



emsea

EUROPEAN MARINE SCIENCE EDUCATORS ASSOCIATION

BOOK OF ABSTRACTS

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ORAL PRESENTATIONS

BLUE EDUCATION





How was the pandemic an opportunity to create a new education strategy in aquariums? The example of the Oceanário de Lisboa

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Public aquariums are inspiring places where society can understand the importance of the ocean, and its role in human wellbeing and sustainable development. They create an exceptional environment, which represent a unique and credible channel to promote ocean literacy. The Oceanário de Lisboa has been a reference in blue education, engaging more than 1.6 million participants in its programmes, since 1999. The pandemic caused the greatest disruption to the education system in recent history, affecting 1.6 billion students in more than 190 countries. School closures created an unprecedented challenge for the education system, but also for the institutions that promote knowledge about the ocean.

However, the pandemic was also an opportunity to rethink the educational strategy, to create innovative programmes, expand beyond walls and reach new publics. To keep a close relationship with society and school communities, during the lockdown, the Oceanário created five new online programmes for schools, in which students, from Pre-K to high school, could visit the aquarium without leaving their homes. The Oceanário also launched a monthly newsletter for teachers, which included curiosities about marine life, and activities to engage students in ocean literacy. Moreover, every month, social media followers can join a live stream on Instagram to know more about the aquarium, often with the participation of aquarists, already with 16,161 visualizations. In 2021, for the first time, the Oceanário's school programmes took participants beyond the aquarium, to discover the natural world of the Tagus estuary, where it is possible to have encounters with flamingos and learn about the traditional culture of salt production. In 2022/2023, this new strategy will continue, with new programmes for schools, where students will explore the biodiversity of the intertidal zone, at beaches around Lisbon.

To target new audiences, and engage returning tourists in the conservation of marine biodiversity, different experiences were created: "Tagus Dolphins" allows participants to discover the dolphin of the Tagus river, accompanied by a marine biologist; the Manta Conservation Experience provides participants with the opportunity to dive with mantas around the Azorean island of Santa Maria, and join the research team of the Manta Catalog Azores project, contributing to the conservation of these species; the Lisbon Ocean Experience takes participants aboard the tall ship Santa Maria Manuela, on an expedition of environmental and cultural enlightenment, guided by a marine biologist, through the coastline of Lisbon and the Arrábida National Park. Additionally, a new corporate education programme was launched, tailored for companies worldwide that want to assume an effective commitment to a more sustainable future and foster behavioural change through basic training in environmental citizenship for employees. It has three training courses (sustainability, marine litter, and climate change) and four team-buildings activities (dolphin and birdwatching, beach clean-up and circular economy). With this new educational strategy, the Oceanário de Lisboa aims to do things differently, and take a step toward a more informed and sustainable society.



Learning with and about the ocean in or through school: A systematic scoping review

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The ocean plays a critical role in sustaining all life, yet children and young people enjoy very little opportunities to learn about this critical role through formal education. This presentation will provide an overview of the preliminary results of a scoping review aiming to map the extent to which children have experienced learning about the ocean in or through school worldwide to date. The review was conducted following the Joanna Briggs methodology for scoping reviews. Given the wide scope of the human-ocean relationship, encompassing many topics and dimensions, this review took a broad approach to defining ocean learning seeking to capture as many instances as possible of opportunities enjoyed by children to learn about the human-ocean relationship through school. Scopus was searched to identify peer-reviewed articles published in English and Portuguese up to June 2021 relating to studies conducted on interventions to integrate topics in formal education, including through fieldwork and school visits. The database search yielded a total 7,644 results of which 72 met the criteria for inclusion in the final review, indicating that there has been a significant effort to include ocean learning in formal education reported in the literature. However, most of the studies found have been published in the past 20 years, and mostly in the Minority Western world. Additionally, there is a strong narrow emphasis on assessing students' levels of knowledge and awareness of ocean topics, with very little effort to focus on other important factors contributing to pro-environmental behaviour. There is also a scarcity of studies attempting to investigate change over time, with most studies involving a short-term intervention, very rarely followed up. A range of pedagogical approaches have been used with a strong emphasis on promoting students' understanding of their local environment. By attempting to map the current state of evidence of ocean learning in formal education, this review contributes to identifying future priorities for research and practice in enacting education's role to tackling the climate and ecological crisis.



Emerging network of marine schools: the experience at the Institut de Ciències del Mar (Barcelona, Spain)

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Despite its great importance for the ecosystem and in our daily lives, the ocean still remains underrepresented in formal teaching around the globe. Since its beginnings, the Institut de Ciències del Mar in Barcelona Spain, a multidisciplinary marine research centre, the fourth largest research institute of the Spanish National Research Council (CSIC) and the largest dedicated to marine research has been committed to bring the knowledge built at the institute to society. An open-access repository of educational and didactic resources (ICM Divulga), regular visits and activities with and for society and different educational projects covering different subjects (e.g., Physics, Biology, Biogeochemical cycles, etc.) are some of the efforts developed during the last years. During 2020-2023, the ICM-CSIC is one of the participants in the European H2020 SwaFs project (ResBios) that incorporates Practices in Responsible Research and Innovation. One of the specific objectives of the ICM-CSIC is to create a common space to connect enthusiastic actors committed to incorporate the ocean vision in formal teaching. In this space, practitioners also learn from each other and share resources and best practices. During the scholar year 2020-2021, a first pilot phase was conducted with seven high schools. In this presentation, the results of this experience and the resultant emergence of the Network of Marine Schools from the ICM-CSIC will be explained as well as the implementation of a formative action and the support plan to make it last in the long term.

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The power of music to deliver blue education and public engagement: the experience of the Claddagh National School in Galway (Ireland) and the Marine Institute's Explorers Education Programme

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Music is a fundamental part of popular culture, and it has been largely proven to be an effective tool to promote environmental education. A survey conducted in 2019 by the National Concert Hall has shown that for Irish people music is the most important cultural facet. This presentation will highlight the power of the collaboration of musicians, outreach teams, teachers and children working together to make a difference in sharing ocean literacy with others in the community. In 2021 Galway Atlantaquaria and the Irish Ocean Literacy Network (IOLN) formed a collaboration with the Galway Ukers, a non-professional musical ensemble to carry out the project 'Amhráin na Mara' ('Songs of the Sea') aimed at raising ocean awareness and action via the creation of original marine-themed songs. In Spring 2022, the music project was further developed via a collaboration with the Claddagh National School in Galway and the Marine Institute's Explorers Education Programme. The work was part of the school's participation in the Explorers 'We are Ocean Champions' school project, which aims to develop children's connection with each other, their local environment, as well as with their local community – becoming ocean champions! The project focused on 'healthy oceans and marine environmental care', it was entered in the ocean literacy creative category and has been successful in winning one of the awards. As part of the Explorers outreach, the 5th class (age 10) were introduced to the ocean literacy principles and marine biodiversity. They then carried out their own research about their favourite marine species and a range of other marine topics of their choice, and were asked to write how they would imagine a healthy and clean ocean. Working with the Galway Ukers, a new original song was composed based on the students' ideas, called 'How we wish the Ocean was blue'. The students recorded the song with a number of the Galway Ukers in the school recording studio, and a video was developed using pictures taken during the performance as well as drawings about the ocean made by the class. Also, as part of their work for the 'Ocean Champion' project, the students recorded a podcast presented by their teacher about some of the marine species and facts they had investigated, which has had a reach beyond the school. The project had a significant impact and engagement with both the children and members of the Galway Ukers, where the lead musician of the group noted that this collaboration has taught him a lot about the ocean. Pre- and post-evaluations will be used to evaluate the effectiveness of the songwriting process in the learning experience of the students. This will be achieved by repeating the knowledge questionnaire which was carried out by the class teacher at the start of the project again at the beginning of the new school year, plus student interviews. Results will also be compared with schools who participated in the 'Ocean Champion' project but used different approaches, which involved visual arts, beach clean ups and seashore safaris.



Meet the Swedish Network for Ocean Literacy

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We will present the Swedish network for ocean literacy - how we work and how we manage to have such an outreach. We will also give examples of ocean literacy teaching and methods at a marine laboratory field station by the Swedish west-coast.

Since the start in 2020 the Swedish Network for Ocean Literacy has grown to over 500 members working within different sectors of society; mainly schools, nature schools, universities, aquariums and science centers, but also authorities, companies and artists. The network is organized with a "source to sea perspective" with two branches - one freshwater branch and one marine branch, which is coordinated by the Swedish Institute for the Marine Environment (SIME), a cooperation between five Swedish universities.

