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Design, development and implementation of an educational tool for evaluating Mediterranean Sea Literacy of school students in the Mediterranean Sea region

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In 2020, the “Mediterranean Sea Literacy” (MSL) guide was published by members of the EMSEA-Med Working Group (EMSEA-Med WG), adapting Ocean Literacy (OL) principles and concepts to the specificities of the Mediterranean Sea. The MSL principles and concepts, serving as guidance for research, education, informed decision-making, and improved citizens’ lifestyles, are expected to raise awareness and create a Mediterranean-Sea-literate society, aiming at environmental protection, conservation, restoration, and a blue innovative and sustainable economy of the Mediterranean Sea region. The EMSEA-Med WG has so far investigated knowledge, attitudes, and behaviour of elementary and middle school students towards ocean sciences issues within the framework of OL revealing moderate knowledge and positive attitudes and behaviour. As the MSL guide has recently been published, the investigation of relevant content knowledge of students concerning the Mediterranean Sea would be of great importance. This pilot study constitutes the next step in promoting OL in the Mediterranean Sea region. Members of the EMSEA-Med WG (marine educators and scientists) from Greece, Italy, and Croatia designed and developed a structured questionnaire based on the principles and concepts of the MSL guide and therefore relevant to Mediterranean Sea issues. Preliminary results of validation and implementation of this questionnaire aiming at investigating for the first time content knowledge of students around the Mediterranean Sea revealed evident lack of knowledge, and therefore the need for adapting the OL framework to the specificities of different regional seas.



The Blue Survey: a new instrument to measure the multiple dimensions of ocean literacy among adults

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Reconciling sustainable use of the ocean's resources while keeping it healthy, is one of the main challenges of this decade. Despite the importance of the ocean for our daily lives, the level of public understanding of basic concepts related to the ocean and the threats associated with human activities remains low. In recent years, ocean literacy (OL) has become a global movement that connects the human dimension to the ocean and intends to be an incentive for positive change in people's behavior. Previous research largely focused on measuring OL among youngsters and less attention was given to other groups in society who have most potential to engage in decisions that impact the ocean. To bridge this gap, we developed and validated the Blue Survey, an international comparative instrument meant to measure OL in adult populations. Based on an extensive literature review, existing OL surveys and expert consultation, 51 items were formulated. Using a convenience sample of 251 professionals with a diverse occupational background, an exploratory factor analysis uncovered six dimensions, viz. knowledge of ocean-related topics, personal interest in ocean-related aspects, ocean stewardship, ocean as economic resource, ocean-friendly behavior and willingness to act responsibly for the ocean. Our analysis resulted in the development of a new validated instrument to assess the various dimensions of OL. This instrument can be deployed to explore the amount of public understanding of ocean-related topics in maritime professionals and will provide valuable information that may be incorporated into decisions to support blue economy strategies.

The stories-we-live-by: Marine literacy and its role in facilitating the sustainable governance of the Baltic Sea macro-region

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The Baltic Sea Region is the EU's first macro-region. The complexity of this multi-level endeavor requires the participation of diverse stakeholders, including non-state and non-expert representatives of relevant societies. To do so, the stakeholders should be equipped with adequate knowledge and critical skills enabling them to navigate the complex governance process. The aim of this presentation is to explore the role of marine literacy in facilitating the sustainable governance of the Baltic Sea macro-region and to demonstrate how the goals specified in the Baltic 2030 Action Plan could be supported by ecolinguistics defined as the study of the impact of language use on the life-sustaining relationship among people, other organisms, and the physical environment. Moreover, it will be argued that ecolinguistics understood as ecological analysis of discourse is a prerequisite for developing full marine (ocean) literacy.

By honing our critical skills in fields of linguistics, ecology, and other relevant disciplines and by exposing both sustainable and destructive stories-we-live-by, this method of discourse analysis may help us access relevant materials, make informed choices and decisions, and have a say in environmental governance matters.

Exploring Ocean Connection in relation to social and cultural background - A case study of Britain's Ocean City

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Socio-cultural values prompt how people appreciate and use natural resources such as those present in marine environments and within the UK's Ocean City of Plymouth. In particular, cultural differences and disparities in children and young people may contribute to differing environmental perceptions, practices and behaviours. The underlying and deep-rooted values that individuals hold and develop through cultural experience may contribute to low levels of Ocean Literacy in groups not traditionally targeted by informal environmental education programs in addition to a disproportionate level of diverse representation within the UK student and professional marine science populace.

We investigated four components on ocean connection whilst considering social and cultural disparities between youth participants using a variety of investigation methods to suit the needs of youth participants. 116 children, aged 10 and 11 responded to questions focusing on Ocean Literacy, Connection to the marine environment, attitudes and values to the marine environment and accessibility to education on ocean related studies. The results presented differing findings in relation to the demographic disparities of the participants. Therefore, outreach and education needs to fit the needs of all and be equally accessible to yield the greatest outcomes in adoption of pro-ocean behaviour.



