

Outline

April 15, 2020

Introduction

- Classical paragraph on plant biodiversity / the phytoplankton paradox
- Importance of the seedling/juvenile stage to explain terrestrial plant biodiversity (definition of some of the mechanisms that can sustain biodiversity)
- Low occurrence of the seed stage in phytoplankton models (defined as cyst later on), even though they do exist in the field.
- Presentation of the observed exchanges that happens between seed bank/ocean/coast, the three compartments that we model here
- Outline of the model (with details on what features of which model we take from whom) and the main hypotheses on the effect of the seed bank (maintenance of biodiversity and production in harsher conditions + effect of exchanges and seed bank on the ocean richness)

Methods

Models

- global presentation of state variables and parameters (Table 1¹), as well as the two main steps in the model (growth; exchanges between compartments)
- focus on the growth rate and the alterations that were made on the Scranton & Vasseur model (only the fact that b_i will be varied; and that Bissinger will be used instead of Eppley. Details will be given in SI)
- Variations
 - Classical BH model: Type I functional response, with a threshold
 - Saturating interaction model (type II functional response)
 - Model with delay (could be related to virus- or copepod- exploitation)
 - * interactions are all due to exploitation with a) specialists (intraspecific coefficient is the only one affected) and b) generalists (all coefficients are affected)
 - * interactions are linked with other phenomena, exploiters affect the loss rate

Parameters from the literature²

In two sentences each, define parameters that are not already described

- loss rate
- sinking rate
- exchange rate

¹Do we indicate in the table which parameter will be calibrated, which parameter will be assessed, which parameter will be used in the scenario

²Will need to find better titles

- cyst mortality and burial
- germination/resuspension

Parameter fit to dataset

Data set

Usual presentation of a REPHY dataset (no detail on monitoring, just basic information on the location and species)

Field-based niche estimates³

Definition of generalist vs specialist, definition of the way we infer which species is what in our dataset, and their thermal optima.

Calibration and model variability

- Definition of diagnostics
- Calibration of interactions
- Analyses of the effect of other parameter variations, defining parameter space
 - sinking rate $\{0.1; 0.3; 0.5\}\beta(0.55, 1.25)$
 - cyst mortality and burial $\approx 10^{-4}/10^{-5} + 0.01; 0.1; 0.3$
 - germination/resuspension $0.1; 0.01; 0.001 * 10^{-5}, 0.1$

Scenarios

1. Effect of seed bank (with seedbank, cyst mortality= 10^{-4} , without seedbank cyst mortality=1) on the coastal community
 - (a) final richness vs mean interspecific interaction strengths. Hypothesis: in the absence of a seed bank, final richness decreases when interspecific interaction strengths increase, in absence of a seed bank.
 - (b) final abundance vs high and low temperatures / or higher variability in the environment. Hypothesis: in the absence of a seed bank, final abundance decreases when there are extreme temperatures or variability
2. Variations in the exchange rate with the ocean, interacting with the effect of the seed bank. In this case, the final richness in the ocean would be a good statistic.

Results

Dynamics

Presentation of the final dynamics observed in the model (Fig. 1)

Parameter effect

Find a way to represent the variation in total abundances in the models (Fig. 2) (mostly bar plots?)

Scenarios

Proposed Fig. 3 and 4 as already shown in the main text.

³I wonder if we shouldn't put this in the SI. We already have an extensive description of the estimation process, and I guess our M&M is already big enough

Discussion

Waiting for at least a few results to beef up the structure, but:

- First paragraph as usual, to remind model and main results
- Second paragraph on the functioning of the model (quadratic programming, sensitivity). Would maybe lead to a discussion of the lack of information on certain key parameters.
- Emergent properties from the model? For instance, storage effect: does the germination rate interact with environmental variation?
- Among others, but wouldn't be the first point: discussion of the impact of the niches, or at least the fact that our definition of the niche/generalist vs specialist could be different in other papers.

Supplementary Information

Dataset

Map of the location (Fig. S1), table of species, time-series (Fig. S2)

Parameter definition

Better explanation of references for each value

- loss rate
- sinking rate: values in the literature + distribution (Fig. S3)
- cyst mortality and burial: explanation of the inference of mortality from McQuoid 2002 + literature on burial by sedimentation
- germination/resuspension: a bit more details, as it may have been really reduced in main text

Focus on growth rate

- Remind the variability of the growth rates of phytoplankton (Balzano 2011 among others), introduce fixed values from the literature Reynolds and dependence on environmental factors (Edwards 2015, 2016)
- Remind the SV growth part and its decomposition between niche and metabolism; add niche width (Fig. S6)
- Equation Eppley and Bissinger for the metabolism part, show comparison of growth rates (Fig. S5) and what we finally chose (already in main text, so we don't have to dwell on that)
- **MAYBE**: field-based niche estimates if we don't already describe it in the MS
- Growth rate as a function of temperature (that is, basically, Fig. S5) for each species defined by b_i and T_i^{opt}

Community matrix

- From MAR to BH
- From type I to type II

Final parameter set/golden set

Tables for the final species-specific parameters (for sinking rates, b , T_{opt})

Effect of variation around the set

Show the changes for each morphotype due to changes in parameter sets (basically, same as Fig. 2, but for each morphotype)

Use of quadratic programming

Definition by Bazaara, use in Maynard, implementation here. Can only be used on the first model, and may smooth the signal a bit much.