

## ***Interactive comment on* “Stable isotopes track the ecological and biogeochemical legacy of mass mangrove forest dieback in the Gulf of Carpentaria, Australia” by Yota Harada et al.**

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The authors provide data from element and stable isotope analyses in order to better understand post-die-off dynamics of a mangrove ecosystems. They interpret an observed enrichment in heavier isotopes as indicators of reduced C and N fixation and reduced S reduction in the impacted mangrove stand, while the increasing number of mangrove recruits over time suggests recovery of the vegetation. The lack of recovery of CNS cycling after 32 months, by contrast, is considered an indicator for the biogeochemical legacy of the mass mortality event.

Introduction: The praise of the stable isotope approach should certainly also include

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some mentioning of its flaws and weaknesses. Among these, the changes in the isotopic signature are not as globally "predictable" as the first paragraph of the Introduction suggests: many of these changes do not only depend on the species (both consumer and resource) involved but also on the specific environmental conditions. . . I suggest the first and second paragraph be merged (as they state essentially the same), following a first paragraph of extreme events (currently 2nd paragraph).

Methods: Before learning about the die-back event (and hypotheses on its causes), I would like to get some information about the mangroves themselves, such as species composition, forest structure and so on! It seems *Avicennia marina* is/was the predominant species in the study area. It is interesting that hypersalinization (as a result of drought) is mentioned as major causative agent of the mass mortality. As *A. marina* is known to also occur under quite adverse conditions (e.g., at distribution limits of mangroves), wouldn't we assume that it is as tolerant to salinity stress as, e.g., *A. germinans* from the AEP? It would be nice to get at least an idea of the sediment salinity this hypersalinization resulted in. The reader might also be highly interested in understanding why the mangrove stand north of the river mouth was impacted, while the nearby(!) stand south-west of the river mouth was not. It is obvious that 3 transects were monitored in each of the two stands – how many sampling plots were established in each transect? How were the data from these plots handled (pooled?, ...)? We need to better understand the (spatial) details of the sampling design! Some more details about the "wood samples" would be helpful: how deep? where on the stem? Etc. . . According to the hydrodynamics of the area, do the offshore water samples reflect material that is likely to be washed into the mangroves or to be derived from the mangroves? How were the photos taken to allow for relating the number of the seedlings on the photo to a given (unit of) area? Even though the transects were chosen as to render the sites for comparison as similar as possible, there remains the fact that "unimpacted" and "impacted" are not replicated – strictly speaking, we are comparison two sites, one of which is by chance impacted, the other one is not. In this very particular case, I don't consider this a real issue, as the difference is very clear,

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but I would like to see that the authors take this non-replicated comparison of two sites that than results in generalized conclusions on "impacted" versus "unimpacted" into account and at least mention this restriction to their conclusions.

Results: "had a 34S value of 16.6%... compared to which value for the unimpacted site? l.225–230 : these values do not seem to be SIGNIFICANTLY different, though? l.230 ff (and throughout) : what is the "forest type" here? I think we are just comparing one impacted and one unimpacted stand (not two forest types), and I suspect it is above (and throughout) – is "consistently" significant? It doesn't look as if it is (except for 2018)... If the values are not significant – please clarify!

Very minor linguistics: l.181: "than at the unimpacted site" l.183: "dominant mangrove species, *A. marina*, did not differ" l.211: "than those from the unimpacted site" l.218: "was similar to value of those collected in the mudflat"

Discussion: "mangrove degradation may be followed by fast colonisation of non-mangrove herbaceous species" – this is an important statement on a general and global problem: in the Caribbean, *Acrostichum aureum*, the Golden mangrove fern, builds up a dense canopy in disturbed/clear-felled mangrove areas. As this species, as well as congeners, also occur in the IWP: was the impacted forest (re-)colonized by the fern, or is there no propagule pool available in the vicinity? l.265: why would the "stomatal conductance" be reduced in the impacted site? The environmental conditions were very similar (c.f. Methods), while one site showed mass mortality and the other one did not – what actually is/was the (environmental) difference between these two sites? Why did the mangroves die here but not there? Is the biogeochemical pattern observed a legacy of the die-back, or might it be related to the reason for the die-back (while a nearby mangrove did not exhibit mass mortality)? Several potential reasons for the observed  $\delta^{13}\text{C}$  pattern are listed – don't the authors want to discuss these? l.275: what might these "chronic stresses" be? Are they a consequence of the die-back, or are they the reason (the drought that seems to have caused the mass mortality can probably not be considered a "chronic stress" but rather a massive disturbance)? l.289: this is very interesting! I would have expected lower rather than

higher variability in (sediment/microbial) processes upon such string disturbance – can you expand on this to explain how/why the drought and/or die-back would increase the variability of processes? l.315: this interpretation of the findings suggests that at the impacted site it was dead wood that was sampled (from standing dead stems?), whereas wood from living trees was sampled at the unimpacted site – is that correct?

Fauna: before we can go into this discussion, the above issue of whether "consistent"/"substantial" is "significant" needs be clarified. Only IF the values are significantly different, it will make sense to discuss or interpret such differences! l.356: I don't follow this line of argument: Bui & Lee (2014) stress a potential enrichment by up to 5 – here we have a difference of 6-7 ... is this sufficient to indicate "some additional contributions"? l.363: does that mean that mangrove leaves did not play a role as food source in BOTH forests? If so, this cannot be an effect of the mass mortality, and –of course– we would then not expect any change over time, as this observation would have nothing to do with mangrove recovery after disturbance... l.395: I don't understand "can reflect consumer tissues with little isotope effect" – how do the patterns in producers reflect patterns in consumers; shouldn't it be the other way round? l.403: what is it that mostly affect MPB? Besides the biotic changes, we would expect much more light, and thus, higher evaporation and less water at the impacted than at the unimpacted site. This already will change MPB drastically. l.425: I do not understand how you derive these scenarios from the present study? I kind of agree with these potential scenarios (there might be other possibilities), but how does this relate to, how is this justified by, the present study? Minor: l.410: omit "-"

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