

# ***Interactive comment on “Dead zone or oasis in the open ocean? Zooplankton distribution and migration in low-oxygen modewater eddies” by H. Hauss et al.***

## **Anonymous Referee #1**

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The authors use the term “Target strength” for the density measure derived from the acoustic record. For those using active acoustics to measure biomass this is confusing. I am still unsure what the measure target strength including in the paper. I assume it is the volume backscatter coefficient according to (MacLennan et al., 2002), calculated by introducing time varied gain to the acoustic record. In plankton and fisheries acoustics the terms “Target Strength” describe the acoustic properties of individuals, and is used to assess biomass (see (MacLennan et al., 2002)). This paper has potentially a wide distribution and such potential confusing use of terms should be avoided. I suggest

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that they try to keep to the accepted standard in the field which is given by MacLennan et al (2002). In this case I assume (not sure) the term SV (mean volume backscattering strength, also used by (Luo et al., 2000)) is synonymous with the term “Target strength” as used by the authors.

The authors try to combine use of optic, acoustic and net sampling methods in their studies of distribution patterns of marine organisms in relation to mesoscale eddies. Combining information from the UVP and the multinet seems relevant, but, as also pointed out by the authors themselves, these methods sample individuals with weak acoustic backscatterer for the 38 and 70 kHz ship based ADCP. Thus the relevance for comparison between catches and acoustics seems vague or irrelevant. On the other hand, the authors do not discuss the potential for plankton to hold micro bubbles. Firstly it is known that phytoplankton aggregates may produce micro bubbles which may become resonant at quite high frequencies. Similarly, the siphonophores may have a gas bubble (pneumatophore) that supports their buoyancy. In both cases they become strong acoustic reflectors with potential high contributions to the frequencies used in this study. I suggest that the authors consider these sources of contribution at least in the discussion.

The discussion around the use of acoustics is vague. Compared to fish with swim-bladder or plankton/aggregates with gas bubbles/pneumatophores copepods and euphausiids will be poor reflectors reaching its highest backscatter at higher frequencies than that used by the vessel (38 and 70 kHz). Also, impact of resonating gas volumes in mesopelagics cannot be excluded at 38 and 70 kHz (Godø et al., 2009). Multiple frequencies analyses are clarifying when simultaneous sampling takes place but might be confusing when comparing independent samples (in time and space). These are all factors that prevent firm conclusions to be drawn. I suggest that the authors bring the mentioned impact factors on the acoustic part of the paper to attention in the Discussion. In particular, these issues should be mentioned in the context of how such studies should be run in future.

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The figure caption of Fig. S1 is unclear to me. What are the lines in the left panel showing? And what is the connection to the right panel?

Godø, O. R., Patel, R., and Pedersen, G. 2009. Diel migration and swimbladder resonance of small fish: some implications for analyses of multifrequency echo data. *ICES Journal of Marine Science*, 66: 1143-1148.

Luo, J. G., Ortner, P. B., Forcucci, D., and Cummings, S. R. 2000. Diel Vertical Migration of Zooplankton and Mesopelagic Fish in the Arabian Sea. *Deep-Sea Research Part II-Topical Studies in Oceanography*, 47: 1451-1473.

MacLennan, D. N., Fernandes, P. G., and Dalen, J. 2002. A consistent approach to definitions and symbols in fisheries acoustics. *ICES Journal of Marine Science*, 59: 365-369.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/12/C8473/2015/bgd-12-C8473-2015-supplement.pdf>

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