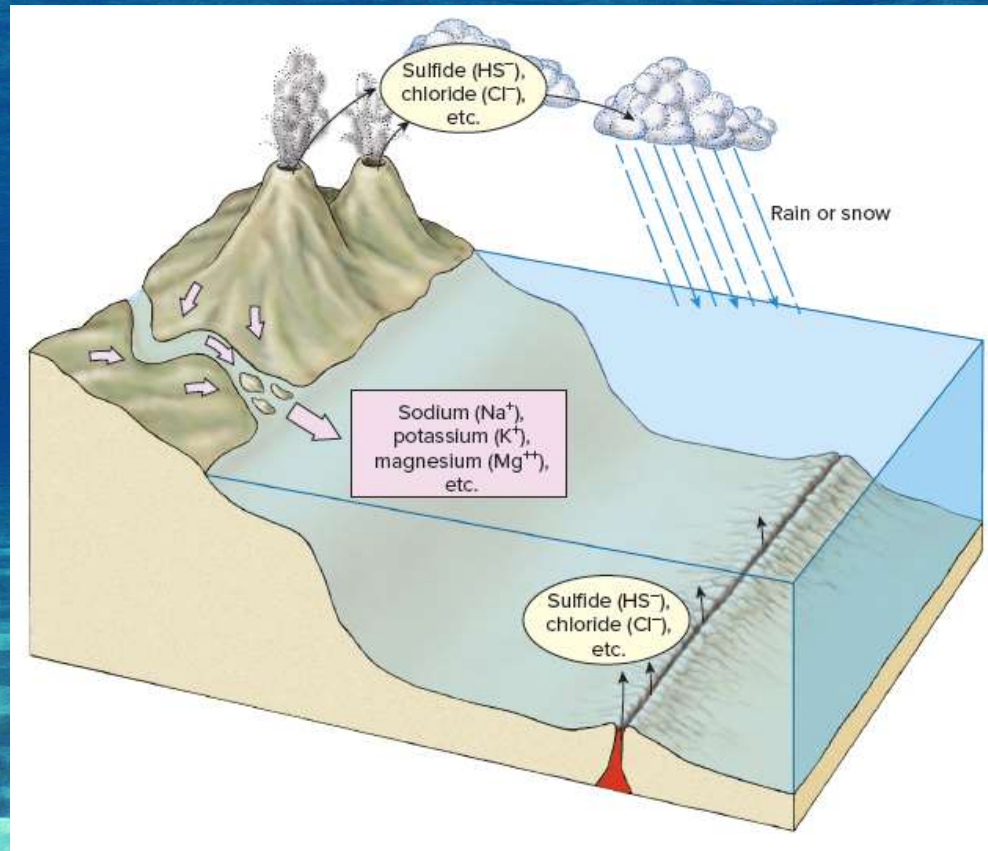


# Ions Entering Seawater



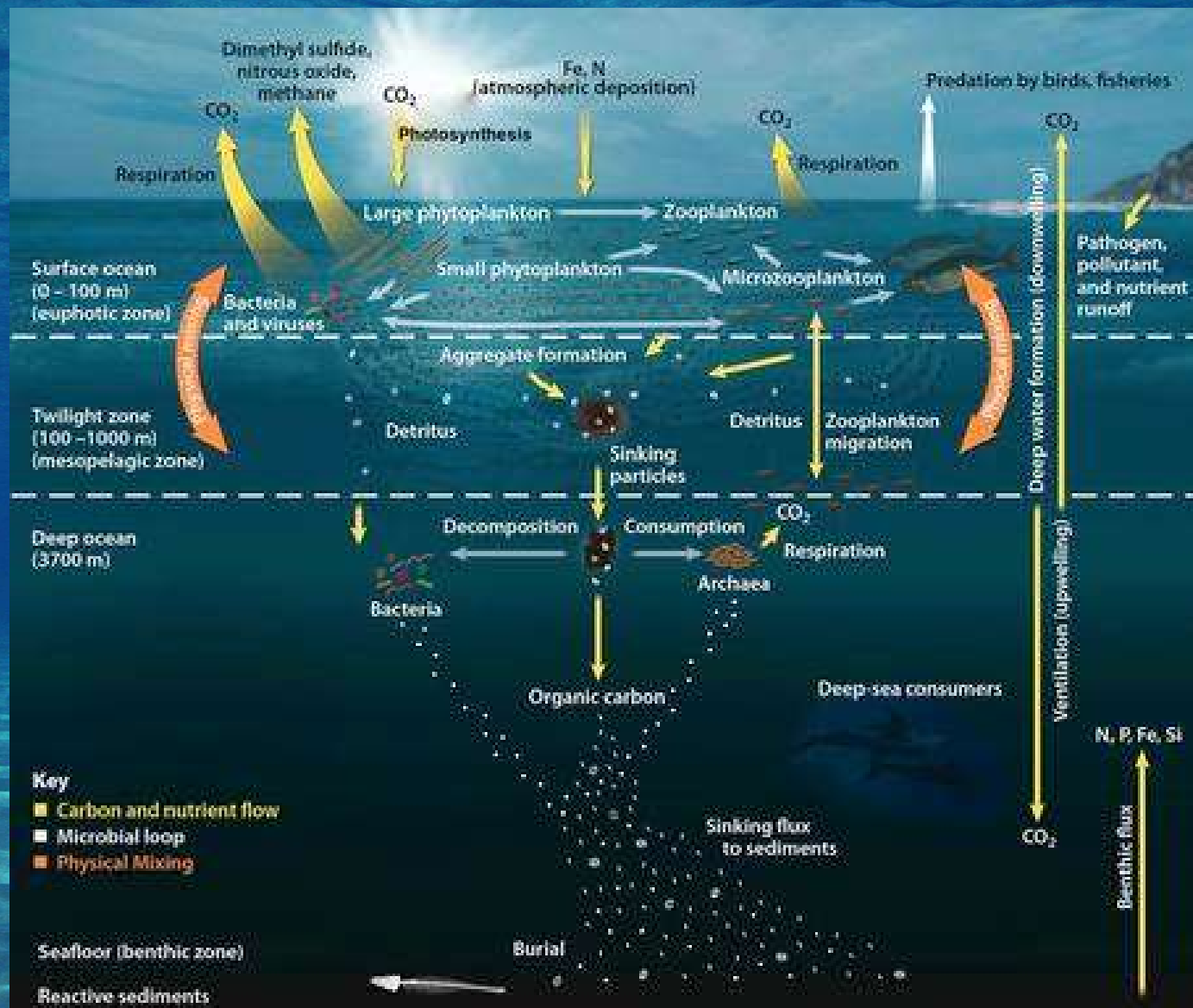
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# Physical Properties

- The physical properties of seawater shape life in the oceans.
- Fundamental properties such as light level, pressure, and transmission of light and sound are drastically different in the oceans than on land.

