



ERASMUS+ KA229 - SCHOOL EXCHANGE PARTNERSHIPS

CONNECTING SEAS

2019-1-RO01-KA229-063231_1

BROCHURE 4 – SEA IN DANGER



Co-funded by the
Erasmus+ Programme
of the European Union



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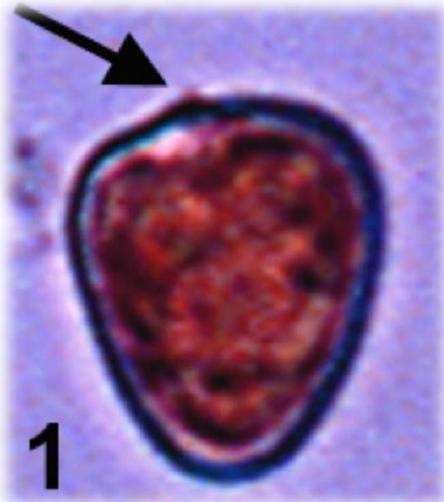
KA 229 - Connecting Seas

*The Influence of Nitrates
and Phosphates on the
Marine Ecosystem*



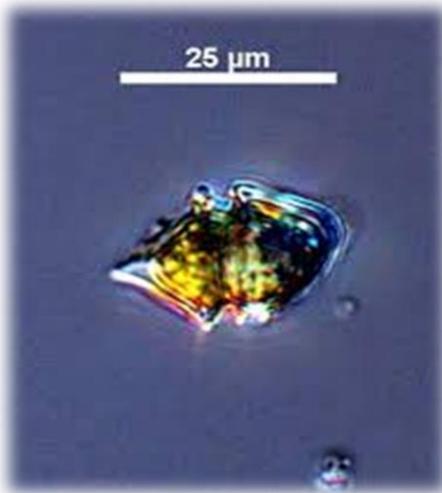
Introduction

- 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 close-up photograph of several glass test tubes and beakers. One tube in the foreground contains a vibrant green liquid. The background is softly blurred, showing more glassware and a white surface. The image is partially overlaid by a dark green diagonal shape on the left side.

- **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).

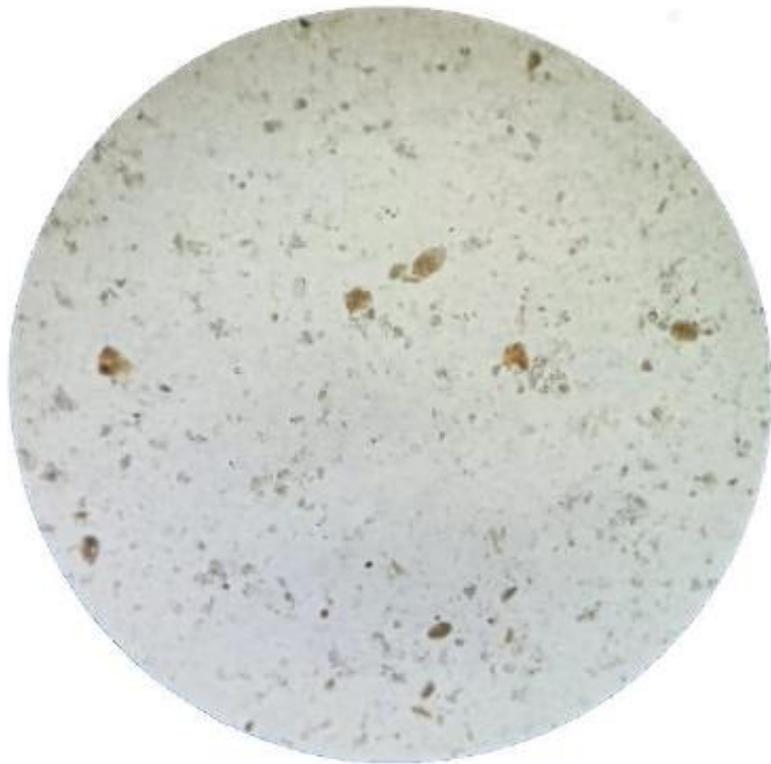
- No. 1 is the blank sample of water from the Black Sea without the addition of nitrates.
- Thus, we tracked the phenomenon of algal flowering (algae multiplication) in the water samples analyzed for 6 weeks.
- Analyzing the samples with a microscope, dinoflagellate seaweed of the *Dinophyte* class was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



