

## ***Interactive comment on “Effects of ocean acidification on the larval growth of olive flounder (*Paralichthys olivaceus*)” by K.-S. Kim et al.***

**Anonymous Referee #1**

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This manuscript, entitled “Effects of ocean acidification on the larval growth of olive flounder (*Paralichthys olivaceus*)”, presents the results of three replicated experiments wherein larval flounder were raised under various elevated CO<sub>2</sub> treatments for the first four weeks of development. I have reviewed this paper for scientific content below, but have not taken the time needed to make grammatical corrections. This manuscript is in great need of substantial editing for clarity and grammatical errors, as it was very difficult to read and sometimes very unclear. A person not familiar with this area of literature would have a very difficult time determining what was done, why, and how it relates to other published results.

The authors present data on the size, growth rate, and concentrations of chemical elements of the larvae. They report an increase in larval size-at-age, growth rate, and,

C2253

elemental concentrations in larvae raised under elevated CO<sub>2</sub> treatments. Unfortunately, the presentation and analysis of this data lacks depth and scrutiny. There are several problems with the methods section. Specifically, the authors assume the water chemistry results from the July experiment can be applied to the May and June experiments despite the fact that no data for those experiments is provided (and may not have been measured). This is a glaring error and in my opinion calls the validity of those experimental data into question since we do not know what the actual treatments were. There is also a complete lack of a description of statistical analysis, and questionable use of linear regression on a non-linear growth process. The discussion is incomplete, does not clearly present the authors’ conclusions, and make some broad generalizations that are not based upon the data presented. Although the results of this series of experiments appear to be intriguing, and may represent an important contribution to this field of study, they need to be analyzed and presented in a more clear fashion before that conclusion can be made. I have prepared comments on each section of the paper below.

My assessment to the specific BGD reviewer questions are as follows: 1. Does the paper address relevant scientific questions within the scope of BG? YES 2. Does the paper present novel concepts, ideas, tools, or data? YES 3. Are substantial conclusions reached? MAYBE 4. Are the scientific methods and assumptions valid and clearly outlined? EXPERIMENTAL METHODS APPEAR SOUND, BUT ASSUMPTIONS ARE NOT VALID AND METHODS ARE NOT CLEARLY OUTLINES. 5. Are the results sufficient to support the interpretations and conclusions? POSSIBLY, IT IS DIFFICULT TO DETERMINE DUE TO METHODOLOGICAL PROBLEMS AND UNCLEAR DISCUSSION 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? MAYBE, NOT ALL METHODS ARE CLEARLY DESCRIBED 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? NOT IS ALL CASES. 8. Does the title clearly reflect the contents of the paper? YES 9. Does the abstract provide a concise and complete summary? YES 10. Is the overall presenta-

C2254

tion well structured and clear? NO 11. Is the language fluent and precise? NO 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? YES, SEE SPECIFIC COMMENTS 14. Are the number and quality of references appropriate? NO, LACKING SEVERAL MANY RELEVANT CITATION, SEE COMMENTS 15. Is the amount and quality of supplementary material appropriate? N/A

#### SPECIFIC COMMENTS:

**ABSTRACT:** A nice and concise summary of the experimental results. Second to last sentence is confusing.

**INTRODUCTION:** The introduction is in need of substantial editing for grammatical errors and use of unclear terminology (i.e. "trouble in marine ecosystems", line 24 on page 7414). This section should be re-written to provide a much more clear introduction to the phenomena of ocean acidification and its impacts on marine organisms.

Paragraph 1 provides a vague description of ocean acidification (OA) and needs to be written more precisely. It is lacking any citation of literature for many of the initial statements about OA, its history, progress, and projected future scenarios.

Paragraph 2 presents detailed information on several studies on non-fish study species. This is unnecessary information for this manuscript, and should be limited to summary statements about the effects of OA on those broad organismal groups (i.e. phytoplankton and invertebrates).

Paragraph 3 again presents detailed information about OA studies on fish, which are more relevant to the topic, but do not provide a broad base of information which a reader can then use to assess the importance of the following data. This section should include less details (less specific numbers, etc.) and a more basic introduction to the current understanding of OA impacts of larval fishes.

