Marine Biology

4th Year Students

Zoology/Chemistry

3- Contents

Topics	No. of hours	Lecture	Tutorial/ Practical
- Introduction of marine environment	2	2	-
Chemistry of sea water	26	2	24
The phytoplankton	4	2	2
The zooplankton	4	2	2
Primary production	6	4	2
Oceanic nekton	2	2	-
Intertidal ecology	2	2	-
Deep-sea biology	2	2	-
Benthos	5	2	3
Marine recourses	2	2	-
Sea Turtles	5	2	3
Coral Reefs	7	4	3

6.2- Essential books (text books)

Nybakken, J. W. (1988) Marine Biology: An Ecological Approach, 2nd edition Harper and Row Pupl. New York, NY (USA).

6.3- Recommended books

Castro, P. and Huber, M. E. (1997) Marine Biology , 2nd edition Wm.C. Brown Publishers.

6.4- Periodicals, Web sites, etc

www.mbl.edu/html/BB/KEYS/KEYScontents.html

www.mbl.edu

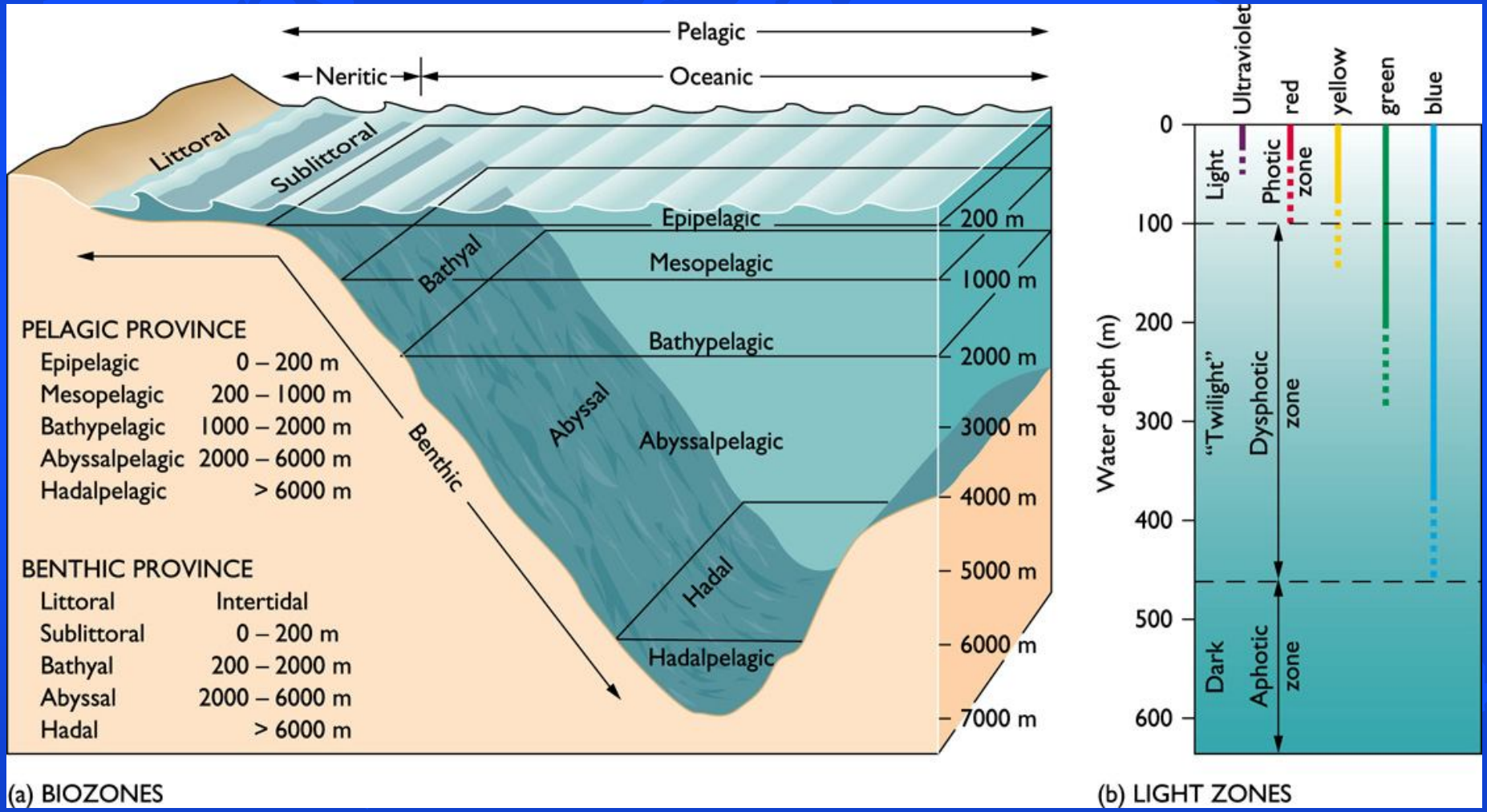
Weighting of assessments

Mid-Term Examination	2.5
Final-term Examination	55
Oral Examination	2.5
Practical Examination	15
Semester Work	-----
Other types of assessment	----
Total	75

Classification of Organisms by Environment

- horizontal: neritic | oceanic
- vertical:
  - epipelagic (top) / euphotic (good)
  - mesopelagic (middle) / disphotic (low)
  - bathypelagic (deep) / aphotic (without)
  - abyssopelagic (“bottomless”)

