ERASMUS+ KA229 - SCHOOL EXCHANGE PARTNERSHIPS

CONNECTING SEAS

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BROCHURE 1 –DIVERSITY OF THE SEA LIFE

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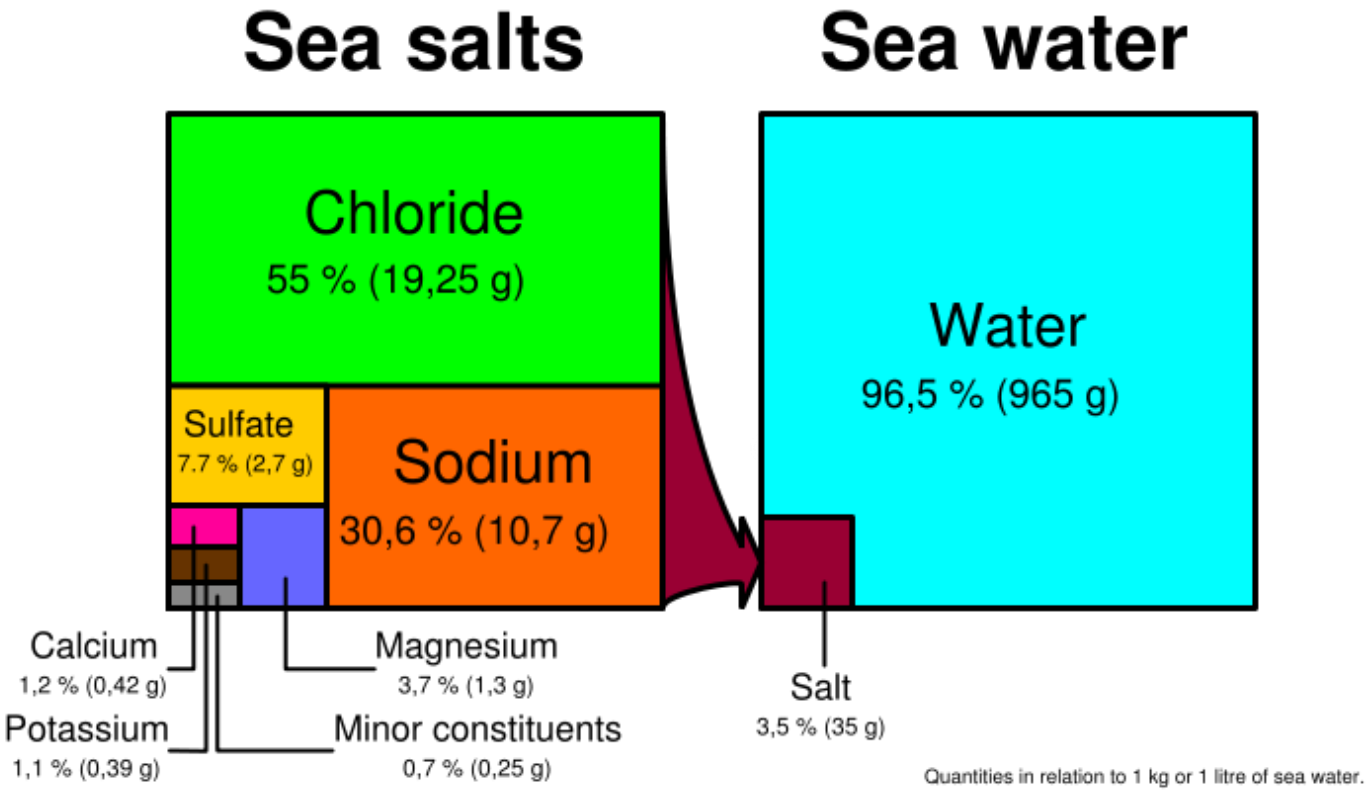
DIVERSITY OF SEA LIFE

The chemical composition of the seawater influences the marine biodiversity and sea life.

