

Interactive comment on “Carbon and nitrogen isotope variations in the water column of Lake Bled (NW Slovenia)” by A. Bratkič et al.

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Responses to the P.A. Meyers, referee #2

I would like to thank for constructive and supportive comments which improved our paper. Please find enclosed the detail answers to reviewers's comments.

1. This dispersion is logical and necessary, inasmuch as it deals with each process that is responsible for the experimental results as they are presented and discussed, but creation of a new Summary and Conclusions section that briefly summarizes the process and evidence for them would tie the whole manuscript together better.

The new section Summary and concluding remarks was added at the end: “This study shows large variability of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in particulate organic material (POM)

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and inorganic carbon and nitrogen species after the algae bloom from August to December in the deepest part of the Lake Bled where anoxic conditions prevail most of the year. It was found that the important process controlling the isotopic composition of autochthonous organic matter representing up to 96% of particulate organic carbon (POC) was the concentration of CO₂ in surface water. The nitrogen isotope composition of POM has not reflected the primary productivity in the surface water. The most important process controlling the $\delta^{15}\text{N}_{\text{PN}}$ values was the ammonium consumption in September and October. The negative linear relationship between concentration and isotope composition of nitrate indicated and active water column denitrification, while at depths between 12 m and 18 m the nitrification was active. In the deep hypolimnium the POM was highly depleted in both ¹³C and ¹⁵N indicating an origin of methanotrophic microorganisms utilizing NH₄ as their nitrogen source. In December the water column was well mixed with constant concentration and isotope composition of dissolved inorganic carbon (DIC). The proportion of allochthonous carbon to POC was higher comparing to other months accounting from 57 to 59%. The N-isotopic composition of nitrate could be explained by pronounced degradation of organic matter and later by nitrification of degradation products. The nitrogen balance in the lake was not affected by sewage, agriculture or atmospheric deposition during our sampling period. The present study further demonstrates that the combination of carbon and nitrogen isotope measurements lead to a better understanding into the processes and factors controlling the cycling of both elements in the water column of a mesotrophic alpine lake with high recycling efficiency. The successful use of N isotopes in tracing the origin and cycling of nitrogen has further direct implication for management practice to preserve the water quality of lakes. “

2. Two minor technical issues could use some clarification. First is in the beginning of the Discussion where the present wording implies that biological activity in Lake Bled is controlled by temperature. Microbial activity is indeed likely controlled by temperature, but photosynthetic activity is more likely to be controlled by light penetration, which is the source of water warmth. I encourage the authors to reword this paragraph more

thoughtfully.

The text was corrected and the following sentences were added on Page 8524 L 5-7: “Oxycline and nitricline were correlated with thermocline, while activity of photosynthetic organisms was more likely to be controlled by nutrient availability and light penetration, which was the source of water warmth.”

3. Second, the discussion of nitrogen isotopic kinetics on page 8528 seems to combine fractionation in aqueous systems with distillation in gaseous systems. Although the processes are indeed linked by differences in isotopic mass numbers, they are still different. I recommend deleting the comment about Rayleigh distillation. The explanation is fine without it.

The text was deleted.

4. A small but important improvement is to modify the title to better represent the time element in the nature of the study and its results. I suggest something along the lines of “Semi-annual carbon and nitrogen isotope variations in the water column of Lake Bled, NW Slovenia”.

The title was modified according to the referee’s suggestion.

Minor stylistic corrections: 1. Page 8517, line 25 – change to read “This effort is usually difficult,”

Corrected.

2. Page 8520, line 28 – insert a space after CO₂

Corrected.

3. Page 8521, line 11 – replace “spanning” with “extending”

Corrected. 4. Page 8521, line 18 – change to read “Deeper O₂ concentration dropped steadily”

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Changed.

5. Page 8522, lines 2-3 – delete “It is seen that”

Deleted.

6. Page 8522, lines 4+9 – replace “more abundant” with “larger”

Replaced.

7. Page 8522, line 8 – delete comma after “prevailed”

Comma was deleted.

8. Page 8523, line 6 – specify whether the C/N ratio is weight or atomic

The C/N is the molar ratio, which was specified in the text.

9. Page 8523, line 23 – replace “it” with “the value”

Replaced.

10. Page 8525, line 12 – replace “failed” with “fell”

Replaced.

11. Page 8525, line 21 – correct spelling of “Cyanophyta”

Corrected.

12. Page 8526, line 17 – replace “0.57 to 0.59” with “57 to 59 %” to be consistent with the rest of this sentence.

The numbers were replaced.

13. Page 8528, line 6 – change “incorporates” to “incorporate”

Changed.

14. Page 8529, line 1 – replace “On the contrary” with “In contrast”

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Corrected.

15. Page 8529, line 4 – replace “as” with “is”

Replaced.

16. Page 8529, line 21 – insert “case” after “In the former”

Corrected.

17. Page 8531, line 9 – insert “difference” after “This”

Corrected.

18. Page 8531, line 23 – should this line read “250 ml of rainfall per square metre”?

Corrected.

Interactive comment on Biogeosciences Discuss., 8, 8515, 2011.

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