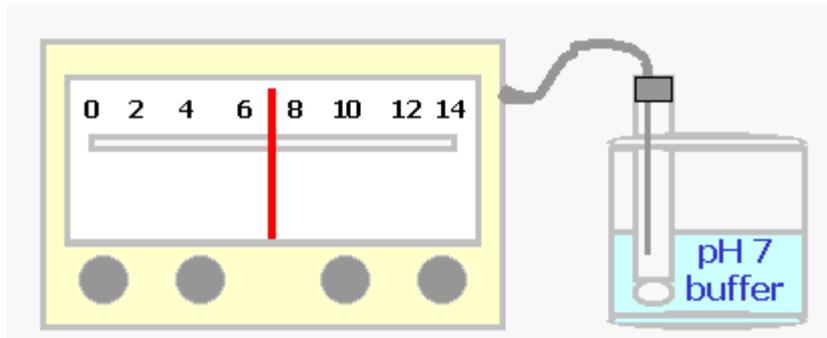
2. The electrometric method with a potentiometer (pH meter)



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



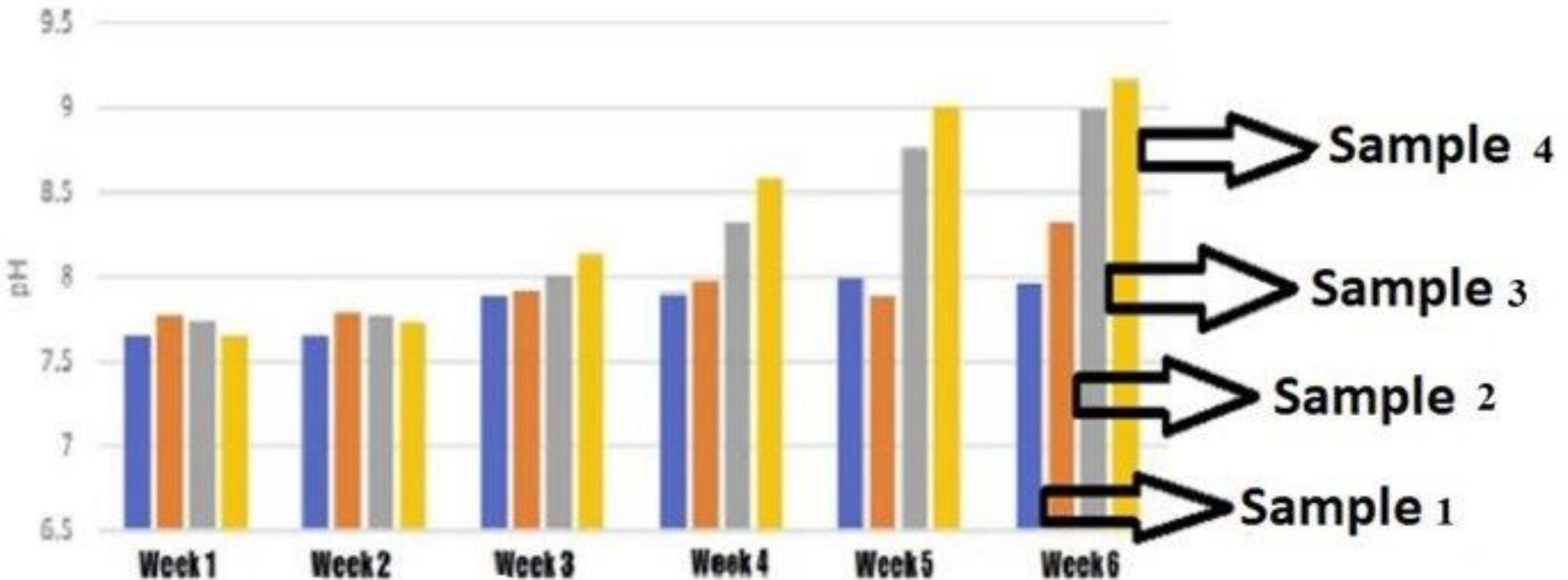
- insert the electrode into the water sample
- the pH value is read on the pH meter scale
- the operation is repeated two more times
- the final value is the average pH range of the all 3 determined values



