

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2021-251

Jacob Allgeier (Referee)

Referee comment on "Global nutrient cycling by commercially targeted marine fish" by Priscilla Le Mézo et al., Biogeosciences Discuss.,
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The study by Le Mezo et al. is an interesting foray into understanding the role of global marine fisheries for biogeochemical cycling. I applaud the authors for providing an interesting perspective on this topic and believe that this study will be a useful contribution to the literature. I have two general comments that I think need to be addressed before being accepted for publication. First, there needs to be some text that clearly tells the reader how this study differentiates from Bianchi et al. As of right now that is not clear. There is obviously massive overlap and I am generally ok with that given all the work done, but the authors simply need to address this up front. Second, the modeling needs to be explained much better. After reading this MS carefully, I still don't fully understand what the main BOATS model does. This is absolutely central to the results and the authors need to lay this out clearly for the reader in a way that is very easy to digest and then continue on with the more specific details. As of right now the methods are not particularly clear in many instances.

- this is a bit confusing – why only egestion? That is a small fraction of excretion+egestion output

47-48. this sentence needs some fleshing out.

Paragraph at 34. There is an important concept about nutrient capacity that seems missing from this section – the storage of the nutrients by the fish is like the bank account – which matters more or less in systems depending on how otherwise available nutrients are (DeAngelis 1989, Allgeier 2016)

The intro does a great job at covering a very diverse literature base.

I am increasingly interested in why 10g is the minimum size of interest. As far as I can tell this would preclude any anchoveta, which is ~ 25% of the world's catch and definitely plays a bit role in recycling. This seems worthy of at least mentioning at some point.

The Methods are generally pretty thin – and that is such an important part of what this paper contributes so it seems the authors need to provide a bit more information in that realm throughout.

- A few more lines about the model are needed here. Time and again below you lean on this model but never really explain the model to the reader – even in general terms, which I think is needed.
- a bit more would be helpful about what is compared
- 1- degree two-dimensional grid – explain

Nutrient Content of fish

Allgeier et al. 2021 (supported by Allgeier et al. 2020) showed that body nutrient content is really all about who you are much more than anything else.

Table 1. 25% dry wt of wet wt? That seems very high and there is no citation. If I remember correctly, it is typically more like 10% I believe.

- Assuming inverts are the same as fish in terms of nutrients is a very big reach. It really depends on how much of the total biomass they make up, but why not just use invert data instead? It is strange given this point to not make it clear at this point how much of the biomass inverts make up – pretty much either way I think using fish numbers for them is problematic.

- Please expand on this as it seems very important.

In general, the use of size spectrum theory needs to be better explained. The reader not familiar with this approach will have a difficult time following and a general overview of the approach is needed. I realize that was the point of Figure 2, but the authors need to go a step further and provide some background as to what size spectrum theory is and why it is appropriate in this application. For example, statements like: “by doing so we avoid accounting for internal nutrient cycling within the spectrum” are not clear. In general, further justification as to why the authors think that the amount coming into the 10g-100kg food web is the same as that leaving needs to be provided.

I think an additional conceptual figure or even table that shows each step of the model is needed for the reader to really be able to grasp and in turn vet the modeling procedures. In addition to being dense, the text is often not very clear and this combination makes understanding the model more challenging than it should be.

- sentence like this are very common in this MS and add to general lack of clarity. "Export of nutrients" from what and "total C export" from what. There are multiple sentences like this throughout the MS making it difficult for the reader to fully understand what is being done.

Section 2.1.3

The first sentence of this section says that you compare nutrient cycling by fish with the demand of nutrients by phytoplankton. The next sentence says demand was calculated by avg satellite PP, but then the word demand is not mentioned again in this section. There is so much here in this paper and the methods are so extensive, in order for a reader to digest what all was done the writing has to lay it out in simple terms. I would suggest that each sub section has a summary sentence where the whole process is laid out for the reader in simple text and then expanded after that.

- "appear more significant compared to... Up to more than 50%" = this is very difficult text to follow. This whole sentence is a lot to take in. This is another example of the type of text that is throughout the MS that needs to be cleaned up for improved clarity.

- text is not clear

- Re: recycling is higher where biomass is higher. This is a really important point and is completely dependent on the size structure of the communities. At this point in the MS I should have a better sense of why this would be, but despite reading carefully I do not. I understand that size is clearly taken into account but how the sizes are determined in the first place and at what level of detail this is incorporated into the model, I do not. If the biomass is dominated by a bunch of big fish then it is very possible that excretion could be higher in areas with lower biomass, but dominated by smaller fish. More clarification on this is needed.

259-61. poor text

269-71. I like what you are trying to do here, but it is not clear that those are comparable as coral reefs have extremely high biomass per unit area relative to most other places in the ocean – so scaling by area is likely not particularly accurate.

- text

