THE INTERTIDAL ZONE AND BENTHIC ORGANISMS

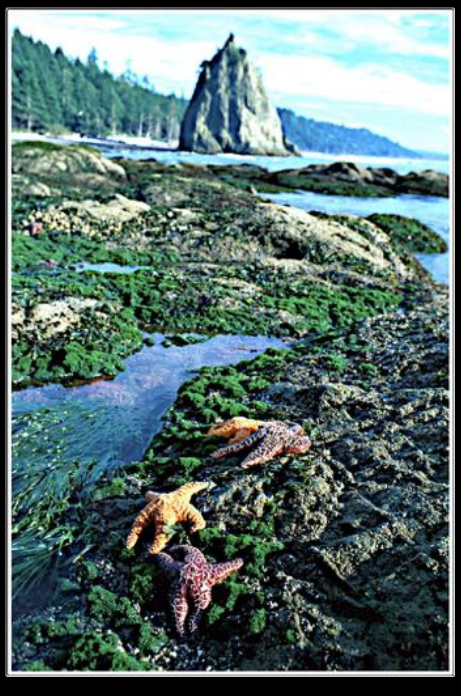
EPSS15 Lab #8

OUTLINE

I. Intertidal zonation
- Tides
- Biotic zonation
- Physical conditions & biotic interactions

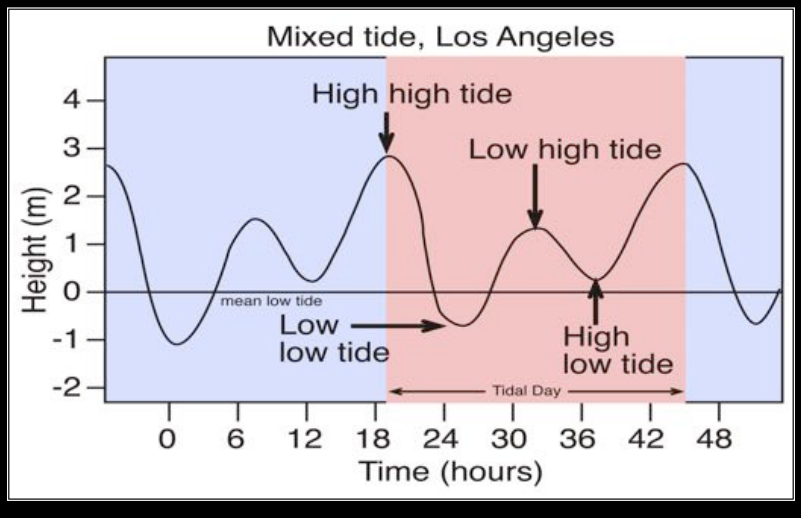
II. Intertidal organisms & adaptations
- Snails
- Mussels
- Limpets & Chitons
- Crabs
- Anemones
- Echinoderms & Echinoids

III. Marine macroalgae (seaweeds)
- Green
- Brown
- Red



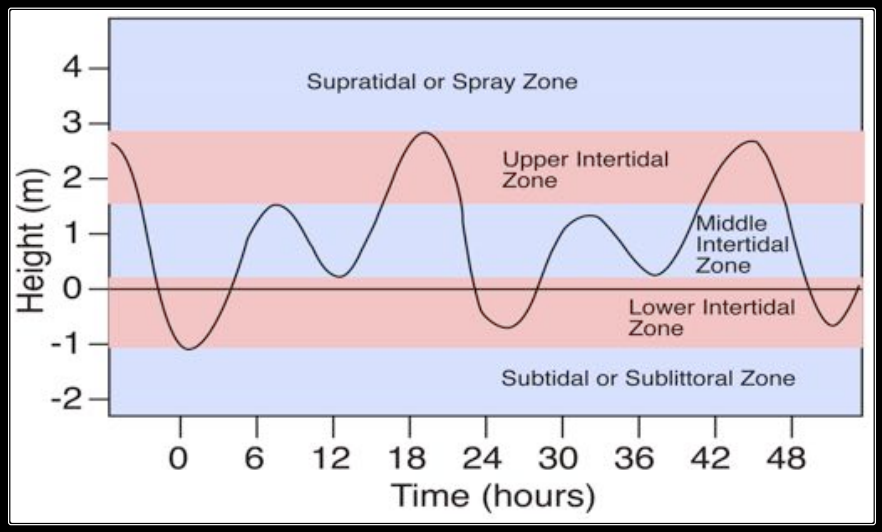
TIDES

"Intertidal" describes the region of the shore that lies between the *highest high tide* and the *lowest low tide*.



