Introduction to the

Biology of Marine Life

Ninth Edition

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Chapter 8

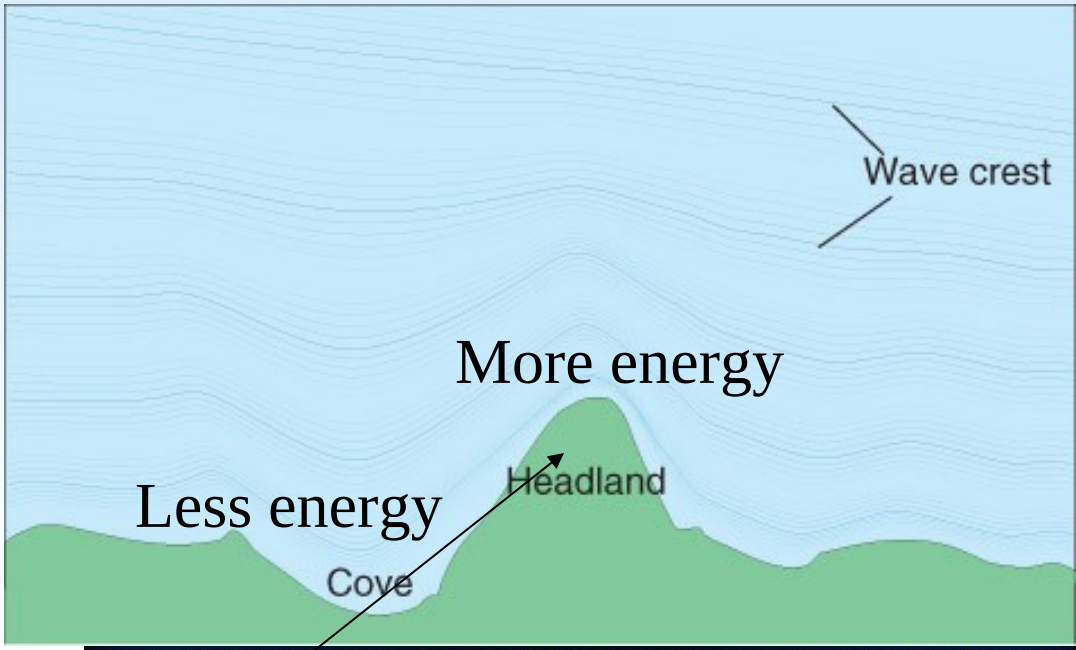
Temperate Coastal Seas
We went/are going here on the fieldtrips!

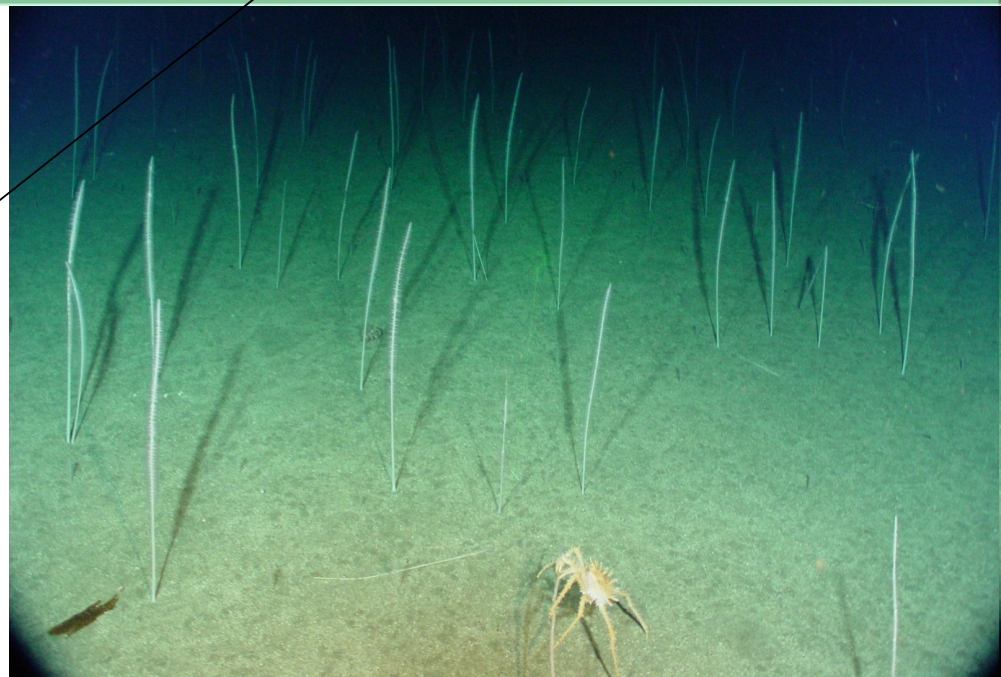
More than 90% of marine animals are benthic, living in close association with the sea bottom.

Seafloor Characteristics

The composition of the sea bottom is determined by:

- plankton, wastes, and detritus that sink
- the activities of organisms that live there
- the energy of water movement in shallow water





Why there is sand at a beach!!!

Seafloor Characteristics

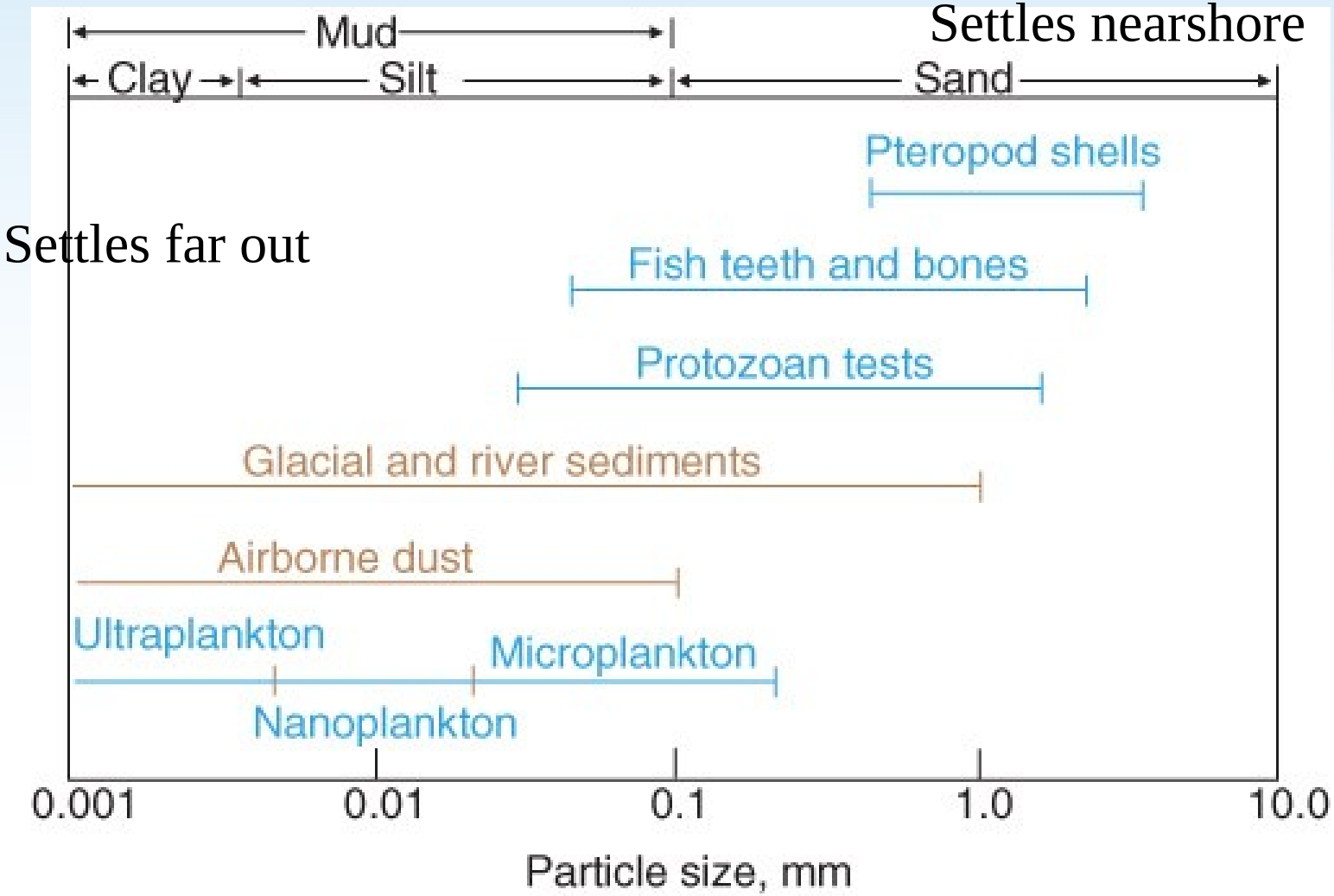
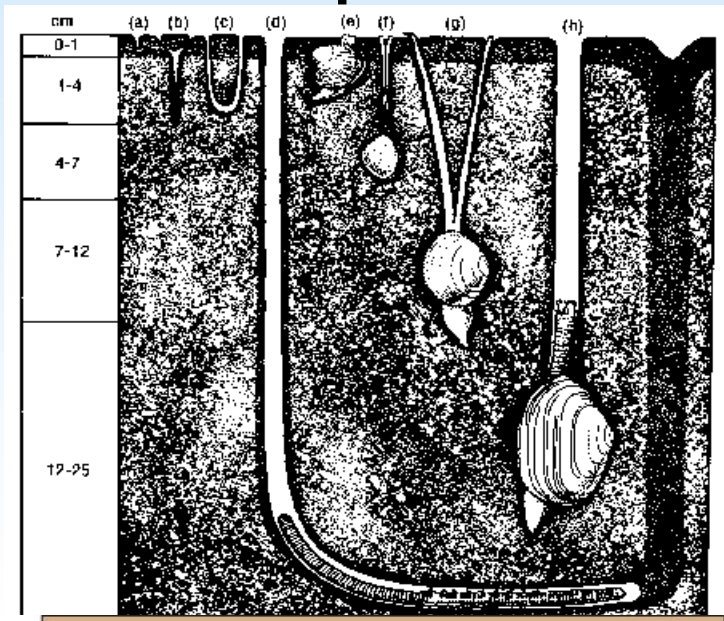


