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Interactive comment on "Rapid abiotic transformation of marine dissolved organic material to particulate organic material in surface and deep waters" *by* Paola Valdes Villaverde et al.

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Interactive comment on "Rapid abiotic transformation of marine dissolved organic material to particulate organic material in surface and deep waters" by Paola Valdes Villaverde et al. Anonymous Referee #2 Received and published: 20 September 2020 The paper by Villaverde et al. presents the results from testing the method for measuring particulate organic matter (POM) in seawater samples, focusing on artifacts associated with filtration. They discuss the implications of these measurements, emphasizing their relevance for conversion of dissolved organic matter to particulate by coagulation processes. The paper presents interesting new ideas that are worth publication, but

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the presentation needs to be improved. There is a lot of repetition of some of the ideas that can make reading this numbing.

GENERAL RESPONSE: The reviewers were understandably skeptical of the process of aggregation of dissolved organics promoted by hydraulic stress on the time scale of seconds. To answer doubts we recently did some additional experiments where we compare pre-filtered coastal surface water that was directly re-filtered as in the data reported in the original manuscript (non-stressed) or passed through a capillary (0.5mm ID) and then re-filtered (stressed). In the new Fig. 4 we show the difference between stressed and non-stressed POC and PON. We show that the difference between stressed minus non-stressed POC and PON are significantly higher than zero. It is difficult to compare quantitatively the hydraulic stress exposure of passing through a capillary or through a filter, but the time scales of exposure are similar. The GF/F filters of stressed and non-stressed samples will contain bacterial biomass, adsorbed organics and gels formed during the prefiltration, but the difference between both samples should be due to aggregated dissolved organics formed by passage through the capillary. See details of our simple and easily reproducible experiment in methods and results. As suggested we calculated a lower limit of detection for the POC and PON method and eliminate the data below this limit from figures and interpretation. One exception are the data were we compared the effect of sample acidification. We had included TEP data in the original manuscript submitted because we wanted to make a link to the abundant TEP literature. We eliminated the TEP data from the new manuscript because they did not present a pattern with statistical significance. We left some of TEP related discussion. Hopefully without the TEP data the new manuscript is more concise. The old Fig. 4 (POC and PON with refiltrations) was eliminated, because some of that information is reported in Fig. 5 and to make the manuscript more compact. As suggested by reviewers we changed the Fig. 5 to distinguish the patterns better even when printed in black and white. We added a figure 9 with a conceptual sketch.

SPECIFIC RESPONSE: Issues: Use of the expression “membrane enclosed particles (MEPs)” is a rather peculiar way to refer to non-TEP, non-gel particles, given that it is mixture of fecal pellets, diatom frustules, dead algae, dead animals, dust, ..., as well as bacteria and algal cells. Logan (Logan 1993 L&O 38: 372; Logan et al. 1994. L&O 39: 390) has made similar observations on the collection by glass fiber filters of organisms that are smaller than the ostensible pore sizes. He used classical filtration theory in his analysis. Similar processes should be occurring with the filtration of colloidal organic matter. That is, the actual mechanism for collection may not be the production of larger particles passing through the filters but be related to direct filtration processes on the colloid removal. It would be nice to see what fraction of the “dissolved” gels is removed by each pass through the filters. This would involve providing filtered volumes and DOM concentrations.

Response: Yes, it will be interesting to complete the budget by measuring TOC, POC and DOC, although it does not resolve the question of what is retained on the GF/F filters in the first and subsequent filtrations. Size selective filtration is difficult because of the aggregation of organics with each passing and the associated hydraulic stress. It is possible that a polycarbonate filter produces less hydraulic stress than a depth filter – we have not tried that. Our results leave the question of gel size formed unanswered but documents the principal of the process. In our manuscript we discuss the passage of bacteria through GF/F filters to show that in refiltered samples we have to expect some bacterial biomass. While this does explain partially the organics retained by a second filter, it does not explain that in deep samples the second filter can retain more organics than in the first filter.

