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Report of the Working Group on Phytoplankton Ecology (WGPE)

16–18 March 2005

Oldenburg, Germany

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Executive summary

The Working Group on Phytoplankton Ecology (WGPE) met in Oldenburg, Germany, from 16 to 18 March 2005. Six scientists from different countries participated.

WGPE started its annual meeting with a long discussion about the group activities in relation to the ICES Action Plan. The discussion on this matter started already in 2004 but no specific priorities were given at that time. WGPE has prepared two tables that summarize the group's points of view about future activities in the frame of the Action Plan. Lack of time hindered a more detailed presentation, and it was agreed that a set of guidelines should be prepared for next year's meeting after consulting with other working groups.

An assesment of the application of remote sensing and numerical modelling for phytoplankton dynamics studies had started. The first step in this work was to review the state of the art situation with examples. Although WGPE recognized that these techniques have seen significant improvement, still they are of only a semi-quantitative character and further work is needed before they can be applied without restriction. However, the examples showed confirmed the value of these techniques. They are quite useful to provide information and resolve issues where full quantitative data are not completely necessary.

WGPE has for a long time being been concerned about the possible impacts of climate change on phytoplankton dynamics. The prevailing view that emerged from the discussion was that this problem is very difficult to resolve without long-term data series. The continuous decline of this kind of data is a threat to properly assessing climate change impact, and WGPE expressed its concern about replacing real data with, i.e., models, when dealing with this question. WGPE agreed on starting a series of presentations at next year's meeting with examples from different regions and ecosystems where long-term observation programs are still being carried out.

Contributions to the Annual Phytoplankton Summary were presented by four countries. Although WGPE has prepared a standard reporting form there is still the problem of the variability in the reporting countries. Unfortunately only countries attending the meeting reported. Countries like Sweden and The Netherlands that have previously presented detailed reports did not attend this year's meeting. WGPE will contact all its members once again and ask them to present their contributions for the 2006 meeting, wh either they attend it or not.

The first draft of the ICES phytoplankton list was presented. WGPE reccomends to name it the ICES Phytoplankton Name List in order to avoid conflicts with taxonomists.The list, containing more than 1300 species names, will be further completed during the intersessional period by adding corrected names already submitted as well as new names from other not yet delivered lists.

WGPE found that the time is still not ripe to hold a Workshop on new methods for measuring Primary Production. This is due to the fact that the newest techniques are still i.in a developing phase, a phase that had taken longer time than previously expected. At the same time WGPE agreed on at if there is the need of a Primary Production database at ICES this should only include data from standarized methods as the one proposed several years ago by WGPE. WGPE recommends, after revision, the publication of the documents describing the ICES incubator.

WGPE regrets that no contribution was prepared for the May 2005 REGNS meeting. However, a new effort will be carried out during the intersessional period to comply with this ICES request.

WGPE will meet again from 29–31 March 2006 at Brorfelde, Denmark.

1 Welcome and opening of the meeting

The meeting of the ICES Working Group on Phytoplankton Ecology (WGPE) was held in Oldenburg, Germany, from 16 to 18 March 2005. Six scientists from different countries participated and they are listed in Annex 1.

The Chair of WGPE, Dr Francisco Rey from Norway opened the meeting at 09:30 and welcomed the attending scientists. The meeting host, Dr Claus Dürselen gave some practical information. A proposal for a Meeting Agenda was presented and approved by the participants (Annex 2).

2 Terms of reference

At its 2004 meeting in Gijón, Spain, WGPE had proposed several Terms of References (TOR) to be discussed at the 2005 meeting. However, the ICES Oceanography Committee at the 92th Annual Science Conference held in Spain in September 2004, made significant changes in the TORs to be discussed and proposed the following resolution later endorsed by ICES:

2C01 The **Working Group on Phytoplankton Ecology** [WGPE] (Chair: F. Rey, Norway) will meet in Oldenburg, Germany, from 16–18 March 2005 to:

a) Critically review the work undertaken by WGPE and prepare a clear set of guidelines for the future direction of this Working Group in relation to other relevant WGs, and take action to encourage wider participation to the group;

b) Start assessing satellite remote sensing data and numerical modelling results for revealing new information on phytoplankton dynamics;

c) Review and report on information on the impact of climate variability on phytoplankton dynamics and phytoplankton-zooplankton-fish interactions;

d) Evaluate and report on annual Phytoplankton Summary Reports and the standardization of the data sets;

e) Review the Phytoplankton Checklist compiled intersessionally and compare if species from checklist fit into ITIS structure to report phytoplankton data to ICES;

f) Plan a Workshop devoted to evaluation of new methods of PP measurements in Bergen 2007;

g) Continue preparations to summarise status and trends of phytoplankton communities in the North Sea (biomass, species and size composition, spatial distribution) for the period 1984–2004, and any trends over recent decades in these communities; for input to REGNS initial assessment in 9–11 May 2005, and final assessment in 2006.

WGPE will report by 29 April 2005 for the attention of the Oceanography Committee, ACME and ACE.

3 Discussion of terms of reference

3.1 Critically review the work undertaken by WGPE and prepare a clear set of guidelines for the future direction of this Working Group in relation to other relevant WGs, and take action to encourage wider participation to the group (ToR a)

WGPE recognized that this ToR was one of the most important issues to discuss concerning the future work of WGPE. Previously the work at WGPE was for the most to answer direct questions and requests from ICES. Several of the earlier members of WGPE had expressed concern about the issues that WGPE was asked to handle. Some did not see any kind of structure in the matters the group was asked to discuss. Within the frame of the Action Plan, the possibility is given to make a real and direct contribution of what WGPE thinks is needed. Before the meeting, the Chair had distributed the Action and Handling Plans in order to assure a fruitful and detailed discussion.

In the opinion of WGPE the most important change perhaps is that ICES is no longer looking at fish stocks primarily, but is now drawing the attention to the whole ecosystem. As a phytoplankton ecologist group, it will be WGPE's task to identify which fields to focus on within the future ecosystem-orientated work, and to propose priorities and solutions. The discussion started with an assesment of which are the most important processes in controlling the seasonal development of phytoplankton and its productivity in the different regions in the ICES area – is it physical forcing, cell physiology, species biological interactions, or grazing? Are these processes of equal importance in the different marine ecosystems? If not, is it possible to identify their regional relative importance? All of these and many other issues were discussed in order to elaborate a concrete proposition to ICES about how WGPE can contribute to achieving the goals of the Action Plan.

The amount of issues that emerged during the discussion was substantial, and the interrelationships between them became quite complicated. It was agreed that the focus on the functioning of marine ecosystems made it necessary to also focus on functional phytoplankton groups, rather than on taxonomical groups as it has been done until today. This view has already been discussed among British phytoplanktologists who have developed a general theory that assume that the health and sustainability of pelagic ecosystems depend not on phytoplankton species diversity or on the existence of key species but on larger functional units that they call "lifeforms". Lifeforms according to this general theory are identified and distinguished by the following four groups of factors:

- Functionality in relation to biogeochemical cycling of biolimiting elements C, N, P, Si, O, and perhaps Fe and Co.
- Functionality in relation to the marine foodwebs, where the key properties (from the point of view of ecosystem health and sustainable human use) are those of providing food for a variety of zooplankters and for fish and shellfish of commercial importance, and avoiding misbalance between production and consumption that might lead to oxygen depletion - that is to say, maintaining eutrophy as opposed to dystrophy.
- Functionality in relation to the physical environment, as implied by the idea of an ecohydrodynamic typology and a type-specific balance of lifefroms.
- High level of taxonomy: recent developments in molecular taxonomy have revealed great differences amongst the main groups of protoctists, implying the ancient origin of these groups and the consequent likelihood that their bio(geo)chemical functioning and cell states tend to particular functional roles.

With these ideas in mind WGPE identified the relative importance of future work to be done in relation to three key areas in the Action Plan: Foodweb (Living Resources), Biogeochemical cycles (Climate change) and Nuisance issues (Economy) as well as identifying the main areas where this is of topicality. However, there was limited time to produce an extensive document and therefore it was decided to prepare tables that through the use of key words summarize the opinion of WGPE on this matter (see Annex 3).

WGPE also discussed the factors that affect phytoplankton growth and productivity that should be focused on in different environmental areas and make an effort to etablish the relative importance of these factors. The results of this discussion are also presented as a table in Annex 4. The results of the discussions are by no means exhaustive and future work should be carried out to provide more details and to suggest more specific themes of investigation taking into consideration particular regional characteristics.

WGPE also agreed that the focus on the ecosystem approach in the Action Plan will probably result in getting more interest among earlier members and possible new members.

WGPE also agreed to intensify the cooperation with WGHABD and SGGIB, and WGZE. Especially phytoplankton–zooplankton interactions should be given high priority. Topics to examine are, for example, the effects of grazing on the development of the phytoplankton bloom, the zooplankton reproduction in connection to the time of the spring bloom (match–mismatch theory) and, within the bloom dynamics, the time when blooms appear and what the triggers are. WGPE agreed on taking contact with the other groups during the intersessional period to further develop these ideas in order to produce a more detailed set of guidelines to ICES.

Some other topics for the work of WGPE, which are related to the different actions required in the ICES Action Plan, are phytoplankton checklists, phytoplankton indices for quality assessment, quality control for methods, cooperation with ecosystem modellists (some groups already start modelling on species level), and databases.

3.2 Start assessing satellite remote sensing data and numerical modelling results for revealing new information on phytoplankton dynamics (ToR b)

Renate Scharek from Spain had prepared a comprehensive review of the actual state of remote sensing of phytoplankton. The review included:

- The basic of detection and the different sensors both old and in actual function that have and are been used for detecting phytoplankton with spectral characteristics.
- A summary of the work being carried out today, including sensor design and perfomance, post-launch sensor calibration stability, atmospheric corrections, bio-optical algorithms, and data treatment.
- A series of examples of the aplication of the methodology.

Andres Jaanus from Estonia presented a more detailed example of how remote sensing has been applied to detect blooms of cyanobacteria in the Baltic Sea. These blooms, due to the cyanobacteria ability to change their buoyancy, are often concentrated in the top layer of the surface and difficult to detect by conventional sampling or by flow-through systems onboard vessels (ferryboat). Also their patchiness is difficult to estimate by these methods. In addition, estimates of the biomass concentration in the blooms can be largely underestimated.

After the two presentations, a discussion on the application of remote sensing to phytoplankton dynamics within the frame of the ICES Action Plan revealed that:

- Although enormous advance in the development of the method both in terms of sensor spectral characteristics and bio-optical algorithms has occurred in the last 10–15 years still the use of remote sensing of phytoplankton in the ICES area is mostly concentrated in locating and quantifying blooms without further coupling of the information to ecosystem studies. Integration of remote sensing data into ecosystems studies should be given high priority.
- Further work is needed in obtaining ground true data to validate the bio-optical algorithms both at spatial and time scales. Especially in coastal waters it is difficult to apply standard algorithms. Future work should emphasize on carrying out field work together with obtaining images for proper calibration and tuning of the algorithms.
- The main disadvange of applying remote sensing techniques in the ICES area is the cloud cover, a fact that has created some scepticism. However, the routine collection of images and the creation of composite images can easily overcome this problem and add a tremendous value to the technique.

- Although one of the main forces behind the application of the technique has been the detection of harmful algal blooms in coastal waters, there are also many other issues where remote sensing can be of great importance. An example from Canadian waters, where remote sensing was applied to determine the timing of the spring bloom, confirmed the close relationship between the timing and the survival of haddock larvae in the eastern continental shelf of Nova Scotia. Information was also presented showing that the timing of the spring bloom in the Norwegian Sea is closely related with the reproduction cycle of *Calanus finmarchicus*, the main food source for herring in the area. If the timing of the spring bloom is also crucial for linking it to the foodweb in other areas, effort should be made in obtaining a more continuous collection of remote sensing data. Regional climate changes studies in the ICES area should also incorporate remote sensing of phytoplankton in a larger scale that it is used today. Global studies have made ample use of the technique but they emphasize the need of more focused analysis in specific areas in order to provide evidence of eventual trends and their causes.
- There is a need to further develop the sensors spectral specifications and more specific algorithms. The possibility of detecting functional groups for instance diatoms and cyanobacteria by using sensors with higher spectral resolution together with refined algorithms open a wide array of applications of this technique to ecosystem studies.

For further and recent information about the methodology and application of remote sensing in phytoplankton dynamics studies, WGPE reccomends a look at the list of Ocean-Colour References prepared by the International Ocean Colour Coordinating Group (IOCCG) at http://www.ioccg.org

Renate Scharek presented a short review of numerical modelling in relation to phytoplankton dynamics. Ecological modelling should have as the main objective to provide unifying concepts in marine ecology and as an ultimate goal to allow dynamical interpretations (predictions). The question of complexity of the models depends on the particular goals. Ecosystem models are supposed to provide a better understanding of the holistic functioning of the ecosystem including physical-biological interactions, foodweb interactions, etc. Process modelling, on the other hand, are focused to understand selected processes as inorganic carbon uptake, phytoplankton aggregate formation and could become quite complex. Finding a balance between complexity and functionality is of the utmost importance. In the view of WGPE the main problem is the lack of consensus between marine biologist about how to implement the different processes coupling physics and biology. While physical oceanographers agree on basic hydrodynamical equations, there have been large differences of opinion about how to model “organism response” among biologist/ecologists. However, some progress has been made in the last years, at least regarding phytoplankton dynamics, in that a certain simplification has been made by using functional phytoplankton groups.

Many numerical models that concern phytoplankton dynamics have been developed in the last years and have been applied to a wide set of problems. In the ICES area most of these models have been developed for coastal areas to look at the response to eutrophication problems (for a recent overview see the review for the OSPAR Commission provided by D. Mills, UK, in Annex 5). Some of these models are being implemented also to cover oceanic areas (example NORWECOM in Norway). In the opinion of WGPE, today’s models, especially coupled physical-biological models, only produce qualitative results in relation to reality in nature. The main problem seems to be that most models are developed by physical oceanographers who assume that, as in the case of physical oceanography, the same set of basic equations and parameters developed for one particular region or area can be applied to others without taking into consideration that the organism response can be quite different. In the opinion of WGPE, a better communication between modellers and biologists is of the utmost importance in order to improve models. Validation with ground-true data, perhaps the weakest point in phytoplankton model work, should be emphasized. This has not been possible due to the lack of observational data sets of sufficient resolution. The acquisition of these kinds of data sets, for instance through remote sensing, and locally tuning of parameters must be given the highest priority. Until this is done, WGPE feels that today's models will continue to provide qualitative results and at the most semi-quantitative ones.

The outcome of the discussion, although it may seem negative, is not that WGPE rejects model work. On the contrary, WGPE acknowledges that models are of high importance in future phytoplankton dynamics work. Therefore, WGPE agreed on taking up this matter again at next year's meeting and during the intersessional period to get a better overview of how the cooperation between modellers and plankton ecologists is being carry out in the different countries.

3.3 Review and report on information on the impact of climate variability on phytoplankton dynamics and phytoplankton-zooplankton-fish interactions (ToR c)

Unfortunately, the scientist who was to introduce this ToR could not attend the meeting at the last minute. However, WGPE decided to have an open discussion on it, in addition to taking up this theme at next year's session.

WGPE agreed that climate variability is an inherent part of nature and that it is expressed mainly by long-term changes in physical processes. In the past years, the major part of the work in the phytoplankton-climate field has concentrated on the role that an eventual increase in carbon dioxide may have on phytoplankton physiology and productivity. But climate variability is much more than that and probably has a much stronger effect on phytoplankton dynamics and further up in the foodweb than an eventual change in carbon dioxide in the oceans. Also, WGPE recognized that to study the impact of climate variability on biological processes the need for long-term data series is of primordial importance.

The interest of WGPE in this theme is an old one. Already in the late 1990s, WGPE arranged a symposium, "The temporal Variability of Phytoplankton and their Physico-chemical Environment", held in Kiel 1997. The initiators made efforts to encourage persons involved in the gathering of long-term series to participate and contribute studies based on the existing data series (Colijn, 1998).

During the symposium a number of long-term data series were revealed, relevant for environmental and pelagic research as well as scientists interested in variability, trends, cycles and changes in pelagic systems (Colijn *et al.*, 1998).

Since then the interest for the use of long-term data series in studies on climate effects and global changes have not dwindled but nevertheless it is still tedious to continue this kind of work. Back then there was concern over the continuation of the CPR (Continuous Plankton Recorder) project. Numerous publications using the extensive data sets, which have been made during the last decade based on the samples from CPR, witness on the usefulness of such series. Therefore it was reasonable to mention in anticipation that there were good prospects for operational unattended sampling devices in 1998. The one onboard ships of opportunity, a flow-through system now developed into the Ferrybox project was presented at the symposium. The system measured surface temperature and salinity, chlorophyll *a* and samples were taken automatically at selected locations for calibration and counting of phytoplankton species. That project has been further developed to include other parameters (nutrients) and has been running smoothly since then and is now included in an extended European project called the Ferry Box (http://www.ferrybox.org).

Other bright prospects at that time were the plans at NASA to send on orbit a satellite with the new sensor, SeaWifs. This has also proved to be a great success. Both these methods to gather data on chlorophyll at the surface layer are by now used as long-term data series (Platt *et al.*, 2003).

The methods are fit to support each other, the first for calibration of satellite data, for more reliable coverage when the clouds prevent usable view and discreate sampling for identification of species, and the second one reveals information on the distribution of chlorophyll at the surface in the world's oceans, with dimensions and frequencies never seen before.

WGPE was also made aware of a recent publication by one of its members, Ted Smayda, where he and other colleagues presented a general introduction to the theme (Responses of marine phytoplankton populations to fluctuations in marine climate. *In* "Marine Ecosystems and Climate variation". Ed. by N. Chr. Stenseth *et al.* Oxford University Press, 2004, pp.59–70).

WGPE agreed on having a special internal session next year on this theme with presentations of long-term series results from different regions in the ICES area:

- Waters around Iceland (Kristinn Gudmundsson);
- Ocean Weather Station Mike, Norwegian Sea (66°N: 2°E) (Francisco Rey);
- Helgoland, German Bight (Claus Dürselen and colleagues);
- Flødevigen, Skagerrak (Lars Nautsvoll);
- East coast of USA (Ted Smayda).

In addition, the Chair of WGPE will, in the intersessional period, contact other scientists in possession of long-term data series and invite them to make a presentation of their results.

References to ToR c

Colijn, F. 1998. Introduction to "The temporal variability of plankton and their physico-chemical environment". ICES Journal of Marine Science, 55: 557–561.

Colijn, F., Tillmann, U., and Smayda, T. (eds). 1998. The temporal variability of plankton and their physico-chemical environment. ICES Journal of Marine Science, 55, 267 p.

Platt, T., Fuetes-Yaco, C., Frank, K.T. 2003. Spring algal bloom and larval fish survival. Nature, 423: 398–399.

3.4 Evaluate and report on annual Phytoplankton Summary Reports and the standardization of the data sets (ToR d)

During our meeting last year a considerable amount of time was spent discussing this item. WGPE agreed on a standard form for reporting this information that includes a part on meta-data on the existing programs (see Annex 3 of the WGPE Report 2004) and a presentation of the results (see Annex 4 of the WGPE Report 2004). During this year's meeting a fine-tuning of the existing reporting programs was made. The non assistance of previous providers of information to the Phytoplankton Summary Reports and the subsequent lack of reporting (has) made it difficult to keep a certain consistency in the report from year to year. This is a matter of great concern for WGPE which was recognized to be closely related to the decision of many members not to participate in WGPE. The Chair and WGPE members have increased their efforts/activities to encourage participation in WGPE without much success. From the 19 member countries at ICES, 14 have appointed representants to WGPE with a total of 28 scientists. Of these six attended the meeting, eight responded that they were not to participate for various reasons, and fourteen did not answer at all.

Two main reasons were identified for the lack of interest in participating in WGPE. One is the decision of some country members to cut off their participation in ICES and made priorities that affect mainly working groups that deal with what they identify as basic science as WGPE, although they have appointed representants. In this respect, for instance, WGPE cannot compete with the sister group, WGHABD, which is concerned with more actual problems directly related to fisheries/aquaculture. Due to this national priority several of the previous members of WGPE now only participate in WGHABD. The second reason is the tight schedules and large workloads most scientists willing to participate in WGPE usually have to cope with in their own countries. Since the participation in WGPE is mainly an honorary activity, care should be taken in not to impose an excessive woarkload on WGPE members, because this could act as a repellant to participation.

WGPE shortly discussed also the actual working group structure of ICES with groups mainly based on the old strategy. With the new focus on ecosystem approach in the new ICES Strategic and Action Plan, WGPE feels that a discussion should take place about changing the scope and composition of the working groups more adjusted to the new reality.

Phytoplankton Summary Reports for 2004 from Germany, Spain, Iceland, and Norway are presented in Annex 6.

3.5 Review the Phytoplankton Checklist compiled intersessionally and compare if species from checklist fit into ITIS structure to report phytoplankton data to ICES (ToR e)

The Chair presented the work done during the intersessional period. Due to the fact that not all the countries that were supposed to contribute with lists did so, several lists were obtained from public sources in the ICES area. The main problem has been that many countries do not have official check lists and are not willing to provide their unofficial lists. Ten lists were obtained for this work:

- Clyde Sea, Scotland: provided by Fiona Hannah, Millport, Scotland;
- EastSound, USA: East Sound Phytoplankton (obtained from http://thalassa.gso.uri.edu);
- Baltic Sea (SpecHelcom (Guy Hällfors, http://www.helcom.fi) obtained from ICES webpage (http://www.ices.dk/));
- Helgoland, German Bight, Germany (obtained from: Hoppenrath,M.(2004) A revised checklist of planktonic diatoms and dinoflagellates from Helgoland (North Sea, German Bight). Helgol Mar.Res., 58: 243–251.);
- Iceland: provided by Kristinn Gudmundsson, MRI, Reykjavik, Iceland;
- IOC Europe: extract of "assumed" european species from IOC Taxonomic Reference List of Toxic Plankton Algae (http://ioc.unesco.org/);
- Nederland: provided by Peter Bot, RIKZ, Den Haag, The Netherlands;
- Skagerrak-Kattegat (obtained from "Checklist of phytoplankton in the Skagerrak-Kattegat"(http://www.marbot.gu.se/);
- North coast of Spain: provided by Manuel Varela, IEO, La Coruña, Spain;
- United Kingdom and Republic of Ireland (UKROI): provided by David Mills, CEFAS, Lowestof, UK.

