' doesn't refer to anything

L333 sustainable and reliable → practical

L337 write out TW, TRO and TM

The readability of the manuscript would improve if there were fewer references. Remove unnecessary repetitive references.

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