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International Council for the
Exploration of the Sea

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Mariculture Committee
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Biol. Oceanography
Cttes
Theme Session S

ANNEX III

TO THE REPORT ON THE HARMFUL EFFECTS OF THE ALGAL BLOOMS
ON MARICULTURE AND MARINE FISHERIES

NATIONAL REPORTS

*General Secretary
ICES
Palægade 2-4
DK-1261 Copenhagen K
DENMARK

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1987 Canada

Location: Lr. St. Lawrence Estuary Quebec

Dates of Occurrence: June-September 1987

Effects: PSP in shellfish

Management decision: affected areas closed to harvesting of shellfish

Causative species: Protogonyaulax tamarensis (400 000 cells/L) determined by vertical net tows and pump profiles

Environment: water column mixed
salinity range 26-29 ppt
temp range 4.5 - 11.5 C

Physical location: Advected populations

Previous occurrences: Annually in summer since 1984

Individuals to contact: Allan Cambella/Richard Larocque
Maurice Lamontagne Institute
Dept of Fisheries and Oceans
P O Box 1000 Mont-Joli Quebec

1987 Canada

Location: British Columbia

Dates of Occurrence: May through October

Effects: PSP in shellfish

Management decision: affected areas closed to harvesting of shellfish

Causative species: Protogonyaulax catenella

Environment: No measurements taken

Previous occurrences: Yearly

Individual to contact: Rudy Chiang
Department of Fisheries and Oceans
Fish Inspection Branch
Burnaby, B.C.

1987 CanadaLocation: Hermitage Bay, NewfoundlandDates of Occurrence: July through AugustEffects: Paralytic shellfish poisoning (mussels)PSP extracts prepared at Department of Fisheries and Oceans
Inspection Laboratory, St. John's, NewfoundlandMouse bioassays done at Department of National Health and
Welfare, Tunney's Pasture, Ottawa.Management Decisions: Affected area closed to the harvesting of
shellfish.Causative Species: Gonyaulax excavata (=tamarensis)Previous Occurrences: Nearly every year since 1982.Individual To Contact: David R.L. White, Inspection Branch, Department
of Fisheries and Oceans, St. John's, Newfoundland.

1987 Canada

Location: Bay of FundyDates of Occurrence: Late July through Early SeptemberEffects: Marine organisms (mussels, softshell clams, scallops)
accumulating PSP toxins.PSP extractions conducted at Black's Harbour, New
Brunswick, Department of Fisheries and Oceans Laboratory.

No discolouration of water.

Management Decisions: Affected areas closed to harvesting of shellfish.Causative Species: Gonyaulax excavata (=tamarensis) (12000 cell/L) -
determined by surface water sample preserved in 2.5% formalin
acetic acid and counted with inverted microscope.Environment: temperature range: 9-12°C
salinity: 32‰
water column: MixedPhysical Location: Advected populations from well mixed offshore
populations of Gonyaulax excavata.Previous Occurrences: YearlyIndividual To Contact: Jennifer Martin, Department of Fisheries and
Oceans, Biological Station, St. Andrews, N.B. EOG 2X0

1987 Canada

Location: B.C.

Dates of Occurrence: March - November

Effects: Mortalities of Cultured Salmonds

Management decision: Monitoring of Bloom species around fish farms
to be expanded

Causative species: Chaetoceros convolutus

Effects on fish noted between 1000 - 3000 cell/L

Cell concentrations up to 8,000 cell/L in March
and as high as 100,000 cell/L in the September -
- October period.

Individual Contact: Edward Black

B.C. Ministry of Agriculture & Fisheries
Aquaculture & Commercial Fisheries Branch
808 Douglas St.
Victoria B.C.

1987 Denmark

Public Health Episodes - nil
 Fish mortalities - nil

PSP

Location Limfjorden
 Dates of occurrence June 8 - 22
 Effects: PSP toxin detected at levels between 40-200 ug PSP/100g mussel meat. Mouse bioassay and HPLC Analyses.
 Management decision: Quarantine restrictions
 Causative species: *Gonyaulax tamarensis* cells or cysts suspected. No *Gonyaulax* found in phytoplankton
 Previous occurrences: None

DSP

Location Limfjorden
 Dates of occurrence mid September - mid November
 Effects DSP toxin detected using Official Japanese mouse bioassay. Okadaic acid detected using HPLC maximum concentrations 78.45u/100g mussel meat.
 Management decision Quarantine restrictions
 Causative species *Dinophysis acuminata*, *D. norvegica*
 Person to contact National Agency of Environmental Protection,
 Marine Pollution Laboratory
 Jaegersborg Alle 1B
 DK 2920 Charlottenlund
 Denmark

FRANCE, NATIONAL REPORTREF : ICES WORKING GROUP ON EXCEPTIONAL ALGAL BLOOMSLISBON, PORTUGAL, 11 - 13 APRIL 1986

STATUS OF 1987 ALGAL BLOOMS STUDIES IN IFREMER

P. LASSUS & J. P. BERTHOME

A. TOXIC DINOFLAGELLATESa) Dinophysis

In 1987 the summer coastal distribution of Dinophysis extended from South Brittany to Vendée and Charentes coastlines, whereas mediterranean coastal salted lakes were also contaminated in September and October.

Areas usually contaminated in precedent years (Antifer harbours, Douarnenez and Vilaine bays) were submitted to toxin analyses in mussels, as well as new contaminated sites. Okadaic Acid was found by HPLC in mussels from Antifer, Douarnenez, Vilaine and Aiguillon bays, as well as from mediterranean coast. Okadaic Acid was also found in phytoplankton samples, as soon as Dinophysis concentrations exceeded one million cells by extract analysed.

A clearer relationship between Okadaic Acid concentrations and mouse assays results (expressed as "mouse units") was established from "in situ" and experimental datas.

