

Biogeosciences review

General Comments:

This is an interesting and well-planned study. It is nicely focused and well-suited to address the question outlined by the authors. I do not see any major flaw with the experimental design or the interpretation, however, I think there are several places where some more clarity and/or improved organization would be helpful to the readers. My “major” comments are that the authors could setup arctic vs boreal comparison a little more purposefully and clearly in the introduction. Also, a map of the sampling area would be really helpful as I (and I think most people) do not have a good image of this region in my head, it could be a supplemental file if need be.

There are also a number of typos and grammatical errors that need to be addressed. Aside from those, I have also outlined below some minor comments that may help improve clarity and a few places where some more context or broader discussion is warranted. Overall, I enjoyed reading this manuscript and the methods, statistics, and interpretation are sound.

Specific Comments:

Pg 4

L8: I would think that each compound should be defined first with the name and formula in parentheses, then you can use the formula after that

L10-13: This sentence and really the whole first pp is on one hand a logical introduction, yet it still leaves me with the thought “what is the point of this pp”? Can the authors make it a more cohesive and setup the transition to N fixation (in the next pp) a little better? (and in the second pp it starts with N fix then goes back to DIN)

L22-26: This last sentence in the paragraph could be clearer. I follow the first half ok, but the second half starting on L24 is not clear to me.

L21: This goes back to a topic discussed in the first pp so I think some more context is needed here because it is a sudden transition to an earlier topic. Also what “observed variations” do the authors refer to here on L22?

L22: Maybe use “DIN” instead of “nutrient” to be more specific

L22: Instead of “a combination of variations” maybe just use “variability”

Pg 6

L4: This pp might be a good place to clearly introduce arctic vs boreal

Pg 5

L4: This might be a good place to briefly discuss the dependence of nitrification on oxygen, which is not really stated anywhere upfront but that information is relevant think.

L14: There is no anaerobic process quantified in Fiore et al. 2013

Pg7

L21: average biomass for boreal sponges is given, is this true for arctic sponges too?

Pg3

L2 and 6: what is meant by “key” here, why were these species chosen?

L9-10: says that sediment was not collected here, so it seems like something about sediment should be mentioned in the paragraph before this one.

L17-22: I can tell the authors tried to make the sampling and setup of experiments clear but I am still a little confused. For one, it would be helpful to describe the shape of the sponges, presumably massive/round? Second, why were these cut into three pieces- for each isotope tracer, is that right?

Pg 9

L17: This setup was on the ship yes? Might be good to remind the reader of that

L18: Why only sand filter for the boreal specimens?

Pg11 L13: Can the authors say how many samples were sampled at each time point rather than “a selection” – or am I missing something here?

Pg13 L12: This seems redundant because of pg 12, which would be ok, but it makes it a little confusing

Pg13 L23: Is it possible to give a little more guidance on the calculation of nitrification derived nitrate? It would be helpful for the reader and worth the word count since this becomes an important piece of information in the discussion.

Pg 14: Out of curiosity, why was amoA not quantified? Since the authors are interested in nitrification rates as well

Pg 17 L3 – I suggest adding some of these calculations (even brief) in a supplemental document

Pg18 L23: “proving” is a strong word... maybe “demonstrating” works better? (when possible in other instances for the use of “prove” is there another word that could work?)

Pg18 L24: Fiore et al. 2010 is a review paper so I don’t know that that fits in here with this sentence

Pg19

L3-9: The information in this pp is fine, but I don’t really see the point of the pp. It could use some language to tie it into the paper more.

L11: This sentence is awkward, try to reword without using “being”- just using “As denitrification is an...” would be much more straightforward.

L15-16: certainly interesting, but this sentence also leaves me wondering, what is the point? It would be nice to have it tied in more clearly for the reader.

Pg20

L1-6: It would be helpful to have more context here on any work that has been done to measure pumping activity – has anyone done this? Do we have any idea of these deep sea sponges behave the same as others? The authors do get to this type of info later in the discussion but this pp seems lacking a bit as is.

L7-8: The use of “(anaerobic)” and “(some)” is confusing to me

Pg21 L16-17: The first point here about oxygen in the specimens here vs explants is confusing as to what the point is. I think I get what the authors want to say but it is not all that clear here and could be tied in better.

Pg22 L20: “prepared and optimized” – I get hung up on “optimized” here, is there better way to say this? I think the authors mean the community is well suited to this environment or adapted to this environment, but optimized sounds odd to me

Pg23 L8: instead of “apparatus turned on” maybe say “genes expressed”
Pg24 L14: would be helpful to give some of this info briefly (sediment denitrification rates)
Pg25 L19-22: seems more to the point here to contrast with nitrification studies showing release of nitrate, rather than discussing “nutrients” as a whole which is vague
Pg26 L4-5: This sentence is not tied in well, so it reads a bit awkward
Pg26 L6-7: This last sentence is a bit awkward and unclear at the end.

Technical Comments:

L10 abstract: “thus lead to that”
pg 5 L21: “This opens for”
Pg 7 L15: check reference format
Pg 15 L 6: “Standard of qPCR”
Pg19 L21: parentheses for references- it looks like it should be: (e.g., Wilson....).
Pg22 L4: “origin” should be “originate” I think
Pg24 L10-11: are the “-” supposed to be there?
Pg24 L18: “since we do know” – maybe just remove “do”
Pg25 L5 and 12: extra parenthesis