

Marine Physical Environment

Objectives

- Understand the physical properties of seawater
- Describe how the clinal variations found in the water column influence how marine organisms are distributed.

Classification of the Marine Environment

Classifications are based on several physical criteria:

- ▶ Temperature
- ▶ Water depth
- ▶ Light availability
- ▶ Proximity to water column or seafloor
- ▶ Bottom features
- ▶ Density

2.2 Properties of Seawater

Density*-temperature relationships

* Density is ratio mass/volume

- ▶ Ice floats because the density of water decreases when it is cooler than 4°C. Sea water freezes at -2 degrees C because of dissolved materials/salts within it.
- ▶ If ice did not float, the oceans at the polar regions would freeze from the seafloor up.
- ▶ As water heats up it expands.

Types of Clines

i.e. variations over spatial dimension.

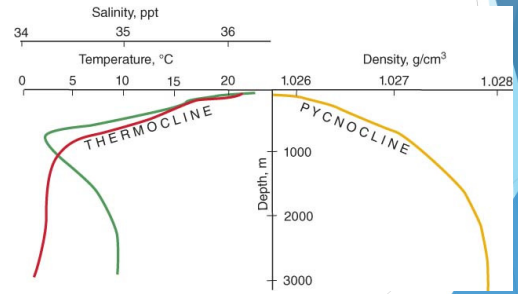
I. Thermocline - the ocean layer, usually near the bottom of the photic zone, marked by a sharp change in temperature that separates the warmer surface waters from the colder deep waters.

II. Halocline - a well defined vertical salinity gradient in marine waters or estuarine waters.

III. Pycnocline - The ocean layer, usually near the bottom of the photic zone marked by a sharp change in density that separates the less dense surface waters from the denser deep waters.

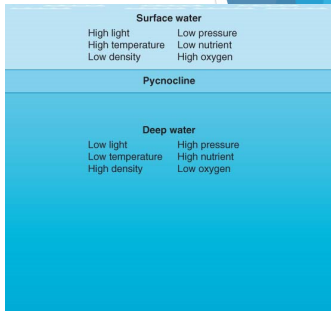
2.2 Properties of Seawater Salinity-temperature-density relationships

Thermocline, Halocline, Pycnocline



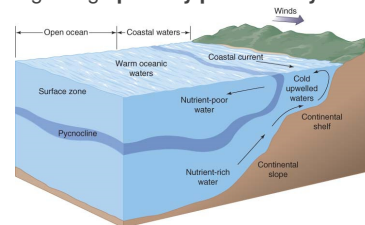
2.2 Properties of Seawater

- Dissolved nutrients like nitrate and phosphate fertilize the sea.
- Algae and submerged aquatic vegetation use nutrients to photosynthesize.
- Nutrients vary with depth, as do most chemicals in the sea.



2.1 The Ocean in Motion Vertical Water Movements—Upwelling

- ▶ **Upwelling** occurs when wind removes warm surface waters, and cool, deep waters move up.
- ▶ Provides surface waters with nutrients, leading to high **primary productivity**.



2.2 Adaptations to deal with temperatures.

Marine organisms are faced with relatively cool environmental temperatures.

- ▶ **Poikilotherms/Ectotherms** do not regulate their body temperatures. E.g. Most fish
- ▶ **Homeotherms/endotherms** maintain a range of body temperature regardless of the outside temperature. E.g. Seals, whales, penguins i.e. mostly mammals & birds.
- ▶ Some large fish are ectothermic, but retain some heat provided by their muscles. E.g. Large sharks and fish like tuna.