SMHI

AlgAware

Oceanographic Unit
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ALGAL SITUATION IN
MARINE WATERS SURROUNDING SWEDEN

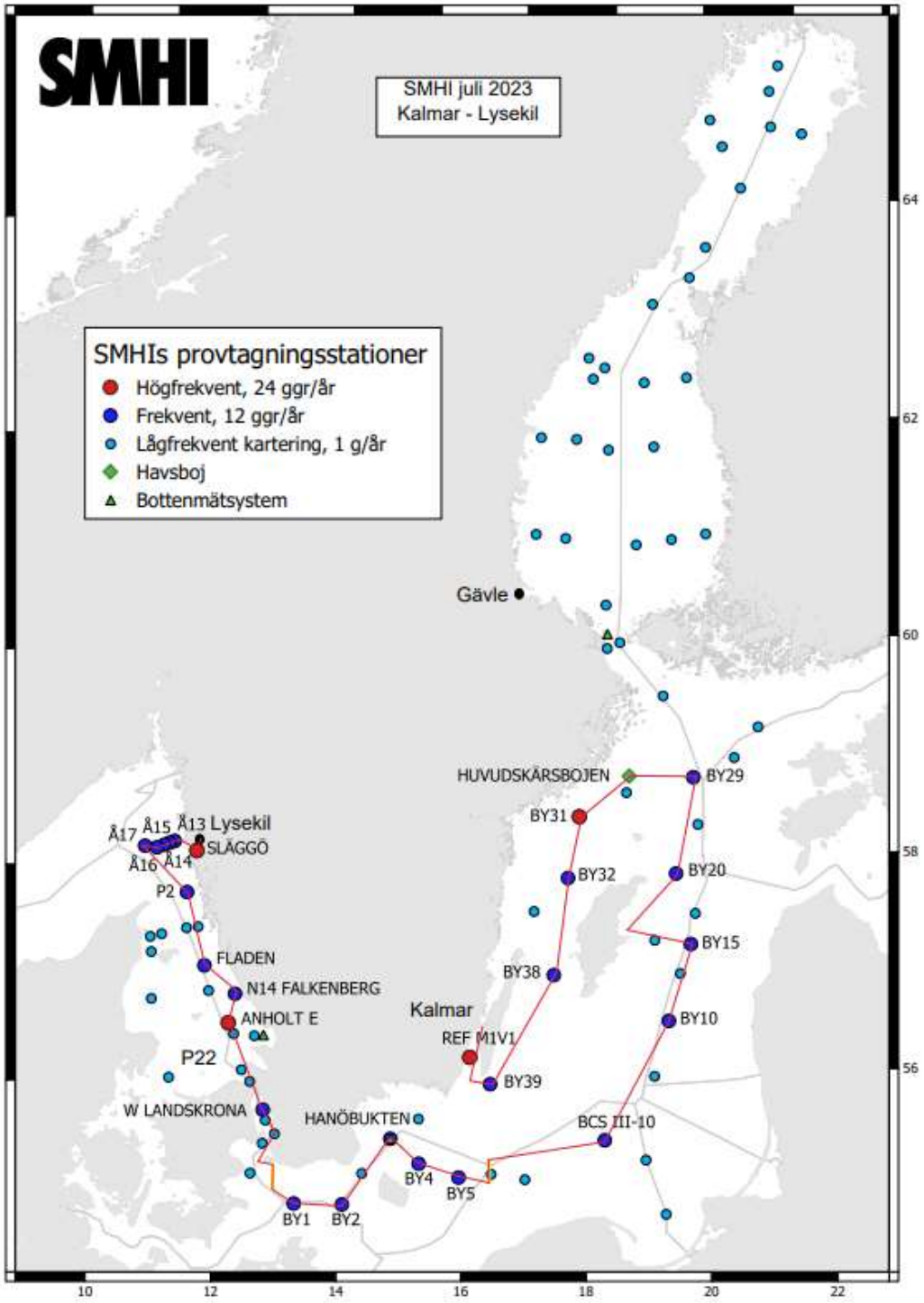

Fig 1. Sampling route of R/V Svea July 2023

Sammanfattning

Analyserna utfördes ombord på fartyget R/V Svea under expeditionens gång. Vatten från integrerade djup alternativt diskreta djup har filtrerats ner på 5µm filter och analyserats med ett rättvänt mikroskop. Metoden innebär framför allt att större celler kan identifieras medans små celler blir svårbestämda och förbises i större utsträckning.

