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Counting approximately 500 diatoms from each of 16 benthic diatom samples collected 11 October 1975 from the Cedar River and its tributaries, the Shell Rock and Little Cedar Rivers, in NE Iowa has yielded 118 taxa. These waters were alkaline (160-210 ppm HCO_3; pH 8.4-9.5); turbidity was negligible in the Little Cedar and rose to 40 FTU in the Cedar. The 5 most abundant taxa and their distributions were: *Stephanodiscus subtilis* (Van Goor) A. Cleve, more than 40% of the 2 Shell Rock samples and rare in the 4 Little Cedar samples; *Cyclotella meneghiniana* Kütz., found in all samples (3%-26%) but most abundant in Cedar River samples; *Diatoma vulgare* Bory, associated mostly with epiphytic samples; *Skeletonema potamos* (Weber) Hasle, most abundant in Cedar River samples; and *Nitzschia acicularis* (Kütz.). W. Sm., present in all samples and over 50% of one sediment sample from the Little Cedar.

The widespread occurrence of *Cyclotella meneghiniana* and the scattered appearance of samples dominated by one taxon is suggestive of the presence of organic or other pollutants. Seasonal sampling of this diatom flora at these stations and others is continuing.

INDEX DESCRIPTORS: diatom, river, benthic, Cedar River.

Specific descriptions of benthic diatoms of the Cedar River and its tributaries in northeast Iowa do not appear to have been published previously. This is in marked contrast to the series of publications in the *Proceedings of the Iowa Academy of Science* by John Dodd and his associates describing the diatom flora of central and western Iowa waters. There are several published and unpublished reports, done for governmental agencies or industrial companies, regarding water quality in the portion of the Cedar River Basin dealt with in this paper. However, most of these reports describe planktonic rather than benthic diatom occurrence.

The purpose of this study is to document variations in the benthic diatom flora resulting from characteristics of the water in different tributaries and the effects of municipalities and other activities of man along the Cedar River.

METHODS AND MATERIALS

Benthic diatoms are being sampled at 14 locations in the Cedar River drainage basin. All stations are located on the Cedar River or one of its tributaries (Figure 1). These stations are numbered in the sequence in which they are sampled during a one day collecting trip. The results reported here represent a preliminary determination of variation in diatom species occurrence and abundance at those stations closest to Waverly, Iowa. Samples are being collected in October, February, May and August of each year.

The six stations reported in this paper and the samples collected from them are described briefly in Table 1. The station farthest down river (no. 13) is located at the Washington-Union access area along the Cedar River about 1-2 km below its confluence with the West Fork of the Cedar River. The Shell Rock River joins the West Fork near this confluence also. Station 10 is located on the Shell Rock River a few meters downstream from the bridge in downtown Shell Rock, approximately 11 km above the river mouth. Stations 14, 1 and 2 proceed successively up the Cedar River from the West Fork. Station 14 is a few meters downriver from the 3rd St. SE bridge in Waverly. Station 1 is on the south shore of the river bend at Cedar Bend Park (Bremer County) and station 2 is about 25 m downriver from the Iowa Highway 188 bridge east of Plainfield. Station 1 lies about 7 km above no. 14 and station 2 is about 13 km above no. 1. The Waverly reservoir separates stations 1 and 2. Station 3 is below a country bridge northeast of Nashua on the Little Cedar River about 1-2 km above its confluence with the Cedar River and 16-18 km above station 2.