All lists were individually checked, at the species names level, against the ITIS system (http://www.itis.usda.gov/) with theirs Plant, Monera and Protozoa Kingdoms and separated into matched and non-matched names. A total of 1375 species names were found to match the ITIS lists (see Annex 7). In order to avoid problems with taxonomists WGPE recommends that this list should be named "ICES Phtyplankton Name List". In the intersessional period the non-match lists will be sent to their authors for comments. Several of the non-matches were due to misspelling of the names and they should be easy to correct. However, most of the species names were not registered and work remains in doing so. This is a large task since the conditions set up by ITIS to register new species is quite strict. It is not certain that the authors of lists will accept this task. A list of possible scientist that could help WGPE in this task was proposed and the Chair will take contact during the intersessional period. At next year's meeting we hope to enlarge the list with new entries. As it is now the list should be called "A Preliminary ICES Phytoplankton Name List".

In relation with this ToR, Michelle Devlin from CEFAS gave a presentation on the work done in the UK on the development of a Phytoplankton Community Index as part of a programme of work designed to improve the understanding of eutrophication. The latter Eutrophication Thematic Programme is focussed on developing tools to improve formal assessment of eutrophication and also research on susceptability to undesirable disturbance arising from anthropogenic nutrient input. WGPE see a large potential in such a programme which also emphasizes the need for continued work with the Phytoplankton Name List.

3.6 Plan a Workshop devoted to evaluation of new methods of PP measurements in Bergen 2007 (ToR f)

The idea of having such a workshop originated from the fact that in 2007 it will be 50 years since the ICES Symposium "Measurements of Primary Production in the Sea" held in Bergen, Norway in September 1957. (See Conseil Permanent International pour L'Exploration de la Mer: Rapports et Procés-Verbaux 144, 1–158, 1958). This symposium defined the radioactive carbon method as the most useful for measuring primary production and ended the use of the oxygen method and others techniques. And this was only five years after the method was introduced by Steeman-Nielsen.

However, still there is considerable discussion about the applicability of the radioactive carbon method to routine measurements due to the high variability of the results. In the last 10–15 years new technologies, mainly based on chlorophyll fluorescence, have appeared and are being put into use. It was thought that the time was possibly ripe to collect the experience acquired during these years and to evaluate the usefulness of such techniques. A short survey done previous to the meeting showed that still, at least regarding the perhaps most common technique in phytoplankton research the Fast Repetition Rate Fluorometry (FRRF), there are a series of uncertainties associated with the application of the technology. Although parameters obtained with the FRRF-technique can be applied to bio-physical models for the estimation of photosynthesis, a more direct estimation of productivtity is still hampered by the difficulty in interpreting the FRRF-parameters. A workshop held in September 2004 at the University of Liverpool during the week of the Challenger Society for Marine Science 11th Biennial Conference, confirmed that the most common FRRF-instrument, the Fastracka, Chelsea Technology Group, is in continuous development and improvement and has not yet being thoroughly compared with traditional ^{14}C techniques in the field. Based on these facts WGPE felt that it was yet too early to conduct a serious comparison of both techniques and recommends that scientists working with these techniques provide their results to WGPE for further evaluation of their usefullness in measuring primary productivity.

The justification for this ToR by the ICES Oceanography Committee states that "*The results of the Questionnaire on Primary Production indicated that there are major problems to compare data submitted to ICES. It is thought that a well-planned workshop on aspects covering methodology and standardization of Primary Production measurements will help ICES to arrive at a useful database on Primary Production*". The problems related to the standarization of Primary Production measurements has been a topic at WGPE meetings since the mid-1980s and one of the results of this was the design, construction and elaboration of procedures for measuring productivity by means of the ICES incubator which detailed description was presented in the WGPE Reports for 1996 and 1998. Despite of the well-known shortcomings of the ^{14}C method, WGPE feels that the only way of creating a consistent ICES database of Primary Production data is through the use of a standarized method, for instance, based on the ICES incubator. This is a decision to be made by ICES and WGPE is willing to take up the challenge of providing such a method based on the already mentioned ICES incubator in the same way as it was done with the measurement of chlorophyll. As pointed out in the conclusions from the Questionnaire on Primary Production carried out in 2003 and reported last year this work will involve a series of workshops, intercomparisons and ring tests among the different laboratories. The willingness of the ICES member countries in financially supporting such work is of the utmost importance for a succesful result. As a first step in this matter WGPE recommends, after revision by the authors, the publication of the documents describing the ICES incubator and the working procedures.

3.7 Continue preparations to summarise status and trends of phytoplankton communities in the North Sea (biomass, species and size composition, spatial distribution) for the period 1984–2004, and any trends over recent decades in these communities; for input to REGNS initial assessment in 9–11 May 2005, and final assessment in 2006 (ToR g)

Unfortunately only Germany complied with the task of providing data for the preparation of such a report despite the insistence from the Chair. This made it impossible to prepare a report at this time. WGPE became aware that much effort to provide a status report on phytoplankton has been made through the WGHABD and we hope that their report will cover most of the REGNS area. WGPE regrets this situation. WGPE will make a new intersessional effort to provide such a summary to REGNS at next year's meeting.

4 Any other business

4.1 Scientific presentation

During the meeting Dr. Stefan Kotzur from the University of Oldenburg gave a presentation on "Modelling phytoplankton dynamics with ERSEM".

4.2 Concluding business

WGPE proposed to hold next year's meeting in Reykjavik, Iceland, a proposal accepted by Dr Kristinn Gudmundsson. However, while writing this report the Chair of WGPE received a request through ICES from WKEUT (Workshop on Time Series Data relevant to Eutrophication Ecological Quality Objectives) that they would like to meet back to back with WGPE next year in Denmark in March. After discussing the matter with WKEUT it was decided to hold the WGPE 2006 meeting at Brorfelde, Denmark from 29–31 March, after the WKEUT meeting (24–28 March). The organizer of WKEUT, Gunni Ærtebjerg, will also take care of the logistics for the WGPE meeting.

4.3 Closing of the meeting

WGPE thanked Dr Claus Dúrselen from AquaEcology for hosting the 2005 meeting.

5 Draft resolutions

5.1 Proposed Terms of Reference for the WGPE 2006 meeting

The **Working Group on Phytoplankton Ecology** [WGPE] (Chair: Francisco Rey, Norway) will meet in Brorfelde, Denmark from 29 to 31 March 2006 to:

a. Evaluate and report on annual Phytoplankton Summary Reports and further improve the standarization of the data sets;

b. Review new additions to the ICES Phytoplankton Name List that have been compiled intersessionally;

c. Review the contribution to REGNS to be prepared intersessionally;

d. To held an internal mini-workshop on the uselfuness of long-term data series for evaluating the impact of climate variability on phytoplankton dynamics and phytoplankton-zooplankton-fish interactions;

e. Assess the activities and frequency of quality control routines concerning phytoplankton parameters (species composition, abundance, biomass, pigments, primary production) performed at the national and international level;

f. Prepare a more detailed set of guidelines for the future work of WGPE based on the outcome of the 2005 meeting;

g. Continue assesing satellite remote sensing and numerical modelling results for revealing new information on phytoplankton dynamics.

WGPE will report by 12 May 2006 for the attention of the Oceanography Committee, ACME and ACE

Supporting Information

Priority:	The activities of this Group are fundamental to the work of the Oceanography Committee. They are critical in understanding the links between physics and living marine resources and play an important role in identifying environmental change. The work of this Group is regarded as high priority
Scientific Justification and relation to Action Plan:	Action Plan No: 1, 2, 4, 5 and 6 Terms of Reference : a. WGPE recognises the need for disseminating information of the phytoplankton status in a timely manner. The material presented will be used to prepare the annual Summary Status Report on Phytoplankton in the ICES area. Reporting results must be supported by significant observations and trends based on time series sampling programmes. It is of importance that the reporting is increased to cover all ICES countries. Improved standardization of the reports will simplify the compilation of the status report; b.The ICES Phytoplankton Name List has been produced as a preliminary list. Further efforts are needed to finalize the compilation of the non-matched names from the already submitted national checklists.. The new ICES Phytoplankton name List contains already considerably more species than the ITIS list. As ICES has decided that the ITIS system must be used for phytoplankton submissions, the list must be continuosuly updated to contain all species present in the ICES area. The new ICES phytoplankton list is being compiled stepwise with the North Sea area as the first critical milestone to meet the REGNS demands; c. The task of summarizing the status and trends of phytoplankton communities in the North Sea (biomass, species and size composition, spatial distribution) for the period 2000-2004 and any trends over recent decades for the input to REGNS in 2005/2006 should have started during 2004. WGPE regrets that this was not done and will make new intersessional efforts to have the compilation ready for discussion and possible amendment during the WGPE meeting in 2006 giving input to the REGNS initial assessment in 2006; d. WGPE started focusing on connections between phytoplankton and climate variability, with the aim at understanding the influence of climate/physics on phytoplankton dynamics. This will be further linked to the impact of phytoplankton on zooplankton and fish dynamics.

	There is a need to evaluate progress in this field. WGPE reviewed the relevant topics during the 2005 meeting and reccomends an internal mini-workshop to in 2006 to evaluate the usefulnnes of long-term data series for this purpose; e.The work during the preparation of the ICES phytoplankton list revealed that quality control of phytoplankton parameters is not optimal. There is the need of an overview of all the activities (intercalibrations, ringtests, procedures for quality assurance,etc) being carried out in the ICES countries regarding this matter (input from SGQAB). WGPE believes that this will show that, with the exception of chlorophyll measurements (QUASIMEME) there are definitely not enough activities to ensure a good data quality. Reccomendations for quality assurance for phytoplankton parameters in the ICES area are needed and can be provided by WGPE; e. WGPE needs to continuously review the work being done in relation to the ICES Action Plan in order to provide more detailed guidelines for future work. This will be also part of a strategy to motivate for wider participation, which in recent years has dwindled significantly; f. Phytoplankton is basically the only biology which is detectable from space, and with the unique spatial coverage (although limited by darkness and clouds). this tool should be central for studying basin scale phenomena. A first step could be to quantify the spatial pattern of the timing of the peak spring bloom. This activity, together with *in situ* observations, should be linked to similar numerical modelling results and analysed under a common framework. The work in assessing these techniques started in 2005 should continue in 2006.
Resource Requirements:	None required
Participants:	Despite new members, WGPE continues to see the need to encourage wider participation to the Group
Secretariat Facilities:	None required
Financial:	None apart from report´s reproduction cost
Linkages To Advisory Committees:	The Group reports to ACME, mainly for the provision of scientific information on phytoplankton and their role in ecosystem function.
Linkages To other Committees or Groups:	Members of WGPE are active participants in a range of other Committees and Groups including WGHABD, SGQAB and SGQAE. Stronger links to WGZE and WGOH are desired in the frame of the Action Plan
Linkages to other Organisations:	Members of this Group are active in IOC HAB Programme, HELCOM, EuroGOOS and OSPAR
Secretariat Marginal Cost Share:	ICES:100 %

5.2 Resolution for an ICES Internal Publication (Category 1)

The document **Working manual and supporting papers on the use of a standardised incubator in primary production measurements**, edited by Prof. F. Colijn (Germany), Dr L. Wetsteijn (Netherlands), Dr L. Edler (Sweden), and Dr O. Lindahl (Sweden), as reviewed and accepted by WGPE, will be published in the *ICES Techniques in Marine Environmental Sciences* series, following final review by the Chairman of the Oceanography Committee. The estimated number of pages is 40.

Supporting Information

Priority:	This has a high priority due to the necessity of having a standard procedure for aquiring data on primary production for an ICES database. Previous attemps to do this have failed because of the large variability in instrumentation, handling procedures and data treatment
Scientific Justification and relation to Action Plan:	Action Plan No: 1,2 The problems related to the standarization of Primary Production measurements has been a topic at the WGPE meetings since the mid-80´s. A large effort was done in 1987 when a workshop on standarization was held in Denmark. The results of this workshop were dissapointing and one of the outcomes of the workshop was the idea of designing, constructing and elaborating procedures for measuring productivity by means of a standard incubator. This incubator, named the ICES incubator, was presented in detail in the WGPE Reports for 1996 and 1998. Despite of the well-known shortcommings of the 14C method, WGPE feels that the only way of creating a consistent ICES database of Primary Production data is through the use of a standarized method, for instance, based on the ICES incubator. This is a decission to be made by ICES and WGPE is willing to take up the challenge of providing such a method based on the already mentioned ICES incubator in the same way as it was done with the measurement of chlorophyll. The publication of the documents describing the incubator as well as the

	working procedures should, after a thorough revision, be publish by ICES.
Resource Requirements:	Publication of this material as a CRR will cost ca 10,000 DKK. The material in the report is fairly straightforward, and therefore no specific additional costs are necessary.
Participants:	Authors of the manual and WGPE to review and finish it. Some 1 month work is required by the editor to finalise this draft.
Secretariat Facilities:	About 1 month of the services of Secretariat Professional and General Staff will be required.
Financial:	Publication costs
Submission of the report:	This report will be submitted by DATE to the ICES Secretariat for the attention of the chair of the Oceanography Committee.
Linkages To Advisory Committees:	This product has been endorsed by OCC/WGPE
Linkages To other Committees or Groups:	None
Linkages to other Organisations	
Secretariat Marginal Cost Share	This part is normally added by the Secretariat and contains details of how the Secretariat's costs are to be divided between ICES and the Regulatory Commissions

Annex 1: List of participants

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Annex 2: Meeting agenda

Agenda WGPE 2005, Oldenburg, Germany.

Wednesday 16 March

9.30 – 09.45	Welcome and practical matters Welcome by our host Claus Dürselen. Francisco Rey, Chair of WGPE welcome all the participants to the meeting. Presentation of the participants to the meeting. Addresses. New participant from Estonia. Revision of the Agenda.
09.45 – 10.45	ToR a: *Critically review the work undertaken by WGPE and prepare a clear set of guidelines for the future direction of this Working Group in relation to other relevant WGs, and take action to encourage wider participation to the group*. Leader: Francisco Rey; Rapporteur: Claus Dürselen
10.45 – 11.15	COFFEE
11.15 – 13.00	ToR a continue
13.00 – 14.00	LUNCH
14.00 – 15.30	ToR b: *Start assessing satellite remote sensing data and numerical modelling results for revealing new information on phytoplankton dynamics*. Leader: Renate Sharek; Rapporteur: Andres Jaanus
15.30 – 16.00	COFFEE
16.00 – 18.00	ToR c: *Review and report on information on the impact of climate variability on phytoplankton dynamics and phytoplankton-zooplankton-fish interactions*.Leader: Ken Jones (did not attend); Rapporteur: Kristinn Gudmundsson

Thursday 17 March

09.00 – 10.30	ToR d: *Evaluate and report on annual Phytoplankton Summary Reports and the standardization of the data sets.*Leader: Peter Bot (did not attend)*;* Rapporteur: Francisco Rey
10.30 – 11.00	COFFEE
11.00 – 13.00	Presentation by Michelle Devlin, CEFAS, of the British work done on Phytoplankton Taxonomics Indexes ToR e: *Review the Phytoplankton Checklist compiled intersessionally and compare if species from checklist fit into ITIS structure to report phytoplankton data to ICES.* Leader: Francisco Rey; Rapporteur: Renate Scharek
13.00 – 14.00	LUNCH
14.00 – 15.30	Presentation by Dr. Stefan Kotzur form Oldenburg University, on Modelling Phytoplaknton Dynamics with ERSEM.
15.30 – 16.00	COFFEE.

16.00 – 18.00	Summarizing the work of the first two days. Start writing the report.
20.00 -	Dinner at Oldenburg.

Friday 18 March

9.00 – 10.30	ToR f: *Plan a Workshop devoted to evaluation of new methods of PP measurements in Bergen 2007.*Leader: Francisco Rey; Referent: Ken Jones
10.30 – 11.00	COFFEE
11.00 – 13.00	ToR g: *Continue preparations to summarise status and trends of phytoplankton communities in the North Sea (biomass, species and size composition, spatial distribution) for the period 1984–2004, and any trends over recent decades in these communities; for input to REGNS initial assessment in 9–11 May 2005, and final assessment in 2006.* Leader: Peter Bot (did not attend); Referent: Claus Dürselen
13.00 – 14.00	LUNCH
14.00 – 15.30	Report preparation. Recommendations to ICES. ToR´s for 2006.
15.30 – 16.00	COFFEE
16.00 – 17.00	Any other business. Next year’s meeting.
17.00	Closing.

Annex 3: Summary of priorities of work within the frame of the ICES Action Plan

Taxonomical groups (functional groups)		Main distribution areas				Relative functional importance			Main functional features
		Open ocean	Shelf	Coastal	Ice edge	Foodweb	Biogeochemical cycles	Nuisance	
		open ocean	Shelf	Coa		Living resources	Climate change	Economy	
Diatoms	Biddulphiales (Centrales)	xxx	xxx	xxx	xx	xxx	xxx	x	High turbulence, low/medium light, high nutrients, Si-walls, chains, zooplank. food, C-sedimentation
	Bacillariales (Pennales)	xx	xxx	xxx	xxx	xxx	xxx	x	Usually attached to a substrate, bloom seed at ice edge, some are toxic
Dinoflagellates	Bloom forming	-	xx	xxx	-	x	x	xxx	Low turbulence, low surface nutrients, high temperatures, toxicity, good N and P source, vertical migration
	Non-bloom forming	x	x	x	x	?	?	x	??, toxicity
Prymnesiophytes (bloom forming)	Coccolithophorids	xxx	xxx	xxx	-	x	xxx	?	High light, low turbulence, high temperature, low nutrients, carbonate pump, DMS-production
	Phaeocystis	xx	xxx	xxx	x	xx	xx	xx	Right after spring diatom bloom, colony forming, DMS-production, avoided by grazers?
	Chrysochromulina	x	x	xx	-	?	-	xx	High light, low turbulence, high temperature, low nutrients (high N/P ratio), toxicity
Cyanobacteria	Colony forming	?	xx	xx	-	?	x	x	High temperature, low salinity, avoided by grazers?
	Filamentous	xx	xxx	xxx	-	?	x	xx	High temperature, low salinity, high light, surface accumulation, toxicity, N-fixation, avoided by grazers?
	Single	x	x	x	?	x	x		N-fixation, microbial loop
Raphidophytes	Bloom forming	-	xx	xx	-	?	-	xx	After spring diatom bloom, low nutrients, stratified conditions?, toxicity
Other species	Background species	x	x	x	x	?	?	?	???

Annex 4: Summary of main factors affecting phytoplankton growth and productivity

Main factors affecting phytoplankton growth and production	Relative importance in main distribution areas			
	Open ocean	Shelf	Coastal	Ice edge
Physical factors				
Upper mixed layer				
Stratification type				
Haline	x	xxx	xxx	xxx
Thermal	xxx	xxx	x	-
Non-stratified	-	-	xxx	-
Turbulence				
Winds	xxx	xx	x	x
Tides	-	-	xxx	?
Current shears	-	xx	x	xx
Fronts	x	xx	x	x
Upwelling	-	xx	x	?
Biological factors				
Grazing	xxx	xxx	xx	xx
Winter species composition and abundance	xxx	x	x	x
Viral infection	x	xx	xx	?
Bacteria	x	x	x	x
Infection by protozoa	?	x	x	?
Aggregation	xx	xxx	xxx	xx
Chemical factors				
Nutrients				
Winter renewal	xxx	xxx	xxx	xxx
Eutrophication	-	x	xxx	-
Heavy metals	x	x	x	-
Organic pollutants	-	x	x	-

Annex 5: Eutrophication Modelling from UK by Dave Mills, Cefas, UK

Background

An agenda item on Eutrophication Modelling (ASMO 04/5/5-E) concluded that modelling tools would be required to support the OSPAR assessment in 2006 and that rather than promote the development of a single model system it would be desirable to make use of, and co-ordinate on a case by case basis, existing activities and models. Against this background a review of the current state of the art has been prepared and examples of the use of models in exploring nutrient reduction presented. Future needs are next described and the report concludes with a consideration of the desirable attributes of models when used to meet policy needs. The degree of model complexity required for eutrophication modelling is identified as a critical issue to be considered In the future this review should be augmented with input from other OSPAR signatories.

State of the art

Models can play an important role in helping to predict and diagnose the anthropogenic process of eutrophication. This section identifies some of the processes that need to be incorporated in such models, the r ange of possible approaches and the degree of complexity that may be implemented illustrated with examples.

The process of (pelagic) eutrophication can be seen as falling into three stages:

1) nutrient addition at a rate sufficient to overcome dilution or losses such as denitrification and leading to potential enhancement of local concentrations;

2) stimulation of phytoplankton growth by these extra nutrients (given sufficient light), followed by the accumulation of extra biomass resulting from this growth (which will not occur if losses of phytoplankton increase to match increased growth), all of which may be summed up as increased primary production;

3) the possible consequences, especially the harmful ones, of the increased production or of change in the balance of organisms resulting from relatively greater stimulation of some species or types of phytoplankter).

