Biogeosciences Discuss.,
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Biogeosciences Discussions
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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.

Paola Valdes Villaverde et al.

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Anonymous Referee #3 Received and published: 21 September 2020 This study presented a phenomenon of POM formation in filtered DOM filtrates. Dynamic exchanges between DOM and POM are well-known and can be caused by an array of physical, chemical, and biological factors, including sunlight, pH, cations, phytoplankton, hydrodynamics, etc. It's also related to concentration, composition, and size of DOM and POM. It's an interesting but complicated topic. However, it's unclear in this study what're the detailed organic matter composition and operation conditions of filtration. According to the description in "Methods" section, it seemed that the filtration proce-

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dures have been partly done onboard. Photo-flocculation can occur but the sunlight doses onboard and in the lab are supposed to different. Moreover, why did the authors use distilled water instead of ultrapure MQ-H2O during the experiments? Distilled water itself may contain some amount of organic matter. In addition, the authors need to take into account of adsorption and subsequent desorption of retained colloidal DOM. Also, using a second filter to estimate filtration blank is problematic. Below are some specific comments: Throughout the manuscript: 1)add a space between number and unit; 2) change GFF filters to GF/F; 3) subscript numbering of filtration times; 4) pay attention to the punctuation and grammars.

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

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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: Line 19 change "Organic particulate matter (POM)" to "Particulate organic matter" Response: Changed

Lines 86-88 This sentence is obscure and need to be re-phrased. Response: The sentence was changed according to some specific suggestions by another reviewer: 'Hydrogels have different physical and chemical properties than MEPs for example, gels are less rigid because they are not contained by membranes or solid material, they are porous, containing large volume portions of water and thus have a specific weight similar to water making them less prone to sink, and sometimes they can float (Mari et al., 2017).'

Lines 101-102 This is speculative. Or please provide reference. Response: In the sentence the word 'show' was changed to 'suggest' : 'Below our data suggest the formation of significant amounts of organic aggregates or micro-gels in filtrates on timescales that are too short for biological production thus suggesting abiotic precursor aggregation.' Hopefully the data from the capillary experiments convince the reviewer

Lines 109-112 Algal cultures are prone to form aggregates within a period of time. Please take this into account. Response: We only used these cultures as producers of EPS, we did not try to relate the physiological condition of the culture to EPS production.

Lines 114 and 122 Correct the degree symbol Response: Corrected

Line 137 "reproducibility o deep...", do you mean "reproducibility of deep..." Response:

Corrected

Line 157 0.45 mm or 0.45 um? Response: Yes, this was an error. It was eliminated together with the other parts related to TEPs

Lines 157-158 What are the grades and brands of these chemicals Response: The TEP part was eliminated

Line 162 Superscript "-1" in the unit Response: Corrected

Line 311 Change "4.1.3" to "4.1.2" and also the following subsection numbers Response: Corrected

Figure 3 "precombusted" or "pre-combusted"? Please be consistent through the manuscript Response: Corrected

Figure 7 missing unit for the filter pore size Response: Figure 7 was eliminated because it showed TEP data

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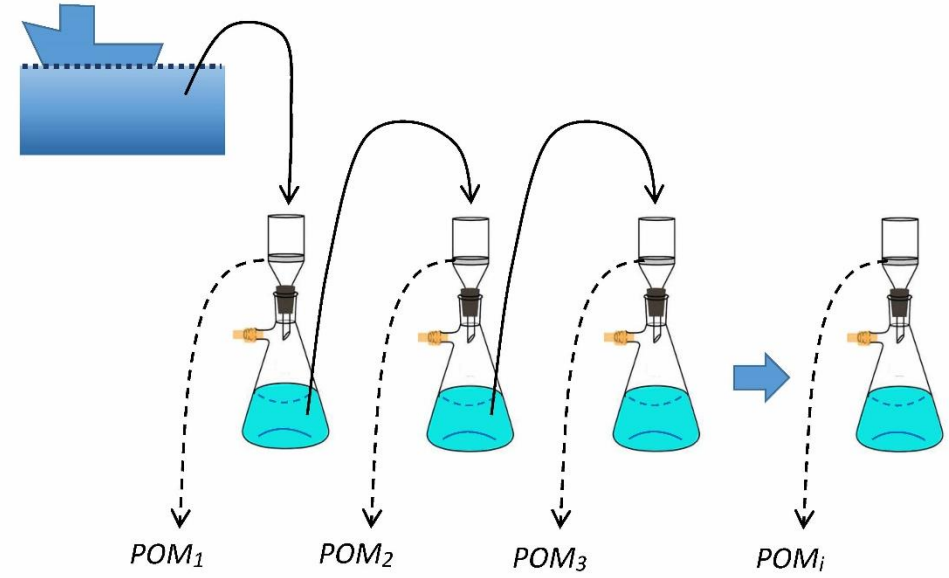

Figure 1. Sequential filtration of seawater samples; sample identifier is indicated.