Need to have clear separation between Methods, Results, and Interpretation (also known as Discussion) sections. For example, - - L172-174 and L185-190 belong in the Methods section. - - L231-236, L238-239, L248-258 all include comparisons of results with previous literature and belong in the Discussion section. The Interpretation/Discussion section needs to be condensed. Given the relatively few experimental

findings and small amount of data interpretation, having 7 pages for the discussion of a 15 page manuscript is a lot. Response: Since the old Fig. 4 was removed most of this former section 3.2. was eliminated. We did not succeed to reduce the discussion, but hopefully it is more concise.

Stylistic suggestions: 1. Use clear demarcation of new paragraphs. For example, indent the beginning of each paragraph or have a blank line between paragraphs. 2. Use different symbol shapes (+, x, o...) for different data sets rather than the same symbols and different colors. The colors are hard to differentiate, particularly for copies made on black and white printers. 3. Break the really long sentences into more than one. Reading technical papers is difficult enough without having to tease apart complicated sentence structures to understand the arguments. 4. Make the notation consistent throughout the manuscript. For example, L13 has POM2/POMi. Should this not be POM2/POM1? In L115-6, POM1, POC1 and PON1 should be italicized and the 1s should be subscripted. Place a space between the number and the unit when giving data (e.g. L13, 14, 26...). Response: Good suggestions to change the figures; please see the new figures. 'POM2/POMi' was an error now corrected. We tried to shorten the manuscript, but ended up with the same number of pages. We attended to the editorial notes of the reviewer in the attachment

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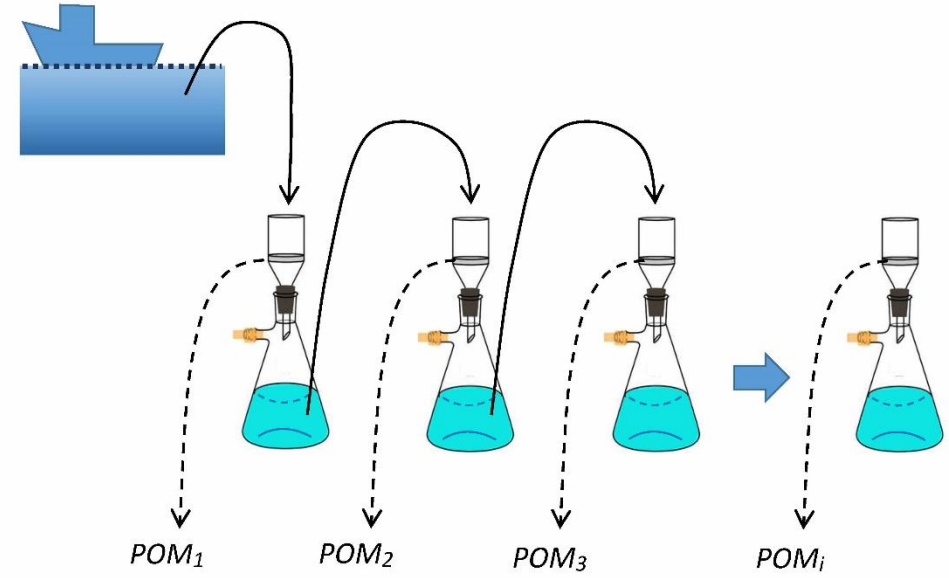

Figure 1. Sequential filtration of seawater samples; sample identifier is indicated.