In each case, models must simulate key features of the physical environment as well as relevant chemical and biological processes. There are two matters to be considered here. First, the environment may be described as a simple box (a point, or 0-D, model), or in terms of variation along 1, 2, or 3 dimensions. However, the simulation of complex physical environments requires detailed seabed topography and more information about initial and boundary conditions, as well as creating more difficulties for numerical integration of model equations. Second is the matter of the degree of complexity in the chemical and biological models. Here the main problem is that of finding good values for parameters that increase in number, generally more than proportionately, to the number of state variables. Models that are simple both physically and biologically may, therefore, have advantages which may outweigh their lack of detail.

Except in cases where denitrification is an important process, requiring chemically complex models for its description (Middleburg *et al*, 1996; Di Toro, 2001), stage 1 of eutrophication is comparatively easy to simulate. The simplest approach balances nutrient inputs against dispersion losses from a box. Such a model, used to assess 'Equilbrium Concentration Enhancement' (ECE) of nutrients (Gillebrand & Turell, 1997), has proven useful at identifying Scottish sea-lochs most at risk from fish-farm nutrients. Gillebrand (2001) used a 2-D physical model of a sea-loch to examine some of the approximations involved in a box model.

Stage 2 concerns the conversion of nutrient into biomass and hence requires biogeochemical models. These were defined by Tett & Wilson (2000) as conserving the totals of the elements simulated, with the advantage of constraining the outcomes of simulations and thus rendering prediction more reliable. One of the simplest of these models was developed by the UK's Comprehensive Studies Task team (CSTT, 1994, 1997; Tett, 2000) and uses a single parameter for the yield of phytoplankton chlorophyll from nutrient to convert ECE nutrient into worst-case biomass. This use of yield was proposed by Gowen *et al*. (1992) and the value of the yield parameter was investigated by Edwards *et al.* (2003). The CSTT model has recently been applied to 6 semi-enclosed coastal waters studied by the OAERRE project which concerned "Oceanographic Applications to Eutrophication in Regions of Restricted Exchange" (Tett, Gilpin, *et al*., 2003).

At the next level of complexity are models with between 3 and 10 state variables yet which remain tightly constrained by the biogeochemistry of nitrogen cycling through a single productive compartment. These include the "strategic fjord simulation model" of Ross *et al*. (1993a, 1993b, 1994) and the microplankton model used by Tett & Walne (1995) in a simulated 2 layer water column, by Smith & Tett (2000) in a 1-D, depth resolving, model, and in the 3-D model COHERENS by Luyten *et al*. (1999). Also in this class is ECOHAM1, which simulates phosphorus-limited phytoplankton within a 3-D representation of the North Sea (Moll, 1998; Skogen & Moll, 2000).

Some of the undesirable consequences of stage 3 of eutrophication can be dealt with by comparatively simple models. An example, dealing with transparency and oxygen concentration of fjordic waters, is the FjordEnv model of Stigebrandt (2001). These remain within the scope of biogeochemical modelling. However, some aspects of undesirable disturbance require simulations of food webs with many components and hence fall into the domain of 'ecological' modelling. This was defined by Tett &Wilson (2000) as involving at least one state variable that was not constrained by a conservation rule. Such models can give rise to simulations involving Lotka-Volterra oscillations or even chaotic behaviour, and hence lead to more uncertain predictions. However, such behaviour can be avoided by suitable choice of parameter values, or by the inclusion of terms that dampen oscillation, for example through simulated switching between prey types. The best-known example of a complex ecosystem model is the European Regional Seas Ecosystem Model (ERSEM), which in its version II (Baretta-Bekker *et al*., 1997) emulates a system containing diatoms, dinoflagellates , autotrophic flagellates, "picoalgae", heterotrophic nanoflagellates, bacteria, microzooplankton and mesozooplankton. It has been successfully used by Pätsch & Radach (1997), with dinoflagellates replaced by Phaeocystis, to simulate changes in the diatom-flagellate balance induced by anthropogenic nutrient enrichment of the southern North Sea. Initial applications of ERSEM used a multicompartment representation of space, with stratified waters divided into an upper 30 m layer and a lower water column. Recently, Proctor *et al*. (2004) have embedded ERSEM in a highly-resolved 3-D simulation of North Sea circulation in order to calculate nutrient fluxes between different parts of the north-western European continental shelf.

ERSEM uses "characteristic organisms", each such organism being a bulk parameterisation of a single population of a typical flagellate, diatom, etc typifying a normally heterogenous mixture. The lower part of the pelagic food web is assembled explicitly out of links between the characteristic organisms. In contrast, the microplankton models used by Tett & Walne (1995) and Smith & Tett (2000), deal with microbial processes in a different way. A microplankton compartment contains both autotrophs (phytoplankton) and microheterotrophs (bacteria and protozoa), with the parameter, η, giving the ratio of microheterotroph to total microplankton carbon biomass. The simulated compartment can be thought of as a mixture of chloroplasts carrying out photosynthesis and driving nutrient assimilation, and mitochondria, responsible for respiration.

Diatoms sink, and flagellates can swim small distances vertically under calm conditions, and the simulation of these motions may be important for predicting the balance of organisms. The microplankton model of Tett & Walne (1995) was implemented in a physical structure of 2 layers (of variable thickness summing to a constant total. ERSEM was originally implemented in 2 thick layers – the upper water column down to 30 metres, and a deeper water layer, with vertical exchange (as well as lateral exchange between boxes) taken from a separate physical model. In both cases, such a structure produces a large numerical enhancement of any advective term and does not allow the formation of midwater features such as a deep chlorophyll maximum. Ruardij *et al*. (1997) implemented ERSEM within a depth-resolving 1-D physical model and found that properly simulating stratification had "a major impact on the biota". ERSEM version III has also been implemented in a 1-D framework and applied to the Baltic (Vichi, 2002) and more recently in unpublished work in the North Sea.

A depth-resolving 1-D model has advantages over a 3-D model when it comes to numerical experiments: it is computationally much simpler, and there is no need to acquire and apply data for extensive, and possibly poorly known, lateral boundary conditions. However, a 1-D model is inaccurate in waters where lateral transport fluxes are substantial, as is the case in the anthropogenically enriched coastal waters of the southern North Sea, for example at the PROVESS southern site (Wild-Allen *et al*, 2002).

The case for complexity and the use of ecosystem models within a 3-D hydrodynamic framework is made by Moll and Radach (2003). They identified 11 three-dimensional coupled physical-biological models for the North Sea. They reviewed 7 in more detail in terms of the complexity, spatial and temporal resolution, the degree of trophic complexity and the processes relating state variables to each other.

They concluded that 7 (NORWECOM, GHER, ECOHAM, ERSEM, ELISE, COHERENS and POL3dERSEM) of these three-dimensional ecological models of the greater North Sea have provided consistent distributions and dynamics of the lower trophic levels on their regional, annual and decadal scales. The results from these model simulations have either confirmed existing knowledge derived from field work or given new insight into the ecosystem structure and function in the North Sea. Model simulations have contributed to improved knowledge of the temporal and spatial development and magnitude of primary production, its mechanisms of limitation, the mechanisms of nutrient regeneration, the effects of riverine and atmospheric nutrient inputs causing eutrophication of coastal waters and the budget for nutrients.

Three of the models, reviewed in more detail by Moll and Radach (2003) have been applied by groups within the UK. These include; POL3dERSEM, ERSEM and COHERENS. Recent applications of POL3dERSEM (now termed POLCOMS-ERSEM) have been carried out within the EU funded MERSEA Strand 1 project (Allen *et al*., 2004) An important conclusion from this work was the need to improve representation of the underwater light climate in shallow (< 20 m) coastal waters in order to better simulate the light-dependent growth of phytoplankton and thereby their response to changes in nutrient input. As the underwater light climate in these waters is largely determined by suspended matter concentration, the representation of the deposition and resuspension processes needs to be improved.

Moll and Radach (2003) concluded that lack of complexity was a weakness in many ecosystem model formulation and they cited ERSEM as an example of a model with the necessary degree of complexity for realistically simulating the North Sea system.

A physical model is a general requirement to provide a framework for application of the biological model as noted earlier. The state of the art of physical modelling will not be dealt with here but a recent review has been carried out by Lenhart & Pohlman, 2004). Nevertheless, it is important to be aware of current limitations particularly in the application of 3-D hydrodynamic models. These authors note the need for reliable data on boundary conditions. Obtaining such information, for example, on riverine inputs of freshwater and the associated flux of dissolved and particulate nutrients is a non-trivial task and should be recognised as a potential limitation on the reliability on coupled physical-biological models used in relation to eutrophication. As a general rule the simpler the physical model the more important the accurate specification of boundary conditions becomes.

Scenario testing

Multiple effects are difficult to distinguish in field data and it is the power of models to distinguish between multiple effects which make them very good tools to carry out (numerical) experiments on the effects of nutrient reduction. In particular, models may be used to distinguish between riverine or atmospheric inputs of nutrients. A further example would be to distinguish between the effects of bed-load transport of particle-bound nutrients and the transport of dissolved nutrients.

An earlier initiative related to scenario testing included the workshop on "Modelling of Eutrophication Issues". This workshop was the second in a series organised by the Environmental Assessment and Monitoring Committee (ASMO) of the Oslo and Paris Commission (OSPARCOM). The first part of the workshop examined the conceptual basis of the models and evaluated the agreement between model results and in situ data. The responsiveness of models to anthropogenic input reduction was the subject of the second part of the workshop. The model responsiveness to the following scenarios was tested and compared;

- the effects of actual trends in riverine inputs, e.g., a 50% reduction of phosphate loadings between 1985 and 1995, as indicated by the available data sets;
- the potential effects of 50% reduction of anthropogenic inputs of both phosphate and nitrogen

It was shown that there is a wide range of predicted response to nutrient load reductions. The responsiveness exercise has shown that a nutrient load reduction of 50% does not linearly translate into a 50% reduction in any of the chosen measures of eutrophication, such as average annual primary production, maximum primary production, summer mean chlorophyll concentration, peak chlorophyll concentration, winter mean chlorophyll concentration, winter mean nutrient concentrations or oxygen depletion. The models in general predict a greater responsiveness in the coastal regions than in the northern North Sea.

Further published work (Lenhart *et al*., 1997) using ERSEM II, investigated a 50% reduction in river nutrient loading to the North Sea. Net primary production decreased by up to 15% in the coastal region but barely 2% offshore. They concluded that the discharges of the major rivers hardly affect the central North Sea but lead to significant changes in nutrient limitations and mass flows in the coastal area. However, the model was run for only 1 year and thus did not allow for the (slow) effects of depleting benthic nutrient pools under long-term reduced nutrient inputs.

EU funded work currently in progress (Eurocat; www.iia-cnr.unical.it/EUROCAT/) aims to study the impact on coastal water quality of future socio-economic changes in European river catchments. This is a large European project researching 8 major European catchments and their coastal zones. Again using ERSEM II 3 nutrient reduction scenarios are being investigated; DG (Deep Green), PT (Policy Target) and BAU (Business as usual) defined within the Eurocat project. A two-layer box model was forced by HAMSOM (http://www.ifm.uni-hamburg.de/~wwwsh/res/HAMSOM/hamsom.html) as the underpinning hydrodynamic model. While simulations near shore, with the emphasis on the catchments may result in realistic simulation for the coastal zone there is greater uncertainty in the robustness of the results for offshore regions.

An important outcome from the earlier work on scenario testing is the apparent lack of responsiveness of the North Sea system to reductions in nutrient loading, on the basis of model output. There does not appear to be a linear relationship between nutrient reduction and changes in the level of assessment variables. In the next section possible explanations are presented and options for meeting future requirements are identified.

Future needs

There is a need for wider debate amongst the key contracting parties in order to share experiences and identify, when appropriate, opportunities for collaboration. A number of issues identified below would benefit from joint discussions and in some cases shared effort.

As a general conclusion Moll and Radach (2003) note lack of complexity as a drawback in most models they reviewed apart from ERSEM. They also note the lack of a systematic way of determining the necessary complexity required in a model in relation to the particular application. This is an important conclusion with regard to future scenario testing. It is therefore, important to consider the necessary degree of complexity to realistically simulate the consequences of nutrient reduction scenarios in relation to eutrophication. Examples of the key biogeochemical and ecological processes that need to be realistically described (and not oversimplified) and robustly parameterised include:

- nutrient and carbon dynamics;
- oxygen dynamics - to include air-sea exchange;
- microbial dynamics and balance of organisms;
- benthic-pelagic coupling;
- controls on sub-surface irradiance (suspended matter deposition and resuspension).

Such a list needs to be established and potentially extended through further dialog with relevant parties. As part of such a dialog, a rationale for determining model complexity should be developed.

With regard to the nutrient reduction scenario testing it is likely the benthos plays a crucial role in buffering the system, through internal nutrient pools, against rapid changes in external nutrient forcing. It is critical that models used in scenario testing include the necessary level of complexity to ensure that this ‘buffering’ role is properly described. Moll and Radach (2003) specifically identify short-comings in the representation of sediment chemistry. They note the absence of burial and remineralisation of organic matter in most of the models cited, with the exception of ERSEM. Evidence of the role of the benthic system in nutrient regeneration is provided by (Vichi, 2002).

There is also a requirement to ensure that model runs are sufficiently long to enable any new equilibrium to be achieved. Evidence from unpublished work with a 1-D hydro-dynamically coupled version of ERSEM III suggests that the effect of a reduction in nutrient loading is not apparent until approximately 5 years later. In order to allow realistic multi-year runs the appropriate meteorological forcing data must be available.

As ecosystem models achieve the necessary complexity and are coupled to appropriate 3-D hydrodynamic frameworks, checking models for realistic behaviour prior to operational use is difficult due to the high computational costs of long model runs and difficulties associated with interpreting complex data sets. One approach to address this problem efficiently is to carry out sensitivity analysis of the ecosystem model in a 1-D framework. The rapid run-times achievable on a typical workstation mean that models can be easily run for decades, allowing even long-term effects of any scenario to manifest themselves, prior to coupling the model code to the associated 3-D hydrodynamic model.

A debate regarding the most appropriate method for validation continues. This issue is addressed in the discussions at the Workshop on Future Directions on Physical-Biological Interactions held under the auspices of ICES in 2004. Of particular relevance to eutrophication modelling is the choice of state variables to compare with observations. Although most ecosystem models represent phytoplankton biomass as carbon they output chlorophyll concentration as a proxy of phytoplankton biomass and validate the model against Chl a observations. These values are typically derived from fixed carbon:chlorophyll ratios. Clearly, this ratio is variable in nature and as a result introduces uncertainty into the validation procedure. A better approach may be to choose system level quantities that are not subject to such uncertainties such as SPM, 02 and nutrient concentrations. These state variables have the advantage of being directly measurable quantities, unlike phytoplankton carbon. With depth resolving physics, modelled and observed concentration profiles can be compared, providing key information on vertical dynamics. Oxygen is a key variable in relation to conveying information about system response to nutrient inputs as well as being regarded as an indirect indicator of eutrophication. For example trends in oxygen concentration will inform of the relative importance of auto- and heterotrophy and hence the likely response to nutrient inputs.

There is also a strong case for comparing modelled rates, such as primary productivity, with field data. The implication of such approaches to model validation is that the choice of variables to be monitored may need to be adjusted to ensure that future model applications are well-tested, robust and reliable.

Supporting policy need through the use of models

Where models are used to support policy implementation (e.g. assessment of eutrophication) or development there is a fundamental requirement for robustness and reliability. As a result the attributes of the model(s) to be applied need to be clearly understood and their needs to be clarity about the way in which the model will be used. A useful distinction is between models used as ‘engineering tools’ or as tools for testing hypotheses. In the first instance the answers must be reliable and stand up to scrutiny. This use is distinct from the latter scientific use where numerical models are designed to improve understanding by testing hypotheses. The desirable attributes of models as engineering tools is that they are not only robust and reliable but also transparent and easily understood with the implication that they are likely to be simple rather than complex in design. However, the debate regarding the need for increased complexity identifies a difference in philosophies within the scientific community that needs to be explored further. The way forward is likely to embrace both sides of the argument by identifying where in the system to be modelled complexity is required and elsewhere that simplicity will suffice.

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Annex 6: Annual Phytoplankton Summary Reports

Germany (presented by C. Dürselen)

Baltic Sea

MURSYS

Marine Environment Reporting System
Information from the North Sea and Baltic Sea

prepared by BSH Hamburg

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Phytoplankton - Summary (2004) for the Baltic Sea

Baltic coast of Schleswig-Holstein

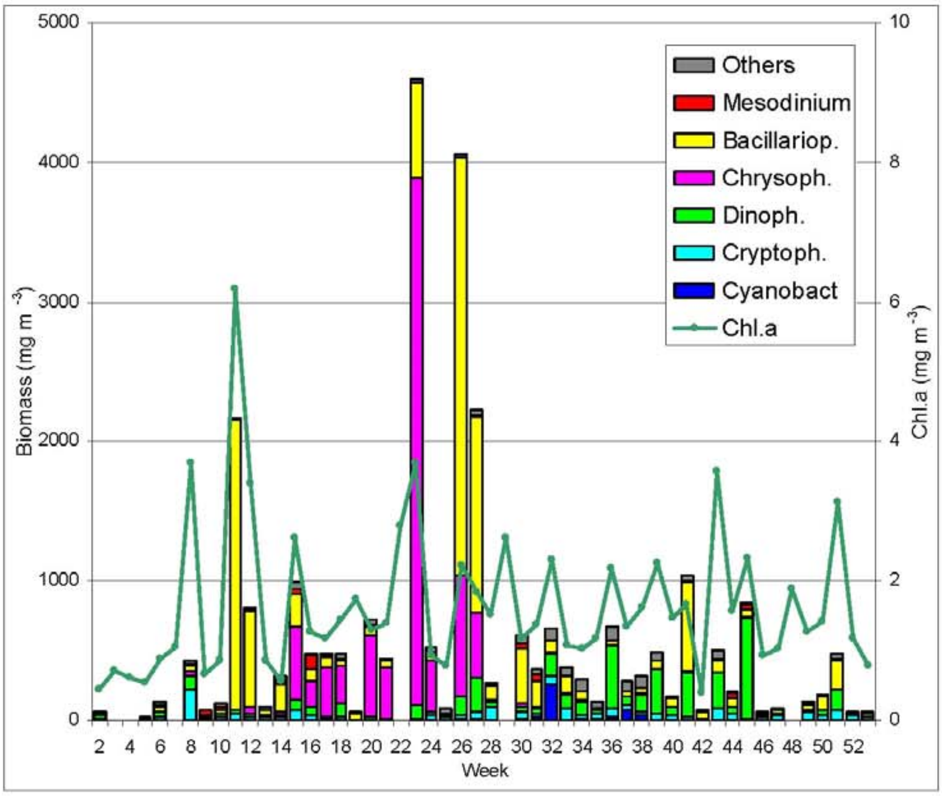
At the beginning of monitoring in early June, an algal bloom of the naked stage of *Dictyocha speculum* was observed, with up to 9 million cells per litre. However, at the end of June and beginning of July, the development of the summer assemblage of plankton was still slow. Cool and windy weather delayed the normal succession of microalgal communities by several weeks. Small flagellate species with high cell concentrations were dominant, and medium to high cell concentrations of typical summer diatoms were observed only in a few areas. Dinoflagellates continued to be rare. By mid-July, the typical assembly of summer plankton had developed in the Baltic coastal waters despite relatively low water temperatures, with higher cell counts of diatoms and dinoflagellates (especially *Ceratium* species). Filamentous blue-green algae of the species *Anabaena* became more abundant, especially in the Bay of Lübeck, but did not accumulate on the surface. At the end of July, cell counts of typical diatom summer species (*Skeletonema costatum*, *Leptocylindrus danicus*, *Proboscia alata*, and *Cerataulina pelagica*) increased also in the inner areas of the Flensburg and Kiel Fjords. Also cell counts of the autotrophic ciliate *Myrionecta rubra* were elevated for some time. In the Fehmarn Sound, western Mecklenburg Bight, and Bay of Lübeck, the typical flakes and accumulations of blue-green algae on the surface were observed temporarily in early August. However, they were much weaker in intensity and spatial extent than in 2003.