# Transparency

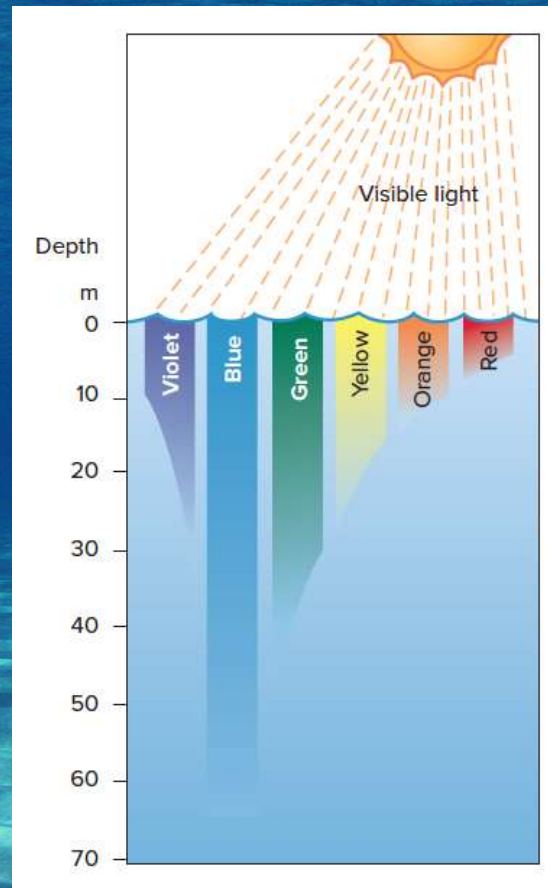
- Water is relatively transparent (one can see through it).
- This means that sunlight shining on the surface can penetrate the surface (crucial for the photosynthetic organisms living underwater).
- #1 If seawater weren't transparent, then there would be little photosynthesis in the sea, only at the surface.



