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Biogeosciences Discussions

Interactive comment on "Contributions of riverborne inorganic and organic matters to the benthic food web in the East China Sea as inferred from stable isotope ratios" *by* N. N. Chang et al.

Anonymous Referee #2

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Rivers bring both nutrients and continental organic matter to estuarine and coastal areas. Riverborne nutrients stimulate marine primary production and may then boost the local secondary production, while continental organic matter might directly sustain the marine food web. The aim of the paper is to evaluate which of these pathways is the most influential offshore form the Changjiand estuary in the East China Sea. The purpose of this paper, at the interface between biology and geochemistry suits the scope of Biogeociences and is of interest for a relatively large audience of marine/coastal scientists. I however found three major weaknesses in this paper which seriously jeopardize the robustness and relevancy of interpretations and conclusions.

1.The first one lies in the fact that the sampling design is not well adapted to the claimed question. Authors relied on C and N stable isotope composition of various consumers to estimate which sources of organic matter sustain the marine food web. To do so, very robust endmembers (proxys for the stable isotope composition of the various organic matter sources, herein riverborne organic matter and marine primary production) are required. In the paper though, no endmember for riverborne nutrients or organic matter are provided. At no point authors mentioned that they measured the stable isotope composition of the riverborne OM, although this was a central requirement in their experimental design. Authors use a value for terrestrial POM (fig 2) which origin is quite unclear. If this is just a value for terrestrial organic matter taken from broad literature, it could be contested that it would be different from the real riverborne organic matter, which might be a mix of altered terrestrial organic matter coming from the Changjiang watershed (and subsequent changes in its stable isotope composition due to microbial reworking) and river primary production. If the stable isotope composition of the riverborne OM is actually somewhat higher than the value they used for Terrestrial OM, all their conclusions would be different. The same problem arises for the estimates of the marine endmember, i.e. the stable isotope composition of the marine primary production. Authors used for each site and site, a single zooplankton sample, with no replicates. As a result, they cannot statistically compare the stable isotope composition of the claimed marine pelagic primary production between sites. They however claim that the marine endmember varies between inshore of offshore sites, although the difference is usually rather small (<0.6 ‰ for 2009 and 2010). Considering the absence of replicates and the 0.15 ‰ of reproducibility in stable isotope measurements), I am sceptical about the 'reality' of this claimed isotope difference, at least for C. Another point lies in the fact that authors did not consider other potential organic matter sources, such as coastal, benthic micro-algae, which have been shown to be a major source of organic matter to coastal food webs (especially benthic crustaceans). The carbon and nitrogen isotope composition of benthic macro-algae can be somewhat higher than pelagic algae and this may explain some of the patterns observed on fish and benthic crustaceans (see below).

2. A second weakness, which is related to the former, is that result interpretation is globally rough and superficial. I feel that the authors missed the major crucial points. Overall, δ15N are poorly exploited and discussed. Fish and benthic crustaceans δ15N values are 6 to 12 ‰ higher than the 'marine pelagic' endmember, which is already a primary consumer (fig 2). In the way they graphically interpret their results (biplots), authors implicitly assume then a unique N source for all benthic and pelagic consumers (pelagic primary production). A 6-12 ‰ range of δ15N would then mean that benthic crustaceans are 2-4 trophic levels higher than zooplankton in the food chain, which is not sound. This point clearly deserves discussion. It points to the irrelevancy of the endmembers and to the potential contribution of other organic matter sources to the marine food web. The high variability of crustacean δ15N values in inshore sites strengthens the idea of multiple N sources to inshore food webs. It may also suggest OM microbial reworking when transferred to benthic habitats, that could increase its δ15N values. More generally, although authors are aware than δ15N can be used in order to assess trophic position in food web, their results are never interpreted in this perspective. Major focus is given on C isotope composition and authors seem less comfortable with δ15N data.

3. δ13C spatial variability also needs deeper discussion. The range of δ13C values observed for fish and benthic crustaceans is much larger than that observed for the 'marine pelagic ' endmember. I do not contest the spatial variability of consumers δ13C is related to local primary production, and this is an interesting point. I yet regret that such a large range has not been further discussed. Some fish values are as high as -14‰ (while the 'marine pelagic endmember is closer to -20‰ and such a 6‰ difference is far higher than what you can expect only from C trophic fractionation along the food chain. This is a central result and a very consistent pattern within years and between benthic crustaceans and fish species. Authors have to explain it. To me, this is another evidence that there might be other OM sources to the system.

The main conclusion of the paper is that the inshore marine food web is supported by marine pelagic primary production which is boosted by riverborne nutrient inputs, rather by terrestrial organic matter. However, because the estimates of isotope endmembers are very contestable and because other OM sources might also contribute (as suggested by δ13C and δ15N variability of fish and benthic crustacean within inshore sites and species), such conclusions are very disputable.

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