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REPORT OF THE ICES/IOC WORKING GROUP ON HARMFUL ALGAL BLOOM DYNAMICS

Vigo, Spain, 11-12 May 1994

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1. OPENING OF THE MEETING

The ICES/IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD) met in the Instituto Español de Oceanografía (Vigo) from 11-12 May 1994, following two days of joint session with the ICES Working Group on Shelf Seas Oceanography (WGSSO). Thirty four scientists from eighteen countries, including five observers, took part and are listed in Annex I. The meeting was chaired by Beatriz Reguera (Spain), who explained and gave her comments about the terms of reference, some of them too broad and extensive as it is usually the case when a new group is set up. Therefore, it was important to identify relevant issues to plan future activities of the group.

2. TERMS OF REFERENCE

At the 81st Statutory meeting in Dublin the Council resolved (C.Res. 1993/2:47) that:
The ICES/IOC Study Group on the Dynamics of Algal Blooms will be re-established as the ICES/IOC Working group on Harmful Algal Bloom Dynamics (Chairman: Ms Beatriz Reguera, Spain) and will meet in Vigo, Spain from 9-12 May to:

a) continue the development of an understanding of the dynamics of harmful algal blooms, including experimental aspects of harmful algal bloom dynamics;

b) review progress in the implementation and/or execution of physical-biological interaction investigations in the pilot study areas (Gulf of Maine, Skagerrak-Kattegat, Iberia);

c) review the results of the Workshop on Modelling the Population Dynamics of Harmful Algal Blooms, and propose further steps to improve the dialogue between physicists and biologists;

d) finalize planning of the Workshop on Intercomparison of *in situ* Growth Rate Measurements;

e) consider the integration of ongoing research activities on harmful algae phenomena in the ICES area into the existing global international programme on harmful algal blooms (IOC-FAO /OSLR/HAB).

f) evaluate strategies useful in investigating HABs and in mitigating their detrimental effects on marine ecosystems, e.g. the efficacy of regional HAB monitoring systems;

g) consider the development of a HAB database;

h) collate and discuss national reports on harmful algal blooms (HABs).

Terms of reference *a*, *b*, and *c* were dealt with during the joint session of the WGHABD with the WGSSO (see report ICES C.M. 1994/L:11, Ref.C).

3. INTEGRATION OF ONGOING RESEARCH ACTIVITIES ON HARMFUL ALGAE PHENOMENA IN THE ICES AREA INTO THE EXISTING GLOBAL INTERNATIONAL PROGRAMME ON HAB (IOC-FAO/OSLR/HAB)

3.1 IOC-FAO ad hoc Interguvernmental Panel on Harmful Algal Blooms (IPHAB)

B.I. Dybern, Chairman of the IPHAB, reported on the activities of the Panel. The Panel has a comprehensive programme with information, training, scientific and management components. The success of the programme depends very much on cooperative assistance from national institutes and

regional and international organizations. Through the knowledge network (especially on scientific and management matters) which exists within ICES, this organization can assist the IPHAB in several ways. One way is through the current invitation to IOC to co-sponsor the Working Group on Harmful Algal Bloom Dynamics. Other ways include sending ICES representatives to meetings of the IPHAB to take an active rôle in the Panel's activities and to place reports and other written information from different ICES bodies (e.g., the Advisory Committee on the Marine Environment and the Working Groups on Phytoplankton Ecology, Shelf Seas Oceanography and Introduction and Transfers of Marine Organisms) at the disposition of the Panel. Further efforts could involve the right of the IOC/IPHAB to use this information for improving institute-libraries in less developed countries. Details on this co-operation may be discussed among representatives for ICES and IOC.

Recognizing the importance of achieving a better understanding of HAB's and improving managerial measures against the harmful effects of these blooms, and following term of reference e, it is recommended that ICES takes an active part in the work of the IOC-FAO ad hoc Intergovernmental Panel on Harmful Algal Blooms (IPHAB).

3.2 Report of the First Meeting of the SCOR/IOC Working Group # 97 on the Physiological Ecology of Harmful Algal Blooms.

This report was presented as an item of information to the ICES Working Group by H. Enevoldsen, IOC representative in this meeting. There has been a good comunication by correspondence between D.M. Anderson, Chairman of the SCOR/IOC working group, and B. Reguera, Chairman of the WGHABD. They agreed that far from considering their terms of reference an overlapping of subjects, the activities developed and results achieved in the SCOR/IOC group will be very useful for a better understanding of the biological processes relevant to the HAB dynamic studies.

To meet their terms of reference, the SCOR/IOC group has recommended in the report that a workshop be held in 1996 at a venue yet to be decided. The timing and structure of this workshop were planned so as to conflict as little as possible with the meeting of the Seventh International Symposium on Toxic Marine Phytoplankton in Sendai, Japan in the summer of 1995. An application for funding from NATO for this workshop has been prepared but funding is not yet assured. The workshop will comprise of a group of 80 to 90 participants, including experts in the relevant fields. A report in the form of a book will be produced as a result, which will summarize the status of current understanding on the topics covered, in direct response to the terms of reference mandated by SCOR. The draft programme, prepared at La Rochelle, France (23-24 October, 1993) in accordance with the policy for a NATO-ASI application, was presented.

The proposed workshop will consist of plenary and key lectures, round table discussions, poster displays and technical demonstrations. Two main themes will be addressed: **Autecology** (including culture, isolation and physiology of various dinoflagellate species) and **Ecophysiological Processes and Mechanisms** (including toxin production, mixotrophic nutrition, small-scale physical processes, bacterial interactions and genetic variation). The discussions will be relevant to modelling and population dynamics of harmful algal species. There will also be a session for assessing emerging issues, including UV irradiation effects, extracellular products, fungi, viruses and other parasites.

The participants aknowledged the scientific interest of the subjects to be treated during the proposed workshop, and considered it would in the future be useful information for the WGHABD activities relating population dynamics with biological processes.

4. WORKSHOP ON INTERCOMPARISON OF *in situ* GROWTH RATE MEASUREMENTS.

4.1 Introduction

Plans for this forthcoming workshop were presented by M. Sampayo. The aim of the workshop is to undertake an intercomparison of *in situ* growth rate measurements of dinoflagellates to be used in support of studies of harmful algal bloom dynamics. The workshop is being organised by the Instituto Portugués para la Investigación del Mar (IPIMAR) at the Regional Center of Aveiro with co-operation from the Instituto Español de Oceanografía (Spain) and the assistance of the invited participants.

4.2 Objective

To use different techniques for measuring *in situ* growth rates of dinoflagellates, mainly the toxic species *Dinophysis* spp, *Gymnodinium catenatum* and *Alexandrium* spp and compare results in order to asses the best approach for the study of the dynamics of harmful algal blooms.

4.3 Study Area

The Ria de Aveiro (8°44' W, 40°38.5' N) is a shallow lagoon with an area of 43-47 km^2. The lagoon has a complex topography with three main channels, several branches, islands and mudflats. Organic pollution levels are high. Various bivalve mollusc species are exploited and PSP and DSP intoxications are regularly recorded.

4.4 Logistics

There is a laboratory with the necessary analytical equipment and two small research vessels will be moored at fixed stations for sampling and incubation studies. A small boat will be available for transfer between the laboratory and the vessels (journey time 20 minutes). Two current meters will be operational during the study period. Accommodation has been booked in an hotel in Aveiro, close to the laboratory, and a draft programme has been prepared. A draft summary of discussions, conclusions and recommendations will be prepared during the workshop.

4.5 Techniques for Comparison

The proposed methods, listed below, were discussed.

(i) *Enclosed water column measurements*
The construction of the plastic bag system was described. It was suggested that the bags should be filled by opening them at the required depth rather than pumping water into them as the latter method may damage some organisms. The problem of sedimentation and stratification in the bags was discussed. It was suggested that dye experiments be carried out in advance of the workshop to evaluate this. A simple and inexpensive device for taking samples at discrete depths without mixing the water column was described. Problems of obtaining representative samples were discussed. It was recommended that light measurements be made at the beginning and end of the experiments and the values obtained compared with field measurements. It was recommended that water samples be screened for cyst formation and that no nutrients should be added to the bags.

(ii) *14 C Method*
Some information was given on the designs of the ICES incubator and the incubator developed and constructed by O. Lindahl. It was suggested that a comparison be made of division rates obtained by cell counts and from the 14 C Method.

(iii) *RNA/DNA and DNA/PCNA Methods*
It was noted that knowledge of the phasing of the division cycle is essential for these methods. Also, that use of flow cytometry may be affected by the expected lower cell numbers of toxic species in the system, compared with other species present. Results may be different from those obtained using monocultures or monospecific blooms.

(iv) *Diffusion Chamber Method*
There were no comments made on this method.

(v) *Mitotic index and Morphological Methods*
Knowledge of phasing of the division cycle will also be required for these methods. This will determine the frequency of sampling. The methods will not be suitable for some species as nuclear and cellular division are complete in less than one hour and the phasing is not precise enough. It was noted that in earlier studies with *Ceratium* it was necessary to examine 1000 cells to give accurate results, and that although the method apparently avoids inaccuracies due to grazing, recently divided cells may be more vulnerable to grazing, so that this assumption cannot necessarily be taken for granted.

(vi) *Single Cell 14 C uptake Method*
The problems involved in comparing results from single cells and up to 1000 cells in obtaining a mean doubling time of the population were noted.

5. STRATEGIES USEFUL IN INVESTIGATING HABs AND IN MITIGATING THEIR DETRIMENTAL EFFECTS

Presently, monitoring programmes provide the basic information required for making management decisions, and are thus therapeutic in character. But with better models, based on the same monitoring data, it should be possible to obtain prognoses which would facilitate more flexible management decisions. An example of this approach was presented by A. Cembella, and is explained in section 5.2.

5.1 Monitoring programmes

Details of some national monitoring programmes, and national reports on toxic/harmful events were presented by representatives and are attached as Annex IV. It was noted that monitoring strategies for toxic phytoplankton had been discussed by the Working Group on "Phytoplankton and the Management of their Effects" and recommended methods had been published in the ICES Co-operative Research Report no. 181. In addition to the national programmes presented, an international programme for Phytoplankton and Environmental Monitoring in the Baltic was presented by K. Kononen. The sampling frequency has been reviewed in relation to the value of the information obtained, which is collected using transects from ships of opportunity. A system for dissemination of the data collected has been initiated.

The national monitoring strategies described can be grouped into three types:

(i) Detailed programmes which include not only identification and enumeration of phytoplankton species but also associated physical and chemical data (e.g. temperature, salinity, nutrients, pigments, etc.)

(ii) Monitoring of water samples for determination of (harmful) algal species only. The effort put into these programmes varies between countries.

(iii) Programmes where most of the monitoring effort is put into the analysis of shellfish flesh samples for toxins and very few data are collected on phytoplankton. This can however be a useful monitoring tool, as described below.

A sub-group was convened to elaborate a draft format to guide a full description of monitoring programmes, which will be compiled during the intersessional period, and presented to the next meeting of the Working Group. The draft format is in Annex II.

5.2 Modelling phycotoxin kinetics using bivalve molluscs

A. Cembella presented a paper putting forward the proposal that mussels can be used as integrators of toxic phytoplankton. The advantages of using mussels are that they have a low sensitivity to the toxins; they are widely distributed; they have a high filtration rate which leads to a rapid build up of toxin; they detoxify rapidly; they have a low rate of toxin transfer from the digestive gland to other tissues; they acclimate quickly and they have a high rate of retention of particles in the size range of interest. One or two compartment models may be applied, in which the rate of change of toxin concentration is a function of ingestion, filtration rate, algal cell concentration, cellular toxin content and excretion. Examples were presented for PSP intoxication, using a standard size of mussel and assuming a filtration rate of 32 litres per day, which gave a good fit to experimental results. The model has not yet been evaluated for DSP intoxication but there is no reason why it should not be applied and experiments are in progress to evaluate rate constants for *P. lima* cells. An example was given by J. Haamer of the use of mussels to monitor DSP on the Swedish coast. Bags of mussels suspended from ropes fixed vertically in the water column are placed strategically in order to give advance warning of the influx of toxic algae to the main growing areas.

In the discussion which followed it was recognised that these methods, which model or measure toxin transfer rather than populations, will only work for certain harmful species. It was further recognised that these methods enhance the value of the monitoring data in that they are not only useful for public health reasons but can also help to give a better understanding of population dynamics in the prediction of potential levels of intoxication. The monitoring data can also be helpful in the design of experimental programmes and as a source of secondary information.

Further discussion dealt with the fate of toxins from cells in mussel faecal pellets or in senescent algal cells. These toxins have been detected in the water column and in the surface of the benthic layer, where they may be grazed, causing intoxication of, for example, abalones. It was recognised however that very little information is available on this aspect.

6. CREATION OF A DATABASE

H. Dooley provided a provocative account (appended in Annex III) of previous efforts within ICES to establish a database of HAB events. Attempts to establish a database within ICES go back as far as 1982 and the issue has been discussed by various groups. There exists an event information database, set up by Dr. Mommaerts, which includes data from 1962-1984. This kind of database is limited by the recording and monitoring inputs from particular areas and at particular times.

It was recommended that attention should be paid to the art of the possible, without making stringent requirements on formatting and data content.

7. NATIONAL REPORTS

National reports were presented for Sweden, Norway, England and Wales, Portugal, Germany, Canada, Iceland, Scotland, The Netherlands, France, Chile, Finland, Spain, Denmark, U.S.A., Mexico, Argentina and Cuba. A summary of the items of greatest interest in the reports presented is given below. The reports are attached as Annex IV.

7.1 Sweden

There were blooms of a variety of species in 1993, although none were exceptional. Cyanobacterial cells in the Northern Baltic were tested to be toxic but no harmful effects were noted. Mussel harvesting was suspended at certain periods, as usual.

7.2 Norway

There were exceptionally high cell concentrations of *Dinophysis norvegica* which, in a mixture with other species, caused small bands of reddish water in some places. DSP was above action levels along the South and mid Norway coast. PSP was above action levels in mid Norway. *Prymnesium parvum* occurs annually in a brackish water fjord system. Fish kills in fjords in West Norway were associated with low cell concentrations of a *Chrysochromulina* species.

7.3 England and Wales

A non-toxic bloom of *Alexandrium tamarense* was detected on the South coast.

7.4 Portugal

Reports were presented for 1992 and 1993. New areas were affected by PSP and at action levels for the first time following no recorded intoxications in 1991. In 1993 a spread in the distribution of the species responsible (*G.catenatum*) from South to North was noticed. There were fewer records of lower intoxication of DSP in 1992 and none in 1993.

7.5 Germany

Blooms of various species were reported, including the annual *Phaeocystis* event. Cysts of *Gymnodinium catenatum* were detected over a wide area, although no vegetative cells were found. This represents a discontinuity in the distribution of this species and stimulated a discussion on where the cysts came from. It was felt that ballast water transport was unlikely to be the cause and that the Shelf Seas Oceanography Group shoud study and comment on the forthcoming paper on this finding.

7.6 Canada

About 60% to 70% of the British Columbia coastline remains closed for shellfish harvesting due to chronic PSP intoxication. PSP in other areas was also at normal levels. There was no record of domoic acid intoxication although *Pseudonitzchia* was detected. Two other toxic incidents are under further investigation, but have not as yet been associated with toxic phytoplankton.

7.7 Iceland

No harmful blooms were detected. Exported scallops, fished in 1992 and stored frozen until 1993, were found to contain PSP above action levels.

7.8 Scotland

No fish kills or exceptional blooms were reported. PSP above action levels were detected in mussel flesh in the Firth of Forth, parts of the West coast and Moray Firth (in scallops) in the Spring and throughout the year in the Orkney Islands.

7.9 The Netherlands

Data were presented for 1992 and 1993, with incomplete analysis of the latter. Various species were recorded including first records for *Chattonella marina* and *Pseudonitszchia* sp.

7.10 France

Toxicity of mussel and oyster flesh was associated with discoloration of the water by *Alexandrium minutum*. DSP was above action levels in fewer instances than previous years. Neuro-toxins in shellfish flesh, which have not as yet been associated with toxic phytoplankton, continued to be reported throughout the Winter from the Atlantic coast and in the Spring from the Mediterranean coast.

7.11 Chile

Blooms of *Leptocylindricus minimus* were associated with low level fish kills although the cause was not clear. PSP is recorded and outbreaks appear to be more frequent. DSP is also recorded from fjord areas.

7.12 Finland

No exceptional blooms were recorded.

7.13 Spain

PSP (*G.catenatum* and *A.minutum*) and DSP (*Dinopyhsis* spp) toxicity causing shellfishery closures occured in the rias of Galicia in the last two years. The most prolonged closure were caused by persistent low concentrations of the *Dinophysis acuminata* complex. No toxic incidents are reported from the Mediterranean coast. Blooms of a non-toxic dinoflagellate, at one time thought to be *G.catenatum*, were recorded in this area.

7.14 Denmark

A small non-toxic bloom of *Chrysochromulina* was recorded.

7.15 U.S.A.

The overall pattern of harmful algal blooms in the United States throughout 1993 did not differ substantially from temporal and spatial patterns that have been recognized in previous years. Blooms of *Alexandrium* occurred in the Northeast, Southwest, and Northwest regions of the country. Blooms of the brown tide organism, *Aureococcus anophagefferens*, occurred in Long Island, New York. Blooms of the ambush predator, *Pfiesteria piscimorte*, occurred in the estuarine waters of North Carolina. Domoic acid contamination on razor clams (*Siliqua patula*) occurred along the coasts of Oregon and Washington.

7.16 Mexico

A range of red tide species occur along various parts of the coast.

7.17 Argentina

There has been an increase in PSP intoxication since 1992. The relationship between this and increased UV-B irradiation is being studied.

7.18 Cuba

There were no exceptional blooms reported, except the chronic cases of Ciguatera.

8. RECOMMENDATIONS

1. The Working Group should seek advice from the ICES Study Group on Zooplankton Production about: i) techniques for grazing measurements and their limitations, ii) documented observations on specific predator-prey links of planktonic organisms, and iii) effects of algae mucilages and/or algal taste on grazing, and from the WG on Environmental Interactions of Mariculture on the influence of benthic bivalves on local hydrodynamics.

2. ICES should recommend that funds be provided for the development of models more appropriate to the management of harmful algal blooms than those presently being developed.

3. Recognizing the importance of achieving a better understanding of HAB's and improving managerial measures against the harmful effects of these blooms, it is recommended that ICES takes an active part in the work of the IOC-FAO ad hoc Intergovernmental Panel on Harmful Algal Blooms.

4. The ICES/IOC Working Group on Harmful Algal Bloom Dynamics will meet during the spring of 1995 in Helsinki (Finland) to:

a) review the results of the Workshop on Intercomparison of *in situ* Growth Rate Measurements;

b) review ongoing activities in the pilot study areas, and other ICES areas, on physical-biological interactions investigations;

c) develop plans for a future practical Workshop on Modelling using real data obtained in monitoring and projects related with HAB Dynamics;

d) assemble and compile, intersessionally, descriptive information about ongoing monitoring programmes on phytoplankton and phycotoxin monitoring, with a view to its presentation in the Intergovernmental Panel on HABs;

e) define the time and space scales of the physical and biological processes relevant to studies of physical-biological interactions in HAB dynamics;

f) review present knowledge of the abilities of certain harmful algal species to **adapt to** and **modify** the microscale physical environment by means for example of vertical migration, mucilage secretion, colony formation, etc.

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ANNEX II: FORMAT FOR THE DESCRIPTION OF NATIONAL MONITORING PROGRAMMES

COUNTRY X MONITORING PROGRAMME

1. REGION

2. HISTORY OF REGION'S HAB PROBLEMS

3. SPECIFIC OBJECTIVES OF MONITORING PROGRAMME

   e.g.: to prevent/minimize economic losses due to fish kills or harvesting bans; human health concerns from algal toxins; long term changes in the environment...

4. MONITORING ACTIVITIES

4.1 Causative organisms (dinoflagellate, diatom, etc)
4.2 Groups/species of concern (shellfish, fish)
4.3 Other factors involved

5. PARAMETERS MEASURED

5.1 Cell counts; cell toxicity; other
5.2 Toxicity in shellfish; effects on fish (mortality, etc)
5.3 Meteorological conditions, hydrography, chemistry, species composition.

6. SAMPLING LOCATIONS (for each parameter)

7. SAMPLING FREQUENCY (for each parameter)

ANNEX III: COMMENTS ON ESTABLISHMENT OF HAB DATA BASE

WG on HAB Dynamics
Vigo, May 1994

Agenda 7 - Comments on Establishment of HAB Data Base.

Background

Attempts to establish an Algal Bloom database within ICES go back many years, in fact to 1982. It is a topic that has been on the agenda of the Biological Oceanography Committee, the Harmful Effects Working Group, the Working Group on Marine Data Management, the Working Group on Phytoplankton and the Management of their Effects, the ACMP, and now this Working Group. I wish the HAB WG every success in coming finally to a happy resolution of this apparently complex and difficult issue!

Recent History

When ACMP dealt with this issue at its 1991 meeting it recommended that the Working Group on Phytoplankton and the Management of their Effects explore at its 1993 meeting the development of the Mommaert's directory and the possibility of the statistical analyses of appropriate time series (see Annex 1). However this Working Group came to no particular conclusion, partly because they did not know about the Mommaerts directory. Also, they only addressed the issue from the point of view of a primary production "data" database.

What do we want now?

The important thing the Working Group has to decide at the outset is to clearly state what it is that is actually required. It is in my opinion that you have to very carefully define what you mean by a database, because one man's database is another man's list is another man's descriptive catalogue is another man's dataset..... To some data means information as well as numbers, to others data means numbers only. I think what you want is a searchable catalogue of information (to some a database!), and if so, say so.

When the issue was first put to the Working Group on Marine Data Management in 1990 (following years of discussion), it was clearly seen as an event information database. Following that discussion I prepared a document which I submitted to ACMP in 1991. This summarised the position at that time, and drew specific attention to the efforts of Dr Mommaerts. His database has no numbers, just searchable and extractable information describing events. Such a "database" was, I think, along the lines envisaged by the "Harmful Effects" group too. However ACMP concluded that such lists were basically devalued by what I call the "Loch Ness Monster Syndrome", as their contents could not be validated by statistical means, and relied very much on chance observations with no knowledge of the"effort" required for each observation. For this reason one possible explanation for the observed trend in HAB events this century may be the increase in the effort of observation.

Databases containing numbers, whether this be chlorophyll, primary production, or phytoplankton numbers, are also vulnerable to such distortion, but in such cases distortions can often be remedied by statistical means. Whether a trend will ever be discernible from such a data set, given all the various competing variables such as spatial and temporal variability, varying standards (both human and instrumental), and varying observational effort, is however a question that has to be addressed too. Maybe the answer lies in both approaches, perhaps capitalising on the capabilities of remote sensing techniques, a capability that was still in its infancy when Mommaerts first set up his database.

