Supplementary Material to: Dynamics of the bacterial community associated with *Phaeodactylum tricornutum* cultures

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3 Speculations on the higher diatom biomass in minimal media

In the experiments we observed a higher cell count for the diatom in minimal media than in complete media. Since the parameter values cannot directly be interpreted biologically, we use the model simulations to speculate on a possible reason.

Abbreviations used in the following: CM (complete media); MM (minimal media); D (diatom); A (alteromonas); P (pseudomonas); PA (pseudoalteromonas); F (flavobacterium); $\mathcal{P}_{CM}$ (parameter set for CM conditions as in manuscript); $\mathcal{P}_{MM}$ (parameter set for MM conditions as in manuscript).

3.1 Metabolite dynamics

What we infer from our putative network of interactions and the relative abundance data is that Alteromonadaceae plays a role in supporting the diatom growth in minimal media. From the simulation results, comparing complete and minimal media metabolite dynamics (Figure 7(b) and 7(d) respectively) we observe that in minimal media the bio-available iron levels are maintained constant (and Alteromonadaceae is the only "producer" in the model). The concentration value is however in general lower than the value at which, in complete media, the diatom enters the decay phase. This is because the diatom growth follows the Equation:

$$\gamma^D = v_\gamma^D \cdot \frac{\mathrm{Vit}}{\mathrm{Vit} + K_{\mathrm{Vit}}^D} \frac{\mathrm{Fe}}{\mathrm{Fe} + K_{\mathrm{Fe}}^D} (1 - \frac{D}{CC^D})$$

and K_{Fe}^D, quantifying the "sensitivity" of the diatom growth to iron levels, is significantly lower in the minimal media parameter set than in the complete media parameter set (Table S12). This is consistent with the general observation that some organisms can enter a "saving" metabolic state in (micro)nutrient scarce environments (*e.g.* Ponomarova and Patil, 2015). If we run the simulation now boosting both iron and vitamin initial levels we obtain the results in Figure S8, showing that now the diatom reaches a higher cell count in complete media. This comes from the fact that the fitted CC^D parameter value is higher in the complete media parameter set.

	$\mathcal{P}_{CM}$	$\mathcal{P}_{MM}$
K_{Fe}^D	0.488680	0.02979
K_{Vit}^D	0.844900	0.46274
CC^D	1.875200	1.57897
$v_{\mathrm{Fe}}^{\mathrm{cons(D)}}$	0.665740	0.31684
$v_{\mathrm{Vit}}^{\mathrm{cons(D)}}$	0.367880	1.78450
v_γ^D	0.194310	0.52737

Table S12: Subset of diatom parameters.

