

A preliminary analysis of the role of mixotrophs in plankton dynamics *different sizes of*



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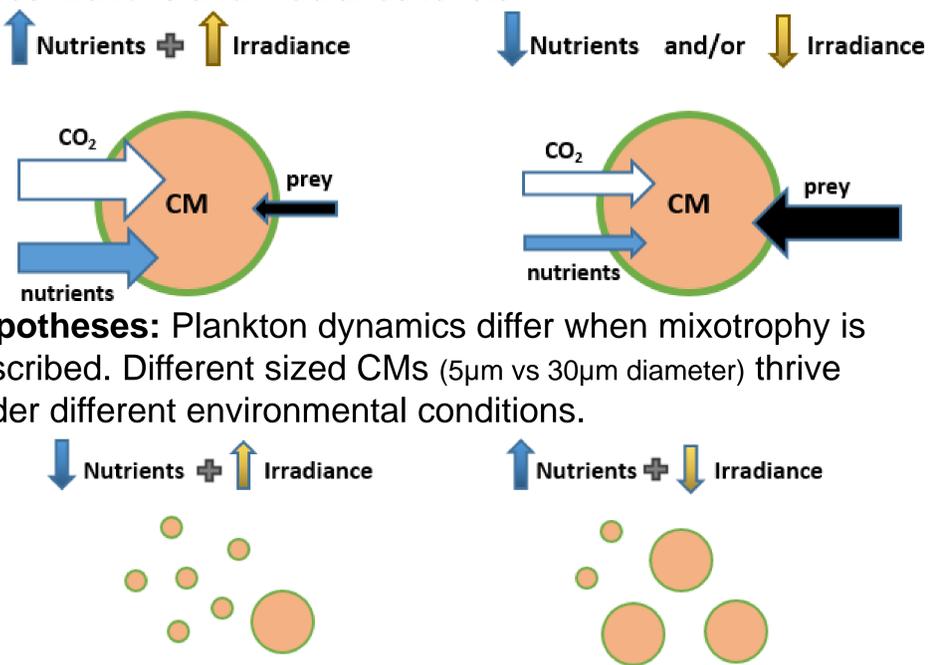
BACKGROUND AND AIM

Mixotrophy is usually neglected in plankton studies despite increasing evidence that most protist “phytoplankton”, including HABs, are mixotrophs that can act as major grazers within the lower trophic levels of marine food-webs.

- **Aim:** To investigate the influence that **constitutive mixotrophs (CMs)**^[1] with different allometries have upon plankton food-web dynamics.
- **CMs:** conform to “plants that eat”; they possess their own photosystems, take up inorganic nutrients, and also feed.

HYPOTHESES

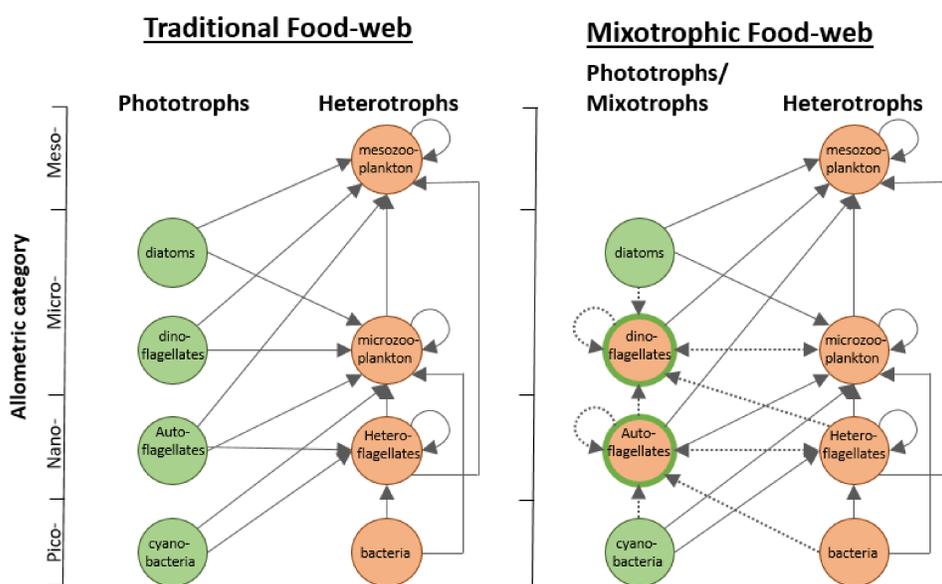
CMs balance heterotrophic growth (feeding) and autotrophic growth (photosynthesis) under varying prey fields, nutrient concentrations and irradiance levels.



Hypotheses: Plankton dynamics differ when mixotrophy is described. Different sized CMs (5µm vs 30µm diameter) thrive under different environmental conditions.