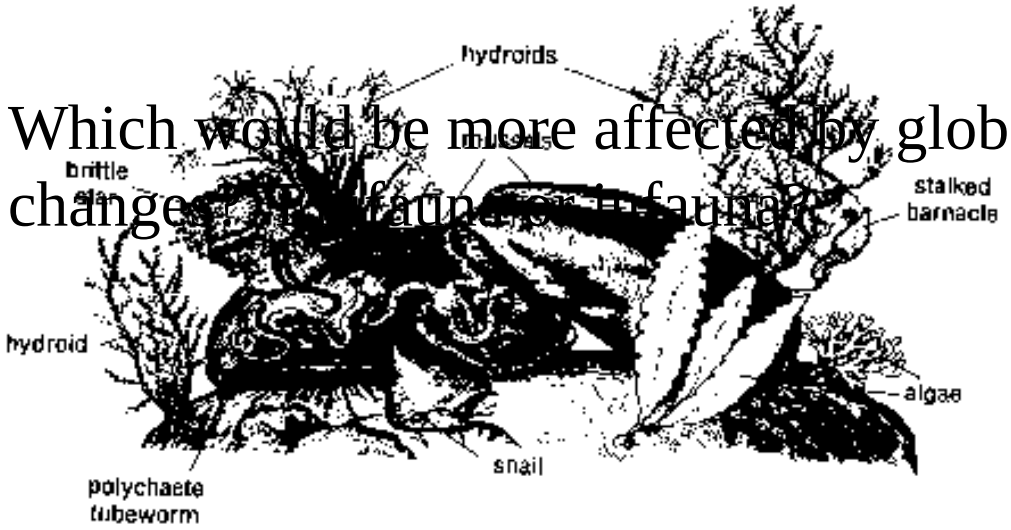
Fig. 8.2 Particle size ranges for some common sources of marine sediments. Biogenic particles are shown in blue and terrigenous particles in tan.

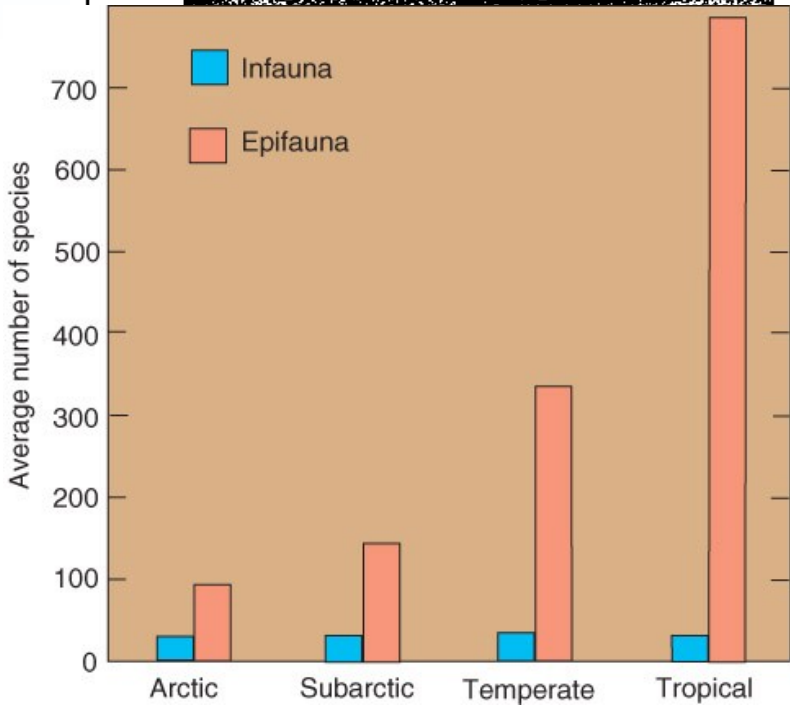
Animal–Sediment Relationships

Benthic animals are either:

- epifaunal, living on the sediment, or
- infaunal, living within the sediment.







Which would be more affected by global changes, epifauna or infauna?

Animal–Sediment Relationships
Some more terms for you!!!

Macrofauna – displace sediment particles

Microfauna – live on sediment particles

Meiofauna – ALSO CALLED INTERSTITIAL ANIMALS

Animal–Sediment Relationships

Organisms in this habitat feed in many different ways!

Suspension and **filter feeders** obtain their food from passing waters

Fig. 8.5 Barnacle, *Balanus*, with its feathery filtering appendages extended.

Animal–Sediment Relationships – deposit feeding

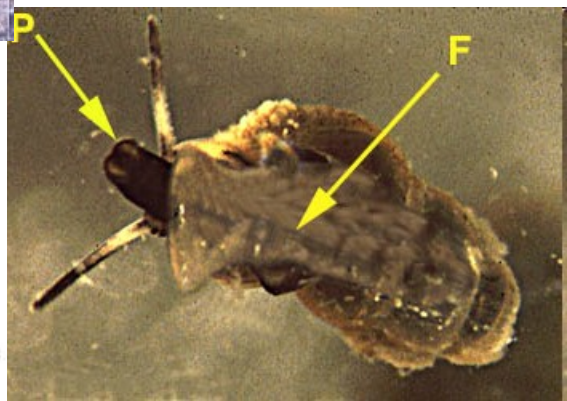


Photo by Dave Cowles, Rosario Marine Invertebrates website http://rosario.wallawalla.edu/inverts

Animal–Sediment Relationships - predation

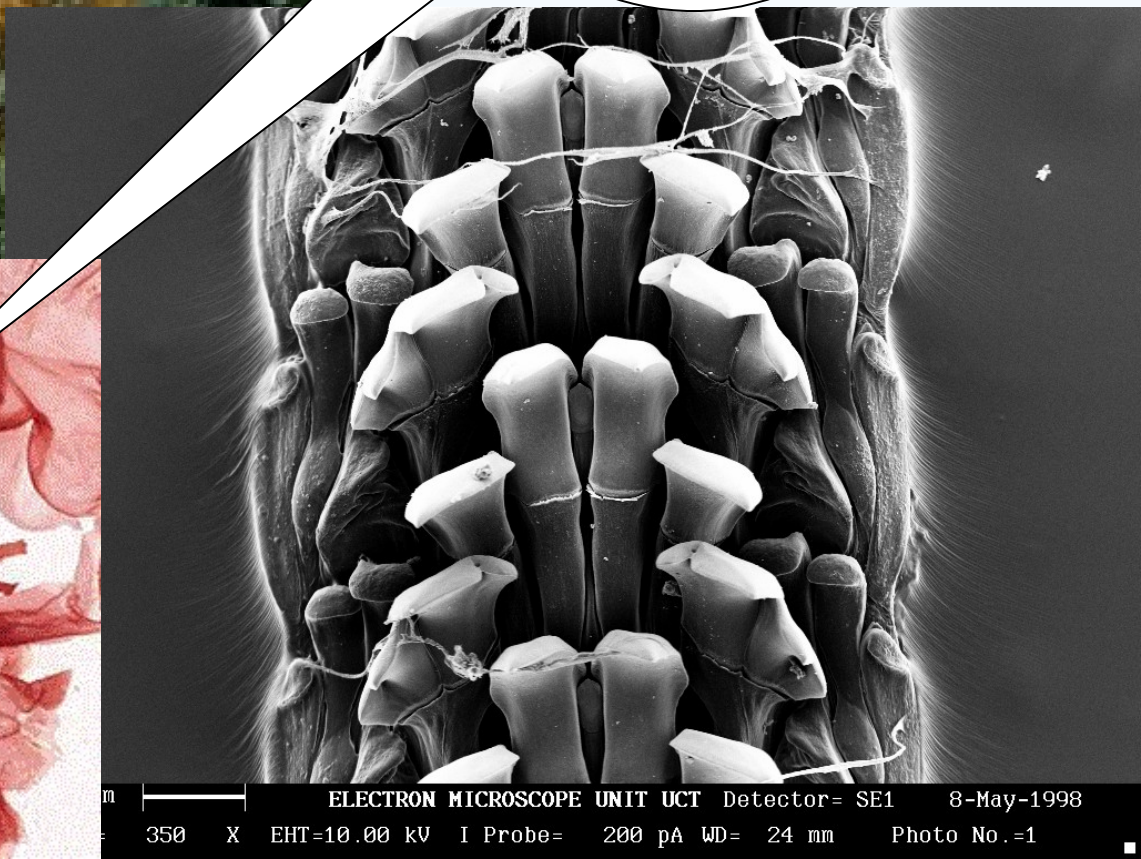
Fig. 8.6 A phalanx of sea stars, *Pisaster,* crops a bed of mussels.

Photo by Dave Cowles, Rosario Marine Invertebrates website http://rosario.wallawalla.edu/inverts

Animal–Sediment Relationships – algal grazing

Fig. 8.7 A large snail grazing on seaweed.

Help!!

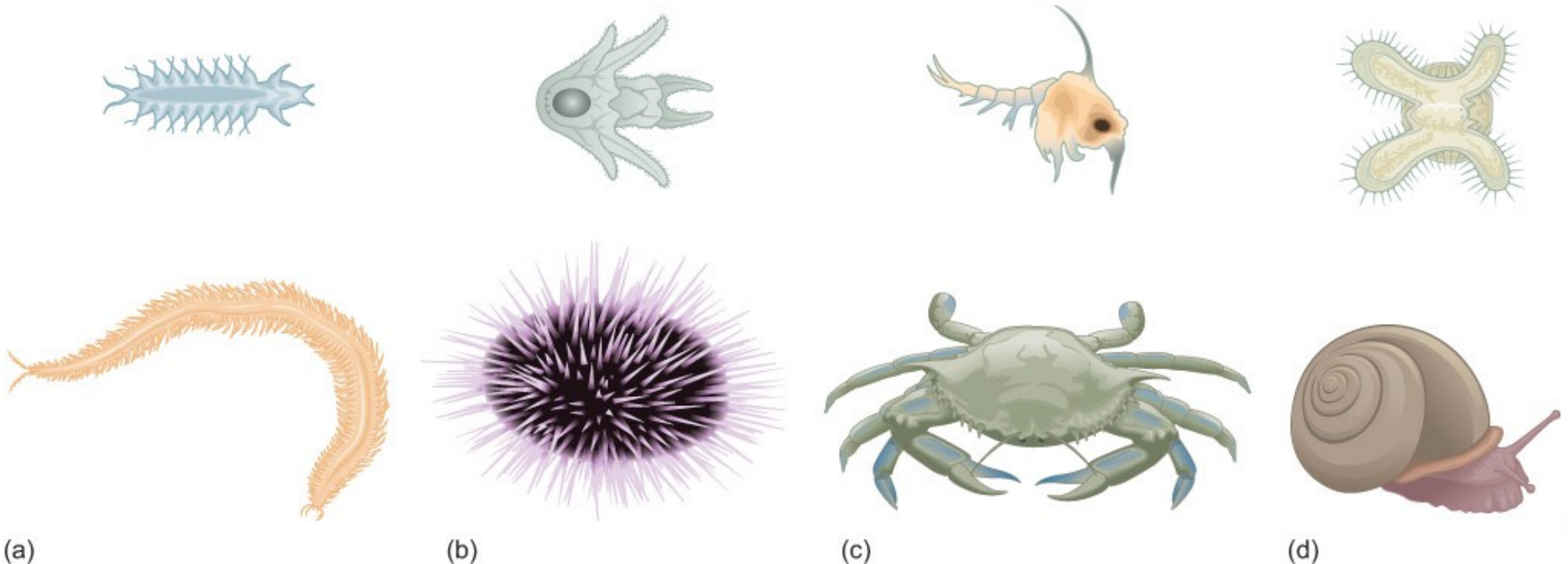

ELECTRON MICROSCOPE UNIT UCT Detector= SE1 8-May-1998
350 X EHT=10.00 kV I Probe= 200 pA WD= 24 mm Photo No.=1