As to ecological survey of Dinophysis sacculus distribution along south Brittany coasts two attempts were made :

- an hydrological and phytoplanktonic survey cruise was realised in June 1987 between Douarnenez bay and Noirmoutier Island. Results corroborates those of June 1986 : highest densities of D. sacculus are found in stratified areas, mainly in the vicinity of large estuaries out flow like Loire river. Nevertheless, the concentrations of Dinophysis being globally lower than in 1986 - as corroborated by a shorter period of toxicity in mussels - it was not possible to find a significative correlation between Dinophysis concentrations and stability index. It was also observed a different pattern in vertical distribution of Dinophysis sacculus and Gyrodinium aureolum. The first one was detected in the upper - 1 m layer and the second one only in the - 10 m layer, corresponding to a maximum in chlorophyll a concentrations,

- first assays aiming to simulate seasonal variations of Dinophysis in Vilaine bay showed the need for ecological parameters like : cysts forming, grazing and migration rates. When introducing those parameters and hydrological factors in the model (temperature, salinity, inorganic phosphorus and nitrogen, light incidence) it was possible to obtain a good simulation of observed Dinophysis growth rates in 1984. It is not assumed that stability index and nutrients are discriminant factors in the bay system, and external factors like introduction of offshore Dinophysis populations have to be tested in the model. This work is to be achieved in 1988.

b) Gyrodinium aureolum

Cooperative research between IFREMER (Brest) and Marine Biological Station (Roscoff) led to several preliminary results :

- mass cultures of G. aureolum (Plymouth strain) revealed non toxic for mussels and oysters embryos,
- scallops (Pecten maximus) post-larvae stopped their feeding activity when exposed to G. aureolum cultures, even when non-toxic algae is added as complementary food (Isochrysis, Pavlova, Chaetoceros).
- G. aureolum cultures were successfully ran out from cells directly collected in discolored waters of July 1987 along Brittany coasts,
- cytofluorimetric DNA index of different strains of G. aureolum revealed as a good criteria for species characterization,
- geographical distribution of G. aureolum extended from north Brittany areas to south Brittany coasts, in locations where it was not detected prior to 1987,
- as in 1983 and 1985, G. aureolum was associated in 1987 with mortalities and growth abnormalities of young Pecten maximus in Brest bay area.

c) Protogonyaulax tamarensis (MOG. 835)

A toxic strain of Protogonyaulax tamarensis (MOG. 835, kindly provided by Dr OSHIMA, Tohoku University) was produced in mass cultures in order to evaluate contamination/decontamination patterns of different shellfishes. Scallops (Pecten maximus), mussels (Mytilus edulis), oysters (Crassostrea gigas) and clams (Ruditapes philippinarum) were thus experimented in a static system with daily changes of water and algal supply. During decontamination period a non toxic algae (Skeletonema costatum) was provided. Unlike to initial toxic arrangement in the strain, a change was observed for major toxins distribution. Only GTX₂, GTX₃ and GTX₈ were detected in cultures, GTX₃ being the major toxin instead of GTX₈ in initial Japanese strain. HPLC detection of gonyautoxins was realised by Veterinary Central Laboratory (Paris).

During contamination period, scallops and mussels reached high toxic levels with predominance respectively of GTX₈ and GTX₃, whereas oysters and clams are poorly contaminated with predominance of GTX₈. In all cases, during decontamination period, amounts of toxins decreased except GTX₂ which remained at constant level. That last result can be corroborated by observed differences in decontamination rates in mussels and scallops.

This work aimed to know physiological responses of french common marketed shellfishes when exposed to a PSP producer. Despite no PSP outbreaks were observed on french coasts in the last 20 years some Protogonyaulax like species were recently detected in different locations at high levels (Alexandrium ibericum, Goniodoma pseudogonyaulax, Gonyaulax fratercula ? etc).

B - DISCOLORED WATERS

a) Docks of "Le Havre" harbour

A two year study of summer discolored waters in a harbour basin showed predominance of the very high amounts of nutrients in exceptional blooms of diatoms and flagellates (chlorophyll a up to 500 mg/m³ !). Competition between r strategic diatoms and brackish flagellates is regulated by available amounts of silicates whereas dinoflagellates discolored waters are controlled by other factors like temperature, light incidence and supply of organic nutrients.

b) Possible mechanisms involved in dinoflagellates discolored waters

A research programme was developed in three steps :

1°) typologic study of Channel and Atlantic sediments in order to find an eventual relationship between "red tides areas" and muddy sands chemical composition,

2°) "in vitro" studies in order to determine inhibitory effects of sediments extracts on Protogonyaulax tamarensis growth and general conditions leading Gyrodinium aureolum to be the dominant species in the algal ecosystem. Concerning that last point it appears that specific competition between Gyrodinium and diatoms is not only regulated by a competition for nutrients but also by a cell concentration threshold in Gyrodinium : for cellular densities exceeding that threshold, extracellular products may inhibit diatoms development,

3°) analyses of active organic components were made in sediments extracts. Methods for concentration, parting and isolation of dissolved organic materials have been improved. After isolation and identification of organic active molecules in the competition between dinoflagellates and diatoms it is planned to evaluate "in situ" rate of production of such compounds.

C. 1987 MONITORING RESULTS

Four comments can be done as to 1987 blooms monitoring :

- when compared to 1985 (30) and 1986 (26) the total number of 1987 bloom events (40) is increasing (discolored waters, mortalities of marine organisms, DSP outbreaks),
- ichthyotoxic dinoflagellates are more frequently blooming and spread in wider geographical areas. This was observed for Gyrodinium aureolum, and also for G. spirale in northern Brittany,
- Dinophysis sacculus is outspreading toward southern Loire estuary and along mediterranean coasts with harmful effects on public health (about 2 000 cases of intoxication (May 1987) despite a large ban of shellfishes marketing),
- Occurrences of species similar to neurotoxic Protogonyaulax have been observed in Vilaine Bay in late Autumn (a chain-forming Protogonyaulax sp) whereas some genera like Alexandrium ibericum and Goniodoma pseudogonyaulax were already detected at high concentrations in 1986.

