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*REPORT OF THE WORKING GROUP ON HARMFUL EFFECTS OF ALGAL BLOOMS ON
MARICULTURE AND MARINE FISHERIES*

Nantes, France, 11 - 14 April 1989

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REPORT OF THE WORKING GROUP ON HARMFUL EFFECTS OF ALGAL
BLOOMS ON MARICULTURE AND MARINE FISHERIES.

Nantes, France, 11 - 14 April 1989.

1 OPENING OF THE MEETING.

1.1 The meeting was opened at 10.00 hours on 11 April 1989 and was hosted by Dr. P. Lassus IFREMER France. Mr. J.M. De Lamare, Director, welcomed participants. The chairman of the Working Group, Dr. D. Lindahl thanked Mr. J.M De Lamare and introduced new members of the Group.

1.2 The agenda was adopted and is attached at Annex I.

1.3 A list of participants is given in Annex II.

1.4 Dr. R. Gowen was appointed as Rapporteur.

1.5 The Chairman advised the Working Group of Council Resolution 2:39 which established the following terms of reference:

a. to finalize draft chapters on site selection, monitoring protocols, predictability, research priorities and toxin detection methodology for inclusion in a proposed Co-operative Research Report on "Management of the Effects of Harmful Algal Blooms on Mariculture and Marine Fisheries".

b. to complete a report on the "currently known causes of and species involved in algal blooms with harmful effects on fisheries and mariculture" with a view to publication.

c. to review the report of the Chrysochromulina polylepis Workshop (C. Res. 1988/2:38), and

d. to report to the June 1989 meeting of the ACMP.

1.6 The chairman pointed out to the Working Group that there appeared to be some confusion regarding the terms of reference of this Working Group and the Working Group on phytoplankton Ecology. Council resolution 2:37 estab-

lished that the Working Group on phytoplankton Ecology should review the report on possible trends in the occurrence of algal and/or harmful events, under preparation by the Working Group on the Harmful Effects of Algal Blooms on Mariculture and Marine Fisheries.

However, resolution 2:39 does not charge the Working Group on Harmful Effects with the task of preparing a report on possible trends in the occurrence of algal blooms and/or harmful events. The Working Group considered the ambiguity and decided that their main objective was in accordance with resolution 2:39 and having in mind that this was a final meeting, its priorities were to finalise chapters for the proposed Co-operative Research Report and to briefly consider prepared documents on possible trends (Annex III).

2 NATIONAL REPORTS.

National reports on the occurrence and effects of harmful algae from ICES member countries (Annex IV) were discussed. The following points arose from the discussion.

2.1 The geographical distribution of harmful species and toxic events.

In Portugal, PSP and DSP, and in the United States, PSP occurred further south than had previously been reported. In Canada domoic acid was detected over a larger geographical area compared to 1987. Furthermore, domoic acid produced by blooms of the diatom Nitzschia pungens was detected at background levels at most sampling stations throughout the southern Gulf of St. Lawrence. Domoic acid was also recorded for the first time in the Bay of Fundy. The potentially serious side effects of this new toxin make these reports worrisome.

2.2 Timing of toxic events and blooms.

Several countries reported earlier initiation of toxic events and extended periods of toxicity. In the Canadian Gulf of St. Lawrence, blooms of Alexandrium excavatum and associated PSP toxicity exhibited an atypical bimodal peak, in late spring and late summer. In Ireland, DSP toxicity occurred earlier and thus closures of shellfish areas were longer (23 weeks instead of a more typical 16 weeks). The late occurrence (October) of a bloom of Heterosigma akashiwo and associated mortalities of farmed fish was reported from Scotland.

Blooms of Gyrodinium aureolum prevailed longer in Norway and Sweden compared to blooms in previous years. In Northern Spain Gymnodinium catenatum was observed in August and caused toxicity which is untypical of its seasonal occurrence.

2.3 New occurrences of harmful species and toxic events.

In the United States, domoic acid was recorded in mussels from Maine and Gyrodinium aureolum caused mortalities of shellfish and invertebrates. In France, there was a toxic red tide of Alexandrium minutum which although previously recorded in French waters, had not formed exceptional blooms. PSP was recorded for the first time along the Gulf of St. Lawrence coasts of New Brunswick and the west coast of Prince Edward Island.

Phaeocystis blooms were reported from Danish waters. It was stated that such blooms are a relatively recent phenomenon along this coast and that these blooms, which also occur in Ireland, could have an adverse effect on fisheries and tourism.

In Norway and Sweden a major bloom of Chrysochromulina polylepis caused mortalities of caged and wild fish, invertebrates and macrophyte algae. Prior to the bloom this species was not thought to be toxic and has not previously been observed in blooms or harmful occurrences.

In the Faeroe Islands mortalities of farmed fish were associated with a bloom of Scrippsiella trochoidea. However, at present Scrippsiella has not been confirmed as the species responsible for the mortalities.

2.4 Toxins in marine mammals.

In the United States, two separate cases of mortalities of marine mammals were reported. In the first case saxitoxin (presumed to have originated from A. tamarensis) in the livers of mackerel caused mortalities of humpback whales. In the second case brevetoxin (from Ptychodiscus brevis) found in Spanish mackerel and menhaden was considered to be the most likely cause of mortalities of dolphins.

These events are the first documented incidents of dinotoxins being found in living commercially important pelagic fish and causing mortalities of marine mammals.

2.5 The 1988 national reports.

The 1988 national reports are included as Annex IV.

3. DISCUSSION OF Chrysochromulina BLOOM.

A brief summary of the dynamics and effects of the large and toxic bloom of Chrysochromulina which occurred in Scandinavian waters in May 1988, was given by Dr. Edler and Mr. Dahl. The request made by ICES according to the terms of reference, to review the report by the Working Group on Chrysochromulina (Bergen, Norway, 1989) was not fulfilled since the report was not available.

4. PREPARATION OF CHAPTERS FOR INCLUSION IN A CO-OPERATIVE RESEARCH REPORT.

The participants were divided into three subgroups for finalizing the draft chapters :

4.1. Toxicology and toxin analysis

Chairman: P. Krogh

4.2. Monitoring and predictability

Chairman: S. Fraga

4.3. Site selection and managements strategies

Chairman: K. Jones

4.4. Currently known toxic and harmful species and known causes of harmful occurrences.

A fourth subgroup was established with P. Lassus as chairman to update a list of currently known toxic and harmful species together with known causes of harmful occurrences. The group decided to include the species list and the known causes as two separate chapters in the Co-operative Research Report.

4.5. Co-operative Research Report.

The proposed co-operative research report on "Management of the effects of harmful algae on mariculture and marine fisheries" will be finished during 1989.

5. RESEARCH PRIORITIES.

The Working Group identified the following areas of research to be of major importance to understanding the

problems associated with harmful effects of phytoplankton on mariculture and fisheries.

5.1 Interdisciplinary studies.

5.1.1 Interactions between biological, chemical and physical processes influencing bloom development in off-shore areas, particularly shelf sea fronts.

5.1.2 Physical processes leading to the transport of blooms between frontal areas and coastal mariculture sites including the relationship between oceanic and coastal phenomena.

5.1.3 The effects of nutrient enrichment of coastal waters by fish farm wastes and anthropogenic inputs. In particular, whether such inputs are likely to contribute to the development on the growth of harmful species and/or the regulation of toxicity.

5.2 Biology and ecophysiology of harmful phytoplankton species.

5.2.1 Identification and culture of harmful phytoplankton species.

5.2.2 Ecology of harmful phytoplankton which includes studies in the open sea, in large enclosed and controlled ecosystems and of laboratory based ecophysiological growth experiments.

5.2.3 The role of algal nutrition in the control of toxin production in a number of harmful algal species.

5.2.4 Factors controlling the persistence of toxicity of PSP and DSP when no toxic species are present.

5.2.5 The effects of extra cellular substances such as ectocrine inhibitors on growth rates of competitor species and species succession.

5.2.6 Distribution and ecophysiology of cysts.

5.2.7 Identification of factors which determine minimum cell numbers which induce toxicity.

5.2.8 The role of bacteria associated with phytoplankton in the production of toxins.

5.2.9 Screening of phytoplankton species which co-occur with Nitzschia sp in areas where domoic acid has been detected.

5.2.10 Levels of toxin produced at different phases of growth in natural blooms and in laboratory cultures.

5.3 Effects.

5.3.1 The effects (acute and chronic) of harmful phytoplankton (present in low concentrations and blooms) on marine organisms.

5.3.2 The mode of action of toxins.

5.3.3 Transfer of toxins through the food chain using both uni algal cultures in laboratory experiments and field studies involving exposure of fish and invertebrates to natural plankton assemblages.

5.3.4 The recovery and recolonisation of natural benthic communities affected by harmful phytoplankton.

5.4 Management techniques.

5.4.1 Development of methods to provide an early warning of the presence of harmful algae and/or toxic effects.

5.4.2 Methods for protecting shellfish and fin-fish from harmful phytoplankton.

5.5 Predictability.

5.5.1 Analyses of harmful phytoplankton occurrences, meteorological and hydrographic data to determine whether such occurrences are correlated with specific conditions which could be used for long term prediction.

5.5.2 Development of models which provide an assessment of the degree of toxicity in shellfish and the level of mortality in finfish.

5.5.3 The manner in which environmental factors influence physiology and behaviour (and hence the response) of the target organism (cultured and harvested) to the effects of harmful algae.

5.5.4 Compilation and evaluation for predictive purposes of case studies of occurrences of harmful phytoplankton species and associated losses.

5.5.5 Evaluation of the extinction dilution method for enumeration of dormant cysts in marine sediments to calculate the most probable number (MPN) and potential germination of toxic species.

5.5.6 Development and evaluation of remote sensing techniques as tools for prediction.

5.6 Toxin analysis.

5.6.1 Provision of reference material for algal toxins.

5.6.2 Evaluation of immunological and cell culture methods for toxin determination.

5.6.3 Intercalibration between biological assays and chemical methods for toxin determination.

5.6.4 Mapping of toxin profiles of toxic species.

5.6.5 Evaluation of procedures for detoxification of shellfish.

5.7 Toxicology.

5.7.1 Evaluation of human health risk by exposure to algal toxins.

6 DISCUSSION OF THE PRESENT SITUATION ON TOXIC/HARMFUL EVENTS IN RELATION TO ICES WORKING GROUPS.

Several members of the Working Group expressed concern regarding the apparent spread of harmful algae, the increased persistence of toxic events, new species becoming toxic, and the magnitude of farmed fish mortalities during the last few years. In addition the recent occurrence of extensive *Phaeocystis* blooms along the coasts of Denmark and Ireland have led to fears regarding the impact of such blooms on tourism, recreation and natural fisheries.

Problems caused by algal blooms and toxicity events, in particular the impact of harmful algae on mariculture, have become serious in many ICES member states, and there is an obvious need to develop strategies to manage these events. The Working Group felt strongly that there was a need for a specialist group within ICES to review and assess algal blooms, toxicity events and the problems they cause. The Working Group was convinced that such a specialist group should be separate from, but liaise closely

with the Working Group on Phytoplankton Ecology. Furthermore, such a specialist group should be made up of applied ecologists, chemists and other scientists who have a direct involvement with mariculture and marine fisheries.

7 RECOMMENDATIONS.

7.1 Publication of Co-operative Research Report.

That ICES publish the finalised chapters and a list of currently known species and causes of harmful blooms as a Co-operative Research Report.

7.2 Working Group on Harmful Phytoplankton and the Management of Their Effects.

That a Working Group called "Harmful phytoplankton and the management of their effects" be established with the following terms of reference:

- a. To exchange and analyse data derived from monitoring programmes to identify possible trends in the occurrence of harmful algae, and to evaluate and improve monitoring programmes.
- b. To identify probable causes or mechanisms responsible for the occurrence of harmful phytoplankton.
- c. To assess and improve management techniques to carry stock through harmful events.
- d. To evaluate current research on progress on harmful phytoplankton in member countries.
- e. To discuss and report on the information collected by members of the Working Group during harmful phytoplankton events each year.
- f. To review, evaluate and report on the toxicological information available on known and newly discovered algal toxins, and the methods for the detection and quantification.
- g. The proposed Working Group on Harmful Phytoplankton and Their Effects should meet for three days 3 - 6 April 1990 in Oban, Scotland, under the chairmanship of Dr. Odd Lindahl.

