



Significance of Algal Blooms: Causes, Effects and Eradication

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DESCRIPTION

An abrupt increase in the amount of algae in freshwater or marine water systems is referred to as an algal bloom, sometimes known as an algae bloom. The pigments in the algae's cells cause the water to turn discolored. The majority of aquatic photosynthetic organisms fall under the umbrella word "algae," including large, multicellular animals like seaweed and tiny, single-celled ones like cyanobacteria. One example of a macroscopic blooming algal community is a kelp forest.

Algal blooms are produced on by nutrients that enter the water environment and promote excessive algae development, such as nitrogen or phosphorus from fertilizers. An algal bloom has an impact on the entire ecosystem; depending on the individual, it can produce positive results such as simply feeding higher tropical levels to more negative effects, blocking sunlight from reaching other species, causing oxygen loss in the atmosphere, and secreting toxins into the environment. Eutrophication is the process of nutrient overstock that results in the development of algae and the reduction of oxygen.

The significance of algae

As an oxygen source: More than 30% of the total oxygen created by photosynthesis is produced by algae. According to some data, algae may replenish 50% of a terrestrial animal's need for oxygen. Fish deaths owing to a lack of oxygen are caused by algal population decline brought on by mineral deterioration in water.

As a food source: Primary producers are algae. They are crucial since a significant portion of aquatic creatures strongly rely on algae for their nutritional needs.

As a pollution indicator: The proliferation of algae is a sign of contaminated water. The rapid growth of algae in the water body is caused by an increase in the mineral content of the water brought on by agricultural pesticides and fertilisers that are high in nitrogen and phosphorus. When algae consume heavy metals in large quantities, plant growth is inhibited.

As a habitat provision: Large algae species provide habitat for several more creatures. For example, kelp forests are sizable algal ecosystems that are home to a wide range of animals, such as snails, shrimp, sea urchins, and others. Multiple kelp species may be present in a kelp forest.

Algal bloom causes in aquatic ecosystems

Nutritional runoff: The presence of substantial levels of nitrogen and phosphate in water is the main cause of an algal bloom. Land and farms that are highly fertilised with nitrogenous and phosphatic fertilisers lose these nutrients to runoff.

When it rains, these leachable nutrients from the soil are washed into rivers and streams, where they eventually end up in enormous reservoirs like lakes and oceans.

Through drainage systems, these fertilisers are also dumped into waterways. Poor sewage treatment results in untreated raw sewage getting into water bodies, where it generates an algal bloom since it contains a lot of nitrogen compounds like nitrates and ammonia.

Raw toxic waste is released into water systems as a result of water pollution, particularly when industrial waste that has not been properly or adequately handled is dumped into waterways. The result is the dense growth of algae since it has nutrients and substances like nitrogen, lead, and phosphorus.

Elevated temperatures: The ozone layer is in danger of being destroyed due to global warming. This is one of the key causes of the rapid growth of the algal bloom. Certain bacteria require a conducive temperature to survive both in and out of water. The rapid decomposition of nutrients like nitrates and ammonia, which are easier forms for bacteria to consume up and proliferate in abundance, has been caused by the abnormally high temperatures experienced as a result of global warming.

Presence of dead organic matter: In general, both water and the atmosphere contain a wide variety of bacteria. They are all looking for nutrient- and growth-rich medium. Because of this,

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the algal bacterium, like other bacteria, benefits from the presence of dead creatures in the water. The decaying organic material ends up promoting the growth of algae in the water along with the nutrients present, resulting in an algae bloom.

Slow-moving water: Large bodies of water that are nearly calm are necessary for algal blooms to flourish. While certain blue-green algae tolerate mixing conditions and turbid settings, most prefer stable water environments with low flows, extended retention durations, light breezes, and little turbulence. Their limited growth in rivers and streams with a fast flow rate is explained by the fact that there are less disturbances in their propagation in such waters.

Light: Blue-green algae populations are reduced when exposed to long periods of high light intensity (photo-inhibition), but they thrive best when exposed just occasionally to high light intensities. Under the water's surface, where the light environment is erratic, these circumstances are prevalent.

Algal blooms impacts on aquatic ecosystems

Threat to human life or health: Toxins produced by algal blooms make water less fit for human consumption. Their extensive presence on the water and their successfully propagating sequences quickly contaminate the water, endangering human health. Such contaminated water causes severe rashes, itching, and even skin conditions when it comes into touch with human skin.

Aquatic life extinction: Any living thing needs oxygen for breathing in order to survive. The oxygen that is dissolved in

water is essential to fish and other aquatic life. The algal bacterium requires oxygen to survive, just like humans do. However, in plant life, rapid growth and high rates of reproduction increase the competition for oxygen, disrupting the aquatic ecology and suffocating fish and other aquatic species. Aquatic life will eventually deteriorate as a result of more aquatic species dying and providing more food for algae.

Algal bloom eradication

Suitable sewage treatment: To avoid over-nutrient-feeding of major water sources including rivers, lakes, oceans, and streams, sterilisation and tertiary treatment to remove components like nitrogen and phosphorus through processes like nitrification and the eventual sludge treatment are required. Additionally, effective water treatment procedures guarantee that people are drinking safe water and, most importantly, safeguard aquatic life.

Using ultrasound to treat bloom: This method employs ultrasonic sound waves to search for algal blooms in water bodies and to restrict their growth once they are found, lowering algae growth by up to 90%. All of this has been tried and tested, so aquatic life is not harmed and it is 100% environmentally benign, with the added benefit of having low operating expenses. This process keeps an eye on huge bodies of water and can evaluate if an algal bloom is a concern or not based on the current situation. To counteract buoyancy, these waves are blasted over the surface of the water bodies, causing them to sink and impeding photosynthesis. The lack of light eventually causes the algae to perish.