

**IRISH FISHERIES
INVESTIGATIONS**

C. Pybus and D. McGrath

Large scale *Phaeocystis* blooms off the west coast of
Ireland in 1990



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Large scale *Phaeocystis* blooms off the west coast of Ireland in 1990

by

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ABSTRACT

The occurrence of blooms of *Phaeocystis* are reported from the West Coast of Ireland in the spring of 1990. Populations were observed along the coastlines of counties Clare, Galway, Mayo, Sligo and Donegal. The causative species is believed to have been *P. globosa*. These blooms represent the largest scale development of this or any other phytoplanktonic species recorded from this geographic area.

INTRODUCTION

The occurrence of large scale algal blooms is not uncommon in Irish coastal waters. In 1976 extensive populations of *Gyrodinium aureolum* developed off the south coast of Ireland (Ottway et al., 1979). The following year a large bloom of a *Noctiluca* species occurred, also off the south coast. No further occurrences of *G. aureolum* were recorded until 1978 when an extensive bloom extended along the south coast and into the bays of south-west Cork (Cross and Southgate, 1981; Jenkinson and O'Connor, 1980; Roden et al. 1980; Pybus, 1980, Parker, 1981). Other organisms, for example *Noctiluca* sp, *Nitzschia* sp and *Gonyaulux polyedra* also developed sufficient populations to excite comment and concern during this period and in this area (Parker, 1981). Species recorded as causing blooms during 1985 and 1986 include *Gonyaulux tamarensis* and *Gonyaulux spinifera* from Cork Harbour, *Rhizosolenia delicatula* off Dundalk, flagellate 'X' (now identified as *Heterosigma akashiwo*) in Mulroy Bay and, off the south coast, *Dinophysis* spp. and *Prorocentrum minimum* (Anon, 1989). The major algal blooms recorded in Irish coastal waters in 1990 included *Dinophysis* sp. and *G. aureolum* off the south and south-west coasts, blooms of *Noctiluca* off the east coast and *Prorocentrum minimum* in Wexford Harbour (Jackson, Doyle and Moran, 1991). These authors also reported a bloom of *Phaeocystis* on the west coast in the summer of 1990. This bloom is examined in more detail in this paper.

To date, on the west coast, only localised, small scale algal blooms have been recorded, including, as the causative agents, the dinoflagellates *Glenodinium foliaceum* (Pybus et al, 1984; 1986), *Gonyaulux spinifera* (Pybus et al, 1986), *Ceratium tripos* (Pybus, 1984) and *Prorocentrum micans* (Pybus, 1990). Blooms of *Heterosigma akashiwo* also developed in some of the bays on the Co. Mayo coast in the late 1980s. In the late spring of 1990 the occurrence of coloured water was reported from a number of west coast localities. This colouration was found to be caused by a bloom of the prymnesiophycean alga *Phaeocystis*. It persisted throughout a period of warm, calm weather in May until it was apparently dispersed by rough weather in early June (Figs. 1 and 2). Further investigations and observations showed that this *Phaeocystis* bloom occurred at a number of localities over a wide geographic area with confirmed reports from over 250 km of coastline.

Although blooms of *Phaeocystis* have been recorded regularly from the North Sea (see for example Cadée and Hegeman, 1986), in the Irish Sea (Evans, 1981; Rogers and Lockwood, 1990) and in the western English Channel, there are few published records of similar occurrences in Irish coastal waters. In three years (1977 to 1979) of weekly sampling at Carna, Co. Galway, there was only one confirmed record of *Phaeocystis*, on 25 April, 1977. The salinity and temperature of the water were 32.1 and 12.2°C respectively. However, in April and May, 1978, it was observed to be a common but minor constituent of the phytoplankton in nutrient enriched seawater tanks, the contents of which were used for feeding oysters at Carna. A very dense bloom of *Phaeocystis* was seen in Ballynakill Harbour, Co. Galway, at low water near the oyster beds on 15 May, 1979. On this occasion the salinity and water temperature were 33.0 and 12.3°C respectively (B.Ottway, pers comm.). *Phaeocystis* bloomed off the mid-region of the south coast in 1981 (Parker et al, 1982) but prior to that the only published record is a reference to a bloom off Knockadoon Head, Co. Cork, in 1972 (Parker, 1981). Therefore it was surprising to discover the extent and duration of the 1990 bloom, whose occurrence off the west coast of Ireland is here described.

