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Biogeosciences
Discussions

Interactive comment on "Coupling of the spatial dynamic of picoplankton and nanoflagellate grazing pressure and carbon flow of the microbial food web in the subtropical pelagic continental shelf ecosystem" *by* K.-P. Chiang et al.

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Q1: I got so confused with the conception of "control". When one system was amended with full resources and one of the components increases, we can say that the component is mainly under "bottom-up control". And if another component does not increase, the component is more under "top-down control". However, if the gross (intrinsic) growth rate is stimulated by the amendment, the bottom-up control is also effective. However, dichotomy between the bottom-up and top-down is only seen in laboratory cultures or the water with high load of resources, where the carrying capacity can be

reached. Here I would like to emphasize, the top-down and bottom-up controls are a matter of relative importance in open waters, where resource supply is scarce and grazing pressure is considerable. We can evaluate the relative importance just by comparing intrinsic growth rates, grazing rates, and net growth rates within a range of environmental parameters (such as nutrient supplies) varying temporally or spatially. At this point, I feel that data presentation in the present manuscript is not sufficient to discuss this issue. P235L6 "a linear food chain" is intuitively not appropriate to describe "the microbial A1: I admit that the methods in our study are improper to discuss the top-down or the bottom-up control concepts. We changed goal of the study into "population growth and nanoflagellate grazing on picoplankton communities" (P 4, L15-16) and rewrote the first paragraph of Section 4.1 with a change in section title to " Resource supply as a control of picoplankton growth in an oligotrophic ecosystem" (P 10, L12-24) Q2: P235L6 "a linear food chain" is intuitively not appropriate to describe "the microbial loop". The way back to bacteria (through decomposition of organic matter) is an important component of the loop. A2: According to reviewer's comment, " a line food chain" was changed to " a food chain".(P3, L1) Q3: P237L5 "microscopic counting of picoplankton" is not mentioned in the other parts of the manuscript A3: According to reviewer's comment, "microscopic counting of picoplankton" was changed to "counting of picoplankton".(P4, L26) Q4: P239L7 Micrometers should be subscript A4: According the reviewer's comment, this mistake was corrected (P7, L6-7) Q5: P237L13 Add "C" after degree signs (also in the other parts). A5: According the reviewer's comment, this mistake was corrected (P5, L13) Q6: Other comments on Methods section: Why are picoeukaryotes and Prochlorococcusnot mentioned in this study? A6: In our study area, The dominant components of picoplankton community are hetertrophic bacteria and Synechococcous, Due to the facts that Procholorococcous was not observed and picoeukaryotes were rare, an investigation was not conducted. We added two explanations in the introduction (P3, L9-11) and the method sections (P6, L22-26), respectively. Q7: Are there any data on nutrients? They would be very helpful in examining controlling factors. A7: Nitrate concentration was shown in Table I and its range was very

small in surface waters occupied by oligotrophic Taiwan Strait Water. We cannot find any relationship between picoplankton abundance, growth or grazing rate, and nutrient concentration. Q8: Did you confirm that the fractionation procedures did not induce nutrient contamination? A8: I have no data to confidently reply this question. But the range of growth rate of picoplankton located in a reasonable range, therefore I think this problem was not serious. Q9: P240L3 “significant difference” Which statistical test did you undertake? (Also in P240L16 and P240L24) A9: On P 240 L3, “significant” was changed into “ noticeable” (P8, L4) On P240 L16 we added one sentence “ one-way ANOVA, P >0.05”(P8, L16) On P 240 L24 we added one sentence “ According to Fig. 4. . ..”.(P8, L24) Q10: P240L7 Units are unnecessary for salinity A10: According to reviewer’s comment, we removed units for salinity. (P8, L8 -9). Q11: P240L23 Nanoflagellates seem to have varied over 1 order of magnitude (rather 2orders of magnitude A11: Corrected according to reviewer’s comment (P8, L23) Q12: P240L27 How do you explain the negative grazing rate? A12: These negative grazing rate usually occurred when both low growth rate and grazing rate of nanoflagellates were low, In this case, the recycled nutrient was released from nanoflagellates, it could be very important to the growth of picoplankton. Therefore we can find a minimum growth effect masking the even low grazing control and created a negative grazing rate. Q13: P241L1 Show the data of nutrients to validate this description. A13: Sorry, we cannot find any relationship between nutrient and picoplankton abundance or picoplankton growth rate. Q14: P241L4 Show the data for “growth rate was not affected by upwelling water”. A14: We added a figure to show the relationship between the growth rate of Synechococcous and temperature in Fig. 5B Q15: P241L9 p > 0.05: : : The coupling relationship is not significant. A15: Corrected according to reviewer’s comment (P9, L5-6) Q16: P241L24 “from June 2011 to September 2006” It is unreasonable: : : A16: According to reviewer’s comment, I corrected this mistake. “September 2006” was changed to “ September 2011” and moved to method section (P 7 L25) Q17: P241L25 This truncation experiment should be written in methods section in more detail. At least, I failed to comprehend the whole image of this experiment from this description. And if

