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Interactive comment on “Scaling of growth rate and mortality with size and its consequence on size spectra of natural microphytoplankton assemblages in the East China Sea” by F. H. Chang et al.

Anonymous Referee #2

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This study tested the applicability of MTE using natural assemblage of marine phytoplankton. The authors used FlowCAM to identify the size category of phytoplankton, however, this technique limited the tested size range between 10-300 μm . Growth rate and mortality of natural assemblage of phytoplankton are controlled not only by intrinsic factors such as size but also other extrinsic factors such as nutrient and light for growth. Therefore, the apparent relationship between size and the rates might be influenced by the extrinsic factors, and it is not easy to find real scaling relationship. The authors used dilution technique to obtain the growth rates with or without nutri-

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ent limitation and grazing mortality. Possibility of light limitation was also minimized by on-board incubation (i.e., exposing enough light).

My main concerns on this ms is on the methodology. The size range of phytoplankton they examined was 10-300 μm . The authors mentioned that the most grazing mortality of microphytoplankton is from microzooplankton. But, the examined microphytoplankton are too large for most microzooplankton (especially for ciliates and crustacean nauplii, and most dinoflagellates). The dominant grazers for the examined microphytoplankton in situ are probably macrozooplankton such as copepod. The bottle-sampled water for the dilution experiment might contain few mesozooplankton. The obtained mortality might be different from in situ mortality of the microphytoplankton.

One of the results from this study is that “grazing mortality of phytoplankton is correlated with growth rate”. However, zooplankton grazing is usually a function of prey concentration (Frost, 1972, *Limnol. Oceanogr.*, 17, 805-815; Kiorboe and Saiz, 1995 *MEPS* 122: 135-145). Encounter possibility to prey which is the function of prey concentration is an essential factor control the feeding rate not only for mesozooplankton but also microzooplankton.

The authors counted microphytoplankton cells only from 6-ml of sea water by means of FlowCAM. In 25% dilution bottle, the number of cells per 6-ml is 1/4 of ambient condition. How many cells they counted for each size category, especially for large size categories? Repeatability? The information is essential to judge the accuracy of the growth and mortality rate from the dilution experiments.

Fig. 4 clearly showed that phytoplankton without nutrient addition was stressed with nutrient limitation. For further analysis of scaling factors, only the growth rates with nutrient addition should be used.

Minor comments:

Page 16596 line 27: Is the silicic acid concentration (0.36 μM) correct? If correct,

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all the diatoms and silicoflagellates in this study were silicic acid limited.

Page 16596 line 13 Show the total number of data prior to removing data of negative values.

Page 16597 It is not described how to treat the chain forming cells. For example, 10 μm ESD cells with connecting 30 cells. Their intrinsic growth and mortality is ruled as small phytoplankton of 10 μm but the grazing mortality is ruled as larger phytoplankton.

Page 16603 line 10: Show the equation of the conversion and explain

Page 16603 line 2 from the bottom: In general, chlorophyll specific light absorption coefficient is larger for small phytoplankton than large phytoplankton due to overlapping chlorophyll in the cell (packaging effect). Chl specific light absorption of large phytoplankton can be 1/2-1/3 of small phytoplankton. Therefore, higher chlorophyll content per mass does not guarantee higher mass specific photosynthesis rate.

Page 16604 line 5-6: Explain more in detail the reason of species succession override the size effect.

Page 16605 Line 2-4 and line 4-6: The authors do not show a $-1/4$ power relationship between mortality and size. Also, the authors found correlation between body size and grazing mortality was just apparent and insignificant (Figs. 3 and 6). I do not follow how did the authors reach this suggestion from the results of this study ($-1/4$ power relationship between size and mortality is largely determined by intrinsic processes). Also, no evidences are shown to reach the statement of line 4-6.

Fig. 2. I don't follow the fig. I do not think this fig helps readers to understand how to calculate growth and mortality.

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