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Interactive comment on "Comparative study of vent and seep macrofaunal communities in the Guaymas Basin" *by* M. Portail et al.

M. Portail et al.

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Dear Lisa Levin,

We would like to thank you for the constructive comments and suggestions you made. We strove to address all of your comments, as shown in the detailed reply below.

We hope that the improvements now make this manuscript suitable for publication.

Sincerely,

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Referee comments #1 Lisa Levin

Abstract I recommend a more quantitative description of the findings. For each results statement in the abstract try to include a quantitative aspect. E.g., What is an important number? What number or fraction of species were shared between the ecosystems. As suggested, we re-phrased the last sentences of the abstract (p.2 line 8): "At the family level, seep and vent similarity reached at least 58 %. All vent families were found at seeps and each seep specific family displayed low relative abundances (<5%). Moreover, 85 % of the identified species among dominant families were shared between seep and vent ecosystems. This study provides further support to the hypothesis of continuity among deep-sea seep and vent ecosystems. "

Methods Are all the sites below the main oxygen minimum zone? If so this should be stated. What are the levels in overlying waters? As suggested, we added the following sentences at the end of the section 2.1.: "All study sites are found deeper than the main oxygen minimum zone (< 0.5 mL.L-1) that is found between 650 and 1100 m along the north east pacific margins from California to Oregon (Helly and Levin, 2004) and within the Guaymas basin (Campbell and Gieskes, 1984). Oxygen measurements made in overlaying waters at our seep and vent study sites showed oxygen concentrations of 1.38 and 1.43 mL.L-1, respectively."

Results These are well presented. In section 3.2.1 I suggest you present some comparisons of densities in hard and soft substrates. While these may reflect 2 dimensions on hard and 3-D on soft substrates, the foundation species add dimensionality to all. As suggested, we added the following sentence at p.16 line 20: "No significant density differences were related to the nature of the substrata (soft versus hard substrata)." In addition, we modified into the discussion the section from p.27 line 3 to line 15, as following:" Densities at relatively low fluid-flux assemblages were enhanced in comparison with the reference and the highest densities were related to two of the high fluid-flux assemblages (vent siboglinid and seep gastropod). However, seep and vent microbial mat assemblages, which showed the highest fluid fluxes, were characterised by reduced density. Comparison across ecosystems of microbial mat and vesicomyid assemblages did not lead to any conclusions on vent-specific effects on density. Within both ecosystems, density variations were found among high fluid-flux assemblages. These differences may result from variable fluid dynamics and the engineering role of foundation species among assemblages whereas the nature of the substratum was not significant. While densities may reflect 2 dimensions on hard and 3-D on soft substrates, the foundation species add dimensionality to all."

Have you examined densities in relation to hydrogen sulfide concentrations? Yes, we tested correlations between density and environmental factors available on all assemblages or supplementary environmental factors available only on soft sediment habitats. Systematically, no significant patterns were found. As methane and hydrogen sulphide were correlated (p 13 line 18 to line 20), the discussion about the global pattern between density and methane concentrations also refers to hydrogen sulphide concentrations.

The sites should be introduced earlier in the methods section (under 2.1 study area) rather than in 2.2 sampling design. The description of the sites should include whether they are considered to be hard or soft substrate. We moved the beginning of section 2.2 ("The Biodiversity and Interactions... Fig. 1") to the end of the section 2.1. and added this paragraph: "In the vent field, we studied two hard-substrate edifices, Rebecca's Roots and Mat Mound as well as two sedimented vents, Mega Mat and the newly discovered Morelos site. At seep, all study sites were newly discovered. Juarez site was characterized by carbonate concretions overlying soft sediments whereas Vasconcelos and Ayala were related to soft sediment sites."

Fig. 6 relationships are not linear (although they might be if you plotted methane on a log scale). Is there a better fit linear correlation? Based on untransformed methane concentrations we obtained the best correlation with a logarithmic regression (R2: 0.8, p: 0.0003). A linear regression is obtained when we log-transform the methane concentrations and gives similar results. As suggested, it may be more interesting to rep-

resent a linear than a logarithmic regression. We thus changed the Figure 6 (attached file).