Divisions of the Marine Environment



Distribution of Marine Lifestyles

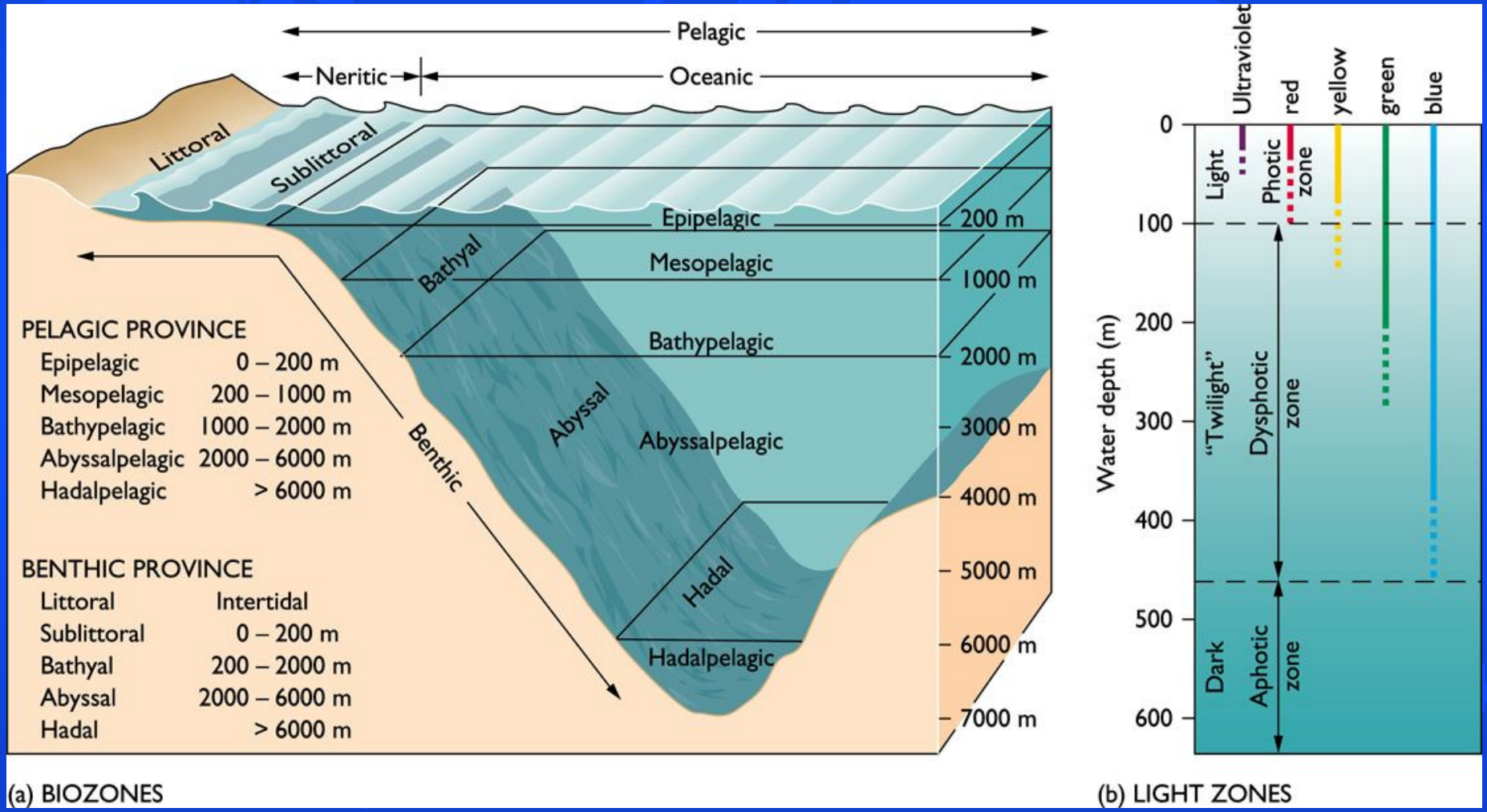
- 16.7% of Earth's animals are marine
- 2% inhabit pelagic environment (most of the oceans are cold and dark)
- 98% are benthic!

Classification of Organisms by Lifestyle

- biota based on lifestyle.
  - plankton (floaters)
  - nekton (swimmers)
  - benthos (bottom dwellers)

