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Interlaboratory comparison 04/2022

Benthic diatoms

Satu Maaria Karjalainen, Annika Vilmi, Riitta Koivikko,
Mirja Leivuori, Keijo Tervonen, Sari Lanteri and Markku Ilmakunnas

PROF TEST SYKE

Finnish Environment Institute

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Abstract

Interlaboratory comparison 04/2022: Benthic diatoms
Proftest SYKE carried out for the first time an interlaboratory comparison (ILC) on the identification of benthic diatoms in lakes and rivers in spring 2022. Diatom species identification was performed from digital photographs and videos of altogether 30 samples. There were 11 participants in this ILC.

The participants of this ILC were experienced in the identification of benthic diatoms as 82 % of the participants received satisfactory result. There was no unsatisfactory performance. All participants identified correctly 47 % of the samples. Challenges in the identification were connected to the availability of the newest diatom identification literature recommended for the ILC and on the use of the newest taxon names. The used approach in the ILC showed to be suitable when epilithic diatoms are identified for research or monitoring purposes. Warm thanks to all participants in this ILC!

Keywords: benthic diatoms, phytobenthos, lakes, running waters, species identification, interlaboratory comparison

Tiivistelmä

Vertailumittaus 04/2022: Pohjan piilevät
Proftest SYKE järjesti keväällä 2022 ensimmäistä kertaa pohjoisten virtavesien ja järvien pohjien piilevien lajitason tunnistamisosaamisen vertailumittauksen. Vertailumittauksessa lajintunnistus tehtiin digitaalisista näytteistä (yhteensä 30 näytettä) ja siihen osallistui yhteensä 11 määrittäjää.

Vertailumittauksen tulosten perusteella osallistujat olivat kokeneita pohjan piilevien lajintunnistuksessa, sillä osallistuneista 82 % ylsi hyväksyttävään tulokseen (90 % taksoneista oikein määritetty). Yhtään ei-hyväksyttävää suoritusta ei ollut. Kaikki osallistujat tunnistivat taksonit oikein 47 % näytteistä. Tunnistuksen haasteet liittyivät vertailumittauksessa suositellun uusimman pohjan piileviin liittyvän määrityskirjallisuuden sekä taksonien uusimpien nimien käyttöön. Vertailumittauksessa käytetty menettelytapa osoittautui sopivaksi kivien päällä esiintyvien piilevien tunnistamisessa tutkimuksia tai seurantoja varten. Kiitos vertailumittauksen osallistujille!

Asiasanat: pohjan piilevät, päällyslevät, järvet, virtavedet, lajintunnistus, laboratorioiden välinen vertailumittaus

Sammandrag

Jämförelse mellan laboratorier 04/2022: Bentiska kiselalger
I våren 2022 genomförde Proftest SYKE för första gången en jämförelse mellan laboratorier, som omfattade artbestämningen av bentiska kiselalger i norra vattendrag och sjöbottnar. I jämförelse gjordes artbestämning från digitala prover (totalt 30 prover). Denna jämförelse hade totalt 11 deltagarna.

Baserat på resultaten av jämförelse hade deltagarna erfarenhet av artbestämning av kiselalger, då 82 % av deltagarna uppnådde acceptabla resultat (90 % av taxan korrekt identifierade). Det var ingen otillfredsställande prestation. Alla deltagare identifierade korrekt taxa i 47 % av proverna. Utmaningarna med identifieringen var relaterade till användningen av den senaste bestämningslitteraturen av kiselalger och de senaste namnen på de taxa som rekommenderades för den jämförelsen. Den procedur som användes vid den här jämförelse mellan laboratorier visade sig vara lämplig för att identifiera epilitiska kiselalger i forsknings- eller övervakningssyfte. Ett varmt tack till alla deltagarna i testet!

Nyckelord: bentiska kiselalger, fytobentos, sjöar, rinnande vatten, artbestämning, jämförelse mellan laboratorier

Contents

1 Introduction

Proftest SYKE carried out for the first time an interlaboratory comparison (ILC) on the identification of benthic diatoms in spring 2022 (DIATOM 04/2022). Diatom species identification was performed from digital photographs and videos. In this ILC, the identification skills regarding benthic epilithic diatom species from northern running waters and lakes were evaluated.

This interlaboratory comparison was organized to assess the proficiency and reliability of professional and semi-professional identification of benthic diatom taxa routinely encountered in biomonitoring of boreal lakes and rivers. The test material included taxa used in ecological status assessments following the requirements of the EU Water Framework Directive (WFD).

The ILC is in line with the WFD's demand for quality assurance of biological data and SYKE's aim to broaden the scope of its accredited methods towards biological proficiency testing. As taxonomic identification of benthic diatoms is routinely done only by a single analyst, Proftest SYKE conducted the benthic diatom interlaboratory comparison for individual taxonomists rather than the organization they represent. Therefore, participants received personal participation certificates indicating the percentage of correctly identified taxa for the ILC.

Finnish Environment Institute (SYKE) is appointed National Reference Laboratory in the environmental sector in Finland. The duties of the reference laboratory include providing proficiency tests and interlaboratory comparisons for analytical laboratories and other producers of environmental information. This ILC has been carried out under the scope of the SYKE reference laboratory and it provides an external quality evaluation between laboratory results, and mutual comparability of analytical reliability. This is important in order to harmonize the identification skills of various laboratories, and thus increase the coherence of environmental data analyzed. The ILC was carried out in accordance with the international standard ISO/IEC 17043 [1] and applying ISO 13528 [2] and IUPAC Technical report [3]. Proftest SYKE is accredited by the Finnish Accreditation Service as a proficiency testing provider (PT01, ISO/IEC 17043, www.finas.fi/sites/en). The organizing of this ILC is not included in the accreditation scope of Proftest SYKE.

2 Organizing the interlaboratory comparison

2.1 Responsibilities

Organizer
Proftest SYKE, Finnish Environment Institute SYKE, Laboratory Centre
Mustialankatu 3, FI-00790 Helsinki, Finland
Phone: +358 295 251 000, Email: *proftest@syke.fi*

The responsibilities in organizing the interlaboratory comparison

Riitta Koivikko	coordinator
Mirja Leivuori	substitute for coordinator
Keijo Tervonen	technical assistance
Markku Ilmakunnas	technical assistance
Sari Lanteri	technical assistance

Analytical experts

Annika Vilmi	SYKE, Freshwater center
Satu Maaria Karjalainen	SYKE, Freshwater center

2.2 Participants

The ILC was aimed at consultants, environmental authorities, and other experts on benthic diatoms. In total 11 experts participated in this ILC (Appendix 1).

2.3 Test material and delivery

The test material comprised of benthic epilithic diatom species that occur in northern running waters and lakes. Identification of benthic epilithic diatoms was done from digital photos and video material. Sample preparation was done in SYKE Freshwater center. In total there were 93 photographs and 41 videos comprising altogether 30 samples, and the number of photographs and videos of taxa varied 2–5 and 1–2, respectively. The photographs of the samples are summarized in Appendix 2 (the resolution is lower than in the original photographs).

The test material was delivered via online file transfer service on 19 April 2022. The results were to be reported at the latest on 27 May 2022 and the participants delivered the results accordingly. The preliminary results report was delivered to the participants via email on 17 June 2022.

2.4 Processing the data

In the given instructions for the ILC it was recommended to use the latest literature and new taxonomic publications in the identification of benthic diatoms [4–19]. Taxon identification was scored from 0 to 1, where 0 is the wrong taxon and 1 is the name of the taxon according to Table 1. In the evaluation, the taxon was approved, i.e. it received one point also in the following cases:

- if the taxon name in the Table 1 was in the comments, even though the column “Taxon name” in the result sheet had an old name i.e. synonym

- the taxon had a typo or typos

- even if the variation name is omitted (when the variation name was the same as the species name)

- even if a variation or subspecies corresponding to the species name has been added to the species name

- in the taxon *Karayevia suchtlandtii*, the genus *Kolbesia* was accepted because it is mentioned as the most recent name in Lange-Bertalot, Hofmann, Werum & Cantonati (2017) [15], although the genus *Kolbesia* is questionable in this species (see https://diatom.ansp.org/nawqa/pdfs/FifteenthNAWQA Workshop.pdf).

The use of a synonym for a taxon in the Table 1 resulted 0.75 points. By following the latest literature for identification of benthic diatoms, one stays involved in taxonomic changes, such as the division of a taxon into new species.

If a taxon was assigned to a genus level, then a correctly determined genus received 0.5 points.

The participant overall result is considered satisfactory, if the participant identifies correctly 90 % of the species (Table 2).

Table 1. Taxons in the samples for the interlaboratory comparison DIATOM 04/2022. The approved taxon name is in accordance with the latest publications which were recommended taxonomic literature in the ILC and presented in the bibliography [4-19]. In addition, the reference of authorship for each taxon is presented among the bibliography [20-44].

