Sea4All

Enhancing critical thinking in schools for marine pollution using innovative ICT technologies

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ
ΙΚΥ

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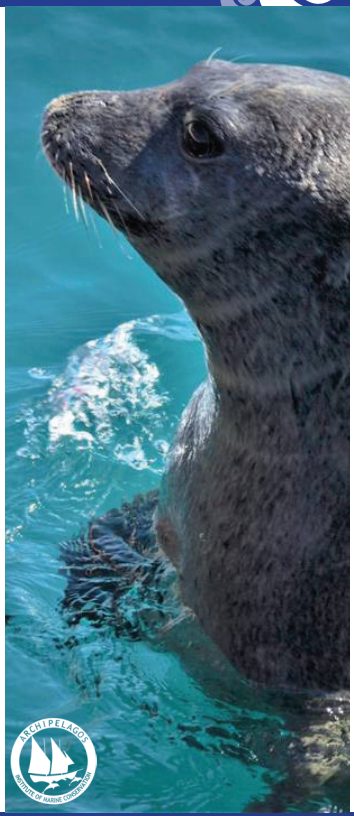
Introduction

Sea4All has developed educational games and classroom material focusing on oil spills and floating objects for school children around the world. The focus of this project has been on pollution derived from oil spills, plastic and other floating objects, and a team of scientists from Greece, Cyprus, United Kingdom and Romania has developed new educational material for teachers and an online game (e-game) mainly for 10-14 year-old pupils that were: a) pilot tested in multiple countries in Europe, b) used in a series of outreach events to enhance the awareness of local communities in terms of the environmental and economic impacts of marine pollution events. Outreach events organised all over Europe have stressed the need for significant behavioural changes from coastal communities so that oil-derived, plastic, microplastic and other pollutants are not released to rivers, streams and, ultimately, to the sea.

Marine Pollution

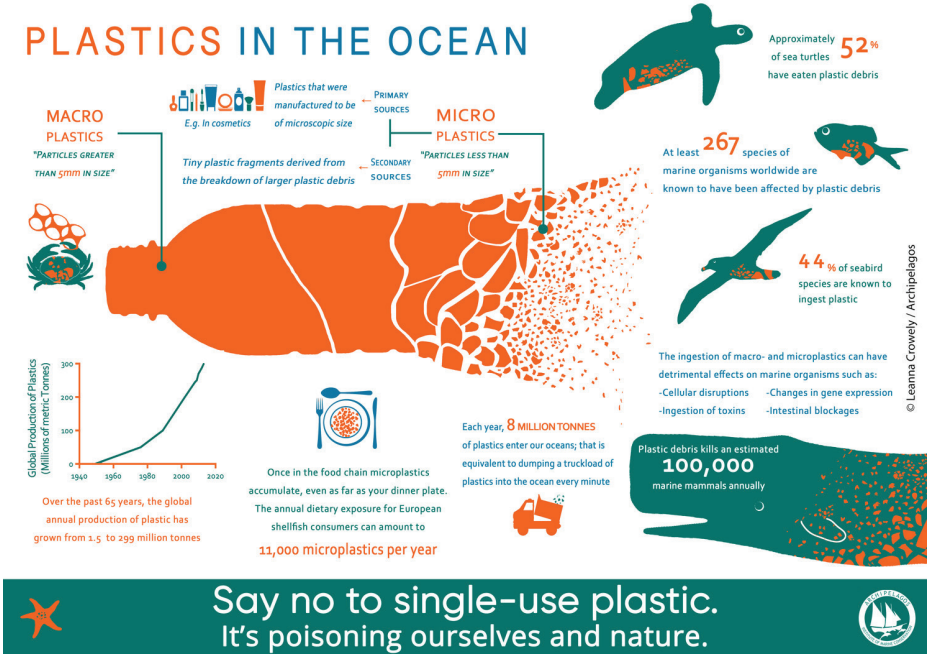
The Greek seas and the Mediterranean overall support great natural wealth. Their biodiversity continues to impress people everywhere, even us at Archipelagos Institute of Marine Conservation who have devoted over 20 years to defending marine life, combining scientific research with conservation actions with the active participation of the local communities.



Even though the Mediterranean only accounts for about 0.8% of the world's seas and oceans, this incredible sea supports about 7% of all marine life known to man. The Greek seas, with over 18.000km of coastline, create one of the most important biodiversity hotspots in the Mediterranean and even Europe. Over the great trenches that exceed 1000m in-depth, we can encounter sperm whales and the less social, Cuvier's beaked whales. The same deep waters support populations of 4 dolphin species, while shallower waters are home to the endangered Mediterranean monk seal and 3 species of marine turtles; this diversity signifies that it is not too late for our marine life. Despite the increasing human impacts, if we make a joint effort to protect the seas and the wildlife we share it with, these wild animals will be able to survive for future

generations.

