

**Seasonality of chrysophyte cyst and diatom assemblages in varved Lake Nautajärvi –
implications for palaeolimnological studies**

**Sanna T. KORKONEN,^{1*} Antti E.K. OJALA,² Emilia KOSONEN,³
Jan WECKSTRÖM¹**

¹Department of Environmental Sciences, University of Helsinki, Viikinkaari 1, 00014 Helsinki

²Geological Survey of Finland, Betonimiehenkuja 4, 02151 Espoo

³Department of Geosciences and Geography, University of Helsinki, Gustaf Hällströmin katu
2b, 00014 Helsinki, Finland

***Corresponding author:** sanna.korkonen@helsinki.fi

Supplementary Tab. 1. Seasonal influx (cysts cm⁻² d⁻¹) for the most common chrysophyte cysts as shown in Fig. 2.

Taxa	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
PEARL 50&52	454.8	832.1	146.8	0.5	242.5	374.8	212.5	0.5
PEARL1	313.3	277.4	88.1	0.5	80.8	507.1	129.3	0.5
PEARL161	0.0	151.3	17.6	0.0	0.0	859.9	83.1	0.5
PEARL113	10.1	554.7	88.1	0.0	0.0	198.4	175.5	0.0
PEARL9	20.2	277.4	82.2	0.5	71.9	220.5	175.5	0.0
PEARL178	131.4	100.9	5.9	0.5	224.6	176.4	46.2	0.5
PEARL94	171.8	353.0	5.9	0.0	9.0	0.0	9.2	0.5
SpineS	10.1	176.5	170.3	0.0	26.9	66.1	92.4	0.5
PEARL30	0.0	453.9	35.2	0.0	0.0	0.0	18.5	0.0
S310	161.7	0.0	5.9	0.5	251.5	0.0	0.0	0.0
PEARL259	0.0	252.2	5.9	0.0	0.0	110.2	27.7	0.0
PEARL34	80.9	176.5	5.9	0.0	9.0	66.1	0.0	0.0
PEARL239	40.4	176.5	17.6	2.3	26.9	22.0	46.2	0.5
PEARL89	20.2	50.4	17.6	0.9	0.0	66.1	157.0	1.0
PEARL5	0.0	50.4	0.0	0.0	0.0	198.4	46.2	0.5
CYST6	10.1	100.9	0.0	0.0	0.0	176.4	0.0	0.0
S161	0.0	277.4	0.0	0.0	0.0	0.0	0.0	0.0
ScabrM	40.4	25.2	0.0	0.0	53.9	110.2	46.2	0.0
CYST3	20.2	0.0	0.0	0.5	215.6	22.0	0.0	0.0
PEARL42	0.0	201.7	11.7	0.0	0.0	44.1	0.0	0.0
PEARL15	40.4	25.2	11.7	0.0	0.0	154.3	18.5	0.0
CYST5	0.0	0.0	17.6	0.0	9.0	220.5	0.0	0.0
ScabrS	10.1	50.4	29.4	0.0	0.0	66.1	73.9	0.0
PEARL57	30.3	0.0	0.0	0.0	35.9	154.3	0.0	0.0
Facher&Schmidt #23	131.4	0.0	17.6	0.0	0.0	66.1	0.0	0.0
CYST2	0.0	50.4	135.1	0.0	0.0	0.0	0.0	0.0
Facher&Schmidt #91	0.0	0.0	0.0	0.5	26.9	132.3	9.2	0.0
PEARL83	0.0	100.9	52.8	0.0	9.0	0.0	0.0	0.0
CYST3B	30.3	25.2	5.9	0.5	80.8	0.0	18.5	0.0
PEARL189	0.0	100.9	0.0	0.0	18.0	0.0	18.5	0.0
PEARL236	0.0	50.4	5.9	0.0	0.0	0.0	64.7	0.0
CYST4	10.1	0.0	0.0	0.0	89.8	0.0	0.0	0.0
PEARL343B	0.0	0.0	52.8	0.0	0.0	0.0	18.5	0.0

sp, spring; su, summer; au, autumn; wi, winter. Due to the low occurrence during winter only less than 20 cysts/winter sample were found and counted.

Supplementary Tab. 2. Seasonal influx values (valves cm⁻² d⁻¹) for diatoms.