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

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- [3] <http://tolweb.org/Dinoflagellates/2445>
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- [6] [Neurotoxins from Marine Dinoflagellates: A Brief Review](#), Da-Zhi Wang, Mar Drugs, 2008, 6(2), pag. 349–371
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Protect to
Preserve

Preserve to Save
the Future of the
Oceans

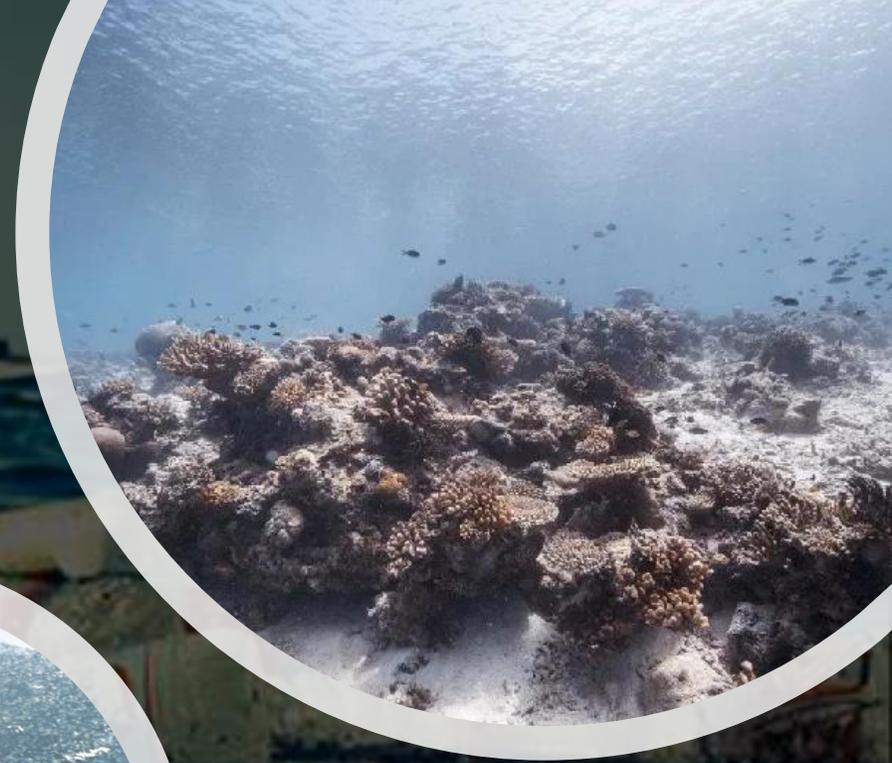
Causes that affect the sea life:

- Over-exploration of fishing;
- Pollution;
- Water heating;
- High concentration of mercury;
- Acidification of the ocean and corals;



Causes that affect sea life:

- Studies confirm that 20% of fishes in Portugal have micro plastics in their stomach;
- The increase of the sea temperature, resulting in modifications in the marine ecosystems, with serious and lethal consequences for many species.