Artdiversiteten var allmänt låg i både Skagerrak och Kattegatt. De större cellerna dominerades av dinoflagellatssläktet *Tripos* tillsammans med *Proboscia alata* vid de flesta stationer. De mindre cellerna var framför allt dominerade av *Emiliania huxleyi* som var talrik vid samtliga stationer. Värt att nämna är att vid Anholt E i Kattegatt påträffades även det centriska kiselalgssläktet *Cyclotella* i större antal. Klorofyllfluorescens maxima noterades vid olika djup och i olika intensitet vid de flesta stationer i Västerhavet. I Kattegatt bestod dessa av släktet *Tripos*. I Skagerrak återfanns även är *Tripos* men även släktet *Pseudo-nitzschia* vid den yttersta stationen. Närmare kusten blev även kiselalgen *Proboscia alata* vanlig i dessa maxima.

Inga tydliga ytansamlingar av cyanobakterier observerades i Östersjön denna expedition. Mycket på grund av vind och vågor som blandade om vattnet. Flertalet stationer hade liknande koncentration av filament i både i ytprover och integrerade prover (0-10 m) vilket indikerar att filamenten var utspridda i översta vattenpelaren. Frånvaron av ytansamlingar var på grund av vindstyrkan men om vinden minskar finns det potential för ytansamlingar i större delen av egentliga Östersjön.

Expeditionen startade denna gång i Kalmar och proverna från västra Östersjön innehöll en hel del cyanobakteriefilament som antagligen var nedblandade en bit i vattenpelaren på grund av vinden. Antal filament ökade successivt norrut vid passage mellan Öland och Gotland och små aggregeringar i form av korn noterades särskilt i den nordvästra delen. I den östra delen av Östersjön, utefter Gotlands östsida, minskade antal filament successivt söderut. I sydöstra Östersjön, nära Polen, återfanns lite mindre antal filament i ytvattnet. Övriga prover tagna I södra östersjön innehöll fler filament vilket sammanföll väl med satellitanalyserna från BAWS (Baltic algal watch system) men inga ytansamlingar noterades.

Abstract

The analyses were made onboard the ship R/V Svea during the cruise. Water from integrated samples or discrete depths were filtrated down to filters with 5µm pore size. The method is more suitable for identifying larger and more robust cells whereas smaller cells or fragile cells are difficult to determine taxonomically and missed to a higher degree.

The diversity was overall low to moderate at most stations along the Swedish west coast. The larger cells were represented by the dinoflagellate genus *Tripos* together with *Proboscia alata* at some stations. The smaller cells were represented by the coccolithophore *Emiliania huxleyi*. Worth mentioning is that at Anholt E, in Kattegat, the small centric diatom genus *Cyclotella* was also found in high cell numbers. Fluorescens maxima at different depths and of different intensity was found at most stations. In Kattegat Tripos dominated in the maxima. In Skagerrak. at the most remote station, it was a mixture of the genus *Tripos* but also the genus *Pseudo-nitzschia*. Closer to the coast both the *Tripos* spp. and *Proboscia alata* was represented in the maxima.

No clear surface accumulations of cyanobacteria were found in the Baltic Sea during this expedition. This was most likely due to relatively high wind speed and waves that mixed the water. Many stations had the same amount of filaments in surface samples compared to the integrated (0-10 m) sample indicating that the filaments were dispersed a bit in the water column. The absence of surface aggregations was due to the wind and as soon as the wind decreases there is potential for surface accumulations in almost all parts of the Baltic Proper.

The cruise initiated in Kalmar and samples from the western part contained many filaments but most likely they were dispersed into the water due to the wind. The amount of filaments increased going northward, between Öland and Gotland, and some grains could be seen especially in the north western part. At the eastern part alongside the east coast of Gotland the amounts of filaments decreased going southward. At the south eastern part, close to Poland, only moderate amounts of filaments appeared in the surface sample. The surface samples taken in the southern part contained more filaments which corresponded well with satellite analyses BAWS (Baltic algal watch system) but no surface aggregations were seen.