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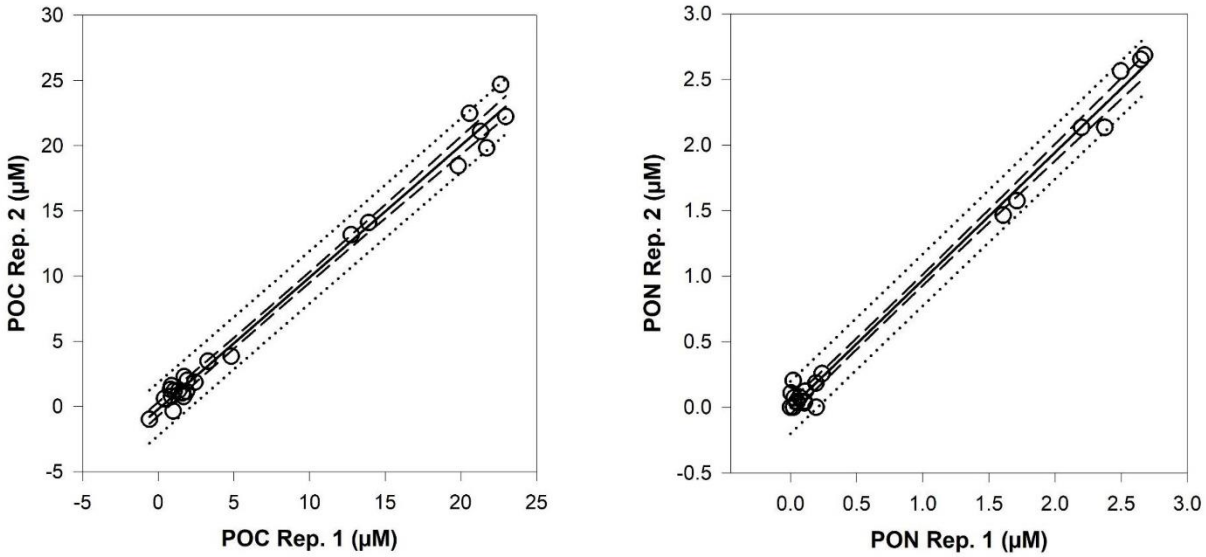

Figure 2. 24 replica pairs of POC and PON were tested for reproducibility of the method. Data pairs include in situ samples, cultures and refiltered samples. Multiple replicates were graphed with random x or y assignment. The 95% confidence interval of the type 2 regression (dashed lines) and the confidence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

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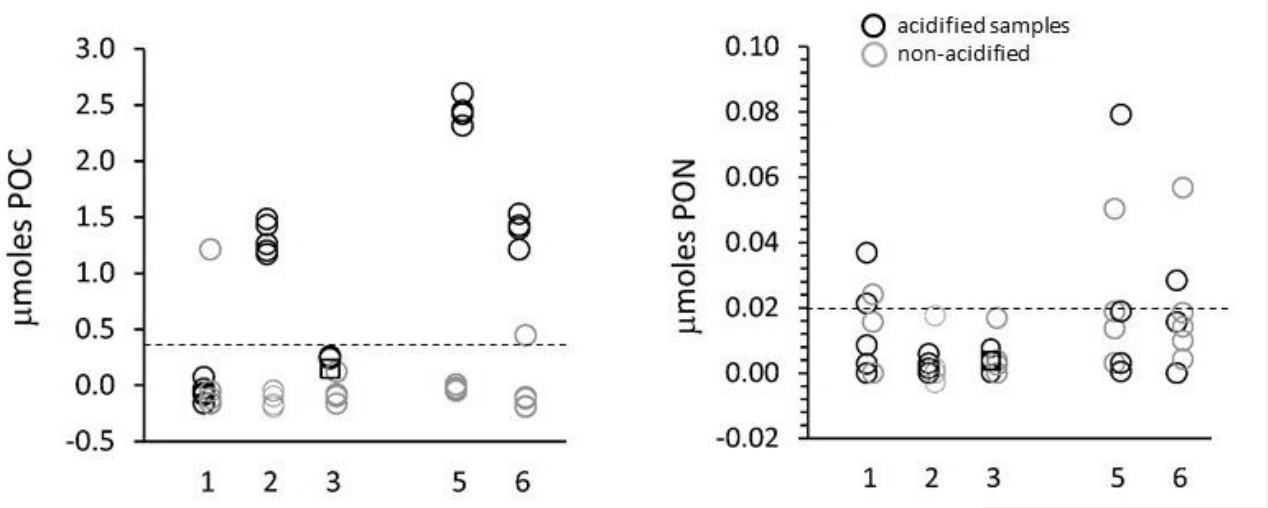

