



Erasmus+

KA 229 - Connecting Seas

The Influence of Nitrates and Phosphates on the Marine Ecosystem

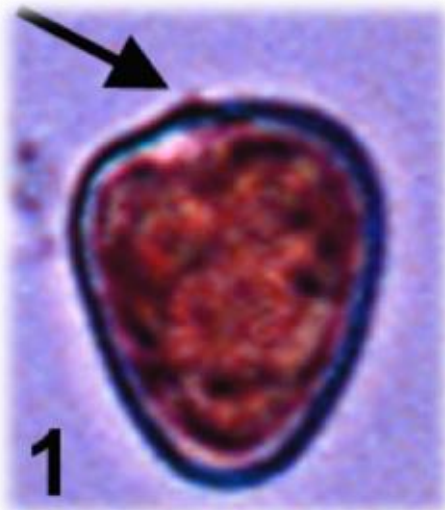
Erasmus + mobility
February 2022- Portugal

Pop Raul-Alin
Petrișor Alexandru *12th Grade*

Ana Aslan Technical College
Cluj-Napoca
Prof. Mariana Szenkovits

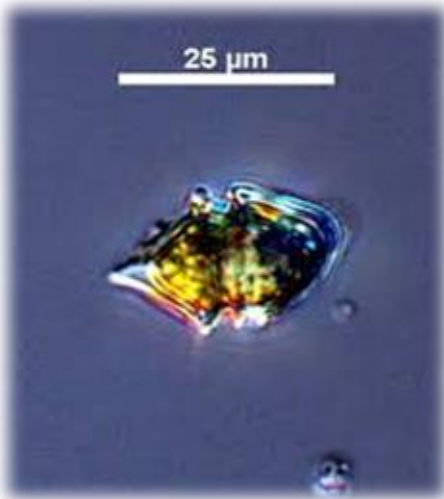
Introduction

- On the Romanian Black Sea coast, a reddening of the sea surface waters was observed in 1974
- *Exuviaella cordata* is a single-cell algae that has determined the phenomenon known as algal blooming or eutrophication



Eutrophication

- Eutrophication is a form of pollution caused mainly by human action.
- Along with the increase of salts, the phenomenon of eutrophication is induced by the sudden increase in temperature and major variation in salinity.



Eutrophication



In spite of the microscopic size, the algae produces a massive number of cells and a chain of negative effects, including a reduction of:

- the concentration, almost up to zero, of oxygen amount in the water
- biodiversity
- macrophyte algae, fanerogams and microphytobentos (vegetation that lives on the sandy or rocky bottom of the sea)

Nitrate and Phosphate concentrations

A photograph of laboratory glassware, including test tubes and beakers, containing a green liquid. The image is partially obscured by a dark green diagonal shape on the left side of the slide.

- **Nitrate** and **phosphate** are contributing significantly to the water pollution.
- The sources of nitrate include anthropogenic, regular use of chemical fertilizers, sewage and landfill by domestic waste.
- Industries like plastic, metal treatment, textile, household cleaning and pharmaceuticals industrial effluents further increase the level of contamination in the ground water
- The agrobased chemicals (artificial and natural fertilizer) are also contributing to the underground water contamination.

Nitrate and Phosphate concentrations

A photograph of laboratory glassware, including test tubes and a beaker, containing a green liquid. The background is a dark green gradient.

- Phosphate and nitrate are major nutrients needed by living microorganisms for their physiological processes. However, they are considered as pollutants if their concentration is more than the recommended limit.
- Heavy nutrient load (nitrate and phosphate) containing water bodies favours the growth of aquatic plants, and creates a negative effect on water quality by increasing the growth of algal clump, bad odour, and decolouration.

Determination of Nitrate and Phosphate concentrations in Marine water

Materials

- Laboratory Photocolorimeter
- Marine water samples
- Test tube



Procedure

1. Select parameters to determine nitrates and phosphates;
2. Introduce the water to be analyzed into the cuvette;
3. Calibrate the device;
4. Insert the reagent corresponding to find the concentration of nitrates and phosphates in the water sample.
5. Mix/stir the sample
6. Read the value of concentration on the screen

Various water samples comparison



Nitrate concentration for various water samples

No.	Water Sample	Nitrate Concentration NO_3^- (mg/l)	Water quality *
1.	Black Sea	0,443	I
2.	Atlantic Ocean	5,316	III
3.	Mediterranean Sea	1,879	II

❖ Type I (best quality standards) to Type V (low quality standards)

Various water samples comparison



Phosphate concentration for various water samples

No.	Water Sample	Phosphate Concentration PO₄³⁻ mg/l)	Water quality
1.	Black Sea	0.08	II
2.	Atlantic Ocean	0.19	III
3.	Mediterranean Sea	0.09	II

Following the eutrophication process



In the second part of the experiment, we prepared 4 samples of water from the Black Sea in which we gradually added different larger amounts of nitrates (artificially).

