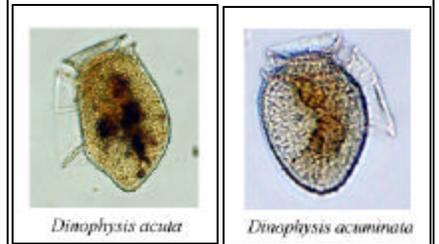


IDENTIFICATION GUIDE to Toxic and Problematic Phytoplankton in Irish Coastal Waters

TOXIC PHYTOPLANKTON

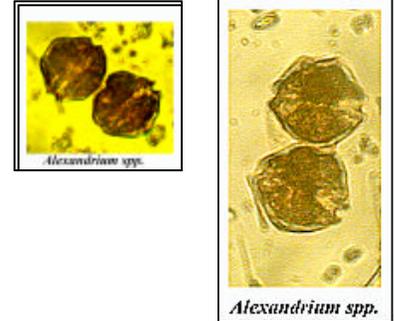
Diarrhetic Shellfish Poisoning (DSP)

Causative organisms: *Dinophysis* sp. and *Prorocentrum lima*
Toxins: Okadaic acid (OA) and Dinophysis toxins (DTXs)
Symptoms: Diarrhoea, nausea, vomiting.
Problem: Accumulates in shellfish flesh and produces the toxins Okadaic Acid and DTX's. Can produce toxins in relatively low numbers.
Description: >200 species described of which ~12 are found in Irish waters. The most common of these are *D. acuta* and *D. acuminata*.
Size Range: *D. acuta* 54-94µm in length, 43-60µm in width.
D. acuminata 38-58µm long, 30-40µm width



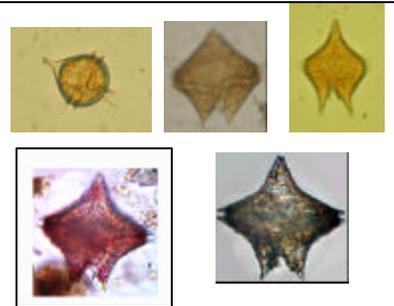
Paralytic Shellfish Poisoning (PSP)

Causative organisms: *Alexandrium* spp. **Toxins:** Saxitoxins, Gonyautoxins
Symptoms: Headaches, dizziness, diarrhoea, nausea, vomiting leading on to muscular paralysis. In severe intoxications respiratory failure may occur.
Problem: Accumulates in shellfish flesh and produces saxitoxins. Can produce toxins in relatively low no's.
Description: Cells small and vary in shape from rounded to elongate. Some spp. can be found as single cells or in pairs, and less commonly in fours. A widespread species in coastal and estuarine waters. Mainly found in cold to cold-temperate waters, but has been reported in warmer waters
Size Range: Large range in size. *A. minutum* 15-30µm in length, 13-24µm in diameter. *A. tamarense* 22-51µm in length, 17-44µm in width. Can resemble a number of other species within the genus especially *A. catenella* and *A. fundyense*.



Azspiracid Poisoning (AZP)

Causative organisms: *Protoperdinium* spp.? A number of species are suspected and associated with this type of toxicity, among others: *P. crassipes/curtipes*, *P. depressum*, *P. oblongum*, *P. brevipes*, *P. stenii* **Toxins:** Azaspiracids
Symptoms: Same as DSP (more acute) with headaches and chills.
Problem: Azaspiracid toxins accumulates in shellfish flesh
Description: These group of organisms are known as armoured dinoflagellates. This means that they are thecate. Cells are characterised (but not exclusively) by two antapical horns or spines and one apical horn. Shape varies between species. These are single cell organisms and don't usually form chains.
Size Range: Large range in size. Sizes range from 20-150µm in length.

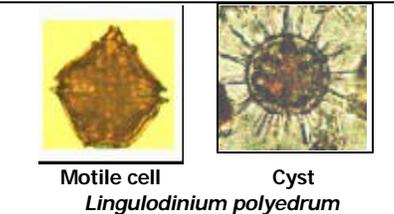


Amnesic Shellfish Poisoning (ASP)

Causative organisms: *Pseudo-nitzschia* spp.
Toxins: Domoic acid
Symptoms: Diarrhoea, nausea, vomiting, abdominal pain, short-term memory loss.
Problem: Domoic acid accumulates in shellfish flesh
Description: Cells are elongate tapering at both ends. Joined in stepped chains by overlapping of cell ends. Widely distributed species found in many coastal areas of the world.
Size Range: There are two main groups according to size. The *Pseudo-nitzschia seriata* group (more than 3µm in width) and the *Pseudo-nitzschia delicatissima* group (less than 3µm in width)



Yessotoxins (YTX): **Causative organisms:** *Protoceratium reticulatum*
Lingulodinium polyedrum
Toxins: Yessotoxins, Homo-yessotoxins **Symptoms:** may cause liver and heart damage
Problem: Accumulates in shellfish flesh. Related to DSP toxins
Description: *Protoceratium reticulatum* are small cells polyhedral shaped with strong reticulations. *Lingulodinium polyedrum* are polyhedral shaped with no spines or horns.
Size Range: *Protoceratium reticulatum* are 28-43µm long and 25-35µm wide.
Lingulodinium polyedrum are 42-54µm wide.