Figure 3. The effect of vapor acidification on POC and PON using precombusted GFF filters wetted with distilled water. Five experiments using five samples each for acid treatment and blanks. Fresh concentrated HCl was used except where noted. 1. The desiccator was cleaned with solvent; 2. Desiccator 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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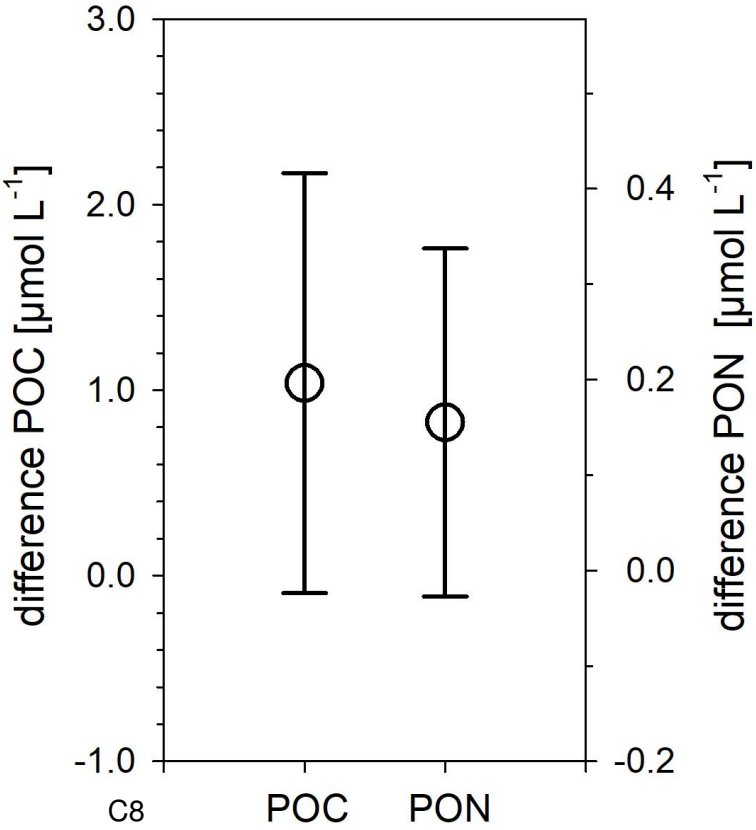

