

Interactive comment on “The effect of light on N₂ fixation and net nitrogen release of field *Trichodesmium*” by Yangyang Lu et al.

Anonymous Referee #3

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This manuscript looks at irradiance vs nitrogen fixation with an emphasis on *Trichodesmium*. This is a highly relevant topic and the authors approached the topic with a set of measurements that promised to increase our knowledge. Unfortunately at this moment, there is some missing information which makes it hard to evaluate the findings of this study. These are listed under major comments with additional items for consideration listed under minor comments

Major comments This manuscript does not include statistical analysis of the data which makes it difficult (impossible) to draw conclusions about the some of the measurements, such as Figure 5 which shows diazotroph derived nitrogen release rates.

It is not clear how the authors are defining a bloom of *Trichodesmium* bloom. I am aware of *Trichodesmium* accumulations in the form of slicks which are visually ob-

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served, but a bloom to me is prolonged and active growth which should be validated

Elemental analysis of POC and PON is missing from the methods section. I suspect it derives from the ¹⁵N-PON analysis but this should be discussed

The uncertainty associated with the light levels should be provided, particularly since the irradiance experiments are a critical component of the manuscript The authors mention 92, 54, 28, 14, 8, 1% but there will be variability associated with all of these values and the authors should say whether it is plus/minus 5%, 10% etc.

There is no mention of monitoring the temperature inside each of the incubators. If the incubators were plumbed with surface seawater then this can easily heat by >1°C and this will have an affect on the rates of carbon and nitrogen fixation.

Its not clear to me why all of the rates are attributed to *Trichodesmium* when the experiments were conducted on natural assemblages of mixed diazotrophs.

Why does Figure 1 show PAR of 4000 µE? I was under the impression that maximum sunlight was approx. 2500 µE.

Minor comments Page 2 Line 11 "NF pathway was likely preferentially blocked under low light to conserve energy for photosynthesis, thus, there is a metabolism tradeoff between carbon and nitrogen fixation pathways under light stress." I disagree with the wording of this statement. I think it is more likely that there is insufficient energy from photosynthesis at low light levels to support nitrogen fixation

Line 13 Define short-term light change. Is short-term <1 h or less than 1 day

Page 3 Bell and Fu (2005) observed an increasing NF rates. remove 'an'

Page 7, Line 1. Its not clear to me how you measured ¹⁵N-TDN.

Page 8 Section 2.7 How much confidence do you have in this filtration method to evaluate the transfer of DDN to no-diazos

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Page 8 Line 23 What confidence do you have that it is *T. thiebautii*

Page 8, Line 24. I am not sure I follow the link between bulk POC and *Trichodesmium*-POC

Page 9 Line 1-6 I suggest moving the water-column nitrogen fixation rates to the previous section on environmental conditions

Page 9 Line 11-14 This should be in the same section as the NF-I

Page 9 How long were the incubations? The changes in POC are substantial and you should compare the increase in POC with the ¹³C-derived rate of productivity to make sure they agree.

Page 10 Section 3.4 This section cannot be included without statistical analysis

Page 10 I am not sure I follow your argument that the high light demand by *Trichodesmium* to fuel nitrogen fixation also help mitigate the problems caused by creating oxygen.

Page 11 Line 9 Did you ever consider conducting your incubations in situ? This would provide the light gradient you are after and as long as you are within the mixed layer then temperature would be constant (hopefully). I realize you lowest light levels might not attainable, but you should be able to cover 25-100% light levels.

Page 12 Line 14-24 I am not sure of the relevance of this paragraph to this study

Table 1 I increasingly see NO_x being reported in the ocean literature and I dislike it application for describing nutrients due to the ambiguity. Report what was measured i.e. nitrate, nitrite...

Figure 2 Given the presence of other diazotrophs, how do you attribute the measured rates to *Trichodesmium*

Figure 3. I suspect the x-axis shows PAR equivalent to 92, 54, 28, 14, 8, 1% of the daily

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averaged value, but this does not highlight the much higher intensities experienced. In Figure 1 you show PAR attaining values of 4000 μ E and if this is true, it needs to be reflected.

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