Intertidal Ecology, Estuaries & Salt Marshes
COVID VERSION

Estuaries

- An estuary is a partially enclosed coastal embayment where fresh water and saltwater meet and mix.
- In most estuaries there is a gradient in salinity from full seawater at the mouth to fresh water at the upper reaches.
- Six major characteristics influence estuaries: salinity, substrate, temperature, turbidity, dissolved oxygen and wave action/currents.

Estuary Types

- The most common type of estuary is the coastal plain estuary. These were formed at the end of the last ice age when the rising sea level invaded low-lying coastal river valleys. (ex. Chesapeake Bay)
- In a techtonic estuary, the sea reinvades the land due to subsidence of the land. (ex. San Francisco Bay)
- A semienclosed bay, or lagoon, forms when sand bars build up parallel to the coastline and partially cut off the waters from the sea. (ex. North Carolina coast)
- The fjords are glacial valleys that have been invaded by the sea.
- A positive estuary, or salt wedge estuary, has a strongly stratified water column with its highest salinity at or near the bottom and lowest at or near the surface.
- A neutral estuary, or homogeneous estuary, has complete mixing leading to similar salinities throughout
- A negative estuary, or evaporite estuary, results from little freshwater input and high evaporation leading to a hypersaline surface.

Salt Marshes

- Salt marshes are communities of emergent grasses in soils alternately inundated and drained by tidal action. The plants occurring there are halophytes, meaning they grow in soils with high salt content. Some areas called salt pans have even higher salt content where no vegetation can grow.
- Wetlands include marshes, swamps and bogs along with seasonal wetlands. Wetlands are important because:
    - provide food and habitat for fish, migratory waterfowl, and other wildlife
    - filter, dilute, and degrade toxic wastes, excess nutrients, sediments, and other pollutants from runoff
    - reduce flooding and erosion by absorbing overflows of streams and lakes

Intertidal Environments: Tidal Pools

- Tidal pools frequently occur along rocky shores, the majority of which are overturned with each tidal cycle. Three major factors influence life in tidal pools:
    - temperature - isolation and exposure to the atmosphere lead to rapid and dramatic temperature changes
    - salinity - the evaporation of water leads to increases in salinity
    - oxygen - as temperature rises and organisms respire, dissolved oxygen decreases

Intertidal Environments: Sandy Shores

- Exposed sand beaches and protected sand flats are common throughout the world. The most important factors influencing these environments are:
    - particle size - coarse sand allows much more water to drain through, while fine sand holds water and better for burrowing
    - wave action - controls erosion and sand movement
    - slope - controls the degree of erosion and sand movement (along with wave action)
- Beaches are deposits of sand or larger rock fragments along an ocean floor and coastline.
- A berm is a raised areas of the beach (higher slopes in the winter, shorter in summer).
- A sand bar is formed by sand carried away from the shore by waves.
- The long shore current is a current that runs parallel to the coastline, transporting sand.
- Barrier islands are isolated former dunes, long narrow offshore ridges of sand.

Intertidal Environments: Muddy Shores

- Muddy shores are restricted to intertidal areas completely protected from open ocean wave activity.
- Muddy shores have a very fine particle size that holds water extremely well. This frequently leads to anoxic conditions.

Marine Organisms of the Day

1. Northern Pipefish aka Common Pipefish (*Syngnathus fuscus*): Pipefish are closely related to seahorses, but have a long slender shape. They are common in estuaries, where they blend in with aquatic grasses.
https://www.youtube.com/watch?v=eo-a25phR8E (2:00-3:40)

2. Freshwater Electric Eel (*Electrophorus electricus*): Electric eels are more closely related to catfish than other eel species. It generates electricity in a way similar to a battery, where there are stacked plates that produce an electric potential difference. Their shocks are very unlikely to cause death in an adult human because the discharge time is so short.
https://www.youtube.com/watch?v=a3sviTa8hZw (2:13)

3. (Nigel) Brown Pelican (*Pelecanus occidentalis*): These birds have been persecuted because people see them as competition for recreational and commercial fishing. Their populations have plummeted due to habitat destruction, environmental pollution, and disturbance of nesting sites.
https://www.youtube.com/watch?v=YLN32hiMoFc (1:55)

4. Sea Otter (*Enhydra lutris*): Sea Otters, the largest of the weasel family, thrive in North Pacific coastal environments. They are considered a keystone species due to their importance to the kelp forest ecosystem, where they help to keep sea urchin populations in check.
https://www.youtube.com/watch?v=o0OyhHeelyo (3:09)

5. Bull Shark (*Carcharhinus leucas*): While not being a freshwater shark (of which there are only three species), Bull Sharks are able to survive in marine, estuarine and freshwater environments. They frequent coastal regions and are one of the three species of shark responsible for the majority of human shark bites (the other two are the Tiger Shark and the Great White Shark).
https://www.youtube.com/watch?v=jzZmJ536s0M (2:57)

6. Southern Flounder (*Paralichthys lethostigma*): One of the most common flounders in North Carolina waters is the Southern Flounder, which is a left-eye flounders. Flounders are identified as left-eye or right-eye depending on which eye migrates as the flounder metamorphosis's from larval to juvenile form.
https://www.youtube.com/watch?v=TzXgWdmeUQA (1:35)

7. Laughing Gull (*Leucophaeus atricilla*): The Laughing Gull is a common gull in North Carolina that gets its name from its loud call which sounds like "ha…ha…ha". They can be found all over the coast, primarily along beaches and marshes but sometimes far inland.
http://video.nationalgeographic.com/video/seagulls_eating_snails (0:55)

8. Saltwater Crocodile (*Crocodylus porosus*): The Saltwater Crocodile is the largest living reptile, reaching lengths of over 20 feet. They have the highest recorded bite strength of any animal at almost 3,700 pounds per square inch.
https://www.youtube.com/watch?v=dcAYb-w5oVY (1:48)

9. Giant Freshwater Stingray (*Himantura chaophraya*): Stingrays aren't typically fatal to humans, but one of the most famous deaths was Steve Irwin, when a stingray pierced his thoracic cavity. The species that killed him is unknown, but suspected to be a Bull Ray. The largest stingray is the Giant Freshwater Stingray, which can grow to over six feet across.
https://www.youtube.com/watch?v=rpD8HMhibeA (3:58)

10. Algae Octopus (*Abdopus aculeatus*): The algae octopus is found in intertidal environments of the south Pacific. They are one the few octopus species that display bipedal locomotion.
https://www.youtube.com/watch?v=23qzi88k3aM (4:35)

Finding Nemo Clips for This Exam

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