**Responses to Editor and Referees**

**Anonymous Referee**

"Biodiversity and trophic ecology of hydrothermal vent fauna associated with tubeworm assemblages on the Juan de Fuca Ridge"

**bg-2017-411**

## I. General comments

"*The manuscript by Lelièvre and colleagues presents interesting information on the structure, biodiversity, and trophic structure of hydrothermal vent sites on the Main Endeavour Field on the Juan De Fuca ridge. This manuscript and their data take a nice holistic approach and compare a variety of different communities that they suggest are different successional stages based on observations there, thus link successional patterns to the greater community and trophic structure that live there. The manuscript is well crafted and they found that predator-prey relationships were not as dominant as the important role of ecosystem engineers in structuring the communities. The research is also important as it provides a nice baseline for future studies that work at these locations, which are near a cabled array system so this is likely to be highly referenced site in the future. My only complaint is a slightly cursory treatment of the isotopic data and the use of individuals per mˆ3 instead of mˆ2 for benthic communities which I believe are muddling some of the results. This is a nice manuscript that advances the field.*"

***Author and co-authors:*** ***We are grateful to the reviewer for the useful and relevant suggestions that helped us significantly improve the manuscript. We have dealt with all the comments/questions following his/her suggestions. Regarding the treatment of the isotopic data, the use of more complex indexes such Layman et al. (2007) or Cucherousset & Villéger (2015) were tested here on our data but did not provide more insight on the observed patterns. We thus limited the complexity of the analyses for clarity. Also, this reviewer notes in a comment below '****I am not sure that a more in depth analysis would be possible with the heterogeneous and every shifting baseline caused by the diversity of microbial communities so that is not what I am recommending […]'.* ***We thus believe that extra analyses would have only complexified the paper without adding any relevant***

***information. Regarding the density of individuals, because the other reviewer also suggested calculating density by surface of tubeworm, we now provide the information in the manuscript (see details below). Our responses are given in bold under each comment. We hope that our comments and modifications increased the quality of our paper for a publication in Biogeosciences.***

## II. Reviewer comments

*"I would say that the introduction could use more specifics about the stable isotopes at vents where there can be pretty significant variation in both C and N at the base of the food web due to symbionts (often negative N) in contrast to other inputs, plus the relatively high N of phytodetritus. It adds a dimension to the isotopic analyses in other systems and without this mention may confuse the reader until it is discussed in the discussion. Simply a sentence or two in the introduction could help the readers have a better foundation for this. L511 in the discussion does point towards it but without specific examples. Simply adding a sentence at line 119 saying that these different sources of primary production vary in del 15 N making clear trophic analysis more complex would be one way to do that."*

***Author and co-authors:*** ***As suggested by the Reviewer, we added a few sentences about this subject, lines 126-134 page 5 of the manuscript:*** *"The carbon signature ($\delta^{13}C$) of primary producers differs according to their carbon fixation pathways that differentially fractionate inorganic carbon sources. Despite the fact that the nitrogen signature ($\delta^{15}N$) does not discriminate primary producers, the variability of $\delta^{15}N$ signatures can be associated to their origins and, also, to local biogeochemical processes (Bourbonnais et al., 2012; Portail et al., 2016). Moreover, due to its degradation in the water column, photosynthesis-derived organic matter is characterized by high $\delta^{15}N$ values in comparison with local vent microbial producers, which are associated with low or negative values characteristic of local inorganic nitrogen sources (Conway et al., 1994).*"

*"Results – I am torn on the use of the 3-dimensional space for extrapolating up the total density of fauna. I believe the numbers could be important but really it is a two-d surface area that is expanded up by ecosystem engineers but limited by the energy input and space, which is more 2-d. At a minimum, a statement and comparison of the 2-d abundance would*

*be an important comparison, especially when comparing different habitats where the increased area of tube worms will decrease the extrapolation up (i.e. fewer fauna per $m^2$ but with a lower height measurement will come up with a much higher ind. Mˆ-3 value than one that had a higher density on the per m2 but since you measured a larger area will be fewer on the $m^3$ metric)."*

***Author and co-authors:*** ***We do not agree that height measurement will bias the density of organisms. Macrofauna species inhabit the full volume of worms with gastropods grazing along the entire length of the tubes. This space exploitation is visible from the video imagery and on the tubes when brought back to the surface. However, in the light of the comments provided by both reviewers, we improved our methodology to assess the structural complexity of tubeworm assemblages using m², lines 220-227 page 8 of the manuscript. To estimate the tube surface area, we measured the tubes both lengthwise and crosswise (i.e. diameter). By assuming the tube has a cylinder shape, we obtained the developed surface (surface of tubeworms) in $m^2$. We therefore added species densities (ind $m^{-2}$) in Table 3. The strong correlation between the developed surface areas and species abundances further supports the fact that macrofauna colonize the entire surface available in a 3-dimensional space.***

