Adaptations of Flora and Fauna in Rhode Island's Estuaries

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Estuarine Habitats

- One of the most biologically diverse habitats in the world
  - Nutrients from Freshwater systems and recycling of nutrients from sea beds combine to create a nutrients rich habitat for large number of estuarine creatures
  - Serves as a 'nursery' to juvenile fish and larval stages, i.e. menhaden spawn off shore but the juveniles feed and grow in the estuary
  - Diversity of species enables economic growth in the form of fisheries and aquaculture

Estuarine Drawbacks

- Salinity

  Mixing of freshwater and saltwater creates nutrients but it also creates barriers for those creatures living in estuaries

- Currents

  The ebbing and flooding of the estuarine basin not only effects salinity but also affects an organisms ability to move or stay with in the estuary

Salinity of Estuaries

The average salinity of ocean water ranges from 33-37 ppt.

The average salinity of Narragansett Bay ranges between 24-32 ppt.

Estuaries are in continual flux where water with a salinity of 0ppt will be converging with water with salinities of 32 ppt.

Therefore organisms existing in the estuaries need to be able to withstand such fluctuation.

Effects of Salinity

- Establishment of a salinity gradient – since saltwater is denser than freshwater at the point of mixing, saltwater will be lower in the the water column while freshwater flows on top of the water column.
- Many marine organisms, such as echinoderms and sea stars, prefer salinities greater than 15ppt. Once the water drops between 10-15 ppt, the occurrence of marine life drops as well.
- Critical salinity range, 3-8ppt, point where marine species become less tolerant since they are unable to regulate their cell volume and freshwater species lose their ability to regulate their cell and cannot venture into even low salinity levels

Salinity Gradient

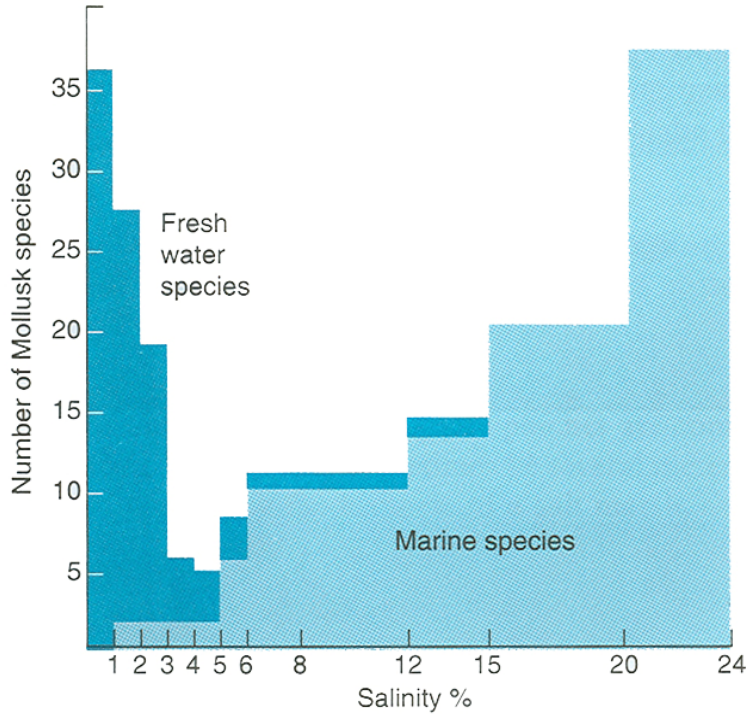


Fig. 14.22 Species richness along the estuarine gradient of the Randersfjord, Denmark. (After Remane and Schlieper, 1971.)

