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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.

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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 #3 Received and published: 3 February 2021 The manuscript (MS) presents a modern imaging techniques such as the acoustic of pelagic communities with advantages to be informative about heterogeneity and transcend multiple spatial scales. The article is based on a large data set (2013-2020) obtained from the application of an alternative innovative approach - a moored Aqualog profiler equipped with an ultrasound probe, a conductivity-temperature-depth (CTD) probe, and a fast

oxygen sensor with the advantage of frequent year-round measurements of collocated vertical profiles of sound scattering, temperature, salinity, and oxygen concentration in the water column from the near-surface to the bottom layer with a high vertical resolution. This topic is not novel but the previous studies are based on ship-borne echograms. The authors clearly indicate their own original contribution. Printer-friendly version Discussion paper The work is interesting, results are sufficient and the paper addresses scientific questions within the scope of OS but needs some revisions.

Response: We are grateful to reviewer for the comments. In the following, we give our point-by-point answers.

Comment #1: The abstract should be condensed and concentrated around the main aim, results and conclusions.

Response: The abstract is condensed although the new information was added to reflect new important contribution about the acoustic data verification based on the zooplankton net sampling.

Comment #2: In the introduction the main sound-scattering zones are defined according to Ostrovskii and Zatsepin (2011) but I suggest to bind them with the density sigma theta which is relevant to the mesozooplankton vertical distribution especially for the Black Sea. As a consequence, it needs to be developed and compared in the results and discussion chapters.

Response: This was done. In the section Results, more information about the isopycnal surfaces is added into the figures, also the new Fig. 11 is added to compare the depth profile of R with the sigma profile of R.

Comment #3: In the MS the lowest depth mentioned was at _Ït' = 15.9 kg m-3. However, in other studies (Mutlu 2007a, b,) sigma theta - 16.2 kg.m-3 , identified as oxygen minimum zone (OMZ) (Tugrul et al. 1992), is a layer where Calanus euxinus spend their daytime. How will the authors comment these differences?

Response: There are regional differences in the lower boundary of the oxygen zone in the Black Sea as it was shown by Glazer et al. (2006a, 2006b). In the southern regions of the Sea adjacent to the Bosphorus strait, the Sea is ventilated due to the inflow of the Mediterranean water. According to Galzer et al. (2006a), "Layers of oxygen intrusion (5 m thick, from 10 to 150 mM OâĆĆ) were present within the suboxic zone of the southwest Black Sea that are not present in the west-central and northeast Black Sea. Oxygen injection also occurs at other depths throughout the southwest and corresponds with small temperature anomalies, suggesting inïňĆuence by Bosphorus inïňĆow up to 150 km from its entrance to the Black Sea." Also according to Glazer et al. (2006b) there are year-to-year-variations in the southwest region as follows: "We observed much less lateral oxygen injection from the Bosphorus in 2003 (less than 95 km from Bosphorus) than in 2001 (up to 150 km). This difference can be attributed to variability in physical processes including seasonal temperature and wind variations between winter conditions (2003) and early summer conditions (2001). Furthermore, suboxic zone thickness varied basin-wide, exhibiting changes in the depth of oxygen extinction and sulïňĄde onset." As concerns with the northeastern Black Sea, the oxygen disappearance was reported for the isopycnal 15.9 (Ostrovskii and Zatsepin, 2016).

Comment #4: The authors presented different seasonal variation in mesoplankton dynamics in relation to dissolved oxygen concentrations. Additionally the SL amplitude showed differences in same months but a reasonable explanation is not presented.

Response: It seems that the difference you noted for the same months is due to the year-to-year variations in the mesozooplankton abundance.

Comment #5: There are two dominant species well acoustically discriminated in the Black Sea – Calanus euxinus and Parasagitta setosa (Mutlu 2007) but the later was not included in the MS which need an explanation.

Response: This is addressed by adding available data of zooplankton sampling nearby

the profiler mooring. The figures 4, 6, 8, and 10 in the revised manuscript show the biomass data for Parasagitta setosa.

Comment #6: Line 315 The authors say ": : :two layers in the cold intermediate layer (CIL) (temperature less than 9_C),::" but according to the literature the positions of the 8_C isotherms have traditionally been considered the lower and upper boundaries of the CIL (Blatov et al., 1984; Ozsoy and Unluata, 1997). Winter cooling, which is an essential element of the seasonal variability could be used for comparison of unlike SL profiles in the same season (month) in different years.

Response: The cold intermediate layer was getting significantly warmer recently. According to (Stanev, E. V., Peneva, E., & Chtirkova, B. (2019). Climate change and regional ocean water mass disappearance: Case of the Black Sea. Journal of Geophysical Research: Oceans, 124, 4803–4819. https://doi.org/10.1029/2019JC015076) "Data from profiling [ARGO] floats reveal that climate change in the Black Sea leads to the disappearance of specific water masses. The warming trend in the cold intermediate layer (CIL) of $\sim$0.05 °C/year was more than double the trend in previous decades, and its temperature approached that of the waters in the deeper layers ($\sim$9 °C), which signified its disappearance. This evolution was due to the warmer winters over the last 14 years. Intermittent major cold water formation events (only three during this period) could not sufficiently refill the CIL."

Comment #7: Conclusions should be rewritten - shortened, concentrated and clearer, emphasizing the research contribution.

Response: The section Conclusions is rewritten in line with your comment.

Comment #8: Correction: Pseudocalanus elongatus (WoRMS) is the right species name, not Pseudocalanus elongates.

Response: Sorry for this mistake. It is corrected.

Comment #9: Figure 3 It is mentioned that "The horizontal axis represents UTC time."

Please, check.

Response: This is corrected.

Comment #10: References should be checked. For example, Arashkevich et al. 2014 (in the text) Arashkevich et al. 2013 (in the reference list); Arashkevich et al. 199, Besiktepe et al., 1998 are missing in the reference list but are cited in the MS and etc.

Response: The missing references are added.

Comment #11: The language should be precise.

Response: We tried to do our best when revised the ms. We also noticed that the journal processing charges include English language copy-editing for final revised papers. We hope that if the ms is accepted it will be edited for precise English language.

Please also note the supplement to this comment:
https://os.copernicus.org/preprints/os-2020-106/os-2020-106-AC3-supplement.pdf

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