METHODS

Quantitative samples were usually collected from the shore in 0.5 or 1 litre containers and returned immediately to the laboratory for examination. All samples were examined live within two hours of collection. No attempt was made to count individual cells. The fresh sample was placed in a glass beaker or petri dish which was held in the beam of a high intensity lamp and the *Phaeocystis* colonies were counted by eye. When necessary, samples were diluted with filtered seawater to facilitate counting.

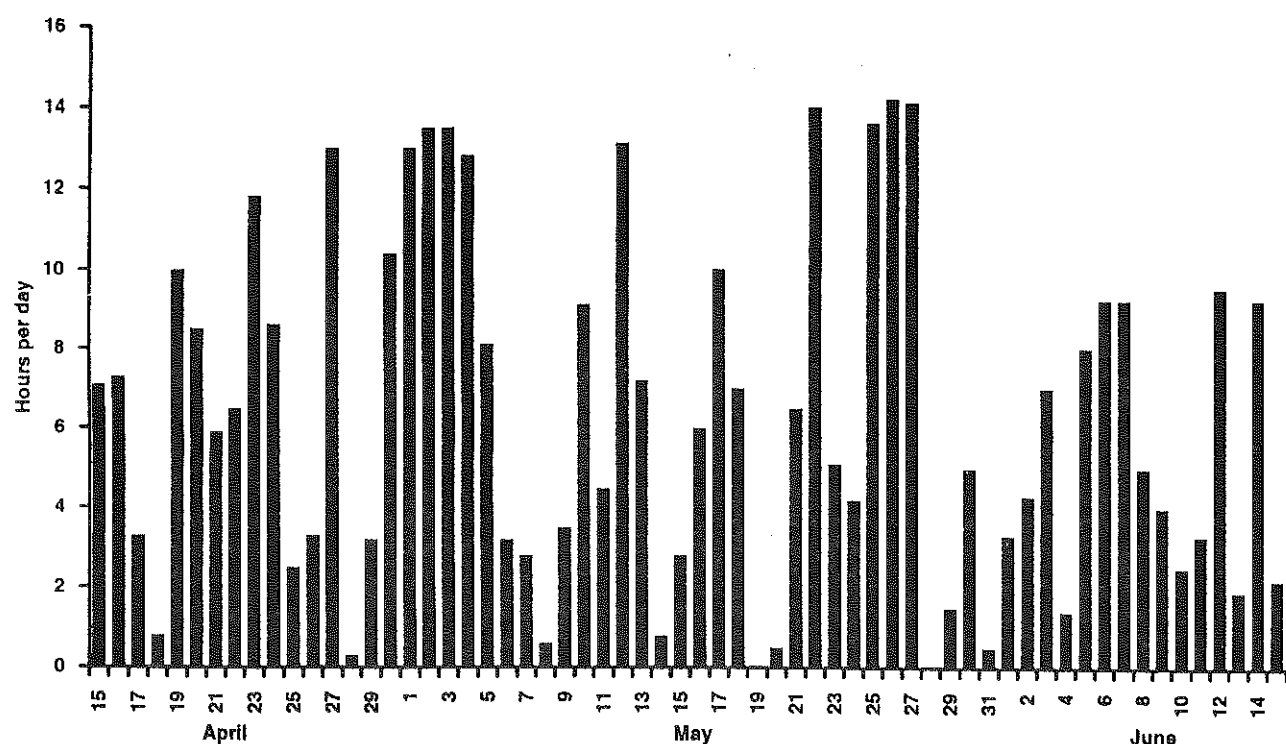


Figure 1. Hours of recorded sunshine on the west coast of Ireland (April to June 1990). Based on data collected at Shannon Airport (Anon., 1990a, 1990b and 1990c).