CREATIVITY, INSPIRATION AND KNOWLEDGE

The main objective for the network is to provide opportunities for the members to meet, interact, enhance their knowledge and most of all become inspired. The pandemic has of course had its effect upon the different activities, but through modern technique (mastered by so many of us by now), the network has been able to arrange a large number of activities. Among these; workshops with a regional perspective, how to communicate ocean literacy by films and filmmaking, music, theatre and storytelling, tips on technical equipment, fact based workshops about e.g. seaweed and algae, and very hands-on tips and tricks for outdoor learning. The network also arranges a yearly national conference. Through the close connection that SIME has with marine universities in Sweden we have access to the latest marine research in our country. This provides a good opportunity for researchers to reach out to a very important target group - marine educators, giving them updated knowledge and news about the ocean.

MEMBERS ARE THE BACKBONE

The network always opts for a bottom-up perspective where we try to engage our members in planning the activities; ask them what they want to learn more about, if they would like to contribute etc. The members are the backbone of the network.

A good example is the Tjärnö Marine Laboratory (University of Gothenburg). Tjärnö Marine Laboratory is a national and international resource for university education and research, within several marine disciplines. The surrounding environment, the lab facilities, and the most species-rich aquarium in Sweden, provide an outstanding arena for outreach activities.

For both school classes and the public Tjärnö offers guided tours, beach excursions, field trips with the research vessel and ROV-filming.

During this workshop marine biologist Christin Appelqvist will highlight some of the public activities at Tjärnö and how the marine laboratory is working with ocean literacy.



Educating a blue generation: the growth of a pilot program and two years of impact assessment

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¹Oceano Azul Foundation

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The program Educating a Blue Generation is currently promoting ocean literacy in more than 200 Portuguese elementary schools of six pilot municipalities in mainland Portugal and in the Azores Region. Since 2018/2019, more than 1100 teachers have received training and educational materials that allow them to integrate the ocean topics into the curriculum of the first cycle of basic education in Portugal, with a flexible, practical and multidisciplinary approach.

The results of two years of external evaluation of the program adequacy and impact, in the pilot municipalities of mainland Portugal, revealed that teachers who received training feel empowered to promote ocean literacy when teaching the curricular topics of the 1st cycle of basic education, and that 84 % of them are implementing the program in schools, either integrated in the curricular disciplines and/or under the context of schools' curricular flexibility.

The longitudinal evaluation results also revealed that students across all the pilot municipalities increased their knowledge and attitudes towards ocean conservation and that 85% of the students are conscious about their influence on the ocean, among other indicators that will be shown.

Moreover, ocean related projects are increasing in the schools involved and the program is also increasingly mobilizing students for action within the community, fostering the collaboration with NGO's, partner municipalities and other local entities. An example was the strong mobilization of more than 1400 students to beach or river cleanup actions during the week of the International Cleanup Day in September 2021. The evaluation process also allowed the identification of topics that are most difficult for teachers and need reinforcement, and the need for some adjustments, that are being considered in order to improve the program adequacy.

The COVID pandemics seriously affected the regular functioning of schools everywhere and urged the need for digital solutions. In our program, the teachers training action was adapted to e-learning format and new materials were produced to guarantee the practical and interactive nature of the training, as well as digital resources available to teachers. A digital platform was developed in order to host the training actions, and a repository of educational resources. This platform will also improve communication within the teachers community and will facilitate follow-up actions, as well as the share of good practices.

The evaluation results and the adjustments made according to the identified needs have been crucial to key stakeholders such as the ministry of education, strengthening a collaboration that will be fundamental to scale the program and to continue paving the way for the implementation of a blue curriculum in Portugal.

OPEN SESSION





Ocean Literacy research: essential to Ocean Literacy and UN Ocean Decade success

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What began as a mission to incorporate ocean science in US science education standards is now international, including a global Ocean Literacy Research Community (OLRC) and Ocean Literacy With All, an endorsed United Nations Ocean Decade Programme (Component 2 is Ocean Literacy research). The original definition, the ocean's influence on you and your influence on the ocean, has three critical components: 1) understanding the Essential Principles and Fundamental Concepts; 2) communicating about the ocean in a meaningful way; and 3) making informed and responsible decisions regarding the ocean and its resources. This three-pronged approach - knowledge, communication, and decision making - is critical to the development of an ocean literate society; however, Ocean Literacy research indicates it is not enough. Recent research suggests at least 10 dimensions - awareness, attitudes, knowledge, behavior, activism, communication, emotional connection, adaptive capacity to change, trust and access, and experience of and with the ocean.

As Ocean Literacy initiatives and discourse continue to evolve, there is a growing focus on the importance of Ocean Literacy research. In response, the OLRC, initiated in July 2021 as part of the UN Ocean Decade's Laboratory series, convened an interdisciplinary global network of marine educators, social scientists, policymakers, and community practitioners. OLRC members define Ocean Literacy research as "an interdisciplinary, cross-sector field of research which explores the diverse dimensions, drivers, influences and impacts of ocean literacy initiatives, and how these aspects may vary in different social, economic, cultural, political and geographic contexts." Additionally, the OLRC co-identified priorities as a starting point for ongoing Ocean Literacy research during the UN Ocean Decade and beyond: 1) measuring Ocean Literacy and its impact; 2) Ocean Literacy and climate change; 3) Ocean Literacy as a policy tool; and 4) Ocean Literacy and sustainable blue economies. The research theme of justice, equity, diversity, and inclusion is cross-cutting. The OLRC also co-developed a forward-looking research agenda focused on improved collaboration between different actors and groups, enhanced engagement with a more diverse range of communities (and their values), and long-term funding to support research to facilitate the success and impact of existing and future Ocean Literacy initiatives.

Ocean Literacy research can inform large-scale projects with support from diverse stakeholders. A key example is the Canadian Ocean Literacy Coalition (COLC), an alliance of organizations, networks, institutions, and communities working together to better understand and advance Ocean Literacy in Canada. COLC grew out of a small informal consultation and national workshop in 2018, leading to the development of an 18-month, mixed methods research study in 2019-2020 involving over 3,000 Canadians and more than 400 organizations across five regions and nine sectors. The study findings led to the co-development of the first national Ocean Literacy strategy (2021).



Additional Ocean Literacy research initiatives are underway. The UK is currently conducting an Ocean Literacy survey, expected to continue throughout the Ocean Decade. Brazil, South Africa, and Nigeria are in the early stages of an Ocean Literacy assessment. This presentation highlights multifaceted efforts of OLRC, including potential session attendee involvement in a multinational survey.



What the non-textbook can teach its authors?

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March 2020 was the time when the whole world stood on its head. Many industries stopped working, including marine education. All the classes, workshops, and field trips were canceled. But the hallmark of maritime educators is their creativity. Many of us came up with various solutions that allowed us to reach recipients despite the horrific situation.

"Non-textbook of oceanology" is a pandemic-driven project of bringing ocean science to the public. This project is led by the Gdynia Aquarium a branch of the National Marine Fisheries Research Institute, the Institute of Oceanology of the Polish Academy of Sciences, in cooperation with the Sopot Scientific Society and Today We Have. These are short films in which marine scientists and educators, using plain language, talk about oceanology, marine biology, marine chemistry, and natural processes. Ocean literacy is the main goal of this initiative. The other aim is to disenchant the image of scientists. To show that their work is unique and requires passion and that scientists are like any other humans. Not as pop culture portrays them. This project is led by the Gdynia Aquarium a branch of the National Marine Fisheries Research Institute, the Institute of Oceanology of the Polish Academy of Sciences, in cooperation with the Sopot Scientific Society and Today We Have. These are short films in which marine scientists and educators, using plain language, talk about oceanology, marine biology, marine chemistry, and natural processes. Ocean literacy is the main goal of this initiative. The other aim is to disenchant the image of scientists. To show that their work is unique and requires passion and that scientists are like any other humans. Not as pop culture portray them. The videos are published on social media.

Many of the initiatives that arose in the first wave of the pandemic did not last long. "Non-textbook of oceanology" is an initiative that is still ongoing. Like on day one, it is a bottom-up project, with no external financing, invented by ordinary employees, based on the social network of local marine biologists.

The project evolves. We learn from our mistakes, evaluate and conduct modifications. The initiative has become a locally recognizable brand. New scientists, educators, and activists are willing to come forward and present their research problems to the audience of "Non-textbook of oceanology". In the coming school year, the series opens up to foreign cooperation and the invites of scientists from abroad.

How to support nonexperienced scientists willing to perform in front of a camera?
Should everyone perform? What should a freshman guide contain?

This presentation is a story of ups and downs and lessons learned from all this initiative. It showcases what over 2 years of nonprofit interinstitutional cooperation have taught us.