ANNEX I

AGENDA

Tuesday, April 11, 1989, at 10.00 hours:

1. Opening of the meeting.
2. Adoption of the agenda.
3. Appointment of rapporteur.
4. Consideration of terms of reference for the meeting and how future work concerning harmful blooms is supposed to be carried out within ICES.
- 5a. National reports on bloom events in 1988.
 - b. Recent changes in the national monitoring programmes.
 - c. Finalize draft chapters on site selection, monitoring, predictability, management strategies and toxin detection methodology.
 - d. Complete the list of terms and definitions for the Working Group's specialised area, for inclusion in the Glossary of Aquaculture Terminology.
 - e. Prepare a list of currently known harmful species together with factors responsible for their occurrence, including the events which occurred during 1988.
6. Adoption of the final version of Co-operative Research Report "Management of Effects of Harmful Algal Blooms on Mariculture and Marine Fisheries".
7. Adoption of the report, especially with regard to ACMP (Advisory Committee on Marine Pollution).
8. Adoption of a Working Group report and draft chapters of a Co-operative Research report and recommendations.
9. Any other matters.
10. Close of meeting.

ANNEX II

LIST OF PARTICIPANTS

Dr. D. Anderson	United States
Ms. C. Le Baut	France
Dr. A. Cembella	Canada
Ms. J. Doyle	Ireland
Mr. E. Dahl	Norway
Dr. L. Edler	Sweden
Dr. S. Fraga	Spain
Mr. E. Gaard	Faeros
Dr. R. Gowen	United Kingdom
Dr. M. Hageltorn	Sweden
Mr. K. Vagn Hansen	Denmark
Dr. K. Jones	United Kingdom
Dr. P. Krogh	Denmark
Dr. P. Lassus	France
Dr. O. Lindahl (Chairman)	Sweden
Ms. M.A. Sampayo	Portugal
Dr. S. Rao	Canada
Mr. S. Tilseth	Norway
Dr. J. Worms	Canada

ANNEX III

DOCUMENTS* CONSIDERED BY THE WORKING GROUP

Fraga, S.: Currently known causes and species involved in algal blooms with harmful effects on fisheries and mariculture in Spain.

Gaard, E.: Toxic algal blooms on the Faeroe Islands.

Belin, C., Berthome, J.P. and Lassus, P.: Toxic dinoflagellates and discolored water phenomena along the French coasts. - Evolution and trends between 1975 and 1988.

* Lodged with ICES Secretariat for consultation on request.

ANNEX IV

NATIONAL REPORTS

CANADA.

Cembella, A., Martin, J. and Worms, J.: Report on toxic phytoplankton blooms.

DENMARK.

Vagn Hansen, Kr.: Occurrences of toxic, potential plankton algae, plankton blooms incl. status for 1988 and the DSP/PSP mussel surveillance observations 1988.

FRANCE.

Lassus, P. and Gentien, P.: France, national report on 1988 algal bloom studies.

GERMANY.

Lenz, J.: Report on the occurrence of toxic algal blooms in German waters 1988.

IRELAND.

Doyle, J.: National report Ireland 1988.

NORWAY.

Dahl, E.: Reports on blooms in Norway.

PORTUGAL.

Sampayo, M.A.: Red tides at coastal waters 1988.

SPAIN.

Fraga, S.: Spain annual report for 1988.

SWEDEN.

Edler, L.: Swedish report on bloom events and shellfish toxicity for 1988.

UNITED KINGDOM.

Jones, K.: Algal blooms in Scottish coastal waters in 1988.

UNITED STATES.

Anderson, D.: Algal bloom reports - United States.

PSP

Date: 1988

Country: Canada

Location: Southwest Bay of Fundy

Date of Occurrence: June through September - Highest shellfish toxicity levels of 530 $\mu\text{g}/100 \text{ g}$. STX equiv. reached at Crow Harbour on July 25.

Effects:

Marine organisms (mussels, softshell clams, scallops) accumulating PSP toxins.

No water discolouration observed.

No human illnesses reported.

Management Decisions:

Harvesting of shellfish prohibited at toxin values greater than 80 $\mu\text{g}/100 \text{ g}$ STX equiv.

Causative Species:

Gonyaulax excavata (= Protogonyaulax tamarensis).

First occurrence May 27 with 160 cells/liter observed.

Maximum number of cells observed - 8.0×10^3 cells/L - July 12

Environment:

Salinity 31-32‰

Temperature 10-12°C

Water column, - Mixed

Physical Location:

Advised populations from well mixed offshore populations of Gonyaulax excavata.

Previous Occurrences: Annually

Individual to Contact:

Jennifer Martin
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B. E0G 2X0

DOMOIC ACID

Year: 1988

Country: Canada

Location: Southwest Bay of Fundy

Date of Occurrence: Late August to early October

Effects: Softshell clams and blue mussels accumulated domoic acid.
Highest levels observed were at the Bar Road in mussels
harvested September 22 - 74 ug/gm.

Management Decisions: Harvesting of shellfish was prohibited at toxin
levels greater than 20 ug/gm.

Causative Species:

The organisms observed in highest concentrations was
Nitzschia delicatissima.

Maximum number of cells - September 23 - 6.0×10^4 cells/L.

Nitzschia pungens

Environment:

Salinity	31-32‰
Temperature	11-13°C
Water column	Mixed

Physical Location:

Possibly in situ growth - further research is required.

Previous Occurrences: Although N. delicatissima has been observed for a
number of years, 1988 was the first year domoic acid levels were
measured in bivalves.

Individual to Contact:

Jennifer Martin
Department of Fisheries and Oceans
Biological Station
St. Andrews, N.B. E0G 2X0

REPORT ON TOXIC PHYTOPLANKTON BLOOMS

1988 Canada

Location : Eastern coast of Prince Edward Island including

- Murray River
- Brudenell River
- Montague River
- Cardigan River
- St Mary's Bay

Date of Occurrence : Started beginning of November 1988

Effects : Toxicification of cultured mussels by domoic acid at levels varying between the action level of 20 ppm and 400 ppm.

Management Decisions : All affected areas closed to harvesting of shellfish.

Causative Species : *Nitzschia pungens* f. *multiseriata* determined by water pumped through 20 μ Nitex and preserved in lugol. Maximum density recorded was 1,200,000 cells/L.

Environment : temperature range over the bloom period was 8°C in November 1988 to -1.3°C in January 1989.

Salinity ~ 28 ‰

Water Column : mixed

Physical Location : bloom likely developed from a resident population of *Nitzschia* although the possibility of advection of cells from the outside of the bays has not yet been eliminated.

Previous Occurrences : First recorded as a genuine phycotoxin problem in November 1987 in the same area, although much more restricted in space.

Individual To Contact : Jean Worms, Department of Fisheries & Oceans, Gulf Region, GFC. PO Box 5030, Moncton, N-B, E1C 9B6, Canada

Annual Phytoplankton Report to ICES Working Group "Harmful Effects of Algal Blooms on Mariculture and Marine Fisheries", Nantes, 1989

Canada, 1988 (Quebec Region)

Submitted by: Allan Cembella

Address Maurice Lamontagne Institute, Biological Oceanography Division,
Dept. of Fisheries and Oceans, P.O. Box 1000, 850 route de la Mer,
Mont-Joli, Quebec, Canada G5H 3Z4

Location The lower St. Lawrence estuary and the Gaspé coast bordering the northern Gulf of St. Lawrence. More specifically, toxic dinoflagellate blooms were observed in nearshore transects of the Gaspé current, from 0 - 5 km offshore, and within the Baie de Gaspé and the Baie of Chaleur.

Dates of Occurrence An early summer bloom dominated by centric diatoms was followed by the appearance of low concentrations of toxic Protogonyaulax tamarensis (<100/litre) in June in the Baie of Gaspé. From mid-August to September 5, 1988, large flagellates tended to dominate in the phytoplankton community in the Gaspé region. This latter bloom contained higher concentrations (10,000 cells/litre) of P. tamarensis than that in early summer. Sinking cells of P. tamarensis were recovered in bottom sediment traps throughout October.

Effects

No visible water discolorations ("red tide") were associated with the occurrence of toxic species in the lower estuary and Gaspé coast. At many stations, PSP levels in late May began to exceed 200 ug STXeq/100 g in wild mussel populations, and toxicity climbed constantly throughout June to a maximum of 8,000 ug STXeq/100 g. PSP toxin levels in cultivated mussels in the Baie of Gaspé reached a maximum of 7,000 ug STXeq/ 100 g in late June, then fell to gradually to levels nearly undetectable by mouse bioassay during mid-summer. A secondary peak of up to 3,000 ug STXeq/100 g was observed in late August to early September. Mouse deaths assigned to UMF (unknown mussel factor) were also noted for some samples of cultivated mussels; the symptoms were atypical of those of PSP intoxication.

Management Decisions

Large sections of the lower St. Lawrence estuary and Gaspé coast were closed to the commercial and recreational harvest of shellfish, due to levels of PSP which exceeded 80 ug STXeq/100 g.

Causative Organism

The source of PSP in the region was definitively established as P. tamarensis. However, in August, particularly in the region of the Gaspé which includes the Baie of Gaspé, multispecific blooms dominated by dinophyoid species, including Phalacrocoma sp., Dinophysis acuminata and D. norvegica, at concentrations of several thousand cells per litre were also observed. The latter two species are possible causes of DSP, although this has not yet been confirmed for this region.

Environment

Water column was relatively unstratified in early summer; strongly subjected to storm and wind action in April and May. However, stratification developed in late summer within the Baie of Gaspé, where mytiliculture installations were placed in a area of water column depth <15 m. Surface salinity 24 - 30 p.p.t.; surface temperature rose from 8 C in early May to 18 C by the end of August.

Advection Populations vs in situ Growth

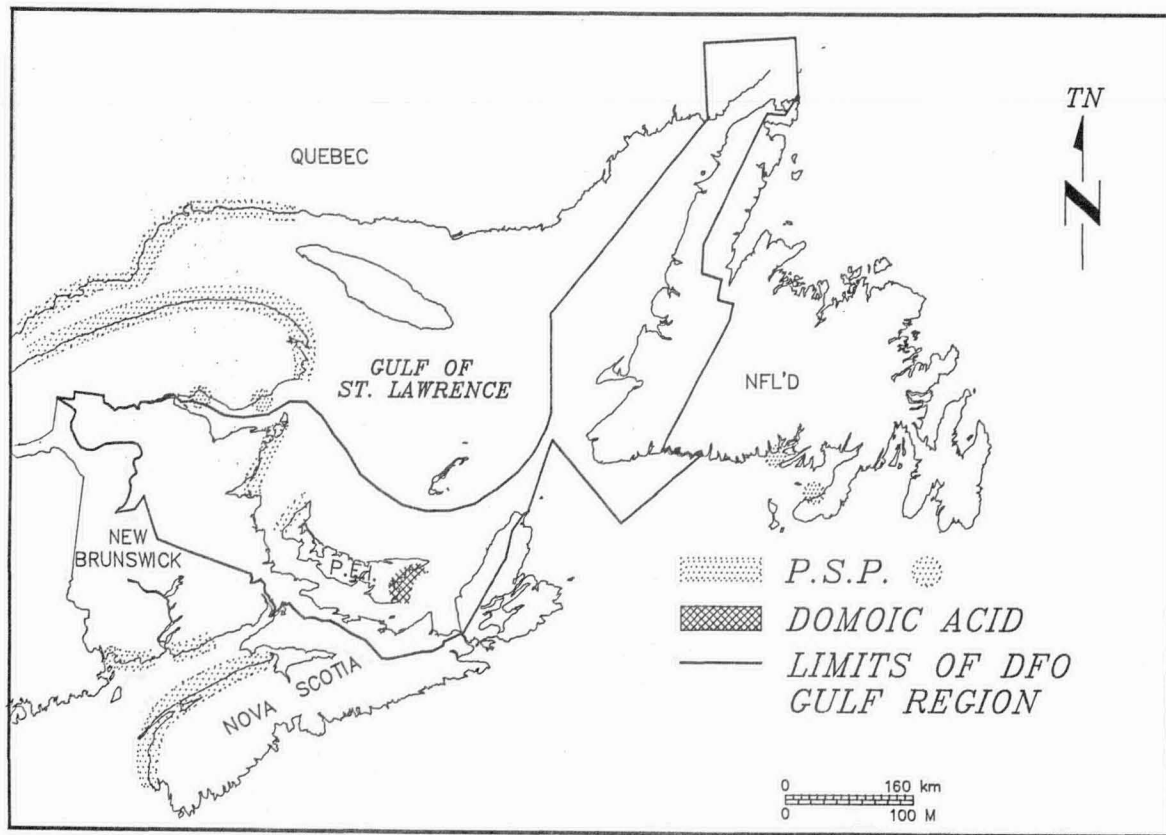
Toxic dinoflagellate populations occurring in the Baie of Gaspé appeared to be advected from outside the bay, as a result of shoreward circulation within the Gaspé current. The evidence is as follows: blooms of Protogonyaulax were first observed outside the bay and approached from the northeast, in situ growth rates in the bay are not sufficient to explain the rapid rise in cell numbers, and endemic cyst populations are insufficient to generate blooms of the magnitude observed.