Harry Dooley
ICES Oceanography Secretary
2 May 1994

ANNEX IV: NATIONAL REPORTS

HARMFUL ALGAL BLOOMS IN 1993 - FINLAND

1. **Locations:** Large areas in the open western Gulf of Finland and the Bothnian Sea. Some miner areas in the northern parts of the eastern Gulf of Finland.
2. **Date of occurrence:** July - September
3. **Effects:** Intensive cyanobacterial bloom forming flocks in the open sea. In some areas the flocks were also drifted to the shore. In northern parts of eastern Gulf of Finland an intoxication of a dog was suspected to have been caused by a cyanobacterial bloom at the end of September.
4. **Management decision:** Media informed
5. **Causative species:** *Nodularia spumigena* (hepatotoxic) and *Aphanizomenon flos-aquae* were the dominant species.
6. **Environment:**
7. **Advected population or *in situ* growth:** *In situ* population in the sea area.
8. **Previous occurrence:** Extensive cyanobacterial blooms were previously observed in the area in 1992.
9. **Additional comments:** The monitoring of the area is intensified by using unattended flow-through analyzer (chlorophyll *a*, temperature, salinity and water samples for species determination) on board merchant ship which has a frequent connection between Helsinki and Travemünde. The system has been started in 1992.
10. **Individuals to contact:** Kaisa Kononen

Juha-Markku Leppänen

Eija Rantajärvi

Seija Hällfors

Finnish Institute of Marine Research

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29.04.94

The Baltic Alga Fax

Peridiniella catenata

Finnish Institute Of
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Phone:+358 0 331 044
Fax: +358 0 331 376

Achnantes taeniata
(orig. T. Tikkanen)

Eija Rantajärvi
Seija Hällfors
Juha-Markku Leppänen

Dear colleagues,

This is the second Baltic Alga Fax in 1994.

The data is based on unattended recordings onboard the merchant ship 'Antares'. The recorded variables are *in vivo* fluorescence of chlorophyll *a*, temperature and salinity. The water for the sensors is pumped constantly from a depth of ca. 5 m while the ship is moving and the spatial resolution is ca. 200 m. The figures are based on the average values counted for one nautical mile. At least once a week 24 water samples are taken automatically during the transect across the Baltic Proper from Lübeck to Helsinki. The microscopic determination of the phytoplankton species composition is done weekly. The analyses of nutrients (total-P, total-N, NH_4-N,NO_2+NO_3-N, SiO_4-Si) are made fortnightly.

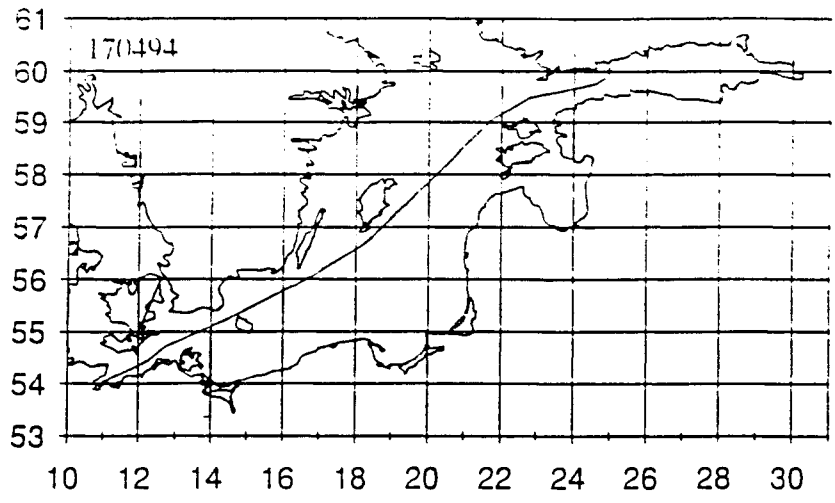

Figure 1. The route map of the merchant ship 'Antares' in 17-19 April 1994.

Results

The results of chlophyll *a* recordings for four subsequent transects are presented below.

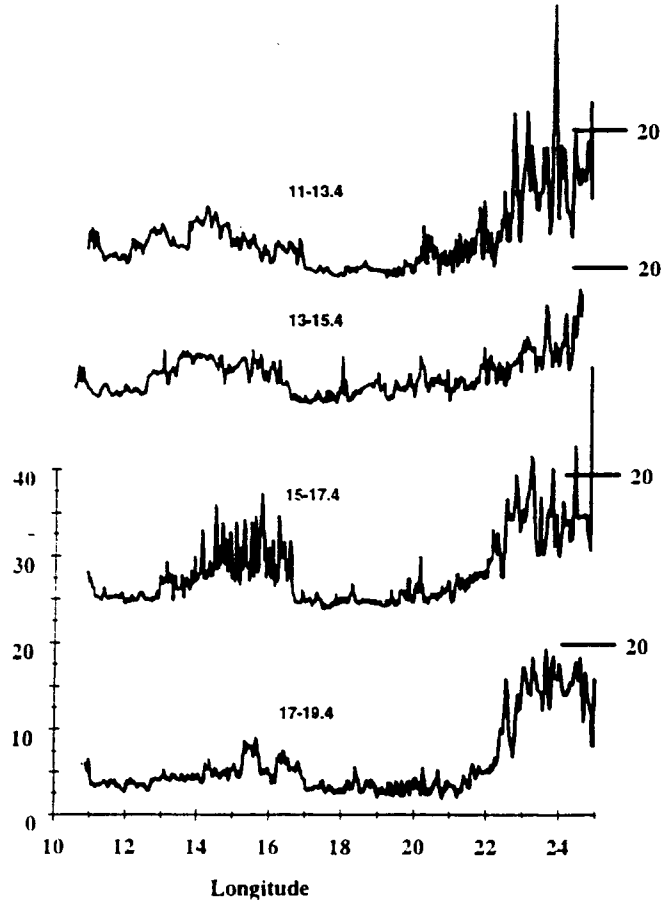

Figure 2.The concentrations of chlorophyll *a* (mg m^{-3}) in 11-19 April along the route.

The phytoplankton species composition

Diatoms and dinoflagellates are still predominating in the whole area.
In the Gulf of Finland the diatoms (*Chaetoceros* spp., *Achnanthes taeniata*) and dinoflagellates (*Peridiniella catenata*, *Peridinium hangoei*) are the dominant groups. In addition to them species of *Pyramimonas* and cryptomonads are present. In the Northern Baltic Proper down to the southern areas of the Gotland Sea the dominant species are dinoflagellates (*Peridiniella catenata*, *Peridinium hangoei*). The amount of diatoms (*Achnanthes taeniata*, *Chaetoceros* spp.) is high as well. Along the Swedish coast and in the Arkona Sea the diatom *Skeletonema costatum* is the most dominant species. The diatoms *Chaetoceros wighamii*, *C. holsaticus*, *Thalassiosira baltica*, *T. levanderi* and small flagellates (*Chrysochromulina* spp., *Pyramimonas* spp., *Cryptomonadales*) occurred in large numbers as well.

The oxygen situation in the Baltic Sea

The research vessel Aranda has made two cruises to the Gotland Deep during this year.

During the cruise of Aranda in February this year the new hydrogen sulfide formation, which was observed already in November 1993, was still ongoing.
In April this year the situation in the **Gotland Deep** was changed. In the Eastern Gotland Basin only a couple of pockets containing hydrogen sulfide were found, one in the Fårö Deep and the other in the southwestern areas of the Basin. Even there the concentrations of hydrogen sulfide were extremely low. Otherwise the entire watermass of the Basin was oxygenated. In the deepest area of Gotland Deep the oxygen concentration was as high as 2 ml/l. The last time this high oxygen concentrations have been observed there, was in1977 and before this only in 1950's.
In the **Gulf of Finland** in November 1993 a weak halocline was observed. However, in April this year it had almost completely disappeared. Consequently, the oxygen concentrations in the bottom waters of the Gulf of Finland had clearly increased. The bottom fauna in the area had survived well the period of low oxygen concentrations in 1993.

The additional information from all of you is highly appreciated. The concentrations of chlorophyll *a* at the depth of ca. 5 m at the monitoring stations of the various institutes would be valuable in order to compile maps on the algal concentrations. All information on bloom events is welcome.

Looking forward to hear from you.

THE ALGAL TEAM

Finnish Institute of Marine Research

To be continued in the near future...

MONITORING OF HARMFUL ALGAL BLOOMS
FRANCE - 1993

The French Phytoplankton Monitoring Network (REPHY), consists of 35 to 40 routine stations sampled all year long (water samples), twice a month in winter, once a week in summer. Systematic cell count of all phytoplankton species is carried out, and a few physico-chemical parameters are measured (temperature, salinity, turbidity and chlorophyll a + phaeopigments).
Many other warning stations may be sampled, once a week, in the event of a growth of a toxic species ; water samples are collected for cell count of toxic or doubtful species, and shellfish samples are collected for mouse-tests (DSP or PSP).
In 1993, shellfish samples were also collected all winter over about 25 stations, once a week, for the detection of an unknown toxin present in mussels (see results below).

Discolored waters were recorded especially along the Brittany coast and the Mediterranean coast (Fig. 1). The responsible species were primarily *Mesodinium rubrum*, *Prorocentrum micans* and different species of *Thalassiosira*, *Chaetoceros* and *Rhizosolenia*.

DSP toxicity affected a few areas, especially in Brittany (Fig. 2). It was always linked with the presence of species of *Dinophysis*.

PSP toxicity was recorded in one area of northwestern Brittany, linked with the presence of *Alexandrium minutum* (Fig. 2).

Fish mortalities were recorded in a pond of Corsica. The responsible species was *Gymnodinium sp.*, very close to *Gymnodinium* cf. *nagasakiense* (Fig. 2).

An **"unknown toxin"** was found in winter in shellfish of many areas of the Atlantic coast (Fig. 2). This toxin was nor DSP neither PSP,but killed mice in few minutes.

Such a toxicity episode began again in spring along the Mediterranean coast, with PSP traces, not enough to explain mice mortality. Then a new toxic event was recorded in November in a little bay of Mediterranean, despite of the absence of DSP and PSP toxins.

No toxic or doubtful phytoplankton species could be linked to this toxicity.

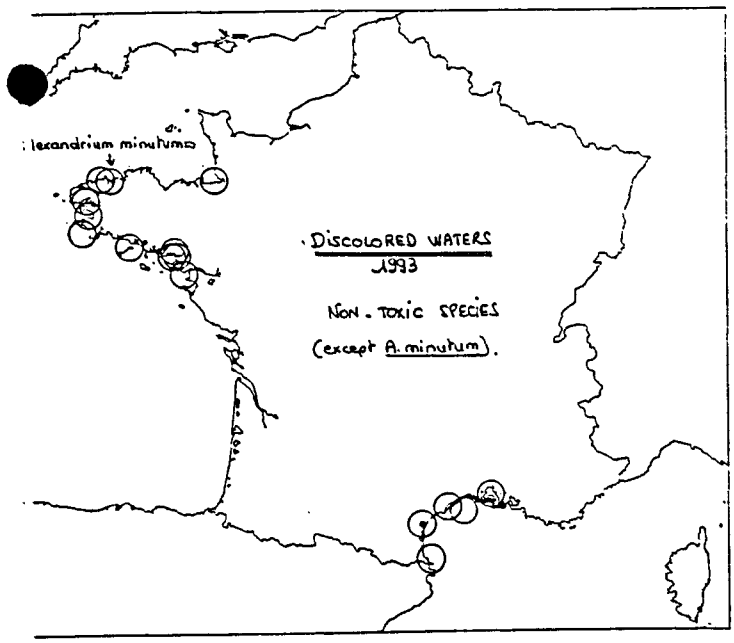

Fig. 1

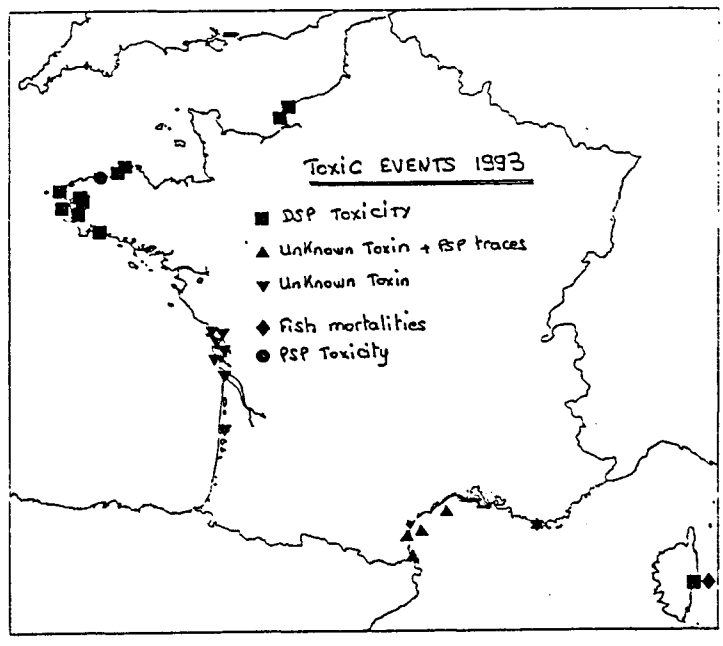

Fig. 2

FRANCE
ALGAL BLOOM REPORT
1993

Catherine BELIN
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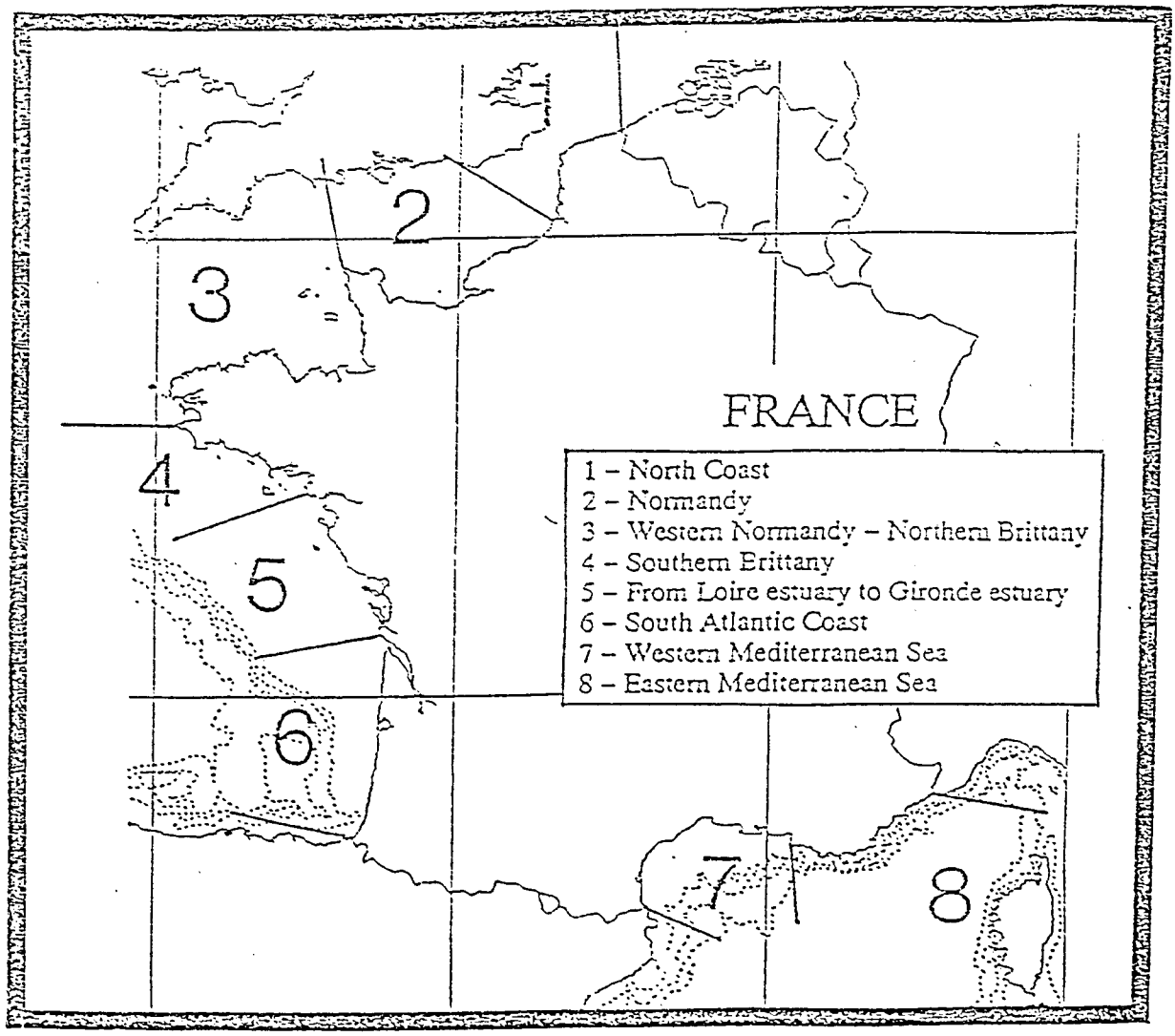

The French coast is divided into 8 areas for description of Harmful Algal Blooms

ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
NORMANDY (area 2)
North of Seine estuary : sites of Fécamp (009) and Antifer (010)

DATE OF OCCURRENCE
August to early September

EFFECTS
DSP toxicity above safety level

MANAGEMENT DECISIONS
Ban of shellfish marketing, from August 19 to September 3

CAUSATIVE SPECIES
Dinophysis spp. (dominant *Dinophysis* cf. *acuminata*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
Advected population from Seine plume

PREVIOUS OCCURRENCES
Fécamp : 1989, 1992
Antifer : 1983, 1984, 1986, 1988, 1989, 1990, 1992

ADDITIONNAL COMMENTS
The largest *Dinophysis* cell counts of the whole French coast are recorded every year in this zone

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
NORTHERN BRITTANY (area 3)
Mont St Michel bay (site 023)

DATE OF OCCURRENCE
March 22

EFFECTS
Discolored water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Thalassiosira rotula / gravida (98 100 cells.l-1)
and *Skeletonema costatum* (72 000 cells.l-1)

ENVIRONMENT
Temperature : 9.1°C
Salinity : $34.8.10^{-3}$
Turbidity : 4 NTU
A-Chlorophyll : 3.11 $mg.m^{-3}$ Phaeopigments : 0.84 $mg.m^{-3}$

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

NORTHERN BRITTANY (area 3)
Perros-Guirrec (site 031) and Lannion-Locquirec (site 032)

DATE OF OCCURRENCE

July

EFFECTS

DSP toxicity above safety level

MANAGEMENT DECISIONS

Ban of shellfish marketing, from July 2 to July 15

CAUSATIVE SPECIES

Dinophysis spp. (dominant *Dinophysis* cf. *sacculus*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

No data available

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE – 1993

LOCATION

NORTHERN BRITTANY (area 3)
Morlaix river (site 033)

DATE OF OCCURRENCE

July 12 to 15

EFFECTS

Reddish water
No PSP toxicity

MANAGEMENT DECISIONS

Ban of shellfish marketing (preventive, because of the presence of PSP toxicity in Penzé river, nearby) from July 7 to 28

CAUSATIVE SPECIES

Alexandrium minutum (max : 2 912 000 cells.l^{-1})

ENVIRONMENT

Temperature : 16 to 18.9°C
Salinity : 31 to 35.10^{-3}
Turbidity : 2.5 to 7 NTU

ADVECTED POPULATION OR IN SITU GROWTH

In situ growth (presence of cysts in the sediment)

PREVIOUS OCCURRENCES

1989, 1990, 1992 in Morlaix bay

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
NORTHERN BRITTANY (area 3)
Morlaix river (site 033)

DATE OF OCCURRENCE
July 05

EFFECTS
Reddish to brown water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Kryptoperidinium foliaceum (4 136 000 cells.l-1)

ENVIRONMENT
Temperature : 16.8°C
Salinity : 16.10^{-3}
Turbidity : 7 NTU

ADVECTED POPULATION OR IN SITU GROWTH
Probably in situ growth

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
NORTHERN BRITTANY (area 3)
Penzé river (site 033)

DATE OF OCCURRENCE
June 21 to July 12

EFFECTS
Pink to reddish colored water
PSP toxicity level above safety level : - up to 474 µg per 100 g of flesh in oysters
- up to 112 µg per 100 g of flesh in mussels

MANAGEMENT DECISIONS
Ban of shellfish marketing from June 24 to July 28

CAUSATIVE SPECIES
Alexandrium minutum (max : 5 012 000 cells.l-1)

ENVIRONMENT
Temperature : 16 to 20°C
Salinity : 23 to 35.10^{-3}
Turbidity : 1.25 to 60 NTU

ADVECTED POPULATION OR IN SITU GROWTH
In situ growth (presence of cysts in the sediment)

PREVIOUS OCCURRENCES
1989, 1990, 1992 in Morlaix bay

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

NORTHERN BRITTANY (area 3)
Ouessant island (site 035)

DATE OF OCCURRENCE

June to July

EFFECTS

DSP toxicity above safety level

MANAGEMENT DECISIONS

Ban of shellfish marketing, from June 10 to July 23

CAUSATIVE SPECIES

Dinophysis spp. (dominant *Dinophysis cf. sacculus*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

No data available

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

NORTHERN BRITTANY (area 3)
Iroise sea (site 036), Elorn river (site 037), Aulne river (site 038) and Douarnenez bay (site 039)

DATE OF OCCURRENCE

May to August

EFFECTS

DSP toxicity above safety level

MANAGEMENT DECISIONS

Ban of shellfish marketing, from :
- May 10 to September 2 (Iroise sea)
- May 27 to July 23 (Elorn and Aulne rivers)
- May 5 to September 2 (Douarnenez bay)

CAUSATIVE SPECIES

Dinophysis spp. (dominant *Dinophysis* cf. *sacculus*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

No data available

PREVIOUS OCCURRENCES

Iroise sea : 1986, 1989, 1990, 1992
Elorn and Aulne river : no
Douarnenez bay : every year since 1983

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
NORTHERN BRITTANY (area 3)
Elorn river (site 037)

DATE OF OCCURRENCE
July 26 to August 30

EFFECTS
Red water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Prorocentrum micans (max : 70 000 000 cells.l^{-1})

ENVIRONMENT
Temperature : 17 to 18.5°C
Salinity : 26 to 35.10^{-3}
Turbidity : 1.4 to 42 NTU
A-Chlorophyll : up to 1008.2 $mg.m^{-3}$

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
1987, 1988, 1990

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE – 1993

LOCATION
NORTHERN BRITTANY (area 3)
Douarnenez harbour (site 039)

DATE OF OCCURRENCE
March 24 – 25

EFFECTS
Very red water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Mesodinium rubrum (2 500 000 cells.l–1)
(+ *Gymnodinium, Gonyaulax* as dominant species, and little cell counts of *Alexandrium minutum*)

ENVIRONMENT
Temperature : 11°C
Salinity : 35.10^{-3}
Turbidity : 6.5 NTU

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
SOUTHERN BRITTANY (area 4)
Audierne bay (site 040)

DATE OF OCCURRENCE
January 4 to February 1

EFFECTS
Brown-greenish water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Chaetoceros armatum (max : 29 400 000 cells.l-1)

ENVIRONMENT
Temperature : 8.5 to 10.5°C
Salinity : 33 to 35.10-3
Turbidity : 4.5 to 20 NTU
A-Chlorophyll : up to 275 mg.m-3

ADVECTED POPULATION OR IN SITU GROWTH
Probably in situ growth

PREVIOUS OCCURRENCES
1989, 1990, 1991, 1992

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
SOUTHERN BRITTANY (area 4)
Concarneau bay (site 043)

DATE OF OCCURRENCE
July to September

EFFECTS
DSP toxicity above safety level

MANAGEMENT DECISIONS
Ban of shellfish marketing, from July 6 to July 30, then from August 11 to October 8

CAUSATIVE SPECIES
Dinophysis spp. (dominant *Dinophysis* cf. *sacculus*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
1985, 1986, 1987, 1988, 1990, 1992

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
SOUTHERN BRITTANY (area 4)
Groix island (site 045)

DATE OF OCCURRENCE
April 20

EFFECTS
Red water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Prasinophyceae

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
SOUTHERN BRITTANY (area 4)
Vilaine bay (site 057)

DATE OF OCCURRENCE
April 9 to 13

EFFECTS
Red water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Mesodinium rubrum (max : 680 000 cells.l^{-1})

ENVIRONMENT
Temperature : 12.2°C

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

SOUTHERN BRITTANY (area 4) and FROM LOIRE TO GIRONDE (area 5)
Vilaine bay (site 057) and Loire estuary (site 060)

DATE OF OCCURRENCE

May 2 to 10

EFFECTS

Green to brown water

MANAGEMENT DECISIONS

Continued surveillance

CAUSATIVE SPECIES

Rhizosolenia delicatula (2 900 000 cells.l-1 in Vilaine, 1 564 000 in Loire)
(and *Rhizosolenia setigera* (280 000 cells.l-1 in Vilaine, 400 000 in Loire))

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

No data available

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
SOUTHERN BRITTANY (area 4)
Vilaine bay (site 057)

DATE OF OCCURRENCE
June 7

EFFECTS
Discolored water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Chaetoceros sp (2 500 000 cells.l-1)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
1988

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

FROM LOIRE TO GIRONDE (area 5) and SOUTH ATLANTIC COAST (area 6)
All sites from Pertuis Breton (065) to Arcachon basin (077)

DATE OF OCCURRENCE

February

EFFECTS

Very rapid mortalities of mice with acetone extract of shellfish digestive gland, despite of the absence of toxic phytoplankton species. No DSP, and no PSP toxins were found by HPLC analysis. The event was very short

MANAGEMENT DECISIONS

Ban of shellfish marketing, from February 2 to February 17

CAUSATIVE SPECIES

No toxic or harmful species, and no very abundant species

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES

Such a toxicity episode was recorded in November and December 1992, in Pertuis Breton (site 065)

ADDITIONNAL COMMENTS

INDIVIDUAL TO CONTACT :

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FRANCE
(National Contact)

ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Argelès, Catalan coast (site 080)

DATE OF OCCURRENCE
August 19 to 21

EFFECTS
Red brown water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Gymnodinium sp. (1 200 000 cells.l-1)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

INDIVIDUAL TO CONTACT :

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and

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

WESTERN MEDITERRANEAN SEA (area 7)
Roussillon coast (sites 080 and 081) and Languedoc coast (site 088)

DATE OF OCCURRENCE

April

EFFECTS

Very rapid mortalities of mice with acetone extract of mussel digestive gland. The HPLC analysis showed the absence of DSP toxins, and the presence of very small quantities of PSP toxins, not sufficient to explain the mortality of mice.

