Checklist of marine diatoms from the Turkish coastal waters with updated nomenclature

Aydın KALELİ, Reyhan AKÇAALAN

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Istanbul University, Faculty of Aquatic Sciences, Department of Marine and Freshwater Resources Management, Istanbul, Turkey

ORCID IDs of the author(s):
A.K.. 0000-0003-3843-1335
R.A. 0000-0002-0756-8972

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Correspondence: Aydın KALELİ
E-mail: aydin.kaleli@istanbul.edu.tr

ABSTRACT

Marine diatom research in the coastal waters of Turkey started nearly two centuries ago. In the last decades, increasing numbers of contributions extended the knowledge of the marine phytoplankton. While several studies dedicated to planktonic forms and the checklists published concerning on the phytoplankton, relatively low numbers of benthic diatom studies were performed. Therefore, this is the first detailed list of the marine diatoms including both planktonic and benthic forms in Turkish coasts. This paper brings up the checklist of the past research referring to the authors in the last two centuries within the scope of the latest nomenclature. A total of 767 taxa (species, varieties and forms) belonging to 183 genera were listed. This study focussed into the study areas according to the reviewed literature and showed that many areas are yet to be investigated.

Keywords: Biogeography, Checklist, Epilithic, Epipelic, Epiphytic, Marine diatoms, Phytoplankton, Turkey

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Introduction

The knowledge of biodiversity and biogeography of diatoms showed remarkable progress in the last two centuries. In marine diatoms, drawings contributed into systematics and biogeography of the diatoms in mid-late 19th century and continued within the early 20th century with many atlas and monographs (Smith, 1853; Schmidt, 1874-1959; Cleve, 1894-1895; Peragallo and Peragallo, 1897-1908), which are still fundamental sources for marine diatom researchers. In the last decades with the use of light microscopy (LM) and scanning electron microscopy (SEM), many species were discovered in the marine coastal waters, which extended the knowledge of diatom assemblages from different coasts. The recent monographs revealed many endemic species and increased the data of widespread taxa and some location-specific taxa with introductions to new locations; e.g., Baltic Sea, Snoeijjs (1993), Snoeijjs and Vilbaste (1994), Snoeijjs and Potapova (1995), Snoeijjs and Kasperovičiené (1996), and Snoeijjs and Balashova (1988), the Bahamas Hein et al. (2008), the Mediterranean, Blanco and Blanco (2014), Madagascar Metzeltin and Lange-Bertalot (2002), Kryk et al., (2020), the Pacific, Lobban et al., (2012), Stidolph et al., (2012). Witkowski et al. (2000) published a monograph of the taxa from different locations of the marine coasts around the world. These monographs and checklists (Hendey, 1974; López-Fuerte and Siqueiros-Beltrones, 2016) provided complete biogeographical dispersal of the benthic diatoms and led further studies in family, genus or even taxon-specific levels (molecular and phylogeny).

The first study in Turkish coastal waters conducted in mid-19th century; Ehrenberg (1844), described species from the Bosphorus in the Sea of Marmara, after some time, Hustedt also described species with drawings in Bosphorus and the Golden Horn in the Sea of Marmara (Hustedt, 1930-1966). Simonsen (1987) illustrated these taxa from Hustedt collection later. However, the first studies were conducted quite a while ago in Turkey; still today, there is very little data in terms of benthic diatoms. The past papers published on the phytoplankton of Turkish coastal waters included several species with ≥ 30 µm diameter which also observed in the benthos. Therefore, some diatom taxa living in benthos with relatively bigger cell size or showing centric morphology which allow cells to suspend in the water column easily (e.g., Pleurosigma elongatum W. Smith, Striatella unipunctata (Lyngbye) C. Agardh, Navicula directa (W. Smith) Brébisson, Coscinodiscus spp.) were reported from the surface waters or open waters in Turkish seas. Several authors published checklists regarding phytoplankton composition in the last decades. Koray (2001) reported the phytoplankton from Turkish seas, while Balkıs (2004) published a checklist from the Sea of Marmara, and Taş and Okuş (2016) from the Black Sea. A checklist of freshwater algae, which includes freshwater diatoms, by Aysel (2005), also covered many benthic diatoms; however, any lists comprising exclusively marine benthic diatoms has yet not published. Even though research on marine phytobenthos is increasing, the biodiversity in the marine coasts and the biogeography of the diatoms in Turkey remained unclear. The low number of studies conducted in the coastlines and the outdated nomenclature used in the previous papers prevented to produce a collective list of the benthic diatoms, even though, Turkey surrounded by seas; Black Sea, Mediterranean Sea, the Aegean Sea, and has an inland sea; the Sea of Marmara. However, several benthic studies were already performed, or checklists were published in the adjacent countries, e.g., Romania (Caraus, 2002, 2012, 2017); Russia (Nevrova, 2016); Greece (Foged, 1986; Louvrou, 2007).

Furthermore, the lack of drawings and micrographs or morphological features allowed most of the taxa remained as doubtful in the past studies (Koray 2001). There were recently increasing research, including morphological details providing comparable data for further studies. However, there was still a need for marine diatom lists to understand and enhance taxonomy and biogeography of diatoms in Turkish coasts.

This paper aimed to create a list of reported marine diatom species with updated nomenclature in the coasts of Turkey with an emphasis on doubtful and illustrated taxa within the results of major marine diatom studies performed so far. The list was created to gather all the scattered previous data to provide a comparable key particularly relying on the illustrated taxa for the future research in Turkey.

Methodology

This diatom checklist was created using information from the publications between 1844-2020. The literature search revealed 56 references included planktonic diatoms and marine benthic diatoms in the coasts, coastal lake and lagoons of Turkey. Habitat information and the study areas were presented for each species (Table 1). The references included articles, reviews, checklists, PhD and MSc thesis. Freshwater species reported in some studies were not excluded due to riverine pressure and salinity changes in different locations from the Mediterranean to the Black Sea. However, there were several marine diatom species found in inland waters, according to Marangoğlu and Gönülol (2020), these taxa were not taken into account due to possible misidentifications.
Some species reported with different names from the latest taxonomical order. An effort was put to classify the species with the updates to their current names, according to Guiry and Guiry (2020) and Kociolek et al. (2020). Systematic classification followed Round et al. (1990). Taxa cited in species-level with “confer” and “sp.” were not evaluated in the list due to a need of confirmation of these species.

Many species lack images and even reported for the first time, there were no illustrations or morphological features (e.g., dimensions, striae or fibulae counts). Therefore, references used in the list with illustrations were shown with an asterisk in Table 1.

The Current Status of Marine Diatoms in Turkey

The list contained a total of 767 taxa (species, varieties and forms) belonged to 183 genera. Amongst all, 70 taxa belonged to class Coscinodiscophyceae, 130 taxa to Mediothyceae and 567 taxa to Bacillariophyceae (See Checklist). Current nomenclature of the formerly reported taxa was listed (See Updated Nomenclature). According to the literature, the most cited genera with highest numbers of species were *Navicula* Bory (57), *Nitzschia* Hassal (55), *Chaetoceros* Ehrenberg (53), *Mastogloia* Thwaites (31), *Cocconeis* Ehrenberg (23), *Amphora* Ehrenberg ex Kützing (18), *Halamphora* (Cleve) Mereschkowsky (16). The most common six genera in terms of species numbers consisted of 33.1% of all taxa found in the literature. The most common species were *Cylindrotheca closterium* (Ehrenberg) Reinmann & Lewin which was reported from 21 studies and followed by *Nitzschia longissima* (Brébisson ex Kützing) Grunow (cited 19), *Coccomeis variabilis* (Grunow) Mereschkowsky, *Pleurosigma normani* Ralfs (cited 17), *Licmophora abbreviata* Agardh, *Achnanthes brevipes* Agardh (cited 15) (Table 2).

The reviewed literature revealed that studies in the coastal waters of Turkey were low in numbers. The Sea of Marmara and the Aegean Sea was the most intensively studied areas with 20 and 19 studies, respectively. Studies in the Mediterranean and the Black Sea were rather scarce with 11 and 14 research in terms of both benthic and planktonic species composition and biogeographical dispersal.

The current paper represents the first exclusively detailed marine diatom list in the Turkish coastal waters. Since the studies started in 1844 with Ehrenberg, several authors showed a significant contribution to the diatom composition through-out the years. Several checklists published in the past by various authors (Koray, 2001; Balkis, 2004; Taş and Okuş, 2016), however, the latest and progressing systematics of diatoms resulted in many synonyms and transferred taxa into a new species of a genus. This paper brings the data altogether with the latest nomenclature with an emphasis on the current names of the cited taxa. An essential part of the studies performed dedicated to mostly planktonic forms of diatoms; the papers here reviewed generally had both benthic and planktonic diatoms. The number of the taxa seems to be high in the checklist; however, diatom species number from the coasts of Turkey are yet far from similar checklists (Hendey, 1974; López-Fuerte and Siqueiros-Beltrones, 2016; Caraus, 2017). The number of only benthic species determined in the Adriatic Sea was 518 (Viličić et al., 2002). In Turkey, the reason for a low number of taxa might be related to the low number of benthic studies performed in these coasts. Most of the studies reviewed in this paper used a similar sampling technique (plankton net), which aimed to take phytoplankton; and in some of these studies, benthic diatoms were also observed. Therefore, the most cited taxa found to be relatively higher in cell size, which observed through the plankton net. However, the recent findings showed (Kaleli et al., 2020) that the number of taxa could increase with the forthcoming studies, which especially aim to reveal benthic species.