# Transparency

- This level of penetration varies greatly depending on the materials dissolved in the water.
- Different colors of light penetrate to different depths in the ocean.

# Light Penetration in Seawater

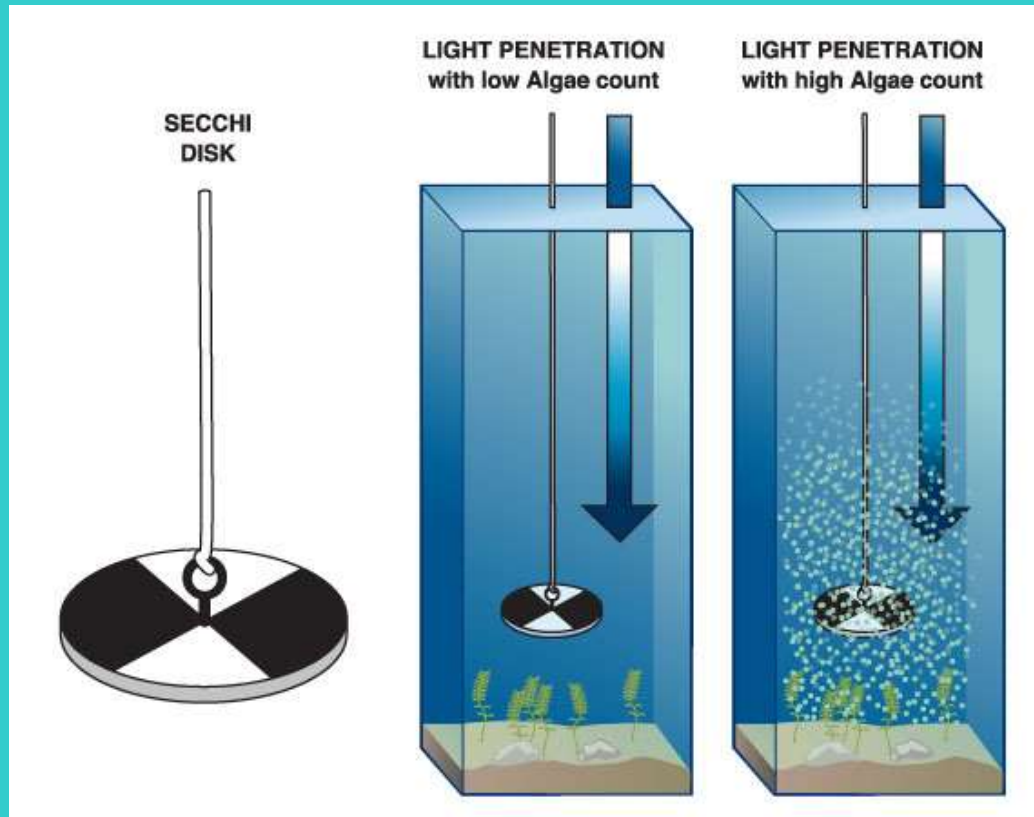


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# Transparency

- #2 Blue penetrates the deepest in the ocean.
- #3 There is no red light deeper in the ocean.
- #4 only darkness remains past 1,000 meters.

#5 secchi disks are commonly used for measuring water clarity.





# Pressure

- Pressure increases dramatically with ocean depth.
- #6 - Organisms on land are under 1 atmosphere of pressure at sea level.
- Marine organisms are under the weight of the atmosphere and the weight of the water.