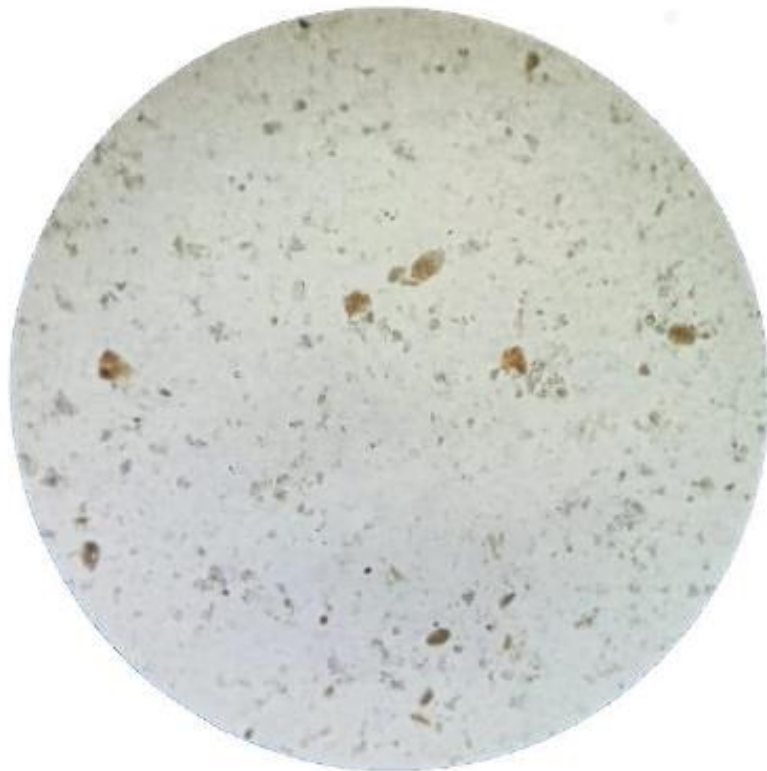
- No. 1 is the blank sample of water from the Black Sea without the addition of nitrates.
- Thus, we tracked the phenomenon of algal flowering (algae multiplication) in the water samples analyzed for 6 weeks.
- Analyzing the samples with a microscope, dinoflagellate seaweed of the *Dinophyte* class was identified, and a massive multiplication was also observed in samples 3 and 4, with a higher nitrate content.

Sample No.	Nitrate concentration NO_3^- (mg/l)	The quality of the water
1.	0,443	I
2.	1,554	II
3.	2,888	II
4.	3,750	III

Experimental Part



Microscope image of dinoflagellate seaweed



Determination of pH



1. The colorimetric Method

pH Paper



Universal indicator



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

Determination of pH



Necessary lab equipment



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



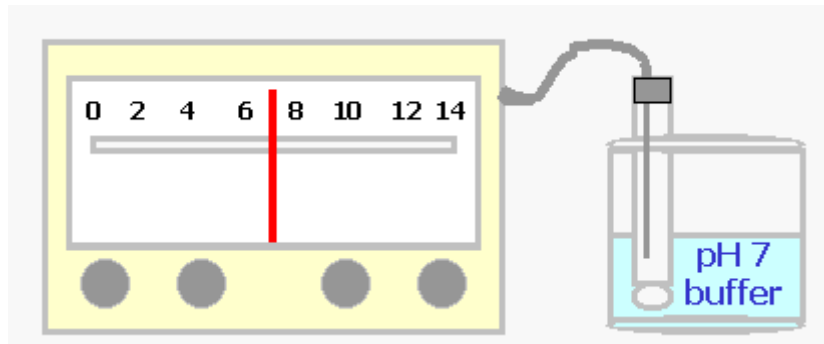
2. The electrometric method with a potentiometer (pH meter)