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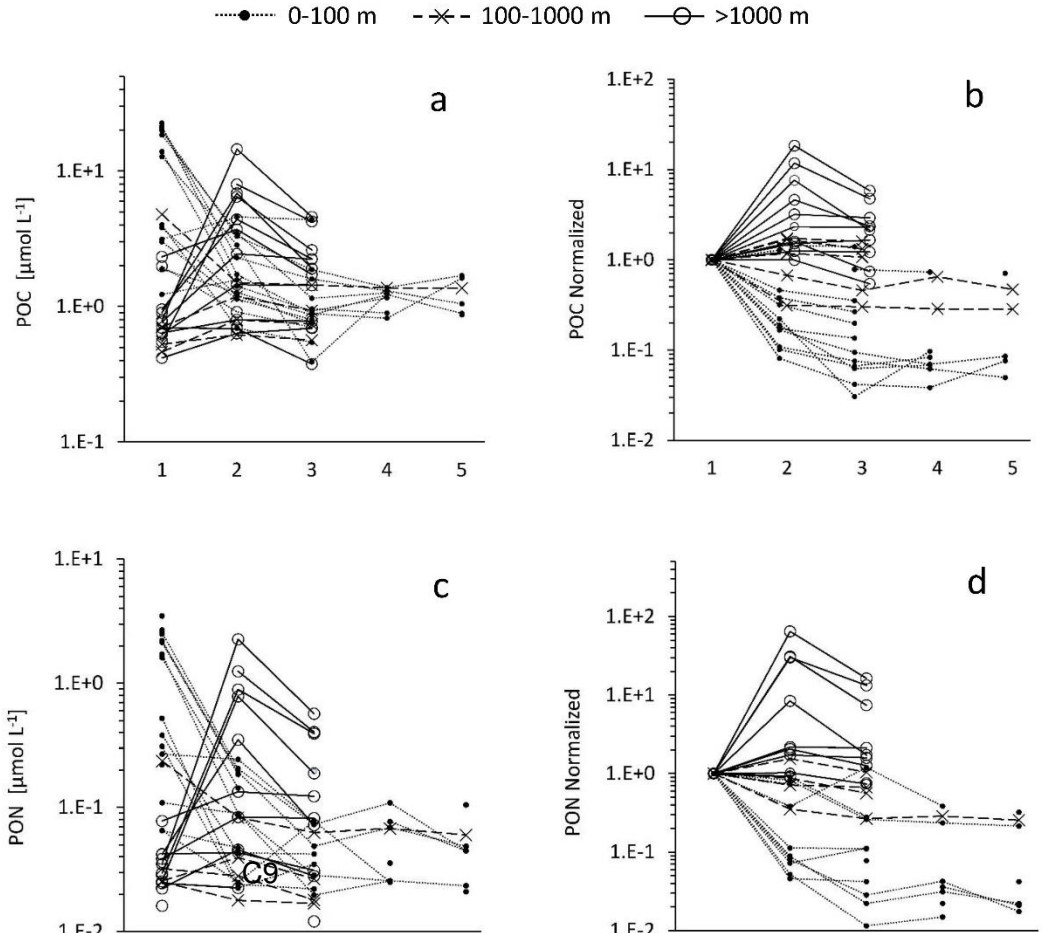

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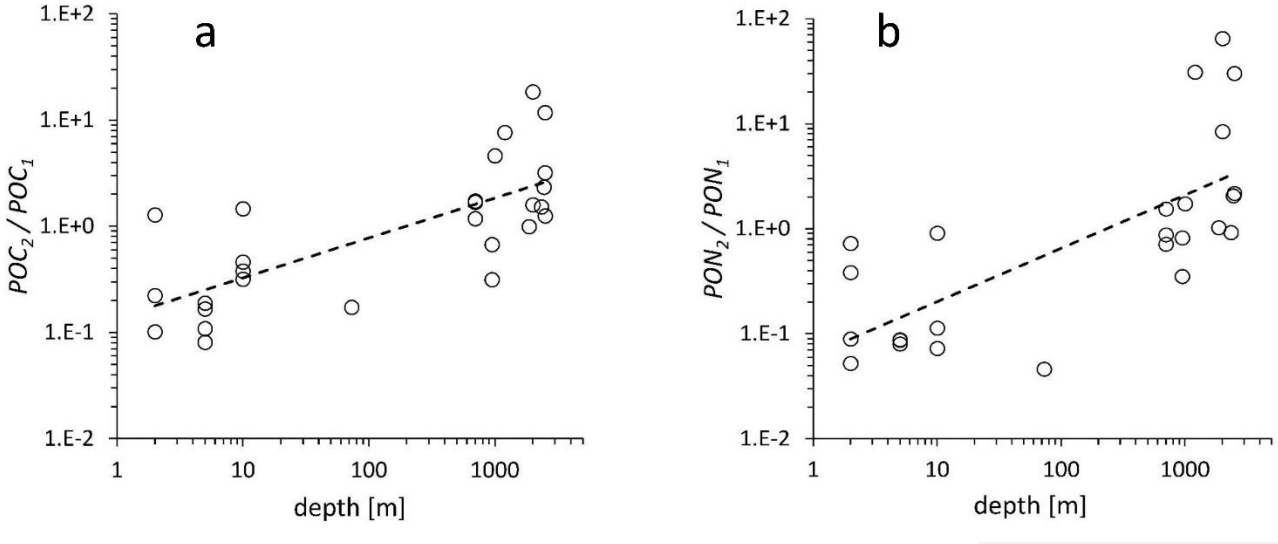

Figure 6. Log/log scale (POM2/POM1) ratio versus (depth). Both type 1 regressions are significant ($p<0.05$).