Measures that can be utilized in order to the marine perservation



1. Reduce marine pollution to all levels

2. Conserving and using in a sustainable way oceans and marine resources to a sustainable development

3. Minimizing ocean acidification

4. End of overfishing and illegal fishing





Save our Ocean, Protect our Future

https://www.un.org/sites/un2.un.org/files/2020/06/good_1.mp4



== UNITED NATIONS ==
OCEAN
CONFERENCE

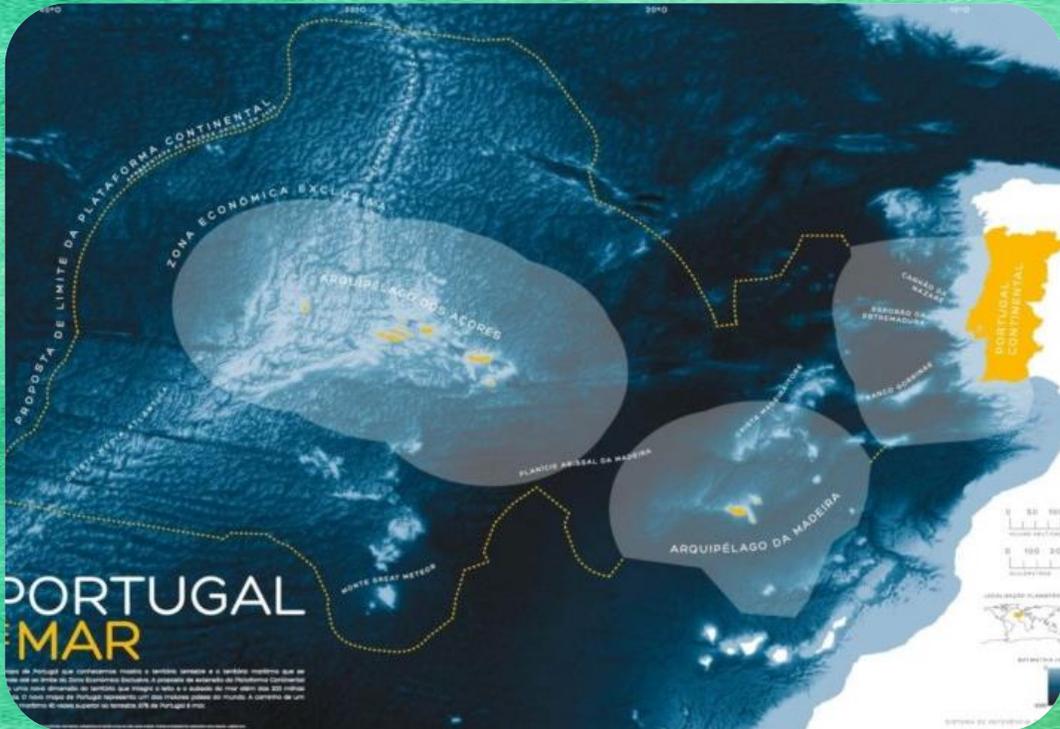
LISBON
27 JUNE -
1 JULY
2022

- We must conserve and sustainably use the oceans, seas and marine resources for a sustainable development;
- Solutions include addressing the threats to health, ecology, economy and governance of the ocean - acidification, marine litter and pollution, illegal, unreported and unregulated fishing, and the loss of habitats and biodiversity.



Protected Marine Areas

- They are an essential part in a conservation strategy and efficient marine management.



Continent	Madeira	Azores
Marine Park Professor Luiz Saldanha - Arrábida	Protected Marine Areas of Porto Santo	Marine Protected Area Network: 123 Areas; 110 000 km ²
Berlengas Nature Reserve	Desertas Islands Nature Reserve	Faial Island: Nature Reserve of Caldeirinhas
Ria Formosa Natural Park	Protected Area of Ponta do Pargo	Santa Maria Island: Nature Reserve of Ilhéus das Formigas

Ria Formosa Natural Park

- 90% of the seahorses population in Ria Formosa has disappeared in the last 20 years;
- The two most common seahorses species in Ria Formosa, shortspine and longspine, are classified as near threatened species by the IUCN – International Union for Conservation of Nature.