Along with the impressive images of rare biodiversity we monitor at Archipelagos Institute, we also record the effects of increasing human-induced threats. The persistent presence of plastic, even in the most remote regions of our seas highlights the destructive impacts of our modern lifestyle. The data of our scientific research agree with those of the international scientific community, verifying the great danger that our plastic footprint poses to the survival of the biodiversity of our seas. Every year, over 8 megatons of plastic end up in the world's oceans contributing to the existing global plastic pollution that will soon exceed 100-150 megatons, of which 60% rests on seafloor and 40% floats in the water column. It is expected that this amount will at least double every decade.



Since 2009, Archipelagos Institute has joined forces with leading universities and research institutes from various parts of the EU with the purpose of quantifying levels of plastic pollution in the NE Mediterranean. The results of this research demonstrate the continuous spread of plastic pollution in marine ecosystems. Microplastic fibres were found in almost 100% of the 1500 analysed fish. Plastic fragments, in addition to microplastic fibers, were found in every dead dolphin, turtle and sea bird that had stranded on the shores of the Aegean. Our research, which also aimed to determine the level of microplastic pollution on the Greek coast by analysing samples from over 110 coastal regions throughout Greece, indicated that concentrations of microplastic fibers on remote islets coasts can often be as high as at that of busy beaches off Athens.

Between 2015 and 2018 Greece had to pay fines of over 100 million euro to the EU authorities, due to the illegal waste management sites that still operate throughout the country. The inefficient management of waste, even in popular tourist destinations, contributes to the growing plastic pollution problem in our seas. One of our many shocking discoveries was to see Eleonora's falcon that nested on an uninhabited islet trying to feed its chicks with a plastic wrapping that it had confused with food. We know now that the once widely held belief that plastic takes centuries to break down has been disproved. When in the sea or exposed to other environmental stressors, plastic can break down much faster than we thought. Some types of plastic break down into small fragments after only a few months, rendering it non-recoverable. It will continue to break down into smaller fragments until it becomes microplastic fibres dispersed throughout the water column and entering the food chain.

The responsibility for this immense problem is shared, as plastic pollution goes far beyond national borders. While important, the currently popular approaches to address this problem, like making only individual lifestyles changes, are threatening to cause us to lose our focus in finding ways to efficiently solve this global issue.

In order to fully address the problem, we need drastic solutions to actually limit the needless use of plastic, to change the waste management approaches, and also to increase our comprehension of the rich biodiversity we share our seas with and how our way of life impacts it. Maybe our generation cannot ensure a better world for the generations to come. What we can definitely do, though, is transform our aggregated knowledge on the issues of plastic pollution into actions and use this knowledge to inspire our youth. They will be the ones to address the multiple environmental problems that our generation are causing; therefore, the least we can do is pass down knowledge and tools with the hope that they will be able to defend wildlife and global ecosystems in a much more efficient manner than we do. The educational material produced in the framework of the Sea4all project aims to contribute towards this purpose.

O1. Training Curriculum

Aim of the Training Curriculum that was created in the framework of the Se4All project was to help teachers understand the marine pollution and conservation issues and its impacts not only to our health but also at the social, cultural, ecological and economic level. The Training Curriculum was created from teachers and educators for teachers, in order to equip them with all the important and necessary scientific knowledge and educational competencies to transfer them in the classroom to the children and motivate them.

So, in the framework of the Curriculum, on one hand the physical and chemical processes are summarized, that can lead to spreading marine pollutants like oil spills and floating objects (e.g. plastics), based on real and scientific facts, and on the other hand the Training Curriculum encompasses the development of the ESD teachers' competences adapted to the special needs of marine pollution. The ESD competences, contribute to the development of the SDGs (Sustainable Development Goals) ensuring among others, the acquisition of knowledge and skills of learners needed to promote sustainable development. In addition, the emphasis is given to the economic and social impact of marine pollution by oil and floating debris to coastal populations.

The Training Curriculum consists of 5 different modules that should contribute to the teacher's professional development, along with the Pedagogical Handbook, the e-learning Platform and the ICT game. The ultimate goal

is to give ideas and motivation to embed the material during class whether indoors or outdoors, or in different settings, like Environmental Educational Centers, coastal areas, sea museums etc.

Furthermore, indicative activities on marine pollution issues are presented, using teaching methods that are often applied in Education for Sustainable Development (ESD), as well as examples based on scientific scenarios related to oil spills and floating objects.