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



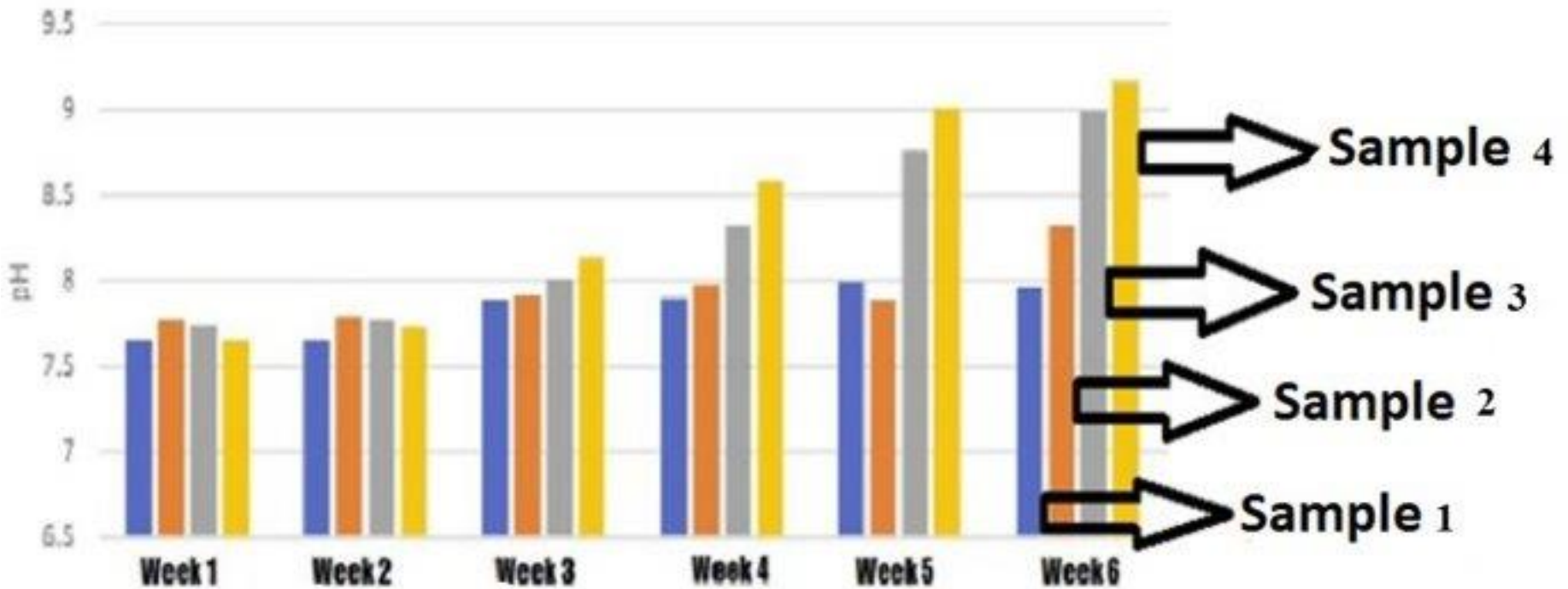
- insert the electrode into the water sample
- the pH value is read on the pH meter scale
- the operation is repeated two more times
- the final value is the average pH range of the all 3 determined values



Variation of pH values in experimental samples populated with microscopic algae



The presence of algae leads to the consumption of CO₂ in water, through the process of photosynthesis, so the pH of the water increases, becoming alkaline.



Conclusions

- More intense eutrophication at **higher nitrate concentrations.**
- A directly proportional relationship between the amount of nitrates and the propagation of algae.
- This negatively **influences marine biodiversity**, resulting in a decrease in the amount of oxygen in the water and a reduction in fish fauna.
- Consequently, monitoring of nitrates and phosphates in water are very **important parameters** in the analysis of water quality.

Sustainability



- The results of this research have been recorded and explained in the presentation we made to obtain the professional qualification certificate at the end of high school.

References

- [1] Boicenco L., "Eutrofizarea, încotro? Doar o altă formă de poluare produsă de acțiunea omului", Știință și Tehnică, Vol. Iulie 2016
- [2] https://www.researchgate.net/figure/Green-colored-waters-from-a-mixed-bloom-of-diatoms-and-Prorocentrum-cordatum_fig9_337992256
- [3] <http://tolweb.org/Dinoflagellates/2445>
- [4] <https://ucmp.berkeley.edu/protista/dinoflagellata.html>
- [5] <https://ucmp.berkeley.edu/protista/dinoflaglh.html>
- [6] [Neurotoxins from Marine Dinoflagellates: A Brief Review](#), Da-Zhi Wang, Mar Drugs, 2008, 6(2), pag. 349–371
- [7] <https://twinspace.etwinning.net/94628/home>



Erasmus+ Connecting Seas

THANK YOU !

Acknowledgements:

This study was carried out within the Erasmus+ Connecting Seas KA229

- School Exchange Partnerships

No.: 2019-1-RO01-KA229-063231_1.



“The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the National Agency and Commission cannot be held responsible for any use which may be made of the information contained therein”.