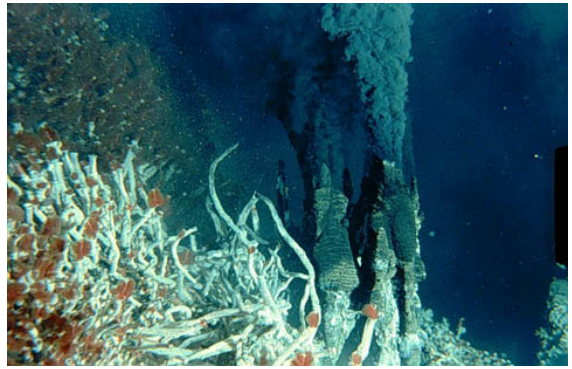
Overview

- New topic each week
- Short lecture/discussion
- Experiments/Demonstrations
- Articles
- Internet research
- Make practice questions
- Mock competition



Marine Biology

What is Marine Biology?

- The study of organisms living in the ocean.

Outline

- Marine lifestyles
- Marine feeding types
- Important groups of plants and animals
- Marine ecosystems

Marine Lifestyles

- Planktonic: live floating in the water
  - Limited swimming ability, go where the currents take them
  - Meroplankton: planktonic for part of life
  - Holoplankon: planktonic for entire life
  - Zooplankton: animal plankton
  - Phytoplankton: photosynthetic plankton
  - Examples: jellyfish, some fish larva, diatoms and dinoflagellates

Marine Lifestyles

- Nekton: Live in water column and have ability to control where they go
  - Examples: fish, dolphins, turtles

Marine Lifestyles

- Benthic: live on bottom
  - Infauna: animals that live in the bottom
    - Examples: worms that burrow into the mud, clams
  - Epifauna: animals that live on top of the bottom
    - Lobsters, halibut and other bottom living fish

Marine Feeding Types

- Predators: actively hunt other animals for food
  - Tuna, whales, some snails, some seastars
- Herbivores (Grazers): eat plant material
  - Some snails, Manatees

Marine Feeding Types

- Suspension (Filter) Feeders: filter small organisms out of the water for food
  - e.g. Mussels, barnacles, corals
- Deposit Feeders: eat dead food items that are deposited on the ground
  - e.g. worms, some crabs, some snails

All living organisms divided into Kindgoms.

- Archaebacteria
- Eubacteria
  - Approximately 1 million bacteria in one teaspoon of seawater!
  - Cyanobacteria can photosynthesize
- Protista
- Fungi
- Plantae
- Animalia

Kingdom Protista

- Single or multi-celled
- Single celled examples:
  - Diatoms and dinoflagellates (photosynthetic plankton)
- Multi-celled examples:
  - Algae (including kelp)

Multi-celled Algae

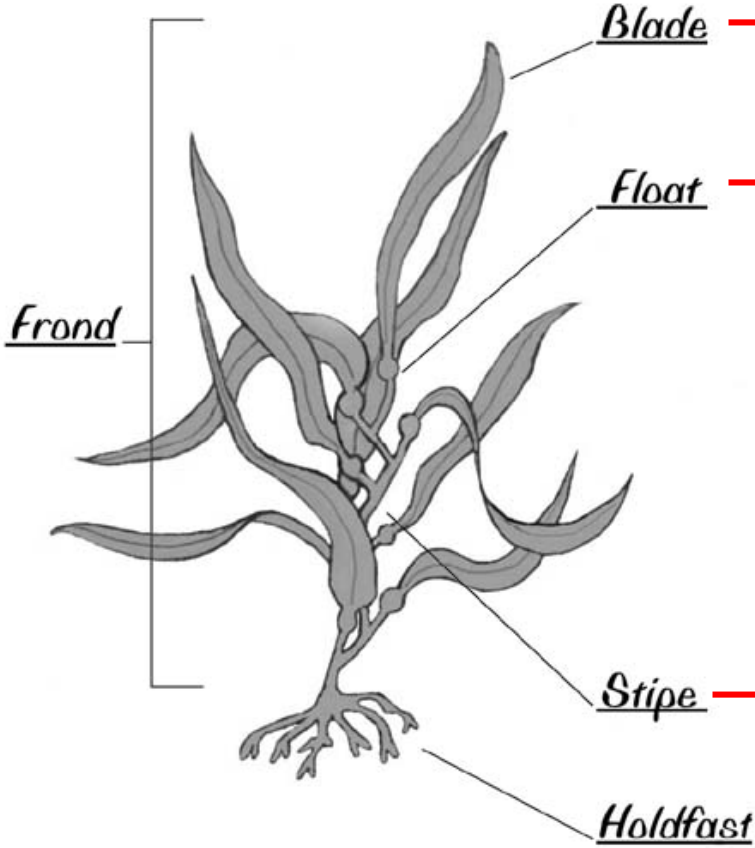
- Have a similar function as plants do on land
  - Photosynthesize, base of food chain, provide habitat for other organisms
- Most live attached to rocks
- Structures are different from plants