Sample	Benthic diatom taxon	Authors
1	*Encyonopsis subminuta*	Krammer & Reichardt 1997 [7]
2	*Eucocconeis laevis*	(Østrup) Lange-Bertalot 1999 [35]
3	*Rossithidium pusillum*	(Grunow) Round & Bukhtiyarova 1996 [40]
4	*Cavinula jaernefeltii*	(Hustedt) D.G. Mann & A.J. Stickle 1990 [41]
5	*Skabitschewskia peragalloi*	(Brun & Héribaud) Kulikovskiy & Lange-Bertalot 2015 [31]
6	*Skabitschewskia oestrupii*	(Cleve-Euler) Kulikovskiy & Lange-Bertalot 2015 [31]
7	*Nupela impexiformis*	(Lange-Bertalot) Lange-Bertalot 1999 [34]
8	*Karayevia laterostrata*	(Hustedt) Bukhtiyarova 1999 [23]
9	*Cavinula pseudoscutiformis*	(Hustedt) D.G. Mann & A.J. Stickle 1990 [41]
10	*Psammothidium rossii*	(Hustedt) Bukhtiyarova & Round 1996 [24]
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	(Hustedt) Bukhtiyarova 1999 [23] ((Hustedt) J.C.Kingston 2000) [29]
12	*Platessa oblongella*	(Østrup) C.E. Wetzel, Lange-Bertalot & Ector 2017 [43]
13	*Brachysira neoexilis*	Lange-Bertalot 1994 [18]
14	*Brachysira brebissonii*	Ross 1986 [28]
15	*Kobayasiella parasubtilissima*	(H.Kobayasi & Nagumo) Lange-Bertalot 1999 [33]
16	*Reimeria sinuata*	(Greogory) Kociolek & Stoermer 1987 [30]
17	*Fragilaria gracilis*	Østrup 1910 [44]
18	*Chamaepinnularia mediocris*	(Krasske) Lange-Bertalot 1996 [17]
19	*Encyonema neogracile* (var. *neogracile*)	Krammer 1997 [7]
20	*Eunotia incisa*	W. Smith. ex W. Gregory 1854 [26]
21	*Mayamaea permitis*	(Hustedt) K. Bruder & Medlin 2008 [22]
22	*Sellaphora saugerresii*	(Desmazières) C.E. Wetzel & D.G. Mann 2015 [19]
23	*Navicula cryptocephala*	Kützing 1844 [32]
24	*Rossithidium anastasiae*	(Kaczmarska) Potapova 2012 [38]
25	*Fallacia vitrea*	(Østrup) D.G. Mann 1990 [41]
26	*Gomphonema coronatum*	Ehrenberg 1840 [25]
27	*Encyonopsis descripta*	(Hustedt) Krammer 1997 [8]
28	*Gomphonema varioreduncum*	Jüttner et al. 2013 [5]
29	*Navicula rhynchocephala*	Kützing 1844 [32]
30	*Encyonopsis falaisensis*	(Grunow) Krammer 1997 [8]

Table 2. The criteria for performance evaluation.

Criterion	Performance
≥ 90 %	Satisfactory
80 – 90 %	Questionable
< 80 %	Unsatisfactory

3 Results and discussion

The correct identifications of the taxa present in the samples are given in the Table 1 and the summary of the participant results is presented in Table 3. The results and the performance of each participant are presented in Appendix 3.

Table 3 shows the share of participants' correct results in this interlaboratory comparison. In total, 82 % of the participants received satisfactory result.

Table 3. The summary of the results in the interlaboratory comparison DIATOM 04/2022.

Participant	Points	%	Result	
1	27.5	91.7	Satisfactory	≥ 90 %
2	30	**100**	Satisfactory	≥ 90 %
3	27.5	91.7	Satisfactory	≥ 90 %
4	27.75	92.5	Satisfactory	≥ 90 %
5	25.5	85.0	Questionable	80 – 90 %
6	29	96.7	Satisfactory	≥ 90 %
7	25.5	85.0	Questionable	80 – 90 %
8	27.25	90.8	Satisfactory	≥ 90 %
9	30	**100**	Satisfactory	≥ 90 %
10	29	96.7	Satisfactory	≥ 90 %
11	28.75	95.8	Satisfactory	≥ 90 %

Average points for each sample are shown in Figure 1. All participants identified correctly 47 % of the samples (1 point as the average result). According to the Figure 1 the most challenging sample to identify was the sample 7, which had the lowest average score for correct identification. The sample 7, *Nupela impexiformis* (Lange-Bertalot) Lange-Bertalot 1999 [34] (synonym *Achnanthes impexiformis* Lange-Bertalot 1989 [16]), was commonly misidentified as *Achnanthes impexa* Lange-Bertalot 1989 [16]. These species look very much alike when frustule's shape and dimensions are viewed. However, there are clear differences between the species. *N. impexiformis* has a large, asymmetrical central area, which reaches valve margin on one side. *A. impexa* has a distinctive stigma in the rapheless valve [16].

In the sample 15 *Kobayasiella parasubtilissima* (H. Kobayasi & Nagumo) Lange-Bertalot 1999 [33] was mistaken to be *Kobayasiella micropunctata* (Germain) Lange-Bertalot 1999 [33]. *K. parasubtilissima* is longer than *K. micropunctata*, thus length-to-width ratio ranges from 6.0 to 9.3 and from 4.9 to 6.0, respectively [20, 21].

In the sample 24 *Rossithidium anastasiae* (Kaczmarska) Potapova 2012 [38] was mistaken to be *Achnanthidium crassum* (Hustedt) Potapova & Ponader 2004 [38]. However, *R. anastasiae* is generally longer (12-26 µm) than *A. crassum* (7.3-19.6 µm). The valves of *R. anastasiae* have uniseriate and slightly radiate striae and stria density of 24-29 in 10 cm [37], whereas *A. crassum* has striae that is parallel to barely radiate at mid-valve and radiate at the ends: stria density at mid-valve is 20-24 in 10 cm, and in rapheless valve 35-40 in 10 µm at the ends [36].

In the sample 27 *Encyonopsis descripta* (Hustedt) Krammer 1997 [8] was mistaken to be *E. cesatii* (Rabenhorst) Krammer 1997 [8]. Even if they have partly overlapping valve dimensions and striae density, they have also clear differences. For example, their apices are distinctively different: *E. descripta* has capitate apices whereas *E. cesatii* has narrow rostrate to subrostrate apices ([8].

Gomphonema varioreduncum Jüttner, Ector, E. Reichardt, Van de Vijver & E.J. Cox 2013 [5] in the sample 28 was mistaken to be *G. exilissimum* (Grunow) Lange-Bertalot & E. Reichardt 1996 [17] or *G. sarcophagus* W. Gregory 1856 [27]. Jüttner et al. [5] brought up the asymmetrical valve shape of *G. varioreduncum*, which clearly differs from *G. exilissimum*. The latter is symmetrical or only very slightly asymmetrical about the apical axis and has mostly subcapitate head poles [5]. In addition, *G. exilissimum* is also usually larger than *G. varioreduncum* (length/width: 20.9–39.2 µm/4.3–5.9 µm versus 13.5–28.4 µm/4.1–5.2 µm) [5]. *G. sarcophagus* is larger and wider (27–38 µm/5–7µm [42] than *G. varioreduncum*. In addition, the striae of *G. sarcophagus* are much coarser (in coarse valve 6–8 in 10 µm and in fine valve 11–14 in 10 µm [42] than that of *G. varioreduncum* (14–18 in 10 µm near valve centre and 16–20 in 10 µm near apices [5].

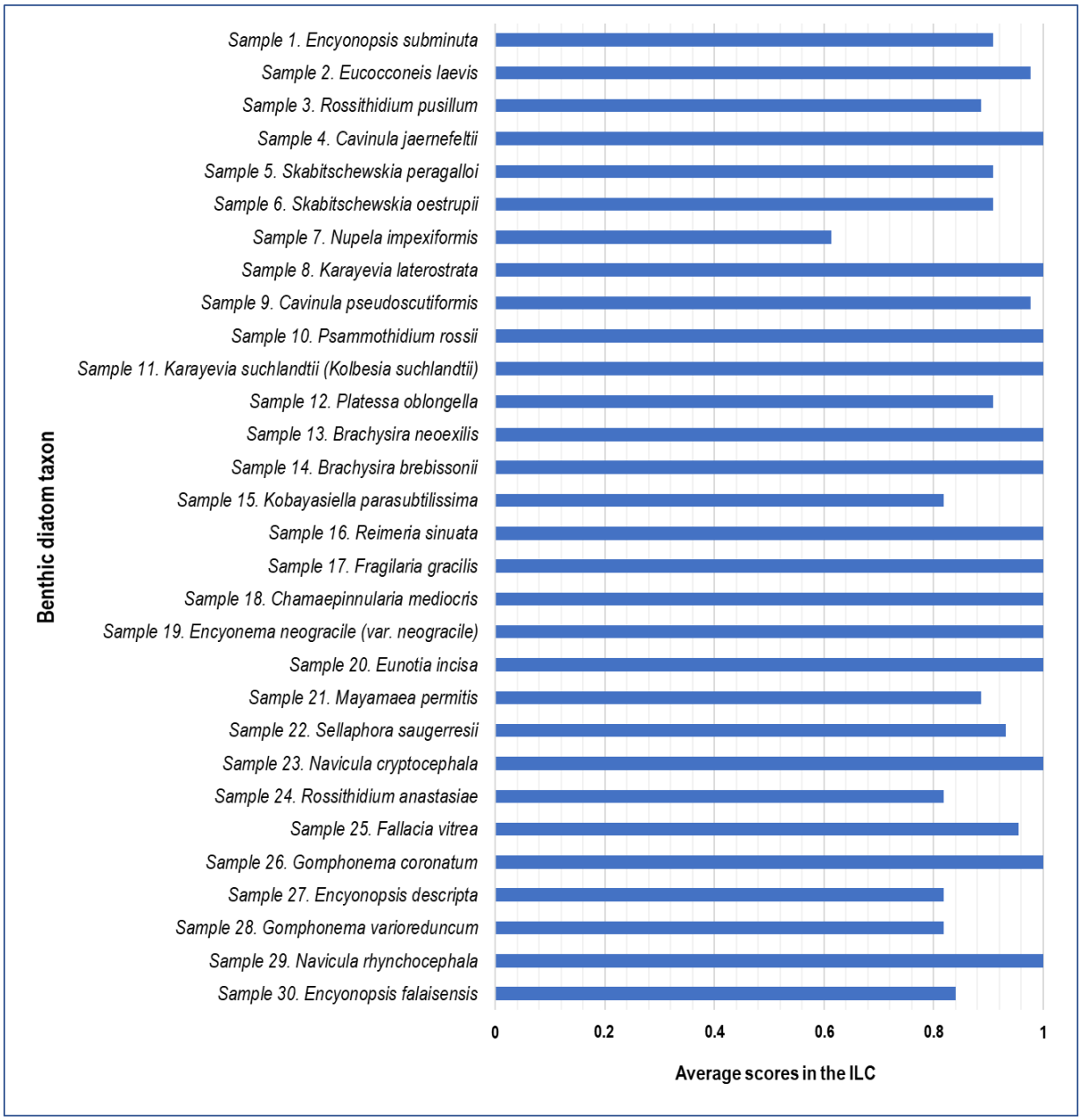

Figure 1. Average scores in the ILC for each sample. Sample with the average score 1 denotes that all participants identified the sample correctly.

