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Biogeosciences Discussions

Interactive comment on "Isotopic composition of nitrate and particulate organic matter in a pristine dam-reservoir of western India: Implications for biogeochemical processes" *by* Pratirupa Bardhan et al.

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Referee Comments: This paper reports some interesting results which demonstrates the potential of stable carbon and nitrogen isotopes to gain insight into biogeochemistry of Indian reservoirs where the monsoons play an important role in controlling vertical mixing and dynamics of carbon and nutrients. However, the quality of the text is not sufficient and the data interpretation needs improvements. Authors' Response: We thank the anonymous referee for her/his contructive comments that have been taken into consideration while revising the manuscript as described below.

Referee Comments: 1- Abstract: Please explain the " POC", " PON", " SPOM" and " DIN" Authors' Response: The abbreviations POC and PON have been expanded in the abstract. In the revised version SPOM has been replaced by POM that is explained in the first line of the abstract.

Referee Comments: 2- Introduction: It is not clear that why did the authors carry out the study? What is the current research progress? Authors' Response: The purpose of this study has been more clearly stated in the revision. The study was undertaken to gain insights into biogeochemical cycling in Indian freshwater reservoirs from which very little information is available so far. The Tillari Reservoir has been selected for detailed investigation that included measurements of natural abundance of nitrogen and oxygen isotopes in nitrate, and nitrogen and carbon isotopes in POM. These data, first of their kind generated from any Indian freshwater body, facilitate an understanding of biogeochemical processes (especially involving nitrogen) that should be typical of any relatively pristine, tropical, monsoon-affected freshwater body.

Referee Comments: 3- Site Description: The description of the study area was not clearly mentioned in this section, such as, land use, evaporation, water quality. Authors' Response: The information sought by the referee has been added under "Site description".

Referee Comments: 4- Sampling and field measurements: Please show the distribution of 51 samples in Figure (horizontal and longitudinal). Authors' Response: The referee mistook "51 samples" as fifty one samples. We meant 5 litre volume. This has now been clarified.

Referee Comments: 5- Figure 2, Figure 4 and Figure 5: The data are only from one sample or are the average values? Authors' Response: Each data point represents one sample. This has now been clarified in figure captions.

Referee Comments: 6- Figure 3: Please show the depth of Epilimnion and Hypolimion. Authors' Response: Epilimnion : 0 – 10 m; Hypolimnion : 15 – 48m. This information has been added in the caption of Figure 3.

Referee Comments: 7- Isotopic and elemental composition of suspended particulate organic matter: The data of δ15N and δ13C should be shown in table or figure. Authors' Response: A figure (tentatively titled Figure A) has now been included that shows mean annual variations of δ15N and δ13C of POM.

Referee Comments: 7- 4.2.2 Denitrification, L10: why did you get 0.95 and 0.85? Authors' Response: In canonical denitrification, both δ15N-NO3$-$ and δ18O-NO3$-$ increase linearly. The enrichment in isotopic value is $\sim$1 in marine systems (Casciotti et al., 2002, Sigman et al., 2005, Granger et al., 2008). However, this value is reported to be lower (0.5-0.7) in freshwater systems (Lehmann et al., 2003 and references therein). The reasons for this difference are not fully understood. Also, studies in freshwater systems are sparse as compared to marine systems. In a batch of culture experiments, Granger et al. (2008) observed that nitrate-reducing enzymes play a role in altering the O to N isotopic enrichment, with periplasmic dissimilatory nitrate reductase (Nap) expressing a lower enrichment value ($\sim$0.62) than the membrane-bound dissimilatory nitrate reductase. Again, there is a lack of data on the isotopic expressions of these enzymes at the ecosystem level. Wenk et al. (2014) attributed the low O:N isotopic effect of $\sim$0.89 to chemolithoautotrophic denitrification, rather than heterotrophic denitrification, in the northern basin of Lake Lugano. Our data from the Tillari reservoir indicates the occurrence of denitrification in the suboxic hypolimnion under stratified conditions. However, this process is restricted to a narrow depth range of 10-20 m which limits the number of data points. There may be several factors responsible for the low (<1) isotopic enrichment factor in the Tillari but our data are not sufficient to identify the exact cause(s). This information is included in the revision.

Referee Comments: 8- I can't find the data from October, November, January, May, June, August and September. Why do you get the diagram to depict different biogeochemical processes taking place in the Tillari Reservoir over an annual cycle in Figure 5. Authors' Response: Figure 5 schematically shows distinct seasonal varia-

tions and major biogeochemical processes occurring in the reservoir. This information in based on regular (monthly) monitoring of the reservoir that includes observations in the months mentioned by the referee. However, the isotope data presented here were not collected on the monthly basis. Shenoy et al. (manuscript under prep.) will provide a more detailed account of intra- and interannual variability in the reservoir based on monthly sampling. This has been clarified in the caption of the figure.

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Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2016-270/bg-2016-270-AC1-supplement.pdf

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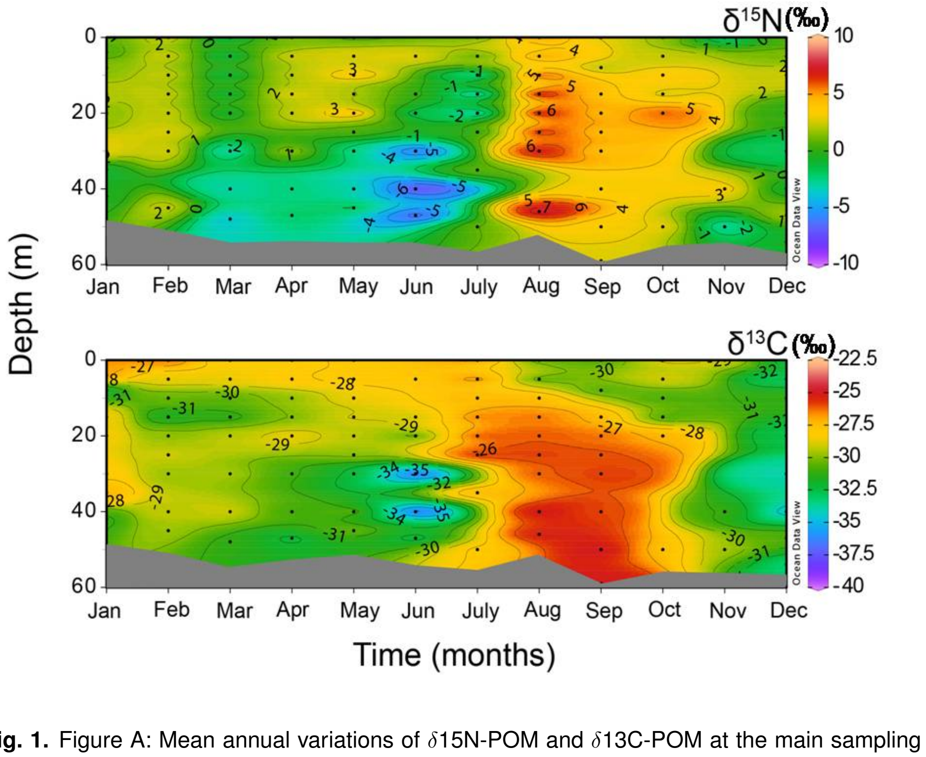

Fig. 1. Figure A: Mean annual variations of δ15N-POM and δ13C-POM at the main sampling location.