Larval Dispersal

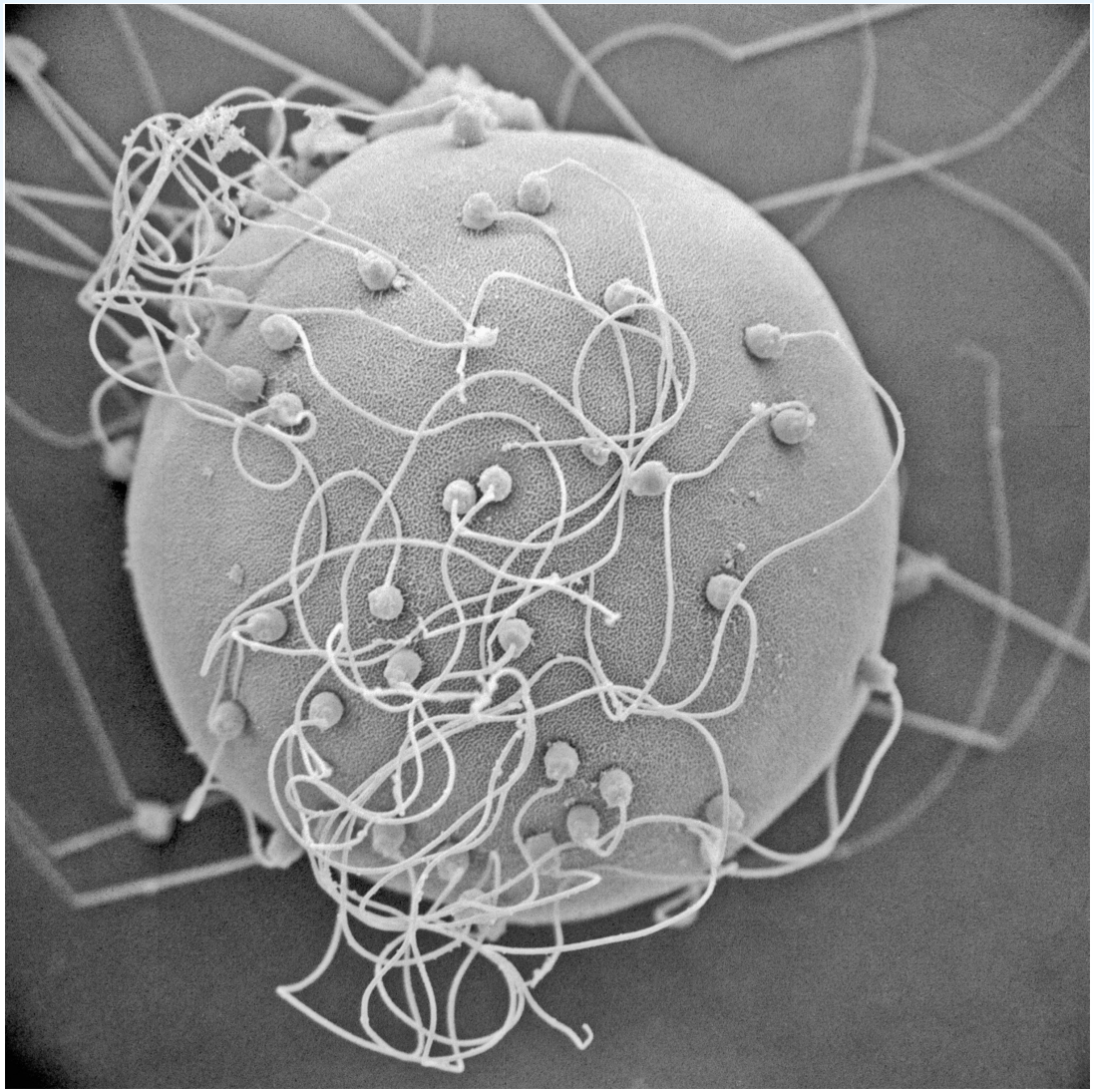
- About 75% of slow-moving, sedentary, or attached animals extend their geographic range via **broadcast spawning** that will result in larvae that are meroplanktonic.

http://www.youtube.com/watch?v=s_z8QVwYVdI

http://www.youtube.com/watch?v=ZTcWGGTKKNE&feature=related



Larval Dispersal



The <u>fecundity</u> of some of these species is amazing!!! A sea hare weighing 5 kg (about 11 lbs.) produced 478 million eggs in 5 months. Why would an organism do this???

Fig. 8.2 A scanning electron micrograph of a sea urchin egg with numerous sperm cells.

Larval Dispersal

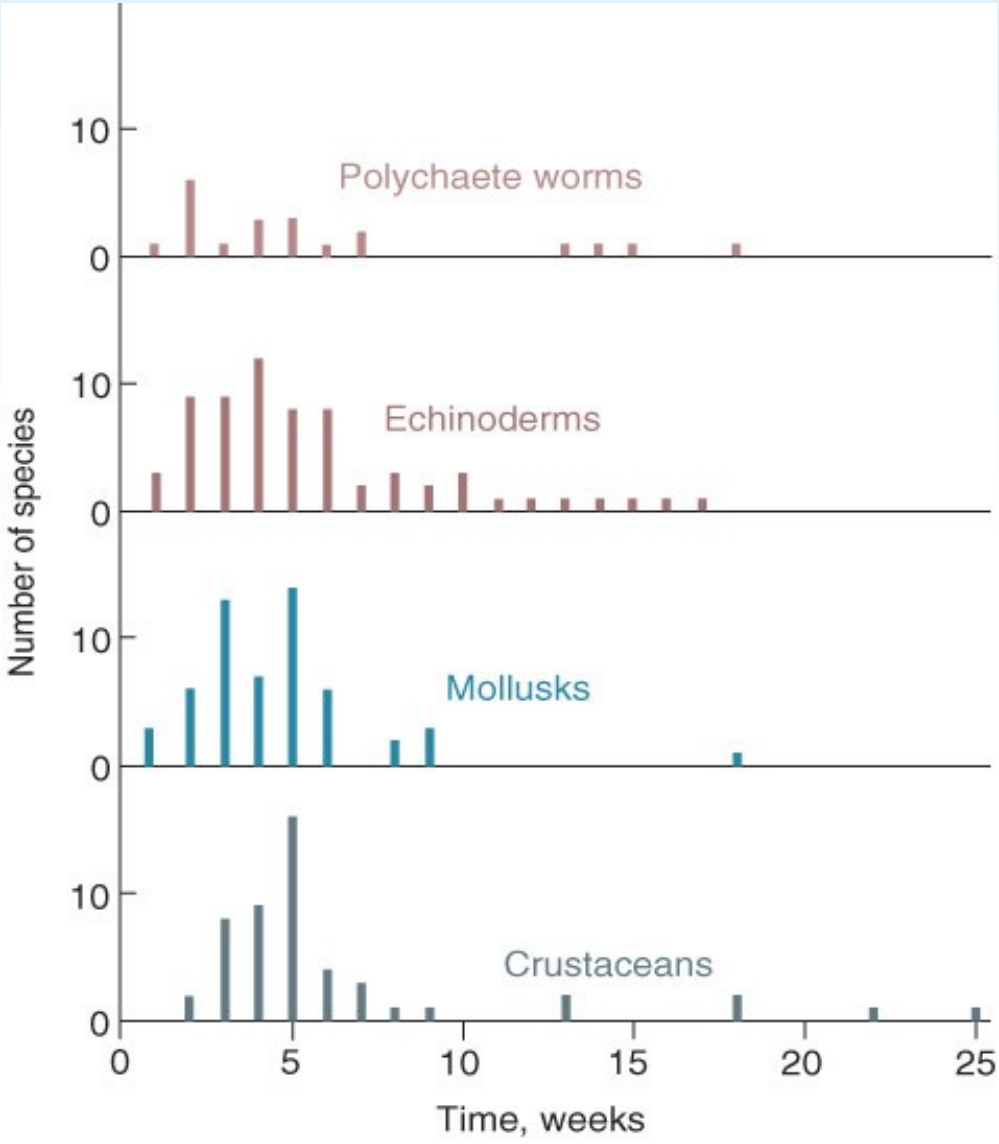


Fig. 8.9 Typical duration of planktonic existence for four common groups of marine benthic invertebrates.