Division (Phylum) Chlorophyta

Division (Phylum) Rhodophyta

Division (Phylum) Phaeophyta

Algae Structures



Photosynthesis, takes up water and nutrients

Buoyancy: air filled, allows algae to float in water

Photosynthesis, takes up water and nutrients

Attaches algae to rock, doesn't grow into rock, only for attachment

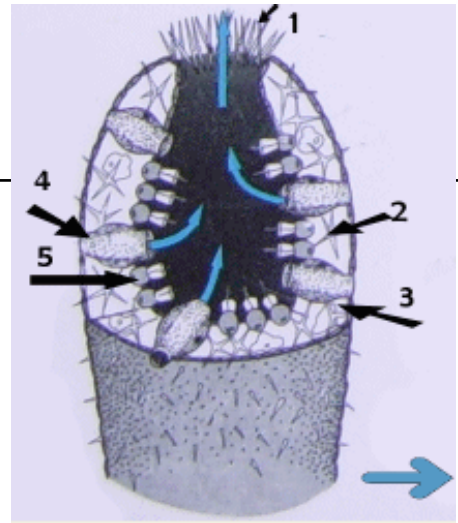
Kingdom Plantae

- Most plants live on land, but some live in the ocean
- Estuaries
  - Plants sometimes covered with water (during high tide)
- Some plants live completely under water
  - Sea grasses

Kingdom Animalia

- Many different phlya (subgroups within kingdoms)
- 95% of all marine animals are invertebrates (have no backbone)

Phylum Porifera



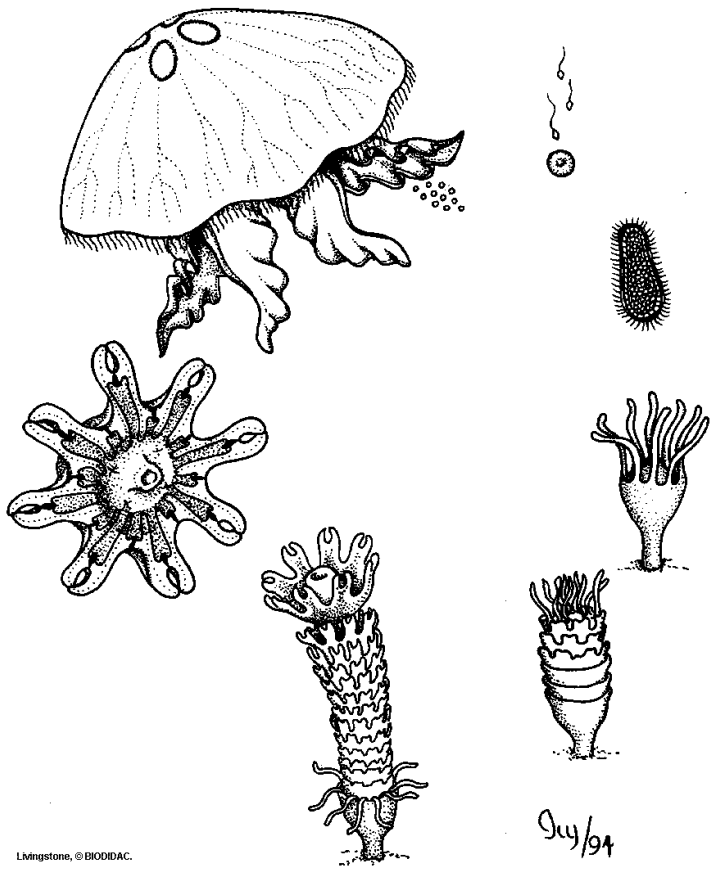
- Sponges
- Simplest animals
- Major Characteristics:
  - No organized tissues
  - Benthic
  - Spicules- hard structures for defense
  - Have specialized cells for collecting food, reproduction
  - Suspension feeders

