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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Groundwater fauna in an urban area: natural or affected?" *by* Fabien Koch et al.

Anonymous Referee #1

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This article is an application of an existing method to assess groundwater ecological condition. The article utilises a classification scheme based on a single threshold of proportion of crustaceans and oligochaetes within sample wells, with varying success. The manuscript acknowledges several limitations of using this single method suggesting that multiple methods should be used to fully understand impacts of humans on groundwater ecology. The research presented increase awareness of groundwater ecosystems and the threats facing them, however requires further analysis to justify some of the claims made. As such, I recommend major revision, purely because of the requirement for further statistical analysis.

General Comments:

Generally, the sections flow well and it is easy to understand. The manuscript needs

to be thoroughly edited as there are multiple issues with grammar, and the manuscript can be reduced in length particularly in the introduction. The figures and table are well presented. The methods and results section needs to have some aspects clarified. There is a lack of statistical analysis throughout the manuscript which detracts from the quality of the paper. The results show some interesting trends in the distribution of biota, however without the necessary statistical analysis of this data, it is difficult to establish if there are significant differences between landuses, or if these trends are just due to differences in sample size (n8-n31) between the two landuses. This needs to be addressed, as currently there are speculations that differences in means indicates differences between landuses without any specific statistical analysis. A simple ANOVA or t-test would, in most cases, suffice and allow a more thorough analysis of this useful data.

Specific comments:

Introduction In general the introduction is a little too long and can be made more concise. Eg paragraph starting line 45 and line 50 could be compressed and merged. Line 35-37: Whilst these may be the usual temperatures for stygofauna within the region of this study, they exist in temperatures well over 14-16 deg on a global basis. This sentence needs to be rephrased. Line 38: Remove 'the' from "the German and European legislation" Line 44 remove 'data recorded by' in the brackets Line 54: Typo error (Protocol for the Assessment. . .... Line 83: Korbel & Hose 2011 is correct reference, also consider Di Lorenzo et al. 2020 Ecological Indicators, 116, 106525.

Methods

Line 116: replace 'with' to 'was' Line 116-117: improve sentence structure 'is mainly caused by' is incorrect, consider 'which' is mainly caused by. . . or rewrite sentence appropriately. Line 120-124: condense and combine sentences Line 139-140: belongs in the results section not methods Section 2.3. I found this section hard to read, particularly due to some grammatical errors. This section is too long and verbose, it needs to

be rewritten to make it clearer. The second paragraph starts well. I suggest removing the sentence start on line 160 “this requires to obtain also. . ..”

Statistical analysis: You do not mention any of the statistical analysis competed in this paper. To be able to distinguish between forest and urban areas, you should at a minimum be completing some statistical analysis of the water quality data you have collected, even if this is simple ANOVA or t-test analysis. This is a major issue that detracts from the quality of this paper. I understand that you have used average values of the sampling wells, however determine whether there are statistical differences between (for instance) temperature at forested areas in comparison with urban areas, and look at the relationships between temperature, well depth and landuses. This analysis would greatly improve the scientific credibility of this study.

Results/Discussion

Line 180: complete statistical analysis to indicate if there are significant differences in temperature between urban and forests areas- it appears that there are. Lines 192: while the box plots show that there are differences between forests an urban areas in DO and nitrate with landuses, these do not appear to be statistically different. I am not convinced that there are differences in DO and Nitrate between landuses this needs further discussion, as does the large differences in n values between the landuses. Line 196: References in chronological order Line 201: ‘hold back’ should be ‘retained’ or ‘held back’ Line 201: suggest these sentences are combined and reduced eg ‘. . ...where atmospheric nitrogen in retained by forest soils and fertilization is prohibited due to water protection regulations’ Line 207-209: Again you cannot claim ‘clear differences’ without adequate statistical analysis of these factors. You need to run further analysis of the data for this statement. Line 231: I would not say that amphipods ‘predominantly live within wells’ rather they have a habitat preference for open spaces such as wells. Paragraph starting line 231: It appears that amphipods are significantly higher in forested areas than urban areas, however without analysis this cannot be determined. This may be ecologically important and should be discussed. It is also

worthwhile looking at the correlation between cyclopoida and amphipods as briefly mentioned in line 238. Line 238-240: Incorrect grammar. . . remove ‘be’ Line 248: Incorrect grammar Line 274- 280: The issue of purging wells needs further discussion as this is a limitation of your study. If you are looking at proportions of crustaceans to oligochaetes this is almost certainly affected by sampling method. The sentence on line 277 needs to indicate that relative abundances and proportions of crustaceans is likely to be impacted by the sampling methods, thus caution must be taken when interpreting the results. Lines 295 -300: Could this also be due to organic carbon supply? Would level 2 assessment clarify these issues if it were undertaken? Line 305: Could the high (35%) of urban areas displaying natural sites be due to the sample methodology; ie were they classified as good incorrectly due to high proportions of crustaceans that may be influenced by the lack of purging of the wells?

Conclusion:

The conclusions of this study to me indicate that the method you have adopted (ie net sample wells and use the proportions of oligo/crustacean populations to determine ecosystem condition) need to be investigated further. The disproportionate number of crustaceans in wells due to sampling methods may be impacting the assigning of “OK” condition to sites that are actually impacted. Potentially a wider range of indicators need to be used including expanding on the use of only oxygen concentration in the classification scheme. The Level 2 assessment (Figure 1) also needs to be discussed in the conclusion.

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