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Mortalities of littoral and sub-littoral organisms associated with an Algal Bloom on the South Coast of Ireland, Summer 1976.

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ABSTRACT

In late July and early August 1976, kills of lugworms and other marine life were reported from several areas of the south coast of Ireland. These reports were investigated and further field observations made. The mortalities were associated with a bloom of a naked dinoflagellate, tentatively identified as Gyrodinium aureolum Hulburt. The possible origins of the bloom and its movement along the coast are discussed.

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INTRODUCTION

In late July reports of substantial lugworm (Arenicola marina) mortalities on the south Wexford coast were received at the Department of Fisheries, Dublin. Further reports came from areas to the West and an investigation was instigated.

The original reports were confirmed and further details were provided by the local inhabitants and fishermen. Affected beaches along the coast were visited and first hand observations were made. In several instances, a discolouration of the sea was noted. Sea water samples were taken in an attempt to identify the causative agent.

FIELD OBSERVATIONS (see Map 1)

Kilmore Quay

Lugworm mortalities were first noticed in the harbour at Kilmore Quay, Co. Wexford on 24.7.76. At the same time a brown discolouration of the sea was noted, both in the harbour and in adjacent lobster holding tanks.

The area was visited on 29.7.76. By this time the water discolouration had cleared. Many hundreds of lugworms

were lying dead and bleached on the shore. Some live lugworm were found wriggling freely in pools, but making no attempt to reburrow. No live Arenicola were taken by digging and no casts were seen on the sand surface. Other animals on the shore (e.g. Crangon crangon, Carcinus maenus, Macoma baltica) apparently suffered no ill effects. Extensive faunal collecting on an adjoining rocky shore showed nothing unusual.

One month later, a number of casts could be seen on the beach, showing that the mortality was not total.

Duncannon

Lugworm mortalities were first noted here on 26.7.76. Worms were still dying when the area was visited on 28.7.76. Mortality seems to have been almost complete. Bait diggers first noticed lugworms again in February/March 1977.

Ballynagaul Dungarvan

Mortalities observed on 3.8.76.

Ardmore

Lugworm mortalities and discolouration of the sea on the 3rd and 4th of August.

Youghal

This was the most westerly occurrence, and the effects here were the most dramatic. Reddish discolouration of the water was first noticed on 5.8.76, it persisted until 15.8.76 although in reduced intensity after 10.8.76. Only partial lugworm mortalities occurred, but other animals were affected. Large numbers of sole, plaice, flounder, and sand eels beached themselves, dying on the shore or in shallow water. Gapers (Mya sp), razor shells (Ensis sp), cockles (Cardium edule) and palourdes (Tapes decussata) surfaced on the beaches and were collected by the local people. Large quantities of fish and shellfish were removed and consumed. Perhaps coincidentally, a bout of diaorrhea swept Youghal at this time.

Oxygen measurements were taken in both surface and bottom waters on 11.3.76. All values were fully saturated.

OTHER OBSERVATIONS

During this period, catches of fish at angling meetings at Ardmore (24.7.76), Tramore (25.7.76) and Youghal (26-28.7.76) were poor or non-existent. However, landings of dermesal and pelagic fish and of shellfish at Dunmore East, the largest Fishery Centre on this coast, did not differ

significantly from the average landings in July and August of the previous five years.

On 12.8.76, the Air Corps flew a search along the coast, between Carnsore and Cork but saw no signs of discoloured water offshore.

No lugworm mortalities were reported on the East Coast of Co. Wexford. A number of beaches on the south coast were also apparently unaffected.

SEARCH FOR A CAUSATIVE AGENT

Reports of water discolouration which occurred during the mortalities suggested that an algal bloom might be responsible. Water samples were taken at Kilmore Quay on 29.7.76. By far the most abundant organism in the samples was a small naked dinoflagellate present at densities of approximately 500 cells/ml. Unfortunately the samples were poorly preserved and a positive identification was not possible. The species was tentatively identified as Gyrodinium aureolum Hulburt. The specimens were in good agreement with the description of G. aureolum given by Ballantine and Smith (1973). The cell densities are not particularly high, but by this time

the water discolouration had cleared and presumably the bloom was declining. Other dinoflagellates were present in the samples (e.g. Ceratium lineatum, Gyrodinium spirale, Protoperidinium steinii, Prorocentrum micans), but at much lower cell densities (total <10/ml). G. aureolum is thus implicated in the mortalities at Kilmore Quay. The behaviour of Arenicola at the other sites would suggest that it was responsible for these events as well. The series of mortalities is very similar to that discussed by Helm et al (1974) and Evans (1976, 1977) during blooms of G. aureolum in the eastern Irish Sea.

