

Interactive comment on “ADCP observations of migration patterns of zooplankton in the Cretan Sea” by Emmanuel Potiris et al.

Anonymous Referee #1

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General comments

This manuscript presents the vertical distribution and migration of macro-zooplankton in the open Cretan Sea as derived from a 75 kHz ADCP dataset that covers a period of 30 months with four deployments. The topic falls within the scope of Ocean Science and might constitute a valuable contribution to the Special Issue “Coastal marine infrastructure in support of monitoring, science, and policy strategies”. The use of ADCP as a non-invasive method to infer the zooplankton distribution has been demonstrated by previous papers published on the subject in other oceanographic regions. The novelty of this study is that it applies the ADCP method for this purpose for the first time in the Eastern Mediterranean, in particular, in the Cretan Sea, a very dynamic and crucial area for the circulation of the EMed. Unfortunately, the first three ADCP deployments

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were shallower (down to 300 m depth) than the fourth one (450 m) and missed some interesting zooplankton features. Despite the above mentioned positive aspects, the manuscript is not clear and focused enough to meet the Ocean Science standards. The manuscript should be more neat and concise to gain in clarity and needs a profound revision to solve the numerous problems I see in the various sections and have detailed in my specific comments. The main limit of this work is the lack of macro-zooplankton data collected with vertical tows that could have helped substantially to interpret the ADCP profiles. The experimental set up was clearly designed on the current measurements and not on zooplankton analysis, which was decided successively (at least, this appears from the content of this manuscript). Other papers have analysed ADCP data for inferring on zooplankton vertical migration without parallel zooplankton sampling, but this does not justify the critical limit determined by this choice.

Specific comments

Introduction needs to be carefully revised because the issues presented are not well linked and not clear in some parts. Topics like: the biological pump, the role of zooplankton vertical migration, the Eastern Mediterranean and the Cretan Sea are not present adequately. The biological pump should be introduced in the first sentence and expanded in the second one. The primary production is not linked to the following paragraph and can be removed because not developed further in this section. To be precise, the biological data from midwater are not lacking but they are few in comparison with epipelagic layers (L22-27, pg.1). The vertical migration of zooplankton comes out of the blue (L30); this topic relevant for this study should be properly introduced and the related papers in the Med should be cited. After that, it should be provided the info on zoo vertical migration available for the EMed and explained the “different migrating strategies” emerged from previous papers. The last part of pg. 1 is quite confused and should be rewritten. The Cretan Sea should be presented in a clear way; it is necessary to provide a brief description of the Sea with basic info on characteristics of hydrology, biochemistry and zooplankton in the area before claiming that it is represen-

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tative of a wider EMed area. The second part of Introduction looks better and requires minor changes, apart the two following ones. 1-The study by Cardini et al. (2003) is misplaced here, in my opinion. If the present study has been stimulated by the hypothesis by Cardini et al. (same place, same ADCP) on zooplankton vertical migration, the rationale and the aim of the present study should be presented first and Cardini after (e.g., this study aimed at...testing the hypothesis by...). If the two studies were not related in any case, the citation should be removed from Introduction and used in Discussion. 2- The last sentence on carbon cycle should be removed: considerations on this topic must be treated with caution and not here, because the present study does not provide results on carbon data.

Methods The experimental set up was not designed to properly interpreting the ADCP data in relation to macro zooplankton distribution because of the lack of parallel zooplankton sampling. The zooplankton sampling done with a 200 μm net at monthly frequency in the upper 100 m and the single oblique tow performed with a Bongo net (330 μm and 500 μm) in Dec 2013 in the 0-500 m layer were useless for interpreting the ADCP data of this work and, in fact, those zooplankton data are not presented. Therefore, this part (pg5, L7-14) should be removed. Similarly, the downward looking 400kHz ADCP data were not used for the present work, so this part should be removed too (pg4, L34-36). The sampling and analytical methods for chlorophyll concentrations in Figure 4 are not presented. I do not understand how the burst velocity may help identifying the optimal sampling strategy for zooplankton; probably you mean “the optimal cell extension for the most appropriate recording of zooplankton signals”? Or something else? This part must be clarified (pg.3, L16). The affirmation on pg. 4, L3 is based on statistical test? Expand the explanation.

The Results section needs a substantial revision and a more synthetic rewriting. The results are interesting, but their too long, detailed and sometimes repetitive description leads to lose the focus and weaken the main messages. This section is definitely too long (9 pages) and repetitive and I found it heavy to read. It is presented in sub-

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sections, but it is not clear enough because the topics cross different sections, the figures are continuously cited back and forth (not in the numerical order for figs 7,9,10,8) and this creates confusion and tiredness in the reader. Links among figures are commented and interpretations are mixed with mere objective results. Links, interpretation, and comments should go all in Discussion to provide the reader with a neat and clear overview of the study. I suggest to follow the typical simple way of result presentation, i.e. describing objectively the data showed by the figures, in the right succession, without anticipating interpretation. This is not a “Results and Discussion” section. Part 3.1 on Environmental conditions is confusing; it is not clear what are the general typical conditions of the area as emerged from previous works and what are the results from the present work. There should be a separated section, placed in Methods, reporting the general characteristics of the area. The use of the past tense would help clarifying what are the results of the present study. The “constant presence of a deep layer of scatterers” (pg8, L11) was actually recorded only in the fourth deployment because deeper down to 450 m, so it cannot be defined “constant”. The affirmation that zooplankton feed at certain depths and hours (e.g. pg.9, L8 and somewhere else) should be changes in likely supposition; the present study does not demonstrate any feeding activity, which might only be hypothesized as (one of the) possible explanation to the vertical zooplankton displacement inferred by ADCP backscatter. There are other strict affirmations that should be changed in interpretative suppositions/hypotheses (e.g., pg.10, L7-12). Many of the migrant macro-zooplankton animals are carnivorous. This kind of interpretation should be presented with more caution.

