

Interactive comment on “Spatial variation in N₂-fixation rate and diazotroph activity in the Tropical Atlantic” by J. P. Montoya et al.

Anonymous Referee #2

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The authors compare rates of N₂ fixation by unicellular diazotrophs and Trichodesmium for five cruises in the North Atlantic. Methods varied slightly among cruises but the authors justify pooling their data to make generalizations about the longitudinal distribution of the two groups of diazotrophs.

That there is a biogeography to diazotrophs is interesting and there appear to be data to support this. However, I find the major limitation of the paper is the use of areal rates because we know little about the depth distribution of unicellular diazotrophs and what we know about the vertical distribution of Trichodesmium suggests a highly variable vertical distribution with populations concentrated nearer the surface. Abundance of diazotrophs of the different groups and vertical distribution of rates are not presented. Despite this distribution, N* fields are calculated over 300m and 750m and no justifica-

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tion is given for this comparison.

Abstract Line 4: change “novel” to something else like “unpublished”? Lines 5 and 6: I suggest stating what the two groups of diazotrophs are somewhere in the abstract

Page 1743 and 1744: Are the results a mix of the 2 methods (15N₂ versus ARA)? Or were Trichodesmium N₂ fixation rates estimated using ARA and unicells with 15N₂. The authors indicate that the methods may not measure the same thing and so this may be a bias.

How were the depth integrated N₂ fixation (areal rates) calculated for the two groups? Were there depth profiles for abundance and rates (or just one or the other)? For the unicellular group it is unclear how one goes from volumetric to areal rates unless one knows the basis for that calculation. For Trichodesmium, the abundance of this group with depth is highly variable.

What was the basis for integrating N* through the upper 300m and 750m? Are these meaningful for diazotrophy?

Given the assertions that the authors make, I think that more clarifications are warranted.

Discussion: For Trichodesmium, the authors need an abundance estimate to get colony-specific N₂ fixation rates to volumetric rates. Were these done? Was a single rate applied to some abundance over some depth to arrive at the areal rate? It seems that there might be a large bias associated with this calculation based on the depth integration. Was colony size accounted for when converting per colony rates to volumetric rates? Are areal rates appropriate for small diazotrophs because it seems that we know little about their vertical distribution (Langlois et al. found depth horizons).

Page 1745: I don't understand the significance of the ANOVA (nor see the need for Table 2). Is this a geographical comparison? Were rates simply similar at the time of the cruises? Was this specific to Trichodesmium? If so, does this mean that colony-

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specific rates were similar?

Again, I think the assumptions that are made in deriving the areal rates need to be laid out given that a primary goal is comparing areal rates for the two groups of diazotrophs.

Page 1746, Lines 15-23: This seems to bring into question the results of the ANOVA and the depth integration exercise. How were the vertical differences in distribution of the two groups accounted for in the depth integration? Was it measured or were there assumptions made?

Page 1747, lines 3-5: I'm not sure that I understand the meaning of this and am not sure I agree because of the lack of experimental details.

Page 1748: It sounds like the authors are saying that there is a biogeography to diazotrophic groups and that Trichodesmium N₂ fixation may be superimposed on some background N₂ fixation rate by more cosmopolitan unicellular diazotrophs. Is this correct?

Page 1749, line 4: At the end of the line add "s" to diazotroph.

Page 1749, last 2 lines to Line 2 on Page 1750: Why wouldn't Trichodesmium N₂ fixation then increase too? Why would input of N result in increases in N₂ fixation in the east?

Fig 2.: Is this ARA data or 15N₂? Lateral offset in Fig 2A is confusing. Are both panels really necessary?

Fig 3: Are these 15N₂ or ARA data? I think it important to specify

Fig 5: Are there just no data for some of the longitudes (Panel A to the east and Panel B to the west)? There appear to be some gaps.

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