Hereby we thank the Editor and Reviewers for valuable and constructive comments.

Substantial changes were made in the revised manuscript in order to improve our research quality. Below we provide the list of major changes made in the revised manuscript and a point-by-point response to the reviewers' comments.

Major changes made in the revised version of the manuscript:

- section "2.1 Data compilation" was deleted - due to lack of age-depth models for mapped Polish sites and different time intervals investigated we decided to delete the whole section, integrating former Fig. 1 with the lithological diagram of the Krępa site (formerly Fig. 2) (see our response to Reviewer #1);

- In line with deleting section 2.1, Supplement materials are not attached to the revised version of the manuscript anymore;

- pollen-based temperature reconstruction for the post-Holsteinian (including annual, January and July mean air temperature) is now included in the manuscript (see section 3.5) to improve our research and is compared with chironomid-based temperature reconstruction in section 4.1.2 Chironomid-inferred reconstructions from the Krępa site in relation to pollen-based reconstructions; additional (including suggested) references was added to the discussion;

- section 4.1.1. was substantially restructured - we shortened the part about possible causes of Chironomidae head capsules' absence in the sediments and linked the remaining part with our actual observations from Krępa;

- Table 1 was transformed into text (see section 3.2) to improve content layout, presentation and to decrease the volume of the manuscript;

- Former Table 2 (now Table 1) was edited: two columns was added - with PCA values and number of Chironomidae head capsules in accordance with Revierwers' suggestions;

- Table 2 (new) was added. It includes cross-validation results for pollen-based MAT and WA-PLS reconstructions (see section 3.5);

- Figure 4 (new) was added. It includes pollen-based reconstructions of mean July air temperature (Tjul), mean annual temperature (Tann), mean January air temperature (Tjan), and annual precipitation sum (Pann) for the Krępa site using MAT and WA-PLS;
- Abstract and conclusion were completely rewritten.

Response to Reviewer #1 comments:

The manuscript by Polkowski et al. presents results of chironomid-inferred temperature reconstruction and vegetation changes during the Holsteinian interglacial from a site located in Poland (Krepa). The authors also present a literature review of sites covering the Holsteinian in Poland. The authors discuss in details the possible reasons of poor preservation or absence of chironomid remains in different parts of their record. Because chironomid-inferred temperature reconstructions are rare during this period, the results of the manuscript are valuable for the community. However, I have comments that should be discussed before acceptance of the manuscript for publication in Climate of the Past.

We thank the reviewer for the detailed and constructive comments on our manuscript and provide point-by-point answers to the issues raised.

Main comments:

1. **Right now, I am a bit sceptical about the chironomid inferred temperature reconstruction. First, the low concentration of chironomid remains makes it hard to reach 50 chironomid per sample. I understand that you merged some adjacent samples to reach higher numbers of chironomids but I think it would be very useful to indicate in Table 2 the number of chironomids in all the samples used for the temperature reconstruction since even after merging some samples still didn't reach 50 head capsules. Also, I don't understand why you decided to keep the sample at 1000 cm (see line 291) since this sample is surrounded by other samples and therefore could be merged. Finally, I don't understand how you get 15 samples (see line 297) after merging since you write that 5 samples had at least 50**

chironomids, 7 samples were merged and you kept the sample at 1000 cm alone: this is 13 samples and not 15. And in Figure 4, I only see 14 dots (which I assume are the samples) on the temperature reconstruction curve. This issue should be solved because at the it is confusing for the reader.

In the revised version, we provided a modified Table 2 (now changed to Table 1) with a column containing the number of Chironomid head capsules used for the temperature reconstruction. As far as solitary sample at 1000 cm is concerned - its taxa composition substantially differs from surrounding samples - for example warm-related *Chironomus plumosus* dominates at 1000 cm, whereas at 995 cm cold-related *Corynocera ambigua* dominates, together with mesotrophic *Chironomus anthracinus* at 1011 cm. Therefore, we decided to leave the 1000 cm as a separate sample. The number of samples was given mistakenly as 15 - there were 13 samples - it was corrected in the revised version

2. **I find it difficult, at the moment, to understand the relevance of the literature review of polish sites covering the Holsteinian interglacial since you do not use these sites in the discussion of your results. I understand that you made a literature review to show the readers that these sites could also be used in the future in the context of chironomid studies but it would be interesting to compare the results of some of these sites that looked at pollen or diatoms, molluscs or other aquatic indicators with the results (chironomid, pollen) you present for your study site. You could also add, in Supplement Table 2, the proxies analysed for each of the sites.**

We admit that the literature review of the Polish sites is not really used in the discussion of our results and therefore doesn't really contribute to the story of our manuscript as mentioned by the reviewer. Therefore, we decided to delete the entire paragraph on the Polish sites (former section 2.1 "Data compilation") in the revised version of our manuscript. However, the related overview map (former Fig. 1) was modified and remained in the revised manuscript. It is now an integral part of a new Fig. 1 and includes also the lithological profile presented previously in Fig. 2 that is part of a revised section 2.1 "Study area" (formerly section 2.3). Comparing these sites might be difficult due to lack of the depth-age models of these sites and their different investigated time intervals. Therefore, we decided to delete the entire section.

3. **I would suggest to work on the discussion because, at the moment, most of your interpretations are often not supported by any other publications. I would suggest trying to find publications supporting your interpretations especially in the section "1.2 Summer temperature and ecological reconstructions based on Chironomids from the Krępa site in relation to environmental change" which is very interesting. I would also suggest using more the pollen in the discussion as, if I understood correctly, these results are not published yet. It would be interesting to compare the vegetation changes at Krepa with other know records.**

   We addressed these issues in the revised manuscript by adding references supporting our interpretations. Comparing vegetation changes with other Central European pollen records is a great idea. However, a separate publication including such comparison is planned. Therefore, we would prefer not to extensively develop this section as the temperature reconstruction remains the main scope of this paper.

4. **I don't see the relevance of the section "1.1 Possible difficulties in climate reconstruction based on Chironomidae analysis during past interglacials" in the discussion. I understand that you want to show possible explanations for the low concentrations, or absence chironomids in some parts of your record. However, you don't really make the link with your chironomid assemblages. In this section you mention species/morphotypes that are not present in your chironomid record, so they should probably not be mentioned there. Also, most of the studies you cite in this section worked with specific species so you should not write "-type" after the species names. My suggestion would be to restructure this section to discuss the possible causes of absence of chironomids in some parts of your record, which is very interesting, by linking them with your actual results.**

   We acknowledge the justified criticism raised by the reviewer regarding our admittedly rather weak attempt to explain the low concentrations / absence of chironomids in our record and regret that we did not provide a proper connection between our actual observations and the fairly theoretical description of ecological preferences of individual taxa provided in former section 4.1.1. Accordingly, we restructured this section, now paying attention to a more proper connection of individual species preferences and our findings.

5. **I would suggest to work on the writing as it is sometimes difficult to understand what you want to say. You also sometimes use the wrong words such as "recreate" instead of "reconstruct". Also please pay attention on the writing of Chironomidae, which should not be written in italic, and the morphotype/species spelling. The morphotypes should always be written with "-type", which should not be in italic, and when you are referring to individual species don't add "-type" after the species name.**

   We addressed all these issues in the revised version of the manuscript.

Other specific comments

We appreciate the reviewer's detailed suggestion for improvements listed below and modified the revised manuscript accordingly where appropriate. If changes were not justified in our opinion, we provided an explanation.

Line 1: don't write Chironomidae in italic but in regular font as it is a family name and family names are written in regular font.

This was corrected accordingly.

Line 19: "utilised" → used

This was corrected accordingly.

Line 21: "*Chironomidae*" should not be written in italic as it is a family name but in the regular form "Chironomidae". Please change it throughout the manuscript.

This was corrected accordingly.

Line 21: "recreate summer thermal conditions" → reconstruct past summer air temperatures or infer past summer air temperatures.