Taxa code	Taxa name	Author	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
FSN061	<i>Tabellaria flocculosa</i>	(Roth) Kütz.	879	3606	164	12	153	1852	102	27
FSN014	<i>Aulacoseira subarctica</i>	NORD-CHILL	445	202	217	34	126	904	1072	47
AU005D	<i>Aulacoseira tenella</i>	(Nygaard) R. Ross in Hartley	323	25	605	11	117	706	887	23
AU004D	<i>Aulacoseira alpigena</i>	(Grun. in Van Heurck) Simonsen	20	504	129	3	117	463	46	7
CY004A	<i>Cyclotella stelligera</i>	(Cleve & Grun. in Cleve) Van Heurck	40	227	241	7	18	198	166	0
FR002C	<i>Staurosira construens</i> v. <i>venter</i>	(Ehren.) P.B.Hamilton	61	328	29	0	63	353	37	0
SS002A	<i>Staurosirella pinnata</i>	(Ehren.) D.M.Williams & Round	51	454	70	2	72	198	18	0
AU002A	<i>Aulacoseira ambigua</i>	(Grun. in Van Heurck) Simonsen	10	252	35	2	63	309	46	3
PS001A	<i>Pseudostaurosira brevistriata</i>	(Grun.) D.M.Williams & Round	121	252	53	2	45	66	46	0
GO013A	<i>Gomphonema parvulum</i>	(Kütz.) Kütz.	91	177	12	4	108	132	9	2
AU001C	<i>Aulacoseira valida</i>	(Grun. in Van Heurck) Simonsen	20	151	65	5	81	132	28	1
AU004A	<i>Aulacoseira lirata</i>	(Grun. in Van Heurck) R. Ross in Hartley	30	0	47	1	36	198	102	3
AC042A	<i>Psammothidium subatomoides</i>	(Hust.) Bukhtiyarova and Round	61	126	41	5	45	88	18	3
SF001A	<i>Fragilaria virescens</i> v. <i>exigua</i>	Grun.	91	177	29	3	27	0	55	1
FSN001	<i>Achnantheidium minutissimum</i>	(Kütz.)	30	101	29	3	63	88	9	1
AD009A	<i>Rossithidium linearis</i>	(W.Smith) Round & Bukhtiyarova	51	50	29	5	63	110	9	7
FU002F	<i>Frustulia rhomboides</i> v. <i>viridula</i>	(Breb. ex Kutz.) Cleve	61	50	29	10	72	44	9	0
CM048A	<i>Encyonema lunatum</i>	(W.Smith) Van Heurck	20	25	6	2	45	110	0	1
BR001A	<i>Brachysira vitrea</i>	(Grunow) R.Ross in Hartley. Ross & Williams	30	76	6	7	45	44	0	0