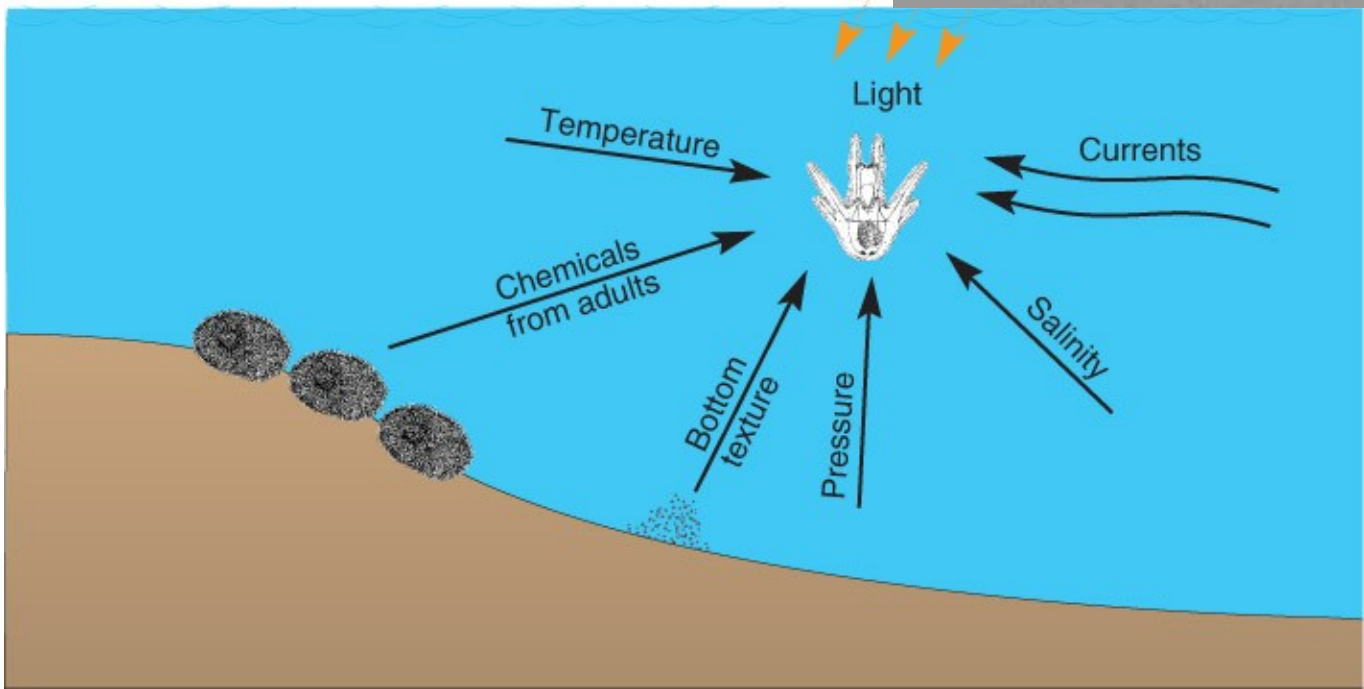
Which organisms would you expect to find the furthest away from the parent population?

Adapted from G. Thorson. Oceanography (1961): 455-474.

Larval Dispersal

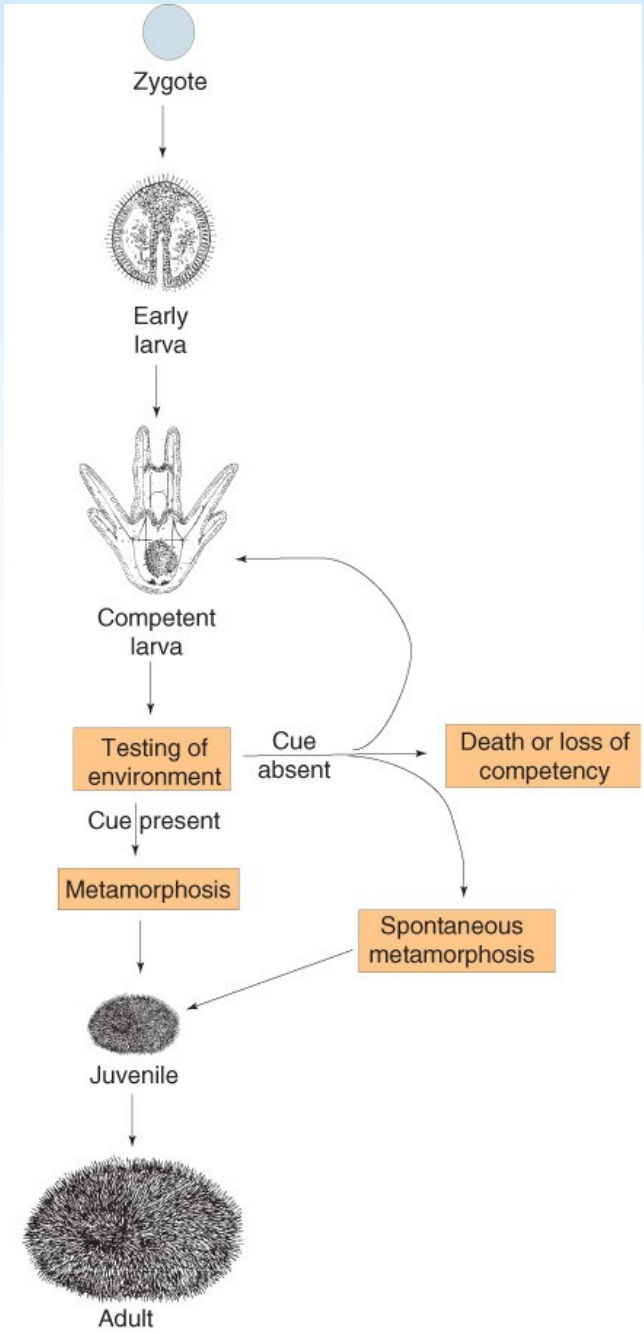
- Many factors influence meroplanktonic larvae to settle on the seafloor and metamorphose into juveniles:
  - bottom type
  - bottom texture
  - chemical attractants
  - current speeds
  - sounds
  - light
  - presence of adults

Sea Urchin larva
Photo: Gerardo Amador



Larval Dispersal

Fig. 8.11 Generalized development pattern for planktonic larvae, illustrating available options in response to food, substrate, or other environmental dues.



Sometimes it's good to be with the adults, sometimes it's bad.

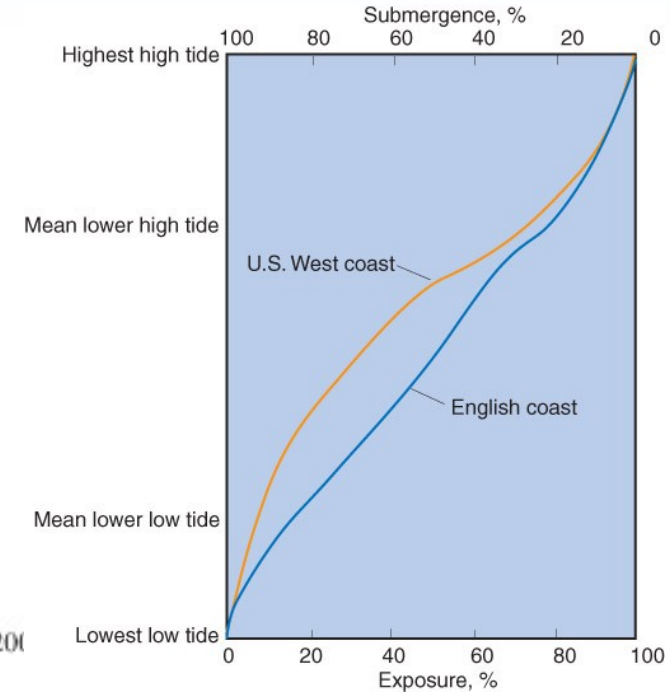
Why do you think this is so? What are the factors that could be good? What are the factors that could be bad?

Intertidal (Littoral) Communities – where the land meets the sea

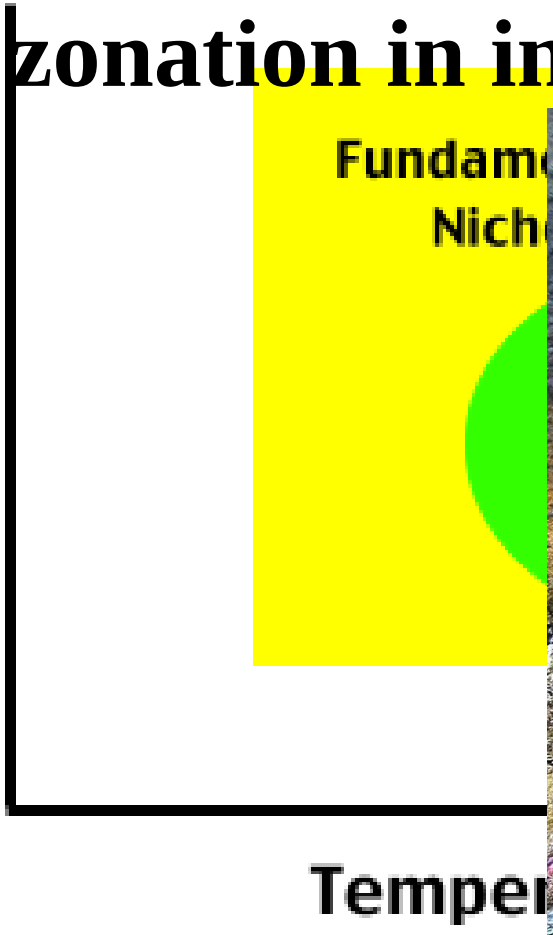
- Much higher biomass here than on sea bottom

- This zone is inhabited by species of marine origin that experience, and somehow tolerate, physiological stress during periods of low tide.

Temperature
Duration of exposure
Wave shock
Light intensity
Predation
Space competition
Dessication



Leads to zonation in intertidal habitats!!!



Each organism has a niche!

combination of physica

factors that frames and

range of an organism's existence

Intertidal Communities – Rocky Shores

- On rocky shores, distance from low water is correlated with variations in physical and biological stresses, resulting in distinct zonation patterns
  - The California Intertidal:
    - –The Upper Intertidal
    - –The Middle Intertidal
    - –The Low Intertidal (closest to the water)

Know what orgs can be found where!!!

These zones aren't set in stone! They are set in rocks however!