Previous Occurrence

Detailed evidence of bloom dynamics in the Gaspé region is not available from previous years, but given the historical pattern of PSP toxicity in the region it is clear that this is an annual event. What is perhaps unique in 1988, is the biphasic peak in shellfish toxicity, and the fact that the toxic Protogonyaulax blooms appeared to occur rather earlier than is typically the case.

Individual to Contact

Allan Cembella, Biological Oceanography Division,
Maurice Lamontagne Institute PHONE: 418-775-6613



ICES Working group on the Harmful Effects of Algal blooms on
Mariculture and Marine Fisheries. Nantes, April 11-14th 1989.

DENMARK

Kr. Vagn Hansen

Occurrences of toxic, potential toxic plankton algae, plankton blooms incl. status for 1988 and the DSP/PSP mussel surveillance observations 1988.

This report summarizes the observations of occurrences of toxic and potential toxic plankton algae and plankton blooms since late 1970'ies. The final report will be published in 1989 by:

J. Larsen and Ø. Moestrup (Taxonomy), H. Munk (Ecology and blooms), P. Krogh (Toxicology), K. Olrik, L. Herborg, T. Bjergskov and Kr. Vagn Hansen.

The monitoring plankton programme is for near coastal waters, the fjords incl. the Limfjord and fresh waters executed by the countries' environmental laboratories. Supporting surveys in the open waters by the Marine Pollution Laboratory (Ministry of Environment) and The Danish Institute for Fisheries and Marine Research (Ministry of Fisheries).

The programme for monitoring toxicity (DSP and PSP) in mussels is executed by The Fish Inspection Service, Ministry of Fisheries, concurrently are taken plankton samples.

Occurrences of toxic, potential toxic and plankton blooms

Prorocentrum micans

The species occurs in all Danish waters from April through November, the highest cell nos. are found during August-September in

coastal waters: the Limfjord, the fjords in East Jylland and in the Southern Kattegat.

The highest cell concentration recorded was in 1987 in the Flensborg Fjord (529.000 cells/liter). In all other areas records vary from 100 to 160.000 cells/liter. There are no observations on ecological effects during "blooms" with redish/brownish discolouration (in the Limfjord).

Prorocentrum minimum (incl. P. mariae-lebouriae and P. triangulatum)

P. minimum was recorded in Skagerrak and N.Kattegat for the first time in 1981, it rapidly got distributed to all Danish waters incl. the Western Baltic with bloom formations in the fjords of East Jylland and in the Limfjord (redish-brownish discolouration), cell concentrations 2-53 mio. cells/liter in 1983, 1984, 1987 - during July-September. (Temp. 16-19°C).

There are no observations on direct harmful effect in Danish waters.

In 1988 P. minimum was found only in low concentrations, max. 2.160 cells/liter.

Prorocentrum balticum

This species occurs in Danish waters during July-December with max. concentrations in August (105.300 cells/liter, 1979). It has never been observed forming blooms in Danish waters. It has not been recorded in the 1988 programme.

Dinophysis

The species listed below have been recorded in Danish waters throughout the year since 1898 and almost always in low numbers.

There is only one observation of discoloured water, caused by *D. acuminata*. In the Limfjord in June 1982.

There are no observations from Danish waters on harmful ecological effects. With regard to accumulated DSP effects in mussels, please refer to pp. 8-9.

Dinophysis acuminata

With the exceptions of the discolouration observed in the Limfjord mentioned above and the observation listed below this species has been found in low cell concentrations 80-8.000 cells/liter from March through December.

1988

<u>Locality</u>	<u>Time</u>	<u>Max. cell nos./liter</u>
Wadden Sea	July-August	1.000
West Coast Jylland	April-November	92.800
Limfjord	April-November	x
Skagerrak	April-October	2.200
Kattegat N.	May-November	160

Dinophysis norvegica

Throughout the year this species has been recorded in Danish waters and fjords, in the inner Danish waters southwards to the Øresund and Flensborg Fjord.

High cell concentrations have been recorded only from the Western Limfjord (14.000 cells/liter in 1985 and 80.500 in 1987).

1988

<u>Locality</u>	<u>Time</u>	<u>Max. cell nos./liter</u>
Wadden Sea	June-July	x
North Sea Coast	May-September	1.700
Limfjord	April-October	500
Skagerrak	April-September	180
Kattegat N.	April-September	580

Dinophysis acuta

This oceanic species is found in Danish waters from April through December and always in very low concentrations, below 1000 cells/liter.

1988

<u>Locality</u>	<u>Time</u>	<u>Max. cell nos./liter</u>
Wadden Sea	August	20
North Sea Coast	June	x
Skagerrak	April, August-September	200
Kattegat N.	January, May August-November	840

Goniadoma ostenfeldii

This species have been recorded in Danish waters and fjords during March-November and always in low concentrations.

In 1988 it was recorded in the Limfjord, March-November, and in the North Sea, April-August (max. cell nos./liter 7.600).

Gonyaulax excavata

The species has been recorded in the Limfjord since 1983 and off the West Coast of Jylland. Always in low numbers - max. 1.300 cell/liter. Period March-August.

Even at these low cell concentrations mussels can accumulate PSP toxin.

Spores of Gonyaulax have been recorded in the Limfjord and Kattegat, and were probably filtered by mussels in a shallow bay in the Limfjord (1987) as PSP was measured in mussels 3 weeks after the algae had disappeared in the plankton.

In 1988 Gonyaulax excavata was found off the West Coast of Jylland in March, April and August and in the Limfjord in June (max. 200 cells/liter).

Gyrodinium aureolum

During the past 10 years G. aureolum blooms have been observed in 1981, 1982, 1985 and 1988 in the North Sea, Skagerrak, Kattegat and the western part of the Limfjord to which it is transported from the North Sea through the Thyborøn Channel. Salinities in regions with blooms:

27-34 o/oo, temp. 10-17°C. Period of blooms: August-October. The species occurs generally from July to November.

Mortality effects on caged fishes have been recorded in the North Sea (1985) and the Limfjord (1981, 1985, 1988). Dead bottom invertebrates were recorded in 1985 and 1988 in the Limfjord. Caged eels have found dead at cells concentrations of 600.000/liter.

1988

<u>Locality</u>	<u>Time</u>	<u>Max. cells nos./liter</u>	<u>Effects observed</u>
North Sea	Sept.-November	2.000.000	Nil
Skagerrak	Aug.-October	2.384.000	Nil
W. Limfjord	Aug.-November	11.000.000	Dead caged fishes and bottom invertebra- ted
Kattegat	Aug.-November	900.000	Nil

Noctiluca scintillans

The red blooms of Noctiluca is a well-known phenomenon along the North Sea, Skagerrak, Kattegat and Limfjord coasts, esp. during July-August; records are available since 1900.

Recent observations indicate that blooms are becoming more frequent and covering larger areas in the North Sea, where Noctiluca blooms follow Phaeocystis blooms, and in the Limfjord where the sequence is tintinnids-Noctiluca. Phaeocystis cells and tintinnids are observed in vacoules of Noctiluca.

The max. cell concentrations recorded during 1988 (200.000 cells/liter) were at similar level as during recent years, when accumulated masses of the flagellate on and off the beaches cause hygienic and aesthetic problems for the tourists industry, as is the case for Phaeocystic. Fish mortality was observed in the Limfjord in October 1986, where Ammodytes were found dead in an area with Noctiluca bloom. The oxygen conc. was normal, however the pH was high 8,5, caused by the high conc. of NH_3/NH_4 , 100 mg/liter.

Chrysochromulina polylepis

The bloom in May-June 1988, its origin, development, and effects has been reported in extensive national reports, which have been discussed and analysed by several international groups and at meetings, the most recent the ICES Workshop held in Bergen, Norway, Febr. 28 - March 2, 1989. Hence reference is here made to national reports and to the forthcoming report from the ICES Workshop.

Phaeocystis pouchetii

This species occur in flagellate stage throughout the year in Danish waters with salinities of 10 o/oo and above. Blooms are observed in waters of salinities 29-34 o/oo. The colony formation and consequent blooms are observed during April-July and first and foremost in the North Sea - a Jutland current effect.

The blooms form a relatively recent phenomenon. Enquiries among fishermen a.o. along the West Coast of Jylland indicate that the now well known discolouration and ill-smelling, slimy foam formations along and on the beaches started early in the 1980'ies and are now here an annual phenomenon.

The blooms are of major concern to the tourist industry. 1988 the Danish Tourist Organization reports that 43% of the tourists complained on the aquatic environment. The number of tourists from FRG had decreased by 25%.

Also the fishery is effected. Fish migrate from blooms areas; gears and nets are covered by thick brown slime.

1988

<u>Locality</u>	<u>Period</u>	<u>Max. cell nos./liter</u>
Wadden Sea	May-June	1.700 mio.
North Sea Coast	April-June	404 -
		- 93 -

Recent observations indicate that Noctiluca graze on smaller Phaeocystis colonies and the Noctiluca blooms in several cases seem triggered by (follows) Phaeocystis blooms.

Prymnesium parvum

The species occurs in the all Danish waters. Blooms are recorded in April-June and only in local brackish waters.

Since 1938 only a few cases of fish mortality have been observed. None in 1988.

The toxicity monitoring programme

In the Limfjord the standard programme was operated from March 15th, 1988. At 6 stations, 1-5 mussel samples were analyzed for toxins and concurrent plankton samples taken with net (to certify presence or absence of Dinophysis) and in water samples, and analyzed for Dinophysis spp. Gouvaulax excavata, Goniodoma ostenfeldii. The standard plankton sampling was stopped on November 26th, 1988 (ref. however below). Frequency of sampling: minimum once a week.

PSP has been found in mussel samples on April 7th, 19th and on Sept. 5th in resp. concentrations 15 μg , 30 μg and 13,3 μg saxitoxin 100 g musselmeat i.i. far below accepted (Danish) level of 80 μg /100 g. These are the only records from Danish waters in 1988.

DSP tests indicated DSP in mussel samples during the first week of May (8,2 μg ocadaic acid) and during first week of August in 4 days in sequence. Further in June, week 23 and 24, 2 cases were observed in the Eastern Kattegat off Hov.

In August, the Fisheries Inspection was instructed by the Ministry of Fisheries that every mussel catch landed by individual

skipper be detained until receipt of a certificate issued by an authorized laboratory stating no PSP in the mussels has been received or that the receiving mussel processing company arrange identical certificate be presented to the Fisheries Inspection before release of the products. In consequence hereof all catches with DSP are destroyed/discharged.

All mussels products: live, frozen, canned or processed otherwise, are hereby coupled with certificates.

Cost of toxicity tests is to be paid by the individual skipper/-company.

The alert system functioned well, per September 20th, 1988, 237 mussel samples had been analyzed for DSP and 116 for PSP (ref. above).

DSP had been found in week 32 (4 days in mussel catches), and in week 34 (1 day) in the Limfjord, in week 33 and in 34 in a mussel area off Eastern Jylland (3 days and 1 day catches resp.). The catches were destroyed/discharged.

On Sept. 20th, 1988 the Fisheries Inspection Service reported that no DSP had been found in mussel samples since August 22nd. In consequence hereof the alert precautions were cancelled on Sept. 29th, 1988 except for the areas: The western Limfjord and the S.W. part of the Belt Sea (off S.E. Jylland), for which areas the system has been maintained.

In consequence of the experiences gathered the following legislation has been introduced by decree issued on December 22nd, 1988 by the Ministry of Fisheries: mussel fishery and landings are prohibited:

For the Wadden Sea, May 1st - June 30th, and outside this period on all Fridays and Saturdays.

For the Limfjord in July. During the other months on Sundays.

For each fishing boat fishing mussels a license must be issued by the Ministry of Fisheries. Valid for one specific territory and period per boat.