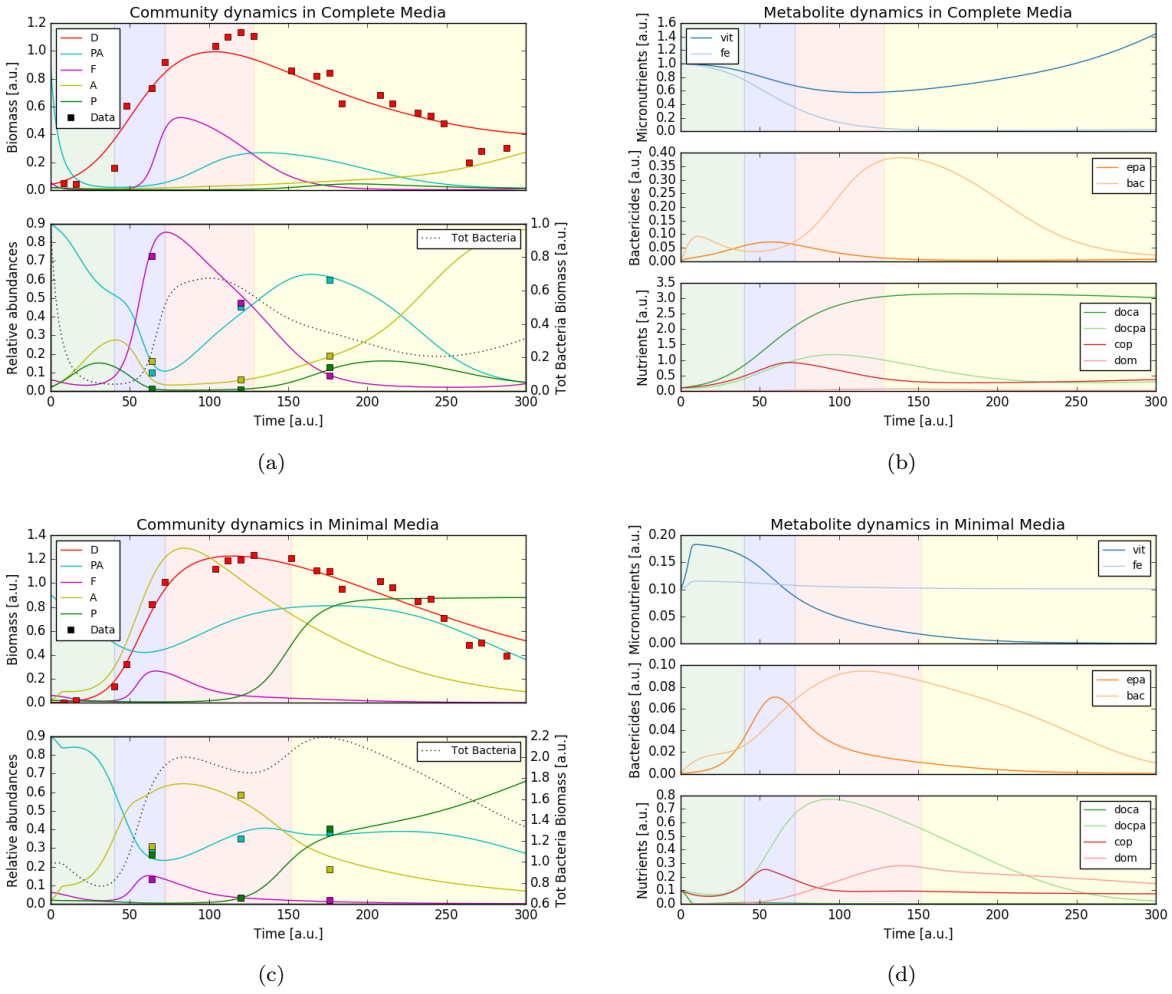

Figure S7: Simulation in standard complete (top) and minimal (bottom) media conditions and parameter sets.

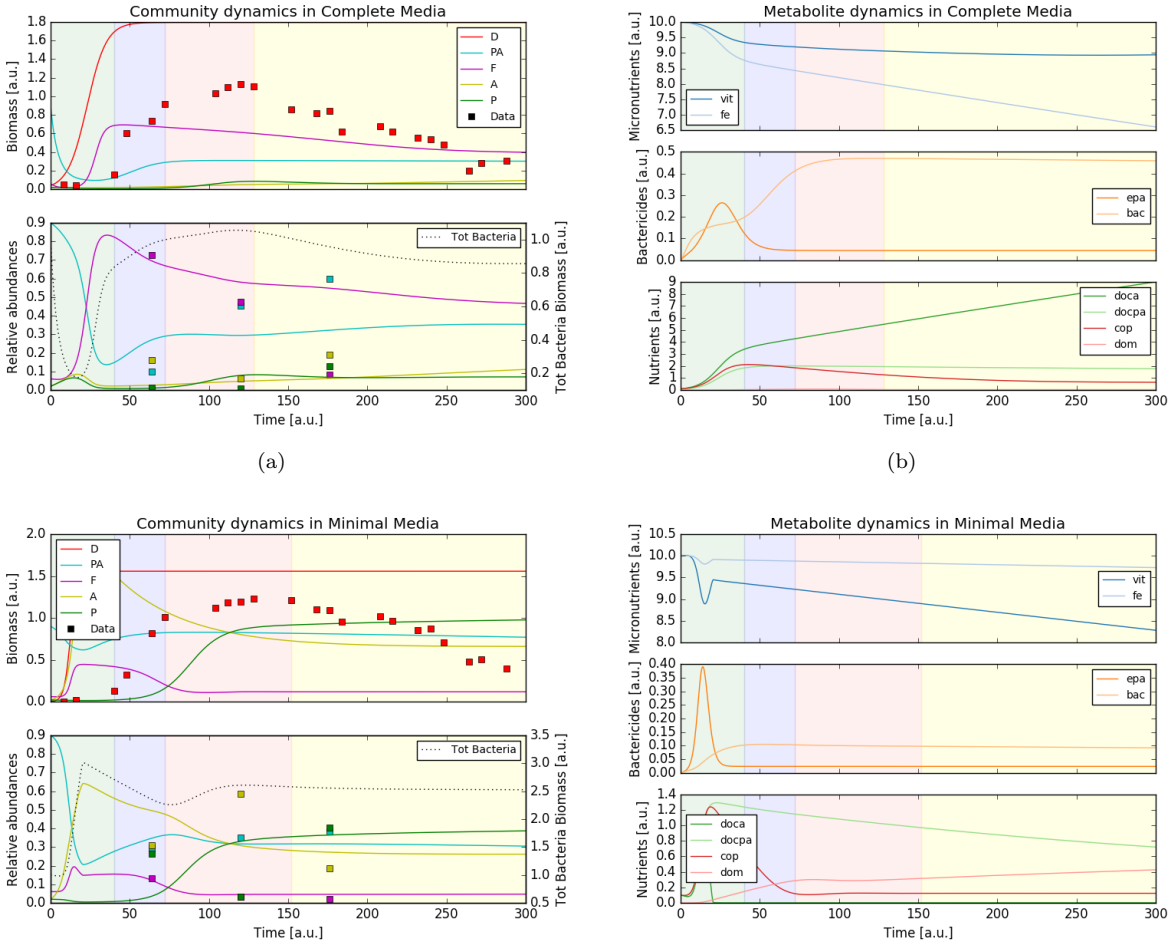

Figure S8: Simulations run with complete (top) and minimal (bottom) media conditions and parameter sets, but with high initial vitamin and iron levels.