Intertidal Communities

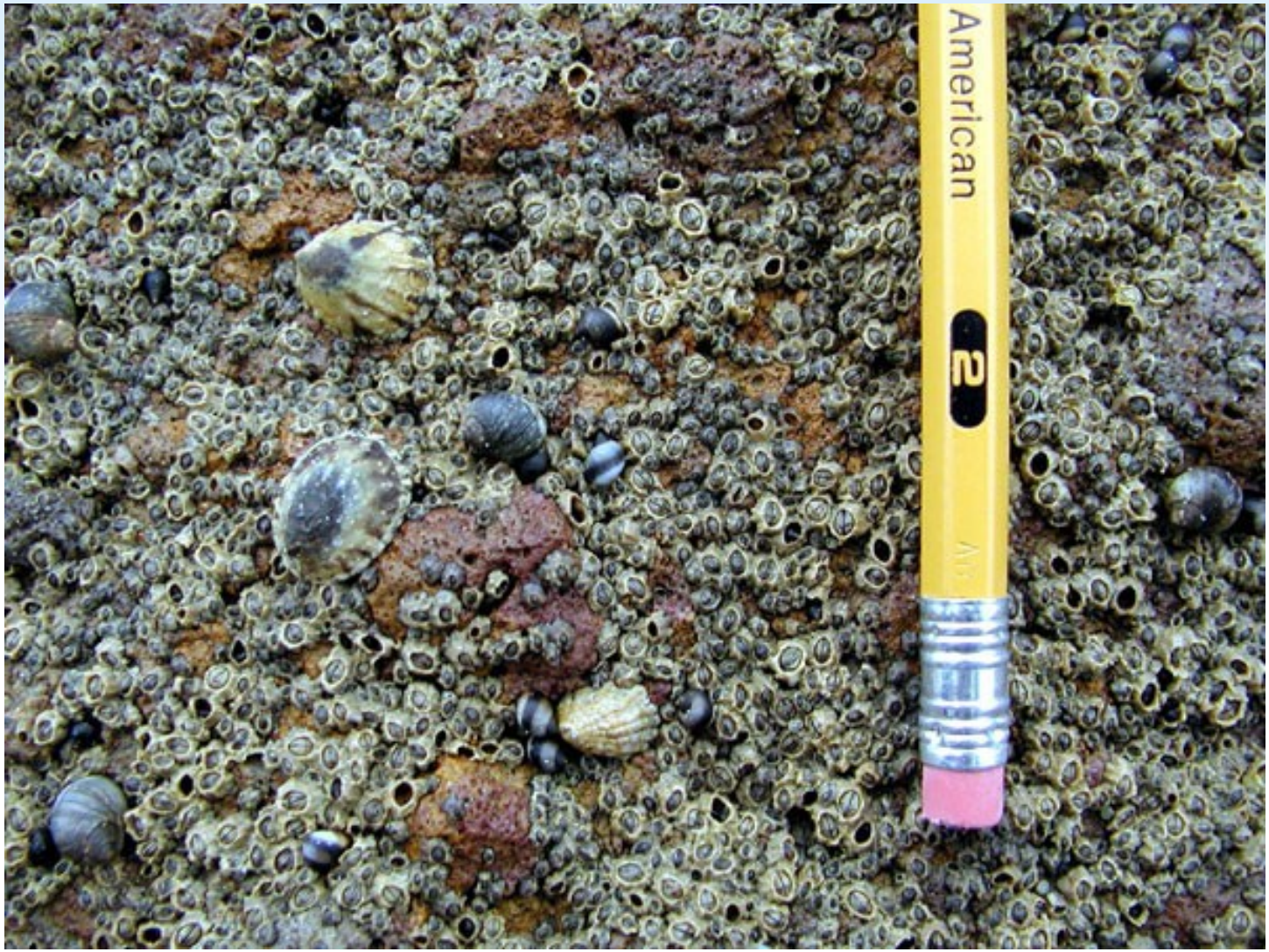
Rocky Shores

- The upper intertidal of rocky shorelines hosts organisms that suffer with frequent desiccation and punctuated food supplies.

Fig. 8.19 Stunted acorn barnacles, *Chthamalus*, survive in the shallow depression of carved letters.

Littorina

Following the mucus trail to paradise…or a good friendship!!!



Chthamalus

Balanus – High and middle

Intertidal Communities

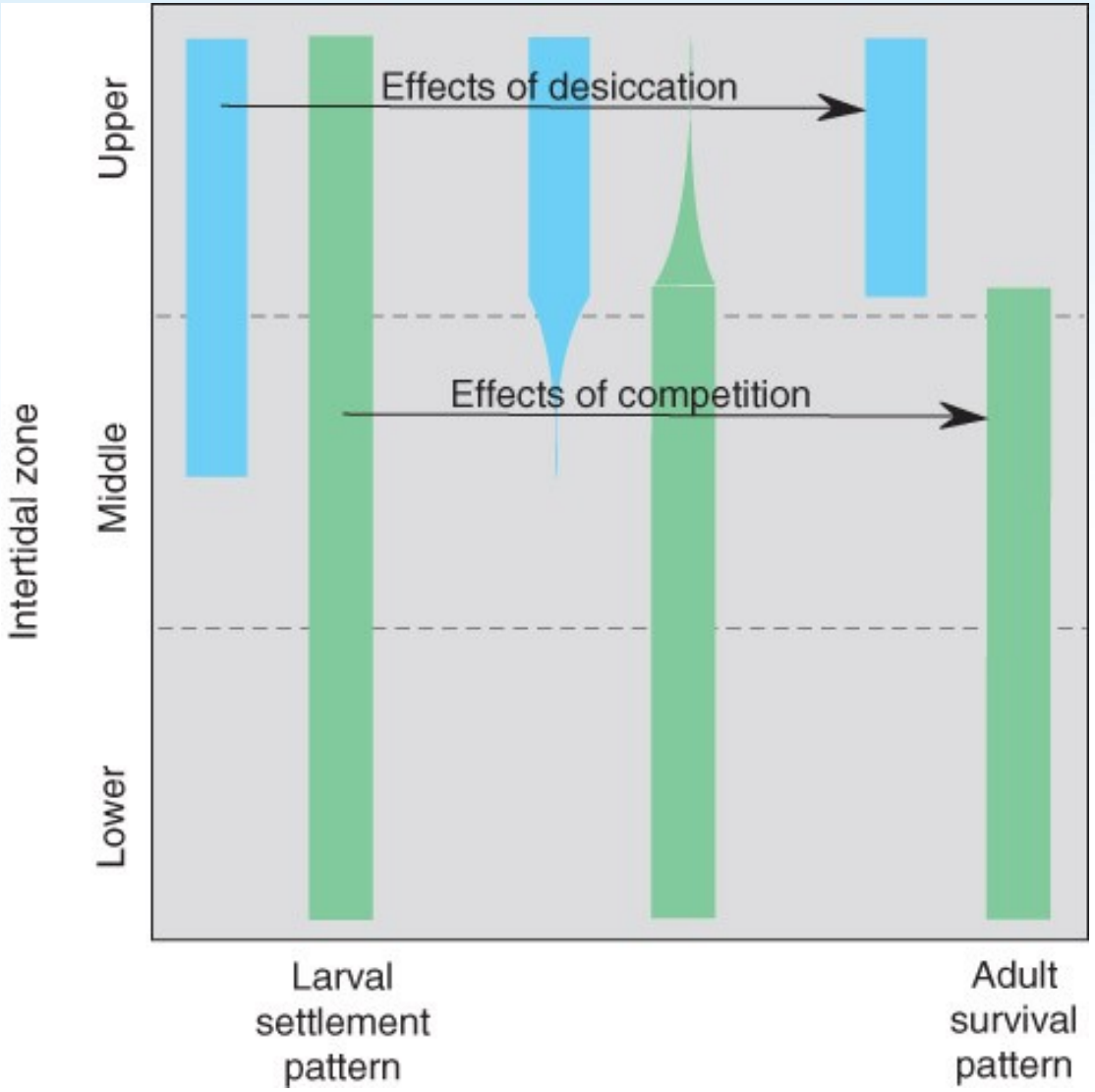


Fig. 8.21 The limiting effects of desiccation and competition on the vertical distribution of two species of intertidal barnacles, *Chthamalus* (blue bars) and *Balanus* (green bars).

Adapted from Connell, J. H. Ecology 42 (1961): 710-723.

Middle Intertidal – Competition more of a factor here than physical limitations of the environment


Pollicipes – the gooseneck or leaf barnacle

Why aren't their tentacles out?

Why do they have bits of shell on them?


acrorhagi

Intertidal Communities

Rocky Shores

Fig. 8.22 The aggregate sea anemone, Anthopleura elegantissima. Exposed individuals (upper right) have retracted their tentacles to avoid dessication.

Intertidal Communities

Fig. 8.25 Tightly packed barnacles compete for space along the intertidal.

Photo by Dave Cowles, Rosario Marine Invertebrates website http://rosario.wallawalla.edu/inverts

Intertidal Communities

Pisaster – mid to low

Fig. 8.26 Sea stars, *Pisaster*, aggregating near the low tide line to avoid dessication.

Intertidal Communities

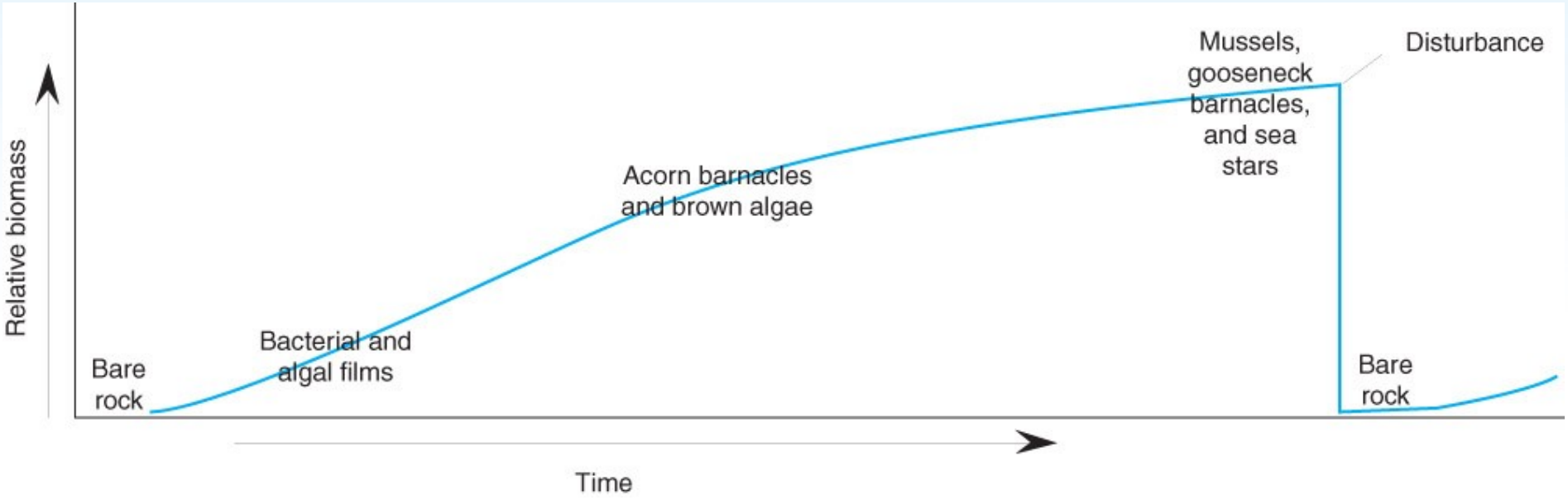


Fig. 8.27 General pattern of succession through time on temperate rocky shores. The blue curve indicates a relative biomass.