*"I found the treatment of the isotope data not comprehensive enough to support the conclusions made. Specifically, L 362 identifies a shift from bactivorous to predator guild, but which species belong to which? How is this shown by these data? I also question whether the term "trophic network" is appropriate. Really these data are just presented and then scaled by biomass, which I like, but is not a trophic network per se. Either modify the term or expand the analyses performed to look more at connections. I am not sure that a more in depth analysis would be possible with the heterogeneous and every shifting baseline caused by the diversity of microbial communities so that is not what I am recommending, but instead I would avoid the term trophic network."*

***Author and co-authors:*** ***We agree with the Reviewer that our isotopic data were not comprehensive enough to support the statement found on line 362 (previous manuscript version). We removed this sentence. As suggested, the expression "trophic network" was replaced with "food/trophic web".***

*"Figures 1-3 are very nice. Figures 4 and 5 have too small of font on the axis and the grey background clutters the visuals, especially when numbered, also too small. I do not consider these two figures ready for publication. The grey should be removed, the lines within the text should be removed and ideally a key with the colors and the species should be included so the reader is not forced to delve heavily into the figure legend to know what they are looking at."*

***Author and co-authors:*** ***As suggested by the Reviewer, we modified Figures 4 and 5 so they are now suitable for publication in Biogeosciences (see below).***

## III. Small suggestions

*"L37 "Fairly" long tubes comes across as vague. Since the actual values are known, please just include them."*

***Author and co-authors:*** **We modified the sentence and added the real measurements line 38** ***page 2 of the manuscript.***

*"L122 – I would suggest adding in "average rate of +3.2" as that is a mean of multiple, often highly variable values."*

***Author and co-authors:*** ***As suggested by the Reviewer, we modified the sentence on line 119 page 5 of the manuscript.***

*"L144 – The sentence that starts on this line seems out of place in this paragraph. It should be either removed or rephrased as to why this builds upon what was said before."*

***Author and co-authors:*** ***As suggested by the Reviewer, the sentence has been removed. The entire paragraph was actually reworked and shortened following additional comments from the other reviewer.***

*"L294-296 It seems that these should either be reported in dmˆ3 or with a different number of significant figures as there was not a mˆ3 counted. I understand why mˆ3 was used so suggest just 17 x 10ˆ6 etc. but also comparing them in a m-2 context."*

***Author and co-authors:*** ***As strongly suggested by both reviewers, we improved species density measurements by calculating the tubeworm surface area. Species density is now expressed in number of individuals per square meter of tubeworm surface (ind $m^{-2}$).***

*"L290- again question whether the right number of significant digits is used on the percentage Line 361 "contributed – 16.4%..."""*

***Author and co-authors:*** ***All percentages have been harmonised and expressed with one significant digit.***

*"L386 – also sampling approaches. Any of the sampling that has occurred with a mussel pot or a Bushmaster could also lead to differences in diversity simply due to methodology. In addition, not suctioning the area could also lead to lesser diversity in other studies."*

***Author and co-authors:*** ***We agree with the Reviewer and modified the sentence, lines 375-376 page 13 of the manuscript:*** *"Variation between sites and regions may be related to discrepancies in sampling effort and methodologies."*.

*"L414 – I question whether a trophic network is the right word here considering the analyses done."*

***Author and co-authors:*** ***As previously reported, the term "trophic network" was replaced with "food web" throughout the manuscript.***