Divisions of the Marine Environment

Figure 9-1



Plankton

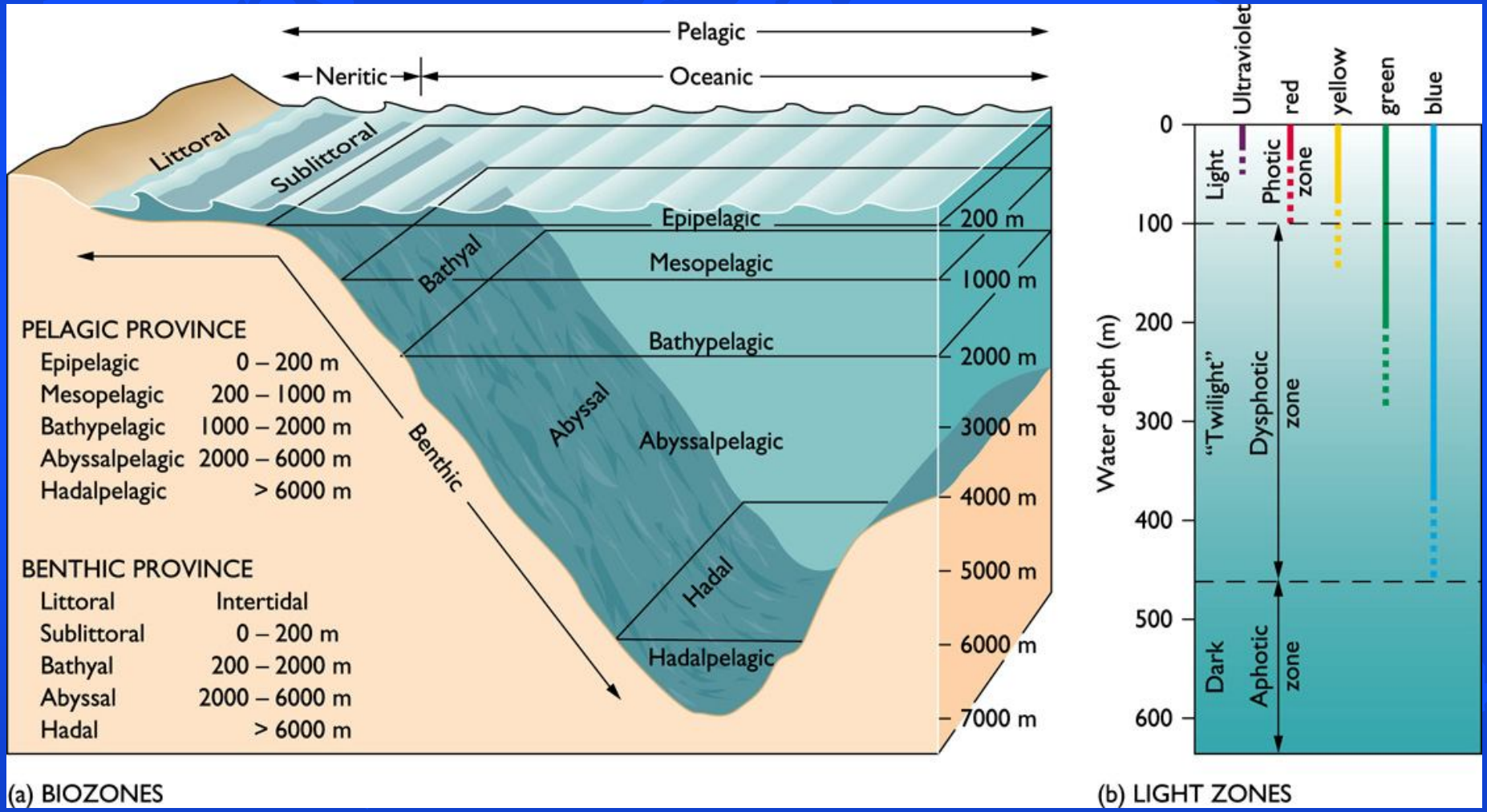
- Plankton are weak swimmers, and are known as drifters, unable to counteract currents.
  - Phytoplankton (plants)
  - Zooplankton (animals)

Nekton

- Nekton are active swimmers capable of counteracting currents
  - Fish
  - Squids
  - Reptiles
  - Birds
  - Mammals

