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Interactive comment on "Small scale variability of geomorphological settings influences mangrove-derived organic matter export in a tropical bay" *by* Geraldina Signa et al.

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General comments: This paper deals with the fate of the mangrove derived organic matter in relation with local geomorphological differences. Using elemental, isotopic and Fatty acids markers, the authors emphasize the combined role of the tide and the riverine water runoff in the distribution of the Mangrove organic matter. This paper is the latest of a long series of studies that characterised OM in Gazi Bay. The "plus" of this paper is the recording of FAs data and the fact that two seasons were sampled. Therefore, the main finding of this paper is the seasonal differences in term of export, which help to better understand the OM dynamic in the Bay; the combined control of tide and runoff is not something exceptional as this is a general feature of estuarine

mangrove and this must have been anticipated.

R: We agree that the combined effect of runoff and tide, together with rainfall and wave action is a general feature of tropical estuarine systems. Indeed, this point was already mentioned in the previous version of the manuscript. Now we will strengthened further this point.

The paper is well written and organised with however overstretching use of the fatty acid method. I have several concern, some I share with the other reviewer, I already read the comments, such as the statistical issues.

R: Following the reviewer's comments, we will dampen the use of the fatty acid approach (see specific comments below). As for the statistical analysis, in the revised manuscript we will carry out permutational analysis of variance (PERMANOVA) to test for spatio-temporal differences in isotopic and elemental signatures of organic matter sources and in their contribution to SOM and SPOM, using the outcomes of the Bayesian mixing models (lower and upper limit of the credibility intervals, mode and mean) as variables.

My main concern is on the manner how fatty acids were ascribed to sources is this study. The Fatty acid markers method, have evolved quiet a lot in the recent years. The use of FAs in a qualitative, at best semi-quantitative, manner (%) need some precautions when it comes to comparing them in living tissues and to extrapolate these relative contributions to "non living" matter in the environment. The conservative feature of these markers do not apply in sediment or POM and most of the fatty acids, at least most of those used in this study, cannot be ascribed solely to one particular source. It is probably not necessary to analyse microorganisms such as Bacteria but it would have been suitable to look at the composition of microalgae and terrestrial sources that can be brought by water draining. Indeed, relating 20:5w3 to red algae is not a good assumption when this FA is readily present in diatoms and/or other brown algae who seem to be dominant in this bay. The question is the big amount of brown algae (+

diatoms) with low % can be of less impact than red macroalgae with high % of 20:5w3 but low biomass? Also, 18:3w3 is also found in large amounts if terrestrial leaves and is more labile than LCFAs in sediments. 18:2w6 is very common in wastes and agriculture waters and we don't have indication about these possibilities in the Method's section. Also there in no indication about the seasonal changes that may affect the composition of sources which certainly can moderate here or there their relative contributions at the surface sediments as well as in the SPOM. A better knowledge on available sources and how their productions are impacted by seasonal patterns would have render this spatially restricted study to be less speculative in term on fatty acids evidences.

R: We are very grateful to the reviewer for the stimulating comments. Now we will soften the use of many FA tracers, using much more caution than in the previous version of the manuscript. In particular, now we will treat 18:3 n3 as a combined marker of mangroves and seagrasses and 18:2 n6 as a combined tracer of seagrasses and agricultural runoff from the sugar plantations diffused around the bay (we will add this information also in the Method's section). In addition, for both fatty acids, we will take into account the potential lability due to decomposition as a discussion point for explaining their low relative abundance in SOM and SPOM. As for 20:5 n3, SIMPER results highlighted high 20:5 n3 content in red algae, and not in brown algae, hence, we treated this FA as a combined tracer of diatoms and red algae. Moreover, as suggested by the reviewer 1, we will discuss the seasonal variability of mangrove litterfall to explain the seasonal patterns recorded in this study. Seasonal and spatial variability was detected also in bacterial biomarker and will be discussed in the manuscript.

Other comments Introduction P4L10 : typo : approaches

R: The typo will be corrected.

P4L2 : it is important de say if it is a qualitative or quantitative contribution

R: We will rephrase the sentence pointing out that the contribution of dominant pri-

mary producers to sedimentary and suspended particulate organic matter pools was assessed based on quantitative (isotope mixing models) and semi-quantitative (fatty acids) approaches.

M&M : P 6 L18: Here and the entire paper, including tables and figures; the terminology of saturated Fatty acids is not properly defined : the is one "0" to much 23:0 instead of 23:00 and so on for all the paper.

R: We will correct the FA nomenclature through the paper.

P7 L4: I am puzzled by the transformation arcsine square root because % data are "transformed " (total 100%) which means that they have to be used as it is.

R: Proportional fatty acid (percentage of total FAME) data require transformation to meet the assumption of multivariate normality (Budge et al. 2006). The arcsine square root transformation is commonly used for proportional fatty acid data (e.g. Iverson, 2009; Thiemann et al., 2011; Raymond et al., 2014).

