Title: Distribution of Arctic and Pacific copepods and their habitat in the northern Bering Sea and Chukchi Sea
Authors: Sasaki et al.
Journal: Biogeosciences

This paper utilized statistical models, mainly principle component analysis (PCA) and generalized additive models (GAM), to quantitatively explore potential linkages between zooplankton abundance distribution and various marine environmental factors (e.g., temperature, salinity, stratification, depth, chlorophyll, and sea ice condition) in the northern Bering and Chukchi Seas. It concluded that all copepod groups were abundant in regions with earlier sea ice retreat and suggested potential positive effects of the reduction of sea ice extent on the distribution of copepods. Although the results are interesting and conclusions are somewhat justified, I feel that overall quality and readability of the paper can be improved after addressing my comments below. Therefore, I recommend the editor to accept it for publication pending a major revision.

Comment-1:
Figure 1 is not as informative as I expect. The authors described different water masses in the northern Bering and Chukchi Seas (Table 1). However, the interactions of these water masses, especially during the summer season when zooplankton samplings were conducted, are not well demonstrated and described. In Figure 1, consider adding more features for better illustrations of this shallow and highly advective system: 1) ocean bathymetry as colored background or contour lines; 2) locations and names of geographical places, e.g., St. Lawrence Island, Bering Strait, Herald Shoal, Herald Canyon, Hanna Shoal, Barrow Canyon; 3) arrows demonstrating dominant summer circulation patterns, including Alaska Coastal Current, Anadyr Water, Bering Shelf Water, Siberian Coastal Current etc. Excellent examples are shown by Grebmeier 2012 Figure 1, Day et al. 2013 Figure 1 and Spall et al. 2014 Figure 1 (Spall, M. A., Pickart, R.S., Brugler, E.T., Moore, G.W.K., Thomas, L., Arrigo, K.R., 2014. Role of shelfbreak upwelling in the formation of a massive under-ice bloom in the Chukchi Sea. Deep. Res. Part II, 105, 17–29. doi:10.1016/j.dsr2.2014.03.017).

Comment-2:
The calculation of vertical density gradient and variability of depth of maximum density gradient are not straightforward to me. Was the density gradient at the each depth calculated by the difference between 1 m above and 1 m below the specific depth using a central difference scheme? Then, how about the most top and bottom depths? How variable are the depths of maximum density gradient, from year to year and from station to station? The depths of maximum density gradient further determine mean values of temperature, salinity and chlorophyll, and later statistical analyses. From readers' perspective, it may be helpful to spatially illustrate Table 3

explanatory variables at all stations using colored dots. If allowed by the journal, consider including these figures as supplementary materials.

Comment-3:
The sea ice concentration (SIC) of 50% seems a bit arbitrary. The conventional sea ice studies used 15% to represent an ice free or open water region. I know this threshold value is probably too small for the months from June to August in this region. A better explanation of this would be valuable. For instance, how sensitive are the anomaly timing of sea ice retreat and the GAM results to this threshold? For instance, will SIC thresholds of 60% or 40% change the overall conclusion regarding the impact of early ice retreat on zooplankton abundance? Since ice retreat timing is very critical for the marine ecosystem, I would like to see figures showing spatial distribution of the climatological mean sea ice retreat date of 1991-2013 (one panel) and the anomaly of sea ice retreat at all sampling locations in 2007, 2008 and 2013 (similar to Figure 3 and 4 except color dots representing anomaly days).

Comment-4:
In Section 3.2 Copepods abundance, the authors should try to use statistical tests (e.g., ANOVA or T-test) to compare spatial and inter-annual differences in copepod abundance of three groups.

Comment-5:
I had a really hard time in interpreting Figure 5 and consequently understanding Section 3.3 Habitats of copepods. In Section 2.3, the authors described that GAM used additive smoothing functions. But throughout the paper, the forms of smoothing functions for the explanatory variables were mystery to authors, which made the interpretations of functional responses of copepod abundance (i.e. independent variables) to explanatory variables in Figure 5 almost impossible. To me, the GAM here looked more like a black box and for the sake of best model fitting to the observation. This authors need to explain more thoroughly GAM underlying assumptions and result interpretations.

Comment-6:
I am also interested to know whether early ice retreat (and ocean warming) could also allow C. glacialis to develop much faster in 2007 than in 2008 and 2013. Of course, such analysis requires other information on zooplankton biomass and stage composition, which were not included in this study and probably not lab analyzed.

Comment-7
The authors should proofread the paper to correct all typos. Just provide a few examples of typo corrections in bolded below:

Page 18672 Line-4: six water **masses**
Page 18674 Line-7: accumulate more **lipids**
Page 18674 Line-10: cold IMW and DW in **spring**
Page 18674 Line-14: Pacific **zooplankton**
Page 18675 Line-27: **A** plausible explanation