Succession – change in a community over time. Disturbances start the process over! What's an example of a disturbance?

Intertidal Communities

Rocky Shores – The Lower Intertidal

- The lower intertidal hosts a diversified assemblage of plants and animals that are exposed to air for only a short period of time each day.

Fig. 8.28 Surf grass covers rocks and helps to keep intertidal organisms moist during low tide.

Intertidal Communities

Fig. 8.29 The green anemone, *Anthopleura xanthogrammica*.

Fig. 8.30 An eolid nudibranch with long finger-like cerata projecting from its dorsal surface.

Intertidal Communities

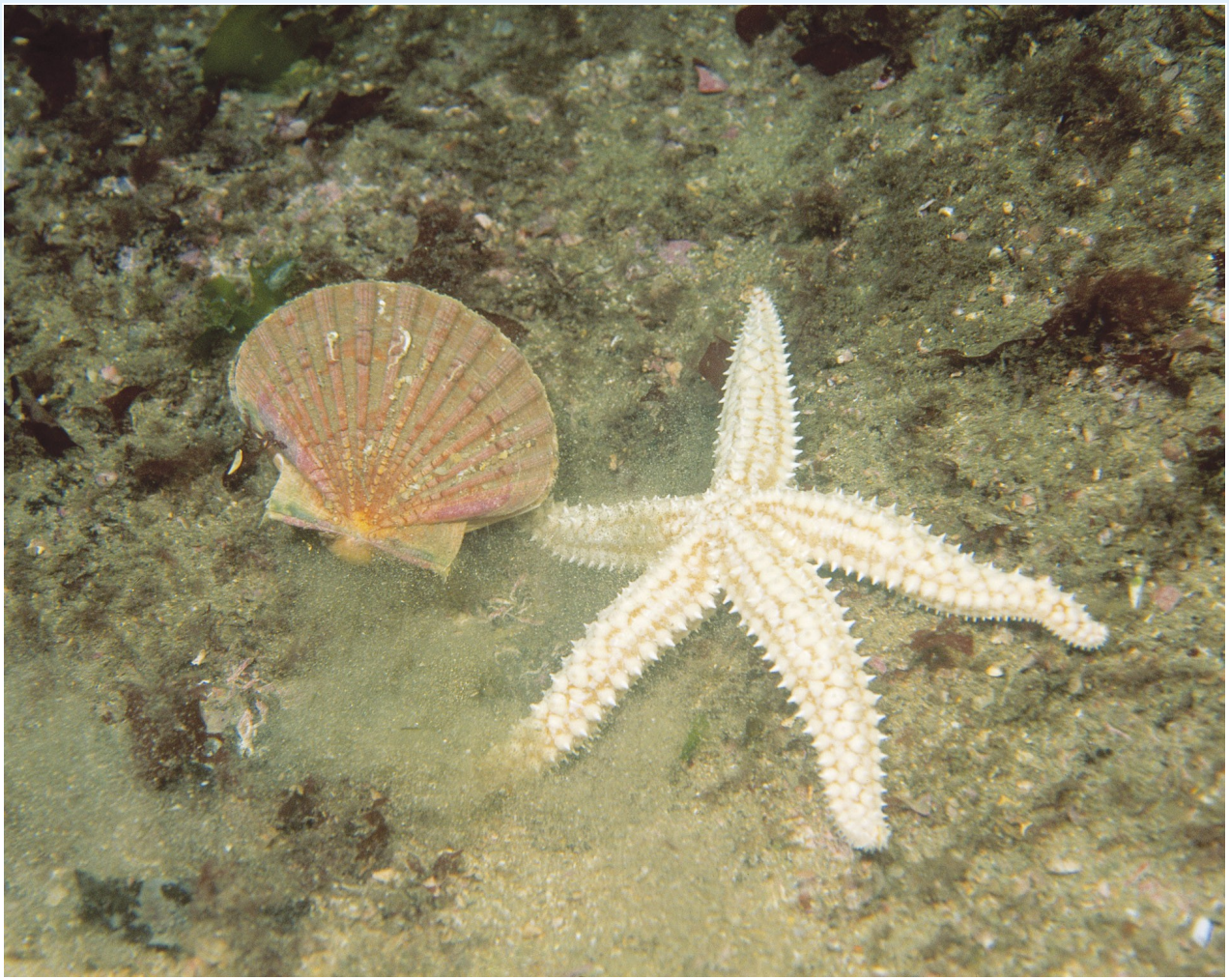


Fig. 8.31 A scallop flaps its valves (shells) vigorously to jet away from a predatory sea star.

Intertidal Communities

Fig. 8.32 Vertical zonation patterns on a 3-m-high rock on the coast of Oregon.

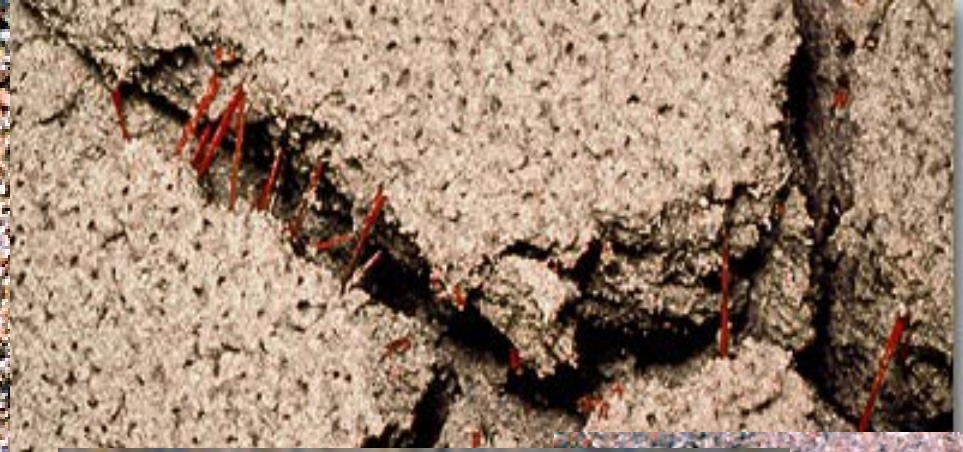
Intertidal Communities

Sandy Beaches – Focus on California

- Sandy beaches are characterized by deposits of unconsolidated sediments and accumulations of detritus.
  - The detritus is the main food source

Are there are many species here compared to the rocky shore???

Beach wrack




Intertidal Communities: Sandy Beaches

http://www.youtube.com/watch?v=LsV9AkjV0q4

http://www.youtube.com/watch?v=j6Bs7_2VTY8

Fig. 8.35 A sand crab, *Emerita*, backing into the sand in preparation for feeding.

Megalorchestia **(beach hopper)**

Emerita **(sand crab)**

Intertidal Communities: Sandy Beaches

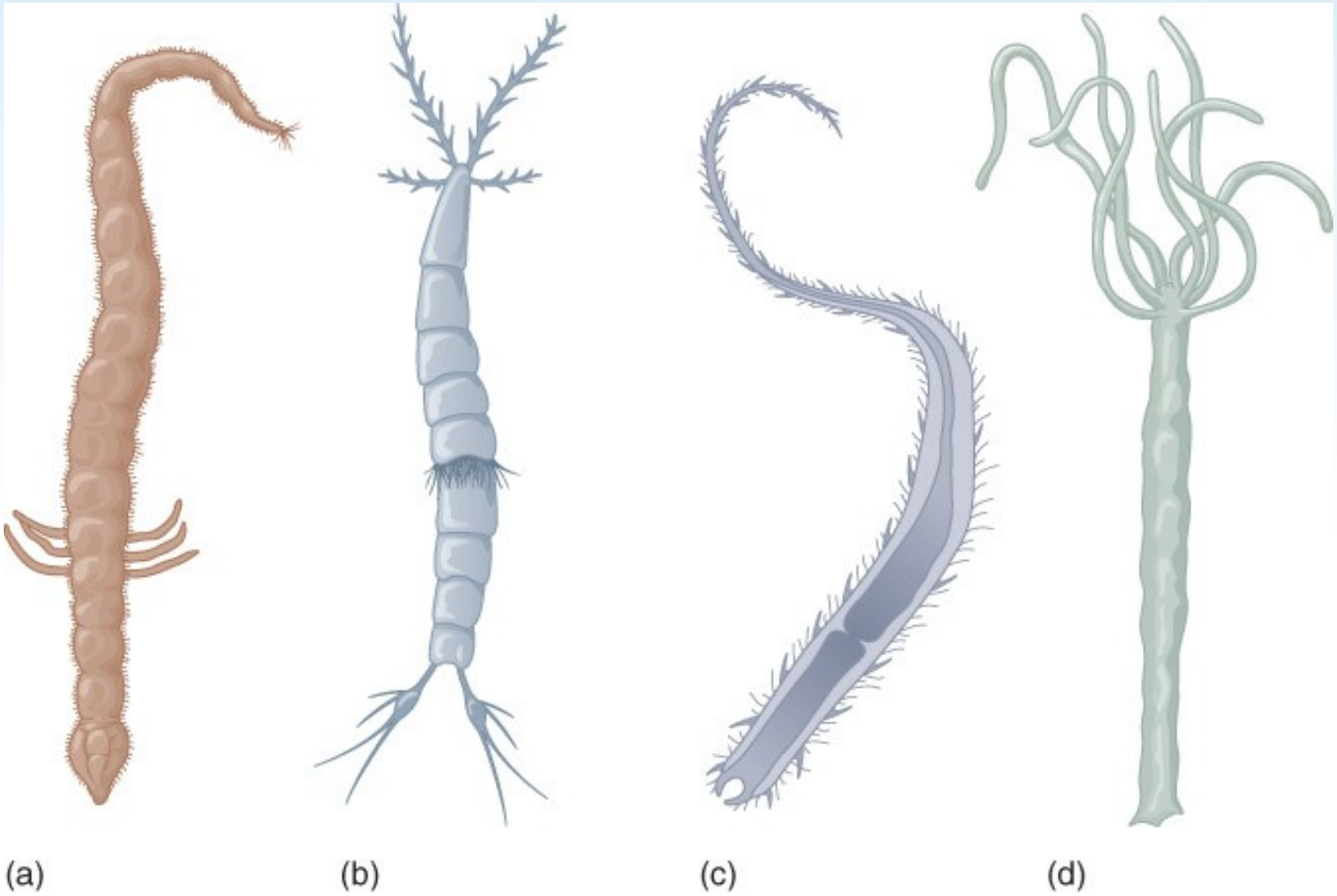


Fig. 8.36 A few examples of the **interstitial** fauna of sandy beaches. Each is of a different phylum, yet all exhibit the small size and worm-shaped body characteristic of meiofauna: (a) polychaete, *Psammodrilus*; (b) a copepod, *Cylindropsyllis*; (c) a gastrotrich, Urodasys; and (d) a hydra *Halammohyra*.

