

## ***Interactive comment on “Spatiotemporal variability of sedimentary organic matter supply and recycling processes in coral reefs of Tayrona National Natural Park, Colombian Caribbean” by E. Bayraktarov and C. Wild***

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We acknowledge the valuable comments of Anonymous Referee #2 and would like to respond to the following points (\*\*):

\*\* 1.) The introduction gives an overview on the ecological role of carbonate sands for aquatic systems. But from what I get from the results the study was conducted in coastal areas where the main component (> 90 %) is silicate sands. The authors state there are different properties between silicate and carbonate sands, but they do

C9355

not mention the ecological role of silicate sediments or how they differ from carbonate sands at all in the introduction. Thus it seems a little incongruous.

We have addressed the ecological role of silicate sands in the Discussion on page 19914, line 9 – 11 of the present manuscript. However, we agree with the reviewer to also present the function of silicate sands within the Introduction section and add this information on page 19897, line 26: “In contrast, silicate sands are usually less permeable and host lower numbers of microorganisms due to their lower specific surface area as compared to carbonate sands (Rasheed et al., 2003; Wild et al., 2005b).”

\*\* 2.) The main point of the manuscript is the assessment of seasonal upwelling and the exposure of the respective sampling sites on the assessed parameters. However, it seems neither indicators for upwelling (e.g., temperature, DOC, inorganic nutrient concentrations...) nor exposure (wave heights and impacts, currents, surge...) have been assessed during the sampling period, which makes relation of the assessed parameters to upwelling and exposure arbitrary.

We agree with the reviewer and refer to our hydrographic and water currents surveys which were performed in parallel or prior to this study and at the same sampling sites, but are presented in different studies. We added an explanation and references to these studies on Page 19899, line 21: “The sampling sites of the present study are identical with the sites where a hydrographic survey was performed in order to assess the indicators for seasonal upwelling (Bayraktarov et al. 2014). The sampling sites with different exposure were chosen based on studies demonstrating a difference in water current dynamics between the Western and the Eastern sides of the bays (Bayraktarov et al. (in press), Bayraktarov et al. 2013)”

\*\* 3.) The particulate carbon turnover has been calculated via oxygen measurements. What about dissolved carbon in the incubation waters? Would parts of the dissolved organic carbon stock not be the more bioavailable fraction for microbes in the sediment and thus serve as food source – at least partly? This seems to prohibit a POC turnover

C9356

rate calculation based on oxygen consumption rates?

We have performed control measurements on the microbial respiration rates in the incubation waters and subtracted these from the oxygen consumption of marine sediments. Thereby, any effects from microbial oxidation of dissolved organic carbon in the incubation waters can be excluded.

\*\* 4.) I know there was a recent manuscript published by this lab (Benthic Primary Production Budget of a Caribbean Reef Lagoon, Naumann et al 2013), describing the sediment as net autotrophic. Following the methods described in Wild et al. 2010 the remineralization incubations were conducted in the dark. The authors mention in the discussion that the potentially higher nutrients may lead to increased primary production during the day. Why was only the dark cycle measured after the previous findings published by this lab? Would not the net diurnal metabolism have more ecological significance?

In this study, we were interested in the assessment of sediment oxygen demand in order to link the quantity of supplied organic matter to sedimentary recycling processes. However, we agree with the reviewer and refer in the updated manuscript version to the study of Eidens et al. (2014) where the benthic primary production budget of benthic communities (including sand inhabiting microphytobenthos) were assessed at the same sampling sites in Gayraca Bay and with seasonal resolution. This study showed that no spatial or seasonal differences were present for the net autotrophic sediment communities.

\*\* Minor comments: Abstract Please try to write concise sentences in the abstract (Line 2 – 7). List the sediment properties in the abstract.

We shortened the text passage in line 2 – 7 to concise sentences and listed the sediment properties e.g. porosity, grain-size, carbonate content, particulate organic matter, pigments, and sediment oxygen demand: "Sediments are fundamental for the function of oligotrophic coral reef ecosystems, because they are major places for organic matter

C9357

recycling. Tayrona National Natural Park (TNNP, Colombian Caribbean) is located between the population center Santa Marta (> 455,000 inhabitants) in the Southwest and several river mouths in the East. Here, coral reef sediments experience pronounced changes in environmental conditions due to seasonal coastal upwelling, but knowledge on relevant spatiotemporal effects on organic matter supply to sediments and recycling processes is not available. Therefore, sediment traps were monthly deployed over 14 months complemented by assessment of sedimentary properties (e.g., porosity, grain-size, carbonate content, particulate organic matter and pigments) and sedimentary O<sub>2</sub> demand (SOD) at water current-exposed and -sheltered sites along distance gradients (12 - 20 km) to Santa Marta and the Eastern river mouths (17 - 27 km)."

\*\* Statistical data analysis It is explicitly mentioned here that differences were examined in respect to wave and current exposure. I cannot find any assessment of these parameters in the manuscript.

In the updated manuscript version we have referred to a study on the physical parameters of the Tayrona Park including water current dynamics, seawater temperature, salinity and wind intensity. This information is now given in the Methods section on page 19899.

\*\* Results What is "close to significant"?

In this case, "close to significant" meant a p-value of 0.057, however, we agree with the reviewer's concern and delete this text passage in the updated manuscript.

\*\* Discussion The first sentence picks up on results which are not significant regarding the parameters measured and correlates them to parameters not assessed? What are low-energy sediments?

In the present manuscript, we showed that the supply with particulate organic carbon from the water column to the sediments was higher at the water currents-exposed than at the –sheltered site (please revise Table 1). However, we agree with the reviewer and

C9358

indicate a reference to previous studies which assessed the different degree of exposure between opposing sites of the Tayrona Park bays: "The organic matter supplied to TNNP reef sediments was generally higher at the wind-, wave- and water current-exposed site and increased significantly during seasonal upwelling. The difference in exposure degrees between the opposing sites was addressed in previous studies (Bayraktarov et al. (in press), Bayraktarov et al. 2013)."

Low-energy sediments can be described as locations with low water current dynamics resulting in a decreased advective transport of solutes and organic matter to the sediments. We included this explanation in the revised manuscript.

#### References

Bayraktarov, E., Bastidas-Salamanca, M. L., and Wild C. (in press) The physical environment in coral reefs of the Tayrona National Natural Park (Colombian Caribbean) in response to seasonal upwelling. *Bol. Invest. Mar. Cost.*

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Eidens, C., Bayraktarov, E., Pizarro, V., Wilke, T., and Wild C. (2014) Spatial and temporal variability of benthic primary production in upwelling-influenced Colombian Caribbean coral reefs. *PeerJ PrePrints* 2:e258v1, <http://dx.doi.org/10.7287/peerj.preprints.258v1>.

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Interactive comment on *Biogeosciences Discuss.*, 10, 19895, 2013.

C9359