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Comment on bg-2021-141 “Population dynamics and reproduction strategies of planktonic foraminifera in the open ocean” by Julie Meilland et al.

Anonymous Referee #1

Referee comment on "Population dynamics and reproduction strategies of planktonic foraminifera in the open ocean" by Julie Meilland et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-141-RC2>, 2021

Interactive comment on “Population dynamics and reproduction strategies of planktonic foraminifera in the open ocean” by Julie Meilland et al.

General comments:

The manuscript entitled “Population dynamics and reproduction strategies of planktonic foraminifera in the open ocean” by Meilland et al. examined the presence, pattern and extent of synchronised reproduction and ontogenetic vertical migration of planktonic foraminifera, the phenomena which have long been discussed since the earliest study of this taxon and always controversial with evidence both in favor and against on. Their finding suggested the presence of synchronised reproduction and ontogenetic vertical migration, superimposed on the large fraction of the population that does not follow the canonical trajectory. The manuscript is well-written, and carefully discussed with adequate data analysis and statistics. This study has fundamental importance not only to help us understand the population dynamics of planktonic foraminifera but also their sedimentary assemblages; what is recorded and how to extract the canonical trajectory from fossil samples.

It was my great pleasure to review this manuscript. I recommend publication after the authors address the issues I have outlined below.

Major points:

- Size measurement protocols

It would be helpful to have a representative series of images showing the size measurement (image processing) procedure, maybe in the supplement. Is it possible to automatically extract shell outline even for specimens with densely radiated spines? Does the "minimum diameter" mean minimum Feret diameter?

- Effective digit

What is the error range of the size measurement and the effective digit? In Table A1, some are shown with two decimal places (e.g., 113.99, 790.89). Please align the number of digit after the decimal point based on the effective digit.

- Size class intervals

I think the size class intervals used here are fine, but how did you determine the interval (or the number of category). Here the size of *G. glutinata* alone is divided into 6 (but in Figure 6 the largest class omitted), whereas the others are 7.

- Calculation of abundances

Did you use a flow meter for the calculation of towed water volume or just use the net aperture area and towed depth? Please specify. If the latter, it is calculated on the assumption that the extent of net clogging is similar among nets.

- The data under 100µm

It is rather surprising that the estimated minimum size of maturity in *G. glutinata* is smaller than 100µm. As is written in the text, a large proportion of specimens is smaller than 100µm and hence excluded from the analysis for calculation of residuals and mortality. I understand why the authors hesitate to use the smaller size classes since the net mesh was 100µm. Although, as I wrote above, if the towed water volume is not calibrated using a flow meter, the net clogging is regarded as the same in this data analysis in the first place. In any case, it is worthwhile to show, in the supplement, the data smaller than 100µm and include in the mortality figure and residual figure. I would recommend including it, at least for *G. glutinata*.

- Background population that does not follow the canonical trajectory

One of the importance of this paper is that they clearly showed that a large population does not follow the canonical trajectory. Then, do you think the background population succeeds in reproduction without synchronizing time and space, or they are just the "leak" of canonical population and less likely to succeed in reproduction (such as abortive migration in fish)? You mention in the abstract that "reproduction might have occurred continuously", so the former would be your idea, I suppose. Then how? Does it contradict the Weinkauff et al. (2020) emphasizing that spatial and temporal synchronization is inevitable for maintaining of the population?

Minor points:

Line 96: Takagi et al. 2020 ---> Maybe Takagi et al. 2019?

Line 203: the minimum diameter ---> Did you use the Feret diameter? Please specify because there are many ways to measure diameter.

Line 284: 114.5 ---> Referring to Table A1, the original number is 114.38. Since the others are rounded to integer, it should be 114 here.

Line 345: method section (2 d) ---> ? (the same "2.d" is in the caption of Figure 7)

Line 392: Because of the overproduction of gametes per individual, the mortality in planktonic foraminifera is expected to be very high among the smallest size class ---> It should be so. But it sounds that gametes are the initial population of planktonic foraminifera which is not true (zygotes are the initial smallest class of population). How about saying like "Because the zygotes (youngest individuals) are overproduced per individual even with the limited rate of reproductive success (a mean of 21 zygotes per individual in the entire population, Weinkauff et al., 2020), the mortality in planktonic foraminifera is expected to be very high among the smallest size class".

Line 409: studies size range ---> studied size range

Line 423: Tâ□□ and Salinity ---> temperature and salinity

Line 459: manypopulations ---> add a space

Line 481: this OVM pattern ---> the ascending OVM pattern

Line 503: This theory corroborates et al., 2021) ---> Are there any papers of this kind for warm water species? Since these studies are on cold water, non-symbiotic species, and more directed on the ocean acidification topics, it would be better to cite something else.

Line 516: the properties of fibrillar bodies hypothesised to help foraminifera maintain their vertical position ---> Indeed the function of the fibrillar bodies has been speculated to be linked to the function of buoyancy. However, recently, LeKieffre et al. (2020) suggested that the fibrillar bodies are the organelle for organic matter synthesis and storage prior to chamber biomineralization. So this possibility can be deleted.

Figure 4: Are the whiskers shown in broken lines? It is better to use normal (full) line which is easier to see.

I hope my comments above would be helpful.