

Review for Biogeosciences paper by Schmidt et al. 2018

General Comments:

This is an exceptionally well-written manuscript describing a study making use of a relatively novel technique (highly branched isoprenoid - HBI - biomarkers) to assess the role of ice algae and ice-conditioned phytoplankton blooms in the summer diet and condition of Antarctic krill. The study serves two primary purposes as I see it. First, it provides validation for the use of IPSO₂₅ (an ice proxy HBI biomarker) to infer food web transfer and the role of ice-derived nutrition in Southern Ocean pelagic grazers. Second, it demonstrates the importance of sea ice in the Marginal Ice Zone (MIZ) to the diet and condition of Antarctic krill, and biomass-dominant copepods - either through the provision of ice algae, or through conditioning of the water column to promote phytoplankton blooms.

The methods have been described clearly and in sufficient detail. The results are well-structured and are presented in effective figures and tables. The results are discussed within the context of the broader literature, both in the Antarctic and Arctic pelagic ecosystems.

Overall, I think this is an excellent paper that provides valuable new knowledge on the ecology of Antarctic krill, as well as novel methods to improve our understanding of the role of sea ice in both the Arctic and Antarctic. I would highly recommend publication after a few very minor edits.

Specific Comments:

I only really have one specific comment, and that is that some of the discussion around the results assumes that the krill collected at each station had been there for a while. For instance, when I/I+H values are explained as a function of time since ice was last present at a particular station. This implies that the krill sampled were still at that station when the ice was last there. This might not necessarily be the case, since krill may be advected into and out of regions by ocean currents.

Technical Corrections:

The following is a list of line-by-line technical corrections:

Line 60: Where is “Here”, do you mean both the Arctic and Antarctic, or just the Antarctic?

Line 68: I would change “...of the polar ecosystem...” to “...of polar marine ecosystems...”

Line 83: I would include the word “melting” as in “...trace elements from melting sea ice...”

Line 84: I would write MIZ out in full here. I know it’s in full with the abbreviation in the abstract, but I think it would be good to have it here too.

Line 106: “...and the krill *Euphausia superba*...”, I would specify the krill as Antarctic krill here.

Line 122: “western Antarctic Peninsula” is used here, but “Western Antarctic Peninsula” has been used in other sections of the manuscript.

Line 136: It would be useful to the reader if you could define “ice-conditioned” here.

Line 202: “Timelines of sea ice over” should be “Timelines of sea ice cover”.

Line 204: Should be “the data were” rather than “the data was”.

Line 225: What were the size classes used? Were they in 1mm increments, or something else? I think it would be useful to state that here.

Line 225: There should be a comma after “per station”.

Line 231: Although it’s obvious, “filtered water” should be “filtered seawater”.

Line 238: You refer to HBI III as triene III here, but the rest of the paper uses HBI III. To avoid confusion for readers, I would change this to HBI III.

Line 246: “seawater” rather than “water”.

Line 334: “There was a highly...” - the “a” is typed in a blue font for some reason.

Line 370: “and may, therefore, not have fed on ice diatoms at all.” - should this rather say “and may, therefore, not have fed on ice diatoms within the last XX days.”. Because, presumably it is possible that they had fed on ice diatoms at some much earlier stage.

Line 502: “...north of the current ice edge...” , I would remove “current”.

Line 532: “...even after they had descended...” , “they” is ambiguous here, do you mean the krill or the ice algae? I’m assuming you mean the ice algae, but the sentence structure could suggest that you mean the krill.

Line 549: I believe that “...krill’...” should be “...krill’s...”.

Line 549: Please replace the colon at the end of the sentence with a period.

Line 610: “...studies has...” should be “...studies have...”

Line 1111 (Fig. 4): “...within the 2002/2003 season.” - in the text, this figure is referred to as showing ice cover from the previous winter, so should this rather be “...within the winter 2002 season.”?

Lines 1111-1112: “Ice cover 30 days before each station was sampled.” - in the text, this figure is referred to as showing ice cover 1 month before the cruise, which is different from 30 days before each station was occupied, given that the stations would have been occupied on different days. Please verify which is correct and change either the figure title or the text accordingly.

Figure 6: Sub-figures A and B need to have “A” and “B” typed next to them, these are missing.

Line 1139 (Fig. 7): “...or longer ago...” - please rather use the amount of time, i.e. ~55 days prior, or something like that.

Line 1147 (Fig. 8): “During spring...” - do you rather mean during summer?

Figure 9: The IPSO₂₅ absent stations are purple in sub-figure A, rather than blue.

Line 1213 (Fig. 11): “...population, dominant by new...” should be “...population, dominated by new...”.