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Interactive comment on "Mangrove habitats provide refuge from climate change for reef-building corals" *by* K. K. Yates et al.

Anonymous Referee #1

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General comments

A climate change refugia is a location that is buffered from an extreme condition associated with climate change. For reef-building corals and coral reef ecosystems, more broadly, we are talking about increased temperature and ocean acidification. Thus, a refugia should limit or reduce exposure to these stressors. Presumably this would be a demonstrated lessening of high temperature exposure that directly reduces bleaching and/or mortality associated with bleaching, or possibly some factor that 'shades' corals as the bleaching response is due to the interaction of temperature and light. The latter has been reported for some time, primarily anecdotally. In respect to ocean acidification, this would be an elevation in carbonate saturation state relative to the prevailing conditions either offshore, or at the nearby reef environment.

This study shows that the mangrove habitat is warmer than the nearby reefs, so it doesn't meet that criteria. What the authors do show is that the mangrove canopy shades corals and this was associated with less bleaching and mortality, but this was only significant for /Diploria labyrinthifomis/ as only 2 colonies out of 67 monitored in the other species assessed, /Colpophylia natans/, bleached. The discussion of ocean acidification is a bit puzzling because the authors compare carbonate chemistry of mangrove sites with and without coral to nearby rocky outcrops. What is perplexing is that there is no measurement of carbonate chemistry on any of the nearby reef environments (where corals primarily live (at least historically) and accumulated framework), nor in the offshore waters. The aragonite saturation state values at the mangrove and rocky outcrop sites reach a maximum mean value of $\sim$3.6, based on Figure 3. I've seen CO2 data, albeit unpublished but analyzed according to 'best practices', that show values on US Virgin islands Reefs from July, including St John, average approximately 3.9, with minimum value of 3.7 and a maximum value of 4.1. Therefore, with respect to acidification, these sites may be more impacted than the nearby reefs if cumulative exposure to aragonite saturation state levels $< 3 - 3.2$ (as discussed in paper) is what is important. This is the value when it has been hypothesized that coral reefs will become net dissolutional (i.e., rates of dissolution exceed calcification). Is this relevant to the non-reef setting studied? We know corals can grow just fine at low saturation states, but generally fail to accrete anything less than about 3.

The paper is unfocused and incomplete as the real link to any possible refugia seems to be associated with shading from the mangrove canopy, yet there is much discussion about carbonate chemistry (e.g., sediment mineralogy and organic matter, rates of net ecosystem calcification [NEC] and net productivity [NCP] etc.). The affirmation that these site are buffered from acidification doesn't seem supported because there is no data from any reef environments. The authors rationale is that the general direction of the current is from the mangrove fringe out to Hurricane Hole to the open ocean, thus the low NEC/NCP ratio in the mangroves buffers the corals to acidification by raising aragonite saturation values. The conclusion of net current flow is based on Lagrangian

drifter studies from one point in time (one August) and a MS thesis. However, the bigger issue is that the authors don't talk about CO2 on reefs, which seems to be lower on the reef vs this environment. It seems difficult to suggest that a site is buffered from acidification if CO2 levels are naturally higher than the reef, right?

This manuscript needs considerable work to tighten focus and narrative. A refugia from corals may be plausible on shaded mangrove prop roots, but this is a thermally related response with little to do with ocean acidification. Also, I'd like to see a discussion about whether or not mangrove environments, different from this one, can serve as refugia. These shallow environments are associated with high thermal variability (as mentioned) and many can receive considerable runoff.

Specific comments

P5055, discussion of reef refugia. What about the deep reef refugia hypothesis (DRRH)? There was an entire issue of the journal Coral Reefs dedicated to this topic and this has garnered a lot of interest in recent years.

P5056, no mention of depths of sites. Please list. You say 0 – 6m. What are the depths the corals are in etc.?

P5061, you discuss a storm event. You need to discuss importance of episodic events. For instance, if you get a significant storm event that causes high rainfall and lowers salinity, this could potentially kill a lot of corals. Need to discuss how this may impact mangrove prop roots as refugia. P5063-4, discuss differences in CO2 at different sites being driven by differing NEC/NCP ratio. Wouldn't a simpler explanation just be that sites with higher saturation state are likely more flushed and receive more water exchange with the open ocean?

Table 1, you present presence/absence data for multiple coral species. Why not any abundance data? It would be helpful to know how abundant the corals are in this environment relative to the reefs. Just cause corals are growing on the prop roots

doesn't necessarily mean it's a refugia. Authors need to do a better job convincing the reader that this is a refugia 'effect' that is driving this trend.

Technical comments

1) Species names of corals aren't italicized 2) Fig 3 and 5 are hard to read

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