

## ***Interactive comment on “Distribution of Arctic and Pacific copepods and their habitat in the northern Bering Sea and Chukchi Sea” by H. Sasaki et al.***

**Anonymous Referee #2**

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General comments:

This work presents an approach combining principal component analysis and generalized additive models (GAM) to model the habitat of marine copepods. The authors applied this method to the Pacific inflow system of the Northern Bering and Chukchi Sea. This region has been extensively studied in the past years and is characterized by a complex water mass structure influenced by a variable sea ice cover. Several studies have already described the interannual variability in the zooplankton community structure of the region and addressed the intrusion of Pacific species in years of strong poleward ice retreat like in 2007.

I have to admit that I had trouble finding what this new study brings as novel findings that could help better understand how this important marine ecosystem functions and

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responds to the impacts of climate change. I believe one reason for this is that the command of the English language is insufficient to make the message clear enough to the reader. In other words, as it is written now, the work is not convincing. Someone with enough proficiency of the English language should have revised this text before submission for publication. I am providing a list of corrections but it is not exhaustive, as it would have been too much work for a referee.

I also think that the authors should have put more effort on the structure of the study. In my opinion, the whole work is way too long as it is when considering the conclusions that were drawn from the results. Abstract, Introduction and Discussion sections could be made more synthetic and shortened. If it's a paper proposing a new method, it should be oriented in a way that would show better the improvements brought in comparison with what was found so far. If it's a study on the distribution of zooplankton, I fear that the results put forward are not enough, as they are merely supporting previous published observations. 2 years (2007-2008) out of this 3-year dataset have already been used in Matsuno et al. (2011). The authors of the present study should find a way to present new advances in the knowledge of copepod distribution that go beyond what Matsuno et al. have shown. At this stage, I failed to see this progress.

The fact that the water column could be divided in two layers whereas the abundance of copepods was integrated over the water column made the description of the preferred habitat of the copepod groups quite confusing.

I seriously think that there is much work to be done before this manuscript is ready for publication in Biogeosciences. I suggest reconsidering after major revision.

Specific comments:

Abstract Could be made shorter. The description of the method is too detailed and the part on the T, S and chl a analysis should be skipped. The methods are standard and the data are ancillary anyway.

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Line 3: remove "i.e" Line 7: replace "by" by "using" Line 8: remove "in the seawater"  
Line 10: remove "the" before "satellite" and put an "s" at "image" Line 11: What is  
magnitude of pycnocline? Line 23: remove "the" before "sea ice" and replace "at ear-  
lier timing" by "early" The Conclusion reaches too far considering the results that are  
limited to the shallow (<60 m) Bering and Chukchi Sea. In the deeper Arctic Ocean  
proper, other important copepods like *Calanus hyperboreus* and *Metridia longa* domi-  
nate zooplankton biomass.

Introduction The message could be straighten up. This is a very long first paragraph to  
introduce the subject and it covers a lot of ground. I think that it would gain by being  
more focused on the topic of the study. First sentence should be rewritten. Line 5:  
"bloom" instead of "blooming". To me, formation of sea ice does not stabilize the water  
column but sea ice melt can contribute. Line 7: "progresses"? I don't get it. Line 8:  
remove "the" Line 10: "to" instead of "the" before "stratification", "nutrient trapping" Line  
12: remove "on" before "higher" Line 13: Remove "The" before "change" Line 16: "to"  
after "leads" Line 21: remove " been" Line 25: "relatively warm" instead of "warmer"  
Line 26: here and after put "oC" after the first range and not the second that relates  
to salinity. Otherwise 31.8-33.0 oC is indeed warm. Page 18664, line 1: remove "the"  
before "depth" Line 7: remove "the" before "both" Line 13: "are" instead of "could be"  
Line 17: the use of "quantify"? I wonder if "assess" would be better Line 20: remove  
"sized" after "large" and after "small" Line 22: replace "distributed" by "abundant" Line  
23: "Metridia" instead of "Meridia". "Neocalanus" instead of "Neocalunus" Line 26: the  
inflow is not always warm. Line 27: sentence should be rewritten. Page 18665, line 1:  
"their" instead of "its" Line 2: sentence should be rewritten for sake of clarity. Probably  
some redundancy with sentence at line 17 of previous page. Line 7: The ship did  
not collect the data. Some parts of the last paragraph would probably fit better in the  
Materials and Methods.