The section on relationships with site characteristics contain many interesting comparisons that could be presented earlier in the paper as hypotheses. e.g., Methane and temperatures and foundation species densities as indicators of composition. As suggested, we rewrote our hypotheses from the end of the introduction: "We tested whether macrofaunal density, diversity and composition patterns are ecosystem-dependent. We assumed that macrofaunal composition overlap between seeps and vents will be larger among low fluid-flux than among high fluid-flux assemblages. Finally, we hypothesized that other factors such as the nature of the substratum and the engineering role of foundation species may further add a non-negligible heterogeneity within both ecosystems."

We thus also changed and moved the p.26 line.23-25 to the end of the 4.2.1 with: "Overall, our hypothesis stating that seep and vent macrofaunal communities may exhibit density and diversity patterns that are ecosystem-dependent can be rejected. Density and diversity patterns were relatively consistent with the conceptual model proposed in Bernardino et al. (2012) and suggest that seep and vent communities are similarly shaped by fluid-flux intensity without a noticeable effect of vent-specific environmental conditions.", the p. 27 line 28 to 31 sentence into: "We hypothesized that seep and vent macrofaunal compositions will be ecosystem-dependent and more specifically, we predicted that macrofaunal overlap may be larger among low fluid-flux than among high fluid-flux assemblages.", and finally we replace the p.28 line 18 sentence by: "In addition to the community composition pattern along fluid-flux intensity, additional significant heterogeneity related to the nature of the substratum and the engineering role of the foundation species was found."

p. 20 line 15-17 – does the relationship to fluid flux indicate sulfide tolerance? How many seep families were unique? Fluid role on the limitation of faunal colonisation to tolerant taxa is discussed in the 4.2.2.(p. 28 line 7-14): "Contrary to our hypothesis, high fluid-input assemblages (. . .) characterised by the presence of ampharetid and dorvilleid polychaetes, known as highly specialised taxa. Indeed, (. . .) they are usually found at seeps in the most sulphide-rich environments (Levin, 2005)." We present the number of seep specific families within the section 3.2.4 (p.20 line 28-p.21 line 4) but it was not well specified, therefore we modified the sentence as follow: "All the 22 families found at vent were also found at seep with seep exhibiting 28 specific families and 6 families only shared with the reference." Additionally within the discussion (p. 30 line 24-25): "This effect of rare species is supported by the fact that 30 species from the 34 additional families at seeps compared to vents were found in low relative densities (< 5%)."

Discussion p. 24 line 1-3 Check Marlow et al. papers for ANME composition of carbonates. I think ANME 1 was dominant on less active rocks. As suggested, we integrated Marlow's papers and re-written p.23 line 30 to p.24 line 3, as such: "Variations were mainly related to higher ANME archaeal abundance at both seep and vent high fluid-flux habitats. Both ANME1 and ANME2 dominance increased with fluid flux intensity and thus contrast with patterns observed at the hydrate ridge methane seeps (Marlow et al., 2014a;Marlow et al., 2014b). There, sediments or carbonates ANME communities were related to higher dominance of ANME2 in high fluid-flux compared to low fluid-flux habitats whereas ANME1 showed the opposite pattern. Nevertheless, within our study, compositions of ANME clades were distinct between seep and vent high fluid-flux assemblages: ANME1 dominated at vent microbial mat assemblage whereas seep microbial mat and gastropod assemblages showed co-dominance of ANME1 and 2. These results support previous studies suggesting that ANME1 are associated with higher temperatures and potentially more permanent anoxic environments compared to ANME2 (Rossel et al., 2011;Biddle et al., 2012;Vigneron et al., 2013;Holler et al., 2011;Nauhaus et al., 2005)."