För att se satellittolkningar av ytansamlingar av cyanobakterier:

https://www.smhi.se/vader/observationer/algsituationen

Please follow the link below to see interpretations of blooms from satellite images in the Baltic:

https://www.smhi.se/vader/observationer/algsituationen

The Skagerrak

Släggö (Skagerrak coast) 16th of July

The integrated sample (0-10m) contained low total cell numbers. Small cells dominated the sample. A few large cells were found belonging to the dinoflagellate genus *Tripos* and also some cells of the diatom *Proboscia alata*. The smaller cells were clearly dominated by the coccolithophore *Emiliania huxleyi*..

Å17 (open Sea) 16th of July

The integrated sample (0-10m) at Å17 contained low total cell abundance and moderate biodiversity. Among the larger cells the diatom *Proboscia alata* dominated in cell numbers but the dinoflagellate genus *Tripos* was also common. The smaller cells were represented by the coccolithophore *Emilinia huxleyi* and small naked dinoflagellates. A very thin but intense fluorescence maximum was found at 30 meters mainly containing the genus *Tripos* and *Pseudo-nitzschia*.

*Fig 2. The potential toxic diatom genus Pseudo-nitzschia was one of the main taxa in the fluorescence peak at Å17.*Photo: M. Johansen.

The Kattegat

Anholt E 15th of July

The biodiversity was moderate but the total cell numbers was relatively low. The sample was dominated by small cells. The larger cells were different species of the genus *Tripos* where *T. muelleri* was found in highest cell numbers. Some medium sized cells of diatom were also recorded such as *Guinardia delicatula, Skeletonema marinoi* and different species belonging to the genus *Chaetoceros.* Among the smallest cells the coccolithophorid *Emiliania huxleyi* and the diatom genus *Cyclotella* was found in highest amount.

A thin but prominent fluorescens maximum was seen at 25 meters and contained lots of cells belonging to the dinoflagellate genus *Tripos* where *T. longipes* dominated in numbers.

N14 Falkenberg 15th of July

The biodiversity and the total cell numbers were relatively low. The sample was dominated by small cells. The larger cells were mainly different species of the genus *Tripos* where *T. muelleri* and *T. longipes* was found in highest amount. Among the smallest cells the coccolithophorid *Emiliania huxleyi* was found in highest amount.

A fluorescens maximum was detected between 20-30 meters and contained lots of cells belonging to the dinoflagellate genus Tripos where *T. longipes*, *T. fusus* and *T. muelleri* dominated in numbers.

Small and narrow fluorescens maximum was found around 20-30 meters at both Fladen and P2 on both occasions the dinoflagellate genus *Tripos* dominated clearly. Several species were found but *T. fusus* was most common.

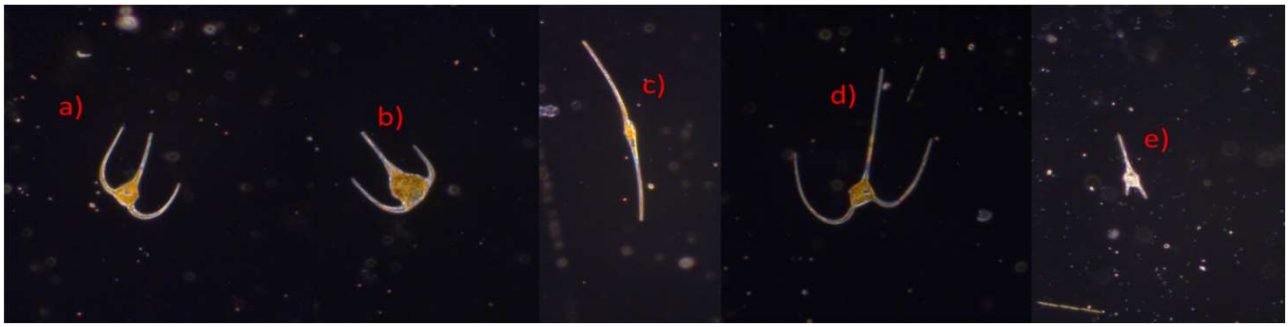

Fig 3. The dinoflagellate genus Tripos dominated in the deeper chlorophyll maximum at most of the stations along the Swedish west coast. From left to right a) T. longipes b) T. muelleri c) T. fusus d) T. macroceros e) T. lineatus Photo: M. Johansen.