This was corrected accordingly.

Line 22: "Non-biting midges remains indicate trophy and pH of water bodies as well." → Chironomid remains can also indicate changes in the trophic state or pH of water bodies.

Entire abstract was rewritten.

Line 23: "MIS 11 period" → the MIS 11 period

Entire abstract was rewritten.

Lines 26-28: "The stratigraphic context for the chironomid-based summer temperature reconstruction is provided by pollen data, together allowing to compare our results in the context of climate development at the end of the Holsteinian Interglacial." → Please reformulate this sentence to make it easier to understand.

Entire abstract was rewritten.

Line 28: "species" → taxa. If you are talking about morphotypes you can not write species as several species can represent each morphotype. See also line 29.

Entire abstract was rewritten.

Line 29: "e.g" → e.g.

Entire abstract was rewritten.

Line 29: "*Corynocera ambigua-type*" → *Corynocera ambigua*. This one is not a morphotype but rather a species as indicated in the different training set available.

This was corrected accordingly throughout the manuscript.

Line 29: "*Chironomus anthracinus-type*" → *Chironomus anthracinus*-type. The "-type" should not be formatted in italic but in regular font. This is the case for all the morphotypes. Please change this issue throughout the text.

This was corrected accordingly throughout the manuscript.

Line 30: "July temperature" → July air temperature.

This was changed to: "summer air temperature".

Line 30: "15,3 °C" → 15.3 °C. In English the decimals should be indicated with a dot and not a comma. Please change this throughout the manuscript. See also line 31.

The manuscript has been inspected again and mistakes of this sort were corrected accordingly.

Line 33: remove “even”.

Entire abstract was completely restructured.

Lines 34-37: “The additional element of this research is indicating sites within the Polish borders that were investigated so far - mostly on the basis of pollen analysis, occasionally *Cladocera*, isotopes, etc. - and might be new objects of studies based on Chironomid-inferred temperature reconstructions.” → Please reformulate this sentence to make it easier to understand and precise which time interval was investigated in these sites.

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 37: “Chironomid” → chironomid. Please write chironomid without capital letter and check throughout the manuscript.

This was corrected accordingly.

Line 37: “of challenges of” → on

This sentence was deleted as the entire abstract was completely restructured.

Line 42: “participation” → influence

This was corrected accordingly.

Lines 44-46: “various scientific disciplines from the establishment of the boundary of the unit through the scale of human influence on the functioning of the natural environment in the Holocene throughout all scales starting from micro, through regional to global (Brondizio et al., 2016).” → Please reformulate this sentence.

This sentence was reformulated as follows: “With respect to human impact during the Holocene, the so-called “Anthropocene” is presently widely debated across various scientific disciplines though its exact timing as well as the actual dimension of human influence on the environment are still debated (Brondizio et al., 2016).”

Line 47: “has” → is

This sentence was completely rephrased.

Line 48: “i.a.” → i.e. Please check the spelling throughout the manuscript.

The manuscript has been inspected again and mistakes of this sort was corrected accordingly

Line 49: “etc.” → remove

This was corrected accordingly.

Line 50: “climatic conditions change” → climatic condition changes

This sentence was rephrased.

Line 52: “water table depth” → water depth

This was corrected accordingly.

Line 54: “is a reconstruction tool for ocean pH” → can be used to reconstruct pH in the ocean

This was corrected accordingly.

Line 55: “vegetation migration” → remove migration

This was corrected accordingly.

Line 55: “can be used” → and can be used

This was corrected accordingly.

Line 56: “the activities of a human in the past” → past human activities

This was corrected accordingly.

Line 58: “*Chironomidae* remnants analysis allows the assessment of the water reservoir trophy and pH as well.” → The analysis of chironomid remains also allows the assessment of the trophic state or pH of freshwater ecosystems.

The sentence was corrected as follows: “…and head capsules of chironomids can serve as the basis for summer air temperature reconstructions (Eggermont and Heiri, 2012) as well as for assessing the trophic state or pH of freshwater ecosystems (Płóciennik, 2005).”

Lines 61-63: "However, these reconstructions are not capable of giving unequivocal information about exact air temperature changes nor whether these changes and their pace are induced by natural causes or human activity" → Please rephrase this sentence.

The sentence was rephrased as follows:: However, these reconstructions neither provide unequivocal information about air temperature changes nor allow to distinguish between the relative contribution of natural drivers and human impact to these changes.

Line 67: "Northern Europe" → Please be consistent in the spelling of Northern Europe throughout the manuscript. See Line 75 "northern Europe".

This was corrected accordingly.

Line 75: "southern European" → "southern Europe"

This was corrected accordingly.

Line 82: "In this research" → In the present study

This sentence was deleted.

Line 83: "(Eggermont and Heiri, 2012)" → Here I would cite other references as examples of temperature reconstructions based on chironomids. For example: Bolland et al., 2021; Engels et al., 2008; Ilyashuk et al., 2022; Rigterink et al., 2024…

This sentence was deleted.

Line 84: "recreate" → "reconstruct

This sentence was deleted.

Line 90: "Nowiny Żukowskie site" → Here I would specify the location of the site by at least mentioning the country

This was corrected as follows:. "…Nowiny Żukowskie site in eastern Poland (Hrynowiecka and Winter, 2016)."

Lines 93-94: "One of the exceptions is Hoxne site in eastern England (Horne et al., 2023)." → Here I would give more information about this study as it is covering the MIS 11 like your

site. You could, for example, specify that they also did a temperature reconstruction based on chironomid.

This was corrected accordingly. Our proposition: "In Northern Europe, there are even fewer records covering MIS 11 e.g. the record from Hoxne in eastern England (Horne et al., 2023) where temperature reconstructions were performed using chironomids (e.g., Brooks, 2006), ostracods (Horne, 2007) and beetle remains (Atkinson et al., 1986)."

Lines 97-98: "We tested temperature reconstruction using the Swiss-Norwegian-Polish Training Set and presented the first Chironomid-inferred temperature reconstruction from Poland before the Last Glacial Period and even for the post-Holsteinian." → Here we present the first chironomid-inferred July air temperature from Poland for the post-Holsteinian.

This was corrected as follows: "Aiming at improving the knowledge about climate variability at the demise of the Holsteinian Interglacial, we present in the following the first quantitative climate reconstructions for the post-Holsteinian in Central Europe, which are based on chironomid and pollen analyses."

Line 104: "quaternary" → Quaternary

This was corrected accordingly.

Line 112: "The research covered sites located in Poland. Holsteinian (Mazovian) Interglacial has been included." → The research included sites located in Poland and covering the Holsteinian (Mazovian) interglacial

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 114: "several sites located in western half of the country" → several sites located in the western half of the country

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 114: "area contained between" → remove "contained"

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 115: "The sites' locations were" → The sites' location are

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 117: "– it" → and therefore

This sentence was deleted in line with the handling of main comment #2 (see above).

Lines 117-118: "location estimation tools" → What are these tools?

This sentence was deleted in line with the handling of main comment #2 (see above).

Line 121: "Supplement Figure 2" → Supplement Figure 1"

Fig. 1 and its caption were modified (please see our response to main comment #2 above).

Line 122: "Glaciation ranges based" → Glaciation ranges are based

Fig. 1 and its caption were modified (please see our response to main comment #2 above).

Line 133: "while modern distribution limits of these taxa are located estimated further to the west" → remove "located"

This was corrected accordingly.

Line 152: "146 m amsl." → 146 m asl

This was corrected accordingly.

Line 160: In this section "2.4" you already interpret the sediment of your site which does not really fit in the section "2. Data and methods" section. You could maybe add a paragraph in section "3. Results and interpretation" for the interpretation of the sediment?

Please see our response to the following comment, which is directly related.