Divisions of the Marine Environment

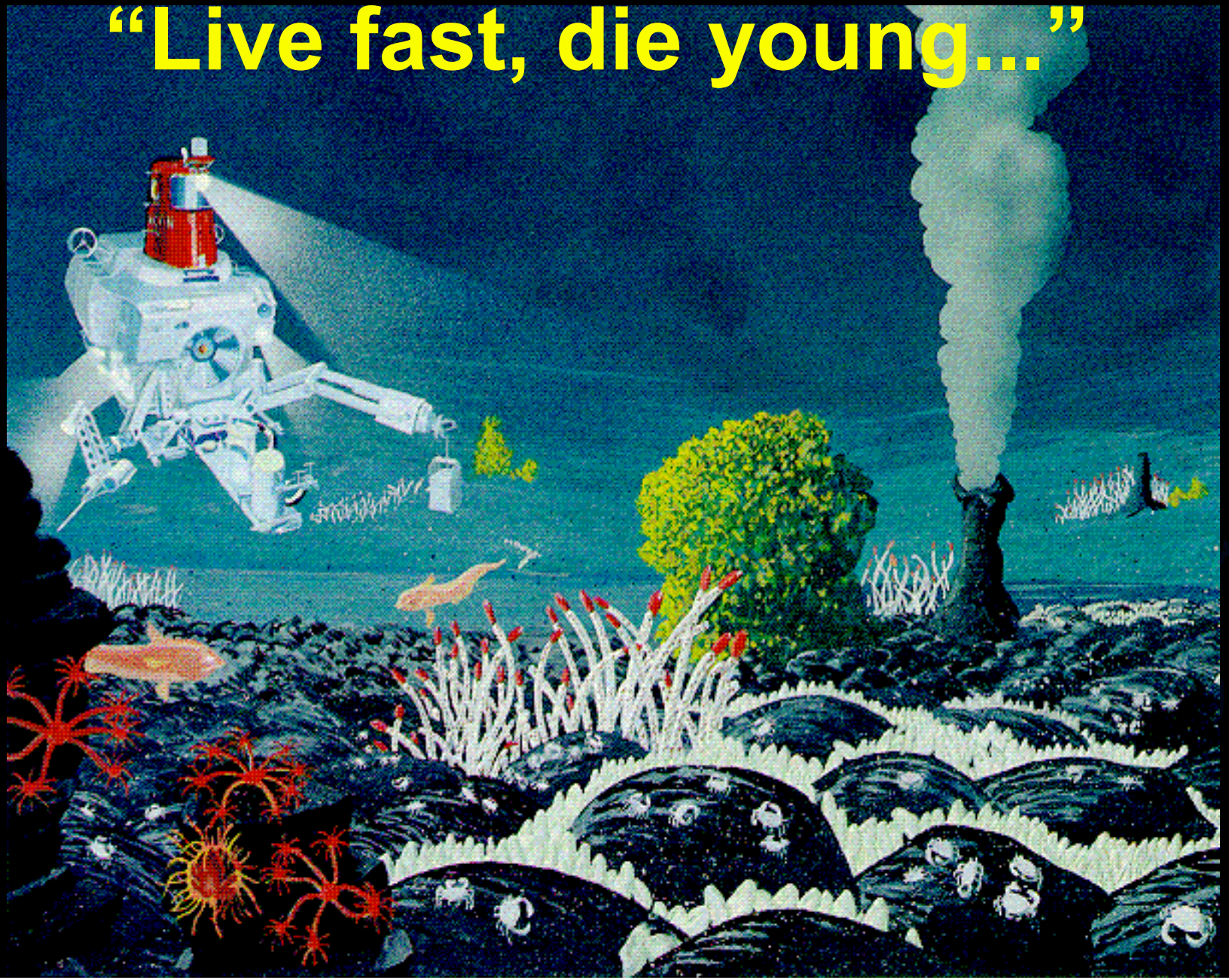
Figure 9-1



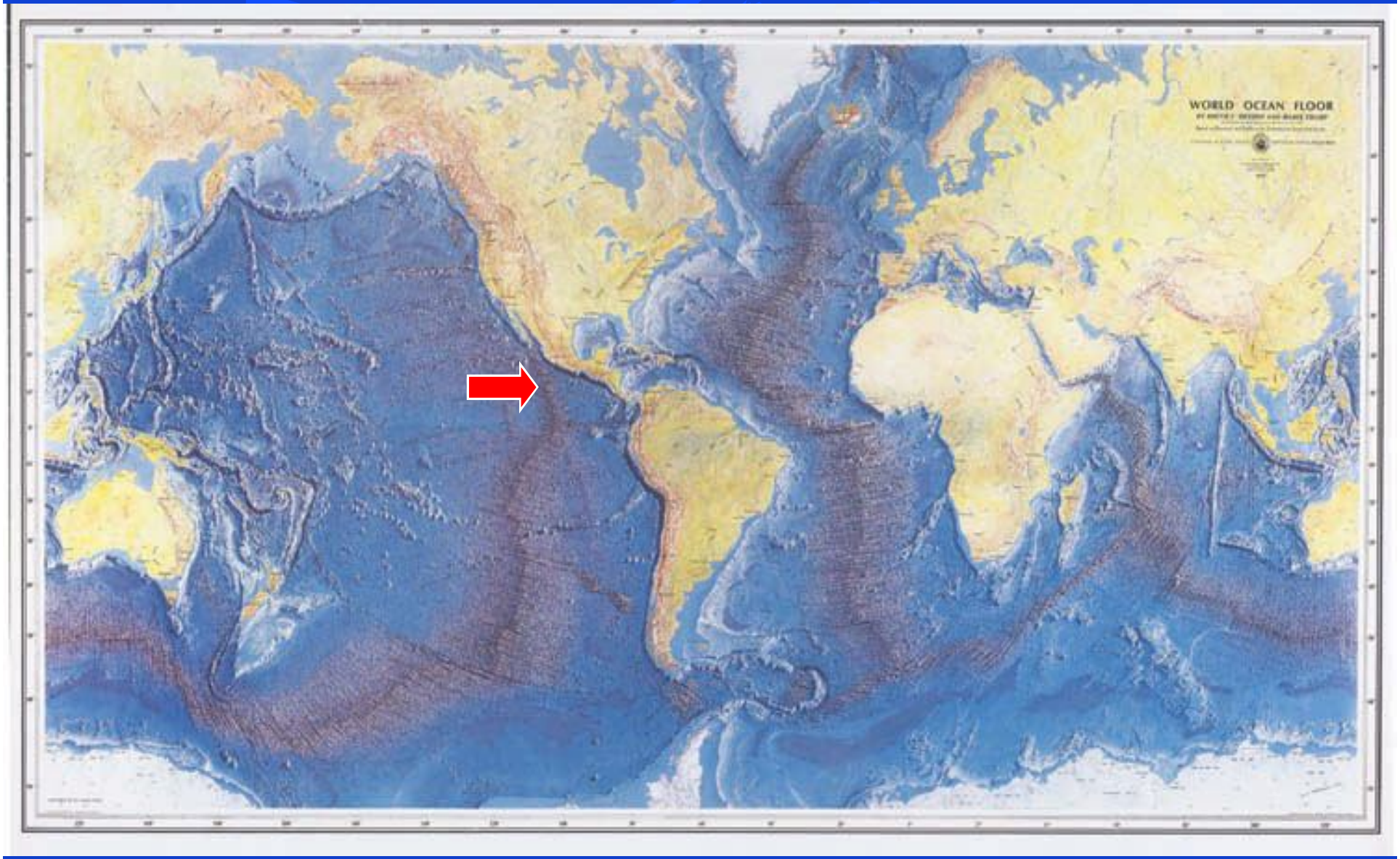
Benthos

- Epiflora or epifauna live *on* the sea bottom.
- Infauna live *in* the sea bottom.
- Benthic plants are restricted to shallow waters - why?
- Benthic animals occur everywhere from shallow depths to the deep sea.