Phylum Cnidaria

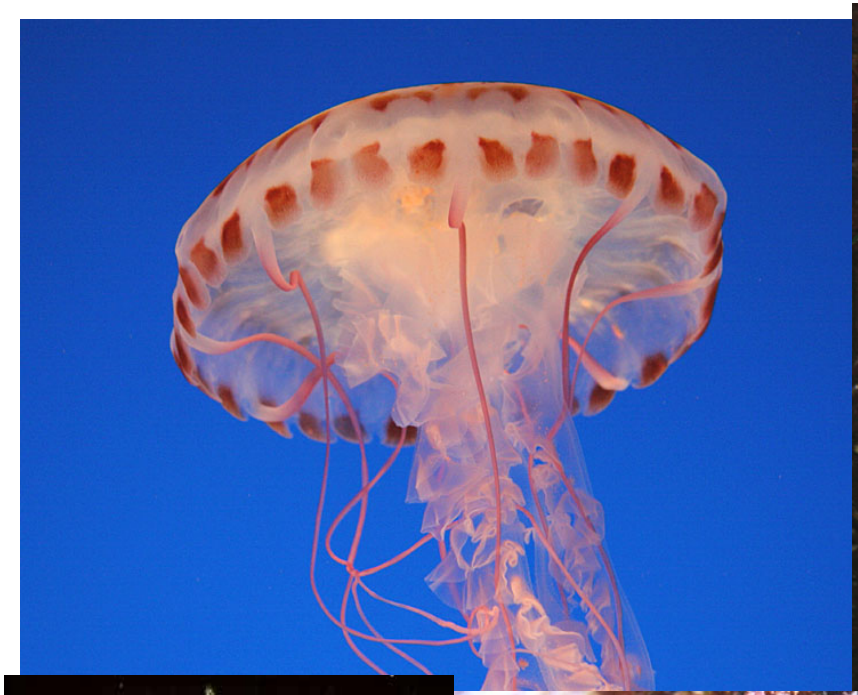
- Jellyfish, corals, anemones, hydroids
- Major Characteristics:
  - Cells organized into tissues
  - Planktonic and benthic stages
  - Nematocysts (stinging cells)
  - Suspension feeders