RESULTS

On 8 May 1990 'dirty water' was reported from a popular bathing beach at Salthill, Co. Galway. Samples of water were collected within two hours of the report. At the time of collection the water appeared clear to the naked eye but on examination in the laboratory colonies of *Phaeocystis*, at a density of 10 per dm³ were found. Initially the species was identified as *P. pouchetii* (Hariot) Lagerheim but subsequent measurements and observations indicated that, at least in Inner Galway Bay, *P. globosa* Scherffel was the bloom-forming organism. The colonies were spherical or disc-like, often over 1mm in diameter and had the constituent cells arranged around the periphery. No colonies showed the lobular arrangement typical of *P. pouchetii* (Jahnke and Baumann, 1987; Sourmia, 1988). However, considering the doubts which still exist over the correct specific designations within this morphologically polymorphic genus (Moestrup and Larsen, 1992) all subsequent references will be made only to the genus *Phaeocystis*.

The following day coloured water was reported from several localities on the north-west Galway Coast (K. Rogers, pers comm.) and further examination of water at various bathing beaches in inner Galway Bay (Fig. 3 and Table 1) confirmed the presence of *Phaeocystis* at several localities. From such observations it became apparent that the colonies gave a coloration to the water at densities in excess of 3 x 10³ colonies per dm³. Accordingly, any reports of coloured water can be assumed to have been made from areas where the colonies existed in similar, or higher, concentrations. A number of the beaches in inner Galway Bay were visited periodically throughout May and quantitative samples collected. *Phaeocystis* was found in most of these samples (Table 1). By the end of May the colonies were starting to disintegrate and none was found at the beginning of June following a period of rough and stormy weather.

These data (Table 1) also indicate that the bloom probably attained its greatest densities during the third and fourth weeks in May although the peak numbers did not coincide at all localities. Indeed occurrences were sporadic and variation at sites was often greater than the variation between sites. This would suggest that the bloom was not evenly distributed throughout the area but was of a patchy occurrence, the patches probably being distributed by tidal movements and localised currents. As samples were collected mostly in shallow water some natural concentration may also have taken place.