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LIGHTHOUSE VS SEA, Participatory narrative theatre on climate change

Meeremans P.¹, Teerlynck R.¹, David J.¹, Moerman B.¹

¹Horizon Educatief vzw, Belgium

Explaining the complexity of climate change to citizens is not that easy. If you point a finger, you quickly lose attention. With Horizon Educatief, we wanted to bring the problem of climate change and the role of the ocean to coastal tourists in a rather fun way. In the summer of 2021 and 2022 we brought an active and participatory narrative theatre on the beach of Ostend, aimed at tourists. We created a funny story that is performed by 3 actors on the beach. In the story, the Lighthouse is at odds with the Sea. The Sea is an absolute fan of climate change because it is only growing. The Lighthouse has some more reserves and wants to protect the people from flooding by the sea. On the beach, the two engage in a dialogue and challenge the participants to think of solutions. The group is divided into two camps, each trying to protect the coast in a different way. One by implementing hard coastal measures (placing sandbags), the other by natural based solutions (creating some kind of oyster reef). The participants are put to work in a fun context and learn about climate change, coastal protection measures and solutions. The theatre is performed during high tide near a work of art by Rosa Barba, Pillage of the Sea. In this way, art and science are united in a playful piece of theatre on the beach.



Fins into the water: Ocean Literacy into practice within the Tavolara - Punta Coda Cavallo MPA (NE Sardinia, Italy)

Gaglioti M.¹

¹Tavolara Diving /EMSEA Med Working group

The Ocean Literacy is one of the main goals of the next decade from a blue perspective. As diving-aholics and sea-addicted we are aware of our privilege as divers. This becomes even greater if we look at marine environment with the eyes of SCUBA diving instructors and trainers engaged in the mission of outreach and blue education of the upcoming generations of divers. On this perspective according to the multidecadal experience of Tavolara diving team, at the end of the 2022 summer season we turned an old friendship into a blue education experience. "Fins into the water" is the right expression to open an eye on our daily commitment amongst bubbles, surrounded by groupers and seagrasses or holding our tanks on the shoulders. Since this field experience to date is sounding great, even if mainly engaged in a non-formal education context, on this perspective we decided to join the EMSEA Conference event for an oral session. This will be a great occasion for us as a team in order to share with all of you some our insights, exchange ideas and unveiling the most relevant aspects of some upcoming initiatives for the season to come.



Is Nemo still around?

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Within the scope of the Open Week of Science and Technology of the University of Aveiro (UA), we created an awareness-raising action for the protection of coastal areas and oceans, "Tá-se bem à BEIRA-MAR ... the planning and protection of resources and coastal areas". Beyond the UA's Open Week of Science and Technology we carry out this action whenever there are organized visits to the department. The workshops have the following objectives: - alert to the conflicts of uses existing in these areas, the associated risks and the role that populations can and should play in protecting this territory and its resources; - to present the existing planning figures and instruments, as well as the role that users and residents can and should play in their implementation.

Aimed to focus the children and young people from pre-school to secondary education, it includes different types of activities suitable for different age groups. In this communication, we focus on activities aimed at children in pre-school and 1st cycle of basic education. We propose a set of activities, like: a) the sea tells stories; b) the flavour of the wind and the sound of the waves; c) between a whale and a shark; d) but who is responsible? Which intend to alert the target audience to the problems existing on the coast and in the oceans and simultaneously show and encourage more sustainable ways of using and conserving their resources.

The movie Finding Nemo, from 2003, was the starting point of the approach to the protection and conservation of coastal and ocean spaces and resources. Nineteen years later, is the message still actual? What changes can we figure out? How can we adjust the aim of that "old action", to the current needs in the field of environmental education and ocean literacy? Those are the questions we try to answer in the present paper.



Rise up children and youth voices for the ocean: the open letter to the United Nations

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The “RISE UP - Blue Call to Action” is a joint call by civil society, fisherfolk, Indigenous peoples and philanthropic organizations, to governments and corporations, to join and agree to bold action to safeguard the ocean. It sets out common priorities, objectives and targets that are vital to tackle the ocean crisis and is currently subscribed by more than 550 entities of the civil society.

Children and youth are agents of change and have the right to be heard and that their opinions are considered in a serious way in decision making and policymaking - according to Article 12 of UN Convention on the rights of the child and Article 24 of EU Charter of Fundamental Rights. Therefore, it is of outmost importance that their opinion is considered when taking decisions that seriously affect their future and the future of the Planet, as it happened during the 2nd United Nations Ocean Conference. With this view, a consortium of entities that implement educational programs promoting ocean literacy in Portuguese schools - The Portuguese Ministry of Education - through the programs “#Estudo em casa” and the “Clubes Ciência Viva na Escola” network -, Oceano Azul Foundation and Oceanário de Lisboa - through the program “Educating a Blue Generation” -, and the Ministry of Economy and Maritime Affairs through the “Blue Schools” program, mobilized more than 21.000 Portuguese students of more than 320 schools where these programs are being implemented, to express their opinion on a referendum to the priorities identified by RISE UP. Students were asked to vote in three RISE UP topics, underpinned by specific priorities for the ocean, that they considered the most important and urgent. In a second moment, a student assembly with representatives of all these educational programs, discussed specific actions for each of the most voted topics. Group discussions included students of different ages and one adult per group, including the Portuguese Minister for Education, a professional bodyboarder, and a representative of one of the pilot municipalities, among others. All these entities committed to the proposed actions.

We will present this process, the results of this referendum and the conclusions of the assembly of students, that resulted in an open letter to the United Nations, signed by the participating students and subscribed by all the organizing entities, and that was delivered to the United Nations to be considered during the 2nd United Nations Ocean Conference.

CAREERS AND JOBS IN THE BLUE ECONOMY





The Eurofleets Marine Professional Training for a sustainable ocean business

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Blue Economy must include a knowledge-based economy based on data and information generated through observations to support sustainability within existing blue economy sectors, to address societal challenges, and to inspire solutions for ocean related issues.

The major technical developments of the last two decades have opened up the deep oceans for a new, high-tech level of exploitation such as oil and gas extraction and more recently deep-sea mining in ecologically sensitive areas. Marine scientific research is key, not only for understanding marine ecosystems, but also in developing ways in which the world's rapidly rising population can benefit from these resources in a sustainable manner.

Eurofleets offer a broad spectrum approach to deliver key skills and capacities needed to meet emerging challenges of the blue economy.

Shared Research Infrastructures offered by Eurofleets+ represent a unique opportunity to offer education and training in marine sciences research activities, attract new Users and prepare the next generation of Marine professional.

Eurofleets+ consolidates, advances and extends the successful education and training delivered in the previous Eurofleets projects, since 2009, opening up world-class marine infrastructures beyond research communities. These actions help bridge the gap between highly-developed and less-developed countries to facilitate collaboration and global interoperability. The training activities use state of the art communication tools and digital technology and are targeted to different users' needs and experience. In order to consolidate and improve the training of marine sciences related young scientists and students, it is necessary to offer more specific and professional courses recognized as continuous professional development. These innovative, accredited activities will ultimately build capacity for sustainable blue growth in Europe and globally.

In particular, Eurofleets+ Training activities aim to:

1. Build capacity in European ocean science research through a series of innovative workshops, labs and floating universities targeted at postgraduate students, early stage researchers and professionals.
2. Facilitate the transfer of knowledge and technology through exchange and mobility of personnel.
3. Increase participation of women in ocean science along with users from less equipped countries.
4. Engage teachers and educators in ocean exploration to promote Eurofleets+ activities to the students worldwide.
5. Attract primary and secondary school pupils to careers in ocean science thereby inspiring the next generation of marine scientists.
6. Create an "Ocean Literate" public through targeted engagement of innovative ocean exploration activities.



Ship officers class seafarers coaching, mentoring, and career evaluations in Turkey maritime education

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Turkey has a very distinctive strategic location on important maritime trade routes. As a consequence, maritime trade activities in the Mediterranean region date back to ancient. The first seafaring academy for commercial shipping was established in 1886. Originally there was only one school in Turkey that trained ocean-going masters in the field of commercial maritime until the 1990s, nowadays there are many courses, schools, and faculties at all levels. The İstanbul Technical University Maritime Faculty, the first education and training institution to meet the high-level manpower requirements of Turkish maritime transport, was founded on December 5, 1884 as the Leyli Merchant Captain School. It was changed its name the High Maritime Trading College in 1934 and was linked to the Ministry of Transport in 1939. On 03.06.1946, renamed and reorganized as the "Maritime High School", and it was transformed into a higher education institution consisting of Deck and Machinery departments under the Ministry of Transport. On 18.08.1981, it was connected to the Naval Forces Command and its name was changed to Maritime High School by law numbered 1507. On 03.07.1992, the law numbered 2809 established today's ITU Maritime Faculty. Its activities have continued as a maritime faculty within the body of Istanbul Technical University. By giving importance in sector to graduate and satisfy number of high rank of seafarers, set up of new of maritime colleges and universities accelerated at the begin of the 2000s. The number of maritime schools and courses started to increase quickly from the beginning of the 2000s. 23,520 students are studying in 91 schools as of 2021. The number of students studying in the maritime field in Turkey increased by 17.2% in the 2020-2021 Academic Year compared to the previous year, reaching 23,520. Every year, the number of officers in Turkey rises. Seafarers trained by Turkish public authorities and maritime stakeholders are expected to work in maritime companies in European Union and developed countries. Pandemic conditions helped to this process and lots of Turkish seafarers started to work in EU shipowners' fleets. Prior to privatizations in Turkey, the government D.B. Maritime Shipping Lines provided practical maritime professional experience as an institution where seafarers officer candidates completed their internships. Within the hierarchy of former graduates, and between classes, and the upper and lower classes, experienced officers were guiding the new officers in the profession. Scholarships were provided by a Turkish shipping company. There are issues with the orientation of the maritime students to the profession and career options due to the increase of schools in Turkey, the difficulties in recruiting trainees, and the creation of sub-specialties according to ship and transportation types. They are seen leave the marine industry and the sea earlier than expected as a result of poor career planning. The coaching, mentoring, and career planning components of ship's crew training in Turkey will be assessed, and recommendations will be made.