The checklist revealed that a high number of freshwater taxa observed in these studies (*Cymbella* spp., *Gomphonema* spp., *Navicula* spp.) mostly in the Black Sea coasts (Soylu et al., 2011; Baytut et al., 2016). It might be related to the freshwater inputs e.g., two major rivers; Kızılırmak and Yeşilırmak, where relatively lower salinity might be a factor to detect the freshwater diatoms in the Black Sea and yielded favourable conditions for the taxa to survive; however, it was observed that marine taxa could dominate in these coastal waters (Kaleli et al., 2017) as well as in the northern Black Sea coasts (Nevrova and Petrov, 2019). Many taxa reported in the list have no documentation or sufficient data on geographical distribution. It is difficult to evaluate the local distribution of the species in comparison to the papers reviewed; however, the list gives an insight into the underlying distribution in the seas of Turkey. The studies used in this checklist revealed that many species lack morphological features and documented as the first record in Turkey. However, in newly reported taxa, LM, SEM and molecular techniques should be given in detail for comparison with the species found in the coasts of Turkey, other coastal areas and beyond. Therefore, this paper revealed the diatom composition in the Turkish coastal waters with the latest nomenclature and could be used as a fundamental list for the latter studies.
Table 1. Literature with all species or partially reported with illustrations marked with an asterisk. Black Sea (B), Sea of Marmara (S), Aegean Sea (A), Mediterranean Sea (M).

| Reference                          | Habitat           | Location |
|------------------------------------|-------------------|----------|
| 1. Ehrenberg (1843)                | Epizoic           | S        |
| 2. Hustedt (1930-1966)*            | Benthos           | S        |
| 3. Egemen et al. (1999)            | Planktonic        | A        |
| 4. Witkowski et al. (2000)*        | Benthos           | M        |
| 5. Aktan (2001)*                   | Epilithic, Epipelic | S          |
| 6. Koray (2001)                    | Planktonic        | B,S,A,M  |
| 7. Polat & Işık (2002)             | Planktonic        | M        |
| 8. Türkoğlu & Koray (2002)         | Planktonic        | B        |
| 9. Balkıs (2003)                   | Planktonic        | S        |
| 10. De Stefano & Marino (2003)*     | Epiphytic         | A        |
| 11. Balkıs (2004)                  | Planktonic        | S        |
| 12. Aktan & Aykulu (2005)*         | Epipelic          | S        |
| 13. Balkıs (2005)*                 | Benthos           | A        |
| 14. Baytut et al. (2005)*          | Benthos           | B        |
| 15. Aka & Polat (2006)*            | Planktonic        | M        |
| 16. De Stefano et al. (2006)*      | Epiphytic         | A        |
| 17. Çevik et al. (2008)            | Benthos           | M        |
| 18. Çolak Sabancı (2008)*          | Benthos           | A        |
| 19. De Stefano et al. (2008)*      | Epiphytic         | A        |
| 20. Sıvacı et al. (2008)           | Benthos           | B        |
| 21. Deniz & Taş (2009)             | Planktonic        | S        |
| 22. Gönülol et al. (2009)          | Epipelic          | B        |
| 23. Çolak Sabancı (2010)*          | Benthos           | A        |
| 24. Çolak Sabancı & Koray (2010)*  | Benthos           | A        |
| 25. Polge et al. (2010)            | Epipelic          | S        |
| 26. Altuğ et al. (2011)            | Planktonic        | S,A      |
| 27. Soylu et al. (2011)            | Epiphytic         | B        |
| 28. Çolak Sabancı (2012)*          | Benthos           | A        |
| 29. Özman-Say & Balkıs (2012)      | Planktonic        | M        |
| 30. Çolak Sabancı (2013)*          | Benthos           | A        |
| 31. Ağlaç & Balkıs (2014)          | Planktonic        | A        |
| 32. Aktan et al. (2014)            | Epipelic          | S        |
| 33. Balkıs & Toklu-Aluş (2014)     | Planktonic        | S        |
| 34. Blanco & Blanco (2014)*        | Benthos           | A        |
| 35. Pailles et al. (2014)*         | Fossil            | S        |
| 36. Taş (2014)                     | Planktonic        | A        |
| 37. Baytut et al. (2016)           | Planktonic        | B        |
| 38. Kisa & Pabuççu (2016)          | Benthos, Planktonic | B             |
| 39. Pennesi (2016)*                | Epiphytic         | A        |
### Table 1. Continue

| Citation                        | Taxon       | Method | Location |
|---------------------------------|-------------|--------|----------|
| Yıldız (2018)*                  | Benthos     | S      |
| Kaleli et al. (2017)*           | Epilithic   | B      |
| Kaleli et al. (2018)*           | Epilithic   | B      |
| Li et al. (2018)*               | Benthos     | A,M    |
| Kaleli et al. (2019)*           | Epilithic, Epipsammic | M      |
| Kaleli et al. (2020)*           | Benthos     | M      |
| Tüfekçi et al. (2008)           | Planktonic  | S      |
| Topçu (2011)                    | Planktonic  | A      |
| Taşkı̈n et al. (2019)           | Planktonic, Benthic | B,S,A,M |
| Baytut et al. (2013)*           | Planktonic  | B      |
| Taş & Okuş (2006)               | Planktonic  | B      |
| Balkıs & Taş (2016)             | Planktonic  | S      |
| Taş (2017)*                     | Planktonic  | S      |
| Taş & Becerril (2017)*          | Planktonic  | S      |
| Ayaz et al. (2018)              | Benthic     | M      |
| Eker-Develi & Kideys (2003)     | Planktonic  | B      |
| Feyzioglu & Seyhan (2007)       | Planktonic  | B      |

### Table 2. Most common species in the Turkish coastal waters.

| Taxon                              | Citations | Taxon                              | Citations |
|------------------------------------|-----------|------------------------------------|-----------|
| Cylindrotheca closterium           | 21        | Thalassionema fraunfeldii          | 15        |
| Nitzschia longissima               | 19        | Striatella unipunctata             | 15        |
| Coscinodiscus radiatus             | 17        | Ditylum brightwelli                | 14        |
| Thalassionema nitzschioides        | 17        | Cerataulina pelagica               | 13        |
| Pleurosigma normanii               | 17        | Chaetoceros affinis                | 13        |
| Licmophora abbreviata              | 16        | Chaetoceros lorenzianus            | 13        |
| Pseudosolenia calcar-avis          | 16        | Hemiaulus hauckii                  | 13        |
| Achnanthes brevipes                | 15        | Pseudo-nitzschia pungens          | 13        |
| Grammatophora marina               | 15        | Skeletonema costatum               | 13        |
| Melosira moniliformis              | 15        | Proboscia alata                    | 12        |
Conclusion

Investigation of the marine diatoms started nearly two centuries ago in Turkish coasts, however, still, a lot of geographical spots were not investigated, and their diatom composition remains unknown. The list comprised many benthic diatoms as well as the previously expressed planktonic forms, nevertheless, showed that total taxa in the Turkish coasts were not entirely determined yet. The future studies should focus on the benthic diatom composition with the help of LM and SEM to provide additional data for further implications. Morphological details of the benthic diatoms would enhance the knowledge not only on the taxonomy but also the biodiversity and their geographical dispersal in the coastal waters like estuarine areas, coastal lakes and lagoons. This paper brought marine planktonic and benthic studies together and comprised a dataset which could be comparative for the future studies in Turkey and other regions. Although there were checklists on marine plankton, this study provided a list of diatoms including both forms from the coasts of Turkey. However, many of the species were not illustrated, future studies could extend the knowledge with accurate identification with the aid of the illustrated studies in the region. It should be noted that there have been no changes in the taxonomy of the genera and species, the nomenclature was updated in several taxa which were transferred or currently not in use anymore, therefore, more research should be carried out to clarify the systematic problems of diatoms in Turkish coastal waters.

