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Biogeosciences Discussions

Interactive comment on "The significance of nitrogen fixation to new production during early summer in the Baltic Sea" *by* U. Ohlendieck et al.

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We greatly appreciate the comments made by H. Paerl and concur with his note on the strong interannual and spatial differences in rates of N_2 fixation measured in our study of the Baltic Sea. Since cells <5 μm appeared to respond to the rates of total N_2 fixation (fraction of 81–92 % was filamentous cyanobacteria) we assumed that these cells were predominantly utilizing excretory products of new production. However, we cannot rule out the importance of single cell non-heterocystous cyanobacteria and their potential significance towards new production in the Baltic Sea at this stage. Wasmund at al. (2001) did not specifically mention picocyanobacteria in their paper but, as the title implies, listed a number of non-heterocystous coccoid cyanobacteria that passed a 10 μm screen. Cells <10 μm would also include nano-sized non-heterocystous cyanobacteria. We found that cells <20 μm did indeed fix N_2 (1–10 % of total) in

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our daytime incubations. Wasmund et al. (2001) however, measured N_2 fixation in cells $<$10 μm overnight and this may account for the higher rates found in their study (43 % of total). We also agree that we cannot rule out aggregations of diazotrophic cells of cyanobacteria. Our current method of crude separations of cells using filtration screens may adversely affect N_2 fixation measurements in aggregations of cyanobacteria. Clusters of single cell cyanobacteria may retain on a larger size screen or the aggregations can break up as a consequence of the screening. In our case, N_2 fixation by non-heterocystous cyanobacteria would then either show up in the $>$20 μm fraction or the diazotrophic cells may cease their activity due to the break-up of the aggregation. Clearly, this warrants further investigations and, we believe, it will lead to further exiting discoveries of the role of non-heterocystous cyanobacteria in the Baltic Sea.

Answer to specific comments:

Page 1282 (line 8); Paerl misspelled – We apologize (as victims of automatic spell-check) the oversight.

Page 1284 (line 23); Nitex misspelled – Nitex nylon monofilament screens are commonly referred to as “Nytex screens” in the literature.

Page 1291 (line 15); ‘Compliment’ change to ‘complement’ – Thanks for pointing this out.

Page 1291; Comment on C and N-incorporation – This is true if you only work with daytime (diel) budget calculations. In this paper however, we avoided the well documented daytime uncoupling of C and N incorporation [as demonstrated by Gallon et al. (2002) for the Baltic Sea] by making our budget calculations on a day-night (24 h) basis. The average of elemental mass ratios ($C:N_{MASS}$) of cells $>$20 μm did not differ significantly from the elemental incorporation rates ($C:N_{RATE}$) in cells $>$20 μm and this may suggest that the community was overall in balance.

Page 1293 (line 9); Substitute ‘release’ for ‘exudate’ – Thanks for pointing this out.

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Page 1294 (line 3); Omit ‘pathway’, sufficient to say ‘source’ – Thanks for pointing this out.

Upon scrutinizing our own text and answering Paerl’s comments, we found a mistake in the Abstract section (page 1280, lines 14–19). The correct wording should be the following; “The molar C:N rate incorporation ratio (C:N_{RATE}) in filamentous cyanobacterial cells was variable (range 7–28) and the average almost twice as high as the Redfield relationship of 6.6 in both years. Since the molar C:N mass ratio (C:N_{MASS}) in filamentous cyanobacterial cells was generally lower than C:N_{RATE} at a number of stations, we suggest that the diazotrophs incorporated excess C on a short term basis (carbohydrate ballasting and buoyancy regulation), released nitrogen or utilized other regenerated sources of N nutrients."

Interactive comment on Biogeosciences Discuss., 3, 1279, 2006.