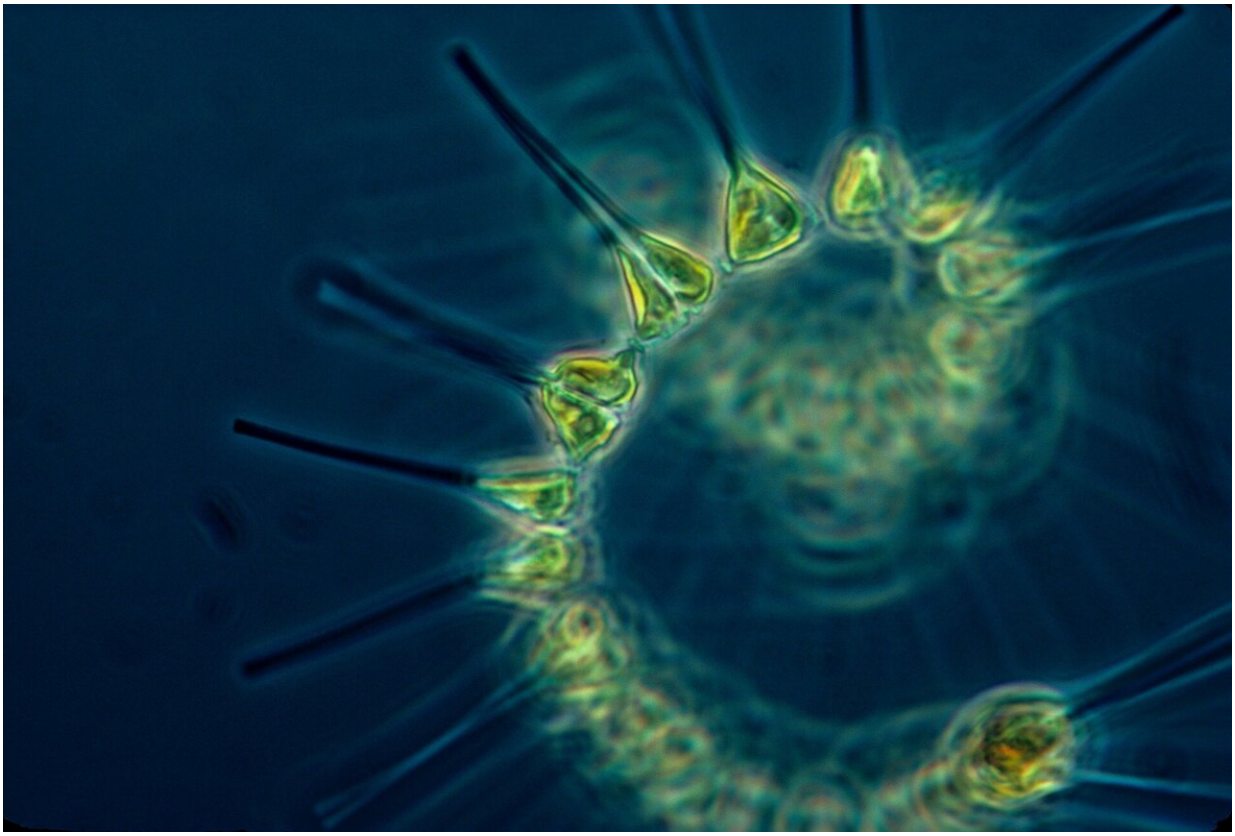
Plankton mark seasons in the sea, just like leaves and flowers on land

September 4 2024, by Abigail McQuatters-Gollop



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Britain's seas are rich in wildlife, but many of its species can only be seen with a microscope. These are the plankton—tiny algae and animals found throughout the ocean that are the foundation of the entire marine

food web.

As UK seas warm and cool with the seasons, the composition and abundance of these plankton communities naturally change. Like plants and animals on land, marine plankton undergo annual cycles that are dictated by seasonal patterns of light, temperature, and settled or unsettled weather. But unlike seasonal patterns on land, the ways plankton shift with the seasons—by migrating, eating, mating, blooming, reproducing or dying—are mostly invisible to the naked eye.

Early each spring, as waters around the UK warm and days lengthen, phytoplankton (single-celled algae) begin to reproduce by dividing, creating a spring "bloom." This event is similar to the mass flowering of daffodils and crocuses that happens around the same time on land and transforms the dull brown of winter into green.

The UK's spring phytoplankton bloom is normally dominated by diatoms , a group of phytoplankton that come in beautiful shapes. Encased in glass-like silica shells, diatoms are mostly green due to the chlorophyll they contain.

The spring bloom of these microscopic algae is quickly followed by a rapid increase in zooplankton—microscopic animals that feast on the verdant phytoplankton. If you examine a sample of seawater under a microscope in spring, you will see tiny crustaceans known as copepods which spend their whole lives as plankton and are a key source of food for fish.

You will also see animals that you probably wouldn't recognize in their microscopic planktonic form, but that grow into crabs, lobsters, worms and barnacles. As these larvae grow by feeding on phytoplankton and then eventually smaller zooplankton, they molt into different shapes until they resemble their adult forms and settle on the shore where you can

eventually spot them in rock pools.

Throughout summer, the abundance of phytoplankton is kept in check by zooplankton, until late summer and early autumn when stormy weather stirs up nutrients from deeper waters.

These nutrients act as fertilizer for phytoplankton at the surface, which burst into abundance again. This time, dinoflagellates are the stars. They are a different type of phytoplankton that moves with a whip-like tail (or "flagella"). Once more, surging populations of zooplankton grazers mop up this phytoplankton bloom.

As autumn turns to winter, the sea cools and the days shorten. With less light and cooler waters, phytoplankton populations drop off and so do zooplankton. Both remain low over the winter, until spring, when the cycle starts again.

Blooming confusing

Global heating has produced warmer winters and an earlier onset of spring in temperate parts of the world like the UK. Daffodils and butterflies are appearing earlier and earlier.

Climate change is also affecting the seasonal cycle of North Atlantic plankton. Spring seas warm earlier, causing some phytoplankton to bloom earlier in the calendar year, which brings the entire spring bloom forward. Sea temperatures also stay warm for longer, pushing autumn plankton blooms until later in the year.

Not all phytoplankton and zooplankton species are responding the same way to climate change. The change in timing of zooplankton blooms may not synchronize with the changed timing of phytoplankton blooms, resulting in less food for zooplankton. Scientists call this shift a "trophic

mismatch," because predator and prey are not in sync. There is some evidence of a trophic mismatch in North Atlantic plankton, but other research has shown that trophic mismatches are not consistently occurring and may in fact be unrelated to temperature.

The reason that it is unclear whether a trophic mismatch is happening among UK plankton is because plankton around the UK are so diverse. Hundreds of species respond differently to changes in light, temperature and nutrients.

Some species may thrive in warmer conditions while others struggle. Some species do well only in some, but not all, warm years. Part of the reason for these inconsistent responses is that there are other processes controlling populations of plankton, such as fishing, the introduction of nutrients by people (like fertilizers spilling off farmland and into the sea) and predation.

Climate-driven trophic mismatches may be occurring in some UK marine ecosystems sometimes, but they are probably not happening consistently everywhere.

What we do know, however, is that climate change is altering the normal seasonal patterns of plankton, increasing the potential for trophic mismatches to occur.

As you watch the trees change color this autumn and daffodils burst into bloom in spring, remember that the plankton communities in UK seas are undergoing a similar seasonal cycle. This may only be visible with a microscope, but it is just as important to the ocean as the seasonality seen on land—and just as vulnerable to climate change.

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