The Sea4All Training Curriculum was mainly created by the Unit of Education of Environment and Sustainable Development of the Cyprus Pedagogical Institute in collaboration with the school partners of the project.

O2. Technological Developments In Marine Pollution

In the framework of the Sea4All project, new research data was gathered and analyzed, concerning marine pollution from oil spills and floating objects (e.g. plastics). Within the project, vast geographical, geological and oceanographic scientific databases, were incorporated, in order to make the produced scenarios and simulations more realistic and adapted to local conditions. A significant number of scenarios and simulations were produced, taking into consideration local conditions like geological, geomorphological, bathymetric, atmospheric, oceanographic, sea state forecasting results and satellite data of different areas. The e-game and its missions, as well as the teaching

Example of litter and other debris released by a crowd of people during a music concert. The photo above was taken in La Coruña, northern Spain, after a music concert on 24 June 2010. Photo by Carlos de Paz at Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 2.0 Generic license.

material are based on these scenarios and the scientific knowledge gathered. All this new innovative material is presented in a simplified way, understandable by teachers but also generally non-specialists, highlighting the different aspects of pollution and the environmental impact of oil spills and harmful floating debris.

Within the scientific and educational material produced, significant questions about the creation of marine pollution (factors, dispersion) are answered, but also the environmental impact on different areas (interaction in oceans, different waters, coastal areas) and species (flora and fauna at coastal areas but also in the water) are considered, as well as the ways of mitigation or avoidance of creation of environmental pollution. To this end, apart from scenarios and simulation, various simplified maps, photos, animations etc were developed.

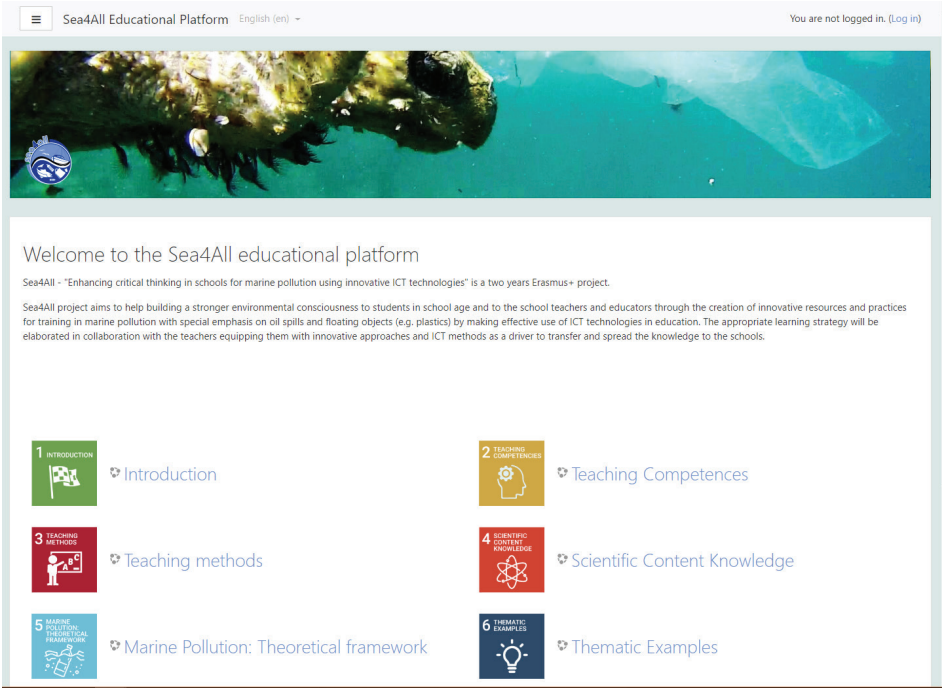
Professional drivers off Hawaii releasing bundles of ghost nets from the sea bottom. This debris pile comprises an agglomeration of a number of nets that had probably been swept together in the North Pacific Gyre. Northwest Hawaiian Islands. This file is licensed under the Creative Commons Attribution 2.0 Generic license.

O3. e-Learning Platform

The e-learning platform (https://www.sea4all-project.eu/edu/) has been developed to support the educational aim of the project. It contains all the scientific information and knowledge produced in the framework of the project concerning marine pollution especially from oil spills and floating objects like plastic but it also goes further. The platform is administered by FORTH and it is open to more information, in order to serve as a point of reference in the future, and contain all related information on marine pollution and ESD competences for people who would like to enrich their knowledge and skills in these domains.

The e-learning platform in contrast with the classic classroom teaching, gives the possibility of full accessibility to all related material, giving flexibility to the learner not only to choose the topics according to his interests and shortcomings but also according to his pace and level of understanding. Furthermore, it addresses not only teachers and educators, but also it can be accessible by the children and of course, the wider school community and public.

