Phaeocystis = P. minimum.

Report on the Incidence and Implications of Phytoplankton Blooms on the East Coast, and particularly Wexford Harbour - Summer 1984

by

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Report on the incidence and implications of Phytoplankton Blooms on the East Coast and particularly Wexford Harbour Summer 1984.

1. Introduction

From June 18th the Fisheries Research Centre have had a number of reports of discoloured water between Brittas Bay Co. Wicklow and Wexford Harbour and south to Kilmore Quay. Samples of water received from Dr. David Jeffrey, Department of Botany Trinity College, collected from Penny-come-quick beach, co. Wicklow on June 17th and examined by Tom Dunne in the Laboratory contained dense colonies of Phaeocystis pouchetii - a microscopic algae.

Subsequent samples collected by Miss Ann Kiley - Pollution Officer, Wexford County Council on June 20th traced the extent of the bloom as far south as Neamstown near Kilmore Quay. A sample taken at Cullenstown west of Kilmore Quay was clear. Also associated with this bloom were large numbers of needle like diatoms (Nitzschia spp.).

More seriously, blooms of another microscopic alga (Prorocentrum minimum) began to develop in early July during the later phase of the Phaeocystis Bloom

2. PHAEOCYSTIS BLOOM

Phaeyocystis seems to find the inorganic nutrient conditions prevalent inshore in early summer suitable for growth (Spencer (1972). During the growth period cells repeatedly divide producing extensive quantities of mucilaginous substances forming bladders around the cells and easily visible to the naked eye. Temperatures and wind direction may be

important factors in bloom concentrations and distribution.

Phaeocystis was first reported from the Irish Sea for the River Mersey in 1931 and choked tow nets with mucilage. In more recent years it has been reported in the Eastern Irish sea (Jones and Haq 1963). It has also been reported from Dutch Coastal areas (Kat 1977). It has previously been reported here from the South Coast of Ireland Parker, Dunne, McArdle (1981)

Het :
Hex:

Spencer (1972) recorded the greatest concentrations close to shore. This coincides with our findings this year on the Wexford Coast where the discoloured water was described as about 100 metres wide and concentrated close to the shore.

Strains of Phaeocystis are known to produce large amounts of extra cellular substances including Acrylic acid. (Guillard and Hellebust 1971).

When Phaeocystis blooms in combination with the needle like structure of Nitzschia then the stinging sensations of the hands and eyes and mild skin irritations or rashes reported by fishermen on the south coast in 1981, may result. Clogging of fishing nets (Parker et al 1982) or avoidance of areas of Phaeocystis bloom by fish have also been reported (Savage 1932).

Phaeocystis has bloomed more frequently in recent years and this may be related to nutrient input.

In summary it is a non-toxic bloom which causes inconvenience and discomfort for fishermen and in amenity areas where it discolours the water and can appear to foul the beaches when it decays and dies. Many reports of "foul smells" were associated withthe bloom in 1984 as reported by Members of the Public.

3. PROROCENTRUM BLOOM

As the initial Phaeocystis bloom persisted, further samples were collected at periods between 1st and 3rd July. Phaeocystis was still the dominant species but those samples taken from Ardcavan area of Wexford Harbour and from Rosslare Beach were found to contain large numbers of Prorocentrum minimum ca. 163 000 cells/litre. This species had been implicated in human mortalities in Japan and in gastro-intestinal disorders in Holland. Immediate action was taken to notify the Health Authorities in Wexford Harbour to post warning notices not to eat shell fish from the area until further notice. By Saturday 7th July cell counts of Prorocentrum had risen to 30 million cells per litre - which is an extraordina bloom.

3.1 Toxic effects of Prorocentrum minimum:

Prorocentrum minimum has been implicated in a number of shellfish poisonings since 1942, when 114 out of 324 victims were killed in Japan from eating clams (Okaichi and Imatomi, 1979) Kat (1979) reported gastrointestinal illness, but no deaths, after consumption of boiled mussels in 1961, 1971 and 1976 coinciding with the presence of Prorocentrum species.

Akiba (1950) extracted a toxin which he called venerupin from clams and Nakajima (1965) and (1966) reported the relationship between the abundance of the dinoflagellate Exuviaella mariare-leburiae and the toxicity of the clam. The species is now knownto be synonymous with Prorocentrum minimum var. mariae-lebouriae. There have also been reports of gastro-intestinal illnesses from Norway(Sakshavg 1984) following Prorocentrum blooms, and in Sweden large mortalities of eider duck were noted following similar blooms (Graneli 1984).

The significance of the current bloom in Wexford Harbour is that there are major mussel beds and cockle fisheries in the area and these can concentrate a toxin from filtering the phytoplankton. The organism Prorocentrum minimum va. mariae lebouriae has been present in very high numbers (up to 30 million cells/litre) in samples examined. From the literature, the nature of the toxin in European waters is not clear. Very little is known about the rate at which toxicity develops in shellfish, since in most cases reported to date the gastro-intestinal disorders of humans have preceded the phytoplankton examination and counts.