Analysis of methodologies for collecting evaluation from pre-service teachers engaged with ocean literacy content, and identification of trends in data relating to curriculum links

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The Marine Institutes, Explorers Education Programme works with education communities to develop and introduce marine content into formal education in Ireland. Since 2017, workshops have been carried out with pre-service teachers at Dublin City University (DCU). Content is centered on Ocean Literacy (OL) and methods for incorporating marine into the science curriculum for children aged 5-12 years. In 2020, workshops were moved online, and a pilot methodology was used to collect feedback, which had previously been collected using exit forms. Results showed that where feedback was optional, low response rates (12% n=351) were achieved, and where reflection was provided directly by tutors, without prior consent to share, only a random sample of anonymous pieces could be used. Based on these lessons, a more robust method for evaluating online workshops was developed in 2021. This included the transition of the process directly to the Explorers team and making evaluation an official student task set by course tutors. This resulted in a marked increase in response rates. Of the 318 students who participated in 2021, 316 completed the evaluation task (99%). This provided valuable data on the impact of the workshops on participants' knowledge of the ocean (4.25), and on knowledge of incorporating marine themes into class (4.29), based on a scale of 1 (no increase) to 5 (increased a lot). Participants also provided an example of how to incorporate a marine theme into a science class, as an open-ended question. Analysis of responses indicated several themes, including biodiversity and science investigations.



The Marine Diaries – Storytelling for ocean literacy

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¹The Marine Diaries

The Marine Diaries is a non-profit organisation using digital media to communicate ocean science through storytelling. We believe in the power of storytelling for science communication and ocean conservation. By telling stories about the ocean, its inhabitants, and the people who rely on it, we inspire people to take steps to protect our blue planet. Information alone rarely changes people's attitudes, beliefs or behaviours. Facts and figures are much less memorable than stories, which create emotional connections to the subject or topic. Stories can help give meaning to information and are much more engaging.

The Marine Diaries tells stories about the marine organisms which live in the ocean, threats which face it, as well as the people who work in marine conservation, whether scientists, filmmakers, artists or policymakers. We use storytelling across all of our activities, campaigns, and projects - this talk will cover some of them, celebrate their success, and share useful insights and best practices for marine science education.



Save the Sea Project – a bottom-up social initiative that worked

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Save the Sea Project is a story of a regular person, not tied to the marine community by profession but by genuine interest, who created the opportunity for herself and for others to have a real impact on the health of the Baltic Sea. In summer 2019 I designed a bracelet made of silver and rPET yarn with the clear intention in mind – to donate 100% of the proceeds to the tangible cause strictly connected to the Baltic Sea conservation and protection.

Looking for the beneficiary that is both willing to accept the money and to be transparent about how it will be used was not easy. Fortunately I found like minded and cause-driven woman from the Gdynia Aquarium Education Center who believed in authenticity of my project and gave an idea – to buy Seabin to Gdynia Marina with the money from my Bracelet. This water surface cleaning device would also be used by the Center for educational purposes during children classes. Drawing upon our need of social belonging as well as ever changing consumer needs, my goal was also to build an ocean literate community genuinely concerned about the state of the Baltic Sea. 31st July 2021 marked the success of our mission. It took us 2 years to make this happen and countless moments of both joy and resignation. The outbreak of the epidemic added to the challenges but also enabled us to focus more on delivering our message that together we can really make a difference.

Latin America Marine Educators Network: a step further in the great marine educator's connection

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The idea appeared during the international marine educators' meeting, at the NMEA Conference, where Latin America had just one representative, who attended thanks to the expanded audience scholarship. Months later, the Latin-American Marine Educators Network (RELATO) started as a wishful think with 2 marine educators in Chile to connect ideas, experiences, and barriers in marine education. Two years later, RELATO, in collaboration with the University of Edinburgh and GCRF fund, organized the first Marine Education Conference for LATAM and the Caribbean, where 500 marine educators took part. The Conference held 4 days of talks, workshops, and activities to connect each other's, and ended with the celebration of the marine education day, holding marine education activities along with Latin America.

Thanks to the Conference, a study was made regarding the marine education situation in LATAM and its results share marine educators' ideas about different topics and their vision for the next steps needs for marine education in their region. Today, RELATO counts with 15 Country Coordinators who represent the network in their regions and more than 1.000 members, demonstrating people's interest in being part of the network to grow and learn together and giving room to great connections between initiatives.

This is a story about how the great connections between networks and educators around the world, and the recent inclusion of Latin America on it, promote a step further to make more visible and stronger the importance of talk about marine education to continue strengthen and improving it.

21st Century Message in a Bottle: Connecting communities around the ocean

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This year, students from Kilglass National School in Galway, Ireland helped the Marine Institute prepare an unmanned miniature sailboat ("miniboat") to learn about ocean currents and more. Facilitated by the Explorers Education Programme in partnership with Educational Passages in the US, the students learned about research around the Atlantic, and saw in action how ocean currents and weather affect water movement as they watched their vessel's GPS location online. Launched by researchers near buoy XX, this 21st Century "Message in a Bottle," ended up as the northernmost miniboat landing to date, a new record for the Miniboat Program. This project is part of the iFADO project where four more boats and countries will launch miniboats this year. Come to this presentation to find out the fate of all 5 boats, what we learned, how students were engaged, and how you can join the adventure. Lead teacher Mr. Kane will share how he engaged his students during the project and some of the learning outcomes. Ms. Dromgool-Regan will share how the Marine Institute and Explorers Education Programme implemented the program. Ms. Stymiest will share how Educational Passages is helping to bring these experiences to classrooms and communities around the world.