Monitoring station „Seebrücke Heiligendamm"

The results of the weekly sampling at the sea-bridge Heiligendamm (54°08,55' N; 11°50,60' E, 300 m off shore, 3 m water depth), performed by the Baltic Sea Research Institute Warnemünde (IOW) are shown in Fig. 1. The line reflects the chlorophyll *a* concentration and the columns the phytoplankton wet weight. The phytoplankton biomass was determined by microscopic counting and the chlorophyll *a* concentration by ethanolic extraction and fluorometric measurement according to the HELCOM manual[1]. Quantitative microscopic counting was not possible in week 3, 4, 7, 22, 29 and 48 due to high content of resuspended sediments in the samples owing to strong wind. As expected, phytoplankton biomass was low in January and February. Only on 17.2.04 (week 8) a relatively high amount of Cryptophyceen (*Teleaulax* spp.) occurred, besides of the dinoflagellate *Heterocapsa rotundata*. On 9.3.04 (week 11), the spring bloom reached its peak. It was dominated by *Thalassiosira nordenskioeldii* (1473 mg m^{-3}), besides of much lower biomasses of *Skeletonema costatum* (101 mg m^{-3}), *Chaetoceros* cf. *debilis* (93 mg m^{-3}) and *Porosira glacialis* (67 mg m^{-3}). Already by the 17.3.04, *Thalassiosira nordenskioeldii* dropped to 87 mg m^{-3}, while the biomass of *Skeletonema costatum* grew to 305 mg m^{-3}. On 23.3.04 (week 13), the bloom was over, which was also indicated by the chlorophyll *a* data. In the year 2003, the spring bloom occurred much earlier (on 26.2.03) and was dominated by *Skeletonema costatum* (= 1662 mg m^{-3}). The biomass of the photoautotrophic ciliate *Mesodinim rubrum* stayed low, like in 2003. On 6.4.04, the naked form of the Dictyochophyceae *Dictyocha speculum* occurred with 429 mg m^{-3}. The stayed the dominant or sub-dominant species until 29.6.04 (week 27). The big diatom *Dactyliosolen fragilissimus* has developed strongly since 2.6.04. It grew to a peak biomass of 2757 mg m^{-3} by the 22.6.04 (week 26) but disappeared almost completely by the 6.7.04 (week 28). It was replaced on 20.7.04 (week 30) by the big diatom *Cerataulina pelagica* (316 mg m^{-3}). It decreased to 56 mg m^{-3} on 3.8.04, while the summer cyanobacteria *Nodularia spumigena, Aphanizomenon* sp. and *Anabaena* spp. developed. However, in contrast to the previous year the

[1] http://www.helcom.fi/Monas/CombineManual2/CombineHome.htm

cyanobacteria did not form a bloom. On 10.8.04 (week 33), the cyanobacteria *Nodularia spumigena*, *Aphanizomenon* sp. and *Anabaena* spp. have already decreased. Also the summer diatoms (*Cerataulina pelagica, Proboscia alata, Dactyliosolen fragilissimus*) disappeared, whereas the slow growth of the typical dinoflagellaten *Ceratium tripos* continued. Cryptophyceae (*Plagioselmis prolonga*) developed, too. All species decreased by the 24.8.04 (week 35). Dinoflagellates (*Ceratium tripos, Prorocentrum micans, Heterocapsa rotundata*) appeared in high biomass on 31.8.04 but decreased already in the next week. Surprisingly, *Nodularia spumigena* reappeared in week 37 but disappeared finally in week 39 (21.9.04). Dinoflagellates (*Ceratium tripos, C. fusus, Prorocentrum micans*) continued their growth. A bloom of the potentially toxic diatom *Pseudonitzschia* cf. *pungens* (349 mg m^{-3}) is remarkable because it is not usual; the last bloom of this species was registered in October 1999. At the same time (5.10.04, week 41), also *Cerataulina pelagica, Guinardia flaccida* and *Ceratium tripos* were frequent. The typical autumn dinoflagellates (*Ceratium tripos, C. fusus, Prorocentrum micans*) dominated on 19.10. and 2.11.04 (week 43 and 45). Afterwards, their biomass decreased drastically. Nevertheless, the diversity was rather high in mid of December, with more than 40 identified taxa. It was mainly formed by diatoms (*Proboscia alata, Guinardia flaccida, Thalassiosira anguste-lineata, Thalassionema nitzschioides, Chaetoceros curvisetus, Ditylum brightwellii, Cerataulina pelagica*), dinoflagellates (*Ceratium tripos, Heterocapsa rotundata*) and Cryptophyceae (*Teleaulax* sp., *Plagioselmis prolonga*).



Chlorophyll *a* concentration and composition of phytoplankton biomass (wet weight) from 6.1. to 28.12.2003 at the coastal station Heiligendamm (surface water).

Outer coastal waters of Mecklenburg-Vorpommern

January and February were without any special developments regarding the species spectrum of phytoplankton and concentrations of chlorophyll-a. Chl a values ranged between 0.6 µg/L (north of Warnemünde) and 4.6 µg/L in the Bay of Lübeck, where the onset of the springtime algal development was slow, starting with the diatom species *Skeletonema costatum*, *Thalassionema nitzschioides*, and species of the genera *Thalassiosira*, *Melosira*, and *Chaetoceros*. The total biovolumes in this area varied between 0.2 and 0.6 mm^3/L, and remained below 0.1 mm^3/L in many other areas. The cryptophyceae *Teleaulax acuta* occurred along the entire outer coast. In March, Chl-a concentrations dropped from 1.6 - 6.5 µg/L at the beginning of the month to 1.0 - 1.7µg/L at the end of the month, marking the end of the spring algal bloom in the western Baltic areas. In the eastern Baltic areas, peak chlorophyll-a levels were measured between Greifswalder Oie and the inner Pomeranian Bight at the end of March, where the measured value of 22.8 µg/L clearly exceeded the long-term means; *Teleaulax acuta* and diatoms of the genus *Melosira* dominated in this area. In May, the chlorophyll-a levels ranged between 1.2 µg/L off Fischland and 7.0 µg/L east of Sassnitz, corresponding to 280 % of the long-term means. Farther east, values below the long-term means were measured, and slightly elevated values in the sea area extending north of Boltenhagen to the waters northwest of Hiddensee. The end of the spring algal growth was marked by biomass volumes ranging from 0.5 mm^3/L north of Boltenhagen to 1.0 mm^3/L in the Pomeranian Bight, where *Diatoma elongatum* was dominant; the dominant species between Boltenhagen and Warnemünde was *Dictyocha speculum*. In June, chlorophyll-a concentrations ranged between 1.1 µg/L (northwest of Hiddensee) and 4.7 µg/L (Pomeranian Bight), clearly exceeding the long-term means (LTM) between Boltenhagen and Fischland. The phytoplankton biovolume ranged from 0.1 mm^3/L northwest of Hiddensee to 1.1 mm^3/L north of Boltenhagen. In July, Chl-a concentrations dropped below LTM, to values between 1.1 µg/L (north of Darsser Ort) and 6.7 µg/L (Pomeranian Bight). At the end of the month, potentially toxic blue-green algae were observed in an area extending from the waters northwest of Hiddensee to east of Sassnitz (*Aphanizomenon flos-aquae*, at up to 128,000 filaments/L). Chlorophyll-a concentrations measured in August in the waters between Boltenhagen and Hiddensee ranged from 1.4 - 2.5 µg/L, which was below LTM. In the area between Cape Arkona and Greifswalder Oie, the measured values of 3.8 – 11.0 µg/L were slightly above LTM. In the Pomeranian Bight, the measured Chl-a values of 5.5 µg/L and 6.3 µg/L reached barely 50 % of LTM. The phytoplankton biomass ranged from 0.1 mm^3/L (north of Boltenhagen) to 1.0 mm^3/L (north of Ahlbeck) in the eastern part, and 0.1 to 0.8 mm^3/L, corresponding to 6.6 % to 46 % of LTM, in the western part, in the sea area north of Warnemünde. Dominant species were the dinoflagellate *Ceratium tripos* (north of Boltenhagen) and, farther east, *Aphanizomenon flos-aquae* (north of Ahlbeck). During special surveys of the abundance of blue-green algae, large algal mats of *Nodularia spumigena* and *Aphanizomenon flos-aquae* were observed in the waters of Greifswalder Bodden and Pomeranian Bight from early August. On 11 August 2004, these species of blue-green algae and, additionally, *Anabaena spp.* were also found east of Sassnitz and north of Cape Arkona, where they formed flakes on the water surface. On 16 August, also *Nodularia spumigena* and *Aphanizomenon flos-aquae*, as a subdominant form, were found besides the typical summer algae of the genera *Prorocentrum, Dinophysis, Chaetoceros, and Ceratium* in the western Baltic coastal waters (northwest of Hiddensee extending to the area north of Warnemünde). They occurred in the form of algal mats or flakes. Farther west, in the area of the Mecklenburg Bight extending from the waters north of Bug to the area north of Boltenhagen, *Aphanizomenon flos-aquae*, *Anabaena cf. lemmermannii* and *Nodularia spumigena*, including some larger accumulations, were observed on 17 August. However, there was no formation of floating algal mats.

Inner coastal waters of Mecklenburg-Vorpommern

In January and February, chlorophyll-a levels varied between 0.9 µg/L and 90.9 µg/L, which was normal for the season. Biovolumes mostly were below 0.1 mm^3/L but reached 0.5 mm^3/L in the brackish "Salzhaff" and Strelasund. In March, Chl-a values between 1.7 (Salzhaff) and 135 µg/L (Darss coastal lagoons) were measured. The values in some areas were markedly below the long-term means, while at some stations they were far above them. In the Greifswalder Bodden, for example, the Chl-a values were 4-6 times higher than normal, which was due in part to massive growth of the diatoms *Skeletonema costatum* and *Melosira arctica*. In the waters of Stettiner Haff, diatoms of the genus *Thalassiosira* as well as *Teleaulax acuta* led to elevated Chl-a values. By 24.03, chlorophyll-a levels and biovolumes had dropped sharply. In the sea area of Strelasund/Greifswalder Bodden, strikingly low chlorophyll-a values between 3.0 and 7.4 µg/L were measured in April (the long-term means range from 16.5 to 20.0 µg/L). On the whole, the diversity of the phytoplankton community was low, and the transition to the summer assemblage was dominated by Chrysophyceae. Small quantities of *Heterocapsa rotundata* and *Teleaulax acuta* were present in all areas. The chlorophyll-a concentrations in May ranged between 2.4 µg/L in the Wismar Bight and 207 µg/L in the Unterwarnow and were mostly below the long-term means. However, the extreme value in the Unterwarnow was 4 time higher than normal, reflecting the dominance of the diatoms *Stephanodiscus hantzschii* and *Melosira granulata*. Phytoplankton in the inner coastal waters of the western Baltic was dominated by *Dictyocha speculum and Skeletonema costatum*. In the Greifswalder Bodden/Strelasund area, extremely high pico- and nanophytoplankton levels were found. In the waters of Stettiner Haff, an atypical phytoplankton community of small flagellates (130 million cells/litre, biovolume 4.3 mm^3/L) and diatoms of the genus *Coscinodiscus* was found, the latter part of the summer assemblage. First Cyanobacteria of the genus *Microcystis* as well as *Aphanizomenon flos-aquae* were observed. Also in June, the Chl-a values were mostly below the long-term means. Values ranged from 1.5 µg/L in the brackish „Salzhaff" to 107 µg/L in the Stettiner Haff, with long-term means clearly exceeded; this was partly due to the typical early summer growth of the diatom species *Coscinodiscus* (biovolumes of 7.0 mm^3/L at 237,000 cells/litre). In July, chlorophyll-a concentrations increased to different levels but remained below LTM. Phytoplankton biovolumes ranged between <0.1 mm^3/L (Wismar Bight) and 10.4 mm^3/L in the Szczecin Lagoon, where the typical early-summer growth of the diatom *Coscinodiscus* led to cell counts of 237,000 cells/L (= 0.7 mm^3/L). In August, chlorophyll-a concentrations between 5.5 µg/L (Salzhaff) and 130 µg/L (Peenestrom) were observed in the inner coastal waters. In the Lower Warnow, the unusually low value of 9.1 µg/L only reached 30 % of LTM; elevated Chl-a levels of 29.5 µg/L (228 %) in the waters of Greifswalder Bodden were caused by a strong growth of blue-green algae. The phytoplankton biovolume consisted of cryptophyceae of the genera *Plagioselmis*, *Teleaulax*, and *Dictyocha speculum*. In the Szczecin Lagoon, cyanobacteria species such as *Aphanizomenon flos-aquae, Microcystis aeruginosa / M. flos-aquae* as well as *Anabaenopsis elenkinii* were dominant. The biovolume remained small, however, at 5.6 mm^3/L (LTM: 15.3 mm^3/L).

North Sea

MURSYS

Marine Environment Reporting System
Information from the North Sea and Baltic Sea

prepared by BSH Hamburg

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Phytoplankton - Summary (2004) for the North Sea

Coast of Lower Saxony

Sampling along the coast of East Friesland to determine the abundance of bloom forming and toxic algae was performed by Niedersächsisches Landesamt für Ökologie (NLÖ, Lower Saxony State Agency for Ecology) at seven near-shore stations. The first samples were collected in early August. An analysis of the entire sampling period from early August to mid-October showed that toxic or HAB (harmful algal bloom) forming phytoplankton species never occurred in any critical quantities. The abundance of such species was generally very low during this year. Some species were not observed at all, for example the dinoflagellates *Dinophysis acuta, D. acuminata,* and *D. norvegica*, which are toxic at low concentrations. Very low concentrations of *Dinophysis rotunda* were found at a single sampling station in early August, but the species was no longer present in samples taken in mid- and late August. It was observed once more at one station in mid-September at a concentration of 100 individuals/L. The bioluminescent alga *Noctiluca scintillans*, a heterotrophic dinoflagellate which does not produce any toxins, occurred at all stations in early August, with maximum cell counts of 180 cells/L, but decreased in abundance until the end of August, when samples at some of the stations were completely free of cells. From mid-September, samples again showed densities of up to 22 cells/L. In mid-October, cell counts again showed slightly higher densities of max. 61 individuals/L. In mid-October, also *Ceratium furca* (dinoflagellate) was more abundant. The foam-forming alga *Phaeocystis globosa*, which belongs to the class of Prymnesiophyceae, was found at three stations in early August in small numbers of colonies (max. 18 colonies/L), after which its abundance decreased continuously. It recurred only once, in mid-September, at all stations with maximally 33 colonies. In early August, nanoflagellates of the genus *Chrysochromulina* (Prymnesiophyceae) and the Raphidophyceae species *Chattonella marina and Fibrocapsa japonica,* all three of which produce toxins, were not found at any of the stations. In mid-August, *Chrysochromulina* cell counts showed 5,800 to 11,700 cells/L at some of the stations, but none of the toxic species *C. polylepis* and *C. leadbeateri* from the IOC list (IOC = Intergovernmental Oceanographic Commission). At the end of August, population densities still reached 7,800 cells/L, after which cells of these species were no longer present until the end of the sampling period. Negligible concentrations of *Chattonella marina* were found at a single station in mid-August but, like *Fibrocapsa japonica*, the species was not observed afterwards at any of the stations. Diatoms of the potentially toxic genus Pseudo-nitzschia, at cell concentrations of up to 18,200 cells/L, were found in early August, increasing to 42,100 cells/L by mid-August. Their abundance then decreased to 2,400 cells/L by the end of the month, rising again to a maximum abundance of 6,200 cells/L in mid-September. Between the end of September and the last sampling date in mid-October, maximally 2,900 and 2,700 cells/L, respectively, were found, with local occurrences of very small numbers of individuals or the complete absence of cells. Low population densities of the ciliate *Myrionecta rubra,* which is capable of photosynthesis due to the presence of endosymbiontic algae, were found only in early August, at three stations. Throughout the sampling period, diatoms were dominant among the non-toxic and non-dangerous algae of the relatively species-rich phytoplankton. Frequently found species were: *Odontella sinensis*, *Lithodesmium undulatum*, *Thalassiosira spp.*, *Chaetoceros socialis*, *Chaetoceros spp.*, *Eucampia zodiacus, Rhizosolenia spp.*, *Biddulphia alternans*, *Coscinodiscus wailesii, C. granii,* and *Guinardia flaccida*.

Helgoland Reede

In March, after low carbon values in winter, a carbon content of 17 µg/dm^3 was measured due to the presence of the diatom *Thalassionema nitzschioides*. In the course of April, phytoplankton stocks in-

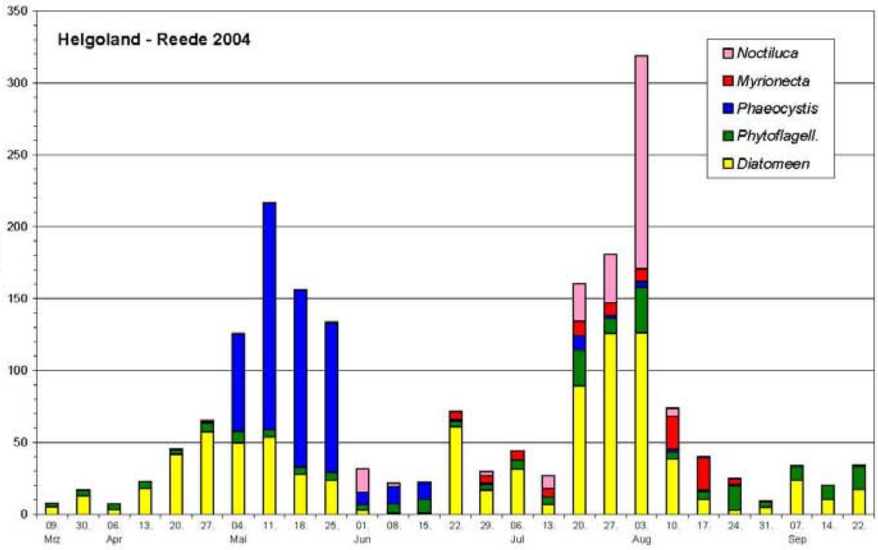
North Sylt Wadden Sea

During the weekly plankton monitoring in the Wadden Sea north of Sylt, not only temperature and salinity but also dissolved and particulate nutrients are analysed. Water temperatures in January and February ranged between 0 and 4 °C, and increased continuously from March until reaching their maximum of 21 °C in August. The salinity minimum of 26 was measured in February, rising to 31 by August. The phytoplankton spring bloom was rather small and reached its maximum in mid-April, dominated by the diatom *Odontella aurita*. Chlorophyll levels reached only 17µg/l, compared to 48 µg/l in the preceding year. The following, rather intensive, *Phaeocystis* bloom reached its maximum Chl-a level of 25 µg/l on 20 May. In the course of summer, the phytoplankton biomass decreased to about 3 µg/l, with only a minor phytoplankton bloom of up to 7 µg/l Chl-a observed in early July. *Phaeocystis* was observed regularly until mid-July. In early July, the diatom *Rhizosolenia imbricata*, and at the end of July *Guinardia striata* were observed frequently. Potentially toxic algae (*Alexandrium*, *Dinophysis*, *Chattonella*) were observed several times, but only at low cell concentrations. After a steady decrease in the phytoplankton biomass to about 3 µg Chl/L during early summer, a small bloom (up to 7 µg Chl/L) occurred in early July. Until mid-July, *Phaeocystis* was observed regularly. In early July, the diatom *Rhizosolenia imbricata* was abundant, in late July *Guinardia striata*. Rather frequently observed algal species during this summer (May to September) were the diatoms *Actinoptychus senarius*, *Cylindrotheca closterium*, *Odontella granulata*, *Odontella rhombus*, *Odontella regia*, *Odontella sinensis*, *Brockmaniella brockmannii*, *Lithodesmium undulatum*, *Delphineis surirella*, *Skeletonema costatum*, *Eunotogramma dubium*, *Chaetoceros densus*, as well as the flagellates *Phaeocystis globosa*, *Hemistasia phaeocysticola*, and *Noctiluca scintillans*. Potentially toxic algae (*Alexandrium*, *Dinophysis*, *Chattonella*, *Chrysochromulina*, *Pseudo-nitzschia*) were observed several times. Until mid-September, chlorophyll values were below 5 µg/L. In autumn, as usual, a very species-rich diatom phytoplankton was observed. At the end of September and in late November, small blooms with biomasses of up to 9 µg/L were observed. *Odontella sinensis* was rather frequent at the end of October. Outstanding occurrences in this year were the relatively late and rather weak spring bloom in mid-April followed by a long and intensive bloom of *Phaeocystis* in mid-May, and the early onset of the seasonal nutrient increase in autumn.

Schleswig-Holstein coastal waters

As a typical seasonal phenomenon of early June, the foam producing alga *Phaeocystis globosa* was very abundant along the entire west coast of Schleswig-Holstein, but with a clearly larger number of colonies than last year. The algal colonies in most areas decayed in mid-June. Diatoms occurred in small to medium numbers. Until the end of June, the species spectrum of phytoplankton was much too small for the season, with markedly lower numbers than usual, which was due to the fact that air and water temperatures had been too low for weeks. The dominant diatom species were *Rhizosolenia imbricata*, *Guinardia delicatula*, and *G. flaccida*. Dinoflagellates like the luminescent *Noctiluca scintillans* occurred only sporadically. *Phaeocystis* colonies had virtually disappeared. In July, the number of summer species still was slightly too low, though with an upward trend. Diatoms showed a higher diversity of species and higher cell counts. *Guinardia flaccida, G. delicatula, G. striata*, and *Rhizosolenia imbricata* occurred everywhere. The occurrence of other species differed locally. *Dinoflagellates* were still below normal. At the end of July/beginning of August, seasonal „red tides" occurred in the waters around Helgoland and southwest of Eiderstedt, caused by the dinoflagellate *Noctiluca scintillans* and the autotrophic ciliate *Myrionecta* rubra. In the southern part of the North Sea coastal waters of Schleswig-Holstein, especially diatoms showed a large species diversity. Cell counts of the dinoflagellate *Heterocapsa rotundata* were high. In the northern part, the species diversity was markedly lower, showing a conspicuously low proportion of dinoflagellates and, in some areas, an increasing abundance of the foam-producing alga *Phaeocystis globosa* (Prymnesiophyceae). By the end of August, phytoplankton had decreased strongly, with diatoms still most abundant and dinoflagellates occurring only sporadically. The transition to autumn plankton species in 2004 was not gradual but characterised by a breakdown in the cell counts and species diversity of phytoplankton.

