

## ***Interactive comment on “Mechanisms of Trichodesmium bloom demise within the New Caledonia Lagoon during the VAHINE mesocosm experiment” by D. Spungin et al.***

**Anonymous Referee #1**

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The initial intent of this study was to follow the development and demise of a Trichodesmium bloom in a mesocosm. Although the mesocosm failed, fortuitously a large bloom occurred "in the wild", so Trichodesmium samples were captured. Spungin et al. report their observations of the subsequent sudden crash of this Trichodesmium bloom. They observed cellular responses to P and Fe stress together with increased expression of suite of PCD genes, and apparent lack of viral activity. They concluded decreased gas vesicles and increased production of TEP contributed to enhanced export flux. Results are interesting and appear technically sound, for the most part.

Overall, this manuscript needs some revision— specifically in 3 sections: 1. Introduction The Introduction is weak because it lacks discussion of the rationale— e.g., for the

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genes they are looking for (e.g. arsenate reductase); these are first mentioned in the Results section. Also a bit of background of what is known about responses to environmental stress.

Is there a controversy as to the fate of Trichodesmium blooms? Again, some rationale for the question should be in the Intro.

2. Description of the experimental design is a bit confusing. An overview of the experimental design (and replication!) is needed.

3. Results section includes discussion (and repeats methods), and introduces factors that should be stated at outset (Introduction). This section should be revised (see details below).

Overall, text is a bit repetitive and there are a number of rambling and/or awkward sentences. Careful editing is needed to "tighten" up the text.

INTRODUCTION lines 84-88— very confusing, and long, sentence; something seems to be missing?? Revise this section, as first authors say no blooms developed so bloom in lagoon was "exploited" (is this the best word?), but then authors say they used mesocosms. But methods section indicates bottles/carboys? This needs clarification.. or delete, as it is explained again in lines 110-113.

METHODS: 115-179: Were 6 net tows done, or 1 tow split among 6 bottles?? 121: How many replicate carboys were filled/ sampled? 126-7: Experiment 2 was sampled only on days 23 -25? How frequently? Replication? 165: Fluorometer

Differential expression- Insufficient information on experimental design is given (replication is not described). I'm assuming no replication, which is problematic since results seem so variable. Some discussion of the method used for analysis of DE is needed; sentence in the methods seems to be taken directly from the methods paper.

RESULTS: 289-291: Revise this long, confused sentence; why not just state chl a (total biomass) increased from xxx to xxxx. 292-294— delete this sentence, as this is

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obvious– or can you estimate what fraction Tricho contributed to the total chl a? 297-8; Should you state that Tricho abundance is measured as # of nif copies? lines 309-311 should be in the methods. lines 315-317 this repeats the methods. Did you look at the samples to verify the absence of other cells (taxa)? line 348-9 very wordy ; revise this sentence

line 363: replace ", which" with "and declined to 0.5 +/- .by day 23." lines 372 - 378 appear to be Discussion, not results 384-5 if increased "significantly", authors should state p-value 386-91– Why are arsenate reductase genes results mentioned? Nothing is stated in Introduction to explain why. DISCUSSION: line 454: remove "phenotypic" comment on Section 4.1: Did the bloom in the lagoon crash as quickly as the sample in the bottles and carboys? Was a control sample, lagoon water with no Trichodesmium, analyzed to see what bacterial community develops? With such differences observed between the 2 replicate bloom samples, this would be an interesting comparison. CONCLUSION Do blooms in the open ocean crash as quickly? Could the shallow lagoon (and enclosure in a bottle) have been a factor in the demise? 642: "yet to be published" is there evidence (unpublished?) REFS Brown et al 2013 missing from refs

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