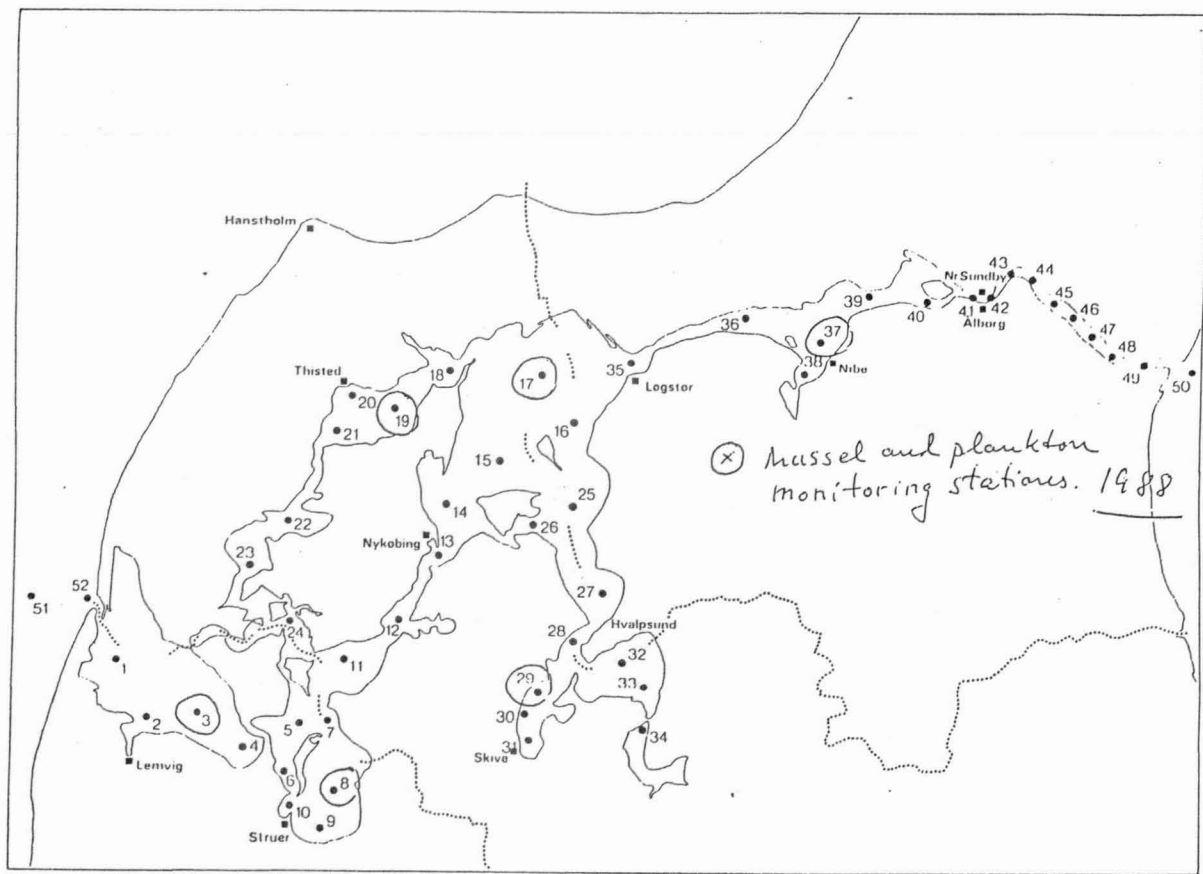


Fig. 1.

Institut für Meereskunde
an der Universität Kiel
Marine Planktologie
Prof.Dr.J.Lenz

Kiel, 14. März 1989
☎ (0431) 5 97 /3865
Ze/V1-851

Dr. Einar Dahl
Flodevigen Biological Station

N-4817 H i s
Norway

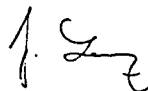
Re: Report on the occurrence of toxic algal blooms in German waters 1988

Dear Dr. Dahl,

During the last year, the German coast areas of the North Sea and Baltic Sea remained almost unaffected by toxic algal blooms. The only event which as a precautionary measure led to a temporary closing of the blue mussel harvest, was the occurrence of Dinophysis acuminata in the West and East Frisian Wadden Sea in summer and early autumn. This species was observed in water samples analysed by the responsible governmental institutions (Veterinärämter in Husum and Oldenburg).

Please, excuse the long delay of this small report. Perhaps it will be still possible to include it into your overview report.

Yours sincerely,



P.S.: Unfortunately, I will not be able to attend
the meeting in Nantes.

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REF. ICES WORKING GROUP ON EXCEPTIONAL ALGAL BLOOMS

NANTES, FRANCE, 11-14 APRIL 1989

FRANCE, NATIONAL REPORT ON 1988 ALGAL BLOOM STUDIES

P. LASSUS and P. GENTIER

1°) TOXIC OR RED TIDE FORMING DINOFLAGELLATES

1.1. Dinophysis (IFREMER, Nantes)

From the 1987 first attempts to simulate *Dinophysis* growth, it rapidly appeared a lack of biological datas. Thus, in 1988, a special attention was paid to vertical migration patterns and to winter crop.

Vertical migration occurs, even in poorly stratified areas (Antifer, Normandy coast) with max. ascendant and descendant migration rates of respectively 0.7 and 1.11 m.h⁻¹. Winter crop is very low (less than 5 cells.l⁻¹) in embayments as well as in offshore areas of Southern Brittany coast. No special winter stage (cyst or dormant-cell) was observed. Further attempts to simulate *Dinophysis* growth rates in Summer were made in 1988, from datas recorded in Vilaine bay or in Antifer oil tankers port. A box model gave the best results, but if the role of waters stability index is corroborated, neither biological (encystment, grazing and migration processes) nor physical (advection, stratification) parameters can completely explain the summer sharp rises in cells densities. Thus, hypothesis of micronutrients as growth promoters is strengthened by the results of June prospection cruise on Atlantic coast (water samples for *Dinophysis* counts were taken at 6 different depths and at 56 stations), but only for embayments and estuaries.

A monthly monitoring of DSP toxins in 3 shellfish production areas of Channel and Atlantic coasts showed no interference between toxicity and mussels physiological stages.

HPLC analyzes of okadaic acid in Antifer phytoplankton extracts revealed significative amounts (4.8 µg.) of O.A. for 500 000 cells of *D. acuminata*. As a last point, decontamination experiences with DSP contaminated mussels from several locations presumably indicated a quick loss of toxicity for initial toxic levels of 1 M.U./g. hepatopancreas or more, and no clear loss of toxicity in 12 days for 0.5 M.U./g hp. or less (2 to 3 µg O.A.).

1.3. Alexandrium minutum (results of Concarneau IFREMER Laboratory and Paris LCHA *) .

An *Alexandrium minutum* red tide ($2.3 \cdot 10^6$ cell.l⁻¹) was observed in late august 1988 in a french Northern Brittany fjord (Aber Wrach). Mussels, oysters and clams were contaminated by PSP toxins as demonstrated by AOAC mouse assays and HPLC analyzes of shellfishes during decontamination period. Highest observed toxic levels for mussels and oysters were respectively 405 µg/100 g and 255 µg/100 g meat. GTX₂ and GTX₃ were dominant gonyautoxins in both shellfishes while GTX₈ and 8p were only detected in mussels. Toxic contribution of GTX₃ is important owing to its letal property. During decontamination period, GTX₃ amounts decreased rapidly and GTX₂ slowly. This last toxin is supposed to hinder detoxication of shellfishes.

1.4. Phaeocystis pouchetii (Roscoff, Marine Biological Station - Caen, University - IFREMER Laboratory of Boulogne) .

A field survey of *Phaeocystis* blooms is performed by several french Lab. in the frame of a EEC international research project. French eastern and western coasts of the english Channel are prospected for common hydrological parameters related to *Phaeocystis* occurrences. From 10 years datas recorded in the vicinity of Gravelines site (nuclear power plant plume) a model was tentatively drawn. Roscoff site, despite relevant hydrological features (a relative increase in nitrogen outputs) was never concerned by *Phaeocystis* blooms and is thus considered as a reference site. Taxonomical studies are carried out on several strains of *Phaeocystis* cultivated in Caen University, and these cultures are also used for exhaustive physiological and cytological studies.

* LCHA : Laboratoire Central d'Hygiène Alimentaire.

1.2. Gyrodinium aureolum (IFREMER, Brest ; Roscoff, Marine Biological Station)

Unlike to years 1983, 1985 and 1987, G. aureolum never reached densities exceeding 500 000 cells.l⁻¹ since max. observed value in 1988 was 150 000 cells.l⁻¹ in Brest bay. Nevertheless, shellfish recruitment in this area was as low as during the years where Gyrodinium summer densities were high. This observation needs further work in order to invalidate the presumed inhibitory effect of Gyrodinium blooms on scallops post larval growth. Horizontal extension of Gyrodinium during summer 1988 was restricted to western Brittany.

An experimental work aiming to demonstrate a toxic or inhibitory effect of G. aureolum mass cultures on Pecten maximus post larvae was ran out in 1988. Unfortunately the cultivated strain showed a loss of toxicity when compared to 1987 first experimental results. On the other hand, inhibition of diatoms growth by G. aureolum ectocrin substances was corroborated by recent studies despite, here too, an observed loss of inhibitory effect when compared to 1987 results and 1988 results from the field. No relationships between both type of toxic effects has been as demonstrated until now.

At last, NO₃ uptake of G. aureolum expressed as Ks showed that this dinoflagellate is unable to satisfactorily use low N concentrations. Thus, nutrient assimilation capabilities cannot by themselves explain the observed dominance of this algae during red tide period.

Two red-tide forming naked dinoflagellates, Gymnodinium nagasakiense (Japanese clone) and Gyrodinium cf. aureolum (french clone), were compared with regard to their external morphology, chromosome number and DNA content. If these two species are morphologically indistinguishable, in contrast, when observing the shape and position of the nucleus, and the DNA content, it appears that G. aureolum and G. nagasakiense differs and that the strain of G. aureolum, here studied, differs from the original description of this species. Nevertheless, G. aureolum and G. nagasakiense can be considered as the same species if ordinary taxonomical parameters are used.

Cytotoxicity tests realised on G. nagasakiense proved this species to be slightly toxic, as previously observed with G. aureolum.

LOCATION	DATES	EFFECTS GENERAL FEATURES	CAUSATIVE SPECIES	CONCENTRATIONS (cells.l ⁻¹)	ENVIRONMENT
Northern France (Gravelines)	05.88	Discolored water	<i>Pseudoisys pouchetii</i>	-	-
Some Bay	21.06.88 to 30.06.88	Pink and reddish water	<i>Noctiluca scintillans</i>	3 000 000 to 2 209 000	T : 17°C
Northern Brittany (Rance Estuary)	27.05.88 to 08.06.88	Brown-red water	<i>Rhizosolenia delicatula</i>	816 000	T : 14 to 14,6°C S : 30,1 to 31,5 ‰
Northern Brittany (Morlaix Bay)	24.06.88 to 27.06.88	Green water	Chlorophyceae	87 900	T : 17,7 to 18,6°C S : 33,6 ‰ O ₂ : 110,2 to 128,1 Turb : 2,5 NTU
Northern Brittany (Abers)	15.08.88 to 10.09.88	- Red water - Ban of shellfishes marketing (toxicity PSP)	<i>Alexandrium minutum</i>	2 300 000	T : 14,2 to 16,9°C S : 30,1 to 31,0 O ₂ : 97 to 135,3 Turb : 0,1 to 1,5 NTU
Brest Bay (Etern)	23.08.88 to 25.08.88	Reddish water	<i>Prorocentrum micans</i>	2 000 000	T : 15,6 to 18,2°C S : 28,1 to 31,7 ‰ O ₂ : 111 to 171 ‰
Southern Brittany (Groix Island to Etel river)	16.05.88 to 17.05.88	Pinkish water	<i>Noctiluca scintillans</i>	-	T : 11,0°C S : 29,5 ‰ Turb : 1,1 NTU
Southern Brittany (Belle-Ile Island)	08.09.88 to 22.09.88	Green water	<i>Scenedesmus</i> <i>Gyrodinium</i> <i>Prorocentrum micans</i>	38 000 - -	-
Southern Brittany (Quiberon Bay)	16.05.88 to 17.05.88	Pinkish water	<i>Noctiluca scintillans</i>	-	T : 11,9°C S : 32,1 ‰ Turb : 0,1 NTU
Southern Brittany (Auray River)	16.05.88 to 17.05.88	Pink and orange water	<i>Noctiluca scintillans</i>	-	-
Southern Brittany (Morbihan Gulf)	16.05.88 to 17.05.88	Pinkish water	<i>Noctiluca scintillans</i>	-	-
Southern Brittany (near Morbihan Gulf)	18.08.88	Yellow-green water	Chlorophyceae	?	T : 20,2°C S : 34,0 ‰
Vilaine Bay	26.04.88	Discolored water	<i>Chlorella</i>	152 000 to 795 200	T : 14,0°C S : 28,6 ‰ Turb : 2,1 NTU
Vilaine Bay and Loire Estuary	21.07.88 to 12.09.88	Green water	<i>Gyrodinium</i> sp.	up to 40 000 000	T : 18,2 to 20,3°C S : 29,1 to 30,5 ‰ Turb : 1,5 NTU
Atlantic coast (Yeu Island)	26.05.88	Discolored water	Different little flagellates	-	-
Atlantic coast (Yeu Island)	28.07.88	Brown water	<i>Gyrodinium aureolum</i> ?	132 200	S : 34,9 ‰
Atlantic coast (Sables d'Olonne, Aiguillon Bay)	13.08.88 to 07.09.88	Green water Fish and shell-fishes mortalities	<i>Gyrodinium</i> sp.	up to 18 350 000	-
Atlantic coast (Oleron Island)	23.08.88 to 19.09.88	Green water	<i>Gyrodinium</i> sp.	730 000 to 290 000 000	T : 17,6 to 22,4°C S : 32,7 to 33,9 ‰ O ₂ : 104 to 130 ‰ Turb : 3,5 to 16 NTU
Atlantic coast (Arcachon)	05.10.88 to 14.10.88	Discolored water	Chrysophyceae	-	-
Mediterranean coast (Berre lagoon)	25.01.88	Brown water	<i>Prorocentrum minimum</i>	5 715 000	T : 15,2°C S : 5 ‰ Turb : 7 NTU
Mediterranean coast (Berre lagoon)	22.07.88	Brown water	<i>Prorocentrum minimum</i>	9 500 000	T : 26,7°C S : 6,3 ‰ O ₂ : 11,7 mg/l Turb : 13 NTU