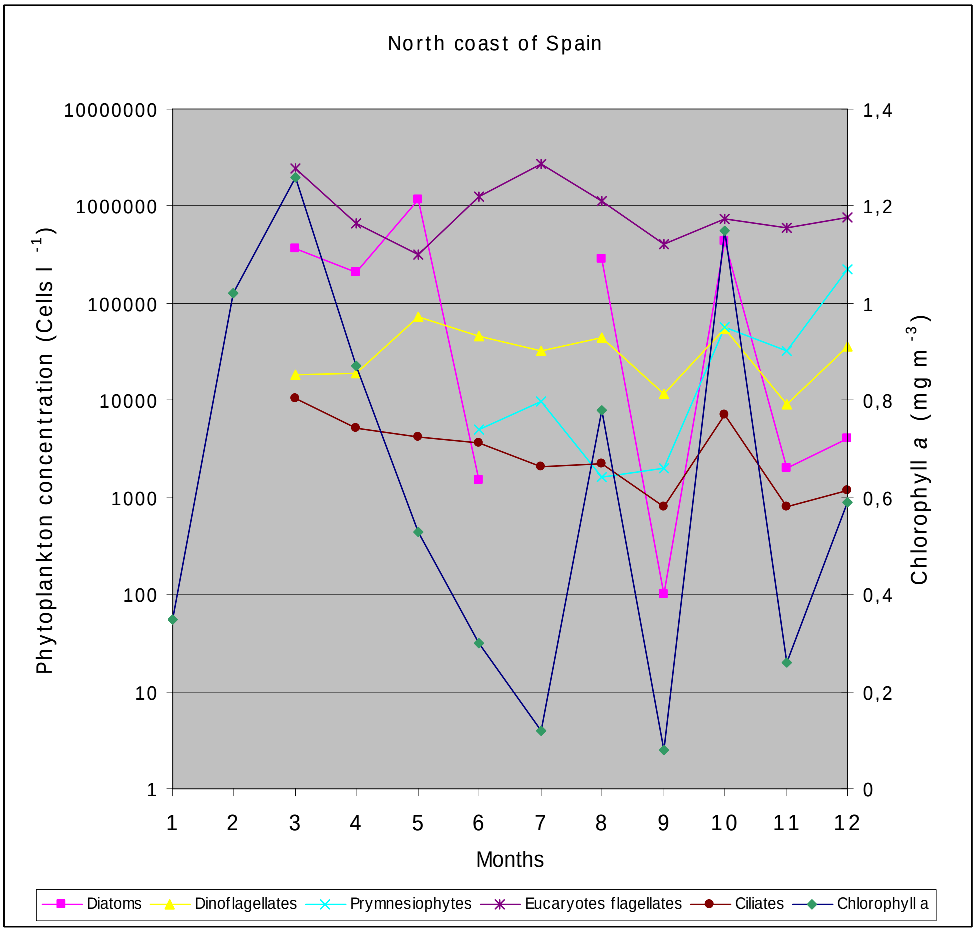
creased as in the preceding year, from 7 to 63 µg C/dm^3. The dominant species were diatoms of the genus *Thalassiosira* as well as *Thalassionema nitzschioides*, *Rhizosolenia setigera, and Guinardia delicatula*. In May, stocks increased to 125 – 216 µg C/dm^3. The dominant species among diatoms, which decreased toward the end of the month, was *Guinardia delicatula*, with a maximum of 43 µg C/dm^3 on 11 May. Also the Prymnesiophyceae *Phaeocystis globosa* was abundant, which also had its maximum of 157 µg C/dm^3 on 11 May. In early June, phytoplankton decreased in abundance, increasing again from mid-June. Values ranged between 15 µg C/dm^3 on 1 June and 71 µg C/dm^3 on 22 June. Besides diatoms (dominant species: *Guinardia delicatula* with a maximum of 50 µg C/dm^3 on 22 June), also *Phaeocystis globosa* was present until the middle of the month (maximum of 12 µg C/dm^3 on 8 June), and a relatively large population of small naked flagellates of about 8 µg C/dm^3 and, at the end of June, the autotrophic ciliate *Myrionecta rubra (*maximum of 6 µg C/dm^3 on 22 June) were observed as well. In July, phytoplankton initially decreased from 45 µg C/dm^3 on 6 July to 18 µg C/dm^3 on 13 July, after which the abundance increased up to 145 µg C/dm^3 by the end of the month. The dominant diatoms were initially *Guinardia delicatula* (maximum on 6 July, at 27 µg C/dm^3), followed by *Guinardia striata (62* µg C/dm^3 on 20 July) and, on 27 July, *Guinardia striata (38* µg C/dm^3) and *Thalassiosira rotula* (40 µg C/dm^3). On 20 July, also *Phaeocystis globosa* (10 µg C/dm^3) and many small naked flagellates *(*10 µg C/dm^3) were observed. The abundance of *Ceratium fusus* peaked on 20 July, at 9 µg C/dm^3. *Myrionecta rubra* ranged between 7 and 10 µg C/dm^3 in July. In August, the phytoplankton biomass decreased from an initially high level of 170 µg C/dm^3 to 9 µg C/dm^3 at the end of the month. On 3 August, the diatoms *Detonula pumila*, at 43 µg C/dm^3, *Chaetoceros socialis* (26 µg C/dm^3), and *Guinardia striata* (6 µg C/dm^3) were the dominant species, followed later by *Guinardia delicatula* (5 µg C/dm^3 on 10 Aug.) and *Bacteriastrum hyalinum* (4 µg C/dm^3 on 17 Aug.). Flagellates, too, were rather abundant on 3 August: small naked flagellates reached 8 µg C/dm^3, and *Ceratium fusus* 10 µg C/dm^3. *Myrionecta rubra* reached its highest population density of the year 2004 on 10 and 17 August, at 23 and 22 µg C/dm^3, respectively. In September, phytoplankton was species-rich without any particularly dominant species. Its biomass ranged from 34 µg C/dm^3 (on 7 and 22 Sept.) to 15 µg C/dm^3 (on 28 Sept.). Flagellates were composed of many small naked species (4 µg C/dm^3) at the end of the month. *Ceratium furca* still was relatively abundant, at C values between 2 and 11 µg C/dm^3 (on 22 Sept.). At the beginning of October, the phytoplankton biomass was low, from 13 to 15 µg C/dm^3.



Carbon biomass and composition of phytoplankton at Helgoland Reede between March and September.

Spain (Renate Sckarek)

The material used for this report was collected at monthly intervals at a station ubicated at 7 nautical miles off Gijón. All samples were collected at 2 meter depth. The diatom bloom in March was completely dominated by *Guinardia delicatula* (>99 %) Data for January and February are not available. Data for Prymnesiophytes are only available from June and contained for the most coccolithophorids. *Phaocystis* spp. Was rarely observed. The other smaller blooms in summer were also heavily dominated by diatoms.



Iceland (Kristinn Gudmundsson)

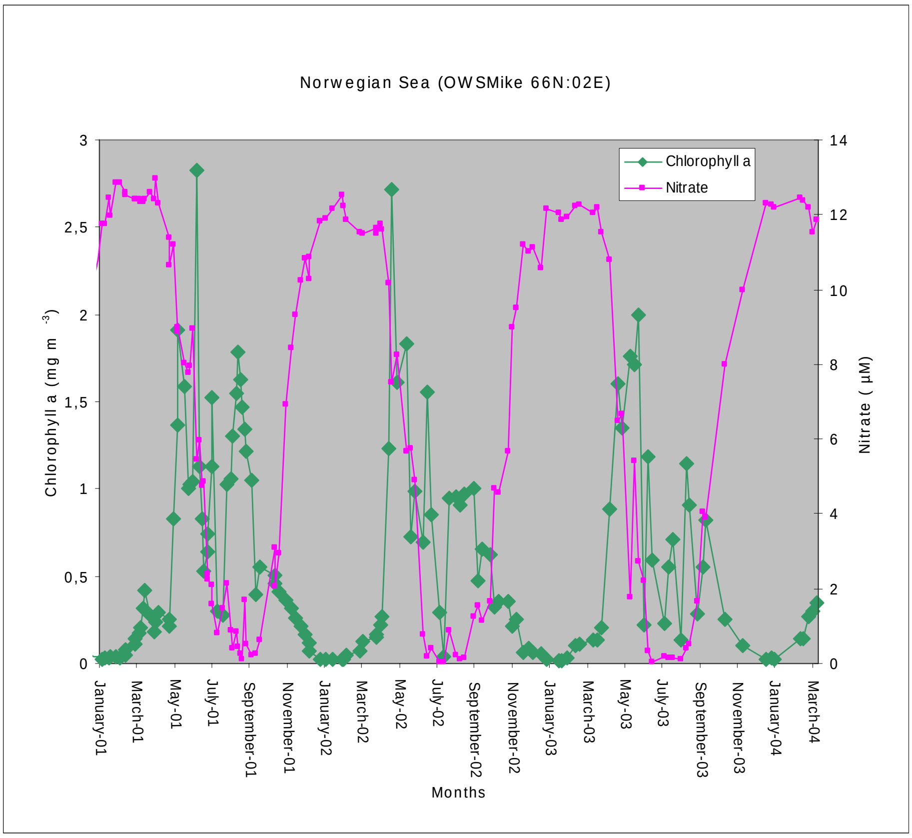
The monitoring of the biological conditions around Iceland is carried out once a year during spring (May). Samples are obtained at 10 meter depths since, as a rule, the difference in chlorophyll *a* concentration between 10 meters and the surface is negligible. The sampling is carried out around the day, so many stations does not have Secchi depth readings. Ancillary data as hydrography and nutrients are still being processed.

The data presented below are from two stations at two of the fixed sections around Iceland:

SECTION	STATION	DATE	CHLOROPHYLL *A* (MG M^{-3})	SECCHI DEPTH (METER)
Siglenes	3	22.05.2000	5.72	-
		23.05.2001	6.53	10
		21.05.2002	5.08	-
		21.05.2003	1.09	12
		25.05.2004	2.18	8
Selvogsbanki	2	31.05.2000	2.21	-
		30.05.2001	9.65	-
		29.05.2002	11.23	6
		30.05.2003	1.21	6
		30.05.2004	6.48	-

Norway (Francisco Rey)

The material presented to this Annual Phytoplankton Report has been collected from 2001 to April 2004 at the Ocean Weather Station Mike (66N;02E) in the Norwegian Sea. Sampling is done on a weekly basis down to 200 meters for Chlorophyll a and to the bottom fo nutients. Here only surface observations are presented. Data for the spring 2004 were not collected due to technical problems. As it can be seen from the figure the spring bloom takes place during May but it can vary up to three weeks from year to year. Also the spring bloom does not reach high chlorophyll *a* concentrations despite of there is still ample with nutrients at the time of the bloom. This feature has been interpreted as a tight control of the bloom size by zooplankton grazing.



Annex 7: ICES Phytoplankton Name List

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
591173	*Acanthoceras zachariasii*	x	x								
13743	*Acanthoeca brevipoda*	x	x								
13742	*Acanthoeca spectabilis*	x	x								
2188	*Acanthoica acanthifera*				x						
2190	*Acanthoica quattrospina*	x	x		x	x	x				
46773	*Acanthostomella norvegica*						x				
3430	*Achnanthes brevipes*	x	x								
3437	*Achnanthes clevei*	x	x								
3445	*Achnanthes conspicua*	x	x								
3471	*Achnanthes delicatula*	x	x								
3474	*Achnanthes dispar*	x	x								
3449	*Achnanthes exigua*	x	x								
3479	*Achnanthes flexella*	x	x								
3485	*Achnanthes hungarica*	x	x								
193784	*Achnanthes laevis*	x	x								
3489	*Achnanthes lanceolata*	x	x								
591166	*Achnanthes lemmermannii*	x	x								
3514	*Achnanthes levanderi*	x	x								
3435	*Achnanthes longipes*	x	x	x				x			
3521	*Achnanthes minutissima*	x	x								
193778	*Achnanthes oblongella*	x									
193780	*Achnanthes parvula*	x	x								
3531	*Achnanthes peragalli*	x	x								
591147	*Achnanthes subsalsa*	x	x								
3478	*Achnanthes suchlandtii*	x	x								
3436	*Achnanthes taeniata*	x	x	x							
591148	*Achnanthes thermalis*	x	x								
183970	*Achradina pulchra*					x					
6099	*Actinastrum hantzschii*	x	x								
183972	*Actiniscus pentasterias*	x	x			x		x			
2659	*Actinocyclus curvatulus*			x				x			
2661	*Actinocyclus normanii*	x	x	x							
2657	*Actinocyclus octonarius*	x	x	x		x		x			
2620	*Actinoptychus senarius*	x	x	x	x	x		x	x		
2621	*Actinoptychus splendens*	x	x	x				x			
2622	*Actinoptychus undulatus*				x		x				
573523	*Alexandrium catenella*								x		
573525	*Alexandrium fundyense*										x
183930	*Alexandrium minutum*	x	x	x	x	x					
573526	*Alexandrium monilatum*			x							x
573527	*Alexandrium ostenfeldii*	x	x	x		x	x				x
573512	*Alexandrium tamarense*	x	x	x		x	x				x
183936	*Amphidiniopsis kofoidii*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
10008	*Amphidinium acutissimum*	x	x		x	x					
10009	*Amphidinium acutum*				x						
183871	*Amphidinium carterae*	x	x	x							
10017	*Amphidinium crassum*	x	x	x	x	x					
10010	*Amphidinium glaucum*			x							
10019	*Amphidinium incoloratum*	x	x			x					
10016	*Amphidinium klebsii*				x						
10007	*Amphidinium longum*	x	x			x					
10001	*Amphidinium operculatum*	x	x	x	x						x
202443	*Amphidinium ovoideum*	x	x								
10004	*Amphidinium pellucidum*	x	x								
10006	*Amphidinium sphenoides*	x	x	x	x	x	x				
4580	*Amphipleura pellucida*	x	x								
4680	*Amphiprora alata*	x	x								
4695	*Amphiprora costata*	x	x								
4690	*Amphiprora kjellmanii*	x	x								
4683	*Amphiprora ornata*	x	x								
4685	*Amphiprora paludosa*	x	x								
9924	*Amphisolenia globifera*				x						
591158	*Amphora coffeaeformis*	x	x								
591157	*Amphora commutata*	x	x								
4731	*Amphora costata*				x						
4783	*Amphora delicatissima*	x	x								
4717	*Amphora lineolata*	x	x								
4764	*Amphora normanii*	x	x								
4721	*Amphora ovalis*	x	x								
4766	*Amphora perpusilla*	x	x								
4728	*Amphora proteus*	x	x								
4729	*Amphora robusta*	x	x								
4739	*Amphora veneta*	x	x								
615885	*Amylax triacantha*	x	x	x		x	x	x			
1129	*Anabaena aequalis*	x									
1107	*Anabaena affinis*	x									
1104	*Anabaena circinalis*	x									
1128	*Anabaena cylindrica*	x									
1101	*Anabaena inaequalis*	x									
1145	*Anabaena lemmermannii*	x									
1114	*Anabaena macrospora*	x									
1127	*Anabaena oscillarioides*	x									
1117	*Anabaena planctonica*	x									
1119	*Anabaena spiroides*	x		x							
1103	*Anabaena torulosa*	x									
1188	*Anabaenopsis arnoldii*	x									
2719	*Anaulus balticus*	x	x								
591169	*Aneumastus tusculus*	x	x								
5878	*Ankistrodesmus falcatus*	x	x								
591168	*Anomoeoneis sphaerophora*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
591692	*Anomoeoneis sphaerophora f. costata*	x	x								
1791	*Apedinella radians*	x	x	x							
1792	*Apedinella spinifera*					x					
634	*Aphanocapsa delicatissima*	x									
627	*Aphanocapsa elachista*	x									
635	*Aphanocapsa grevillei*	x									
632	*Aphanocapsa rivularis*	x									
646	*Aphanothece clathrata*	x									
640	*Aphanothece microscopica*	x									
643	*Aphanothece saxicola*	x									
644	*Aphanothece stagnina*	x									
8302	*Arthrodesmus incus*	x	x								
1091	*Arthrospira jenneri*	x									
3120	*Asterionella formosa*	x	x	x							
3117	*Asterionella japonica*				x						
615890	*Asterionellopsis glacialis*	x	x	x	x	x	x	x	x		
615891	*Asterionellopsis kariana*	x	x	x							
9531	*Asteromonas gracilis*	x	x			x					
2636	*Asteromphalus flabellatus*										
2634	*Asteromphalus heptactis*			x			x				
610122	*Asteromphalus hyalinus*					x					
615884	*Attheya septentrionalis*	x	x	x	x	x	x				
2629	*Aulacodiscus argus*							x			
591204	*Aulacoseira alpigena*	x	x								
591194	*Aulacoseira ambigua*	x	x								
591208	*Aulacoseira distans*	x	x								
591207	*Aulacoseira granulata*	x	x								
591482	*Aulacoseira islandica*	x	x								
591483	*Aulacoseira italica*	x	x								
591108	*Aulacoseira lirata*	x	x								
591206	*Aulacoseira subarctica*	x	x								
2676	*Auliscus pruinosus*	x	x								
2675	*Auliscus sculptus*	x	x	x							
10116	*Aureodinium pigmentosum*			x		x					
5301	*Bacillaria paxillifer*			x				x			
2864	*Bacteriastrum delicatulum*			x	x		x				
2865	*Bacteriastrum elongatum*	x	x	x		x	x				
573687	*Bacteriastrum furcatum*			x			x				
2866	*Bacteriastrum hyalinum*	x	x	x	x	x		x			
2727	*Bellerochea horologicalis*				x						
2726	*Bellerochea malleus*	x	x	x				x			
2679	*Biddulphia alternans*			x	x			x			
2700	*Biddulphia granulata*	x	x								
2689	*Biddulphia mobiliensis*				x					x	
2694	*Biddulphia obtusa*	x	x								
2690	*Biddulphia pulchella*	x	x								
2696	*Biddulphia regia*				x					x	

List											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
2691	*Biddulphia rhombus*				x						
2698	*Biddulphia sinensis*				x					x	
2695	*Biddulphia subaequa*	x	x								
43823	*Bodo designis*	x				x					
203851	*Bodo ovatus*	x									
6308	*Botryococcus braunii*	x	x								
5425	*Brachiomonas submarina*	x	x			x					
591199	*Brachysira brebissonii*	x	x								
591203	*Brachysira serians*	x	x								
591201	*Brachysira vitrea*	x	x								
573337	*Cachonina hallii*			x	x						
10204	*Cachonina niei*			x	x						
2195	*Calciopappus caudatus*	x	x		x	x	x				
2197	*Calciosolenia murrayi*				x						
4371	*Caloneis amphisbaena*	x	x								
4382	*Caloneis bacillum*	x	x								
4379	*Caloneis liber*				x						
591183	*Caloneis molaris*	x	x								
4421	*Caloneis permagna*	x	x								
4392	*Caloneis schumanniana*	x	x								
4393	*Caloneis silicula*	x	x								
4376	*Caloneis subsalina*	x	x								
2200	*Calyptrosphaera oblonga*				x						
5404	*Campylodiscus clypeus*	x	x								
590976	*Campylodiscus hibernicus*	x	x								
5406	*Campylodiscus noricus*	x	x								
3191	*Campylosira cymbelliformis*							x			
3173	*Catenula adhaerens*	x	x					x			
591188	*Cavinula cocconeiformis*	x	x								
591185	*Cavinula lacustris*	x	x								
591184	*Cavinula pseudoscutiformis*	x	x								
591156	*Cavinula variostriata*	x	x								
2754	*Cerataulina bergonii*				x						
2755	*Cerataulina pelagica*	x	x	x	x	x	x	x	x		
2711	*Cerataulus turgidus*	x	x								
10398	*Ceratium arcticum*	x	x	x		x	x				
550467	*Ceratium arietinum*	x	x	x	x	x		x			
550468	*Ceratium azoricum*			x	x						
550540	*Ceratium breve*				x						
10418	*Ceratium candelabrum*	x	x		x	x					
10444	*Ceratium carriense*				x						
550541	*Ceratium compressum*				x						
550469	*Ceratium declinatum*				x						
331677	*Ceratium deflexum*				x						
10427	*Ceratium extensum*			x	x						
10399	*Ceratium furca*	x	x	x	x	x	x	x	x		
10400	*Ceratium fusus*	x	x	x	x	x	x	x	x		

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
331676	*Ceratium gibberum*				x						
550472	*Ceratium gravidum*				x						
573343	*Ceratium hexacanthum*			x							
10411	*Ceratium hirundinella*	x	x								
10428	*Ceratium horridum*	x	x	x	x	x	x	x			
550471	*Ceratium inflatum*				x						
10401	*Ceratium lineatum*	x	x	x	x	x	x	x			
10402	*Ceratium longipes*	x	x	x	x	x	x	x			
573345	*Ceratium longirostrum*			x							
10403	*Ceratium macroceros*	x	x	x	x	x	x	x			
10412	*Ceratium massiliense*			x	x						
10417	*Ceratium minutum*			x	x						
10406	*Ceratium pentagonum*				x						
573352	*Ceratium petersii*			x							
550544	*Ceratium platycorne*			x	x						
573510	*Ceratium porrectum*				x						
10448	*Ceratium pulchellum*				x						
10420	*Ceratium setaceum*			x	x						
10438	*Ceratium symmetricum*			x							
10431	*Ceratium teres*			x	x						
10413	*Ceratium trichoceros*			x	x						
10408	*Ceratium tripos*	x	x	x	x	x	x	x			
2837	*Chaetoceros aequatorialis*				x						
2759	*Chaetoceros affinis*	x	x	x	x	x	x	x	x	x	
2763	*Chaetoceros anastomosans*			x	x						
2769	*Chaetoceros atlanticus*	x	x	x	x	x	x				
2774	*Chaetoceros borealis*	x	x	x		x	x	x			
2776	*Chaetoceros brevis*	x	x	x	x	x	x				
2777	*Chaetoceros ceratosporus*	x	x	x	x	x					
2778	*Chaetoceros cinctus*	x	x	x		x	x				
2779	*Chaetoceros coarctatus*			x	x						
2780	*Chaetoceros compressus*	x	x	x	x	x	x	x			
2781	*Chaetoceros concavicornis*	x	x	x	x	x	x		x		
2783	*Chaetoceros constrictus*	x	x	x	x	x	x				
2784	*Chaetoceros convolutus*	x	x	x	x	x	x	x	x		
2785	*Chaetoceros costatus*	x	x	x	x	x		x			
2838	*Chaetoceros crinitus*	x	x	x			x	x			
2839	*Chaetoceros criophilus*						x				
2786	*Chaetoceros crucifer*								x		
2787	*Chaetoceros curvisetus*	x	x	x	x	x	x	x	x		
2789	*Chaetoceros danicus*	x	x	x	x	x	x	x	x	x	
2790	*Chaetoceros debilis*	x	x	x	x	x	x	x	x	x	
2791	*Chaetoceros decipiens*	x	x	x	x	x	x	x	x	x	
2794	*Chaetoceros densus*	x	x	x	x	x	x	x			
2795	*Chaetoceros diadema*	x	x	x	x	x	x	x	x		
2796	*Chaetoceros dichaeta*			x							
2797	*Chaetoceros didymus*	x	x	x	x	x	x	x	x	x	