Research Video Clips:
"Live fast, die young..."



The World Ocean Floor



Varying Lifestyles

- exceptions to a classification scheme.
- life style of a species may change as it ages.
- Many benthic animals, e.g., crabs, clams, starfish have a planktonic larval stage.

Basic Ecology

- factors regulating the distribution and abundance of organisms in the ocean.
- influence of physical and chemical parameters on organisms in the various ecosystems that constitute the ocean.
- An ecosystem includes both the living (biotic) and non-living (abiotic) portions of the environment.
  - e.g., coral reefs, the North Pacific Gyre.

Migratory Fish

Diadromous

- **Catadromous**: sea → freshwater (breed)
- **Anadromous**: freshwater → sea (breed)
- **Amphidromous**: sea ⇔ freshwater (non-breeding)

Potadromous

- wholly freshwater

Oceanodromous

- wholly seawater

Hydrostatic Pressure

- Hydrostatic pressure is the pressure caused by the height of water.
- It is a function of the density of water and the total height of the water column.
- Pressure generally increases at a rate of 1 atm per 10 m of water.

Think You're Under Pressure Now?

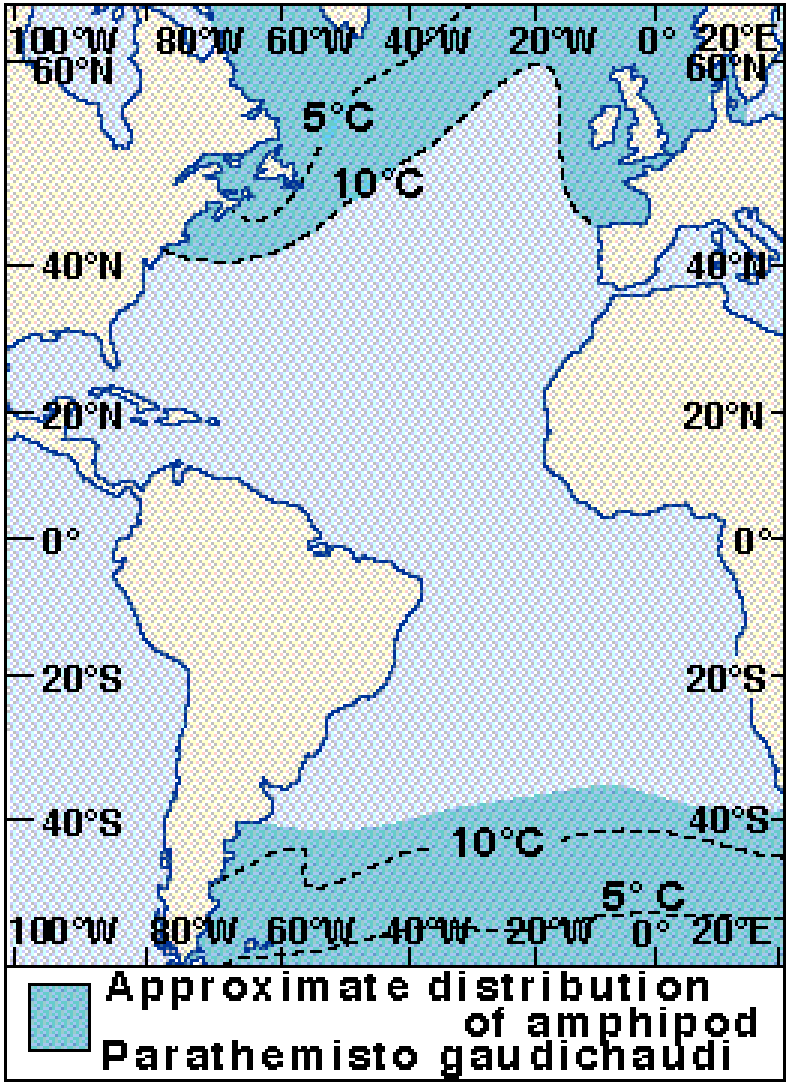
Hydrostatic Pressure

(Cont.)

- enormous in the deep sea yet animals live there.
- Animals do not contain gases.
- However, mesopelagic fish have gas-filled swim bladders to help maintain neutral buoyancy
  - unable to move rapidly between depths
  - pressure change could cause bladder explode.