Recommendations of the organizer:

- It is strongly recommended to use the latest literature and new taxonomic publications in the identification of benthic diatoms. The laboratory should have at least the literature recommended in ILC. In addition, participation in taxonomic seminars and workshops and/or following taxonomic publications ensures up-to-date identification skills.

4 Feedback from the interlaboratory comparison

The feedback from the ILC is shown in Appendix 4. The comments from the participants mainly dealt with the accepted taxon names and their synonyms, and with their respective scores. In the provider replies, the importance to use the recommended identification literature and thus the newest taxa name was emphasized. As the provider does not know the literature used in each laboratory, the best available literature can only be recommended. However, the use of recommended literature will increase the level of harmonized diatom identification of different parties. All the feedback from the ILC is valuable and is exploited when improving the activities.

5 Conclusions

The performance evaluation of the participants was based on the identification skills and the use of latest taxon names. The interlaboratory comparison showed that the participants were experienced with diatom identification as there was not any unsatisfactory result. Most of the participants reached the good level of the test, as only two participants were at the questionable level. Challenges for those participants at the questionable level were either misidentification of the species and the use of synonyms of accepted names or not being able to identify the species nor the genus. In these cases, the availability of the literature recommended for the ILC may help the participants in species identification in the future.

This interlaboratory comparison for benthic epilithic diatoms was now organized for the first time with photographs and videos. It was based on 2–5 photographs and 1–2 videos from each of 30 samples, all of which contained one taxon to be identified. This test is suitable when epilithic diatoms are identified for research or monitoring purposes. However, this test does not evaluate the competence of making permanent diatom slides and counting from these slides. These phases in diatom analyses are also crucial for reliable results and are tested in addition to identification skills in the intercalibration exercise of Nordic-Baltic network for benthic algae in freshwater (NorBAF).

6 Summary

Proftest SYKE carried out for the first time an interlaboratory comparison (ILC) on the identification of benthic diatoms in lakes and rivers in spring 2022. Diatom species identification was performed from digital photographs and videos of altogether 30 samples. There were 11 participants in this ILC.

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The used approach in the ILC showed to be suitable when epilithic diatoms are identified for research or monitoring purposes. For evaluation on the competence of making permanent diatom slides and counting from these slides in addition to identification skills are tested in the intercalibration exercise of Nordic-Baltic network for benthic algae in freshwater (NorBAF), which can be recommended especially for the beginners in this field as well as for the harmonization of Nordic-Baltic diatom identification.

7 Summary in Finnish

Proftest SYKE järjesti keväällä 2022 ensimmäistä kertaa pohjoisten virtavesien ja järvien pohjien piilevien lajitason tunnistamisosaamisen vertailumittauksen. Vertailumittauksessa lajintunnistus tehtiin digitaalisista näytteistä (yhteensä 30 näytettä) ja siihen osallistui yhteensä 11 määrittäjää.

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Vertailumittauksessa käytetty menettelytapa osoittautui sopivaksi kivien päällä esiintyvien piilevien tunnistamisessa tutkimuksia tai seurantoja varten. Pätevyyden arviointia kestopreparaattien valmistamisessa ja niistä laskettavien piilevälajien tunnistamisessa testataan NorBAF-verkoston vertailukokeessa, jota suositellaan erityisesti piilevämääritystyön aloittaneille sekä pohjoiseurooppalaisen lajimäärityksen yhtenäistämiseksi.

References

1. SFS-EN ISO 17043, 2010. Conformity assessment – General requirements for Proficiency Testing.

2. ISO 13528, 2015. Statistical methods for use in proficiency testing by interlaboratory comparisons.

3. Thompson, M., Ellison, S. L. R., Wood, R., 2006. The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry laboratories (IUPAC Technical report). Pure Appl. Chem. 78: 145-196, www.iupac.org.

Recommended taxonomic literature in the ILC

4. Hofmann, G., Werum, M. & Lange-Bertalot, H. 2011. Diatomeen im Süßwasser-Benthos von Mitteleuropa: Bestimmungsflora Kieselalgen für die ökologische Praxis. Über 700 der häufigsten Arten und ihre Ökologie. (Ed. Lange-Bertalot, H.). A. R. G. Gantner Verlag K.G., Ruggell. Koeltz Scientific Books. 908 pp.

5. Jüttner, I., Ector, L., Reichardt, E., Van de Vijver, B., Jarlman, A., Krokowski, J. & Cox, E.J. 2013. *Gomphonema varioreduncum* sp. nov., a new species from northern and western Europe and a re-examination of *Gomphonema exilissimum*. Diatom Research, 28:3, 303-316. https://doi.org/10.1080/0269249X.2013.797924

6. Kahlert, M., Kelly, M.G., Mann, D.G., Rimet, F., Sato, S., Bouchez, A. & Keck, F. 2019. Connecting the morphological and molecular species concepts to facilitate species identification within the genus Fragilaria (Bacillariophyta). J. Phycol., 55: 948-970. https://doi.org/10.1111/jpy.12886. See also: Erratum. J. Phycol., 56: 243-243. https://doi.org/10.1111/jpy.12946.

7. Krammer, K. 1997a. Die cymbelloiden Diatomeen. Eine Monographie der weltweit bekannten Taxa. Teil 1. Allgemeines und *Encyonema* part. Bibliotheca Diatomologica Band 36. J. Cramer, Stuttgart. 382 pp.

8. Krammer, K. 1997b. Die cymbelloiden Diatomeen. Eine Monographie der weltweit bekannten Taxa. Teil 2. *Encyonema* part., *Encyonopsis* und *Cymbellopsis*. Bibliotheca Diatomologica Band 37. J. Cramer, Stuttgart. 469 pp.

9. Krammer, K. 2000. Diatoms of Europe. Diatoms of the European Inland Waters and Comparable Habitats. Vol. 1. The genus *Pinnularia*. A.R.G. Gantner Verlag K.G, Ruggell. 703 pp.

10. Krammer, K. 2002. Diatoms of Europe. Diatoms of the European Inland Waters and Comparable Habitats. Vol. 3. *Cymbella*. A.R.G. Gantner Verlag K.G, Ruggell. 584 pp.

11. Krammer, K. 2003. Diatoms of Europe. Diatoms of the European Inland Waters and Comparable Habitats. Vol. 4. *Cymbopleura*, *Delicata*, *Navicymbula*, *Gomphocymbellopsis*, *Afrocymbella*. A.R.G. Gantner Verlag K.G, Ruggell. 530 pp.

12. Lange-Bertalot, H. 1993. 85 Neue Taxa und über 100 weitere neu definierte Taxa ergänzend zur Süsswasserflora von Mitteleuropa Vol. 2/1-4. Bibliotheca Diatomologica 27. J. Cramer, Stuttgart. 393 pp.

13. Lange-Bertalot, H. 2001. Diatoms of Europe. Diatoms of the European Inland Waters and Comparable Habitats. Vol. 2. *Navicula sensu stricto*. 10 Genera Separated from *Navicula sensu lato*. *Frustulia.* A.R.G. Gantner Verlag K.G, Ruggell. 526 pp.

14. Lange-Bertalot, H., Bak, M., Witkowski, A. & Tagliaventi, N. 2011. Diatoms of Europe. Diatoms of the European Inland Waters and Comparable Habitats. Vol. 6. *Eunotia* and some related genera. A.R.G. Gantner Verlag K.G, Ruggell. 747 pp.

15. Lange-Bertalot, H., Hofmann, G., Werum, M. & Cantonati, M. 2017. Freshwater Benthic Diatoms of Central Europe: Over 800 Common Species Used in Ecological Assessment. English edition with updated taxonomy and added species. (Eds. Cantonati, M., Kelly, M.G. & Lange-Bertalot, H.) Koeltz Botanical Books. 942 pp.

16. Lange-Bertalot, H. & Krammer, K. 1989. *Achnanthes*, eine Monographie der Gattung, mit Definition der Gattung *Cocconeis* und Nachträgen zu den Naviculaceae. Bibliotheca Diatomologica 18. J. Cramer, Stuttgart. 393 pp.

17. Lange-Bertalot, H. & Metzeltin, D. 1996. Indicators of oligotrophy - 800 taxa representative of three ecologically distinct lake types, Carbonate buffered - Oligodystrophic - Weakly buffered soft water. Lange-Bertalot, H. (ed.), Iconographia Diatomologica. Annotated Diatom Micrographs. Vol. 2. Ecology, Diversity, Taxonomy. Koeltz Scientific Books. Königstein, Germany, 2:390 pp.

18. Lange-Bertalot, H. & Moser, G. 1994. *Brachysira*: Monographie der Gattungen. Bibliotheca Diatomologica 29. J. Cramer, Stuttgart. 212 pp.

19. Wetzel, C.E., Ector, L., Van de Vijver, B., Compére, P. & Mann, D.G. 2015. Morphology, typification and critical analysis of some ecologically important small naviculoid species (Bacillariophyta). Fottea, Olomouc, 15(2): 203-234. https://doi.org/10.5507/fot.2015.020

Other references

20. Bahls, L. 2012a. *Kobayasiella micropunctata*. In Diatoms of North America. Retrieved November 13, 2022, from https://diatoms.org/species/kobayasiella_micropunctata

21. Bahls, L. 2012b. *Kobayasiella parasubtilissima*. In Diatoms of North America. Retrieved November 13, 2022, from https://diatoms.org/species/kobayasiella_parasubtilissima

22. Bruder, K. & Medlin, L.K. 2008. Morphological and molecular investigations of naviculoid diatoms. II. Selected genera and families. Diatom Research 23(2): 283-329.

23. Bukhtiyarova, L. 1999. Diatoms of Ukraine inland waters. National Academy of Sciences of Ukraine, M.G. Kholodny Institute of Botany, Kyiv, Ukraine. 133 pp.

24. Bukhtiyarova, L. & Round, F. E. 1996. Revision of the genus *Achnanthes sensu lato*. *Psammothidium*, a new genus based on *Achnanthidium marginulatum.* Diatom Research 11: 1-30.

