



Lesson Plan for Positive Actions

Please send your Queries/Submit the lesson plan to Dr Pramod Kumar Sharma at pramod@fee.global

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2. Has the lesson plan tried in a classroom (Please write a brief)

Course class in Physics-Chemistry and Geography with the purpose of contributing that the "Ria" continues to be "Formosa" ... for this we need that each student becomes, in the future, a knowledgeable successful citizen, being able to integrate knowledge continuously in an autonomous way (who enjoy to learn), to solve problems cooperatively (in group work), to master different scientific and technical languages (multidisciplinarity), has aesthetic and artistic sensitivity (Ria Formosa ecosystem) and takes care not only of their sole well-being, but also about the quality of life of those around them and of a better environment.

This field trip plan has been built and tested over the last 7 years under the "Environmental Volunteer for Water" project in the "Ria Formosa Natural Park", which is part of the "Natura 2000 Network" and the "Ramsar Sites", due to the high biodiversity. It requires classroom preparation and laboratory classes and fieldwork in the methodology for collecting and evaluating sea weeds for the determination of water quality, ecosystem and carbon sequestration. This project is part of the following ODS, in descending order of impact: **14** - Protect marine life; **15** - Protecting the earthly life; **11** - Sustainable communities; Climate action; **4** - Quality education; **17** - partnerships for implementation.

3. The lesson plan

A. Introduction:

The Ria Formosa is the livelihood for the population living in the Island of Culatra, approximately 750 inhabitants, many of them live from economic activities related to Ria Formosa (cultivation of oysters and clams and salt exploitation, salicornia production, tuna frame, fishing, in addition to touristic activities in the water and on land). The Culatra is one of the islands of the Natural Park, whose population dedicates, mostly to the sea. When we disembarked at Culatra, we realized that we were in a fishing place. The village is endowed with several infrastructures and services. Access to Praia da Culatra is done through a wooden walkway recently built according to the standards of the Ria Formosa National Park. This beach is ample and it extends to lose of sight, as much for west as for nascent. This beach is devoid of any infrastructures. During the bathing season the Faro Municipal Town Hall assures the service of rescuer swimmers and provides access to a bathroom. Here you can see the rich flora of dune fields and the numerous species of birds that live in these quiet spots, warm and calm waters. After a two-hour walk east you come to Barra Grande, where you can appreciate the inviting natural sandy pools and an ever-changing landscape.

With this Project, a set of actions is developed whose main purpose is:

- Educate for the awareness and protection of terrestrial and marine ecosystems, emphasizing the importance of maintaining sea grasses in the construction of a low carbon economy;
- Recognize ecosystems as forms of renewable natural capital, whose functioning depends on the biodiversity that composes them and whose preservation and recovery must be done at the local level to maintain and restore connectivity between broader natural areas;
- The practices of soil conservation, marine prairies, oriented to the conservation of nature and water resources, are reflected in the reduction of environmental impacts. This good management contributes decisively to the improvement of the water cycle and biodiversity.

It is recognized that the identification of environmental problems and their resolution involves not only civic participation by informing management entities of the problems detected, but also by the voluntary actions of ecosystems, combating environmental degradation and promoting recovery of coastal areas.

The "Environmental Volunteer for Water" project is an initiative promoted by the Portuguese Environment Agency since 2009, with the general objective of promoting education for the conservation and sustainable development of freshwater, coastal and transitional water ecosystems through voluntary monitoring of environmental quality. The specific objectives of this project are:

- Mobilizing and involving citizens in the monitoring and management of water resources;
- Systematize a voluntary observation/monitoring network that complements official monitoring networks.

The target group for the actions is mainly the school community, but these are also aimed at the general public, having partnerships with several entities, namely the University of the Algarve, the union of Parish of Faro, Culatra Primary (1st Cycle) School and Faro Municipal Town Hall authorizing us to travel in their boat career, free of charge.

The actions are developed with the necessary scientific rigor, where the initial formation of teachers / monitors is developed by university researchers to enable that the required scientific procedures are learned. The information is registered and made available on the website dedicated to it, and the volunteer undertakes to evaluate the environmental status of the section that corresponds to it, through a common methodology to allow temporal and spatial comparisons. Environmental valuation actions are also carried out annually, such as the removal of invasive plants and the cleaning of garbage.

The quality of the data collected is assessed through periodic scientific audits of results, a periodic evaluation of the methodology applied and from the results obtained.