Ocean Literacy for a more sustainable blue economy: maritime professionals and their connection to the ocean

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Several initiatives to connect people to the ocean have been carried out in the last years. The effectiveness of these initiatives is usually not easy to assess given the lack of baseline data on the ocean literacy levels of participants. However important this baseline data, there are only few studies that quantified the levels of ocean literacy in society, this was mostly done for pupils at school. To date, there is no data on ocean literacy levels available for other sectors of society such as the blue economy. In this study, we deployed the Blue Survey, a validated survey to measure ocean literacy, among maritime professionals in Europe. From a total of 710 participants, 536 complete responses were used in the analysis. Using two Exploratory Factor Analyses (EFA), we found that ocean literacy was composed by five dimensions, viz. knowledge of ocean-related topics, attitudes towards ocean sustainability, ocean-friendly behaviour, attitudes towards the use of the ocean and personal interest. Our results indicated significant relationships between sociodemographic variables such as age, coastal precedence, blue economy sector, company size, occupation, and each of the ocean literacy dimensions. Additionally, we identified discrete groups of maritime professionals using cluster analysis. These results might set a benchmark for current and future blue initiatives targeting maritime workers and may help researchers and practitioners to better understand the factors which contribute to shaping an ocean-literate maritime professional.

OCEAN TECHNOLOGY & EDUCATION





IOT low cost sensors to study marine litter dispersion: a citizen science approach developed in the framework of the EU BlueS_Med project

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The BlueS_Med project, funded by Erasmus+, involves 10 partners from four Mediterranean countries: France, Italy, Greece and Malta. Its objective is to involve pilot blue schools of various age groups to develop marine educational activities, also called 'blue challenges'. Project partners, school teachers and pupils co-create projects to inspire action for the protection of the Mediterranean Sea, together with local stakeholders.

In the framework of this project, the Italian partner CNR-ISMAR, together with the EU Blue School IIS Capellini - Sauro of La Spezia, proposed the implementation of a "dispersion experiment" carried out with a citizen science approach to study how anthropogenic waste is transported from river into the sea, to follow its dispersion and to understand how it is distributed on the beaches. The experiment has been coordinated by CNR-ISMAR and INGV (Istituto Nazionale di Geofisica e Vulcanologia), in collaboration with other CNR institutes (IFC and IGG), and supported by the Migliarino, Massacciuccoli and San Rossore Natural Park - the area where the experiments were carried out - and by the State Police, which provided its boats and personnel. In the period between January 2022 to May 2022, four classes of the "electronics/informatics" and "chemistry" courses at IIS Capellini-Sauro, about 80 pupils and teachers, were involved in the design and implementation of special smart "drifters" that can be used to track the movement and dispersion of waste from rivers to the sea. It consists of "real traceable waste," i.e., plastic bottles of different shapes and sizes, as well as wooden tablets, on which a "smart" tracking system has been installed consisting of low-cost electronics and solar panels to ensure complete autonomy. The tracking system is based on the GSM network and guarantees a range of no more than 10 kilometers from the coast, but allows the tracking to be recorded and all data to be sent next time it is connected. This practical activity put the pupils through their paces as part of a large research project, sharing and developing various skills, such as teamwork aptitudes. The activity involves many subjects such as: chemistry, computer science, electronics, physics, maths, English, biology, history, fitting perfectly into a project based on a "Blue STEM" approach. Moreover, it is a way to disseminate scientific topics among citizens and pupils of various levels and grades, making them aware of and, above all, participating in the problems, thus contributing to the request of the Marine Strategy Framework Directive (2008/56/EC, Galgani et al., 2010, 2013, 2014) to increase monitoring studies and people's awareness of the marine litter (ML) problem.



AULAMAR: a school project for coastal oceanography

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We present the ongoing educational project AULAMAR, born with the objective of promoting a harmonic relation between the citizens of Barcelona and the sea. Today, Barcelona's coastal ecosystem is in a state of vulnerability due to the pressure of urban activity and climate change (Harley et al., 2006). Furthermore, the pressure of tourism during the last decade has reduced the possibility that the citizen be fully aware of the health and emotional values of its marine environment. In order to help revert this situation, we have design AULAMAR, a real oceanographic research project for the youngest generations. AULAMAR is a science education project for high school students in the framework of citizen science, willing to offer tools to better understand the city's coastline and encourage critical reflection. AULAMAR is the continuation of the successful experience of the Patí Científic, a citizen science project (Ortigosa et al., 2022) where sensor prototypes were developed and installed in sustainable boats or other recreational sailing devices (i.e., rowing, surfing kayaking). In the frame of AULAMAR, high school pupils will build seawater monitoring low cost instruments during educational workshops, in particular temperature-depth profilers, bathymetric probes, multi-parametric fixed stations and micro-plastics tow nets. The participating schools will have the possibilities to make their own instruments and take the measurements, which will be available on an open database. In this way, schools will be able to actively participate towards a better knowledge of the health of their coastal environment. The measurements and other activities, such as workshops, are expected to increase the awareness of non-specialized public about the interaction between coastal cities and marine ecosystems. Moreover, these oceanographic instruments will help increase the amount of physical variables measured through sustainable boats and devices. We will present the first results already achieved with different scholar groups.



The impact of a digital ocean education program during Covid-19 pandemic: discover the ocean with Kids Dive

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Kids Dive (www.kidsdive.pt) is a hands-on ocean literacy program that includes specially designed underwater educational activities. In 2020-21, during the Covid-19 pandemic, it was fully replaced by a virtual program in order to cope with the social restrictions imposed at the time. The new program involved target schools in activities such as: 1) a scuba diving experience with cardboard virtual reality masks (VR360), via ZOOM; 2) live field sessions from local intertidal rocky shores to nearby target schools, via IGTV; 3) virtual guided visits to Lisbon Oceanarium and Lisbon Zoo (Portugal). To evaluate the impact of this virtual program in each participant learning experience, inquiries were designed to: i) measure different levels of ocean literacy; ii) evaluate students' attitudes and behaviour towards marine protection; and iii) assess the overall curiosity to further explore the ocean with real scuba diving activities. The 201 valid pre and post-program inquiries were equally distributed between both genders and included students from the 8th (12 years old) to 11th grade (16 years old) from different regions in Portugal. A significant increase on different levels of ocean literacy were observed throughout this study, even considering the pandemic constraints. Significant differences were also detected between school years but not between genders. The program impacted mostly 8th and 10th grade students which, in the Portuguese learning system, are also the ones with biology and ecology in their programs. In our view (not evaluated by the inquiries) this could be related with the reinforcement made on marine conservation topics by the teachers in the classroom. This program brought no significant changes in students' attitudes and behaviour towards marine protection, but we must consider that most behavioural changes were severely limited during social confinement. However, higher female students' proactivity, which was already present before the program, persisted throughout this study. Interestingly, striking differences were found considering the overall curiosity to continue exploring the ocean in the future and the potential use of virtual tools in ocean literacy programs. Willingness to engage real scuba diving activities increased from 64% to 94% after the virtual experience. Also, the positive view of VR360 cardboard masks as effective educational tools, facilitating the understanding of scientific contents, increased from 52% to 92%. These cardboard masks can be individually sent to schools and have the advantage to be inexpensive and therefore more inclusive educational tools. They can be shared with each student friends and families or even be used for other educational activities, with the recent increase in VR360 contents available online. Digital learning tools can reach wider audiences, can engage communities away from the ocean, can attract students that are more prone to technology than to scuba diving or field activities, can reduce the ecological footprint associated to environmental education activities and adapt educational programs to additional social confinement periods. In the future, coupling practical and virtual activities, such as local dives and field surveys, will probably increase the impact of these programs, promoting an emotional connection to the Ocean.