25. Ehrenberg, C.G. 1840. Characteristik von 274 neuen Arten von Infusorien. Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich-Preussischen Akademie der Wissenschaften zu Berlin 1840: 197-219.

26. Gregory, W. 1854. Notice of the new forms and varieties of known forms occurring in the diatomaceous earth of Mull; with remarks on the classification of the Diatomaceae. Quarterly Journal of Microscopical Science 2: 90-100.

27. Gregory, W. 1856. Notice of some new species of British fresh-water Diatomaceae. Quarterly Journal of Microscopical Science, New Series 4: 1-14.

28. Hartley, B. 1986. A check-list of the freshwater, brackish and marine diatoms of the British Isles and adjoining coastal waters. Journal of the Marine Biological Association of the United Kingdom 66(3): 531-610.

29. Kingston, J.C. 2000. New combinations in the freshwater Fragilariaceae and Achnanthidiaceae. Diatom Research 15(2): 409-411.

30. Kociolek, J.P. & Stoermer, E.F. 1987. Ultrastructure of *Cymbella sinuata* and its allies (Bacillariophyceae), and their transfer to *Reimeria*, gen. nov. Systematic Botany 12(4):451-459. http://www.jstor.org/stable/2418882

31. Kulikovskiy, M.S., Lange-Bertalot, H. & Kuznetsova, I.V. 2015. Lake Baikal: Hotspot of Endemic Diatoms II. Iconographia Diatomologica 26.

32. Kützing, F.T. 1844. Die Kieselschaligen Bacillarien oder Diatomeen. pp. [i-vii], [1]-152, pls 1-30. Nordhausen: zu finden bei W. Köhne.

33. Lange-Bertalot, H. 1999a. *Kobayasiella* nov. nom. ein neuer Gattungsname für *Kobayasia* Lange-Bertalot 1996. In: Iconographia Diatomologica, Annotated Diatom Micrographs (H. Lange-Bertalot, ed.), Vol. 6, pp. 272-275, A.R.G. Gantner Verlag K.G., Vaduz.

34. Lange-Bertalot, H. 1999b. Neue Kombinationen von Taxa aus *Achnanthes* Bory (sensu lato) Iconographia Diatomologica 6: 276-289.

35. Lange-Bertalot, H. & Genkal, S.I. 1999. Diatoms from Siberia I. Islands in the Arctic Ocean (Yugorsky-Shar Strait) Iconographia Diatomologica 6: 1-292.

36. Polaskey, M. 2018. *Achnanthidium crassum*. In Diatoms of North America. Retrieved November 13, 2022, from https://diatoms.org/species/achnanthidium_crassum

37. Potapova, M. 2011. *Rossithidium anastasiae*. In Diatoms of North America. Retrieved November 13, 2022, from https://diatoms.org/species/rossithidium_anastasiae

38. Potapova, M.G. 2012. New species and combinations in monoraphid diatoms (family Achnanthidiaceae) from North America. Diatom Research 27(1-2): 29-42.

39. Potapova, M.G. & Ponader, K.C. 2004. Two common North American diatoms, *Achnanthidium rivulare* sp. nov. and *A. deflexum* (Reimer) Kingston: morphology, ecology and comparison with related species. Diatom Research 19(1): 33-57.

40. Round, F. E. & Bukhtiyarova, L. 1996. Four new genera based on *Achnanthes* (*Achnanthidium*) together with a re-definition of *Achnanthidium* Diatom Research 11: 345-361.

41. Round, F.E., Crawford, R.M. & Mann, D.G. 1990. The Diatoms. Biology and Morphology of the Genera. Cambridge University Press, Cambridge, 747 pp.

42. Walls, J. 2016. *Gomphonema sarcophagus*. In Diatoms of North America. Retrieved November 14, 2022, from https://diatoms.org/species/gomphonema_sarcophagus

43. Wetzel C.E., Lange-Bertalot, H. & Ector L. 2017. Type analysis of *Achnanthes oblongella* Østrup and resurrection of *Achnanthes saxonica* Krasske (Bacillariophyta). Nova Hedwigia, Beiheft 146, p. 209–227.

44. Østrup, E. 1910. Danske Diatoméer med 5 tavler et Engelsk résumé. Udgivet paa Carlsbergfondets bekostning. pp. [i]-xi, 1-323, pls 1-5. Kjøbenhavn [Copenhagen]: C.A. Reitzel Boghandel Bianco Lunos Bogtrykkeri.

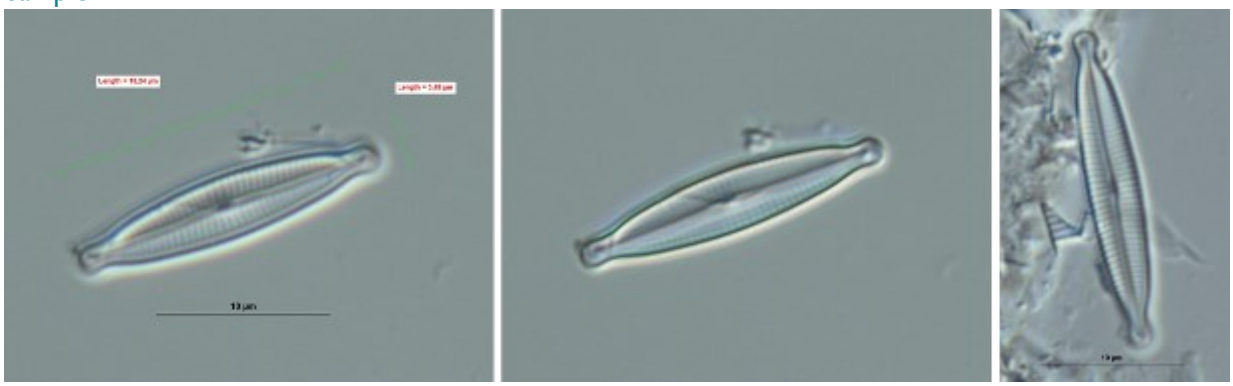
Appendix 1. Participants in the interlaboratory comparison

Country	Participant	Organization
Estonia	Urmas Anijalg	Estonian Environmental Research Centre
Finland	Eeva-Leena Anttila	AFRY Finland Oy
	Raino-Lars Albert	Ecomonitor Oy
	Juha Miettinen	Ecomonitor Oy
	Jonna Hänninen	KVVY Tutkimus Oy
	Arja Palomäki	KVVY Tutkimus Oy
	Aino Juutinen	University of Oulu
	Tiina Eskola	University of Oulu
Lithuania	Dalia Augutiene	Environmental Protection Agency
Norway	Petra Thea Mutinova	Norwegian Institute for Water Research (NIVA)
Sweden	Eva Herlitz	Department of Aquatic Sciences and Assessment, SLU

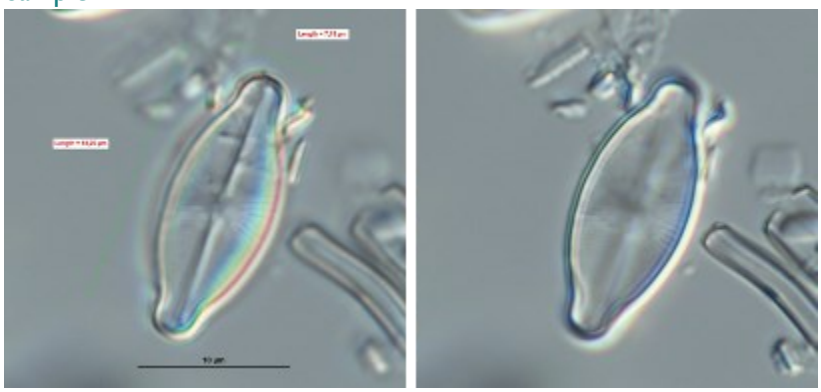
Appendix 2. The photographs of the samples

Please note that the resolution here is lower than in the original photographs.

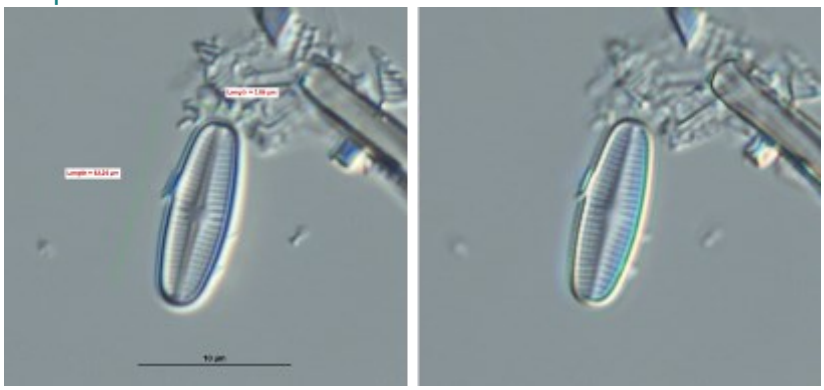
Sample 1



Sample 2



Sample 3



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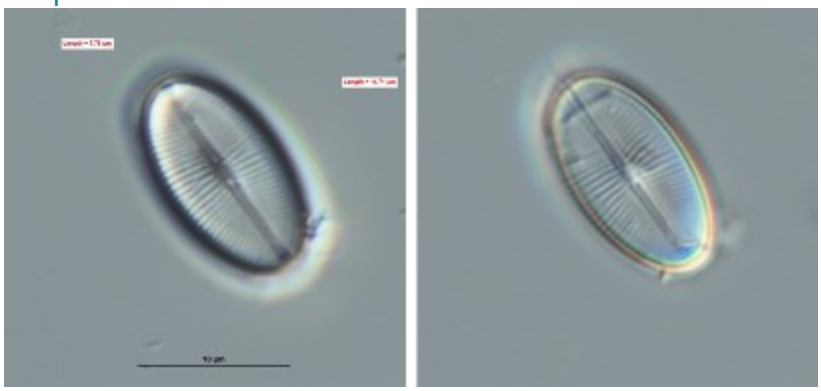