Lines 161-187: In this section it would help to better link the first and second paragraph to better understand your interpretations of the sediment. For example: Because of the presence of laminated sandy silts and sandy-clayey silts the unit 2 is interpreted as a result of glaciolimnic sedimentation in a relatively shallow water body…

As suggested in this and the previous comment, we combined the first and second paragraph for better comprehensibility and also move the combined paragraph from section 2 (previously "Data and methods", now "Study site and methods") to the very beginning of section 3 ("Results and interpretation") in the revised version of our manuscript, then appearing as the first part of the new section 3.1 "Lithological description of the Krępa sediment succession and palaeoenvironmental interpretation". After changes, the paragraph reads as follows:

"The basal part of the 23.8-m-long sediment core that was recovered from the Krępa sediment succession in 2015 (Fig. 1) consists of a 2-m-thick layer of massive, light greyish brown sandy clays with a large number of rock fragments (unit 1), which is interpreted as glacial till. As indicated by its stratigraphic position and its petrographic characteristics (Drozd and Trzepla, 2007), this till was accumulated during the Elsterian glaciation (Sanian 2 glaciation in Poland), which is considered to correspond to MIS 12. Directly above the till, a 0.6-m-thick layer of laminated sandy silts and sandy-clayey silts is found (unit 2). These sediments are interpreted as the result of glaciolimnic sedimentation in a relatively shallow water body between blocks of dead ice during the recession of the Elsterian ice- sheet. The glaciolimnic sediments of unit 2 gradually turn into a carbonate gyttja with small interlayers of carbonatic-minerogenic gyttja (unit 3), which was most likely deposited in the profundal of an already relatively deep lake. Between 1187 and 760 cm core depth, non-carbonatic organic-minerogenic gyttjas with a generally increasing mineral content towards the top are found (unit 4). The limnic sediments of unit 4 are interpreted to reflect the gradual shallowing of the lake due to continuing sediment infill. At the same time, the systematic increase in mineral components in the sediments most probably reflects increased denudation and erosion in the catchment, likely favoured by reduced vegetation cover in response to a change towards colder climate conditions. The gyttja sequence of unit 4 is overlain by a 1.9-m-thick layer of massive clays (unit 5), which probably represent accumulation in a periglacial lake. The following 1.1-m-thick layer of fine- to medium-grained sands (unit 6) as well as the overlying 3.1-m-thick layer of rhythmically laminated sandy silts (unit 7) are interpreted as proglacial sediments (units 6 and 7) of the transgressing Early Saalian (MIS 10) ice sheet. Above this succession, the profile is capped by a 1.5-m-thick layer of sandy morainic till with rock fragments (unit 8) related to the Early Saalian glaciation."

Lines 171-173: "The sediments of unit 2 are interpreted as the result of glaciolimnic sedimentation in a relatively shallow water body between blocks of dead ice during the recession of the Elsterian glacier. The glaciolimnic sediments gradually pass into limnic

sediments (unit 3), which are interpreted to be deposited in the profundal of an already relatively deep lake." → Did you take in consideration in your interpretation of the chironomid results these possible changes in water depth? This could have a strong influence on the chironomid assemblages and could potentially explain why sometimes the concentration of chironomids is very low or even you don't find any chironomids in your samples.

We took the water level into account here. This is one of the hypotheses that we unfortunately can neither confirm nor deny. The problem is the lack of comparative data that we could refer to. Another difficulty is that with three analyses, such as: XRF, pollen and Chironomidae, we do not have certain information about the water level in the reservoir. It is also common in the literature not to write about the lack of individuals. Often in articles, fragments with low numbers or with the lack of remains of some proxy are simply not described. This makes it difficult to refer to the literature.

Line 190: In the section "2.5 Pollen analysis" please indicate the number of pollen samples analysed, the volume of sediment analysed and the batch number and number of Lycopodium spores per tablets that you used. It would also be good to indicate which identification keys/books were used if the pollen data are not already published which I assume is the case since you do not refer to any publications. It would also be good to indicated how the Local Pollen Assemblage Zones were determined. Did you use any statistics (optimal sum of squares partitioning, broken stick model) to divide the pollen record into zones? Also, if you did numerical analyses please indicate which software was used.

The requested information on the methodology (e.g. number of samples, information on Lycopodium spores, determination of local pollen assemblage zones) was added in the revised manuscript. The pollen data are so far not published in a peer-reviewed manuscript but only part of PhD thesis - we added the respective reference.

Line 198: "in a shortened pollen diagram" → in a simplified pollen diagram

This was corrected accordingly.

Line 201: "The Holsteinian (Mazovian) commences" → The Holsteinian (Mazovian) starts

This sentence was deleted in the revised version of the manuscript

Line 205: In the section "2.6 Chironomidae analysis" please indicate the number of samples analysed. How did you measure the volume of your samples? And why are you writing "approximately 1 cm3? As it seems that the chironomid remains in your samples were often damaged I think it would be good to specify how you counted them (halves, presence/absence of mandibles...). As you are dealing with very old chironomid remains, I think it would be valuable to add a plate with pictures of the main chironomid taxa present in your samples. Please indicate what was the KOH concentration used and how long did you leave your samples in heated KOH. Also indicate why you used a 212 µm and if at then end you combined the chironomid remains present in the 212 and 100 µm fractions. Please also indicate which microscope and which magnification was used for the identification of chironomid remains.

The information requested was added in the revised manuscript. As long as the plate with the pictures of chironomids is concerned - according to the Chironomid-inferred reconstruction author, the differences between individuals found at Krępa and those from younger periods aren't significant. The paragraph after proposed changes reads as follows:

"Initially, 79 sediment samples of 1 cm^3, taken between 800 and 2160 cm depth at 5-40 cm intervals, were investigated for the presence of Chironomidae head capsules. However, only 30 of them (965-1155 cm depth) simultaneously contained more than 0-2 individuals, creating a sequence that enabled a summer temperature reconstruction. Chemical preparation followed Brooks et al. (2007). The precipitate was initially heated with KOH. The wet sediment was then passed through 212 µm (to remove larger sediment particles) and 100 µm mesh sieves and subsequent residues were treated in an ultrasonic bath for 3 sec. The processed sediment was subsequently examined under a stereomicroscope (Zeiss Axio Lab A1) at 25× magnification. Chironomid head capsules from each sample were picked and mounted in Euparal. In case of damaged head capsules, individuals were counted as one if more than half of a body was preserved. Identification of chironomid head capsules followed Wiederholm (1983), Schmid (1993), Klink and Moller Pillot (2003), Brooks et al. (2007) and Andersen et al. (2013). Ecological preferences of identified taxa are based mainly on Brooks et al. (2007), Brundin (1949), Brodersen and Lindegaard (1999b) and Saether (1979)."

I don't think Brooks et al. (2007) is the best reference to find the ecological preferences of chironomid taxa. I would probably also look in other references such as Saether (1979), Brundin (1949), Brodin (1986), Janececk et al. (2017)...

This was corrected accordingly.

Line 209: “stereo binocular microscope” → stereomicroscope

This was corrected accordingly.

Line 210: “followed by” → followed

This was corrected accordingly.

Line 214: In the section “2.7 Mean July air temperature reconstruction” please indicate why you chose the Swiss-Norwegian-Polish training set and not other available training sets (Finnish, Russian, Swiss-Norwegian)? I assume it is probably because it contains lakes from Poland but it I think it would be good to specify it. Also did you calculated the nearest modern analogues for each of your fossil samples? And the goodness of fit? If so it would be good to mention it here as well as the software used for that. If not, I would recommend to calculate these diagnostic statistics that you could show in the Supplementary material (see Bolland et al., 2021). In this section it would also probably be good to mention how many samples (after merging) were used for the temperature reconstruction, as well as how the samples were merged.