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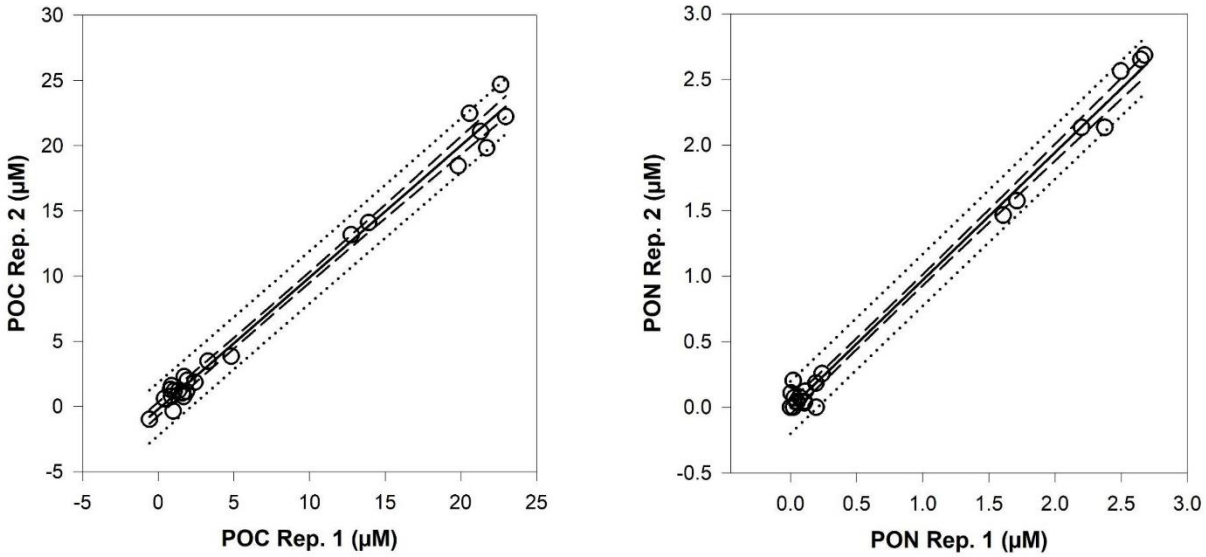

Figure 2. 24 replica pairs of POC and PON were tested for reproducibility of the method. Data pairs include in situ samples, cultures and refiltered samples. Multiple replicates were graphed with random x or y assignment. The 95% confidence interval of the type 2 regression (dashed lines) and the confidence interval of the population (dotted line) is indicated (SigmaPlot).

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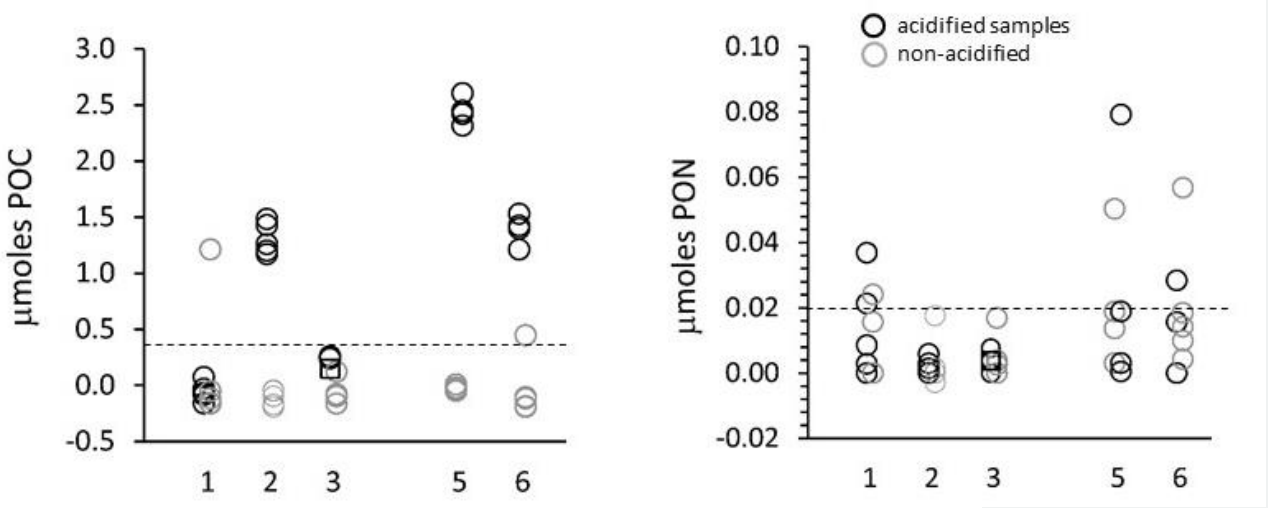

Figure 3. The effect of vapor acidification on POC and PON using precombusted GFF filters wetted with distilled water. Five experiments using five samples each for acid treatment and blanks. Fresh concentrated HCl was used except where noted. 1. The desiccator was cleaned with solvent; 2. Desiccator was cleaned with water and detergent; 3. Desiccator cleaned with solvent. The desiccator top was sealed with grease in 5 and 6. In experiment 3 one acid treated sample is marked as a square because we applied half of the concentration of two duplicates measured together. The dashed line indicates the lower limit of detection.