# Pressure

- With each 10 m of increased depth, another atmosphere of pressure is added.
- #7 As pressure increases, gases are compressed.
- Changing pressures affect marine organisms and the scientists that study them.

# Pressure

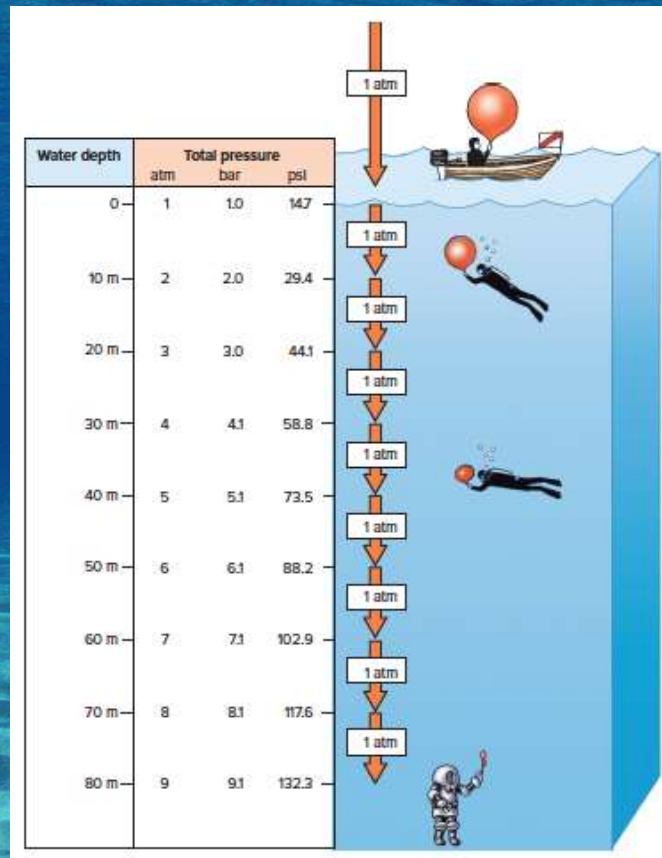
- #8 Bringing a fish up too quickly can cause a swim bladder to blow up and injure the animal.

This grouper has a swim bladder which blows up like a balloon if brought to the surface too quickly because of decreased pressure.

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# Pressure Increases with Depth



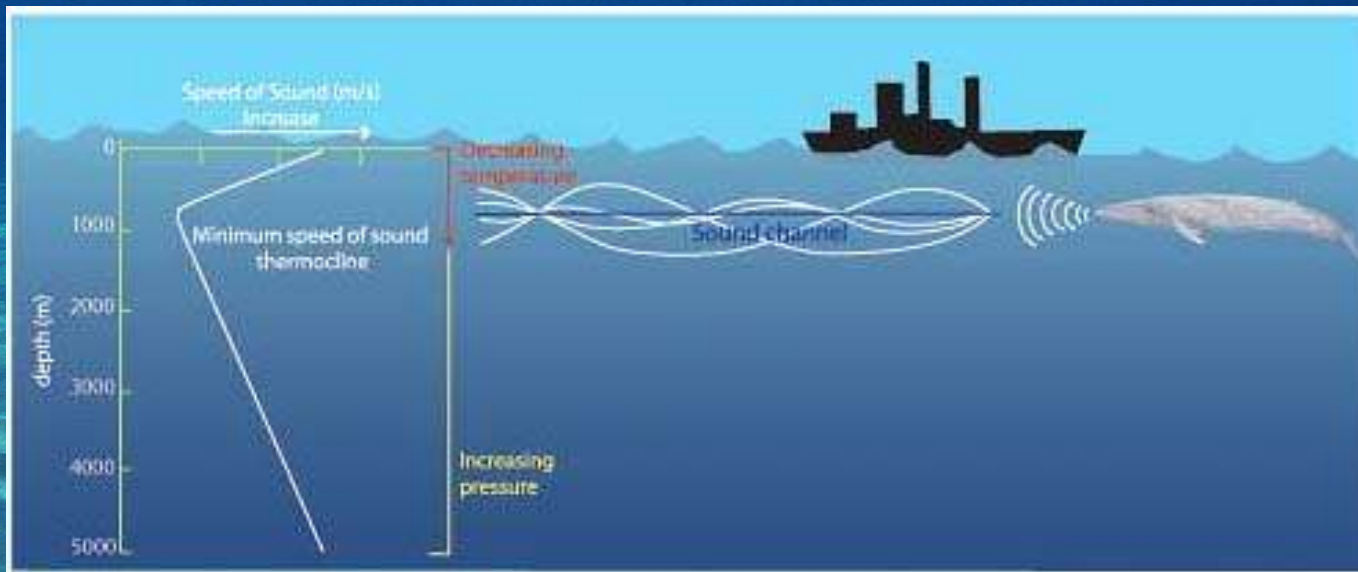
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# Sound Propagation

