Zooplankton

- Zoos are extremely diverse, almost every major animal group is represented
- Some herbivores, carnivores, omnivores
- Unicellular (cell division) and multicellular (sexual reproduction)
- Most can swim vertically. Many migrate to the surface at night to graze.
- Includes jellyfish, crustaceans, larvae

Classification by Life History

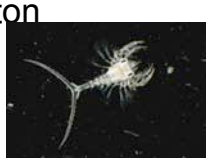
- **Meroplankton**
  - spend only part of their life in the plankton
- **Holoplankton**
  - spend their entire lives in the plankton

The megalopa, the last larval stage of *Callinectes sapidus* belongs to the meroplankton

Heteropod *Atlanta peronii*
A seafaring snail with a thin fragile shell containing only the heart and gills. It swims upside down, using its tiny shell as a keel. It is a voracious hunter, capable of devouring prey as large as itself.

Zooplankton

- Also are denser than seawater
- Adaptations
  - Spines, antennae, etc
  - Swimming motion
  - Body shape that increases surface area to volume ratio
  - Store fats & oils

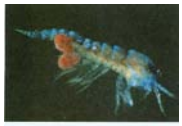


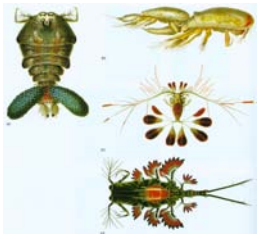
Copepods

- Phylum Arthropoda
  - Subphylum Crustacea
- Primary holo-planktonic grazer of phytoplankton
- Found everywhere in the ocean - most abundant animal in the world
- Major link from primary production to higher trophic levels

Copepods

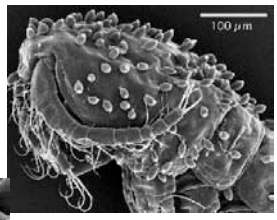
- Microscopic, shrimp-like
- Hard exoskeleton, segmented, joints
- Majority of ocean's animal biomass

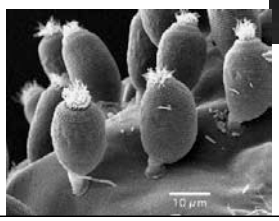




Parasites

Even copepods have parasites

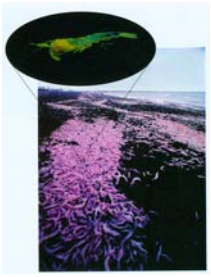




The peritrichs are a large and distinctive group of ciliate protozoa.

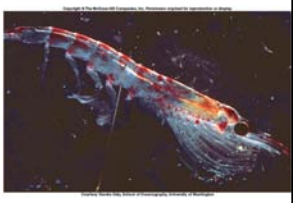
Euphausiids (Krill)

- Look like mini-shrimp or large copepods
  - No bigger than 5 cm
- Larger, slower, longer lives than copepods
- Occur everywhere in the world, but highest populations are in polar regions
- Consumed by fish, baleen whales

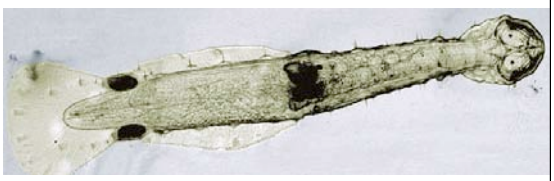


Krill - dominant Antarctic zooplankton

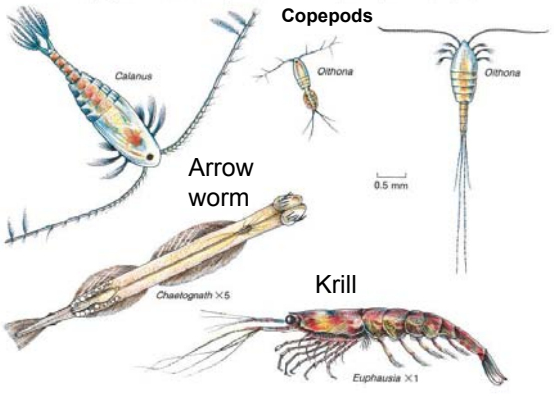
- Feed on diatoms
- Food for sea birds through largest whales
- Prefer cold oceanic waters
- Efficient filter feeders
- Fished extensively in the 1960's - 1980's for livestock feed. Harvests were limited in 1991.



Chaetognath

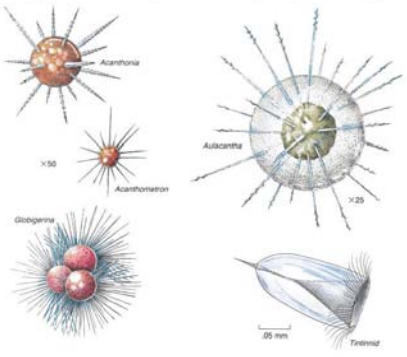


- Predatory marine worms
- Found everywhere in the world's oceans
- 2mm to 12 cm
- Poisonous spines used to hunt larvae, copepods