Temperature

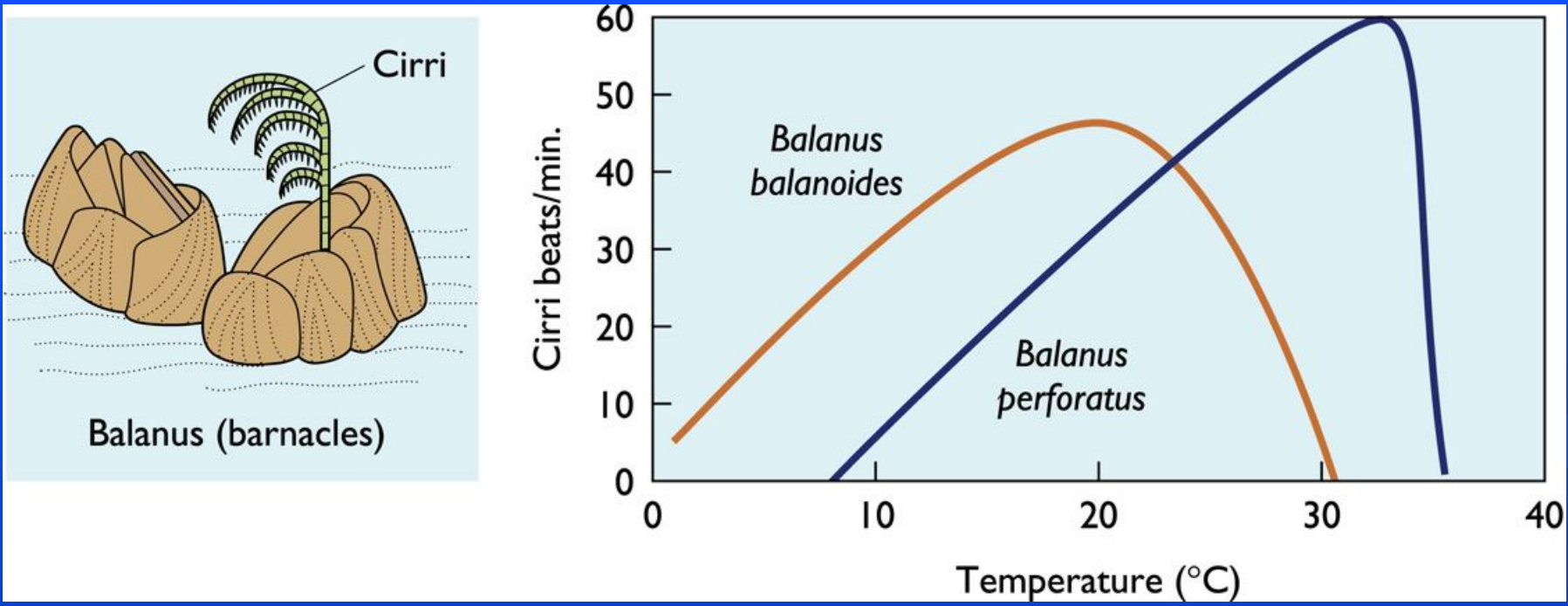
- The distribution of species closely follows the shape of *isotherms*.



Temperature

Figure 9-10

- controls rates of chemical reactions and thus metabolic rates, growth rates, feeding rates, etc.

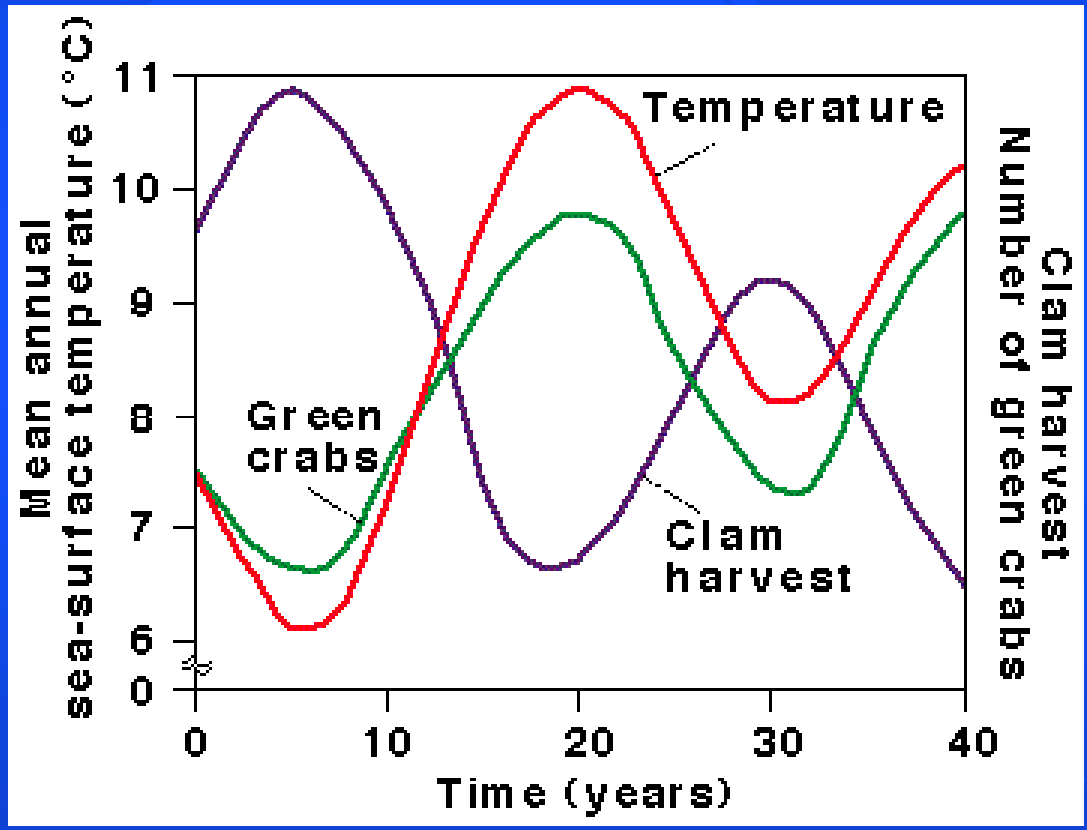


Temperature
(Cont.)