Section 4.2 Consider including a conceptual diagram to illustrate the points made in this section as they pertain to vents and seeps studied here. As suggested, we included

a conceptual diagram (attached file) at p.30 line 6: "Overall, macrofaunal community structure within Guaymas chemosynthetic ecosystems was significantly driven by the fluid-flux intensity, regardless of the ecosystem (Fig. 11). Comparisons of microbial mat and vesicomyid assemblages across ecosystems further support the absence of vent-specific structuring factors. In addition, heterogeneity due to the type of substratum and the engineering role of foundation species were significant, especially within low fluid-flux settings." Figure 11: Conceptual diagram of macrofaunal diversity, density and composition patterns along a fluid-flux gradient in the chemosynthetic ecosystems of the Guaymas basin. The top panel illustrates the distribution of foundation species as well as density and diversity macrofaunal patterns along increasing methane concentrations and fluid flux. The middle panel lists the dominant families within macrofaunal communities. The bottom panel highlights the significant role of engineering effect of foundation species and substratum nature on community patterns.

Page 27 line 25-26. Does overlying low oxygen water influence this? As our study sites were not in the OMZ, we did not consider oxygen limitations as a factor driving similarities among seeps and vents. We still added the following sentence: "Reduced compound concentrations (methane, hydrogen sulphide) as well as other correlated factors not measured within our study, such as oxygen concentration could be considered as the seep and vent common structuring factors." In addition we deleted the sentence p. 26 line 27 to p27 line 1, from: and/or to lower (. . .) habitat oxygenation".

Page 28 par 1. See Levin et al. 2013 (DSR) on dorvilleids and Thurber et al. 2012 on ampharetids for more information about radiation, resource partitioning and coping with stress. Levin, Lisa A., Wiebke Ziebis, Guillermo F. Mendoza, Victoria J. Bertics, Tracy Washington, Jennifer Gonzalez, Andrew R. Thurber, Briggite Ebbe, Raymond W. Lee. Ecological release and niche partitioning under stress: Lessons from dorvilleid polychaetes in sulphidic sediments at methane seeps. Deep-Sea Research II, 92: 214-233. http://dx.doi.org/10.1016/j.dsr2.2013.02.006 (2013) As suggested, we rewrote the paragraph including the suggested references: "Surprisingly, high fluid-input assemblages were similar at seeps and vents. In both ecosystems, these assemblages were characterised by the presence of ampharetid and dorvilleid polychaetes, known as highly specialised taxa. Indeed, to cope with sulphide and/or thermal stress, ampharetid polychaetes live in vertical tubes from which they deploy their gills over and above the substratum as an adaptation to harsh environmental conditions (Treude et al., 2009;Thurber et al., 2013). In addition, ampharetids at seeps have been shown to benefit from a chemosynthesis-derived nutrition (Thurber et al., 2013). Dorvilleids are known to be sulphide-tolerant and colonise sewage and other organic-rich settings (Jumars et al., 2015). Dorvilleids are usually found in the most sulphide-rich environments at seeps (Levin, 2005) where they have been found to exhibit multiple trophic strategies including diets specialised on chemoautotrophic microbes (Levin et al., 2013;Thurber et al., 2012)."

p. 30 line 5-11. Are there useful comparison of vents and seeps in the Okinawa Trough by Watanabe which should be cited? Watanabe, H., Fujikura, K., Kojima, S., Miyazaki, J. I. & Fujiwara, Y. 2010 Japan: vents and seeps in close proximity. In The vent and seep biota: aspects from microbes to ecosystems (ed. S. Kiel), pp. 379–401. Netherlands: Springer.(doi:10.1007/978-90-481-9572-5_12) We changed the end of the 4.3 (p. 32 line 12-26) into : "Overall, Guaymas seep and vent species composition suggest that, with the exception of a few species, including the foundation species that are vent-endemic, a large part of macrofaunal communities can colonise variable ecosystems and cope with environmental variations. In addition, our results contribute 20 additional species to the list of species common to seeps and vents in the world's oceans (Table 6). Our study thus supports strong faunal similarity among reducing ecosystems in the absence of biogeographic barrier. Nevertheless, the sedimentary context of the Guaymas basin may reduce seep and vent fluid discrepancies, allowing greater faunal exchange among ecosystems. Similar suggestion has been made around Japan where seep and vent communities significantly differed but where some vents, including the Okinawa Though sedimented vents, showed higher similarities to methane seeps than to other hydrothermal vents (Watanabe et al., 2010;Nakajima et al., 2014). Thus, more