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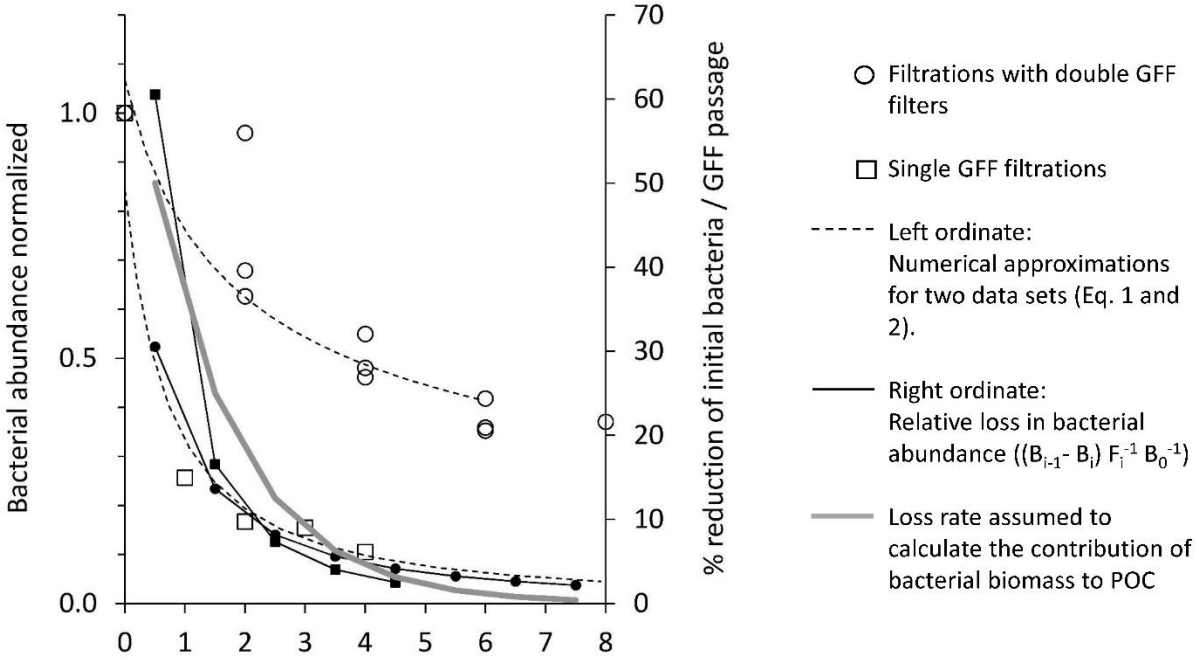

Figure 7. Bacterial abundance after filtration step *i* (B_i) normalized to prefiltration abundance (B_i/B_0) is indicated for filtrations with double GFF filters and single GFF filtrations. In this graph the abscissa numbers indicate the number of passage (F_i) through pre-combusted GFF filters before 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