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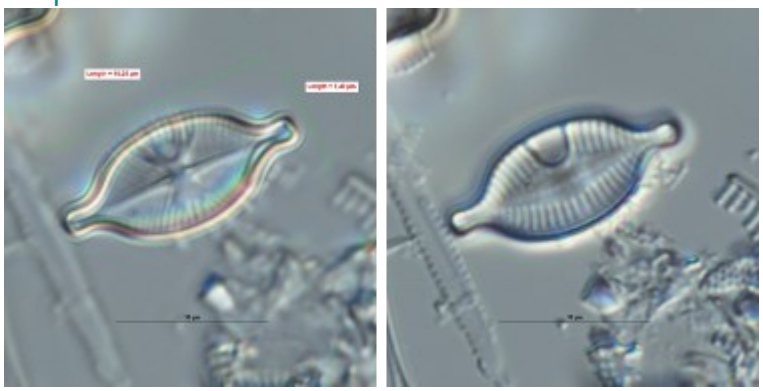

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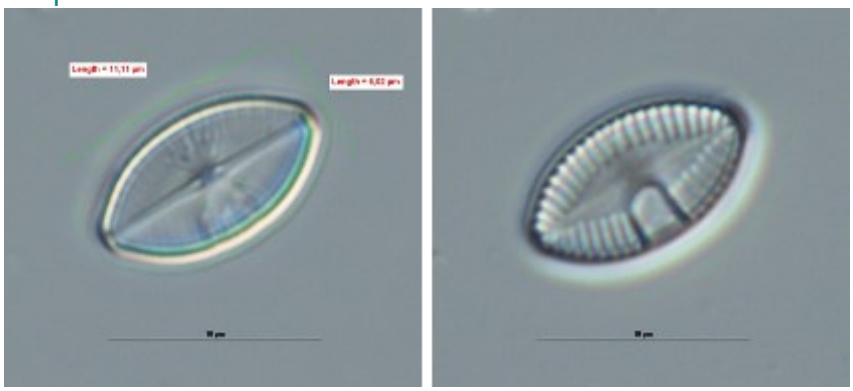

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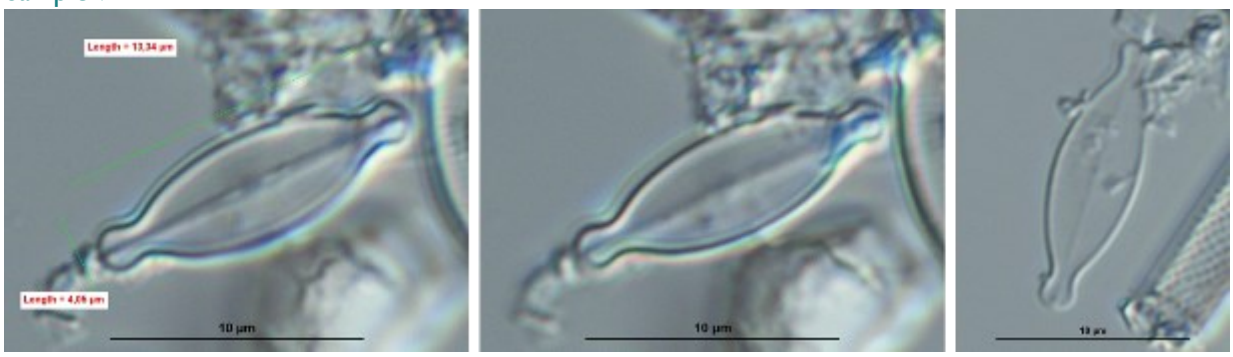
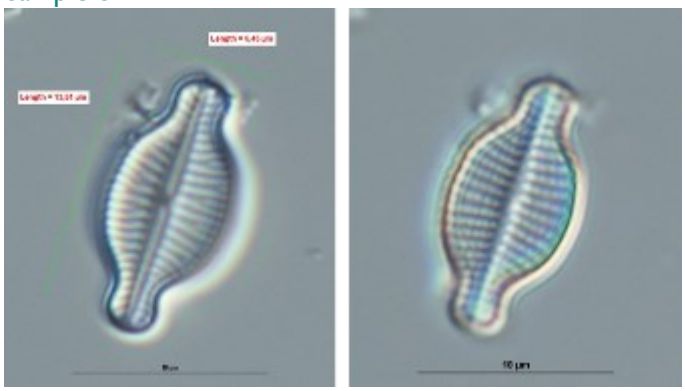


Sample 8



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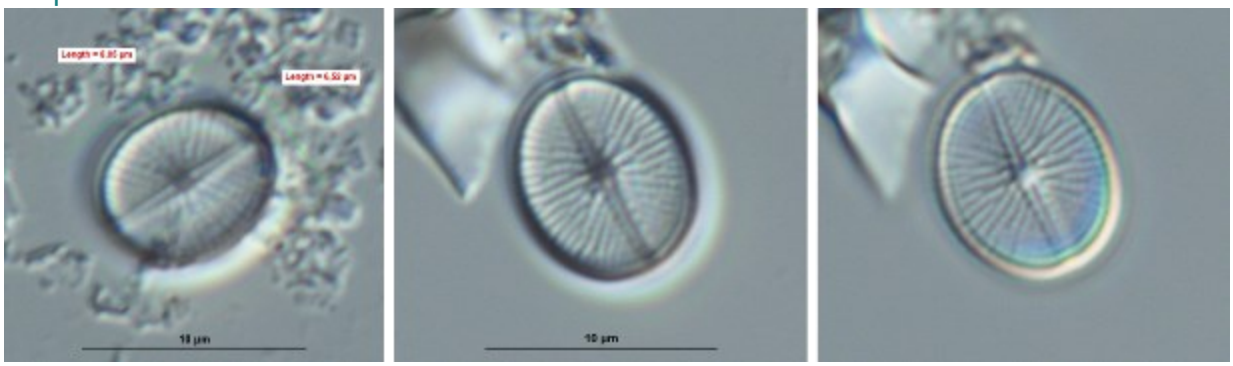
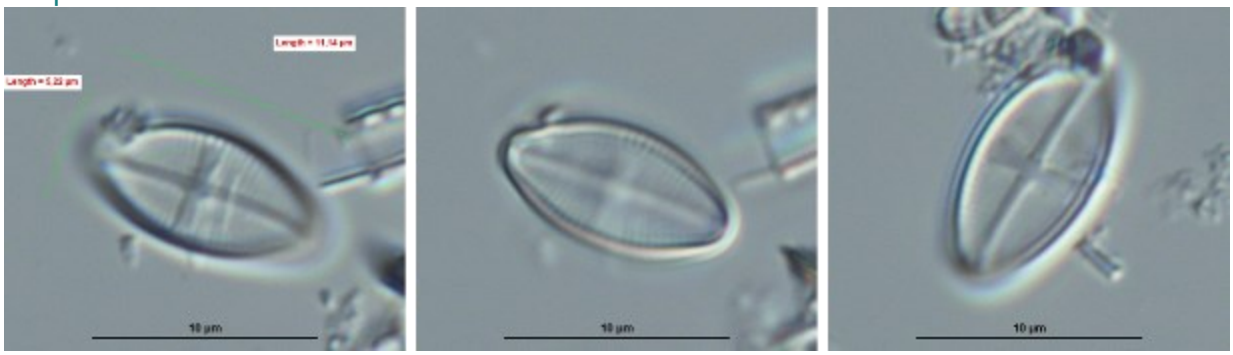
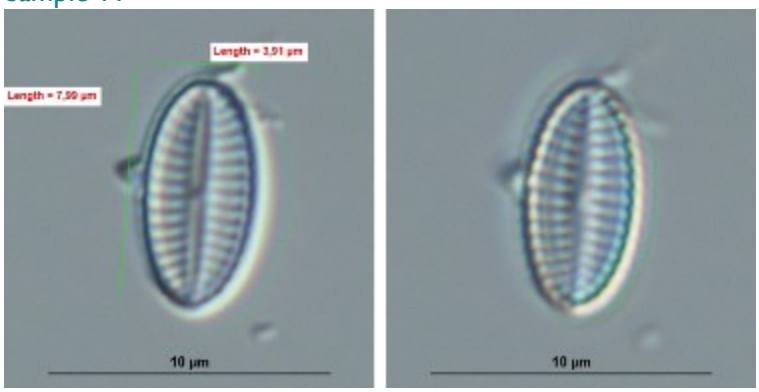


Sample 10



Sample 11



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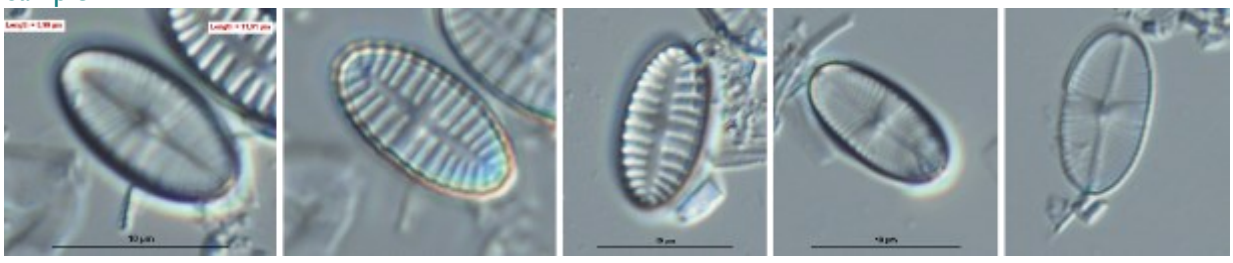