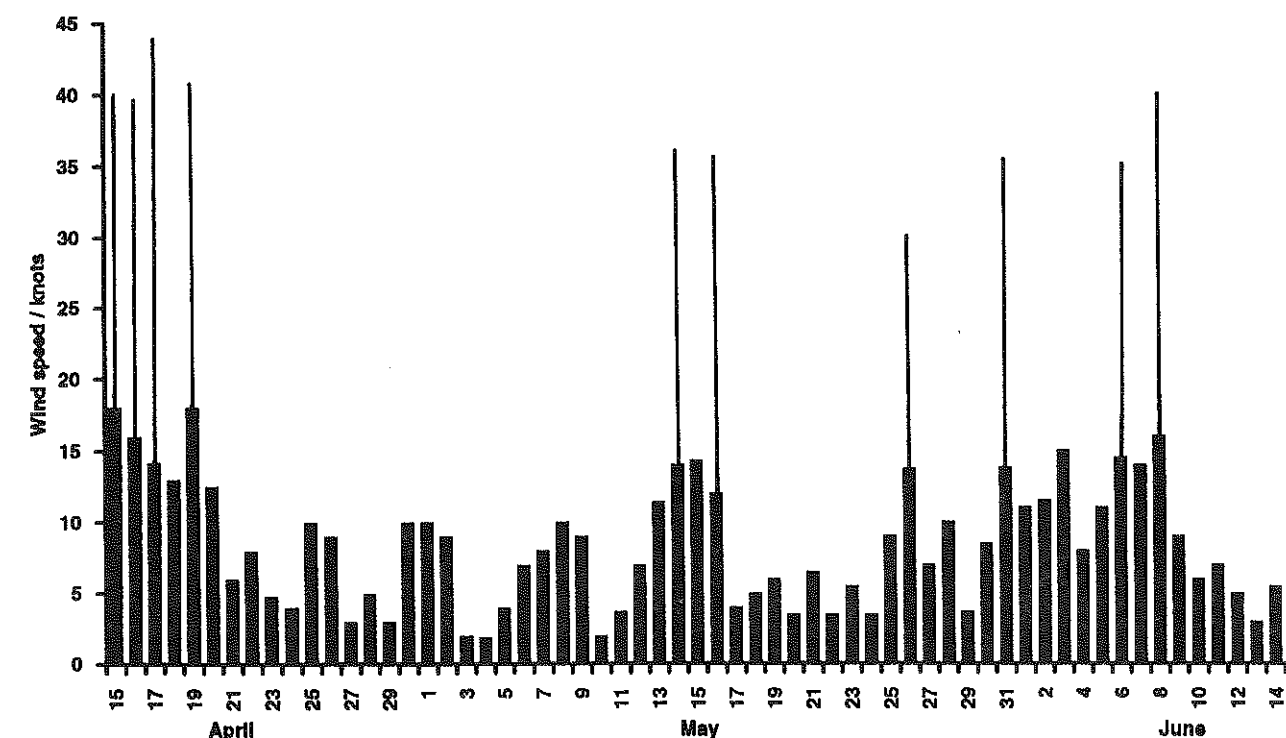


Figure 2. Mean wind speed and significant (> 33.5 kt) gusts recorded at Shannon Airport. Based on data collected at Shannon Airport and Cahersiveen (Anon., 1990a, 1990b and 1990c).

In an attempt to determine the area covered by the *Phaeocystis* bloom several fish farms were contacted. Operatives at these establishments keep routine records of variables such as water clarity and are often well placed to make observations on developing algal blooms. Many were able to provide useful information which contributed to a knowledge of the geographical range of the bloom and in some cases water samples were examined at the Fisheries Research Centre in Dublin. These data are presented in Table 2 and their locations are shown in Fig. 4. They indicate that *Phaeocystis* was present, often at high densities, at many localities along the west coast, from Co. Donegal in the north to Co. Clare in the south. The fact that most observations were recorded from the Galway and Mayo coastlines probably reflects the greater numbers of observers and interest in mariculture in these areas.

The earliest confirmed occurrence was in inner Galway Bay on the 28/29th April. Unfortunately no counts are available. There then followed a period of settled weather, with above average sunshine (Fig. 1), low rainfall and generally light winds (Fig. 2), ideal conditions for the development of algal blooms. The weather deteriorated at the beginning of June and a period of rough weather appears to have caused the bloom to disperse and the colonies to disintegrate. After this date only two further occurrences were recorded: within the surveyed area *Phaeocystis* was found at Bertraghboy Bay on the 11th of July at a density of 40 colonies per litre, and on the east coast its presence was noted at Roanacarrig, Greystones, Co. Wicklow (J. Silke, pers comm.).

There was no obvious pattern evident in the distribution and chronology of the reports to suggest that the initial development of the bloom was localised in any one particular area. However the chronology of the reports appears to indicate that, at least for the Galway Bay area, the populations developed earlier at the more seaward localities than in the inner bay even though it is known that *Phaeocystis* was present in the inner bay during April.

Many incidental reports, mainly of a biological nature, were also made by the various observers. These are listed in Tables 1 and 2 and are referred to by their table and record number in the following paragraph. No substantial records of mortalities of any organism were attributed to *Phaeocystis*, although some dead ragworms were seen on the shores of Ballynakill Harbour (2.24) and many dead medusae were found in the