Because of the increasing number of Dinophysis events every year and especially in 1987 it was decided to increase the sampling frequency in 1988 : twice a month from September to April and every week in summer.

1987 BLOOMS REPORTED ALONG FRENCH COASTS

Location	Dates	Effects-general features	Causative species	Concentrat. (Cells/l ⁻¹)	Environment
Normandy (from Orne to Seulle river)	04.07.87 to 08.08.87	Ban of shellfishes marketing	Dinophysis acuminata	max : 17800	-
Northern Brittany (St Malo)	02.06.87	Green discolored water	Pyramimonas parkeae	1 000 000	-
Northern Brittany (La Rance)	22.07.87	Red water	Gonyaulax spinifera	1 010 000	temper. 18° C salin. 31,3-10 ⁻³
Northern Brittany (Lannion - Locquirec)	30.07.87 to 06.08.87	Shellfishes mortalities	Gyrodinium spirale	10 000	-
			Gyrodinium aureolum	3 600	
Northern Brittany (Abers)	27.08.87	Clams mortalities in nursery ponds	Gyrodinium aureolum	up to 267 000 in late July Only 200 in August 27	temper. 15° C salin. 35-10 ⁻³ oxygen 105 % turb. 1.75 to 2.5 NTU
Northern Brittany (Abers)	24.09.87	Clams mortalities in nursery ponds	undetected	-	temper. 15.8° C salin. 35.3-10 ⁻³ oxygen 103 % turb. 1.75 NTU
Brest Bay (Elorn)	20.08.87 to 07.09.87	Brown discolored water. Sharp decrease in dissolved oxygen and probable H ₂ S production. Mortalities in 40 to 50 % of mussels on cultures beds.	Prorocentrum micans	620 000 to 10 000 000 from 20 to 23.08.87	temper. 18-21° C salin. 28-35-10 ⁻³ oxygen 74 % turb. 50 NTU

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Location	Dates	Effects-general features	Causative species	Concentrat. (Cells/l ⁻¹)	Environment
Brest Bay (Aulne, Tinduff)	01.07.87 to 31.07.87	Mortalities in young scallops	Gyrodinium aureolum	up to 500 000	
Brest Bay (Aulne)	05.08.87	Offshore red-brown water	Prorocentrum micans	300 000 to 650 000	
Ushant front (Camaret)	17.07.87 to 24.07.87		Gyrodinium aureolum	640 000 to 22081 000	temp. 15.8 - 16.4° C turb. 400-500 cm
Douarnenez Bay	13.04.87	Mortalities in oysters (35 to 40 t) Probable anoxia	Dictyocha speculum	1 300 000	salin. 29.5 to 30.10 ⁻³
Douarnenez Bay	27.05.87 to 23.07.87	Ban of shellfishes marketing	Dinophysis sacculus	up to 6 100 but generally less than 1 000	-
	03.09.87	Ban of shellfishes marketing	Dinophysis sacculus	between 100 and 2 000	
Douarnenez Bay	20.07.87	Bloom	Gyrodinium aureolum	250 000 to 1 400 000	
Audierne Bay	26.05.87	Brown water	Rhizosolenia sp.	up to 1 250 000	
	11.08.87	Mortalities of Donax trouculus	?	-	temp. 16.2° C ₋₃ salin. 34.1 10
Concarneau Bay	05.08.87	Reddish water	Glendinium sp.	400 000 000	
Southern Brittany (Mousterlin to Trevignon)	09.07.87 to 23.07.87	Ban of shellfishes marketing	Dinophysis sacculus	up to 700	

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Location	Dates	Effects-general features	Causative species	Concentrat. (Cells/l ⁻¹)	Environment
Southern Brittany (Aven)	25.05.87 to 20.07.87	Brownish water	Glenodinium sp.	920 000 to 1 275 000	
Southern Brittany (Lorient Ter Lagoon)	02.06.87 to 03.06.87	Brown-red water	Prorocentrum minimum	6 000 000	
Southern Brittany Etel estuary Listrec bay	29.06.87 to 30.06.87	Flat fishes mortalities. Probable anoxia caused by a bloom	Oxyrrhis marina Glenodinium foliaceum	up to 6 000 000 100 000	temper. 30°C
Vilaine Bay	28.10.87 7.11.87	brown water no effect no discolored water	Leptocylindrus sp. Protogonyaulax sp	up to 2900 chain forming organism up to 25 cell/chain 360 to 640	temper. 13°C salin. 24.7.10 ⁻³
Vilaine Bay (Penerf Estuary)	19.03.87 to 23.03.87	Red Brick oysters	Thalassiosira sp. Navicula sp.	-	-
Vilaine Bay (Pen Be)	15.07.87 to 27.07.87	Bloom	Gyrodinium aureolum	437 500 to 3 200 000	
Vilaine Bay	27.05.87 to 19.06.87	Ban of Shellfishes marketing	Dinophysis sacculus	up to 9 000 generally less than 1 000	
Northern Loire estuary (Le Croisic)	15.07.87 to 27.07.87	Bloom	Gyrodinium aureolum	430 000 to 637 600	
Northern Loire estuary (St Nazaire)	01.06.87	Brown water ?	Prorocentrum minimum	1 500 000	