MANAGEMENT DECISIONS

Ban of shellfish marketing, from April 8 to April 22

CAUSATIVE SPECIES

Presence of *Dinophysis spp.*, *Alexandrium minutum*, and *Prorocentrum minimum*, all these species in very small concentrations

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

INDIVIDUAL TO CONTACT :

Catherine BELIN and **Jean-Louis GUILLOU**
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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Salses-Leucate lake (site 083)

DATE OF OCCURRENCE
May to July

EFFECTS
Very rapid mortalities of mice with acetone extract of mussel digestive gland. The HPLC analysis showed the absence of DSP toxins, and the presence of very small quantities of PSP toxins, not sufficient to explain the mortality of mice.

MANAGEMENT DECISIONS
Ban of shellfish marketing, from

CAUSATIVE SPECIES
Presence of *Dinophysis spp.*, *Alexandrium minutum*, and *Prorocentrum minimum*, all these species in very small concentrations

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Bages pond (site 085)

DATE OF OCCURRENCE
January 12

EFFECTS
Red water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Prorocentrum micans (230 000 cells.l^{-1})

ENVIRONMENT
Salinity : 18.5.10^{-3}
Turbidity : 1.7 NTU

ADVECTED POPULATION OR IN SITU GROWTH
In situ growth

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Thau lake (site 087)

DATE OF OCCURRENCE
February 15 - 16

EFFECTS
Brown water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Heterocapsa triquetra (10 000 000 cells.l-1)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
In situ growth

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Languedoc coast (site 088)

DATE OF OCCURRENCE
June 16

EFFECTS
Red brown water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Mesodinium rubrum (2 500 000 cells.l-1)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
No data available

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
WESTERN MEDITERRANEAN SEA (area 7)
Berre - Vaine lake (site 095)

DATE OF OCCURRENCE
September 20

EFFECTS
Discolored water

MANAGEMENT DECISIONS
Continued surveillance

CAUSATIVE SPECIES
Thalassionema nitzschioïdes (267 200 cells.l^{-1})
(and *Prorocentrum minimum* 17 800 cells.l^{-1})

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES
No

ADDITIONNAL COMMENTS

INDIVIDUAL TO CONTACT :

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

EASTERN MEDITERRANEAN SEA (area 8)
Toulon roads (site 100)

DATE OF OCCURRENCE

March to May then again in November and December

EFFECTS

Very rapid mortalities of mice with acetone extract of mussel digestive gland. The HPLC analysis showed the absence of DSP toxins, and the presence in April of very small quantities of PSP toxins, not sufficient to explain the mortality of mice. In December, no DSP and no PSP toxins were found in samples.

MANAGEMENT DECISIONS

Ban of shellfish marketing, from March 30 to June 4 and from November 25 to ?? (the toxicity is still present in April 94)

CAUSATIVE SPECIES

No toxic or harmful phytoplankton species

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION
EASTERN MEDITERRANEAN SEA (area 8)
Urbino pond (site 114) in Corsica

DATE OF OCCURRENCE
March to May

EFFECTS
DSP toxicity above safety level

MANAGEMENT DECISIONS
Ban of shellfish marketing, from March 2 to May 18

CAUSATIVE SPECIES
Dinophysis spp. (dominant *Dinophysis* cf. *sacculus*)

ENVIRONMENT

ADVECTED POPULATION OR IN SITU GROWTH
In situ growth

PREVIOUS OCCURRENCES
1988, 1992

ADDITIONNAL COMMENTS

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ALGAL BLOOM REPORTS
FRANCE - 1993

LOCATION

EASTERN MEDITERRANEAN SEA (area 8)
Diana pond (site 114) in Corsica

DATE OF OCCURRENCE

September and October

EFFECTS

Fish mortalities (about 3 tons of sea perchs and gilthead breams)

MANAGEMENT DECISIONS

Reinforced surveillance

CAUSATIVE SPECIES

Gymnodinium sp., very close to *Gymnodinium* cf. *nagasakiense* (max : 2 720 000 cells.l^{-1})

ENVIRONMENT

Temperature : 19 to 25°C
Salinity : 36.2 to 37.1.10^{-3}

ADVECTED POPULATION OR IN SITU GROWTH

In situ growth

PREVIOUS OCCURRENCES

No

ADDITIONNAL COMMENTS

A first bloom was recorded in February - March

INDIVIDUAL TO CONTACT :

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ICES - 1994 Vigo May 1994 WG Harmful Algal Bloom Dynamics

NATIONAL REPORT : GERMANY 1993

North Sea :

The annual recurrent bloom of ***Phaeocystis globosa*** showed high colony numbers in the East Frisian Waddensee, up to 10^5 colonies dm^{-1}. In late july, there was a bloom of ***Ceratium furca*** around Helgoland with cell numbers as high as 2 $x10^5$ dm^{-1}. ***Prorocentrum redfieldii*** was not so abundant as in 1992. ***Gyrodinium*** cf ***aureolum*** was abundant from June to August, but no fish kill has been reported. ***Dinophysis*** species were present only in low cell numbers, 3000 dm^{-1}. For the first time, cysts identified as those from the toxic species ***Gymnodinium catenatum*** had been found over large areas of the German Bight. Vegetative stages have not been reported so far. The same applies for ***Alexandrium minutum***, see also report for the Baltic Sea.

Baltic Sea :

In Kiel Bight, ***Chrysochromulina*** species showed cell densities up to several million cells per liter, toxic events were not reported. Blue greens were not so abundant as in 1992, were surface discoloration have been reported, but nevertheless high abundancy was reported end of june and in july. For the first time, cysts identified as those from the toxic species ***Gymnodinium catenatum*** and ***Alexandrium minutum*** have been found at the sediment surface over large areas.

In the Arkona Basin in june, july high densities of the pontially toxic ***Nodularia spumigena*** was reported, other genera present were ***Aphanizomenon*** and ***Anabaena.*** Very early in the year, already in april started a dense bloom of ***Nodularia***, ***Aphanizomenon***, and ***Anabaena*** in the "Bodden" of Rügen, but no toxic effect has been reported. In addition, there was no bad smell and no negative influence on the taste of fish as in earlier years.

Summary on **Longterm observations** and **Monitoring** of **Harmful Algal Blooms** in Germany

1) **Longterm Observations**

The BIOLOGISCHE ANSTALT HELGOLAND continues with Longterm observations of phytoplankton in coastal waters of Germany at Helgoland and Sylt.

a) Helgoland : each working day : phytoplankton; salinity, temperature, pH, nitrite, nitrate, ammonium, phosphate, silicate

b) List/Sylt : once a weak : phytoplankton; salinity, temperature, pH, nitrite, nitrate, ammonium, phosphate, silicate

2) **Monitoring** of **Harmful Algae**

a) STATE of NIEDERSACHSEN :

North Sea coastal waters from the Dutch Boarder to river Elbe : 10 stations, every second week from march to october : harmful algal species; phytoplankton, salinity, temperature, pH, oxygen, nitrite, nitrate, ammonium, phosphate, silicium

b) STATE of SCHLESWIG- HOLSTEIN :

North Sea : from river Elbe to Danish Boarder : from 19. april to 13. october every second week, 15 stations : harmful algae, temperature, salinity, pH, nitrite, nitrate, ammonium, phosphate, silicate

c) STATE of SCHLESWIG-HOLSTEIN :

Baltic Sea : from Danish Boarder to Fehmarn : from 26. april to 10 october, once a week, 14 stations : harmful algae

d) STATE of MECKLENBURG-VORPOMMERN

Baltic Sea : from Fehmarn to Polish Boarder : 50 stations 1 x per month : phytoplankton, salinity, temperature, pH, oxygen, nitrite, nitrate, ammonium, phosphate, chlor. a,

Algal bloom report - Iceland

To our best of knowlegde there were no harmful algal blooms in Icelandic waters during 1993.

However, with respect to last years report on harmful algal blooms in Icelandic waters, we want to add some recently gathered information. We have learned that a cargo of frozen scallopmuscles with gonads exported from Iceland in 1993 was found to contain PSP when checked by Danish authorities. The poisonous scallop was caught in Southern Breiðafjörður in June 1992.

Mouse tests made by the Industry Control of the Fishery Ministry in Denmark showed 1534 Mu pr. 100 g sample, i.e. 306 µg PSP pr. 100 g. This was verified by HPLC analyses. Further sampling of the same cargo showed quite a variation in PSP content and in 13 samples the range was from 24 to 176 µg saxotoxin equivalents pr. 100 g. These results therefore show that there was in fact a harmful blooming of PSP containing species in Southern Breiðafjörður in early summer 1992.

As far as we know there are two species commonly found in Icelandic waters which may contain PSP, *Alexandrium tamarense* and *A. ostenfeldi*. This is, however, the first time a harmful event caused by PSP is recorded in Icelandic waters.

Contribution of The Netherlands to the ICES Working Group on Harmful Algal Bloom Dynamics. Vigo, Spain, May 9-12 1994.

Communicated by J.C.A. Joordens, National Institute for Coastal and Marine Management/*RIKZ* (Rijkswaterstaat).
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NUISANCE AND POTENTIALLY TOXIC PHYTOPLANKTON IN DUTCH COASTAL WATERS (1992-1993)

INTRODUCTION

Since 1990 phytoplankton monitoring forms part of the monitoring programme of the National Institute for Coastal and Marine Management (till January 1994 called Tidal Waters Division), in close cooperation with the North Sea Directorate. A total number of 31 sampling stations cover the Dutch coastal and off-shore zones (fig. 1), the Dutch Wadden Sea including the Ems-Dollard estuary (Fig. 2) and the Dutch Delta area including the Westerschelde estuary, the Oosterschelde tidal basin, the brackish Lake Veere and the saltwater Lake Grevelingen (Fig. 3). Results from 1992 are reported in Koeman et al. (in press) and in Rademaker & Koeman (1993). Results from 1993 will be reported by end 1994, and are presented in a preliminary way in this document.

SAMPLING AND ANALYTICAL PROCEDURES

Sampling frequencies at all stations are once a month during the period October-March, and (mostly) twice monthly during April-September. At all stations surface samples are taken. In stratified areas CTD- and fluorescence profiling guide sampling at more depths: surface, thermocline, bottom.
Samples of 1 l are preserved with 4 ml Lugol. At regular intervals fresh samples are taken for convnient analysis and also for comparison of microscopic with flowcytometric counts. Storage and transport take place under cool and dark conditions.
Species determination and cell counts are made using inverted microscopes. Sometimes samples are treated with Fluorescent Brightener for an easier identification of thecate dinoflagellates. Also other microscopial techniques (phase-contrast, differential interference contrast and fluorescence microscopy with green, blue and UV filters) are used. Sample analysis always takes place with the same standard procedures.

RESULTS 1992

In this contribution only results from the year 1992, and in a preliminary way results from 1993 will be presented with respect to potentially toxic phytoplankton and Phaeocystis sp. The results from the Delta area in 1992 have not yet been analyzed, and will therefore not be reported here.
Results on the following potentially toxic species are reported: Dinophysis acuminata, D. acuta, D. rotundata, Alexandrium spp., Gyrodinium aureolum, Prorocentrum redfieldii, P. minimum, P. micans, P. balticum, Gonuaulax spinifera, Noctiluca scintillans and Chatonella sp..

NORTH SEA:

Dinophysis acuminata:
D. acuminata occurred at offshore station R70 at the Rottum transect in July, with cell numbers of 5.10^3 cells/l at the surface and near the thermococline. In October 27 cells/l

were counted at T235.

Dinophysis acuta:
In October at T235 265 cells/l of this species were found.

Dinophysis rotundata:
In July this species was found at N10 (1065 cells/l) and at N2 (252 cells/l). D. rotundata occurred in September at the Terschelling coastal station T4 with 481 cells/l.

Alexandrium spp.:
The following species could be distinguished by using Fluorescence Brightener: A. tamarense (Lebour)Balech, A. ostenfeldii (Paulsen)Balech & Tangen, A. leei (Balech)Balech, A. minutum Halim, A. cohorticula (Balech)Balech, A. affine (Inoue et Fukuyo)Balech. These species were found in 1992 at the offshore station T135 of the Terschelling transect in cell numbers generally less than 100 cell/l. Alexandrium cysts have been found at the bottom of T235 in 1992. Following this, bottom samples have been taken at this station from January 1992 till January 1994 along the Terscelling transect. These samples have not been analyzed yet.

Gyrodinium aureolum:
Contrary to the situation in 1991, in 1992 no bloom of G. aureolum was found at T135. Further off-shore at T235 concentrations of 16.10^3 cells/l were counted in October.

Prorocentrum redfieldii:
This species reached densities of 3.10^4 cells/l in August along the Rottum transect. Also in August, at coastal stations along the Terschelling transect densities of 5.10^4 cells/l were found. Along the Noordwijk transect in August P. redfieldii was encountered as well: N2 (3.10^4 cells/l), N10 (4.10^4 cells/l) and N20 (3.10^4 cells/l). At the off-shore station N70 some Prorocentrum species were counted, but not as many (3.10^3 cells/l). At the coastal stations along the Walcheren transect blooms were noted in summer and late summer, with a maximum cell number of 7.10^4 cells/l on W20. In late summer at station G6 (Goeree) cell numbers of 7400 cells/l were counted.

Prorocentrum minimum:
This Prorocentrum species has been noted in September samples from the Rottum transect: at R70 around 1000 cells/l, at R50 600 cells/l and at R3 around 1000 cells/l. In equal numbers the species was found in autumn samples from the Walcheren transect: 1000 cells/l at W2. The species was also encountered at T235 in June: 2000-2500 cells/l.

Prorocentrum micans:
Along the Rottum transect P. micans was found in June-August, in numbers around 500-1500 cells/l at the off-shore stations. In the same period this species was found along the Terschelling transect (10^3-10^4 cells/l), both at the off-shore and on-shore stations.

Prorocentrum balticum:
About 10^3 cells/l were counted at T235 in June. At the same time, 2.10^4 cells/l of this species were found at the coastal station T10.

Gonyaulax spinifera:
Gonyaulax was identified at the Rottum transect (R50) in August, in a concentration of 1230 cells/l. Also in August this species was found at T235 (80 cells/l), and in September at T4 250 cells/l were counted. In June at T4 522 cells/l were found, at T10 130 cells/l and at N2 760 cells/l.

Noctiluca scintillans:
This heterotrophic organism was found along the Noordwijk transect in June and July, especially at the coastal stations in cell numbers ranging from 500 to 3.10^3 cells/l. The species also occurred at the coastal stations G6 and W2 in July (200-500 cells/l).

Phaeocystis sp.:
In spring this species bloomed with 6.10^6 cells/l at coastal stations on the Terschelling transect; offshore numbers were lower, with a maximum of 10^5 cells/l. A second bloom of Phaeocystis occurred in summer, with cell numbers above 10^6 cells/l only at the coastal station T4. Phaeocystis bloomed a third time in August, this time with cell numbers above 10^6 cells/l at T4 and T10.
Along the Noordwijk transect Phaeocystis was the dominant species, especially in spring. Maximum cell numbers were found at N20 (in April 3.10^7 colonial cells/l and 3.10^6 flagellate cells/l); in offshore direction numbers decreased.
At the Goeree station Phaeocystis bloomed in April, with colonial cell numbers amounting to 10.10^6 cells/l and flagellate cells amounting to 2.10^5 cells/l.
Along the Walcheren transect the bloom started in April with maximum concen-trations at coastal stations, reaching 15.10^6 cells/l at W20 and 3.10^6 cells/l at the offshore station W70. In late summer a second bloom was found with maximum cell numbers of 10^6 cells/l.

WADDEN SEA:

Dinophysis rotundata:
A concentration of 124 cells/l was found at the Western inlet of the Wadden Sea (W30) in September.

Prorocentrum redfieldii:
In August at the station W420 concentrations of 24.10^3 cells/l occurred. At the Western inlet of the Wadden Sea (W30) 8.10^3 cells/l were counted in July, 23.10^3 cells/l in August and 2600 cells/l in September.

Prorocentrum minimum:
At W590 15.10^3 cells/l of this species occurred by the end of July. In September 785 cells/l were counted at this station. At the western inlet of the Wadden Sea (W30) around 10^3 cells/l were found in August-Sepember.

Prorocentrum micans:
P. micans was encountered at W420, with cell numbers varying from 46.10^3 cells/l in July to 1300 cells/l in September-October. Also at W590 the species was found from end June till August, with concentrations of 4.10^3 cells/l in June, 14.10^3 cells/l in July and 1200 cells/l in August. At the Western inlet of the Wadden Sea (W30) concentrations varying between 10^3 and 20.10^3 cells/l were counted in the period July sepember, with the maximum cell numbers occurring in July.

Gonyaulax spinifera:
By the end of May at W420 G. spinifera was encountered at a concentration of 1051 cells/l, and at W30 (the Western inlet of the Wadden Sea) 1238 cells/l. In the Ems-Dollard estuary (E250) 168 cells/l were counted in September.

Noctiluca scintillans:
In April Noctiluca occurred at W590 (1400 cells/l), in May at W420 (1050 cells/l) and in the Ems-Dollard estuary (E250) with 1330 cells/l.

Phaeocystis pouchetii:
Throughout the period end March till half October Phaeocystis was present at W420, in cell numbers generally varying between 16.10^4 cells/l and 77.10^4 cells/l. The maximum concentration was found in June: 15.10^6 cells/l! The same pattern was encountered at W590, though without the June bloom. At the Western inlet of the Wadden Sea (W30) Phaeocystis abounded in the period March till November, with cell numbers ranging from 16.10^4 cell/l 14.10^6. The maximum was found at the end of May: 5.10^7 cells/. In the Ems-Dollard estuary (E250) Phaeocystis occurred from March till the end of september, with concentrations generally ranging from 6.10^3 cells/l to 13.10^5 cells/l. The maximum

concentration was measured by the end of May: 18.10^5 cells/l.

PRELIMINARY RESULTS 1993

In spring 1993 Phaeocystis was found at all coastal sampling stations with cell numbers around 5.10^7 cells/l.
In May 1993 Alexandrium spp. (A. tamarense, A. ostenfeldii, A. minitum) were encountered at T135 with cell numbers varying between 200-500 cells/l. Also closer to the coast Alexandrium was present, but not in high numbers.
In May Chatonella marina was found along the Terschelling transect at T100 (3.10^5 cells/l), and along the Rottum transect at R70 (2.10^5 cells/l).
Chrysochromulina polylepis occurred in 1993 at coastal stations in concentrations of 5.10^5 cells/l.
Gyrodinium aureolum was found at T175 (9.10^3 cells/l).
In August 1993 a Ceratium furca bloom was encounterd at the Rottum off-shore station R70 (4.10^4 cells/l).

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Peperzak, L., 1994. Plaagalgen in de Noordzee. Report DGW-93.053, National Institute for coastal and Marine Management/RIKZ, The Hague (in Dutch).