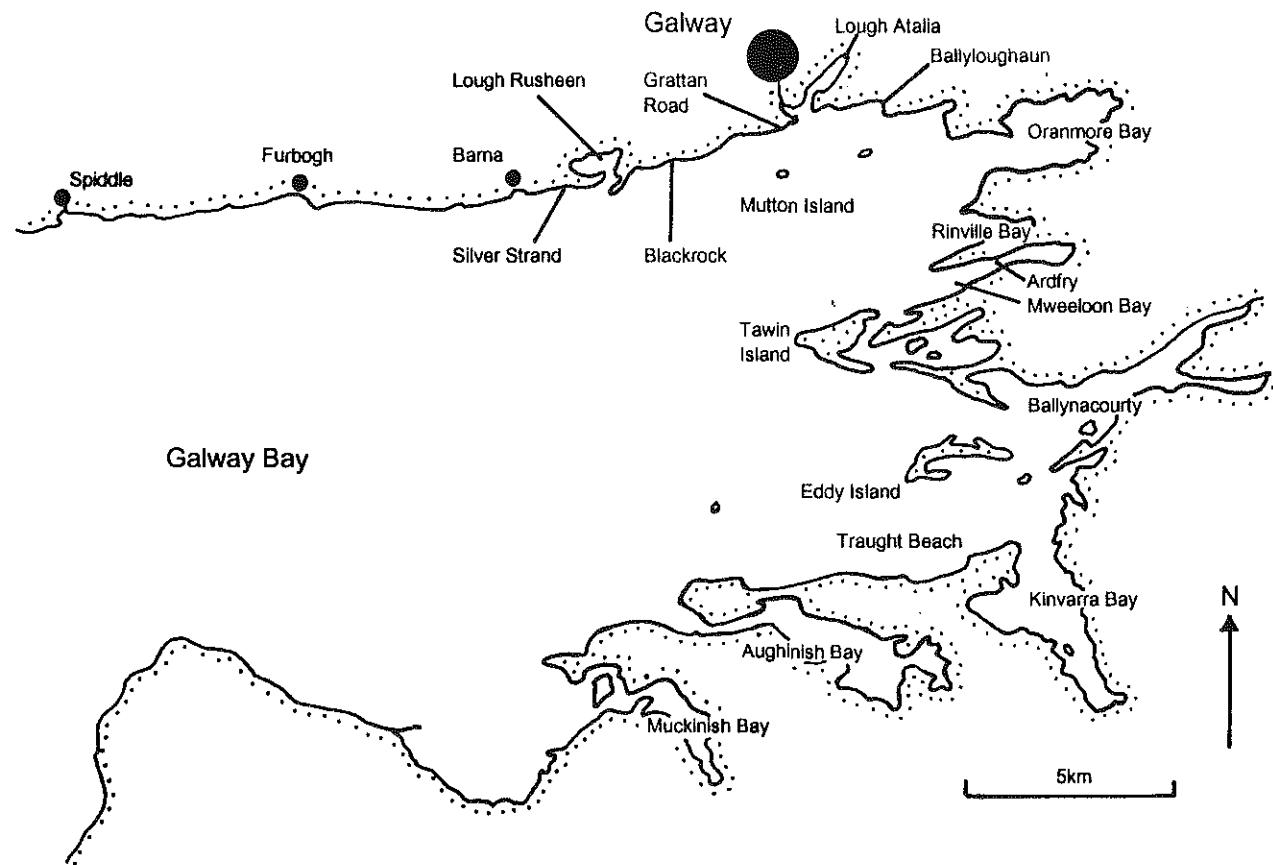


Figure 3. Locations in Inner Galway Bay where *Phaeocystis* was found. See Table 1 for details of colony counts.

water at this same locality. Caged salmon were reported to keep to the bottom of their cages (2.20) and were disinclined to feed (2.13, 2.22 and 2.28). On the other hand gobies in rock pools (1.5) were apparently unaffected by the *Phaeocystis* colonies as were other fish in open water (1.17). An absence of mussel (*Mytilus*) larvae from the zooplankton of Killary Harbour was also noted (2.1, 2.22, 2.28, 2.34), though mysids were noted swimming in the bloom (2.22, 2.28). Some intertidal invertebrates, including *Carcinus* (1.49) and *Eurydice* (1.43), and sand eels (1.6) also seemed to be normally active and unaffected when seen in water containing *Phaeocystis*. Oxygen supersaturation was observed at two locations, Bertraghboy Bay (2.9) and Ballynakill (2.24). Such supersaturation has also been associated with a *Phaeocystis* bloom in the North Sea (Tijssen and Eijgenraum, 1980).

DISCUSSION

The causes of the 1990 *Phaeocystis* blooms are unknown. Algal blooms, including those of *Phaeocystis*, have been studied by many people working in the North Sea and adjacent waters. In a recent review Richardson (1989) suggested that algal blooms in the North Sea are a natural phenomenon but their increase in intensity and frequency may be the result of eutrophication from anthropogenic sources. Also, Cadée (1990) and Lancelot et al. (1991) consider eutrophication to be an important factor in the development of *Phaeocystis* blooms in coastal waters of the Channel and the North Sea which are influenced by the effluents from continental rivers. The *Phaeocystis* bloom which developed in the north-western English Channel in 1990 was closely monitored and described by Davies et al. (1992). The factors leading to the initiation of this bloom could not be positively identified. They suggested, however, that populations of flagellate cells overwintering near the sea-bed in inshore waters developed rapidly when adequate quantities of light became available. The flagellates gave rise to the colonial forms which floated towards the surface and were carried out into the open waters of the Channel by the then prevailing winds. As the bloom declined motile flagellate cells were transported downwards where it is suggested that they form new overwintering populations. If this happened to the Irish populations of *Phaeocystis* it is possible that further blooms could be expected in these coastal waters when suitable conditions occur.