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Location	Dates	Effects-general features	Causative species	Concentration (Cells/l ⁻³)	Environment
Northern Loire estuary (La Baule Bay)	21.08.87	"thick" brown water	Skeletonema Costatum	8 000 000	
Bourgneuf Bay	06.07.87 to 10.07.87	Brown water	Gyrodinium aureolum	11 400 000	temp. 18.6°C salin. 31-10 ⁻³
Atlantic coast (Les Sables d'Olonne)	29.07.87	Brown water	Gyrodinium aureolum	293 600	temp. 18.5°C
Vendée Charentes Maritimes	27.05.87 to 30.06.87	Ban of shellfishes marketing	Dinophysis sacculus	up to 2 500 generally less than 1 000	
Southern atlantic coast (Hossegor)	25.08.87 to 07.10.87	Brown-red discolored water. Mortalities in old oysters	Prorocentrum minimum	9 500 000	temp. 24°C-26°C
Camargue Mediterranean coast (Stes Maries)	24.06.87	red water	?		
Languedoc Roussillon	19.08.87 to 22.10.87	Ban of shellfishes marketing	Dinophysis sacculus	up to 1 200 generally less than 500	
Boûches du Rhône	21.08.87 to 24.09.87	Ban of shellfishes marketing	Dinophysis sacculus	up to 1 400	
Boûches du Rhone (Fos Gulf)	20.08.87 to 26.08.87	Brown water	Prorocentrum micans	up to 180 000	

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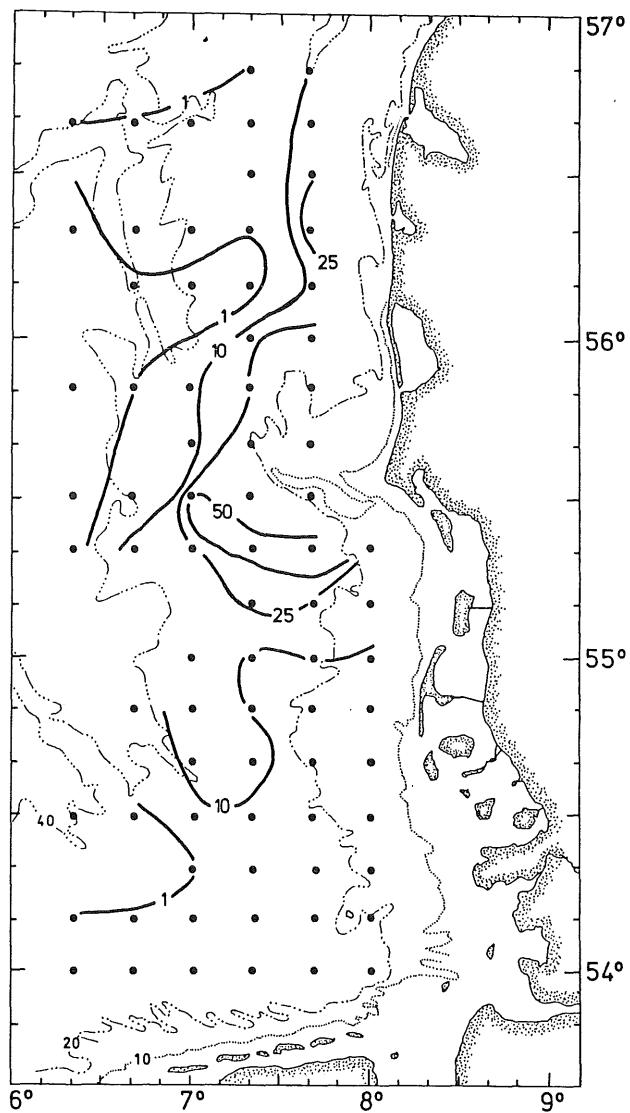
Location	Dates	Effects-general features	Causative species	Concentrat. (Cells/l ⁻³)	Environment
Bouches du Rhône (Berre lagoon)	31.03.87 to 15.06.87	Brown-red waters Mortalities in benthic fishes	Prorocentrum minimum	35 000 to 6 900 000	temp. 8 to 21°C salin. 11 to 17.10 ₋₃ turb.1 to 32 NTU oxygen 86 to 97 %
Corse Island	19.10.87	Red water	Prorocentrum minimum	37 500	
Corse Island (Urbino lagoon)	19.10.87	Brown water	Prorocentrum minimum	19 500	

**Institut für Meereskunde
an der Universität Kiel**Marine Planktologie
Prof. Dr. J. LenzKiel, 14. März 1988
☎ (0431) 5 97 3865
Le/Se-358Annual Report 1987 to the ICES Working Group on Harmful Effects on Algal
Blooms on Mariculture and Marine Fisheries

There are no reports on the occurrence of toxic mussels along the German coasts of FRG (North Sea and Western Baltic) in 1987.

Except for Phaeocystis which forms blooms almost every summer in the eastern and northern Frisian coastal waters of the German Bight, no exceptional algal blooms were observed either. Gyrodinium aureolum was not detected.

An attached map shows the occurrence of Dinophysis norvegica in the German Bight in August 1987.



Dinophysis norvegica (10^3 cells/l) August 1987

DSP in Ireland 1987

- 1) Locations: South west coast of Ireland - Roaringwater Bay, Dunmanus Bay, Bantry Bay, Kenmare Bay, Dingle Bay (Ventry)
- 2) Dates: July 1987 - December 1987
- 3) Effects:
 - DSP in mussels on suspended rope culture at all depths.
 - Maximum toxicity Rat bioassay (+++)
 - No human illness reported due to early detection.
- 4) Management decision: Areas closed for sales of bivalve molluscs until areas clear for at least two successive weeks. All areas except Ventry clear by 27 November. Ventry clear 11 December.
- 5) Causative species: Dinophysis acuta max 19,760 cells/l
Dinophysis acuminata " 6 160 " "
in single discrete sample taken on 17 August 1987. Other counts in range 50 - 2000 cells per litre. Mostly less than 500 cells/litre while toxicity persisted.
- 6) Environment:
 - temperature 14 °C July - 10 °C December
 - salinity not measured
 - no other physical measurements taken
 - Water coloration - no evident change
- 7) Physical location: Mussel longlines in sheltered bays
- 8) Previous occurrences: DSP in 1984
- 9) Comments: Very patchy distribution - Schull became reinfested briefly following 3 weeks clear
Toxicity persisted for a more protracted period than 1984 with serious disruption to trade.
- 10) Individuals to contact: Ms. J. Doyle/Mr. P. McDaid
Fisheries Research Centre
Abbotstown, Castleknock,
Dublin 15
Ireland
Tel: 210111 Telex: 31236 FRC