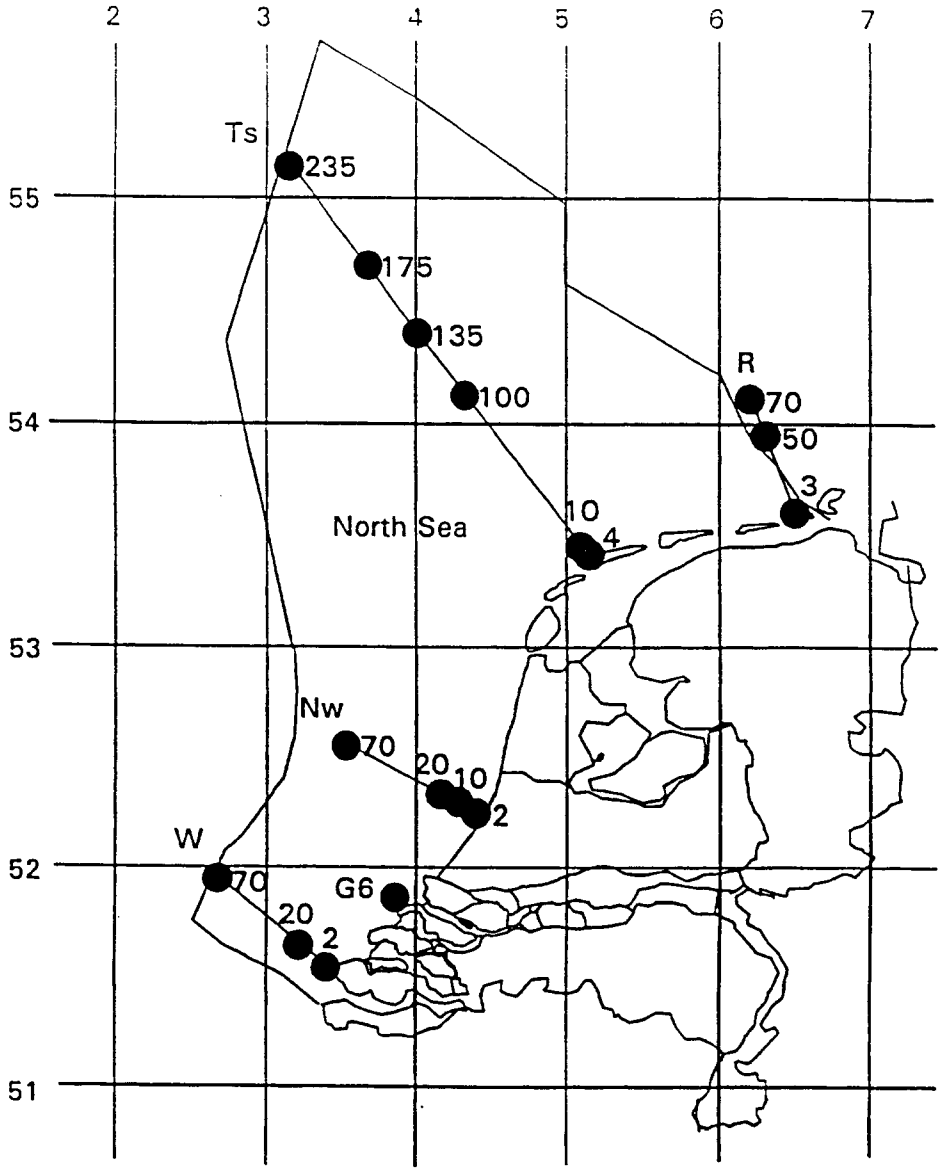

Figure 1. Map of the Dutch Continental Shelf with sampling stations in the North Sea. R = Rottum transect; Ts = Terschelling transect; Nw = Noordwijk transect; W = Walcheren transect. Numbers indicate distance (km) offshore.

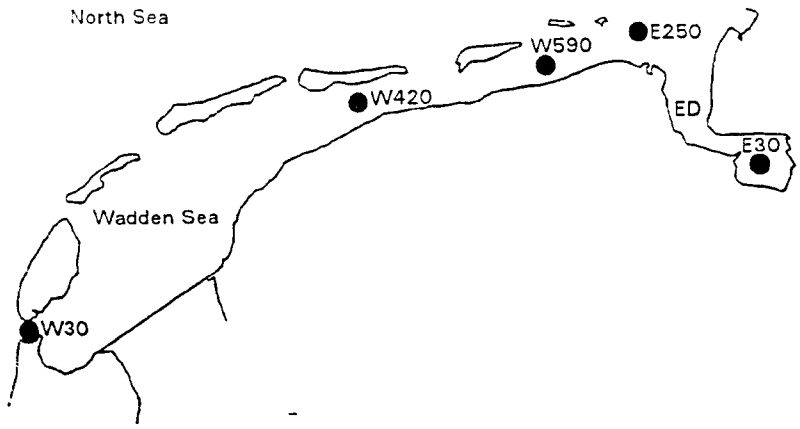

Figure 2. Sampling stations in the Dutch Wadden Sea. ED = Eems-Dollard estuary.

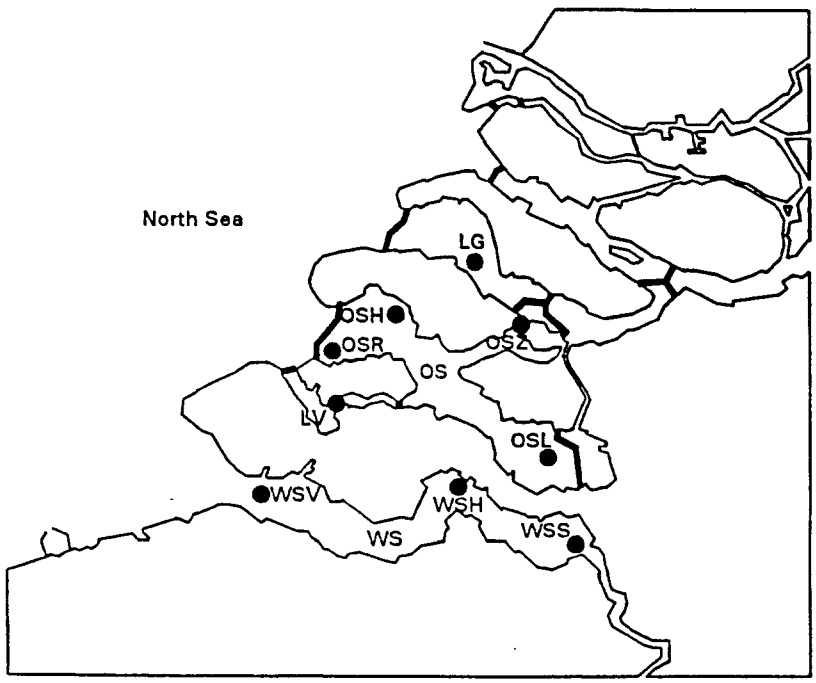

Figure 3. Sampling stations in the Dutch Delta area. LG = Lake Grevelingen; OS = Oosterschelde; LV = Lake Veere; WS = Westerschelde estuary.

HARMFUL ALGAL BLOOM IN NORWAY 1993

Prymnesium cf. parvum

LOCATION	Ryfylkefjordene (near Stavanger), South-west Coast of Norway.
DATES	Late June throughout August, 1993.
EFFECTS	About 6 tons of salmon were killed.
MANAGEMENT DECISIONS	Fish farms in the danger zones escaped the area.
CAUSATIVE SPECIES	*Prymnesium cf. parvum*, up to 2,5 million cells per liter were recorded.
ENVIRONMENT	The temperature range was 10-15 °C. In the most intensive bloom period 13-15 °C. The Secchi depth varied between 4.5- 6 m.
ADVECTED POPULATION	The bloom was first located in the inner parts of the fjord system. Some advection of algae and especially toxic flakes are observed throughout the fjord system.
PREVIOUS OCCURRENCE	Bloom occurred in 1989, 1990, 1991 and 1992.
ADDITIONAL COMMENTS	To verify toxicity of the algae, test-cages of salmon were placed on different locations in the fjord-system. To detect floating toxic flakes an open well-boat with salmon was tracked in the fjord system. When entering toxic water the fish biked over. Mostly they recovered when entering clean water.
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HARMFUL ALGAL BLOOM IN NORWAY 1993
Chrysochromulina sp. (unknown)

LOCATION	Byfjorden Bergen, on the West Coast of Norway.
DATES	May 1993.
EFFECTS	Some few tons of salmon were killed.
MANAGEMENT DECISIONS	
CAUSATIVE SPECIES	*Chrysochromulina sp.*, so far unknown species. Identified in electron microscopy by Wenche Eikrem, University of Oslo.
ENVIRONMENT	Secchi depth 3 m, temperature 12-13 °C and salinity 15-18 PSU. *Chrysochromulina* sp. was mixed up with *Chaetoceros wighamii* and *Skeletonema costatum*. A mixed bloom of *Emiliana huxleyi* and diatoms was going on in adjacent fjords, which were under the influence of the Norwegian Coastal current.
ADVECTED POPULATION	*In situ* growth. The bloom probably started in a cove with some advection into the fjord.
PREVIOUS OCCURRENCE	
ADDITIONAL COMMENTS	The water showed positive synaptosome test when tested for toxicity. Anne Sophie Meldahl, Norwegian Defence Research Establishment, division for Environmental Toxicology.
INDIVIDUAL TO CONTACT	Ingrid Martinussen, HOV-center, DNMI, Allegt. 70, N- 5007 Bergen. Tel +47 55 23 66 60, Fax +47 55 23 66 61, or Einar Dahl, Institute of Marine Research Station N-4817 HIS, Phone +47 37 01 05 80, Fax +47 37 05 2515

HARMFUL ALGAL BLOOM IN NORWAY 1993

Dinophysis spp. **Diarrhoeic Shellfish Toxins**

In 1992 regular monitoring of algae and control of shellfish toxicity by mouse bioassy along the Norwegian Coast were established. The 1993 results from this program concerning Diarrhoeic Toxins are summarized below.

LOCATION	Dinophysis spp. were recorded all along the Norwegian Coast, but most numerous along the South-west Coast.
DATES	From March and throughout the year.
EFFECTS	Toxins recorded above the action level according to mouse bioassy at one or another station from March on. Harvesting and consumption banned.
MANAGEMENT DECISIONS	Harvesting was locally banned. The public was warned against collecting toxic mussels.
CAUSATIVE SPECIES	Most probably *Dinophysis* spp..
ENVIRONMENT	The problem occurred over a wide range of temperature and salinities.
ADVECTED POPULATION	Along the South Coast there are some evidence that algae and toxin problems are spread by advection. Along theWest Coast the "hot spots" seem to be rather patchy, which indicate local concentration of the algae and/or *in situ* growth.
PREVIOUS OCCURRENCE	A few more dubious historical records. A yearly more or less large scale and long lasting phenomenon since 1984 according to mouse bioassay. The phenomenon was not so extensively monitored before 1992.
ADDITIONAL COMMENTS	Concentrations of some few hundred cells/l or more were recorded at some stations. In September-October even small patches of reddish water due to mass occurrence of *Dinophysis norvegica* were seen along the South Coast of Norway.
INDIVIDUAL TO CONTACT	Einar Dahl, Institute of Marine Research Station N-4817 HIS, Tel +47 37 0105 80, Fax +47 37 05 2 15 or Ingrid Martinussen, HOV-center, DNMI, Allegt. 70, N- 5007 Bergen. Tel +47 55 23 66 60, Fax +47 55 23 66 61.

HARMFUL ALGAL BLOOM IN NORWAY 1993

Paralytic Shellfish Toxins

In 1992 regular monitoring of algae and control of shellfish toxicity by mouse bioassy along the Norwegian Coast were established. The 1993 results from this program concerning Paralytic Shellfish Toxins in 1993 are summarized below.

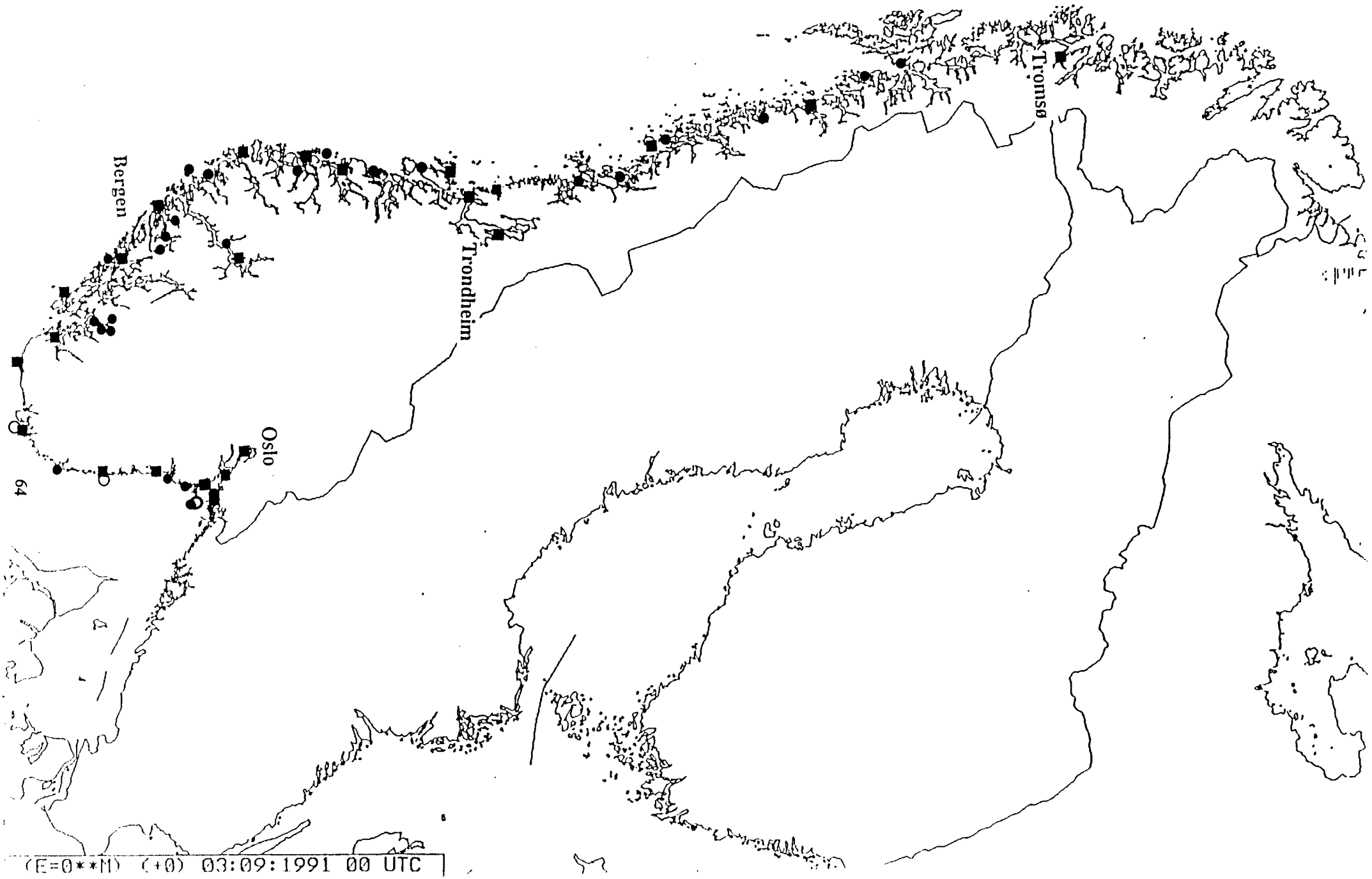
LOCATION	Toxicity were recorded in musssels along the South-west Coast of Norway.
DATES	March - June 1993.
EFFECTS	Toxins recorded above the action level (400 ME/100 g) according to mouse bioassy.
MANAGEMENT DECISIONS	Harvesting was locally banned. The public was warned against collecting (picking) toxic mussels.
CAUSATIVE SPECIES	*Alexandrium* spp.
ENVIRONMENT	No information.
ADVECTED POPULATION	Mainly due to *in situ* growth ?
PREVIOUS OCCURRENCE	A few historical records. More or less regular occurrence in the area during the recent years. However, the spatial and temporal extent may vary significantly from one year to another.
ADDITIONAL COMMENTS	Extensively monitored in 1992 and 1993.
INDIVIDUAL TO CONTACT	Einar Dahl, Institute of Marine Research Station N-4817 HIS, Tel +47 37 01 05 80, Fax +47 37 05 2 15 or Ingrid Martinussen, HOV-center, DNMI, Allegt. 70, N- 5007 Bergen. Tel +47 55 23 66 60, Fax +47 55 23 66 61

ALGAE MONITORING ALONG THE COAST OF NORWAY

For the last three years HOV has coordinated algae data in Norway. Weekly we receive 'real time data' which are sampled and analyzed from Monday through Wednesday. The data are organized in one report which is distributed on Thursdays. To get an idea about the geographical pattern Satellite data from AVHRR imagery giving SST-data (sea surface temperature) are used in combination with a mathematical model giving a 48 hours prognoses.

The algae data are collected by other institutions for different purposes. The Directorate of Fisheries collect data to survey the fish farming industry, The Norwegian Food Control Authority collect algae data to give information about DSP and PSP producing algae. Some algae data are collected for purely scientific reasons. Our goal is to produce a nowcast of the algal situation at different areas along the coast of Norway and give an early warning to the fish farming industry in case of occurrence of harmful algal bloom.

■ Stations run by The Norwegian Food Control Authority, ● Stations run by The Directorate of Fisheries, HOV, and the Institute of Marine Research. ○ Anchored buoys for optical recording of phytoplankton growth.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Trondheim
Tromsø
Oslo
64
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PSP

After one year break (1991) the problem appeared again at the portuguese coast but in areas never before affected.
For the first time values over 80ug/100g were detected in the coast south from Lisbon and at the Algarve coast. The responsible species was as since 1986 *Gymnodinium catenatum.*

1. and 2 -**Location and areas of occurrences:**

- Algarve coast - June - July and September - October (500ug/100g).
- Setúbal coast - July - August (125ug/100g)
- Albufeira Lagoon - June - December (110ug/100g).

3. **Effects:**

Most of the bivalve molluscs from these regions presented PSP toxins however some of them did not reach the 80ug/100g threshold, the most affected were:

- Algarve coast: -*Spisula solida*, *Venus gallina*, *Mytilus edulis* and *Ostrea edulis*
-Setúbal coast: -*Callista chione*
- Albufeira Lagoon: -*Mytilus edulis* .

4. **Management decisions :**

Bivalve species with PSP values over 80ug/100g closed to harvest.

5. **Causative species :**

The causative organism was *Gymnodinium catenatum* .
Highest detected concentrations :- Off Algarve July 21 - 13600 cells/L.
-Off Setúbal July 23 - 2000 cells/L.
-At Albufeira Lagoon June 12 - 7000 cells/L.

6. **Environment :**

Temperature range : 15 - 20 °C
Salinity range: 34 - 36‰.

7. **Advected population or *in situ* growth :**

Most probably a combination of both.

8. **Previous occurrences :**

At this southern part of the country this year was the first with values of PSP over 80 ug/100g in bivalves.

10. **Individual to contact :**

Maria Antónia de M. Sampayo and Maria da Graça Vilarinho
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Av. Brasilia 1400 LISBON PORTUGAL

PORTUGAL 1992

DSP

DSP toxinas were only found in bivalves from the northern coast including Aveiro Ria and Modêgo Estuary.

1 and 2. **Location and data of occurrences:**
...-Minho Estuary 20 October - 3 November
...-Mondêgo Estuary (Figueira da Foz) 3 - 24 August
... Aveiro Ria 15 - 30 June -and 8 August - 12 October

3. **Effects:**
-Most of the bivalves from these regions presented DSP toxins.
-At Minho Estuary - *Mytilus edulis*
...-At Mondêgo Estuary - *Mytilus edulis* and *Scrobicularia plana* .
-At Aveiro Ria - *Mytilus edulis* and *Cerastoderma edule.*

The Mouse bioassay ,following Yasumoto method,1984, was used to determine toxification.

4. **Management Decisions:**
...Harvest of affected species closed during toxification.

5. **Causative species:** -*Dinophysis* cf *acuminata* and *D. acuta.*
-Minho estuary- *D.* cf *acuminatas* (400 cells/L).
-Mondêgo Estuary- *D. acuta* (200 cells/L) and *D.* cf *acuminata* (600 cells/L)
-Aveiro Ria- *D. acuta* (6300 cell/L) and *D.* cf *acuminata* (1100 cells/L).

6. **Environment:**
-Temperature range: 15 - 18°
-Salinity range : 24 - 35‰.

7. **Adevected population or *in situ* growth:**
- Most probably a combination of both.

8. **Previous occurrences:**
-In Portugal since 1987 ,the year of the first confirmed occurrence, every year until 1992 we are having the problem this year the affected areas were reduced not only in space but also in the duration of toxication .Aveiro Ria is always the most affected area.

10. **Individual to contact:**
Maria Antónia de M. Sampayo and Maria da Graça Vilarinho
IPIMAR
Av. Brasilia 1400 LISBON PORTUGAL

PORTUGAL 1993

PSP

This year all the portuguese coast was affected starting at Albufeira Lagoon ,Algarve coast and Setúbal litoral in January followed by Lisbon litoral in February, Obidos Lagoon in March, São Martinho do Porto in April, Figueira da Foz (Mondêgo Estuary) in June as well as Aveiro Ria and litoral ,and all the northern coast.

1. and 2 -**Location and areas of occurrences:**

- Algarve coast (Sagres) -January - October (3497 ug/100g)
- Sines coast March - December (525 ug/100g)
- Setúbal coast - January - May (1185 ug/100g) and July - September (1954 ug/100g)
- Albufeira Lagoon - January - March (756 ug/100g) , July - September (520 ug/100g) and October (128 ug/100g).
- Lisbon coast February - March (496 ug/100g) and July - September (9145 ug/100g)
- Obidos Lagoon - March (277ug/100g) and Sptember (145 ug/100g).
- São Martinho do Porto - March (210ug/100g).
- Figueira da Foz (Modêgo Estuary) - June - November (918 ug/100g).
- Litoral Aveiro - July (540 ug/100g).
- Aveiro Ria - June - July (762 ug/100g), August (130 ug/100g) and December (273 ug/100g).
- Espinho and Northern coast - June - July (2870 ug/100g) ,August (129 ug/100g) ,September - October (461 ug/100g) ,November (262 ug/100g) and December (113 ug/100g).

3. **Effects:**

All the exploited bivalve molluscs from these regions presented PSP toxins:

- Algarve coast (Sagres region): *Mytilus edulis* and *Ostrea edulis*
- Sines litoral: *Ensis siliqua* and *Spsisula solida.*
- Setúbal coast: -*Callista chione*,*Ensis siliqua* ,*Donax trunculus*, *Chamalea striatula* and *Venus verrucosa.*
- Albufeira Lagoon: -*Mytilus edulis* .
- Lisbon litoral: -*Ensis siliqua* and *Donax trunculus.*
- Obidos Lagoon: -*Spisula solida* and *Venerupis pullastra.*
-São Martinho do Porto:- *Mytilus edulis.*
- Figueira da Foz (Mondêgo Estuary): -*Scrobicularia plana* and *Mytilus edulis.*
- Litoral Aveiro: -*Spisula solida.*
- Ria de Aveiro: -*Mytilus edulis*, *Cerastoderma edule* and *Venerupis pullastra.*
- Espinho Litoral and Northern coast: *Spisula solida* and *Mytilus edulis.*

4. **Management decisions :**

Bivalve species with PSP values over 80ug/100g closed to harvest.

5. **Causative species :**

The main causative organism was *Gymnodinium catenatum* but at Obidos Lagoon it was what we call *Alexandrium lusitanicum.*

Highest detected concentrations :- Off Algarve (Sagres region) 26200 cells/L, July 20.