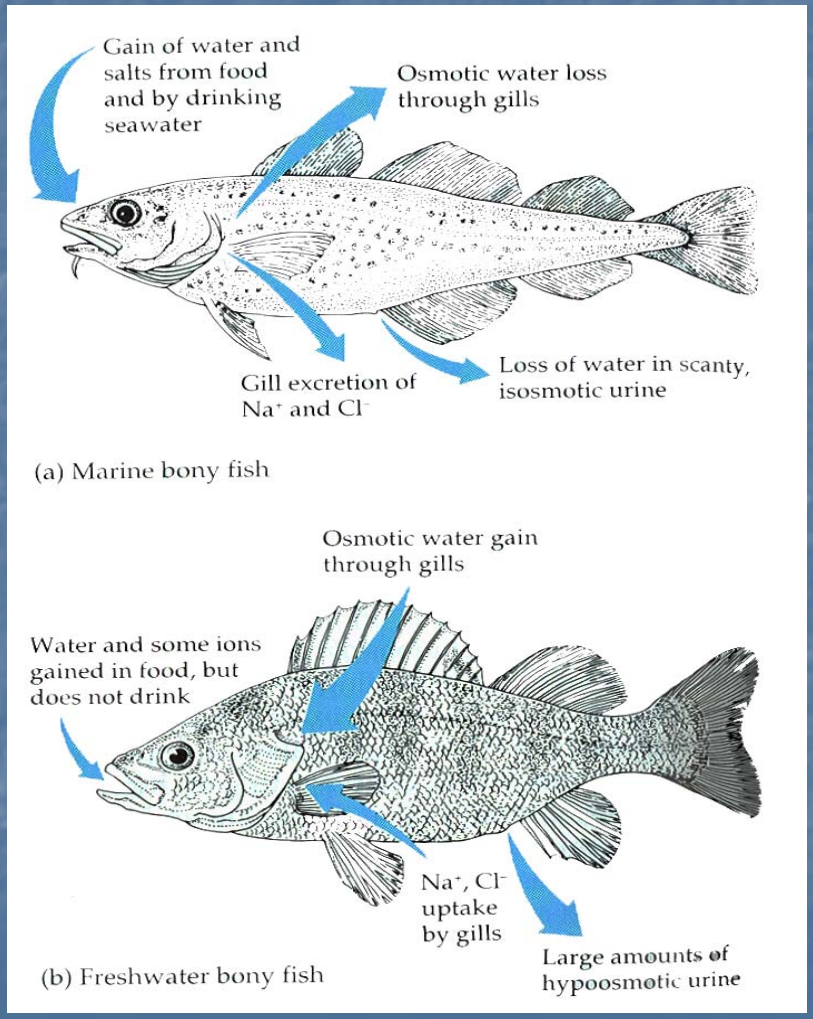
As freshwater flows into the estuary, saltwater is pushed to the bottom of the water column and freshwater flows toward the top. The effect: many bottom dwelling marine organisms have a further range towards the river mouth than those marine organisms that swim within the upper water column.

Salinity Tolerance

- Some fish such as striped bass, salmon and shad, are among the organisms that can swim through the salinity barriers.
- The ability to regulate the influx of pure water through a semi-permeable membrane is known as osmoregulation. Both freshwater and salt water fish have a highly efficiency of osmoregulation.

Osmoregulation in Fish

- Saltwater fish are able to drink saltwater, extract the pure water and dispose the extra salts via their urine which isosmotic.
- Freshwater fish are capable of retaining the salts in their bodies and excreting hyposmotic fluid in their urine.



Diadromous Fish

- Anadromous – Spawn in freshwater and grow in the ocean, i.e. salmon, shad, herring
- Catadromous – Spawn in saltwater and grow in freshwater ponds, i.e. American Eel
- Both have a unique ability to be able to withstand changes in salinity via biochemical processes

Example of Smoltification

BEFORE

- Freshwater Fish
- Territorial
- Bottom Dwellers
- Dark "parr" marks on sides for camouflage in fresh water

AFTER

- Salt Water Fish
- Schooling Fish
- Reside in water column
- Denoted by silvery color

Ebbing and Flooding Tides

- As tides come into estuary, brings in nutrients from see and mixes with freshwater.
- Marine organisms have adapted to life of constant turmoil

