CHAPTER 14
Animals of the Pelagic Environment

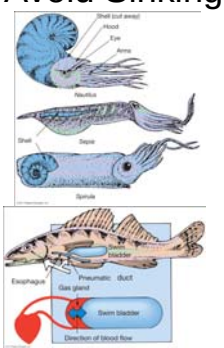
Oh, to be a fish
With nary a care at all
Well, being eaten…

Chapter Overview

- Pelagic animals use a variety of adaptations to help them survive.
- Marine mammals share similar characteristics with land mammals.

Marine Animals Avoid Sinking

- May increase buoyancy
- Use of gas containers
  - Rigid gas containers
  - Swim bladders



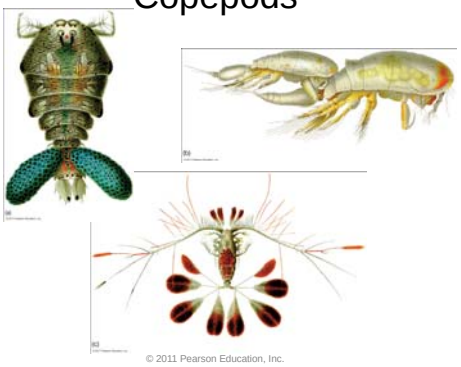
Avoiding Sinking

- Ability to float
  - Zooplankton – some produce fats or oils to stay afloat
- Ability to swim
  - Nekton – larger fish and marine mammals

Floating Zooplankton

- Microscopic zooplankton have shells or tests.
  - Radiolarians
  - Foraminifers
  - Copepods

Copepods

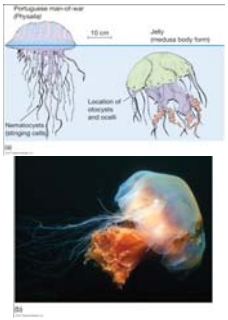


Macroscopic Zooplankton

- Krill
  - Resemble mini shrimp or large copepods
  - Abundant near Antarctica
  - Critical in Antarctic food chains

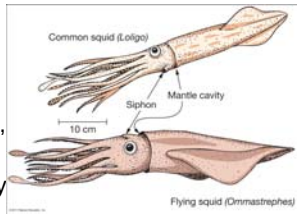
Floating Macroscopic Zooplankton

- Cnidarians
  - Hydrozoan (Portuguese man-of-war)
    - gas-filled float
  - Scyphozoan (jellyfish)
    - Soft, low-density bodies

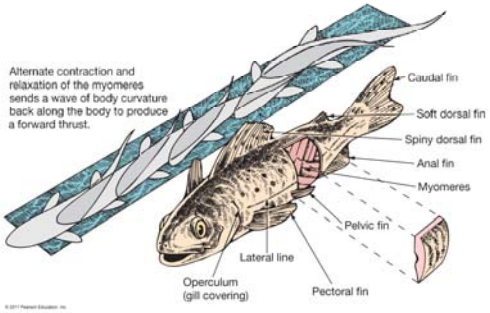


Swimming Organisms

- Fish, squids, sea turtles, marine mammals
- Swim by trapping water and expelling it, e.g., some squid
- Swim by curving body from front to back



Swimming Motion and General Fish Features



Fin Designs in Fish

- Paired vertical fins as stabilizers
- Paired pelvic fins and pectoral fins for "steering" and balance
- Tail fin (caudal) for thrust

Fin Designs in Fish

- Rounded caudal fins
  - Flexible
  - Maneuver at slow speeds
- Truncate fins and forked fins
  - Useful for both maneuvering and thrust


(b)

Fin Designs in Fish

- Lunate fins
  - Rigid, little maneuverability
  - Efficient propulsion for fast swimmers
- Heterocercal fins
  - Asymmetrical,
  - Lift for buoyancy (shark)


(d)

Adaptations for Finding Prey

- Mobility
- Lungers wait for prey and pounce (grouper).
  - Mainly white muscle tissue
- Cruisers actively seek prey (tuna).
  - Mostly red muscle tissue

Lungers and Cruisers


(a)


(b)

Adaptations for Finding Prey

- Swimming speed
- Speed generally proportional to size
- Can move very fast for short time (mainly to avoid predation)