- Temperature tolerance varies tremendously among marine organisms.
- Young stages are generally less tolerant of large changes.
- e.g., eggs and young of the California sardine cannot survive below 13 ^{o}C.

Temperature
Figure 9-11

- Temperature may indirectly effect a species due to a direct effect on its predator.
  - This is exemplified by the interrela-tionship of clams, crabs, and temperature in Casco Bay, ME.



Salinity

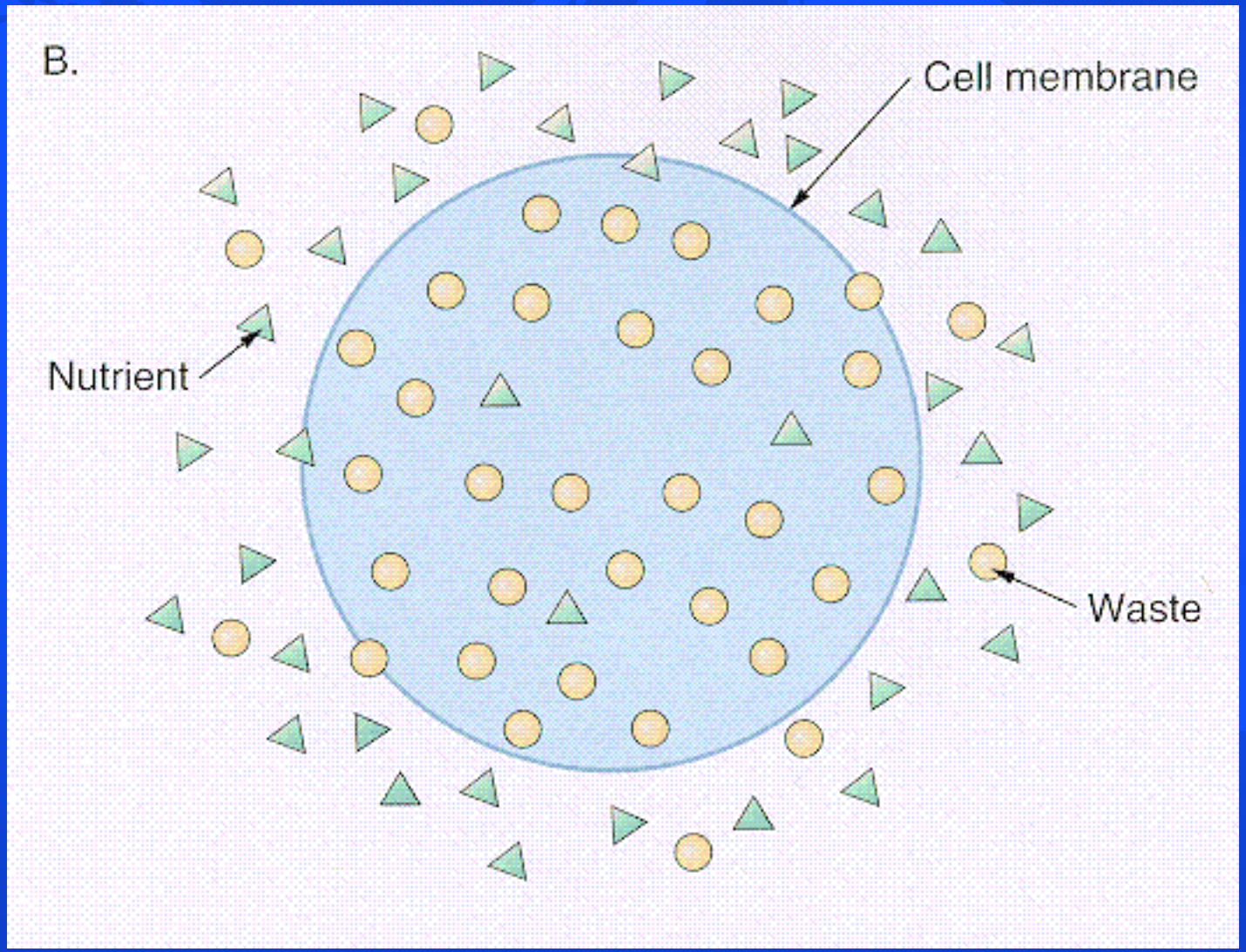
- Many of the elements used for growth.
- Salinity tolerance is also important in limiting distribution.

Salinity
(Cont.)

- Salinity fluctuates most in coastal waters due to shifts in river flow.
  - Organisms that are mobile can *migrate* offshore if they cannot tolerate a certain salinity, but attached organisms must *cope* with the changes or die.
  - clams, oysters, and barnacles manage to survive by closing their shells.

Diffusion:

molecules move from high to low concentrations



Diffusion

- internal fluids of marine organisms also contain salts
- chemical gradient - salts inside the body relative to the surrounding seawater
- salts will diffuse from an area of high concentration to low concentration.
  - nutrient uptake and the elimination of waste products.

