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Ocean Science Discussions

Interactive comment on "Annual cycle of sound-scattering mesoplankton in the oxycline and hypoxic zone in the northeastern Black Sea" *by* Alexander G. Ostrovskii et al.

Anonymous Referee #1

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The manuscript (MS) showed a pure acoustical scattering layer daily migrating using an autonomous water current profiler operating at 2 MHz during months of some years in the Black Sea. The Black is very good environment to study the zooplankton acoustics because of less diversified organisms and daily layered migration of each species in separate. There are some studies published already on this topic as inferred from the introduction of the MS. The MS however has not covered the scientific aspects rather different than the results of the previously published papers using the echosounder and ADCP because of the main problems presented in the MS as follows: Introduction of the MS did not present lack of the other studies and their innovations to purpose the annual cycle of the SL with the reasons. Material Methods would have data analyses

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and processing methodology with the methodical terms and study area description for the oxygen and other physical parameters which confine the DVM, e.g. the R and its distinguished importance from the acoustical energy , relationships between the orientation and each transducer of the profiler, acoustical intensity or amplitude calculation, removal of unwanted targets else (fishes, particles, marine snows and some untargeted individuals nearby targeted species relative to frequency) than the zooplankton, detection range of the frequency and dynamic ranges proportion to the aforementioned zooplankton. Results showed only pure SL moving up/downward and staying at constant depths during the days of the different months. On surface SL, one or two SL migrating daily, and one DSL staying at constant depth in time looking at the R terms which lack of importance and distinguished description of the other scattering energy units. The 2 MHz was expected to detect particles in size down to 0.2 mm in diameter equivalent to the spherical particles regardless of the beam pattern of the organisms. The beam pattern of the organism is needed to outdraw depending on the orientation and shape during the both direction migration and duration at deep depth and surface, shall the three transducers particularly A3, help information on the body shape and orientation. Some questions are arisen to be explained so; The 2 MHz must detect many species but only one or sometimes two SL were observed during the diel movement. As a consequence, some studies showed two scattering layers belonging to two different species of fluid-like organisms depending on their acoustical reflection coefficients in the Black Sea (copepods, Cheatognatha) as well as significant detection of moon jellyfish using rather lower frequencies than the frequency used in the MS. Main of the results and findings have showed one scattering layer migrating during the day, which could be more number of scarring layer in the present study. The SL was compared only with dissolved oxygen and not other physical parameters such as sigma-t of water density which describe the DVM in the Black Sea, and study area was well described for the regional differences such as upwelling or downwelling, rim currents which course the DVM and their speed across oxygen and water density so depth of water column. Daily differences could be ignored using the water density along the

rim currents. Some vertical lineations occurred from surface down to greater depth of the SL which could be attributed presumably to the particle sedimentations. The SL amplitude as counts showed daily differences in same months without a reasonable explanation. Mostly, one SL migrated between surface and a certain depth above the minimum oxygenated layer, not reaching the hypoxia layer, but other studies observed different DVM reaching deep layers as well as staying at minimum oxygen layer during diapausing and daytime. The R values are expected to changes in time during the DVM, because mainly of the changes in individual swimming speeds and organisms concentration insonified volume by the acoustics. Therefore, what is importance of the R to denote significance in the intensity of the SL. The swimming speed through the oxygen concentration is one of the recognition parameters identical for some species migrating during the day in the Black Sea. When the DSL arrived non-migrating SL at sub-surface, there was however no aggregation of the SL during the night. Inherently, some scattering layers must occur at sub-surface even if the orientation of the organisms change over there. What is the difference between Fig. 11 and 12 as well as Fig. 9, one was average of amplitude of A1 and A2, the next one is based on their ratio through the same water column denoted with the oxygen concentrations. Indeed, both figures contain zooplankton migrating upward and downward through the same water column in order to show the orientation of the organisms. They had similar information. Breaking apart from the DVM SL, some SL returned back or stopped going down at the middle way of the water column during the DVM as shown in Fig. 10. In general, the echogram data show revealing much information remained unexplained because of lacked one of the ground-truthing methods, discrete layered zooplankton samples. Discussions were not well written to justify the findings, observations and acoustical parameters used in the MS. Most of the results were postulated to the assumptions for the justification. One DVM SL was predominated in the present study, seemed to be typical characters of Calanus euxinus' DVM from a region of a downwelling zone, not reaching the minimum oxygen layer of the Black Sea. Juday net samples are missing to show the DVM of the zooplankton Calanus euxinus and Pseudocalanus elongates,

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which are claimed to be observed by the acoustics, but one DVM SLs are presents overall in the MS. The swimming speed estimated in the MS was discussed with those of the other studies, but there were no data for the swimming speed of the zooplankton in the results MS. Why other zooplankton which contain the similar body material properties to two targeted copepod species did not appear in the SL of the DVM using the very high frequency, even though the results were discussed for the two mesozooplankton. Such questions could be clarified already in the MS but the English of the MS is not comprehensible to me.

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