Budge, Suzanne M., Sara J. Iverson, and Heather N. Koopman. "Studying trophic ecology in marine ecosystems using fatty acids: a primer on analysis and interpretation." Marine Mammal Science 22.4 (2006): 759-801.

Iverson, Sara J. "Tracing aquatic food webs using fatty acids: from qualitative indicators to quantitative determination." Lipids in Aquatic Ecosystems. Springer New York, 2009. 281-308.

Thiemann, Gregory W., et al. "Individual patterns of prey selection and dietary specialization in an Arctic marine carnivore." Oikos 120.10 (2011): 1469-1478.

Raymond, Wendel W., Alexander T. Lowe, and Aaron WE Galloway. "Degradation state of algal diets affects fatty acid composition but not size of red urchin gonads." Marine Ecology Progress Series 509 (2014): 213-225.

P7 L10 : using SIMPER to identify potential FAs is somehow wrong , SIMPER give you what are the FA that contribute the most to the similarity . A small contribution of a “specific” FA, say a Branched one for Bacteria, would be a enough to trace the OM and still, will not show up in the best five of the primer analysis. This practice adds confusion on the data that are % but discussed in a quantitative manner.

R: SIMPER is a common routine to identify fatty acids that contribute to similarity within groups and dissimilarity between groups. We agree with the reviewer that this approach can be misleading in some cases. However, in this study, we used SIMPER only to identify the main fatty acids that characterized the primary producers sampled in the area (accordingly to Kelly and Scheibling, 2012). Then, the identified FAs were used as indicators of specific primary producer-derived organic matter in the abiotic compartments, assuming that the relative abundance of specific FA indicators in sedimentary or suspended organic matter will be proportional to the contribution of the correspondent primary producer. The contribution of other potential organic matter sources to SOM and SPOM, as Bacteria, was assessed using the biomarkers published in literature. To clarify better the aims and the results of this statistical approach, we will specify better the objectives of the SIMPER analysis highlighting that this approach is used to identify the FAs that contributed more to the similarity within and dissimilarity between primary producer groups (Clarke and Warwick, 2001). Therefore, we will specify that these FAs are used only as indicators of specific primary producer-derived organic matter for sedimentary and suspended particulate material characterisation, together with those reported in current literature. To add clarity to these information, we will include also the dissimilarities between groups in the table (Suppl. 1).

Kelly, Jennifer R., and Robert E. Scheibling. "Fatty acids as dietary tracers in benthic food webs." Marine Ecology Progress Series 446 (2012): 1-22.

Clarke K.R., Warwick R.M. "Change in marine communities: an approach to statistical analysis and interpretation." Plymouth, UK: Primer-E (2001).

Results : P7 L15to L21: all comparisons need to be tested statistically

R: All comparisons will be tested through permutational analysis of variance (PERMANOVA).

P8 L5 the Bayesian model (SIAR) is may be not needed to see the contributions of the sources since there is no fractionation to correct.

R: Bayesian models are valid tools to assess the contribution of sources to consumers (in this case SOM and SPOM) even regardless of fractionation value. In this study, we analysed the contribution of organic matter sources to sediment and particulate compartment assuming that their isotopic compositions remained unchanged after their incorporation in SOM and SPOM accordingly to Gonneea et al. (2004). Now we will specify this the manuscript.

P9 : L 25: Using 18:2w6+18:3w3 as tracers of seagrasses in zone full of mangrove is very risky.

R: We agree and now we will be much more cautious in using FAs as tracers of primary producers. The whole paragraph will be rephrased, considering 18:3 n3 as a tracer of both seagrasses and mangroves, 18:2 n6 as a tracer of both seagrasses and agricultural runoff and 20:5 n3 as a tracer of both diatoms and red macroalgae.

Discussion : P10 L26 : In this paragraph it will be useful to discuss possible ocean inputs (seaward station)

R: The influence of oceanic input in the seaward station, in terms of influence of oceanic dissolved inorganic carbon on the carbon isotopic signature of primary producers, was discussed in the subsequent sentence. In particular, we stated that “A similar enrichment was already observed in Gazi Bay and other tropical areas (Hemminga et al., 1994; Lugendo et al., 2007) and mirrors changes in d13CDIC (Alongi, 2014; Maher et al., 2013). d13CDIC is typically more negative close to mangroves as a result of the intense localized mineralization of mangrove detritus (Bouillon et al., 2007) and increases seaward due to the increased contribution of oceanic DIC, whose d13C is typically around 0‰ (Bouillon et al., 2008)". If necessary, further details will be added.

P13 L4-L5 : Speculative.

R: We will remove this sentence.