it has been already published in Lin et al. (2009), it should not be demonstrated here as a new result and it should be referred to in Discussion section with appropriate citation. A17: The content in fig 10 might not be correctly understood by the reviewer, the turnover rate of nanoflagellate is 4.32/2,62=1.6 d, it is very close to the value of bacteria (1.4 d) or Synechococcous (1.1 d). I think these figures are reasonable. Q18: P242L5 “in aread” should be “in areas”. A18: According to reviewer’s comment, “ in aread we studied “ was change into “ in our study area” (P9, L31) Q19: P242L11-L25 This should be in Introduction. A19: This paragraph was canceled in the revised version (P10L12-24) Q20: P243L12 I think it is important to separate the effects of temperature itself and of nutrients advected with the upwelling water. There have been some reports on Q10 valuesof bacteria and Synechococcus. Thus you can calculate the expected effect of temperature itself on growth of these picoplankton assemblages A20: Based on Rivikin et al (1996), an analysis 66 published studies on temperature and growth rate of bacteria from the world’s ocean demonstrated a weak relationship between specific growth rate and temperature with Q10=1.5. Our result showed a negative relationship between growth rate and temperature, therefore the temperature effect is not exist in our study area. Q21: P243L17 Is the model by Word and Coffin (1984) based on varying abundance and growth rate at similar nutrient environments? The situation in your study is based on varying nutrient environments (and temperature), so the extrapolation of this model is difficult to interpret. (1) In the upwelling area, water temperature was low. (2) In the colder water, the bacteria grew faster. (3) Where the bacteria grew fast, its abundance was low. I think that these three facts just suggest that the bacteria in this area may be limited by nutrient supply, but that the grazing limitation (top-down) is so high as well to suppress the effect of nutrient amendment by upwelling. A21: Gasol et al. (2002) confirmed the correction of the model by Word and Coffin (1984). When data collected in the open central Atlantic (equatorial and subtropical regions) was compared to data collected in the eutrophic area on the Argentinean continental shelf, there were clear differences between the locations. A negative relationship between growth rate and abundance existed in shelf region, while

no relationship was found in open ocean ecosystem. According to the model, in shelf waters bacterial abundance was controlled by resource supply. This relationship was also demonstrated in an estuary-offshore transect in the NE Atlantic. Therefore, we believe that the model could be applied in a broader range of marine ecosystems. In our study area, temperature varied in a narrow range (<3âĎČ) and nitrate is lower than 1 μm. It is the oligotrophic Taiwan Strait Warm Current Water with minor influences from the upwelling water. In addition, the low abundance and high growth rate were found in the cold upwelling so that it fits the concept of the model by Word and Coffin (1984). But the high grazing rate was also found in the upwelling area, therefore the spatial dynamic of picoplankton abundance was controlled by net growth rate (growth rate –grazing rate) which was explained in the manuscript. Q22: P244L25 This is the description on the phenomenon generally known. Thus you can omit "In the present study" and add appropriate citation A22: Corrected according to reviewer's comment (P 13 L 2-4) Q23: P245L2 "Growth rates of both: : :" This is a repetition of the precedent sentence. A23: According the reviewer's comment cancel the sentence in the revised version (P 13 L 8-9) Q24: P245L17 "smaller" should be "larger". A24Corrected according to reviewer's comment (P 13 L 21) Q25: P245L22 "the growth rate of picoplankton is controlled by its abundance" contains leap of logic. You just observed a negative relationship between the growth rate and abundance. A25: According the reviewer's comment, I canceled this sentence in the revised version (P13, L 26-27). Q26: P245L21 How about Prochlorococcus and eukaryotic phytoplankton? A26: In our study area, The dominant components of picoplankton community are hetertrophic bacteria and Synechococcous, Due to the facts that Procholorococcous was not observed and picoeukaryotes were rare, an investigation was not conducted. We added two explanations in the introduction (P3, L9-11) and the method sections (P6, L22-26), respectively. Q27: P247L1 Describe how you corrected the grazing rate in more detail. A27: This part was canceled in the abstract (P 1 L24-27) and the discussion section (P14 L28-P 15-8) in the revised version. Q28: P247L5 Show the corrected figures to validate this description. A28: This part was canceled in the abstract (P 1 L24-27) and

the discussion section (P14 L28-P 15-8) in the revised version. Q29: Fig. 3 Where is a border between TCWW and KW? And this graph is almost blank space. Rearrange the scales of the two axes. A29: According to reviewer's comment, we redrew Fig. 3. Q30: Figs. 4-9 These graphs can be drawn in black and white A30: Correct according to reviewer's comment.

Interactive comment on Biogeosciences Discuss., 10, 233, 2013.