C2255

Paragraph 4 presents some useful information about the physiological effects of OA on fishes, and mentions the potential problems with rapid OA and the ability for species to adapt. However, this paragraph is very vague (i.e. "The results for various groups of scientists", lines 4 and 5 on pg 7416) and the ultimate point that the author is making is not clear.

Paragraph 5 introduces the study species well, but then provides very vague mention of projected OA scenarios.

**MATERIALS AND METHODS:** This section is in need of substantial editing for grammatical errors. In general, the authors provide a somewhat clear description of what was done. However, someone who is unfamiliar with this type of research would have difficulty determining the precise methods. There is a major problem with the reporting of chemical water parameters and the assumption made to apply results from one experiment to all experiments. There is no mention of methods for determining growth rate (until it is presented in the Results section). There is no presentation of the statistical methods used for analysis.

Pg. 7417, line 14-15: unclear whether the statement of light being detrimental to survival is based on personal experience or literature. . .please include citation.

Pg. 7418, line 10: author should describe how "regularly" pH was monitored

Pg. 7418, lines 16-18: the authors assume that pCO<sub>2</sub> calculated in one experiment could be applied to the other experiments. This is incorrect and it should be made clear that the measurements/calculations are only valid for the July experiment. This is a serious problem regarding the results of the May and June experiments, because experimental systems often experience technical problems that may go undetected without measurements. If the measurements for May and June are available, they should be reported, otherwise this is a SERIOUS problem because there is no way to determine the actual treatments experienced by the fish, in which case those results are only anecdotal evidence of a possible treatment effect.

C2256

Last paragraph: It is not made clear why the concentration of chemical elements were measured. The method is only described as “hot plate digestion” (pg. 7419, line 7) and lacks a citation. There is no mention of how many larvae were tested, although it is mentioned in the abstract that statistics were not possible due to single measurements. . .was only 1 fish measured???

RESULTS: Experimental results are presented in a vague manner, with many references to means of “about...” a certain magnitude. This does not provide a clear description of the results and should be changed to include specific means and variances/errors. This section is missing references to statistical analyses, except for a couple occasions. The ANCOVA results of growth rate seem to be driven by a couple data points when referencing figure 3. I am not convinced of the validity of fitting a linear regression to growth data that is clearly not linear and in general is known to be non-linear for fishes. Very unclear why no statistics were performed on the chemical analysis results!

DISCUSSION: The discussion needs to be presented in a more clear manner, presenting a summary of results and their relation to published literature. The authors do not clearly present their conclusions and more text should be dedicated to this section.

Paragraph 1- The authors begin this section with discussion of invertebrates, instead of discussion of their results. This is not very relevant to this experiment.

Paragraph 2- The discussion of possible reasons for increased size and growth includes some important points (possible increased appetite or gustatory sensation), but lacks discussion or any reference to other papers that also report increased size with OA (Munday 2009, Proc R Soc B).

Paragraph 3- The discussion of chemical elements is very confusing. There is not citation for the precipitation of  $\text{CaCO}_3$  in the fish gut (pg. 7422, line 10). It is very unclear what the authors mean by “caused by these processes” (pg. 7422, line 12-13).

C2257

Paragraph 4- Discussion of ecological consequences of increased size/growth is satisfactory. However, the statement “temperature and acidification with ultimately determine the consequences” (Pg. 7422, lines 25-26) should not be stated as fact, but as a possibility. The last three sentences seem out of place and provide a weak finish to the discussion.

TABLE 1: this table does not provide any SE ranges for these measurements, so it is unclear how much the treatments varied over the course of the experiment. Figure 1: nice diagram of the experimental setup. Figure 2: graphs are clear, but no statistical results are presented. Figure 3: Why are there no error bars on these data points? Unclear which line is associated with which data series. Figure 4: graph is clearly presented.

TECHNICAL/GRAMMATICAL COMMENTS: Substantial editing is needed.

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C2258