INTERTIDAL ZONES

Determined by the amount of time spent above water



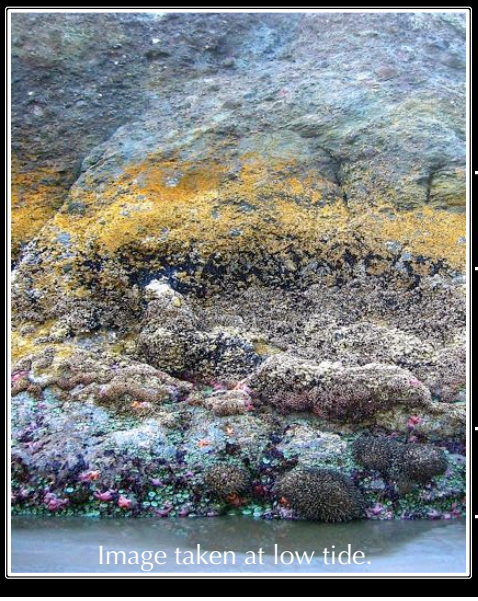
BIOTIC ZONATION

- Organism distribution controlled by:

- **Physical conditions**
  - –determines upper limit of organisms in each Zone
  - –"You can't live outside of your environment"
- **Biological interactions**
  - –Determines lower limit of organisms in each Zone
  - –"You won't last long where your predator lives"

ROCKY INTERTIDAL BIOTIC ZONATION (TYPICAL ALONG CALIFORNIA COAST)

Algae and other encrusting organisms are indicators of biotic zonation.



Supratidal

Upper Intertidal

Middle Intertidal

Lower Intertidal

Subtidal

PHYSICAL CONDITIONS

- **Waves**
  - bring nutrients & moisture
  - can detach organisms from substrate
- **Exposure time**
  - tissues will not function if desiccated
- **Heat & cold**
  - temperature changes more extreme above water
- **Substrate**
  - support very different communities with varying diversity and abundance
- **Available space**
  - organisms need a place to live

BIOLOGICAL INTERACTIONS

- Predation
  - terrestrial predators
  - sea stars eat mussels
  - sea otters eat sea urchins
  - sea urchins eat kelp
- Competition
  - seawater brings nutrients to organisms, so space is the most contested resource
  - Some organisms live on top of other organisms (encrusting)
- Adaptation
  - Physiological and morphological ways to deal with physical challenges

COMMON INTERTIDAL ORGANISMS AND THEIR ADAPTATIONS

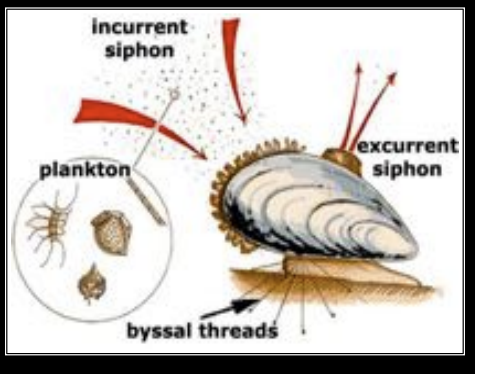
PERIWINKLE SNAILS

Larger shell volume allows more water storage.

This adaptation allows some species to resist desiccation longer, allowing survival much higher in the Upper Intertidal Zone.

MUSSELS

- Benthic, non-mobile
- Open when submerged to filter plankton from the water column
- Close up when the tide goes down to prevent dehydration

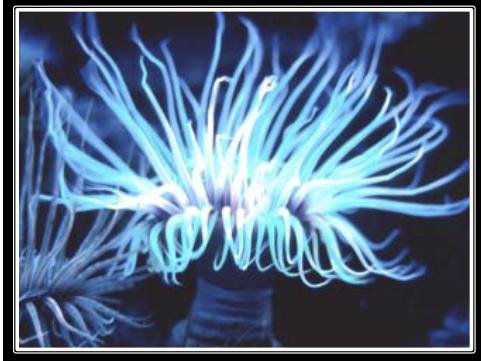


LIMPETS & CHITONS

- Mobile grazers that feed on algae when submerged
- Clamp down to avoid desiccation during times of exposure

Crabs store water in gill chambers and can move to concealed areas or into the water if necessary.

ANEMONES CLOSE UP …



- Feed by using their "arms" to paralyze prey drifting by, it is then grabbed and consumed.

- Other organisms can secrete mucous to protect themselves from the anemone, thereby using them for habitats and safety.