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
2801	*Chaetoceros difficilis*	x	x	x		x					
2803	*Chaetoceros diversus*			x		x					
2804	*Chaetoceros eibenii*	x	x	x	x	x		x	x		
2840	*Chaetoceros filiformis*			x	x						
2841	*Chaetoceros fragilis*			x							
2805	*Chaetoceros furcellatus*	x	x	x			x				
2806	*Chaetoceros gracilis*	x	x	x	x	x	x				
2807	*Chaetoceros holsaticus*	x	x	x		x					
2853	*Chaetoceros ingolfianum*						x				
2808	*Chaetoceros karianus*			x			x				
2809	*Chaetoceros laciniosus*	x	x	x	x	x	x		x		
2848	*Chaetoceros lauderi*	x	x	x	x	x	x	x			
2811	*Chaetoceros lorenzianus*	x	x	x	x	x			x		
2812	*Chaetoceros messanensis*			x							
2813	*Chaetoceros mitra*	x	x	x		x					
2849	*Chaetoceros muelleri*	x	x			x					
2814	*Chaetoceros pelagicus*	x	x		x		x				
2819	*Chaetoceros pendulus*				x						
2815	*Chaetoceros perpusillus*			x	x	x	x		x		
2816	*Chaetoceros peruvianus*			x	x		x				
2820	*Chaetoceros pseudocrinitus*	x	x	x	x	x			x		
2821	*Chaetoceros pseudocurvisetus*			x	x						
2822	*Chaetoceros radicans*	x	x	x		x	x	x	x		
550512	*Chaetoceros rostratus*			x							
2824	*Chaetoceros seiracanthus*	x	x	x	x	x					
2825	*Chaetoceros septentrionalis*				x						
2826	*Chaetoceros similis*	x	x	x		x	x	x	x		
2844	*Chaetoceros simplex*	x	x	x	x	x	x	x			
2827	*Chaetoceros socialis*	x	x	x	x	x	x	x	x	x	
2828	*Chaetoceros subsecundus*				x						
2829	*Chaetoceros subtilis*	x	x	x		x	x	x	x		
2830	*Chaetoceros teres*	x	x	x	x	x	x	x	x		
2831	*Chaetoceros tetrastichon*			x							
2832	*Chaetoceros tortissimus*	x	x	x	x	x		x			
2833	*Chaetoceros vanheurckii*								x		
2834	*Chaetoceros vistulae*	x	x								
2835	*Chaetoceros wighamii*	x	x	x		x	x				
2836	*Chaetoceros willei*			x	x			x		x	
5491	*Chlamydomonas braunii*	x	x								
5465	*Chlamydomonas pulsatilla*	x	x								
5812	*Chlorella marina*					x					
5813	*Chlorella ovalis*					x					
5815	*Chlorella vulgaris*	x	x								
5548	*Chlorogonium maximum*	x	x								
1719	*Chromulina ovalis*	x	x								
664	*Chroococcus cohaerens*	x									
665	*Chroococcus dispersus*	x									

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
656	*Chroococcus limneticus*	x									
669	*Chroococcus minimus*	x									
670	*Chroococcus minor*	x									
671	*Chroococcus minutus*	x									
655	*Chroococcus turgidus*	x									
10617	*Chroomonas baltica*	x	x								
10615	*Chroomonas vectensis*	x	x								
1827	*Chrysamoeba radians*	x	x								
2165	*Chrysochromulina kappa*	x	x								
2161	*Chrysochromulina minor*	x	x								
2162	*Chrysochromulina parkeae*	x	x			x					
2164	*Chrysochromulina strobilus*	x	x			x					
1762	*Chrysococcus minutus*	x	x								
1753	*Chrysococcus rufescens*	x	x								
46125	*Ciliophrys infusionum*	x				x					
183952	*Cladopyxis claytonii*	x	x								
10487	*Cladopyxis setifera*	x	x								
2735	*Climacodium frauenfeldianum*				x						
5927	*Closteriopsis longissima*	x	x								
7273	*Closterium acerosum*	x	x								
7286	*Closterium aciculare*	x	x								
7262	*Closterium acutum*	x	x								
7305	*Closterium cornu*	x	x								
7308	*Closterium costatum*	x	x								
7318	*Closterium dianae*	x	x								
7323	*Closterium ehrenbergii*	x	x								
7258	*Closterium gracile*	x	x								
7338	*Closterium kuetzingii*	x	x								
7342	*Closterium lanceolatum*	x	x								
7352	*Closterium lineatum*	x	x								
7278	*Closterium lunula*	x	x								
7357	*Closterium moniliferum*	x	x								
7365	*Closterium parvulum*	x	x	x							
7378	*Closterium pronum*	x	x								
7266	*Closterium setaceum*	x	x								
7270	*Closterium strigosum*	x	x								
7437	*Closterium tumidulum*	x	x								
2249	*Coccolithus pelagicus*	x	x			x	x				
3578	*Cocconeis costata*	x	x		x						
3610	*Cocconeis disculus*	x	x								
591118	*Cocconeis neodiminuta*	x	x								
3617	*Cocconeis pediculus*	x	x								
3593	*Cocconeis pinnata*	x	x								
3596	*Cocconeis placentula*	x	x		x						
3584	*Cocconeis scutellum*	x	x	x	x						
3587	*Cocconeis stauroneiformis*	x	x								
10022	*Cochlodinium achromaticum*				x	x					

List											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
10026	*Cochlodinium helicoides*	x	x			x					
10027	*Cochlodinium helix*				x						
10029	*Cochlodinium pellucidum*	x	x			x					
573360	*Cochlodinium pupa*	x	x			x					
6275	*Coelastrum cambricum*	x	x								
6279	*Coelastrum microporum*	x	x								
6281	*Coelastrum reticulatum*	x	x								
6282	*Coelastrum sphaericum*	x	x								
796	*Coelosphaerium dubium*	x									
792	*Coelosphaerium kuetzingianum*	x									
797	*Coelosphaerium minutissimum*	x									
793	*Coelosphaerium naegelianum*			x							
9755	*Colacium arbuscula*	x	x								
10168	*Coolia monotis*			x							x
2387	*Corethron criophilum*	x	x	x	x	x					
2388	*Corethron hystrix*			x	x		x	x	x		
180776	*Corymbellus aureus*			x							
573363	*Corythodinium diploconus*			x							
2588	*Coscinodiscus apiculatus*	x	x								
2599	*Coscinodiscus argus*	x	x								
2551	*Coscinodiscus asteromphalus*	x	x	x		x					
2552	*Coscinodiscus centralis*	x	x	x							
2555	*Coscinodiscus concinnus*	x	x	x	x	x	x	x		x	
2574	*Coscinodiscus decrescens*			x							
2556	*Coscinodiscus excentricus*				x						
2557	*Coscinodiscus granii*	x	x	x	x	x		x		x	
2586	*Coscinodiscus granulosus*	x	x								
2559	*Coscinodiscus lineatus*				x						
2560	*Coscinodiscus marginatus*	x	x	x							
2587	*Coscinodiscus obscurus*	x	x								
2562	*Coscinodiscus oculus-iridis*	x	x	x		x	x				
2563	*Coscinodiscus perforatus*	x	x	x							
2567	*Coscinodiscus radiatus*	x	x	x	x	x	x	x		x	
2568	*Coscinodiscus stellaris*	x	x					x			
2571	*Coscinodiscus wailesii*	x	x	x		x		x		x	
2542	*Coscinosira oestrupii*				x						
2541	*Coscinosira polychorda*				x						
7879	*Cosmarium bioculatum*	x	x								
7850	*Cosmarium botrytis*	x	x								
7915	*Cosmarium dentiferum*	x	x								
7942	*Cosmarium granatum*	x	x								
7957	*Cosmarium impressulum*	x	x								
7966	*Cosmarium laeve*	x	x								
8012	*Cosmarium ornatum*	x	x								
8203	*Cosmarium phaseolus*	x	x								
8060	*Cosmarium pyramidatum*			x							
8148	*Cosmarium turpinii*	x	x								

LIST											
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8155	*Cosmarium undulatum*	x	x								
591127	*Cosmioneis lundstroemii*	x	x								
591119	*Cosmioneis pusilla*	x	x								
591123	*Craticula ambigua*	x	x								
591122	*Craticula cuspidata*	x	x								
591481	*Craticula halophila*	x	x								
6228	*Crucigenia fenestrata*	x	x								
6235	*Crucigenia quadrata*	x	x								
6226	*Crucigenia tetrapedia*	x	x								
10577	*Crypthecodinium cohnii*					x					
10655	*Cryptomonas curvata*	x	x								
10641	*Cryptomonas erosa*	x	x								
180947	*Cryptomonas obovata*	x	x								
10646	*Cryptomonas ovata*	x	x								
180950	*Cryptomonas platyuris*	x	x								
591126	*Cyclostephanos dubius*	x	x								
2459	*Cyclotella antiqua*	x	x								
2457	*Cyclotella atomus*	x	x	x		x					
2440	*Cyclotella caspia*			x							
2464	*Cyclotella comensis*	x	x								
591103	*Cyclotella distinguenda*	x	x								
2470	*Cyclotella glomerata*	x	x								
591105	*Cyclotella krammeri*	x	x								
2445	*Cyclotella meneghiniana*	x	x			x					
2472	*Cyclotella ocellata*	x	x								
591102	*Cyclotella planctonica*	x	x								
591101	*Cyclotella radiosa*	x	x								
591099	*Cyclotella socialis*	x	x								
2452	*Cyclotella stelligera*	x	x								
2453	*Cyclotella striata*	x	x			x					
5318	*Cylindrotheca closterium*	x	x	x	x	x	x	x	x	x	
615881	*Cylindrotheca gracilis*	x	x	x							
3259	*Cymatopleura elliptica*	x	x								
3262	*Cymatopleura solea*	x	x								
4803	*Cymbella affinis*	x	x								
4804	*Cymbella amphicephala*	x	x								
193816	*Cymbella amphioxys*	x	x								
4810	*Cymbella aspera*	x	x								
4815	*Cymbella cesatii*	x	x								
4816	*Cymbella cistula*	x	x								
4821	*Cymbella cuspidata*	x	x								
4893	*Cymbella cymbiformis*	x	x								
4906	*Cymbella ehrenbergii*	x	x								
4827	*Cymbella gracilis*	x	x								
4908	*Cymbella helvetica*	x	x								
4832	*Cymbella hustedtii*	x	x								
4836	*Cymbella lanceolata*	x	x								

LIST											
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4840	*Cymbella leptoceros*	x	x								
4796	*Cymbella microcephala*	x	x								
4852	*Cymbella naviculiformis*	x	x								
4853	*Cymbella norvegica*	x	x								
4854	*Cymbella obtusiuscula*	x	x								
4860	*Cymbella pusilla*	x	x								
4900	*Cymbella rupicola*	x	x								
4871	*Cymbella tumida*	x	x								
4899	*Cymbella tumidula*	x	x								
2398	*Dactyliosolen antarcticus*			x			x				
573637	*Dactyliosolen blavyanus*			x	x	x					
615882	*Dactyliosolen fragilissimus*	x	x	x	x	x	x		x		
2399	*Dactyliosolen mediterraneus*				x						
13711	*Desmarella moniliformis*	x	x								
8863	*Desmidium grevillii*	x	x								
8860	*Desmidium swartzii*	x	x								
2535	*Detonula confervacea*	x	x			x	x	x			
573633	*Detonula pumila*	x	x	x	x	x		x	x		
13746	*Diaphanoeca grandis*	x	x								
591295	*Diatoma ehrenbergii*	x	x								
193761	*Diatoma mesodon*	x	x								
2140	*Dicrateria gilva*					x					
2141	*Dicrateria inornata*					x					
183978	*Dicroerisma psilonereiella*					x					
1805	*Dictyocha fibula*	x	x	x	x	x	x				
615931	*Dictyocha octonaria*				x						
615928	*Dictyocha speculum*	x	x	x	x	x	x				
6299	*Dictyosphaerium ehrenbergianum*	x	x								
6298	*Dictyosphaerium pulchellum*	x	x								
591283	*Didymosphenia geminata*	x	x								
3187	*Dimeregramma minor*	x	x								
6304	*Dimorphococcus lunatus*	x	x								
1520	*Dinobryon balticum*	x	x	x	x	x					
1522	*Dinobryon bavaricum*	x	x								
1542	*Dinobryon borgei*	x	x								
1530	*Dinobryon cylindricum*	x	x								
1534	*Dinobryon divergens*	x	x			x					
1537	*Dinobryon pediforme*	x	x								
1521	*Dinobryon petiolatum*				x						
1517	*Dinobryon sertularia*	x	x								
1525	*Dinobryon sociale*	x	x								
1538	*Dinobryon suecicum*	x	x								
9938	*Dinophysis acuminata*	x	x	x	x	x	x	x	x		x
9930	*Dinophysis acuta*	x	x	x	x	x	x	x			x
9931	*Dinophysis arctica*	x	x			x	x				
9939	*Dinophysis caudata*	x	x	x	x	x					
9975	*Dinophysis dens*	x	x	x	x	x		x			

LIST											
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9947	*Dinophysis fortii*			x	x						x
9948	*Dinophysis hastata*	x	x	x		x	x				
9944	*Dinophysis homunculus*						x				
9945	*Dinophysis lenticula*				x						
9963	*Dinophysis mitra*										x
9932	*Dinophysis norvegica*	x	x	x		x	x	x	x		x
331235	*Dinophysis odiosa*			x			x				
9936	*Dinophysis ovum*			x					x		
9979	*Dinophysis pulchella*			x							
9951	*Dinophysis punctata*			x	x						
9933	*Dinophysis rotundata*	x	x	x	x		x	x			x
573380	*Dinophysis sacculus*			x							
9941	*Dinophysis tripos*	x	x	x	x	x					
9981	*Dinophysis uracantha*				x						
4333	*Diploneis bombus*	x	x		x						
4334	*Diploneis crabro*			x	x						
4348	*Diploneis didyma*	x	x		x						
4349	*Diploneis domblittensis*	x	x								
4350	*Diploneis elliptica*	x	x								
4353	*Diploneis finnica*	x	x								
4340	*Diploneis interrupta*	x	x								
4360	*Diploneis oblongella*	x	x								
4354	*Diploneis oculata*	x	x								
4357	*Diploneis ovalis*	x	x								
591285	*Diploneis papula*	x	x								
4335	*Diploneis puella*	x	x								
4328	*Diploneis smithii*	x	x	x							
4344	*Diploneis vacillans*	x	x								
573521	*Diplopelta parva*					x					
10171	*Diplopsalis lenticula*	x	x	x	x	x	x	x			
610146	*Diplopsalis minor*			x							
10200	*Diplopsalopsis orbicularis*	x	x			x	x				
2256	*Discosphaera tubifer*	x	x		x						
180940	*Dissodinium lunula*	x	x	x	x	x		x			
550492	*Dissodinium pseudolunula*	x									
10339	*Dissodium asymmetricum*			x							
1810	*Distephanus speculum*								x		
2928	*Ditylum brightwellii*	x	x	x	x	x	x	x	x	x	
1814	*Ebria tripartita*	x	x			x	x				
9413	*Elakatothrix gelatinosa*	x	x								
9415	*Elakatothrix genevensis*	x	x								
591271	*Ellerbeckia arenaria*	x	x								
2251	*Emiliania huxleyi*	x	x	x	x	x	x				
591280	*Encyonema caespitosum*	x	x								
591273	*Encyonema gracile*	x	x								
591284	*Encyonema lacustre*	x	x								
591268	*Encyonema minutum*	x	x								

LIST											
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591266	*Encyonema prostratum*	x	x								
591272	*Encyonema silesiacum*	x	x								
615900	*Ephemera planamembranacea*			x							
1587	*Epipyxis tabellariae*	x	x								
591291	*Epithemia adnata*	x	x								
5006	*Epithemia argus*	x	x								
573699	*Epithemia frickei*	x	x								
5019	*Epithemia sorex*	x	x								
5020	*Epithemia turgida*	x	x								
8598	*Euastrum insulare*	x	x								
2731	*Eucampia cornuta*			x	x						
2732	*Eucampia groenlandica*			x		x	x				
2733	*Eucampia zodiacus*	x	x	x	x	x	x	x	x	x	
813	*Eucapsis alpina*	x									
5598	*Eudorina elegans*	x	x								
5599	*Eudorina unicocca*	x	x								
9622	*Euglena acus*	x	x	x							
180797	*Euglena geniculata*			x							
180799	*Euglena hemichromata*	x	x								
9639	*Euglena oxyuris*	x	x								
9627	*Euglena proxima*	x	x								
9630	*Euglena spirogyra*	x	x								
9635	*Euglena tripteris*	x	x								
9671	*Euglena variabilis*	x	x								
9636	*Euglena viridis*	x	x	x							
3339	*Eunotia arcus*	x	x								
3344	*Eunotia diodon*	x	x								
3348	*Eunotia exigua*	x	x								
3353	*Eunotia glacialis*	x	x								
3379	*Eunotia incisa*	x	x								
193765	*Eunotia minor*	x	x								
3357	*Eunotia pectinalis*	x	x								
3365	*Eunotia praerupta*	x	x								
3371	*Eunotia septentrionalis*	x	x								
3372	*Eunotia serra*	x	x								
3375	*Eunotia tenella*	x	x								
3414	*Eunotia zasuminensis*	x	x								
9607	*Eutreptia lanowii*	x	x			x	x				
9608	*Eutreptia viridis*	x	x				x				
9610	*Eutreptiella marina*			x							
591248	*Fallacia pygmaea*	x	x								
591218	*Fallacia subhamulata*	x	x								
2953	*Fragilaria capucina*	x	x	x							
2933	*Fragilaria crotonensis*	x	x		x						
2965	*Fragilaria cylindrus*				x						
202433	*Fragilaria hyalina*	x	x								
2966	*Fragilaria islandica*			x			x	x			

List											
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591222	*Fragilaria nitzschioides*	x	x								
2941	*Fragilaria striatula*	x	x	x							
2942	*Fragilaria vaucheriae*	x	x								
591250	*Fragilariforma virescens*	x	x								
550522	*Fragilariopsis antarctica*				x						
610089	*Fragilariopsis curta*				x						
5076	*Fragilariopsis cylindrus*	x	x		x	x					
573688	*Fragilariopsis kerguelensis*				x						
5140	*Fragilariopsis oceanica*	x	x	x			x				
5142	*Fragilariopsis pseudonana*						x				
5959	*Franceia droescheri*	x	x								
5960	*Franceia ovalis*	x	x								
4565	*Frustulia rhomboides*	x	x	x							
4571	*Frustulia vulgaris*	x	x								
6466	*Geminella mutabilis*	x	x								
2258	*Gephyrocapsa oceanica*				x						
10183	*Glenodinium armatum*	x	x								
10176	*Glenodinium danicum*	x	x								
10177	*Glenodinium foliaceum*			x	x	x					
10188	*Glenodinium warmingii*	x	x								
1300	*Gloeotrichia echinulata*	x									
6315	*Golenkinia radiata*	x	x								
4919	*Gomphonema acuminatum*	x	x								
4956	*Gomphonema affine*	x	x								
4927	*Gomphonema angustatum*	x	x								
4933	*Gomphonema augur*	x	x								
4999	*Gomphonema bohemicum*	x	x								
4941	*Gomphonema gracile*	x	x								
4947	*Gomphonema grovei*	x	x								
4948	*Gomphonema helveticum*	x	x								
591028	*Gomphonema olivaceum*	x	x								
4975	*Gomphonema parvulum*	x	x								
193820	*Gomphonema truncatum*	x	x								
715	*Gomphosphaeria aponina*	x									
10456	*Goniodoma polyedricum*	x	x		x		x				
5574	*Gonium pectorale*	x	x								
5575	*Gonium sociale*	x	x								
10362	*Gonyaulax alaskensis*			x							
10378	*Gonyaulax apiculata*	x	x								
10379	*Gonyaulax diegensis*				x			x			
573390	*Gonyaulax digitale*	x	x	x	x	x	x	x			
550477	*Gonyaulax grindleyi*			x		x					
10370	*Gonyaulax polyedra*			x	x						
10371	*Gonyaulax polygramma*	x	x	x	x	x	x				
10372	*Gonyaulax scrippsae*			x		x					
10361	*Gonyaulax spinifera*	x	x	x	x	x	x	x			
10383	*Gonyaulax tamarensis*				x						