Seahorse
(*Hippocampus hippocampus*)

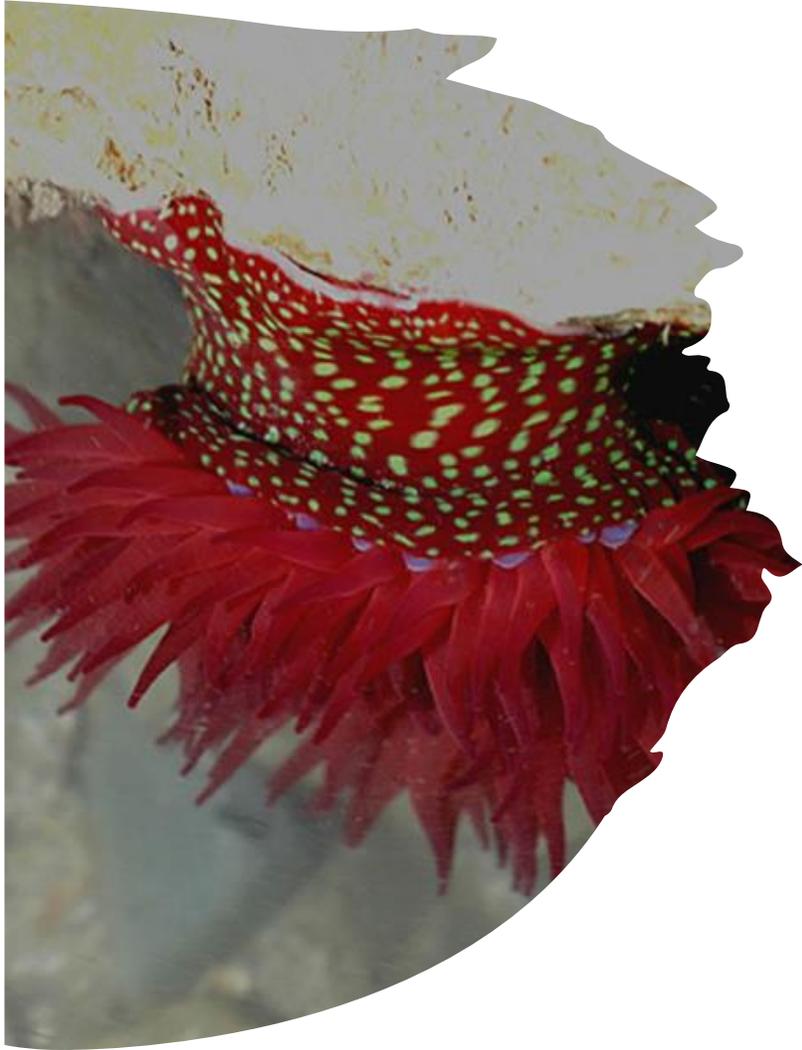
Berlengas Nature Reserve



Protected
marine species:

Strawberry Anemone (Actinia fragacea)

- Large base up to 10cm;
- Red or Purplish Tentacles;
- Conspicuous ring with spots.



Protected Sea Creatures:

The Common-turtle (Caretta caretta)

- Portuguese waters are a nursery for this species, it grows in Madeira sea, Azores sea and southern Portugal sea;
- The most remarkable difference between males and females is that males have thicker tails and smaller shells than females.



[Madeira]

[Azores]

Azores and Madeira

Islands Sustaining Biodiversity

AZORES

- The seas around the Azores are among the richest in marine life in the Atlantic Ocean. In them we can find diverse species of great size;
- There are several species of fish typical of the Atlantic Ocean that are common to all European coastal areas and Mediterranean coasts;
- Species such as the Blue Whale, the Sperm Whale, the Humpback Whale and the Whale Shark, among others, which are considered **endangered**, have been recovering in the Azores Sea.