WHY IS THE SEAWATER SALTY?

https://www.youtube.com/watch?v=SPF6cSan6tc

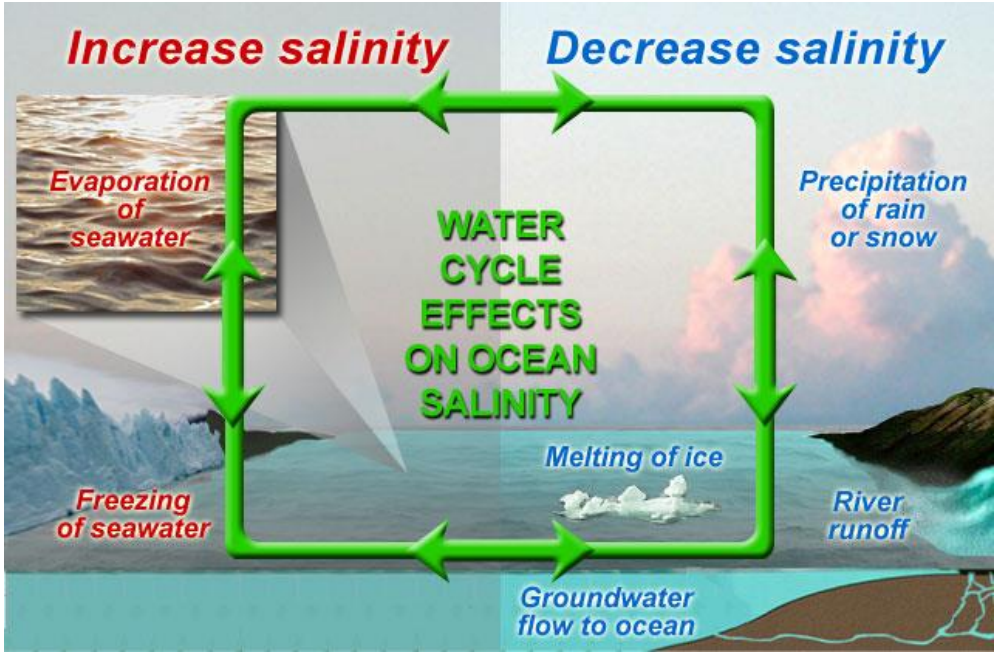
Main chemical constituents in seawater



Seawater chemical composition at a salinity of 35 ‰ (parts per thousand) and a pH between 7.5 and 8.3 (common range 7.8 - 8.2)

Cation	Strength (g/kg)	Anion	Strength (g/kg)
Na^+	10,77	Cl^-	19,354
Mg^{2+}	1,29	SO_4^{2-}	2,712
Ca^{2+}	0,412	HCO_3^-	0,140
K^+	0,399	Br^-	0,067
Sr^{2+}	0,0079	CO_3^{2-}	0,018
		SiO_2	0,006
		F^-	0,0013

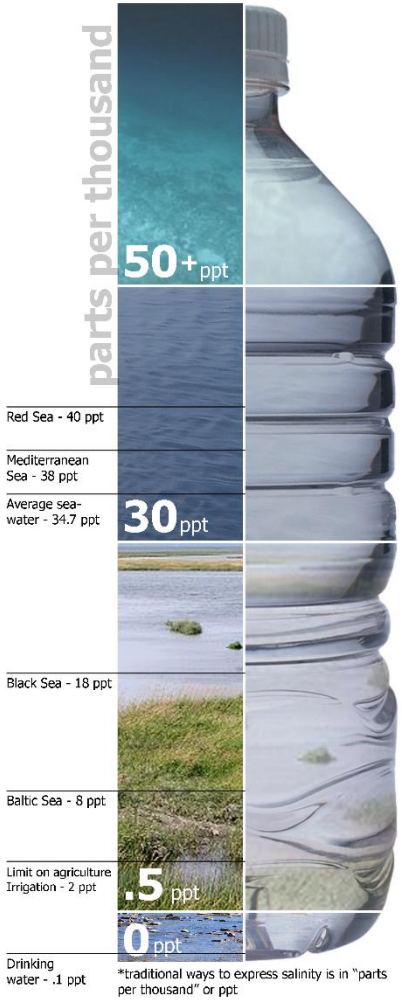
Seawater salinity



- The Black Sea has low salinity (180/00), because many rivers flow into it.
- The Mediterranean Sea has a salinity of 390/00 because rivers with low flow are discharged in it.
- The Atlantic Ocean has the highest salinity (35.40 / 00); this is explained by the transport of hot and salt water.