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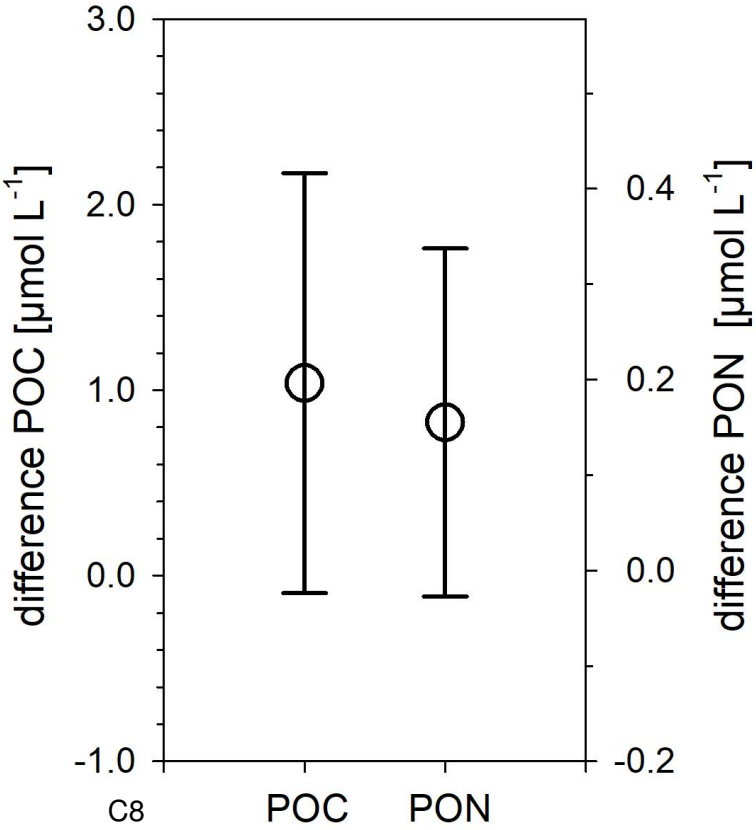

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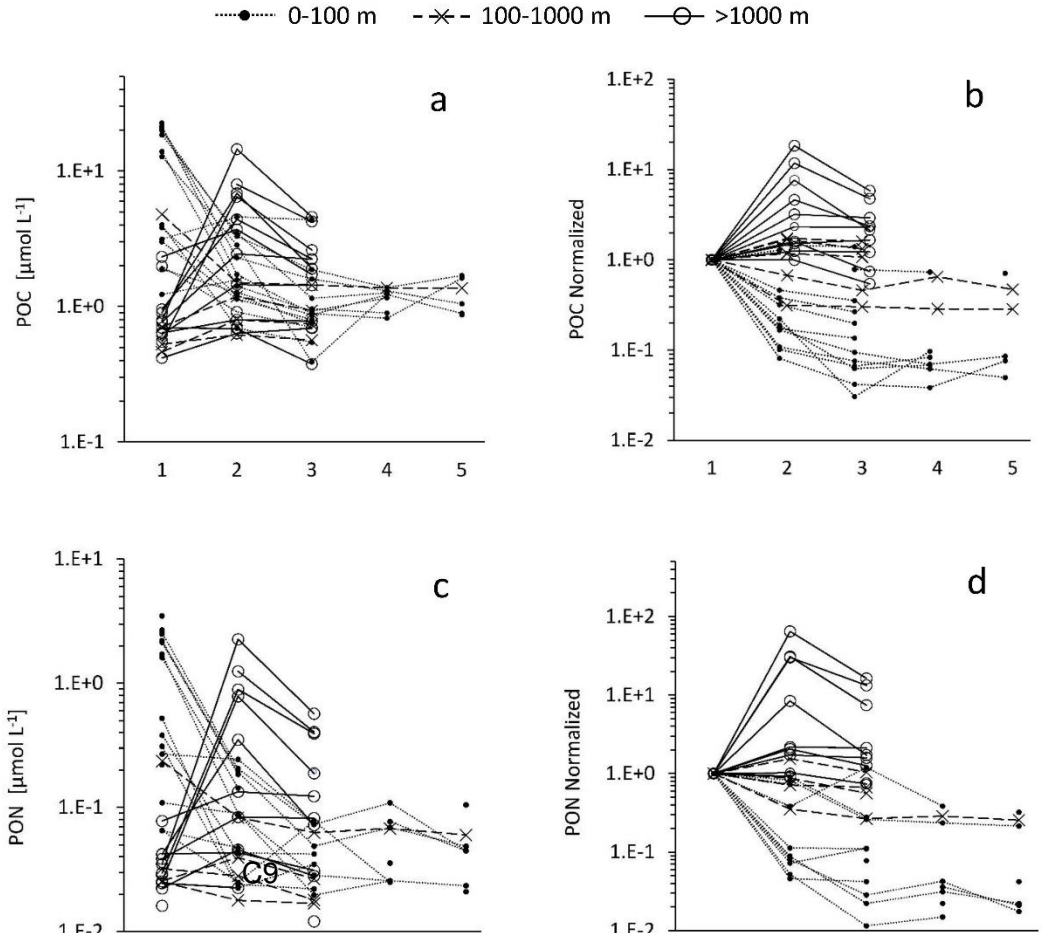

