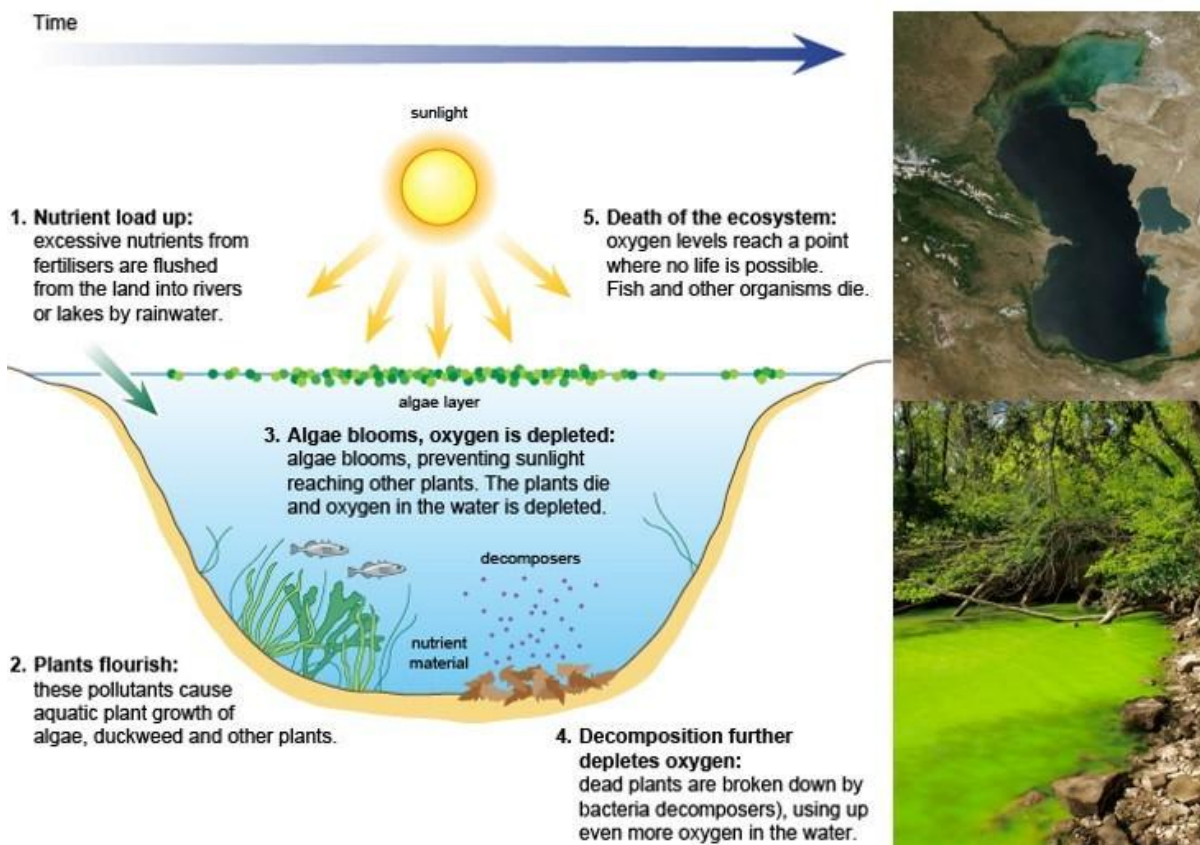


## Issue of Algal Bloom

### 1) What is Algal Bloom?

- An algal bloom or marine bloom or water bloom is a rapid increase in the population of algae in an aquatic system.
- Algal blooms may occur in freshwater as well as marine environments.
- Blooms which can injure animals or the ecology are called "harmful algal blooms(HAB)"
- Harmful Algal Bloom can lead to fish die-offs, cities cutting off water to residents, or states having to close fisheries.
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### 2) What causes Algal Bloom?

- Nutrients
  - a) Nutrients promote and support the growth of algae and Cyanobacteria.
  - b) The Eutrophication (nutrient enrichment) of waterways is considered as a major factor
  - c) The main nutrients contributing to Eutrophication are phosphorus and nitrogen.
  - d) External sources include runoff and soil erosion from fertilized agricultural areas, erosion from river banks, river beds, land clearing (deforestation), and sewage effluent

- e) Internal origin of nutrients comes from the lake/reservoir sediments.
- f) When dissolved oxygen concentration is low in the water, sediments release phosphate into the water column. This phenomenon encourages the growth of algae.

- Temperature

- a) Early blue–green algal blooms usually develop during the spring when water temperature is higher and there is increased light.
- b) Water temperatures above 25°C are optimal for the growth of Cyanobacteria.
- c) In temperate regions, blue–green algal blooms generally do not persist through the winter months due to low water temperatures.
- d) Higher water temperatures in tropical regions may cause blue–green algal blooms to persist throughout the year.

