Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2015-523-RC2, 2016

Hydrology and Earth System Sciences
Discussions
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EGU

Interactive comment on "Can mussels be used as sentinel organisms for characterisation of pollution in urban water systems?" *by* E. S. Reichwaldt and A. Ghadouani

Anonymous Referee #2

Received and published: 19 February 2016

General comments: [Content] This manuscript sets as an overarching framework the increasing pollution of water bodies located within or in the vicinity of urbanised areas. The authors have carried out a kind of proof-of-concept analysis where they investigate the potential for mussels to serve as an archive of nitrogen stable isotope signatures – as a proxy for spatial and temporal variability of nutrient pollution in the urban and tidally influenced estuary of the Swan River in Western Australia. Their results show that d15N signatures in mussels do not change significantly over time – thereby suggesting that they are very much site specific. The authors conclude from their findings that mussels have the potential for becoming a robust tool for detecting and characterising aquatic pollution in urban environments.

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[Structure] The article is well written and structured. When going first through the manuscript, I had the impression that the introduction was pretty long (it is almost $\frac{1}{4}$ of the text). Having said that, there is a lot of useful information and references included. One option could be to shorten a bit the introduction, or to introduce a few sub-headings in order to make it an easier read: basically it is about (1) increasing human impact on aquatic ecosystems, (2) the need for a better understanding of the spatial and temporal variability of pollution levels with a view to better manage these often irreversibly impacted systems, (3) the focus on nutrient pollution, (4) the use of stable isotopes (especially of N) for investigating anthropogenic nutrient pollution, and (5) the introduction of mussels as a sentinel organism in that specific context. The remaining parts of the manuscript are well structured – the number of figures is appropriate.

Specific comments: 1-Introduction [pages 2-4]: When reading the introduction, and more specifically the paragraphs to the end where mussels are introduce as sentinel organisms, I was surprised (unless I am mistaken) not to learn about what species have eventually been used for this study. I think this is a very important aspect that the authors have not taken into consideration for their manuscript. In an area where they expect living organisms to be a living archive of the local average environmental conditions it is essential to know a minimum about the metabolism of that organism. Especially in a journal that has a large community of readers from hydrological sciences, we cannot necessarily expect them to know much about this topic. Moreover, since this is a kind of proof-of-concept study, the authors should carefully describe the organisms, growth rates, sensitivity to changing environmental conditions etc. These aspects are likely to be crucial when it comes to eventually understand and discuss the isotopic signatures of N in the mussel's foot tissue. As mentioned further down in this assessment, there is existing literature in this respect and it would certainly be of value to take this into consideration in a revised version of the manuscript.

2-Material and methods [page 5 study sites & 6 sampling and analyses]: When read-

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ing the changing conditions in the Swan River estuary, one could expect differences between mussel species that are exposed to these fluctuations in salinity (between high tide and low tide). Is there only one mussel species in the studied area? If not (what is very likely), what are the other species that are present – what species has the sampling protocol been targeting – was it a mix of species – how sure can we be that different sensitivities to changing environmental conditions (including pollution) can lead to differences in metabolic activity? A few examples of literature along these lines can be: - Atkinson et al., 2010. Stable isotopic signatures, tissue stoichiometry, and nutrient cycling (C and N) of native and invasive freshwater bivalves. Journal of the North American Benthological Society 29(2):496-505. - Gustafson et al., 2007. Temporal and spatial variability in stable isotope compositions of a freshwater mussel: implications for biomonitoring and ecological studies. Oecologia 152: 140-150. - Hawkins, A.J.S., Bayne, B.L., 1985. Seasonal variation in the relative utilization of carbon and nitrogen by the mussel Mytilus edulis : budgets, conversion efficiencies and maintenance requirements. Mar. Ecol. Prog. Ser. 25(2): 181-188

3-Results [page 8 physicochemical parameters]: given that the study was carried out during rather dry conditions, the prevailing environmental parameters measured in the investigated area have also been rather unusual as stated in the manuscript. Here again, it would be interesting to see how the mussels populations have responded to that (if at all) – is there any information available on that? On page 8, line 10 units should be added to salinity. On page 10 the delta symbol should be homogenised.

4-Discussion [page 13]: In lines 6 to 8 I would be careful when stating that stable isotope signatures in mussels of tidally influenced estuaries are less impacted by seasonal changes in watershed input and chemistry compared to large rivers. This statement make sense considering the results of this study, but given the particularly dry conditions that prevailed during this investigation and the proof-of-concept character of this study, there need most probably to be more investigations before a strong statement in this sense.

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5-Conclusion [page 13]: A similar comment as for the point above can be made for the 1st paragraph of the conclusion. Again the lack of information on the studies species, their metabolism, etc comes into play here. Of interest could also be to see if there are differences in signatures between species. In the conclusion it is stated that the future studies should contribute in similar (low) polluted systems to better understand the baseline of spatial natural isotopic variability in urban aquatic systems. I was wondering if this is not somehow contradictory with what is announced in the title – are mussels then really used in the sense of sentinels of pollution or rather as indicators of the baseline of 'spatial natural isotopic variability in urban aquatic systems'. Again here I am possibly confused by the fact that no information is given on how sensitive those organisms are eventually to pollution. As a last comment, one could also say that nutrient pollution is not really an urban problem or at least the origin of it can most of the time be found further upstream in agricultural parts of the catchments. In urban environments, one could also be targeting other sources of pollution, such as heavy metals, xenobiotics, etc.

Concluding remarks: This manuscript is certainly a very interesting contribution for the readers of this journal and I enjoyed very much reading it. It is an interesting case study – or more specifically a proof-of-concept study – introducing mussels as a sentinel organism for investigating nutrient pollution in an urban aquatic environment. Since existing literature on similar applications/studies is not much referred to in the manuscript, the innovative character of this study might however be slightly overrated.

Given the assessment provided above, this manuscript should undergo – prior to publication – what should be considered moderate to major revisions.

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