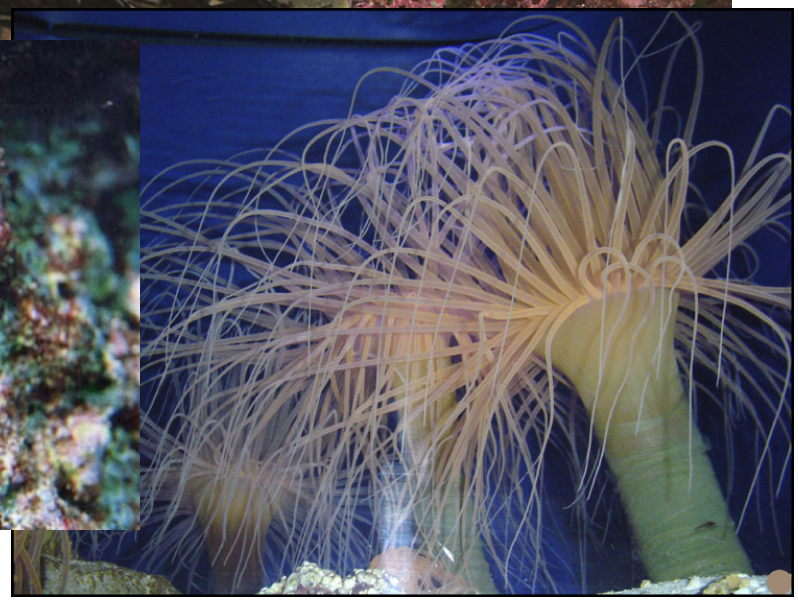
Cnidaria Life Cycle

Medusa: Planktonic



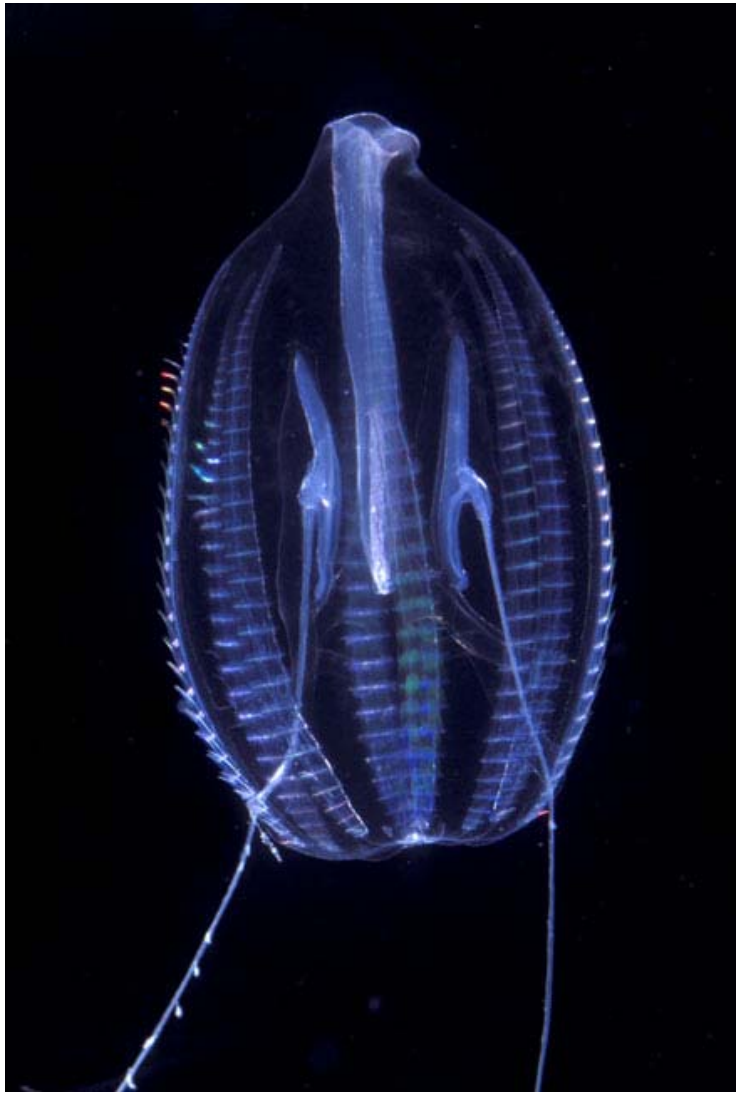
Polyp: Benthic

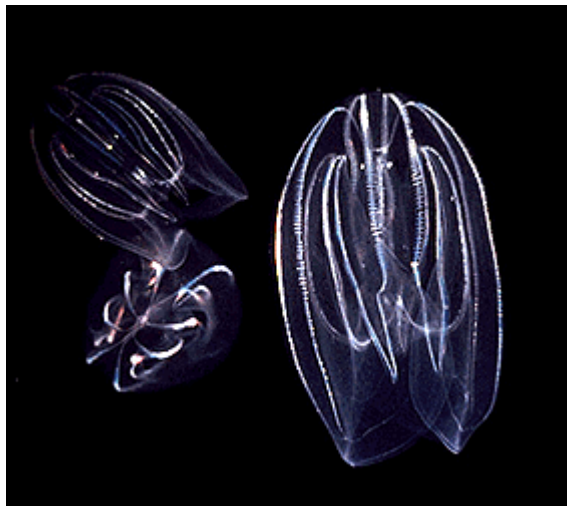




Phylum Ctenophora

- Comb jellies
- Major Characteristics
  - Cells organized into tissues
  - Entirely planktonic
  - Colloblasts (sticky cells)
  - Suspension feeders, some predators





Worm Phyla

- Platyhelmenthes- flat worms
- Nemertea
- Nematoda- many parasitic
- Annelida
  - Largest worm phylum
  - Includes Earthworms

Phylum Annelida
Subphylum Polychaeta

- Most marine worms belong to this phylum
- Major Characteristics:
  - Segmented