It is an online platform that can be accessed wherever internet connectivity is

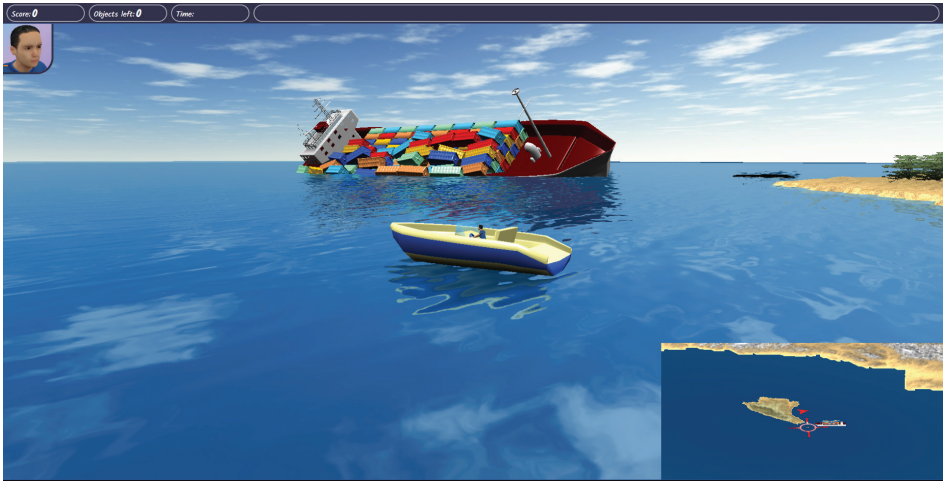


Screenshot from the online education platform of Sea4All, where the main training topics are presented.

available and supports multilingual environment. It can also deliver educational material in synchronous and asynchronous learning. The educational material in the Platform is structured in modules, according to the thematic units of the Training Curriculum, related to education and marine pollution aspects. It comprises not only of the material produced within the Sea4All project, like the Training Curriculum, the Pedagogical Handbook, the scenarios, webinars etc but also of presentations, quizzes, animations, documents, useful links and others.

O4. ICT Based Learning Game

The e-game is a new innovative way of attracting children and helping them understand the marine pollution issues in a more active and experiential way, facilitating the acquisition of appropriate knowledge, and promoting critical thinking. This online electronic game (e-game) was developed mainly for 10-14 old pupils, as a key tool for raising awareness, cultivating consciousness and acquiring knowledge on marine pollution issues. The different missions of the game focusing on marine pollution with respect to oil spills and floating objects (e.g. plastics) cover various activities for the learner in order to take actions and address specific pollution issues. Through stories based on scientific information, the learner has to carry out missions completing various educational tasks in a playful manner, utilizing existing and newly acquired knowledge during play. It gives the opportunity among other innovative features to present multimedia content, to simulate processes and structured stories. The different assets of the game, the user interfaces, and the mechanisms (e.g. rewarding system) enrich learning activities and gaming experience, providing active engagement to the users.



An in-game screenshot of the online educational game which depicts the three-dimensional environment within the browser. By looking carefully one can distinguish the oil-spill pollution in the background near the shore.

O5. Pedagogical Handbook

Aim of the Sea4all Pedagogical Handbook is designed to be used as a useful guide for school teachers, educators and counsellors. It consists of conceptual knowledge, pedagogical approaches and assessment methodologies based on successful and inspiring experiences on marine pollution. The ultimate goal is the transformational learning and the acquisition of new attitudes and behaviour on marine pollution by the pupils in class but also by the whole school community. It describes in-depth information, basic concepts, definitions and innovative methodological approaches on marine pollution for School Education, in collaboration with the Training Curriculum that provides the theoretical framework and the competencies identified within the ESD.

The Handbook consists of an introduction on the theoretical framework of sustainability, a detailed glossary, additional readings and recommendations for raising awareness, but most important of all it consists of 10 exhaustively analytical lessons for cultivating consciousness and acquiring knowledge on marine pollution issues. The lessons can function as models and inspiring examples, for teachers to use them in class and adapt them and take them further, according to the needs and pursuits of their pupils. The lessons are designed in such a way that they can be used as such and autonomously in classroom. Every lesson is composed of 2 or 3 units were the objectives, the time needed and the necessary materials are clearly defined. Every unit is composed by a number of different activities offering innovative and useful information, proposing experiential and exploratory learning activities, learning through interesting challenges, activities with multi-faceted goals such as cognitive, socio-emotional experiences, through worksheets, etc

Partners

Foundation for Research and Technology – Hellas

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Regional Directorate Of Primary And Secondary Education Of Crete

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