comparative studies along the seep and vent environmental continuum are needed to confirm the faunal commonality of reducing ecosystems communities. "

p. 31 line 5 – explain ecosystem filtering. We changed the sentence into: "However, we cannot exclude the possibility that harsher and specific conditions at vents (e.g. temperature, metals) may contribute to limit the colonisation of these rare macrofaunal taxa." Furthermore, we deleted as suggested by the second referee the p.4 line 32 which included the term "ecosystem filtering" and we modified the p.31 line 23 sentence by: "Thus, our study suggests relatively strong faunal exchanges between Guaymas seep and vent ecosystems."

Minor edits Be sure to include spaces between references (e.g., page 2 line 24), Cite reference strings in chronological order from earliest to latest (e.g. p. 4 line 16-17) Editor's editing

Page 4 line 22 – clarify if you are referring to overlying waters? Vent fluids? We changed the sentence into: "Vent fluids usually exhibit greater temperature anomalies, higher metal concentrations, lower pH and oxygen concentrations as well as higher outflow rates and temporal instability than seep fluids (Tunnicliffe et al., 2003;Sibuet and Olu, 1998;Herzig and Hannington, 2000)."

p. 5 line 13 insert 'sites' after vent and before suggest We modified the text as suggested.

p. 6 line 8 delete 'an' We modified the text as suggested.

p. 6 line 17 were the carbonate concretions sampled? Some pieces of carbonate concretions have been occasionally sampled, but associated fauna was not characterized within this study.

p. 6 line 28 insert 'has' after but We modified the text as suggested.

p. 19 line 14 a word is missing after whereas We modified the text as suggested.

p. 20 line 1 repland end with 'hand' We changed the sentence into: "At one axis end, hard substrata mainly (. . .). At the other axis end (. . .)."

p. 21 line 3-4 : all the 22 families found at ventS were also found at seep ecosystemS while seep SAMPLES had 28 additional families. We modified the text as suggested.

p. .21 line 8 were restricted to vents. We modified the text as suggested.

p. 26 line 27 and an 'a' after 'to0' We modified the text as suggested.

p. 28 line 32 – explain the alvinelid engineering role. We added the definition of the alvinelid engineering role in the paragraph p.24 line 4-16 at the line 14. "Alvinellid worms secrete tubes or mucus on the surfaces they colonize and may locally modify environmental conditions (fluid emission and mineral precipitation) promoting other species colonization (Sarrazin and Juniper, 1999;Zbinden et al., 2003;Le Bris et al., 2005;Pradillon et al., 2009)."

p. 29 line 6 should this be Trough? We modified the text as suggested.

p.29 line 15 should be taxon not taxa We modified the text as suggested.

p.29. line 23 place an 'a' after indeed We modified the text as suggested.

p.31 line 2 ecosystemS, line 4 ventS than seeps We modified the text as suggested.

Interactive comment on Biogeosciences Discuss., 12, 8497, 2015.