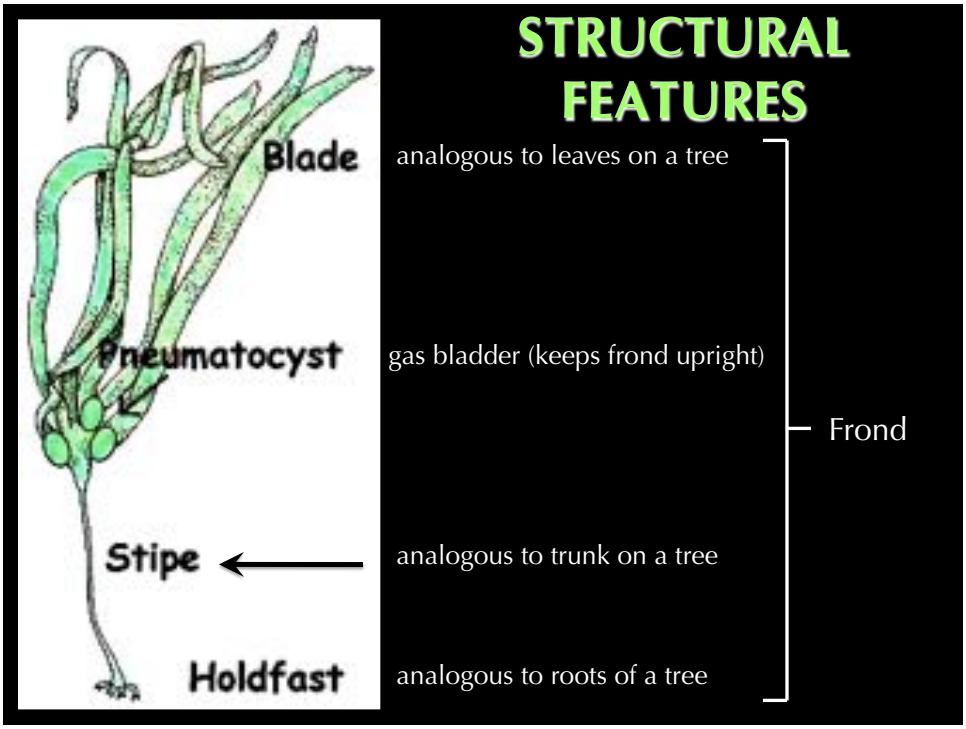
- Echinoderms (starfish) and echinoids (sea urchins) move into tide pools to avoid desiccation.

- Can pry open their slow-moving prey (clams, mussels etc.)and devour them from the inside-out.

MACROALGAE (SEAWEED)

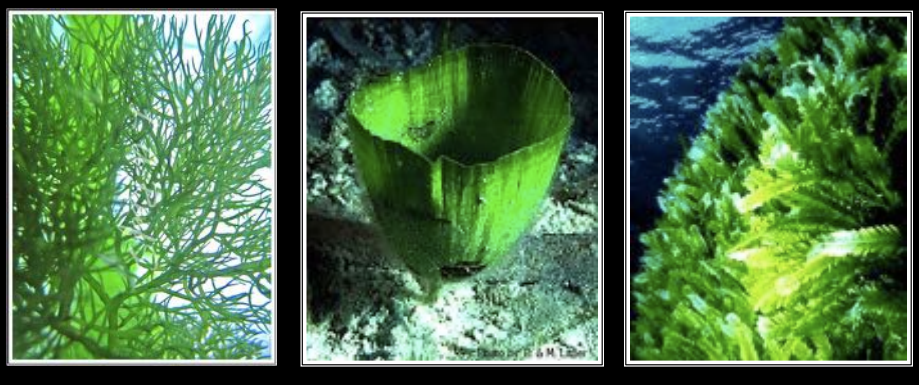
- Macroalgae are:
  - Photoautotrophic
  - Aquatic
  - Eukaryotes
  - Unicellular or
  - Multicellular

- Macroalgae are NOT:
  - PLANTS (they do not have specialized tissues)
    i.e. (blade ≠ leaf), (stipe ≠ trunk), (holdfast ≠ roots)



GREEN ALGAE (CHLOROPHYTA)

- Green algae ancestor gave rise to terrestrial plants
- Closest relation to terrestrial plants
- Cell walls made of cellulose (like terrestrial plants)
- Can overgrow and kill coral reefs



BROWN ALGAE (PHAEOPHYTA)

- Largest of all algal species (giant kelp can grow to hundreds of feet)
- Structurally most complex of all seaweeds
- Largest component of "kelp forests" (contain ~800 distinct species)



RED ALGAE (RHODOPHYTA)

- Able to inhabit deep water environments
  - better at absorbing blue light, which penetrates deeper than other wavelengths
- "Coralline" species secrete $CaCO_3$ "skeletons"
- In coral reefs, red algae contribute more $CaCO_3$ than corals
- Some encrust other algae