The requested information was included in the text. The modified wording of the paragraph is:

“In order to reconstruct mean July air temperatures (Tjul-Ch) from the Krępa chironomid assemblage, the Swiss-Norwegian-Polish (SNP) training set (Kotrys et al., 2020) was used as this covers a higher temperature span than other available European training sets (e.g. the Finnish, Russian, Swiss-Norwegian training sets) (Kotrys et al., 2020). The SNP training set includes 357 lakes, 134 taxa, covers a temperature range between 3.5 and 20.1 °C. and uses the weighted averaging-partial least squares transfer function (WA-PLS). The RMSEP for this combined training set is 1.39°C, and the R2 is 0.91 (Kotrys et al., 2020). Detrended Correspondence (MinDC) was also calculated. The temperature reconstruction was carried out using the C2 software (Juggins, 2007).

Chironomidae subfossil larvae were obtained from a total of 30 samples from the lacustrine sediments. Samples that contained fewer than 50 head capsules were merged except for a solitary sample at 1000 cm core depth. For 5 samples the required number of 50 head capsules was obtained and the remaining 24 samples were merged into seven clusters. After merging, sample clusters at 975 cm, 1080 cm, 1120 cm and 1125 cm core depth still did not reach 50 head capsules, but

nonetheless, these samples and the one from 1000 cm core depth were included in the reconstruction because the test of the reconstruction showed acceptable results. The lowest number of head capsules used for the $T_{jul\text{-}Ch}$ reconstruction was 5 individuals at 1070 cm core depth whereas the highest number was 78 at 985 cm core depth. After merging, the total number of samples used for the $T_{jul\text{-}Ch}$ reconstruction was 13."

Line 219: Please indicate the version of the software

Version of the C2 software used was 1.6.

Line 224: Please also mention the chironomids in the caption of the table. For the column dealing with the chironomids you could write: "Main features in the chironomid record" or replace "significant" with "significance". Please also indicate the unit of the depth column.

The information previously contained in the table was organised as plain text (now section 3.2) to improve presentation of our data and to lower the manuscript volume

Line 237-238: "Assemblages could indicate a deterioration of environmental conditions (*Chironomus anthracinus-type* and *Corynocera ambigua-type*)." → Could you explain your interpretation in more details and link it to other publications?

Paragraph was modified. Proposed wording would be as follows:

"Assemblages could indicate a wide range of environmental conditions (e.g. Chironomus anthracinus-type is a profundal species that is tolerant to a wide thermal spectrum (Brooks et al. 2007; Luoto et al. 2019) and Corynocera ambigua is indicative for colder conditions (Brooks, 2006; Brooks et al., 2007)."

Lines 239-240: "contains mainly cold-adapted and freeze-resistant species like *Corynocera ambigua-type, Glyptotendipes pallens-type* and *Glyptotendipes severini-type*, which are often associated with algae and diatoms or mine leaves (Tarkowska-Kukuryk, 2014)." → Actually, *Glyptotendipes pallens*-type and *Glyptotendipes severini*-type are often associated with relatively warm conditions (Heiri et al., 2011; Nazarova et al., 2015; Luoto, 2009; Kotrys et al., 2020).

The paragraph was reformulated as follows:

“LPAZ KR-12b (1072.5-1122.5 cm) contains mainly cold-adapted species like Corynocera ambigua and freeze-resistant species like Glyptotendipes pallens-type and Glyptotendipes severini-type, which are often associated with algae and diatoms or mine leaves, (Tarkowska-Kukuryk, 2014). LPAZ KR-12c is characterised by species highly resistant to difficult environmental conditions, such as Chironomus anthracinus-type, which is typical for nutrient-rich conditions with wide environmental tolerances (Seather 1979, Self et al. 2011), Corynocera ambigua, which has a broad thermal tolerance (Brodersen & Lindegaard 1999) and Glyptotendipes pallens-type, which can better tolerate harsh winter conditions and lives in different types of substrates (Moller Pilot 2013, Cerba et al. 2022).”

Lines 241-242: “LPAZ KR-12c (1022.5-1072.5 cm) is characterized by species highly resistant to difficult environmental conditions, i.a. *Chironomus anthracinus-type, Corynocera ambigua-type* and *Glyptotendipes pallens-type*.” → Please provide references to other publications to support your interpretation.

We added the following references:

Brodersen, K. P. and Lindegaard, C.: Mass occurance and sporadic distribution of Corynocera ambigua Zetterstedt (Diptera, Chironomidae) in Danish lakes. Neo- and palaeolimnological records, J. Paleolimnol., 22, 41–52, https://doi.org/10.1023/A:1008032619776, 1999.

Čerba, D., Koh, M., Vlaičević, B., Turković Čakalić, I., Milošević, D., and Stojković Piperac, M.: Diversity of Periphytic Chironomidae on Different Substrate Types in a Floodplain Aquatic Ecosystem, Diversity, 14, 264, https://doi.org/10.3390/d14040264, 2022.

Moller Pillot, H. M.: 2 General Aspects of the Systematics, Biology and Ecology of the Chironomini, in: Chironomidae Larvae, Vol. 2: Chironomini, KNNV Publishing, 8–21, 2013.

Saether, O. A.: Chironomid communities as water quality indicators, Ecography, 2, 65–74, https://doi.org/10.1111/j.1600-0587.1979.tb00683.x, 1979.

Self, A. E., Brooks, S. J., Birks, H. J. B., Nazarova, L., Porinchu, D., Odland, A., Yang, H., and Jones, V. J.: The distribution and abundance of chironomids in high-latitude Eurasian lakes with respect to temperature and continentality: development and application of new chironomid-based climate-inference models in northern Russia, Quat. Sci. Rev., 30, 1122–1141, https://doi.org/10.1016/j.quascirev.2011.01.022, 2011.

Lines 243-246: "During LPAZ KR-13b (877.5-244 967.5 cm) the number of *Chironomidae* gradually increased with indicators of progressive eutrophication (e.g. *Chironomus plumosus-type* and *Dicrotendipes nervosus-type* (Iwakuma and Yasuno, 1981)) and cold oligotrophic but post-eutrophic environments (*Corynocera ambigua-type*)(Brooks et al., 2007) occurring more frequently." → I would suggest to reformulate this sentence as it is hard to understand what you want to say here. Is there an increase of taxa indicator of eutrophication and then, after, an increase of oligotrophic indicators? Or they both increase at the same time?

This fragment of the text was reformulated as follows:

"During LPAZ KR-13b the number of chironomid head capsules gradually increased with indicators of progressive eutrophication (e.g. Chironomus plumosus-type and Dicrotendipes nervosus-type (Iwakuma and Yasuno, 1981)) and cold oligotrophic species (such as Corynocera ambigua) (Brooks et al., 2007) still occurring frequently."

Line 254: "inhabiting shallow Arctic" → inhabiting shallow arctic.

This was corrected accordingly.

Lines 279-282: "Both *Chironomus anthracinus-type* and *Corynocera ambigua-type* are species found in stratified lakes (e.g., Saether, 1979; Heiri, 2004). As we can see, both species can be called resistant to unfavorable environmental conditions. They have a fairly wide range of conditions in which they occur today and can even withstand long periods of anaerobic conditions in lake reservoirs." → Please provide a reference to a publication explaining that *Corynocera ambigua* is tolerant to anaerobic conditions.

Sentences were rephrased as follows:

"The appearance of Chironomus anthracinus-type and Glyptotendipes pallens-type in the Krępa sediment may thus indicate the onset of eutrophication. Both Chironomus anthracinus-type and Corynocera ambigua are found in stratified lakes (e.g., Saether, 1979; Heiri, 2004). As we can see, both species are relatively resistant to unfavourable environmental conditions, thus having a fairly wide range of conditions in which they can occur."

Line 290: "Chironomidae subfossil larvae were obtained from a total of 30 samples from the lacustrine sediments." → Please specify the sedimentary units of the samples.