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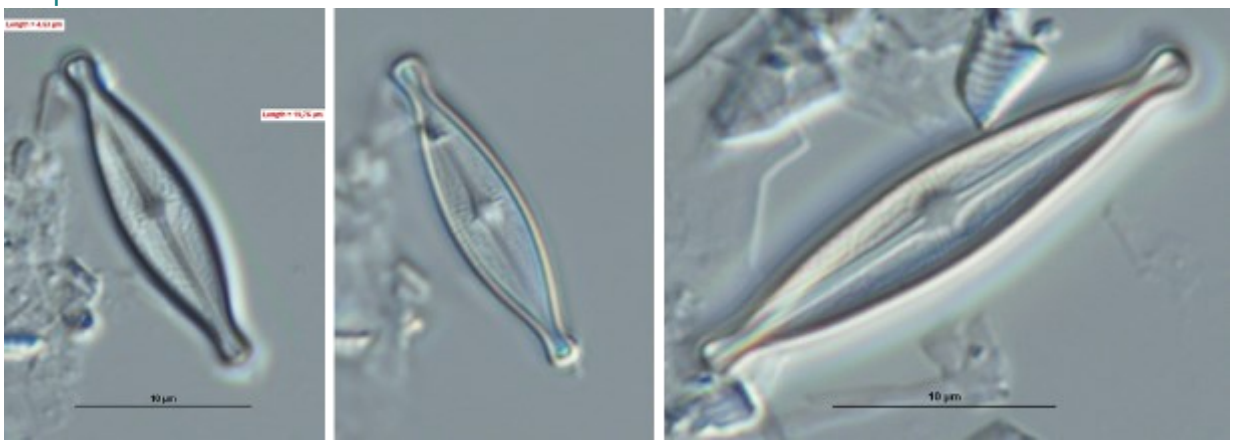

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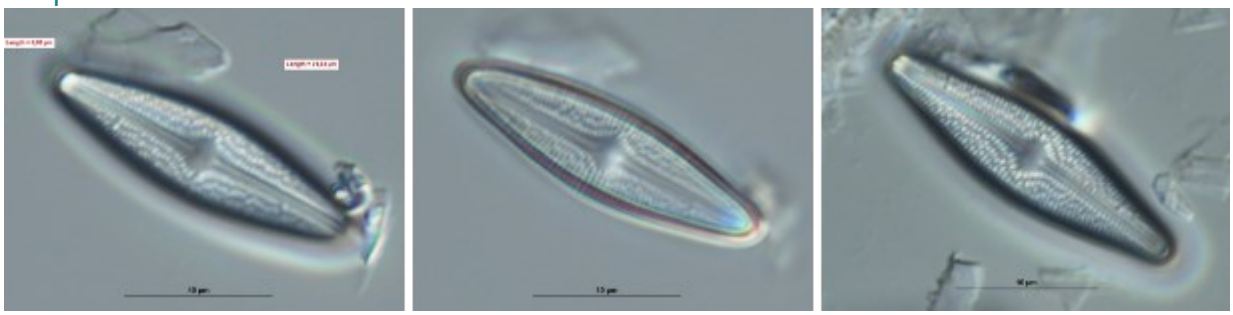

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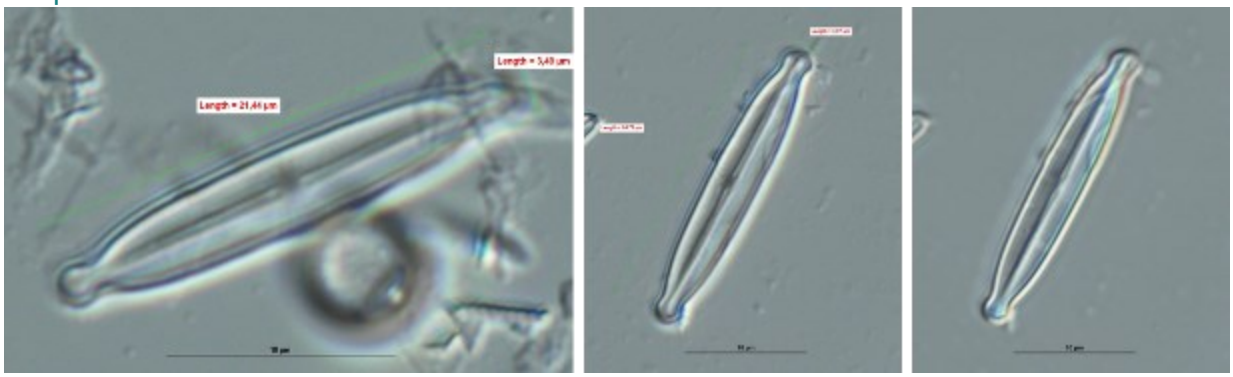

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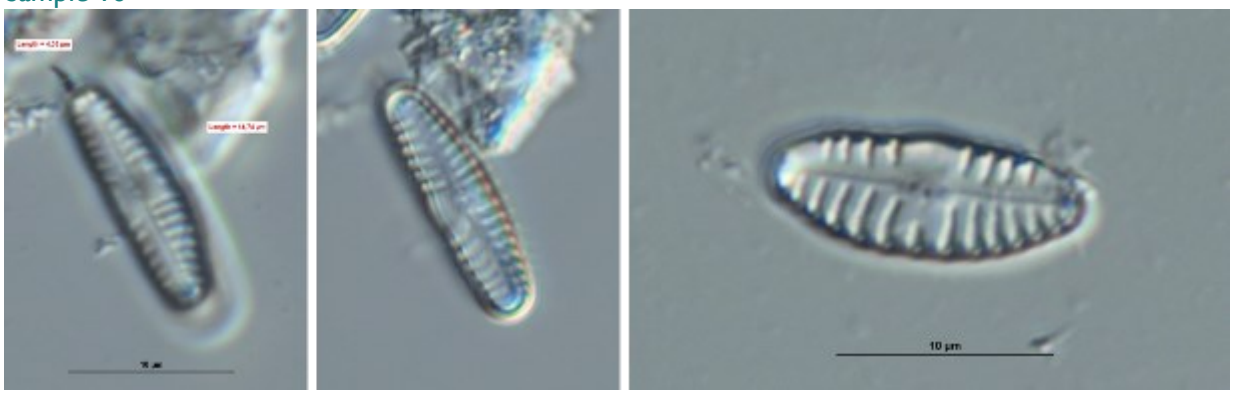
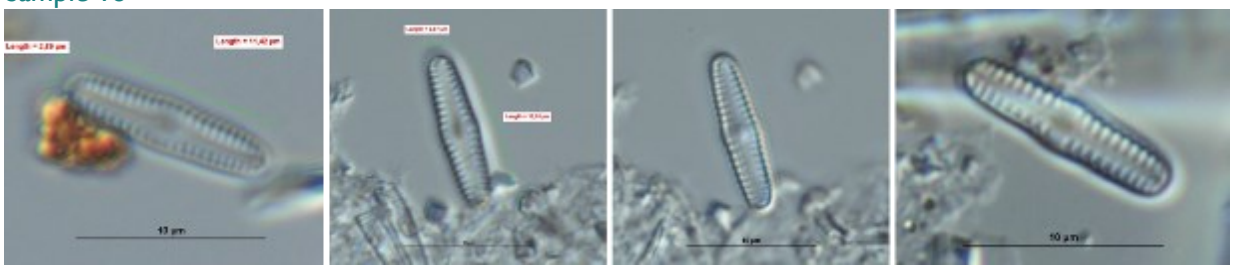


Sample 17

Sample 18



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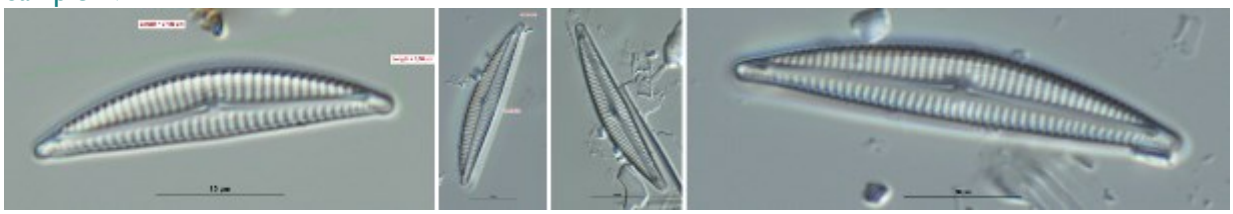

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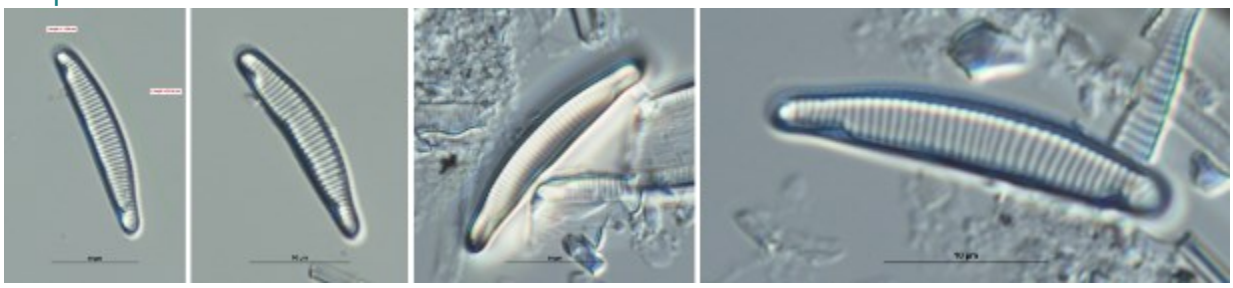

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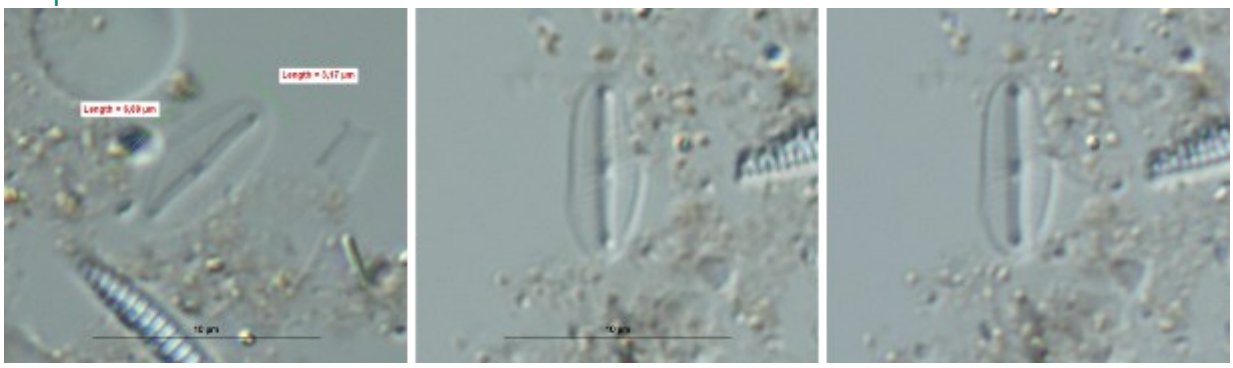

