3.8 Phytoplankton

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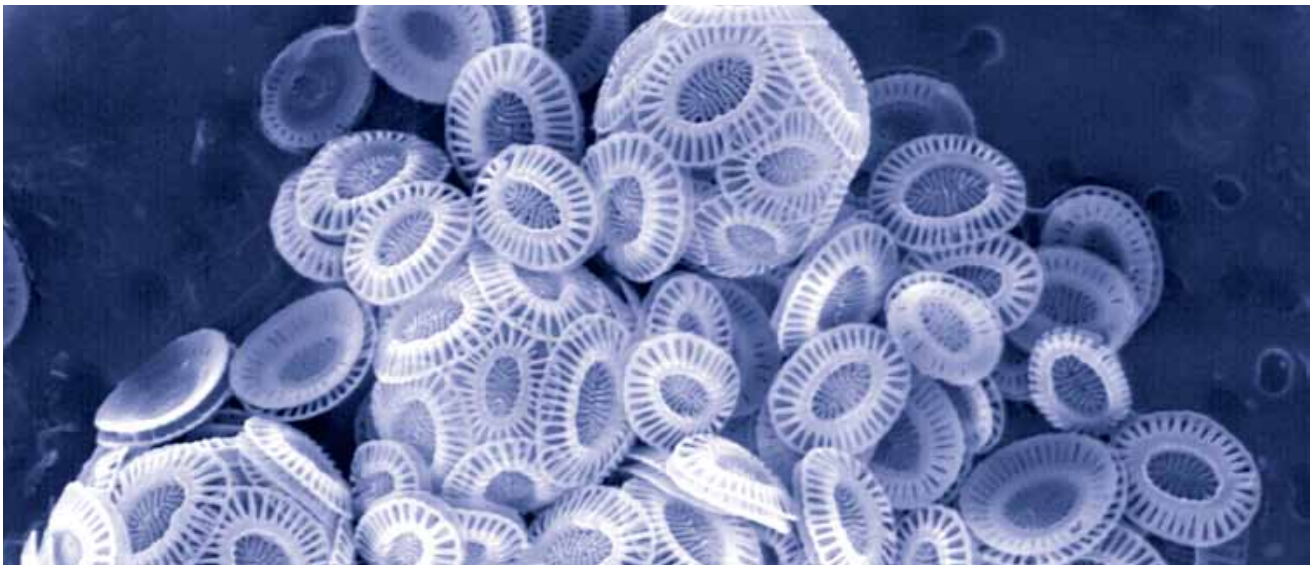
Phytoplankton are minute organisms, mainly single-cell plants, that live in water. Like terrestrial plants they contain chlorophyll and require sunlight, nutrients, and appropriate physical water conditions to flourish. They are responsible for absorbing significant amounts of carbon dioxide (CO_2) from the atmosphere, although much of this is released when the plankton die. They are at the base of the marine food chain. Although not harvested directly by humans, phytoplankton are key to the health of marine ecosystems: therefore, any impact of climate change on phytoplankton will have significant knock-on effects.



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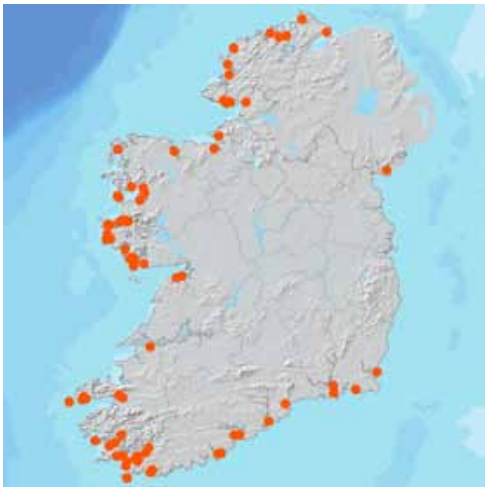

Map 3.8. Location of phytoplankton observation stations.

'The percentage occurrence of some potentially harmful species during the winter months has increased since 2000.'