OCCURENCES OF DSP WITH BAN OF SHELLFISHAN MARKETING ALONG FRENCH COASTS IN 1988

LOCATION	DATES	CAUSATIVE SPECIES	CONCENTRATIONS (Cells. l ⁻¹)	ENVIRONMENT (at the beginning of the phenomenon)
Normandy (Fecamp - Fletat - Antifer)	29.08 ^a to 30.09	<i>Dinophysis acuminata</i>	-	-
Normandy (Antifer to Barfleur headland)	13.07 to 05.08	<i>Dinophysis acuminata</i>	Up to 23 500 (Antifer) (average 2 000 to 3 000)	T : 16 to 16,8°C S : 30,2 to 31,8 ‰
Normandy (from Orne to Sculles river)	15.06 to 05.08	<i>Dinophysis acuminata</i>	Up to 12 700 in general 400 to 600	T : 15,5 to 16,40°C
Normandy (Barfleur)	24.06 to 25.07	<i>Dinophysis acuminata</i>	Up to 700	T : 14,5°C
West Brittany	16.06 to 30.06	<i>Dinophysis sacculus</i>	Up to 400	T : 16°C S : 34,5 ‰
Douarnenez Bay	02.06 to 13.07	<i>Dinophysis sacculus</i>	Up to 2 800 average 200	T : 15,4°C S : 31,2 ‰
Concarneau Bay	23.06 to 08.07	<i>Dinophysis sacculus</i>	Up to 700	T : 17,5°C S : 32 ‰ Turb : 2 NTU
Southern Brittany (Aven and Belon Rivers)	20.05 to 02.06	<i>Dinophysis sacculus</i>	Up to 2 400 in Aven river	T : 15°C S : 29 ‰ Turb : 3 NTU
			Up to 800 in Belon river	T : 15,5°C S : 30 ‰ Turb : 4,5 NTU
Orlent Bay	02.06 to 30.06	<i>Dinophysis sacculus</i>	Up to 1 300	T : 17°C S : 29 ‰ Turb : 25 NTU
Etel river	02.06 to 16.06	<i>Dinophysis sacculus</i>	Up to 3 900	T : 15°C S : 32,4 ‰ Turb : 2,7 NTU
Belle Isle Island	02.06 to 07.07	<i>Dinophysis sacculus</i>	Up to 500	-
Vilaine Bay (upstream)	02.06 to 07.07	<i>Dinophysis sacculus</i>	Up to 20 400 generally 2 000 to 3 000	T : 17°C S : 16 ‰ Turb : 28 NTU
	and 28.07 to 11.08		Up to 7 800	T : 19,6°C S : 28,1 ‰ Turb : 8,7 NTU
North of Vilaine Bay	02.06 to 07.07	<i>Dinophysis sacculus</i>	Up to 11 400 generally 2 000 to 3 000	T : 16°C S : 20 ‰ Turb : 31 NTU
South of Vilaine Bay	27.05 to 07.07	<i>Dinophysis sacculus</i>	Up to 13 300 generally 2 000 to 3 000	T : 16,4°C S : 28,4 ‰ Turb : 3,5 NTU
	and 22.07 to 11.08			T : 18,2 S : 32 ‰ Turb : 1,9 NTU
Arzoe (Yeu Island)	17.06 to 22.07	<i>Dinophysis sacculus</i>	-	-
Ouessen (Urhins pond)	22.01 to 06.05	<i>Dinophysis sacculus</i>	700 to 2 200	T : 17,9°C S : 33,9 ‰ Turb : 2 NTU Q _z : 104,5 ‰

ICES Working Group on Harmful Effects of Algal Blooms on
Mariculture and Marine Fisheries - National Report

Ireland 1988

DSP

- 1) Locations: Southwest coast of Ireland - Roaringwater Bay, Dunmanus Bay, Bantry Bay, Kenmare Bay and Dingle Bay (Ventry)
- 2) Dates 6 June 1988 - 8 November 1988
- 3) Effects
 - DSP in mussels on suspended rope culture at all depths
 - Maximum toxicity Rat bioassay (+++) Mouse bioassay (+++)
 - Okadaic acid (max 201 ug/100g total mussel meat) in all samples tested
 - DTX1 (max 25ug/100g total mussel meat) in four of the samples detected by M. Hageltorn, Sweden using HPLC
 - No human illness due to early detection
- 4) Management decisions:

Areas closed for harvest of bivalves until two successive weeks clear of toxin.

<u>Area</u>	<u>Periods of Toxicity</u>	<u>Maximum toxicity</u>
Roaring W. Bay	27.06.88 - 29.08.88	++
Bantry Bay		
- Glengarrif	7.06.88 - 29.08.88	+++
- Bantry W.I.	7.06.88 - 15.08.88	+++
- Castletown- bere	7.06.88 - 05.09.88	+++
Kenmare Bay		
- Ardgroon Hb	13.06.88 - 29.08.88	+
- Kilmakilloge	13.06.88 - 12.09.88	+++
- Sneem	4.07.88 - 5.09.88	++
Dingle Bay		
- Ventry	8.08.88 - 24.10.88	+++

5) Causative species

Dinophysis acuminata max 1500 cells/litre and D.acuta max 240 cells/litre. Cell counts generally less than 500 cells/litre. Very few recorded after end of August. Other spp present P.micans, Ceratium fusus and Gonyaulax triacantha

6) Environment

- Onset of toxicity about six weeks earlier than in previous years. Weather in preceding weeks exceptionally sunny and warm. Heavy rainfall week ending June 4th
- Temperature 12.5 C (June)
- No other physical measurements taken
- No evident changes in water coloration

7) Physical location Mussel longlines in sheltered bays8) Previous occurrences 1984 and 1987 August - November9) Comments: Early onset and protracted closures caused trade disruption. Fortunately most areas cleared before significant losses of stock. Distribution and toxin levels very similar to 1987 event.Other bloom eventsPhaeocystis pouchettiLocation

- 1) Widespread bloom occurred on south coast from Ardmore Bay to the west and Tramore Bay to east side of Waterford coast. (see attached map).
- 2) Dates 15-19 June 1988
- 3) Effects Nuisance smells and fouling of beaches. Some reports of skin irritation in swimmers and fishermen.
- 4) Management decision - None required except reassurance to Public Health and Local Authorities.
- 5) Causative species: Phaeocystis pouchetti
- 6) Environment Open sea/coast. Two weeks of calm sunny weather preceded by heavy rains. No other data available.
- 7) Previous occurrences Irish Sea 1931, Waterford region 1981 and 1982, East coast 1984.

Gonyaulax sp.

- 1) Location Cork Harbour, South coast
- 2) Date 10 - 17 August 1988
- 3) Effects
 - Patchy distribution of red water
 - No human health problems reported
 - PSP negative for oysters and mussels
- 4) Management decision: None required

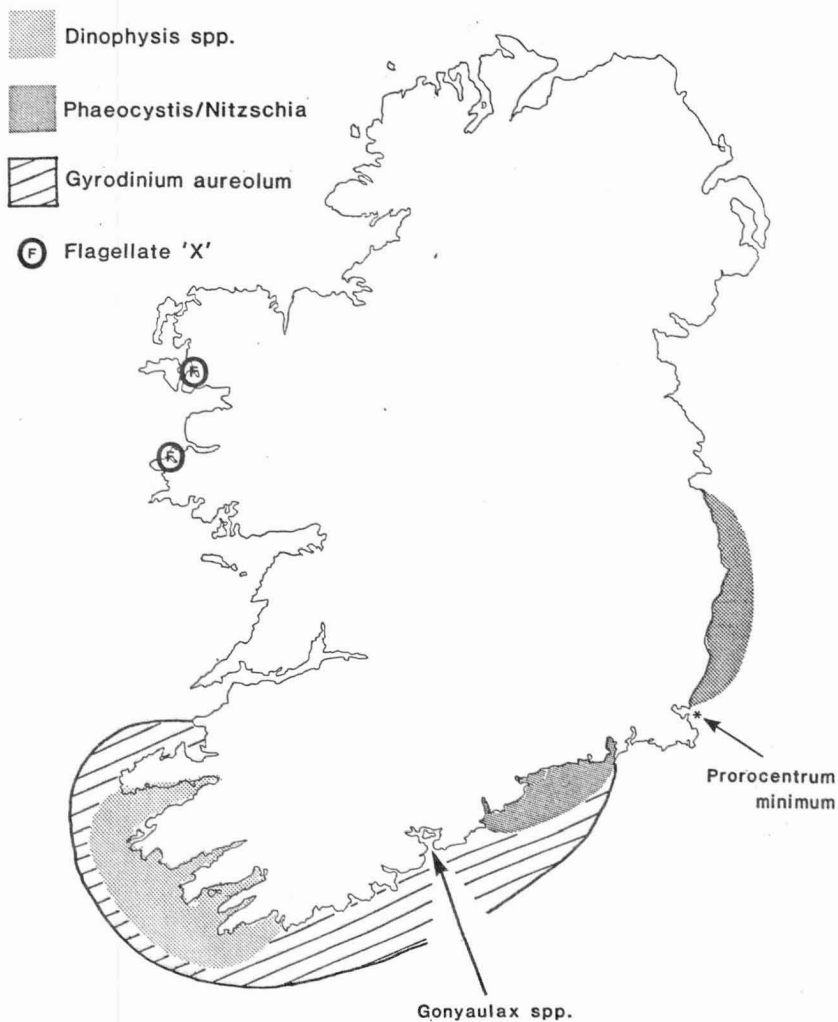
- 5) Causative species: Gonyaulax spinifera maximum 1.14 x 10 cells/litre
- 6) Environment: No data available
- 7) Previous occurrences: June 1984 and 1985 June/July 1987
- 8) Comments

As with previous occurrences this species bloomed briefly and in very localised areas of the Harbour possibly concentrated in shallow bays by tide and wind.

Individuals to contact: J. Doyle/P. McDaid,
Fisheries Research Centre,
Abbotstown, Castleknock,
Dublin 15
Ireland

Tel No: 210111 Telex: 31236 FRC EI
Fax: 205078

IN IRISH COASTAL WATERS 1976 - 1988



ICES WG, Nantes 11-14 April 1989

Report on Blooms in Norway

Chrysochromulina polylepis

1. Location: Along the coast from the Swedish border to Haugesund at the west coast, and in the open Skagerrak.
2. Dates: From the beginning of May to the beginning of June 1988.
3. Effects: Severe mortalities among encaged fish, even wild fish and invertebrates living along the coast in the upper 10-15 m were killed. Also some seaweeds, mainly red algae were damaged during the bloom. Toxins were accumulated in mussels and harvesting was banned.
4. Management: Towing of about 120 fish farms from the west coast skerryguard into the large fiords to save the fish from exposure of algal water.
5. Causative organism: *Chrysochromulina polylepis*
6. Environment: The bloom occurred in the surface of strongly stratified waters of relatively high temperature and low salinity during a period with bright and calm weather. The concentrations of nutrients were normal (relatively low), however, atomic N:P was high, from about 20 to more than hundred.
7. Advectioned population or in situ growth: Probably a combination, mainly in situ growth in the eastern part of Skagerrak and more an advectioned population on the west coast of Norway.
8. Previous occurrences: Yes, but in low concentrations only.
9. Additional comments: The bloom caused much and unexpected damage to marine life and public attention. Many reports on the bloom are already available or under preparation.
10. Individual to contact: E. Dahl, Flødevigen Biological Station, N-4817 His, phone 041 10580.

Gyrodinium aureolum

1. Location: The Norwegian coast from the Swedish border to the Trøndelag area at the north-west coast.
2. Dates: The middle of August to the end of October 1989.
3. Effects: Patches of brownish water were recorded all along the coast and some encaged fish exposed to such patches were killed.
4. Management: At a few sites cages were towed a short distance out of the most dense patches of brown water.

5. Causative species: Mainly *Gyrodinium aureolum* , but *Ceratium furca* also caused brownish patches along the coast, the latter without severe mortalities.

6. Environment: The dense concentrations were mainly restricted to the upper 2-3 m. The distribution was very patchy, accumulation of cells in bays due to wind driven surface currents. The precipitation along the coast was above the normal before and during the bloom.