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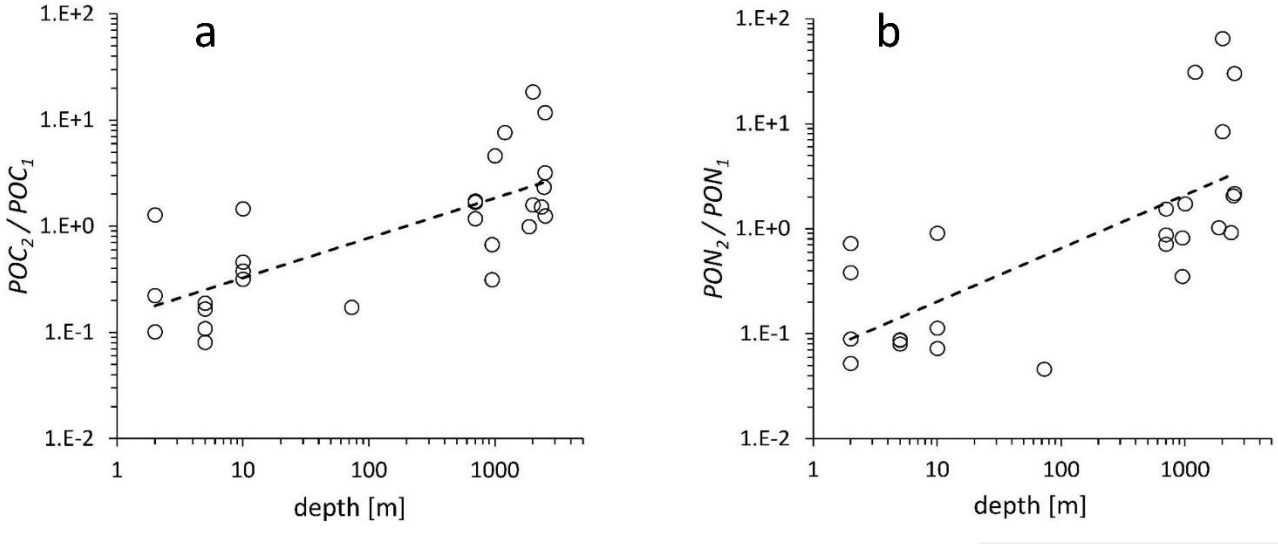

Figure 6. Log/log scale (POM2/POM1) ratio versus (depth). Both type 1 regressions are significant ($p<0.05$).