  - Parapodia (“legs or feet” located on each segment)
  - Benthic or Planktonic
  - Some are reef building

Phylum Mollusca

- Clams, mussels, snails, chitons, nudibranchs, squid, octopus
- Major Characteristics
  - Most have a hard shell
  - Soft foot for movement
  - Show all feeding types

Bivalves

Cephalpods

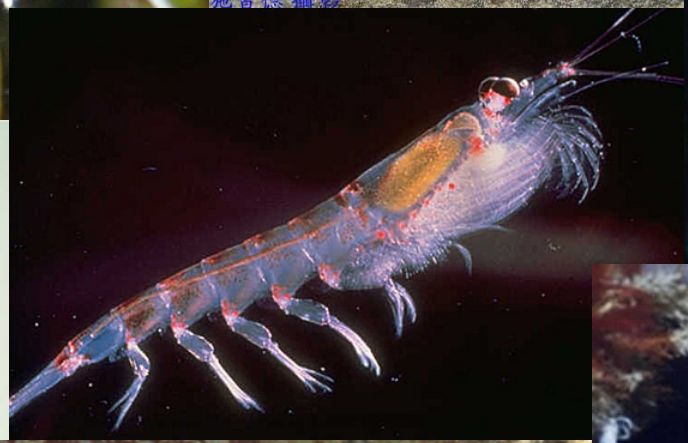
Chitons

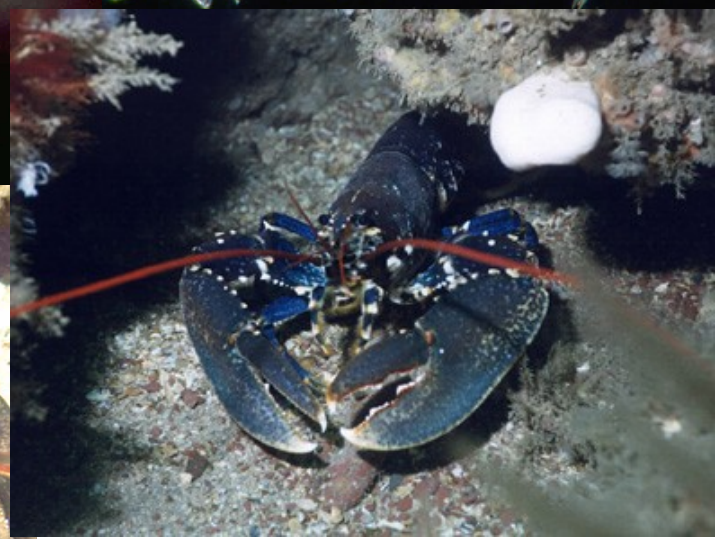
Gastropods

Phylum Arthropoda
Subphylum Crustacea

- Lobster, crab, shrimp, amphipods, isopods, krill, copepods
- Major Characteristics
  - Benthic or planktonic
  - Exoskeleton
  - Segmented
  - Jointed appendages (legs, antenna, etc)


