Marine Geography & Biogeography
Continental Margin

- **Continental Shelf**
  - Shallowest part of the oceans
  - Biologically richest part of the ocean
  - Ends at the shelf break
Continental Margin

- Continental slope
  - 3000-4000 m
- Submarine canyons
- Continental rise
  - Deep-sea fan
Deep-Ocean Basins

- Abyssal plain
- **Submarine ridge**: underwater mountain ranges (Mid-Atlantic ridge)
Deep-Ocean Basins

- Oceanic Trenches
- Seamounts
Habitats & Life Habitats

- Plankton
  - Phytoplankton
  - Zooplankton

- Nekton

- Neuston

- Benthic

- Benthos
  - Infauna
  - Epifauna
Habitats & Life Habitats

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Habitats & Life Habitats

- **Pelagic**
  - Neritic
  - Oceanic

  \{ \text{Horizontal zonation} \}

- **Epipelagic**
- **Mesopelagic**
- **Bathypelagic, abyssopelagic, and hadalpelagic (hadopelagic)**

  \{ \text{Vertical zonation} \}
Habitats & Life Habitats

- Intertidal or littoral
- Subtidal or sublittoral
The Marine Environment

How physical and chemical properties of water affect life in the sea
Salinity

- Seawater contains a variety of dissolved solids

- Salinity is measured:
  - Conductivity of Cl⁻
  - Refractometer

Table 3.1 The Composition of Seawater of 35‰ Salinity

Although the concentration varies slightly from place to place in the ocean, the percentage of total salinity of each ion remains constant.

<table>
<thead>
<tr>
<th>Ion</th>
<th>Concentration %</th>
<th>Percentage of Total Salinity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride (Cl⁻)</td>
<td>19.345</td>
<td>55.03</td>
</tr>
<tr>
<td>Sodium (Na⁺)</td>
<td>10.752</td>
<td>30.59</td>
</tr>
<tr>
<td>Sulfate (SO₄²⁻)</td>
<td>2.701</td>
<td>7.68</td>
</tr>
<tr>
<td>Magnesium (Mg²⁺)</td>
<td>1.295</td>
<td>3.68</td>
</tr>
<tr>
<td>Calcium (Ca²⁺)</td>
<td>0.416</td>
<td>1.18</td>
</tr>
<tr>
<td>Potassium (K⁺)</td>
<td>0.390</td>
<td>1.11</td>
</tr>
<tr>
<td>Bicarbonate (HCO₃⁻)</td>
<td>0.145</td>
<td>0.41</td>
</tr>
<tr>
<td>Bromide (Br⁻)</td>
<td>0.066</td>
<td>0.19</td>
</tr>
<tr>
<td>Borate (H₂BO₃⁻)</td>
<td>0.027</td>
<td>0.08</td>
</tr>
<tr>
<td>Strontium (Sr²⁺)</td>
<td>0.013</td>
<td>0.04</td>
</tr>
<tr>
<td>Fluoride (F⁻)</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>Other dissolved material</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
How salinity affects marine organisms

Changes in salinity affect organisms through osmosis.
Sea Surface Temperature
Temperature Stratification

- Thermocline
Measuring Temperature

Niskin Bottles

CTD

Satellite Imagery
Temperature Regulation

**Metabolism**
- Ectothermic
- Endothermic

**Environment**
- Poikilotherms
- Homeotherms
Density, Salinity, and Temperature Relationship

- Seawater becomes denser as it gets saltier, colder or both
  - Halocline
  - Pycnocline
Dissolved Gases

- Oxygen ($O_2$)
- Carbon dioxide ($CO_2$)
- Nitrogen ($N_2$)
- The amount of oxygen in a body of water depends on:

Sunlight $+ 6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6$ (Glucose) $+ 6O_2$
Transparency

Electromagnetic spectrum of sunlight

- Gamma rays
- X rays
- Ultraviolet waves
- Infrared waves
- Radar waves
- Radio and television waves

Visible Light

wavelength (nm)

Surface

Increasing depth

about 100 m

Photic Zone

Transmission of light in "pure" fresh or saltwater

Transmission of light in coastal marine water

Surface

about 20 m

Transmission of light in estuarine water

Surface

1-6 m

Photic Zone

Transmission of light in "pure" fresh or saltwater

Aphotic Zone

Transmission of light in "pure" fresh or saltwater
Transparency
Pressure

- Atmosphere
  - 14.7 psi

- 10 meters = +1 atm

- 4000 meters =