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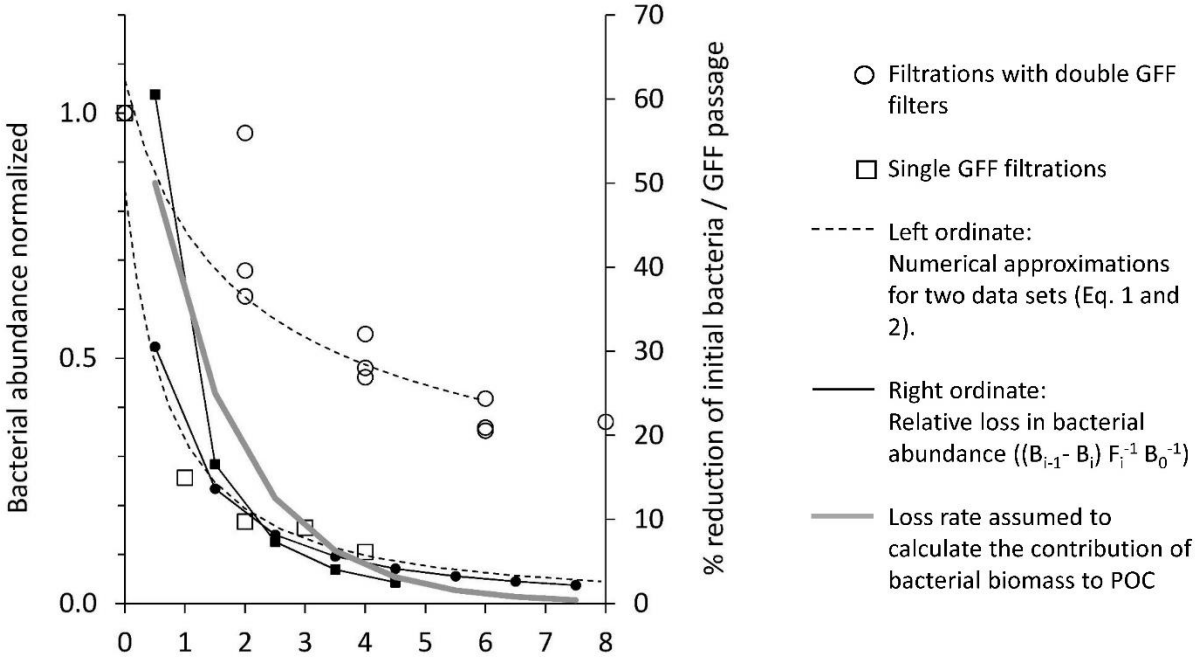

Figure 7. Bacterial abundance after filtration step *i* (B_i) normalized to prefiltration abundance (B_i/B_0) is indicated for filtrations with double GFF filters and single GFF filtrations. In this graph the abscissa numbers indicate the number of passage (F_i) through pre-combusted GFF filters before the bacterial abundance was sampled; i.e. position 0 shows the normalized bacterial abundance in the original sample, *i* = 2 indicates the relative abundance after passage

