ESTUARIES

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Estuaries

- An estuary is an area where a freshwater river or stream meets the ocean.
- When freshwater and seawater combine, the water becomes brackish.
- An estuary may also be called a bay, lagoon, sound, or sloughish.

...Estuaries

- Water continually circulates into and out of an estuary. Tides create the largest flow of saltwater, while river mouths create the largest flow of freshwater.
- When dense, salty seawater flows into an estuary, it has an estuarine current. High tides can create estuarine currents. Saltwater is heavier than freshwater, so estuarine currents sink and move near the bottom of the estuary.
- When less-dense freshwater from a river flows into the estuary, it has an anti-estuarine current. Anti-estuarine currents are strongest near the surface of the water. Heated by the sun, anti-estuarine currents are much warmer than estuarine currents.
- In estuaries, water level and salinity rise and fall with the tides. These features also rise and fall with the seasons. During the rainy season, rivers may flood the estuary with freshwater. During the dry season, the outflow from rivers may slow to a trickle. The estuary shrinks, and becomes much more saline.

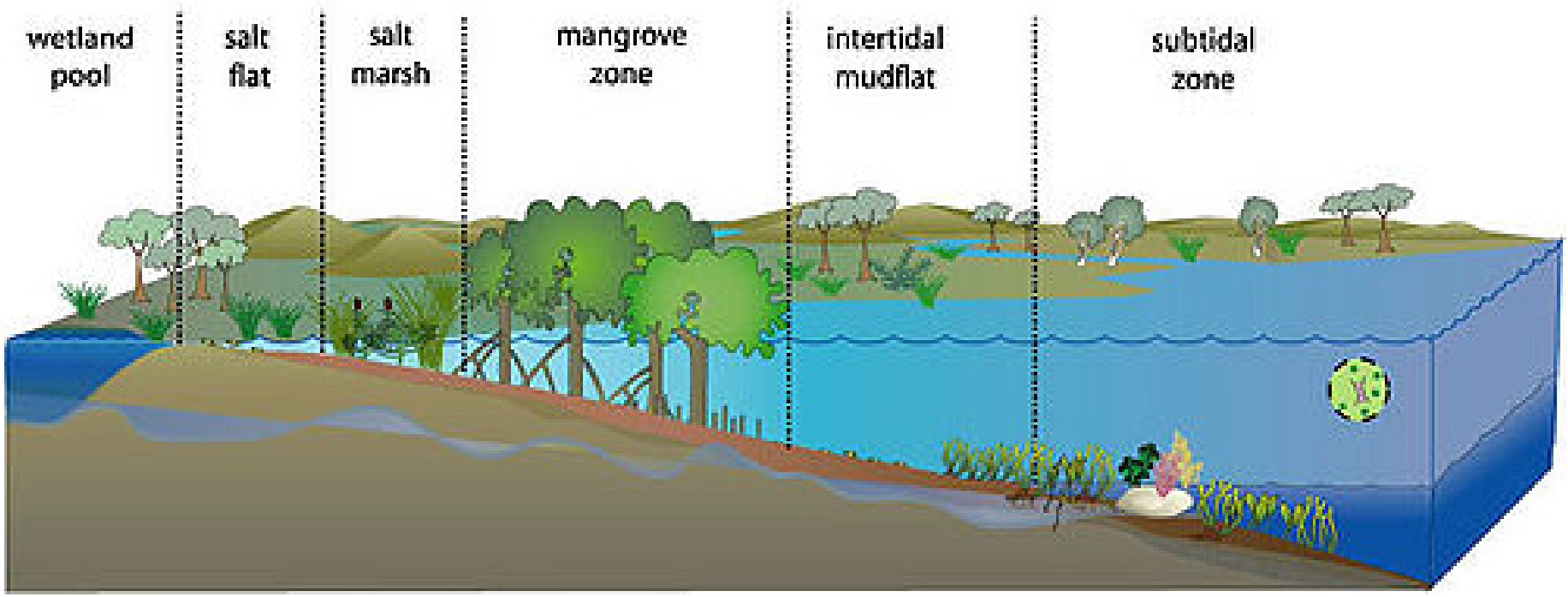
Types of Estuaries

- **Coastal plain estuaries:** are created when sea levels rise and fill in an existing river valley. eg. The Chesapeake Bay, on the East Coast of the United States.
- **Tectonic estuaries:** Tectonic activity, the shifting together and rifting apart of the Earth's crust, creates tectonic estuaries. eg. California's San Francisco Bay.
- **Bar-built estuary:** When a lagoon or bay is protected from the ocean by a sandbar or barrier island, it is called a bar-built estuary. The Outer Banks, a series of narrow barrier islands in North Carolina and Virginia, create sandy, bar-built estuaries.
- **Fjord estuaries:** are a type of estuary created by glaciers. Puget Sound is a series of fjord estuaries in the U.S. state of Washington.