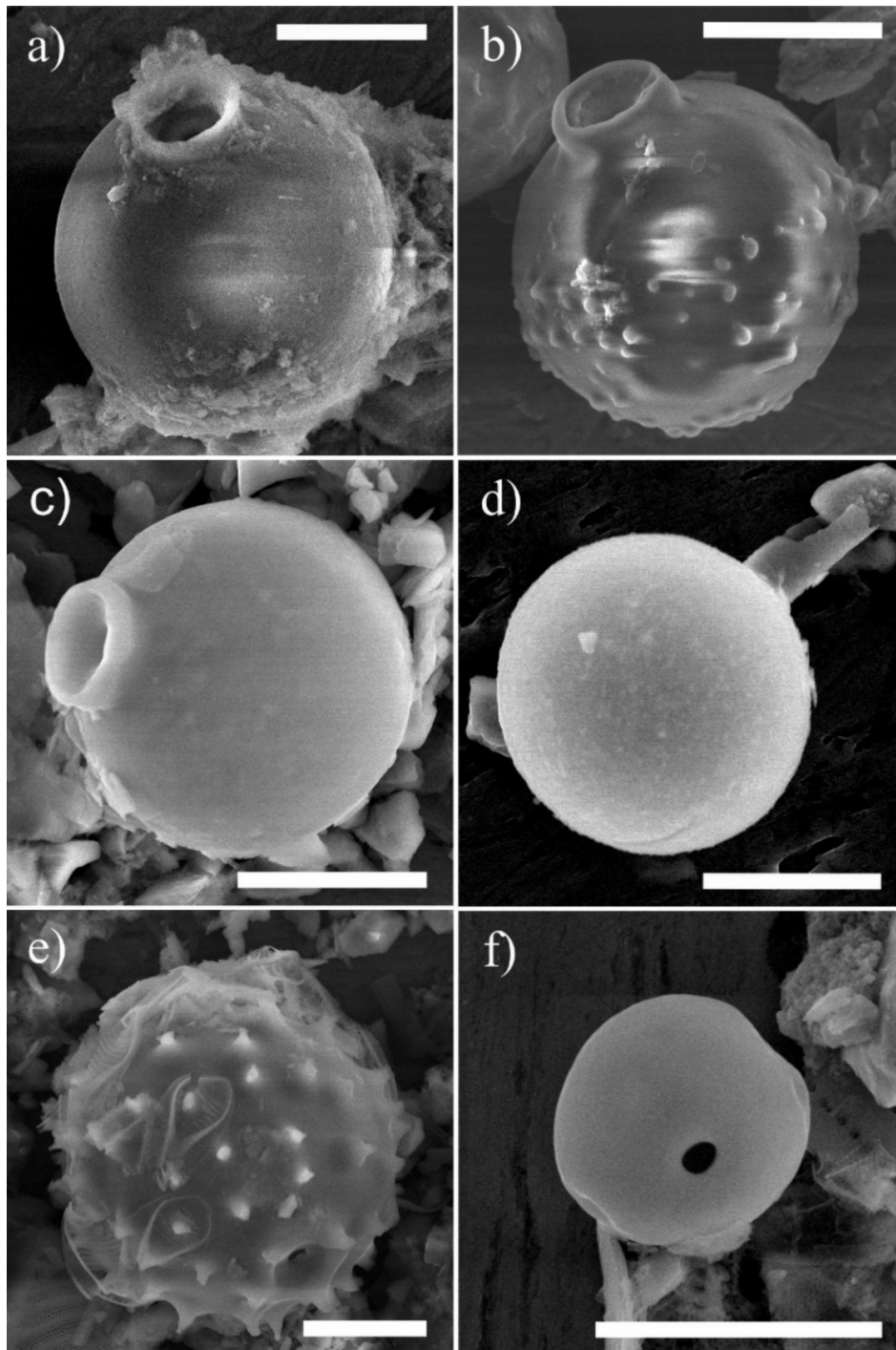
Taxa code	Taxa name	Author	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
PI022A	<i>Pinnularia subcapitata</i>	W.Gregory	61	76	0	0	63	0	0	0
AC014C	<i>Psammothidium helveticum</i>	(Hust.) Bukhtiyarova and Round	40	126	12	1	18	0	0	0
NA156A	<i>Navicula leptostriata</i>	Jørgensen	10	76	0	1	9	88	9	1
PI018A	<i>Pinnularia interrupta</i>	W.Smith	30	50	12	1	18	44	9	0
AC152A	<i>Achnanthes carissima</i>	Lange-Bertalot in Lange-Bertalot & Krammer	30	50	0	0	9	66	0	0
SL003A	<i>Navicula minima</i> v. <i>minima</i>	Grun.	0	101	6	0	18	0	0	0
NA112D	<i>Adlafia minuscula</i> v. <i>muralis</i>	(Grun.) Lange-Bertalot	10	50	18	0	0	44	0	0
EU002E	<i>Eunotia pectinalis</i> v. <i>minor</i> f. <i>impressa</i>	(Ehr.) Hust.	0	76	0	0	36	0	0	0
SL002A	<i>Sellaphora seminulum</i>	(Grun.) D.G.Mann	20	25	0	0	36	22	0	2
FF001A	<i>Fragilariforma virescens</i>	(Ralfs) D.M.Williams & Round	0	0	6	0	99	0	0	0
GO004A	<i>Gomphonema gracile</i>	Ehren.	20	25	0	0	36	22	0	1
MR001B	<i>Meridion circulare</i> v. <i>constrictum</i>	(Ralfs) Van Heurck	0	50	12	0	36	0	0	1
PI006A	<i>Pinnularia mesolepta</i>	(Ehren.) W.Smith	0	25	0	0	9	44	18	0
AS001A	<i>Asterionella formosa</i>	Hassall	30	0	0	0	0	44	18	0
EUZASU	<i>Eunotia zasuminensis</i>	(Cabejsz.) Körner	30	0	0	0	0	44	18	0
EU009A	<i>Eunotia exigua</i>	(Brébisson ex Kützing) Rabenhorst	30	25	0	1	36	0	0	0
AU004B	<i>Aulacoseira lacustris</i>	(Grun.) Krammer	40	0	23	0	27	0	0	0
CY052A	<i>Pantocsekiella rossii</i>	(H.Håkansson) K.T.Kiss & E.Ács	10	0	0	1	36	44	0	0
AC044A	<i>Psammothidium levanderi</i>	(Hust.) Bukhtiyarova & Round	0	25	6	0	18	22	18	0
FSN004	<i>Achnantheidium daonense</i>	(Lange-Bertalot) Lange-Bertalot, O.Monnier & L.Ector	0	25	0	0	45	0	18	0
FR009G	<i>Fragilaria capucina</i> subsp. <i>rumpens</i>	(Kützing) Lange-Bertalot	10	50	0	0	18	0	0	0