7. Advected population or in situ growth: The most dense surface populations were due to on site concentration of cells by physical and migration mechanisms. Compared to previous occurrences of this alga along the Norwegian coast the bloom in 1988 was probably due to growth along the coast rather than advection of off-shore populations.

8. Previous occurrences: Mass occurrences of *G. aureolum* have previously been recorded along the Norwegian coast in 1966, 1976, 1981, 1982 and 1985. The bloom in 1988 propagated further north along the west coast than before.

9. Additional comments: -

10. Individual to contact: E. Dahl, Flødevigen Biological Station, N-4817 His, phone 041 10580.

PORTUGAL

RED TIDES AT COASTAL WATERS 1988

(without harmful effects)

1. and 2. Location and dates of occurrences:

- a) Ria Formosa Lagoon (Favira) - March 10
- b) Ericeira - June 22
- c) Inner branch of Óbidos Lagoon (Barresa) - June 25 - 30
- d) São Martinho de Porto Bay - August 3 - 10

3. Effects: Oxygen deficiency observed at several localities in the early morning.
Fish kills : NONE

4. Management decisions:

5. Causative species:

- a) Favira: Glenodinium feliaeum 10×10^6 cells/l
Euglenidae 6.8×10^6 cells/l
(water sample also rich in Melosira spp)
- b) Ericeira: Oxyrrhis marina 1.4×10^6 cells/l
Other counts: Ciliates 0.2×10^6 cell/l ; small flagellates 2.9×10^6 /l
- c) Barresa: Prorocentrum minimum max. 3.7×10^7 cells/l on the 27.
Other counts: little centric diatoms 3.3×10^7 /l ; small flagellates 7.3×10^6 /l.
- d) S. Martinho Bay: Heterosigma akashiwo max. 9.7×10^6 cells/l on the 9.
Other counts: Skeletonema costatum 2×10^6 /l ; small flagellates 3.7×10^6 ;
Dinoflagellates 0.2×10^7 /l.

6. Environment:

- a) Temp. 18-4°C ; sal. 16‰ ; water discoloration : greenish-brown.
- b) Temp. 16-18°C ; sal. 35‰ ; discoloration: milky brownish-green
- c) Temp. 16-18°C ; sal. 22-25‰ ; discoloration: brownish-green
- d) Temp. 16-18°C ; sal. 34-35.5‰ ; discoloration: intense brown

7. Physical location:

- a) Probably in situ growth as well as b) and c)
- d) Probably advected from offshore and concentrated inside the Bay associated with some in situ growth.

8. Previous occurrences :

- a) In the same region 1986 and 1987 ; at Sides Lagoon several times in the last decade.
- b) First report for an open coastal zone ; frequent in fish ponds.
- c) Frequent at Óbidos Lagoon and Albufeira Lagoon.
- d) Cascais Bay 1982 ; Albufeira Lagoon 1987 ; mariculture ponds at Ria Formosa Lagoon (Algarve coast) 1987.

9. Additional comments :

- d) Heterosigma akashiwo has been associated with fish kills in other countries, in the Portuguese case only in the mariculture ponds at Algarve 1987 there was some mortality ,this may be attributed to the confinement of the animals in the ponds.

10. Individual to contact:

M. A. de M. Sampaio
INIP
Av. Brasília 1400 Lisboa PORTUGAL

PORTUGAL

BLOOM AFFECTING FISH AND SHELLFISH 1988

(mortalities)

1. and 2. Location and date of occurrence:

- Óbidos Lagoon March 20 to April 6

3. Effects: The fish seemed stressed and avoided the discoloured water at beginning.
Large mortalities in fish and shellfish in the subsequent days.

4. Management: None

5. Causative species: Prymnesium parvum max. 7×10^7 cells/l on the 30;

other counts: Skeletonema costatum 4×10^7 /l ; and 2×10^6 cells/l of other little diatoms and small flagellates.

6. Environment: Temp. 12 - 16.5°C ; sal. 14.5 - 19‰ ; Water discoloration brownish.

Dredging of channel to the sea to open the Lagoon which was closed between 13 and 16 of March.

7. Physical location : in situ growth.

8. Previous occurrences: 1972 Óbidos Lagoon

1987 Inside fish ponds at Aveiro Lagoon.

9. Additional comments: Mortalities associated with Prymnesium spp blooms at Portuguese coastal zones are always related with salinities lower than 30‰.

10. Individual to contact:

M. A. de M. Sampaio

INIP

Av. Brasília 1400 Lisboa PORTUGAL

No other physical parameters taken

Water colouration - no evident change

7. Physical location : In situ exocystment must be the most important factor at most locations.

8. Previous occurrences : 1986, 1987 .

9. Comments : Similar situation to 1987 ; however the problem is expanding down South. PSP toxins were for the first time detected outside Setubal. Toxin levels lower.

10 Individual to contact:

- Carmen Lima and M. A. de M. Sampaio
INIP Av. Brasilia 1400 Lisboa PORTUGAL

- Suzana Franca
INSA 1699 Lisboa Cedex PORTUGAL

PSP 1988 (PORTUGAL)

1. and 2. Location and dates of occurrences:

- a) Off Espinho and northern coast 24 Aug. - 3 Nov. (max. 127 ug)
- b) Aveiro Lagoon and coast 13 Aug. - 15 Nov. (max. 159 ug, Nov. 2)
- c) Mondego Estuary and coast 1 Aug. - 13 Dec. (max. 173 ug, Oct. 3, Dec. 13)
- d) Óbidos Lagoon 5 Aug. - 24 Oct. (max. 66 ug/100g)
- e) S. Martinho Bay Aug. 8 - Oct. 27 (max. 40 ug/100g)
- f) Off Setúbal Aug. 3 - Oct. 24 (max. 50 ug/100g)

3. Effects: All bivalve molluscs affected (max. 173 ug/100g)

No human illness reported.

4. Management decisions: Harvesting of shellfish banned when toxin level upper than 80 ug/100g

5. Causative species: Gymnodinium catenatum

- a) First occurrence Feb. 17: 100 cells/l ; toxin detection: none
Max. 16 000 cells/l on Oct. 20, being the dominant species in the sample followed by Dinophysis acuta (11 500 cells/l)
Other counts mostly in range 500 - 2000 cells/l
- b) First occurrence Feb. 22: 450 cells/l ; toxin detection: none
Regularly in the phytoplankton between Jul. 20 and Nov. 15.
Max. 12 000 cells/l on Oct. 18, dominant species D. acuta (24 000 cells/l).
Other counts mostly in the range 500 - 7000 cells/l
- c) First occurrence Jun. 14: 500 cells/l - toxin level 50.4 ug/100g in Scribicularia plana.
Max. 13 000 cells/l on Aug. 9 being the dominant species followed by D. acuta (6 500 cells/l).
Other counts mostly in the range 500 - 3000 cells/l
- d) First occurrence Jul. 27: 500 cells/l ; toxin detection: none.
Regularly in the phytoplankton until Oct. 3.
Max. 2 000 cells/l on Aug. 2, dominant species Skeletonema costatum (4 x 10⁶ cells/l).
Other counts in the range 200 - 1000 cells/l until Oct. 12.
- e) First occurrence Aug. 4: 100 cells/l ; toxin detection: none
Max. 2500 cells/l plus 1500 cysts/l on Oct. 18 (scanty sample).
Other counts : regularly in the phytoplankton during August in the range 100 - 2000 cells/l. In September 14 (1500 cells/l) After, only the above maximum.
- f) First occurrence March 13: 200 cells/l ; toxin detection: none.
Max. 2000 cells/l on Jul. 21, dominant species Chaetoceros spp. always sporadic and in the range 300 - 500 cells/l until 16 Nov.

6. Environment : Temp. 13 - 18° C

Sal. 20 - 35.5 ‰

pH 7.8 - 8.1

6) Environment: Temp. 16 - 22° C

Sal. 26 - 35.5 ‰

pH 7.8 - 8.2

No other physical measurements taken

Water colouration - no evident change

7) Physical location : bivalve mollusc beds

8) Previous occurrences : 1987

9) Comments : Very patchy distribution. Toxicity in bivalve molluscs generally detected two weeks after Dinophysis acuta and/or D. sacculus appear in the phytoplankton.

The problem at Portuguese coast is expanding to South.

10) Individual to contact:

- Carmen Lima and M.A. de M. Sampaio
INIP, Av. Brasília 1400 Lisboa PORTUGAL

- Suzana Franca
INSA, 1699 Lisboa Cedex PORTUGAL

(1) In Sorbieularia plana a bivalve mollusc growing at river Pranto, Mondego Estuary, there are positive results for DSP almost all around the year. The first positive result for 1988 it was on April 20; the harvesting of this species from the area is banned.
We can't find any relation between this toxicity and phytoplankton.

DSP 1988 (PORTUGAL)

1. and 2. Location and date of occurrence:

- a) Off Espinho and northern coast 20 Jul. - 16 Nov.
- b) Aveiro Lagoon and coast 13 Jul.- 6 Dec.
- c) Mondego Estuary⁽¹⁾ and coast 1 Aug.- 6 Dec.
- d) Óbidos Lagoon 3 Aug.- 1 Nov.
- e) S. Martinho Bay 28 Aug - 24 Oct.
- f) Off Setúbal 6 Sept.- 18 Oct. - 27 Oct.

3. Effects: All bivalve molluscs affected; toxin levels and retention time depending on species.

Maximum toxicity (Mouse assay, Yasumete 1986) +++

No human illness reported.

4. Management decisions: Harvesting of shellfish banned

5. Causative species:

- a) Dinophysis acuta; First occurrence July 6: 300 cells/l ;
max. Oct. 20 : 14 000 cells/l
D. sacculus ; First and only detection Sept. 6: 1000 cells/l
- b) D. acuta ; First detection June 14: 100 cells/l ;
max. 25 600 cells/l Sept. 27
D. sacculus ; First detection April 20 , Second detection Jul. 7 .
Both 100 cells/l
- c) D. acuta ; First detection July 13: 100 cells/l ;
max. Aug. 9: 13 000 cells/l
- d) D. sacculus ; First occurrence Jul. 26: 7000 cells/l = max.
D. acuta ; First occurrence Jul. 13: 500 cells/l ;
max. 4000 cells/l Aug. 2
- e) D. acuta ; First occurrence Aug. 8: 2500 cells/l = max.
- f) D. acuta ; First occurrence June 28: 500 cells/l = max.
D. sacculus ; First and only detection Jul. 21: 300 cells/l

Other counts mostly in range 100 - 2000 cells/l. Relation between cell numbers and toxicity depending on the density of the most toxic accompanying species.

Toxicity detection in bivalve molluscs at least a fortnight after first occurrence of toxic species in the phytoplankton of the affected areas.

PORTUGAL

LIST OF SPECIES WITH HARMFUL EFFECT (PSP , DSP , ICTYOTOXINS)

PSP: Alexandrium lusitanicum (ex Gonyaulax tamarensis)

Óbidos Lagoon 1958, 1959, 1962

Gymnodinium catenatumCoastal areas Northern from Carvoeiro Cape 1986, 1987
" " " " " plus Setúbal area 1988DSP: Dinophysis sacculusÓbidos Lagoon , Aveiro Lagoon and coastal areas Northern from Aveiro
1987, 1988
Setúbal coastal zone 1988Dinophysis acutaMénfega Estuary and coastal zone, all Northern coast 1987, 1988
Setúbal coastal zone 1988.Prorocentrum minimum (ex P. balticum)

Óbidos Lagoon 1958, 1961, 1962

Prorocentrum lima

Ria Formosa Lagoon 1988

Ichthyotoxins: Prymnesium spp

Óbidos Lagoon 1972, 1988

Aveiro Lagoon (inside fish ponds) 1987

Amphidinium carterae

Sado Estuary (inside fish ponds) 1977

Ria Formosa Lagoon (inside mariculture ponds) 1987

Heterosigma akashiwo (ex Olisthodiscus luteus)

Ria Formosa Lagoon (inside mariculture ponds) 1987

NOTE: I am not listing species which very dense blooms have had an anoxic effect inside fish ponds.