Action taken at Fisheries Research Centre (FRC)

We have been in contact with Dr. Kat of the Netherlands Institute for Fishery Investigations who has confirmed Tom Dunnes identification of Prorocentrum minimum va. mariae-lebourae as the dominant form in samples sent to her.

The results of the rat bioassay were negative for samples of mussels sent to her on July 10th. No D.S.P. (Diarrhetic Shellfish Poison)

could be detected. Please see attachment.

The method for toxicity testing used by the FRC is the same as that employed in the Netherlands. White rats of 100-150 grams weight are starved for 24 hours before being fed on test food containing extracts of contaminated mussels. After 24 hours they are examined for the presence of diarrhoea. In severe cases the rats may die and this can occur within 48 hours. Control rats are fed using mussels from a non affected area - Bellacragher Bay in Co. Mayo. Samples of phytoplankton and mussels from the area affected by the bloom have been taken at weekly intervals since 10th July. Up to 29 ~~August~~ July a series of five toxicity tests have been carried out on starved white rats fed on gut-hepatopancreas, whole raw mussel tissue and whole cooked tissue. Only trace responses have been noted to date. No rat deaths have occurred.

Summary of Results

Test No.	Date	Source	Result
1.	July 10/11	Raven Point Wexford Hb	Negative
2.	July 11/13	Blackman Wexford Hb	Trace response-mild diarrhoea soft fecal pellets
3.	July 12/14	Blackman Wexford Hb	Trace response mild diarrhoea, soft fecal pellets
4.	July 17/19	Blackman and Drinagh Wexford Hb	Trace response soft fecal pellets
5.	July 27/29	ditto	Trace response - soft fecal pellets

Comment:

The first batch of mussels taken were from an area in the Harbour where there was a low concentration of blooms. Tests No. 2 and 3 were carried out on mussels from an area with a high concentration of Prorocentrum minimum as were subsequent tests.

The trace response was a mild diarrhoea after 48 hours in one rat fed on gut heptopancreas of mussel. Other test rats produced soft faecal pellets. Control rats fed on mussels from Co. Mayo produced normal faecal pellets. The production of large loose faecal pellets is an indication of the presence of trace amounts of toxin, as is the mild diarrhoea reported in tests 2 and 3.

Results of Tests No. 4 and 5 suggest that the toxin is still present in very low levels.

The density of the bloom within the Harbour remained high up to and including the 22nd July when densities of between 6 and 8.5 million cells/litre were reported. On an inspection on Sunday 22nd July Tom Dunne reported high numbers upstream of Ferrycarrig Bridge which indicates the extensive distribution of the bloom within the Harbour. Under the weather conditions prevailing up to the 30th July the bloom was expected to persist for some time.

Further action proposed:

It will be essential to continue toxicity tests until the bloom has disappeared and for a number of weeks after that to ensure negative results. Samples of both mussels and phytoplankton should continue to be collected at weekly intervals.

The assistance of Miss Ann Kiely in this regard has been greatly appreciated.

We propose to send duplicates of the August 1st samples to Dr. Kat in the Netherlands for further testing there.

Results of Test No. 6 should be available from the Fisheries Research Centre on August 3rd but cannot be expected from Dr. Kat until August 7th.

Recommendation:

Since the rate of development of toxicity is unknown we would recommend that the ban on eating shellfish remain in force until the bloom disappears and for a period of time (3 weeks) after that during which consecutively negative results for toxins must be obtained.

References cited

Akiba et al (1950). Studies on the poisoning caused by Asari and Oyster. Report for the Research Problem supported by the Grant from the Ministry of Education.

Graneli, E. (1984). Personal communication.

Guillard, R.R. and Hellebust, J.A. (1971). Growth and the Production of Extra cellular Substances by Two Strains of Phaeocystis poucheti J. Phycol. 7 330-338.

Jones, P.G. and Haq, S.M. (1963). The Distribution of Phaeocystis in the Eastern Irish Sea. J. Cons. Explor. Mer. 27 (1) 1 - 20.

Kat, M. (1977). Four years Phytoplankton investigations in Dutch Coastal Area 1973-1976. ICES CM 1977/L:2.

Kat, M. (1979). The occurrence of Prorocentrum species and coincidental gastrointestinal illness of mussel consumers. In Toxic Dinoflagellate Blooms Vo. 1 Ed. by D. Taylor and H. Seliger.

Nakajima, M. 1965. Bull. Jap. Soc. Sci. Fish. 31 198-203

1968 " " " " " 34 130-132

Okaichi, T. and Imatomi, Y (1979). Toxicity of Prorocentrum minimum var. mariae lebouriae. Assumed to be a Causative Agent of Short-necked Clam Poisoning. In Toxic Dinoflagellate Blooms Vol. 1. Ed. by D. Taylor and H. Seliger.