The role of sustainable tourism and first-hand experience in achieving Ocean Literacy: EcoMarine Malta experience

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Engaging citizens in first-hand experiences and practical activities is a key factor in improving the public's understanding of the importance of the ocean and the influence it has on our lives. On the other hand, education is fundamental to inform about the impact of our behaviour on it. Marine ecotourism can support the development and the achievement of Ocean Literacy through the direct contact with the sea and its wildlife and the involvement of different stakeholders in the implementation of such activities.

By experiencing personal connection with the marine environment and witnessing the complex issues threatening the Mediterranean Sea, such as unsustainable coastal development, overfishing, pollution, intense shipping and climate change, citizens are motivated to support policies and actions aimed at preserving the ocean's health.

EcoMarine Malta finds its main pillars in Ocean Literacy and Environmental Education to educate people through different activities such as Eco Tours around the Maltese archipelago on a sailing boat providing marine ecology lectures and marine wildlife spotting sessions. Specialised marine science courses for adults and children as part of the non-formal education programme. Involvement of Citizens in scientific research as volunteers to help collect essential data while learning the crucial role of science for conservation. Team building for companies focusing on sustainability and multicultural inclusion. Furthermore, as an indirect effect, cross-organizational collaborations, and the involvement of different stakeholders to implement such activities increase the awareness on different levels and help spread the importance of becoming ocean literate.



Gen Z and the sea – Digitally connecting young people with the ocean: Learnings from a youth-led digital festival

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¹ Incredible Oceans

Siren Calling: a youth led digital festival run in mid February 2021. In this session we'll explore creation of engaging digital content, it's importance in reaching young people and reconnecting them with the ocean. We'll discover the issue of eco-anxiety and how can we tackle this mental health epidemic in our young people. What are the best ways to reach a youth audience?



Underwater archaeology as tool for increasing young people interest towards the sea

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The Romanian Black Sea shore, like many other coastal areas, has a rich history, starting from the Greeks and Romans, to the Genovese and others. Many remains of the local cities (Tomis, Callatis etc) are now covered by the Black Sea waters and several shipwrecks, ancient or modern, are found near the shore. Even if archaeologists studied, over the decades, the submerged cities, there are not many opportunities for the youngsters (local or tourists) to get closer to the underwater treasures.

Creating a program that allowed young people to understand better which are the jobs connected with underwater archaeological exploration (historian, geologist, engineer, diver, meteorologist, biologist) is a mean to get them oriented on the labor market, starting from their interest for sciences, history or IT during the high school. Making the local community aware of the richness of the coastal waters might be a way of promoting the conservation of the local treasures, fostering the idea of marine citizenship. This kind of initiative creates the opportunity for both educators and learners to design a research based project that allowed a true STEAM structure. Starting from a local relevant theme, the educators can create an appealing environment which open different "gates" for the learners – towards marine sciences, to historical connections (social, political, economical) and to the present consequences.

A collaborative strategy allowed each learner to find the best way to develop learning skills (creativity, critical thinking, communication), literacy skills (media analysis, processing information, technology usage) and life skills (flexibility, initiative, productivity).



Think (of) Blue – popularization of STEAM through Ocean Literacy and vice versa

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¹Marine Explorers Society - 20000 Leagues

Marine conservation and STEAM are important for improving the quality of life on Earth and are the key to sustainable development. In Croatia, a significant negative trend was observed in the achievements of students in science literacy. The lack of funds in the education system has resulted in a reduction in practical science classes. It is a major shortcoming, especially in underdeveloped rural and island areas. Similar can be observed in other Mediterranean countries.

The knowledge of the sea can unite practically all areas of STEAM and is the basis of science literacy. The combination opens the possibility for a very picturesque and simple way of approaching physics, chemistry, biology, technology and the importance of their interdisciplinarity for sustainable development and nature protection. The best way to present is through visual art.

The aim of “Think (of) blue” project is to effectively convey the importance of science, interdisciplinarity, conservation, restoration and sustainable use of the ocean and its resources. It actively involves everyone to “think blue” and to understand what impact we have on the ocean and what it has on us through workshops for primary and high school students, study trips, new educational programs and innovative content like equipping a trailer and a boat into mobile educational centres. It also aims to encourage critical thinking and present complex certain scientific aspects of how the ocean enables the life on Earth through experiments and small research tasks for participants as well as through an educational photo exhibition.



AMOR - Active Youth for Sustainable Development

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Project „AMOR” was envisioned to promote sustainable development education among children and youth by creating and implementing four educational programs focused on sustainable development, nature protection, active participation for sustainable development, and civil rights development. Three educational programs were directly related to the Ocean Literacy concept. They explored the marine Natura2000 sites (shallow coastal waters, sandy beaches, and rocky intertidal). In a series of workshops, elementary school children were participating in an outdoor learning experience. The final aim was to empower them to explore, observe, feel, and experience nature around them attractively and directly. That way, they could better understand the way nature works and become inspired by new knowledge to permanently adopt the need to preserve the natural world for future generations. The created educational programs were embedded in a regular school curriculum and will be used in future Biology classes. One of the programs was developed to become a standard educational offer of the local nature conservation institution. The main topics included in the programs were: biodiversity of salt marshes, sustainable use of sandy beaches, microplastics in the sediments, and the effect of tides on the nearshore environment and organisms, and marine organisms' adaptation to harsh environmental conditions. Special attention was put on a connection between the functioning of a shoreline ecosystem and human health. The results of educational programs developed through AMOR activities directly respond to UN's Sustainable Development Goals 4, 13, 14, and 15 and many national strategies.