Blue education and the European Atlas of the Seas: new developments!

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Looking for a user-friendly interactive map-based educational tool on the ocean?

The European Atlas of the Seas (www.european-atlas-of-the-seas.eu) is an online atlas available in 24 languages. Thanks to its multilingual features, the European Atlas of the Seas makes it possible for citizens from all around Europe, teachers and students to explore a wide range of popular marine topics, such as environment, marine life, nature conservation, sea surface temperature trends, sea level rise, marine litter, fisheries, aquaculture, tourism, energy, transport, and much more! With a catalogue of more than 275 interactive map layers that is constantly updated and enriched and the possibility to create custom maps that can be printed, shared and embedded in articles, presentations, websites and blogs, the European Atlas of the Seas is an easy and attractive way to connect to our blue planet and better understand how the ocean influences us and how we influence the ocean. A Teachers Corner is associated with the Atlas where teachers can find ready to use map-based exercises in English, French and Portuguese for students of different age groups as well as fun activities such as a virtual boat race! Students can develop a multitude of competences by using the Atlas such as

- reading, understanding and interacting with a map;
- reading and understanding graphic information;
- creating a map using different map layers;
- measuring distances on map;
- learning to search for information online and summarizing findings into a presentation;
- working in different languages.

The Atlas can thus be used in the classroom to expand knowledge in geography, Science, Technology, Engineering, and Mathematics (STEM), nature conservation, environmental issues, economy and sustainable development. In addition to being used in the students' mother language, the Atlas can also support the students' learning of other languages.

Thanks to the release of the interactive help in 24 languages, teachers will gain a rapid understanding of how the Atlas works and an overview of all of the available features and ways that the Atlas can be used in the classroom. Moreover, students can also become quickly autonomous in their use of the Atlas to carry out their own research for information.

An expanded cognition of the oceans is essential to accomplish the revolution with and for people and nature, the collaborative revolution

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The last revolutions, industrial and digital, have taken humankind to the verge of collapse. The one-and-a-half century old but still ongoing industrial revolution is introducing so much greenhouse gases into the atmosphere that in a few years our planet will have surpassed the thresholds for a non-return climatic change, with major impacts on the most vulnerable populations. The digital revolution is taking far too many individuals, particularly from the highly industrialized countries, into a growing spiral of action whose outcome is fatigue, discouragement and occupational burnout. In these societies, technology turns into an objective rather than a pathway for enhanced inner wellness.

Humankind desperately needs a new revolution, a collaborative transformation with and for people and nature. This collaborative revolution implies feeling and acting as part of nature rather than its owner, a real collaboration among people and with nature, with the ocean as a main participant. Emerging from the true meaning of sustainable development – *subs tenere des-envelopper* or to grow together towards greater complexity – the collaborative revolution is much more than a correct managing of the Earth's finite resources, it recognizes that individual and planetary health are intimately connected, it grows from individual into planetary consciousness.

To reach the collaborative revolution, humankind has to achieve expanded cognition of nature. Intellectual cognition of the functioning and fundamental importance of the ocean in our lives – from its role on climate and particularly the hydrological cycle to the concepts of fluid brain, life as a process, enaction, symbiogenesis and epigenetics – is necessary but not sufficient. To establish lasting connections, intellect has to come together with a continued sensory experience of the oceans. This can be attained with seagoing activities and aided through the innovative combination of arts and sciences. It is only through the combination of mental cognition and sensory experience that we can aim at the expanded cognition of the ocean – only *senses* and *mind* together can bring powerful and lasting *sentiments*.

The collaborative revolution – with and for people and nature – needs expanded cognition – transformative blue education that blends intellectual knowledge and sensory experiences into deep and lasting feelings. The challenge is to develop methods, tools and strategies that can translate this expanded cognition to society, particularly to the school system, the youth networks and stakeholders.

OCEAN CONSERVATION





The power of educational tourism: How to transform marine conservation through unforgettable and meaningful experiences

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Understanding the marine ecosystem is fundamental to address ocean-related environmental issues, to demonstrate the magnitude of the problem and to generate solutions. Moreover, marine conservation is essential to prevent further destruction and to reverse the damage that has already been done. For conservation projects to ensure a sustainable future for the ocean, top priorities should include engaging local communities and tourists in nature conservation and raising awareness of the deteriorating state of marine life and the urgency of protecting it. The Oceanário de Lisboa designed educational tourism programmes based on exclusive and meaningful experiences to engage participants in ocean conservation. The Oceanário finances various conservation projects around the world, including the “Manta Catalog Azores” that aims to provide a better understanding of the mobulid ray population in the Azores and the Eastern Atlantic. Promoting manta ray conservation, the Oceanário launched, in 2021, “The Manta Conservation Experience” to ensure financial sustainability for conservation projects and engage wider society in citizen science. In this experience, divers join the research teams leading the “Manta Catalog Azores” project. For one week, participants get the opportunity to dive with manta rays in the best diving spots of Santa Maria Island and get hands-on experience in conservation research; learn Photo-ID techniques and upload their work on the project’s database, contributing to the wider knowledge of these threatened species and their conservation.

Moreover, in 2022, along with the Portuguese tall ship Santa Maria Manuela, the Oceanário curated the “Lisbon Ocean Experience”, a unique live aboard expedition of ecological, maritime, and cultural discovery. This four-days voyage starts in the company of a local experienced marine biologist for a private behind the scenes tour of the Oceanário. On board, participants can learn to sail as they voyage along Lisbon’s historic city shoreline; explore the coast of Arrábida National reserve by kayak, dive or snorkel; learn more about the unusually diverse ecosystem of the marine protected area, in an educational talk from the resident marine biologist; travel to the Sado Estuary and discover one of only three sedentary dolphin communities in Europe; meet local fisherman and learn how to make, in a sustainable way, the most traditional Portuguese fish dishes. With this experience travellers will be thrilled by unique moments with a deep connection to the ocean and the Portuguese cultural traditions. The “Ocean Experiences” are ecotourism programmes that aim to help grow a wider community of ambassadors for the conservation of the ocean and marine ecosystems.

SAVE THE MED - Regenerating an island through education and community action

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With a Mediterranean Sea in crisis, we shift our objective from conservation to REGENERATION of marine life.

Mallorca is home to a rich biodiversity of species and also one of the biggest tourist destinations in Europe. Navigating such a contradictory landscape is challenging - but it's of paramount importance to create an awareness of our impact on nature and ignite the desire to protect it. Our projects aim to engage schools and communities in an inclusive and effective way - fostering a passion for marine wildlife and a sense of ownership when it comes to the surrounding environmental heritage.

AREAS UNDER REGENERATION - FORMENTOR AND SA DRAGONERA

The Serra de Tramuntana coastline is a UNESCO World heritage site. Surrounding underwater habitats contain key species, but are left fragile and threatened. To successfully regenerate these areas, our team is working with stakeholders to develop a tailor-made protection plan with the local community in mind and involved.

EDUCATION PROJECTS

Dos Manos - why it's no longer a "beach clean"

One of Save The Med's first educational activities and an easy way to involve schools is to conduct beach surveys of ocean plastic with our "Dos Manos" workshop. This free program is not just a simple beach clean, but a citizen science project looking at plastic pollution on the Mallorcan coastline, with a solution focused objective. We want kids to be aware of the problem, its effect on the ecosystem and while gaining a deeper understanding of the root causes of plastic pollution. We focus on REDUCE REFUSE.

REUSE as the Three Rs.

The Changemakers Project - pro-actively changing our plastic lifestyles.

Engaging students aged 8 to 18, with a Junior and Senior edition, the Changemakers project involved hundreds of students over the years and created a wave of plastic pollution reduction in schools around the island. Forming teams, students develop ideas to combat single-use plastic and present them to our panel of judges. As of 2018, we don't accept any clean-up or recycling projects and urge students to tackle the source of the issue: cut consumption and production. Top selected teams are invited on-board expeditions with Save The Med, where they learn techniques in marine biology, spot marine wildlife and study ocean plastic pollution.

Whose mess is it anyway? Rebuilding a broken system.



Plastic pollution (along with climate change, loss of biodiversity etc.) can be an overbearing subject for young students who are learning about environmental issues. One important notion we try to include in our messaging is the understanding that the responsibility of a clean planet is not just down to them. Businesses, corporations, governments and institutions need to be accountable for their plastic footprint and must be involved in the process of finding alternatives to the issue. This is exemplified in one of our projects: Plastic Free Balearics: a certification to help reduce single-use plastics aimed at: companies in the hospitality sector, consultants, trainers and teachers involved in the sustainable economy.