This paragraph was moved to the "Study site and methods" chapter to the new section "2.6 Chironomid-based mean July air temperature reconstruction". New wording of this sentence is as follows:

"Chironomidae subfossil larvae were obtained from a total of 30 samples from the gyttja sediments (unit 4 on Fig. 1)"

Lines 290-291: "Samples that contained significantly fewer than 50 head capsules were merged except for a solitary sample at 1000 cm core depth." → Please explain why you kept a solitary sample at 100 cm. Because to me it seems that this sample is surrounded by other samples on the diagram of Figure 4 and therefore could have merged with other samples.

Keeping a solitary sample at 1000 cm instead of merging it with the remaining clusters was dictated by the differences with the species composition between this particular solitary sample and samples below. Moreover, the number of head capsules was considered sufficient (even though slightly below 50) to avoid merging in this case.

Lines 294-295: "were included in the reconstruction because the test of the reconstruction showed acceptable results." → Please which test did you perform.

This part was reformulated as it was unclear - no statistical test was performed. It was also moved to section 2.6. At the initial stage of Chironomidae analysis, the performance of the reconstruction was checked - including or excluding the solitary sample from 1000 cm depth. Including this sample seemed to give acceptable results (which was assessed based on the knowledge and experience of reconstruction's author).

This sentence after corrections reads as follows:

"After merging, sample clusters at 975 cm, 1080 cm, 1120 cm and 1125 cm core depth still did not reach 50 head capsules, but nonetheless, these samples and the one from 1000 cm core depth were included in the reconstruction as preliminary results seemed credible in terms of obtained temperature values."

Lines 296-297: "After merging, the total number of samples used for the Tjul reconstruction was 15." → From your explanation just above, I understood that you used 5 samples with sufficient amount of chironomids, 7 merged samples and 1 solitary sample to calculate the

temperature reconstruction. And these are 13 samples, not 15. Please modify the text where it is necessary.

This was corrected accordingly (and moved to section 2.6) - total number of samples after merging is 13.

Line 310: "(MinDC") → How did you calculate the dissimilarity? Please indicate that in the section "2.7 Mean July air temperature reconstruction"

The Chironomidae temperature reconstruction was performed using the Modern Analogue Technique (MAT) (Guiot 1190).

Lines 325-326: "to reconstruct the average July palaeotemperature quantitatively" → to quantitatively reconstruct July air temperature.

This fragment was rephrased as follows:

"Because of the excellent preservation of their larvae's head capsules in lake and peat bog sediments for several hundreds of thousands of years, the analysis of their subfossil remains offers the possibility to reconstruct environmental and climatic changes in the past, quantitative reconstructions of the average July air temperature and the trophic state of the inhabited water body as well as the type and dynamics of the lake, the water pH, and microhabitats. Furthermore, training sets are also available to reconstruct the water level, salinity or oxygen content (Lotter et al., 1997)."

Line 326: "the trophy of the reservoir" → the trophic state of the reservoir.

#See rephrased fragment from the comment above.

Line 327: "Training sets were also created" → Training sets are also available.

#See rephrased fragment from the comment above.

Lines 453-545: "These data indicate that summer temperature maximum during the post-Holsteinian period was even slightly higher than indicated in the Polish training set (17-20°C)(Kotrys et al., 2020)." → Please reformulate this sentence as it is unclear to me what you want to say.

This sentence was reformulated as follows: “These data indicate that summer temperature maximum during the post-Holsteinian period is consistent with the temperature range of the Polish training set (3.5-20.0°C)(Kotrys et al., 2020)

Lines 470-472: “Considering the dominance of herbs and dwarf shrubs in the pollen spectrum, the limiting factor for the development of forest communities was more likely connected to low winter temperatures as summer temperatures were still relatively high. → Please develop your interpretation and support it with other publications.

This issue was addressed in the revised manuscript and this section was completely rewritten.

Line 474: “In the following” → Following zone?

This section (4.1.2) was completely rewritten.

Lines 480-481: “Summer temperatures during this period reached only 15°C, but the limiting factor for vegetation development still remained the winter temperatures.” → Here again I would suggest developing your interpretation and refer to other publications.

This section (4.1.2) was completely rewritten.

Line 482: “being equivalent” → corresponding

This was corrected accordingly.

Lines 483-484: “As the pollen record during stadials is mostly controlled by wind-pollinated overproducers such as Poaceae and the long-distance transport of tree pollen (mostly Pinus)” → Here you need a reference.

This section (4.1.2) was completely rewritten.

Figures and Tables

Figure 2: I don’t understand what “Clay, Silt, Sand, Gravel” at the bottom of the figure represent. Also, there is no unit for the numbers between the units and the sediment profile. I assume the unit is meters but I think it should be indicated on the figure. “glaciolimnic sedimentation” at the top of the figure → Glaciolimnic sedimentation with a capital “G” to be consistent with the other sediment types.

"Clay, Silt, Sand, Gravel" at the bottom of Fig. 2 refer to the predominant grain size of the individual units. The numbers along the sediment profile indeed refer to the profile depth in centimeters. The figure was corrected according to the suggestions.

Table 1: Depth of KR-4 is overlapping with depth of KR-3. I suggest to add a column specifying the Marine Isotope Stage of each Local Pollen Assemblage Zone. What is the difference between "No *Chironomidae*" and "No individuals of *Chironomidae*"? Please specify it, in the caption of the table, if there is a difference. Please check the writing of the depths (the decimals should be indicated with a dot and not a comma in English): see for example "KR-8 1497,5 – 1647.5". For LAPZ KR-12b, I would suggest to change "high contents of *Chironomus anthracinus-type*" to "relatively high abundances of *Chironomus anthracinus*-type". Also for the same LAPZ you probably forgot words in the second sentence describing the Chironomidae: "The number of *Glyptotendipes pallens-type* and *Glyptotendipes severini-type*." For LAPZ KR-13a, you write that "on average 450 individuals per sample" but in the Figure 4 the maximum sum of chironomid in samples is around 80. Why is that? I would also suggest condensing the table because it is on 9 pages now. You could, for example, reduce the space between each LAPZ and shorten the description of the pollen results.

This was corrected accordingly. Table 1 was transformed into text to improve the content layout and presentation.

Figure 3: I think it would be good to have a horizontal line (or dotted line) on the diagram for each zones so that it is easier for the reader to see the differences between the zones. For the lithology it would probably be good to followed the same code as in Figure 2. Please specify the type of spores shown in the diagram (Fern? Fungal?). Please also write the unit of the different pollen types, which I assume is percentage, and for Pediastrum (number of remains?). If possible, it would be good to specify what is included in "Other thermophilic", "Other AP", "Other NAP".

Horizontal dotted line for each zone was added as well as the unit for pollen types (percentages)(in the title of the Fig. 2). We decided to delete the lithological part of the diagram and leave it only in Fig. 1.

"Other NAP" category includes: *Achillea t., Alchemilla, Alnus viridis, Amaranthaceae, Anemone, Anthemis t., Apiaceae undiff., Armeria maritima, Aster t. Asteraceae undiff., Brassicaceae, Bupleurum, Calluna vulgaris, Caltha t., Campanula, Cannabis sativa, Carduus t., Caryophyllaceae*

undiff., Centaurea cyanus, C. jacea t., C. montana, Cerastium t., Cichorioideae, Cicuta virosa, Cirsium t., Elymus t., Ephedra, Ephedra distachya t., Ephedra fragilis t., Epilobium t. 38 Ericaceae undiff., Euphorbia, Fabaceae undiff., Filipendula, Galeopsis t., Geum, Helianthemum nummularium t., Heracleum, Lathyrus, Ledum palustre, Liliaceae undiff., Linum austriacum t., Lysimachia nummularia t., Lythrum salicaria t., Mentha t., Papaver rhoeas, Persicaria, Peucedanum palustre, Phyteuma t., Plantago lanceolata, P. major, P. media, Polygonum, Polygonum aviculare t., P. bistorta, P. persicaria, P. viviparum, Potentilla t., Ranunculus acris t., Ribes alpinum, R. spicatum, Rosaceae undiff., Rubiaceae, Rumex undif., R. acetosella, Salix herbacea t., Saxifraga oppositifolia t., Saxifragaceae, Stellaria holostea, S. nemorum, Succisa t., Thalictrum, Urtica, Vaccinium t., Valeriana undiff., V. officinalis t.