PSP in Ireland

IRELAND - 1987

1. Location: Estuary of R. Lee, Cork Harbour on South coast
2. Dates: 25 June - 28 July 1987
3. Effects: No human health problems reported.
- PSP detected in shellfish Mussels and Oysters (max 452 ug/100g meat)
4. Management Decision: Shellfish quarantine for four weeks
Cork Harbour only as no other adjacent bays were affected.
5. Causative species: Gonyaulax tamarensis (maximum 6.5×10^6 cells per litre)
G.spinifera dominant (max $44.5^1 \times 10^6$ cells/litre) Scrippsiella sp. and some Herterocapsa sp. in low numbers
(Confirmed by N. Paige Dept. of Botany, Royal Holloway and Bedford New College)
6. Environment: Temperature 16°C pH 8.75
7. Population: very localised and patchy within the Harbour area replaced by Chaetoceros sp. bloom 28 July.
8. Previous occurrences: June 1984 and 1985 and again very localised and with sub-lethal toxicity to mice. No human health incidents reported.
9. Additional Comments: During previous surveys of shellfish growing waters in Irish coastal waters no PSP toxin was detected and G.tamarensis is rarely noted. Routine PSP bio-assays are conducted for shellfish exports.
10. Individuals to contact Ms. Jacqueline Doyle/Mr. P. McDaid
Fisheries Research Centre
Abbotstown, Castleknock
Dublin 15
Ireland
Tel No.: 210111 Telex: 31236 FRC
EI

Fish Kills - Ireland 1987

1. Location: Ardbear Bay near Clifden Co. Galway
2. Dates: June 1987 - November 1987
3. Effects: Stress and reduced feeding response
Fish mortalities occurred on following dates
7, 14 and 21 September 1% - 11% mortalities
and on 13 October 65% mortalities.
4. Causative species: Flagellate "X" sensu Droop
(max 4.5×10^6 cells per litre).
5. Management decisions: Early slaughter commenced
21 September. Site abandoned for 1988 for
May - October.
6. Environment: Temperature 14°C at surface 10°C at 10m
depth.
Secchi 2.5m at cages 4.0m in exposed
part of Bay.
Colour - greenish
7. Population: Source of seed population in tidal lake where
mussel culture being undertaken. Bloom
appears to initiate there and is carried by
ebbing tides to cage site which is beyond a
sand bar but still within a deep hole in an
otherwise shallow area.
8. Previous occurrences: Mortalities due to this species
occurred in 1985 and 1986 despite relocation
of cages.
9. Additional comments: This flagellate has not yet been
taxonomically specified due to remote location
of the farm and difficulties in getting live
samples. Preservation with Lugols Iodine
causes breakup of the cell structures within a
short period of time. Similar flagellates
have frequently been found in other sheltered
sites and associated with stress or
mortalities. Relocation of farms and on site
rotation appears to be the only management
option.
10. Individuals to contact: Ms. J. Doyle/Mr. P. McDaid
Fisheries Research Centre
Abbotstown, Castleknock,
Dublin 15,
Ireland
Tel: 210111 Telex: 31236 FRC EI

National Report ICES Working group on Harmful Effects on Algal Blooms on Mariculture and Marine Fisheries.

Marie Kat, Netherlands Institute for Fishery Investigations,
P.O. Box 68, 1970 AB IJMUIDEN, The Netherlands.

Location: Dutch Waddensea - The Netherlands

Dates of occurrence: 28 September - 2 November 1987.

Effects: DSP in mussels (all sizes)
rat bioassay (++)
water colour ation - not relevant

Management decision: Area closed for shellfish fishery 28 September -
11 November 1987.

Causative species:

Dinophysis acuminata max obs. 30 cells/litre net hauls of 60 litres water.
-identification no problems.
-no chlorophyll measurements.

Environment: - temperature 16-10°C
- salinity not measured
- mixed water column
- O₂ saturated

Physical location: mussel beds in shallow waters.

Previous occurrences : DSP outbreaks in 1961, 1971, 1976, 1979, 1981, 1986.

Comments: No bloom but even low cell concentrations of Dinophysis acuminata are able to infest mussels for consumption.

ICES Working Group on Harmful Effects of Algal Blooms on
Mariculture and Marine Fisheries - Lisbon 11-13 April 1988
NATIONAL DETAILED REPORTS - NORWAY 1987

BLOOMS AFFECTING FISH FARMING

Heterocapsa triquetra

1. Location: Vindafjord, Rogaland county, west coast of Norway
2. Dates: 5 and 6 July 1987
3. Effects: The fish seemed stressed and avoided the discoloured surface water and stopped feeding. No increased mortality was observed.
4. Management:
5. Causative species: Heterocapsa triquetra occurred in brown patches. As much as 200 million cells per litre was counted in a surface sample. Eutreptiella sp. was also numerous, 1 million cells per litre.
6. Environment: No data. The weather was calm.
7. Advected population or in situ growth: The mass occurrence is believed to have been a combination of in situ growth and concentration at the surface by physical processes combined with positive phototaxis of the algae.
8. Previous occurrences: Not known in this area
9. Additional comments: No
10. Individual to contact: E. Dahl, Flodevigen Biological Station, N-4800 Arendal, phone (041) 10580

Ceratium furca

1. Location: The Southern and western coast of Norway, (a large scale phenomenon)
2. Dates: The peak along the coast in August 1987
3. Effects: The fish avoided the discoloured water and stopped feeding in some cases
4. Management decision: The results from the algae monitoring programme were transmitted through MARINET, a computer based information system owned by the fish farmers central administration.
5. Causative species: Ceratium furca up to 3 mill. cells per litre were recorded in brown patches.