The Baltic Sea

Kalmar sound south 11th of July

A sample was collected at surface even if no aggregates were visible. Only a few filaments of the potentially toxic species *Nodularia spumigena** was observed

BY 39 Öland south 11th of July

Some small streaks were noted at surface but not clear at all. The sun was low which might have made the visibility poor. A surface sample was collected with a bucket and quite many filaments of both the genus *Dolichospermum* and *Nodularia spumigena** were observed but no filaments of *Aphanizomenon flosaquae* were found. The integrated sample (0-10 m) mainly contained filamentous cyanobacteria. The diatoms were represented by small cells of *Chaetoceros*, *Cyclotella* and *Skeletonema marinoi*. some colony forming cyanobacteria and the genus *Dinobryon* were also present in higher amounts. The amount of filamentous cyanobacteria at surface and in the integrated sample suggests that most of the filaments were at surface.

BY 38 Karlsö Deep 12th of July

The surface sample contained quite many filaments of *Nodularia spumigena** and *Aphanizomenon flosaquae* but only a few filaments of the genus *Dolichospermum*. The sample was collected at night so aggregations at surface was not possible to see. The hose sample (0-10 m) contained less filaments than the surface sample suggesting that most of the filaments were at the surface. The hose sample contained some cyanobacteria filaments, some *Ebria tripartita* and small round cells that could not be determined to any taxonomic entity.

BY 32 Norrköping Deep 12th of July

Small aggregates were noted in the water. The wind stress was probably enough to circulate them in the first meter. If the wind stress decreases the aggregates will most likely form surface accumulations. The surface sample contained a lot of *Nodularia spumigena** and *Aphanizomenon flosaquae* but only a few filaments of the genus *Dolichospermum.* The integrated sample (0-10m) was quite diverse and cell numbers were moderate. Several cells of the potentially toxic species *Dinophysis norvegica** were noted together with different colony forming cyanobakteria. Several cells of different naked dinoflagellates were also found. The hose sample (0-10 m) contained less filaments than the surface sample suggesting that most of the filaments were close to the surface.

Fig 4. The three groups of filamentous cyanobacteria found in the Baltic Sea a) Nodularia spumigena, b) Dolichospermum and c) Aphanizomenon flosaquae

BY31 Landsort Deep 12th of July

No visible aggregations at surface were seen most probably due to the wind stress and waves. The surface sample contained mostly *Aphanizomenon flosaquae* and *Dolichospermum* in relative high amount but some *Nodularia spumigena** filaments was also present but less common. The integrated sample (0-10 m) was dominated by filamentous cyanobacteria and *Ebria tripartita*. Several smaller roundish cells were also found and by help from Helena Höglander determined to be *Colacium vesiculosum*. The hose sample (0-10 m) and the surface sample contained equal amounts of filaments than suggesting that the filaments were equally distributed in the first 10 meters of the water column.

Huvudskär buoy 12th of July

A surface sample was collected and it consisted of almost equal amounts of filaments of all three groups that is, *Aphanizomenon flosaquae*, *Dolichospermum* and *Nodularia spumigena**. The total amount of filaments was relatively high and the highest so far on the cruise. The CTD cast indicated that the filaments could be dispersed in the first 20 meters.

BY29 12st of July

The surface sample was collected at night and accumulations or aggregates of cyanobacteria were not possible to see. The surface sample contained equal amounts of filaments of all three groups that is, *Aphanizomenon flosaquae*, *Dolichospermum* and *Nodularia spumigena**. The total amount of filaments was less compared to Huvudskär Buoy. The integrated sample (0.10 m) had a large amount of filamentous cyanobacteria in equal amounts as the surface sample suggesting that the filaments were dispersed in the water column. Besides this there were quite few cells belonging to the genus *Dinophysis* and also quite many colonies of the cyanobacteria *Aphanothece parallelliformis*.