Taxa code	Taxa name	Author	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
FU002B	<i>Frustulia saxonica</i>	Rabenhorst	0	0	0	1	45	22	9	0
EU002D	<i>Eunotia pectinalis</i> v. <i>undulata</i>	(Ralfs) Rabenhorst	0	25	6	0	45	0	0	1
NA007A	<i>Navicula cryptocephala</i>	Kütz.	0	50	0	0	27	0	0	0
AC161A	<i>Achnanthes ventralis</i>	(Krasske) Lange-Bertalot	0	50	6	0	0	0	18	0
FSN047	<i>Sellaphora pupula</i>	(Kütz.) Mereschkovsky	40	25	6	1	0	0	0	1
SA001A	<i>Stauroneis anceps</i>	Ehren.	0	50	12	0	9	0	0	0
EU049A	<i>Eunotia bilunaris</i>	(Ehren.) Schaarschmidt	20	25	6	2	18	0	0	0
AU010B	<i>Aulacoseira perglabra</i> v. <i>florinae</i>	(Camburn) E.Y.Haworth	10	50	0	0	0	0	0	0
NA006A	<i>Chamaepinnularia</i> <i>mediocris</i>	(Krasske) Lange-Bertalot & Krammer	0	50	6	0	0	0	0	0
PI015C	<i>Pinnularia abaujensis</i> v. <i>linearis</i>	(Hust.) R.M.Patrick	0	0	0	0	45	0	9	0
PS002A	<i>Staurosira</i> <i>pseudoconstruens</i>	(Marciniak) Lange-Bertalot in Krammer & Lange-Bertalot	0	0	0	0	9	44	0	0
NA738A	<i>Nupela vitiosa</i>	(Schimanski) P.Siver & P.B.Hamilton	0	0	12	0	9	22	9	0
CV002A	<i>Cavinula jaernefeltii</i>	D.G.Mann & A.J.Stickle	20	0	0	0	0	22	9	0
AC035A	<i>Rossithidium pusillum</i>	(Grun.) Round & Bukhtiyarova	40	0	6	0	0	0	0	0
NA003A	<i>Navicula radiosa</i>	Kütz.	10	25	6	0	0	0	0	0
FSN058	<i>Pinnularia nodosa</i>	(Ehren.) W.Smith	0	25	6	0	0	0	9	0
PI007A	<i>Pinnularia viridis</i>	(Nitzsch) Ehren.	0	0	0	0	18	22	0	0
FSN007	<i>Nupela impexiformis</i>	(Lange-Bertalot) Lange- Bertalot	10	25	0	1	0	0	0	0
AC001A	<i>Planothidium lanceolatum</i>	(Brébisson ex Kützing) Lange-Bertalot	0	25	0	0	9	0	0	1
PI015A	<i>Pinnularia abaujensis</i>	(Pantocsek) R.Ross	0	0	0	0	36	0	0	0
AC034A	<i>Karayevia suchlandtii</i>	(Hust.) Bukhtiyarova	0	25	0	0	9	0	0	0
NA005B	<i>Navicula seminulum</i> v. <i>intermedia</i>	Hust.	0	25	0	0	9	0	0	0
AC046A	<i>Psammothidium altaicum</i>	(Poretzky) Bukhtiyarova	0	0	0	0	0	22	9	0