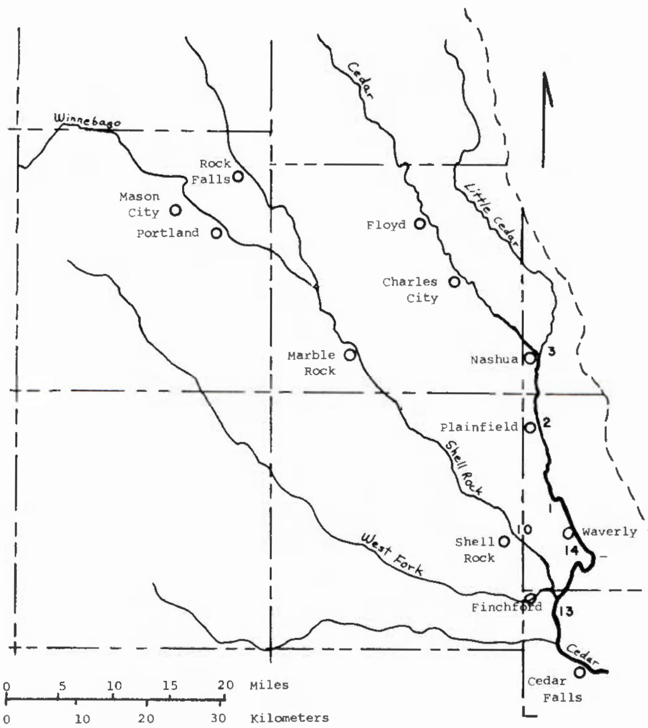

Figure 1. *Sampling Stations on the Cedar River and Tributaries.*

A sandy mud bottom prevails at all Cedar River stations with the exception of 14 (small to large rocks) and 2 (gravel). Station 10 on the Shell Rock is rocky, while sand predominates at station 3 of the Little Cedar. All samples were collected from less than 10 cm water depth which was usually near shore.

Samples were collected from bottom sediments and submerged rocks by suction using a large pipette with a rubber bulb. Epiphytic samples were collected by hand. After microscopic examination to note which diatoms were living and to identify other algae in the samples, the diatoms were cleaned by boiling in nitric acid. Rinsed diatoms were mounted in Hyrax; unmounted portions of the samples were preserved in formalin and stored in sealed vials.

Diatom counts of 500 per slide were made by scanning slides using an 1000X oil immersion lens.

Simultaneously with diatom samples, water samples were collected

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from immediately beneath the surface. Determinations of temperature, pH, CO_2, and O_2 were made at the time of collection. Samples were refrigerated in glass bottles until color, turbidity, alkalinity, nitrate, total phosphate, orthophosphate, and silica tests could be made. All tests were made using a Hach DR-EL water test set (Hach Chemical Co., Ames, Iowa).

RESULTS

On 11 October 1975, 16 samples were collected from the 6 stations (Table 1). These included 5 samples of material closely associated with sediments (13A, 1C, 2A, 3A, 3B), 4 samples from rock surfaces (10B, 14A, 1A, 1B), and 7 epiphytic samples (10A, 14B, 14C, 3C, 3D) including 2 from woody substrates (13B, 2B).

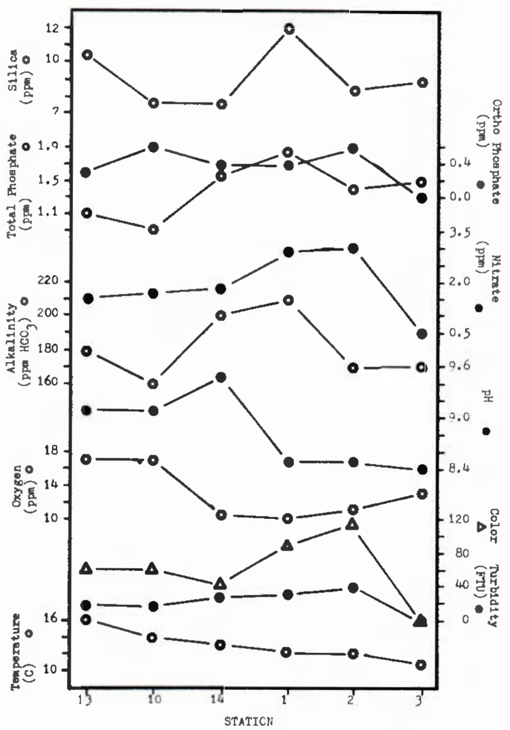

Figure 2. *Comparison of Environmental Data for 6 Cedar River Stations, 11 October 1975.*