Individual to contact: M.A. de M. Sampaio
INIP
Av. Beira-Mar
1400 LISBOA

ICES Working Group on Harmful Effects of Algal Blooms on
Mariculture and Marine Fisheries

Nantes, France, 11-14 April 1989

Spain Annual Report for 1988

1. Location
Ría de Ares y Betanzos (North of Galicia)
2. Dates of occurrence
14 April - 3 May
3. Effects
No toxic effects reported
4. Management Decisions
Warning
5. Causative Species
Dinophysis acuminata
Maximum concentration reported: 6,600 cells/liter
6. Environment
Temperature: 15.5 °C
7. Adected population or in situ growth
No data
8. Previous occurrences
Common species
9. Additional comments
10. Individual to contact
M^a Jesús Cármos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

1. Location
Galician rias. (NW of Spain)
2. Dates of occurrence
Mid July to September
3. Effects
PSP toxicity in shellfish
4. Management Decisions
Shellfish quarantine for 3 to 8 weeks in different areas according with the toxicity.
5. Causative Species
Gymnodinium catenatum
Maximum concentration reported: 36,100 cells/liter
6. Environment
Temperature: 13.5 - 18.0°C
7. Advected population or in situ growth
Probably in situ growth
8. Previous occurrences
Many times after the first occurrence in 1976
9. Additional comments
This was not the typical bloom of G. catenatum in mixed surface waters that usually blooms in the fall.
10. Individual to contact
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain.

Mã Jesús Campos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

1. Location
Ría de Ares y Betanzos
2. Dates of occurrence
August, 2
3. Effects
No shellfish toxicity was reported
4. Management Decisions
Warning
5. Causative Species
Dinophysis acuminata
Maximum concentration reported: 5,800 cells/liter
6. Environment
Temperature: 17.8 - 18.8°C
7. Advected population or in situ growth
No data
8. Previous occurrences
Common species
9. Additional comments
10. Individual to contact
M^a Jesús Campos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

1. Location
Ría de Ares y Betanzos (North of Galicia)
2. Dates of occurrence
September, 5
3. Effects
Slight paralytic shellfish toxicity.
4. Management Decisions
Warning. No closures as toxin concentrations were below quarantine levels
5. Causative Species
Alexandrium lusitanicum
Maximum concentration reported: 74,000 cells/liter
6. Environment
Temperature: 18.2 °C
7. Advected population or in situ growth
No data
8. Previous occurrences
1984
9. Additional comments
10. Individual to contact
M^a Jesús Campos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

1. Location
Rías Bajas
2. Dates of occurrence
November
3. Effects
No effects reported.
4. Management Decisions
At this time, most of the culturing areas were closed for harvesting due to PSP.
5. Causative Species
Dinophysis acuta
Maximum concentration reported: 7,440 cells/liter
6. Environment
Temperature: 15 -16 °C
7. Advected population or in situ growth
Both mechanisms
8. Previous occurrences
Common species
9. Additional comments
10. Individual to contact
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain.

Ma Jesús Cárpos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

1. Location
Rías Bajas (West of Galicia)
2. Dates of occurrence
November
3. Effects
PSP toxicity in shellfish
4. Management Decisions
Stop harvesting in areas of more than 80 um/100g meat
5. Causative Species
Gymnodinium catenatum
Maximum concentration reported: 21,200 cells/liter (Vigo)
6. Environment
Temperature: 15 - 16°C
7. Advectioned population or in situ growth
Both mechanisms.
8. Previous occurrences
Since 1976. Last bloom two months before.
9. Additional comments
The typical bloom conditions of this species.
10. Individual to contact
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain.

Ma Jesús Cármos
Instituto Español de Oceanografía
Apdo. 130, 15080 La Coruña, Spain.

CHRYSOCHROMULINA BLOOM ALONG THE SWEDISH WEST COAST

SWEDEN 1988

LOCATION	The Kattegat, the Skagerrak, the Öresund
DATES	May to mid June
EFFECTS	Severe damage to marine life, including fish, mollusca, macro algae and probably zooplankton
MANAGEMENT DECISION	Transportation of fish cages into fjords, or river mouths in order to reach low saline water, where the causative organism obviously did not have a toxic effect. Considerable monitoring in order to know the distribution of the organism.
CAUSATIVE SPECIES	Chrysochromulina polylepis (maximum records of c. 80 million cells/L. Common concentration c. 10 million cells/L)
ENVIRONMENT	Present in salinities of 8-30 ‰ and temperatures of c. 10-15 °C.
PREVIOUS OCCURRENCES	Probably normal component of the flora, but not reported as a bloom forming species.
ADDITIONAL COMMENTS	This bloom also affected Norwegian and Danish waters.
INDIVIDUAL TO CONTACT	Odd Lindahl, Rutger Rosenberg and Anna Bisther, Kristineberg Marine Biological Station S-450 34 Fiskebäckskil, Sweden. tel. 46-523-22087, fax. 46-523-22871. Bo Sundström and Lars Edler, Dept. of Marine Ecology, Univ. of Lund, Box 124 S-221 00 Lund, Sweden. tel 46-46- 108366, 108371, fax. 46-46-146030.

RED TIDE ON THE SWEDISH WEST COAST

SWEDEN 1988

LOCATION	Göteborg and Tjörn area
DATES	September-October
EFFECTS	Fish kills. Caged rainbow trout and eel affected
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Gyrodinium aureolum (c. 10 million cells/L)
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Frequent blooms during the 80-ies.
ADDITIONAL COMMENTS	-
INDIVIDUAL TO CONTACT	Odd Lindahl, Kristineberg Marine Biological Station S-450 34 Fiskebäckskil, Sweden. tel. 46-523-22087, fax. 46-523-22871.

RED TIDE ON THE SWEDISH WEST COAST

SWEDEN 1988

LOCATION	Gullmar Fjord
DATES	20-30 August
EFFECTS	no effects
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Gyrodinium aureolum (3 million cells/L) Ceratium furca (1 million cells/L)
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Frequent blooms during the 80-ies
ADDITIONAL COMMENTS	-
INDIVIDUAL TO CONTACT	Odd Lindahl, Kristineberg Marine Biological Station S-450 34 Fiskebäckskil, Sweden. tel. 46-523-22087, fax. 46-523-22871.

RED TIDE IN THE ÖRESUND

SWEDEN 1988

LOCATION	Barsebäck-Landskrona
DATES	24 August
EFFECTS	Not reported
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Prorocentrum minimum (up to 16 million cells/L)
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Blooms nearly every year since 1981
ADDITIONAL COMMENTS	
INDIVIDUAL TO CONTACT	Lars Edler, Dept. of Marine Ecology, Univ. of Lund, Box 124, S-221 00 Lund, Sweden. tel. 46-46-108366, fax. 46-46-146030.

CYANOBACTERIA BLOOM IN ÖRESUND

SWEDEN 1988

LOCATION	Barsebäck-Landskrona
DATES	10-15 August
EFFECTS	Not reported
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Aphanizomenon flos-aquae, Nodularia spumigena, Microcystis reinboldii
ENVIRONMENT	Salinity ~ 10 ‰
PREVIOUS OCCURRENCES	Blooms certain years of Aphanizomenon flos-aquae, Nodularia spumigena, depending on the outflow from the Baltic Sea. Blooms of Microcystis reinboldii less common previously.
ADDITIONAL COMMENTS	-
INDIVIDUAL TO CONTACT	Lars Edler, Dept. of Marine Ecology, Univ. of Lund, Box 124, S-221 00 Lund, Sweden. tel. 46-46-108366, fax. 46-46-146030.

CYANOBACTERIA BLOOM IN THE BALTIC SEA

SWEDEN 1988

LOCATION	Trelleborg
DATES	First days of September
EFFECTS	Not reported
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Nodularia spumigena
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Blooms nearly every summer.
ADDITIONAL COMMENTS	-
INDIVIDUAL TO CONTACT	Bo Sundström, Dept. of Marine Ecology, Univ. of Lund, Box 124, S-221 00 Lund, Sweden. tel. 46-46-108371, fax. 46-46-146030.

CYANOBACTERIA BLOOM IN THE BALTIC SEA

SWEDEN 1988

LOCATION	Åhus
DATES	First days of September
EFFECTS	Not reported
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Microcystis reinboldii
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Blooms nearly every summer.
ADDITIONAL COMMENTS	In low salinity surface water from river discharge
INDIVIDUAL TO CONTACT	Bo Sundström, Dept. of Marine Ecology, Univ. of Lund, Box 124, S-221 00 Lund, Sweden. tel. 46-46-108371, fax. 46-46-146030.

MESODINIUM RUBRUM BLOOM ON THE SWEDISH WEST COAST

SWEDEN 1988

LOCATION	Laholm Bay
DATES	30 August
EFFECTS	-
MANAGEMENT DECISION	-
CAUSATIVE SPECIES	Mesodinium rubrum (maximum records of c. 150 000 cells/L)
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Reported from the area, but not as bloom forming.
ADDITIONAL COMMENTS	-
INDIVIDUAL TO CONTACT	Lars Edler, Dept. of Marine Ecology, Univ. of Lund, Box 124 S-221 00 Lund, Sweden. tel 46-46- 108366, fax. 46-46-146030.

PSP IN BOHUSLÄN**SWEDEN 1988****LOCATION**

Lyrö, Brattö, Kulefjord and Resö

DATES

5. 6. 9 and 11 April: 40-80 µg/100 g. After that negative until 17 May when mussels from Resö had more than 80 µg

EFFECTS**MANAGEMENT DECISION****CAUSATIVE SPECIES****ENVIRONMENT****PREVIOUS OCCURRENCES****ADDITIONAL COMMENTS****INDIVIDUAL TO CONTACT**Bertil Evaldsson. KM-Lab. S. Hamng. 12, S-451 81
Uddevalla. tel. 46-522-96160

DSP IN BOHUSLÄN**SWEDEN 1988**

LOCATION	Grebbestad	wild blue mussels
DATES	15-20 October	
EFFECTS	Diarrhea, vomiting. Totally c. 30 persons in Lidköping, Malmö and Lund.	
MANAGEMENT DECISION	Authorities threatened the public to be prosecuted if mussels were harvested and sold without being tested.	
CAUSATIVE SPECIES		
ENVIRONMENT		
PREVIOUS OCCURRENCES		
ADDITIONAL COMMENTS	Toxin conc. 65-112 µg Okadaic acid/100 g. Possibly the unknown toxin. New analyses will be made on frozen mussels	
INDIVIDUAL TO CONTACT	Matts Hagellörn, Inst. of Food Hygiene, Sveriges Lantbruksuniversitet, S-750 07 Uppsala, Sweden tel 46-18-171000.	

Algal Blooms in Scottish Coastal Waters in 1988

Month	Species	Cell density	Effect
May	Flagellate X (Heterosigna akashiwo)	1.64×10^6 cells l^{-1}	Mortalities of farmed salmon
July	Chaetoceros eibeni/atlanticus, danicus	5.22×10^6 cells l^{-1}	"
October	Flagellate X (Heterosigna akashiwo)	6.84×10^6 cells l^{-1}	"

*Samples collected 24 hours after the peak of the bloom (assessed by intensity of discolouration of the sea).

1988

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Cobscook Bay and Eastport, Maine
2. Date of Occurrences: September 1988
3. Effects: Toxicity of Blue mussels, Mytilus edulis
Domoic acid concentrations of 5 - 20 ppb.,
analyzed by HPLC.
4. Management Decision: Closure of area to the harvesting
of all shellfish.
5. Causative Species: presumably Nitzschia sp.
6. Environment:
7. Advected population or in situ growth: Probably in situ
growth, species known to occur in Maine coastal waters.
8. Previous Occurrences: none known
9. Additional Comments:
10. Individual to Contact: John Hurst
Dept. Marine Resources
W. Boothbay Hbr., ME 04575

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Maquoit Bay, Brunswick, Maine
2. Date of Occurrences: September 1988
3. Effects: Mortalities of marine invertebrates: shellfish and marine worms.
Coloration of water - brown
4. Management Decision: Closure of area to the harvesting of all shellfish.
5. Causative Species: Gymnodinium nagasakiense (Gyrodinium aureolum)
Concentrations: 1800000 cells/liter in sample from 1 liter original examined by epifluorescence by the Bigelow Laboratories. Total cell counts for the sample were not unusually high for that time of year; unlikely to cause anoxia.
6. Environment: Temperature: 14.0 - 14.5 C
Oxygen: 8 ppm
Salinity: 33 ppt
7. Advection, population or in situ growth: Probably advected population.
8. Previous Occurrences: none
9. Additional Comments:
10. Individual to Contact: John Hurst
Dept. Marine Resources
W. Boothbay Hbr., ME 04538