Diffusion

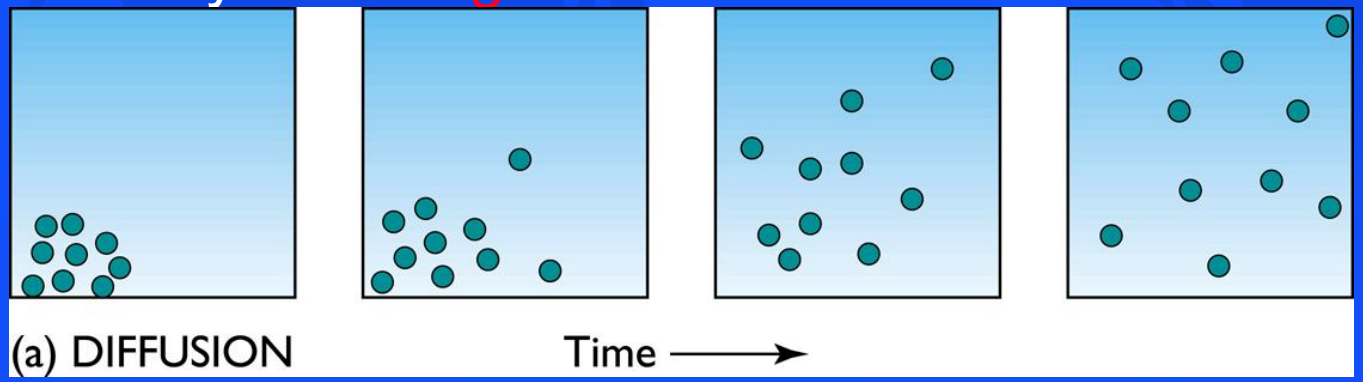
(Cont.)

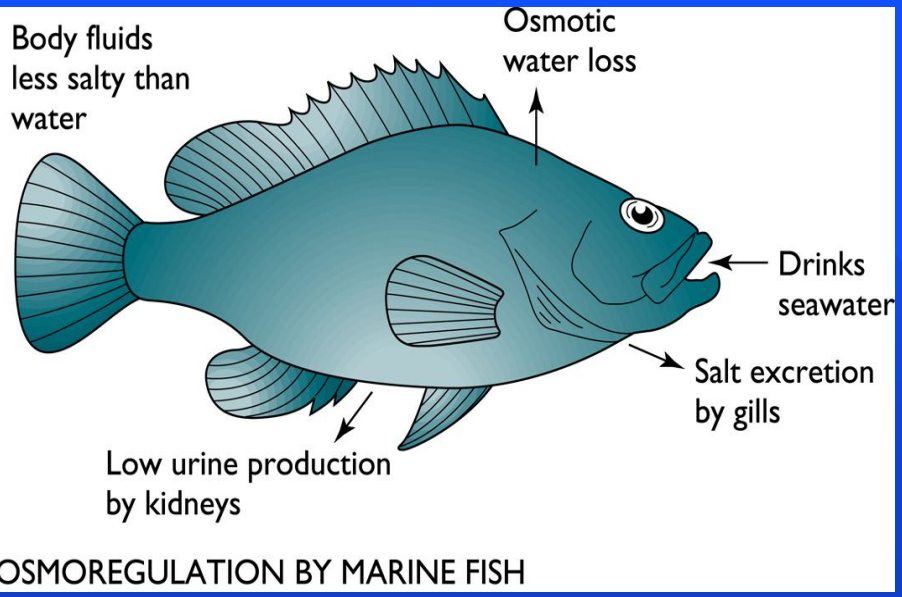
- Diffusion is also the mechanism by which water molecules pass through cell membranes. This is called osmosis.

Diffusion/Osmoregulation

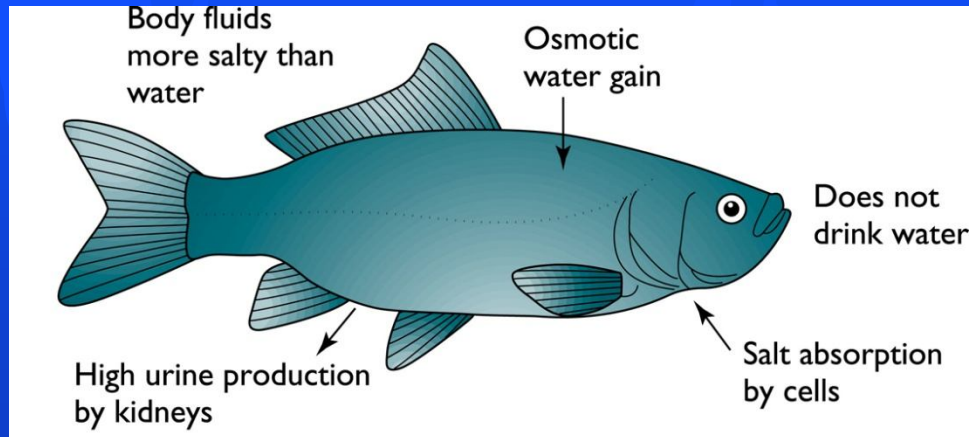
Figure 9-12

Some organisms can regulate the movement of water into and out of the cells by osmoregulation.





(b) OSMOREGULATION BY MARINE FISH



(c) OSMOREGULATION BY FRESHWATER FISH