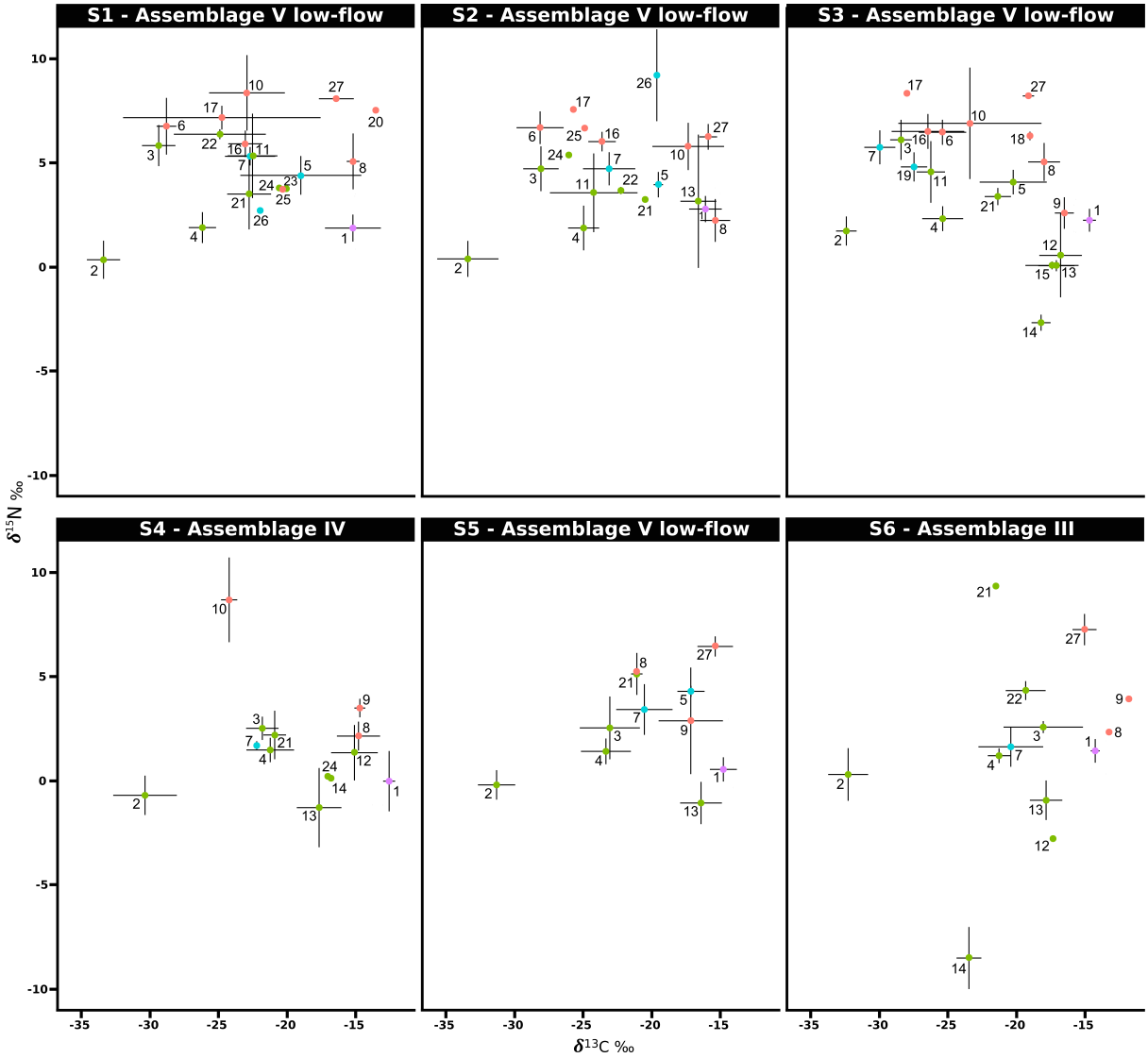


**Figure 4.** Stable isotope bi-plots showing vent consumers' isotope signatures (mean $\delta^{13}C$ versus $\delta^{15}N$ values ± standard deviation) for the six vent assemblages sampled on the Grotto hydrothermal edifice. Each vent species is designated by a number: 1 = *Ridgeia piscesae*; 2 = *Provanna variabilis*; 3 = *Depressigyra globulus*; 4 = *Lepetodrilus fucensis*; 5 = *Buccinum thermophilum*; 6 = *Clypeosectus curvus*; 7 = *Amphisamytha carldarei*; 8 = *Branchinotogluma tunnicliffeae*; 9 = *Lepidonotopodium piscesae*; 10 = *Levensteiniella kincaidi*; 11 = *Nicomache venticola*; 12 = *Paralvinella sulfincola*; 13 = *Paralvinella palmiformis*; 14 = *Paralvinella pandorae*; 15 = *Paralvinella dela*; 16 = *Hesiospina* sp. nov.; 17 = *Sphaerosyllis ridgensis*; 18 = *Ophryotrocha globopalpata*; 19 = *Berkeleyia* sp. nov.; 20 = *Protomystides verenae*; 21 = *Sericosura* sp.; 22 = *Euphilomedes climax*; 23 = *Xylocythere* sp. nov.; 24 = Copepoda; 25 = *Copidognathus papillatus*; 26 = *Paralicella cf. vaporalis*; 27 = *Helicoradomenia juani*. Known trophic guilds are distinguished by a colour code: pink: symbiont; green: bacterivores; blue: scavengers/detritivores; red: predators. For more information on the interpretation of guilds, please consult the web version of this paper.