TOXICITY

At most sites, only lugworms were affected. At Youghal, however, mortalities of other benthic invertebrates and epibenthic fish occurred. Mobile epibenthic invertebrates do not appear to have been affected, though in Youghal there were unconfirmed reports that crabs deserted the inner estuary.

It is not known how G. aureolum kills lugworms. Helm et al (1974) suggest that mortalities were due to oxygen depletion in the substrate caused in part by the decomposition of the dinoflagellate bloom. The behaviour of fish at Youghal is reminiscent of that described by May (1973) during the

'Jubilees' in Mobile Bay, when fish are driven ashore by in-washing de-oxygenated water. In Youghal, however, measurements showed no oxygen depletion of the water.

Another possibility is that G. aureolum produces an irritant which drives lugworms to the surface where they die for other reasons (e.g. exposure).

Paralytic Shellfish Poisoning (P.S.P.) assays (Mc Farren, 1958; Ayres, pers. comm.) were carried out on mussels collected at Kilmore Quay, Tramore, Youghal and Wexford. All tests were negative. Helm et al (1974) also found no PSP toxin in mussels collected during a G. aureolum bloom.

ENVIRONMENTAL CONDITIONS AND THE DEVELOPMENT OF THE BLOOM

It is conceivable that a number of small local blooms were responsible for mortalities at individual sites. A more attractive idea is that a single offshore bloom passing along the coast was responsible for all the incidents. The sequential chronology of events east to west lends support to this idea, particularly as the residual tidal drift moves westward along this coast. Further, the drift west of Youghal is southward, away from the coast ( ). No incidents occurred west of Youghal. The sporadic nature of

the incidents could be accounted for if the bloom, or moribund fractions of it were swept inshore at intervals by the tide.

Weather data from two stations in the area are available (see table 1). Winds were mostly light, north-westerly. Rainfall was unusually low. Air temperatures were normal for the time of year (about 15°C), though the weather was somewhat overcast with little bright sunshine. Sea surface temperature records are available for the area from the Coningbeg light-ship. Over the bloom period they averaged 13.0°C which is within the normal range for this time of year.

The origin of the bloom must be considered. Blooms of G. aureolum have been reported by Pingree et al (1975, 1977) associated with the thermal front which develops in the Celtic Sea during the summer. Comparable fronts occur where the stratified offshore water becomes affected by tidal mixing (Pingree et al 1975). It is conjectural that activity at this coastal tidal front could have been responsible for the development of a Gyrodinium bloom offshore. This bloom then moved westward along the coast at a speed of approximately 8 km/day.

PREVIOUS OCCURRENCES

Gyrodium aureolum blooms were first recorded in European waters off the Norwegian coast in 1966 (Braarud and Heimdal, 1970). G. aureolum blooms have occurred on a number of occasions in recent years in the eastern Irish Sea (Helm et al 1974, Evans 1976, 1977) and offshore in the Celtic Sea (Pingree et al 1975, 1977).

There have been no previous recorded instances in Irish coastal waters. During collection of information on this event, several fishermen mentioned that substantial lugworm kills had occurred before in unspecified years. Red tides are known to occur on this coast, but have not given rise to concern and no scientific investigations have been conducted.

CONCLUSIONS

It seems likely that lugworms and other mortalities which occurred on the South coast of Ireland during July and August of 1976 were associated with a bloom of Gyrodium aureolum. This bloom appears to have developed in the Kilmore Quay area and moved westwards with the residual drift. This is the first

recorded case of a bloom of G. aureolum in Irish coastal waters.