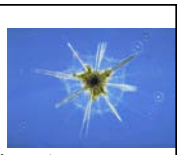


Protozoans

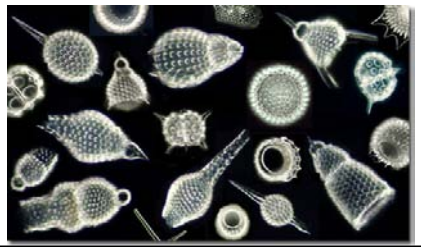
- **Single celled**
- **Feed on detritus, algae, bacteria**
- **Radiolarians**
  - **Siliceous shell**
- **Foraminiferans**
  - **Calcareous shell**
- **Tintinnids**
  - **Cilia**



Radiolarians

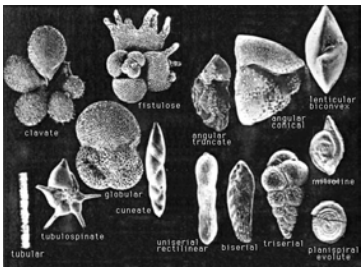


- Glass (silicon dioxide) shells
- Shells covered with spines
- Found in warm waters
- Large component of deep water sediments



Foraminifera (forams)

- Calcium carbonate shells (tests)
- Large component of shallow water sediments



Forams

- Thin organic filaments called rhizopodia extend through perforations in the test.

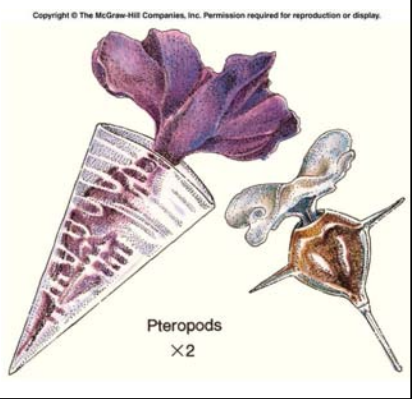
Tintinnids

- Identified by numerous cilia
- Have protective, transparent shell

•Mollusks

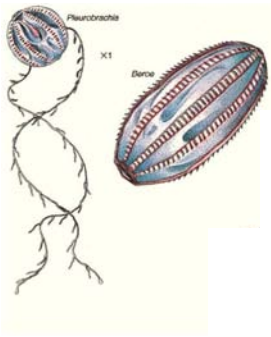
•Pteropods

- Foot acts as a "wing"
- Many have calcareous shells



- Herbivores and carnivores
- Shelled and non-shelled
- Global distribution
- Important prey for whales and fishes (tuna)

Ctenophores (comb jellies)



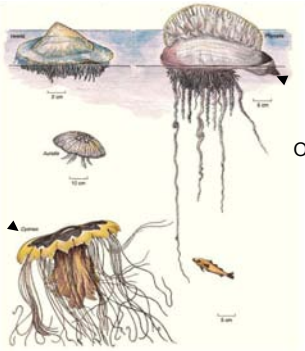
- Transparent
- Bioluminescent
- Carnivores
- Float near the surface
- Eight rows of beating cilia

Tunicates

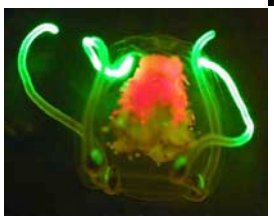
- Transparent
- Herbivores
- Often found in large numbers over many km^2

Cnidaria: Jellyfish

Holoplankton

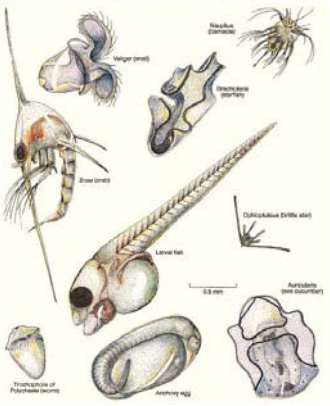


Colonial Organisms



Mero-plankton

- Eggs,juvenile and larval stages of nekton and benthos



Tube Anemone Larva

Flounder Larva

The role of phyto and zooplankton

- Primary production vs. primary productivity
- Production of organic material from inorganic nutrients using light energy is Primary Production
- Total amount of organic material produced is gross primary production
- Phytoplankton also respire, using up organic matter.
- Net primary production is gain on organic matter from photosynthesis minus the organic material lost by respiration

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The role of phyto and zooplankton

Primary production vs. primary productivity

- Primary productivity (the rate) is most often measured by tracking the amount of oxygen produced or the amount of carbon dioxide consumed
- Redfield Ratio provides the typical ratio of different elements, allowing for conversion from one element ("currency") to another
- Redfield Ratio (mass):

  O_2:C:N:P = 109:41:7.2:1

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- Standing stock is the total biomass of phytoplankton at any instant in time
  - Function of growth, reproduction, death, grazing
- All photoautotrophs use chlorophyll a; it provides a direct measure of standing stock
- Chlorophyll a can be estimated using fluorescence or ocean color

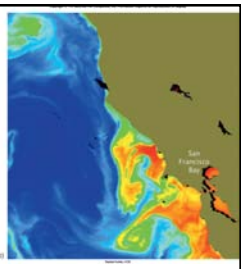

Fig. 12.28