Authors response

Dear editor,

First, we would like to thank you for raising these two concerns. We hope that the modifications provided below will clarify them. Also, we would like to thank again the referee #1 and #2 for their careful evaluation of our manuscript and revised manuscript, and their suggestions which allowed us to improve it.

First, regarding a potential control simulation without mixotrophs, was something like this performed using the model? The experiment list in Table 3 would suggest not, and I've not been able to see anything like this. If you have performed such an experiment – even if it is confined to supplementary material – please note this in the manuscript. If you have not performed such an experiment, could you please confirm why not and add a note in the manuscript. Alternatively, if such a thing is easy to do, it might be worth performing such an experiment. However, I fully appreciate that while attractive and ostensibly simple to undertake with a model, the reality can be that too many changes are needed to perform such a control.

We performed such simulations as sensitivity analyses during the development phase of the model and during the discussion phase. In addition to the configuration with mixotrophs, we also implemented two configurations without mixotrophs: a first one in which mixotrophs and their associated biogeochemical processes are simply deleted (D configuration) and a second one in which we replaced mixotrophs by organisms with strict diets (heterotroph and autotroph) (R configuration). Both configurations considered the same forcings as the typical simulation (Table 5).

We add these experiments to the Section 2.4.2 (l.323):

[In these conditions, we also performed two simulations without mixotrophs as control simulations. These simulations correspond to two configurations of Eco3M_MIX-CarbOx without mixotrophs: a first one in which mixotrophs and their associated biogeochemical processes are simply deleted (D configuration in Table 5) and a second one in which we replaced mixotrophs by organisms with strict diets (R configuration in Table 5). These configurations and their results are presented in the supplementary material.]

and Table 5:

Table 5: Summary of simulations properties. Configurations without mixotrophs are detailed in the supplementary material.

Simulation name	Mixotrophs	[DIN]	[DIP]	Irradiance
D configuration	Absent	SOLEMIO interpolation	SOLEMIO interpolation	WRF
R configuration	Absent	SOLEMIO interpolation	SOLEMIO interpolation	WRF
Typical	Present	SOLEMIO interpolation	SOLEMIO interpolation	WRF
Nutrient limited	Present	7.5×10^{-3} mmolN m^{-3}	4.5×10^{-4} mmolP m^{-3}	WRF $\times$ 2
Light limited	Present	1.5 mmolN m^{-3}	0.09 mmolN m^{-3}	WRF $\times$ 0.05

As suggested, we detailed these configurations (conceptual model, balance equations and modifications from the configuration with mixotrophs) and provided the simulations results (ecosystem composition in carbon biomass, dynamics of modelled organisms in carbon biomass for the three simulated years (2017 repeated three times), total chlorophyll, percentage of each prey in total copepod grazing, predation on copepods by higher trophic levels, and total photosynthesis and respiration fluxes) in the supplementary material which is attached in this file upload.

Second, I would agree concerning the complexity of Figure 5. Would it be possible to expand the caption to make its content more self-explanatory? For instance, stating that the experiments shown represent hypothesis testing / sensitivity analysis of mixotroph formulation might be helpful. It's also

unclear why some experiments are illustrated through grazing while others show photosynthesis. And while Figure 5 has a NCMP4 panel, there's no corresponding entry in Table 2.

We considered your suggestion and modified the caption of Figure 5:

[Figure 5: Assessing mixotrophs dynamics in the model: (a-d) NCM and (e-f) CM properties (cf., Table 2). Plotted values represent daily averages of grazing and photosynthesis fluxes.]

to:

[Figure 5: Assessment of mixotrophs representation in the model. Each frame represents the test of a property stated by Stoecker (1998) for NCM Type IIIB: grazing is independent of (a) DIM concentration (NCMP1), (c) irradiance (NCMP3), and photosynthesis (b) is independent of DIM concentration (NCMP2), (d) increases with food concentration (NCMP4) ; and CM Type IIA: photosynthesis increases with (e) food concentration (CMP1), (f) DIM concentration (CMP2), and grazing (g) decreases when DIM concentration increases (CMP3), (h) increases with irradiance (CMP4). Properties are detailed in Table 2 and associated simulations are detailed in Tables 3 and 4. Plotted values represent daily averaged grazing and photosynthesis. DIM: dissolved inorganic matter (sum of dissolved inorganic nitrogen and dissolved inorganic phosphorus).]

We hope that this modification will provide a better understanding of figure 5.

Thank you again for your comments, we hope that the above modifications will clarify these points. We remain at your disposal for any further information,

Sincerely,

Lucille Barré, on behalf of all co-authors.