

## ***Interactive comment on “Ice Acidification: A review of the effects of ocean acidification on sea ice microbial communities” by Andrew McMinn***

### **Anonymous Referee #1**

Received and published: 27 April 2017

Andrew McMinn has done a good job summarizing the (relatively scarce) literature that is available about effects of ocean acidification on sea ice microorganisms. I think this is an important topic, and I am generally in favor of the publication of this type of synthesis paper. However, I do believe that the author needs to elaborate the review paper before it is ready for publication. I feel like the manuscript summarizes the main findings from the studies quite well, but I am lacking key points and overall conclusions from the synthesis of these papers. I would like to see more emphasis on general conclusions that can be drawn from reviewing the literature, other than a collection of findings (albeit solid and worth publishing). More specifically, my key points are:

I am lacking a section about future directions on the topic (and perhaps an overall summary in the end of the review). What are the key points lacking in the field of sea ice acidification and how should we best approach them? For instance, the author dis-

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cusses strong pH fluctuations in sea ice – how can we best address these fluctuations experimentally?

I would also like to see that the author comments on the technical issues working with ocean acidification in sea ice – is there a “best practice” approach for doing it? The author lists a number of approaches (e.g. cultures, brine communities, in situ experiments). Ocean acidification experiments are relatively complicated to perform by themselves, considering the effort needed to control the CO<sub>2</sub>-system well. Doing it in sea ice may be intimidating for scientists new to sea ice work. I believe that suggestions for a best practice approach would be very helpful to our community to increase the scientific effort on the topic (especially in the Arctic).

Why do you think everything is performed in the Southern Ocean? Would you expect to see differences in the Arctic, considering the differences in sea ice characteristics?

I would also be happy to hear about the author’s opinion about the importance of ice acidification in relation to planktonic acidification. By the limited number of published studies available on ice algae, can you draw any conclusions about the sensitivity of sea ice algae compared to phytoplankton? Is ocean acidification more important in the water mass than in sea ice?

I am also a bit reluctant about Figure 1. It describes a highly generalized seasonal cycle of pH and nutrients. Why are nutrients there, and what type of nutrients is the author referring to (I am assuming inorganic macronutrients)? Nutrients are never discussed in relation to Figure 1 in the text, so please elaborate on this. Some nutrients (mainly phosphorous) are accumulated in the brine before the melt in summer (Fripiat et al 2017, Elementa), so I think it is important to note that this figure is quite generalized.

I would also like to bring some additional papers to the author’s attention, which are not discussed in the review but could perhaps be relevant for the discussion. The main papers that I am referring to are Barr et al (2017, Limnology and oceanography: Methods), Søgaard et al (2011, Polar Biology) and Torstensson et al (2013, Biogeosciences).

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Minor points:

Title: Please revise the title so that it starts with “Reviews and synthesis:”, according to the journal’s instructions.

P3, L31: Please clarify “ice water interface (surface communities)”. This term might be confusing for a reader who lacks knowledge about surface flooding (if that is what the author is referring to). I believe that many readers could misinterpret the “ice-water interface” as the bottom community.

P4, L7-11: This section needs some elaboration. Please explain how it relates to ocean acidification studies and the context of this review.

P5, L6-8: Please elaborate this statement. I would imagine that temperature would affect sea ice thickness, melt pond formation and less multiyear ice (in the Arctic at least), which definitely have large impacts on the environment in sea ice.

P7, L6-12: What about indirect physiological effects on bacterial communities from changes in algal physiology? Engel et al (2013, Biogeosciences) reported elevated bacterioplankton growth due to shifted nutrient stoichiometry and DOC production in Arctic phytoplankton.

Table 1: Would a column with a short summary of the results (e.g. positive/negative/no effect) be in place in this table? That way this could be a central Table summarizing the whole review quite well.

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