-Off Sines.6500cells/L, July 7.
-Off Setúbal 1400 cells/L, March 12; 2700 cells/L, July 6.
-At Albufeira Lagoon 1800 cells/L,March 21; 1750 cells/L, July 5.
-Off Lisbon 1000 cells/L, March 23; 63500 cells/L, July 20.
-At Obidos Lagoon 14000 cells/L, September 7 (*A.lusitanicum*)
-At São Martinho do Porto Bay 2000 cells/L, March 16.
-At Figueira da Foz (Mondêgo Estuary) 24000 cells/L, August 17.
-At Ria de Aveiro 22000 cells/L,July 6
-Off Aveiro 8500 cells/L, July 13.
-Off Espinho 18500 cells/L, July 14; 4800 cells/L, September 16;

6. **Environment :**

Temperature range : 14 - 20 °C
Salinity range: 20 - 36‰.

7. **Advected population or *in situ* growth :**

Most probably a combination of both.

8. **Previous occurrences :**

Since 1986 and until 1990 *Gymnodinium catenatum* was responsible for PSP occurrences at the portuguese coast north from Roca cape. In 1991 the problem did not occur and in 1992 it appeared again but displaced from the usual area, now at the south coast of Lisbon and at the Algarve coast.

1993 was the first year with PSP almost all arround the year and covering as well almost all the coast seaming that there was indeed a spreading of the species from south to north.

10. **Individual to contact :**

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DSP

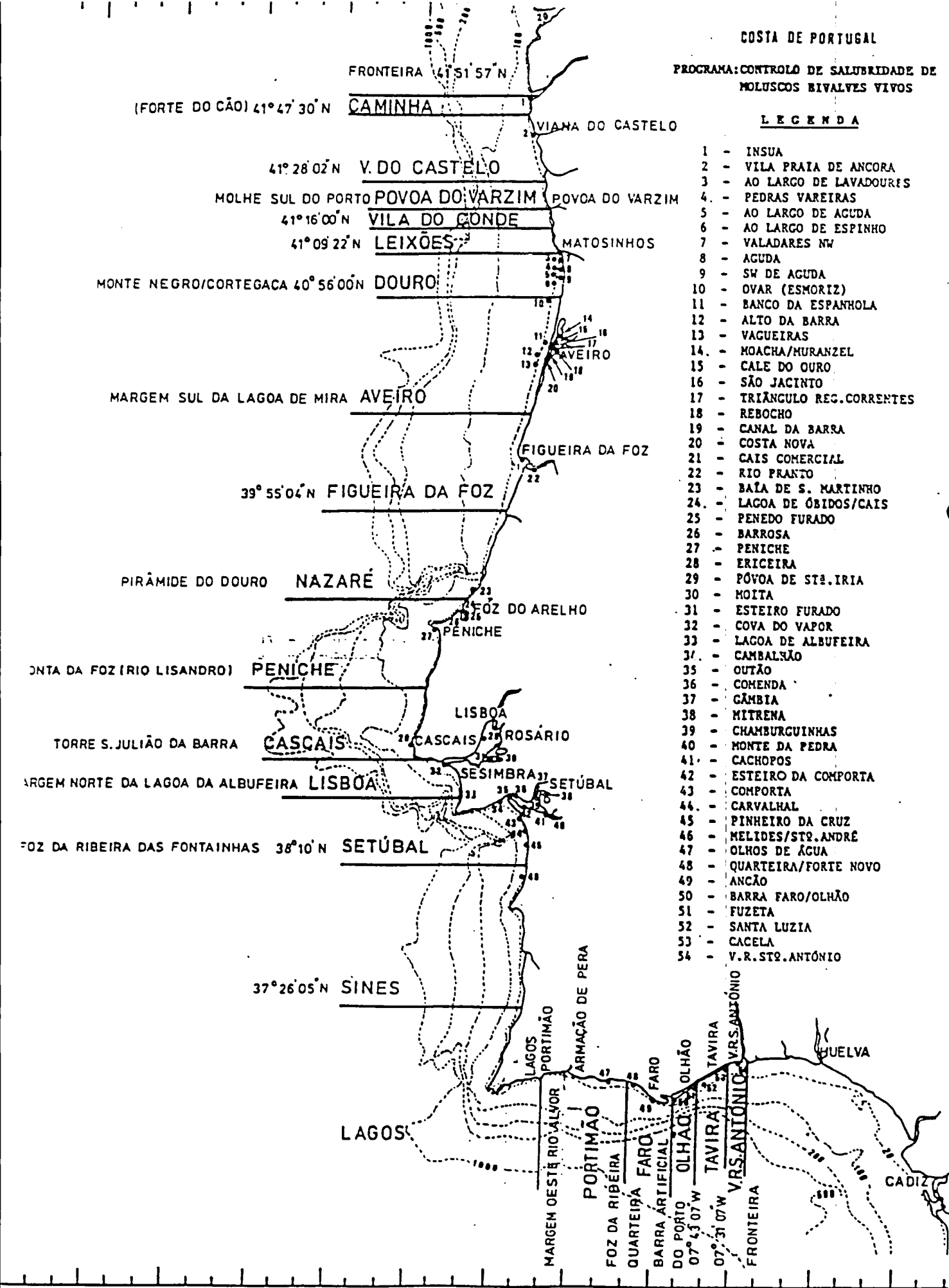
For the first year since 1987 there were any positive results of DSP in the bivalves from the Portuguese coast.

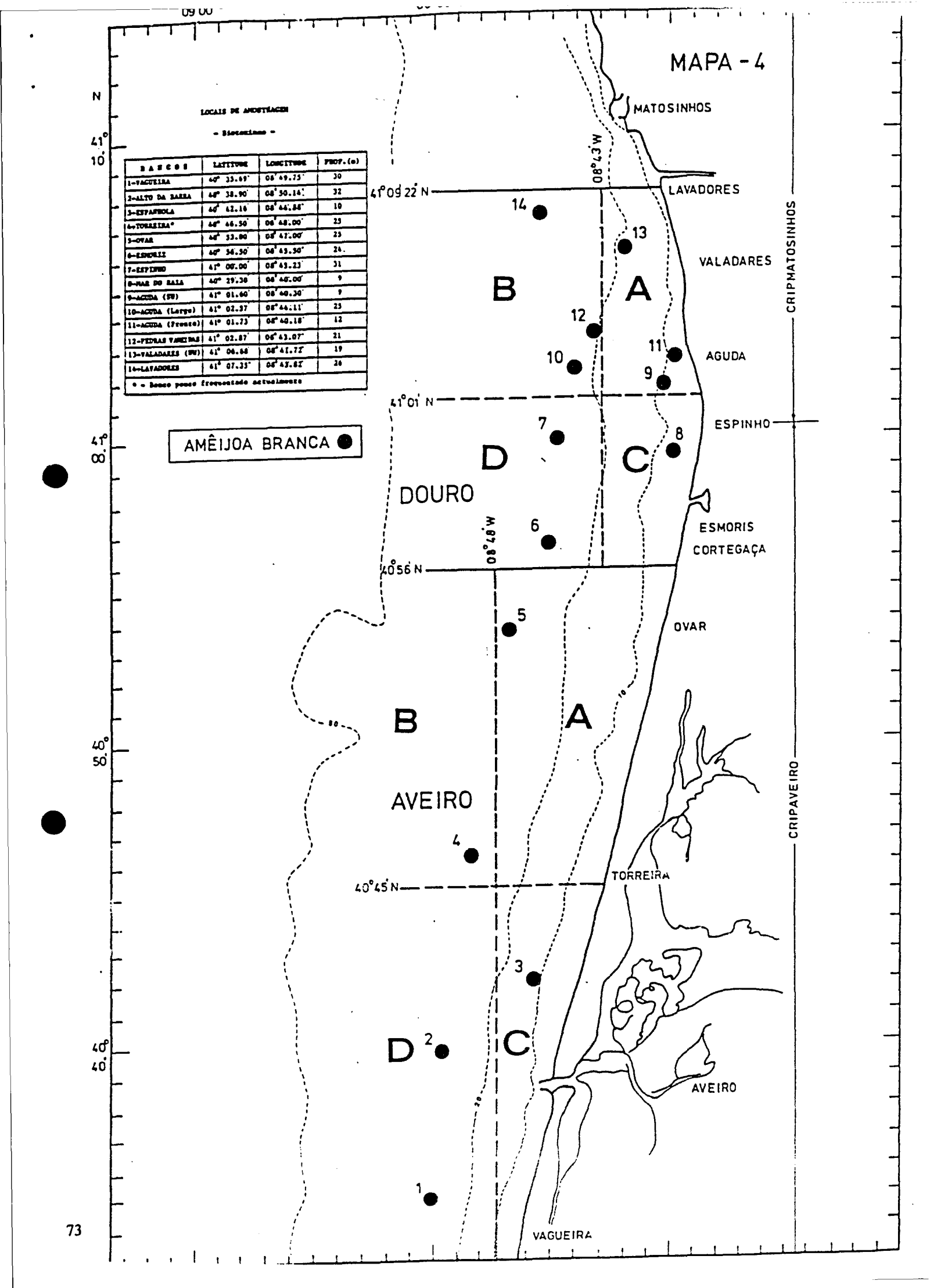
MONITORING IN PORTUDAL

There are 85 sample stations along the coast and inside estuaries and coastal lagoons (maps in annex)

From each station at least once a month and more frequently twice a month water samples are taken from surface or from an integrated 5M water column for phytoplankton studies.
From the same stations bivalves are sampled for PSP and DSP analysis.
In each station salinity and temperature are measured. At the inside stations from Algarve sea lagoons dissolved oxygen and pH are also measured.

Whenever toxic species are found or there are positive results in biotoxin analysis the sampling is intensified becoming weakly or even twice a weak. until bivalves are cleared from toxins and the toxic species are not found or rare in the water samples. Sampling is made mostly by fishermen and by our Regional Centers.


COSTA DE PORTUGAL
PROGRAMA: CONTROLO DE SALUBRIDADE DE MOLUSCOS BIVALVES VIVOS
LEGENDA
1 - INSUA
2 - VILA PRAIA DE ANCORA
3 - AO LARGO DE LAVADOURES
4 - PEDRAS VAREIRAS
5 - AO LARGO DE AGUDA
6 - AO LARGO DE ESPINHO
7 - VALADARES NW
8 - AGUDA
9 - SW DE AGUDA
10 - OVAR (ESMORIZ)
11 - BANCO DA ESPANHOLA
12 - ALTO DA BARRA
13 - VAGUEIRAS
14 - MOACHA/MURANZEL
15 - CALE DO OURO
16 - SÃO JACINTO
17 - TRIÂNGULO REG.CORRENTES
18 - REBOCHO
19 - CANAL DA BARRA
20 - COSTA NOVA
21 - CAIS COMERCIAL
22 - RIO PRANTO
23 - BAÍA DE S. MARTINHO
24 - LAGOA DE ÓBIDOS/CAIS
25 - PENEDO FURADO
26 - BARROSA
27 - PENICHE
28 - ERICEIRA
29 - PÓVOA DE STª.IRIA
30 - MOITA
31 - ESTEIRO FURADO
32 - COVA DO VAPOR
33 - LAGOA DE ALBUFEIRA
34 - CAMBALHÃO
35 - OUTÃO
36 - COMENDA
37 - GÂMBIA
38 - MITRENA
39 - CHAMBURGUINHAS
40 - MONTE DA PEDRA
41 - CACHOPOS
42 - ESTEIRO DA COMPORTA
43 - COMPORTA
44 - CARVALHAL
45 - PINHEIRO DA CRUZ
46 - MELIDES/STº.ANDRÉ
47 - OLHOS DE ÁGUA
48 - QUARTEIRA/FORTE NOVO
49 - ANCÃO
50 - BARRA FARO/OLHÃO
51 - FUZETA
52 - SANTA LUZIA
53 - CACELA
54 - V.R.STº.ANTÓNIO
FRONTEIRA 41°51'57"N
(FORTE DO CÃO) 41°47'30"N CAMINHA
VIANA DO CASTELO
41°28'02"N V. DO CASTELO
MOLHE SUL DO PORTO POVOA DO VARZIM
POVOA DO VARZIM
41°16'00"N VILA DO CONDE
41°09'22"N LEIXÕES
MATOSINHOS
MONTE NEGRO/CORTEGACA 40°56'00"N DOURO
AVEIRO
MARGEM SUL DA LAGOA DE MIRA AVEIRO
FIGUEIRA DA FOZ
39°55'04"N FIGUEIRA DA FOZ
PIRÂMIDE DO DOURO NAZARÉ
FOZ DO ARELHO
PENICHE
ONTA DA FOZ (RIO LISANDRO) PENICHE
LISBOA
TORRE S. JULIÃO DA BARRA CASCAIS
CASCAIS
ROSÁRIO
SESIMBRA
SETÚBAL
ARGEM NORTE DA LAGOA DA ALBUFEIRA LISBOA
FOZ DA RIBEIRA DAS FONTAINHAS 38°10'N SETÚBAL
37°26'05"N SINES
LAGOS
PORTIMÃO
ARMAÇÃO DE PERA
FARO
OLHÃO
TAVIRA
V.R.S.ANTÓNIO
HUELVA
CADIZ
LAGOS
MARGEM OESTE RIO ALVOR
PORTIMÃO
FOZ DA RIBEIRA
FARO
QUARTEIRA
BARRA ARTIFICIAL
OLHÃO
DO PORTO
07°43'07"W
TAVIRA
07°31'07"W
V.R.S.ANTÓNIO
FRONTEIRA


MAPA - 4
LOCAIS DE AMOSTRAGEM
- Biscaminho -
BANCOS | LATITUDE | LONGITUDE | PROF.(m)
1-VAGUEIRA | 40° 33.69' | 08° 49.75' | 30
2-ALTO DA BARRA | 40° 38.90' | 08° 50.14' | 32
3-ESPANHOLA | 40° 42.16' | 08° 46.84' | 10
4-TORREIRA* | 40° 46.50' | 08° 48.00' | 25
5-OVAR | 40° 53.80' | 08° 47.00' | 25
6-ESMORIZ | 40° 56.50' | 08° 43.50' | 24.
7-ESPINHO | 41° 00.00' | 08° 43.23' | 31
8-MAR DO BALA | 40° 29.38' | 08° 46.00' | 9
9-AGUDA (SW) | 41° 01.60' | 08° 46.30' | 9
10-AGUDA (Largo) | 41° 02.37' | 08° 44.11' | 25
11-AGUDA (Fronte) | 41° 01.73' | 08° 40.18' | 12
12-PEDRAS VAMEIRAS | 41° 02.87' | 08° 43.07' | 21
13-VALADARES (SW) | 41° 06.68' | 08° 41.72' | 19
14-LAVADORES | 41° 07.35' | 08° 43.82' | 26
* - Banco pouco frequentado actualmente
AMÊIJOA BRANCA
09 00
N
41° 10'
41° 00'
40° 50'
40° 40'
41°09 22 N
41°01' N
40°56 N
40°45 N
08°43'W
08°48'W
MATOSINHOS
LAVADORES
VALADARES
AGUDA
ESPINHO
ESMORIS
CORTEGAÇA
OVAR
TORREIRA
AVEIRO
VAGUEIRA
CRIPMATOSINHOS
CRIPAVEIRO
DOURO
AVEIRO
A
B
C
D
1
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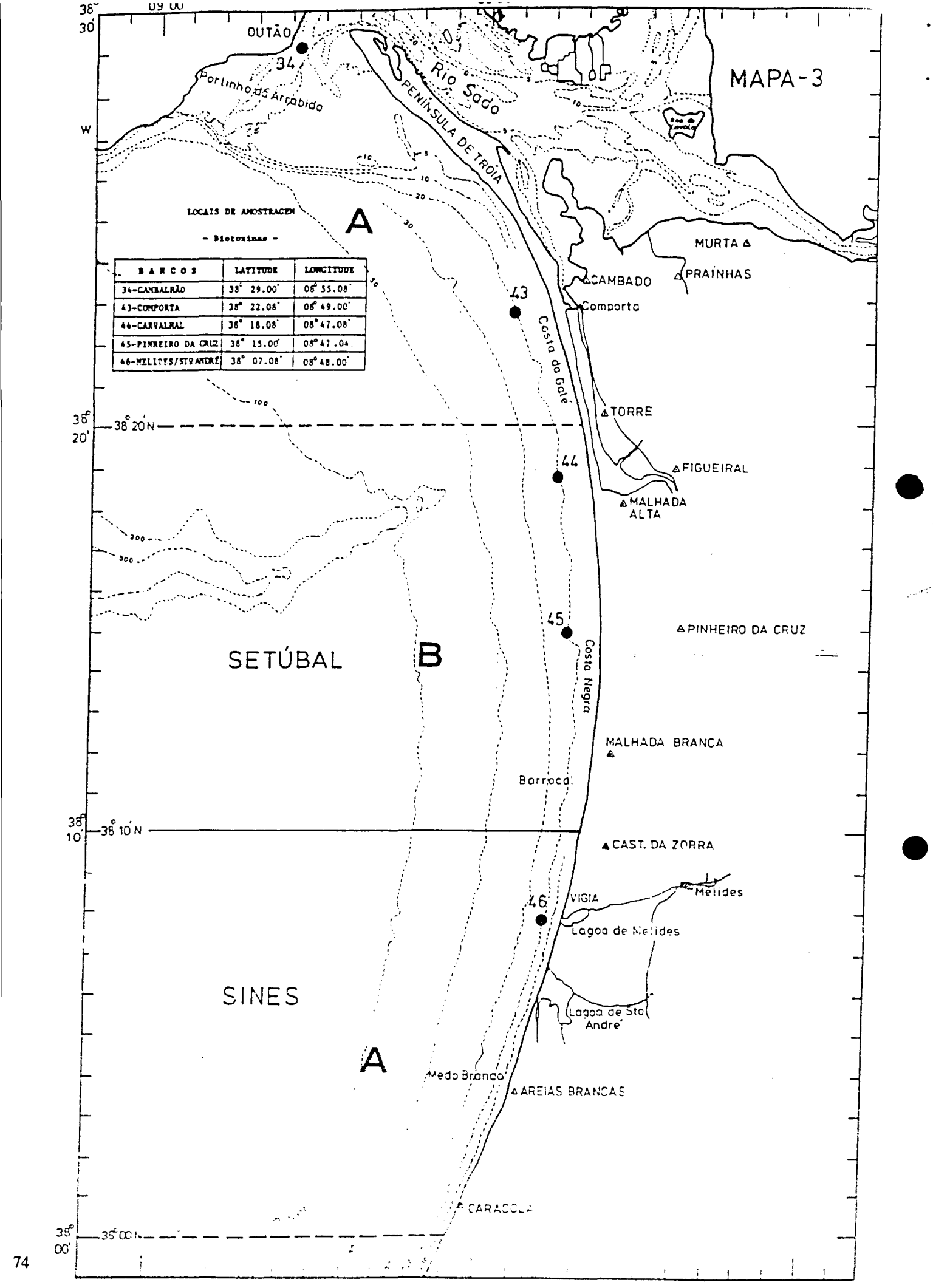
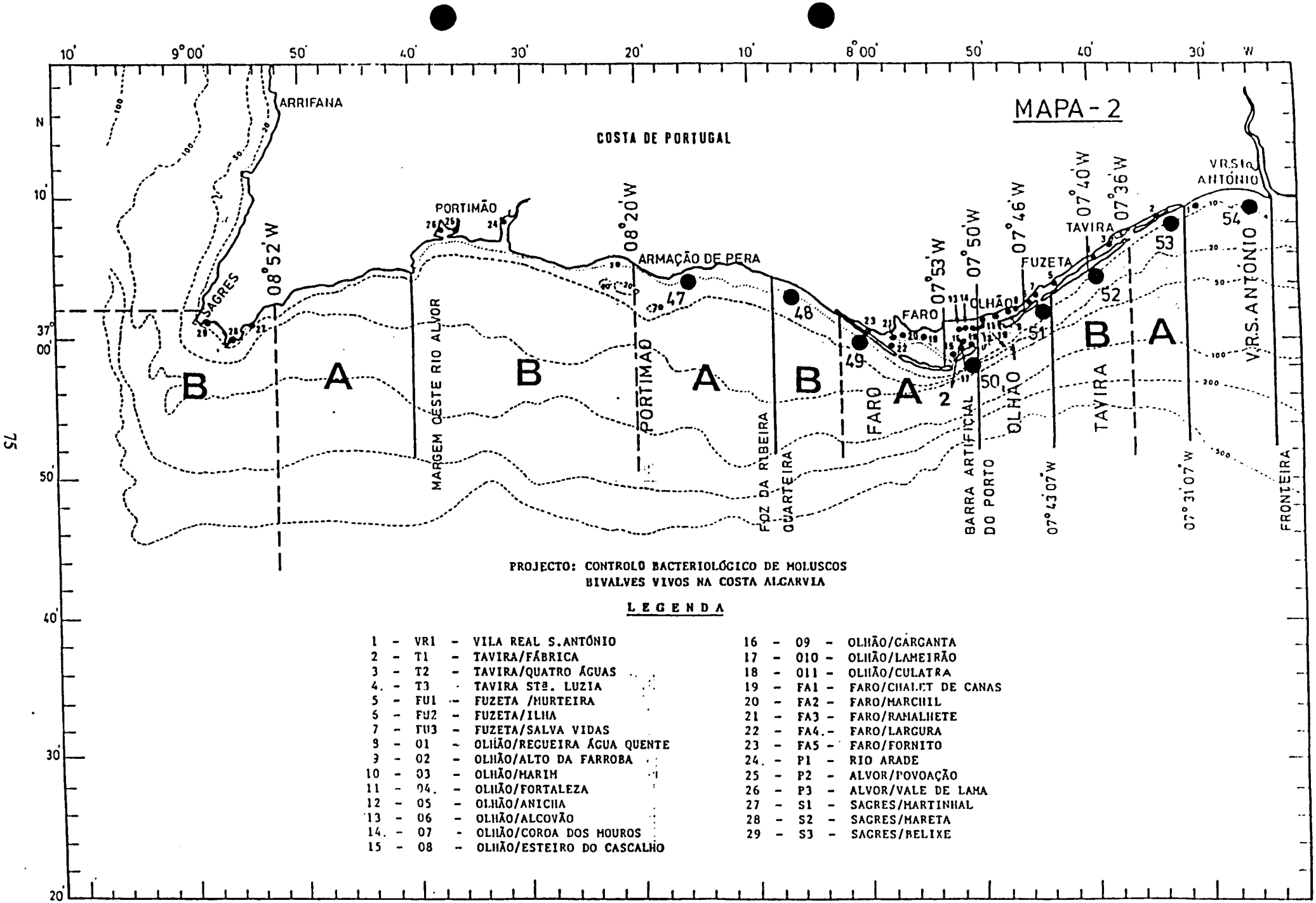


BANCOS	LATITUDE	LONGITUDE
34-CAMBALRÃO	38° 29.00'	08° 55.08'
43-COMPORTA	38° 22.08'	08° 49.00'
44-CARVALRAL	38° 18.08'	08° 47.08'
45-PINHEIRO DA CRUZ	38° 15.00'	08° 47.04'
46-MELIDES/STº ANDRÉ	38° 07.08'	08° 48.00'



PROJECTO: CONTROLO BACTERIOLÓGICO DE MOLUSCOS BIVALVES VIVOS NA COSTA ALGARVIA

LEGENDA

1	VR1	VILA REAL S.ANTÓNIO	
2	T1	TAVIRA/FÁBRICA	
3	T2	TAVIRA/QUATRO ÁGUAS	
4	T3	TAVIRA Stª. LUZIA	
5	FU1	FUZETA /MURTEIRA	
6	FU2	FUZETA/ILHA	
7	FU3	FUZETA/SALVA VIDAS	
8	01	OLHÃO/REGUEIRA ÁGUA QUENTE	
9	02	OLHÃO/ALTO DA FARROBA	
10	03	OLHÃO/MARIM	
11	04	OLHÃO/FORTALEZA	
12	05	OLHÃO/ANICHA	
13	06	OLHÃO/ALCOVÃO	
14	07	OLHÃO/COROA DOS MOUROS	
15	08	OLHÃO/ESTEIRO DO CASCALHO	
16	09	OLHÃO/GARGANTA	
17	010	OLHÃO/LAMEIRÃO	
18	011	OLHÃO/CULATRA	
19	FA1	FARO/CHALET DE CANAS	
20	FA2	FARO/MARCHIL	
21	FA3	FARO/RANALHETE	
22	FA4	FARO/LARGURA	
23	FA5	FARO/FORNITO	
24	P1	RIO ARADE	
25	P2	ALVOR/POVOAÇÃO	
26	P3	ALVOR/VALE DE LAMA	
27	S1	SAGRES/MARTINHAL	
28	S2	SAGRES/MARETA	
29	S3	SAGRES/BELIXE	

1. Location: Rías Bajas Gallegas (Vigo, Pontevedra, Arosa and Muros).

2. Date of Occurrence: From June to November 1991.

3. Effects: DSP was detected in mussel cultivated on rafts from June until September or December depending on the area.

4. Management Decision: Areas where DSP was detected were closed to the harvesting of mussels.

5. Causative Species: *Dinophysis acuminata* and *Dinophysis sacculus* were the causative species. In ría de Pontevedra two main peaks were observed: one of *Dinophysis acuminata* from 23 June to 1 July, the second of *D. sacculus* on 23 September (both with maximum concentrations of 8.10^3 cells.l in integrated samples).