Updated Nomenclature

List of updated species nomenclature (Taxa) cited in the previous studies (Cited Name), and their synonyms.

| Current Name | Cited Name |
|--------------|------------|
| Achnanthes brevipes var. intermedia (Kützing) Cleve | Achnanthes intermedia Kützing |
| Achnanthes parvula Kützing | Achnanthes brevipes var. parvula (Kützing) Cleve |
| Achnanthes wellsiæ (Reimer) Witkowski & Lange-Bertalot | Astartiella wellsiæ (Reimer) Witkowski & Lange-Bertalot |
| Actinocyclus octonarius var. ralfsii (Smith) Hendey | Actinocyclus ralfsii (Smith) Ralfs |
| Amphicoconeis disculoides (Hustedt) Stefano & Marino | Cocconeis disculoides Hustedt |
| Amphitricetes antediluvianus Ehrenberg | Triceratium antediluvianum (Ehrenberg) Grunow |
| Aneumastus tuscula (Ehrenberg) Mann & Stickley | Navicula tuscula (Ehrenberg) Grunow |
| Ardissonea formosa (Hantzsch) Grunow | Synedra formosa Hantzsch |
| Asterionellopsis glacialis (Castracane) Round | Asterionella japonica Cleve |
| Azpeitia nodulifera (Schmidt) Fryxell & Sims | Coscinodiscus nodifer Schmidt |
| Bacillaria socialis (Gregory) Rafis | Bacillaria paradoxoa Gmelin |
| | Nitzschia paradoxoa (Gmelin) Grunow |
| Berkeleya scopulorum (Brébisson ex Kützing) Cox | Navicula scopulorum Brébisson ex Kützing var. scopulorum |
| Biddulphia biddulphiana (Smith) Boyer | Biddulphia pulchella Gray |
| Brebissonia lanceolata (Agardh) Mahoney & Reimer | Navicula lanceolata (Agardh) Kützing |
| Caloneis amphibesa var. subsalina (Donkin) Cleve | Caloneis subsalina (Donkin) Hendey |
| Catacombas gaillonii (Bory) D.M.Williams & Round | Synedra gaillonii (Bory) Ehrenberg |
| Chaetoceros atlanticus var. neopolitanus (Schröder) Hustedt | Chaetoceros neopolitanus Schröder |
| Chaetoceros neogracilis Van Landingham | Chaetoceros gracilis Schütt |
| Chaetoceros protuberans Lauder | Chaetoceros didymus var. protuberans (Lauder) Gran & Yendo |
| Chaetoceros willei Gran | Chaetoceros affinis var. willei (Gran) Hustedt |
| Cocconeis distans Gregory | Cocconeis granulifera Greville |
| Conticribra weissflogii (Grunow) Stachura-Suchoples & Williams | Thalassiosira weissflogii (Grunow) Fryxell & Hasle |
| Coronia decora (Brébisson) Ruck & Guiry | Campylocidiscus decorus Brébisson |

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Disclosure: -
| Species                                                                 | Authors                                                                                       |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Coscinodiscopsis jonesiana (Greville) Sar & Sørensen                    | Coscinodiscus jonesianus (Greville) Ostenfeld                                                |
| Coscinodiscus pavillardii Forti                                        | Coscinodiscus perforatus var. pavillardii (Forti) Hustedt                                     |
| Cricotus cuspidatus (Kützing) Mann                                     | Navicula cuspidata (Kützing) Kützing                                                          |
| Cricotus cuspidatus var. heribaudii (Peragallo) J.Y.Li & Y.Z.Qi         | Navicula cuspidata var. heribaudii (Peragallo) Cleve                                          |
| Cricotus halophila (Grunow) Mann                                       | Navicula cuspidata var. halophila Grunow                                                      |
| Ctenophora pulchella (Ralfs ex Kützing) Williams & Round               | Synedra pulchella (Ralfs) Kützing                                                            |
| Cylindrotheca closterium (Ehrenberg) Reimann & Lewin                   | Nitzschia closterium (Ehrenberg) Smith                                                       |
| Cymbopleura inaequalis (Ehrenberg) Kramer                             | Cymbella inaequalis (Ehrenberg) Rabenhorst                                                    |
| Cymbopleura naviculiformis (Auerswald ex Heiberg) Kramer               | Cymbella naviculiformis (Auerswald) Cleve                                                     |
| Dactylolosolen fragilissimus (Bergon) Hasle                           | Rhizosolenia fragilissima Bergon                                                             |
| Dactylolosolen mediterraneus (H. Peragallo) H.Peragallo                | Leptocylindrus mediterraneus (H.Peragallo) Hasle                                              |
| Delphineis australis Watanabe, Tanaka, Reid, Kumada & Nagudo           | Rhaphoneis surirella var. australis (Petit) Grunow                                            |
| Delphineis surirella (Ehrenberg) Andrews                               | Rhaphoneis surirella (Ehrenberg) Grunow                                                      |
| Didymosphenia geminata (Lyngbye) Mart. Schmidt                         | Gomphonema geminatum (Lyngbye) Agardh                                                        |
| Diploideis crabo (Ehrenberg) Ehrenberg                                | Navicula crabo (Ehrenberg) Kützing                                                           |
| Ellerbeckia arenaria (D.Moore ex Ralfs) R.M.Crawford                   | Melosira arenaria Moore ex Ralfs                                                             |
| Encyonema leiblenii (Agardh) Silva, Jahn, Veiga Ludwig & Menezes       | Encyonema prostratum (Berkeley) Kützing                                                      |
| Entomoneis alata (Ehrenberg) Ehrenberg                                | Amphipora alata (Ehrenberg) Kützing                                                          |
| Entomoneis pulcha (Bailey) Reimer                                      | Amphipora costata Hustedt                                                                    |
| Euxypidica turriss (Greville) S.Blanco & C.E.Wetzel                   | Stephanopyxis turriss (Greville) Ralfs                                                        |
| Fallacia forcipata (Greville) Stickle & Mann                          | Navicula forcipata Grevillei                                                                 |
| Fallacia forcipata var. densestriata (A.W.F.Schmidt) Gogorev          | Navicula forcipata Grevillei var. densestriata A.Schmidt                                      |
| Fogedia finnrichica (Cleve & Grunow) Witkowski, Metzeltin & Lange-Bertalot | Navicula finnrichica (Cleve & Grunow) Cleve                                                   |
| Fragilaria tabulata var. truncata (Greville) Lange-Bertalot            | Synedra fasciculata Ehrenberg var. truncata (Greville) Patrick                              |
| Fragilariaopsis rhombica (O‘Meara) Hustedt                            | Nitzschia angulata Hasle                                                                     |
| Grammatophora oceanica Ehrenberg                                      | Grammatophora oceanica (Smith) Hustedt                                                        |
| Guinardia delicatula (Cleve) Hasle                                    | Rhizosolenia delicatula Cleve                                                                |
| Guinardia striata (Stolterfoth) Hasle                                 | Rhizosolenia stolterfothi H. Peragallo                                                       |
| Gyrosigma acuminatum (Kützing) Rabenhorst                             | Gyrosigma spenceri (Quekett) Griffith & Henfrey                                              |
| Gyrosigma macrum (W.Smith) J.W.Griggh & H. Frenfrey                   | Pleurosigma macrum Smith                                                                     |
| Gyrosigma reversum (Gregory) Hendey                                    | Pleurosigma reversum Gregory                                                                 |
| Gyrosigma robustum (Grunow) Cleve                                     | Pleurosigma robustum Grunow                                                                  |
| Halamphora coffeiformis (C.Agardh) Levkov                             | Amphora coffeiformis (Agardh) Kützing                                                         |
| Halamphora costata (W.Smith) Levkov                                   | Amphora costata Smith                                                                       |
| Halamphora exigua (Gregory) Levkov                                    | Amphora exigua Gregory                                                                      |
| Halamphora holsatica (Hustedt) Levkov                                 | Amphora holsatica Hustedt                                                                    |
| Halamphora normannii (Rabenhorst) Levkov                              | Amphora normannii Rabenhorst                                                                 |
| Halamphora subholsatica (Krammer) Levkov                              | Amphora subholsatica Krammer                                                                 |
| Halamphora veneta (Kützing) Levkov                                    | Amphora veneta Kützing                                                                       |
| Halamphora wisel (Salah) Álvarez-Blanco & Blanco                       | Amphora turgida var. wisel Salah                                                              |
| Helicocorda thamesis (Shrubsole) Ricard                               | Streptotheca tamesis Shrubsole                                                               |
| Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski | Navicula capitata Ehrenberg                                                                  |
| Iconella biseriata (Brébisson) Ruck & Nakov                            | Surirella biseriata Brébisson                                                                |
| Karayaevia clevei (Grunow) Round & Bukhtiyarova                        | Achnanthes clevei Grunow                                                                    |
| Karayaevia rostrata (Hustedt) Bukhtiyarova                            | Achnanthes clevei Grunow var. rostrata Hustedt                                                |
| Lyrella abrupta (Gregory) Mann                                         | Navicula abrupta (Gregory) Donkin                                                             |
| Lyrella atlantica (Schmidt) Mann                                       | Navicula abrupta var. atlantica (Schmidt) Peragallo & Peragallo                              |
| Lyrella lyra (Ehrenberg) Karajeva                                      | Navicula lyra Ehrenberg                                                                      |
| Lyrella lyroides (Hendey) Mann                                         | Navicula lyroides Hendey                                                                     |
| Mastogloia albertii A.Pavlov, E.Jovanovska, C.E.Wetzel, L.Ector & Z.Levkov | Mastogloia smithii var. amphicephala Grunow                                                  |
| Mastogloia lacustris (Grunow) Grunow                                   | Mastogloia smithii var. lacustris (Grunow) M.Voigt                                           |
| Species | Synonym |
|---------|---------|
| **Tabularia affinis var. acuminata** (Grunow) Aboal | **Synedra tabulata var. acuminata** (Grunow) Hustedt |
| **Tabularia fasciculata** (Agardh) Williams & Round | **Synedra affinis** Kützing  
**Synedra fasciculata** (Agardh) Kützing  
**Synedra tabulata** (C. Agardh) Kützing var. fasciculata (Kützing) Grunow |
| **Tetramphora intermedia** (Cleve) Stepanek & Kociolek | **Amphora rhombica** Kitton var. intermedia Cleve  
**Tetramphora ostrearia** (Brébisson) Mereschkowsky |
| **Thalassionema fraunfeldii** (Grunow) Hallegraeff | **Thalassiothrix fraunfeldii** (Grunow) Grunow |
| **Thalassiosira eccentrica** (Ehrenberg) Cleve | **Coscinodiscus eccentricus** Ehrenberg |
| **Thalassiosira gravida** Cleve | **Thalassiosira rotula** Meunier |
| **Toxarium hennedyanum** (Gregory) Pelletan | **Synedra hennedyana** Gregory  
**Tetramphora intermedia** (Cleve) Stepanek & Kociolek  
**Tetramphora ostrearia** (Brébisson) Mereschkowsky  
**Thalassiothrix frauenfeldii** (Grunow) Grunow |
| **Tryblionella apiculata** Gregory | **Nitzschia apiculata** (Gregory) Grunow |
| **Tryblionella granulata** (Grunow) Mann | **Nitzschia granulata** Grunow |
| **Ulnaria danica** (Kützing) Compère & Bukhtiyarova | **Synedra ulna** (Nitzsch) Ehrenberg var. danica (Kützing) Grunow |

