Outline

April 9, 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, 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)
  - Delayed mortality (with a delay on the intraspecific interaction coefficient?)

Parameters from the literature[1][2]

In two sentences each:

- loss rate
- sinking rate
- exchange rate
- cyst mortality and burial
- germination/resuspension

[1] Will need to find better titles

[2] moved phenology to the field-based calibrations part

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 estimates

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

Calibration

- Quadratic programming

Definition by Bazaara, use in Maynard, implementation here (on mean abundances and interactions only, contrary to what is done in their paper).

- Calibration of the interactions, based on dynamics

Sensitivity analyses[3]

Parameter space

- sinking rate $\{0.1; 0.3; 0.5\}\beta(0.55, 1.25)$
- cyst mortality and burial $\approx 10^{-4}/10^{-5} \times 0.01; 0.1; 0.3$
- germination/resuspension $0.1; 0.01; 0.001 * 10^{-5}, 0.1$

Diagnostics

- Mean abundance
- Amplitude and timing of the bloom

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

Quadratic programming

Variation in interaction strengths due to quadratic programming. (Fig. 1)

Sensitivity analyses

Find a way to represent the main variation in the models (Fig. 2); extract the best parameter set.

[3] I am using this term here, but we can still call it another way if you think that's too strong a word for a few parameter values.

Scenarios

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

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 varition?
- 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 defintion

- 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)
- Growth rate as a function of temperature (that is, basically, Fig. S5) for each species defined by b_i and T_iˆopt

Community matrix, from MAR to BH