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Interactive comment on “Influence of chemosynthetic substrates availability on symbiont densities, carbon assimilation and transfer in the dual symbiotic vent mussel *Bathymodiolus azoricus*” by V. Riou et al.

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Gill condition

The use of a gill index of (gill dry wt./shell length)*100 is inappropriate, since, for mussels from the same collection, this index value increases exponentially with shell length. Since the mussels used varied by as much as 20 mm (53.6–74.1 mm) and the sample size was only 1–3 in January, the result would largely depend on the size of the mussels taken. The appropriate index is (gill dry wt./rest of body dry wt.)*100 that, for mussels from the same collection, does not vary with shell length above lengths of

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approximately 37 mm.

C-Fixation rates

The fixation rates recorded are low, a maximum of $0.23 \mu\text{moles C h}^{-1}\text{g}^{-1}$ dry gill for CH_4 and $0.32 \mu\text{moles C h}^{-1}\text{g}^{-1}$ for CO_2 fixation in the presence of sulphide. Uptake of both methane and sulphide by isolated gills of freshly collected *B. azoricus* is linear with concentration over the range of concentrations used in this study and are in the region of $2.46 - 48 \mu\text{moles h}^{-1}\text{g}^{-1}$ dry gill over the $14\text{-}200 \mu\text{M}$ concentration range used in the experiment. Even allowing for the 70% fixation rate found by Kochevar this is considerably in excess of the amount of methane fixed. Methane toxicity is unlikely to be the cause, since respiration rates only start to fall at concentrations above $400 \mu\text{M}$. For sulphide, the uptake rate is 0.4 to $6.4 \mu\text{moles S h}^{-1}\text{g}^{-1}$ dry gill over the $2\text{-}32 \mu\text{M}$ sulphide concentrations used. Assuming that 5 moles of S are required to reduce 1 mole of CO_2 (Kelly, D.P., Kuenen, J.C., 1984. Ecology of the colourless sulphur bacteria. In: Codd, G.A. (Ed.), Aspects of Microbial Nutrition and Ecology. Academic Press, New York, pp. 211-240.), then this would allow a maximum fixation of 0.08 to $1.28 \mu\text{moles C h}^{-1}\text{g}^{-1}$ dry gill, excluding any chemical oxidation of sulphide before it reaches the bacteria. Thus the CO_2 fixation rate in the presence of sulphide appears closer to that predicted from sulphide-uptake rates.

The fixation of some CO_2 in the absence of sulphide is most likely due to uptake, by enzymes such as pyruvate carboxylase or PEP carboxylase, into organic acids. Pyruvate carboxylase is known to be present in *Mytilus edulis* and Felbeck has that a lot of the CO_2 is converted to malate in the plume of *Riftia*, well away from the bacteria in the trophosome.

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