



## Algal Blooms

Algae are photosynthetic organisms found in the water requiring warmth, sunlight and nutrients to grow and reproduce. They form the basis of the aquatic food chain; an algal bloom is a population explosion. Blooms can occur naturally in both freshwater and marine environments and typically only one or a few species are involved. Algal blooms can be composed of either phytoplankton (microscopic algae) floating in the water column or macro algae (seaweed) growing on the seabed. Different species of algae bloom at various times of year under different environmental conditions. For example, in marine waters diatoms, one common group of algae, often blooms in the spring while another common alga, *Phaeocystis*, blooms in late spring to early summer. Macroalgal blooms of the seaweeds *Enteromorpha* and *Ulva* (sea lettuce) are widespread in summer in some estuaries, and are visible at low tide as lush mats of green seaweed.

Nitrogen and phosphorus are two of the main nutrients required for algal growth. In freshwater, phosphorus is usually the nutrient that limits algal growth while in marine waters it is often nitrogen. Both nutrients occur naturally, but human activities can give rise to excess nutrients contributing to exceptionally large algal blooms. Anthropogenic nutrient inputs include point sources such as treated sewage from wastewater treatment plants and septic systems, and diffuse sources such as run-off from agricultural land.

Eutrophication is defined as 'the enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.' It is a process that results in a water body being in an unnatural state. For it to be considered eutrophic it must have abundant nutrients, accelerated algal/plant growth and consequently undesirable ecological disturbance.

## Consequences of Algal Blooms

Adverse effects from phytoplankton blooms are relatively rare in our coastal waters and blooms of non-toxic algae are more common than those of toxic species. Decaying phytoplankton blooms can indirectly affect aquatic organisms by reducing the oxygen content of the water and, in extreme cases, this can lead to the death of fish and other organisms.

Some non-toxic algal blooms can cause aesthetic nuisance such as discoloration of the water, accumulation of foams and scums. Some phytoplankton blooms do cause direct adverse effects on other organisms, and these are referred to as Harmful algal blooms (HABs). They include blooms that can cause the death of fish and shellfish through the production of toxins or by physically clogging and damaging fish gills. Some species of algae can cause poisoning through the food chain when shellfish become contaminated with toxins from ingested algae. Controls to protect humans from the health implications of eating contaminated shellfish are in place via an EC Directive, and CEFAS routinely monitor commercial shell-fisheries for contaminants.

Adverse effects from the second type of algal bloom, macroalgal mats, include ecological disturbance such as vegetation smothering or changing bird feeding behaviour. A dense layer of seaweed causes de-oxygenation of the underlying mudflats reducing the diversity of invertebrates. These mats can interfere with recreational use of the water and can become detached, causing an aesthetic nuisance when they accumulate on the shoreline. Decomposing seaweed mats can produce hydrogen sulphide which, in large quantities, is toxic to marine life or even people in extreme concentrations.



*Phytoplankton causing a 'red tide' in Southampton Water  
Photo courtesy of Environment Agency*

## Preventing Algal Blooms

Algal blooms are a natural phenomenon given the right environmental conditions, but the prevention of excessive blooms and eutrophication requires that the sources of excess nutrients are controlled. Measures include controlling agricultural, urban, and storm water runoff, proper maintenance of septic systems, and improving the management of residential applications of fertilisers. It is important that measures are taken across a wide geographical area to prevent excess nutrient loading. Nutrients can be exported from rivers and estuaries to cause effects at more distant locations, and algal blooms can cover large geographical areas and move with the waves and tides.

Legislative and policy frameworks are already in place to assist with the management of eutrophication. The OSPAR Eutrophication Strategy's objective is to combat eutrophication in the OSPAR maritime area, in order to achieve and maintain by 2010 a healthy marine environment. The Environment Agency published a Strategy on Eutrophication in 2000. The EC Water Framework Directive seeks to achieve good ecological status of water bodies, including estuaries and coastal waters, within 15 years. Defra is working to promote good agricultural practice, encourage catchment sensitive farming and implement the EC Nitrates Directive.

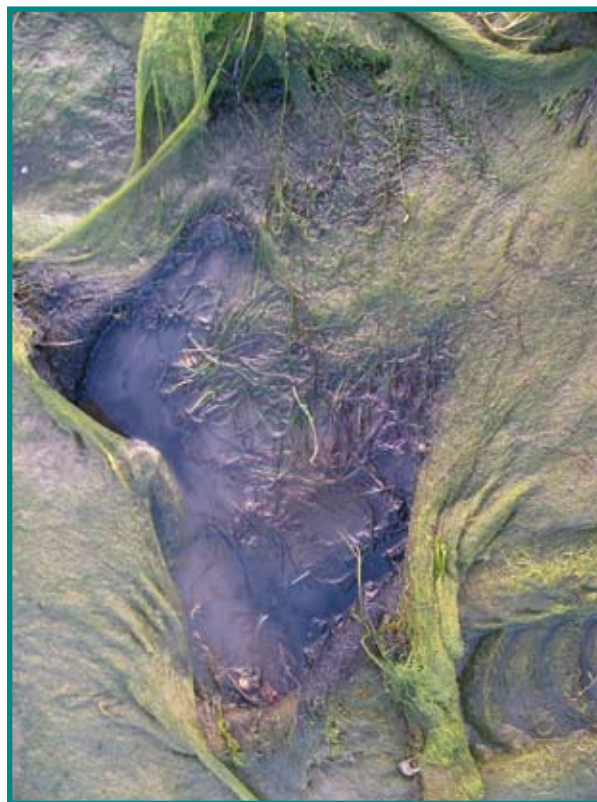
## Impacts on the Solent

Widespread growth of green seaweeds occurs in many intertidal areas of the Solent. This came to the attention of the press in summer 2009, following incidents on beaches on the Brittany coast. In the Solent this is not a new phenomenon as abundant growth of green seaweeds was first recorded in Langstone harbour in the early 1970s. High levels of nutrients and perfect growing conditions, such as sheltered mudflats and sunny weather, enable the seaweeds to proliferate each summer.

Investigations by the Environment Agency in the Solent harbours have resulted in the designation of Langstone, Chichester, Portsmouth, Pagham, Medina, Newtown and Hamble estuaries as both Sensitive Areas (eutrophic) and Polluted Waters (eutrophic) under the Urban Waste Water Treatment Directive and Nitrates Directive.

Following these designations, Southern Water Services are upgrading sewage treatment works in the Solent area to reduce nutrient inputs. Further improvements at some of these sewage works is being planned to take account of the requirements of the Habitats Directive and the impact of population growth in the southeast. In addition, agriculture is being targeted to reduce nutrient inputs to rivers and estuaries discharging to the Solent area. This is being tackled through the introduction of Nitrate Vulnerable Zones, catchment sensitive farming projects and a local diffuse pollution project targeting streams discharging into the harbours.

However, it is likely to take a decade before the level of nutrients reduces sufficiently in the Solent Harbours to be a limiting factor in seaweed growth. Only after this point will the amount of seaweed in the Solent area reduce visibly.



*Green macro algal mats covering eelgrass,  
Photo courtesy of Hants and Wight Wildlife Trust*