6. Environment: Summer bloom developed during upwelling time with surface temperatures of 15-17° C and 13°C at 10 m. The second peak developed following strong stratification and temperatures of 17-21°C.

7. Advected Population or In Situ Growth: On some occasions *Dinophysis acuminata* appears in the outer parts of the rías because of advection from the shelf not far off the coast, and increases in number due probably to *in situ* growth. On the contrary *D. sacculus* is observed mainly in the inner parts of the rías.

8. Previous Occurrences: *D. acuminata* has been found in the Rías Bajas since the beginning of the monitoring programme in 1977. *D. sacculus* is rare in the area, and more common in the Rías Altas.

9. Additional Comments:

10. Individual to Contact:

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Instituto Español de Oceanografía
Centro Oceanográfico de Vigo
Aptdo. 1552
36280 VIGO
34 86 492111 (Voice)
34 86 492351 (Fax)

HARMFUL ALGAL BLOOMS IN 1991 - SPAIN

1. Location: Rías Bajas Gallegas (Vigo, Pontevedra, Arosa and Muros).

2. Date of Occurrence: 23 September 1991.

3. Effects: No effects detected.

4. Management Decision

5. Causative Species: *Heterosigma carterae* (Hada) Taylor reached 759,000 cells l^{-1}.

6. Environment: Surface temperature of 19-20°C and stratification in water column (17°C at 7 m).

7. Advected Population or *In Situ* Growth: Probably in situ growth was the most important factor.

8. Previous Occurrences: In 1980 up to 8,000 cells ml^{-1}.
In 1986 until 1700 cells ml^{-1}.

9. Additional Comments:

10. Individual to Contact:

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HARFMUL ALGAL BLOOMS IN GALICIA IN 1992

1.- Location: Ría of Ares-Betanzos

2.- Date of Occurrence: From the end of April to the end of May 1992.

3.- Effects: PSP bivalve toxicity.

4.- Management Decision: Harvesting was closed when PSP toxin was equal to or above 80 μg equiv. STX /100 g meat.

5.- Causative Species: *Alexandrium lusitanicum*. Maximum cells concentrations: 446,900 cells l^{-1} in the inner part of the ría in mid-May.

6.- Environment: Bloom associated with high runoff, low salinity and water column stratified (14°C at bottom and 19°C at surface).

7.- Advected Population or *In Situ* Growth: Most probably, the population grew *in situ*.

8.- Previous Occurrences: Up to 10^7 cells l^{-1} in the same month and ría in 1984 (Blanco et al., 1985). In that bloom they found salinities between 22 and 27 UPS and a temperature of 15°C in the same month.

9.- Additional Comments:

10.- Individual to Contact:

J. Mariño; J. Maneiro; Y. Pazos
Condicions Oceanográficas e Fitoplancton
Centro para o Control da Calidade do Medio Mariño
Peirao de Vilaxoán. D. P. 36600
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Fax. +34 86 51 23 00

HARFMUL ALGAL BLOOMS IN GALICIA IN 1992

1.- Location: Rías of Pontevedra, Arousa, Muros and Ares-Betanzos

2.- Date of Occurrence: 1992.

3.- Effects: DSP bivalve toxicity.

4.- Management Decision: Harvesting was closed when DSP toxin was detected.

5.- Causative Species: *Dinophysis acuminata*. Maximum cells concentrations were:

- 2320 cells l^{-1} in mid-March in Pontevedra.
- 16240 cells l^{-1} in Muros and values higher than 2000 cells l^{-1} in Arosa, Muros and Pontevedra from the end of May to the beginning of June.
- 3900 cells l^{-1} in the mouth of Ares- Betanzos and high values in the mouth of Pontevedra and Muros in mid-July.
- 3720 cells l^{-1} in Muros in the middle of August.
- 3280 cells l^{-1} in Ares-Betanzos in mid-September.
- 6120 cells l^{-1} in Pontevedra at the end of November.

6.- Environment: D. acuminata was found within the whole range of temperature and salinity values common in the region.

7.- Advected Population or In Situ Growth: Increases of *D. acuminata* populations in the Rías were not associated with shelf waters Probably they represent *in situ* growth.

8.- Previous Occurrences: Very frequently recorded since the phytoplankton monitoring programme started in 1977.

9.- Additional Comments:

10.- Individual to Contact:

J. Mariño; J. Maneiro; Y. Pazos
Condicions Oceanográficas e Fitoplancton
Centro para o Control da Calidade do Medio Mariño
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HARFMUL ALGAL BLOOMS IN GALICIA IN 1993

1.- Location: Rías of Vigo, Pontevedra, Arousa and Muros.

2.- Date of Occurrence: 1993.

3.- Effects: DSP bivalve toxicity.

4.- Management Decision: Harvesting was closed when DSP toxin was detected.

5.- Causative Species: *Dinophysis acuminata*. Maximum concentrations:
- 3920 cells l^{-1} in the mouth of Arosa with values more than 2000 cell/l in Pontevedra, Arosa and Muros in mid-May.
- 5120 cells l^{-1} in the mouth of Vigo in mid-August.
- 10640 cells l^{-1} in the inner part of Pontevedra with values of more than 2000 cells l^{-1} in Pontevedra, Vigo and mouths of Arosa and Muros in mid-September.

6.- Environment: D. acuminata did not show any salinity or temperature preferences while occuring within the whole range of salinity and temperature values for the region.

7.- Advected Population or *In Situ* Growth: The increases of *D. acuminata* populations in the Rías were not associated with shelf waters. Probably they represent *in situ* growth.

8.- Previous Occurrences: It has been very frequently recorded since the phytoplankton monitoring programme started.

9.- Additional Comments:

10.- Individual to Contact:

J. Mariño; J. Maneiro; Y. Pazos
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HARFMUL ALGAL BLOOMS IN GALICIA IN 1993

1.- Location: Rías of Vigo, Pontevedra, Arosa, Muros and Camariñas.

2.- Date of Occurrence: From mid-September to mid-November.

3.- Effects: PSP bivalve toxicity reaching a maximum concentration of 6175 STX eq. g/100 g meat.

4.- Management Decision: Harvesting was closed when PSP toxin content was equal or higher than reached 80 μg equiv. STX /100 g meat.

5.- Causative Species: *Gymnodinium catenatum*. The maximum cell concentration was 140,080 cells l^{-1} .

6.- Environment: During maximum cell numbers the temperatures ranged from 14°C to 17°C and the salinity from 30 to 36 USP.

7.- Advected Population or *In Situ* Growth: The initial population was clearly advected. The initial (and largest) population increase was very sudden and coincided with a downwelling episode. The population was maintained in the Rías for two months period of stratification, and persisted during moderate donwnwelling and upwelling pulses, disappearing when a strong upwelling period started.

8.- Previous Occurrences: Blooms of this species were recorded in the Rías Bajas in autumn 1981, 1985, 1986, 1987, 1988 and 1990. In these two latter years, small populations were also found during summer.

9.- Additional Comments:

10.- Individual to Contact:

J. Mariño; J. Maneiro; Y. Pazos
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HARFMUL ALGAL BLOOMS IN GALICIA IN 1993

1.- Location: Rías of Pontevedra, Arosa, Muros and Vigo.

2.- Date of Occurrence: From the beginning of July to mid-August 1993.

3.- Effects: PSP bivalve toxicity reaching a maximum concentration of 1550 μg equiv. STX /100 g meat.

4.- Management Decision: Harvesting was closed when PSP toxin was equal to or above 80 μg equiv. STX /100 g meat.

5.- Causative Species: *Gymnodinium catenatum*. The maximum cell concentration was 10,280 cells l^{-1}.

6.- Environment: During the bloom, the water column was stratified (14°C at bottom and 19°C at surface).

7.- Advected Population or *In Situ* Growth: The initial increase of the population followed a downwelling episode characterized by homogeneous vertical temperature and salinity distributions in the water column (18-20°C and about 34 UPS in the stations at the mouths of the Rías). The population was maintained in the Rías for a month while thermal stratification persisted, disappearing when a strong upwelling period started. Both, advection and *in situ* growth were possible mechanisms to maintain the population.

8.- Previous Occurrences: Blooms of this species were recorded in the Rías Baixas in autumn 1981, 1985, 1986, 1987, 1988 and 1990. In these two latter years, low abundance populations were also found during the summer.

9.- Additional Comments: This species was also recorded in very low concentrations in the Ría of Ares-Bentanzos.

10.- Individual to Contact:

J. Mariño; J. Maneiro; Y. Pazos
Condicions Oceanográficas e Fitoplancton
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HARMFUL ALGAL BLOOMS IN 1993 - SPAIN

1. Location: Coast of Cataluña .

2. Date of Occurrence: From 27 July to middle of August .

3. Effects: The high concentration of cells and the associated mucus made large patchs in the sea causing a nuisance to tourism. No toxicity detected.

4. Management Decision:

5. Causative Species: *Gyrodinium impudicum* Fraga (in press). Maximum concentration of 5.10^6 cells l^{-1}.

6. Environment: The salinity of the water was 37.7 and the temperature 23-24°C.

7. Advected Population or In Situ Growth:

8. Previous Occurrences: This species was also observed reaching very high concentrations on the Valencia coast during summer 1992.

9. Additional Comments: The morphology of this organism is very similar to *Gymnodinium catenatum*. The differences were described in a paper presented in the "Sixth International Conference on Toxic Marine Phytoplankton" (Nantes, 1993) by Fraga et al.

10. Individual to Contact:

Maximino Delgado
Instituto de Ciencias del Mar
Paseo Nacional s/n
08039 Barcelona
Telf: 3106450
Fax : 3199842

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION: Skagerrak
Kristineberg

DATE: May xx

CAUSATIVE SPECIES: Eutreptiella gymnastica
Halosphaera viridis

CONCENTRATION: xx

EFFECTS: No

MANAGEMENT DECISIONS: –

ENVIRONMENT: xx

ADVECTED POPULATION OR IN SITU GROWTH: In situ growth

PREVIOUS OCCRUENCE: xx

ADDITIONAL COMMENTS: xx

CONTACT PERSONS:

Odd Lindahl
Kristineberg Marine Biological Station
450 34 Fiskebäckskil, Sweden
tel 46 523 18512
fax 46 523 18502

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION: Skagerrak coast
Kattegat

DATE: September xx

CAUSATIVE SPECIES: Ceratium xx

CONCENTRATION: xx

EFFECTS: No

MANAGEMENT DECISIONS: –

ENVIRONMENT: xx

ADVECTED POPULATION OR IN SITU GROWTH: In situ growth ??

PREVIOUS OCCRUENCE: Nearly every year

ADDITIONAL COMMENTS: xx

CONTACT PERSONS:

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Kristineberg Marine Biological Station
450 34 Fiskebäckskil, Sweden
tel 46 523 18512
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Lars Edler
SMHI
Doktorsgatan 9
262 52 Ängelh
tel 46 431 8085
fax 46 431 831

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION: Baltic Sea

DATE: April xx

CAUSATIVE SPECIES: Peridinella catenata
Dinophysis acuminata
Dinophysis norvegica

CONCENTRATION: xx

EFFECTS: No

MANAGEMENT DECISIONS: –

ENVIRONMENT: xx

ADVECTED POPULATION OR IN SITU GROWTH: In situ growth

PREVIOUS OCCRUENCE: Occur every year but usually in lower concentrations

ADDITIONAL COMMENTS: xx

CONTACT PERSONS:

Lars Edler
SMHI
Doktorsgatan 9D
262 52 Ängelholm. Sweden
tel 46 431 80854
fax 46 431 83167

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION:	North west Baltic Sea	Askö area
DATE:	June and August	
CAUSATIVE SPECIES:	Mesodinium rubrum	
CONCENTRATION:	xx	
EFFECTS:	No	
MANAGEMENT DECISIONS:	–	
ENVIRONMENT:	xx	
ADVECTED POPULATION OR IN SITU GROWTH:	In situ growth and advection	
PREVIOUS OCCRUENCE:	91, 92,	???
ADDITIONAL COMMENTS:	xx	

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION: North west Baltic Sea Askö area

DATE: June and August

CAUSATIVE SPECIES: Mesodinium rubrum

CONCENTRATION: xx

EFFECTS: No

MANAGEMENT DECISIONS: –

ENVIRONMENT: xx

ADVECTED POPULATION OR IN SITU GROWTH: In situ growth and advection

PREVIOUS OCCRUENCE: 91, 92, ???

ADDITIONAL COMMENTS: xx

CONTACT PERSONS:

Susanna Hajdu
Dept. of System Ecology, Univ. of Stockholm
Box 7050, 750 07 Uppsala, Sweden
tel 46 18 673155
fax 46 18 673156

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION: Baltic Sea Bothnian Sea

DATE: July - August

CAUSATIVE SPECIES: Aphanizomenon flos aquae
Nodularia spumigena
Chrysochromulina spp.

CONCENTRATION: xx

EFFECTS: No

MANAGEMENT DECISIONS: –

ENVIRONMENT: xx

ADVECTED POPULATION OR IN SITU GROWTH: In situ growth and advection

PREVIOUS OCCRUENCE: Every year

ADDITIONAL COMMENTS: xx

CONTACT PERSONS:

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Dept. of System Ecology, Univ. of Stockholm
Box 7050, 750 07 Uppsala, Sweden
tel 46 18 673155
fax 46 18 673156

NATIONAL REPORT OF PHYTOPLANKTON BLOOMS 1993

SWEDEN

LOCATION:	Bothnian Sea
DATE:	November
CAUSATIVE SPECIES:	Aphanizomenon flos aquae Nodularia spumigena
CONCENTRATION:	xx
EFFECTS:	Hepatotoxin found No effects reported
MANAGEMENT DECISIONS:	–
ENVIRONMENT:	xx
ADVECTED POPULATION OR IN SITU GROWTH:	Advected
PREVIOUS OCCRUENCE:	??
ADDITIONAL COMMENTS:	xx
CONTACT PERSONS:	Susanna Hajdu Dept. of System Ecology, Univ. of Stockholm Box 7050, 750 07 Uppsala, Sweden tel 46 18 673155 fax 46 18 673156

NATIONAL REPORT OF HARMFUL ALGAL EFFECTS 1993

SWEDEN

LOCATION: Swedish Skagerrak coast

1	Tjärnö
2	Stridsfjord
3	Björnsund
4	Nösund
5	Styrsö

DATE:

1	August. 12	–	April. 25. 1994
2	September. 3	–	April. 25. 1994
3	October. 12	–	November. 2
4	August. 27	–	April. 25. 1994
5	August. 28	–	April. 25. 1994

CAUSATIVE SPECIES: Dinophysis spp ?????

CONCENTRATION:

EFFECTS: DSP

MANAGEMENT DECISIONS: Harvest ban

ENVIRONMENT:

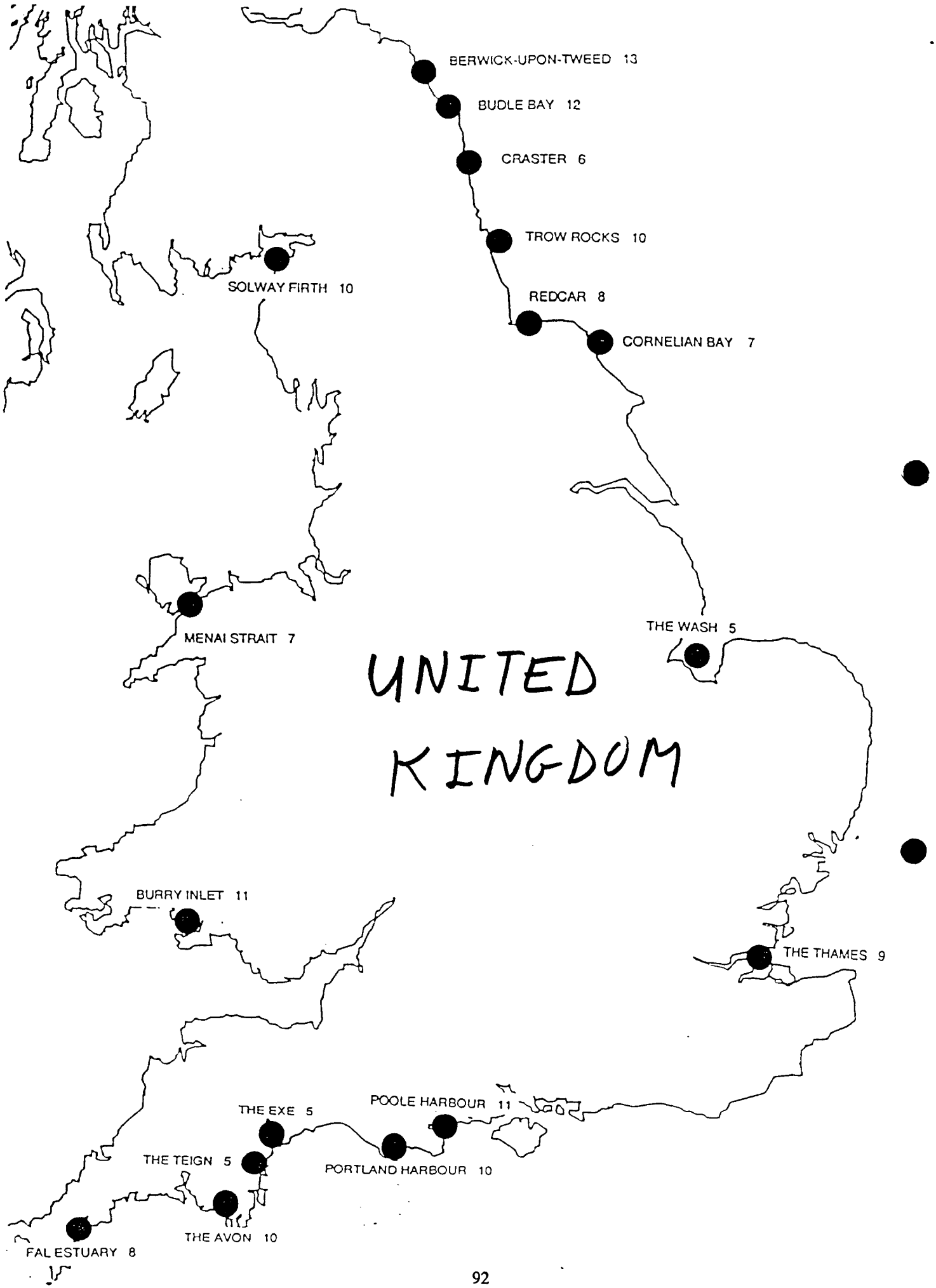
ADVECTED POPULATION OR IN SITU GROWTH:

PREVIOUS OCCRUENCE: Nearly every year

ADDITIONAL COMMENTS:

CONTACT PERSONS:

Joel Haamer
Dept. of Oceanography, Univ. of Göteborg
Box 4038, 400 40 Göteborg, Sweden
tel 46 31 131893
fax 46 31


BERWICK-UPON-TWEED 13
BUDLE BAY 12
CRASTER 6
TROW ROCKS 10
SOLWAY FIRTH 10
REDCAR 8
CORNELIAN BAY 7
MENAI STRAIT 7
THE WASH 5
UNITED KINGDOM
BURRY INLET 11
THE THAMES 9
POOLE HARBOUR 11
THE EXE 5
THE TEIGN 5
PORTLAND HARBOUR 10
THE AVON 10
FAL ESTUARY 8

SOAFD PSP/DSP MONITORING PROGRAMME

Sampling of bivalves for phycotoxins is carried out at 65 stations covering the Scottish mainland and island coasts, usually starting in early April and continuing until September. In areas where PSP has been previously detected, sampling is carried out weekly and fortnightly at all other locations. When toxins are detected, sampling frequency is increased and if levels exceed 1000 mu, commercially exploited crustaceans are also sampled. Monitoring continues beyond September in areas where toxicity is still being detected.

DSP monitoring is also carried out, but to date on a smaller scale.

No routine water sampling is carried out for phytoplankton species analysis.

HARMFUL ALGAL BLOOMS 1994 - SCOTLAND

1. **Location:** East coast of Scotland

2. **Date of Occurrence:** Late April to July 1994

3. **Effects:** PSP was first detected in Moray Firth shellfish in late April and on 10th May levels in mussels from Firth of Forth had reached 6751 mu, before falling below 400 mu by early June. Wild scallop stocks were also affected with samples from the Moray Firth in early June recording levels of 2734 mu in gonads and 1210 mu in muscle.

4. **Management Decision:** A closure order was placed on the Moray Firth on 23rd June and was lifted on 28th July.

5. **Causative Species:** Low concentrations of Alexandrium cf. tamarense were detected in water samples from the Forth area.

6. **Environment:** Water column in the Firth of Forth was well stratified in late April with a thermocline at around 10m. By late May this stratification had broken down. Summer weather was cool and wet.

7. **In situ Population or Advected Growth:** Firth of Forth is a known site of Alexandrium cyst abundance, so could be in-situ population.