The physical and chemical factors determined for each station are compared in Figure 2. Values for CO_2 are not reported because of problems with the field test. The pH test was repeated in the laboratory when several weeks elapsed before the tests could be completed. The pH of sample 1 changed to 3.8 by the time the water tests were completed (none of the other samples varied more than 1 pH unit), and therefore results for nutrient levels for this station are suspect. The pH values reported here are the field results.

The clearest water encountered was in the Little Cedar River; nutrient levels were also moderate to low at this station. Nitrate levels varied from station to station showing similar fluctuations to turbidity. Phosphate and silica values corresponded more with alkalinity. The alkalinity values are typical for other Iowa surface waters (Bachmann, 1965). Temperature and dissolved oxygen variations relate mostly to the time of day, since sample 1 was taken at 8:45 am and the last sample (14) was taken at 6:30 pm. The pH values similarly are lowest in the morning and highest in the evening.

A total of 104 diatom taxa were counted in the 16 samples (see Appendix). An additional 14 taxa were observed on the slides but were not part of the counts, and presumably more occur since not every part of each slide was examined.

The only unidentified taxon commonly found was a species of *Gomphonema*. *Gomphonema* sp. 12 has a striae count like that of *G. parvulum* (Kütz.) Grun., but the shape and arrangement of the striae differ distinctly.

The most abundant diatom was *Stephanodiscus subtilis* (Van Goor) A.Cl. (Table 2). Specimens of this taxon are 10-15 μm in diameter and have radiate striae. However, they are weakly silicified and neither the striae nor the hyaline interspaces are visible toward the middle of the valve. Most abundant in the Shell Rock River samples and barely present in the Little Cedar River samples, this taxon exhibited no substrate preference.

Most taxa appeared at all stations but a few had distribution patterns restricted to certain groups of stations or showed substrate preferences (Table 2). *Cyclotella meneghiniana* Kütz., and *Skeletonema potamos* (Weber) Hasle tended to be most abundant in Cedar River samples. *Cyclotella atomus* Hust. and *C. pseudostelligera* Hust. were less abundant in the Little Cedar River than they were elsewhere, whereas *Melosira varians* Agardh was more abundant there. *Navicula viridula* var. *rostellata* (Kütz.) Cl. and *N. cryptocephala* Kütz. were absent from the Shell Rock River samples but found at all other stations. Diatom taxa occurring more frequently in epiphytic samples than in other benthic samples included *Diatoma vulgare* Bory, *Nitzschia dissipata* (Kütz.) Grun., *Navicula cryptocephala* var. *veneta* (Kütz.) Rabh., *Cocconeis pediculus* Ehr., *Rhoicosphenia curvata* (Kütz.) Grun. ex Rabh., and the species of *Gomphonema*. The remainder grew more abundantly on non-living benthic surfaces, except for a few taxa which showed no preferences, such as *Nitzschia acicularis* (Kütz.) W. Sm., *Navicula salinarum* var. *intermedia* (Grun.) Cleve, and perhaps *N. cryptocephala* and *Amphora perpusilla* (Grun.) Grun. Not enough specimens of most of the remaining taxa have been observed to make any reasonable generalizations.

DISCUSSION

The weather for several weeks preceding 11 October 1975 had been free of rain and often sunny. With reduced run-off and erosion, water conditions in the rivers should have been optimum. The cool, clear weather and water should favor diatom growth. Therefore, the diatoms sampled should represent an "ideal" fall flora. This assumption excludes possible effects of pollutants from point sources.