Adapted from S. K. Eltringham. Life in the Mud and Sand. Crane, Russak, 1972.

Intertidal Communities: Sandy Beaches

http://www.youtube.com/watch?v=2Dxoa1IRB6Q

Fig. 8.37 Grunion, *Leuresthes*, spawning in the sands of a southern California beach. Males coil around females that dig themselves into the sand to deposit their eggs.

Shallow Subtidal Communities

Below the effects of waves and tides, kelp communities dominate in temperate areas.

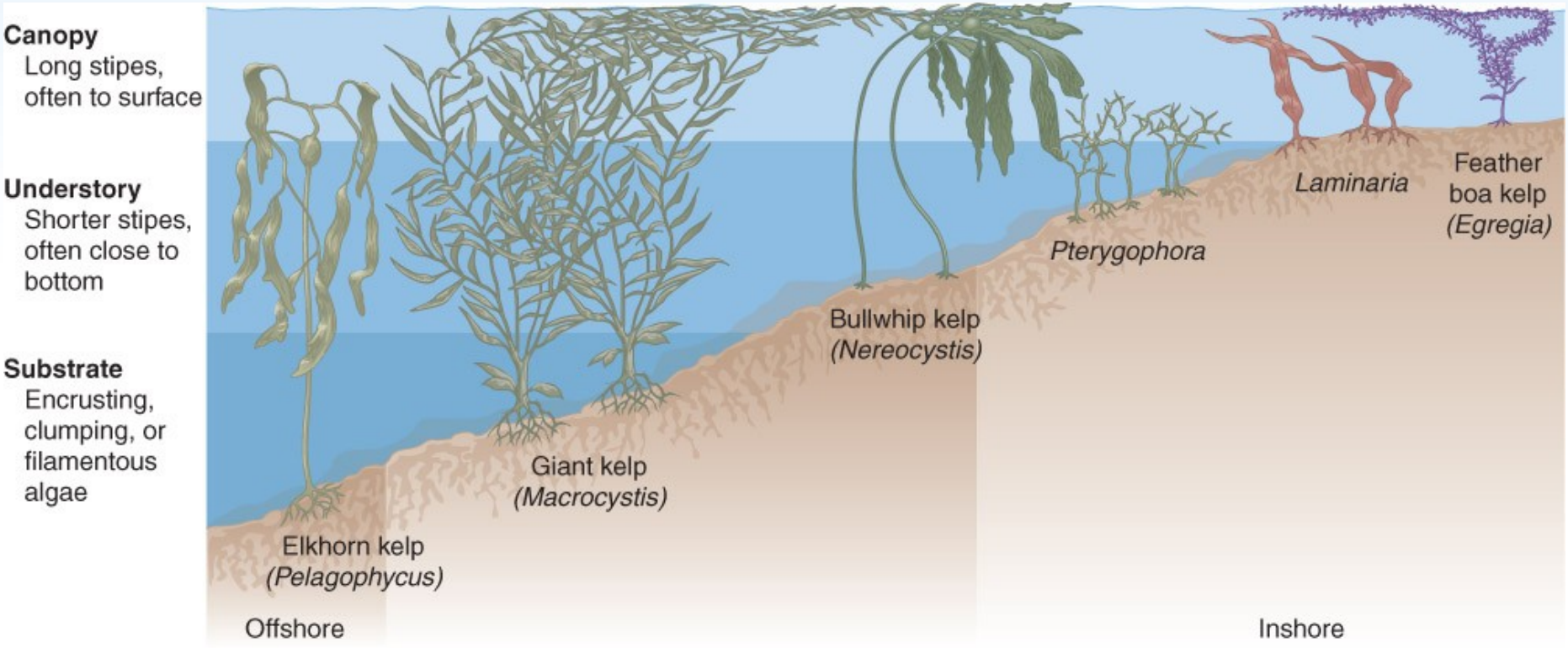


Fig. 8.45 General structure of a West Coast kelp forest, with a complex understory of plants beneath the dominant *Macrocystis* or *Nereocystis*.

Shallow Subtidal Communities

Fig. 8.44 Several species of kelp-community fishes sheltering near giant kelp, *Macrocystis*.

Shallow Subtidal Communities

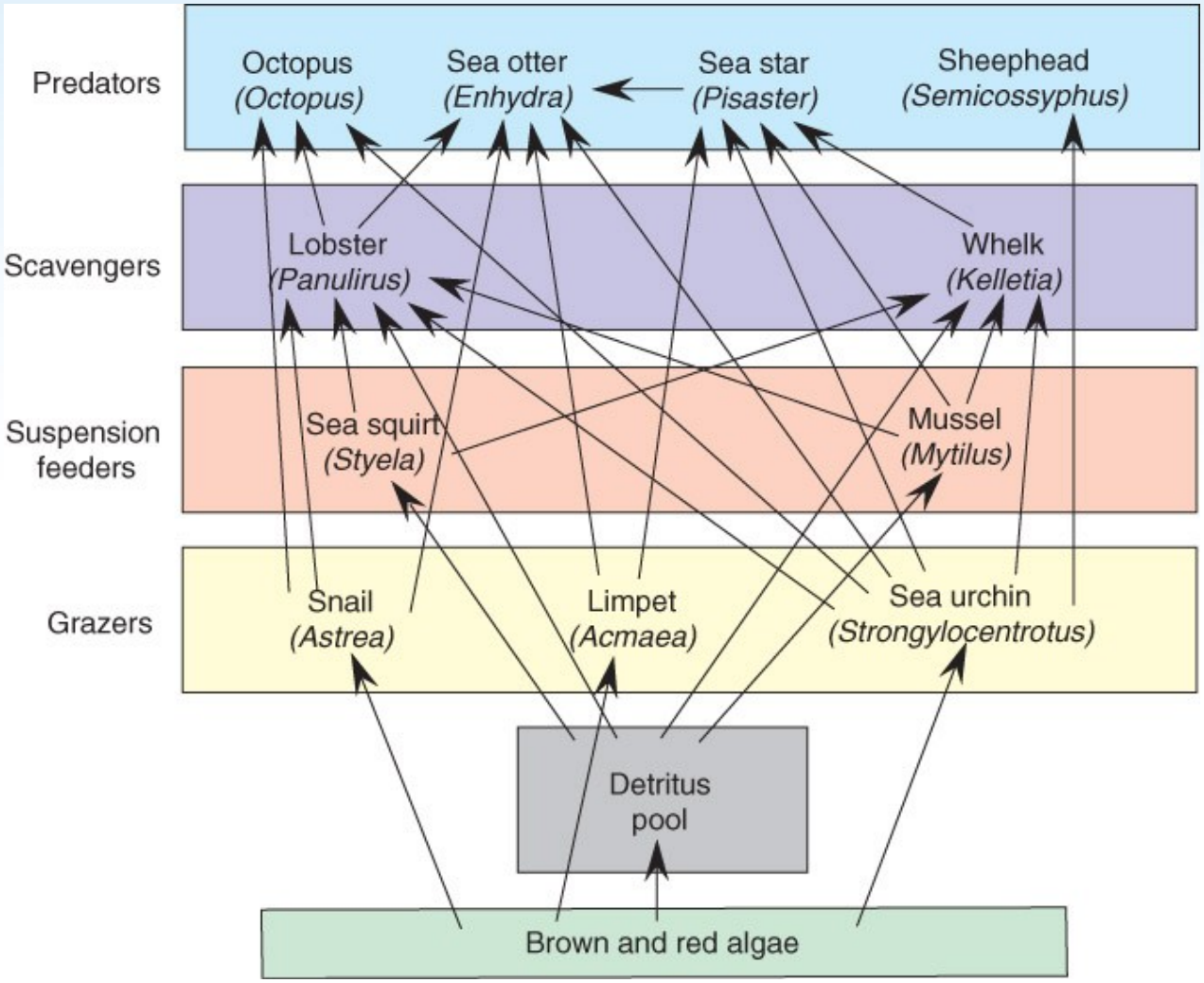
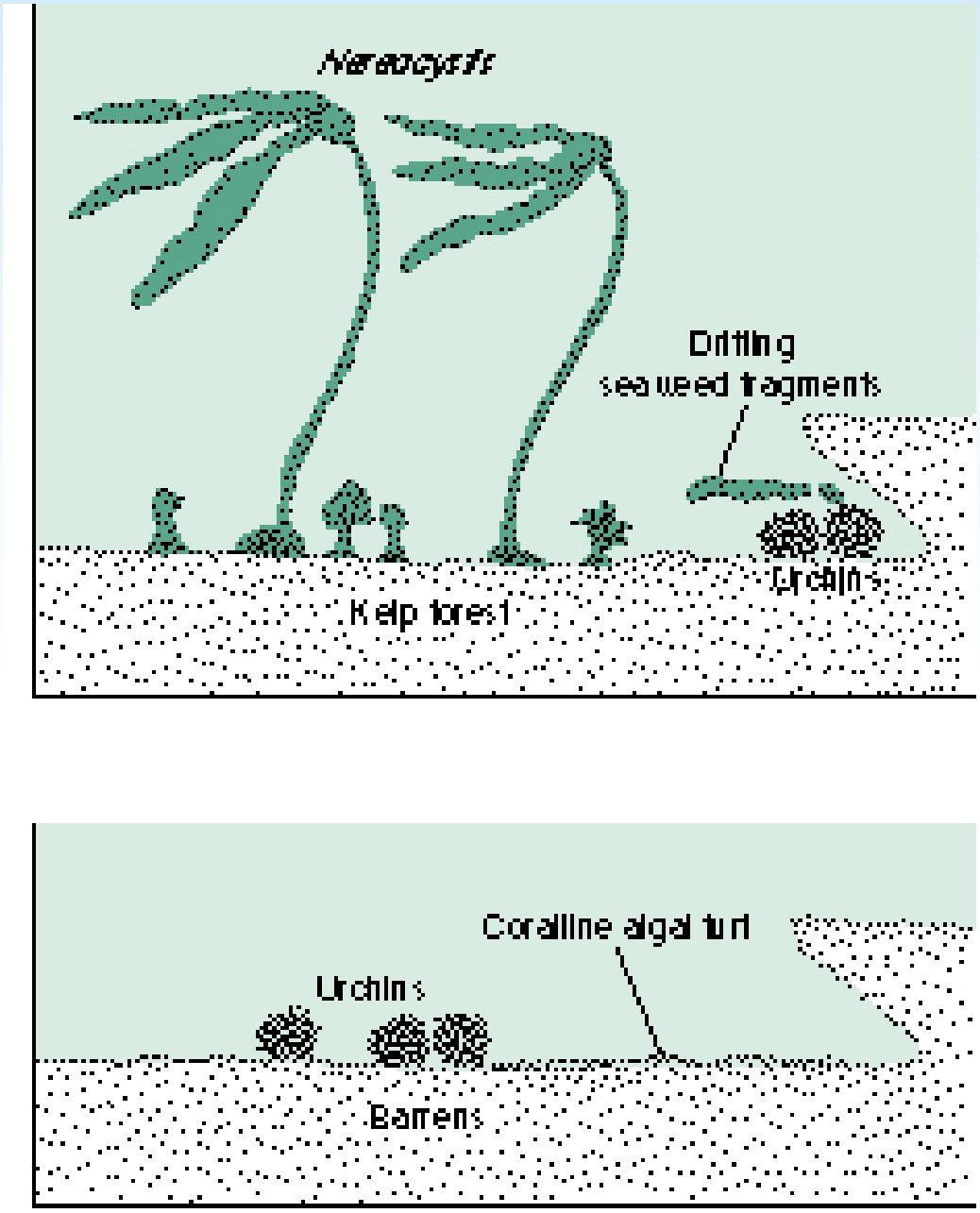