#### Materials and methods

Line 3: Again, it is not the ship by itself that conducted this sampling. "(1392t)" not  
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useful. Line 10: "of" instead of "with" Line 12: "to" instead of "with". "Depended on  
distribution, generation length and reproduction of copepods referred Falk-Petersen et  
al. (2009) and Dvoretzky and Dvoretzky (2009), and we summarized the copepods  
species into three groups :". This first part of the long is difficult to understand. It should  
be rewritten. Line 16: Here and after: "s" at "occur". "Once" instead of "at one time" Line  
20: "using a" instead of "by" Line 21: "Water samples for chlorophyll a were taken with:"  
Line 24: "with" instead of "by" Page 18667, line 1: "obtained" instead of "calculated by  
using NASA Team Line 11: "environmental variables" instead of "environments" Line  
13: remove "them" after "defined" Line 19: remove "Given" Line 21: "their" instead of  
"its" Line 25: "s" at "image" Page 18668, line 20: "verify" instead of "verifying" Line 22:  
"Explained deviance"?

#### Results

Divide the long first sentences into 2 sentences. Page 18670, line 10: "especially with"  
Line 19: if *Calanus glacialis* is the only member of Coparc-L, why not keep its name  
instead of the less meaningful Coparc-L acronym? Line 20: "represented" instead of  
"occupied". "of the total abundance" after "%". "was" after "and" Line 22: I guess  
Coparc-S included other taxa than *Pseudocalanus*? Then what would be the point  
of mentioning that *Pseudocalanus* was included into this group? Or did the authors  
mean to indicate that *Pseudocalanus* dominated this group? Page 18671, line 9: "s" at  
"stations" Line 10: remove "the" after "where" Line 20: "ranging" instead of "ranged"

#### Discussion

Subsection 4.1. I think it's a mistake not to start the Discussion with selling the most  
compelling results of the study. As it is now, it does not entice the reader interested in  
zooplankton distribution in the Bering-Chukchi region to read further. I would reshuffle  
altogether the information in this subsection of the Discussion to present it with the  
copepods distribution to describe in a more synthetic way their different habitat.

Subsection 4.2. Line 8: remove "were" after "species" Line 11: "For example, large

Arctic copepods (Coparc-L) were slightly abundant in the water with cold/lower salinity IMW at upper layer and the colder/high salinity DW in bottom layer corresponding to higher PC1 and low-medium PC2 and PC3, or cold/high-higher salinity BSAW and AW in both layer corresponding to medium PC1, medium-high PC2 and low-medium PC3." I find this sentence terribly difficult to understand. The authors should try to rework it and avoid jargons in the Discussion. In general I find this first paragraph hard to read. Line 16: "more abundant" instead of "concentrated"? Line 20: But then, where do we go once this is said? Line 24: "salinity" instead of "saline" Line 27: "Pseudocalanus" instead of "Pseudocalunus" Page 18674, line 9: "Falk-Petersen" Line 10: "spring" and not "pring" Line 12. Pseudocalanus might not be able to accumulate as much lipids as Calanus but it can withstand the overwintering season in the high Arctic and it can feed on ice-algae (Hattori and Saito 1997). I don't think that the argument presented by the authors is valid if Pseudocalanus spp. dominate the Coparc-S. Or the species are subarctic but then they should not be considered as arctic.

Hattori, H., and H. Saito. 1997. Diel changes in vertical distribution and feeding activity of copepods in ice-covered Resolute Passage, Canadian Arctic, in spring 1992. *J. Mar. Syst.* 11: 205-219.

Line 14: remove "s" from "zooplanktons"

Section 4.3 The first paragraph is too long and too far from the results of this study. Start by presenting the findings of your study before spending a lot of time on other things such as timing of blooms. Furthermore, this topic has already been touched upon in the Introduction.

Page 18675, line 22: The lack of strong relationship between abundance of small copepods and phytoplankton may also be due to the fact that the coarse net (>300  $\mu\text{m}$ ) used does not sample quantitatively the young copepodite stages.

Page 18676, line 2: "Falk-Petersen" Line 16: "shallower" and not "sallow". It is difficult to gauge the argument presented here because the authors don't give the minimum

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salinity in the shallower areas or the total copepod abundances. To some extent in deeper areas, there are more niches and thus more zooplankton. Line 19: remove "and its communities". "has" instead of "have"

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