**Checklist**

List of diatom species reported from previous 56 papers. Nomenclature updated, according to Guiry and Guiry (2020) and Kociolek et al. (2020). Systematics followed Round et al. (1990).

### Coscinodiscophyceae

| Species | Synonym |
|---------|---------|
| **Actinocylus cuneiformis** (Wallich) F.Gómez, Lu Wang & Senjie Lin | 3 |
| **Actinocylus normanii** f. subsalus (Juhlín-Dannfelt) Hustedt | 37 |
| **Actinocylus octonarius** Ehrenberg | 6,37,48 |
| **Actinocylus octonarius** var. ralfsii (Smith) Hendey | 6 |
| **Actinocylus subtilis** (Gregory) Ralfs | 5 |
| **Actinoptychus splendens** (Shadbolt) Ralfs | 6,48 |
| **Asterolampra grevillei** (Wallich) Greville | 6,7,29,31,36,48,51 |
| **Asterolampra marylandica** Ehrenberg | 6,7,15,29,31,36,48 |
| **Asterolampra vanheurckii** Brun | 6,48 |
| **Asteromphalus flabellatus** (Brébisson) Greville | 6,7,18,29,36,48 |
| **Asteromphalus heptactis** (Brébisson) Ralfs | 6,7,29,36,48 |
| **Asteromphalus hookeri** Ehrenberg | 6,15,29,48 |
| **Asteromphalus hyalinus** Karsten | 6,48 |
| **Aulacoseira granulata** (Ehrenberg) Simonsen | 14,25,37 |
| **Aulacoseira italica** (Ehrenberg) Simonsen | 25 |
| **Aspeitia nodulifera** (Schmidt) Fryxell & Sims | 3,6,48,56 |
| **Coscinodiscopsis jonesiana** (Greville) Sar & Sunesen | 6,48 |
| **Coscinodiscus asteromphalus** Ehrenberg | 6,48 |
| **Coscinodiscus centralis** Ehrenberg | 6,8,11,29,48,51 |
| **Coscinodiscus concinnus** Smith | 6,8,21,31,37,48,51,52 |
| **Coscinodiscus gigas** Ehrenberg | 6,48 |
| **Coscinodiscus granii** Gough | 3,6,8,9,11,48,51,52,56 |
| **Coscinodiscus janischii** Schmidt | 37 |
| Species                                                      | Authors                                      | References |
|--------------------------------------------------------------|----------------------------------------------|------------|
| *Coscinodiscus marginatus*                                    | Ehrenberg                                    | 6,8,48     |
| *Coscinodiscus oculus-iridis*                                 | (Ehrenberg) Ehrenberg                        | 6,48,51    |
| *Coscinodiscus pavillardii*                                   | Forti                                        | 6,8,48     |
| *Coscinodiscus perforatus*                                    | Ehrenberg                                    | 7,8,9,11,15,29,31,37,51 |
| *Coscinodiscus radiatus*                                      | Ehrenberg                                    | 6,7,8,9,11,15,21,26,29,31,33,37,48, 50,51,52,56 |
| *Coscinodiscus wailesii*                                      | Gran & Angst                                 | 6,37,48    |
| *Dactyliosolen antarcticus*                                   | Castracane                                   | 6,29,48    |
| *Dactyliosolen blavyanus*                                     | (H.Peragallo) Hasle                          | 6,48       |
| *Dactyliosolen fragilissimus*                                 | (Bergon) Hasle                               | 6,8,9,11,33,46,48,50,51,52,56 |
| *Dactyliosolen mediterraneus*                                 | H.Peragallo                                  | 6,29,31,48,51 |
| *Ellerbeckia arenaria*                                        | (D.Moore ex Ralfs) R.M.Crawford              | 6          |
| *Eupyxidicula turris*                                         | (Greville) S.Blanco & C.E.Wetzel             | 6,11,51    |
| *Gallionella asperula*                                        | Ehrenberg                                    | 1          |
| *Guinardia cylindrus*                                         | (Cleve) Hasle                                | 6,9,48,51  |
| *Guinardia delicatula*                                        | (Cleve) Hasle                                | 6,8,11,31,48,50,51,52 |
| *Guinardia flaccida*                                          | (Castracane) Peragallo                       | 6,8,9,11,31,33,46,47,48,51 |
| *Guinardia striata*                                           | (Stolterfoh) Hasle                           | 6,8,11,17,29,31,47,48,50,51,52 |
| *Hyalodiscus scoticus*                                        | (Kützing) Grunow                             | 37         |
| *Melosira borreri*                                            | Greville                                     | 6,8,48     |
| *Melosira dubia*                                              | Kützing                                      | 2          |
| *Melosira moniliformis*                                       | (Müller) Agardh                              | 3,4,5,6,9,11,12,15,25,29,32,37,48,51,52 |
| *Melosira moniliformis var. octogona*                        | (Grunow) Hustedt                             | 4          |
| *Melosira nummuloides*                                        | Agardh                                       | 2,3,5,6,12,21,25,37,48,51,52,56 |
| *Melosira varians*                                            | Agardh                                       | 22,25,37,56 |
| *Neocalyptrella robusta*                                      | (Norman ex Ralfs) Hernández-Becerril & Meave del Castillo | 3,6,31,48,51,52 |
| *Paralia sulcata*                                             | (Ehrenberg) Cleve                            | 6,25,29,48,51 |
| *Podosira hormoides*                                          | (Montagne) Kützing                           | 37         |
| *Proboscia alata*                                             | (Brightwell) Sundström                       | 3,8,9,11,29,31,33,46,51,52,55,56 |
| *Proboscia alata f. alata*                                    | (Brightwell) Sundström                       | 6,47,50    |
| *Proboscia alata f. gracillima*                               | (Brightwell) Sundström                       | 6,50       |
| *Proboscia indica*                                            | (H.Peragallo) Hernández-Becerril             | 6,47,50    |
| *Pseudosolenia calcar-avis*                                   | (Schultze) Sundström                         | 6,8,9,11,17,29,31,33,46,47,48,50,51,52,55,56 |
| *Rhizosolenia acuminata*                                      | (H.Peragallo) H.Peragallo                    | 6,48       |
| *Rhizosolenia bergonii*                                       | H.Peragallo                                  | 6,48       |
| *Rhizosolenia castracanei*                                    | H.Peragallo                                  | 6,31,48,52 |
| *Rhizosolenia faeroensis*                                     | Ostenfeld                                    | 51         |
| *Rhizosolenia hebetata*                                       | J.W.Bailey                                  | 11,33,51,52 |
| *Rhizosolenia hebetata var. semispina*                        | (Hensen) Gran                                | 6,48,50    |
| *Rhizosolenia imbricata*                                      | Brightwell                                   | 3,6,8,29,47,48,50,51 |
| *Rhizosolenia setigera*                                       | Brightwell                                   | 6,8,9,11,33,46,47,48,51,52 |
| *Rhizosolenia styliformis*                                    | Brightwell                                   | 6,11,29,31,46,47,48,50,51 |
| *Rhizosolenia temperei*                                       | H.Peragallo                                  | 6,48,51    |
| *Stephanopyxis palmeriana*                                    | (Greville) Grunow                            | 6,8,48     |
| *Triceratium dubium*                                          | Brightwell                                   | 6,48       |
| *Triceratium favus*                                           | Ehrenberg                                    | 6,48       |
| *Triceratium pelagicum*                                       | (Schröder) Sournia                           | 6,48       |