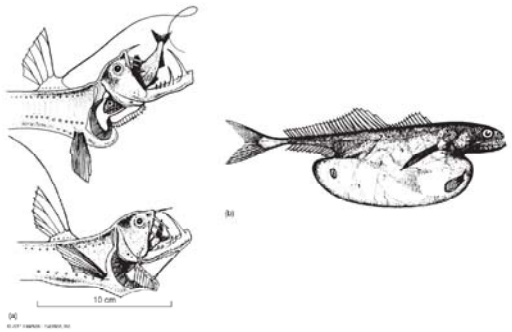
Cold-Blooded vs. Warm-Blooded

- Most fish are cold-blooded – poikilothermic
  - Bodies same temperature as environment
  - Not fast swimmers
- Some are warm-blooded – homeothermic
  - Found in warmer environments
  - Helps them capture prey

Adaptations of Deep-Water Nekton

- Mainly fish that consume detritus or each other
- Lack of abundant food
- Bioluminescence
  - photophores
- Large, sensitive eyes
- Large sharp teeth
- Expandable bodies
- Hinged jaws
- Counterillumination

Deep Sea Nekton



Adaptations to Avoid Predation

- Schooling
  - Safety in numbers
  - School may appear as single larger unit
  - Schooling maneuvers confuse predator

Adaptations to Avoid Predation

- Symbiosis – two or more organisms mutually benefit from association
- Commensalism – less dominant organism benefits without harming host

Adaptations to Avoid Predation

- Mutualism – both organisms benefit
  - Example: clown fish and anemone
- Parasitism – parasite benefits at expense of host

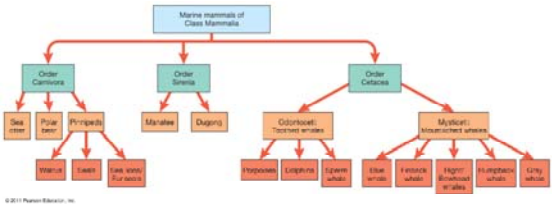
Adaptations to Avoid Predation

- Speed
- Poisons
- Mimicry
- Transparency
- Camouflage
- Countershading

Marine Mammals

- Land-dwelling ancestors
- Warm-blooded
- Breathe air
- Hair/fur
- Bear live young
- Mammary glands for milk

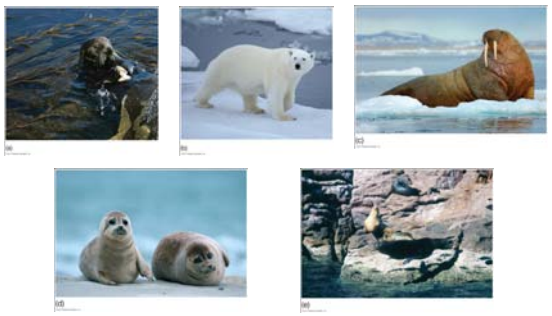
Major Marine Mammal Groups



Order Carnivora

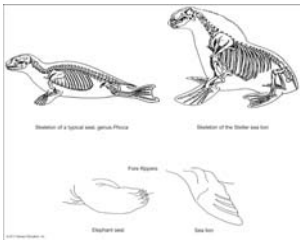
- Prominent canine teeth
- Sea otters
- Polar bears
- Pinnipeds
  - Walruses
  - Seals
  - Sea lions
  - Fur seals

Carnivora



Seals vs. Sea Lions and Fur Seals

- Seals lack prominent ear flaps
- Seals have smaller front flippers
- Seals have fore flipper claws
- Different hip structures
- Different locomotion strategies



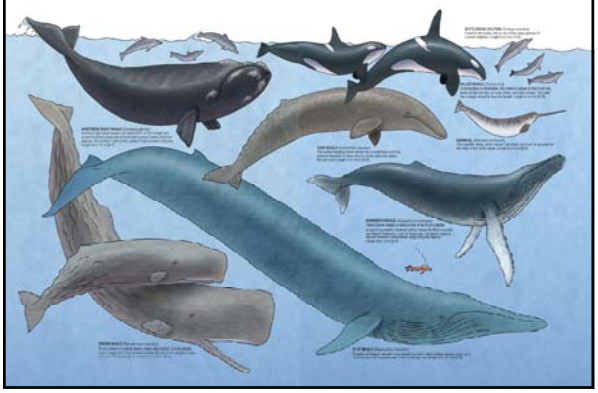
Order Sirenia

- Herbivores
- Manatees
  - Coastal areas of tropical Atlantic Ocean
- Dugongs
  - Coastal areas of Indian and western Pacific Oceans

