Peer Community In Ecology

Untangling Eutrophication Effects on Coastal Lagoon Ecosystems

Nathalie Niquil *based on peer reviews by* ***Matthew J. Pruden***, ***Kaylee P. Smit*** *and* ***Kendyl Wright***

Auriane G. Jones, Gauthier Schaal, Aurélien Boyé, Marie Creemers, Valérie Derolez, Nicolas Desroy, Annie Fiandrino, Théophile L. Mouton, Monique Simier, Niamh Smith, Vincent Ouisse (2024) Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons. bioRxiv, ver. 4, peer-reviewed and recommended by Peer Community in Ecology.
https://doi.org/10.1101/2022.08.18.504439

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Disentangling the effects on ecosystem structure and functioning of natural and human-induced impacts in transitional waters is a great challenge in coast ecology. This is due to the observation that the ecosystems of transitional waters are naturally dynamic systems with characteristics of stressed systems. For example, the benthic communities present low species richness and high abundance of species with a high tolerance to variations, e.g., salinity. This general observation is known as the paradigm of the "Transitional Waters Quality Paradox" (Zaldívar et al., 2008) derived from the previously described "Estuarine Quality Paradox" (Elliott and Quintino, 2007).

In Jones et al. (2024) "Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons", a great diversity of lagoons is analyzed to disentangle the effects of eutrophication from those of natural environmental variability on benthic macroinvertebrates and understanding the links between environmental variables affecting benthic macroinvertebrates. These authors use a very elegant set of numerical approaches, including correlograms, linear models and variance partitioning. They apply this suite to a dataset of macrobenthic invertebrate abundances and environmental variables from 29 Mediterranean coastal lagoons in France.

Through this suite of analyses, they demonstrate the strong complexity of the mechanisms interplaying in a situation of eutrophication on lagoon macrobenthos. The mechanisms involved are direct, like toxicity, or indirect, for example, through modifications of the sediment's biogeochemistry. Such a result on the different interactions involved is very important in the context of the search for indicators to define ecosystem status.

Improving the definition of metrics is essential in environmental management decisions.

References:

Elliott, M. and Quintino, V. (2007) The estuarine quality paradox, environmental homeostasis and the difficulty of detecting anthropogenic stress in naturally stressed areas. Marine Pollution Bulletin 54, 640–645. https://doi.org/10.1016/j.marpolbul.2007.02.003

Jones et al. (2024) Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons bioRxiv, 2022.08.18.504439, ver. 4 peer-reviewed and recommended by Peer Community in Ecology. https://doi.org/10.1101/2022.08.18.504439

Zaldívar, J. (2008). Eutrophication in transitional waters: an overview. https://doi.org/10.1285/I18252273V2N1P1

Reviews

Evaluation round #2

Reviewed by Matthew J. Pruden, 23 April 2024

Second Review of: "Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons" by Jones, Schaal, Boyé, Creemers, Derolez, Desroy, Fiandrino, Mouton, Simier, Smith, and Ouisse for PCI Ecology.

General Comments:

This is my second time reviewing the preprint "Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons", and after careful evaluation of the author's responses to both mine and the other reviewers' comments, I am pleased to say that I do not have any major comments or concerns. My only recommendations regard the inclusion of a couple of graphs to the appendix / supplementary material (see Minor Comments). Overall, I thank the authors for thoroughly addressing the reviewer's comments. The manuscript was a pleasure to read and review, and I am glad to see more work is being done to understand and disentangle the effects of natural variability and anthropogenic stressors on metrics that play a vital role in environmental management decisions.

Minor Comments:

- I ask that the authors consider adding the graph they produced in response to my prior Major Comment Question 2.1, which displayed the linear relationship between the M-AMBI calculated per replicate and averaged by station and M-AMBI calculated at the station level, to either the appendix or supplement, with the appropriate intext citation at lines 314-315. As the authors mentioned in their response to Question 2.1 "It is true that we are therefore not perfectly calculate the M-AMBI as recommended in the WFD". By including the supplementary graph, the authors can easily address any concerns that a future reader could have to the change in methodology.
- In response to my prior Major Comment Question 2.2 regarding the reference conditions chosen, the authors note that they have compared their M-AMBI scores calculated using the default reference conditions (highest richness, highest Shannon-Weiner entropy, and lowest AMBI) to the M-AMBI scores calculated using the reference conditions established by the French government, and found that they were highly correlated (Pearson correlation coefficient ~0.99 – 1). Similarly to my previous comment, I ask that the authors provide

graphs showing the correlations to the appendix / supplementary material, as a future reader may question why the authors did not use the reference conditions established by the French government. An intext citation could be added to the first paragraph of the Discussion subsection titled “The M-AMBI and recommendations for its use as an indicator for the Mediterranean coastal lagoons” [Lines 838-845].

Evaluation round #1

DOI or URL of the preprint: https://doi.org/10.1101/2022.08.18.504439
Version of the preprint: 2

Authors’ reply, 19 March 2024

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Decision by Nathalie Niquil, posted 26 October 2023, validated 30 October 2023

Revision recommended

Dear authors,

We have received the 3 reports from our reviewers on your manuscript, ”Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons ”. Based on the advice received, your manuscript will be reconsidered for publication should you be prepared to incorporate the proposed revisions. Please carefully consider the reviewers’ comments which are attached.