The stations on the Little Cedar and Shell Rock Rivers were distinguished by several features. The physical and chemical characteristics of the water suggest that these tributaries are clearer and less nutrient-enriched than the Cedar River. However, the only samples having 40% or more of the individual diatoms counted belonging to one species were at these stations (3A and 3C: *Diatoma vulgare*; 3B: *Nitzschia acicularis;* and *Stephanodiscus subtilis* at 10A and 10B). This situation at the Little Cedar station may be related to the probable presence of organic enrichment. Just above station 3, the Little Cedar flows through a pasture and cattle wade across the river which is less than 1 m deep at normal flow. Whether or not organic nutrient levels are high in the Shell Rock River near station 10 is not known. However, it might be interesting to monitor dissolved organic levels at all stations.

Previous research (Bradbury, 1973) suggests that *Cyclotella meneghiniana* occurs frequently in waters that are organically or

Table 1. *Benthic Diatom Sample Descriptions, Cedar River Basin, 11 October 1975.*

Sample Number	Location	Substrate	Number of Diatoms Counted	Number of Taxa Counted
13A	Cedar River Washington-Union Access	flocculent mass on bottom	516	28
13B	Cedar River Washington-Union Access	submerged roots	514	31
10A	Shell Rock River Bridge, Shell Rock, Iowa	*Cladophora* epiphytes	513	24
10B	Shell Rock River Bridge, Shell Rock, Iowa	silt on rocks	512	26
14A	Cedar River 3rd St. Bridge, Waverly	sediment crust on rocks	512	27
14B	Cedar River 3rd St. Bridge, Waverly	*Cladophora* epiphytes	513	32
14C	Cedar River 3rd St. Bridge, Waverly	deteriorating *Cladophora*	516	35
1A	Cedar River Cedar Bend Park	silt on rocks	516	44
1B	Cedar River Cedar Bend Park	sediment crust on rocks	522	38
1C	Cedar River Cedar Bend Park	bottom silt	516	43
2A	Cedar River Plainfield Bridge	bottom silt	507	35
2B	Cedar River Plainfield Bridge	submerged branch	511	37
3A	Little Cedar River NE Nashua	flocculent mass on bottom	519	35
3B	Little Cedar River NE Nashua	sediment crust	511	39
3C	Little Cedar River NE Nashua	*Oedogonium* epiphytes	516	39
3D	Little Cedar River NE Nashua	*Cladophora* epiphytes	515	42

Table 2. *The 31 most abundant benthic diatom taxa collected from the Cedar River Basin, 11 October 1975, and their abundance in each sample. See Table 1 for sample descriptions. Values given are the number counted in each sample. + means present but not included in count. See Appendix for full list of distributions of all taxa.*

Taxa	Samples																
	13A	13B	10A	10B	14A	14B	14C	1A	1B	1C	2A	2B	3A	3B	3C	3D	Total
Stephanodiscus subtilis	108	159	229	236	168	141	95	102	89	92	75	4	4	3	4	5	1514
Cyclotella meneghiniana	71	113	45	81	126	62	144	80	94	121	94	80	13	15	14	29	1182
Diatoma vulgare	0	0	83	0	0	8	17	2	+	2	1	+	237	8	273	33	664
Skeletonema potamos	4	22	2	0	73	29	28	81	16	105	111	67	4	17	0	0	557
Nitzschia acicularis	35	+	8	12	15	3	4	23	8	17	14	17	68	276	2	7	509
Nitzschia dissipata	11	46	9	6	10	45	39	6	50	2	4	46	20	4	39	64	401
Stephanodiscus tenuis	26	11	55	33	33	23	26	22	15	13	5	71	0	0	0	0	333
Cyclotella atomus	8	16	10	48	21	20	16	37	29	17	34	23	4	10	5	4	302
Cyclotella pseudostelligera	11	30	6	21	22	24	15	40	39	33	23	25	2	7	1	3	302
Nitzschia subcapitellata	87	13	7	13	5	3	3	21	12	7	36	11	34	32	5	3	292
Navicula viridula var. *rostellata*	43	10	0	0	1	1	2	10	5	9	21	4	17	39	15	21	198
Cocconeis pediculus	0	0	1	0	1	20	10	0	0	0	+	0	0	0	27	117	176
Navicula salinarum var. *intermedia*	14	16	14	13	5	7	8	9	15	5	9	7	7	5	+	3	137

