

## ***Interactive comment on “Gradients in intact polar diacylglycerolipids across the Mediterranean Sea are related to phosphate availability” by K. J. Popendorf et al.***

**Anonymous Referee #2**

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The authors present an interesting and very well written manuscript describing the spatial variability of intact polar diacylglycerolipids (IP-DAGs) in relation to spatial gradients in phosphate availability from the western to eastern Mediterranean. The authors further compliment their water column sampling with the first experimental data presenting physiological shifts in membrane composition as a response to direct manipulation of nutrient availability within a natural microbial community. The study is likely to be of broad interest and I have no hesitation in recommending publication in Biogeosciences. I have a few comments which the authors might wish to consider in revising the manuscript for final publication, these are all fairly minor and some may reflect my own conceptual biases, so the author's should feel free to rebut.

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### General comments

Page 7924, Line 20, Page 7939, Line 15 etc. The authors sometimes describe the system they are studying, and the Sargasso sea, as 'Phosphorous-limited'. Although phosphorous is clearly severely depleted in both the Sargasso and the (Eastern) Mediterranean, the authors describe their system as 'not phosphate limited' on the basis of their own experiments see Line 17 Page 7938 (described more fully by Tanaka et al. 2011 who suggest the system is N or NP co-limited). I am not aware of any direct evidence that the Sargasso is any more 'limited'? Although this may seem pedantic, I personally would prefer a description of both the Sargasso and Mediterranean as phosphorous depleted.

Related to this, it is interesting that the authors only find evidence of a small decrease in SQDG:PG on P amendment in the most Eastern experiment (C), consistent with this experimental location being the only one to the east of the strongest gradient in SQDG:PG, Fig 4a. This can be interpreted as evidence of physiological response to P deficiency in situ in the absence of 'limitation' as diagnosed using direct experimentation. To me this suggests that the physiological changes in membrane composition are likely acting as (or contributing to) successful mechanisms for preventing the development of P limitation in a phosphorous depleted environment.

Additional minor points.

Page 7930, line 19. Presumably the range of IP-DAGs per cell will reflect in some way that there is a big change in cell sizes, this could be mentioned briefly.

Page 7936, Line 1. Could this be presented? E.g. a plot of the ratio of phospholipids/total IP-DAGs against phosphate? Or an additional panel in Fig. 2?

Figure 6. Would it be possible to include an additional set of panels showing the overall community response to nutrient manipulation? E.g. chlorophyll? I realise this data is in Tanaka et al. 2011, but it might help a reader to orientate.

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