Taxa code	Taxa name	Author	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
EU016A	<i>Eunotia diodon</i>	Ehren.	20	0	0	0	9	0	0	0
FSN057	<i>Pinnularia microstauron</i>	(Ehren.) Cleve	0	25	0	0	0	0	0	0
EY006A	<i>Encyonema elginense</i>	(Krammer) D.G.Mann	0	25	0	0	0	0	0	0
CM020A	<i>Encyonema gaeumannii</i>	Meister	0	25	0	0	0	0	0	0
EU054A	<i>Eunotia hexaglyphis</i>	Ehren.	0	25	0	0	0	0	0	0
EU053A	<i>Eunotia quaternaria</i>	Ehren.	0	25	0	0	0	0	0	0
FR007A	<i>Fragilaria vaucheriae</i>	(Kütz.) J.B.Petersen	0	25	0	0	0	0	0	0
FSN246	<i>Placoneis abiskoensis</i>	(Hust.) Lange-Bertalot & Metzeltin	0	0	23	0	0	0	0	0
EU051A	<i>Eunotia vanheurckii</i>	R.M.Patrick	0	0	0	0	0	22	0	0
FU001B	<i>Frustulia vulgaris</i>	(Thwaites) De Toni	0	0	0	0	0	22	0	0
CM009A	<i>Cymbopleura naviculiformis</i>	(Auerswald ex Heiberg) Krammer	10	0	0	0	9	0	0	0
NA048A	<i>Chamaepinnularia soehrensii</i>	(Krasske) Lange-Bertalot & Krammer	0	0	0	1	18	0	0	0
FR002B	<i>Staurosira construens</i> v. <i>binodis</i>	(Ehren.) P.B.Hamilton	0	0	0	0	0	0	18	0
AU005L	<i>Aulacoseira humilis</i>	(Cleve-Euler) Genkal & Trifonova in Trifonova & Genkal	0	0	0	0	18	0	0	0
EU017A	<i>Eunotia flexuosa</i> v. <i>flexuosa</i>	Kütz.	0	0	0	0	18	0	0	0
EU047A	<i>Eunotia incisa</i>	W.Smith ex W.Gregory	0	0	0	0	18	0	0	0
GO006A	<i>Gomphonema acuminatum</i>	Ehren.	0	0	0	0	18	0	0	0
TE001A	<i>Tetracyclus lacustris</i>	Ralfs	10	0	6	0	0	0	0	0
EU020A	<i>Eunotia meisteri</i>	Hust.	0	0	6	0	0	0	9	0
GO006C	<i>Gomphonema coronatum</i>	Ehren.	10	0	0	0	0	0	0	0
AC082A	<i>Achnanthydium kriegeri</i>	(Krasske) Hamilton. D.Antonini & Siver	10	0	0	0	0	0	0	0
AC022A	<i>Psammothidium marginulatum</i>	(Grun.) Bukhtiyarova & Round	10	0	0	0	0	0	0	0
PE002A	<i>Peronia fibula</i>	(Brébisson ex Kützing) R.Ross	10	0	0	0	0	0	0	0

Taxa code	Taxa name	Author	sp 09	su 09	au 09	wi 09	sp 10	su 10	au 10	wi 10
PI012A	<i>Pinnularia borealis</i>	Ehren.	10	0	0	0	0	0	0	0
DA007A	<i>Navicula perpusilla</i>	Grun.	0	0	0	0	9	0	0	0
PI170A	<i>Pinnularia braunii</i>	Cleve	0	0	0	0	9	0	0	0
AC039A	<i>Achnanthes didyma</i>	Hust.	0	0	0	0	9	0	0	0
AC001R	<i>Planothidium frequentissimum</i>	(Lange-Bertalot in Krammer and Lange-Bertalot) Lange-Bertalot	0	0	0	0	9	0	0	0
CM052A	<i>Encyonopsis descripta</i>	(Hust.) Krammer	0	0	0	0	9	0	0	0
FSN369	<i>Diatoma anceps</i>	(Ehren.) Kirchner	0	0	0	0	9	0	0	0
DP010A	<i>Diploneis finnica</i>	(Ehren.) Cleve	0	0	0	0	9	0	0	0
NA008A	<i>Navicula rhynchocephala</i>	(Kütz.)	0	0	0	0	9	0	0	0
NE003B	<i>Neidium affine v. longiceps</i>	(W.Gregory) Cleve	0	0	0	0	9	0	0	0
SA012A	<i>Stauroneis kriegeri</i>	R.M.Patrick	0	0	0	0	9	0	0	0
SY009A	<i>Synedra nana</i>	F.Meister	0	0	0	0	9	0	0	0
CV004A	<i>Cavinula pseudoscutiformis</i>	(Hust.) Mann and Stickle in Round. Crawford and Mann	0	0	6	0	0	0	0	0

sp, spring; su, summer; au, autumn; wi, winter.



Supplementary Fig. 1. Possibly new chrysophyte cyst morphotypes found in Lake Nautajärvi sediment trap samples 2009-2010. These will be described according to the guidelines of the International Statospore Working Group (Cronberg & Sandgren 1986) in the near future. a) CYST2; b) CYST3; c) CYST3B; d) CYST4; e) CYST5; f) CYST6. Scale bars: 5 μm .