Thank you for your submission of high quality. We look forward to receiving your revised manuscript.

With kind regards,

Nathalie Niquil

Reviewed by Kaylee P. Smit, 08 October 2023

Thank you for the opportunity to review the preprint, ”Disentangling the effects of eutrophication and natural variability on macrobenthic communities across French coastal lagoons”. This paper used a broad dataset from 29 lagoon systems located along the French Mediterranean coast to identify the environmental drivers of macroinvertebrate communities, based on a number of key features including the level of connection to the sea, water column and sediment characteristics and local macrophyte community. Further, this paper aimed to identify the contriubtion of anthropogenic drivers, linked to eutrophication and oxygen levels, to the structure and distribution of the macrofauna assemblages, in order to better understand the response of various indicaators (multivarite and univariate indices) to natural or anthropogenic stressors, given the highly dynamic nature of these systems.

This paper was a pleasure to read and to review, and was one of the very few papers that I have reviewed lately that doesn’t require major revision. I must commend the authors on their effort and the quality and standard of this work, and their attention to detail, particulalry with regard to the statistical robustness of this paper. It is refreshing to see (and review) a piece of work that has given proper thought and consideration to the data processing and analysis, and statistical testing required to address the aims and objectives of the paper, which I find is worryingly neglected in many of the other papers I review. I enjoyed reading this paper, I found it interesting and relevant and will be of value to the scientific community.

I include here just a few minor comments and suggestion provided in more detail below.

Introduction:

Is there a specific definition for lagoon (like those in this context)? If so, it might be good to brielfy include it in the beginning of the introduction somewhere, particularly for people that are not used to working with

these systems. For example, I am more familiar with estuarine systems, and I'm not sure how they differ or compare with one another.

Line 69 - is it meant to be "lagoons"? (or lagoonal systems?)

Lines 71/72 - Perhaps consider briefly explaining what the "transitional waters quality paradox" is, which would help readers that are not very familiar with this work.

Lines 122/123 - I'm not really used to the use of the word compartment(s) in the way that the authors have used it in the introduction, but that's just me. Perhaps just try to be conscious of making it clear as to what types of compartments you are referring to. Like here, my immediate reaction was "what compartments/what are you referring to here), but a simple fix in this line would be to move the content in brackets (water column, sediments...) to immediately after the word "compartments".

Methods:

In figure 1, this is the first place where you mention the groupings of the stations into salinity types and group membership. It might be nice to briefly introduce this (and you don't have to include the details that you provide later on) in the Study sites section. I also didn't notice any details about how the sites were classified into the different salinity groups (not sure if I missed this).

Lines 167-169: "and to large inter-lagoon..." - Is this meant to be "two"? or are there some words missing here? This part of the sentence is a bit confusing and difficult to follow, perhaps consider re-wording it.

Discussion:

Lines 650-654 "Overall, our results..." - I'm not sure if your tests and results actually showed the second part of this (primary colonization and/or post-disturbance recolonization of lagoons by marine-originating larvae through dispersal and recruitmen). If you think it did then you might have to elaborate on this, to show how you came to this conclusion.

Line 656 - which communities are you referring to here? Do you mean all macrobenthic assemblages overall?

Paragraph from line 688. There is a bit of disconnect in this paragraph. What is the point you are trying to make with regards to the stations in La Palme? And then how does this part relate to the next part where you seem to be summarising a key finding?

Lines 751-753 - "as previously done for freshwater and marine organisms (Alonso and Camargo, 2006; Boardman et al., 753 2004; Camargo et al., 2005)" - it might be useful to briefly elaborate on what these studies actually showed or found, in this context.

Line 755: What are the low and intermediate abundance taxa you are referring to here? And how did you classify these groups? I might have missed this, but I don't remember seeing details about this, and these groups feature in the paper. Something to consider since I couldn't really relate to this as I read this sentence.

Line 761 - What exactly do you mean by this decimeter scale?

Line 798 - In this paragraph, is it worth discussing the possible influence of the reference values used in the calculations of this index? What do other studies use as reference values? Are there no national or regional standards and thresholds that could be used for the parameters used in this study? How could this possibly affect the index and the perceived response of the system?

Lines 904-907 "Finally a functional approach..." - But didn't the previous sentence just contradict this recommendation? (regarding the limtations of using traits due to the plasticity) - perhaps this just needs to be re-worded.

Abstract:

I'm just confused by this sentence of the abstract: "Conversely, AMBI was the only tested index that uniquely responded to eutrophication variables, which nonetheless explained less than a third of its variability" - But I thought the results from this paper showed that AMBI was not very responsive, and didn't show any significant relationship with [Chla], among other variables? And AMBI (only M-AMBI) is not included in Figure 5 which represents the variance partitioning.

Reviewed by **Matthew J. Pruden**, 13 October 2023

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Reviewed by **Kendyl Wright** , 17 October 2023

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