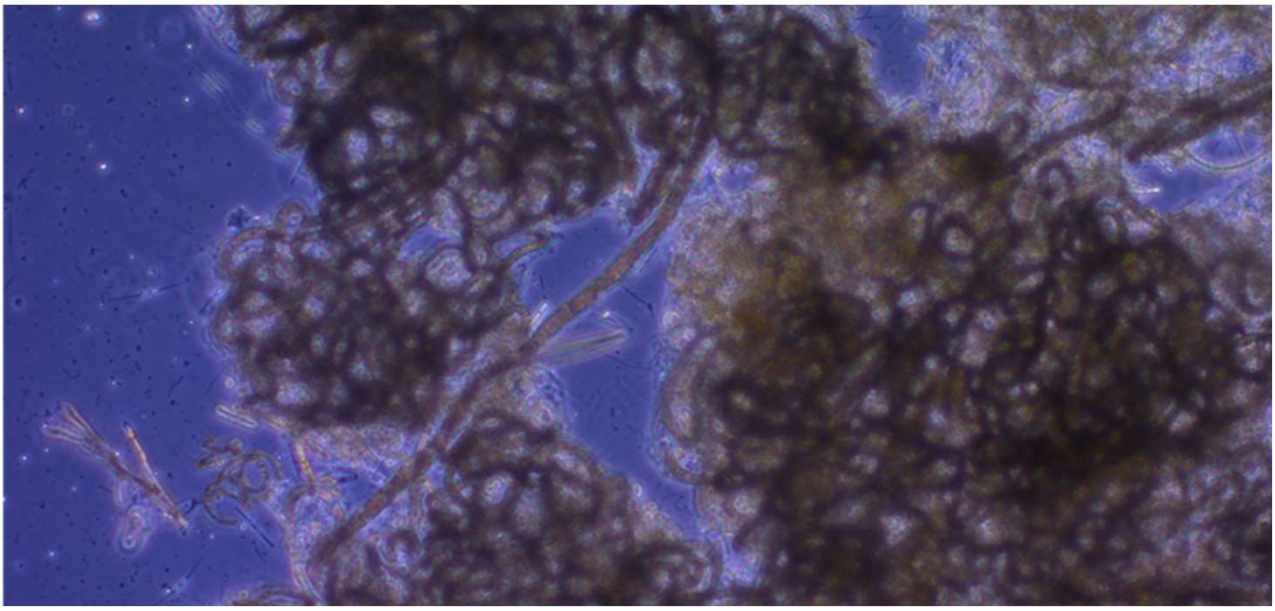

Fig 5. The three groups of filamentous cyanobacteria found in the Baltic Sea a) Nodularia spumigena, b) Dolichospermum and c) Aphanizomenon flosaquae

BY 20 Fårö Deep 13th of July

The windstress created waves and no aggregations could be seen from the boat. The surface sample collected contained less filaments than at BY 29 and only *Aphanizomenon flosaquae*, and *Nodularia spumigena** were present in the sample. The integrated sample (0-10 m) was dominated by both filamentous and colony forming cyanobacteria, cryptomonadales and *Colacium vesiculosum*. The surface sample and the integrated sample contained equal amounts of filaments indicating that the filaments were equally distributed at least in the first 10 meters of the waters column.

Östergarnsholm 13th of July

The wind stress was less prominent at this station located closer to the east of Gotland but even so no grains or accumulations were visible. The collected surface sample hade although quite a few filaments of *Aphanizomenon flosaquae* and *Nodularia spumigena**.

BY15 Gotlands Deep 13st of July

No surface accumulations were seen at the station due to wind stress. The surface contained many filaments of *Aphanizomenon flosaquae* and *Nodularoa spumigena**. The CTD plot showed a homogenous chlorophyll column to about 7 meters which indicates that the filaments were mixed down. The hose sample (0-10 meters) had a dominance of *Aphanizomenon flosaquae*, *Nodularia spumigena** and several colony forming cyanobacteria. Among the colony forming cyanobacteria *Aphanothese paralelliformis* was most common.