Sea In The Park

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Sea In The Park is an outreach programme that ran across summer 2022 - the aim was to bring the fun and magic of the ocean to a park nearest you. The programme identified 16 community events in Plymouth, UK through communications with various community works who were able to signpost towards underprivileged communities who have lost their connection to the ocean. Sea In The Park connected visitors with the oceans through a variety of engaging activities based at a stall, including a sensory rockpool, shipwreck history games, arts activities and introduced many to using a microscope for the first time. The activities covered more than just science-based topics in order to empower a variety of visitors to become more ocean literate, and to become more aware of what the National Marine Park can provide for them. Furthermore, the programme also provided further accessibility to the path for ocean citizenship through guides and routes for local beaches and free bus tickets to ease financial inaccessibility. A swimwear donation scheme was also set up so people of all ages, size and gender had something to wear whilst exploring the National Marine Park. The response to Sea In The Park was extremely positive, with visitors of all educational backgrounds coming away from the event remarking that they learnt something new and they would apply their knowledge the next time they visit a blue space. We learnt that in Plymouth it was very hard to come across those who had never visited a blue space, but those we had met still needed the encouragement to become more ocean literate. This report aims to show how to deliver informal education to a wide range of audiences, bringing people closer to ocean conservation.



Seagrass – The wonder plant Everyone needs to know about seagrass – why and how?

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Seagrass is the only marine flowering plant, found across the globe from the tropics to the Arctic, providing environmental, economic, and social benefits to humankind including enhanced biodiversity, carbon storage and coastal protection. Almost 30 % of global seagrass has been lost since the 1900's¹. Recent research estimates that in the UK seagrass meadows have declined by 44% since 1936 with 39% of those losses occurring since the 1980's and some values reaching as high as 92% (Green et al. 2021)²

Protecting and restoring seagrass meadows is vital and one way we can do that is to educate, engage and inspire people of all ages to value this wonder plant. Project Seagrass (www.projectseagrass.org) established in 2013 has been a leading force in raising awareness of the value of seagrass. Scientific research has shown our meadows are threatened by a number of anthropogenic impacts from pollution to recreational activities such as anchoring and mooring. Concerns over the latter resulted in a successful bid to the EULIFE programme in 2019. LIFE Recreation ReMEDIES (Reducing and Mitigating Erosion and Disturbance Impacts affecting the Seabed) is a £2.5 million, four-year marine conservation partnership project to save our seabed at five Special Areas of Conservation (SACs) in Southern England. Led by Natural England working in partnership with the Ocean Conservation Trust, Marine Conservation Society, Royal Yachting Association/The Green Blue and Plymouth City Council/Tamar Estuary Consultative Forum. The project has 3 objectives to:

1. Protect and reduce recreational pressures to England's most important and at risk intertidal/subtidal seagrass/maerl beds thus moving 5 SACs towards Favourable condition.
2. Demonstrate large scale successful restoration and management techniques.
3. Promote awareness and inspire better care by recreational users. Use relevant stakeholder networks and public at a local, national and trans-national levels to maximise the longevity and sustainability of the project actions.

The aim of this presentation is to share with the audience the tasks, lessons learnt and results of the first 3 years of the project (since poster session EMSEA 2019) with a focus on education led by our partner the Ocean Conservation Trust. To gauge from the audience the level of Ocean literacy around seagrass in Europe and to inspire all through images, video and conversation why seagrass the wonder plant needs you!

¹ United Nations Environment Programme (2020). *Out of the blue: The value of seagrasses to the environment and to people*. UNEP, Nairobi.

² Green, A.E., Unsworth, R.K.F., Chadwick, M.A. and Jones, P.J.S. (2021). Historical analysis exposes catastrophic seagrass loss for the United Kingdom. *Frontiers in Plant Science*.

POSTER PRESENTATIONS





Marine makers: making and marine science for social impact

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The Marine Makers are a project-based workshop communicating the principles of ocean literacy and marine sciences while equipping the students with practical skills using the frugal technologies of a Makerspace. The first version of the Marine Makers took place with six sessions in spring 2022 in Port Antonio, Jamaica. The Caribbean, especially Jamaica, suffers from anthropogenic disturbances such as overfishing, coral bleaching, and marine pollution. Nevertheless, the ocean is one of the most important resources for the island due to the fishing industry and tourism. Still, few know the consequences of anthropogenic interruptions on the marine ecosystem and adjacent communities. Marine Makers aims at college students who live on the coast and can directly observe or experience ecosystem disturbances. This immediate connection with the ocean might motivate them to become future changemakers within their community. The workshop consists of theoretical and practical sessions. The theory encompasses marine science, microcontrollers (Arduino), sensors, coding, and design thinking. Participants also learn about the United Nations Sustainable Development Goals (SDGs) and how Making, Design Thinking, and frugal technologies can tackle the goals of the SDGs. Since the East Portland Fish Sanctuary hosted the workshop, the students also gained insights into the work at the Marine Protected Area in the field and the lab. During the practical sessions, the students focus on coding and electronics to then use those skills to develop their own projects in a team addressing SDG 14 and 6 by creating solutions for problems within their community. Throughout the project development, the students apply concepts from design thinking and create prototypes of devices that should improve a local problem related to the ocean or preliminary experimental setups that would monitor (marine) water quality. The post-workshop survey showed that the students particularly enjoyed the practical aspects of the workshop. They appreciated learning about Arduino coding and electronics and acknowledged the value of those skills for their professional career. Although this cohort consisted predominantly of students of the Bachelor of Environmental Science and Technology, the session on salt water and its significance in marine ecosystems and related SDGs also provided new knowledge and insights.

Another workshop will be conducted in 2023 for Jamaican students with an adjusted format to accommodate feedback from the last cohort. Because the projects focus on local problems related to the SDGs, Marine Makers could happen in other regions, addressing relevant problems related to the ocean.



Greek prospective teachers' knowledge about marine sciences: a typology development

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Ocean Literacy movement is a broad effort made by scientists and educators to include Marine Sciences in school curricula in order to create a society capable of making informed and responsible decisions to preserve the marine environment. The successful integration of these science concepts into school curricula requires teachers to obtain excellent knowledge of basic Marine Sciences topics. The purpose of this study is to develop a typology for prospective primary school teachers regarding their knowledge on marine environment. For this purpose, the SOLE-30 (Survey of Ocean Literacy & Experience-30) questionnaire was administered to a sample of 250 undergraduate students of a Pedagogical Department of Primary Education in Greece. Their average scores on the SOLE-30 questions revealed a low to moderate level of knowledge. The application of a method that combines Correspondence Analysis with K-means clustering demonstrated that prospective teachers are not a homogeneous group in terms of their level of knowledge on these subjects. In particular, the survey showed that three distinct groups compose the sample of pre-service teachers in terms of their level of knowledge on general Marine Sciences issues. These three groups differ in terms of their socio-demographic characteristics and specifically in the educational level of their parents. Also, they differ in relation to the use of the Internet as a means of information on issues related to the marine environment. The prospective teachers of the smallest group, having parents with a low level of education and being "sporadic users" of the Internet, declaring a very limited use of it both for general issues and for issues related to the marine environment, presented a "low level of knowledge" about general topics of Marine Sciences. The prospective teachers of the largest group, having parents with a moderate level of education and being "basic users" of the Internet, as they presented a basic use of it for issues related to the marine environment, are characterized by a "moderate level of knowledge" on general topics of Marine Sciences. Finally, the prospective teachers of the second largest group, having parents with a high level of education and being "regular users" of the Internet, declaring very frequent use and advanced utilization of it for issues related to the marine environment, presented a "high level of knowledge" for general Marine Sciences issues.

According to the above, the prospective primary school teachers in Greece are in need of different support policies for the acquisition of Internet skills. The implementation of properly adapted support policies to the different profiles of future teachers in terms of the use of Internet Technologies could significantly contribute to the expansion of knowledge on general issues of Marine Sciences. The findings of this study can be used within the curricula of primary education departments to design customized instructional strategies and interventions in order to improve teacher candidates' knowledge of important Marine Science topics and ultimately promote a society that is well-informed on issues of the marine environment.



Teaching about seagrasses in primary education

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Marine angiosperms or seagrasses provide a variety of environmental, social, economic and cultural services to people on a global scale. However, a global trend of seagrass loss has been documented due to the interaction of site-specific anthropogenic stressors. Therefore, increasing recognition of the value, but also the vulnerability of seagrasses is necessary and raising awareness of seagrasses is crucial for the sustainability of these vital marine ecosystems. This awareness should be developed since early age.

The present study examines children's perception of baseline seagrass meadows and tests the impact of an educational intervention with a pre- and post survey. A total of seventy-two 10-11 year-old students from two primary schools located in Alexandroupolis, a coastal town in Northern Greece, participated in the study. A short questionnaire concerning knowledge of and attitudes towards seagrass meadows was developed using clear, age-appropriate language and was completed by students before and immediately after the intervention.