Taxa	Samples 13A	13B	10A	10B	14A	14B	14C	1A	1B	1C	2A	2B	3A	3B	3C	3D	Total
Navicula crypto-cephala var. veneta	2	6	1	0	7	30	20	3	5	1	2	16	16	2	6	16	133
Cyclotella glomerata?	0	8	0	0	0	0	0	0	58	23	19	8	3	6	0	0	125
Rhoicosphenia curvata	0	1	3	0	0	18	16	1	+	+	0	+	1	+	31	33	104
Navicula rhynchocephala var. germainii	23	10	3	6	1	1	3	3	10	3	9	8	3	12	3	0	98
Nitzschia linearis	11	1	+	4	1	1	0	11	5	10	8	+	8	12	5	3	80
Nitzschia frustulum var. perpusilla	0	0	1	1	1	1	1	2	3	2	0	56	2	3	0	6	79
Navicula cryptocephala	3	3	0	0	2	4	4	5	0	5	3	0	16	7	4	5	60
Gomphonema tergestinum	0	0	0	0	0	0	9	0	0	0	0	0	0	0	2	43	54
Gomphonema sp. 12	0	0	0	+	0	1	37	15	0	0	0	0	0	0	0	0	53
Navicula seminulum var. intermedia	0	0	0	0	0	1	1	0	0	0	0	1	6	+	2	33	44
Navicula pupula	29	0	0	+	+	+	0	+	+	+	0	0	2	8	0	1	40
Navicula luzonensis	0	2	0	0	2	1	3	0	0	2	0	24	1	5	0	0	40
Gomphonema olivaceum	0	0	0	0	1	6	5	2	2	2	+	0	+	0	7	14	39
Melosira varians	0	+	0	0	0	+	1	0	0	0	0	0	25	3	6	4	39
Navicula symmetrica	1	6	+	0	1	3	1	+	15	1	1	6	1	1	0	1	37
Amphora perpusilla	0	1	0	1	1	1	1	3	2	2	1	2	3	3	4	9	34
Gomphonema parvulum	0	5	+	1	+	13	3	2	2	0	0	2	+	0	4	+	32
Navicula tripunctata	1	10	+	0	0	1	4	2	6	3	0	1	1	0	+	2	31

agriculturally enriched. It is also reported to be a late summer form. It will be interesting to see if it is as abundant in future samples as in this study. Lowe (1974) indicates that *Skeletonema potamos* is considered to be nearly as pollution tolerant as *C. meneghiniana*.

With the exception of the unidentified *Gomphonema* sp., the only diatoms represented by more than 30 individuals in this study but not previously reported from Iowa are *Gomphonema tergestinum* (Grun.) Fricke, *Skeletonema potamos*, *Stephanodiscus subtilis* and *S. tenuis* Hust. The last two taxa closely resemble *S. invisitatus* Hohn and Hellerman and *S. hantzschii* Grun., respectively, both of which have been reported from Iowa. *Skeletonema potamos* is a very small diatom (2-3μm diam.) of widespread occurrence and variable morphology (Hasle and Evensen, 1976). It is seen in girdle view and may be easily ignored or destroyed in preparation.

Other, less abundant, taxa not previously reported in Iowa, but included in the Appendix for this paper include *Coscinodiscus lacustris* Grun., *Gomphonema clevei* Fricke, *Melosira distans* (Ehr.) Kütz., *M. distans* var. *lirata* (Ehr.) Bethge, *Navicula protracta* forma *subcapitata* (Wisl. *et* Por.) Hust., *Nitzschia elegans* Hust., and *N. linkei* Hust. These are tentative designations based on examination of only a very few specimens and have not been confirmed.