BY10 13th of July

The station was sampled at night and eventual surface accumulations could thereby not be recorded. The concentration of filaments in the sample collected at the surface

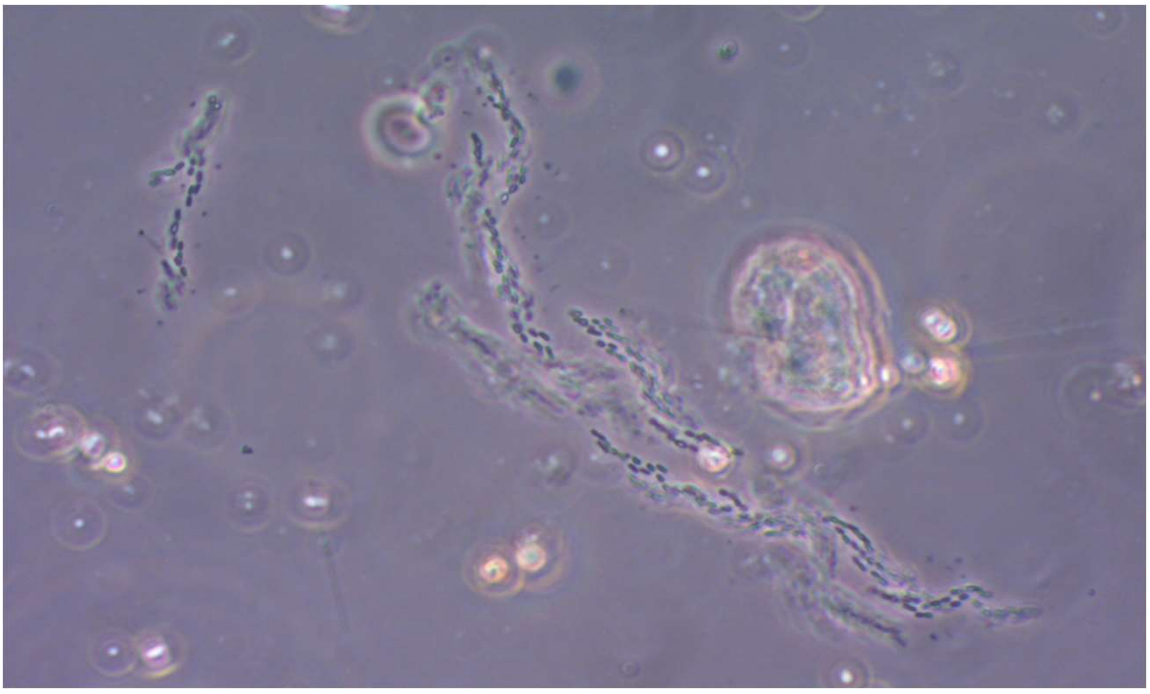

Fig 6. The colonyforming cyanobacteria Aphanothese paralelliformis among others was common in the eastern part of the Baltic Proper

BCS III-10 14th of July

The wind stress was relatively high and no surface accumulations could be seen from the boat. The surface sample contained both *Nodularia spumigena** and *Aphanizomenon flosaquae* in equal and moderate amounts of filaments. The first 20 meters of the water column was mixed so the filaments were probably dispersed in the water column. The integrated sample (0-10 m) also contained moderate filaments of cyanobacteria supporting that the filaments were dispersed in the water. Many small colonies of colony forming cyanobacteria and some chains of the diatom *Chaetoceros castracanai* was found.

BY5 Bornholms Deep 14th of July

The wind was moderate and no surface accumulations were visible but a lot of small grains dispersed in the water column could clearly be seen. The amount of grains was the highest so far on this cruise. The surface sample contained plenty of filaments of both *Nodularia spumigena** and *Aphanizomenon flosaquae* and the grains contained many long filaments of *N. spumigena** bundled up like a ball of yarn. The integrated sample (0-10 m) contained quite low total cell numbers and the biodiversity was rather low. The lesser amount of cyanobacteria filaments in the integrated sample compared to surface sample suggests that the filaments were concentrated to the first meters of the water column. The diatom *Chaetoceros danicus* and *C. castracanai* were found in higher amounts so also *Ebria tripartita*.