The two-hour intervention was designed to highlight the seagrass environmental benefits and beach grooming practices. It took place in the school class and students worked in teams. The intervention consisted of three activities and also made use of relative video presentations among these activities to support the conclusions which arose from them. The first one concerned a live comparison of a seagrass plant, a seaweed and a grassy plant and students had to complete relative work sheets. The second one concerned a board game which highlighted the importance of the seagrass meadows for the survival of sea animals. The third activity initiated students in scientific methodology concerning seagrass monitoring and students had to compare the coverage rates of two seagrasses in different time periods and suggest possible reasons for the differences on their coverage.

According to the results before the intervention, most students distinguished seaweeds from seagrasses but were not able to understand the difference between the second ones and grassy plants. They were not familiar with the ecological functions of seagrass meadows. Most of them did not know that seagrasses are photosynthetic organisms and that they compose the wrack on beaches, while they also think that this material must be moved away from beaches. After the intervention, children's knowledge about seagrasses and their ecological functions raised significantly. They learnt that wrack is composed of seagrasses and it should not be moved away from beaches.

Overall, the results indicate that the intervention may underpin students' knowledge about seagrasses and strengthen their attitudes for their preservation, raising their potential to bring change either by influencing the local society or as future citizens by conserving, restoring and sustainably managing marine resources.



Researching Coastal Lagoons: an educational guide for primary and secondary school students

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Coastal lagoons constitute a common type of coastal environment. Coastal lagoons are transitional systems between land and sea, which are formed, in most cases, at river deltas. They are also characterized as dynamic systems with vast environmental variability, which, differ seasonally or even daily between coastal lagoons, within regions in the same coastal lagoon. These systems host exceptional biotic communities and are deemed as one of the most productive ecosystems on earth, whilst providing social services and cultural value to humans and the society in general. The educational guide titled "Researching the Coastal Lagoons", was developed within the framework of the Research Project with title "Engaging Primary and Secondary school students in Marine Sciences", 3rd Call for Action "Science and Society" - Research, Innovation and Dissemination Hubs, of the Hellenic Foundation for Research and Innovation - H.F.R.I.

The development of this educational guide has as its ultimate goal to literate the students and teachers in relation to coastal lagoon ecosystems and to raise their awareness regarding their sustainable management. This purpose can be achieved by field research in coastal environment and more specifically by collecting biological samples, following a specific research formula, that aims to learn the flora and fauna of these ecosystems. Further, the aforementioned purpose of this research will be accomplished through the analysis of the avifauna as well as the measurement of physical and chemical parameters.

Specifically, the educational guide, designated for both the teacher and the student, includes elementary information on coastal lagoon characteristics, organisms found in coastal lagoons, food web, as well as the preparation needed before and after the visit in the field, along with the field activities. Finally, it includes assessment sheets for teachers and students alike.

The utilization and application of the educational guide will give students the opportunity to define coastal lagoons, to recognize geomorphological coastal lagoon types, to comprehend the variability of coastal lagoon environment, to account for the plant and animal organisms of this ecosystem as well as to interpret its food web. Simultaneously, the guide will give students the opportunity to cultivate observational and research skills, to compose and evaluate data, as well as to familiarize with the application of scientific methodology criteria for the study of ecosystems, encouraging the conversion of scientific information to innovation. Additionally, the usage of internet technologies as well interactive teaching environments, through the accomplishment of the activities of the educational guide, could enhance students' interest in research and critical thinking, regarding the most efficient way to approach and understand the modern environmental problems of coastal lagoon ecosystems. The application and usage of this educational guide could be considered as a valuable tool in the educational development of teachers and students, capable of raising their awareness in matters concerning coastal lagoon ecosystems and the protection of the marine environment in general.



The Erasmus+ BlueS_Med project: experiences from the second training event (c2) in Crete, Greece

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The Erasmus+ project entitled "Supporting the development of socially-inclusive Blue Challenges in schools in the Mediterranean Sea basin" (BlueS_Med) aims at developing, implementing, and evaluating innovative approaches to integrate marine sciences, issues and challenges in the curriculum and educational activities of schools in different Mediterranean countries (2020-2023) based on four key principles: co-building, inclusivity, interactivity and sustainability. Ten partners from France, Italy, Greece, and Malta with high level of expertise in education, marine science and policy as well as ocean literacy initiatives are closely working with teachers of 14 pilot "blue" schools (applications for the EU Blue Schools certification) of their countries with pupils of primary and secondary age groups.

The project focuses on co-creating "blue challenges" (sea-related projects), throughout their development, the implementation of their activities and the dissemination of their results in order to inspire action to protect the Mediterranean Sea, alongside local stakeholders. The project will deliver five key outcomes (i.e., a framework and guidance document, a blue challenge activity proposed by each individual school, results of the monitoring and evaluation of the blue challenges, a web-based interactive knowledge platform of tested marine educational material, a road map for supporting the uptake of blue challenges in the Mediterranean Sea basin). In addition, three training events are planned and designed for both teachers and pupils, as well as four national multiplier events and one regional event that will showcase lessons learnt, best practices and way forward.

This presentation describes the second training event (C2) organized for 45 teachers and pupils of the four partner countries within the framework of the project. Ten partners participated, too. This training event took place at the premises of the Hellenic Centre for Marine Research (HCMR) in Crete (Greece) between 5th and 8th of May 2022. It included workshops, labs and field work organized by the Educational Teams of HCMR (HCMR-Crete, HCMR-Athens, Cretaquarium).

Day 1: A welcome session helped break the ice between participants while an overview of roles and responsibilities was made. A guided tour at the Cretaquarium was followed. Day 2: A workshop including fieldwork on marine biodiversity of different types of beach (e.g., sand and pebbles) and lab activities focusing on plankton was performed. Presentation of the different blue challenges by the teachers/pupils by using videos, animations, presentations and games was followed. Day 3: A guided tour at the Archaeological Museum of Heraklion whereby all the marine related heritage and artwork was explained to highlight the strong links between the Greek (and



Mediterranean) culture and the sea was performed. Lab activities concerning sea currents, hydrodynamics and density stratification combined with fieldwork focusing on marine litter found on the beach were then carried out. Day 4: The collaborative work accomplished also helped to define tools and the process for monitoring and evaluation of the blue challenges. In addition, sharing experiences and practices among partners, teachers and pupils of different countries as well as the feedback from the pupils gave new insights for the required actions and steps forward concerning the project.



"Baltic Scientist" - meetings with scientists

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The core curriculum in Polish primary schools includes knowledge of the marine environment, but it is still rather poor. Informal education is a source of knowledge for a child, as well as a teacher, and a parent, who take the role of educators during distance learning. All forms of such education are very important to deepen the knowledge of seas and oceans. Non-formal marine education can take many forms such as thematic meetings, field workshops, or the creation of audiovisual works.

In 2022 the Gdynia Aquarium Education Center launched the project called "Bałtycki Naukowiec" ("Baltic Scientist"). It assumes the production of 12 short films for children in a form of "meetings with scientists". The project is focused on the popularization and promotion of science, and the main characters are scientists and people closely related to the marine environment. The movie characters discuss topics in an accessible and understandable way and talk about their work, research, analytic devices, laboratories, and gear. The camera also visits a research vessel operating on the Baltic Sea, showing the equipment and the scope of work performed on the board. Children learn about oceanography areas such as marine biology, water chemistry, and marine geology. The films are enriched with interesting graphics, video shots (also underwater), photos, and sounds. Each film features guests from various scientific and research institutions dealing with maritime issues. In this way, the audience meets a very large group of scientists, researchers, and professionals related to the sea. The films have a Polish Sign Language interpreter and subtitles in Polish as well as English for international audiences.

The project aims to show the oceanographers' work, thus encouraging the young generation to learn about the Baltic Sea and other marine reservoirs. This is a part of an idea to broaden the access to knowledge about the Baltic Sea - our national maritime treasure - for the next generations. The project is designed to develop care for the natural environment, respect it and support pro-ecological attitudes. Moreover, an additional source of knowledge may influence the future decisions of children, who, perhaps inspired in the early years of life, would acquire professional education in maritime subjects in the future. Our films make young viewers aware of the diversity of oceanography subjects and their activities (ranging from research to culture).



