

Interactive comment on “Adding nitrate and phosphate separately or together in the Central Indian Ocean: a nutrient enrichment experiment” by S. Tang et al.

S. Tang et al.

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We are truly grateful to the reviewer’s comments and thoughtful suggestions. Our responses to the comments and questions are given below. 1.“I have no major problem with the manuscript apart from the fact that there is nothing very new or far reaching about the authors’ findings. I do not know every papers that present analyses of phytoplankton growth response to N and P enrichment but I am pretty sure that similar experiments have already been conducted in the Central Indian Ocean.” 2.“The evident conclusion from the present work is that primary productivity in the area is N limited rather than P limited. However the authors do not reach this conclusion. There is also

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very little discussion of the relevance of their results in the context of previous works, for example in the debate about the relative importance of P and N for phytoplankton growth.”

Firstly, our work provided new materials for the study of nutrient limiting on phytoplankton growth. Authors have searched titles and abstracts of publications on web of ScienceDirect and ISI Web of Science using key words such as enrichment, experiment, Indian Ocean, nutrient, etc. We have not found similar enrichment experiments conducted with the surface seawater near our sampling location in the Central Indian Ocean. Secondly, detailed data after phytoplankton bloom about the enrichment experiment were provided in the paper, which was seldom reported before. So our work could provide new information to understand the nutrient limiting to phytoplankton. Thirdly, as the reviewer said in the comments, “There is also very little discussion of the relevance of their results in the context of previous works, for example in the debate about the relative importance of P and N for phytoplankton growth.” Authors discussed the relative importance of N and P for phytoplankton growth (in the last paragraph in the section of “The influence of nutrient addition to phytoplankton growth”) and reached the conclusion that primary productivity in the area is N limited rather than P limited (see in the section of “conclusion”) in the revised paper. In addition, previous studies have indicated that temperature and N: P ratio was important factors to influence phytoplankton growth. Authors concluded that neither temperature nor N: P ratio could control the phytoplankton growth completely in our experiment, which could provide useful thoughts in the relative research.

3.“The main findings of the authors, i.e. phytoplankton response is greater after N and N+P addition rather than P addition, is very much in agreement with previous findings in marine systems and notably with the compilation made by Elser et al.1 for marine ecosystems.” “Some important references seem to be missing, for instance Tyrell et al.2 or Elser et al.1.”

Authors agree that the two references mentioned in the comments are important in the

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relative research and supplement them in the revised paper.

4. “Initial N:P ratio is low in B1 (ambient waters) and below the Redfield ratio: what does that mean? Could it be the effect of denitrification in the Arabian sea?”

The reason why the initial N: P ratio is low in ambient waters has not been discussed in detail in the paper, for the main purpose of our work was to investigate the limitation of nutrient to phytoplankton growth. Authors do not think the low N: P in the surface sea water was mainly caused by the denitrification in the Arabian Sea. There are mainly two reasons. One is that the sampling location (50.17°E, 37.81°S) for our experiment was far from the Arabian Sea, which is northwestern part of the Indian Ocean. For the other, although the northeast monsoon prevailed in the Indian Ocean when we sample the seawater, the winter monsoon current in the Arabian Sea is primarily a geostrophic current, with Ekman drift modulating it (see detail in D. Shankar, et al, 2002). With such current condition, it is difficult that the denitrification in the Arabian Sea has obvious effect on the nutrient condition of the seawater we sampled. Authors think the low N:P in the sampled surface seawater may be caused by the local phytoplankton growth or the seasonal variation, which need more in situ observation to judge. [D. Shankar, et al. The monsoon currents in the north Indian Ocean. Progress in Oceanography, 52, 63-120, 2002]

5. “I am not convinced that the last figure (Fig. 4) shows adequately the absence of relationship between total growth and N:P ratio. I would rather draw a plot showing the average N:P or initial N:P ratio in each experiment compared to the average or cumulated phytoplankton growth. ”

Think of the average N: P, Chl_{ave} (average of chlorophyll a concentration), and Chl_{BSP} (chlorophyll a concentration when phytoplankton blooming) have been shown clearly in table 3, authors have not drawn a plot to show the relationship between phytoplankton growth and N:P ratio. And Figure 4 is mainly to show the results of the experiment like other figures. To discuss the relationship between them, authors compare the trends

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of N: P with the variation of chlorophyll a concentration in detail in the section of “The influence of N: P to phytoplankton growth”, along with the correlative analysis between N: P and Chlorophyll a concentration or R (table 4).

6. “I found the method for Chlorophyll a measurements not adequately described. The paper is not always clearly written. ”

The method for Chlorophyll a measurements has been described clearly in the paper “Changes in major carbon components during a fertilization experiment with surface water from the Central Indian Ocean”, which could be downloaded from the website (URL: <http://nopr.niscair.res.in/handle/123456789/4561>). And authors have supplemented this reference in the revised discussion paper. In addition, authors read the paper carefully and modified some sentences in the revised paper.

Please see the revised paper and detailed revisions in the supplement.

Please also note the supplement to this comment:

<http://www.ocean-sci-discuss.net/6/C875/2009/osd-6-C875-2009-supplement.zip>

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