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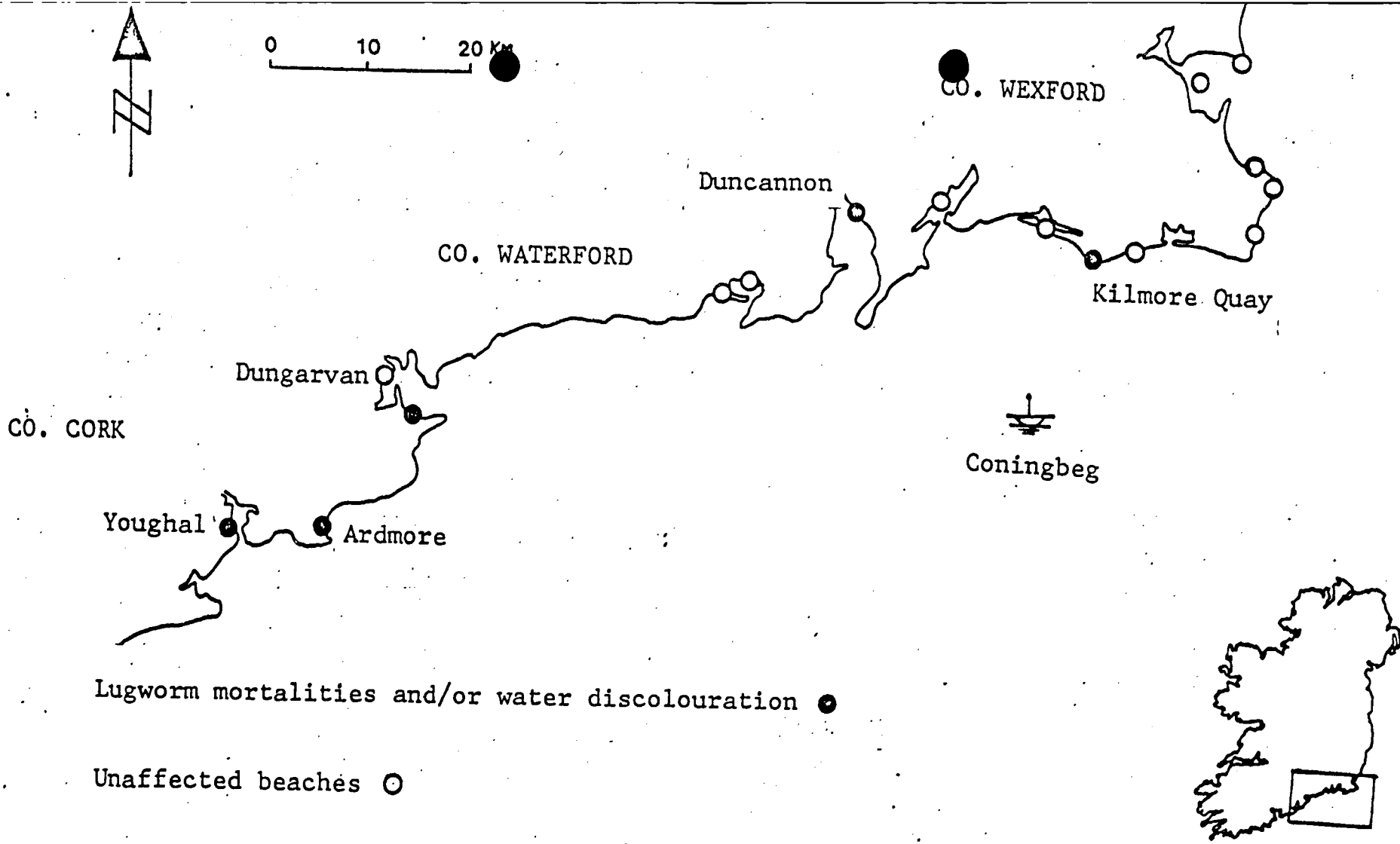

Map 1 South East Ireland, showing the distribution of lugworm mortalities and water discolouration.

TABLE 1

WEATHER DATA

Averaged for the stations at Rosslare (Co. Wexford) and Roches Point (Co. Cork).

1976		Mean Windspeed (knots)	Mean Daily Bright Sunshine (hrs)	Mean Daily Rainfall (mm)	Mean of Max-Min temperatures (°C)
July	18-24	9.5	2.0	Tr	14.6
July	25-31	8.6	5.4	Tr	15.0
August	1-7	6.9	2.0	Tr	15.4
Thirty Year Averages					
July		9.6	6.0	2.3	15.2
August		10.7	6.0	2.2	15.4

Tr = Trace

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