施習德 攝影



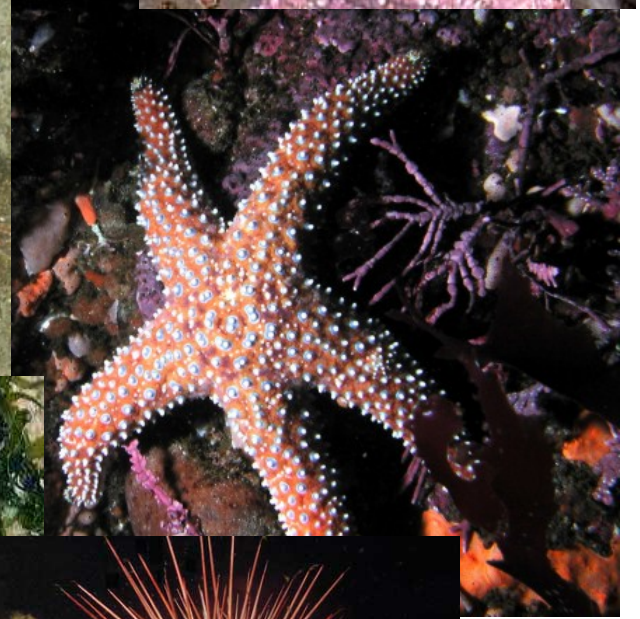


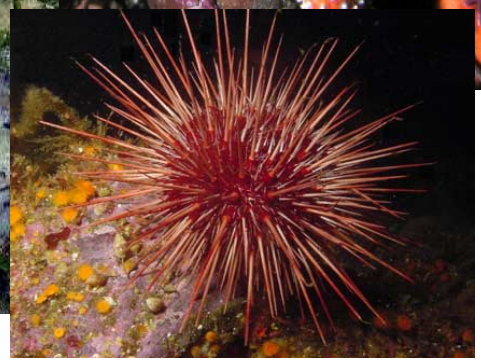
Phylum Echinodermata

- Sea stars, brittle stars, sea cucumbers, sea urchins, sand dollars
- Major Characteristics
  - Most Benthic
  - Phylum most closely related to Chordates
  - Endoskeleton (not like ours)
  - Tube feet
  - Water vascular system (kind of like veins)





