EGUsphere, referee comment RC1
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# Comment on egusphere-2022-794

Anonymous Referee #1

Referee comment on "The response of zooplankton network indicators to winter geothermal water warming in shallow reservoirs" by Anna Maria Goździejewska and Marek Kruk, EGUsphere, https://doi.org/10.5194/egusphere-2022-794-RC1, 2022

General comments:

This study investigated zooplankton communities in three freshwater mine pit reservoirs differently influenced by geothermal water inflow, using network graph analyses. Zooplankton structure and the type of their relationships were analyzed over a period of ~2.5 years. The coldest reservoir was most cohesive and controlled by rotifers and copepods with an equivalent number of positive and negative interspecific relationships. Increased water temperature led to a decrease in primary production, thus affecting resource availability for zooplankton. Both networks of warmer reservoirs disintegrated into clusters (sub-networks). While moderate winters increased the role of ecologically and functionally diverse rotifer species, small cladocerans and rotifers formed the least cohesive network in the warmest reservoir with an apparent disruption of the phenology of copepods. The authors emphasize the relevance of their study as a potential projection for anthropogenically influenced water reservoirs facing global change by reflecting how the thermal regime might influence future ecosystem services.

Overall, the current study contains an interesting dataset and I like the network analysis approach the authors use to disentangle zooplankton interactions and food web properties. However, temperature was the only factor considered as a determinant for food web properties, while neglecting other equally important determinants that were measured such as nutrients (and other abiotics) or phytoplankton biomass. These other parameters are insufficiently presented and related to zooplankton community structure. Furthermore, all data were pooled across all time points, neglecting temporal/seasonal dynamics, thus leveling out or masking potential effects over time. Given the emphasis the authors put on the differences in seasonal thermal gradients of the different reservoirs, it would be very interesting to also look at the temporal dynamics of zooplankton in conjunction with phytoplankton and abiotic determinants. It might be useful to include additional analyses (such as linear mixed models including time as a factor) testing the effect (and effect strengths) of abiotic parameters on phytoplankton biomass, and the effect (strengths) of abiotics and phytoplankton biomass on zooplankton biomass, possibly also on diversity.

Moreover, the authors try to draw comparisons to warming effects in the course of global change and state that their study might be useful as a projection for reservoirs facing global warming – however, they do not set the investigated temperature regimes sufficiently into a respective context in the discussion. I find it a bit hard to understand how a constant geothermal warm water inflow of this extent can be related to global change scenarios, as it neither reflects a realistic predicted temperature range in the face of global warming, nor a temporal disturbance.

Overall, this study yields a great dataset, which is, however, insufficiently analyzed and presented, hampering the interpretation of the data and derivable conclusions. Therefore, I can recommend this manuscript for publication only after major revision.

Specific comments:

Abstract:
• ll. 29-33: before stating the hypotheses, it would be good to give a brief overview of what the study is about
• l. 38: please state what a decrease in the values of centrality attributes indicates as the reader might not be familiar with the network analysis method
• abstract and conclusion contain very similar information and are to a large extent redundant –the results summary in the conclusions section is in my opinion clearer and more confined to the most relevant findings without going into too much detail; I recommend moving parts of the conclusions to the abstract and tighten it, while the conclusions section should take a step forward and set the relevance of the current study into a broader scientific context (e.g. regarding climate change, further steps to do etc.)

Introduction:
• l. 65, l. 72: please specify the term “surface waters” and “water bodies” – what kind of water bodies are generally influenced by geothermal waters?
• ll. 73 – 74: what kind of climatic factors?
• ll. 97 – 104: this sentence is very long and mixes up effects of warming and eutrophication, please reformulate
• l. 107 – 110: in this context, the authors should refer to the potential mismatch of phyto- and zooplankton succession that has been observed under warming scenarios, e.g. earlier hatching of copepod nauplii, while phytoplankton spring bloom starts later (differential impact of warming on phototrophs and heterotrophs)
• ll. 136-138: Please specify these potential mutualistic interactions
• l. 139: rather “indicative of indirect negative effects by competing for a common food source” instead of “indicative of grazing on phytoplankton”?
• l. 140: please specify by what mechanism.
• ll. 148-149: why do the authors expect a weakened role of crustaceans under warming? Before they state that warming increases the proportion of copepod larvae and crustacean growth?
• ll. 150-151: It would be useful to state the temperature range already in the introduction and set these into the context of predictions on global warming
• l. 154: please add “seasonal” to the water temperature gradient
• ll. 157 – 160: Why is this relevant in the context of the current study which investigates stable conditions that cannot be compared to a temporal disturbance as the authors stated

above?