6. Environment: No data

7. Advected population or in situ growth: The alga was first numerous in the Skagerrak and was then transported along the coast with the Coastal Current, however, local growth along the coast may have maintained and even increased the algal population along the coast. The patches of brown water are believed to have been a combination of concentration by physical processes and positive phototaxis of the algae.

8. Previous occurrences: Ceratium furca is a very common species along the Norwegian coast in late summer and through the autumn. Brownish water due to mass occurrence of this alga happened also in 1986.

9. Additional comments: None

10. Individual to contact: E. Dahl, Flodevigen Biological Station, N-4800 Arendal, phone (041) 10580.

Polykrikos sp..

1. Location: The south and west coast of Norway, a large scale phenomenon.

2. Dates: September and October 1987

3. Effects: As for Ceratium furca

4. Management: As for Ceratium furca

5. Causative organism: Polykrikos cf. schwartzii/kofoidii

6. Environment No data

7. Advected population or in situ growth: Advocated and concentrated by hydrographical processes.

8. Previous occurrences: The occurrence was very similar to the year 1986

9. Additional comments None

10. Individual to contact: E. Dahl, Flodevigen Biological Station, N-4800 Arendal, phone (041) 10580.

BLOOMS AFFECTING SHELL FISH FARMING

Dinophysis spp. (D.acuminata, D.acuta, D.norvegica)

1. Location: The southern and western coast of Norway

2. Dates: Most of the year except for the winter (January, February and March)
3. Effects: Caused mussel toxicity (DSP)
4. Management: Harvesting of mussels were banned, at some locations all through the year. Administrated according to results from mouse bioassay.
5. Causative organism: Probably both D.acuminata,D.acuta and D.norvegica
6. Environment: No data
7. Advected population or in situ growth: The distribution is believed, to a certain extent, to be related to the propagation of the Norwegian Coastal Current.
8. Previous occurrences: Similar situation in 1984,1985 and 1986
9. Additional comments: None
10. Individual to contact:
E.Dahl, Flodevigen Biological Station, N-4800

Protoconyaulax/Alexandrium

1. Location: The south and west coast of Norway
2. Dates: May-July 1987
3. Effects: PSP was recorded along the south and west coast
4. Management decision: Mussels harvesting was banned.
5. Causative organism: Protoconyaulax/Alexandrium
6. Environment: No data
7. Advected population or in situ growth: In situ growth may be most important at most locations, however, the alga seems also, to a certain extent, to be distributed with the Norwegian Coastal Current.
8. Previous occurrences: PSP is recorded along the Norwegian coast.
9. Additional comments
10. Individual to contact: E. Dahl, Flodevigen Biological Station, N-4800 Arendal, phone (041) 10580

1987 Portugal

PSP

Location and dates of occurrences

- Mondego Estuary 1 Sept - 9 December 1987
- Aveiro Lagoon 10 - 18 November 1987
- off Espinho 24 August - 14 September 1987

Effects: PSP in Bivalve Molluscs (max 218ug/100g Mondego Estuary)

Management decisions: Harvesting of shellfish banned

- off Espinho and Northern Coast 26/8/87-29/10/87
 - All the coast and coastal lagoons North from NAZARE 8/9/87 - 21/12/87
- Mouse bioassay AOAC Method 1985

Causative species: Gymnodinium catenatum (18,000 cells/litre max)

Environment No discoloration of water noted
 Temperature range: 13-16 C
 Salinity range 20-35ppt

Physical location In situ growth. Probably due to excystment from the previous year population

Previous occurrences 1987 October and December on coast North from Cape Carvoeiro.

DSP

Location and Dates of Occurrences

- Obidoslagoon 6 - 20 August
- Mondego Estuary 1 September to 10 November (persisted until Dec in River Prante mouth)
- Aveiro 13 August to 18 November
- off Espinho 18 August to 1 September

Effects DSP toxins present in most bivalves as detected by the mouse assay (Yasumoto 1986)

Management decisions Shellfish harvesting closed

- Obidos Lagoon 11.8.87 - 24.9.87
- Aveiro region 13.8.87 - 24.11.87
- off Espinho and Northern coast 24.8.87 - 29.10.87

Causative species Obidos lagoon Dinophysis sacculus 24,000 cells.litre.
D.acuta 1000 cells/litre
 Modego estuary D.acuta 1000 cells/litre
 Aveiro D.sacculus 4000 cells/litre
D.acuta 6000 cells/litre
 Espinho D.acuta 28,000 cells litre
D.sacculus 2000 cells litre

Environment Temperature ranges 14-18 C
 Salinity 20-36ppt

Previous occurrences: The first time the presence of DSP toxins confirmed in bivalve molluscs related to Dinophysis species mainly D.sacculus

Individual to contact: Mania A. de M. Sampayo
 INIP
 Av. Brasilia 1400 Lisbon
 Portugal

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

Lisbon, Portugal, 11-13 April 1988

Spain Annual Report

1. Location
Ria de Camariñas (Galicia)
2. Dates of occurrence
July
3. Effects
 - No harmful effects. There are not shellfish fisheries in the area.
 - Mice bioassays and HPLC analysis of plankton samples have shown PSP toxins
 - Red discoloration
4. Management Decisions
There is not cultured shellfish in the area
5. Causative Species
Alexandrium tamarense. Maximum recorded concentration
30,000,000 cells/L in surface bucket samples
No chlorophyll measurements available
6. Environment
No data
7. Adverted population or in situ growth
No data
8. Previous occurrences
First record of PSP toxins in the west coast of Galicia due to species of genus Alexandrium
9. Additional comments
10. Individual to contact
M. J. Campos
Instituto Español de Oceanografía
Apdo. 130, 15080 A Coruña, Spain