Be Ocean Wise

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¹Agrupamento de Escolas Dr. Alberto Iria

The Be Ocean Wise project aims to encourage our students to become united Eco citizens, educating them to become guardians of the Ocean and ChangeMakers. As we are part of the ASP.net (UNESCO Associated Schools Project Network) the Project “Be Ocean Wise” was based on the implementation strategies for ESD for 2030.” Not only we promoted Goal 4 (Quality Education), but as we live near the sea Goal 14 (Life below Water) was an issue to be addressed and tackled by our students, as they felt the need to preserve and protect their cultural and natural heritage. Thus, it became imperative to study and adopt a hands-on approach to address the issue of Ria Formosa’s Biodiversity Protection. The Project engaged students in several field trips, workshops, exhibitions and presentations. The students then decided to build their own website called Be Ocean Wise as a way of gathering all the research and activities they were involved in. The activities included Short Animations; Short Stories; Comic Strip; Infographics and Presentations about Ocean Literacy; Climate Change and Sea Rising; Ocean Pollution; Biodiversity and Habitats.

The short animation called “The Not Perfect World” was awarded the 1st prize in the international competition “I Live by the Sea” and the Comic Strip “Hank the Crab talks about Ria Formosa’s Pollution” won the 1st prize in a National Contest. This project was implemented on the eTwinning Platform along with partners from Croatia and Romania. With this Project we applied to become a Certified European Blue School.

Sea and marine litter: everybody's and nobody's

Arianna Bucci¹, Anna Bozzano¹

¹El Peix al Plat

El Peix al Plat is an initiative created by marine biologists in Barcelona (Spain) to foster ocean literacy and responsible consumption through workshops about life in the sea, fisheries-related tourism activities, and distribution of seafood from responsible fishery, seafood cooking classes, and communication campaigns. With this activity, students aged 11-18 experience the magnitude of the issue of marine litter, with a holistic approach that covers all the steps from its origin to the effects on organisms and the environment, and human life.

At the fishing port, students are introduced to different fishing boats and gears, they meet fishermen and craftsmen fixing nets on the docks. They discover that a large amount of marine litter is collected by fishermen every day, causing them economical losses and additional work. Students sort and analyse samples of marine litter caught with trawling nets, to infer its origin, path to the sea, and to extrapolate its abundance on the seafloor. We therefore provide samples of litter from beach clean-ups, samples of sand with microplastics from a nearby beach, as well as pictures of hake stomach-content with microfibers, to visualize debris degradation and entrance in the food web. We debate about the most common litter items found, more sustainable alternatives, and strategies to reduce our impact on the sea. Even though measuring the effectiveness of the activity on students' habit change is challenging, the feedback obtained during this workshop evidences an emotional impact, as well as an increased awareness about our link with the sea.

EU Life ReMEDIES - Save our Seabed in Schools

Loveday Trinick¹

¹Ocean Conservation Trust

Led by Natural England, The EU Life ReMEDIES project works in 5 Special Areas of Conservation (SAC's) - Isle of Scilly Complex, Fal and Helford, Plymouth Sound and Estuaries, The Solent Maritime and Essex Estuaries. Key areas of work for ReMEDIES are: a) restoration of seagrass habitat within Plymouth Sound and Estuaries and the Solent Maritime; b) working with recreational boat users to increase use of Advanced Mooring Systems (AMS); c) a school's programme of sustained engagement.

ReMEDIES School Programme: Sustained engagement is a key feature of this programme. The schools programme runs projects based around key areas of the project:

- Seed to Seagrass – students grow a seagrass plant alongside a terrestrial plant like poppies or cress,
- Engineering for the seabed – students learn about protecting the environment while still being able to go out and enjoy it by designing their own anchor system, testing it out and seeing what works,
- Speaking for seagrass –the project challenge is to produce a persuasive piece of media to inform people about the issues facing seabed habitats alongside ways in which they can help.

Seagrass allows the sessions to link to the principles of Ocean Literacy. As a plant, it helps shape our Earth and has roles in influencing weather and climate. The seabed is a feature which changes in our one Ocean and it provides habitat for many animals. Impacts, as well as the ecosystem services, show the link between humans and the Ocean.

Blue Schools in Europe: paving the way to collective action

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The importance of protecting and sustainably managing the ocean is gaining increasing political and societal attention. In particular, efforts are made to engage children and to “bring the ocean” into the education system, so that they can also understand its importance, and how we can better act towards a more sustainable use of the ocean. Recently, the Network of EU Blue schools was launched as part of the wider EU4Ocean coalition supported by the European Commission, DG Mare. In European Blue Schools students are challenged to learn from real-life topics related to the ocean. By bringing marine and maritime contexts to the classroom, students are encouraged to become responsible and engaged ocean literate European citizens, aware of socio-economic issues and sustainable development challenges, supporting our democratic values and Europe’s environmental ambition.