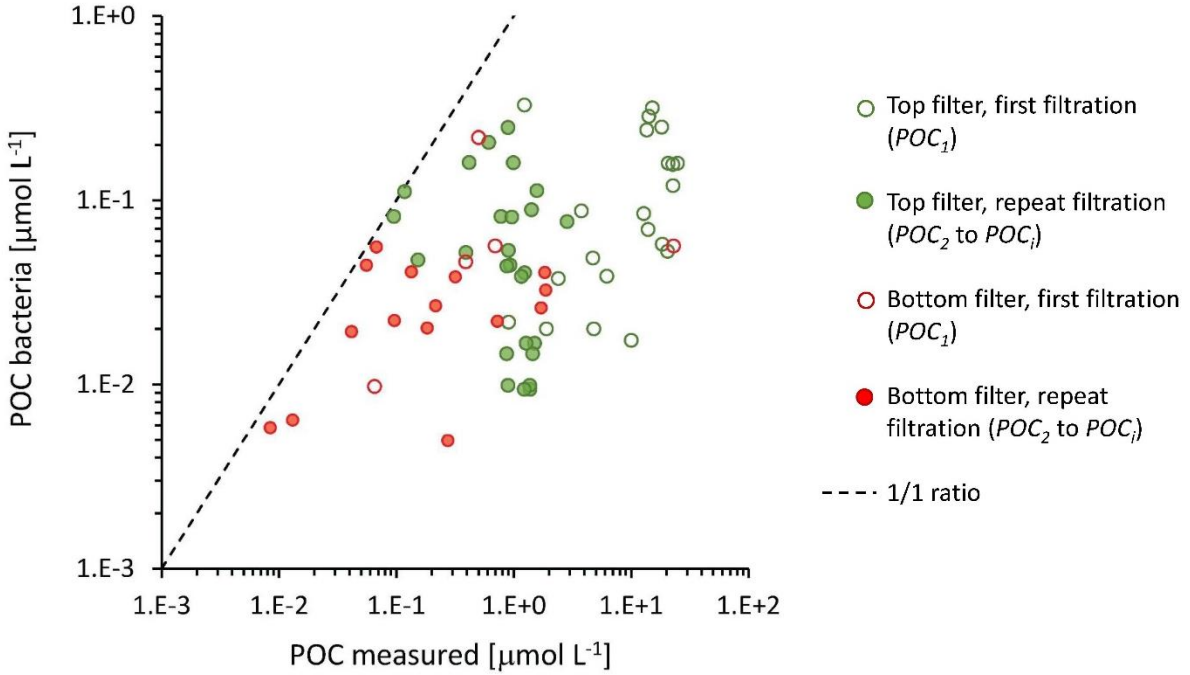

Figure 8. Measured POC versus the POC calculated to represent the bacterial biomass retained by the GFF filter. Bacterial POC was calculated from bacterial abundance of the sample and a retention efficiency of 50% per GFF passage.

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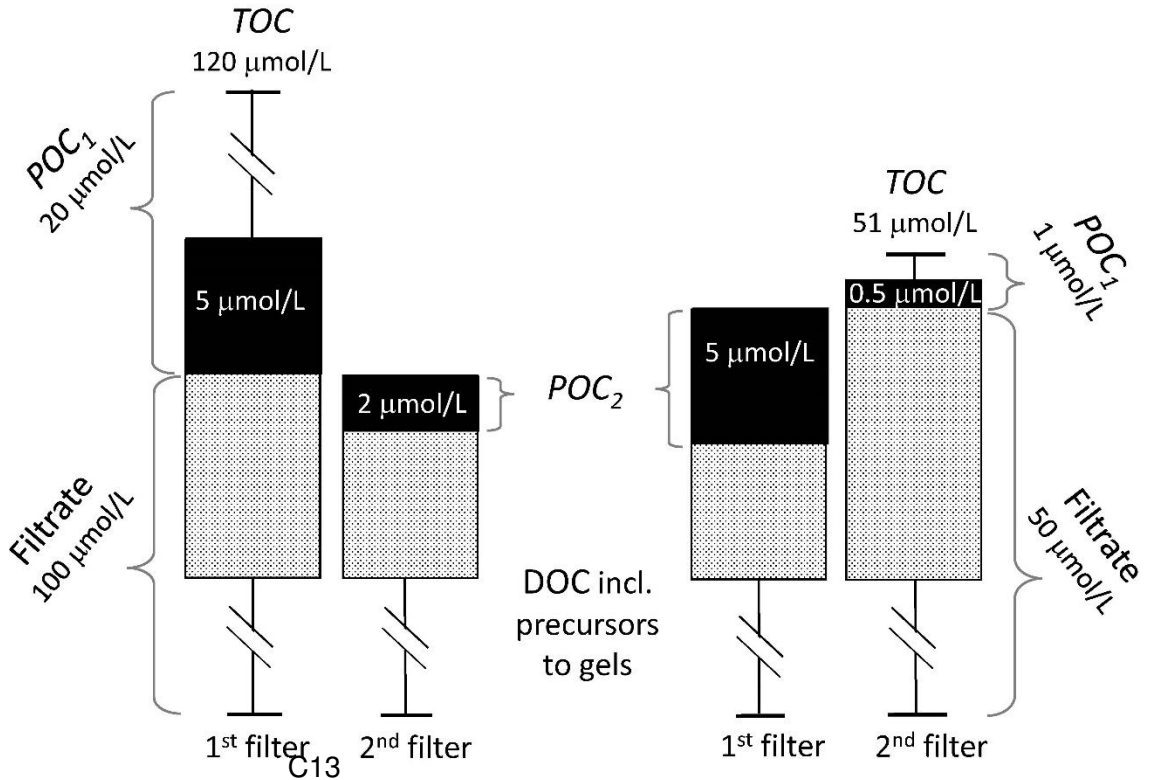

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