B. Age group

The age range is 12 to 14 years.

Students of the 3rd cycle.

C. Objectives or Learning Outcomes

- Make known the Water Framework Directive, WFD, which defines the objectives and targets to be achieved in view of the good ecological status of water;
- Raising awareness of the sustainability of aquatic ecosystems under the WFD;
- Educate for sustainability and contribute to the implementation of Agenda 2030 - ODS;
- Promote education for the conservation of biodiversity and the sustainable development of ecosystems in the streams of Algarve;
- Promote actions in a volunteer perspective;
- Raising awareness of bioindicators;
- To make known the importance of water quality assessment through bioindicators.
- Monitor water quality using marine herbs as a bioindicator;
- Evaluate the ecosystem services provided by Ria Formosa.
- Quantify the Blue Carbon of the coastal systems of the eastern Algarve.
- Promote the reflection and development of critical attitudes, leading to informed decision-making, on environmental problems caused by human activity;
- Developing intervention and responsible positions, aiming to contribute to the scientific literacy of members of the educational community on issues of environmental and social impact to the local community;
- Sensitize the students and through them the populations to the double aspect of protection and valorization of our areas classified by the services provided by their ecosystems;
- Mobilize society for the participatory management of resources;
- To value resources and ecosystems;
- Promote environmental volunteering and citizen science (voluntary monitoring network);
- Motivation for the investigation of aquatic ecosystems through experimental learning and the scientific method;

- To deepen the knowledge of the biocenosis of the Ria's mobile substrate, its trophic relationships and its dependence on pollution and anthropic impacts.

SDG Learning Outcome

Assessment of the ecological status of water using marine herbs as a bioindicator.

Our workplace is divided between the following locations:



- In the travel course to the Culatra Island, by boat, the students observe the Ria Formosa ecosystem and register what they observe, freely (drawing, text, phrases, words, photographs), and deliver / send the result of that to the teacher;

- Primary school (work centre) where tables are available, with equipment (computer and magnifying glass-binocular), necessary for the identification of benthic macro invertebrates and for the observation of water samples from the estuary, and for identification of the micro plastic.

- Vale Covo, a coastal area, on the Ria side, which is exposed in the empty tide, allowing the collection of the sediment with the macro invertebrates and the collection of water to observe the micro plastics;

- Travel distance between places and to the beach, where garbage and invasive plants are collected, on the way.

- Beach on the side of the Ria where the marine litter is collected. On the other hand, on the beach on the sea side the marine litter from that side is also collected (according to the needs defined by the local entities);

- Return trip to Faro, boat, snack and the teachers talk about the impressions of the work they performed (oral evaluation).

D. Time to apply the lesson plan.

100 minutes of preparation class;

1 day (8h) of empty tide between 8am and 10am.

E. Resources needed to apply the lesson plan

Empty tide; boat transportation to Culatra Island;

Class of students authorized by the parents;

Partnerships with the University of Algarve, the union of parish of Faro and Faro Municipal Town Hall.

F. Activity

The field trip to Culatra - Ria Formosa - in Faro, aims to make known, in loco, the prairies of sea grass, as one of the most productive ecosystems in the world. In Portugal, and especially in the Ria Formosa, 3 species of sea grasses, *Zostera noltii*, *Zostera marina* and *Cymodocea nodosa* can be found. Seagrasses promote increased biodiversity, providing habitats for other plant and animal species (shelter, feeding, breeding) and, among other things, improve water quality.

In this action we will monitor the ecological quality of the water masses in the Ria Formosa using the marine weeds in the determination of water quality and evaluate their evolution in the Ria Formosa, using methodologies and protocols of sampling of sea grasses in permanent transects made available by the group ALGAE - Ecology of Marine Plants of CCMAR.

1st Lesson - introduction to program contents, analysis of the experimental protocol, planning and carrying out experimental activities on coastal and marine ecosystems.

2nd Lesson - field trip: travel to the place where the seagrass collection activities take place in a certain transept; collection of the sludge sediment for the determination of the carbon retained.