In a European Blue School, teachers do not simply deliver information to their students, but assist them to craft a project where they can research, collaborate, and reflect actively on ocean issues. Students get the opportunity to develop a wide range of secondary (21st century) skills (social skills, solution-oriented thinking, creative thinking, among others). The concept of open schooling fosters a blend between formal and non-formal education and the participation of the community in school activities and projects: the school becomes an “agent of community well-being”, a hub for action and behaviour change.

The European Blue School, students work on sustainable development issues such as climate change and biodiversity. Some of the main topics that are addressed are “Food from the ocean”, “Ocean and climate”, “Healthy and clean ocean” which are in line with the EU policies “From farm to fork”ⁱ and the European Climate Pactⁱⁱ. The initiative will further complement the European Green Deal, Mission Ocean and the European Biodiversity Strategy for 2030ⁱⁱⁱ. Students explore Active European Citizenship through ocean subjects. To equip young people for a future as European citizens, we need to stimulate them to engage more in society and feel concerned by local issues and the wider European aims and objectives.

i European Commission From Farm to Fork (2021) https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/farm-fork_en

ii European Commission Climate Pact (2020) https://ec.europa.eu/clima/policies/eu-climate-action/pact_en

iii European Commission Biodiversity 2030 (2021) https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en and the objective to become carbon neutral by 2050



A virtual Blue School Program. Making waves within the classroom & beyond. How the American Farm School became a blue school with distance learning

Kaitlyn Waters¹

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The purpose of this presentation is to discuss the pertinent relevance of an Ocean Literacy curriculum for students and what it has meant in a Greek educational context within my experience during the spring 2021 semester. I will explain my role as a Blue Teacher from February 2021 - April 2021 and how we adapted/modified our entire curriculum to have the same content but delivered on the Zoom platforms. The feature of how it came to fruition there were guest experts in fields of Underwater Cultural Heritage, Protection of the Mediterranean Monk Seal and Blue Careers. Additionally, I will elaborate on the types of qualitative assignments that the eighth graders in my class were expected to complete for this Ocean Literacy course including interpretive and scenario-based applications of the day's lesson. Finally, I will explain the benefits and potential further implications including for enhancing accessibility and diversity for this method of Ocean Literacy as a tool for teachers in Europe and elsewhere.

"L'Oceà a casa" (The Ocean at Home): resources to learn from home during COVID-19 lockdown

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How to literate about the ocean from home? To provide educational resources during the COVID-19 lockdown, the Institut de Ciències del Mar (ICM-CSIC) from the Spanish National Research Council (CSIC) created the initiative "L'oceà a casa" (The ocean at home), an online blog to gather educational content and resources that families could follow from home, oriented to children from 4 to 10 years old. The initiative consisted of an online blog with 15 daily entries about topics that covered all the different Ocean Literacy principles and were aligned with Sustainable Development Goals. This resulted from a bottom-up collective effort of more than 28 experts from the ICM-CSIC and 2 contributors. "L'Oceà a Casa" developed videos, activities, games and online seminars and reached a wide audience, getting more than 5 thousand visits in a month. Online tools such as web, surveys, newsletter and social networks analytics were used to collect data and opinions to collect information for educational research purposes and improvement. This session will describe the ICM's experience with Ocean Literacy and will give a summary of the main conclusions derived by "L'Oceà a Casa" and best practices that could inspire the development of OL initiatives in other institutions.

Three additional ways to increase a holistic approach to Ocean Literacy in Europe.

Peter D Tuddenham^{1,2}

¹ College of Exploration; ² European Marine Science Educators Association (EMSEA)

Achieving Ocean Literacy in Europe is one of the European Marine Science Educators Association's objectives. The current activities and plans need to be expanded in three ways:

1. Increase the local and personal relevance of the ocean to the citizens of Europe. Many people in Europe do not live by the sea, nor even visit the sea side, never mind an ocean coast. I believe we need to start with personal knowledge and understanding of relevance to water to our personal and collective health, and to develop water literacy and stream and river literacy,
2. Add Appreciation and Control. The definition of ocean literacy is an "understanding of our influence on the ocean and the ocean's influence on us." There are two other actions that we need to add to influence. They are a) building an individual and collective "Appreciation" of the whole effect of the ocean on our lives, and b) knowing how we control our behavior in relation to the ocean and how the ocean controls our behaviour,
3. Develop greater linguistic, cultural and representative participation in the language and actions and decisions related to the water-stream-river-sea-ocean system. New ways of engaging in citizen participation and deliberation on all aspects of the water system are crucial as the effects of climate change across Europe are felt, from floods to fires.



Are in-service elementary school teachers ocean literate? A case study from Greece

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The ocean is the root of the creation and perseverance of life on Earth. However, human activities have had a disastrous impact on it across the years foreshadowing its future ominous. Today's students will be the ones who will need to make their best to reverse this situation. The task of raising awareness among young students, regarding the ocean, lies within the hands of their teachers, who of course need to first raise the level of their ocean literacy accordingly.

This study constitutes a first attempt to portray Greek elementary school in-service teachers' ocean literacy, according to the essential principles and fundamental concepts of the Ocean Literacy Framework, by combining quantitative and qualitative methodological approaches. The results revealed a limited level of ocean literacy and incomplete mental models with a slight lead of males over females, making the introduction of ocean-related subjects into their classes a hard task. Although teachers consider themselves to possess adequate pedagogical content knowledge, their ocean content knowledge on several issues is missing, especially when it comes to geomorphological features of the ocean bottom, ocean acidification and carbon cycle, productivity issues, and pollution sources such as microplastics. The study concludes with suggestions concerning the training of future teachers as well as in-service teachers on relevant issues, aiming at the best possible introduction of ocean sciences issues into formal education.