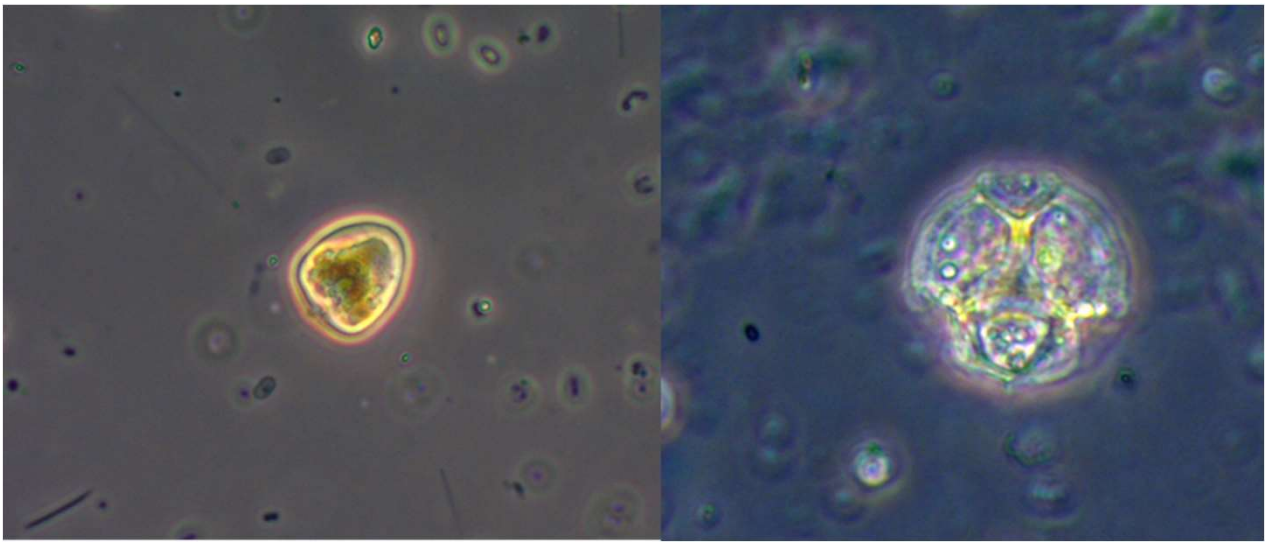

Fig 7. The dinoflagellate Prorocentrum cordatum (left), a quite small cell, was common in the south western part of the Baltic Proper. Ebria tripartita (right) was common at several stations in the Baltic Proper.

BY4 Christiansö 14th of July

No surface aggregations could be seen. A sample was collected with a bucket at dusk and quite a few filaments of cyanobacteria were found, mainly *Aphanizomenon flosaquae* was present. The integrated sample contained, besides filaments of cyanobacteria, the diatoms *Chaetoceros danicus* and *C*. castracanai. The dinoflagellate *Prorocentrum cordatum* and also *Ebria tripartita* was common.

Bay of Hanö 14th of July

The station was sampled at night. The surface sample contained only a few cyanobacteria filaments dominated by *Aphanizomenon flosaquae* and only a couple of *Nodularia spumigena** filaments.

BY2 Arkona Deep 15th of July

The station was sampled at night. The surface sample contained moderate amounts of *Nodularia spumigena** and *Aphanizomenon flosaquae.* The integrated sample (0-10m) had moderate biodiversity and total cell numbers. The larger cells were represented by filamentous cyanobacteria and the dinoflagellate *Tripos muelleri* Among the smaller cells the dinoflagellate *Prorocentrum cordatum* and the diatom *Cyclotella chocthawhatcheeana* were found in higher cell numbers.

BY1 15th of July

No surface accumulations were seen. The surface sample contained moderate amounts of *Nodularia spumigena** and *Aphanizomenon flosaquae.*

W Landskrona 15th of July

Surface samples were collected. No surface accumulations of cyanobacteria were noted. The CTD presented increasing fluorescence and salinity going down in the water column. A sample was therefor analysed from 40 meters and it contained almost exclusively the diatom *Guinardia flaccida* most likely brought in via currents from Kattegat.