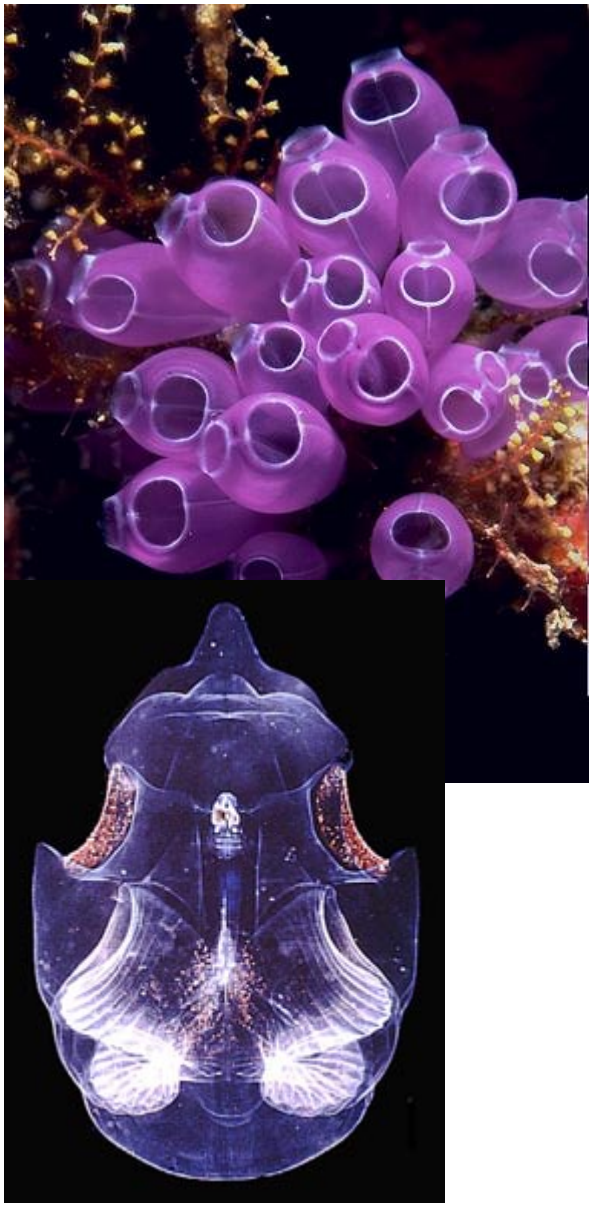



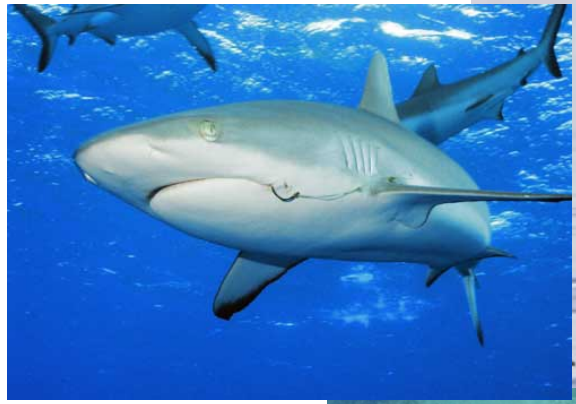
Phylum Chordata

- Mammals, reptiles, birds, amphibians, fish, tunicates
  - Notochord: stiff rod
  - Nerve cord
  - Gill slits (even humans!)
  - Postanal tail (even humans!)

Urochordata



Vertebrata



Marine Ecosystems

- Coral Reefs
  - One of the most productive marine ecosystems
  - Calcium-carbonate skeleton of coral accumulates over time to build the reef
  - Coral have associated dinoflagellates called zooxanthellae
  - Coral very sensitive to water conditions
    - Can lead to coral bleaching

Marine Ecosystems

- Kelp Forests
  - Subtidal (never exposed by low tide)
  - Found in temperate areas with hard rocky bottoms (for holdfast attachment)
  - Kelp can grow very tall (like a forest)
    - Some 20-30m (~60-90ft)
  - Support many fish and invertebrate communities
  - Kelp forest - sea urchin - sea otter relationship

Marine Ecosystems

- Intertidal
  - Area between low and high tide
    - Organisms tolerant of changing conditions
    - Euryhaline organisms (tolerant to changes in salinity)
  - Rocky Intertidal
    - Animals and algae live attached to rocks
  - Soft bottom intertidal
    - Animals burrow into the mud/sand

Marine Ecosystems

- Estuaries
  - Occur where freshwater flows into the ocean
  - Only a few types of plants can live here
  - Support many invertebrates, bird, and fish species
  - Serve as hatcheries for many commercially important fish species

Marine Ecosystems

- Open Ocean
  - Base of food web is mostly small phytoplankton (cyanobacteria).
  - Phytoplankton remove significant amounts of carbon from the atmosphere through photosynthesis
  - Most organisms have floating mechanisms so they do not sink

Marine Ecosystems

- Hydrothermal Vents
  - Found in the deep ocean where continental plates are spreading
  - Sulfur bacteria are primary producers
    - Get energy from sulfur not the sun
    - Chemosynthesis
  - These communities contain unique organisms not found any where else

Fishery Facts

- “Tragedy of the commons”
  - Shared resources are used at a rate that exceeds sustainability.
  - Each person takes what is best for them with out regard to what is best for everyone as a group.
  - Over time resources are depleted and no one gets enough

Fishery Facts

- Sustainability
  - Meeting the needs of the present without limiting the availability of other people, species, or future generations to survive

Fishery Facts

- Fishing pressure has increased in the past 100 years
  - Increased population
  - Better technology
- Farmed fish
  - Trying to decrease pressure on natural stocks
  - Have own set of problems (waste, antibiotics, etc)