Beach School, providing professional development based on ocean literacy for early year educators

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Piloted in 2018/2019, beach school delivered a learning experience outside of the classroom to children at a pre-school age (3-5 years) in the Galway area of Ireland. The school was based around a visit to the local seashore, plus a follow-on visit to the crèche or Montessori setting. The trial was carried out between Galway Atlantaquaria, Galway Childcare Committee and Wonder Years Pre-school and was funded through the community action 'LA21' fund. It was expanded in 2019/2020 to include settings from Galway City and County but due to Covid restrictions the project was altered to incorporate more service providers, with engagement with the childcare practitioners themselves.

During the expanded beach school, participants were tested on their ocean literacy knowledge, before being introduced to the seven ocean literacy (OL) principles. This was carried out through Survey Monkey and the use of OL facts, trigger questions and examples of practical child lead tasks. Topics included biodiversity, the physical environment, caring for the ocean, our emotional connection to the shore, food from the sea, and how the ocean is connected to our weather and climate. The approaches used included active learning, use of artefacts, using the environment, play and games, and guided discovery. Now in its third year, the project is developing further and is currently in process of developing an online training platform for early year's educators.

In our talk we will share our learning experiences with this process, as 'Beach School' has developed over the last three years, and the feedback we have received from early year practitioners, children, and their families.

Biofilms, Biodiversity, and Microplastics

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Plastic debris in aquatic and marine environments often breaks up into fragments that are smaller than 5 millimeters, which is then classified as microplastics. While there is not yet a standardized and validated methodology for characterizing microplastics, we have developed a protocol that uses methods for isolating and observing microplastics from biofilm samples from urban waterways. Project-based learning (PBL) has been proven to be a successful strategy in K-12 science education; the implementation of PBL provides opportunities for student-driven inquiry and provides teachers with a means to integrate curriculum with current research and to consider the effects of human impacts on the environment.

This session will describe and demonstrate aspects of the protocol developed for high school teachers to educate students about microplastics and how to successfully isolate and observe them. Teachers and students in Maryland have successfully isolated microplastics from biofilm samples from the Inner Harbor, Baltimore, MD, and shared their results. International teachers and students in Barcelona, Spain, involved in a related project, had similar results and shared experiences through images, video, and online meetings. These collaborations provide important opportunities for student-driven inquiry, awareness of ocean literacy principles and for engaging teachers and their students in methods of current scientific research.

Development and psychometric properties of the Seagrass Awareness Scale (SeAS)

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Seagrasses occur in most coastal areas of the world, forming extensive underwater meadows. Seagrass meadows provide multiple functions and services that support human welfare globally. However, society largely lacks knowledge of seagrasses and their importance. In addition, human activity results in a global seagrass loss. Thereby, an increase in the recognition of seagrass value and vulnerability is needed to put pressure on decision- and policy- makers for seagrass protection. In this context, the development of comprehensive tools for the measurement of seagrass knowledge is needed.

The present study aims to develop a comprehensive tool, which could be used to measure the level of knowledge of seagrass science issues. To this end, the Seagrass Awareness Scale (SeAS) was developed. It contains 25 multiple choice questions aiming to assess fundamental knowledge about important seagrass topics, including seagrass characteristics, taxonomy, biogeography, ecology, ecosystem function and value to the environment, ecosystem services, threats, loss, protection and research. The psychometric characteristics of the SeAS were investigated in a sample of prospective primary school teachers in Greece, using Rasch analysis. The evaluation highlighted the overall psychometric adequacy of the instrument and it can be used as a unidimensional measure to assess knowledge of seagrass science issues. Consequently, the instrument could indirectly advance the contemporary practice of environmental education in general.



Exploring creative approaches to virtually communicate remote sensing and its use for monitoring our ocean

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Making Space (MS) is a science public engagement project designed to bridge the gap between underrepresented groups (socially, economically and educationally disadvantaged) and astronomy. In 2020/2021 the project content was expanded to include the addition of ocean literacy and topics relating to remote sensing and the ocean. Our aim was to create an environment in which everyone, regardless of their background or previous knowledge, could benefit from our activities. As part of the MS Programme, we explored the potential of combining arts and ocean literacy in a community-based programme, which had two main objectives: (i) to investigate the use of approaches that valued the importance of exchange and collaboration among participants; (ii) to explore the use of art as a powerful way to engage a diverse community with marine concepts and the topic of remote sensing in an informal learning environment. Our main activity was based around an intergenerational programme, called Young Hearts, run by Croí na Gaillimhe a Resource Centre of St Vincent de Paul since 2010, in collaboration with the Physics Department in the National University of Ireland and funded by the Royal Astronomical Society (RAS). This involved a group of teenagers and members of a local active retirement group. The content of the programme was designed based on the initial assessment of the participants' interests and prior content knowledge of the ocean and remote sensing. It included topics such as the ocean literacy, the history of ocean exploration, the importance of seabed mapping, and developments in technology.