Bodies of water by salinity

Water salinity			
Fresh water	Brackish water	Saline water	Brine
< 0.05%	0.05 – 3%	3 – 5%	> 5%
< 0.5 ‰	0.5 – 30 ‰	30 – 50 ‰	> 50 ‰



briny water
brine pools
50+ ppt

saline water
seawater, salt lakes
30-50 ppt

brackish water
estuaries, mangrove swamps, brackish seas and lake, brackish swamps
.5-30 ppt

fresh water
ponds, lakes, rivers, streams, aquifers
0-.5 ppt



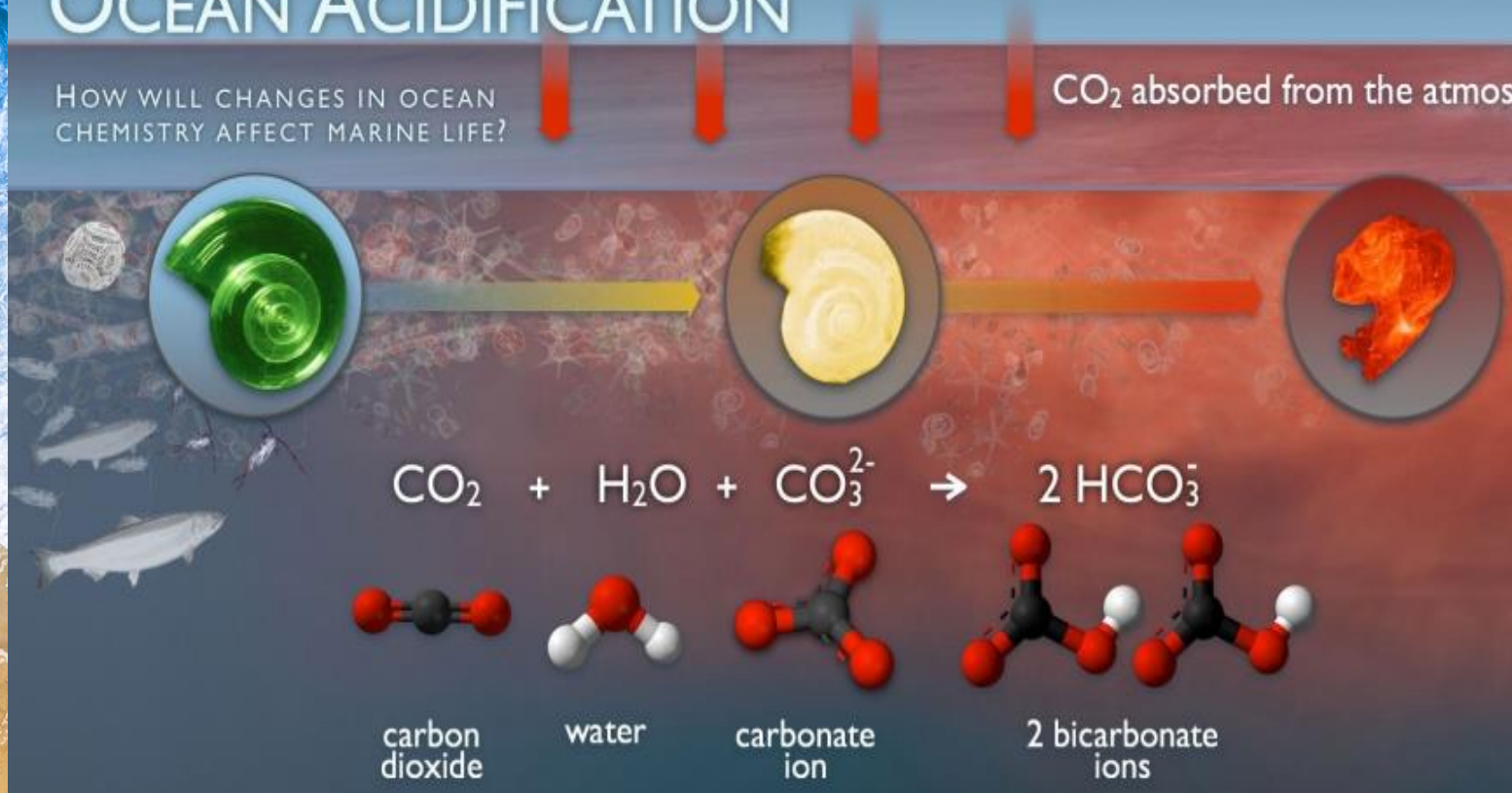



Salinity and Marine Organisms

- 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

Ocean Acidification

How will changes in ocean chemistry affect marine life?