| Mediophyceae                                                  |                                             |            |
|--------------------------------------------------------------|----------------------------------------------|------------|
| *Amphitetrus antediluvian*                                    | Ehrenberg                                    | 18         |
| *Ardissonea crystallina*                                      | (C.Agardh) Grunow                            | 5,18       |
| *Ardissonea crystallina var. dalmatica*                       | (Kützing) Mills                              | 41,45      |
| *Ardissonea formosa*                                          | (Hantzsch) Mills                             | 17         |
| *Bacteriastrium comosum*                                      | Pavillard                                    | 6,48       |
| Species                                      | Authors                              | References                       |
|---------------------------------------------|--------------------------------------|----------------------------------|
| Bacteriastrum delicatulum                   | Cleve                                | 3, 6, 8, 11, 29, 47, 48, 51       |
| Bacteriastrum elegans                       | Pavillard                            | 6, 29, 31, 48                    |
| Bacteriastrum elongatum                     | Cleve                                | 6, 48                            |
| Bacteriastrum hyalinum                      | Lauder                               | 3, 6, 8, 11, 29, 47, 48, 51, 52  |
| Bacteriastrum mediterraneum                 | Pavillard                            | 6, 48                            |
| Bellerochea horologicalis                   | Stosch                               | 6, 48                            |
| Biddulphia alternans                        | (Bailey) Van Heurck                   | 6, 37, 48, 51                    |
| Biddulphia biddulphiana                     | (Smith) Boyer                        | 6, 7, 29, 48                     |
| Biddulphia tridens                         | (Ehrenberg) Ehrenberg                | 6, 48                            |
| Cerataulina pelagica                        | (Cleve) Hendey                       | 6, 8, 9, 11, 29, 31, 33, 37, 46, 48, 51, 52, 56 |
| Chaetoceros aequatorialis                   | Cleve                                | 52, 53                           |
| Chaetoceros affinis                         | Lauder                               | 6, 8, 9, 11, 29, 37, 48, 50, 51, 52, 53, 56 |
| Chaetoceros anastomosans                    | Grunow                               | 6, 48, 50                        |
| Chaetoceros atlanticus                      | Cleve                                | 6, 48                            |
| Chaetoceros atlanticus var. neopolitanus    | (Schröder) Hustedt                   | 6, 31                            |
| Chaetoceros borealis                        | Bailey                               | 6, 48                            |
| Chaetoceros brevis                          | Schütt                               | 6, 8, 11, 48, 50, 51, 52, 53, 56 |
| Chaetoceros coarctatus                      | Lauder                               | 6, 48                            |
| Chaetoceros compressus                      | Lauder                               | 6, 8, 37, 48, 50, 51, 52         |
| Chaetoceros constrictus                     | Grunow                               | 6, 8, 9, 11, 37, 48, 50, 51, 52, 53, 56 |
| Chaetoceros contortus                       | Schütt                               | 53                               |
| Chaetoceros costatus                        | Pavillard                            | 6, 9, 11, 31, 48, 50, 51, 52, 53 |
| Chaetoceros crinitus                        | Schütt                               | 6, 48, 56                        |
| Chaetoceros criophilus                      | Castracane                           | 51                               |
| Chaetoceros curvisetus                      | Cleve                                | 6, 8, 9, 11, 37, 48, 50, 51, 52, 53, 55, 56 |
| Chaetoceros daadayi                         | Pavillard                            | 6, 29, 31, 48                    |
| Chaetoceros danicus                         | Cleve                                | 6, 8, 9, 11, 29, 31, 48, 50, 51, 52, 53, 56 |
| Chaetoceros debilis                         | Cleve                                | 6, 8, 9, 48, 51, 52, 53          |
| Chaetoceros decipiens                       | Cleve                                | 6, 8, 9, 29, 31, 37, 47, 48, 50, 51, 52, 53, 56 |
| Chaetoceros densis (Cleve)                  | Cleve                                | 6, 11, 48, 51                    |
| Chaetoceros diadema (Ehrenberg)             | Gran                                 | 6, 9, 11, 31, 48, 50, 51, 52, 53 |
| Chaetoceros didymus                         | Ehrenberg                            | 11, 29, 31, 33, 48, 51, 52, 53   |
| Chaetoceros didymus var. anglicus (Grunow)   | Gran                                 | 6                                |
| Chaetoceros diversus                        | Cleve                                | 6, 11, 29, 37, 48, 51            |
| Chaetoceros eibenii                         | Grunow                               | 6, 31, 48                        |
| Chaetoceros fragilis                        | Meunier                              | 51                               |
| Chaetoceros holstaticus                     | Schütt                               | 6, 8, 9, 11, 31, 48, 50, 51, 52, 53 |
| Chaetoceros imbricatus                      | Mangin                               | 6, 48                            |
| Chaetoceros lacinius                        | Schütt                               | 6, 8, 9, 11, 48, 50, 51          |
| Chaetoceros lauderi                         | Ralfs ex Lauder                      | 6, 11, 48, 51, 52, 53, 56        |
| Chaetoceros lorentianus f. forceps          | Meunier                              | 53                               |
| Chaetoceros lorentianus                     | Grunow                               | 6, 8, 9, 11, 29, 37, 46, 47, 48, 50, 51, 52, 53 |
| Chaetoceros messanensis                     | Castracane                           | 6, 8, 31, 48, 50, 51             |
| Chaetoceros neogracilis                     | Van Landingham                       | 6, 8, 37, 48                     |
| Chaetoceros pendulus                        | Karsten                              | 37                               |
| Chaetoceros perpusillus                     | Cleve                                | 6, 48                            |
| Chaetoceros peruvianus                      | Brightwell                           | 6, 9, 11, 29, 31, 37, 48, 50, 51, 52, 53 |
| Chaetoceros protuberans                     | Lauder                               | 6, 8                             |
| Chaetoceros pseudocurvisetis                | Mangin                               | 6, 8, 31, 37, 48                 |
| Chaetoceros rostratus                       | Ralfs                                | 6, 11, 29, 31, 33, 48, 51, 53    |
| Chaetoceros saltans                         | Cleve                                | 6, 48                            |
| Chaetoceros similis                         | Cleve                                | 6, 48, 50, 51                    |
| Chaetoceros simplex                        | Ostenfeld                            | 6, 37, 48, 50, 51                |
| Chaetoceros socialis                        | Lauder                               | 6, 8, 11, 31, 37, 48, 51, 52     |
| Scientific Name                              | Authors                                      |
|--------------------------------------------|----------------------------------------------|
| *Chaetoceros subsecundus* (Grunow ex Van Heurck) Hustedt | 8,37,51                                      |
| *Chaetoceros tenuissimus* Menuier           | 37,49                                        |
| *Chaetoceros teres* Cleve                  | 6,48,50,52,53                                |
| *Chaetoceros tetrastichon* Cleve            | 6,48,50                                      |
| *Chaetoceros tortissimus* Gran              | 6,8,48,51,52,53                             |
| *Chaetoceros vistulae* Apstein              | 6,48                                         |
| *Chaetoceros vixvisibilis* Schiller         | 56                                           |
| *Chaetoceros wighamii* Brightwell           | 6,8,37,48,50,51,52,53,56                     |
| *Chaetoceros willei* Gran                   | 6,50,51                                      |
