Chapter 15 Ocean Water and Ocean Life

Summary

15.1 The Composition of Seawater

Because the proportion of dissolved substances in seawater is such a small number, oceanographers typically express salinity in parts per thousand.

- **Salinity** (*salinus* = salt) is the total amount of solid material dissolved in water.

Most of the salt in seawater is sodium chloride, common table salt.

Chemical weathering of rocks on the continents is one source of elements found in seawater.

The second major source of elements found in seawater is from Earth’s interior.

- Some of the processes affecting the salinity of seawater are runoff and melting icebergs, which decrease salinity, and evaporation and the formation of sea ice, which increase salinity.

The ocean’s surface water temperature varies with the amount of solar radiation received, which is primarily a function of latitude.

- The **thermocline** (*thermo* = heat, *cline* = slope) is the layer of ocean water between about 300 meters and 1000 meters, where there is a rapid change of temperature with depth.

Seawater density is influenced by two main factors: salinity and temperature.

- **Density** is defined as mass per unit volume. It can be thought of as a measure of how heavy something is for its size.
- The **pycnocline** (*pycno* = density, *cline* = slope) is the layer of ocean water between about 300 meters and 1000 meters where there is a rapid change of density with depth.

Oceanographers generally recognize a three-layered structure in most parts of the open ocean: a shallow surface mixed zone, a transition zone, and a deep zone.

- The **mixed zone** is the area of the surface created by the mixing of water by waves, currents, and tides. The mixed zone has nearly uniform temperatures.
- The transition zone includes a thermocline and associated pycnocline.
- Sunlight never reaches the deep zone, which accounts for about 80 percent of ocean water.
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- In high latitudes, the three-layered structure of the open ocean does not exist because there is no rapid change in temperature or density with depth.

15.2 The Diversity of Ocean Life

- Marine organisms can be classified according to where they live and how they move.

- Plankton (planktos = wandering) include all organisms—algae, animals, and bacteria—that drift with ocean currents.
  - Among plankton, the algae that undergo photosynthesis are called phytoplankton.
  - Animal plankton are called zooplankton and include the larval stages of many marine organisms.

- Nekton (nektos = swimming) include all animals capable of moving independently of the ocean currents, by swimming or other means of propulsion.

- The term benthos (benthos = bottom) describes organisms living on or in the ocean bottom.

- Three factors are used to divide the ocean into distinct marine life zones: the availability of sunlight, the distance from shore, and the water depth.
  - The upper part of the ocean into which sunlight penetrates is called the photic zone (photos = light).
  - The area where the land and ocean meet and overlap is the intertidal zone.
  - Seaward from the low-tide line is the neritic zone, which covers the continental shelf.
  - Beyond the continental shelf is the oceanic zone.
  - Open ocean of any depth is called the pelagic zone.
  - The benthic zone includes any sea-bottom surface regardless of its distance from shore and is mostly inhabited by benthos organisms.
  - The abyssal zone is a subdivision of the benthic zone and includes the deep-ocean floor.
  - At hydrothermal vents, super-heated and mineral-filled water escapes into the ocean through cracks in the crust. At some vents, high water temperatures support organisms found nowhere else in the world.

15.3 Oceanic Productivity

- Two factors influence a region’s photosynthetic productivity: the availability of nutrients and the amount of solar radiation, or sunlight.
  - Primary productivity is the production of organic compounds from inorganic substances through photosynthesis or chemosynthesis.
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- **Photosynthesis** is the use of light energy to convert water and carbon dioxide into energy-rich glucose molecules.

- **Chemosynthesis** is the process by which certain microorganisms create organic molecules from inorganic nutrients using chemical energy.

- The availability of solar energy is what limits photosynthetic productivity in polar areas.

- Photosynthetic productivity in tropical regions is limited by the lack of nutrients.

- In temperate regions, which are found at midlatitudes, a combination of two limiting factors, sunlight and nutrient supply, controls productivity.

- The transfer of energy between trophic levels is very inefficient.
  - A **trophic level** is a feeding level in a food chain. Plants and algae make up the first level, followed by herbivores that eat the plants, and a series of carnivores that eat the herbivores.

- Animals that feed through a food web rather than a food chain are more likely to survive because they have alternative foods to eat should one of their food sources diminish or disappear.
  - A **food chain** is a sequence of organisms through which energy is transferred, starting with the primary producer.
  - A **food web** is a group of interrelated food chains.