- Water is denser than air.
- #9 Water molecules are more compact than air molecules.
- #10 The higher density of water causes sound to travel 4.5 times faster in water than in air (340 m/s in air and about 1,520 m/s in the shallow ocean).

# Sound Propagation

- #11. In the Deep Sound Channel, low-frequency sound waves can travel uninterrupted for thousands of kilometers.



# Sound Propagation

- 12. Animals like fishes, marine mammals, and shrimps use sound for communication, navigation, reproduction, and predator and prey detection.
- 13. Loud human activity can affect animal behavior, cause hearing loss, increases in stress, and death



# Chemical Properties

- The chemical properties of seawater distinguish it from freshwater habitats.
- Salinity is one chemical property of the ocean.

# Salt Composition

- Most of the solutes (dissolved materials) are made up of a small number of ions.
- Only six ions compose more than 99% of the material dissolved in seawater.
- #14 Sodium and chloride account for about 85% of the ions.

# Salt Composition

**Table 3.1** The Composition of Seawater of 35‰ Salinity

Ion	Concentration ‰	Percentage of Total Salinity
Chloride (Cl <sup>-</sup> )	19.345	55.03
Sodium (Na <sup>+</sup> )	10.752	30.59
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	2.701	7.68
Magnesium (Mg <sup>2+</sup> )	1.295	3.68
Calcium (Ca <sup>2+</sup> )	0.416	1.18
Potassium (K <sup>+</sup> )	0.390	1.11
Bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	0.145	0.41
Bromide (Br <sup>-</sup> )	0.066	0.19
Borate (H <sub>2</sub> BO <sub>3</sub> <sup>-</sup> )	0.027	0.08
Strontium (Sr <sup>2+</sup> )	0.013	0.04
Fluoride (F <sup>-</sup> )	0.001	0.003
Other dissolved material	<0.001	<0.001

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# Salt Composition

- #15 Salinity is the total amount of salt dissolved in water.
- Salinity is usually expressed as the number of grams of salt dissolved into 1,000 grams of seawater. If 35 grams of salt were dissolved into 1,000 grams of seawater, the seawater has a salinity of 35 parts per thousand, or 35‰.

- #16 Most marine organisms will die in freshwater. Even slight changes in salinity harm some. Brackish organisms have evolved specific mechanisms to cope with salinity changes.

# Salt Composition

- #17 The relative percentage of the major ions in seawater remains constant even though the total amount of salt varies slightly from place to place. This is called the rule of constant proportions.
- Proportions can vary near hydrothermal vents, where rivers flow into the ocean, and where there is intense biological activity.