Parker, M., Dunne, T. and McArdle, J. (1982). Exceptional Marine Blooms in Irish Coastal Waters. ICES CM 1982/L:44

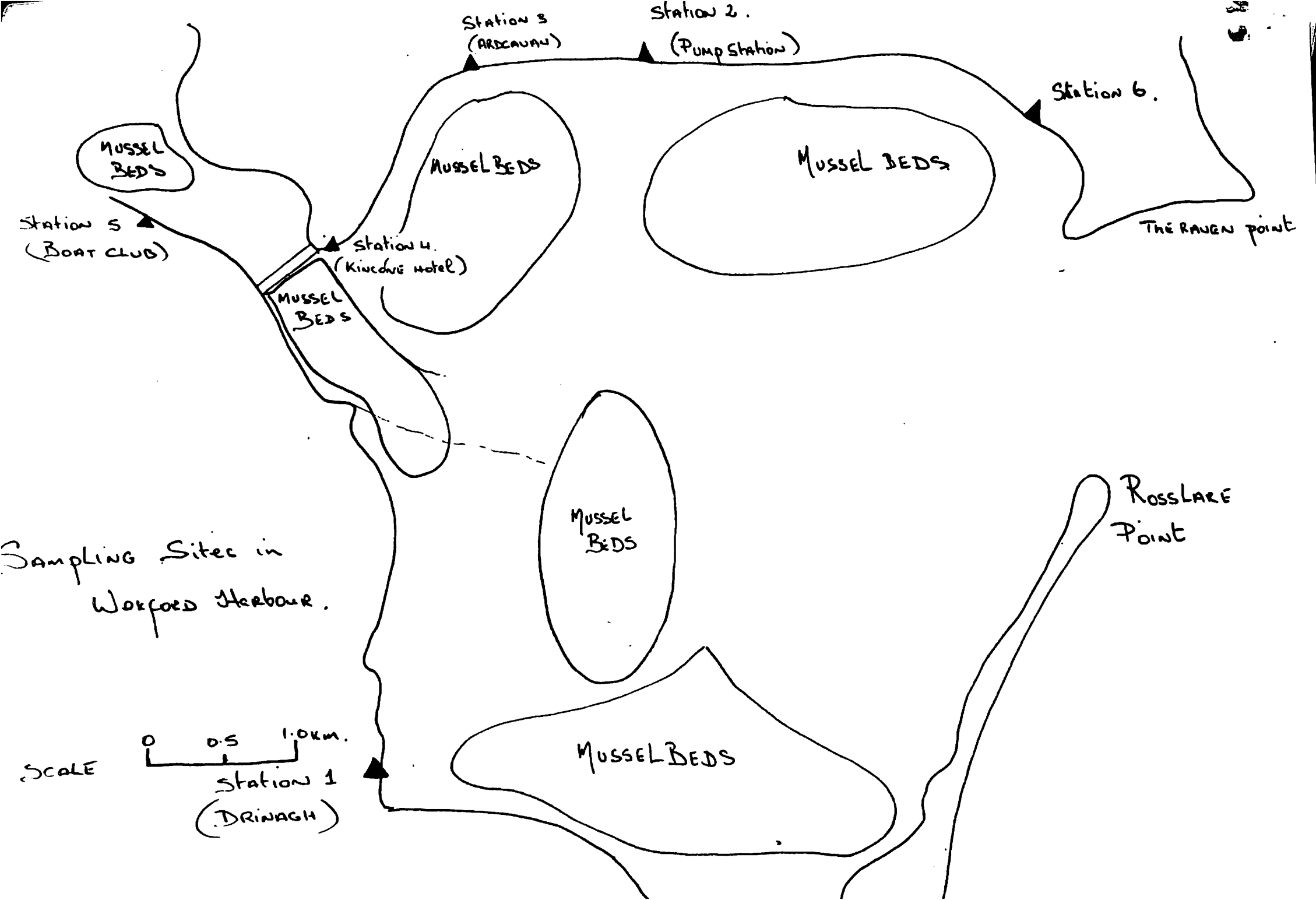
Sakshavge, E. (1984). Personal Communication.

Savage, R.E. (1932). Phaeocystis and Herring Shoal J. Ecol. 20. 826-840

Spencer, C.P. (1972). Plant Nutrient and Productivity Study. Appendix 16. Rept. of Working Party on Disposal of Sludge in Liverpool Bay. Vol. 2. HMSO 1972.

Attachments:

1. Map of Area affected
2. Letter from Dr. M. Kat
3. Scientific Paper by Tomotoshi Okaichi and Yukiya Imatomi
4. " " by Marie Kat


Station 3
(Ardcanan)
Station 2.
(Pump Station)
Station 6.
Mussel Beds
Mussel Beds
Mussel Beds
The Raven point
Station 5
(Boat Club)
Station 4.
(Kinsale Hotel)
Mussel Beds
Mussel Beds
Mussel Beds
Mussel Beds
Rosslare Point
Sampling Sites in Wexford Harbour.
Scale
0 0.5 1.0km.
Station 1
(Drinagh)