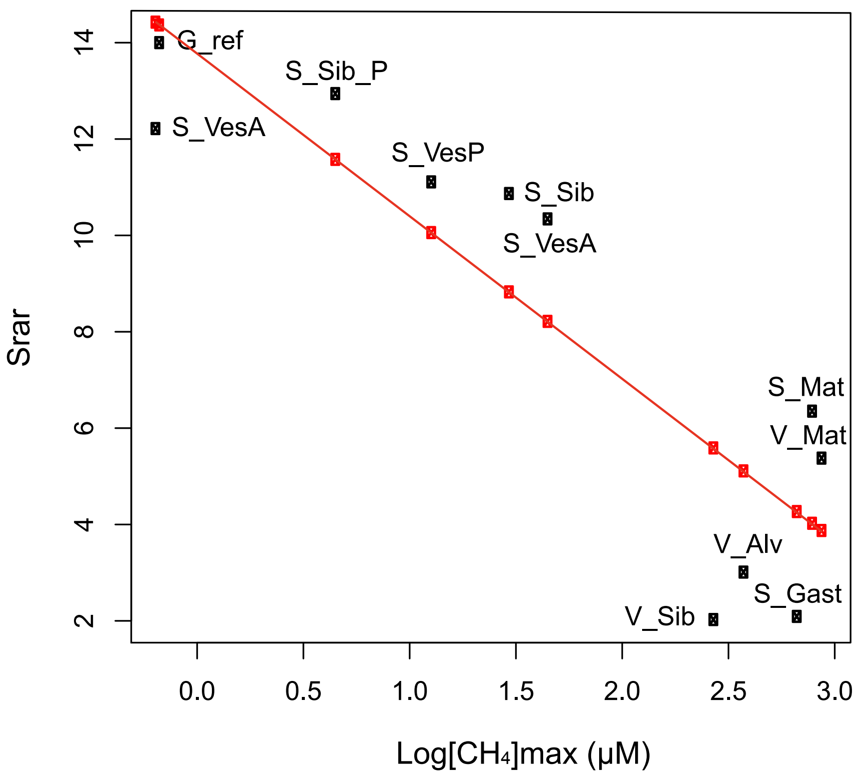
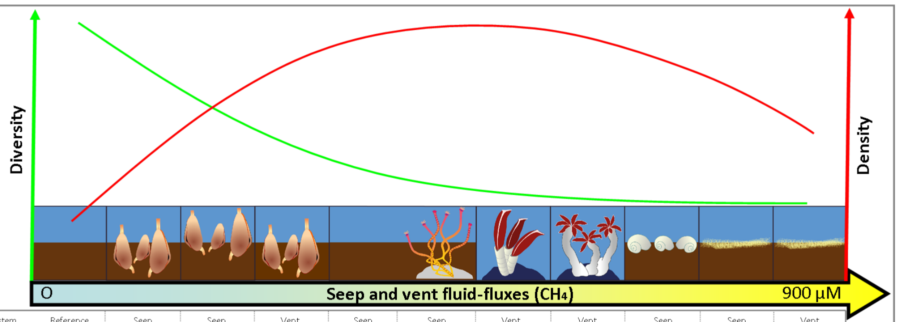


Fig. 1. Figure 6



Ecosystem	Reference	Seep	Seep	Vent	Seep	Seep	Vent	Vent	Seep	Seep	Vent
Foundation species	-	*Archivesica gigas*	*Phreagena soyoae*	*Archivesica gigas*	-	*Lamellibrachia barhami* *Escarpia spicata*	*Riftia pathyptila*	*Paralvinella grasslei* *P. bactericola*	*Hyalogyrina* sp	*Beggiatoa* spp	*Beggiatoa* spp
Dominant macrofaunal taxa	cirratulid paraonid nereidid ampharetid	dorvilleid bathyspinulid ampharetid aplacophora	bathyspinulid provannid ophiurid neolepetopsid	dorvilleid bathyspinulid provannid ampharetid	cirratulid dorvilleid lumbrinerid cossurid	lepetodrilid polynoid serpulid neolepetopsid	dorvilleid ampharetid	dorvilleid polynoid ampharetid	ampharetid dorvilleid	dorvilleid ampharetid bathyspinulid hesionid	dorvilleid ampharetid nereidid provannid
Engineering effect	-	*	*	*	-	*	ns	ns	ns	ns	ns
Hard substratum effect	-	-	-	-	-	*	ns	ns	-	-	-

Fig. 2. Figure 11