1988
ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Massachusetts, New Hampshire, Maine
In Massachusetts - North & South Shores
Southern extent - entrance to Cape Cod
Canel, Nantucket Shoals
Isolated outbreaks in Eastham and Orleans
on Cape Cod
2. Date of Occurrence: May 9 to end of July
3. Effects:
 - 1) Closure of Shellfish Beds - Mya arenaria, Mytilis edulis and other species in Maine, N.H. & Massachusetts.
 - 2) Toxin detected in offshore mussels on Nantucket Shoals.
 - 3) No known human or marine mammal illnesses.
4. Management Decision: Shellfish bed closures in three states ($>80\mu\text{g}$ toxin/100 grams shellfish)
5. Causative Species: Alexandrium fundysense
6. Environment: Temperature - $6-7^{\circ}\text{C}$ at bloom initiation; $9-11^{\circ}\text{C}$ 1 month later in offshore bloom.
Salinity - $30-31$ ‰
Stratification - yes, cell preferred $\sigma_t = 24.5$.
Salinity front along coast.
Cell numbers - 1,000 - 5,000 cells/liter
Nutrients - $<1\mu\text{g}$ atom N/liter $\text{NO}_2 + \text{NO}$,
7. Advection population or in situ growth: Source - most likely Maine - cells were advected alongshore to the South into Massachusetts waters, carried by the predominately counterclockwise currents in the Gulf of Maine during Spring. In situ growth may have occurred during transport. Isolated outbreaks in Salt Ponds of Cape Cod were probably in situ growth.
8. Previous Occurrences: Annual event in most years since Sept. 1972, usually in May/June, but may also occur later in summer & early autumn. Outbreaks in Maine prior to 1972. No spring bloom in 1987 in Massachusetts.
9. Additional Comments: 1) Cell numbers $> 1,000$ cells/liter detected at some offshore areas in Cape Cod Bay, just prior to management decision to reopen some of the beds in Massachusetts. Maine beds remained closed through Aug./Sept.
2) Monitoring responsibility unclear for offshore areas (Nantucket Shoals) outside the jurisdiction of the state.
10. Individual to Contact: Dr. Donald M. Anderson
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Great South Bay, Long Island, N.Y.
Peconic Bay System, Long Island, N.Y.
2. Date of Occurrence: Isolated blooms peaked in Mid-June, then dwindled to undetected levels of causative sp. by end of summer.
3. Effects: Growth suppression in Mercenaria mercenaria reported.
4. Management Decision: Suffolk County monitoring program carried out.
5. Causative Species: Aureococcus anophagefferens
Maximum cell number in Great South Bay <500,000 ml⁻¹
Cell numbers in Peconic system ranged to 1000,000 ml⁻¹
6. Environment: Salinity range 25-30 ‰
Temperature range 26-28° C.
7. Advected population or in situ growth: In situ
8. Previous Occurrences: Major blooms in 1985-1986 (initial blooms).
9. Additional Comments:
A. anophagefferens possibly was expatriate species. It is not a common estuarine species. Since initial blooms it has bloomed in situ but in diminishing amounts.
10. Individual to Contact:
Dr. Elizabeth Cosper
Marine Sciences Research Center
SUNY, Stony Brook, New York
(516) 632-8745

Dr. Robert Nuzzi
Suffolk County
Dept. of Health Services
County Center
Riverhead, New York
(516) 548-3330

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: W. Sayville, New York. Great So. Bay, Long Island.
2. Date of Occurrence: 1988, May 26th until August 18th (approx.)
3. Effects: growth suppression in M. mercenaria; delay of spawning in M. mercenaria until count/ml. decreased to much lower levels (<350,000 c/ml)
4. Management Decision: raw water upwelling systems moved to L.I. Sound to avoid Aureococcus. "Wait it out."
5. Causative Species: Aureococcus anophagefferens
6. Environment: Estuarine, avg. depth ~5 ft.; numerous shoals; bottom composition variable (sand, shell, stone, and mixtures thereof).
7. Advectioned population or in situ growth: Bloom occurred Baywide from Fire Island Inlet, East. At times, concentrated regions could be seen. Tidal movement (net) is East.
8. Previous Occurrences: 1985, 1986
9. Additional Comments: 1985 & 1986 showed obvious spawning inhibition and unusually abundant spawning when c/ml counts dropped down.
10. Individual to Contact: Craig E. Strong
Bluepoints Co., Inc.
Atlantic Avenue
W. Sayville, New York 11796

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Reeves Bay, an arm of Flanders Bay
Long Island, New York.
2. Date of Occurrence: May, 1988
3. Effects: Paralytic shellfish toxin detected in mussels for toxin
monitoring.
Levels relatively low.
4. Management Decision:
5. Causative Species: Protoconyaulax tamarensis identified in area.
6. Environment:
7. Advised population or in situ growth: Suspect In situ population.
8. Previous Occurrences: May 1986, 1987
9. Additional Comments:
10. Individual to Contact: Dr. Robert Nuzzi
Suffolk County Department of Health Services
County Center
Riverhead, New York 11901

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Raritan Bay - Sandy Hook Bay, southern half.
2. Dates of Occurrence: May 24 - Aug. 2
3. Effects: reddish-brown water
fauna kills June 22-28; Aug. 2, Sandy Hook Bay south shore.
The fauna kill in June included mortalities of finfish, especially northern pipefish, scup, northern sea robin, smallmouth flounder, and summer flounder. Megainvertebrates killed included shore shrimp, sand shrimp, blue crab, and lady crab. The early August kill also involved finfish and shellfish, primarily demersal species (flounder, crabs, etc.).
4. Management Decision: Increased surveillance.
5. Causative Species:

<u>Olisthodiscus luteus</u>	}	
<u>Katodinium rotundatum</u>	}	dominant 5-25 x 10 ³ cells ml ⁻¹
<u>Eutrepia lanowii</u>	}	
<u>Proccrocentrum minimum</u>	}	sub dominant 1-5 x 10 ³ cells ml ⁻¹
<u>P. triestinum</u>	}	
6. Environment:
 Water turbid
 Water column mixed
 Chlorophyll maximum: 278 ug l⁻¹
 Chlorophyll throughout bloom ranged 20-278 ug l⁻¹
 D.O. levels as low as 2.2 mg/l
7. Advectioned population or in situ growth: In situ population
8. Previous Occurrences: Chronic annual blooms.
9. Additional Comments: Kills attributed to localized hypoxia, contributed by wind and tide.
10. Individual to Contact:

Paul Olsen	For information on fauna killed:
New Jersey Department of	Stuart Wilk
Environmental Protection	U.S. Department of Commerce
(609) 633-7003	NOAA, NMFS, NEFC, Sandy Hook Laboratory
	(201) 872-0200

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Raritan Bay and entire coast of New Jersey, from beach to a few miles off.
2. Date of Occurrence: May 24 - June 8, 1988
3. Effects: Brown flocculent material, or foam, on much of New Jersey shore.
4. Management Decision: Increased surveillance.
5. Causative Species:
Ceratulina pelagica, cell concentrations ranged $1-20 \times 10^3$ cells ml^{-1} but usually ranged $1-10 \times 10^3$ cells ml^{-1}
Subdominant, Skeletonema costatum, in some places, $1-10 \times 10^3$ cells ml^{-1}
Sampling was surface from helicopter; counting by Sedgewick-Rafter strip.
6. Environment:
Chlorophyll ranged $3-10 \mu g\ l^{-1}$
Temperature range: inshore, surface 16.7 - 17.0; at 9 mi. from shore 16.6 - 17.0.
Salinity, not available.
Water column stability: mixed to slightly stratified.
DO (at bottom) <3.0 ppm at Long Branch; 1-5 - 4.8 ppm at Seaside Heights.
7. Advised population or in situ growth: In situ. Bloom initiated in Hudson-Raritan estuary.
8. Previous Occurrences: Nuisance annual blooms began in 1985.
9. Additional Comments: Nuisance conditions first noted in 1985 but had been abundant previously.
10. Individual to Contact: Paul Olsen
New Jersey Department of
Environmental Protection
(609) 633-7003

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Barnegat Bay, New Jersey.
2. Date of Occurrence: Mid July - late September
3. Effects: Brownish water discoloration.
Large mats of dead eel grass on shores, coincident with brown water.
4. Management Decision: Increased surveillance.
5. Causative Species: Nannochloris atomus (presumptive identification)
dominant
Aureococcus anophagefferens $\leq 7.5\%$
Total picoplankton $10^2 - 10^6$ cells ml⁻¹
Chlorophyll North end 12 ug l⁻¹
Chlorophyll South end 24 ug l⁻¹
6. Environment: Temperature range: 22-27° C
Salinity range: 20-27 ppt
Water column mixed
7. Advected population or in situ growth:
In situ (?). N. atomus present for at least 20 years
A. anophagefferens, unknown origin
8. Previous Occurrences: 1985, 1986, 1987 (brown water blooms)
9. Additional Comments: Presence of Aureococcus anophagefferens confirmed by D. Anderson, W.H.O.I.
10. Individual to Contact: Paul Olsen
New Jersey Department of
Environmental Protection
(609) 633-7003

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Gulf Stream Samples 33° 53' N, 76° 25' W 17 August 1988
Nearshore 19 September 1988 in Onslow Bay (below Cape Lookout, NC).
2. Date of Occurrence: Gulf Stream 17 August 1988
Onshore 19 September 1989
3. Effects: No direct effects on fishery because highest cell counts were 4,700 cell/l Ptychodiscus brevis, below the 5,000 cell/l which necessitate closure of shellfish beds.
4. Management Decision: None necessary.
5. Causative Species: Ptychodiscus brevis
6. Environment: Western wall Gulf Stream
Onslow Bay (continental shelf and nearshore)
7. Advected population or in situ growth: Gulf Stream was probably advected population and the nearshore may have been in situ growth. There was onshore movement of Gulf Stream water on 12 Sept. 1988
8. Previous Occurrences: First ever recorded Ptychodiscus brevis bloom along the North Carolina coast was 1987-88.
9. Additional Comments: This is not a bloom but does serve to confirm our suspicions that the cells were traveling northward in the GS. Gulf Stream waters had not been on the continental shelf off Raleigh or Onslow Bays, NC since mid-July until about 12 Sept.
10. Individual to Contact:
Patricia A. Tester
National Marine Fisheries Service, NOAA
Beaufort, NC 28516
USA

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Alaska Peninsula, 16 miles ENE of Chignik. Chignik Bay 56°22'N, 158°00'W.
2. Date of Occurrence: June 15, 1988.
3. Effects: Paralytic Shellfish Poisoning. Consumption of butter clam, mussels and cockles. Three people hospitalized and transferred from Dillingham to Providence Hospital in Anchorage, AK. Samples collected on 6/28/88 showed cockles - 367.2 µg/100 g, littleneck clams 85.0 µg/100 g and mussels 3265.9 µg/100 g. (Analyzed by Alaska Department of Environmental Conservation Lab. in Palmer, Alaska).
4. Management Decision: Affected area in a non certified (classified) area. Not an approved commercial shellfish area.
5. Causative Species: No species identification was performed. Symptoms, sample results and diagnoses all consistent with PSP.
6. Environment:
7. Advised population or in situ growth:
8. Previous Occurrences: General area is affected per epidemiological outbreaks in the past.
9. Additional Comments:
10. Individual to Contact: Michael J. Ostasz
c/o Alaska Dept. of Environmental Conservation
3601 "C" Street - Suite 1324
Anchorage, AK 99503
(Phone) (907)-563-0318

ALLGAL BLOOM REPORTS - UNITED STATES

1. Locations: Santa Monica Bay, Santa Monica, CA.
2. Date of Occurrence: June 19, 1988
3. Effects: Water colouration brilliant orange mostly on the surface with an approximate depth of 2mm.
No other data is available. No Health Department Report was issued.
4. Management Decision: None available
5. Causative Species: A species of Noctiluca predominant dinoflagellate. Many species of diatoms also observed but not identified. Photomicrographs taken for identification and no further confirmation was sought.
6. Environment: No data available
7. Advised population or in situ growth: No data available
8. Previous occurrences: July 8, 1987
A bloom of Prorocentrum micans in Santa Monica Bay with co-occurring species of diatoms. No other data available.
9. Additional Comments: Most of the blooms go unreported
10. Individual to Contact: Dr. Maria R. Ross
Department of Biology
UCLA
405 Hilgard Avenue
Los Angeles, CA. 90024
(213) 206-3528

ALGAL BLOOM REPORTS - UNITED STATES

1. Locations: Drakes Estero Area 17 and Drakes Bay, Marin County, California
2. Date of Occurrence: December 20, 1988
3. Effects: Paralytic shellfish toxin in commercial mussel beds
Drakes Estero bay mussels 87 ug/100 g
Drakes Bay sentinel Sea mussels 290 ug/100 g
Mouse bioassay by the Department of State Health Laboratory, Berkeley, Ca.
No colouration of the water observed
4. Management Decision: Area closed to commercial harvesting
5. Causative Species: Most likely Protogonyaulax catenella no
No attempt made to identify positively and no other data available.
6. Environment: No temperature, salinity, oxygen concentration
or water column stability measurement data available.
7. Advected population or in situ growth: Most likely in situ
growth because there have been previous occurrences. No other available data on the dinoflagellate population.
8. Previous Occurrences: 1980, 1984, 1986
9. Additional Comments: Northern California coast is where most
of the shellfish aquaculture industry and commercial shellfish beds are located.
10. Individual to Contact: Dr. Maria R. Ross
Department of Biology
University of California
405 Hilgard Avenue
Los Angeles, CA. 90024
(213) 206-3528