**Cachalote or
Sperm Whale**
(*Physeter macrocephalus*)

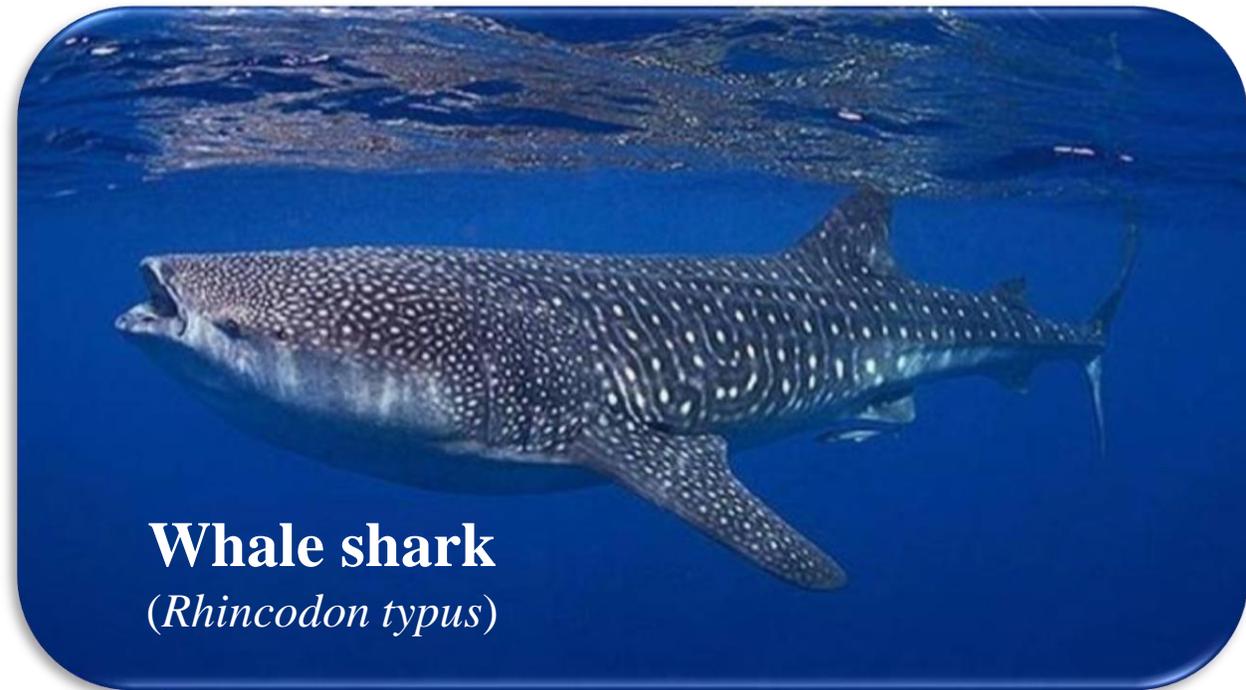


Blue Whale
(*Balaenoptera musculus*)

Whale Watching in the Azores



Humpback Whale
(*Megaptera novaeangliae*)