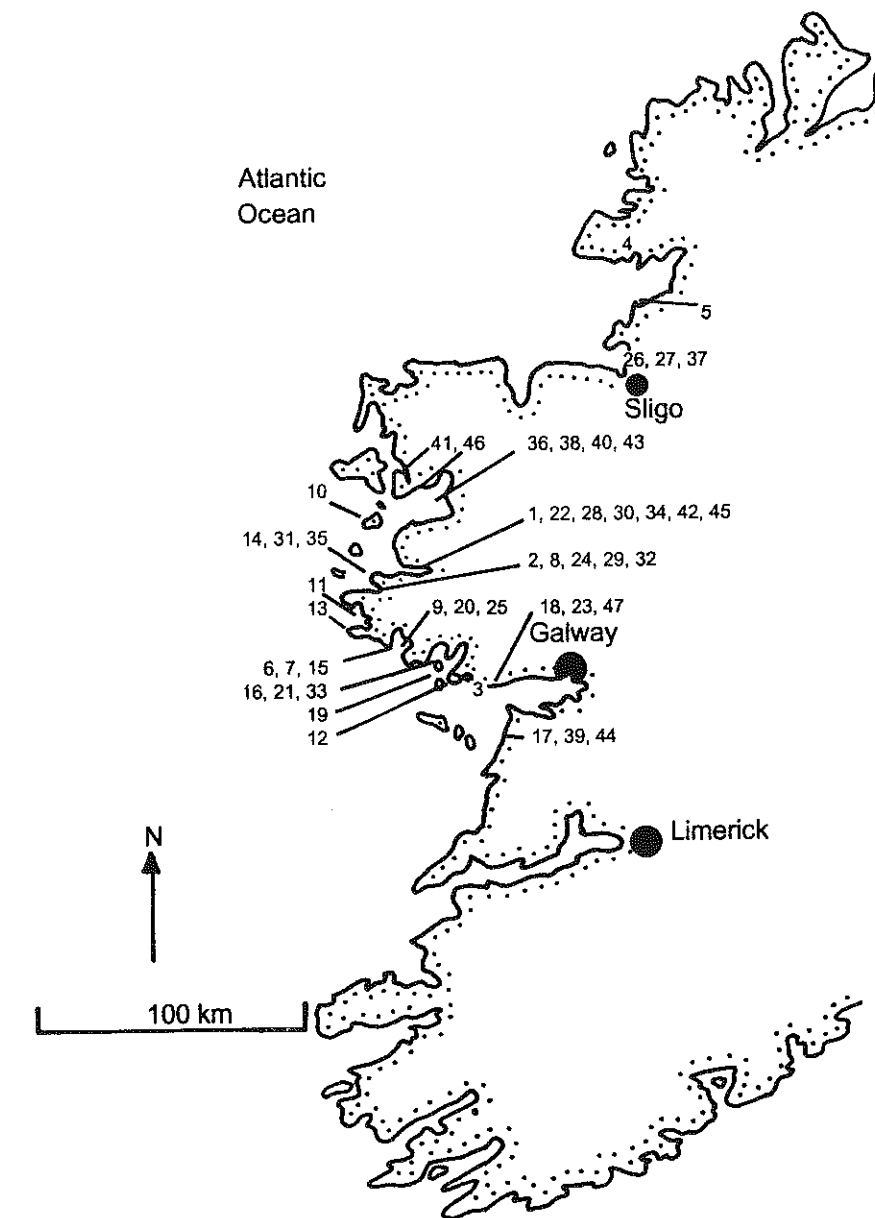


Figure 4. Locations on the west coast of Ireland where *Phaeocystis* was observed. Numbers referred to details in Table 2.

