Biogeosciences Discussions

Biogeosciences Discuss., referee comment RC2
https://doi.org/10.5194/bg-2022-170-RC2, 2022

Comment on bg-2022-170

Anonymous Referee #2

Referee comment on "Role of formation and decay of seston organic matter for the fate of methylmercury within the water column of a eutrophic lake" by Laura Balzer et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-170-RC2, 2022

General comments.

This paper builds on several prior studies that show that the water column of lakes and oceans can be an important site for MeHg formation. It differs from most water column studies by focusing on a eutrophic urban lake and by specifically targeting MeHg abundance in bulk seston at different depths and dates for clues about formation and decay mechanisms. Unfortunately, the sampling technique lumped zooplankton in with seston, potentially introducing bias due to biomagnification. And the sampling scheme was spatially inconsistent, which makes the comparison of depth profiles on different dates difficult. The reason that the entire water column was sampled on one date and only the upper water column on most other dates is unexplained, and it compromises the authors' conclusions about what's going on as particles sink (especially in the hypolimnion since it was rarely sampled). Among other things (below), the authors need to justify their sampling methods and revisit the interpretation of changes in Hg speciation across depth and time. They also need to reconsider conclusions about links between climate change, productivity and bioaccumulation. This will require major revision.

Specific comments.

- The term "endogenic" should be reconsidered. It means "within the system", which for lakes technically includes sediments. "Water column" would be better, unless they mean "within the seston" – in which case the title and text need to be re-worded
- Line 89 is an incomplete sentence
- Line 90: why a 25um net? It would allow many cyanophytes and chlorophytes to pass through, and bias collection toward zooplankton (which are not "seston"). Why not a

clean pump-and-sieve/filter system instead?

- L220-225. The seston samples collected on those dates are not really much closer to the sediment surface. There's just one hypo sample and it's directly beneath the RTZ. You'd need to sample more depths to justify. Revise.
- L235. But peak concentrations of MeHg in seston occur in the suboxic RTZ on 4 of the 5 dates when the lake was strongly stratified. On the remaining date, seston MeHg concentrations are highest in the upper hypolimnion. During stratification, MeHg is never highest in the oxic epilimnion. If anything, these finding suggest that MeHg production is associated with microbial respiratory pathways that are less energy efficient than O2 reduction (e.g. sulfate reduction, Fe reduction). Revise.
- L240-245. Alternatively, low MeHg during high productivity may reflect biodilution in the larger phytoplankton biomass (i.e. parental seston). Lacking sound data, one can't distinguish zooplankton bias from biodilution in microplankton, and neither necessarily point to sestonic microniches. Revise
- L255-263. They could also be explained by the presence of free-water microbes that possess the methylation gene pair hgcAB and occupy the O/A boundary. DOM rather than POM could be their carbon source. Revise.
- L275-284. Sestonic MeHg in the 20% range is not atypical for unpolluted temperate lakes. What's unusual is the very low %MeHg in April
- L346. Actually, this was first shown in Little Rock Lake, which is only 10m deep (but the eutrophic part may be right).
- L346-end. Note that the range of Hg and MeHg in the seston of this eutrophic lake is on the low end of seston data reported for mesotrophic to oligotrophic North American lakes, both for MeHg concentration and %MeHg. High productivity is not necessarily conducive to abnormally high rates of MeHg accumulation in bioseston. In fact, most data suggest the opposite due to biodilution. It may be true that higher amounts of OM decomposition in eutrophic lakes does indeed exacerbate O2 depletion and enhance methylation in suboxic water, but that was not measured here. It seems that the most you can say with the data presented here is that the opposing forces of high biodilution and high decomposition need to be reconciled before addressing the impact of climate change. Revise