8. **Previous Occurrences:** Regular occurrence every year since 1968 in Forth.

9. **Additional Comments:** PSP toxins were also detected in brown crab and Nephrops hepatopancreas, but only twice did levels exceed 400 mu.

10. **Individual to Contact:**

G Howard/E Macdonald
SOAFD Marine Laboratory
PO Box 101
Victoria Road
Aberdeen AB1 6HQ
UK

HARMFUL ALGAL BLOOMS 1994 - SCOTLAND

1. **Location:** Orkney Islands, Scotland

2. **Date of Occurrence:** Early May until September

3. **Effects:** PSP toxins detected in pectinids, mussels and razor fish from many sites in the area. Maximum toxicity (5040 mu) was recorded in early June and although levels then declined, they did not drop below 400 mu until early September.

4. **Management Decision:** Six closure orders were enforced beginning on 21st May and finally lifted on 17th September.

5. **Causative Species:** Low concentrations of Alexandrium cf. tamarense (< 1000 cells l^{-1}) were detected in water samples from Waulkmill Bay.

6. **Environment:** No detailed information. Summer weather was generally cool and wet.

7. **In situ Population or Advected Growth:** There is a small population of Alexandrium cysts in parts of Scapa Flow, so in some cases, toxicity could be caused by in-situ populations.

8. **Previous Occurrences:** Regular occurrence since 1990.

9. **Additional Comments:** PSP toxins were also detected in brown crab and lobsters but were found to be mainly <400 mu. Velvet crabs had toxin levels up to 1924 mu. No action necessary, as fisherman imposed a voluntary closed season.

10. **Individual to Contact:**

G Howard/E Macdonald
SOAFD Marine Laboratory
PO Box 101
Victoria Road
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UK

HARMFUL ALGAL BLOOMS 1994 - SCOTLAND

1. **Location:** West coast of Scotland

2. **Date of Occurrence:** Early May to July.

3. **Effects:** PSP was first detected in Loch Hourn in early May and then declined before a second peak in early June, lasting six weeks. Maximum toxicity (1716 mu) was detected in late June. Toxicity was also detected in the Clyde (August) and Solway (June) areas, with levels reaching 1680 mu in the Clyde.

4. **Management Decision:** Voluntary closures of all shellfish farms in the affected areas.

5. **Causative Species:** Low concentrations of Alexandrium cf. tamarense were detected in water samples from Loch Hourn (<1000 cells l^{-1}).

6. **Environment:** No detailed information. Generally, summer was cool and wet.

7. **In situ Population or Advected Growth:** Not known.

8. **Previous Occurrences:** Outbreaks of PSP have been previously recorded around Skye and the Inner Sound, but 1994 was the first year toxins were detected in the Clyde.

9. **Additional Comments:**

10. **Individual to Contact:**

G Howard/E Macdonald
SOAFD Marine Laboratory
PO Box 101
Victoria Road
Aberdeen AB1 6HQ
UK

ALGAL BLOOM REPORTS - ENGLAND AND WALES

1. Location: Estuary of River Avon, South Devon

2. Date of occurence: 9 June to 2 Sept 1993

3. Effects: None

4. Management decision: Increase sampling frequency. Take samples of mussel flesh for PSP analysis

5. Causative species: *Alexandrium tamarense*, > 1.7 million cells l^{-1} on 6/8/93.

6. Environment: No data

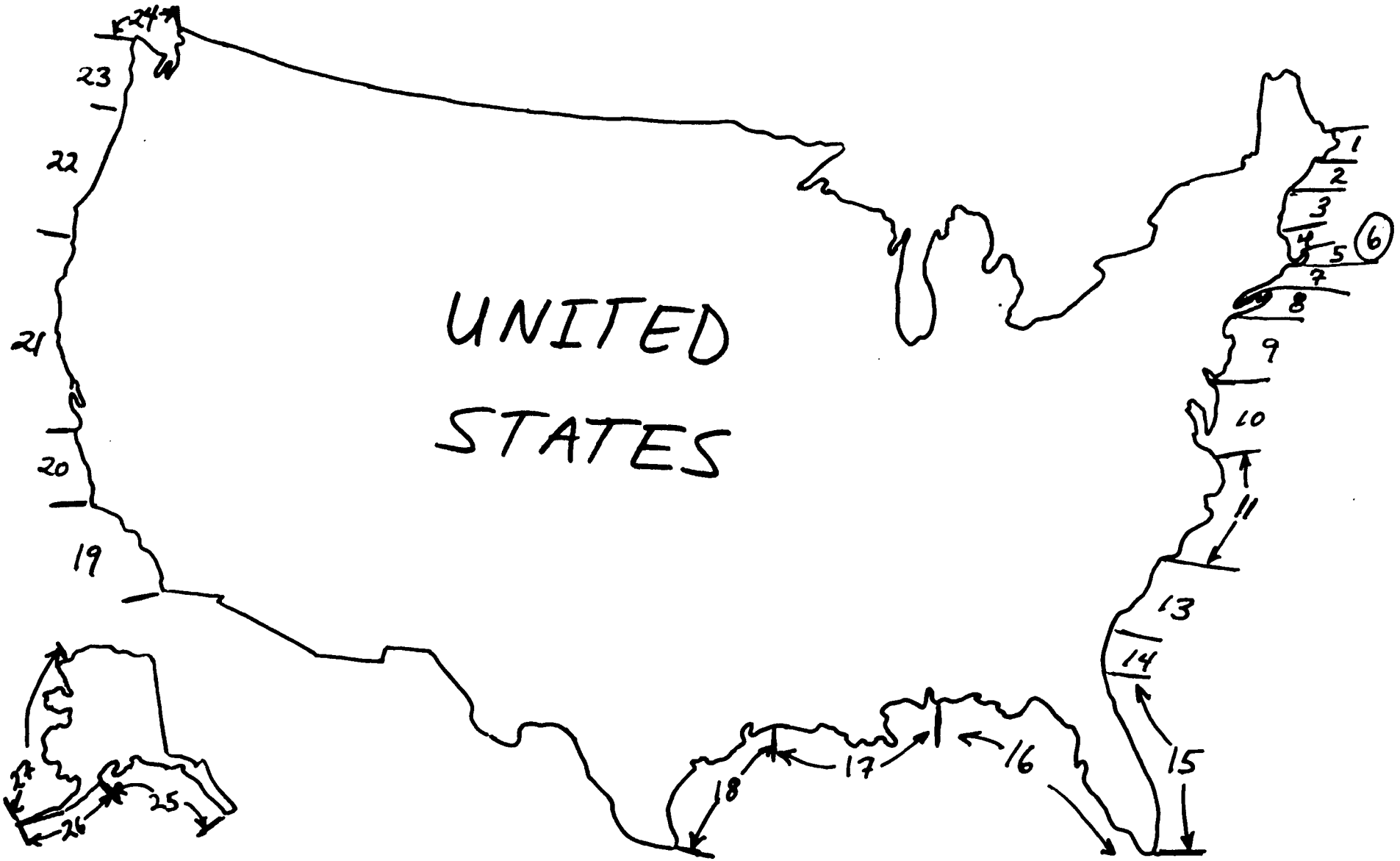
7. Advected population or in situ growth: no data.

8. Previous occurrences: no data

9. Additional comments: No toxins detected.

10. Individual to contact:

I.Laing
M.A.F.F.
Fisheries Laboratory
Benarth Road
Conwy
Gwynedd LL32 8UB



CODE DESIGNATIONS FOR

BLOOM REPORTING

Harmful Algal Blooms in the United States - 1993

1. Location: Kittery - Stonington, Maine

2. Date of Occurrence: May - September

3. Effects: PSP in shellfish (Mytilus edulis, Mya arenaria, Spisula solidissima, Modiolus modiolus, Euspira heros)

4. Management Action: Affected areas closed to the harvest of specific species

5. Causative Species: Alexandrium tamarensis

6. Environment:

7. Advected Population or In Situ Growth:

8. Previous Occurrences:

9. Additional Comments:

10. Individual to Contact: John W. Hurst, Jr.
Department of Marine Resources
W. Boothbay Harbor, ME 04575

Harmful Algal Blooms in the United States - 1993

1. Location: Tremont, Maine to the Canadian border

2. Date of Occurrence: January - August (Arctica remained closed throughout the winter)

3. Effects: PSP in shellfish (Mytilus edulis, Mya arenaria, Modiolus modiolus, Arctica islandica, Placopecten magellanicus)

4. Management Action: Affected areas closed to the harvest of specific species

5. Causative Species: Alexandrium tamarensis

6. Environment:

7. Advected Population or In Situ Growth:

8. Previous Occurrences:

9. Additional Comments:

10. Individual to Contact:

John W. Hurst, Jr.
Department of Marine Resources
W. Boothbay Harbor, ME 04575

HARMFUL ALGAL BLOOMS IN THE UNITED STATES---1993

1. Location: "North Shore" of Massachusetts- Cape Ann to the northern MA border
"South Shore" of Massachusetts - communities directly south of Boston
Cape Cod salt ponds

2. Date of Occurence: mid-May through early July

3. Effects:
- Shellfish toxicity on both North and South Shores (100-400ug/100g shellfish) - *Mytilis edulis*, *Mya arenaria*, and others
- Longer shellfish toxicity event than usual near the South Shore (see additional comments)
- Shellfish toxicity barely detectable in several Cape Cod salt ponds; ponds already closed due to high coliform
- No known human or marine mammal illnesses

4. Management Action:
- Closure of shellfish beds (>80ug toxin/ 100g shellfish) - May
- reopened shellfish beds when toxins in shellfish were not detectable for 3 consecutive weeks detection limit (40 ug toxin/ 100g shellfish) - June and July

5. Causative Species: *Alexandrium fundyense*

6. Environment:
- Temperature: 8-10 degrees C
- Salinity: 25-30 PSU
- Stratification: Yes, mostly due to spring run off, not local heating
- Cell numbers: 100-1000 cells/liter
- Nutrients: Data not yet available

7. Advected Population or *In Situ* Growth:

Source-most likely southern Maine coastal waters; cells were presumably advected southward and alongshore into Massachusetts coastal waters via a buoyant coastal plume or surface current formed from spring run-off. *In situ* growth may have occurred during transit and within Massachusetts Bay as the run off subsided and the southward-flowing coastal current appeared to slow down. Within the restricted salt ponds *in situ* growth dominates.

8. Previous Occurences:

Annual event in most years since Sept. 1972, usually in May/June, but may also occur later in summer and early autumn. Outbreaks on the "South Shore" are more sporadic than the "North Shore". For instance, in 1991 and 1992 there was no occurence of shellfish toxicity on the "South Shore", while in 1993, there was a rather large protracted bloom probably due to increased spring runoff compared to the previous two years.

9. Additional Comments:

The bloom in Massachusetts Bay was particularly long in 1993. It lasted for about 2 months and extended further south within Mass Bay/Cape Cod Bay than previously recorded. This was probably due to the subsidence of earlier strong run off and the slow transport that followed which enabled the cells to maintain themselves within the Bays. If this event had been recorded after the controversial offshore Boston Harbor sewage outfall was operational, the potential conclusion would have been that the new outfall caused an increase in the red tide. However, 1993 documents that this event was part of the "normal" interannual variability during pre-existing conditions within the region. Preliminary data now suggests that the pre-existing conditions (i.e. the current outfall) may have contributed to the stimulation of the bloom near the "South Shore".

The lack of development of a major bloom on the "North Shore" may have been due to upwelling which pushed the toxic dinoflagellates offshore away from the shellfish beds and dissipated the bloom north of Cape Ann. Therefore, the dynamics on the "North Shore" and "South Shore" became decoupled when wind conditions changed to upwelling favorable.

10. Individual to Contact:

Donald M. Anderson
Woods Hole Oceanographic Institution
Woods Hole, MA USA 02543
508-548-1400 x2351
E-mail: Danderson@whoi.edu

HARMFUL ALGAL BLOOMS IN THE UNITED STATES -- 1993

1. Location: Georges Bank (offshore, Area 6)

2. Date of Occurrence:

3. Effects:

4. Management Decision: The closure of Georges Bank to the harvesting of molluscan shellfish with the exception of sea scallop adductor muscles was continued throughout 1993 because of the risk of paralytic shellfish poisoning.

5. Causative Species: Alexandrium fundyense and/or A. tamarense (variety not yet determined)

6. Environment: Georges Bank is an open ocean environment, 100-200 miles from the nearest land (Cape Cod). Much of the Georges Bank area is very shallow (10-15 m). The region is a rich fishing grounds for shellfish and finfish. Stratification of the waters overlying Georges Bank starts to occur in May, at which time the surface waters are about 10-12° C.

7. Advected Population or In Situ Growth: The origin of the offshore toxicity and its relationship with inshore toxicity remain unknown.

8. Previous Occurrences: High levels of paralytic shellfish toxins were first observed in Georges Bank shellfish in 1989. Toxin levels increased in 1990. Despite the apparent absence of Alexandrium blooms in the Georges Bank region since 1990, the persistence of the toxins in surf clams has resulted in a continuing closure of the Georges Bank surf clam fishery.

9. Additional Comments:

10. Individual to Contact:

Dr. Alan White
Northeast Fisheries Science Center
National Marine Fisheries Service
Woods Hole, MA, USA 02543
Tel: 508-548-5123 Fax: 508-548-5124

Algal Bloom Reports - United States-1993

1. **Locations**: West Neck Bay and Coecles Harbor, Shelter Island, N.Y., on the eastern end of the Peconic Bay system. Densities of up to 6.5×10^3 cells/ml occurred in West Neck Bay, and up to 1.3×10^4 cells/ml in Coecles Harbor.

2. **Dates of Occurrence**: May through July, with peak concentrations occurring during late May and early June.

3. **Effects**: None apparent - the aesthetic effects typically associated with this bloom (water discoloration (brown) and reduced transparency) are generally not visible until concentrations approach 2.0×10^5 cells/ml. Effects on various shellfish species have previously been reported, but again occurred when cell numbers were higher than those seen during 1993.

4. **Management Decisions**: Continue weekly monitoring program.

5. **Causative Species**: **Aureococcus anophagefferens**

6. **Environment**: Temperature: 15.3 - 26.6 degrees C
   Salinity: 26.13 - 29.40 ppt
   Dissolved Oxygen: 5.6 - 8.4 mg/l
   Water column stability: mixed

7. **Advected population or in-situ growth**: in-situ growth.

8. **Previous occurrences**: The bloom was present throughout the entire Peconic Bay system from 1985 through 1987, with densities occasionally exceeding 10^6 cells/ml. Cell numbers declined through 1988 and 1989, and were generally undetectable during 1990 with the exception of those from the West Neck Bay station. During 1991, densities of up to 2×10^6 cells/ml occurred in Flanders Bay (on the western end of the system) and West Neck Bay. During 1992, numbers approached 8.5×10^5 cells/ml in Coecles Harbor and 10^6 cells/ml in West Neck Bay.

9. **Additional Comments**:

10. **Individual to Contact**: Dr. Robert Nuzzi
Bureau of Marine Resources
Suffolk County Department of Health Services
Riverhead, New York 11901
516-852-2082

Algal Bloom Reports - United States - 1993

1. **Locations**: Great South Bay (N.Y.). The bloom was present throughout the bay from January through March, with highest concentrations occurring in the eastern bay area between Bayshore and Bellport. Concentrations ranged from $< 10^3$ to 2.6×10^5 cells/ml. A secondary bloom occurred in the fall from August through November, when counts ranged from $<10^3$ to 6.5×10^3 cells/ml.

2. **Dates of Occurrence**: January through March, and August through November.

3. **Effects**: Its effects are primarily aesthetic - water column discoloration (brownish), and reduced transparency. Secchi depth readings were less than 0.5 meters during peak bloom periods.
Effects on various shellfish species have previously been reported.

4. **Management Decisions**: To increase the frequency of monitoring activities.

5. **Causative Species**: **Aureococcus anophagefferens**

6. **Environment**: Temperature: -0.6 - 23.8 degrees C.
Salinity: 22.26 - 30.04 ppt.
Dissolved Oxygen: 6.0 - 12.9 mg/l.
Water column stability - mixed

7. **Advected population or in-situ growth**: Probably in-situ growth

8. **Previous occurrences**: 1985, 1986: $> 10^6$ cells/ml
1988: $10^3 - 5 \times 10^5$ cells/ml (June - August)
1989: $< 2.5 \times 10^4$ cells/ml (April - September)
1990: $< 1 \times 10^4$ cells/ml (May - December)
1991: $< 10^4$ cells/ml (January - June)
1992: $10^3 - 10^6$ cells/ml (January - December)

9. **Additional Comments**:

10. **Individual to Contact**: Dr. Robert Nuzzi
Bureau of Marine Resources
Suffolk County Department of Health Services
Riverhead, New York 11901
516-852-2082

Algal Bloom Reports - United States - 1993

1. **Locations**: Moriches and Shinnecock Bays (N.Y.). The bloom was mainly concentrated in eastern Moriches Bay, Quantuck Bay, and western Shinnecock Bay, where peak cell densities of > $2x10^5$ cells/ml occurred.

2. **Dates of Occurrence**: January through February, and May through November.

3. **Effects**: Its effects are primarily aesthetic - water column discoloration (brownish), and reduced transparency. Secchi depth readings were less than 0.5 meters during peak bloom periods.
Effects on various shellfish species have previously been reported.

4. **Management Decisions**: To increase the frequency of monitoring activities.

5. **Causative Species**: **Aureococcus anophagefferens**

6. **Environment**: Temperature: -0.3 - 25.3 degrees C.
Salinity: 26.51 - 31.50 ppt.
Dissolved Oxygen: 4.9 - 12.3 mg/l.
Water column stability - mixed

7. **Advected population or in-situ growth**: Probably in-situ growth in Quantuck Bay, eastern Moriches Bay, and western Shinnecock Bay, with other areas containing advected populations. Both bays are subject to significant tidal flow through ocean inlets.

8. **Previous occurrences**: 1989: < 1.3×10^5 cells/ml in Moriches Bay
< 2.3×10^4 cells/ml in Shinnecock Bay
1990: < 10^3 to $9.6x10^5$ cells/ml
1991: < 10^3 to > 10^6 cells/ml
1992: >10^6 cells/ml

9. **Additional Comments**:

10. **Individual to Contact**: Dr. Robert Nuzzi
Bureau of Marine Resources
Suffolk County Department of Health Services
Riverhead, New York 11901
516-852-2082

HARMFUL ALGAL BLOOMS IN THE UNITED STATES -- 1993

1. Location: North Carolina coast

2. Date of Occurrence: June and July, 1993

3. Effects: In June, the Bear Creek Clam Hatchery lost $7,500 worth of Mercenaria mercenaria seed clams maintained in static culture with water from Bogue Sound. Planozygotes (50-100 μm) similar to the ones described by Burkholder (1994) were observed. In July, at the Duke University Marine Laboratory in Beaufort, NC, sea urchins held overnight in seawater tanks died suddenly; dinospores (2/ml) and cysts of Pfiesteria piscimorte were observed upon backwashing the seawater filters.

4. Management Decision: None

5. Causative Species: Pfiesteria piscimorte

6. Environment: Estuarine and near coastal

7. Advected Population or In Situ Growth: Probably in situ

8. Previous Occurrences: Similar occurrences in previous years involving fish and shellfish

9. Additional Comments: These are incidents that I know of. Dr. JoAnn Burkholder (NC State University) is the main contact for NC State workers when they see fish kills.

10. Individual to Contact:

Dr. Patricia A. Tester
Southeast Fisheries Science Center
National Marine Fisheries Service
101 Pivers Island Road
Beaufort, NC 28516

HARMFUL ALGAL BLOOMS IN 1993 - UNITED STATES

1. Locations: MARIN COUNTY, CALIFORNIA areas and shellfish affected. Drakes Bay (SSM, SBM), Drakes Estero (SSM, SBM, WBM, CPO), Keho Beach (WSM), Stinson Beach (WSM), Tomales Bay (SSM, SBM, WBM, CBM, CPO, WC)

2. Date of Occurrence: March, April, May, June, October PSP concentration above alert level. In November PSP levels were in the high detectable range below the alert.

3. Effects: Sentinel sea mussels (SSM) assayed at 1900 ug/100 g meat in March but decreased through June to 320 micrograms and through September to non detectable levels. Again in November the level increased to 220 ug. In March the WSM's PSP level elevated to 1300 ug, in SBM to 1700 ug and in CPO's to 1400 ug. A sample of GC reached 81 ug/100g tissue.

4. Management Decisions: A special quarantine was established on March 12 on all species of mussels taken for human consumption. The annual quarantine on sport harvested mussels goes into effect on May 1, 1993 and continues through October 31,1993. Closure of the growers harvest areas was instituted and harvesting resumed on a batch release basis. The quarantine was lifted on October 31.

5. Causative Species: Alexandrium catenellum

6. Environment: No data available

7. Advected Population or In Situ Growth: In situ growth. Sea water samples collected March 9 contained an abundance of the dinoflagellate A. catenellum but the shellfish collected contained low detectable toxin levels however the concentration increased to very high throughout the month of March. In April a secondary bloom seemed to occur.

8. Previous Occurrences: 1927, '29, '32, '54, '62, '63, '64, '65, '66, '70, '71, '76, '80, '81, '82, '84, '86, '87, '88, '89, '90, '91, '92, '93.

9. Additional Comments: This is the area of the shellfish aquaculture industry. All the beds are monitored continuously for toxin levels. The new phytoplankton monitoring program initiated in 1993 will certainly alert the industry to increase shellfish monitoring efforts and insure consumer safety.