consumption of carbonate ions impedes calcification

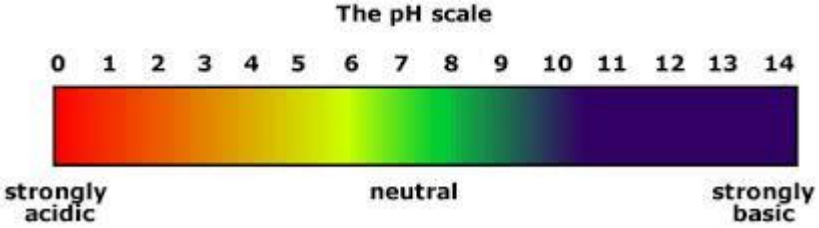
Determination of pH

Indicators

- Litmus paper
- pH paper

Colorimeter

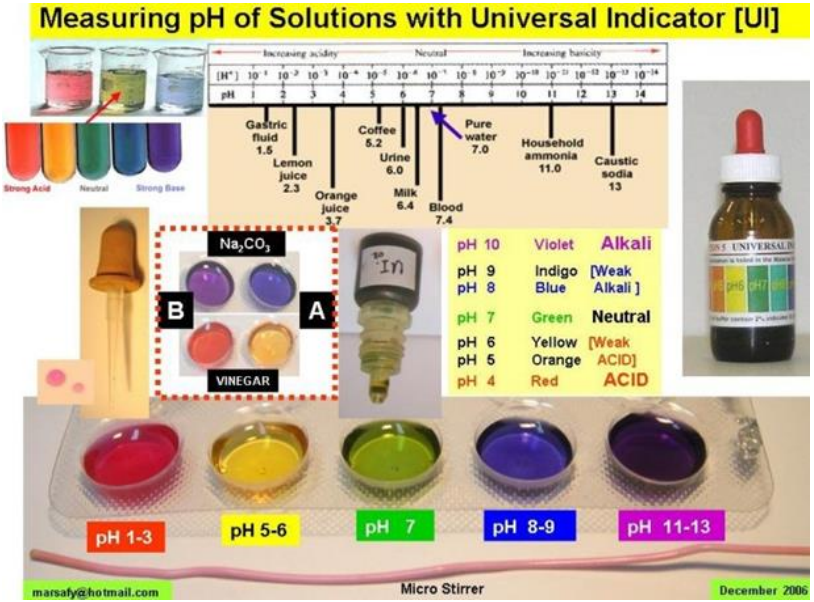
pH meters



1. The colorimetric Method

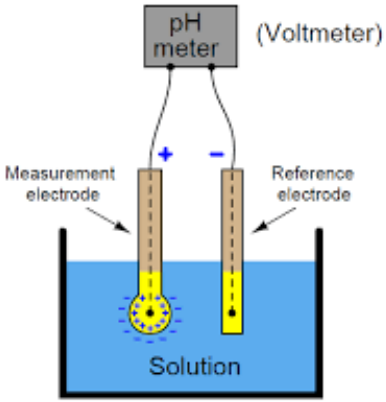
pH Paper

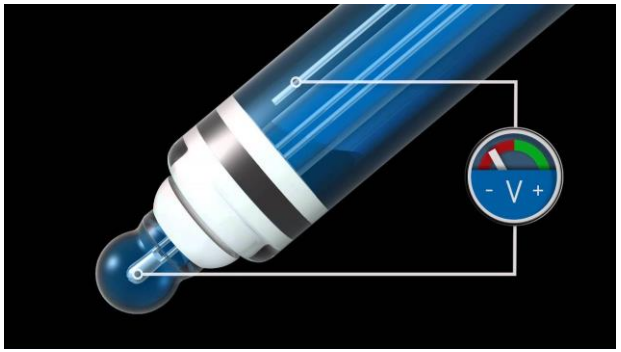
Universal indicator



pH: 1-3 5-6 7 8-9 11-13

2. The electrometric method with a potentiometer (pH meter)





- The potential difference between a glass electrode and a reference electrode (saturated calomel-KCl), introduced into the water sample, varies linearly with the pH of the water sample.