It is possible that a eutrophic effect combined with favourable weather conditions led to the development of the 1990 *Phaeocystis* bloom. Little published information exists concerning the concentrations of plant nutrients off the west coast of Ireland. Limited investigations by An Foras Forbartha indicate that the water quality in Galway Bay, for example, is 'generally' satisfactory but localised concentrations of ammonia and other nutrients do occur (Toner et al, 1986). It is also possible that natural *Phaeocystis* blooms develop periodically off the west coast of Ireland but have not previously been recorded. Finally the significance of this bloom must be emphasised. It is the first large-scale bloom to have been recorded from this part of the west coast of Ireland. Although it does not represent as large a scale development as some of the *G. aureolum* blooms of the south coast it is, nevertheless, one of the most extensive recorded occurrences of a single phytoplankton species in Irish coastal waters and in particular off the west coast.

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Table 1 Observations and colony counts of *Phaeocystis* from Inner Galway Bay in 1990.

No	Date	Location	Observations	Colonies/litre	Observer
1	28-Apr	Inner Galway Bay	Colonies in water		BO
2	7-May	Margaretta/Tawin	Bad visibility, mucus on nets		DMG
3	8-May	Blackrock	Complaints from bathers		CP
4	13-May	Barna	Colour present	600	
5		Furbogh	Very dense colour		
6		Spiddle	Dense colour		
7	14-May	Ballyloughaun	None seen		
8		Barna	Not as dense as previous day		
9		Blackrock		31	
10		Furbogh		280	
11		Grattan Road		7	
12		Lough Rusheen	Present but not abundant		DMG
13		Silver Strand	Present		
14		South Galway Bay	Present		MH
15	15-May	Ardfry	Present but none seen on previous day		DDH
16		Aughinish and Muckinish	Present		DA
17		Ballynacourty	Also present previous week	5 000	DMG
18		Mweeloon Bay		8 000	DMG
19		Rinville Bay	Very dense	48 000	DMG
20	16-May	Ballynacourty		20 000	CJ/CP
21		Tawin Island	Present		DMG
22	17-May	Ballyloughaun	None seen		
23		Barna		12	
24		Blackrock	Colonies fragmenting	3 000	
25		Furbogh		9	
26		Grattan Road		1 200	
27		Lough Atalia		4	
28		Silver Strand	Coloured water	21 000	
29		Spiddle	Colonies too delicate to count		
30	18-May	Grattan Road	Present moderate density		
31		South Galway Bay	High numbers present		MH
32	19-May	Ballynacourty	Very dense, water pinkish in colour		DMG
33		Blackrock	Dense but little colour		
34		Mweeloon Bay	Water a reddish brown colour		CM
35		Rinville Bay	Water a brownish-red colour		DMG
36		Tawin Island	Water apparently clear		DMG
37	20-May	Eddy Island	Dense throughout the area	15 000	DMG
38		Kinvarra	Present		DMG
39		Traught Beach	Water turbid, brownish in colour, locally dense		DMG
40	21-May	Ballyloughaun	Dense red brown, colonies fragile	2 000	
41		Barna	Obvious but no colour	3 000	
42		Blackrock	Dense with colonies		DMG
43		Furbogh	Water quite clear	50	
44		Grattan Road	Dense red brown	44 000	
45		Lough Atalia		390	
46		Mweeloon Bay	Colonies possibly decaying		DMG
47		Oranmore Bay	Water red brown with dense colonies		DMG
48		Rinville Bay	Red strips on shore?	21 000	
49		Silver Strand	No colour	2 000	
50		Spiddle		2	
51	22-May	Grattan Road	Present but fewer than on 21-May		
52	23-May	Furbogh	Yellow-brown, pea soupy	1 000	