Tidal Adaptations

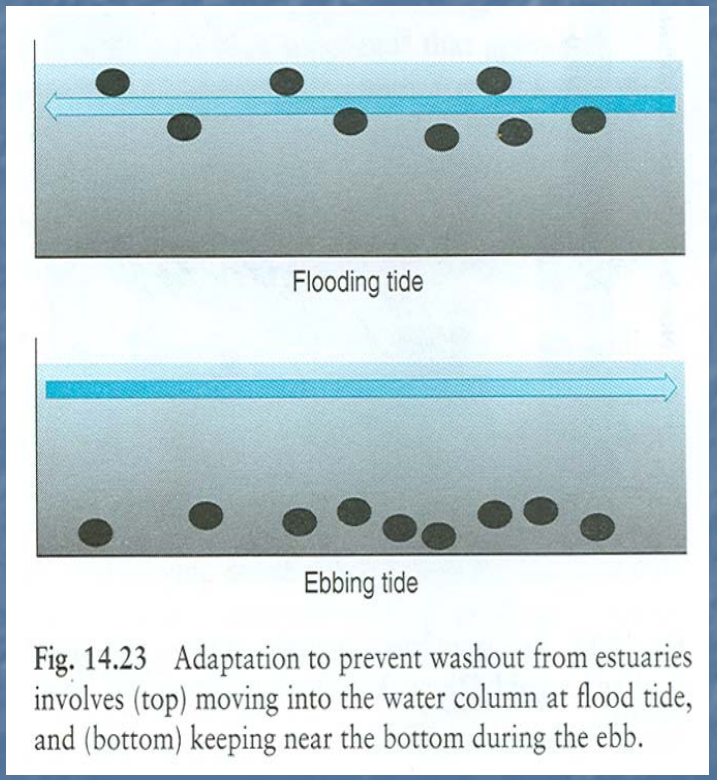
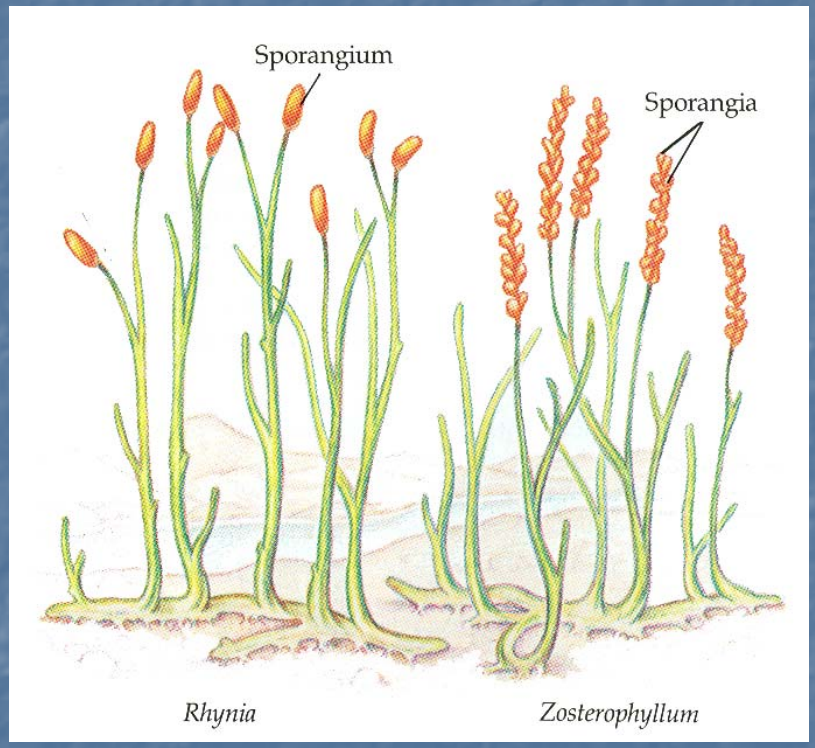


Fig. 14.23 Adaptation to prevent washout from estuaries involves (top) moving into the water column at flood tide, and (bottom) keeping near the bottom during the ebb.

- As the tide ebbs (goes towards the ocean) in estuary fish will stay towards the bottom so that they are not swept away in current
- As the tide floods the estuary, fish will return to the surface to swim into the estuary
- Organisms depend on this for migration, i.e. striped bass, mud crab larvae

Tidal Adaptations (cont.)

- Sea grasses and marsh grasses attach to sedimented bottoms and form shallow rhizome system that do not require oxygen.
- Reproduce asexually by send up vertical shoots.
- Depends solely on the tide to distribute pollen



Other Tidal Adaptations

- Holdfasts on algae
- Bissel threads on mussels and scallop larvae
- Large amount of organisms larvae attach to rocks, algae, and seagrasses sa as not to be whisked away
- Burrow in the mud