

## ***Interactive comment on “Nitrogen and oxygen availabilities control water column nitrous oxide production during seasonal anoxia in the Chesapeake Bay” by Qixing Ji et al.***

### **Anonymous Referee #2**

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#### General Comments:

The authors have presented a well-designed and well-executed experiment on N<sub>2</sub>O production in Chesapeake Bay. While the experiments and data are worthy of publication, the manuscript itself needs major revisions before it is accepted for publication. In reading the manuscript the introduction and methods were written clearly and concisely, but the results and discussion needs a substantial reworking. The paragraphs jumped from one topic to the next and often I found the subtitled headings were not appropriate for the range of topics covered in the text below. In the abstract the authors suggest two potential impacts of what reducing N to the bay will have on N<sub>2</sub>O produc-

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tion. I think the paper is missing a more detailed explanation of how the experiments done lead to the conclusions they make, and they should expand on the specific details of these impacts that they suggest. I also think the authors could elaborate on the limitations of their study and what could be done in the future.

#### Minor Comments:

##### Abstract:

Pg1 line15: “N<sub>2</sub>O production was positively correlated with the ratio of nitrate to nitrite concentrations.” Please clarify if this was in situ concentrations or the nitrate and nitrite added to the incubation.

Pg1 line18-19: What do you mean by nitrogen deficiency? What lengths of time are you referring to when you write “short term” and “in the long-run”, can you approximate the time scale?

##### Methods:

Pg4 line15: Why do you add 20 nM N<sub>2</sub>O before the incubation? If it is so you can have enough N<sub>2</sub>O to measure the N<sub>2</sub>O production, could you add it after the incubation is killed? Can you clarify here in the text? Do you think adding it before, could affect the production of N<sub>2</sub>O?

Pg4 line17: What was the total concentration of nitrite+nitrate of tracer added?

Pg5 line8: How does 5μM of tracer compare to the in situ amounts of nitrite and nitrate.

##### Section 3.2 Active N<sub>2</sub>O production by denitrification

Pg8 line3: In the title you suggest all N<sub>2</sub>O is from denitrification, it would be good discuss why it is not from nitrification, if you are using that as the section title.

Pg8 line16: I think it's good you say here they are potential rates of N<sub>2</sub>O production, because you are removing all the oxygen, even if that's not the in situ value. I am

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curious why there are no potential rates in May. Can you add some discussion on why removing the oxygen does not stimulate N<sub>2</sub>O production in May versus November?

Pg9 lines1-13: This section seems disjointed from the paragraph above and the title of the section. This paragraph refers more to removal of fixed nitrogen from the bay rather than N<sub>2</sub>O production.

Section 3.3 N<sub>2</sub>O production pathways regulated by availability of nitrogen substrate

Pg9 line16: I was confused by this term “NO<sub>2</sub>- (NO<sub>3</sub>-), is this synonymous with “NO<sub>2</sub>- or NO<sub>3</sub>- ”? If so, I would suggest changing it to the latter.

Pg10 lines1-21, pg 11 lines1-8: This could use a different subheading? Could you reformat the equations to be easier to read? Also in general this section could use a little more description, as is, it is a little hard to follow. I would start off the section with the punch line (on pg 11) and then describe why the calculations back up that statement.

Section 3.4 Oxygen inhibits N<sub>2</sub>O production by denitrification

Title: I suggest changing the title to something more detailed.

Pg11 lines11-19: These sentences seem to belong to the other section about N influx to the bay. They could be moved or deleted during restructuring of discussion sections because it is somewhat repetitive from before.

Pg12 lines9-15: The result that there is a different oxygen tolerance for nitrite vs. nitrate reduction is really interesting. I think here is where you should expand on more why you get this result. I know you touch on it more in a later section, but it might be best to put it all together (maybe in it's own section). Could it be from nitrifier denitrification? How would nitrite oxidation affect the production rate? At low levels of oxygen I would suspect there would be some nitrite oxidation to nitrate.

Pg12 lines16-19: This paragraph seems out of place? Again, would you suspect some

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nitrite oxidation in these nitrate reduction to nitrite measurements? How would that affect results?

Pg13 lines3-4: This line should go with the section on differences of nitrite-stimulated production vs. nitrate-stimulated N<sub>2</sub>O production.

Pg13 lines10-18: This paragraph is out of place.

Pg13 lines19-22: Should this be in the conclusion and outlook?

Section 4 Conclusion and outlook

Pg14 lines14-19: I would reorder this section and put these lines first.

Conclusion and outlook section as a whole: Could you add something connecting the two pathways of management (nitrogen influx vs. oxygenation)? Also, could you quantify how each change inhibits N<sub>2</sub>O production?

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