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
573400	*Gonyaulax turbynei*			x							
550478	*Gonyaulax verior*	x	x	x	x	x		x			
3198	*Grammatophora angulosa*				x						
3199	*Grammatophora marina*	x	x	x	x		x	x			
3200	*Grammatophora oceanica*	x	x	x							
3203	*Grammatophora serpentina*			x	x						
2923	*Guinardia blavyana*				x						
615883	*Guinardia delicatula*	x	x	x	x	x	x				
2922	*Guinardia flaccida*	x	x	x	x	x		x		x	
10042	*Gymnodinium abbreviatum*			x		x					
10076	*Gymnodinium aeruginosum*	x	x								
180891	*Gymnodinium albulum*	x	x								
10043	*Gymnodinium arcticum*	x	x								
10157	*Gymnodinium breve*			x							
331276	*Gymnodinium catenatum*	x	x	x	x						x
573402	*Gymnodinium conicum*				x						
573404	*Gymnodinium diploconus*				x						
10049	*Gymnodinium endofasciculum*	x	x			x		x			
10040	*Gymnodinium fuscum*	x	x		x						
573547	*Gymnodinium galatheanum*	x	x								
331273	*Gymnodinium gracile*	x	x			x		x			
10052	*Gymnodinium gracilentum*	x	x								
180899	*Gymnodinium helveticum*	x	x								
10069	*Gymnodinium heterostriatum*	x	x	x	x	x					
180901	*Gymnodinium lacustre*	x	x								
180902	*Gymnodinium latum*	x	x								
331277	*Gymnodinium mikimotoi*	x	x	x	x	x					
331284	*Gymnodinium ostenfeldii*	x	x			x					
10035	*Gymnodinium pygmaeum*	x	x	x		x					
10070	*Gymnodinium rhomboides*	x	x			x					
331274	*Gymnodinium sanguineum*	x	x	x		x					
10036	*Gymnodinium simplex*	x	x	x	x	x					
10037	*Gymnodinium splendens*			x	x						
10055	*Gymnodinium stellatum*					x					
10068	*Gymnodinium striatissimum*							x			
10039	*Gymnodinium variabile*			x							
573413	*Gymnodinium veneficum*			x							
573414	*Gymnodinium wulffii*	x	x								
10078	*Gyrodinium aureolum*			x	x	x					
10080	*Gyrodinium calyptoglyphe*							x			
331290	*Gyrodinium crassum*	x	x			x					
10082	*Gyrodinium dominans*	x	x			x					
10089	*Gyrodinium estuariale*			x		x					
331291	*Gyrodinium fissum*			x							
10088	*Gyrodinium fusiforme*	x	x	x	x	x					
10084	*Gyrodinium pellucidum*			x							
10085	*Gyrodinium pingue*	x	x			x					

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
573417	*Gyrodinium prunus*			x				x			
10101	*Gyrodinium resplendens*	x	x			x					
10086	*Gyrodinium spirale*	x	x	x	x	x		x			
10095	*Gyrodinium uncatenum*	x	x								
10096	*Gyrodinium undulans*	x	x			x		x			
4633	*Gyrosigma acuminatum*	x	x								
4634	*Gyrosigma attenuatum*	x	x								
4623	*Gyrosigma balticum*	x	x		x						
4628	*Gyrosigma diaphanum*	x	x								
4648	*Gyrosigma distortum*	x	x	x							
4646	*Gyrosigma eximium*	x	x								
4624	*Gyrosigma fasciola*	x	x	x							
4637	*Gyrosigma hippocampus*	x	x								
4650	*Gyrosigma macrum*	x	x								
4649	*Gyrosigma nodiferum*	x	x								
591383	*Gyrosigma obscurum*	x	x								
591040	*Gyrosigma parkeri*	x	x								
4640	*Gyrosigma scalproides*	x	x								
4642	*Gyrosigma strigilis*	x	x								
4627	*Gyrosigma tenuissimum*	x	x								
4631	*Gyrosigma wansbeckii*	x	x								
9597	*Halosphaera viridis*	x	x				x				
3322	*Hannaea arcus*	x	x								
5304	*Hantzschia amphioxys*	x	x	x							
5311	*Hantzschia virgata*	x	x								
615899	*Haslea wawrikae*				x				x		
10548	*Helgolandinium subglobosum*			x							
2261	*Helicosphaera carteri*				x						
46699	*Helicostomella subulata*						x				
2749	*Hemiaulus hauckii*	x	x	x	x	x					
2751	*Hemiaulus sinensis*	x	x	x	x	x					
10160	*Hemidinium nasutum*	x	x								
2668	*Hemidiscus cuneiformis*			x	x						
331225	*Hemiselmis simplex*					x					
10606	*Hemiselmis virescens*	x	x	x		x					
573531	*Herdmania litoralis*			x							
610150	*Heterocapsa minima*	x	x	x		x		x			
10207	*Heterocapsa triquetra*	x	x	x	x	x	x	x			
9576	*Hexasterias problematica*	x	x								
2383	*Hyalodiscus scoticus*	x	x								
8752	*Hyalotheca dissiliens*	x	x								
6080	*Hydrodictyon reticulatum*	x	x								
2210	*Hymenomonas carterae*				x						
2148	*Imantonia rotunda*	x	x			x					
2143	*Isochrysis galbana*	x	x								
2721	*Isthmia nervosa*	x	x								
10108	*Katodinium asymmetricum*	x	x	x							

List											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
10105	*Katodinium glaucum*	x	x	x	x	x		x			
10106	*Katodinium rotundatum*			x							
1768	*Kephyrion sitta*	x	x								
1779	*Kephyrion spirale*	x	x			x					
5905	*Kirchneriella contorta*	x	x								
5896	*Kirchneriella lunaris*	x	x								
5901	*Kirchneriella obesa*	x	x								
6475	*Klebsormidium flaccidum*	x	x								
331429	*Kofoidinium velleloides*			x	x	x					
10353	*Kryptoperidinium foliaceum*	x	x								
5872	*Lagerheimia ciliata*	x	x								
6019	*Lagerheimia genevensis*	x	x								
6022	*Lagerheimia longiseta*	x	x								
5868	*Lagerheimia quadriseta*	x	x								
2533	*Lauderia annulata*	x	x	x	x	x	x	x	x		
2531	*Lauderia borealis*			x	x					x	
9760	*Lepocinclis ovum*	x	x								
9761	*Lepocinclis texta*	x	x								
2395	*Leptocylindrus danicus*	x	x	x	x	x	x	x	x		
573636	*Leptocylindrus mediterraneus*	x	x	x	x	x	x				
2396	*Leptocylindrus minimus*	x	x	x	x	x	x	x			
189419	*Leptolyngbya tenuis*	x									
10669	*Leucocryptos marina*	x	x	x		x	x				
3168	*Licmophora abbreviata*	x	x	x							
3161	*Licmophora flabellata*			x							
3162	*Licmophora gracilis*	x	x		x						
3169	*Licmophora juergensii*	x	x								
3167	*Licmophora oedipus*	x	x								
3163	*Licmophora paradoxa*	x	x								
573538	*Lingulodinium polyedrum*	x	x	x		x	x				
2925	*Lithodesmium undulatum*	x	x	x	x	x		x			
591443	*Luticola mutica*	x	x								
872	*Lyngbya aestuarii*	x									
875	*Lyngbya lutea*	x									
877	*Lyngbya majuscula*	x									
1599	*Mallomonas acaroides*	x	x								
1615	*Mallomonas alpina*	x	x								
1604	*Mallomonas caudata*	x	x								
1621	*Mallomonas crassisquama*	x	x								
1625	*Mallomonas elongata*	x	x								
1627	*Mallomonas heterospina*	x	x								
1633	*Mallomonas mangofera*	x	x								
1634	*Mallomonas multiunca*	x	x								
1635	*Mallomonas oviformis*	x	x								
1609	*Mallomonas producta*	x	x								
1612	*Mallomonas tonsurata*	x	x								
591440	*Martyana martyi*	x	x								

List											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
10114	*Massartia rotundata*				x						
555625	*Mastogloia baltica*	x	x								
4550	*Mastogloia braunii*	x	x								
4558	*Mastogloia elliptica*	x	x								
4562	*Mastogloia pumila*	x	x								
4552	*Mastogloia rostrata*				x						
4553	*Mastogloia smithii*	x	x								
2291	*Melosira arctica*	x	x	x		x					
2326	*Melosira dubia*	x	x								
2297	*Melosira granulata*				x						
2309	*Melosira lineata*	x	x	x							
2293	*Melosira moniliformis*	x	x	x	x		x	x			
2294	*Melosira nummuloides*	x	x	x	x		x	x		x	
2311	*Melosira octogona*	x	x								
2315	*Melosira undulata*	x	x								
2339	*Melosira varians*	x	x	x							
3238	*Meridion circulare*	x	x								
732	*Merismopedia elegans*	x									
728	*Merismopedia glauca*	x		x							
738	*Merismopedia punctata*	x									
739	*Merismopedia tenuissima*	x									
46288	*Mesodinium pulex*	x									
46289	*Mesodinium rubrum*	x		x	x						
9920	*Mesoporos perforatus*	x	x		x	x					
615896	*Meuniera membranacea*	x	x	x	x	x					
2221	*Michaelsarsia elegans*				x						
573441	*Micracanthodinium claytonii*					x	x				
10486	*Micracanthodinium setiferum*	x	x				x				
6322	*Micractinium pusillum*	x	x								
6327	*Micractinium quadrisetum*	x	x								
180728	*Microcrocis geminata*	x									
745	*Microcrocis sabulicola*	x									
750	*Microcystis aeruginosa*	x	x	x							
768	*Microcystis pulverea*	x									
9520	*Micromonas pusilla*	x	x			x					
573689	*Minutocellus polymorphus*					x					
5991	*Monoraphidium contortum*	x	x								
5992	*Monoraphidium griffithii*	x	x								
13714	*Monosiga marina*						x				
13715	*Monosiga ovata*	x	x								
5826	*Nannochloris atomus*					x					
3651	*Navicula ammophila*	x	x								
3757	*Navicula amphibola*	x	x								
3656	*Navicula arenaria*	x	x								
3804	*Navicula atomus*	x	x								
3699	*Navicula cancellata*	x	x		x						
3720	*Navicula capitata*	x	x								

List											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
3821	*Navicula cari*	x	x								
3741	*Navicula cincta*	x	x								
3828	*Navicula citrus*	x	x								
3839	*Navicula costulata*	x	x								
3782	*Navicula crucicula*	x	x								
3662	*Navicula cryptocephala*	x	x								
591338	*Navicula cryptotenella*	x	x								
3669	*Navicula directa*	x	x	x							
3670	*Navicula distans*			x							
3859	*Navicula graciloides*	x	x								
573648	*Navicula granii*	x	x	x							
3860	*Navicula gregaria*	x	x								
3867	*Navicula hustedtii*	x	x								
591333	*Navicula jentzschii*	x	x								
4032	*Navicula kotschyi*	x	x								
3879	*Navicula krasskei*	x	x								
3766	*Navicula lanceolata*	x	x								
3884	*Navicula laterostrata*	x	x								
3677	*Navicula membranacea*				x						
3749	*Navicula menisculus*	x	x								
591358	*Navicula meniscus*	x	x								
3889	*Navicula minima*	x	x								
3894	*Navicula minuscula*	x	x								
3736	*Navicula oblonga*	x	x								
3729	*Navicula palpebralis*	x	x								
3675	*Navicula pelagica*	x	x	x	x						
3917	*Navicula pelliculosa*	x	x	x							
3752	*Navicula peregrina*	x	x								
3744	*Navicula phyllepta*	x	x								
3929	*Navicula platystoma*	x	x								
3933	*Navicula protracta*	x	x								
3952	*Navicula radiosa*	x	x								
591352	*Navicula reinhardtii*	x	x								
3678	*Navicula rhynchocephala*	x	x								
3712	*Navicula salinarum*	x	x								
3963	*Navicula schoenfeldii*	x	x								
3967	*Navicula scutelloides*	x	x								
3684	*Navicula septentrionalis*			x							
3978	*Navicula similis*	x	x								
3993	*Navicula subtilissima*	x	x								
3686	*Navicula transitans*	x	x	x							
4048	*Navicula tripunctata*	x	x								
3695	*Navicula vanhoeffenii*	x	x			x					
4008	*Navicula vaucheriae*	x	x								
4010	*Navicula ventralis*	x	x								
4013	*Navicula viridula*	x	x								
4017	*Navicula vitabunda*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
4021	*Navicula vulpina*	x	x								
3270	*Neidium affine*	x	x								
3291	*Neidium dubium*	x	x								
3295	*Neidium iridis*	x	x								
3310	*Neidium productum*	x	x								
10129	*Nematodinium armatum*			x		x		x			
5994	*Nephrochlamys subsolitaria*	x	x								
5965	*Nephrocytium agardhianum*	x	x								
5968	*Nephrocytium limneticum*	x	x								
5967	*Nephrocytium lunatum*	x	x								
9523	*Nephroselmis minuta*	x	x			x					
180796	*Nephroselmis olivacea*	x	x								
5099	*Nitzschia acicularis*	x	x	x							
193824	*Nitzschia acula*	x	x								
5160	*Nitzschia amphibia*	x	x								
5163	*Nitzschia angularis*	x	x	x							
5143	*Nitzschia bicapitata*				x						
5073	*Nitzschia bilobata*			x							
5196	*Nitzschia capitellata*	x	x								
5165	*Nitzschia clausii*	x	x								
5149	*Nitzschia closterium*				x						
5223	*Nitzschia communis*	x	x								
5226	*Nitzschia commutata*	x	x								
5186	*Nitzschia dissipata*	x	x								
193825	*Nitzschia dubia*	x	x								
5230	*Nitzschia fasciculata*	x	x								
5231	*Nitzschia filiformis*	x	x								
5198	*Nitzschia fonticola*	x	x								
5078	*Nitzschia frigida*	x	x			x					
5150	*Nitzschia frustulum*	x	x								
591447	*Nitzschia gandersheimiensis*	x	x								
5234	*Nitzschia gracilis*	x	x								
5205	*Nitzschia granii*				x						
5238	*Nitzschia hantzschiana*	x	x								
591453	*Nitzschia homburgiensis*	x	x								
5201	*Nitzschia hybrida*	x	x								
193822	*Nitzschia inconspicua*	x	x								
5242	*Nitzschia intermedia*	x	x								
5246	*Nitzschia lacunarum*	x	x								
5104	*Nitzschia linearis*	x	x								
5080	*Nitzschia longissima*	x	x	x	x	x		x			
5169	*Nitzschia lorenziana*	x	x								
5108	*Nitzschia macilenta*				x						
5194	*Nitzschia microcephala*	x	x								
5273	*Nitzschia nana*	x	x								
5085	*Nitzschia obtusa*	x	x		x						
5291	*Nitzschia ovalis*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
5088	*Nitzschia pacifica*				x						
5208	*Nitzschia palea*	x	x								
5250	*Nitzschia paleacea*	x	x								
193823	*Nitzschia perminuta*	x	x								
5185	*Nitzschia prolongatoides*				x						
5091	*Nitzschia pungens*				x						
591471	*Nitzschia pusilla*	x	x								
5195	*Nitzschia recta*	x	x								
193826	*Nitzschia scalaris*	x	x								
5093	*Nitzschia seriata*				x						
5294	*Nitzschia sicula*				x						
5118	*Nitzschia sigma*	x	x	x							
5127	*Nitzschia sigmoidea*	x	x		x						
5177	*Nitzschia socialis*	x	x								
5175	*Nitzschia spathulata*	x	x		x						
5261	*Nitzschia sublinearis*	x	x								
5278	*Nitzschia subtilis*	x	x								
591465	*Nitzschia valdestriata*	x	x								
5135	*Nitzschia vermicularis*	x	x								
5204	*Nitzschia vitrea*	x	x								
10150	*Noctiluca scintillans*	x	x	x	x	x		x	x		
1226	*Nodularia harveyana*	x									
1228	*Nodularia sphaerocarpa*	x									
1227	*Nodularia spumigena*	x		x							
550480	*Oblea baculifera*	x	x	x		x					
10194	*Oblea rotunda*	x	x	x		x	x				
610098	*Odontella aurita*	x	x	x		x	x	x			
610124	*Odontella granulata*	x	x	x				x			
573696	*Odontella longicruris*								x		
610129	*Odontella obtusa*							x			
610126	*Odontella regia*	x		x	x			x			
610128	*Odontella rhombus*	x	x	x				x			
610143	*Odontella rhombus f. rhombus*	x	x								
610144	*Odontella rhombus f. trigona*	x	x								
610127	*Odontella sinensis*	x	x	x		x		x			
4791	*Okedenia inflexa*				x						
1905	*Olisthodiscus luteus*				x						
5833	*Oocystis borgei*	x	x								
5834	*Oocystis elliptica*	x	x								
5837	*Oocystis lacustris*	x	x								
5849	*Oocystis marssonii*	x	x								
5838	*Oocystis parva*	x	x								
5828	*Oocystis pelagica*	x	x								
5845	*Oocystis pusilla*	x	x								
5846	*Oocystis solitaria*	x	x								
5830	*Oocystis submarina*	x	x								
3006	*Opephora marina*	x	x								

LIST											
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2223	*Ophiaster hydroideus*				x	x					
2028	*Ophiocytium elongatum*	x	x								
9988	*Ornithocercus magnificus*				x						
948	*Oscillatoria bonnemaisonii*	x									
967	*Oscillatoria chlorina*	x									
944	*Oscillatoria curviceps*	x									
934	*Oscillatoria erythraea*		x								
976	*Oscillatoria limosa*	x									
926	*Oscillatoria margaritifera*	x									
928	*Oscillatoria princeps*	x									
951	*Oscillatoria sancta*	x									
10146	*Oxyrrhis marina*	x	x	x	x	x		x			
573451	*Oxytoxum belgicae*				x						
573453	*Oxytoxum caudatum*				x						
10475	*Oxytoxum constrictum*				x						
10477	*Oxytoxum coronatum*				x						
573456	*Oxytoxum crassum*			x							
550532	*Oxytoxum curvatum*				x						
573461	*Oxytoxum gracile*					x					
573461	*Oxytoxum gracile*				x						
550489	*Oxytoxum laticeps*			x	x						
10467	*Oxytoxum longiceps*				x						
10472	*Oxytoxum scolopax*			x	x						
10476	*Oxytoxum sphaeroideum*				x		x				
10474	*Oxytoxum turbo*				x						
10465	*Oxytoxum variabile*				x						
9580	*Pachysphaera pelagica*	x	x				x				
5580	*Pandorina morum*	x	x								
2346	*Paralia sulcata*	x	x	x	x	x	x				
1646	*Paraphysomonas butcheri*	x	x			x					
1648	*Paraphysomonas cribosa*	x	x			x					
1649	*Paraphysomonas cylicophora*	x	x			x					
1651	*Paraphysomonas foraminifera*	x	x			x					
1652	*Paraphysomonas imperforata*	x	x			x					
1653	*Paraphysomonas sideriophora*	x	x			x					
1654	*Paraphysomonas vestita*	x	x			x					
13748	*Parvicorbicula socialis*	x	x								
10509	*Paulsenella chaetoceratis*						x	x	x		
1474	*Pavlova lutheri*	x	x								
6067	*Pediastrum angulosum*	x	x								
6050	*Pediastrum biradiatum*	x	x								
6032	*Pediastrum boryanum*	x	x								
6036	*Pediastrum duplex*	x	x	x							
6057	*Pediastrum integrum*	x	x								
6069	*Pediastrum kawraiskyi*	x	x								
6045	*Pediastrum simplex*	x	x								
6053	*Pediastrum tetras*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
1786	*Pedinella hexacostata*					x					
573519	*Pentapharsodinium dalei*	x	x	x		x					
573517	*Peridiniella catenata*	x	x			x					
10196	*Peridiniopsis borgei*	x	x								
10328	*Peridinium balticum*			x							
10213	*Peridinium belgicum*						x				
10329	*Peridinium cinctum*	x	x	x							
10292	*Peridinium globulus*						x				
10331	*Peridinium inconspicuum*	x	x								
10333	*Peridinium pusillum*	x	x								
10262	*Peridinium quinquecorne*			x		x					
10334	*Peridinium umbonatum*	x	x								
10256	*Peridinium willei*	x	x								
180843	*Petalomonas minuta*	x	x								
180847	*Petalomonas pusilla*	x	x								
553098	*Pfiesteria piscicida*										x
5620	*Phacotus lenticularis*	x	x								
9797	*Phacus curvicauda*	x	x								
9771	*Phacus longicauda*	x	x								
9775	*Phacus pleuronectes*	x	x								
9779	*Phacus pyrum*	x	x								
9782	*Phacus tortus*	x	x								
610059	*Phaeocystis globosa*	x	x	x							x
2173	*Phaeocystis pouchetii*	x	x	x		x					x
4787	*Phaeodactylum tricornutum*	x	x	x	x	x					
9934	*Phalacroma rotundatum*				x	x					
331298	*Pheopolykrikos beauchampii*					x					
193808	*Pinnularia appendiculata*	x	x								
4462	*Pinnularia borealis*	x	x								
591380	*Pinnularia dactylus*	x	x								
4449	*Pinnularia gibba*	x	x								
4480	*Pinnularia globiceps*	x	x								
193809	*Pinnularia hemiptera*	x	x								
4498	*Pinnularia major*	x	x								
4499	*Pinnularia mesolepta*	x	x								
4500	*Pinnularia microstauron*	x	x								
4504	*Pinnularia nodosa*	x	x								
4509	*Pinnularia subcapitata*	x	x								
193804	*Pinnularia sudetica*	x	x								
4440	*Pinnularia viridis*	x	x								
591404	*Placoneis clementis*	x	x								
591406	*Placoneis elginensis*	x	x								
591407	*Placoneis exigua*	x	x								
591408	*Placoneis gastrum*	x	x								
591409	*Placoneis placentula*	x	x								
3196	*Plagiogramma staurophorum*	x	x								
10673	*Plagioselmis prolonga*	x	x	x		x					

