Nutrients in the Estuary

Estuaries are semi-enclosed areas, such as bays and lagoons, where fresh water meets and mixes with salty ocean waters. Estuaries are dynamic systems with constantly changing tides and temperatures where salinity varies temporally and spatially.

Survival of plants and animals in estuaries requires special adaptations, traits contributing to organisms’ survival. The ebb and ﬂow of tides may leave some plants and animals, such as marsh grasses and oysters, temporarily high and dry. Temperatures in shallow estuarine waters can range from freezing to more than 100°F during the course of a year and expose marine organisms to intense sunlight and drying. Estuarine organisms are naturally adapted to withstand these ranges in salinity (concentration of salt in the water), tides, sunlight, and temperatures. They must, however, have a balanced ﬂow of fresh and salt water. This balance can be upset if too much fresh water enters the estuary, which can happen when causeways are constructed, impeding the free ﬂow of tides; or if too little fresh water is available, as occurs during a drought and when a river is diverted or dammed. Estuarine-dependent marine life may die if the balance of fresh and salt water is not maintained.

Estuaries are among the most productive landscapes in nature. Rivers and streams drain into estuaries, bringing nutrients from uplands. Plants use these nutrients along with the sun’s energy, carbon dioxide, and water to manufacture food. Among the important plant forms that contribute to estuaries are microscopic ﬂoating algae called phytoplankton and larger macroalgae that are attached to the bottom. Rooted plants include marsh grasses, mangroves, and seagrasses. When these larger plants die, they are colonized by microbes (bacteria, fungi, and other organisms) that break them down into detritus. During decomposition, detritus becomes smaller and smaller until the nutrients and particles can become food for billions of small animals. Larger animals feed directly on these tiny particles and on smaller animals that fed on the detritus, and energy is transferred through the food web to progressively larger organisms. As long as nutrient-rich, pollutant-free, fresh water continues to mix with marine waters in our estuaries, they will remain productive ﬁsheries.

Nutrients, especially nitrogen and phosphorus, are key indicators of water quality in estuaries. Plants require many nutrients to grow and reproduce. Of these, nitrogen and phosphorus are the most essential for aquatic plants.  
  
Nitrogen and phosphorus naturally enter estuarine waters when freshwater runoff passes over geologic formations rich in phosphate or nitrate, or when decomposing organic matter and wildlife waste get flushed into rivers and streams. Manmade sources of nutrients entering estuaries include sewage treatment plants, leaky septic tanks, industrial wastewater, acid rain, and fertilizer runoff from agricultural, residential and urban areas. Too much nitrogen and phosphorus acts as a pollutant in the water. This leads to explosive blooms in algae that cloud the water and deplete it of the oxygen that is critical for aquatic animals. This is called eutrophication.  
  
Excessive nutrient concentrations have been linked to hypoxic (very low oxygen) conditions in more than 50 percent of U.S. estuaries. Under the worst conditions, the waters of an estuary can become anoxic (having no oxygen). These conditions can cause fish-kills and harm estuarine organisms. High nutrient concentrations have also been linked to algal blooms such as red and brown tides, some of which produce harmful toxins.

Read It: Part 1 Questions

1. What are estuaries?
2. What is an adaptation?
3. Why does survival of plants and animals in estuaries require special adaptations?
4. Why are estuaries among the most productive landscapes in nature?
5. What are manmade sources of nutrients entering estuaries?
6. Define:
   * Eutrophication
   * Hypoxic
   * Anoxic
7. What can happen if excessive nutrient concentrations are in the estuary?