Table 2: I would suggest to add the number of chironomids per sample in the table so that the readers know which samples might be problematic because they have "too low" numbers of chironomids.

Table 2 was corrected accordingly.

Figure 4: Why the chironomids from LAPZ-14 are not shown on the diagram? Based on Table 1, the abundance of chironomids is very low in this zone but you still found two Chironomus plumosus-type so I think it would be good to also show them on the diagram. Also, in this figure the y axis unit is in meters whereas it is in centimeters in Figure 3 and in Table 2. Please be consistent in all figures and tables. Add "Chironomid diagram" in the caption of the figure as you also show the abundances of chironomid and not only the temperature reconstruction. Please indicate what the grey bars indicate on the temperature reconstruction curve (I assume they are the errors?). I would suggest, if possible, to have a better quality of the figure because when zooming on it the names become a bit fuzzy. Please specify the units of the x axes (percentages, counts, °C). "sume" → "Sum" or "Total chironomids". Please also mention and explain what "MJAT °C" in the text or in the caption of the figure.

The LPAZ-14 zone was not included in the chironomid diagram due to very low abundance of chironomids and as this zone was not included in the temperature reconstruction. Units (cm) were added to y axis in all figures. Caption was modified according to the suggestions.

Supplement table 2: Why are some references in brackets? See for example "Barkowice Mokre".

Supplementary Table 2 was deleted in the revised manuscript.

Response to Reviewer #2 comments:

The manuscript egusphere-2024-3129 presents the first Chironomidae-inferred mean July air temperature reconstruction for the post-Holsteinian (MIS-11b) period. The reconstruction is unique, as few studies use Chironomidae as a palaeoclimatic proxy for periods older than the Eemian Interglacial. The research is valuable, and the authors provide interesting data interpretations, referencing a wide range of relevant literature.

The manuscript is well-structured, although the entire review in Section 4.1.1 partly repeats information provided earlier in the text. In this paper, it is unnecessary to extensively review the ecology of Chironomidae and their subfossil deposition in sediments. This content is out of context and should be removed from the manuscript. It could be published separately as a review paper in another journal, rather than in Climate of the Past. A significant challenge for climate reconstructions based on Chironomidae subfossils from such ancient sediments is the speciation rate and potential changes in the species' environmental preferences represented by morphotypes over such a long timescale. Another issue is the zoogeographical context that influences assemblage composition. Due to successive glacial-interglacial cycles up to the present day, when the SNP TS was conducted, species ranges have changed multiple times, affecting regional faunal composition. Can we assume that the morphotypes of subfossils collected from the Krępa post-Holsteinian sediments represent the same species as in the SNP TS? This issue should be briefly discussed in the context of Section 4.1.1. The authors refer to the "actuality of geological processes," but can we make a similar assumption for the climatic preferences of species after such a long time? This is a central issue for climatic reconstructions from such ancient subfossils. As the authors note, Chironomidae have short life cycles, which suggests a fast rate of phylogenetic processes. I agree that temperature reconstructions from such old sediments are possible and reliable, but they should be treated with caution when compared to those from the Holocene, Weichselian, or Eemian periods. Chironomidae are present in only a short section of the Krępa sediments, whereas pollen is ample throughout the entire core. I wonder how a pollen-inferred temperature reconstruction would compare in this case. Would it confirm the chironomid-inferred July air temperatures or not? I leave this question to the authors for consideration. It could be an interesting addition, though the midge-based reconstruction from the post-Holsteinian is already highly unique and sufficient for a strong paper in Climate of the Past.

We thank the reviewer for the detailed and constructive comments on our manuscript and provide point-by-point answers to the issues raised.With respect to the issues raised here briefly, we will address them as follows:

We restructured section 4.1.1, now paying attention to a more proper connection of individual species preferences and our findings. However, we would rather try to better integrate this part with the remaining part of the discussion than entirely delete it from the revised manuscript.

Responding to the issue considering the influence of speciation rate / changing environmental preferences through time - We believe it can be applied to any multi-proxy analysis in post-Holsteinian sediments. The applicability of temperature reconstruction is determined using various statistical methods, including canonical correspondence analysis (CCA). Relationships between chironomid communities and summer temperature using the cross-correlation coefficient differentiation (DCCA) on square-root transformed data in CANOCO v. 4.5 (ter Braak and Sˇmilauer 2002).

Also the range of analogy of fossil communities to contemporary communities using Modern Analog Technique (MAT) (Birks et al. 1990). By marking individuals, we can determine that the same morphologically similar individuals still occur in the same area as in the Holocene (Płóciennik et al. 2023).

For example, we can give the rate of speciation of the tribe Tanytarsini. Subfossil individuals are from Palaeogene (Eocene/Oligocene ~ 40–45 Ma), Fenno-Sarmatia: 4 species, 3 genera). Currently there are 187 species of 16 genera recorded in Europe. Speciation within the Tanytarsini is mainly ecological and geographic isolation (Giłka 2011). The second factor confirming the applicability of the analysis is its correlation with the results from other multi-proxy analyses. If the results create a coherent whole of factors and their responses with the results from the analyses of pollen, Cladocera, diatoms, Ostracoda, or macroremains, then they confirm the results and applicability of the method. Of course, we can assume that each organism undergoes speciation, but each of these organisms has a different life cycle length. Therefore, here we can assume that this speciation would occur at a different rate. This is a very interesting aspect. That is why it is so important to use other analyses, especially for such old sediments, but with just a few sites investigated we can see that this can be a big challenge, because the sediment is periodically poor in any remains.

As far as pollen-inferred temperature reconstruction is concerned: we decided to add pollen-based temperature reconstruction for the MIS 11b period to be consistent with chironomid-based temperature reconstruction (see new section 3.5 and substantially modified section 4.1.2).

The authors indicate in Section 2.1 that they reviewed 80 sites with Holsteinian sequences in Poland in Table 1, but the table contains different content. I could not locate this data compilation in the manuscript. The text is already lengthy, so I suggest saving this subject for another paper. Additionally, I recommend reducing the manuscript's length by 20% by deleting Section 4.1.1 and moving Table 1 to the supplementary materials.

We completely removed the entire section 2.1 as the presentation of the other Polish sites is not a part of the revised manuscript anymore. As stated in the general comment before, section 4.1.1 was reduced and integrated with the remaining part of the discussion but not entirely deleted.

The manuscript's English requires substantial revision by a native speaker fluent in ecology. I also suggest the following minor comments:

Lines 1-3: The title should be rephrased to be more compact and maybe focused on temperature more than Chironomidae. The paper does not refer to the "central European perspective".

The title was rephrased as follows:

"Chironomid- and pollen-based quantitative climate reconstructions for the post-Holsteinian (MIS 11b) in Central Europe".

In the whole text, lines 1, 21, 23, 28, 33, 54-58, 58-59, 82, 95, 97, 103, Table 1, 227, 228, 230, 231, 233, 237, 244, 247, 289, 290, 319, 321, 325, 331, 334, 351, 357, 359, 362, 364, 373, 388, 389, 390, 392, 395, 398, 401, 430, 435, 441, 495, 461, 475, 491, 493, 494, 507, 509, 514, 515, 520, 521 and elsewhere – Chironomidae is a Family name and according to taxonomic nomenclature it should be written in the regular font, not italics. The chironomid/chironomids is an informal name like a dog, a fox, or a cat, and should be written starting from the small, not a capital letter.

This was corrected accordingly.

Lines 18, 34, 101, 103, 104, 106, 107, 344, 345, 348, 515, 516, and in many other places please change the personal mood of the sentence to impersonal.