3rd Lesson - laboratory activity of preparation, drying, counting, weighing the respective analysis and conclusion

Resources:

2 steel sediment anchors;

1 square of 50 x 50 cm;

1 plastic ruler (50 cm);

1 core (PVC pipe, diameter approximately 11 cm, height 20 cm);

6 wash sieves;

6 plastic bags (identified with the sample number);

1 permanent marker;

1 glacier;

6 trays;

12 paper bags (to dry the samples);

1 drying oven (or alternatively a dry and hot room);

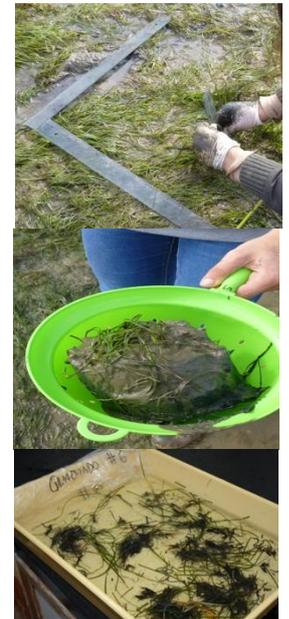
1 analytical balance (0.01 g precision).

Kit of the Environmental Education Network for Marine Ecosystems Services (REASE) with equipment needed for field activities.

Scientific method of collection and analysis:

A - Marine herbs

- 1st Step - establish transept of 25 m in the intertidal zone
- 2nd Step - placement of the 50x50 cm sampling square on the field of sea grasses
- 3rd Step - Measuring the height of the sea grass
- 4th Step - sediment taken from the heart
- 5th Step - sediment placed in a sieve
- 6th Step - Sediment Wash
- 7th Step - separation and counting of shoots
- 8th Step - separation of rhizome / root shoots
- 9th Step - drying and determination of the dry weights
- 10th Step - Promote the discussion of the results and consequences related to contaminants of ecosystems.



B - Blue carbon sequestration

- Step 1 – Register the dominant species, date and location on the record sheet of the sampling site.
- Step 2 - Use the thermometer to measure the temperature of the sediment.
- Step 3 - Remove the plunger from the sediment sampler and bury it in the sediment to a depth of 5 cm. Replace the plunger and remove the sampler. This process should be repeated until you have 2 zip bags with 5 sediment samples each. Each zip bag corresponds to one sample and must be identified with a code that is recorded on the record sheet.
- Step 4 - Transport the samples to the laboratory and initiates the laboratory protocols. If it is not possible to start the protocol on the same day, samples may be frozen until the date of analysis.
- Step 5 - Identify and weigh one aluminium container per sample (Container, g). Place approximately 5 g of the sediment sample into the aluminium container and record the total (Total wet, g).
- Step 6 - Weigh the sample after 48 hours in the oven at 60°C (dry total, g).
- Step 7 - Weigh the sample after 4 hours at 450°C in the muffle oven (if you have several samples, use a white paper to draw a map of your locations inside the oven). (Total burned, g).
- Step 8 - Calculate the weight of the samples after subtracting the weight of the container.
- Step 9 - Calculate the percentage of water in your sample.
- Step 10 - Calculate the percentage of organic matter in your sample.

G. Evaluation and Results

The evaluation of the action is based on the following parameters:

- students' commitment to the proposed tasks;
- creativity of the works presented;
- thoroughness of the conclusions presented.

H. Suggestions for variation or additional lesson plan reading

We can consider this activity in partnership with the disciplines of Geography and Natural Sciences.

I. References

SALDANHA, L. (1995). Fauna submarina atlântica. Edição revista e aumentada. Publicações Europa América, Lisboa: 364 pp.

MUZAVOR et al. (2000, 2001, 2003, 2006). Roteiro Ecológico da Ria Formosa, Vol. I, II, III, IV, V. Edição Universidade do Algarve/CIMA.

GAMITO, S. (2007). Fichas de apoio Fundamentos de Ecologia. Fauna da Ria Formosa.

<http://www.biorede.pt/index1.htm>

<http://www.Marbef.org/>

<http://species-identification.org/>

<http://www.apambiente.pt/dqa/>

<http://voluntariadoambientalagua.apambiente.pt/Site/FrontOffice/default.aspx?clear=yes>

<http://www.unric.org/en/subjective-development-engineers>

http://www.nhmc.uoc.gr/confresh/www2.nhmc.uoc.gr/confresh/CARDS_PORTO.pdf

https://www.apambiente.pt/_zdata/DESTAQUES/2016/ENEA_final.pdf

<https://www.casadasciencias.org/cc/redindex.php?err=1>

<http://www.dge.mec.pt/autonomia-e-flexibilidadecurricular>

School textbooks adopted in the disciplines: Physics-Chemistry, 8th and 9th, Natural Sciences 8th year and Geography 9th year.