Of the diatoms now reported from the Cedar River basin, all of those listed in Lowe (1974) are described as alkaliphilous or alkalibiontic. One of these designations should also apply to the rest of those found here considering the chemistry of these waters. A few of the taxa observed have been more often associated with plankton rather than periphyton. Lowe (1974) lists *Cyclotella glomerata*, *Nitzschia acicularis*, and *Skeletonema potamos* as planktonic and all *Stephanodiscus* species are so designated. *Nitzschia acicularis* was easily observed in living samples, characterized by healthy plastids and active motility. The centric taxa were less easily distinguished from one another in the living condition, but most centrics observed appeared healthy. *N. acicularis* has also been found in other benthic habitats in Iowa (Fee, 1967; Lowe, 1972; Edwards and Christensen, 1972). In previous Iowa studies *Cyclotella pseudostelligera* and *Navicula rhynchocephala* var. *germainii* (Wallace) Patr. have only been reported from plankton (Gudmundson, 1972). While seeding from the plankton is not ruled out, my evidence suggests many of these taxa previously described as plankton are functional members of the benthic communities sampled. In other words, they are physiologically active when in surface films as well as when suspended in water.

The areas of the Cedar River and its tributaries studied have alkaline waters of moderate inorganic nutrient levels and variable turbidity. The possibility of organic and agricultural enrichment exists. The benthic diatom flora is representative of that found in Iowa surface waters in other drainage basins. Most samples had large numbers of species but, very few species of high relative abundance. The observation of higher turbidity in the Cedar River than in its tributaries suggests one experimental approach to determining a cause, if any, for corresponding variations in abundances of certain species of *Cyclotella* and *Navicula*. The response of diatom distributions to point sources of organic and inorganic pollutants also requires closer examination. Some of this information could be provided by the continuation of this study.

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Appendix: *Diatom taxa observed or counted in samples from the Cedar River and some of its tributaries, 11 October 1975. Values given are percentages; + indicates present but not included in count; −1 signifies less than 1%.*

	Station 13		Station 10		Station 14			Station 1			Station 2		Station 3			
	A	B	A	B	A	B	C	A	B	C	A	B	A	B	C	D
Achnanthes:																
clevei Grun.										+	−1	+				
deflexa Reim.							+									
hauckiana var. *rostrata* Schulz								+			+					
hungarica (Grun.) Grun.				+												
lanceolata (Breb.) Grun.	−1	+		+		−1		−1	1	−1			+	−1	+	−1
lanceolata var. *dubia* Grun.										+	−1					
minutissima Kütz.	+						+	−1		−1	+				4	1
Amphora:																
perpusilla (Grun.) Grun.		−1		−1	−1	−1	−1	1	−1	−1	−1	−1	1	1	1	2
submontana Hust.									+			−1				
Caloneis ventricosa var. *minuta* (Grun.) Patr.														−1	−1	
Cocconeis:																
pediculus Ehr.			−1		−1	4	2				+				5	23
placentula Ehr.		−1	−1									−1				4
placentula var. *euglypta* (Ehr.) Cleve				−1				−1	+	−1	1	−1	−1	−1	2	1
Coscinodiscus lacustris Grun.			−1													
Cyclotella:																
atomus Hust.	2	3	2	9	4	4	3	7	6	4	7	5	1	2	1	1
glomerata Bachmann		2							11	4	4	2	1	1		
meneghiniana Kütz.	14	22	9	16	25	12	26	16	18	24	19	16	3	3	3	6
nana Hust.					1	−1	1									
pseudostelligera Hust.	2	6	1	4	4	5	3	8	7	6	4	5	−1	1	−1	1
Cymatopleura solea (Breb.) W. Smith	−1	−1		−1				1	−1	+	−1	+	−1	1		
Cymbella:																
microcephala Grun.								−1	1	+						
minuta var. *pseudogracilis* (Choln.) Reim.										−1						
minuta Hilse *ex* Rabh.			−1	−1								+				−1
sinuata Greg.													−1	+	−1	−1
tumida (Breb. *ex* Kütz.) V.H.		−1	−1									+	1		−1	1
Diatoma vulgare Bory			16			2	3	−1	+	−1	−1	+	46	2	53	6
Entomoneis ornata (J. W. Bailey) Reim.				+												
Eunotia sp.														−1		
Fragilaria:																
brevistriata Grun.			+													
construens (Ehr.) Grun.					+						−1					
construens var. *subsalina* Hust.												+				
construens var. *venter* (Ehr.) Grun.				−1						−1						
pinnata var. *lancettula* (Schum.) Hust.									−1							
Gomphonema:																
angustatum (Kütz.) Rabh.							1									1
clevei Fricke		+			1	1	1							−1	−1	−1
gracile Ehr. emend V. H.												+				
olivaceum (Lyngbye) Kütz.					−1	1	1	−1	−1	−1	+		+		1	3
parvulum (Kütz.) Grun.		1	+	−1	+	3	1	−1	−1			−1	+		1	+
tergestinum (Grun.) Fricke							2								−1	8
#10												1				
#12			+		−1	7	3									
#13		−1														