This was corrected accordingly.

Lines 18-19: This sentence is complex and hard to read. Please use shorter sentences all over the text.

We checked the entire text with respect to comprehensiveness and shortened some sentences where possible and necessary.

Line 20: Pollen can be used for quantitative reconstructing of the annual temperature, the temperature of the warmest month, the temperature of the coldest month, as well as precipitation and vegetational season duration.

Entire abstract was rewritten.

Line 21: Please change "recreate" to 'reconstruct'.

This was corrected accordingly.

Lines 22, 326, and elsewhere: Please change "trophy" to "trophic state" in the text.

This was corrected accordingly.

Line 23: "..of the Holocene" - please add 'and Late Weichselian'.

This was corrected accordingly.

Lines 30, and 31: In English decimals should be written with '.' not ','. Please change here and elsewhere in the text.

This was corrected accordingly.

Line 32: How do you know, if there is no quantitative temperature reconstruction inferred from the pollen?

The pollen data from Krępa site are (at the moment) published only as a part of Artur Górecki's (co-author of this manuscript). However, as stated above, we added pollen-based temperature

reconstruction which is the first quantitative palaeoclimate reconstruction for the post-Holsteinian in Central Europe.

Line 34: I'm not sure the word 'enhancing' well fits in this context, could you use some other?

The word was changed to “improving”.

Lines 34-37: This sentence is hard to read. Please rephrase. Also according to the taxonomic codex, Cladocera should be written here and elsewhere with the regular font.

We completely removed this sentence as the presentation of the other Polish sites is not a part of the revised manuscript anymore.

Lines 37-38: Please rephrase the sentence

We completely removed this sentence as the presentation of the other Polish sites is not a part of the revised manuscript anymore.

Line 38: Maybe it is better to refer to research than data.

Entire abstract was rewritten.

Line 39: I suggest to discuss them wider in the 'Discussion' chapter.

Entire abstract was rewritten.

Line 41: Please change the words 'numerously' and 'triggered' to some others. They don't fit the context.

This was corrected as follows:

“Earth’s history is characterised by repeated climate fluctuations, which had until the present interglacial, the Holocene (marine isotope stage (MIS) 1), only natural causes and were not influenced by humans.”

Line 42: Maybe 'gives' would be better than "creates"?

This was corrected as follows:

“This offers the opportunity to compare natural climatic changes in the past with the current ones in order to better assess the anthropogenic impact on the present climate.”

Lines 43-46: This sentence is long and hard to read, please rephrase.

This sentence was rephrased as follows:

“With respect to human impact during the Holocene, the so-called “Anthropocene” is presently widely debated across various scientific disciplines though its exact timing as well as the actual dimension of human influence on the environment are still debated (Brondizio et al., 2016).”

Lines 47-49: From 11,500 years (cal ?) BP there is only one Marine Isotope Stage - MIS 1.

The complete sentence was rewritten as follows:

“Holocene environmental archives, such as lake, palaeolake and ocean sediments provide material for comprehensive palaeoecological analyses.”

Lines 49-51. Please try to write this sentence in more simple words. Please change "species structure" to 'structure of the communities.

This sentence was corrected as follows:

“The sensitivity of some groups of organisms in these archives to changing hydrological or climatic conditions allows to reconstruct past events that directly affected the abundance or structure of the communities (Battarbee, 2000).”

Line 52: Please change "requirements" to 'preferences' and delete "table", just stay with 'water depth'.

This was corrected accordingly.

Line 54: Foraminifera should start with a capital letter as this is the higher taxa name

This was corrected accordingly.

Lines 54-58: This sentence is too long and hard to read. Please cut it to a few shorter sentences.

This was corrected as follows:

“For example, Foraminifera can be used to reconstruct ocean pH (Foster and Rae, 2016; Roberts et al., 2018), pollen provide information about changes in vegetation (Ralska-Jasiewiczowa et al., 2004; Kupryjanowicz et al., 2018) and can be used to reconstruct past human activity (Chevalier et al., 2020) or past climate conditions (e.g. Rylova and Savachenko, 2005; Hrynowiecka and Winter, 2016). Head capsules of chironomids can serve as the basis for summer air temperature reconstructions (Eggermont and Heiri, 2012) as well as for assessing the trophic state or pH of freshwater ecosystems (Płóciennik, 2005).”

Lines 58-59: The word "remnants" does not fit the context, better use 'subfossils' or 'head capsules' instead.

This was corrected accordingly.

Lines 61-63: This sentence is hard to read, please rephrase. The word "pace" does not fit to the context.

This was corrected as follows:

“However, these reconstructions neither provide unequivocal information about air temperature changes nor allow to distinguish between the relative contribution of natural drivers and human impact to these changes.”

Line 66: Once you explained the abbreviation MIS in line 24, later on in the text you can use it without referring to the full name "Marine Isotope Stage". Just write MIS.

This was corrected accordingly.

Line 84: The Word "recreate" does not fit the context.

This sentence was completely rephrased.

Line 88: Maybe 'analysed' would be better than "conducted" in this case.

This sentence was completely rephrased.

Maybe I am wrong but I think there is no sense of connection between sentences in line 94 and lines 95-96.

We restructured the entire paragraph on other MIS 11 sites in Europe.

Line 100: Maybe 'brings the' would be better than "gives" in this case?

This sentence was deleted.

Line 104: Should Quaternary start here from a capital letter?

This was corrected accordingly.

Line 105: Please change "ecological requirements" to 'species ecological preferences'.

The sentence was reformulated as follows:

“In addition, we discuss the potential of chironomid analysis for palaeoecological studies of Quaternary sediments as well as the challenges for chironomid analysis arising from both the evolution and interchanging adaptations to species ecological preferences and the preservation of fossil remains.”

Line 107: Please delete the phrase "on the map".

We completely removed the entire section 2.1 as the presentation of the other Polish sites will not be a part of the revised manuscript anymore.

Line 114: Please change "they are focused" to 'they aggregate'.

We completely removed the entire section 2.1 as the presentation of the other Polish sites is not a part of the revised manuscript anymore.

Line 199: What method was used for pollen zonation?

The method used was CONISS cluster analysis function. This paragraph after reformulating reads as follows:

“Local Pollen Assemblage Zones (LPAZ) were established using the CONISS cluster analysis function within riojaPlot and were visually adjusted if necessary.”

Section 2.6: Please give the total number of Chironomidae head capsules.

The total number of Chironomidae HC in the investigated core was 716.

Line 211: Please change "Pillot" to 'Moller Pillot' as it is a double surname.

This was corrected accordingly.

Table 1: Please, move Table 1 to the supplements. Please change in the table and everywhere in the text (i.e. line 479) “dominance” to ‘domination’, also in scientific papers word “significance” is restricted to statistical significance, please change in Table 1 and elsewhere to ‘clear’, or ‘distinct’ or ‘substantial’, etc. At line 410 maybe to 'lower impact' or 'smaller impact'.

The information contained so far in Table 1 was integrated in the main text as a new section 3.2 “Vegetation changes during the Holsteinian Interglacial and the Early Saalian Glacial at Krępa site”

Tab. 1 KR-11b: Please give space between "percentages" and "and".

The information contained so far in Table 1 was integrated in the main text, the suggested changes were made accordingly.

Tab. 1 KR-12a section Chironomidae - please replace "amounts" with 'number'.

The information contained so far in Table 1 was integrated in the main text, the suggested changes were made accordingly.

Tab. 1 KR-12b section Chironomidae: please change "content" to 'share', also next sentence about G. pallens-type and G. severini-type is not complete - What do you mean?

The information contained so far in Table 1 was integrated in the main text, the suggested changes were made accordingly.

Tab. 1 KR-13b section Chironomidae - please change the font in "occur" to regular.

The information contained so far in Table 1 was integrated with the main text, the suggested changes were made accordingly.