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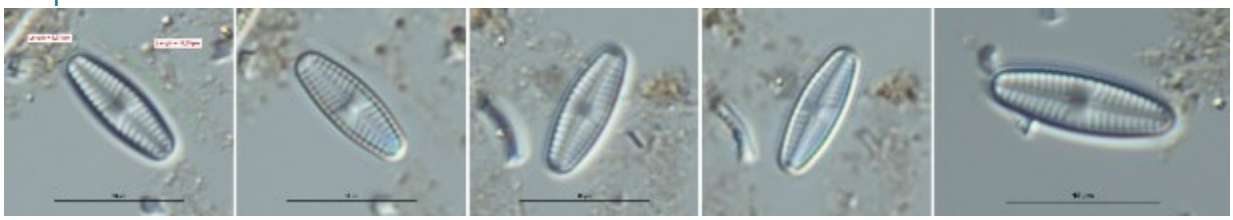

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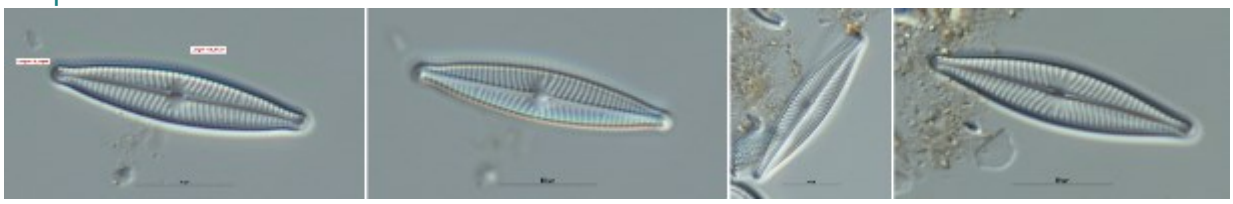

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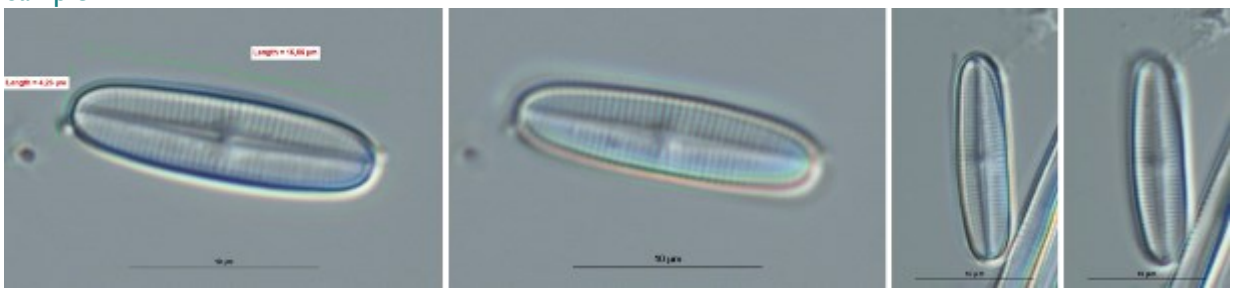
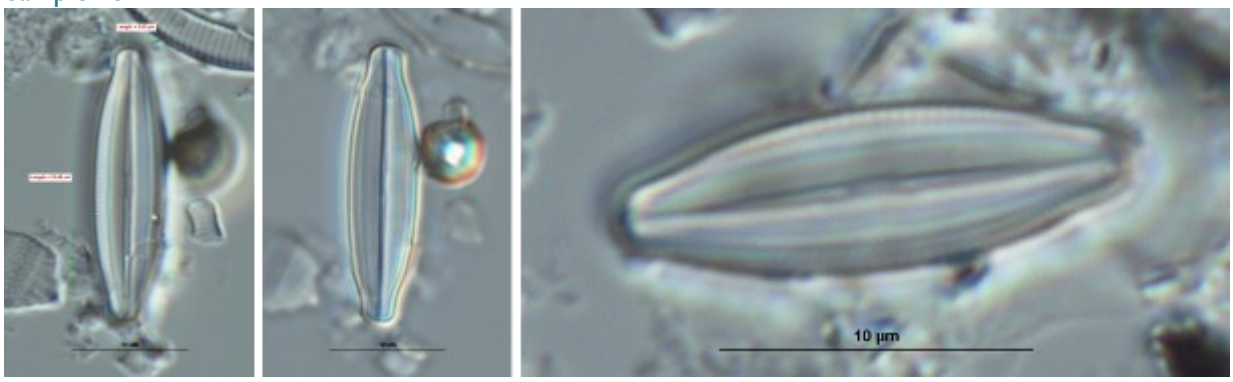
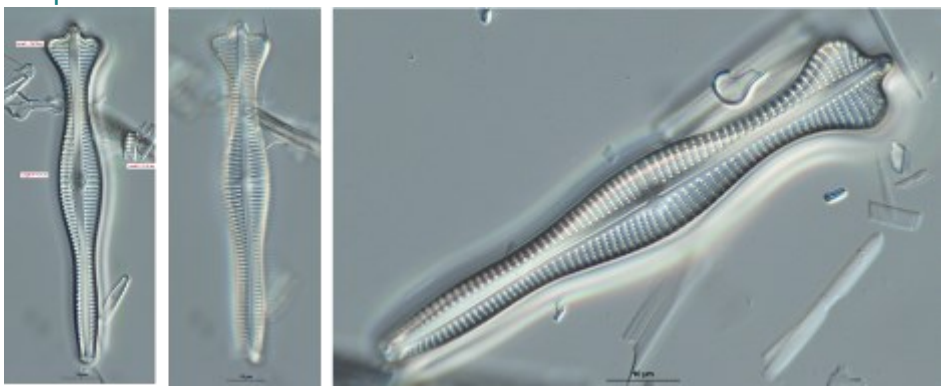


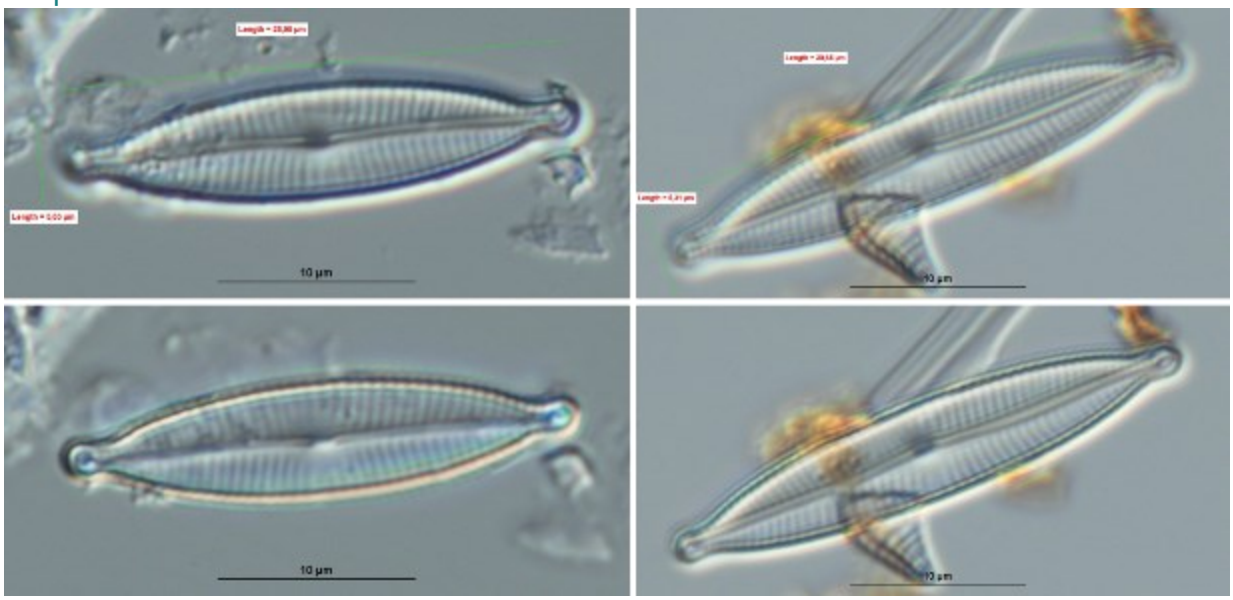
Sample 25



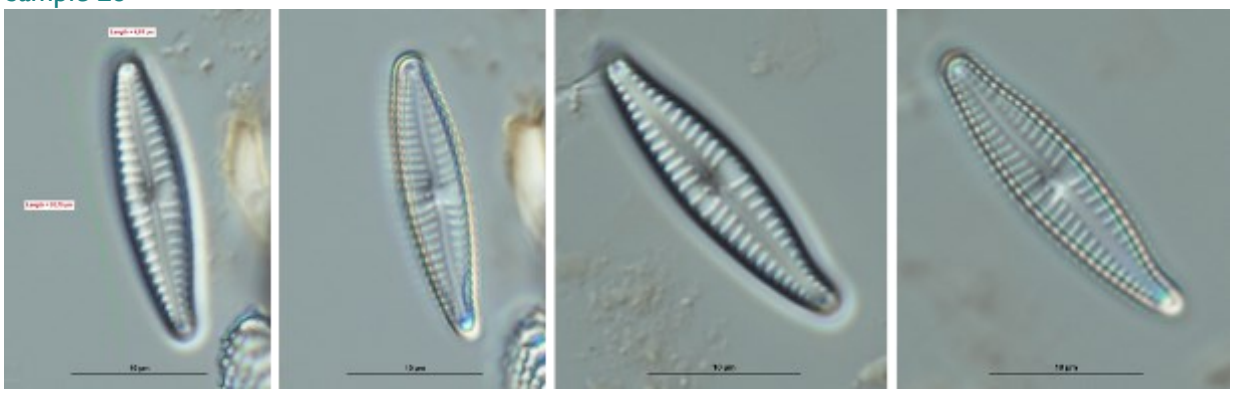
Sample 26



Sample 27



Sample 28



Sample 29

Sample 30

Appendix 3. Results of each participant

Participant 1			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Achnanthes pusilla*	0.75
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Planothidium peragalli*	0.75
6	*Skabitschewskia oestrupii*	*Planothidium oestrupii var. oestrupii*	0.75
7	*Nupela impexiformis*	*Achnanthes impexa*	0
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Achnanthes oblongella*	0.75
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile var. neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea atomus var. permitis*	0.75
22	*Sellaphora saugerresii*	*Sellaphora seminulum* (*Sellaphora saugerresii**)	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthidium linearioides*	0.75
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	27.5

*The correct taxon was given in the comments (when the synonym was given as the taxon name, see Chapter 2.4 Processing the data).