Materials and Methods:
- ll. 166: "CH1, PN, WIW" – the full names should be given at first mentioning
- ll. 172-173: Only temperature? What about inorganic nutrients and other abiotic parameters?
- l. 173: please specify atmospheric water, meltwater, and capillary water, or provide a reference
- ll. 182-185: this is a huge temperature difference – how can that be related to projected climate change scenarios? The authors really need to set their study and the respective temperature regimes into perspective.
- l. 196: coastal zones usually refer to marine systems (rather littoral zone?); please specify the "vicinity of the filter zone"
- l. 197: "Patalas trap" – please specify or provide a reference
- ll. 198-199: this is a field study, not an experiment
- l. 199: how do 3 samples à 5L add up to 20L? Apparently, the 3 different samples were pooled?
- ll. 209-217: a lot of parameters were determined in the reservoir itself (that are not described in the Results section, see below); were these parameters also determined in the geothermal water sources? That would have been great in order to estimate the amount of nutrient input fueling phytoplankton production.
- ll. 220 – 224: please specify your statistical analyses – what were the response variables tested, especially regarding zooplankton (abundances, biomass, diversity?), were these tests repeated for each sampling event, were data pooled across all time points, or was time included as a factor in the analysis? This does not become clear at all. Furthermore, it would be useful to include additional analyses (see above). So far, the authors relate their results exclusively to temperature, while it is well known that other abiotic factors and of course food supply may have equal and also interactive effects on zooplankton communities.
- l. 225: Please specify what parameters you refer you - zooplankton ID based abundances? sizes? functional groups?
- L. 233: please specify "the parameters of the entire network"

Results:
- 1st paragraph: does mean annual temp. and mean winter temp. refer to the pooled data across all time points? Which time points were part of the "winter" samples? The authors state that "significant variations were also observed in DO, chlorophyll a, TOC, TN, and the parameters describing suspended solids (turbidity, color, SDT, Tot susp) (Table 1)." HOW did the reservoirs differ?? The authors should describe these differences and relate them to their zooplankton data, as phyto- and zooplankton is strongly influenced by a range of different abiotic parameters and not only by temperature (see also general comments).

ll. 269-274: Correlations have not been mentioned in the methods section – the authors should describe all of the analyses conducted. How was the effect of temperature on zooplankton species richness tested? This is also not specified.
- ll. 282 – 284: Were these analyses conducted across all seasons with all sampling time points pooled? In general, pooling all data over time might level out important seasonal dynamics, which are of utmost importance if the aim is to compare the food web dynamics in reservoirs differing in temporal (seasonal) thermal gradients (see above)
- ll. 285 – 287: How was this tested? As the effect of temperature on single taxa? Or were the actual temperature differences calculated between different seasons?
- ll. 326-327: again, the authors relate all differences solely to temperature without taking the other factors into account

Discussion:
• ll. 363: what do the authors mean with the term "energy of water"? does the thermal gradient refer to the temporal/seasonal gradient?
• l. 364: which processes? Please specify.
• l. 370: how do the authors come to that conclusion? Did they measure organic matter recycling? I don't really get the argumentation here – in the warmer reservoirs organic matter cycling was already higher in winter due to the warm water inflow and did not increase as much in spring as in the CW?
• ll. 373 – 376: Was that observed in the study in terms of lower Chl. a, or is this an assumption? Wouldn't you assume that phytoplankton production increases more rapidly in spring, when the water is already warmer? How were the reservoirs stratified – was that somehow determined?
• ll. 376-380: I don't get this point - why would heating lead to less rapid cycling? I can only imagine that under continuous recycling induced by warmer temperature, not as much organic matter accumulates rapidly, leading to clearer water and thus more macrophytes can establish?
• ll. 380 – 382: Why? Because the delta of environmental change (temperature) is higher? Please explain, this is hard to understand.
• l. 394: eutrophic conditions do not necessarily relate to good food conditions, as the food quality is usually constrained under eutrophic conditions. The authors refer to the nutrient concentrations measured in the reservoirs in the next sentence for the first time – these patterns need to be described in the Results section
• ll. 397 – 401: These results differ, but also the conditions investigated in the present study are completely different than climate change scenarios (see above) – so please specify the predictions you're referring to.
• ll. 402- 403: please explain, why would an increase in trophy levels (was that observed?) contribute to a higher content of mineral suspensions?
• ll. 451-452: does this statement refer to the aforementioned study, or to the current study?
• ll. 466-467: Why? Functionally diverse communities do not necessarily mean dynamic zooplankton communities (dynamic over time?)
• l. 474: what does immobilization refer to?
• ll. 487-489: This could also be an indication for an indirect effect of better water quality characterized by less eutrophic conditions and fewer blooms of potentially inedible phytoplankton.