Table 1—continued

No	Date	Location	Observations	Colonies/litre	Observer
53		Spiddle		2 000	
54	24-May	Blackrock		18	CP
55		Blackrock		760	DMG
56		Grattan Road		890	
57		Lough Atalia		130	
58		Mutton Island		4 000	DMG
59		Salthill to Mutton Island	Present along shore		DMG
60		Silver Strand		1 000	
61		Spiddle	None seen		
62	25-May	Ballyloughaun	Very dense orange brown	80 000	
63	26-May	Rinville Bay	Whole bay brown in colour, colonies dense		DMG
64	27-May	Furbogh	Colonies very delicate	10	DMG
65	27-May	Spiddle	No trace		
66		Ballyloughaun	Quite clear	27	
67		Barna	Murky but no colour	57	
68		Furbogh	None seen		
69		Grattan Road	Quite murky	199	
70		Rinville Bay	Colonies disintegrating	12	
71		Silver Strand	Murky but no colour	32	
72		Spiddle	None seen		
73	1-Jun	Ballyloughaun	Unreliable count	4	
74		Blackrock	Colonies disintegrating	170	
75		Grattan Road	Unreliable count	4	
76		Lough Atalia	None seen		
77	7-Jun	Ballyloughaun	None seen		
78		Barna	None seen		
79		Furbogh	None seen		
80		Grattan Road	None seen		
81		Rinville Bay	None seen		
82		Silver Strand	None seen		
83		Spiddle	None seen		

Table 2 Observations of *Phaeocystis* from the west coast of Ireland in 1990. The location of each record is indicated by a number in Fig. 4. The full names of the observers may be found in the acknowledgments.

No	Date	Location	Observations	Observer
1	3-May	Killary Harbour	No oyster or mussel larvae	DMN
2	9-May	Ballynakill Harbour	Large numbers of colonies	MH
3		Carraroe Bay	Abundant	JS
4		Inver Bay	Present at 10m depth	JS
5		Mullaghmore	Reports only	MH
6		Roundstone	Abundant	JS
7		Roundstone to Inishlacken	Substantial numbers present	MH
8	10-May	Ballynakill, Inner and Outer Harbour	Present at depths of 0 and 10m	JS
9		Bertraghboy Bay	From Salt Hill to Inishlacken	MH
10		Clare Island	Dense brown colour also apparent before today	NM
11		Clifden Bay	Present	MH
12		Greatman's Bay	Dense 100 colonies/litre	MH
13		Mannin Bay to Slyne Head	Very dense throughout the water column	MH
14		Rinvyle Beach	Present	MH
15		Roundstone	High numbers visible in water	KR
16	11-May	Kilkieran Bay	'Jelly' settled on sea-bed, underwater visibility bad	JC
17	13-May	Fanore	Turbidity noticed by divers at 13m, 'feel' to water	BM
18		Inverin	None seen	DMG
19	14-May	Casheen Bay	Present	MH
20	15-May	Bertraghboy Bay	Dense, visibility 20cm, fish deep in nets	KR
21		Kilkieran Bay	Present	KR
22		Killary Harbour	No mussel larvae, mysids seen in blooms	MH
23		Inverin	Present but sparse	DMG
24	16-May	Ballynakill Harbour	Dense, dead ragworms on the shore	MH
25		Bertraghboy Bay	High numbers at depth	MH
26		Drumcliff Bay	Abundant at 0m	JS
27		Drumcliff Bay	20 colonies per litre	KOK
28		Killary Harbour	High density of colonies	MH
29	17-May	Ballynakill Harbour	Present but at lower densities	MH
30		Killary Harbour	Present	MH
31		Rinvyle/Lettergesh	Present	BK
32	18-May	Ballynakill Harbour	Clear	MH
33		Kilkieran Bay	Thick scum on sea-bed	JC
34		Killary Harbour	Dense colonies, no mussel larvae	MH
35		Rinvyle/Lettergesh	Water brownish in colour	MH
36	19-May	Clew Bay	Present	MH
37		Bellacragher Bay	Present	KOK
38	20-May	Clew Bay	Highest numbers at depth	MH
39		Fanore	Abundant	JS
40	21-May	Clew Bay	Contradictory reports, clear/reddish water	DMN
41		Bellacragher Bay	Present at 1m depth	JS
42		Killary Harbour	Present in Inner Harbour only, water reddish brown	DMN
43	22-May	Clew Bay	26 and 140 colonies/litre at two sites	MH
44		Fanore	Divers reported poor underwater visibility	CM
45		Killary Harbour	Still present	MH
46	23-May	Mulranny Bay	Water clear	DMN
47	27-May	Inverin	None seen	DMG

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1967. 1. (1) Stocks of *Nephrops norvegicus* off the south coast of Ireland. F. A. Gibson, Ph.D.
 (2) Irish investigations on the lobster (*Homarus vulgaris* Edw.). F. A. Gibson, Ph.D.
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