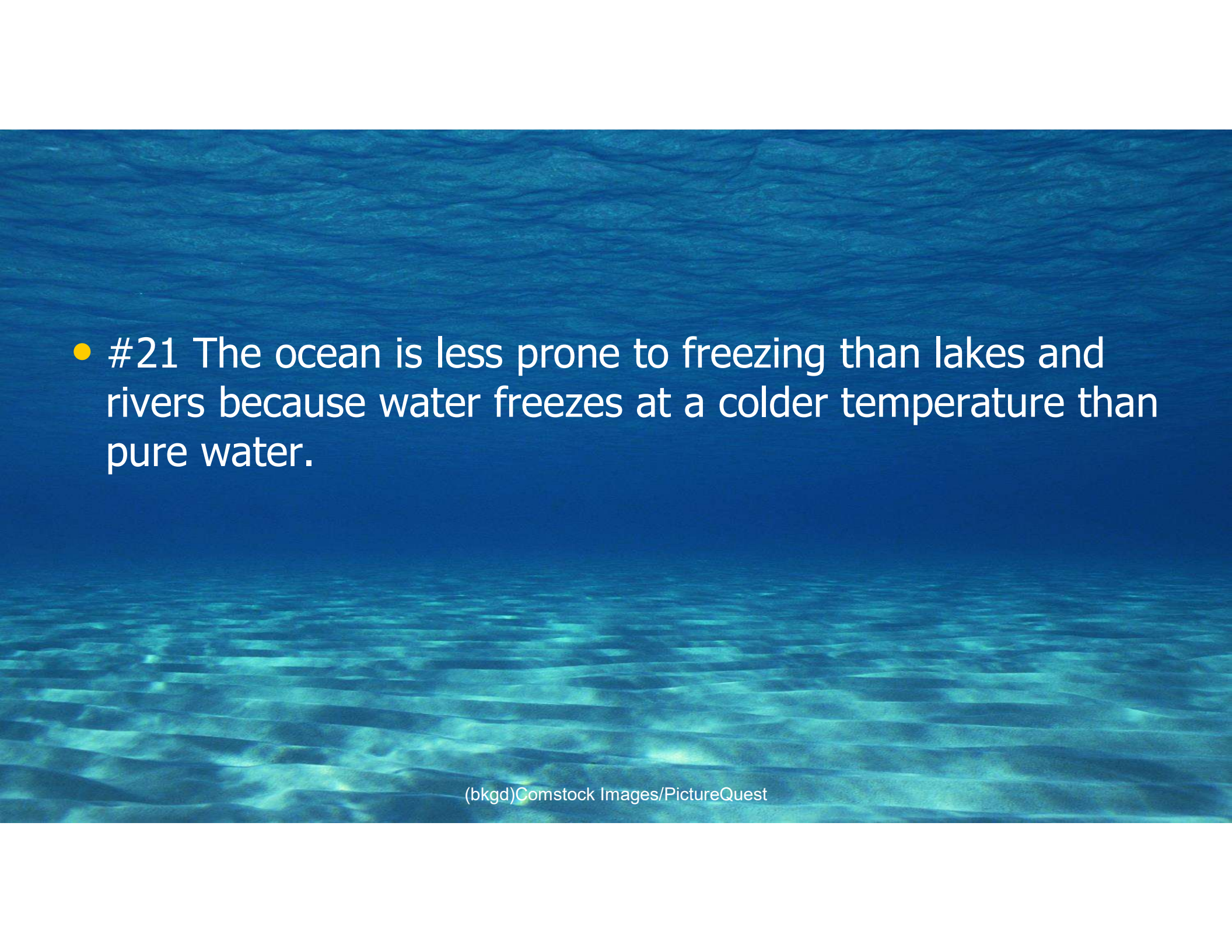
# Salt Composition

- For the most part, the oceans are chemically well mixed.
- Variations to ocean salinity are usually the result of the addition or removal of pure water.
- #18 water is removed from the ocean primarily by evaporation and to a lesser extent by freezing (water freezes mostly pure)

# Salt Composition

- #19 Water is added to the ocean by precipitation and to a lesser extent, melting of glaciers and polar ice sheets.
- #20 The average salinity of the ocean is about 35‰.



- 
- The background of the slide is a photograph of an underwater scene. Sunlight filters through the water surface from above, creating a pattern of bright, shimmering light rays and darker, shadowed areas on the seabed. The water has a deep blue-green hue, and the overall atmosphere is serene and mysterious.
- #21 The ocean is less prone to freezing than lakes and rivers because water freezes at a colder temperature than pure water.

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# Salinity, Temperature, Density

- The higher the salinity, the denser the water.
- The density of seawater depends on temperature and salinity.
- The colder the water, the denser the water.
- Temperature in the ocean varies considerably more than salinity; so density is usually controlled more by temperature than salinity.