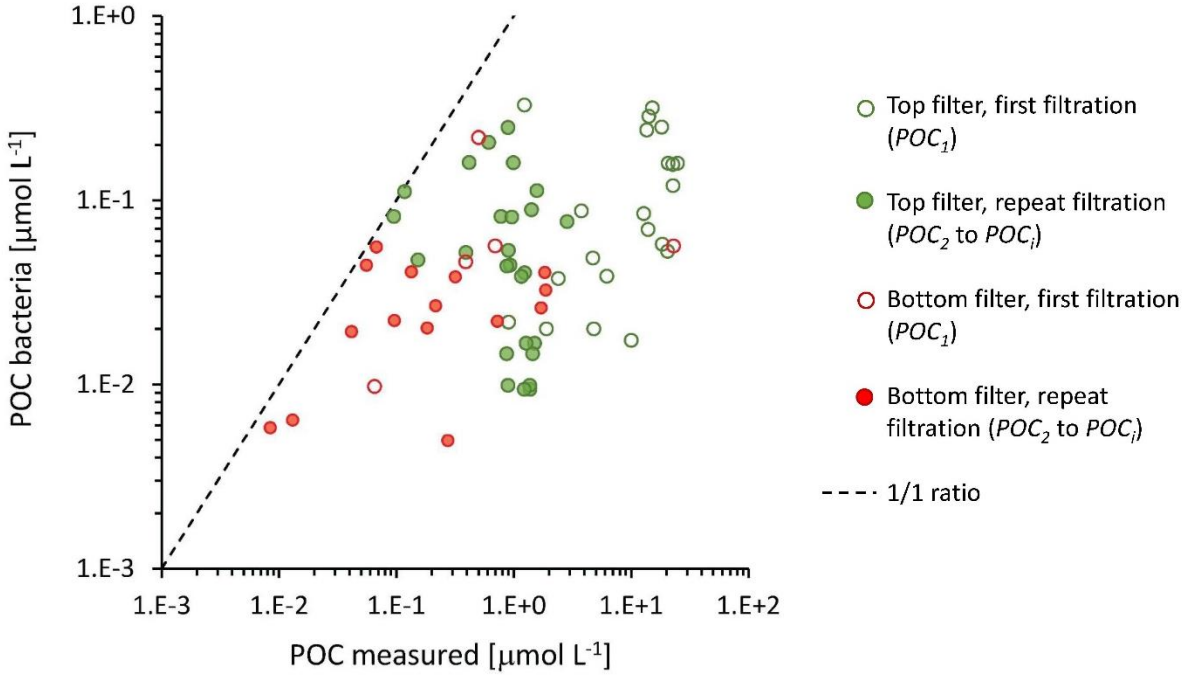

Figure 8. Measured POC versus the POC calculated to represent the bacterial biomass retained by the GFF filter. Bacterial POC was calculated from bacterial abundance of the sample and a retention efficiency of 50% per GFF passage.

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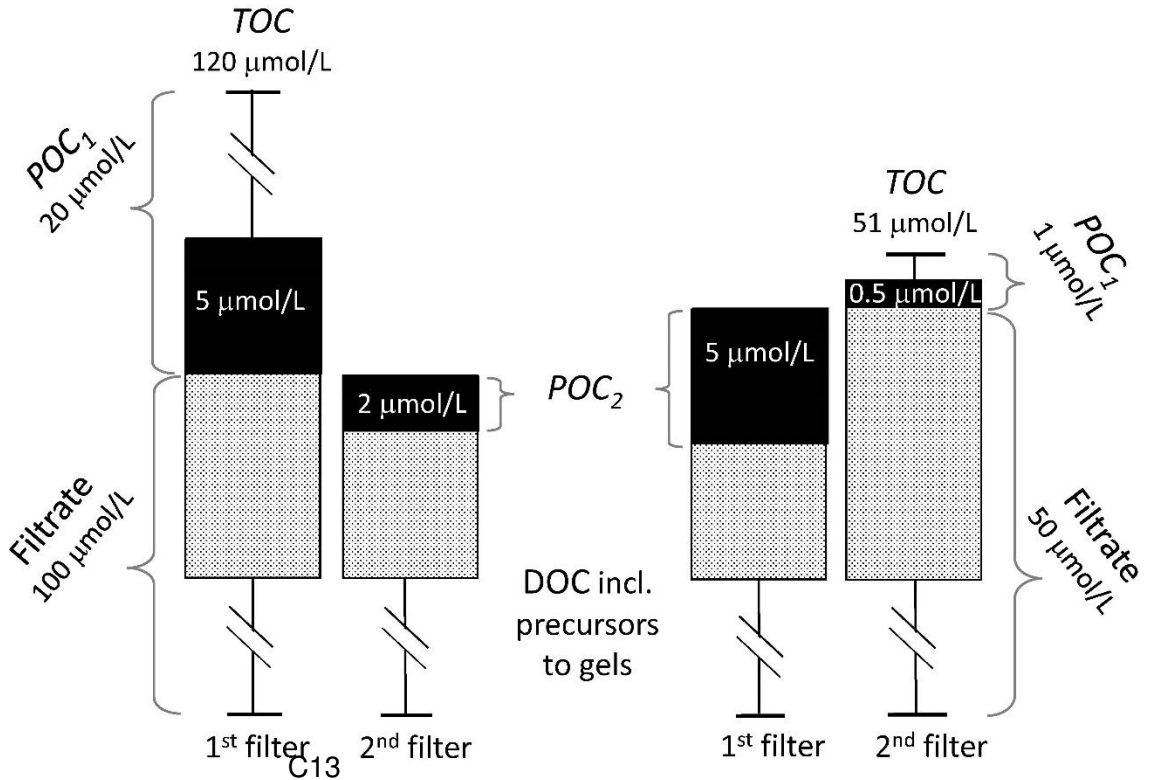

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