Phytoplankton analysis and text:
Marie Johansen

Selection of observed species	Anholt E	N14 Falkenberg	Släggö	Å17
Red=potentially toxic species	15/7	15/7	16/7	16/7
Hose 0-10 m	presence	presence	presence	presence
Centrales	present			
Cerataulina pelagica			common	common
Chaetoceros			present	present
Chaetoceros affinis	present		present	
Chaetoceros similis				present
Chaetoceros socialis			present	present
Chaetoceros subtilis	present	present		
Chaetoceros throndsenii	present			
Cyclotella	common			
Cyclotella choctawhatcheeana	present			
Cylindrotheca closterium		present		present
Guinardia delicatula	common			
Leptocylindrus danicus			present	
Leptocylindrus minimus				present
Nitzschia longissima	present			present
Proboscia alata			present	common
Skeletonema marinoi	present			present
cf. Azadinium	present		present	
Dinophysis norvegica		present		
Dinophysis tripos			present	
Diplopsalis CPX		present		
Gymnodiniales		present	common	common
Heterocapsa rotundata			present	
Peridiniales				present
Phalacroma rotundatum	present	present		
Prorocentrum cordatum	present	present		
Prorocentrum micans	present			
Protoperidinium claudicans		present		
Protoperidinium divergens			present	
Protoperidinium pellucidum	present	present		
Scrippsiella GRP				common
Tripos furca	present	present		
Tripos fusus	present	present	present	present
Tripos lineatus			present	
Tripos longipes	present	common		common
Tripos muelleri	common	common	present	common
Dinobryon balticum	present			
Dinobryon faculiferum		present	present	present
Cryptomonadales	present	present		present
Emiliania huxleyi	very common	common	very common	common
Prymnesiales		present		
Octactis speculum			present	

Selection of observed species	BCS III-10	BY2	BY5	BY15	BY20	BY31	BY32	BY38
Red=potentially toxic species	14/7	15/7	14/7	13/7	13/7	12/7	12/7	12/7
Hose 0-10 m	presence	presence	presence		presence	presence	presence	presence
Actinocyclus	present	present	present	present				
Chaetoceros castracanei	common	present	common					
Chaetoceros danicus	present	common	common	present	present		present	common
Chaetoceros subtilis						present		present
Chaetoceros throndsenii		present						
Cyclotella			present			present		
Cyclotella choctawhatcheeana	present	common	present					
Cylindrotheca closterium		present	present					
Dinophysis acuminata				present	present		present	
Dinophysis norvegica	present			present	present		common	
Diplopsalis CPX					present		present	
Gymnodiniales		present	present	present	common	present	common	present
Phalacroma rotundatum						present	present	
Prorocentrum cordatum		common	present					
Tripos muelleri		common						
Dinobryon							present	
Dinobryon faculiferum								present
Cryptomonadales	present	present	common		common	present	present	
Colacium vesiculosum			present		present	common		
Eutreptiella gymnastica							present	
Oocystis		present	present		present	present	present	
Binuclearia lauterbornii				present				present
Aphanizomenon flosaquae	common	common	common	common	present	common	common	common
Aphanocapsa	present		present	common	common		present	present
Aphanothece	common			present			present	
Aphanothece paralleliformis	present			common	common		present	
Dolichospermum	present					common	present	present
Lemmermanniella				present				
Nodularia spumigena	common	present	common	common	present	present	common	common
cf. Planktolyngbya	present							
Snowella	present		present	present	present		present	
Ebria tripartita	present	present	common		present	common	present	common
Helicostomella subulata					present		present	

Surface samples, bucket	The following filamentous cyanobacteria were observed:		
Station:	*Aphanizomenon flosaquae*	*Nodularia spumigena* *	*Dolichospermum spp.*
Kalmar sund 11/7		present	
BY 39 Öland södra 11/7	present	common	common
BY38 Karlsödjupet 12/7	common	common	present
BY32 Norrköpingsdjupet12/7	common	common	present
BY31 Landsortdjupet 12/7	common	present	common
Huvudskär buoy12/7	common	common	common
BY29 12/7	common	common	common
BY20 13/7	common	common	
Östergarnsholm 13/7	common	common	
BY15 13/7	common	common	
BY10 13/7	common	common	
BCS III-10 14/7	common	common	
BY5 Bornholm 14/7	very common	very common	present
BY4 Kristiansö 14/7	common	present	
Hanöbukten 14/7	common	present	
BY2 Arkona 15/7	common	common	
BY1 15/7	common	common	present
West Landskrona 15/7			

Havs
och Vatten
myndigheten