10. Individual to Contact:

Dr. Maria R. Ross
Biology Department
University of California at Los Angeles
405 Hilgard Avenue
Los Angeles, California 90024
(310) 206-3528

Ref:State of California Department of Health Services (SCDHS)
Shellfish Monitoring Program

CALIFORNIA COUNTIES 1993 PSP CONCENTRATION

DEL NORTE - In March, April, Aug., Sep. the wild sea mussels (WSM) exhibited high measurable levels of PSP. In Oct. the concentration in the shellfish exceeded the alert level reaching 170 ug/100g meat. Special quarantine on sports harvested mussels was lifted on Dec. 15. Previous occurrences: 1981, '91, '92, '93

HUMBOLDT - In May, Aug., Sep. the sentinel sea mussels (SSM) contained high measurable concentrations of PSP which in Oct. elevated to 220 ug. Also, the WSM concentrations during April, May, Sep., Oct. although below alert levels were in the measurable range. Special quarantine was extended to December 15. Previous occurrences: 1969, '71, '73, '89, '92, '93

MENDOCINO - In March the PSP concentration in WSM assayed at 980 ug/100g meat. Special quarantine was instituted for all species of mussels which was lifted on October 31. Previous occurrences: 1932, '62, '66, '67, '69, '75, ''82, '84, '89, '90, '91, '92, '93

SONOMA - In March WSM PSP level was just above the alert at 82 ug/100g. The Washington clam (WC) contained high measurable PSP content below the alert concentration in both the siphon and viscera. Special quarantine was issued on March 23 for all species of mussels and continued for sport harvested WC. Previous occurrences: 1927, '29, '30, '32, '37, '54, '62, '68, '69, 70, '71, '76, '80, '81, '82, '87, '89, '90, '91, '92, '93

SAN MATEO - In April and May the level of PSP in WSM was below the alert but in the measurable range. Previous occurrences: 1970, '71, '82, '83, '84, '86, '87, '89, '90, '91, '92, '93

SANTA CRUZ - In April measurable low PSP levels found in WSM and in Oct. 71 ug per 100g of wild rock scollop tissue . Ptrevious occurrences: 1971, '84, '89, '91, '92, '93

LOS ANGELES - In April the WSM sample contained 74 ug/100g meat Previous occurrences: 1970, '71, '72, '83, '85, '86, '87, '89, '91, '92, '93

SAN FRANCISCO, MONTEREY, SAN LOUIS OBISPO, SANTA BARBARA, VENTURA, ORANGE, SAN DIEGO
No detectable levels of PSP in shellfish samples submitted

INDIVIDUAL TO CONTACT: Dr. Maria R. Ross
Biology Department
University of California at Los Angeles
405 Hilgard Avenue
Los Angeles, California 90024
(310) 206-3528

Ref:State of California Department of Health Services, Shellfish Monitoring Program

1993

CALIFORNIA COUNTIES

TOXIC EPISODES AND SHELLFISH AFFECTED

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max PSP ug/100g tissue
DEL NORTE	<43	<40	57	41	<41	<39	<38	36	77	170	<35	<35	170 WSM
HUMBOLDT	<40	<39	<36	<32	46	<39	<37	42	76	220	<35	<36	220 SSM
	ns	ns	<37	35	44	<41	<40	<38	46	55	<36	ns	55 WSM
MENDOCINO	<41	<41	980	<36	<40	<42	<38	<41	<41	<35	<36	<38	980 WSM
SONOMA	ns	ns	ns	34	ns	ns	ns	ns	ns	ns	ns	ns	34 SSM
	ns	ns	82	<41	<41	<44	<38	ns	ns	ns	ns	ns	82 WSM
	ns	ns	68	78	ns	49	ns	ns	ns	ns	ns	ns	78 WCS
	ns	ns	51	62	ns	51	ns	ns	ns	ns	ns	ns	62 WCV
MARIN	<41	<41	1900	400	640	320	<37	<41	<36	220	65	54	1900 SSM
	ns	ns	1300	ns	<42	41	<40	<38	<35	55	ns	ns	1300 WSM
	<38	<40	1700	44	530	<42	<38	<39	<40	ns	40	64	1700 SBM
	ns	ns	ns	36	ns	ns	ns	ns	<38	ns	ns	ns	36 WBM
	<42	<40	44	36	<40	<36	<37	<38	<36	ns	<36	<35	44 CBM
	<39	<39	1400	43	92	41	<38	<39	<38	<35	34	43	1400 CPO
	<43	ns	ns	ns	<43	ns	ns	ns	ns	ns	ns	ns	nd WCS
	<43	ns	ns	ns	<43	ns	ns	ns	ns	ns	ns	ns	nd WCV
	ns	ns	81	ns	ns	ns	ns	ns	ns	ns	ns	ns	81 GC
SAN FRANCISCO	<40	<41	ns	ns	ns	<38	<42	<38	<35	<38	<36	ns	nd SSM/WSM
SAN MATEO	ns	ns	<38	41	54	<39	<36	<37	<37	38	<34	<34	54 WSM
SANTA CRUZ	<37	ns	<36	44	<41	<35	<38	ns	ns	<38	<38	ns	44 WSM
	ns	ns	ns	ns	ns	ns	<40	ns	ns	74	ns	ns	74 WRS
MONTEREY	ns	<39	<36	<42	<43	<36	ns	ns	ns	ns	<37	ns	nd WSM
SAN LOUIS OBISPO	<39	<37	ns	<42	<38	<36	<40	ns	<38	<35	<38	<36	nd WSM
	<44	ns	ns	<42	ns	ns	ns	ns	ns	ns	ns	ns	nd WBM
	<42	<38	<38	<42	ns	<38	<37	<39	<35	<37	<37	<36	nd CBM
	<41	<40	<38	<36	<39	<37	<36	<38	<37	<37	<35	<36	nd CPO
	ns	<40	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	nd PC
SANTA BARBARA	ns	ns	<34	<41	<41	<38	<37	<38	<37	<35	<36	<37	nd WSM
	<41	<41	46	<36	<40	<36	<38	<40	<37	<35	<36	<34	46 WBM
VENTURA	ns	<40	<42	<42	<43	<42	<37	<40	ns	<34	<38	ns	nd WSM
LOS ANGELES	<42	ns	<36	75	<43	<40	<37	<35	<40	<37	ns	<34	75 WSM
	<42	<40	ns	ns	ns	ns	ns	ns	ns	<38	ns	ns	nd WBM
ORANGE	<42	<39	<38	<40	<40	<36	<39	<40	<38	<36	<37	<36	nd WSM
SAN DIEGO	ns	<38	ns	<41	ns	<44	<40	ns	<37	ns	ns	ns	nd WSM
	ns	ns	<36	<35	<41	<35	<38	<38	<37	<35	<34	<36	nd CBM
	ns	ns	ns	ns	ns	ns	ns	ns	<35	ns	ns	ns	nd SBM

Sentinel Sea Mussel (SSM)
Wild Sea Mussel (WSM)
Wild Rock Scallop (WRS)
Cultured Pacific Oyster (CPO)
Washington Clam Siphon (WCS)
Gaper Clam (GC)
Not Detectable (nd)

Sentinel Bay Mussel (SBM)
Wild Bay Mussel (WBM)
Culturd Bay Mussel (CBM)
Sentinel Pacific Oyster (SPO)
Washington Clam Viscera (WCV)
Pismo Clam (PC)
No Sample (ns)

Ref: State of California Department of Health Services (SCDHS)
Shellfish Monitoring Program

1993

DURATION OF TOXIC EPISODES

PARALYTIC SHELLFISH TOXIN (PSP)

COUNTIES	AREA	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	[Max Toxin] ug/100g
DEL NORTE	21			57	41				36	77	170			170 WSM
HUMBOLDT	21				35	46			42	76	220			220 SSM
MENDOCINO	21			980										980 WSM
SONOMA	21			82	78		51							82 WSM
MARIN	21			1900	400	640	320				220		64	1900 SSM
SAN FRANCISCO	21													
SAN MATEO	20				42	54								54 WSM
SANTA CRUZ	20				44						74			74 WRS
MONTEREY	20													
SAN LOUIS OBISPO	20													
SANTA BARBARA	19													
VENTURA	19													
LOS ANGELES	19				75									75 WSM
ORANGE	19													
SAN DIEGO	19													

PSP concentration below alert level

PSP concentration above alert level

Ref: State of California Department of Health Services (SCDHS)
Shellfish Monitoring Program

Harmful Algal Blooms in the United States – 1993

1. **Location:** Domoic acid occurred in razor clams on Pacific coast beaches.

2. **Date of Occurrence:** April through December

3. **Effects:** Toxicity in Pacific razor clams, Siliqua patula

4. **Management Action:** Partial closure of recreational razor clam fishery during scheduled spring and fall harvest seasons.

5. **Causative Species:** Unknown, but Pseudonitzschia pungens, P. australis, and P. pseudodelicatissima were found in coastal waters in November.

6. **Environment:** Coastal surf zone

7. **Advected Population or In Situ Growth:** Unknown

8. **Previous Occurrences:** October 1991 - June 1992

9. **Additional Comments:**

10. **Individual to Contact:**
Mary McCallum
Washington State Department of Health
Environmental Health Programs
P.O. Box 47824
Olympia, WA 98504-7824
Phone: (206) 753-5964

Harmful Algal Blooms in the United States – 1993

1. **Location:** PSP occurred at various localities around Puget Sound and in the surf zone of coastal beaches.

2. **Date of Occurrence:** June - October in Puget Sound
March through summer in the coastal surf zone

3. **Effects:** Shellfish toxicity exceeded closure level of 80 µg/100 g.

4. **Management Action:** In Puget Sound, there were short-term closures of some commercial growing areas and advisory closures for recreational shellfish harvest. In the coastal area, there was a partial closure of the recreational razor clam fishery.

5. **Causative Species:** Alexandrium catenella

6. **Environment:** Estuarine/inland waters/protected embayments in Puget Sound
Coastal surf zone

7. **Advected Population or In Situ Growth:** Puget Sound: in situ
Coastal area: ??

8. **Previous Occurrences:** Annually in Puget Sound
Occassionally in coastal zone

9. **Additional Comments:** Closures in 1993 were not unusal in terms of locations, duration, or maximum levels of toxicity in Puget Sound. In the coastal area, only razor clams were affected; toxin concentration above the closure level persisted in edible tissue through the summer.

10. **Individual to Contact:**
Mary McCallum
Washington State Department of Health
Environmental Health Programs
P.O. Box 47824
Olympia, WA 98504-7824
Phone: (206) 753-5964

DURATION OF TOXIC EPISODES

TYPE OF TOXICITY (PSP, DSP, ASP, NSP, ETC.): PSP

YEAR	area	code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Maximum toxicity (ug/100g)
1993	Puget Sd	24						x	x	x	x	x			4,012 blue mussels
1993	coastal	23			x										180 edible tissue of razor clams

This table should be used to indicate the duration of the toxic episodes and the maximum level of measured toxicity.

DURATION OF TOXIC EPISODES

TYPE OF TOXICITY (PSP, DSP, ASP, NSP, ETC.): ASP

YEAR	area	code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Maximum toxicity (ug/100g)
1993	coastal	23				x									17 ppm edible tissue of razor clams
1993	coastal	23											x		23 ppm edible tissue of razor clams

This table should be used to indicate the duration of the toxic episodes and the maximum level of measured toxicity.

HUMAN INTOXICATIONS

NONE IN WASHINGTON STATE

YEAR	MONTH	AREA (CODE)	COMMENTS

MORTALITY OF FISH AND OTHER MARINE ORGANISMS

NONE IN WASHINGTON STATE

YEAR	MONTH	AREA (CODE)	COMMENTS

Harmful Algal Blooms in the United States – 1993

1. Location: Oregon coast from Yachats to the California border, but not in the bays.

2. Date of Occurrence: PSP in mussels (only species affected) began in August.

3. Effects: One large mussel shipper was closed for 1 week until testing assured product safety.

4. Management Action: Commercial and recreational shellfish harvesting was closed on the beaches only, between between late August and early November. Bay clamming was not closed.

5. Causative Species: Not confirmed, thought to be Alexandrium catenella.

6. Environment: Typical late summer and fall weather conditions with water temperatures 10-13 C, salinity between 25-30 ppt or greater. Fall rains began in early November which is later than usual.

7. Advected Population or In Situ Growth: Not known

8. Previous Occurrences: The last Oregon PSP alert began on the northern beaches in August 1992 in mussels and continued to be present in razor clams through 1993.

9. Additional Comments:

10. Individual to Contact:

Deb Cannon
Shellfish Program Specialist
Oregon Department of Agriculture
635 Capitol St. NE
Salem, OR 97310
USA

Harmful Algal Blooms in the United States – 1993

1. Location: Oregon coast from Cape Lookout near Netarts to the Columbia River. This area is called the Clatsop Beaches.

2. Date of Occurrence: Domoic acid levels in razor clams increased to 10 ppm in November 1993. Levels were 16 ppm in late December 1993. Mussels tested at 1 ppm in November.

3. Effects: The razor clam fishery was already closed because of PSP.

4. Management Action: Razor clam harvest on Clatsop Beaches continued to be closed due to PSP.

5. Causative Species: Not known

6. Environment: Typical late summer and fall weather conditions with water temperatures 10-13 C, salinity between 25-30 ppt or greater. Fall rains began in early November which is later than usual.

7. Advected Population or In Situ Growth: Not known

8. Previous Occurrences: The last Oregon domoic acid alert started on the northern beaches in November 1991 in razor clams and continued to exceed 5 ppm until July 1992.

9. Additional Comments: Mussel sampling on Clatsop Beaches was difficult this fall making it impossible to see trends. Climate conditions in 1993 were different from 1991 when the rains came earlier and were more frequent than in 1993. Also, domoic acid levels were higher in 1991 being up to 122 ppm.

10. Individual to Contact:

Deb Cannon
Shellfish Program Specialist
Oregon Department of Agriculture
635 Capitol St. NE
Salem, OR 97310
USA

Harmful Algal Blooms in the United States – 1993

1. Location: Oregon coast from Cape Lookout near Netarts to the Columbia River (area known as Clatsop Beaches).

2. Date of Occurrence: Continuation of PSP even that began in August 1992. Toxin in mussels until April 1993. Razor clams contained PSP through all of 1993.

3. Effects: Toxin levels in razor clams ranged from 195-298 µg/100 g in late October 1993 to 50-93 µg/100 g in late December. Two razor clam processors have almost discontinued this part of their businesses. Motels and restaurants are affected because of fewer tourists. Intensified testing of razor clams has increased collection and laboratory costs of the Oregon Shellfish Program.

4. Management Action: Commercial and recreational harvest of razor clams on Clatsop Beaches remains closed. Harvest of mussels reopened in April 1993.

5. Causative Species: Not confirmed, but thought to be Alexandrium catenella.

6. Environment: Typical local conditions with late summer and fall water temperatures 10-13 C, salinity 25-30 ppt or greater. Fall rains began in early November which is later than usual.

7. Advected Population or In Situ Growth: Not known

8. Previous Occurrences: The last Oregon PSP alert began 9/25/91 in mussels, peaking at 150 µg/100 g and declining to < 50 µg/100 g by 10/30/91.

9. Additional Comments:

10. Individual to Contact:

Deb Cannon
Shellfish Program Specialist
Oregon Department of Agriculture
635 Capitol St. NE
Salem OR 97310
USA

DURATION OF TOXIC EPISODES

TYPE OF TOXICITY (PSP, DSP, ASP, NSP, ETC.): PSP

YEAR	area	code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Maximum toxicity (ug/100g)
1993	coastal	22	x	x	x	x									mussels 50 ug/100 g
1993	coastal	22	x	x	x	x	x	x	x	x	x	x	x	x	razor clams: 298 ug/
															100 g

This table should be used to indicate the duration of the toxic episodes and the maximum level of measured toxicity.

DURATION OF TOXIC EPISODES

TYPE OF TOXICITY (PSP, DSP, ASP, NSP, ETC.): ASP

YEAR	area	code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Maximum toxicity (ug/100g)
1993	coastal	22											x	x	razor clams: 16 ppm
1993	coastal	22											x	x	mussels: 1 ppm

This table should be used to indicate the duration of the toxic episodes and the maximum level of measured toxicity.

HUMAN INTOXICATIONS

NONE IN OREGON STATE IN 1993

YEAR	MONTH	AREA (CODE)	COMMENTS

MORTALITY OF FISH AND OTHER MARINE ORGANISMS

NONE IN OREGON STATE IN 1993

YEAR	MONTH	AREA (CODE)	COMMENTS

HARMFUL ALGAL BLOOMS IN THE UNITED STATES — 1993

1. **Location:** Point Louise: point of land on the mainland, S. point of entrance to Rudyerd Bay, Behm Canal (55°32'42"N, 130°52'05"W).

2. **Date of Occurrence:** 20 June 1993.

3. **Effects:** One person hospitalized for a day and has now recovered.

4. **Management Action:** Press release warning.

5. **Causative Species:** Mussels. Suspect *Alexandrium.*

6. **Environment:** Inside waters of southeast Alaska.

7. **Advected Population or In Situ Growth:** N/A.

8. **Previous Occurrences:** Unknown.

9. **Additional Comments:** Ate mussel on 19 June 1993 from area with no ill effect. Harvested product on 20 June 1993 and became ill within 5 minutes. Laboratory tests on mussels revealed over 400 µg/100 gms.

10. **Individual to Contact:** Michael J. Ostasz, Shellfish Coordinator, Seafood Program
Department of Environmental Conservation
Division of Environmental Health
State of Alaska
Dimond Center
800 East Dimond Boulevard, Suite 3-455
Anchorage, Alaska 99515
Tel: (907) 349-7343; Fax: (907) 349-4715

HARMFUL ALGAL BLOOMS IN THE UNITED STATES — 1993

1. **Location:** Near Island, Kodiak, Alaska. 1.5 mile long in St. Paul Harbor, 0.5 mile S. of Kodiak Island (57°47'N, 152°, 24'W)

2. **Date of Occurrence:** 15 June 1993

3. **Effects:** One person hospitalized and released. Ate butter clams (*Saxidomus giganteus)* and experienced symptoms of tingling to the feet, difficulty with walking, euphoria, sore stomach, mouth feeling funny and throat feeling like closing. Ate six (6) large butter clams raw. Onset from consumption to symptoms was one hour.

4. **Management Action:** Press release warning

5. **Causative Species:** Suspect *Alexandrium*

6. **Environment:** Small island near Kodiak, Alaska.

7. **Advected Population or In Situ Growth:** North end of Kodiak Island — small island within shipping/boat channel.

8. **Previous Occurrences:** Area has had PSP cases in the past. Mussels have been implicated in past episodes.

9. **Additional Comments:** PSP levels: 1824 µg/100 gms. 30 composited whole animals.

10. **Individual to Contact:** Michael J. Ostasz, Shellfish Coordinator, Seafood Program
Department of Environmental Conservation
Division of Environmental Health
State of Alaska
Dimond Center
800 East Dimond Boulevard, Suite 3-455
Anchorage, Alaska 99515
Tel: (907) 349-7343; Fax: (907) 349-4715

HARMFUL ALGAL BLOOMS IN THE UNITED STATES — 1993

1. **Location: North Island** — .4 mile long, off east shore of Favorite Channel, 1.2 miles SW of Yankee Cove and 37 miles NW of Juneau, Alaska (58°34'35"N, 134°55'40"W).

2. **Date of Occurrence:** 12 June 1993.

3. **Effects:** One person hospitalized and released. Symptoms developed within 10 minutes of consumption of mussels.

4. **Management Action:** Press release warning.

5. **Causative Species:** Suspect *Alexandrium.*

6. **Environment:** Inside waters in southeast Alaska.

7. **Advected Population or In Situ Growth:** Small island area.

8. **Previous Occurrences:** Unknown.

9. **Additional Comments:** PSP levels: Whole raw mussels — 3500 µg/100 gms.
   Cooked mussels — 1982 µg/100 gms.

10. **Individual to Contact:** Michael J. Ostasz, Shellfish Coordinator, Seafood Program
Department of Environmental Conservation
Division of Environmental Health
State of Alaska
Dimond Center
800 East Dimond Boulevard, Suite 3-455
Anchorage, Alaska 99515
Tel: (907) 349-7343; Fax: (907) 349-4715

HARMFUL BLOOMS IN ARGENTINE

Hugo Benavides

The shellfish Monitoring Program was established in 1981, after the first observation of a PSP outbreak caused by *Alexandrium tamarense*. Since that time, the species became endemic and the toxicity area expanded throughout the Argentine coast as far as Magallanes Strait. South of this place, the PSP monitoring on the coast of the Tierra del Fuego province started from 1985, but no detectable levels were measured.

In January 1992, a sharp toxicity increase in the mussel population of the Beagle Channel (55°S) was recorded, reaching a maximum of 127.000 μg STXeq.100gr^{-1} in about 10 days. The toxic species *Alexandrium catenella* was found in a high concentration (821 cells.ml^{-1}) decreasing towards the east side of the channel, same as toxicity distribution. An exceptionally high toxin content per cell (325 pg STX.cell^{-1}) was measured in the natural population. The mussel toxicity decreased at a low rate. The half time of detoxification was 17.5 days, however the toxicity level has never gone below 80 μg STXeq.100gr^{-1} since that time up to the present.

A research project will be starting from this year in order to test the hypothesis that, in addition to windstress and radiation, toxicity oubreaks could be related to the increase in the atmospheric UVB level; since this southern region is markedly affected by the seasonal decrease in the ozone layer, and this species, as well as *A. tamarense*, is known to produce UV-absorbing compounds, which could represent a significant competitive advantage with respect to other members of the phytoplankton community.

HARMFUL ALGAL BLOOMS IN CHILE

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HABs up to now are restricted to the archipelago and fjords systems.

Alexandrium catenella blooms and hence PSP outbreaks are located in the southermost part of South America and in recent years have been more severe than the last two decades.

DSP has been found in the north and midle parts of the fjords systems and the causative agent is Dinophysis acuta.
Salmonids kills have occurred due to the presence of large concentrations (> 10 000 cells/mL) of Leptocylindrus minimus.

A recent local and subsurface bloom of D. cf. acuminata in a strong stratified fjord seems to be an useful event which could be modelled due to the well defined boundaries conditions (2-D, X and Z). An important approach should focus on small scale of physical and biological vertical processes.

HARMFUL ALGAL IN 1991-1992 - MEXICO

1. **Location:** NW Pacific coast and bays (Baja California, Todos Santos bay, Cedros Island, Tortugas bay).

2. **Dates of occurrence:** Spring-summer 1991, summer 1992.

3. **Effects:** PSP was analysed in mussels cultivated on rafts at Todos Santos bay and it was not detected.

4. **Management decisions:** Emmergency planning started.

5. **Causative species:** Sampling was carried out with van Dorn bottles at surface and at Secchi disk lecture depth, during red tide blooms. Cells counts were performed using a in Setwick-Rafter and hematocymeter camera with an error of 0.09 and 7.54% among 6 replicates. During the 1991 espisode, two species were the most important in the area: at Tortugas bay at Baja California Sur, *Gymnodinium splendens* (5469 x 10^3 cel l^{-1}). In the mussel cultured area *G. splendens* (928 x 10^3 cel l^{-1}) and *Gonyaulax polyedra* (907 x 10^3 cel l^{-1}) were settled in one patch. In 1992 *Gonyaulax polyedra* was the predominant species (5469 x 10^3 cel l^{-1}). *Dynophysis* species were present during both events show low concentrations.

6. **Environment:** NW winds (breeze regime) with velocities up to 4 m s^{-1} predominate at Pacific cost. However, exceptional Eastern gust (10 m s^{-1}) took place on March, 25, 1991 and 14 April, 1991 were related with upwelling event and higher cell counts.

7. **Advected population or in situ growth:** Both mecanisms could occur. In 1991 event the displacement of red tide patchness were observed from the Southern area to Northern area and at the Island the same coastal species were observed. Also all dinoflagellates species seem to be growing authochtonous, while the tintinid species seem to be carried by "El Niño" waters.

8. **Previous occurrences:** During the summer, 1985 a *Prorocentum micans* and other species blooms were observed from along the coast recorded on satellite images (Pelaez, 1987). Every year during the summer the dinoflagellates are dominant in the coastal area but 1991 conditions were exceptional in extention and time. A very intensebut shorter and located phenomen was recorded in 1992. In the harbor a continuous discouloured water is observed during all the year due a mixed settled species.

9. **Additional comments:** Aditional information in Orellana Cepeda *et al.*, (*in literis*) Variabilty of *Gonyaulax polyedra* y *Gymnodinium splendens* during the red tide event at Mexican North Oriental Pacific.

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