1. Location
Rias Bajás (West coast of Galicia)
2. Dates of occurrence
October
3. Effects
 - No human illnesses
 - Mice bioassays (AOAC method) with maximum score of 121 ug STX/100 g.
 - No water discoloration visible
4. Management Decisions
Quarantines during more than a month variable according with the area
5. Causative Species
Gymnodinium catenatum. Maximum concentration of 21,000 cells/L in the upper 5m using the Lindahl's method
6. Environment
Temperature about 18 C
Salinity about 35.0
7. Adverted population or in situ growth
Probably advected from offshore and concentrated inside the rias.
8. Previous occurrences
1976, 1981, 1985 and 1986
9. Additional comments
10. Individual to contact
M.J. Campos
Instituto Español de Oceanografía
Apdo. 130, 15080 A Coruña, Spain.

S. Fraga
Instituto Español de Oceanografía
Apdo. 1550, 36280 Vigo, Spain.

1. Location
Ria de Vigo
2. Dates of occurrence
June
3. Effects
None

4. Management Decisions
Not necessary
 5. Causative Species
Dinophysis acuminata. 3,200 cells/L
(Integrated sample from 0-10m using Lindhal's method)
 6. Environment
Temperature 13-17 C
 7. Advected population or in situ growth
 8. Previous occurrences
It is a common species in these waters
 9. Additional comments
 10. Individual to contact
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain.
-
1. Location
Rías Bajas (West Galicia)
 2. Dates of occurrence
October
 3. Effects
 - No human illnesses recorded
 - DSP mice bioassays positive
 - No water discoloration
 4. Management Decisions
DSP toxins were detected during the PSP quarantine.

Causative Species
- Dinophysis acuta. Maximum recorded concentration of
3,000 cells/L in the upper 5m using the Lindahl's
method.
 6. Environment
Temperature about 18 C
Salinity about 35.5
 7. Advected population or in situ growth
 8. Previous occurrences
It is a common species in these waters.
 9. Additional comments
A sample of picked up cells was analyzed by the group of
Prof. T. Yasumoto by HPLC and Okadaic acid was detected.
 10. Individual to contact
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain.

1. Location
Rias Bajas (West coast of Galicia)
2. Dates of occurrence
July
3. Effects
 - Observed mortalities of cultured adult bass and juveniles turbot in pools could be caused by this plankton bloom.
 - Conspicuous brown discoloration
4. Management Decisions
5. Causative Species
Heterosigma akasiwo.
Maximum observed concentration 18,000,000 cels/L in a bucket sample.
6. Environment
Temperature about 16 C.
7. Advected population or in situ growth
In situ growth
8. Previous occurrences
1980, 1985 and 1986,
9. Additional comments
Water from the red tide was added at a small tank with young turbot causing their death.
10. Individual to contact
(Fish mortalities)
Ricardo Arnaiz
Centro Experimental de Vilaxoán
Apdo. 208, Vilagarcía de Arousa, Pontevedra, Spain.

(Plankton bloom)
Santiago Fraga
Instituto Español de Oceanografía
Apdo. 1552, 36280 Vigo, Spain

M.J. Cãmos
Instituto Español de Oceanografía
Apdo. 130, 15080 A Coruña, Spain

1. Location
Fuengirola, Málaga
2. Dates of occurrence
November
3. Effects
 - No human illnesses
 - PSP toxins were detected on samples of Venus verrucosa by mice bioassay (AOAC method) with a maximum score less than the quarantine level.
4. Management Decisions
No closures necessary
5. Causative Species
Unknown
6. Environment
No data available
7. Adlected population or in situ growth
No data available
8. Previous occurrences
This is the first time, PSP toxins detected in the Spanish Mediterranean coast.
9. Additional comments
10. Individual to contact
Ana Martinez
Sanidad Exterior
Vigo, Spain

RED TIDE ALONG THE SWEDISH WEST COAST

SWEDEN 1987

LOCATION From the Norwegian border to the south part of Kattegat

DATES 1-9 September 1987

EFFECTS oxygen deficiency observed at several localities

MANAGEMENT DECISION -

CAUSATIVE SPECIES assemblage of *Ceratium furca* (750 000 cells/L),
C. fusus, *C. lineatum*, *Prorocentrum micans*

ENVIRONMENT

PREVIOUS OCCURRENCES blooms nearly every autumn, but not with such high cell concentrations and not so widespread

ADDITIONAL COMMENTS

INDIVIDUAL TO CONTACT Odd Lindahl, Kristineberg Marine Biological Station
S-450 34 Fiskebäckskil, Sweden. tel. 46-523-22008
Bo Sundström and Lars Edler, Dept. of Marine Ecology, Univ.
of Lund, Box 124 S-221 00 Lund, Sweden. tel 46-46-
108366.