	Station															
	13		10		14			1			2		3			
	A	B	A	B	A	B	C	A	B	C	A	B	A	B	C	D
Gyrosigma spencerii (Quek.) Griff. and Henfr.	−1	−1			+	+	−1	1	1	1	1	+		+		
Melosira:																
distans (Ehr.) Kütz.									+	+						
distans var. *lirata* (Ehr.) Bethge											−1					
granulata (Ehr.) Ralfs		−1	1	1	+	−1		−1	1							
granulata var. *angustissima* Müll.			−1	1				−1	+		+					
varians Agardh		+				+	−1						5	1	1	1
Navicula:																
accomoda Hust.	−1															
arvensis Hust.				−1				−1	1			1				
citrus Krasske			+													
cryptocephala Kütz.	−1	−1			−1	1	1	1		1	1		3	1	1	1
cryptocephala var. *veneta* (Kütz.) Rabh.	−1	1	−1		1	6	4	1	1	−1	−1	3	3	−1	1	3
cuspidata (Kütz.)	+	+						−1	−1	−1				+		−1
decussis θstr.						+			−1	−1			1	1	1	1
heufleri Grun.	−1	1			−1			−1				−1				
heufleri var. *leptocephala* (Breb. ex Grun.) Patr.											1			−1	−1	
lanceolata (Agardh) Kütz.											−1					
luzonensis Hust.		−1			−1	−1	1			−1	+	5	−1	1		
menisculus var. *upsaliensis* (Grun.) Grun	+	+			+	−1	−1							−1	−1	−1
minima Grun.			1						1	−1	−1	−1	−1	1	−1	+
mutica Kütz.					−1			−1		−1	+	+			−1	
mutica var. *tropica* Hust.				−1				+								
notha Wallace									−1	+		+	+	+	−1	
pelliculosa (Breb. *ex* Kütz.) Hilse								−1				1				
protracta forma *subcapitata* (Wis. *et* Por.) Hust.												+				
pupula Kütz.	6			+	+	+		+	+	+			−1	2	−1	−1
pygmaea Kütz.			+									−1			−1	
radiosa var. *parva* Wallace		−1														−1
rhynchocephala Kütz.	−1		+	+				3	−1	−1	−1	−1				
rhynchocephala var. *germainii* (Wallace) Patr.	5	2	1	1	−1	−1	1	1	2	1	2	2	1	2	1	−1
salinarum var. *intermedia* (Grun.) Cleve	3	3	3	3	1	1	2	2	3	1	2	1	1	1	+	1
seminulum var. *intermedia* Hust.						−1	−1					−1	1	+	−1	6
symmetrica Patr.	−1	1	+		−1	1	−1	+	3	−1	−1	1	−1	−1		−1
tantula Hust.																−1
tenelloides Hust.									1				+			
tripunctata (O.F. Müll.) Bory	−1	2	+			−1	1	−1	1	1		−1	−1		+	−1
viridula (Kütz.) Kütz. emend V. H.	−1								+		1			+		
viridula var. *argunensis* Skv.										−1						
viridula var. *rostellata* (Kütz.) Cleve	8	2			−1	−1	−1	2	1	2	4	1	3	8	3	4
#7																−1
Neidium dubium (Ehr.) Cleve																−1
Nitzschia:																
acicularis (Kütz.) W. Sm.	7	+	2	2	3	1	1	4	2	3	3	3	13	54	−1	1
amphibia Grun.		−1	−1	1		−1		−1	−1			1		−1		
amphioxoides Hust.									−1							
apiculata (Greg.) Grun.	−1	+	+											−1		+
dissipata (Kütz.) Grun.	2	9	2	1	2	9	8	1	10	−1	1	9	4	1	8	12