Discussion contains some repetitions of Results; the two sections should be rewritten in parallel to separate objective results from interpretation and discussion. This would make the manuscript much clearer and more interesting and pleasant to read. Discussion should be also organized in sub-sections to address the different aspects of this study. Light is interpreted as “the main factor affecting zooplankton migration” (pg.14, L28); it can be a triggering signal, a factor acting directly or indirectly on individual animals, or on swarms. This interpretation should be more exhaustively expanded by

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using information from the literature on light perception by zooplankton groups. The last part of Discussion (pg.17, from L17) is dedicated to comments on the limits of this work, which are quite heavy indeed and should have been addressed at the beginning of the study, planning a more appropriate in-field-experimental design. It is right and honest to discuss on the limits, but this section should be closed with positive conclusions highlighting how this work contributes to increase the knowledge on zooplankton in the Cretan Sea. I am positive that this work might be useful to Mediterranean zooplanktonologists, but the authors should convince better the readers.

Technical corrections -The past tense must be used for presenting the results of this study, not the present tense. -Zooplankton, as collective name, need plural verb. - Population must be removed or replaced by "assemblages" when associated to zooplankton because "population" has to be used only referring to species. -"Sampling" should be replaced by "recording" in relation to ADCP data; sampling is properly used for collection of samples (e.g. pg.3, L19-24 and somewhere else) -Some units are often written incorrectly with missing space throughout the manuscript (e.g., ms-1, cms-1 instead of the correct m s-1, cm s-1). -Velocity and speed are used indifferently (e.g. in the caption of Fig. 8); better using one of the two throughout the whole manuscript. Pg.1, L28: Basin instead of "Part" Pg2, L4: "several meters" length pertains to long chains of gelatinous zooplankton like salps, for example; it is written wrong here because it seems that some medusae (jellyfish) are several meters large, that's not true in the Med. Pg2, L10: delete "However" L10-13: the two sentences repeat the same concept (ADCP detects zooplankton) and should be merged. L35: "south Aegean Sea" must be indicated the first time the Cretan Sea is mentioned in Introduction, not here. L37: "Water-plankton sampling" is an awkward expression; it should be Niskin sampling for chlorophyll measurements (or phytoplankton, microzooplankton) or net tows for zooplankton sampling. L39: 6 months not 7, from 15/11/2012 till 20/5/2015 Pg3, L16: "behaviour" can be many things, specify "vertical movement" or migration Pg4, L18, L20:"pieces" should be replaced by "datasets" or "sections" or a more appropriate term. L19: it's not really a long-term, better specify seasonal and interannual variability

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ity L33, 34: add "depth" after 100 m and 250 m (check throughout the manuscript) Pg5,L1,2: "M" must be replaced by "months Pg6, L21: "typical values" are averages, medians? Clarify L25: zooplankton has not been introduced yet; this link between results should be moved to Discussion. Pg7, L5; "Figure" is repeated L7: as reported by Cardin et al. (2003). Pg8, L9: . . .four ADCP deployments. . . Pg9, L10: the daily data are embedded in the graphs of Fig.5 but the daily resolution is not visible. Pg10, L8: might be due, not "must" Pg14, L26: I do not understand how groups A and B "are coupled in a behavioural relation"; it should be rephrased and clarified.

Figures Fig.2- the research vessels should not be mentioned in the figure captions; the upper values of y-axis in panels a, d, e, should be indicated. Fig.3-the unit "m" is missing on the y-axis Fig.4- The "grey dotted lines" are barely visible in the upper panel. I see only a single value in blue, and not a range above each cast; is it the max value? Fig.5- The explanation of the black and yellow circles in the caption is wrong, it's the opposite. Repeat here the explanation of the triangles and bars. Fig.6- The day and night times should be indicated in this figure as referred to in the text. Fig.8- I do not see the 4 hours indicated in the text (pg.10, L26); the hours should be indicated in the graph. I suppose that "largest speed measurements" mean actually "highest speed values"(or velocity?). Fig.9- The velocity unit on the reference coloured bar is missing. For each deployment, the data displayed are time-averaged, I suppose. This has to be clearly indicated. Fig. 10- The events of harsh weather reported in section 3.4 should be indicated on panel e). Fig.11- It is nice but not necessary because it shows a qualitative snapshot (1 sample) of the zooplankton community captured with a 500 μ m Bongo net, not useful enough to interpret the ADCP data.

References The Mann&Lazier book is reported as 2005 edition here and 1991 in the text (pg.2, L1).

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