Freshwater Estuaries

- Some estuaries not located near oceans.
- These freshwater estuaries are created when a river flows into a freshwater lake.
- Although freshwater estuaries are not brackish, the chemical composition of lake and river water is distinct.
- River water is warmer and less dense than lake water.
- The mixing of the two freshwater systems contributes to lake turnover—the mixing of the waters of a lake.
- Freshwater estuaries are not affected by tides, but large bodies of water do experience predictable standing waves called seiches.
- The Great Lakes, in the United States and Canada, experience seiches and have many freshwater estuaries.

Conceptual diagrams of estuarine vegetation



Estuaries ecosystem

- The productivity and variety of estuarine habitats support a wonderful abundance and diversity of species.
- Thousands of species of fish, shore birds, marine mammals, clams, shellfish and other wildlife survive in and around estuarine habitats.
- Much of the organic matter carried to an estuary by rivers, produced by phytoplankton, or derived from marshes, is deposited on the sediment.
- Oxygen is the most important electron acceptor in organic matter respiration, but at the water column of anerobic estuarine or saturated sediment sulfate become more significant electron acceptors.
- The major product of sulfate reduction is hydrogen sulfide, which gives salt marsh soils a pungent smell.
- In general, the environment is oxidizing, near the sediment–water interface and more reduced deeper in the sediment.
- Microbial heterotrophic activity and primary production play very important roles in the formation and turnover of organic matter in eutrophic estuaries.

Microbial communities

- **Bacteria:** Sediments and salt marsh soil generally harbor more bacteria per unit volume than does the water column.
- Within the water column, high densities may be found in the surface layer than subsurface layer.
- Most of the bacterioplankton in typical estuary are closely related to surrounding freshwater or marine bacterial groups and belong to the phyla proteobacteria, Bacteroidetes, and Actinobacteria.
- Aerobic and facultative anaerobic bacteria are most common, and pseudomonads and *Vibrio* are the most often isolated species.
- Higher bacteria densities have been found in most estuaries than in nearby coastal seawater and river water.
- **Fungi:** The number of fungi living in estuaries is extremely large.
- Some of fungi are unique in estuaries, while others have a broader range of habitats.
- The active species of fungi primarily are found in surface aerobic zones.
- The densities of fungi decrease rapidly with soil depth, but the spores of fungi are found throughout sediments.

Processes associated with microorganisms

- **Photosynthesis** is mainly carried out by algae, bacteriopankton and phytoplankton in estuarine.
- Cyanobacteria play an important role as primary producers.
- In bottom waters of stratified estuaries, oxygen consumed primarily by bacteria exceeded atmospheric and photosynthetic reoxygenation. Thus many of the sediment and water-logged soils of estuaries are anoxic, anaerobic decomposition of complex organic matter is important by heterotrophic bacteria.
- **Methanogenic Archaea** (usually belongs to order Methanosarcinales or Methanomicrobiales) are important for the mineralization of organic matter in anoxic estuarine environments.
- **Sulfate-reducing bacteria** often outcompete methanogens for hydrogen and acetate in estuarine sediments.
- **Nitrogen** is a major limiting nutrient for primary production in estuaries.
- The N-cycling processes that are dominated by microbial activity include nitrification, dissimilatory nitrous oxide reduction, and nitrogen fixation, and by ammonia oxidizing archaea.
- Estuaries are periodically refreshed with oxygen and chemical sediments from the ocean; thus, bacterioplankton communities shift their respiratory processes and phylogenetic composition as chemical conditions change seasonally.

Questions

- Write an essay on microbial communities of estuaries.
- Write short note on estuaries.
- What is fresh water estuary?

Sources

- https://www.nationalgeographic.org/encyclopedia/estuary/
- https://microbewiki.kenyon.edu/index.php/Estuaries