| *Climacosphenia elongata* Mereschkowsky     | 6,8,48                                       |
| *Climacosphenia moniliger* Ehrenberg        | 6,7,15,17,29,36,48,50,52                     |
| *Conticribra weissflogii* (Grunow) Stachura-Suchoples & Williams | 6,48 |
| *Cyclotella atomus* Hustedt                 | 37                                           |
| *Cyclotella caspia* Grunow                  | 56                                           |
| *Cyclotella choctawhatcheeana* Prasad       | 37                                           |
| *Cyclotella meneghiniana* Kützing           | 6,20,25,37                                   |
| *Cyclotella radiosa* (Grunow) Lemmermann   | 25                                           |
| *Cyclotella striata* (Kützing) Grunow       | 3                                            |
| *Cymatosira belgica* Grunow                 | 45                                           |
| *Cymatosira lorentziana* Grunow             | 41,45                                        |
| *Detonula confervacea* (Cleve) Gran         | 6,37,48,50,51,52                            |
| *Detonula pumila* (Castracane) Grunow       | 6,11,48,50,51                               |
| *Ditylum brightwellii* (T.West) Grunow      | 6,8,9,11,31,33,37,46,47,48,50,51,52,56       |
| *Eucampia cornuta* (Cleve) Grunow           | 6,31,48                                      |
| *Eucampia zodiacus* Ehrenberg               | 6,31,29,47,48                               |
| *Eunotogramma marinum* (Smith) H.Peragallo & M.Peragallo | 18,28,41,45 |
| *Helicotheca tamesis* (Shrubsole) Ricard    | 6,9,11,33,48,51                             |
| *Hemiaulus hauckii* Grunow                 | 6,8,9,29,31,33,37,47,48,50,51,52,56         |
| *Hemiaulus membranaceus* Cleve             | 6,48,51                                      |
| *Hemiaulus sinensis* Greville              | 6,11,31,48,51,52                            |
| *Lauderia annulata* Cleve                   | 6,9,11,33,47,48,50,51,52                     |
| *Leptocylindrus danicus* Cleve              | 6,8,9,33,37,46,47,48,50,51,52,56            |
| *Leptocylindrus minimus* Gran               | 6,8,11,29,37,47,48,50,51,52                  |
| *Lindavia comta* (Kützing) Nakov, Guillory, Julius, Theriot & Alverson | 38 |
| *Lindavia glomerata* (H.Bachmann) Adesalu & Julius | 37 |
| *Lithodesmium undulatum* Ehrenberg          | 6,29,31,48                                   |
| *Neohuttonia reichardtii* (Grunow) Hustedt   | 45                                           |
| *Odontella aurita* (Lyngbye) Agardh         | 6,15,29,41,48                               |
| *Odontella obtusa* Kützing                  | 37                                           |
| *Odontella sinensis* (Greville) Grunow      | 51                                           |
| *Pantocsekiella comensis* (Grunow) Kiss & Ács | 20                                           |
| *Pantocsekiella kuetzingiana* (Thwaites) Kiss & Ács | 27,37                                        |
| *Pantocsekiella ocellata* (Pantocsek) Kiss & Ács | 22,25,27                                    |
| *Plagiogrammopsis vanheurckii* (Grunow) Hasle, Stosch & Syvertsen | 6,48 |
| *Pleurosira laevis* (Ehrenberg) Compère     | 25                                           |
| *Skeletonema costatum* (Greville) Cleve     | 6,8,9,11,31,32,33,46,47,48,50,51,56         |
| *Skeletonema dohnii* Sarno & Kooistra       | 37                                           |
| *Skeletonema marinoi* Sarno & Zingone       | 49,52                                        |
| *Skeletonema menzeli* Guillard, Carpenter & Reimann | 6,48                                      |
| *Stephanodiscus hantzschii* Grunow          | 37                                           |
| *Stephanodiscus minutulus* (Kützing) Cleve & Möller | 37 |
| *Thalassiosira allenii* Takano              | 6,8,9,11,21,48,50,51                        |
| *Thalassiosira angulata* (Gregory) Hasle     | 6,9,11,37,48,51                             |
| *Thalassiosira angustelineata* (Schmidt) Fryxel & Hasle | 6,8,9,11,21,33,37,48,51,56 |
| Species Name                        | Author                  | References |
|-----------------------------------|-------------------------|------------|
| Thalassiosira antarctica          | Comber                  | 51         |
| Thalassiosira antiqua              | (Grunow) Proschkina-Lavrenko | 37         |
| Thalassiosira decipiens           | (Grunow) Jørgensen      | 6,8,21,48,56|
| Thalassiosira eccentrica          | (Ehrenberg) Cleve       | 6,8,11,25,37,50,51|
| Thalassiosira fragilis            | G.Fryxell               | 51         |
| Thalassiosira gravida             | Cleve                   | 6,8,9,11,21,31,33,37,48,51,52,56|
| Thalassiosira hyalina             | (Grunow) Gran           | 6,48,51    |
| Thalassiosira leptopus             | (Grunow) Hasle & Fryxell| 6,8,11,48,51|
| Thalassiosira minima              | Gaarder                 | 52         |
| Thalassiosira nordenskioeldii     | Cleve                   | 6,8,9,11,29,37,48,51,52,56|
| Thalassiosira parva               | Proschkina-Lavrenko     | 37         |
| Thalassiosira subtilis            | (Ostenfeld) Gran        | 6,8,48     |
| Thalassiosira tenera              | Proschkina-Lavrenko     | 6,48       |
| Toxarium hennedyanum              | (Gregory) Pelletan      | 6,48       |
| Toxarium undulatum                | Bailey                  | 3,6,7,8,17,29,36,37,48,50,52|
| Trieres mobiliensis               | (Bailey) Ashworth & Theriot | 6,7,15,18,29,31,36,37,48|
| Trieres regia                     | (Schultze) Ashworth & Theriot | 6,48 |
| **Bacillariophyceae**             |                         |            |
| Achnanthes bacillaris             | Ehrenberg               | 1          |
| Achnanthes brevipes var. angustata| Greville                | 18,20      |
| Achnanthes brevipes var. brevipes | Agardh                 | 3,4,5,6,9,11,12,18,25,28,33,37,38,48,51|
| Achnanthes brevipes var. intermedia| (Kützing) Cleve        | 17,18,25,28|
| Achnanthes coarctata              | (Brébisson ex W.Smith) Grunow | 37 |
| Achnanthes danica                 | (Flögel) Grunow         | 45         |
| Achnanthes kuwaitensis            | Hendey                  | 18         |
| Achnanthes lacunarum              | Hustedt                 | 25         |
| Achnanthes longipes               | Agardh                  | 3,6,8,18,28,36,37,48,56|
| Achnanthes parvula                | Kützing                 | 17,18,25,28|
| Achnanthes pseudobrevipes         | Aleem                   | 18         |
| Achnanthes wellsiae               | (Reimer) Witkowski & Lange-Bertalot | 25 |
| Achnanthidium affine              | (Grunow) Czarnecki      | 38         |
| Achnanthidium minutissimum        | (Kützing) Czarnecki     | 20         |
| Adlafia brockmannii               | (Hustedt) Bruder & Hinz | 37         |
| Amphicocconeis debesi             | (Hustedt) De Stefano    | 16         |
| Amphicocconeis disculoides        | (Hustedt) Stefano & Marino | 3,10 |
| Amphipleura pellucida             | (Kützing) Kützing       | 20         |
| Amphiprora angustata              | Hendey                  | 3          |
| Amphora angustata                 | Hendey                  | 3          |
| Amphora arenicola                 | Grunow ex Cleve         | 48,56      |
| Amphora bigibba var. interrupta   | (Grunow) Cleve          | 41         |
| Amphora binodis                   | Gregory                 | 18         |
| Amphora cingulata                 | Cleve                   | 37         |
| Amphora commutata                 | Grunow                  | 20,22,25   |
| Amphora cymbamphora               | Cholnoky                | 41,44,45   |
| Amphora delicatissima             | Krasske                 | 5,12,51    |
| Amphora eximia                    | J.R.Carter              | 37         |
| Amphora graeffiana                | Hendey                  | 41         |
| Amphora hamata                    | Heiden                  | 44         |
| Amphora helenensis                | Giffen                  | 40         |
| Amphora laevis                    | Gregory                 | 37         |
| Amphora marina                    | Smith                   | 6,41,48    |
| Amphora ocellata                  | Donkin                  | 37         |
| Amphora ovalis                    | (Kützing) Kützing       | 5,6,12,18,20,25,27,29,32,37,51,56|
| Amphora pediculus                 | (Kützing) Grunow        | 20,25,37   |
| Species                                                                 | Authors             |
|------------------------------------------------------------------------|---------------------|
| Amphora proteus Gregory                                                | 18,28,41,44         |
| Aneumastus tuoscule (Ehrenberg) Mann & Stickle                         | 5,12,32,51          |