Necessary lab equipment and reagents

pH paper

pH meter

Berzelius beaker

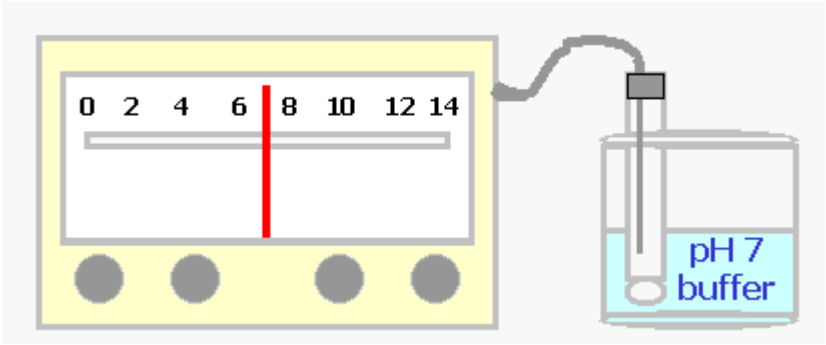
Procedure

1. The colorimetric method

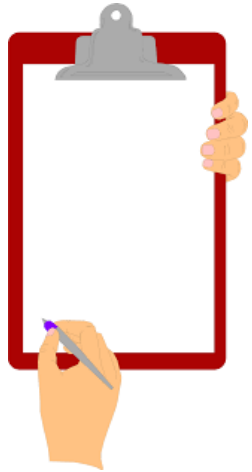
- a quantity of water is taken from the sample to be analyzed
- the sample is placed in a Berzelius beaker
- take a piece of indicator paper/pH paper and insert into the water sample
- the color that appears on the paper is observed and it is compared with the calibration scale after which the pH value is read

2. The electrometric method with a potentiometer (pH meter)

- insert the electrode into the water sample
- the pH value is read on the pH meter scale
- the operation is repeated two more times
- the final value is the average pH range of the all 3 determined values



LABORATORY TASK # 1



- ✓ **Determine the pH value of your water sample, and write the value on your worksheet, through the:**

1) **Colorimetric Method**
2) **Electrometric method**

Sample No.	The source of the water sample	pH	Standard water pH	Remarks
1	Atlantic Ocean		6.5-9	
2	Adriatic Sea		6.5-9	
3	Black Sea		6.5-9	
4	Fresh water		6.5-8.5	

Determination of water electric conductivity

- The conductivity reflects the salt content of the water
- The electrical conductivity of the water depends on the content of electrolytes and their strength.
- The electric conductivity of the water is measured in the laboratory with a device called conductometer.
- The electrical conductivity has as Siemens unit of measure per meter, S · m-1 and its sub-multiples.

Necessary lab equipment and reagents

water sample

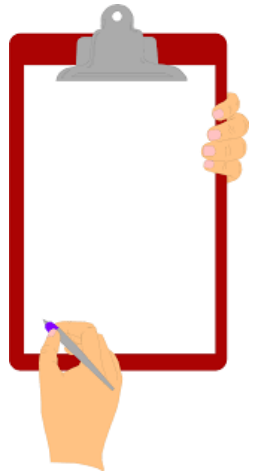
conductometer

Berzelius beaker

Procedure

- calibrate the device with distilled water
- insert the electrode into the water sample
- read the determined value