Impacting Teachers' Perspectives on Climate Change through Study Abroad Experiences

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Studying climate change and human impact in the context of a global study abroad course provides both in-service and pre-service teachers with a uniquely impactful experience. Reform documents in science education, A Framework for K-12 Science Education (NRC, 2012) and the Next Generation Science Standards (NGSS) (Achieve, 2013), advocate that all students should understand the causes, effects, and methods of mitigating climate change. As science educators, we have designed three courses to equip our students with the science content knowledge and growth opportunities we feel only an immersive experience such as studying abroad can provide. Students in our programs rarely have traveled abroad; therefore, in addition to providing a unique opportunity to study science concepts, studying abroad has provided students with a broader perspective on the world and our place in it. Teaching climate change is essential for developing students into scientifically literate citizens for making informed decisions about this issue and its impact both locally and globally. Our courses use a systems thinking framework to explore impacts of climate change in different coastal regions that impact ecological areas using multiple perspectives. Sherrardson et al., (2012) have recommended using models and modeling of the climate system and a conceptual framework for teaching about climate change. Beyond modeling, this immersive field experience supports the systems thinking approach through our emphasis on the interactions and relationships between the Earth's spheres (geosphere, biosphere, atmosphere, and hydrosphere), focusing on the impacts on the ecological and biological systems. In each course we focused on issues of climate change and human impact in coastal ecosystems. In the summer of 2018 in our course, Using a Systems Thinking Approach to Explore Costa Rican Ecology and the Impact of Global Climate Change, our first group of teachers experienced the unique biodiversity of the cloud forest and participated in a research project at a biological station in Monteverde, an international hub for climate change research. In the summer of 2019, in our second course, Ridges to Reefs: Teaching Human Impact in Tropical Ecosystems in the Dominican Republic, thirteen future teachers explored sustainable farming and business practices, participated in a coral reef restoration project and met with locals to discuss on-going community conservation efforts for this coastal community. In June of 2022, 8 students explored the effects of climate change on the coast of northwest Ireland, the Wild Atlantic Way. Contribution to the Science Education

Science education is uniquely suited for study abroad experiences. The interconnectedness of humans to their environments is essential for science educators to understand to effectively teach their students. This presentation will explain the positive impacts such experiences provide and will detail a pathway for science teacher educators who wish to provide similar opportunities for their students. In the poster session, we will outline our unique curriculum, designing the experiences, recruiting for, and implementing the programs. Our research design for measuring educators' understanding of climate change on coastal regions will be discussed. This presentation will be beneficial to methods instructors, curriculum developers, and educational researchers.



Seastainability, blue is the new green: how to engage employees in sustainability and blue education?

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The ocean and environmental health are at stake, compromising present and future generations. It is urgent to understand the role of the ocean for the balance of the planet and realize that the path to sustainability requires a profound transformation in values, attitudes, and in our way of thinking and acting. In order to do things differently, to challenge the *status quo* and bridge the gap between the will to act and the capacity to do so, the Oceanário de Lisboa created a corporate environmental education program, called *Seastainability, blue is the new green*.

This program is an opportunity for corporations that aim to assume an effective commitment and dedication to contribute to a more sustainable future, to adopt a position of reference on environmental issues, and to foster active behavioural change through basic training in environmental citizenship for their employees. Participants can take part in three different training courses - sustainability; marine litter; and climate change - and carry out four team-building activities - beach clean-up; dolphin watch; birdwatching; or from waste to taste (circular economy) -, developed in partnership with wildlife observation associations and young circular start-ups. The training course will engage participants to understand how the ocean regulates and influences the Earth's climate, discover the latest findings on climate change and the strategies and solutions to adapt to climate-related risks and natural disasters, characterize the problem of plastics in the ocean and discuss the solutions. Hands-on activities, such as beach clean-ups or wildlife observation, are unique experiences that encourages collaborative work, strengthens team spirit, and allows adults to get to know the biodiversity and be engaged in the protection of marine ecosystems. Discovering iconic species, such as dolphins and flamingos, in the Tagus estuary and river, a nature reserve around Lisbon, creates an emotional connection with biodiversity and mobilizes participants to act for a more sustainable future. In the activity "From waste to taste", participants take the first steps towards a circular economy, learning how to recover waste coffee grounds, turning them into mushrooms. In 2022, the first year of the program, more than 400 professionals have already been engaged, not only in Portugal, but also across borders, reaching new audiences in India, Spain, Peru, Brazil, Australia, and New Zealand. The goal is not to turn participants into experts on sustainability, but to challenge them to reflect and discover new ways to act with less impact on the environment.



Boosting careers for a blue future: the new specialization track on “ocean literacy, education and communication” as part of the International Master in Marine Biological Resources (IMBRSea)

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Currently, there is a growing global ocean movement connecting ocean science and education for sustainable development. Ocean literacy is more than just educating or informing the public, it aims at facilitating the creation of a society connected to the ocean. Ocean Literacy is an essential component of the UN Decade for Ocean Science. The tenth challenge of the Decade highlights the need of an ocean literate society, and asks to ensure that the multiple values and services of the ocean are widely understood, and to identify and overcome barriers to behaviour change required for a step change in humanity’s relationship with the ocean. The International Master in Marine Biological Resources (IMBRSea) is a joint Master program organised by eleven leading European universities in the field of marine sciences. This program is devoted to preparing students for the rapidly evolving demands of the blue bio-economy as well as research on the sustainable use of marine biological resources. In response to the increasing demand for an ocean literate society and the goals on the Decade, in 2022 IMBRSea has launched a new specialization track on Ocean literacy, Education and Communication featuring three units of 6 ECTS focused on the Basic Concepts on Ocean literacy, Education and Training in Marine Science, and Applied Communication and Outreach. The goal of this specialization track is to provide students with foundation knowledge of modern methods and tools used in teaching and communicating about ocean-related topics and to equip them with the necessary knowledge about what teachers do, both in the preparation and in the actual performance of educational activities, and what are the consequences thereof for students’ learning. The course will take place from September to early November every year at the marine station in Villefranche-Sur-Mer (France), and students can choose this track for the second year of the master. The course counts with several guest speakers, from a multidisciplinary background, that are actively working in marine education, citizen science and marine science communication. Additionally, a two-days mini-symposium will be organized at the end of the course to meet experts in the field and networking, as well as to showcase the final projects carried out by students.



Citizen science and education approach of the EU NAUTILOS Project

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NAUTILOS is an H2020 project funded under the Future of Seas and Oceans Flagship Initiative and it is developing new generation of cost-effective sensors and samplers to democratize the marine environment monitoring to Citizen Science activities. More specifically, samplers and scanners for the identification of micro-plastics, as well as devices for imaging of the seabed and monitoring of phytoplankton are being developed in order to engage citizen scientists in relative activities and therefore increase the magnitude of collectible data. In this framework, many activities are being designed for the general public, targeting especially students of different educational levels. Reaching out and setting partnerships with other Citizen Science projects (e.g. SeaCleaner project (<https://sites.google.com/view/seacleaner>) and educational initiatives (e.g. Blue Schools Med project), NAUTILOS is mobilizing hundreds of citizens and students in Europe, which proactively participate in data collection, coastal and ocean monitoring, enrichment of the European Marine Litter Registry and consequently, environmental conservation and restoration. Thanks to the NAUTILOS experts network, collected data are going to be validated and hence ingested by key European Marine Data Infrastructure/Integrators (e.g. EMODnet Physics and EMODnet Chemistry). NAUTILOS has also another outstanding target: to disseminate currently faced issues and environmental problems among citizens and students of various levels and grades, making them aware of and, above all, part of the solution for the problems addressed. Indeed, Citizen Science is not only a possible means of collecting useful data for research, but also a very engaging and inspiring way of bringing people, and especially the younger generation, closer to the most contingent problems, urging them to address issues with greater knowledge and awareness, and providing them with the tools to be able to face the challenges of the future, including the Blue Challenge for the conservation of our Ocean.

WORKSHOP





Ocean Games on the Seashore

Cushla Dromgool-Regan, Marine Institute Explorers Education Programme & Camden Education Trust / EMSEA Board Member; Mark Ward, Somerset Wildlife Trust / EMSEA Board Member

The Marine Institute's Explorers Education Programme delivers over 400 marine themed modules to 14,000 children and 500 teachers in primary schools in Ireland in 2021-2022. Over half the modules delivered were carried out on the seashore, providing children with an opportunity to learn about marine science – living things in an outdoor environment.

The Explorers Programme aims to create ocean champions and to do this, we believe it is important to instill a passion for the ocean at a young age, so as to create long-term change in ocean literacy - forming a better understanding of how the ocean has an influence on our lives and how we impact the ocean. Through a range of interactive seashore outdoor games, we support the sustainable development goal SDG14 and the introduction of 21st Century Skills. Working in teams we incorporate building and sharing knowledge about the ocean, as well as developing personal skills in communication, collaboration, critical thinking as well as mindfulness and creativity.

At EMSEA 2022, in association with Somerset Wildlife Trust, the Explorers team will be introducing some of the Explorers seashore games we use on the seashore in Ireland and the UK to inspire teaching children about the ocean. We will also be working with participants to develop an EMSEA seashore game that incorporates all things EMSEA!