Greek prospective teachers' knowledge of seagrass science issues: Preliminary results

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Seagrasses form one of the most valuable marine ecosystems. However, a worrying decline of global seagrass area has been documented, leading to international initiatives to raise awareness of seagrasses.

An empirical study was conducted to assess Greek pre-service teachers' knowledge of seagrass science issues, using a newly-developed structured questionnaire (Seagrass Awareness Scale, SeAS). The instrument used also contained questions related to information sources on marine sciences issues. Latent Class Analysis identified three groups of students that differed in their seagrass knowledge and information sources utilization. Students of the largest subgroup possessed a low seagrass knowledge; they rarely or almost never use the Internet to find information on marine issues. Students of the second largest subgroup possessed a moderate knowledge about some seagrass science issues; they often to always use the Internet to find information on marine issues. Students of the smallest subgroup possessed the highest level of seagrass knowledge; they often to always use the Internet to find information on marine issues, mostly rely on Internet search engines to undertake project related to the marine environment, and consider citizen science programs and non-governmental environmental organizations (NGOs) as the most important source of information on marine issues.

The above results suggest an inadequate implementation of seagrass science issues in school curricula and teacher preparation programs in Greece. These results also suggest that participation in marine citizen science projects and NGOs, and regular and advanced use of the Internet technologies, constitute an effective way to increase seagrass knowledge. The study findings could be utilized to design customized education strategies and planning interventions to achieve a seagrass-literate society.

Having a 'Kraken' time creating Blended Learning Materials

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¹Camden Education Trust

The Marine Institute's Explorer's Education Programme team in Ireland hope to showcase our new 'Explorer's Learning about Squid: Cephalopod Science Investigations' resource pack at the EMSEA Virtual Summit 2021, to help inspire other educators to promote ocean literacy in the classroom.

With an increased need for educators to engage with interactive online blended learning materials, the Explorer's team at the Camden Education Trust have focused on creating a series of teaching resources that are accessible and innovative to use for primary school teachers and children. Our interactive presentation will provide participants with an opportunity to review the resources and take part in creating their own Kraken monster online!

These resources include:

1. Squid Dissection: This exciting video features stunning squid footage and photographs, allowing the teacher to follow a dissection of real squid, enabling the students to become familiar with the external and internal features of squid,
2. Squid for Beginners Booklet: This booklet provides teachers with a colourful introductory resource that outlines information about squid. This includes the squid's internal and external features; the history of the mighty Kraken; how squid impact our lives today through modern science; and lots more,
3. Our Favourite Squid Species Booklet: This guide provides children with some of the most interesting squid species from the giant squid to the pygmy squid, where they learn about the animals key features,
4. The Squid Workbook & Activities: Has been developed to allow students to get creative with cross-curricular projects including science, art, history, English, and geography.



How does ocean literacy research develop in a global scale?

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Ocean literacy is a relatively new concept that connects humans to the ocean and that is defined as the understanding of the ocean's influence on us and our influence on the ocean. Ocean literacy has evolved from a local initiative to a global scale movement, increasing its popularity among several research communities, which was reflected in scientific publications. However, it is less clear how these research advancements are developing in structure, what is the relationship among research communities and which are the topics that are attracting the researchers' attention. We used the information contained in scientific publications to answer these questions and to identify the current gaps. We applied a combination of bibliometric analysis and science mapping to a dataset of publications obtained from Web of Science and Scopus between 2005 and 2019. Our findings suggest that despite the substantial collaborations among researchers, countries and institutions, the number of scientific publications on ocean literacy increased slowly over time. Furthermore, ocean literacy still face considerable limitations to its dissemination in Latin America and Africa. Topics related to education and science were identified as core areas of research, while topics related to the economic activities happening in the ocean were sparse. Hopefully, these results could orient future studies and could be translated into efforts to support this purposeful movement by promoting collaboration among scientists, decision-makers, the industry and relevant practitioners.



I love BLUE

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Šimun Kožičić Benja Elementary School applied for the Blue Schools Project in 2020 with a project called "Find Blue" with the aim of bringing children closer to the importance of the sea in various ways to raise awareness that the sea is a system to support life on our planet and should be protected.

We considered the early involvement of children in project teaching, mutual teaching and research on the marine system and its importance for planetary sustainability as key elements we implemented in our school curriculum with the aim of sensitizing local authorities to involve schools in this topic. We introduced the topic into the school curriculum from 1st to 8th grade; "Our blue sea" where we have enriched the previous teaching units with our practical and presentation activities. The beginning of the project was designed in such a way that we introduced children from 7 to 14 years of age to the theme of the sea according to the principle "We know and we want to know". After insight into their knowledge, we designed a series of workshops that included presentation and practical activities. Some of the workshops were conducted at the school and along the coast in collaboration with the local university and association.

The project also included the development of educational materials for the needs of the local community. The project covered 80 children from 7 to 14 years of age, and the method of teaching "student for student" was implemented. After the completion of the project activities, the project was presented by the students themselves through the school newspaper, the school website and an organized museum exhibition, where the wider local community was introduced to the results of the project.

Ocean Literacy in the kindergarten – example of good practice from Croatia

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We are living in the era of rapid environmental changes and nowadays marine education is probably more important than ever. Stronger collaboration between scientific and preschool organizations is necessary to provide knowledge transfer and raise interest and awareness of the preschool children for the ocean issues. The main aim of our action was to include preschool children in the creation of the educational picture book.