LABORATORY TASK # 2

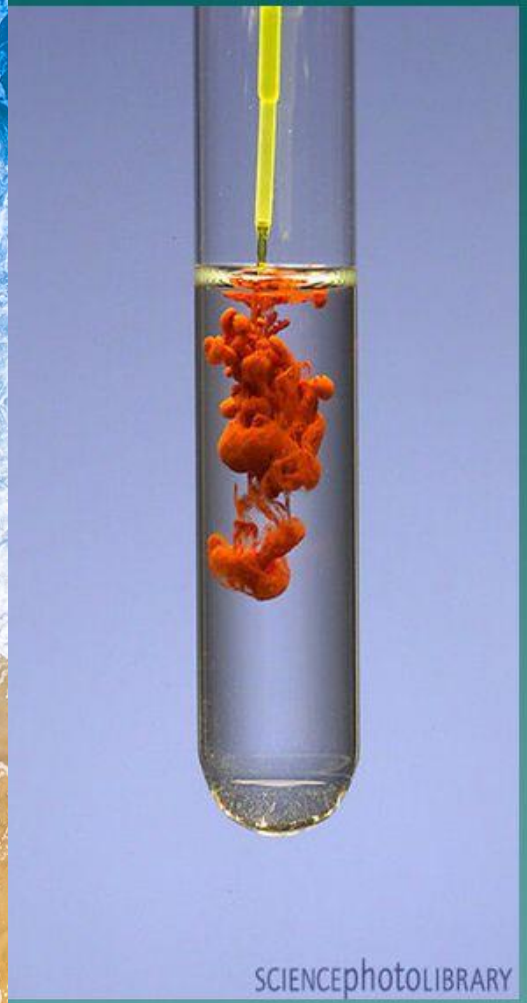


- ✓ **Determine the electric conductivity of your water sample, and write the value on your worksheet.**

Sample No.	The source of the water sample	Conductivity, µS/cm	Standard Conductivity of water µS/cm	Remarks
1	Atlantic ocean		≥ 2500	
2	Adriatic sea		≥2500	
3	Black sea		≥2500	
4	Fresh water		≤2500	

Determination of water salinity

- Salinity is a chemical property of seawater that plays an important role thermal regime flow, in the water currents formation and in the development of marine life conditions.
- The salinity of water is determined by the chlorides in the water
- Chlorides from water result from soil or from animal/human pollution.
- The chloride concentration in the water varies over time.



Mohr method

Mohr titration is used for determination of halide in a solution.

Potassium chromate can serve as an indicator for the determination of chloride, and bromide ions by reacting with silver ion to form a brick-red silver chromate (Ag_2CrO_4) precipitate in the equivalence-point region.

Necessary lab equipment and reagents

Berzelius beaker

Biurette

Graduated cylinder

Erlenmeyer beaker

0.1 N $AgNO_3$ solution

10% K_2CrO_4 solution

0.1 N NaOH solution or 0.1 N H_2SO_4 solution

acid-basic indicator

Procedure

- take 100 ml of water sample in an Erlenmeyer beaker, neutralized in the presence of an acid-basic indicator, with sulfuric acid (H_2SO_4) or with sodium hydroxide (NaOH)
- take the same amount of water again and introduce the exact amount of NaOH or H_2SO_4 from the beginning to neutralize the sample
- add a few drops of potassium chromate solution
- titrate with silver nitrate solution ($AgNO_3$), until the color turns from yellow to red – brick

Calculations

$$mg\ Cl^- / dm^3 = \frac{V_{AgNO_3} \cdot c_{AgNO_3} \cdot A_{Cl}}{V_p} \cdot 1000$$

- Where:

V_{AgNO3} - stands for the volume of $AgNO_3$ solution used in titration, measured in ml

C_{AgNO3} – stands for the concentration of the solution of $AgNO_3$

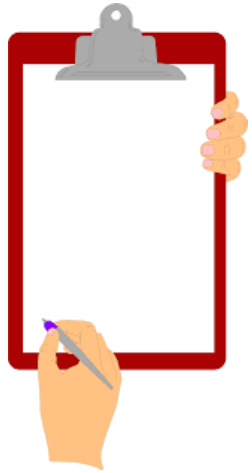
A_{Cl} – stands for the atomic mass of chlorine (35,5)

V_p - stands for the water sample volume, measured in ml

- Salinity is calculated by the Knudsen method

Q = 1,811×Cl (0/00)

LABORATORY TASK # 3



- ✓ **Determine the salinity of your water sample, and write the value on your worksheet.**

Sample No.	The source of the water sample	Salinity of analyzed water 0/00	Standard Salinity of water 0/00	Remarks
1	Atlantic ocean		33-37	
2	Adriatic sea		35-38	
3	Black sea		18	
4	Fresh water		≤ 0.5	

TASKS

- Compare the results of the analyzes with the standard values.
- Compare the water properties of the Atlantic ocean, Adriatic sea and Black sea.
- Each team will identify the species specific to the salinity content in their area.

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This is a final outcome of the Erasmus+ KA229 School partnership `Connecting Seas` (2019-2022). This is an open educational resource and can be used in class as long as it is presented as a result of the project funded through the Erasmus+ Programme and cited as above.