| Anomoeoneis sphaerophora (Kützing) Pfitzer                             | 17,20,22,44         |
| Anomoeoneis sphaerophora var. sculpta (Ehrenberg) Müller               | 17                  |
| Anorthoneis exentrica (Donkin) Grunow                                   | 5,12,51             |
| Anorthoneis vortex Sterrenburg                                          | 45                  |
| Asterionella bleakeleyii Smith                                          | 11,51               |
| Asterionella formosa Hassal                                              | 37                  |
| Asterionella notata Grunow                                              | 6                   |
| Asterionellopsis glacialis (Castracane) Round                           | 6,7,8,11,15,29,36,48,50,51,52,56 |
| Bacillaria paxillifera (Müller) T.Marsson                              | 3,6,7,8,11,15,17,20,26,29,31,37,48,51 |
| Bacillaria socialis (Gregory) Ralfs                                     | 18                  |
| Berkeleya antarctica Grunow                                             | 41                  |
| Berkeleya micans (Lyngbye) Grunow                                       | 40,41               |
| Berkeleya obtusa (Greville) Grunow                                      | 40                  |
| Berkeleya rutilans (Trentepohl ex Roth) Grunow                          | 41                  |
| Berkeleya scopulorum (Brébisson ex Kützing) Cox                        | 18,28               |
| Berkeleya sparsa M.Mizuno                                               | 40,41               |
| Biremis lucens (Hustedt) Sabbe, Witkowski & Vyverman                    | 40                  |
| Brachysira aponina Kützing                                              | 44                  |
| Brachysira estonarium Witkowski, Lange-Bertalot & Metzeltin             | 44,45               |
| Brebissonia lanceolata (Agardh) Maloney & Reimer                        | 6,8,20              |
| Caloneis amphibaena (Bory) Cleve                                       | 20,25               |
| Caloneis amphibaena var. subsalina (Donkin) Cleve                       | 3,37                |
| Caloneis bacillum (Grunow) Cleve                                        | 37                  |
| Caloneis clevei (Lagerstedt) Cleve                                      | 20                  |
| Caloneis liber (Smith) Cleve                                            | 45                  |
| Caloneis linearis (Cleve) Boyer                                         | 18,41               |
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| Caloneis silicula (Ehrenberg) Cleve                                     | 22,27               |
| Caloneis undulata (W.Gregory) Krammer                                   | 37                  |
| Caloneis westii (W.Smith) Hendey                                       | 20,37               |
| Campylocodiiscus bicostatus W.Smith ex Roper                           | 20                  |
| Campylocodiiscus echeneis Ehrenberg ex Kützing                           | 48                  |
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| Cocconeis peltoides Hustedt                | 45                 |
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| Cocconeis placentula var. rouxi (Héribaud-Joseph & Brun) Cleve | 25             |
| Cocconeis pseudo-marginata Gregory        | 18,23,28,48        |
| Cocconeis scutellum Ehrenberg             | 5,6,8,12,18,19,28,32,37,44,48,51 |
| Cocconeis scutellum var. parva (Grunow) Cleve | 19             |
| Cocconeis scutellum var. posidoniae M.De Stefano, D.Marino & L.Mazzella | 19         |
| Cocconeis speciosa Gregory                | 3                  |
| Coronia decora (Brébisson) Ruck & Guiry   | 6,17,37,48         |
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| Criculata cuspidata var. heribaudi (Peragallo) J.Y.Li & Y.Z.Qi | 18         |
| Criculata halophila (Grunow) Mann          | 18                 |
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| Cymbella hustedtii Krasske                 | 37                 |
| Cymbella lanceolata (C.Agardh) C.Agardh    | 6,8,20             |
| Cymbella turgidula Grunow                  | 6                  |
| Cymbella ventricosa Kützing                | 27                 |
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| Gyrosigma strigilis                          | (Smith) Cleve                                | 27      |
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| Halamphora exigua                            | (Gregory) Levkov                             | 5,12,18,28,37,51|
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| Haslea spicula | (Hickie) Bukhtiyarova |
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| Iconella biseriata | (Brébisson) Ruck & Nakov |
| Karayevia amoena | (Hustedt) Bukhtiyarova |
| Karayevia clevei | (Grunow) Round & Bukhtiyarova |
| Karayevia rostrata | (Hustedt) Bukhtiyarova |
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| Licmophora dalmatica | (Kützing) Grunow |
| Licmophora debilis | (Kützing) Grunow ex Van Heurck |
| Licmophora ehrenbergii | (Kützing) Grunow |
| Licmophora ehrenbergii f. grunowii | (Mereschkowsky) Hustedt |
| Licmophora flabellata | (Greville) Agardh |
| Licmophora gracilis | (Ehrenberg) Grunow |
| Licmophora hyalina | (Kützing) Grunow |
| Licmophora lyngbyei | (Kützing) Grunow ex Van Heurck |
| Licmophora paradoxa | (Lyngbye) Agardh |
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| Lyrella atlantica | (Schmidt) Mann |
| Lyrella clavata | (W.Gregory) D.G.Mann |
| Lyrella lyra | (Ehrenberg) Karajeva |
| Lyrella lyroides | (Hendey) Mann |
| Mastogloia acutiuscula | Grunow |
| Mastogloia alberti | A.Pavlov, E.Jovanovska, C.E.Wetzel, L.Ector & Z.Levkov |
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| Mastogloia braunii | Grunow |
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| Mastogloia labuensis | Cleve |
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| Mastogloia maxima | Lewis |
| Mastogloia pumila | (Grunow) Cleve |
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Navicula pseudosilicula Hustedt
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Navicula ramosissima var. mollis (W. Smith) Hendey
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Navicula resecta J.R.Carter
Navicula rostellata Kützing
Navicula ryhnocephala Kützing
Navicula salinarum Grunow
Navicula scabriuscula (Cleve & Grove) Mereschkowsky
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| Navicula viridula (Kützing) Ehrenberg | |
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| Nitzschia prolongata Hustedt | |
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| Nitzschia vidovichii          | (Grunow) Grunow                   | 24    |
| Odontidium hyemale            | (Roth) Kützing                    | 56    |
| Olifantiella muscatinei       | (Reimer & Lee) Van de Vijver, Ector & Wetzel | 42    |
| Paraplaconeis placenta        | (Ehrenberg) Kulikovskiy & Lange-Bertalot | 20,22,32 |
| Parlibellus bennikei          | Witkowski                         | 28    |
| Parlibellus berkeleyi         | (Kützing) Cox                     | 18,40,41 |
| Parlibellus calvus            | Witkowski, Metzeltin & Lange-Bertalot | 40    |
| Parlibellus delognei          | (Van Heurck) E.J.Cox              | 41    |
| Parlibellus plicatus          | (Donkin) Cox                      | 17    |
| Petrodictyon gemma            | (Ehrenberg) Mann                  | 6,18,28,29,31,48,51,52 |
| Petroneis humerosa            | (Brébisson ex Smith) Stickle & Mann | 5,12,20,32,48,51 |
| Petroneis latissima           | (Gregory) Stickle & Mann          | 3     |
| Phaeodactylum tricornutum     | Bohlin                            | 6,48  |
| Pinnularia aestuarii          | Cleve                             | 37    |
| Pinnularia bipectinalis       | (Schumann) Greguss                | 37    |
| Pinnularia borealis           | Ehrenberg                         | 37    |
| Pinnularia clavicus           | (Gregory) Rabenhorst              | 37    |
| Pinnularia gentilis           | (Donkin) Cleve                    | 37    |
| Pinnularia interrupta         | W.Smith                           | 22    |
| Pinnularia lundii             | Hustedt                           | 37    |
| Pinnularia microstauron       | (Ehrenberg) Cleve                 | 37    |
| Pinnunavis elegans            | (Smith) Okuno                     | 3     |
| Placoneis amphibola           | Cleve                             | 25    |
| Placoneis clementis           | (Grunow) Cox                      | 20    |
| Placoneis elginensis          | (Gregory) Cox                     | 27,38 |
| Placoneis gastrum             | (Ehrenberg) Mereschkowsky         | 38    |
