Biogeosciences Discuss., 10, C6401–C6405, 2013
www.biogeosciences-discuss.net/10/C6401/2013/

Biogeosciences
Discussions
Open Access

Interactive comment on "Stable isotopes dissect food webs from top to the bottom" *by* J. J. Middelburg

Anonymous Referee #2

Received and published: 9 December 2013

General overview

The manuscript of J. J. Middelburg reviews the use and the potential future use of stable isotopes for reconstructing end-to-end food webs in aquatic ecosystems. It first reviews the classical approach (the use of C and N stable isotopes in natural abundances) in food-web studies and then brings present and future ways to improve the use of stable isotopes in food web studies, with emphasis to include the microbial domain. It is true that the classical approach fails in robustly investigating the base of the food web and alternative approaches are very welcome. Also very welcome is a review manuscript dedicated to strengths and weaknesses of stable isotopes as tools to study food webs (and especially the microbial domain), since there are still some issues with these tools. In those ways, the manuscript of J. J. Middelburg is very welcome. In addition

this manuscript is very clear, concise and falls within the scope of BG.

However, I disagree one statement of the manuscript, find the manuscript not very deep (i.e. not as deep as a review article should be) and find that there are some gaps that have to be filled before the acceptance of the manuscript. The latter concerns weaknesses of some tools that need to be discussed and the recent development of models that represent avenues for future use of stable isotopes in food web reconstruction and that need to be cited in this manuscript. I hope the below comments will help to strengthen and improve this very welcome manuscript.

Main comments

Trophic enrichment

Contrarily to what is stated in the manuscript, the trophic enrichment is not always very small for carbon isotopes (e.g. Dang et al., 2009) and it usually has to be taken into account in food web studies (Caut et al., 2009). In the first paragraph of section 2, the text should be reworded and the equation modifyed accordingly.

Since tissues usually exhibit different isotopic signatures (e.g. Lorrain et al., 2002), the value of trophic enrichment to use for estimating trophic position and trophic resources also depend on the tissue that has been analyzed (Caut et al., 2009). This should be added in the manuscript (third paragraph of section 2).

At last a Dynamic Isotope Budget model (DIB) has been recently developed (Emmery et al., 2009) in order to take into account the dynamics of the isotopic signatures of the food source and the turnover of the isotopes in the consumer tissues for the determination of trophic enrichment between food sources and consumers. Such models represent a step forward in the determination of trophic enrichment. This should be stated in sections 2 and 6 of the manuscript.

Compound specific isotopes

Stable isotope analysis on specific compounds (biomarkers) is indeed a powerful tool

to investigate the base of the food webs. As pointed out by the author, one issue regarding amino acids is that the trophic enrichment differs between amino-acids. Another issue is the isotopic fractionation between a biomarker and the whole cell or tissue. This fractionation is usually not well known and future work should focus on the determination on this fractionation and its variability. This should be discussed in the manuscript.

Coupling stable isotope mixing models and inverse modelling

In some occurrences in the manuscript (e.g. in the last paragraph of section 6), the argumentation implicitly calls for the coupling of stable isotopes and inverse modelling. Such a coupling has been successfully performed (Pacella et al., 2013) and is a future avenue for studying end-to-end food webs. This coupling should be cited in the manuscript.

Title

Since the manuscript mainly deals with aquatic ecosystems, the title of the manuscript should include the word “aquatic”: “Stable isotopes dissect aquatic food webs from top to the bottom”.

Technical corrections and minor comments

Introduction: page 14924, lines 19-26, and page 14925, lines 1-5 References are needed.

Section 3: page 14929, line 27 Replace “composition” with “compositions”.

Section 3: page 14930, lines 16-17 Check and reword these lines.

Section 3: page 14931, line 1 It looks like one word is missing after “powerful”.

Section 3: page 14931, line 7 “0.25+/-0.1”: do you mean 25%+/-10%?

Section 4: page 14932, lines 2-3 One reference is needed.

Section 5: page 14933, line 24 Replace “decade” with “decades” (see the references cited on page 14934, lines 1-17).

Section 5: page 14934, line 12 Add “Enriched” before “Stable isotopes”.

References Bouillon et al., 2011 (as in the text) or 2012 (as in the list of references)? Add ‘Bogalhu et al., 2008’ in the list.

Table 1 This table is not needed since it is very redundant with the text (page 14934, line 21 and followings).

Additional references

Caut, S., Angulo, E., Courchamp, F., 2009. Variation in discrimination factors (Δ15N and Δ13C): the effect of diet isotopic values and applications for diet reconstruction. J. Appl. Ecol. 46, 443-453.

Dang, C., P. G. Sauriau, N. Savoye, N. Caill-Milly, P. Martinez, J. Haure, C. Millaret, X. de Montaudouin, 2009. Determination of diet in Manila clams by spatial analysis of stable isotopes. Marine Ecology-Progress Series, 387, 167-177.

Emmery A., S. Lefebvre , M. Alunno-Bruscia, S.A.L.M. Kooijman, 2011. Understanding the dynamics of δ13C and δ15N in soft tissues of the bivalve Crassostrea gigas facing environmental fluctuations in the context of Dynamic Energy Budgets (DEB). Journal of Sea Research 66 361–371.

Lorrain A., Y-M. Paulet, L. Chauvaud, N. Savoye, A. Donval and C. Saout, 2002. Differential δ13C and δ15N signatures among scallop tissues: implications for ecology and physiology. Journal of Experimental Marine Biology and Ecology, 275, 47-61.

Pacella S. R., B. Lebreton, P. Richard, D. Phillips, T. H. DeWitt, N. Niquil, 2013. Incorporation of diet information derived from Bayesian stable isotope mixing models into mass-balanced marine ecosystem models: A case study from the Marennes-Oléron Estuary, France. Ecological Modelling, 267, 127–137.

Interactive comment on Biogeosciences Discuss., 10, 14923, 2013.