Order Cetacea

- Whales, dolphins, porpoises
- Elongated skull
- Blowholes on top of skull
- Few hairs
- Fluke – horizontal tail fin for vertical propulsion

Order Cetacea



Order Cetacea

- Adaptations to increase swimming speed
  - Streamlined bodies
  - Specialized skin structure
    - 80% water
    - Stiff inner layer
    - Narrow canals with spongy material

Order Cetacea

- Adaptations for deep diving
- Use oxygen efficiently
  - Able to absorb 90% of oxygen inhaled
  - Able to store large quantities of oxygen
  - Able to reduce oxygen required for noncritical organs
- Muscles insensitive to buildup of carbon dioxide
- Collapsible lungs

Order Cetacea

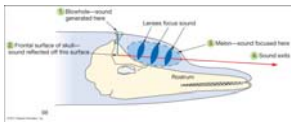
- Suborder Odontoceti (toothed)
  - Dolphins, porpoises, killer whale, sperm whale
  - Echolocation to determine distance and direction to objects
  - Determine shape, size of objects

Dolphins vs. Porpoises

- Porpoises
  - Smaller, more stout body shape
  - Blunt snout
  - Triangular, smaller dorsal fin
  - Blunt or flat teeth
- Dolphins
  - Larger, more streamlined shape
  - Longer rostrum
  - Falcate dorsal fin (hooked)
  - Pointy teeth like killer whales (orca)

Echolocation

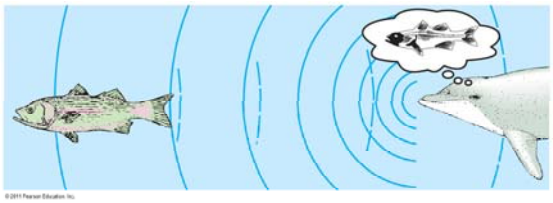
- Good vision of marine mammals is limited by ocean conditions.
- Mammals emit clicks of different pitches.
  - Low frequency – great distance
  - High frequency – closer range
- Dolphins can detect schools of fish at more than 100 meters (330 feet).



Echolocation

- Toothed whales send sound through water.
- Sound is reflected, returned to the animal, and interpreted.
- An evolved inner ear structure may help toothed whales pick up sounds.
- Increased marine noise pollution may affect cetacean echolocation.

Echolocation



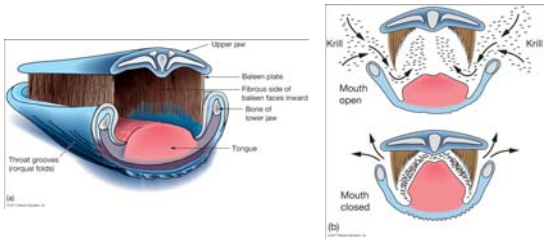
Intelligence in Toothed Whales

- Large brains relative to body size
- Communicate with each other
- Brains convoluted
- Trainable

Order Cetacea

- Suborder Mysticeti
- Baleen whales
- Blue whale, finback whale, humpback whale, gray whale, right whale
- Fibrous plates of baleen sieve prey items
- Vocalized sounds for various purposes

Use of Baleen



Baleen Whale Families

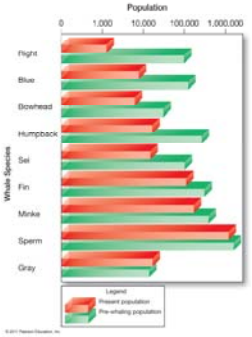
- Gray whales
- Rorqual whales
  - Balaenopterids
  - Megapterids – humpback whales
- Right whales

Gray Whale Migration

- 22,000 km (13,700 miles) annual migration from coastal Arctic Ocean to Baja California and Mexico
- Feeding grounds in Arctic (summer)
- Breeding and birthing grounds in tropical eastern Pacific (winter)

Whales as Endangered Species

- Fewer whales now than before whaling
- International Whaling Treaty
- Hunting of gray whale banned in 1938
- Gray removed from endangered list in 1993 as population rebounded



Gray Whale Friendly Behavior

Whaling

- International Whaling Commission (IWC) 1948 – established to manage whale hunting
- In 1986, 72 IWC nations banned whaling
- Three ways to legally hunt whales:
  - Objection to IWC ban
  - Scientific whaling
  - Aboriginal subsistence whaling

End of CHAPTER 14
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