Pectenotoxins (PTX): **Causative organisms:** *Dinophysis fortii*
Toxins: Pectenotoxins **Symptoms:** may cause liver and heart damage
Problem: Accumulates in shellfish flesh. Related to DSP toxins. Can produce toxins in relatively low numbers.
Description i.e. *Dinophysis fortii* is a medium size cell broadly sub-ovoid, broadest posteriorly. Sulcal lists well developed. Red-brown chloroplasts present. Widely distributed from cold temperate to tropical waters. **Size Range:** *Dinophysis fortii* are 62-66µm long.

HARMFUL ALGAL EVENT/NUISANCE BLOOMING PHYTOPLANKTON

These Phytoplankton species are not toxic but can bloom in ideal conditions creating harmful algal events (HAE) or red tides as are commonly known. These can cause fish kills and shellfish spat mortalities.

Most phytoplankton species have the ability to bloom under the right conditions but there are a number of species that causes problems to the shellfish and finfish industry regularly in Ireland.

Noctiluca scintillans: This single cell organism is associated with high temperatures. Cells are large, 200-2000µm in diameter, visible to the naked eye. They are sub-spherical to kidney shaped, have a tentacle and a flagellum. Their blooms are orange/ red in colour and causes bioluminescence. The decaying blooms can cause levels of ammonia to surge in the water column causing finfish and shellfish mortalities. It is cosmopolitan in distribution.

Karenia mikimotoi: These single cell organisms are naked dinoflagellates that can reach high concentrations in the order of millions of cells per litre and are associated with causing fish, shellfish (clams) and benthic invertebrate (lugworms) mortalities. The resultant blooms are red in colour. The cells are round/oval in shape, typically 20-25µm in length and 20-25µm in width. This organism has a wide distribution.

Phaeocystis sp: Cells solitary or in gelatinous colonies that when conditions are right bloom very rapidly. They are not toxic but they produce acrylic acid, dimethyl sulfide, and mucilage. Mucilage clogs gills of finfish and shellfish and also clogs fishnets. Huge masses of foam are the characteristic of these blooms. These cells are cosmopolitan in distribution.

Heterosigma akashiwo: Cells small, generally less than 25µm in diameter, and compressed. Many golden chloroplasts surrounding the cell periphery present. Cell shape variable from spherical to ovoid to oblong, sometimes appearing lumpy (potato shape). This organism can produce cysts, which under the right climatic conditions can germinate creating blooms. These blooms, which are brown in colour, are toxic to fish but the mechanism of toxicity is unknown. Cosmopolitan in distribution.

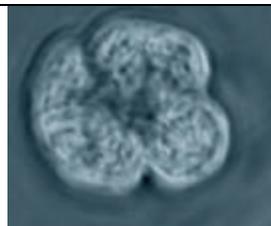
Amphidinium sp: A genus of naked dinoflagellates distinguished by having a reduced epicone and the girdle situated near the anterior end of the cell. These species are littoral organisms living in rock pools, sand grains on beaches and salt marshes. If they bloom in sufficient numbers they may discolour the beach green or brown at low tide. They are known to be involved in Ciguatera fish poisoning (CFG). Cosmopolitan in distribution.



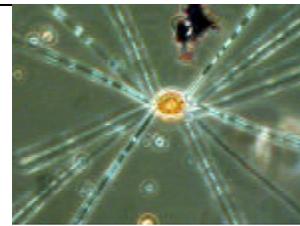
Noctiluca scintillans



Chaetoceros cf convolutus



Karenia mikimotoi



Chaetoceros densus

ICTHYOTOXIC PHYTOPLANKTON

These are Phytoplankton species that are not toxic but when present in the water column can create problems to farmed finfish.

These cells belong to the genus *Chaetoceros* subgenera *Phaeoceros*. The cells are usually joined in straight, curved or coiled chains of different lengths. The cells are large robust species with strong, thick, often long, setae or spines. They are differentiated from other *Chaetoceros sp.* because they contain chloroplasts in their spines visible under light microscopy.

The main species found in Irish waters are: ***Chaetoceros covolutus*, *Chaetoceros concavicornis*, *Chaetoceros densus*, *Chaetoceros eibenii* and *Chaetoceros danicus*.**

These organisms when in contact with fish tend to clog their gills, causing irritation and therefore mucus production by the gill tissue, which stresses the fish, sometimes causing mortalities on farmed finfish.