| Placoneis placenta            | (Ehrenberg) Mereschkowsky         | 20,32,51 |
| Plagiogramma minus            | (Gregory) Chunli, Ashworth & Witkowski | 18,41 |
| Plagiogramma minus var. nanum | (Gregory) Chunlibian Li, Ashworth & Witkowski | 41,45 |
| Plagiogramma pulchellum var.  | pygmaeum (Greville) H.Peragallo & M.Peragallo | 45    |
| Plagiogramma tenuissium       | Hustedt                           | 41,45 |
| Plagioptris lepidoptera       | (Gregory) Kuntze                  | 37,41 |
| Plagioptris lepidoptera var.  | minor (Cleve) Czarnecki & J.L.Weé  | 41    |
| Plagioptris lepidoptera var.  | proboscidea (Cleve) Reimer        | 41    |
| Planothidium deperditum       | Witkowski, Lange-Bertalot & Metzeltin | 40,41 |
| Planothidium hauckianum       | (Grunow) Bukhtiyarova             | 18,38 |
| Planothidium hauckianum var.  | rostratum (Schulz ex Hustedt) Andresen, Stoermer & Kreis, Jr. | 25    |
| Planothidium lanceolatum      | (Brébisson ex Kützing) Lange-Bertalot | 25    |
| Planothidium liljeborgei      | (Grunow) Witkowi, Lange-Bertalot & Metzeltin | 45    |
| Planothidium rostraholoarcticum | Lange-Bertalot & Bąk            | 25    |
| Species                                      | References |
|---------------------------------------------|------------|
| Pleurosigma aestuarii (Brébisson ex Kützing) W.Smith | 37         |
| Pleurosigma angulatum (Quekett) Smith        | 5,6,8,12,51|
| Pleurosigma delicatulum Smith               | 6,48       |
| Pleurosigma elongatum Smith                 | 6,7,15,17,25,29,37,38,44,48 |
| Pleurosigma formosum Smith                  | 6,41       |
| Pleurosigma formosum var. dalmatica (dalmaticum) Grunow | 18         |
| Pleurosigma normani Ralfs                   | 3,6,7,9,15,17,18,21,29,31,33,36,41,48,50,51,56 |
| Pleurosigma rigidum Smith                   | 6,18,48    |
| Pleurosigma salinarum (Grunow) Grunow       | 5,12,18,25,28,51 |
| Pleurosigma strigosum Smith                 | 3,44       |
| Podocystis perinensis Ricard                | 6,17,29    |
| Proschninia bulnheimii (Grunow) Karayeva    | 45         |
| Proschninia complanata (Grunow) D.G.Mann    | 41         |
| Psammodictyon panduriforme (W.Gregory) D.G.Mann | 5,6,12,18,28,37,48,51 |
| Psammodictyon panduriforme var. continuum (Grunow) Snoeijs | 45         |
| Psammodictyon rudum (Cholnoky) D.G.Mann     | 41         |
| Psammodiscus nitidus (Gregory) Round & Mann | 18,28,48   |
| Pseudo-nitzschia calliantha Lundholm, Moestrup & Hasle | 48,49,51,52 |
| Pseudonitzschia delicatissima (Cleve) Heiden | 6,8,11,31,48,50,51,56 |
| Pseudo-nitzschia fraudulenta (Cleve) Hasle  | 6,11,48,50,51 |
| Pseudo-nitzschia pseudodelicatissima (Hasle) Hasle | 6,8,9,29,31,48,51,55 |
| Pseudo-nitzschia pungens (Grunow ex Cleve) Hasle | 3,6,8,9,11,31,46,47,48,50,51,52,56 |
| Pseudo-nitzschia pungens var. aveirensis Lundholm, Churro, Carreira & Calado | 49         |
| Pseudo-nitzschia seriata (Cleve) H.Peragallo | 11,48,51   |
| Pseudostaurosira elliptica (Schumann) Edlund, Morales & Spaulding | 44         |
| Pseudostaurosira perminuta (Grunow) Sabbe & Wyverman | 41         |
| Pteroncola inane (Giffen) Round             | 5          |
| Rhabdonema adriaticum Kützing               | 5,6,8,15,18,28,29,36,48 |
| Rhabdonema arcuatum (Lyngby) Kützing        | 48         |
| Rhabdonema minutum Kützing                  | 37         |
| Rhaphoneis amphiceros f. gemmifera (Ehrenberg) Peragallo & Peragallo | 18         |
| Rheicosphenia abbreviata (Agardh) Lange-Bertalot | 20,27,37   |
| Rheicosphenia marina (Kützing) Schmidt      | 5          |
| Rhopalodia acuminata Krammer                | 44         |
| Rhopalodia constricta (W.Smith) Krammer     | 18         |
| Rhopalodia gibberula (Ehrenberg) Müller     | 20         |
| Rhopalodia musculus (Kützing) Müller        | 17,18,28   |
| Scoliopleura peisonis Grunow                | 28         |
| Sellaphora papula (Kützing) Mereschkowsky   | 20,32,51   |
| Seminavis basilica Dainelidis               | 41         |
| Seminavis eulensteini (Grunow) D.B. Danielidis, K.Ford & D.Kennett | 18         |
| Seminavis insignis A.Blanco & S.Blanco      | 40,41      |
| Seminavis robusta Danielidis & Mann         | 23,41,48   |
| Seminavis strigosa (Husted) Danielidis & Economou-Amilli | 40,44      |
| Simonsenia delognei (Grunow) Lange-Bertalot | 20         |
| Stauroneis anceps Ehrenberg                 | 20         |
| Stauroneis membranacea (Cleve) Hustedt      | 5          |
| Stauroneis smithii Grunow                   | 22         |
| Staurophora amphioxys (Gregory) Mann        | 18,28      |
| Staurosirella martyr (Héribaud-Joseph) E.A.Morales & K.M.Manoylov | 37         |
| Staurosirella pinnata (Ehrenberg) D.M.Williams & Round | 38         |
| Stenopterobia signatella (Gregory) Ross     | 6          |
| Striatella delicatula Kützing Grunow ex Van Heurck | 6,8,48,56 |
| Species                                      | References         |
|----------------------------------------------|--------------------|
| *Striatella unipunctata* (Lyngbye) Agardh     | 5,6,7,8,9,11,15,17,18,29,31,32,36,37,41,48,50,51,52 |
| *Surirella angusta* Kützing                   | 20,37              |
| *Surirella brebissonii* Kramer & Lange-Bertalot | 22                 |
| *Surirella elegans* Ehrenberg                 | 17,37              |
| *Surirella fastuosa* (Ehrenberg) Ehrenberg    | 3,6,7,17,18,29,48   |
| *Surirella minuta* Brébisson                  | 25,37              |
| *Surirella muelleri* Hustedt                  | 37                 |
| *Surirella ovalis* Brébisson                  | 14,20,27,37        |
| *Surirella pandura* Peragallo & Peragallo     | 6,48               |
| *Surirella robusta* Ehrenberg                 | 3                  |
| *Surirella striatula* Turpin                  | 3,4,6,17,18,20,25,48|
| *Synedra fulgens* (Greville) Smith           | 6                  |
| *Synedra gaillonii* var. *macilenta* (Grunow) H.Peragallo | 18,23            |
| *Tabellaria flocculosa* (Roth) Kützing         | 6                  |
| *Tabularia affinis* var. *acuminata* (Grunow) Aboal | 25            |
| *Tabularia fasciculata* (Agardh) Williams & Round | 5,12,18,25,28,37,44,51 |
| *Tabularia investiens* (W.Smith) Williams & Round | 37,41          |
| *Tabularia parva* (Kützing) D.M.Williams & Round | 5,12,18,44,51    |
| *Tabularia tabulata* (C.Agardh) Snoeijis      | 6,25,32,44         |
| *Tetramphora intermedia* (Cleve) Stepanek & Kociolek | 18               |
| *Tetramphora lineolata* (Ehrenberg) Mereschkowsky | 41                |
| *Tetramphora rhombica* (Kitton) Stepanek & Kociolek | 6,48            |
| *Tetramphora sulcata* (Brébisson) Stepanek & Kociolek | 41              |
| *Tetramphora ostrearia* (Brébisson) Mereschkowsky | 45               |
| *Thalassionema fraunfeldii* (Grunow) Hallegnaeff | 3,6,7,8,15,17,21,26,29,31,36,48,50,51,52 |
| *Thalassionema nitzschioides* (Grunow) Mereschkowsky | 3,6,7,8,9,11,21,29,31,36,37,48,50,51,52,55,56 |
| *Thalassiophysa hyalina* (Greville) Paddock & P.A.Sims | 7,29,48          |
| *Thalassiothrix longissima* Cleve & Grunow    | 3,6,8,26,29,48,50,51|
| *Thalassiothrix mediterranea* Pavillard        | 6,7,8,15,29,31,36,37,48,50 |
| *Toxonidea insignis* Donkin                   | 5,12,18,51         |
| *Trachyneis aspera* (Ehrenberg) Cleve         | 13,18,41,48        |
| *Trachysphena acuminata* Peragallo            | 45                 |
| *Trachysphena australis* Petit                | 18,28,48           |
| *Trachysphena australis* var. *rostellata* Hustedt | 23               |
| *Tryblionella acuminata* Smith                | 18,20,28           |
| *Tryblionella angustata* W.Smith              | 22,25              |
| *Tryblionella apiculata* Gregory              | 5,12,18,27,28,41,44,51 |
| *Tryblionella circumsuta* (Bailey) Ralfs      | 48                 |
| *Tryblionella coarctata* (Grunow) Mann        | 4,28,41            |
| *Tryblionella compressa* (Bailey) Poulin      | 24,28              |
| *Tryblionella granulata* (Grunow) Mann        | 18,44              |
| *Tryblionella hungarica* (Grunow) Frenguelli  | 25                 |
| *Tryblionella levidensis* W.Smith             | 22                 |
| *Tryblionella marginulata* (Grunow) Mann      | 45                 |
| *Tryblionella navicularis* (Brébisson) Ralfs  | 18                 |
| *Tryblionella pararostrata* (Lange-Bertalot) Clavero & Hernández-Maríné | 44              |
| *Tryblionella punctata* Smith                 | 18                 |
| *Tryblionella victoriae* Grunow               | 38                 |
| *Ulnaria acus* (Kützing) Aboal                | 22                 |
| *Ulnaria danica* (Kützing) Compère & Bukhtiyarova | 14,37             |
| *Ulnaria ulna* (Nitzsch) Compère              | 6,7,15,17,20,27,29,34,38,56 |
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