- Light

- a) Blue–green algae populations are diminished when they are exposed to long periods of high light intensity but have optimal growth when intermittently exposed to high light intensities.
- b) These conditions are met under the water surface where light environment is fluctuating.
- c) Even under low light conditions, blue–green algae have higher growth rates than any other group of algae.

- Stable Conditions

- a) Most of blue–green algae prefer stable water conditions with low flows, long retention times, light winds and minimal turbulence
- b) Thermal stratification occurs when the top layer of the water column becomes warmer and the lower layer remains cooler. When the two layers stop mixing, the upper layer becomes more stable and summer blooms of blue-green algae are supported.

- Turbidity

- a) Turbidity is caused by the presence of suspended particles and organic matter in the water column
- b) When turbidity is low, more light can penetrate through the water column. This creates optimal conditions for algal growth.

- increased aquaculture operations leading to enrichment of coastal waters, dispersal of toxic species through currents, storms, ship ballast waters and shell fish seeding activities are some of the factors triggering the blooms

### 3) Effects of Algal Bloom

- Loss of fresh water lakes

- a) Eutrophication eventually creates detritus layer in lakes and produces successively shallower depth of surface water.
- b) Eventually the water body is reduced into marsh whose plant community is transformed from an aquatic environment to recognizable terrestrial
- New species invasion:
  - a) Eutrophication may cause the ecosystem competitive by transforming the normal limiting nutrient to abundant level. This cause shifting in species composition of ecosystem.
- on human health
  - a) exposure to Cyanobacteria or their toxins may produce allergic reactions such as skin rashes, eye irritations and respiratory symptoms
  - b) The most likely pathway to exposure for humans is through accidental ingestion or inhalation during recreational activities in lakes, rivers and bays.
- Algal Blooms restrict the penetration of sunlight resulting in death of aquatic plants, and hence restricts the replenishment of oxygen.
- The primary consumers like small fish are killed due to oxygen deprivation caused by algal blooms.
- Death of primary consumers adversely affects the food chain and leads to the destruction of higher life forms.
- Loss of coral reefs: Occurs due to decrease in water transparency (increased turbidity).
- Affects navigation due to increased turbidity
- A bloom often results in a colour change in the water. Algal blooms can be any colour, but the most common ones are red or brown. These blooms are commonly referred to as red or brown tides.
- HAB events adversely affect commercial and recreational fishing, tourism, and valued habitats, creating a significant impact on local economies and the livelihood of coastal residents.

#### 4) Algal Bloom in India

- HAB lethal for human beings and marine ecosystems alike, are steadily increasing in intensity in the Indian waters.
- It was the Arabian Sea that experienced the most number of blooms over the decades.
- The Bay of Bengal recorded blooms by and large during the northeast monsoon when cyclonic storms occurred in the region.
- Global warming and the resultant storminess could also influence the frequency of bloom formation in the Indian seas
- Upwelling, formation of mud banks, nutrient discharges from estuaries and run-off from the land during southwest and northeast monsoons cause some algae blooms in coastal waters.

- Increase in harmful algal bloom events in the Indian waters could be due to increase in anthropogenic enrichment of the coastal environment
- other Eutrophication such as increased coastal aquaculture farming and discharge of ballast water drawn from coastal ports
- The Bay of Bengal is relatively free of algal blooms except off the Ganges–Brahmaputra Estuarine Frontal system and estuarine and coastal regions where nutrients are abundant supply.

### 5) Mitigation of Eutrophication

- programs to treat wastewater, reduce the overuse of fertilizers in agriculture and reducing the bulk flow of runoff can be effective for reducing severe algal blooms
- Nitrogen testing & modelling: N-Testing is a technique to find the optimum amount of fertilizer required for crop plants. It will reduce the amount of nitrogen lost to the surrounding area.
- Encouraging organic farming.
- Reduction in nitrogen emission from vehicles and power plants.
- Reducing the use of phosphates as builders in detergents
- Using tertiary sewage treatment methods to remove phosphate and nitrate before discharging the effluent into rivers and lakes
- Aerating lakes and reservoirs to prevent oxygen depletion particularly during algal blooms

### 6) Recent Development for monitoring algal bloom?

- An integrated optical system capable of detecting and monitoring algal bloom has been developed by a team of researchers at the Indian Institute of Technology (IIT), Madras.
- ISRO's Oceansat-2 satellite launched in 2009 can cover larger areas and provide global ocean colour observations
- NASA sensor MODIS-Aqua provides an important tool for reliable observations of the changing ocean surface algal bloom paradigms in coastal and oceanic waters around India.