Measurements

The Marine Institute analyses seawater samples for the presence of a wide variety of harmful and toxic phytoplankton from aquaculture sites around the Irish coast (red). The sampling programme is the responsibility of the Sea Fisheries Protection Authority (SFPA). At well-mixed shallow sites, surface seawater samples are collected while at deeper sites an integrated seawater sample from the water column is collected.

Measurements from a number of satellite sensors that detect radiation reflected from the ocean surface (ocean colour) are used to infer chlorophyll and hence phytoplankton concentrations. One of the longest continuous global satellite records is from the NASA *SeaWIFS* sensor which has been in operation since 1997, whilst the European *ENVISAT* made measurements of ocean colour from 2002 to 2012.

Time-series and Trends

An analysis of data on the presence and abundance of a potentially harmful microalga, *Karenia mikimotoi*, for the period 1990 to 2010 indicates its presence in Irish waters with a large interannual variability. Figure 3.16 shows the percentage of coastal water samples in which *K. mikimotoi* was present for each month since 1990. The most notable change is an increase, especially since 2001, in the percentage of samples in which it is found throughout the year, including winter. Over the last decade a warming trend has been observed in SST throughout the year in Irish waters. The Atlantic Multidecadal Oscillation (AMO) accounts for at least half of this change. This is currently in its warm (positive) phase and may be one of the reasons *K. mikimotoi* has been observed in winter samples.

'There is no operational climate change programme in place to monitor changes in phytoplankton community assemblages in Irish waters.'

Maintaining the Observations

Currently, there is no operational climate change programme in place to monitor changes in phytoplankton community assemblages in Irish waters. The data presented in this report originates from the National Monitoring Programme for Biotoxins. Phytoplankton are used as one of the biological quality elements for assessing changes in the nutrient levels of water bodies as part of the EU Water Framework Directive, coordinated by the EPA.

Further Information and Data Sources

Cusack, C. (2009) Phytoplankton, in *Irish Ocean Climate and Ecosystem Status Report 2009*. Nolan, G., Gillooly, M. and Whelan, K. (eds.) Marine Institute, Galway, Ireland, pp. 100.

Silke, J., O'Beirn, F. and Cronin, M. (2005) Karenia*: An Exceptional Dinoflagellate Bloom in Western Irish Waters, Summer 2005.* Marine Environment and Health Series 21. Marine Institute, Galway, Ireland, pp. 44.

The phytoplankton data presented here are archived by the Marine Institute and may be accessed on request: http://www.marine.ie/home/publicationsdata/RequestForData.htm

Data from plankton tows in the North Atlantic are available from the Sir Alister Hardy Foundation for Ocean Science (SAHFOS): http://www.sahfos.ac.uk/

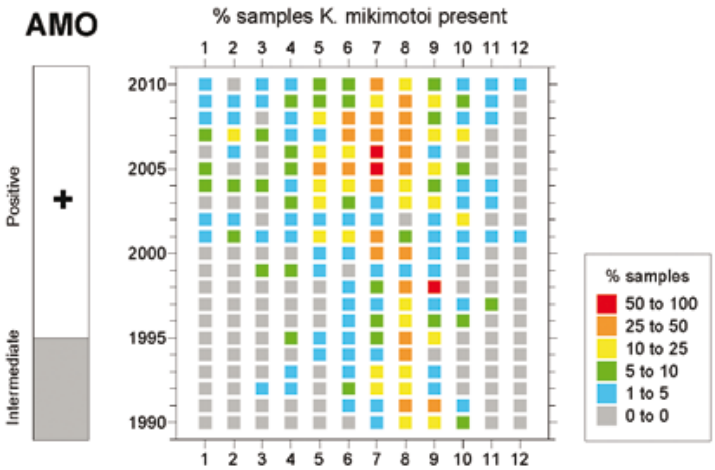

Figure 3.16. Percentage of coastal water samples in which *K. mikimotoi* was present for each month in the period 1990–2010. Also shown is the phase of the Atlantic Multidecadal Oscillation (AMO).