P4L15 : 16:1w7/16:0 is certainly not an indicator of dino/diatoms and , 20:5w3/22ww3 is a diatom/dino marker (not the opposite) . Another reason to not ascribed 20:5w3 to red algae.

R: We thank the reviewer for pointing out this mistake. Now we will correct it and change the sentence giving more importance to 20:5 n3/22:6 n3 as a diatom/dinoflagellate marker. We have decided to eliminate the mention to 16:1w7/16:0 because there was not a univocal pattern.

P14 L25 : it is very speculative to relate a relative increase of bacterial FA (compare to what ?) to an increase bacterial activity , at best it may show an increase in biomass but only if to compare the same site, for instance between season.

R: We are grateful to the reviewer for this comment. We will change "greater benthic mineralization" with "high bacterial biomass".

Figure 1 : the limit of the mangrove forest is not obvious in the map, please write Mkurumunji RIVER

R: We agree that Figure 1 was not clear, as it was pointing out also by reviewer 1. Then we have changed it to improve clarity. The names of the stations have been placed in the right position. "Creek" and "river" have been added to the watercourse names. Moreover, we have drawn the transects and the coastline to improve the identification of the limits of the mangrove forest.

Fig 7 and 8 : besides all my comments on the use of markers, here I would like to emphasize that Branched and 18:1w7 are surely tracers of bacteria, but one should complete the other and must not any more be added as it was done 20 years ago .

there are many papers that show discrepancy between these two type of markers.

R: We have modified figures 7 and 8 (now 6 and 7) showing individually the two bacterial markers (branched and 18:1 n7) . Moreover, following previous comments of the reviewer, also 18:3 n3 and 18:2 n6 have been indicated individually.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2016-302/bg-2016-302-AC2-supplement.pdf

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-302, 2016.

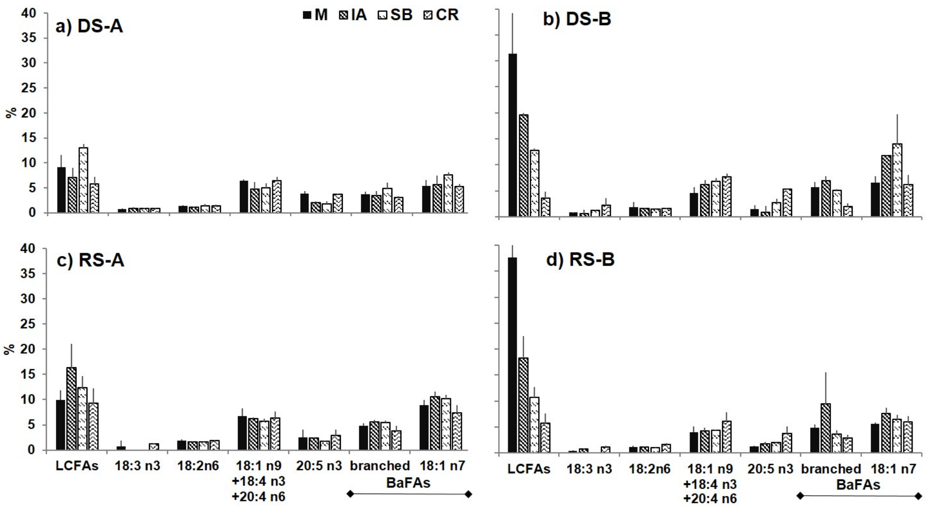

Fig. 1. figure 6

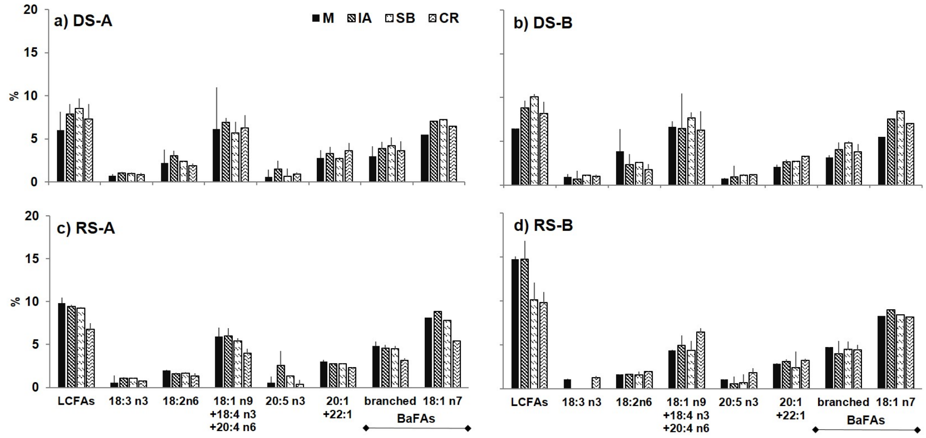

Fig. 2. figure 7