Participant 2			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalli*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile var. neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Rossithidium anastasiae*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	30

Participant 3			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Planothidium peragalli*	0.75
6	*Skabitschewskia oestrupii*	*Planothidium oestrupii*	0.75
7	*Nupela impexiformis*	*Achnanthes impexa*	0
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Karayevia oblongella*	0.75
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile var. neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa var. incisa*	1
21	*Mayamaea permitis*	*Mayamaea atomus var. permitis*	0.75
22	*Sellaphora saugerresii*	*Navicula seminulum*	0.75
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthes linearioides*	0.75
25	*Fallacia vitrea*	*Navicula festiva (Fallacia vitrea*)*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	27.5

*The correct taxon was given in the comments (when the synonym was given as the taxon name, see Chapter 2.4 Processing the data).

Participant 4			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalloi*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoxilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasia micropunctata*	0
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa var. incisa*	1
21	*Mayamaea permitis*	*Mayamaea atomus var. permitis*	0.75
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthidium crassum*	0
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioredunkum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis failaisensis*	1
		Total:	27.75

Participant 5			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Achnanthes laevis var. laevis*	0.75
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Achnanthes peragalli*	0.75
6	*Skabitschewskia oestrupii*	*Achnanthes oestrupii var. oestrupii*	0.75
7	*Nupela impexiformis*	*Achnanthes impexiformis*	0.75
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Navicula pseudoscutiformis*	0.75
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Karayevia oblongella*	0.75
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii ssp. Brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella micropunctata*	0
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea atomus var. permitis*	0.75
22	*Sellaphora saugerresii*	*Navicula seminulum*	0.75
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthes linearioides*	0.75
25	*Fallacia vitrea*	*Navicula festiva*	0.75
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema sarcophagus*	0
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	25.5

Participant 6			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Achnanthidium pusillum (Rossithidium pusillum*)*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalloi*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthidium anastasiae (Rossithidium anastasiae*)*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis cesatii*	0
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	29

*The correct taxon was given in the comments (when the synonym was given as the taxon name, see Chapter 2.4 Processing the data).

Participant 7			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	-	0
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Achnantidium rivulare*	0
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalli*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Kolbesia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile var. neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Rossithidium anastasiae*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Cymbopleura sp.*	0
28	*Gomphonema varioreduncum*	*Gomphonema exilissimum*	0
29	*Navicula rhynchocephala*	*Navicula rhyncocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis sp.*	0.5
		Total:	25.5

Participant 8			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Planothidium peragallii*	0.75
6	*Skabitschewskia oestrupii*	*Planothidium oestrupii*	0.75
7	*Nupela impexiformis*	*Achnanthes impexa*	0
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Karayevia oblongella*	0.75
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile var. neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa var. incisa*	1
21	*Mayamaea permitis*	*Mayamaea atomus var. permitis*	0.75
22	*Sellaphora saugerresii*	*Navicula seminulum*	0.75
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Achnanthes linearioides*	0.75
25	*Fallacia vitrea*	*Navicula festiva*	0.75
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	27.25

Participant 9			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalli*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Kolbesia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Rossithidium anastasiae*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis falaisensis*	1
		Total:	30

Participant 10			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Eucocconeis laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalli*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Nupela impexiformis*	1
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Karayevia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimaria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Rossithidium anastasiae*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Encyonopsis cesatii*	0
		Total:	29

Participant 11			
Sample	**Benthic diatom taxon**	**Participant result**	**Points**
1	*Encyonopsis subminuta*	*Encyonopsis subminuta*	1
2	*Eucocconeis laevis*	*Achnanthes laevis v. laevis*	1
3	*Rossithidium pusillum*	*Rossithidium pusillum*	1
4	*Cavinula jaernefeltii*	*Cavinula jaernefeltii*	1
5	*Skabitschewskia peragalloi*	*Skabitschewskia peragalli*	1
6	*Skabitschewskia oestrupii*	*Skabitschewskia oestrupii*	1
7	*Nupela impexiformis*	*Achnanthes impexa*	0
8	*Karayevia laterostrata*	*Karayevia laterostrata*	1
9	*Cavinula pseudoscutiformis*	*Cavinula pseudoscutiformis*	1
10	*Psammothidium rossii*	*Psammothidium rossii*	1
11	*Karayevia suchlandtii* (*Kolbesia suchlandtii*)	*Kolbesia suchlandtii*	1
12	*Platessa oblongella*	*Platessa oblongella*	1
13	*Brachysira neoexilis*	*Brachysira neoexilis*	1
14	*Brachysira brebissonii*	*Brachysira brebissonii*	1
15	*Kobayasiella parasubtilissima*	*Kobayasiella parasubtilissima*	1
16	*Reimeria sinuata*	*Reimeria sinuata*	1
17	*Fragilaria gracilis*	*Fragilaria gracilis*	1
18	*Chamaepinnularia mediocris*	*Chamaepinnularia mediocris*	1
19	*Encyonema neogracile* (var. *neogracile*)	*Encyonema neogracile*	1
20	*Eunotia incisa*	*Eunotia incisa*	1
21	*Mayamaea permitis*	*Mayamaea permitis*	1
22	*Sellaphora saugerresii*	*Sellaphora saugerresii*	1
23	*Navicula cryptocephala*	*Navicula cryptocephala*	1
24	*Rossithidium anastasiae*	*Rossithidium anastasiae*	1
25	*Fallacia vitrea*	*Fallacia vitrea*	1
26	*Gomphonema coronatum*	*Gomphonema coronatum*	1
27	*Encyonopsis descripta*	*Encyonopsis descripta*	1
28	*Gomphonema varioreduncum*	*Gomphonema varioreduncum*	1
29	*Navicula rhynchocephala*	*Navicula rhynchocephala*	1
30	*Encyonopsis falaisensis*	*Cymbella falaisensis cf.*	0.75
		Total:	28.75

Appendix 4. Feedback from the interlaboratory comparison

Feedback from the participants

Please note that all feedback is not reproduced here word for word but has been shortened.

Participant	Comments from the participants	Action / Proftest SYKE
1	In the given instructions the organizer did not inform the participants that the use of old taxonomic name would reduce the points. Therefore, the participant used the available literature. It is not according to the given instructions that the synonyms were not fully accepted. The criteria for scoring the data should have been given beforehand, especially the criteria related to the use of synonyms. Further, the official list of names and synonyms should be available.	In the given instructions for the ILC (information and sample letters) the organizer recommended to use the latest literature as well as new taxonomic publications for the identification of benthic diatoms. As the provider does not know the literature used in each laboratory, the best available literature can only be recommended. Therefore, the importance to use the recommended identification literature and thus the newest taxa name was emphasized. The use of recommended literature will increase the level of harmonized diatom identification of different parties. This ILC was organized for the first time and, therefore, only the criterion for good (satisfactory) overall result was given beforehand.
	The author(s) should be mentioned in the Table 1.	The authors are mentioned in the final report, Table 1.
	If possible, in future there could be a table including all the accepted synonyms.	The accepted synonyms can be seen from the tables in Appendix 3. The more challenging synonyms are discussed in Chapter 3
	In the preliminary results report the results of each participant for all samples were not shown.	The results and performance of each participant are presented in the final report, Appendix 3. Thank you for the remark and the organizer will consider including the information in future already into the preliminary results report.
	The technical execution of the ILC with the photographs and videos worked well.	Thank you for the positive feedback.
2, 9	The link to the online file transfer service did not work.	The link was fixed, and the participants were informed.

Participant	Comments from the participants	Action / Proftest SYKE
3	The given instructions especially for the use of synonyms was inadequate.	In the given instructions for the ILC (information and sample letters) the organizer recommended to use the latest literature as well as new taxonomic publications for the identification of benthic diatoms. As the provider does not know the literature used in each laboratory, the best available literature can only be recommended. Therefore, the importance to use the recommended identification literature and thus the newest taxa names was emphasized. The use of recommended literature will increase the level of harmonized diatom identification of different parties. This ILC was organized for the first time and, therefore, only the criterion for good (satisfactory) overall result was given beforehand. New database for benthic diatoms is under development and, in future, the newest taxon will be available for the professionals via this database.
11	In the given instructions for the ILC it was recommended to use the latest literature as well as new taxonomic publications for the identification of benthic diatoms. This should have been more clearly emphasized and not as a recommendation. The participant used old name for some samples as the description was crucial for identification. The participant noticed only after the publication of the preliminary results that one of the listed references, Freshwater benthic diatoms of central Europe (2017), has two versions from the same year.	As the provider does not know the literature used in each laboratory, the best available literature can only be recommended. Therefore, the importance to use the recommended identification literature and thus the newest taxa name was emphasized. The use of recommended literature will increase the level of harmonized diatom identification of different parties. This ILC was organized for the first time and, therefore, only the criterion for good (satisfactory) overall result was given beforehand. New database for benthic diatoms is under development and, in future, the newest taxon will be available for the professionals via this database.
	Achnanthes impexa/ impexiformis is described as inseparable, and both Finnish and Swedish listings are using the name *impexa*.	Swedish taxa list defines *Achnanthes impexa* and *Nupela (Achnanthes) impexiformis* as separate species. The Finnish listing has not been in use anymore (thus it has been removed from the Biological monitoring methods webpage).

Interlaboratory comparison 04/2022: Benthic diatoms

SYKE

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