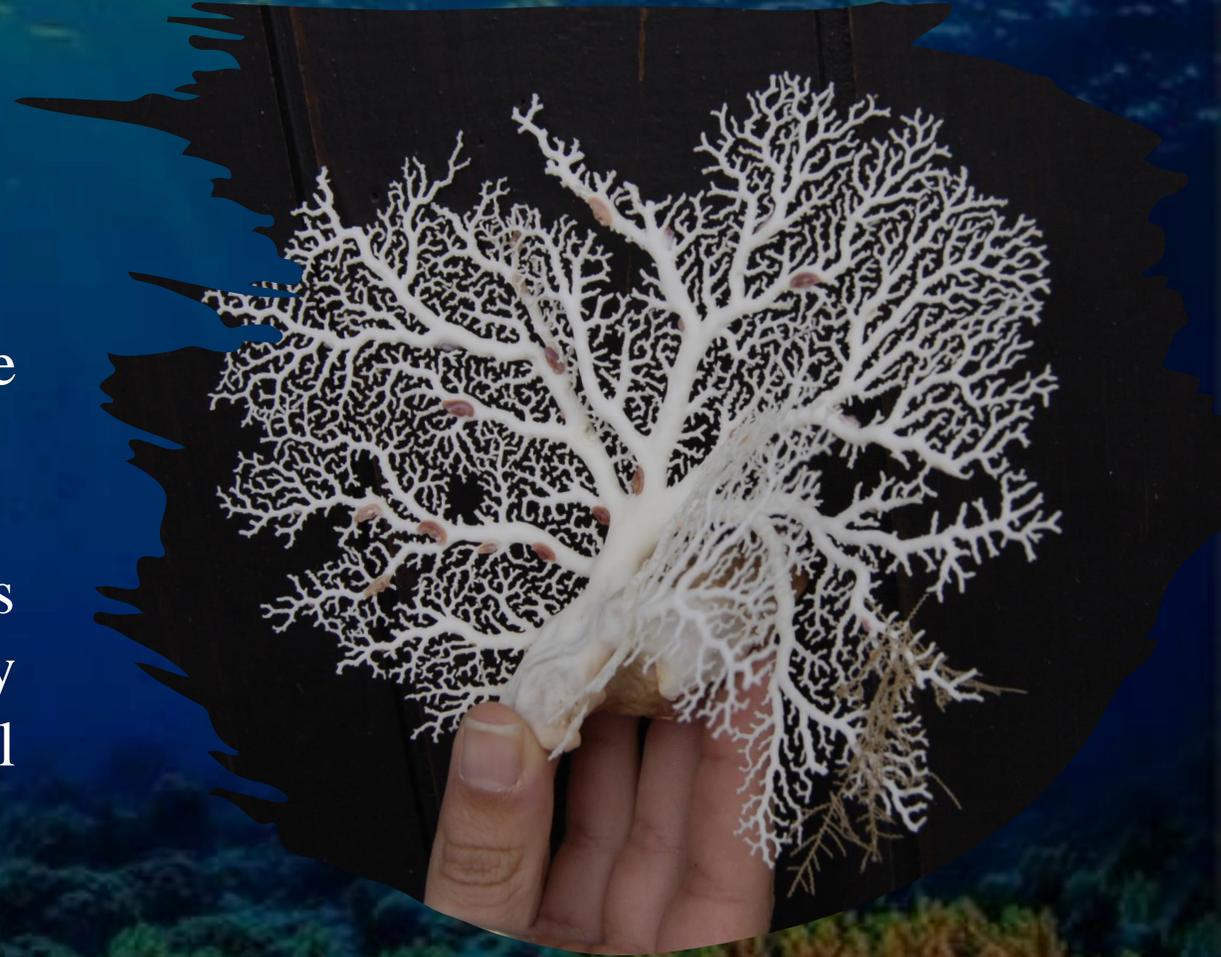


Whale shark
(*Rhincodon typus*)

Protected marine species:

Hidrocoral (*Errina dabneyi*)

- This species of coral is endemic to the Azores;
- The scientific name of this hydrocoral was inspired by the surname of the Dabney family, which had a great impact on the social and economic life of the island of Faial;
- Until today, there is no more information about this species, threatened by water acidification.



MADEIRA ISLANDS

- The marine fauna of the Desertas Islands, showing European and Mediterranean affinities, especially in terms of the fish and crustaceans of the coast;
- Countless species of turtles and cetaceans can also be observed in the surrounding waters of these islands;
- The Desertas Islands represent one of the last refuges worldwide.

Nature Reserve of The Desertas Islands



- The Desertas Islands Nature Reserve is located to the southeast of Madeira Island, and comprises a land area composed of three islands (Ilhéu Chão, Deserta Grande and Bugio);
- They are the largest marine reserve in the North Atlantic and its area has been increased 27 times in the recent years;
- There are several rare and endemic species found in the Desertas Islands, but it was the urgent need to preserve a small colony of Mediterranean **monk seals** (*Monachus monachus*), that motivated the protection of this area.

Mediterranean monk seal

(*Monachus monachus*)

- The only species of seal that lives in Portuguese territory;
- Threat of extinction by contacting with human beings (illegal fishing);
- Inhabit in marine protected areas, like Ilhas Desertas (in Madeira, Portugal).





Erasmus+ Connecting Seas



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.”