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
591410	*Plagiotropis lepidoptera*	x	x	x							
6455	*Planctonema lauterbornii*	x	x								
2483	*Planktoniella sol*			x	x		x				
5910	*Planktosphaeria gelatinosa*	x	x								
189421	*Planktothrix agardhii*	x	x								
4620	*Pleurosigma acutum*				x						
4593	*Pleurosigma angulatum*	x	x								
4593	*Pleurosigma angulatum*			x							
4611	*Pleurosigma directum*			x							
4594	*Pleurosigma elongatum*	x	x								
4594	*Pleurosigma elongatum*				x						
4599	*Pleurosigma formosum*			x							
4613	*Pleurosigma naviculaceum*			x							
555629	*Pleurosigma salinarum*	x	x								
4618	*Pleurosigma strigosum*	x	x	x							
591417	*Pleurosira laevis*	x	x								
8713	*Pleurotaenium trabecula*	x	x								
10501	*Podolampas palmipes*				x	x	x				
2385	*Podosira montagnei*	x	x								
2382	*Podosira stelliger*				x			x			
5932	*Polyedriopsis spinulosa*	x	x								
10139	*Polykrikos schwartzii*	x	x	x		x	x	x	x		
2228	*Pontosphaera syracusana*				x						
2537	*Porosira glacialis*	x	x	x	x	x	x	x			
9568	*Prasinocladus marinus*	x	x								
573490	*Preperidinium meunieri*	x	x			x	x				
610099	*Proboscia alata*	x	x	x	x	x	x	x			
10144	*Pronoctiluca pelagica*	x	x	x		x	x				
331424	*Pronoctiluca spinifera*			x	x						
9886	*Prorocentrum aporum*				x		x				
9888	*Prorocentrum balticum*	x	x	x	x	x	x	x			
9914	*Prorocentrum cassubicum*	x	x								x
9890	*Prorocentrum compressum*	x	x	x	x	x	x				
9902	*Prorocentrum cordatum*			x							
9904	*Prorocentrum dentatum*				x						
9904	*Prorocentrum dentatum*			x							
9901	*Prorocentrum gracile*			x	x						
9893	*Prorocentrum lima*	x	x	x	x	x					x
9898	*Prorocentrum maximum*				x						
9879	*Prorocentrum micans*	x	x	x	x	x		x	x		
9880	*Prorocentrum minimum*	x	x	x	x	x		x			x
9905	*Prorocentrum nanum*				x						
9908	*Prorocentrum ovum*			x							
9910	*Prorocentrum rostratum*			x	x						
9912	*Prorocentrum rotundatum*				x						
9884	*Prorocentrum scutellum*	x	x	x		x					
9885	*Prorocentrum sphaeroideum*				x						

LIST											
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9881	*Prorocentrum triestinum*			x	x	x					
10390	*Protoceratium reticulatum*	x	x	x			x	x			x
10242	*Protoperidinium achromaticum*	x	x	x				x			
10304	*Protoperidinium avellana*	x	x	x							
10210	*Protoperidinium bipes*	x	x	x	x	x	x	x			
10255	*Protoperidinium breve*	x	x	x		x	x				
10215	*Protoperidinium brevipes*	x	x	x	x	x	x	x	x		
10218	*Protoperidinium cerasus*	x	x	x	x	x		x			
10246	*Protoperidinium claudicans*	x	x	x		x		x			
10248	*Protoperidinium conicoides*	x	x	x		x	x				
10220	*Protoperidinium conicum*	x	x	x	x	x	x	x	x		
10306	*Protoperidinium crassipes*	x	x	x	x	x	x				
10250	*Protoperidinium curtipes*	x	x	x	x	x	x	x			
10222	*Protoperidinium curvipes*	x	x	x		x	x	x			
10291	*Protoperidinium decipiens*	x	x			x					
10252	*Protoperidinium deficiens*		x								
180928	*Protoperidinium denticulatum*	x	x	x		x	x	x			
10224	*Protoperidinium depressum*	x	x	x	x	x	x	x	x		
10308	*Protoperidinium diabolum*			x	x	x					
550482	*Protoperidinium divergens*	x	x	x	x	x	x	x			
10226	*Protoperidinium excentricum*	x	x	x		x		x	x		
10228	*Protoperidinium granii*	x	x		x	x	x	x			
10286	*Protoperidinium islandicum*	x	x			x	x				
10282	*Protoperidinium leonis*	x	x	x	x	x	x	x	x		
10280	*Protoperidinium marielebouriae*			x							
10310	*Protoperidinium minutum*	x	x	x	x	x		x			
10312	*Protoperidinium mite*			x	x						
10277	*Protoperidinium oblongum*	x	x	x	x	x	x	x	x		
10275	*Protoperidinium obtusum*			x				x			
10273	*Protoperidinium oceanicum*	x	x	x	x	x	x				
10237	*Protoperidinium ovatum*	x	x	x	x	x	x	x			
10233	*Protoperidinium pallidum*	x	x	x	x	x	x	x	x		
10235	*Protoperidinium pellucidum*	x	x	x	x	x	x	x	x		
10270	*Protoperidinium pentagonum*	x	x	x	x	x		x	x		
10267	*Protoperidinium punctulatum*	x	x	x		x		x			
10265	*Protoperidinium pyriforme*	x	x	x	x	x	x	x			
10341	*Protoperidinium quarnerense*					x	x				
10316	*Protoperidinium roseum*	x	x			x	x				
10259	*Protoperidinium subinerme*	x	x	x		x	x	x			
10239	*Protoperidinium thorianum*	x	x	x		x	x	x			
10297	*Protoperidinium tuba*			x	x						
2170	*Prymnesium parvum*	x	x	x		x					x
1180	*Pseudanabaena mucicola*	x									
584562	*Pseudo-nitzschia australis*			x	x						
584563	*Pseudo-nitzschia delicatissima*	x	x	x	x	x	x	x			x
610105	*Pseudo-nitzschia heimii*					x					
584564	*Pseudo-nitzschia multiseries*	x	x	x		x					x

List											
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615880	*Pseudo-nitzschia prolongatoides*				x						
584565	*Pseudo-nitzschia pseudodelicatissima*	x	x	x		x	x		x		
584566	*Pseudo-nitzschia pungens*	x	x	x	x	x		x	x		x
615879	*Pseudo-nitzschia seriata*	x	x	x	x	x	x			x	x
591385	*Pseudostaurosira brevistriata*	x	x								
5631	*Pteromonas aculeata*	x	x								
9582	*Pterosperma cristatum*	x	x			x	x				
9583	*Pterosperma cuboides*					x					
9584	*Pterosperma dictyon*					x					
9585	*Pterosperma marginatum*					x					
9587	*Pterosperma moebii*					x					
9588	*Pterosperma nationalis*					x					
9590	*Pterosperma polygonum*					x					
331267	*Ptychodiscus noctiluca*			x	x						
9538	*Pyramimonas grossii*	x	x			x					
550497	*Pyramimonas longicauda*	x	x			x					
9540	*Pyramimonas obovata*	x	x								
10552	*Pyrocystis lunula*				x	x	x				
10559	*Pyrocystis noctiluca*				x		x				
10557	*Pyrocystis pseudonoctiluca*				x						
10162	*Pyrophacus horologicum*	x	x				x				
5944	*Quadrigula pfitzeri*	x	x								
834	*Radiocystis geminata*	x									
193818	*Reimeria sinuata*	x	x								
806	*Rhabdoderma lineare*	x									
3210	*Rhabdonema adriaticum*			x							
3209	*Rhabdonema arcuatum*	x	x								
3211	*Rhabdonema minutum*	x	x	x							
2264	*Rhabdosphaera claviger*			x	x		x				
2265	*Rhabdosphaera hispida*						x				
2263	*Rhabdosphaera stylifera*				x						
3147	*Rhaphoneis amphiceros*			x				x			
2880	*Rhizosolenia acuminata*			x							
2881	*Rhizosolenia alata*				x					x	
2887	*Rhizosolenia bergonii*			x	x						
2888	*Rhizosolenia calcar-avis*				x						
2889	*Rhizosolenia castracanei*			x							
610106	*Rhizosolenia curvata*				x						
2890	*Rhizosolenia cylindrus*				x						
2891	*Rhizosolenia delicatula*				x					x	
2892	*Rhizosolenia fragilissima*				x					x	
2893	*Rhizosolenia hebetata*	x	x		x						
2895	*Rhizosolenia hebetata semispina*					x					
2897	*Rhizosolenia imbricata*	x	x	x	x	x	x	x			
2900	*Rhizosolenia obtusa*			x							
2901	*Rhizosolenia robusta*	x	x		x	x	x				
2902	*Rhizosolenia setigera*	x	x	x	x	x	x	x		x	

LIST											
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2903	*Rhizosolenia stolterfothii*									x	
2904	*Rhizosolenia styliformis*	x	x	x	x	x	x	x		x	
182985	*Rhodella maculata*					x					
10667	*Rhodomonas lacustris*	x	x								
10666	*Rhodomonas lens*	x	x								
5041	*Rhopalodia gibba*	x	x								
5025	*Rhopalodia gibberula*	x	x								
5055	*Rhopalodia musculus*	x	x								
1082	*Romeria elegans*	x									
13736	*Salpingoeca frequentissima*	x	x								
13751	*Savillea parva*	x	x								
6154	*Scenedesmus aculeolatus*	x	x								
6105	*Scenedesmus acuminatus*	x	x	x							
6155	*Scenedesmus acutiformis*	x	x								
6156	*Scenedesmus acutus*			x							
6202	*Scenedesmus apiculatus*	x	x								
6139	*Scenedesmus arcuatus*	x	x	x							
6143	*Scenedesmus dimorphus*			x							
6178	*Scenedesmus granulatus*	x	x								
6181	*Scenedesmus incrassatulus*	x	x								
6160	*Scenedesmus obliquus*	x	x	x							
6201	*Scenedesmus obtusus*	x	x								
6194	*Scenedesmus opoliensis*			x							
6110	*Scenedesmus quadricauda*			x							
6151	*Scenedesmus serratus*			x							
9199	*Schizochlamys gelatinosa*	x	x								
2392	*Schroederella delicatula*				x						
5657	*Schroederia setigera*	x	x								
5562	*Scourfieldia complanata*	x	x								
10537	*Scrippsiella trochoidea*	x	x	x	x	x	x	x			
6252	*Selenastrum bibraianum*	x	x								
6257	*Selenastrum capricornutum*	x	x								
6255	*Selenastrum gracile*	x	x								
6251	*Selenastrum spinulosum*	x	x								
591395	*Sellaphora bacillum*	x	x								
591396	*Sellaphora laevissima*	x	x								
591302	*Sellaphora pupula*	x	x								
590950	*Sellaphora seminulum*	x	x								
2402	*Skeletonema costatum*	x	x	x	x	x	x	x	x	x	
2414	*Skeletonema potamos*	x	x								
2403	*Skeletonema subsalsum*	x	x								
6089	*Sorastrum americanum*	x	x								
9554	*Spermatozopsis exsultans*	x	x								
9170	*Sphaerocystis schroeteri*	x	x								
7014	*Spirogyra inflata*			x							
1064	*Spirulina laxissima*	x									
1054	*Spirulina major*	x									

List											
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1065	*Spirulina meneghiniana*	x									
1055	*Spirulina subsalsa*	x									
8472	*Spondylosium planum*	x	x								
7603	*Staurastrum anatinum*	x	x								
7445	*Staurastrum gracile*	x	x								
7533	*Staurastrum muticum*			x							
7549	*Staurastrum paradoxum*	x	x								
7673	*Staurastrum pilosum*	x	x								
7824	*Staurastrum pingue*	x	x								
7674	*Staurastrum planctonicum*	x	x								
7712	*Staurastrum teliferum*	x	x								
7200	*Staurodesmus cuspidatus*	x	x								
7205	*Staurodesmus dejectus*	x	x								
4147	*Stauroneis anceps*	x	x								
4223	*Stauroneis legumen*	x	x								
4129	*Stauroneis membranacea*				x					x	
4252	*Stauroneis phoenicenteron*	x	x								
4265	*Stauroneis prominula*	x	x								
4283	*Stauroneis smithii*	x	x								
4132	*Stauroneis spicula*	x	x								
4300	*Stauroneis thermicola*	x	x								
591075	*Staurophora amphioxys*	x	x								
590965	*Staurosira construens*	x	x								
590962	*Staurosirella lapponica*	x	x								
590961	*Staurosirella leptostauron*	x	x								
590892	*Staurosirella pinnata*	x	x								
610108	*Stellarima microtrias*	x	x								
193829	*Stenopterobia delicatissima*	x	x								
2419	*Stephanodiscus alpinus*	x	x								
2329	*Stephanodiscus binderanus*	x	x								
2426	*Stephanodiscus hantzschii*	x	x								
590878	*Stephanodiscus minutulus*	x	x								
590876	*Stephanodiscus parvus*	x	x								
2422	*Stephanodiscus rotula*	x	x								
2435	*Stephanodiscus subtilis*	x	x								
2373	*Stephanopyxis palmeriana*			x	x	x					
2374	*Stephanopyxis turris*	x	x	x	x	x	x	x	x	x	
6412	*Stichococcus bacillaris*	x	x			x					
1881	*Stichogloea doederleinii*	x	x								
2729	*Streptotheca thamensis*				x						
3180	*Striatella unipunctata*			x	x						
9743	*Strombomonas deflandrei*	x	x								
5394	*Surirella angusta*	x	x								
591053	*Surirella bifrons*	x	x								
5366	*Surirella biseriata*	x	x								
590928	*Surirella brebissonii*	x	x								
5395	*Surirella capronii*	x	x								

LIST											
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5396	*Surirella didyma*	x	x								
5340	*Surirella elegans*	x	x								
5332	*Surirella fastuosa*			x							
5343	*Surirella gracilis*	x	x								
5381	*Surirella linearis*	x	x								
5392	*Surirella minuta*	x	x								
5348	*Surirella ovalis*	x	x								
5361	*Surirella ovata*			x							
5357	*Surirella robusta*	x	x								
5398	*Surirella spiralis*	x	x								
590907	*Surirella splendida*	x	x								
5364	*Surirella striatula*	x	x								
555634	*Surirella tenera*	x	x								
5389	*Surirella turgida*	x	x								
3056	*Synedra acus*	x	x								
3064	*Synedra amphicephala*	x	x								
3067	*Synedra berolinensis*	x	x								
3068	*Synedra capitata*	x	x								
3088	*Synedra nana*	x	x								
3089	*Synedra parasitica*	x	x								
3108	*Synedra toxoneides*	x	x								
3023	*Synedra ulna*	x	x								
3021	*Synedra undulata*				x						
1660	*Synura echinulata*	x	x								
1663	*Synura sphagnicola*	x	x								
1664	*Synura spinosa*	x	x								
1656	*Synura uvella*	x	x								
2238	*Syracosphaera mediterranea*				x						
2235	*Syracosphaera pulchra*				x						
2235	*Syracosphaera pulchra*			x							
3252	*Tabellaria binalis*	x	x								
3242	*Tabellaria fenestrata*	x	x								
3247	*Tabellaria flocculosa*	x	x	x							
590882	*Tabularia fasciculata*	x	x								
590870	*Tetracyclus rupestris*	x	x								
6246	*Tetradesmus wisconsinensis*	x	x								
9564	*Tetraselmis cordiformis*	x	x								
9561	*Tetraselmis gracilis*	x	x								
6267	*Tetrastrum elegans*	x	x								
6263	*Tetrastrum staurogeniaeforme*	x	x								
182944	*Thalassionema frauenfeldii*	x	x	x	x	x		x			
3139	*Thalassionema nitzschioides*	x	x	x	x	x	x	x	x		
2485	*Thalassiosira aestivalis*				x			x			
573679	*Thalassiosira angulata*	x	x	x	x	x	x	x			
2504	*Thalassiosira antarctica*			x	x	x	x				
2486	*Thalassiosira baltica*	x	x	x		x					
550500	*Thalassiosira binata*					x					

List											
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2487	*Thalassiosira bioculata*						x				
2523	*Thalassiosira conferta*					x					
2525	*Thalassiosira constricta*			x		x					
2489	*Thalassiosira decipiens*	x	x	x	x	x		x		x	
2520	*Thalassiosira delicatula*			x		x		x			
2503	*Thalassiosira eccentrica*	x	x	x	x	x	x	x	x		
2528	*Thalassiosira fallax*				x					x	
2490	*Thalassiosira gravida*	x	x	x	x	x	x		x	x	
2514	*Thalassiosira guillardii*	x	x			x					
610112	*Thalassiosira hispida*					x					
2496	*Thalassiosira hyalina*	x	x	x	x	x	x				
2511	*Thalassiosira lacustris*	x	x			x					
2524	*Thalassiosira leptopus*	x	x	x		x	x				
2529	*Thalassiosira levanderi*	x	x	x	x	x					
331673	*Thalassiosira mala*			x		x		x			
2521	*Thalassiosira mendiolana*				x						
573692	*Thalassiosira minima*			x		x		x			
2522	*Thalassiosira minuscula*					x					
2492	*Thalassiosira nordenskioeldii*	x	x	x	x	x	x	x		x	
2505	*Thalassiosira oestrupii*			x	x		x				
2493	*Thalassiosira pacifica*			x							
2508	*Thalassiosira polychorda*				x						
2509	*Thalassiosira pseudonana*	x	x	x		x					
573691	*Thalassiosira punctigera*			x		x					
2494	*Thalassiosira rotula*	x	x	x	x	x		x		x	
2495	*Thalassiosira subtilis*			x	x	x	x	x			
590872	*Thalassiosira weissflogii*	x	x	x		x					
3133	*Thalassiothrix frauenfeldii*				x		x				
3134	*Thalassiothrix longissima*	x	x	x	x	x	x				
3135	*Thalassiothrix mediterranea*				x						
10122	*Torodinium robustum*	x	x	x	x	x		x			
331287	*Torodinium teredo*	x	x		x	x					
9691	*Trachelomonas armata*	x	x								
9692	*Trachelomonas hispida*	x	x								
9697	*Trachelomonas volvocina*	x	x								
4548	*Trachyneis aspera*			x	x						
5922	*Treubaria triappendiculata*	x	x								
573506	*Triadinium polyedricum*			x							
2060	*Tribonema affine*	x	x								
2067	*Tribonema viride*	x	x								
2680	*Triceratium alternans*				x						
2740	*Triceratium favus*	x	x	x				x			
941	*Trichodesmium lacustre*	x									
4658	*Tropidoneis lepidoptera*				x		x				
590873	*Tryblionella angustata*	x	x								
590874	*Tryblionella apiculata*	x	x								
590906	*Tryblionella debilis*	x	x								

LIST											
TSN	**Scientific Name**	**HelCom**	**Nederland**	**UKROI**	**Spain**	**Skag-Katt**	**Iceland**	**Helgoland**	**East Sound**	**Clyde Sea**	**IOCToxEurope**
590896	*Tryblionella gracilis*	x	x								
590897	*Tryblionella hungarica*	x	x								
590898	*Tryblionella levidensis*	x	x								
590899	*Tryblionella victoriae*	x	x								
1485	*Uroglena americana*	x	x								
1484	*Uroglena volvox*	x	x								
590900	*Urosolenia eriensis*	x	x								
590901	*Urosolenia longiseta*	x	x								
5585	*Volvox aureus*	x	x								
5584	*Volvox tertius*	x	x								
10132	*Warnowia parva*	x	x								
10134	*Warnowia polyphemus*					x					
331306	*Warnowia rosea*	x	x			x		x			
5970	*Westella botryoides*	x	x								
10126	*Woloszynskia pascheri*	x	x								
180935	*Zygabikodinium lenticulatum*			x							
Nr. Species	1375	1046	976	402	344	315	181	156	61	35	25

Annex 8: Action Plan Progress Review 2005

Year	Committee Acronym	Committee name	Expert Group	Reference to other committees	Expert Group report (ICES Code)	Resolution No.		
2004/2005	OCC	Oceanography	WGPE		2005:\C:01	2C01		
Action Plan	Action Required	ToR's	ToR	Satisfactory Progress	No Progress	Unsatisfactory Progress	Output (link to relevant report)	Comments (e.g., delays, problems, other types of progress, needs, etc.
No.	Text	Text	Ref. (a, b, c)	S	0	U	Report code and section	Text
Please list relevant numbers and I will add text.	1.2 and 1.3	Critically review the work undertaken by WGPE and prepare a clear set of guidelines for the future direction of this Working Group in relation to other relevant WGs, and take action to encourage wider participation to the group;	a)	S			WGPE Report 2005	Identification of main areas of interest has been made
Please list relevant numbers and I will add text.	1.5	Start assessing satellite remote sensing data and numerical modelling results for revealing new information on phytoplankton dynamics;	b)	S			WGPE Report 2005	Work has started and it will continue
Please list relevant numbers and I will add text.	1.6	Review and report on information on the impact of climate variability on phytoplankton dynamics and phytoplankton-zooplankton-fish interactions;	c)			U	WGPE Report 2005	Work incomplete Postponed to 2006
Please list relevant numbers and I will add text.	2.2	Evaluate and report on annual Phytoplankton Summary Reports and the standardization of the data sets;	d)			U	WGPE Report 2005	Lack of continuity in the reporting from different countries
Please list relevant numbers and I will add text.	2.2	Review the Phytoplankton Checklist compiled intersessionally and compare if species from checklist fit into ITIS structure to report phytoplankton data to ICES;	e)	S			WGPE Report 2005	First List delivered to ICES
Please list relevant numbers and I will add text.	1.1	Plan a Workshop devoted to evaluation of new methods of PP measurements in Bergen 2007;	f)		O		WGPE Report 2005	Workshop has been postponed without time frame
Please list relevant numbers and I will add text.	1.8	Continue preparations to summarise status and trends of phytoplankton communities in the North Sea (biomass, species and size composition, spatial distribution) for the period 1984–2004, and any trends over recent decades in these communities; for input to REGNS initial assessment in 9–11 May 2005, and final assessment in 2006.	g)		O		WGPE Report 2005	No work done. Will try to do it before 2006 meeting