Lines 234-235: Delete "remains of" from "remains of head capsules", also change "," to '.' in "1222,5 cm". It should be '1222.5 cm'.

This was corrected accordingly.

Line 237: Please change "amounts" to 'number' 'populations' or 'abundance'.

According to the suggestion, “amounts” was changed to “abundance”.

Lines 239-240: G. pallens-type and G. severini-type are warm stenotherms. Please rephrase the sentence.

We corrected this paragraph as follows:

“LPAZ KR-12b (1072.5-1122.5 cm) contains mainly cold-adapted species like Corynocera ambigua and freeze-resistant species like Glyptotendipes pallens-type and Glyptotendipes severini-type, which are often associated with algae and diatoms or mine leaves, (Tarkowska-Kukuryk, 2014). LPAZ KR-12c is characterised by species highly resistant to difficult environmental conditions, such as Chironomus anthracinus-type, which is typical for nutrient-rich conditions with wide environmental tolerances (Seather 1979, Self et al. 2011), Corynocera ambigua, which has a broad thermal tolerance (Brodersen & Lindegaard 1999 and Glyptotendipes pallens-type, which can better tolerate harsh winter conditions and lives in different types of substrates (Moller Pilot 2013, Cerba et al. 2022).

Line 246: Please add space between "(Corynocera ambigua-type)" and "(Brooks et al., 2007)".

This was corrected accordingly.

Line 247: Please change "amount" to 'abundance' or 'number'.

According to the suggestion, “amount” was changed to “number”.

Line 247: Please add 'stenotherm' between "warm" and "species".

This was corrected accordingly.

Lines 255-256: Please change "has a growth period" to 'larvae develop'.

This sentence was deleted.

Lines 259, 282, 326, 327, 353, 358, 385, 389, 414: Please change here and elsewhere in the text "reservoir" to 'lake'/'lakes/water body/water bodies' (at line 389 to 'bottom').

This was corrected accordingly.

Line 260: Please change 'number' to 'abundance'. Also, it should be 'has been shown'.

This sentence was deleted.

I think that sentence in lines 273-274 is unnecessary. I suggest to delete it.

As suggested, the sentence was deleted.

Please move the paragraph from lines 290-297 to the section 2.7.

As suggested, the paragraph was moved to the new section "2.6. Chironomid-based mean July air temperature reconstruction."

Fig. 4: Please indicate in the figure caption whether Chironomidae are presented in the percent shares or counted numbers of specimens. Also, if you want to be super-correct give Tanytarsini indet. in the regular font. The figure presents not only the mean July air temperature reconstruction but also a stratigraphic diagram of the Chironomidae assemblages.

The figure caption was corrected as suggested. As we combined Fig.1 and 2 of our initial submission into one figure, the figure numbering will shift and Fig. 4 will be Fig. 3 in the revised manuscript.

Line 320: Please change " and an important element of" to 'conducted in'.

This was changed accordingly.

Line 321: Please change "order" to 'suborder' (!).

This was changed accordingly.

Line 325: Please delete: "the diversity of", and "centuries".

This was corrected accordingly.

Line 340: Please change "amount" to 'number'.

This was changed accordingly.

Lines 346, 348, and elsewhere: Please keep American or British English throughout the whole text.

In the revised manuscript we used British English.

Sentence at lines 358-360: Meaning unclear, please rephrase. Maybe "attract" is used inadequately and should be replaced by another word, but then still, the sentence needs to be rephrased.

This was corrected as follows:

“Large lakes like the one that most probably existed at Krępa (1) have a greater variety of habitats, thus being characterised by a larger biodiversity of Chironomidae (Allen et al., 1999; Heino, 2000; Tarr et al., 2005). and (2) are more resilient to extreme droughts and other extreme events. In contrast, small lakes with less diverse and isolated habitats reveal a reduced species diversity and dispersal (Roberts, 2003).”

Line 361: What do you mean by the "remote habitats"?

This sentence was corrected. Please see our response to the comment above.

Line 374: Chaoboridae and Ceratopogonidae are the Family names and should be given in regular font, not italics.

This sentence was deleted as we completely rewritten section 4.1.1.

Line 379: Please delete "the amount of".

This was corrected accordingly.

Line 385: "morphological" - do you mean bathymetry?

This sentence was deleted as we completely rewrote section 4.1.1.

Sentence at lines 392-393: Do you mean living larvae of Chironomidae or rather head capsules (subfossils)? If you mean the subfossils then you can't refer to "behaviour", rather you mean redeposition processes.

The complete sentence was rewritten as follows:

“Another factor limiting the preservation of chironomid head capsules in sediments are mechanical factors that cause damage to the head capsules.”

Lines 401-402: Please add 'subfossils of' before "multivoltine" and change "being" to 'can be'.

This was corrected accordingly.

Line 403: Maybe 'parameters' would be more suitable than "properties".

This sentence was deleted as we completely rewrote section 4.1.1.

Lines 405-408: Please cut the sentence to a few shorter ones, also "extinction" seems to be a bit too big word in this context.

This sentence was deleted as we completely rewrote section 4.1.1.

Line 413: Please delete "and the bottom of the reservoir".

This was corrected accordingly.

Line 418: Please add 'waters at' before "cold", also for whom is favourable? And from what is more favourable? The anaerobic environments, peat bogs, and aquatic habitats in deserts and cold regions are usually less favourable for chironomids than i.e. lakes with good oxygen conditions, and neutral pH that is localised in temperate regions.

This sentence was deleted as we completely rewrote section 4.1.1.

Sentence at lines 418-419: Meaning unclear.

This sentence was deleted as we completely rewrote section 4.1.1.

Line 419: I am not sure if the word "properties" is properly used in this sentence.

This sentence was deleted as we completely rewrote section 4.1.1.

Line 426: "sites" - do you mean 'samples'?

This paragraph was moved to section “2.5 Chironomidae analysis” and changed as follows:

“Preliminary tests of sample preparation avoided the use of chemicals and included soaking the samples in water for a long time instead to reduce mechanical stress exerted to the head capsules during sample sieving as much as possible. Nevertheless, intact head capsules could not be extracted from some sediment samples even when using this gentle way of sample preparation, likely because of the already highly compacted sediment.”

Paragraphs at the lines 425-429 and 438-444 should be moved to the section 2.6.

The first paragraph was moved to section “2.6. Chironomidae analysis” according to the suggestion. The second paragraph was deleted as we completely rewrote section 4.1.1.

Line 439: "functional" - do you mean 'functioning'?

This sentence was deleted as we completely rewrote section 4.1.1.

Line 441: Please change "macroremians" to 'subfossils'.

This sentence was deleted as we completely rewrote section 4.1.1.

The section 4.1.2 is dedicated mostly to the comparison of Chironomidae-inferred summer temperatures with the interpretation of pollen data. Please change the title of the section focusing more on pollen-based reconstructions.

This was corrected accordingly. We suggest the following:

“Chironomid-inferred reconstructions from the Krępa site in relation to pollen-based reconstructions.”

Line 454: Please add space between "...C)" and "(Kotrys...".

This was corrected accordingly.

Lines 486-487: Something is missing in this sentence, please rephrase.

We deleted the complete sentence.

Lines 507-508: I recommend comparing the trend in the temperature with trends in Chironomidae assemblages reflected by some ordination analysis - i.e. plotting temperatures against DCA/PCA Ax 1 and Ax 2 values. PCA can be very easily calculated in C2.

PCA values were calculated and added to Table 1 (now in section 3.4).

Line 508: Please delete the sentence "They are an environmental indicator." It is redundant.

This sentence was deleted as suggested.

Line 518: Please change "abundantly" to 'with higher concentration'.

This sentence was deleted.

Line 746: Please change "Pillot" to "Moller Pillot" as it is a double surname. Also, he is cited usually as H. K. M.

This was corrected accordingly.