DSP IN BOHUSLÄN

SWEDEN 1987

LOCATION	Entire coast of Bohuslän
DATES	6 October - at least the end of November 1987
EFFECTS	DSP with values more than 40 µg Okadaic acid equivalents/100 g mussel meat.
MANAGEMENT DECISION	Shellfish ban
CAUSATIVE SPECIES	Not confirmed. <i>Dinophysis acuta</i> suspected
ENVIRONMENT	-
PREVIOUS OCCURRENCES	DSP every autumn since 1984
ADDITIONAL COMMENTS	Maximum values at different localities varied between 60 and 140 µg Okadaic acid equivalents/100 g mussel meat. In Gullmar fjord 340 µg Okadaic acid equivalents/100 g mussel meat was measured on October 22.
INDIVIDUAL TO CONTACT	Matts Hageltorn, Inst. of Food Hygiene, Sveriges Lantbruksuniversitet, S-750 07 Uppsala, Sweden. tel 46-18-171000. Lars Edler and Bo Sundström, Dept. of Marine Ecology, Univ. of Lund. Box 124, S-221 00 Lund Sweden. tel. 46-46-108366

PSP IN BOHUSLÄN

SWEDEN 1987

LOCATION	Entire Bohuslän
DATES	11 May - 6 July 1987
EFFECTS	PSP with values of more than 80 µg Saxitoxin equivalents/100 g mussel meat at Brattö (central Bohuslän) between 21 May and 6 July.
MANAGEMENT DECISION	Shellfish ban
CAUSATIVE SPECIES	Gonyaulax excavata (max cell concentration 24 000 cells/L).
ENVIRONMENT	-
PREVIOUS OCCURRENCES	Spring 1986
ADDITIONAL COMMENTS	
INDIVIDUAL TO CONTACT	Matts Hageltorn, Inst. of Food Hygiene, Sveriges Lantbruksuniversitet, S-750 07 Uppsala, Sweden. tel 46-18-171000. Bo Sundström, Dept. of Marine Ecology, Univ. of Lund. Box 124, S-221 00 Lund Sweden. tel. 46-46-108366.

BROWN TIDE

USA - 1987

1. Location: Peconic Bay, Great South Bay - Long Island, New York
(possibly also in Barnegat Bay, New Jersey)
2. Dates of Occurrence: July 1987 - February 1988
3. Effects:
 - no human illness
 - mortality of juvenile and larval scallops
 - water coloration - brown
 - eelgrass mortality
4. Management Decision: Re-seeding of juvenile scallops attempted;
unsuccessful due to mortality
5. Causative Species:
 - *Aureococcus anorexefferens* (maximum 10^6 cells/ml)
 - chlorophyll (maximum 25-30 $\mu\text{g/l}$)
6. Environment:
 - temperature: 0-26°C
 - salinity: 22-30 ‰
 - water column/stability: well-mixed, shallow
 - oxygen conditions: normal
7. Population: in situ growth
8. Previous Occurrences: 1985, 1986
9. Individual to Contact: Dr. E. Coper
Marine Science Research Center
SUNY at Stony Brook
Stony Brook, New York 11794
(516) 632-8745

WHALE MORTALITIES

USA - 1987

1. Location: Massachusetts and Cape Cod Bays
2. Dates: November, December 1987
3. Effects:
 - mortality of 15 humpback and 2 minke whales
4. Management Decisions: Public health advisory issued warning consumers about consuming mackerel, especially the viscera.
5. Causative Species: Saxitoxin has been positively identified (using mouse bioassay, HPLC, immunoassay, and TLC) in the viscera and liver of mackerel from the entire Gulf of Maine region and in the liver of some of the dead whales. Quantities range from 40 to 600 mg per 100 g of liver or viscera, or about 20 µg/kg fish. We have no knowledge of where and when the mackerel obtained their toxin. No toxin was detected in plankton tows in the areas where the whales were feeding. Saxitoxin in the mackerel probably killed the whales, but the final proof will be difficult or impossible to obtain.
6. Environment:
 - Temperature: 6-10°C
 - Salinity: 31-33 ‰
 - Oxygen: normal
- 7.
8. Previous Occurrences: This many whale deaths in a one month period is unprecedented in this region and perhaps globally as well.
9. Comments: Other fish have been tested, but the mackerel are the most toxic. Note that the toxin levels per fish are very low and do not pose a human health threat. The flesh of the fish was never toxic.
10. Individual to Contact: Dr. D. M. Anderson
Biology Department
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

PSP IN MAINE

USA - 1987

1. Location: Cape Porpoise to York, Maine
2. Dates of Occurrence: August, September 1987
3. Effects:
 - PSP detected in shellfish (800 ug/100 g meat)
4. Management Decision: Quarantine
5. Causative Species: Gonyaulax tamarensis
6. Environment: No measurements taken
7. Population: Seemed to be in situ growth, localized around Cape Porpoise
8. Individual to contact: John Hurst
Maine Department of Marine Resources
Boothbay Harbor, Maine 04575
(207) 633-5572

NSP IN NORTH CAROLINA

USA - 1987

1. Locations: Continental shelf of North Carolina south and west of Cape Lookout, including sounds and inlets inside the Outer Banks and southern Barrier Islands.
2. Dates: November 1987 - February 1988
3. Effects:
 - neurotoxic shellfish poisoning (NSP), 47 illnesses; respiratory irritation in humans; fish and scallop mortalities (more than 50%); water coloration - visible.
4. Management Decision: Shellfish quarantine for waters to south of Cape Hatteras.
5. Causative Species: Ptychodiscus brevis (confirmed by K. A. Steidinger).

At least 20×10^6 cells/l maximum concentration.
6. Environment:
 - temperature: 20-23° at onset; about 5-10°C in February as blooms declined
 - salinity: 24-36 ‰
 - offshore stratification: water mass with population maintained offshore, with pulses of cells brought to shore with wind events
7. The population was clearly advected north from Florida via the Gulf Stream. Some in situ growth is probable once the species was deposited in North Carolina waters.
8. Previous Occurrences: This outbreak is the furthest north that P. brevis has ever been reported in North America. This is a major spreading event.
9. Additional Comments: Although this species is usually confined to the warm waters of the Gulf of Mexico, it is still present in waters that are 5-10° C at this writing, although it is apparently not dividing. The concern is that if it survives the winter, it can then become a recurrent annual problem.
10. Individual to Contact: Dr. Patricia A. Tester
National Marine Fisheries Service
Beaufort, NC 28516
(919) 728-8735