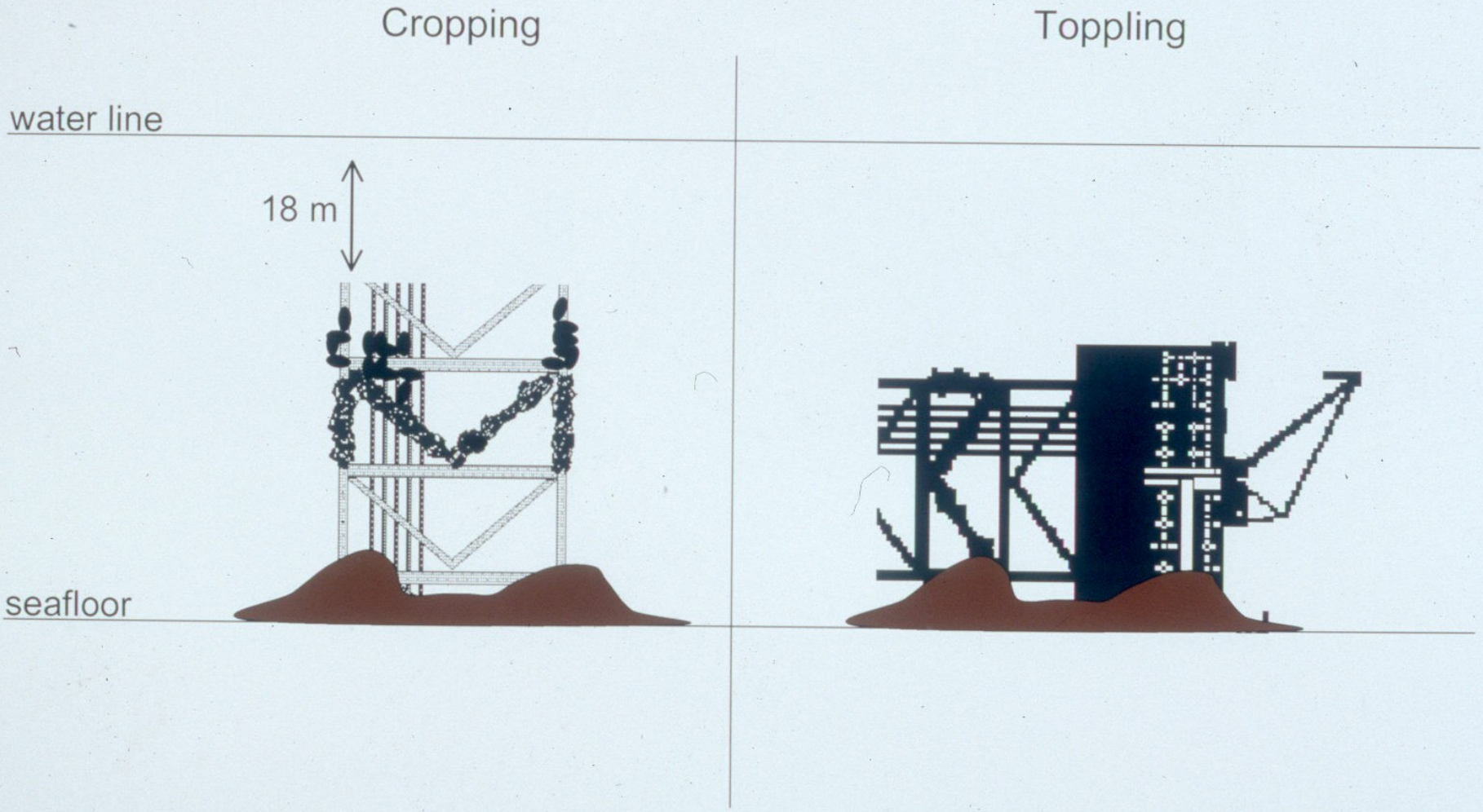
Fig. 8.46 Trophic relationships of some dominant members of a southern California kelp community.

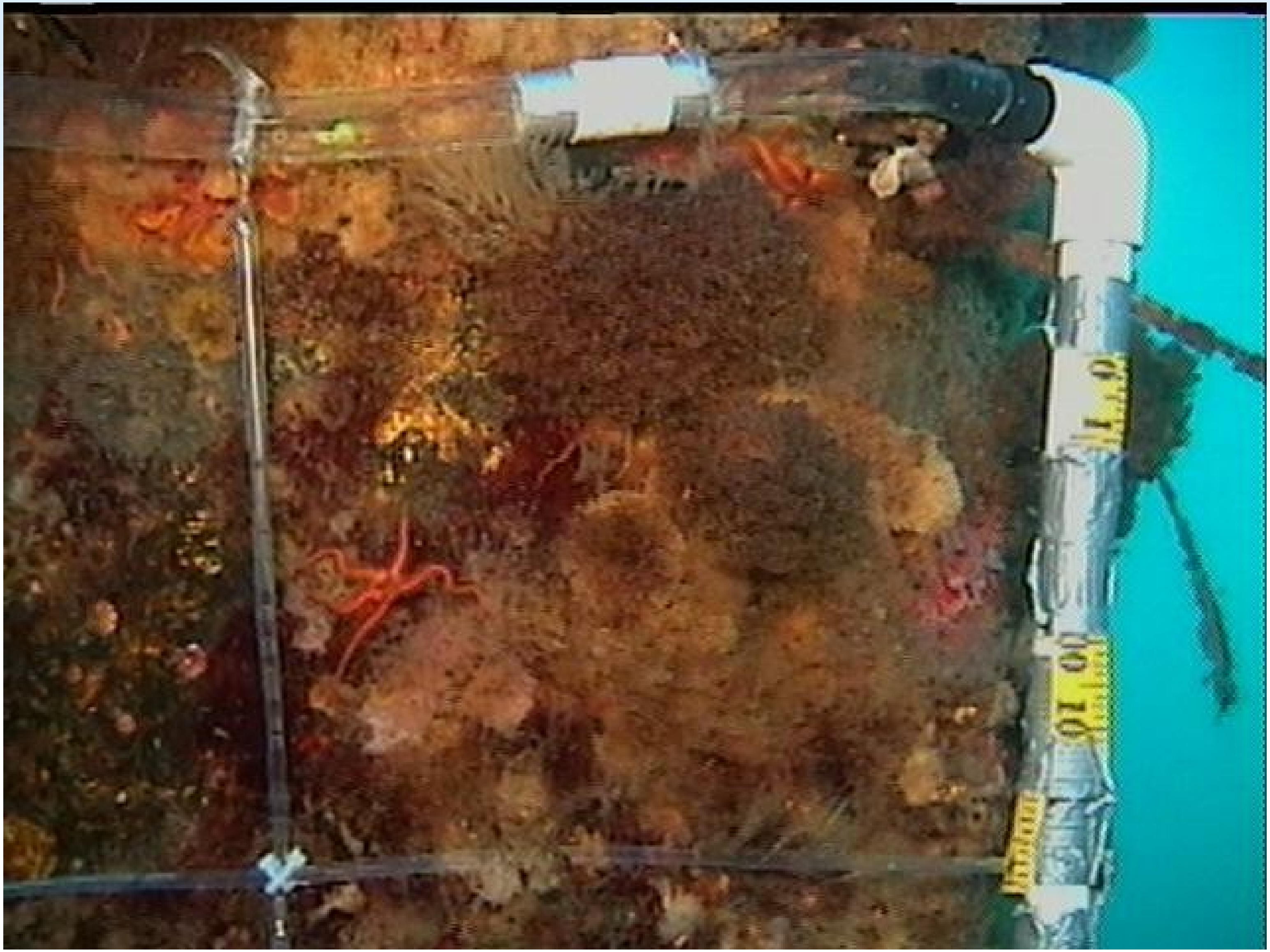
Some environmental issues facing California coasts!!!

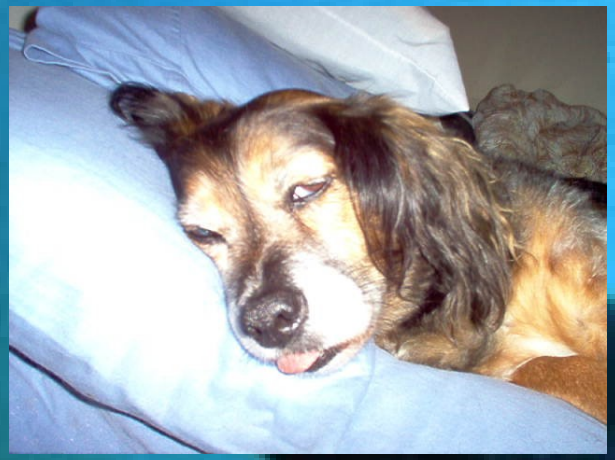
1. Urchin barrens
2. Oil Platforms



Decommissioning options







The end!