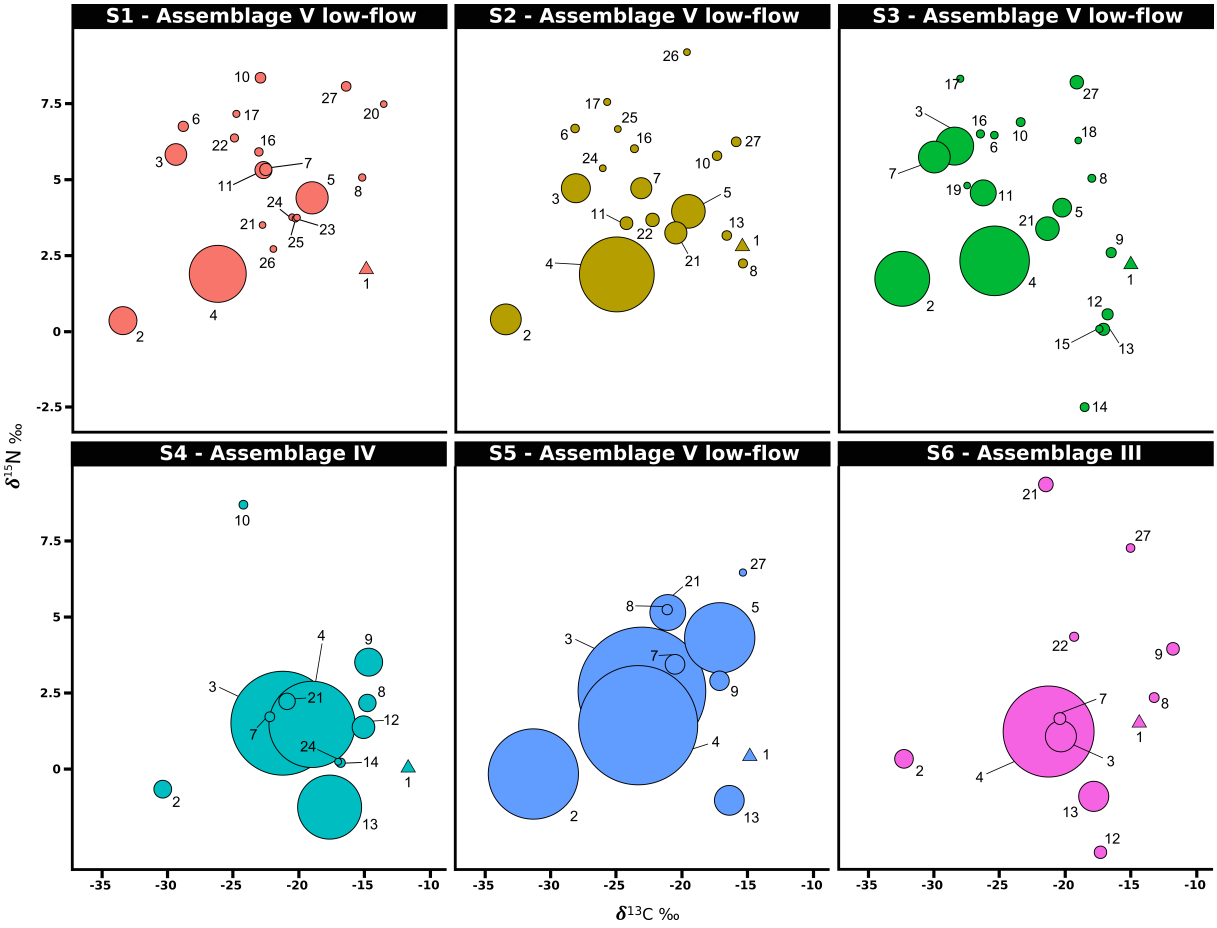


**Figure 5.** Stable isotope bi-plots showing vent consumers' isotope signatures weighted by biomass per square meter of tubeworms (filled circles) for the six vent assemblages (S1 to S6) sampled on the Grotto hydrothermal edifice. Considered as a habitat, the biomass of *Ridgeia piscesae* (denoted by a triangle symbol) is not shown. Each vent species is designated by a number: 1 = *Ridgeia piscesae*; 2 = *Provanna variabilis*; 3 = *Depressigyra globulus*; 4 = *Lepetodrilus fucensis*; 5 = *Buccinum thermophilum*; 6 = *Clypeosectus curvus*; 7 = *Amphisamytha carldarei*; 8 = *Branchinotogluma tunnicliffeae*; 9 = *Lepidonotopodium piscesae*; 10 = *Levensteiniella kincaidi*; 11 = *Nicomache venticola*; 12 = *Paralvinella sulfincola*; 13 = *Paralvinella palmiformis*; 14 = *Paralvinella pandorae*; 15 = *Paralvinella dela*; 16 = *Hesiospina* sp. nov.; 17 = *Sphaerosyllis ridgensis*; 18 = *Ophryotrocha globopalpata*; 19 = *Berkeleyia sp. nov.*; 20 = *Protomystides verenae*; 21 = *Sericosura* sp.; 22 = *Euphilomedes climax*; 23 = *Xylocythere* sp. nov.; 24 = Copepoda; 25 = *Copidognathus papillatus*; 26 = *Paralicella cf. vaporalis*; 27 = *Helicoradomenia juani*. For legibility, the biomass of *P. pandorae* in collection S6 is not shown.