

1  **CHAPTER 12**

Marine Life and the Marine Environment

2  **Chapter summary in haiku form**


Crucible of life?

Where did it all get started?


“Primordial soup”

3  **Overview**


- More than 250,000 identified marine species
- Most live in sunlit surface seawater
- Species success depends on ability to
 - Find food
 - Avoid predation
 - Reproduce
 - Cope with physical barriers to movement

4  **Classification of living organisms**


- Physical characteristics
- Three domains
 - Archaea
 - Bacteria
 - Eukarya
- Five kingdoms
 - Monera
 - Protocista
 - Fungi
 - Plantae
 - Animalia

5  **Five kingdoms**










- Monera simplest organisms, single-celled
 - Cyanobacteria, heterotrophic bacteria, archaea
- Protocista single and multicelled with nucleus
 - Algae, protozoa
- Fungi
 - Mold, lichen
- Plantae multicelled photosynthetic plants
 - Surf grass, eelgrass, mangrove, marsh grasses
- Animalia multicelled animals
 - Simple sponges to complex vertebrates

6  **Taxonomic classification**

- Systemized classification of organisms
- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species
 - Fundamental unit
 - Population of genetically similar, interbreeding individuals

7  **Classification by habitat and mobility**

- Plankton (floaters)

- Nekton (swimmers)
- Benthos (bottom dwellers)
- 8  **Classification by habitat and mobility**
- 9  **Plankton**
 - Most biomass on Earth consists of plankton
 - Phytoplankton
 - Autotrophic
 - Zooplankton
 - Heterotrophic
 - Bacterioplankton
 - Virioplankton
- 10  **Plankton**
 - Holoplankton
 - Entire lives as plankton
 - Meroplankton
 - Part of lives as plankton
 - Juvenile or larval stages
 - Macroplankton
 - Large floaters such as jellyfish or *Sargassum*
 - Picoplankton
 - Very small floaters such as bacterioplankton
- 11  **Nekton**
 - Independent swimmers
 - Most adult fish and squid
 - Marine mammals
 - Marine reptiles
- 12  **Benthos**
 - Epifauna live on surface of sea floor
 - Infauna live buried in sediments
 - Nektobenthos swim or crawl through water above seafloor
 - Most abundant in shallower water
- 13  **Hydrothermal vent biocommunities**
 - Abundant and large deep-ocean benthos
 - Discovered in 1977
 - Associated with hot vents
 - Bacteria-like archaeon produce food using heat and chemicals
- 14  **Number of marine species**
 - More land species than marine species
 - Ocean relatively uniform conditions
 - Less adaptation required, less speciation
 - Marine species overwhelmingly benthic rather than pelagic
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- 15  **Adaptations of marine organisms**
 - Physical support
 - Buoyancy
 - How to resist sinking
 - Different support structures in cold (fewer) rather than warm (more appendages) seawater
 - Smaller size
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- 16  **Adaptations to marine life**

- Appendages to increase surface area
- Oil in micro-organisms to increase buoyancy
- 17 **Adaptations to marine life**
 - Streamlining important for larger organisms
 - Less resistance to fluid flow
 - Flattened body
 - Tapering back end
- 18 **Adaptations to marine life**
 - Narrow range temperature in oceans
 - Smaller variations (daily, seasonally, annually)
 - Deep ocean nearly isothermal
- 19 **Adaptations to marine life**
 - Cold- versus warm-water species
 - Smaller in cooler seawater
 - More appendages in warmer seawater
 - Tropical organisms grow faster, live shorter, reproduce more often
 - More species in warmer seawater
 - More biomass in cooler seawater (upwelling)
- 20 **Adaptations to marine life**
 - Stenothermal
 - Organisms withstand small variation in temperature
 - Typically live in open ocean
 - Eurythermal
 - Organisms withstand large variation in temperature
 - Typically live in coastal waters
- 21 **Adaptations to marine life**
 - Stenohaline
 - Organisms withstand only small variation in salinity
 - Typically live in open ocean
 - Euryhaline
 - Organisms withstand large variation in salinity
 - Typically live in coastal waters, e.g., estuaries
- 22 **Adaptations to marine life**
 - Extracting minerals from seawater
 - High concentration to low concentration
 - Diffusion
 - Cell membrane permeable to nutrients, for example
 - Waste passes from cell to ocean
- 23 **Adaptations to marine life**
 - Osmotic pressure
 - Less concentrated to more concentrated solutions
 - Isotonic
 - Hypertonic
 - Hypotonic
- 24 **Marine versus freshwater fish**
- 25 **Marine versus freshwater fish**
- 26 **Adaptations to marine life**
 - Dissolved gases
 - Animals extract dissolved oxygen (O₂) from seawater through gills
- 27 **Adaptations to marine life**
 - Water's transparency

- Many marine organisms see well
 - Some marine organisms are nearly transparent to avoid predation
- 28 **Adaptations to marine life**
 - Camouflage through color patterns
- 29 **Adaptations to marine life**
 - Countershading
- 30 **Adaptations to marine life**
 - Disruptive coloring
- 31 **Adaptations to marine life**
 - Water pressure
 - Increases about 1 atmosphere (1 kg/cm²) with every 10 m (33 ft) deeper
 - Many marine organisms do not have inner air pockets
 - Collapsible rib cage (e.g., sperm whale)
- 32 **Main divisions of the marine environment**
 - Pelagic (open sea)
 - Neritic (< 200 m) and oceanic
 - Benthic (sea floor)
 - Subneritic and suboceanic
 - Another classification scheme:
 - Euphotic
 - Disphotic
 - Aphotic
- 33 **Pelagic environments**
 - Epipelagic
 - Mesopelagic
 - Bathypelagic
 - Abyssopelagic
- 34 **Pelagic environments**
 - Dissolved O₂ minimum layer about 700-1000 m
 - Nutrient maximum at about same depths
 - O₂ content increases with depth below
- 35 **Benthic environments**
 - Supralittoral
 - Subneritic
 - Littoral
 - Sublittoral
 - Inner
 - Outer
 - Suboceanic
 - Bathyal
 - Abyssal
 - Hadal
- 36 **End of Chapter**