METHODS

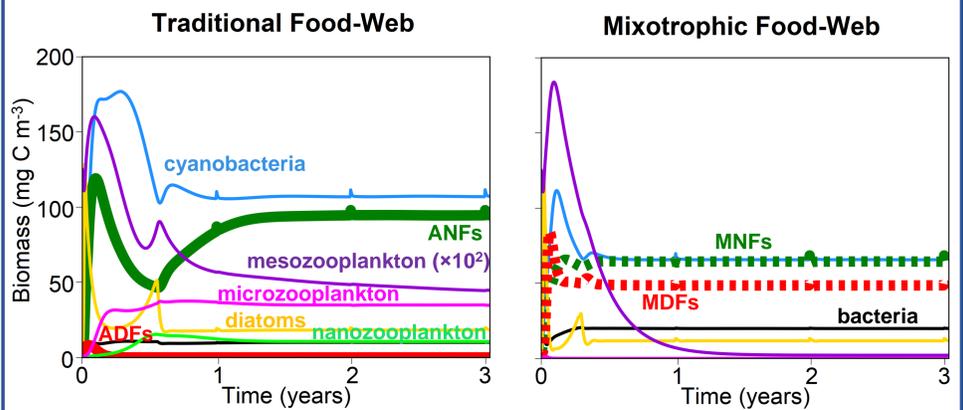
- Simulations of plankton dynamics in a theoretical 0D mixed layer model comparing two food-web configurations:



- **Traditional food-web:** phototrophy (green), heterotrophy (orange). Mixotrophy is not described.
- **Mixotrophic food-web:** realigned food-web with explicit inclusion of CMs (green outline and orange fill).
- **Model:** 0D ERSEM ^[2], but all protist plankton replaced by a common base model (modified from ^[3]), with different parameterizations for each functional group.
- **Simulation scenarios:** Light (PFD) + inorganic nitrogen (N) replete; PFD deplete; N deplete; PFD + N deplete.

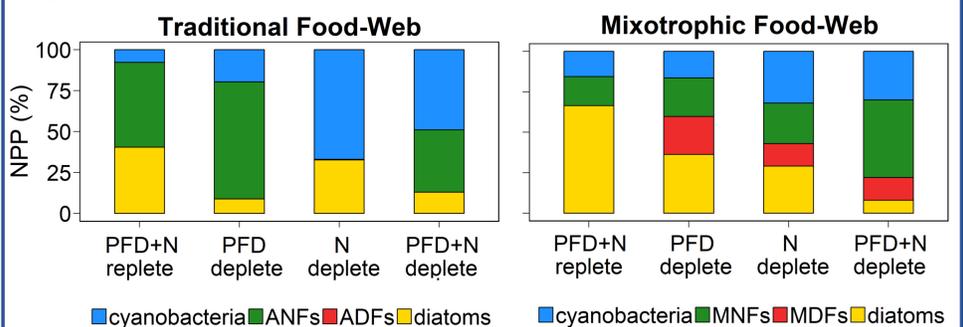
TRADITIONAL VS MIXOTROPHIC FOOD-WEBS

- **Plankton succession** and **biomass** progressions differ between the traditional and mixotrophic food-webs (*results below for the PFD+N deplete scenario*) ...

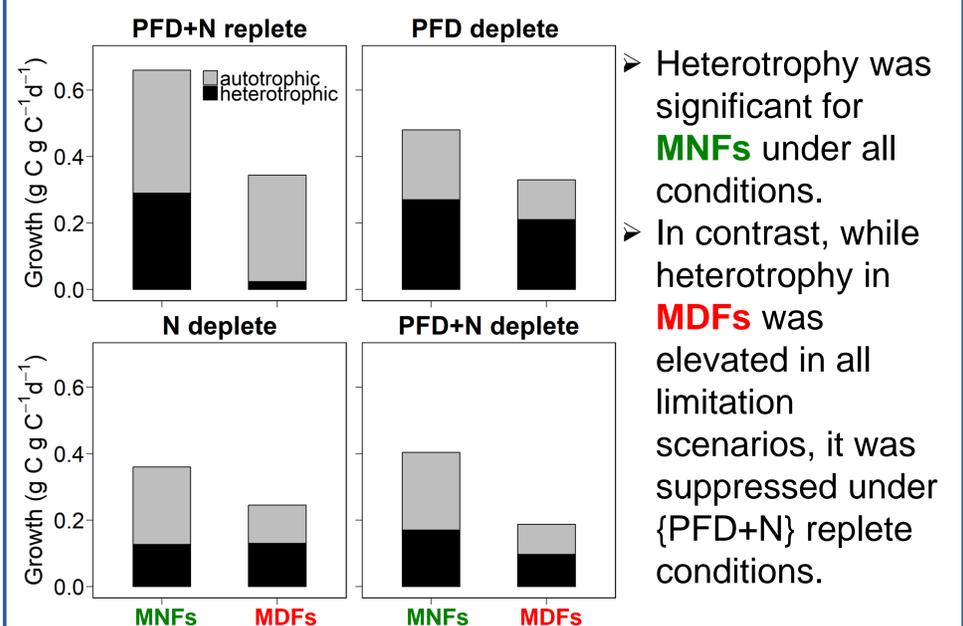


5µm ANFs & MNFs: Autotrophic & Mixotrophic NanoFlagellates, respectively
30µm ADFs & MDFs: Autotrophic & Mixotrophic DinoFlagellates, respectively

- ... as well as differences in the contribution of plankton groups to the total **net primary productivity (NPP)**:



DIFFERENCES BETWEEN CMs



- The biomass of **MDFs** increased with light limitation while the opposite was observed for **MNFs**. Under N deplete conditions, biomass values were similar among CM groups. Prey type & availability plays an important role in the success of different CMs.

TAKE-HOME MESSAGES

- **The activity of protists that are in reality CMs is misrepresented in traditional food-webs.**
- **CMs of different types & sizes have different dynamics.**

^[1] Mitra A et al. (2016) *Protist*, **167**, 106-120

^[2] Butenschön M et al. (2016) *Geosci Model Dev*, **9**, 1293-1339

^[3] Flynn KJ, Mitra A. (2009) *J Plankton Res*, **31**, 965-992