	Station															
	13		10		14			1			2		3			
	A	B	A	B	A	B	C	A	B	C	A	B	A	B	C	D
elegans Hust.				+												
fonticola Grun.			+					−1	−1	1	1		−1		−1	−1
frustulum (Kütz.) Rabh.	1	−1	+	−1	+		+	+					1	1		
frustulum var. *perpusilla* (Rabh.) Grun.			−1	−1	−1	−1	−1	−1	1	−1		11	−1	1		1
hungarica Grun.		−1		+				−1	−1							
linkei Hust.										−1				−1		
linearis (Agardh) W. Smith	2	−1	+	1	−1	−1		2	1	2	2	+	2	2	1	1
palea (Kütz.) W. Smith			+	1	1		1			1		−1		−1	−1	
sigmoidea ? (Nitz.) W. Smith													−1			
subcapitellata Hust.	17	3	1	3	1	1	1	4	2	1	7	2	7	6	1	1
tryblionella var. ?			−1				+	+		+				+	−1	
#5	1				−1		−1	−1			−1	−1	+			
Opephora martyi Heribaud												−1				
Rhoicosphenia curvata (Kütz.) Grun. *ex* Rabh.		−1	1			4	3	−1	+	+		+	−1	+	6	6
Skeletomema potamos (Weber) Hasle	−1	4	−1		16	6	6	16	3	20	22	13	1	3		
Stauroneis anceps Ehr.										−1						
Stephanodiscus:																
astraea var. *minutula* (Kütz.) Grun.	−1	1	1	1	−1		−1					−1				
niagarae Ehr.				+												
subtilis (van Goor) A. Cl.	20	31	45	46	33	27	18	20	17	18	15	1	1	1	1	1
tenuis Hust.	5	2	11	6	6	4	5	4	3	3	1	14				
Surirella:																
angusta Kütz.						+		+		−1	−1					
ovata Kütz.			+				−1	−1		−1	−1	−1		+		
ovata var. *pinnata* (W. Sm.) Hust.											+	+		−1		
robusta var. *splendida* (Ehr.) V. H.								+			+					
Synedra:																
acus Kütz.	+	+	2				+	−1					1		−1	
amphicephala var. *austriaca* (Grun.) Hust.								−1			−1	1				
parasitica var. *subconstricta* (Grun.) Hust.									−1	−1						
socia Wallace			+					−1	+	−1						
ulna (Nitz.) Ehr.										−1						
ulna var. *contracta* θstr.												+				
Thalassiosira fluviatilis Hust.	−1		−1	1				−1	−1	1	−1			−1		
Total counted or observed	**34**	**41**	**42**	**36**	**36**	**38**	**42**	**53**	**49**	**54**	**46**	**53**	**41**	**48**	**42**	**45**

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