Our preschool group consisted of 20 children, three to six years old. The action consisted of two types of activities i) educational activities - two interactive workshops led by scientists and an educational visit to the Institute of Oceanography and Fisheries; ii) creative activities - creative workshop led by kindergarten teachers. After educational activities, the group was encouraged to creatively express their view of the learned. Kids were illustrating some of the main ocean issues such as pollution, global warming, new species and nursery ground protection. Furthermore, they illustrated how a healthy ocean looks like and what we can do to reduce our negative effects on the planet. We wrote rhyming songs and scientific text adjusted for the children that together with kids illustrations were included in the educational picture book. The online version of picture book was presented during the Science Festival 2021 and also printed in 700 copies. Online version was free to download while hardcopy was distributed in around 80 kindergarten groups and 10 libraries. We hope that through this picture book our young readers will realize the importance of the ocean.



Project “Percorsi nel Blu”: Ocean Literacy & Citizen Science as a valid tool to monitor Marine Heterobranchia. The case study of the first records of the alien species *Favorinus ghanensis* and the Mediterranean *Okenia cf. longiductis*, as updating records for the Italian coasts

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Touristic marinas and harbour are not immune from biological invasions as consequence of the strong pressure in shipping and boating. Since 2019, a Science Teacher of the Institute “ISA2” carried out in the Gulf of La Spezia (Ligurian Sea) the Ocean Literacy and Citizen Science Project “Percorsi nel Blu” (“Blue Paths”), by promoting an educational and operative program linked to the BIOBlitz activity “Animali Fantastici e dove trovarli”. The surveillance plan deals with the coastal monitoring of the fouling community, along artificial floating pontoons at the Marinas of the Gulf of La Spezia. “Percorsi nel Blu” Project highlights how important is the contribution of excellent ocean literate students-scientists in collecting data on native and alien species, despite Covid-19 crisis.

With respect to the fouling community at Marina of Fezzano, we report the relevant first records of Marine Heterobranchia (Mollusca; Gastropoda): the alien species *Favorinus ghanensis*, from Ghana, western Africa, a first record for the Italian coasts; the Mediterranean species *Okenia cf. longiductis* (since frequently misidentified as *O. zoobotryon*, molecular analysis is currently underway) and *Runcina brenkoeae*, as first records for the Ligurian Sea. At Marina of Lerici, we report the native species *Doto cervicenigra*, a first record for the Ligurian Sea. For the Gulf of La Spezia, we also report the first records of the Mediterranean species *Berthella cf. aurantiaca*, *Eubranchus exiguus*, *Caloria quatrefagesi*, *Polycera quadrilineata*, *Spurilla neapolitana* and a new record of the alien species *Polycera hedgpethi*.

Talking the Coast - an interdisciplinary journey

Scott Xavi Gudrich¹

¹ Plover Rovers

Bringing together the scientific marine community with coastal communities, we aim to increase Ocean Literacy and be part of the transformation of our relationship with our seas and coasts. We emphasise person-to-person interaction: Most of our events are informal guided walks where a marine scientist takes a group out along the coast, talking about their research and how it relates to local people as well as its place in the bigger picture. With this approach, we demystify science, making it more accessible. All events are free which further aids accessibility. We work with local artists and conservation groups. This feeds into our 4-level approach to enhancing ocean literacy:

- a) Science Communication: Present relevant science focussing on active dialogue between scientists and members of coastal communities, enabling conversations with transformative power for both sides.
- b) Art and Emotion: Art aids science communication by providing both an active and immersive “discovering nature” experience as well as enhanced emotional connectivity to the natural world.
- c) Activism: A direct pathway from an informative setting to active engagement consolidates the acquired theoretical knowledge and builds a sustained connection to the natural environment.
- d) Heritage and Storytelling: Collect stories from local people to explore and understand their connection to the sea.

Running a project with no budget creates a special kind of beauty: The absence of money frees up creativity. We invite our volunteers to add their vision to our mission, we experiment, we value the process, we learn from each other constantly and we have fun!



“Children hands about climate change” – the project in sign language

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“Children hands about climate change” was a project launched by the Gdynia Aquarium and dedicated to the deaf and hearing-impaired 8 to 15 year-olds from Wejherowo - a small city situated in the close vicinity of southern shores of the Baltic Sea, in the northern part of Poland. The project was implemented in September 2020 and involved three parts, in all of which a translator of sign language was participating: a) organizing eco-workshops on the exhibit and in laboratories of the Gdynia Aquarium, but also in the nearby marina; b) holding brainstorm sessions and stimulating the participants to talk about eco-problems of the Earth; c) recording five-minute movie with subtitles in which children performed as the main actors (!) and spoke using sign language.

The project was encouraging, socializing and stimulating partakers in order to act concerning environment protection. The superior goal of the project was to increase participant’s knowledge related to the eco-issues, i.e.: what climate change means exactly and which of various human activities cause the changes; how they influence ocean’s water; how vulnerable coral reefs are and what is the impact of human activity on coral’s life.

The project was launched thanks to awarding of the financial prize in the nationwide competition organized by the Ikea Retail Sp. z.o.o. in January 2020.